SIEBTECHNIK TEMA

Blanko- Montage- und Betriebsanleitung

Hinweis:

Siebtechnik übernimmt keinerlei Gewährleistung für die Verwendung dieser Montage- und Betriebsanleitung, da diese nach aktuellen Richtlinien erstellt wurde und der aktuelle Zustand und die Einbausituation der Maschine nicht bekannt ist.
Diese Blanko-Betriebsanleitung stellt keine Konformitätserklärung einer im Betrieb befindlichen Maschine im Sinne der Maschinenrichtlinie dar!

Maschinentyp: **Siebschneckenzentrifuge**
Conturbex H 400

Siebtechnik GmbH
Platanenallee 46
45478 Mülheim
Deutschland
Internet: www.siebtechnik-tema.com

Sales: E-mail: sales@siebtechnik.com
Tel.: +49/(0)208/5801 268

Service: E-mail: service.centrifuges@siebtechnik.com
Tel.: +49/(0)208/5801 266

Revisionsnachweis

Revision.	Datum	Art der Revision
0		

Sie müssen diese Bedienungsanleitung für die gesamte Lebensdauer der Maschine aufbewahren und jederzeit in der Nähe der Maschine griffbereit haben.

Alle Abbildungen in dieser Bedienungsanleitung sind beispielhaft und können gegebenenfalls von der beschriebenen Maschine abweichen.

Aus Gründen der besseren Lesbarkeit wird in der Betriebsanleitung auf die gleichzeitige Verwendung der Sprachformen männlich, weiblich und divers (m/w/d) verzichtet. Sämtliche Personenbezeichnungen gelten gleichermaßen für alle Geschlechter.

Siebtechnik GmbH
Platanenallee 46
45478 Mülheim
Deutschland
Internet: www.siebtechnik-tema.com

Sales: E-mail: sales@siebtechnik.com
Tel.: +49/(0)208/5801 268

Service: E-mail: service.centrifuges@siebtechnik.com
Tel.: +49/(0)208/5801 266

Table of contents

1. Technical Data 8
1.1 Intended use 8
1.3 Regular checking of the centrifuge / inspection book 9
1.3.1 Inspections prior to the first commissioning 10
1.3.2 Inspection in the operating state (annually) 11
1.3.3 Inspections in the dismantled state (triennially) 11
1.3.4 Results of the checks and inspection book 12
1.4 List of performed inspections 13
1.5 Inspection reports 14
1.5.1 Performed inspections 16
1.5.2 Remarks on the performed inspections 19
1.5.3 Test run 21
1.5.4 Remarks on the test run 22
1.6 After Sales 23
1.6.1 Spare parts 23
1.6.2 Siebtechnik qualified fitters 23
1.6.3 Training service 23
2. How to use the operating instructions 24
3. Safety 26
3.1 Liability and warranty 26
3.2 Declaration of conformity 27
3.3 Required qualifications 27
3.4 Competency 28
3.5 Intended use 28
3.6 Commissioning 29
3.7 Safety and protective devices 29
3.8 Symbols in these operating instructions 29
3.9 Symbols on the machine and in the plant 30
3.10 Personal protective equipment 31
3.11 Transportation 32
3.12 Storage 33
3.13 Replacement and wear parts, accessories 33
3.14 Workshop equipment 34
3.15 Special tools and special devices 34
3.16 Potentially explosive atmosphere (ATEX), optional 34
3.17 Removal and disposal 34
3.18 Regular tests 35
3.19 Hazards 35
3.19.1 Electrical voltage 35
3.19.2 Vibration 36
3.19.3 Substances 36
3.19.4 Process conditions 37
3.19.5 Temperature 37
3.19.6 Pressure 38
3.19.7 Rotational speeds 38
3.19.8 Noise 38
3.19.9 Dust 38
3.19.10 Welding hazards 38
3.20 Safety during work and operation 39

4. Machine description 41
4.1 Design configuration 43
4.2 Overview of subassemblies 46
4.3 Materials 47
4.4 Specific auxiliary and special equipment 47
4.5 Centrifuge characteristics and circumferential speed 48
4.6 Drive and gearbox 49
4.7 Residual moisture 50
4.7.1 Retention time of the solid matter 51
4.8 Ventilation, pressure compensation and air recirculation 51
4.9 Worm gap towards the drum 52
4.10 Sealing 52
4.11 Machine lubrication 53
4.11.1 Hydraulic system 53
4.12 Dehydration 54
4.12.1 Layer thickness 54
4.13 Washing the solid matter 54
4.14 Solid matter discharge 56
4.15 Overload protection 57
4.15.1 Functional description for friction clutch 58
4.15.2 Overload detection by pilot pump 58
5. Delivery, transport and storage 59
5.1 Checking the delivery for completeness 59
5.2 Transportation 60
5.2.1 Attachment points and transport lock 61
5.2.2 Transportation sketch 62
5.3 Transport package 63
5.4 Storage 63
5.4.1 General storage recommendations 63
5.4.2 Storage after use: 64
5.4.3 Corrosion recommendations 64
5.4.4 Care instructions for stored machines 65
5.4.5 Care instructions for attachment components 66
5.5 Measures to be taken before recommissioning 67
5.6 Care and storage of the devices 67
5.7 Storing gearbox (as spare part) 68
5.7.1 Cycloid gearbox 69
5.7.1.1 Corrosion protection for fully assembled cycloid gearbox 69
5.7.1.2 Long-term storage of cycloid gearboxes (> 12 months) 69
6. Mounting and Installation 70
6.1 Erection and required space 70
6.2 Substructure 71
6.3 Set-up of the centrifuge 71
6.4 Assembly at the installation site 72
6.4.1 Transport of the centrifuge 72
6.4.2 Vibrating elements 73
6.5 Connecting the centrifuge 75
6.6 Supply of the feed material 77
6.7 Solids discharge 78
6.8 Liquid drainage and ventilation 80
6.9 Washing and rinsing 81

6.9.1 Shaft feedthrough/sealing 82
6.9.2 Preliminary drainage gutter (optional) 82
6.10 Electrical connections 83
6.11 Lubricating oil 84
6.12 Assembly of motors and V-belts 85
6.12.1 Assembly of V-belt pulleys and V-belts. 85
6.12.2 Final assembly and check of rotational direction 86
7. Commissioning 87
7.1 Measures during a shutdown of the centrifuge 88
7.2 Checks prior to commissioning 88
7.3 Check of the running characteristics 90
7.4 Test run without product 91
7.4.1 Switching on the centrifuge for the test run 92
7.5 Checks during the test run 94
7.5.1 Checking the centrifuge rotor 95
7.5.2 Vibration 95
7.5.2.1 Vibration limit values 95
7.5.2.2 Effective vibration velocity 96
7.5.3 Oil temperature 96
7.5.4 Hydraulic system (pusher centrifuge only) 97
7.5.5 Leakage (oil, liquids, gas) 97
7.5.6 Oil pressure 97
7.5.7 Oil condition 98
7.5.8 Switching off the centrifuge after the test run 98
7.5.9 Running down the centrifuge 98
7.5.10 When the centrifuge has come to a standstill 98
7.6 Commissioning with product 99
7.6.1 Switching on the centrifuge for commissioning / production 100
7.6.2 Checks in the production state 101
7.6.3 Quantity loading 101
7.6.4 Electric power consumption 101
7.6.5 Draining off solid matter and filtrate 101
7.6.6 Inerting, rinsing and washing systems 101
7.6.7 Separating performance 102
7.6.8 Switching off the centrifuge after production 102
8. Operation, maintenance and servicing 104
8.1 Safety information and rules of conduct for assembly work 105
8.1.1 Notes and Rules 105
8.1.2 Personal Protective Equipment 106
8.1.3 Power supply 106
8.1.4 Pressure, temperature, centrifuged material residues 106
8.1.5 Special tools 107
8.1.6 Component weights and stability 107
8.1.7 Test run 107
8.2 Rinsing / Cleaning 107
8.2.1 Rinsing 108
8.2.2 Manual cleaning 108
8.3 Disuse of the rinsing spaces 109
8.4 Maintenance intervals / Maintenance schedule 110
8.4.1 Daily maintenance 113
8.4.2 Weekly maintenance 114

8.4.3 Monthly maintenance....114
8.4.4 Maintenance every six months....115
8.4.5 Annual maintenance....115
8.4.6 Two year maintenance....116
8.4.7 Three year maintenance....116
8.5 Inspection....117
8.6 Lubrication....118
8.6.1 Set up....119
8.6.2 Oil change intervals....120
8.6.2.1 Motors and pumps....120
8.6.3 Oil type....120
8.6.4 Filling in the oil....121
8.6.5 Oil pressure / Oil flow....121
8.6.6 Cleanliness of the oil....122
8.6.7 Oil temperature and Limit values....122
8.6.8 Oil pressure gauge....123
8.6.9 Oil return from needle bearing and product side main bearing....123
8.7 Drive....124
8.7.1 Motor / drive concept - double drive with two motors....125
8.7.2 Oil pump motor....126
8.7.3 Overload protection (friction clutch)....127
8.7.3.1 Setting and checking of the overload clutch....128
8.7.4 Modification of the speed....130
8.8 V-belt....131
8.8.1 Installation and replacement of V-belts and pulleys....131
8.8.2 V-belt tension....133
8.8.2.1 Calculation of the necessary indentation depth....133
8.8.2.2 Measurement of the deflection force K....134
8.8.2.3 Check of the V-belt tension....134
8.8.2.4 Deflection force K (table)....135
8.9 Rotating parts....137
8.9.1 Removal and assembly of the worm complete with worm hub....139
8.9.2 Screening elements....143
8.9.2.1 Sheet metal screen change:....144
8.9.2.2 Wedge wire basket changing....147
8.9.3 Disassembly and fitting of the drum complete with drum hub....148
8.9.3.1 Disassembly of the drum complete with drum hub....149
8.9.3.2 Fitting the drum complete with drum hub....150
8.10 Bearing....152
8.10.1 Disassembling the bearings....152
8.10.2 Assembly of the bearings....152
8.11 Seals....153
8.11.1 Labyrinth-sealing....154
8.11.2 Static sealings....154
8.11.3 Shaft sealing rings....154
8.11.4 Chamber packing....155
8.12 Gearbox maintenance....157
8.12.1 Removal of the gearbox....158
8.12.2 Installing of the gearbox....160
8.13 Thread connections....161
8.13.1 Tightening torque....161

8.13.2 Handling of thread connections made of stainless steel....164
8.13.3 Thread connections for regular use....164
8.14 Electrical system....165
9. Electrical equipment, control system....166
9.1 Motors....167
9.1.1 Rotational direction of the motors....167
9.2 Integrity of safety-related parts of the control system....168
9.2.1 Vibration and speed monitoring....168
9.2.1.1 Monitoring of the operating speed....169
9.2.2 Monitoring of the shaft sealing....169
9.3 Monitoring of the lubricating oil supply....170
9.4 Pusher control unit (for SHS pusher centrifuges)....170
9.5 Additional equipment....170
9.6 Auxiliary aggregates for suspension, solids and filtrate....171
9.6.1 Suspension feed....171
9.6.2 Discharge aggregates for solid matter and filtrate....172
9.7 Interlocking of the centrifuge with plant aggregates....173
9.7.1 Machine stop (emergency stop, trip signal)....174
9.7.1.1 Switch-off devices of the surrounding aggregates....174
9.7.2 Plant stop (emergency stop)....175
10. Trouble shooting....176
11. Drawings and lists....195
11.1 Drawings....195
12. Spare and wear parts lists....196
13. Sub-Suppliers Documentation....197
14. QM-Documentation....198

1. Technical Data

At regular intervals, the centrifuge must be checked for its occupational safety according to relevant national regulations.
Applicable in Germany is the Occupational Safety Directive, realised with the German Statutory Accident Insurance (DGUV) regulation 100-500 (previously German Trade Association Regulation (BGR) 500). This chapter contains information about the technical data of your centrifuge (delivery state) and is meant to plan the required inspections.

For Germany, this chapter is part of the inspection book for centrifuges according to the DGUV guidelines 313-001 (previously Trade Association Principle (BGG) 934).

1.1 Intended use

Centrifuges are power-driven machines separating liquids and solid matter mechanically, given in the data sheet, and this is their only intended use.

Any other utilisation or operation beyond these limits is not deemed to be intended use.

For the intended use, it is essential that these operating instructions, including annexes and supplements as well as the contractual agreements are mandatory.

1.3 Regular checking of the centrifuge / inspection book

At regular intervals, the centrifuge must be checked for its occupational safety according to relevant national regulations.
Applicable in Germany is the Occupational Safety Directive, realised with the German Statutory Accident Insurance (DGUV) regulation 100-500 (previously German Trade Association Regulation (BGR) 500).

According to these regulations a centrifuge must be inspected annually in its operating state and at least once every three years in its dismantled state, if necessary at shorter intervals (e.g. in the case of severe corrosion or abrasion) for proper occupational safety of the machine by a competent person.

The results of the checks must be documented.
The operator is responsible for the documentation of all required data of the annual or triennially inspections and test runs.
The inspection book records can be kept informally.

For Germany this chapter applies as informal inspection book for centrifuges according to the German Statutory Accident Insurance (DGUV) guidelines 313-001 (previously Trade Association Principle (BGG) 934).

Templates for documenting the required inspection reports are compiled in this chapter. This Chapter 1 may be consulted as inspection book for documenting the required inspections and test runs.

Particular attention must be paid to the rotating parts, which are subject to high levels of both dynamic stress and exposure to particular risks from corrosion and abrasion.

Shut down the machine immediately in the case of malfunctions! All shortcomings found during the inspection must be eliminated immediately and without any delay.

During all work, it is essential that the instructions in Chapter *3 Safety* and in Chapter *8.3 Securing the centrifuge for installation work* are complied with. Siebtechnik provides no warranty for damage incurred through failure to comply with the stipulated safety instructions. The risk is borne solely by the user.

After each inspection or reinstallation, carry out a test run and functional test in any case and observe the checks specified in Chapter 7 *Commissioning* before recommencing operation.
These checks must be documented!

Your centrifuge was designed and manufactured specifically for your application taking the safety assessments under consideration and according to the currently applicable standards, directives and laws.

In general, SIEBTECHNIK does not permit any unauthorised modifications and changes to the machines!
SIEBTECHNIK does not provide warranty for any damage caused by unauthorised modifications and changes. The operator is solely responsible for such changes.
As operator you must ensure, taking the applicable legislation under consideration, that the occupational safety of centrifuges intended for other tasks, which have been modified or supplied with further equipment that is not specified in the operating instructions of the centrifuge manufacturer, is checked by a competent person prior to the first commissioning.

1.3.1 Inspections prior to the first commissioning

Check the occupational safety of your centrifuges prior to the first commissioning.
If an inspection prior to the first commissioning is not possible, this inspection may alternatively be carried out during the commissioning.

Basically, the inspection prior to the first commissioning must include the following:

- Arrangement of operating elements for emergency command systems (emergency stop) and main switches
- Installation site suitable
- Escape of materials with hazardous properties
- Electrical equipment
- Potentially explosive atmosphere
- Danger area divided in zones
- Noise in the case of installation in the workshop
- Measures to protect against fire hazards from neighbouring systems
- Measures to protect against explosion hazards from neighbouring systems
- Transmission of vibrations
- Stability is given
- Centrifuge is suitable for intended operation
- Accessories are fully present
- Approx. 30 cm clearance for laboratory centrifuges

- Required documentation is available
  - complete operating instructions
  - inspection book

1.3.2 Inspection in the operating state (annually)

Basically, the periodic inspection in operating state must include the following:

- Condition of components and equipment,
- Possible changes to the safety devices,
- Completeness and effectiveness of the safety devices,
- Compliance of the technical data of the centrifuge with the specifications in the manufacturer certification,
- Readability, attachment and data of the signage (nameplate, operating display)
- Completeness of the inspection book,
- Test run of centrifuge without charge material,
- Speed control system,
- Unbalance sensor.

1.3.3 Inspections in the dismantled state (triennially)

Basically, the periodic inspection in the dismantled state must include the following:

- Steady installation and levelling of the machine
- Compliance of the technical data of the centrifuge with the specifications in the operating instructions of the manufacturer,
- Readability, attachment and data of the signage (Nameplate, operating display)
- Attachment and condition of the supporting construction
- Mechanical attachment of the centrifuge parts (including auxiliary units, cover plates, etc.)
- Effectiveness of the lid lock
- Condition of housing and coatings which may possibly be provided
- Condition of the collecting bin and cover
- Condition of the shafts, bearings, gaskets, suspension, drive clutch, etc.
- Condition of the protective equipment
- Hitch and attachment of the spindle
- Completeness, condition of the rotating parts (if appropriate, crack test)
- Corrosion, abrasion, cracks of parts which come into contact with the product (if appropriate, crack test)
- Corrosion, abrasion, cracks in the screen element (if appropriate, crack test)
- Corrosion on the carrier material under wear protection (ceramic, rubber, carbide bushings, etc., if available)
- Sealing of the processing space
- Proper functioning and condition of the electric control and interlocking systems
- Condition and layout of infeed and discharge pipelines

- Completeness of the inspection book

1.3.4 Results of the checks and inspection book

The results of the checks must be documented and kept in an inspection book.

The inspection book records can be kept informally and should contain the following:

- Title page and designation of the centrifuge with the following specifications:
  - Serial number, manufacturer number
  - Design and type designation
  - Manufacturer
  - Operator
- Index of the manufacturer certifications
- Manufacturer certification
- Result of the risk assessment
- Scope of inspection for centrifuges
- List of performed inspections
- Inspection results

Templates for documenting the required inspection reports are compiled in this chapter. This Chapter 1 may be consulted as inspection book for documenting the required inspections and test runs.

1.4 List of performed inspections

The following lists are supposed to be helpful during the required inspections:

Inspections prior to the first commissioning

Date	Signature:

Periodic inspections

Date Inspection report	Inspection in Operating state	Inspection in Dismantled state	Signature:	Next inspection

1.5 Inspection reports

The results of the checks must be documented according to relevant national regulations.

The operator is responsible for the documentation of all required data of the annual or triennially inspections. The inspection book records can be kept informally.

Templates for documenting the required inspection reports are compiled in this chapter. This Chapter 1 may be consulted as inspection book for documenting the required inspections and test runs.

A complete inspection report consists of this Chapter ***1.5 Inspection reports***. If appropriate, non-applicable sections can be omitted.

A performed inspection requires completed inspection reports and a performed and documented test run as a necessity.

When working with SIEBTECHNIK centrifuges, all legal and operational rules of conduct as well as all rules of conduct and safety instructions contained in these operating instructions must be complied with. It is mandatory to comply with the following conditions in the course of your daily work with the centrifuge (see Chapter *3 Safety*).

Inspection report	
Date	
Machine no.	
Machine type	
Operator	
Installation site	

Type of test (tick off the applicable)	
Inspection in operating state	
Test in the dismantled state	

Inspection result (tick off the applicable)	
Centrifuge can be operated without concern	
Centrifuge can only be operated to a limited extent	
Centrifuge must not be operated	
Next inspection:	

Test implementation	
Location, date	
Inspector / company	
	Name (block letters) / signature
Operator	
	Name (block letters) / signature

Remedy of defects	
Location, date	
Inspector / company	
	Name (block letters) / signature
Operator	
	Name (block letters) / signature

1.5.1 Performed inspections

	Parts	**Scope of inspection** Visual inspection of the following parts	Status OK.	Condition cannot be assessed
1	**Housing, basic unit, base frame**	Stability Attachment, condition, corrosion, erosion Damage as a consequence of mechanical load and wear Function Levelling*		
1.1	Nameplate, signage	Attachment, data, readability		
1.2	Arrow of direction of rotation			
1.3	Frames, supporting components	Stability Attachment, condition, corrosion, erosion Damage as a consequence of mechanical load and wear Function		
1.4	Mechanical attachment centrifuge			
1.5	Mechanical attachment of auxiliary units			
1.6	Housing cover			
1.7	Covers, cladding			
1.8	Gaskets			
1.9	Splash guards and suchlike in the interior			
1.10	Protective covers, (mechanism, hinges, gaskets)			
1.11	Cover locking system			
1.12	Cover closing device			
1.13	Product supply/discharge			
1.14	Rotor chamber*			
2	**Vibration foundation**	Condition and attachment		
3	**Auxiliary units**	Condition, leak-tightness, attachment and functioning		
3.1	Feed worm			
3.2	Rinsing pipe and washing devices			
3.3	Lubricating oil unit	Status Leak-tightness, condition and age of the hoses		
3.4	Filtrate pump	Condition, leak-tightness, attachment and functioning		
3.5	Solid matter transport worm (discharge)			

Date: _____ Signature, operator: _____ Signature, inspector: _____

	Parts	**Scope of inspection** Visual inspection of the following parts	Status OK.	Condition cannot be assessed
4	**Drives**	Condition and functioning Hitch, tight fitting, stress marks, wear, damage		
4.1	Attachment of rotor, gearbox			
4.2	Drive shaft			
4.3	Drive suspension			
4.4	Drive clutch			
4.5	Vibration damper			
4.6	Hydraulic drive	Status Leak-tightness Condition and age of the hoses		
5	Maintenance and lubrication plan	Adherence		
6	**Drum**	Marking Condition, corrosion, erosion, mech. damage, crack formation Function Permissible drum speed Wall thickness Stress marks		
6.1	Drum body			
6.2	Drum inserts (e.g. sieve, filter cloth)			
6.3	Linings			
6.4	Riveted, threaded and welded connections			
6.5	Drum attachments and their elements			
6.6	Drum cover locking device			
6.7	Drum shaft / seat			
7	**Worm**	Marking Condition, corrosion, erosion, mech. damage, crack formation Function Stress marks		
7.1	Worm body			
7.2	Linings, wear protection			
7.3	Riveted, threaded and welded connections			
7.4	Worm attachments and their elements			
7.5	Worm shaft / seat			

Date: _____ Signature, operator: _____ Signature, inspector: _____

	Parts	**Scope of inspection** Visual inspection of the following parts	Status OK.	Condition cannot be assessed
8	**Rotor**	Condition, corrosion, mechanic damages, crack formation		
8.1	Rotor installations			
8.2	Rotor inserts			
8.3	Welded joints			
8.4	Rotor attachments and their elements			
8.5	Rotor, bucket, suspension* All rotors, buckets, suspension allocated according to the inspection book of the machine	Condition, function, completeness, corrosion, erosion, mechanical damage, and, if appropriate, crack test		
9	**Rotor bearing arrangement**	Condition, corrosion, mechanic damages, crack formation		
9.1	Bearing seat			
9.2	Shaft seals			
9.3	Gaskets			
10	**Electrical equipment**	Condition, tight fitting, functioning, cable routing (twists, sharp bends, sharp edges) Insulation condition		
10.1	Switches			
10.2	Control fields			
10.3	Warning lights			
10.4	Pipelines, pipe connections			
10.5	Fuses			
11	**Ex. operating equipment**	Ex labelling, function and condition		

* laboratory centrifuge only

Date: _____ Signature, operator: _____ Signature, inspector: _____

1.5.2 Remarks on the performed inspections

Short description of the performed work, condition of the machine, suggestions, etc.:
Defects found on items:
The following parts were replaced with new ones during assembly:

Date: _____ Signature, operator: _____ Signature, inspector: _____

The following parts must be replaced at short notice, but were not available:
The following parts were recommended to be replaced, which, however, was not desired by the operator: (A warranty on the part of SIEBTECHNIK is excluded.)

Date: _____ Signature, operator: _____ Signature, inspector: _____

1.5.3 Test run

	Parts	Scope of inspection Functional checks	Status OK.	Condition cannot be assessed
1	**Test run after assembly**			
1.1	Cover locking system	Functional check		
1.2	Cover closing device			
1.3	Drum cover locking device			
1.4	Braking device			
1.5	Vibration measurement			
1.6	Check of the rotation speed			
1.7	Rotational speed limit*			
1.8	Rotational speed display			
1.9	Protection against overspeed			
1.10	Inert system			
1.11	Program sequence (Logic)			
1.12	Safety shutdown systems (unbalance sensor)			
1.13	Emergency stop function			
1.14	Test run with charge material			
1.15	Test run without charge material			
1.16	Abnormal operating noises			
1.17	Filling device			

Date: _____ Signature, operator: _____ Signature, inspector: _____

1.5.4 Remarks on the test run

Test run (tick off the applicable)	
Test run <u>with</u> product carried out	
Test run <u>without</u> product carried out	
<u>No</u> test run for operational reasons (Operator takes on the responsibility for performing the test run at a later time and the start-up of the machine)	

The centrifuge shows the following behaviour:
The following changes must be made by Siebtechnik / the customer:

Date: _____ Signature, operator: _____ Signature, inspector: _____

1.6 After Sales

1.6.1 Spare parts

Siebtechnik centrifuges are special machines, specifically designed for your application. Thus, important spare components are affected by this single-piece production with respectively long replacement times.

For your centrifuge we recommend to maintain individual minimum stocks of special components in order to ensure the operational readiness of the machine.

In order to make rapid processing possible please provide the following information concerning your centrifuge and the required spare parts in all correspondence:

- Machine type
- Machine number of the centrifuge
- Identification number of the centrifuge
- Identification number and item number on the bill of materials of the parts in question

1.6.2 Siebtechnik qualified fitters

Siebtechnik provides a team of qualified fitters for all necessary assembly and maintenance work.

You can make use of this team for individual assembly work or conclude maintenance contracts that are tailored especially to suit your company's needs.

1.6.3 Training service

Thorough training of the operating and maintenance personnel forms the basis for plant production operation without problems and helps save costs.

For this purpose, Siebtechnik offers special training agreements.

2. How to use the operating instructions

The operating instructions on hand provide relevant references for working with Siebtechnik machines/plant and support you and your personnel:

- to understand the functions of the machine/plant
- to carry out the set-up and installation
- to operate the machine/plant safely and properly and to use it economically
- to provide safe working conditions
- to draw up specific maintenance and repair schedules applicable to your plant
- to remedy machine/plant faults

Siebtechnik machines and plants are designed according to state of the art and the approved technical safety regulations. Nevertheless, in the case of improper utilisation, danger for the life and limb of the operator and other persons can arise and/or the machine and other property could be damaged.

Prior to working with Siebtechnik machines and plants, read the operating instructions carefully to acquire accurate knowledge of the correct operation, safety regulations to be applied and the warning instructions to be observed. Keep these operating instructions such that it is available for reference whenever needed.

You - as operating authority - are responsible for ensuring that the operating personnel is properly qualified for working with the machine, is informed regarding the operating and maintenance instructions and complies with them accordingly.
It is absolutely essential to provide separate special training for operating personnel having a different native language and to familiarise such persons with the inherent hazards of the machine according to the operating instructions.
You are also responsible for ensuring that the applicable regulations for the prevention of accidents and for environmental protection are complied with.

SIEBTECHNIK accepts no liability for damage resulting through failure to comply with the stipulated safety instructions or through improper utilisation of the plant (see Chapter ***3 Safety*** and Chapter ***1 Datasheet***). The risk is borne solely by the user.

In addition to the contractually agreed services, the intended use also includes the observance of the assembly and operating instructions as well as the inspection and maintenance conditions.

Any other utilisation or operation beyond these limits, e.g. for higher power or speed of rotation, is not deemed to be intended use. SIEBTECHNIK is not liable for any injuries of persons or damage of equipment resulting therefrom. The corresponding risk is carried solely by the owner.

Adequate workshop equipment must be used for maintenance and servicing. Professionally qualified repairs can be carried out only by the manufacturer.

Never carry out any changes, expansions or modifications, which might affect the safety of the machine/plant. This also applies to the incorporation and adjustment of safety devices.

Please observe the warnings and instructions for the entire machine and if necessary, the individual safety devices.

Shut down the machine/plant in case of safety-relevant changes or changes to its operating behaviour immediately and report the faults to the responsible body / person.

Detailed information and instructions for the design of the substructure is not subject of these operating instructions. The implementation and planning depend on the local conditions and on the requirements (e.g. with regard to building construction and statics) resulting from the planned installations and the technical and statutory building regulations.

These operating instructions have been compiled with greatest possible care. If you nevertheless desire further information, please contact us as follows:

SIEBTECHNIK GmbH

Platanenallee 46
45478 Mülheim an der Ruhr

Telephone: **+49 (0)208/5801-00**
Fax: **+ 49 (0)208/5801-300**

Internet: **www.siebtechnik-tema.com**
Email: **sales@siebtechnik.com**

The company SIEBTECHNIK reserves the right to make changes.

3. Safety

For the operation of the **SIEBTECHNIK machines** and **plants**, handling of dangerous materials and working under hazardous process conditions **national** guidelines, which have to be followed by operators, apply.

This chapter on ***Safety*** is intended to familiarise you with the basic regulations and instructions as well as specific rules of conduct for safe working with **SIEBTECHNIK - machines** and **plants**.

Be sure to observe the safety regulations specified in these operating instructions.

Depending on the place of installation, the tasks and process conditions, operating Siebtechnik machines pose a danger to personnel, the plant and the machine itself against which they must be protected.

This always requires competent and safety-conscious behaviour of the operator and the personnel during operation, maintenance and servicing.

Ensure that before starting work, the operator and the specialist personnel have read the operating instructions and taken note of all safety regulations and rules of conduct. Have this confirmed by your employees with their signature.

You as the operator are obligated to perform a risk assessment for the respective workplace to prevent possible dangers by technical and/or organisational protective measures.

3.1 Liability and warranty

SIEBTECHNIK machines and **plants** are designed according to state of the art and the approved technical safety regulations. Nevertheless, in the case of improper utilisation, danger for the life and limb of the operator and other persons can arise and/or the machine and other property could be damaged.

SIEBTECHNIK does not accept warranty for damages caused by a failure to comply with operating instructions, regulations, rules of conduct or non-intended use of the machine/plant.

The operating instructions on hand provide important instructions for the work with Siebtechnik machines/plants. Furthermore, these operating instructions can assist you in complementing your internal factory safety regulations.

Failure to observe the safety instructions:

- may result in a hazard for persons, environment, machine and plant.
- can lead to loss of all claims for compensation of damage.

In particular, non-compliance can, for example, entail the following hazards:

- Failure of important functions of the machine/plant
- Failure of stipulated methods for maintenance and servicing
- Hazard for persons through mechanical and chemical influence
- Danger for the environment

Ensure that before starting work, the operator and the specialist personnel have read the operating instructions and taken note of all safety regulations and rules of conduct. Have this confirmed by your employees with their signature.

Unauthorised modifications and changes to Siebtechnik machines/plants are not permitted.

3.2 Declaration of conformity

SIEBTECHNIK machines and **plants** conform to the current standards and directives of the EU, which is certified by the attached EC declaration of conformity or declaration of incorporation.

Deviating exceptions apply to spare parts.

3.3 Required qualifications

Note that maintenance, repairs, trouble shooting and commissioning of Siebtechnik machines/plants must only be performed by specialist personnel.

Mind that personnel undergoing specialised or general training or instruction may only work at the machine under constant supervision of an experienced person.

Observe the prohibition notice. Young persons under 18 years of age must not be commissioned with operation and maintenance of machines, except for the purpose of achieving the training goal.

- **Specialist personnel** are persons that due to their specialised training, experience and instructions have sufficient knowledge of:
  - safety regulations,
  - accident prevention regulations,
  - directives and recognised rules of engineering (for instance, VDE regulations, DIN standards).
- Specialist personnel must:
  - be able to assess the work assigned to them, detect and avoid possible risks.
  - be authorised by the person responsible for the plant safety to perform the required work and activities.
  - must have read and understood these assembly and operating instructions.
- **Operators** are persons informed during instructions by the operator about the assignments and possible risks in case of improper behaviour, and which have read and understood these assembly and operating instructions.

  Operators may not perform any maintenance, repair, trouble shooting and commissioning on **SIEBTECHNIK machines** and **plants**.
- If necessary, you may request **Siebtechnik specialist personnel** for all maintenance, repair, trouble shooting and commissioning required.

3.4 Competency

As the operator, you must define precisely the scope of responsibility of your personnel.

3.5 Intended use

You may only use **SIEBTECHNIK machines** and **plants** for the contractually defined applications. In Chapter ***1 Technical data***, you find additional information on the intended use.

The operating safety is only ensured with intended use. The specified limit values (see type plate or Chapter *1 Technical data*) must never be exceeded. It is essential that you observe the specifications of SIEBTECHNIK.

In addition to the contractually agreed services, the intended use also includes the observance of the assembly and operating instructions as well as the inspection and maintenance conditions.

3.6 Commissioning

Prior to the commissioning, you must check that SIEBTECHNIK machines and plants have been installed properly, that all safety and protective devices are active and ensure that no defects are visible.

SIEBTECHNIK machines and plants may only be operated if:

- the respective input and output lines have been properly connected
- integration into the control circuits of the overall plant may have been carried out
- the mobile components of the machine have been protected against contact
- all safety and protective devices have been mounted and activated properly

3.7 Safety and protective devices

You may only operate Siebtechnik machines and plants with properly assembled and activated safety and protective devices. Safety devices must neither be removed, neither rendered unusable nor by-passed.

3.8 Symbols in these operating instructions

Various symbols, the meanings of which you must know, are used in these operating instructions:

This symbol refers to a *possible* or *direct* danger to the life and health of individuals.
Failure to observe these signs can lead to severe health damage or even potentially lethal injuries.

This symbol indicates a situation which may be hazardous.
Failure to observe these signs can lead to minor injuries or equipment damage.

Remarks which are particularly emphasised by this symbol contain a process or a series of processes of particular interest or importance. All instructions should be fulfilled in the interest of proper utilisation of the machine.

3.9 Symbols on the machine and in the plant

Symbols attached to the machine or in the plant indicate particular hazards or required protective equipment, e.g.

Warn signs

Warning of hot surface
Do not touch hot surfaces

Warning against hand injuries
To avoid hand injuries caused by closing mechanical parts of a machine/equipment.

Warning of electrical voltage
Do not come into contact with electrical voltage

General warning sign
Observe the danger conveyed by additional signs

Warning of obstacles on the ground
Caution near obstacles on the ground

Warning of danger of falling
Be careful near falling edges

The industrial safety statutes and associated stipulations, directives and regulations make it mandatory to mark possible dangers at the workplace. Within the scope of the harmonisation throughout the EC, these markings are comparable to road traffic signs. However, deviations are possible. The markings distinguish between the following groups:

Instructions and symbols attached directly to the machine, such as warning signs, actuating signs, rotation direction arrows, component designations, etc., must always be observed.
They must not be removed and must be maintained in fully legible condition. If these instructions are no longer legible or are missing, they must be replaced immediately.

3.10 Personal protective equipment

The **P**ersonal **p**rotective **e**quipment (**PPE**) is always to be worn when hazards at the place of work cannot be completely eliminated by technical and/or organisational measures.

You, as the operator, are responsible for the personal protective equipment of your personnel. When selecting the personal protective equipment make sure to observe that it is suitable for the work to be performed. Furthermore, you must specify appropriate clothing if required by the job to be done.

PPE = Personal Protective Equipment:

Helmet
Falling objects

Respiratory protection
Gases, dusts

Protective goggles
Parts flying off
Harmful radiation

Protective footwear
Falling objects,
stepping into objects

Protective clothing
Heat, cold,
Electrical voltage

Protective gloves
Hazardous Substances,
Electrical voltage

Hearing protection
Excessive noise levels
> 85 dB(A)

Protection against falling down
At construction and assembly sites

Follow the instructions
Read the instructions before starting work and/or operating equipment or machinery.

Observe the respective national regulations.

3.11 Transportation

The following notes will help to transport the machine safely.

Observe the national and international regulations for lifting loads!

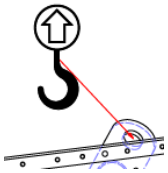
Only use ropes, suspension materials and hoisting gear of adequate load bearing capacity. Always take into account the dead weight of the machine (see Chapter 1 *Datasheet*).

Caution: Danger to life and danger of injury from tilting or falling loads! Make sure that nobody is standing under suspended loads or is working there.

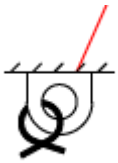
Observe the icons for storage and transportation according to instructions applied to the package.

Lift the machine at the provided attachment points (see installation plan in Chapter 11 *Drawings* and Chapter 6 *Attachment points and transport locks*). Observe that other handling eyebolts may be available that are only to be used for transporting the component. These assembly eyebolts only serve for mounting or dismantling the component and are only designed to carry the weight of the component. Attaching the entire machine provides a risk for personnel and machine/plant.

Attachment points



Lifting eye for lifting a machine with a suitable sling, e.g. load hook.



Transport eyelet for lashing a machine to / on a suitable means of transport

You must ensure that the machine is properly attached and secured so that it cannot lead to any danger.

Ensure that the personnel for the operation of cranes and forklift trucks are appropriately qualified.

Commission only experienced personnel with suspending loads and directing crane drivers! The directing person must be positioned within the field of view of the operator or be in voice contact with him.

Ensure that a commissioning is excluded if a possibly available transport damage might endanger the proper operation of your machine/plant.

For transport purposes, remove all process media.

Always observe the recommendations on Siebtechnik machines/plants in the Chapters *Delivery, transport and storage* and *6 Set-up and installation*.

Note that there are national and international provisions and regulations to be complied with for the transport of machines/plants.

3.12 Storage

Avoid hazards due to improper storage:

Ensure the stability of the stored machines and components.

Use the transport and storage devices, if available.

Always observe the recommendations on Siebtechnik machines/plants in Chapters *5 Delivery, transport and storage* and *6 Set-up and installation*.

3.13 Replacement and wear parts, accessories

Note that the installation and use of externally manufactured products may adversely modify properties of the machine/plant specified by design, and thus affect the safety for man, machine or other property.

3.14 Workshop equipment

Use appropriate workshop equipment when working on the machine.

3.15 Special tools and special devices

Special tools and special devices may only be used for the work for which they are intended according to these operating instructions.

3.16 Potentially explosive atmosphere (ATEX), optional

As of 1 July 2003 devices and protection systems marketed for operation in explosion-protected areas must be approved according to the directive 2014/34/EU This directive harmonises the various requirements within the EU with the intention of establishing a unified safety standard and to overcome trading barriers.

For machines within the area with a potentially explosive atmosphere, special regulations and behaviour must always be complied with.

Comply with the directive (RL) 2014/34/EU for avoiding explosion hazards.

Siebtechnik machines in ATEX design must only be operated in the area with a potentially explosive atmosphere for which it was designed. Ensure that the *ATEX directives* of these operating instructions are complied with.

Ensure that work on ATEX machines is only performed at standstill and in the absence of a potentially explosive atmosphere.

For a machine with inerting, in the case of an inert gas leak, you must monitor the environment of the machine and ventilate it adequately so that the maximum permissible inert gas concentration is not exceeded.

3.17 Removal and disposal

Observe the laws, regulations and provision on waste disposal measures and routes that respectively apply to you.

3.18 Regular tests

SIEBTECHNIK machines and plants must be checked at regular intervals to ensure that they are in a safe working condition. There are national regulations to be observed.

In the case of functional faults of the machine/plant, it must be shut down and secured immediately! Remedy faults immediately!

After each inspection it is mandatory to carry out the checks specified in Chapter *7 Commissioning* before recommencing operation.

You must comply with the adjustment, maintenance and inspection tasks and scheduled dates stipulated in the operating instructions, including the stipulations for replacing components and subassemblies.

Document all tests.

3.19 Hazards

3.19.1 Electrical voltage

Note that all work on Siebtechnik machines and plants may only be performed in a de-energised state.

- **Disconnect the machine from the mains before starting any mechanical work:**
  - Switch off the power supply to the machine (mains plug, emergency stop).
  - Secure the machine against unintentional restart.
  - Ensure the isolation from supply before starting the work.
  - Ensure that unlocking the EMERGENCY STOP equipment does not lead to an unintentional or undefined restart.
  - Always make sure that you discharge statically before touching electronic components.

Live parts and lines pose risks:

- Mind correct power supply.
- Never deactivate or bypass fuses.
- Keep moisture away from live parts.

Note that work on electrical systems or operating material may be carried out only by a trained electrician or by instructed persons under the supervision of a trained electrician in compliance with the electrotechnical regulations.

In case of faults within the electric power supply switch off the machine and the power supply immediately (e.g. use emergency stop switch/main switch or disconnect mains plug)

3.19.2 Vibration

Never underestimate the hazard due to uncontrolled vibration for:

- Plant
- People
- Machine
- Foundation
- Pipelines

There is a risk of crushing between vibrating and static components!

3.19.3 Substances

Make sure to observe the national and international regulations that apply to you (e.g. Dangerous Substances Directive) on handling used materials/auxiliary materials and the prevention of:

- Poisoning
- Caustic burns
- Explosion
- Environmental pollution
- Health hazards
- uncontrolled chemical reactions
- unsanitary production conditions,
- etc.

During the processing of hazardous substances, take necessary protective measures and inform the personnel with regard to possible risks.

In order to keep these risks to a minimum, the following information must be provided:

- designation and chemical composition of the material (e.g. safety data sheet)

- safety-relevant specifications
  - occupational exposure limit
  - harmful to health (e.g. carcinogenic, corrosive, toxic, explosive, flammable),
  - possible chemical reactions with other substances
- reference to protective equipment required
- first-aid measures
- instructions on the disposal, transport and cleaning of the machine.
- possibly, EU labelling requirements

Ensure that the personnel for all work on the machine/plant cannot come into contact with hazardous substances.

3.19.4 Process conditions

Comply with the national regulations applicable to you for operating aggregates and plants under the process conditions provided.

Your machine is designed for the contractually specified operating conditions (see also Chapter *1 Datasheet)*.

The following parameters must not be changed or exceeded:

- Type and quantity of the contractually agreed product data
- Process parameters
- Maximum values
  - see Contract, Datasheet, Machine description and if necessary, machine type plate

3.19.5 Temperature

Depending on process or plant conditions, some unit parts may become very hot during operation

Ensure that work is only performed on a cooled down machine/plant to avoid injuries.

3.19.6 Pressure

Note that the machine/plant may not be pressurised or in a state of negative pressure before starting work.

3.19.7 Rotational speeds

Note that the specified maximum rotational speed must never be exceeded.
Exceeding it poses a risk for life, health as well as machine and plant.

3.19.8 Noise

Note that noise emission may occur when operating the machine. This noise emission may be greater when the machine is operated with material than when it is operated without material. Ensure that appropriate personal protective equipment is worn during all work on the machine.

3.19.9 Dust

Be aware that there may be increased dust exposure during machine operation, maintenance and inspection. Ensure that appropriate personal protective equipment is worn during all work on the machine.

3.19.10 Welding hazards

Refrain from all welding work on the machines/equipment. Improper execution can lead to damage. If welding work is unavoidable, e.g. during installation or dismantling, you must take all measures to avoid a fire hazard.

3.20 Safety during work and operation

In addition to the national accident prevention regulations applicable to you, note the following rules of conduct to prevent hazards in the daily work with **SIEBTECHNIK machines** and **plants**:

When working with Siebtechnik machines/plants, it is essential that all of the rules of conduct and safety regulations described in these operating instructions are complied with.

Note that SIEBTECHNIK machines and plant may only be operated in a technically perfect condition and any faults, which may endanger a safe operation must be removed immediately.

Check whether EMERGENCY STOP control units are available and, if so, were they are located. Ensure that available switches are freely accessible!

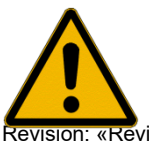
In the case of an emergency stop, long stopping times may be required until the machine has come to a complete standstill. (visual inspection)

Note that SIEBTECHNIK machines and plants must not be operated without safety devices. Safety devices must neither be removed, rendered neither unusable nor by-passed.

Never switch off safety locks or devices during operation.

Ensure that contact with the running machine is impossible. In the case of high rotational speeds, some of the components are not visible when the machine is running, e.g. clearing vanes, bolt heads, pulse vanes and recesses in pulse discs. Such components are capable of amputating limbs and/or dragging a person into the machine.

Make sure that no openings such as flaps or doors can be opened when the machine is running. Material spraying out or reaching into the material flow can cause injuries.



Secure the workplace against environmental hazards and keep the escape route clear. Provide the increased space required in the environment of the machine.

Always ensure that no unauthorised personnel are admitted to the working area during any of these operations.

Please note that SIEBTECHNIK machines and systems must not be walked on during operation.

For all assembly work, use suitable special tools and the devices possibly included in the scope of delivery.

Secure the rotor of the machine against rotation. The rotor can be set in motion by the force of its weight due to unsymmetrically adhering product residues. Even a very slow rotating component can be very dangerous due to inertia and can shear off fingers, for example.

Always bear in mind the dead weight of components and the possibly unfavourable working posture and grasping security.

Ensure that no personnel can fall, and no tools, tramp material and machine parts are able to enter your process system.

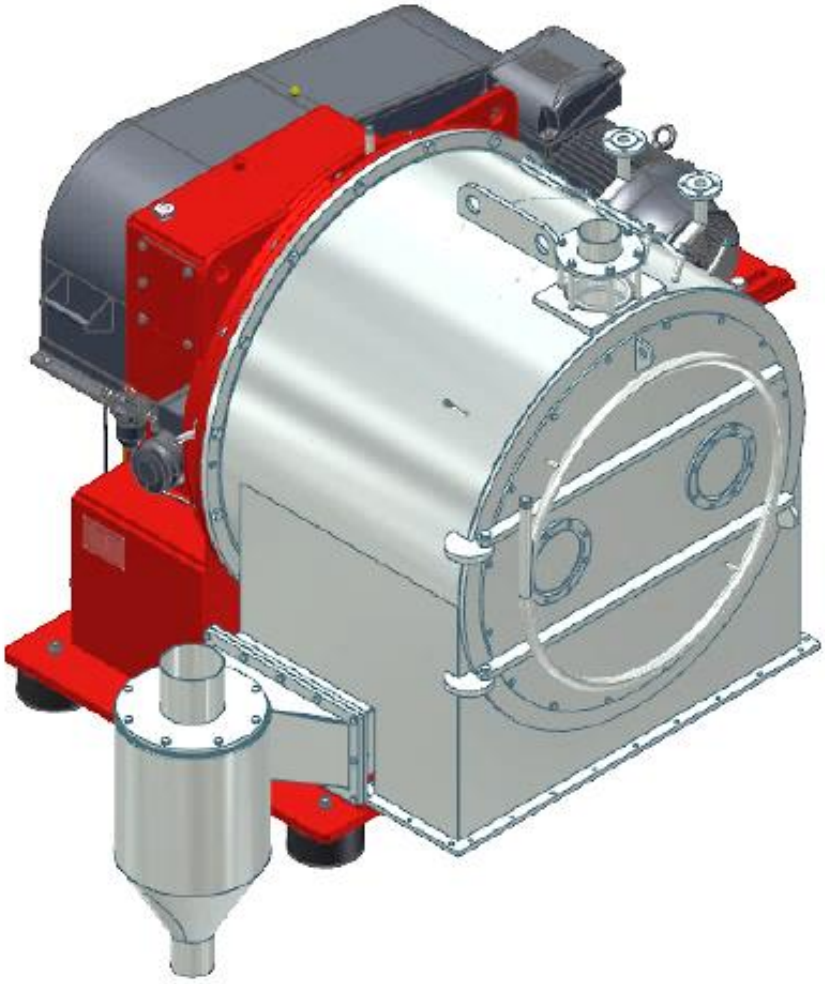
Secure dismantled components against slipping and falling over.

Ensure that personnel wear appropriate clothing for all work on SIEBTECHNK machinery and equipment.

4. Machine description

Siebtechnik screen worm centrifuges Conturbex have been developed for various separating tasks.

Frame sizes from H 200 to H 1000 of a great many alternative designs are available for the product-specific design.

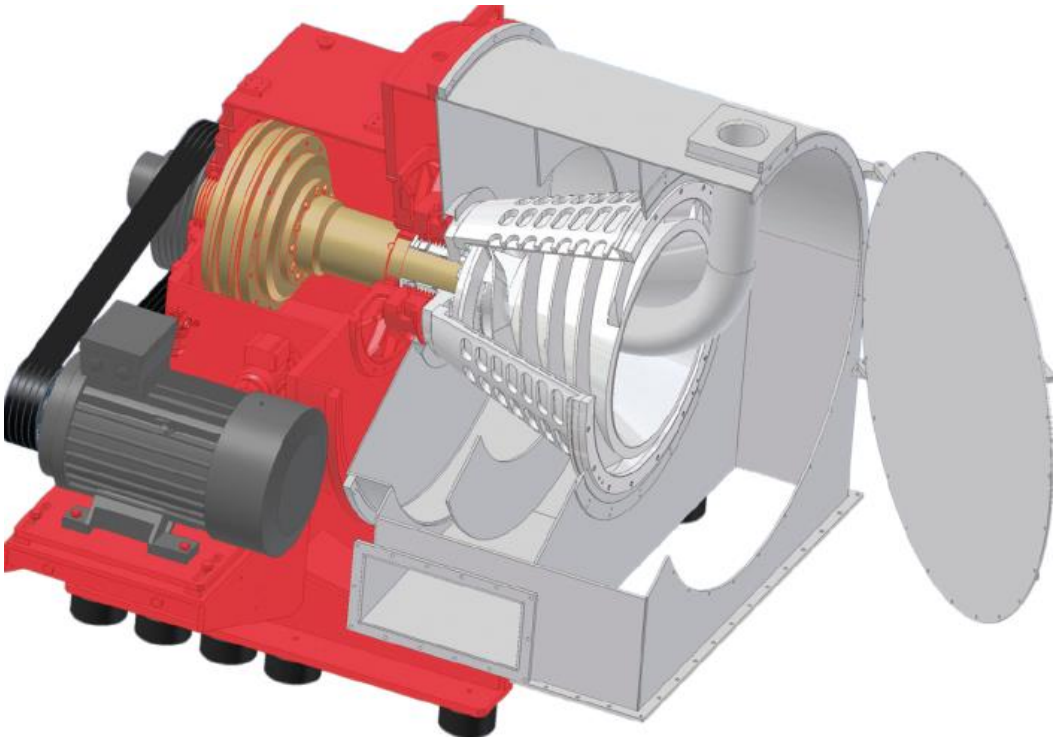


Screen worm centrifuge CONTURBEX H 700

The drive and bearings, the rotating parts in the fluid area and the solid matter discharge are arranged synoptically and maintenance friendly.
The centrifuge is driven by V-belts. The rotational speed of the rotating parts is matched to the procedural engineering requirements.

The solid matter retained by the screen coating is conveyed by the drum inclination and by a worm with slightly different rotational speed from small to large diameter and there thrown off into the product housing. Thus with respective drum inclination matched to the input feed material, various products of different origin and consistency can be separated most successfully from the suspension fluid and, if necessary, cleaned by washing.

A centrifuge gearbox ensures the required differential rotation speed between the drum and the worm even in the case of high friction of the material on the screen coating. An overload protection system protects the gearbox to prevent damage. The gearbox and the bearings are equipped with circulating oil lubrication, except for the H 170 and H 200 which are equipped with a gearbox with oil filling.



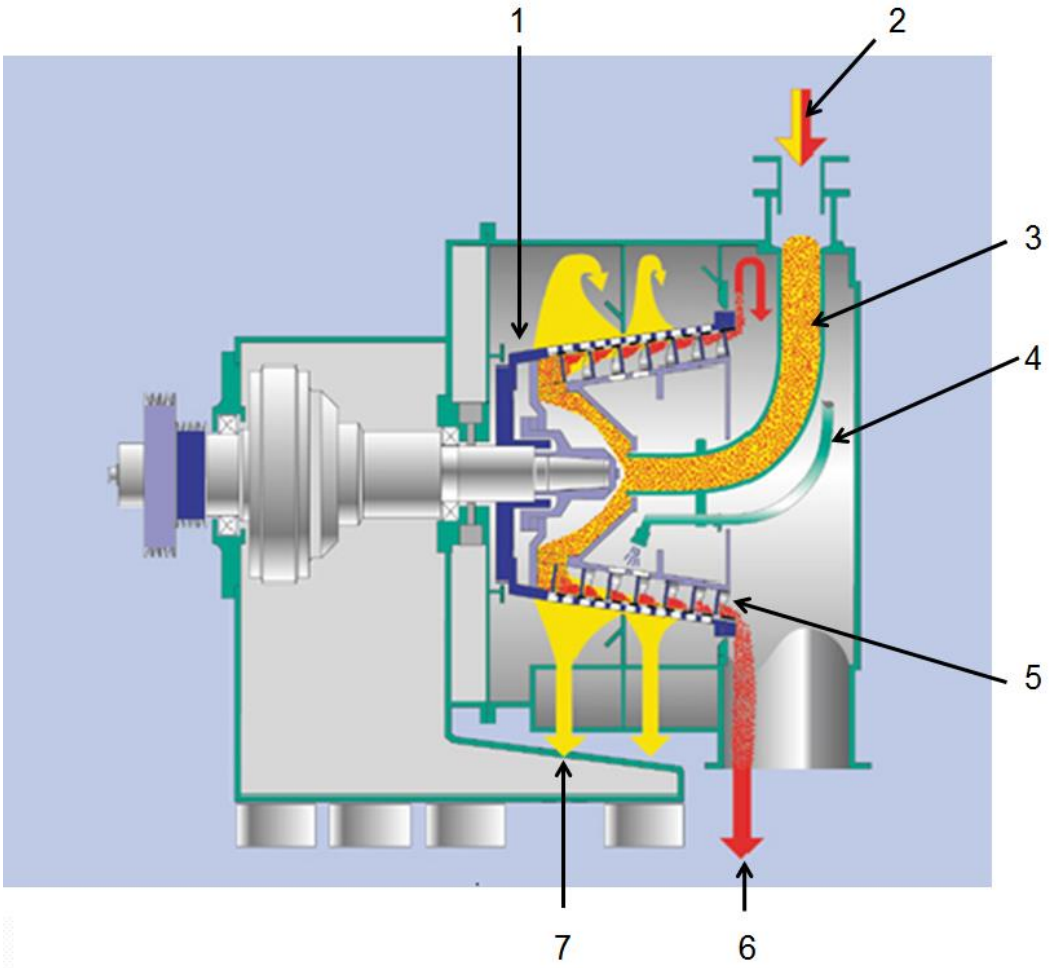
The machine and drive motor are connected as a unit to the substructure via rubber buffers. Thus even large centrifuges do not require any special foundations or damping masses. The relative movement of the worm prevents imbalance due to uneven distribution of the material in the drum. No product residues leading to imbalance remain in the machine after switch off. The rotary screen drum is equipped - depending on the wear stress - with perforated plates or with wedge wire screens.

The largest fluid portion is separated on the small drum diameter in the area of low circumferential speed and small centrifugal acceleration.
Towards the large diameter the small amount of residual fluid is flung off with increasing centrifugal acceleration.

The rotating parts usually have conical shape. Inclination angles of the drum basket jacket with respect to the rotation axis in the range from 10° to 20° have proved to be successful because the friction coefficients of nearly all products correspond to the tangential values of these angles.

With ideal choice of drum angle the solid matter slides without significant intervention of the feed worm from the input area on the small diameter of the drum along a mantle line to the large diameter and thus to the discharge. The worm must perform a regulating function during the retention time of the solid matter. In the initial phase it prevents too rapid slipping of the wet solid matter and later, when the friction coefficient has become greater due to the centrifugal drying, it pushes the solid matter towards the removal discharge.

The construction and functional principles of the versatile screen worm centrifuge CONTURBEX are shown in the sectional drawing.



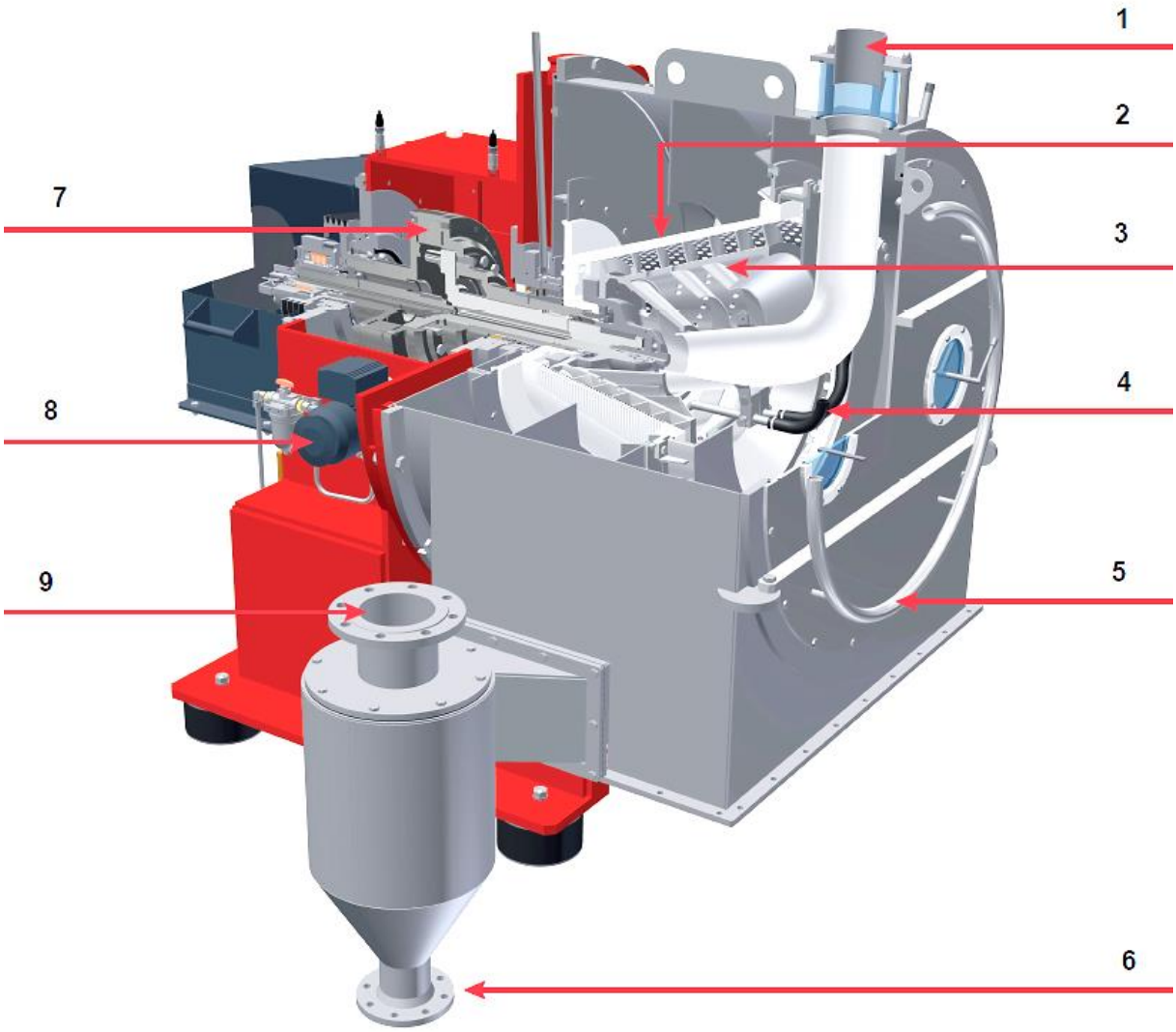
Sectional drawing of a screen worm centrifuge

1	Drum	5	Worm
2	Suspension feed	6	Solid matter discharge
3	Inlet pipe	7	Filtrate discharge
4	Washing pipe		

4.1 Design configuration

The name "screen worm centrifuge" specifies the chief features of this kind of centrifuge:

- screen element for retaining the solid matter in the centrifuge drum,
- feed worm for continuous feed of the solid matter.



3D-Modell Konturbex Typ H

1	Suspension feed	6	Liquid phase drain
2	Rotary drum	7	Gearbox
3	Worm	8	Circulating oil lubrication
4	Rinsing of the product (optional)	9	Exhaust duct (optional)
5	Flushing line (optional)		

The centrifuge is driven by an electric motor with V-belts. Depending on the process requirements, it is also possible to use frequency converters to achieve a variable control of the main speed and/or differential rotation speed.

The drum and the worm rotate in the same direction with high centrifugal force, but with a slight mutual rotational speed difference resulting from the conveying effect of the worm.

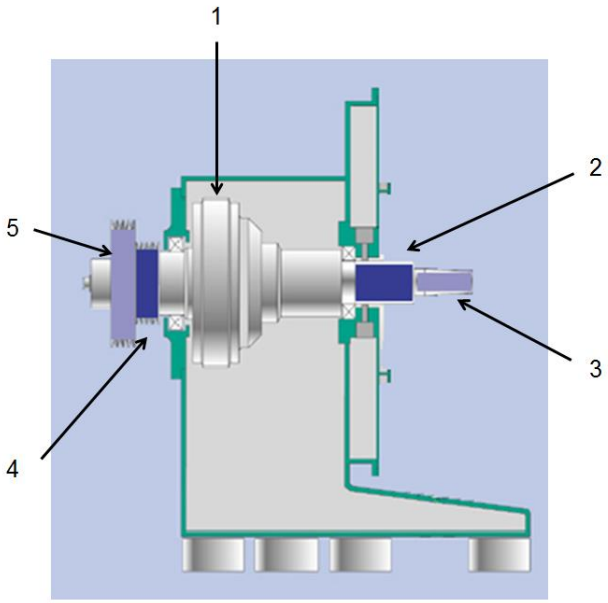
The drum is equipped with a special profile wedge wire screen lining. Depending on the application, a special screening plate can be used alternatively. In every case the screen elements can be replaced very easily.

The rotating parts, carried by the cantilevered shafts of the drive, project into the product area. This arrangement has the advantage of clear separation between the oil-lubricated drive and the processing space, so that only a fast running component has to be sealed against the product housing.

The centrifuge rotor thereby terminates behind the separating wall of the solid matter ejection space and thus ensures free and unhindered ejection of the solid matter out of the product housing.

The product housing comprises all rotating parts in contact with the product and is used to collect and discharge the filtrate and the solid matter.
For a separate outfeeding of the filtrate and the solid matter, the product housing is subdivided into a filtrate space and a solid matter space.

Optionally, the centrifuge housing can be equipped with rinse connections for cleaning the parts in contact with the product (CIP – cleaning in place).



Sketch of drive unit

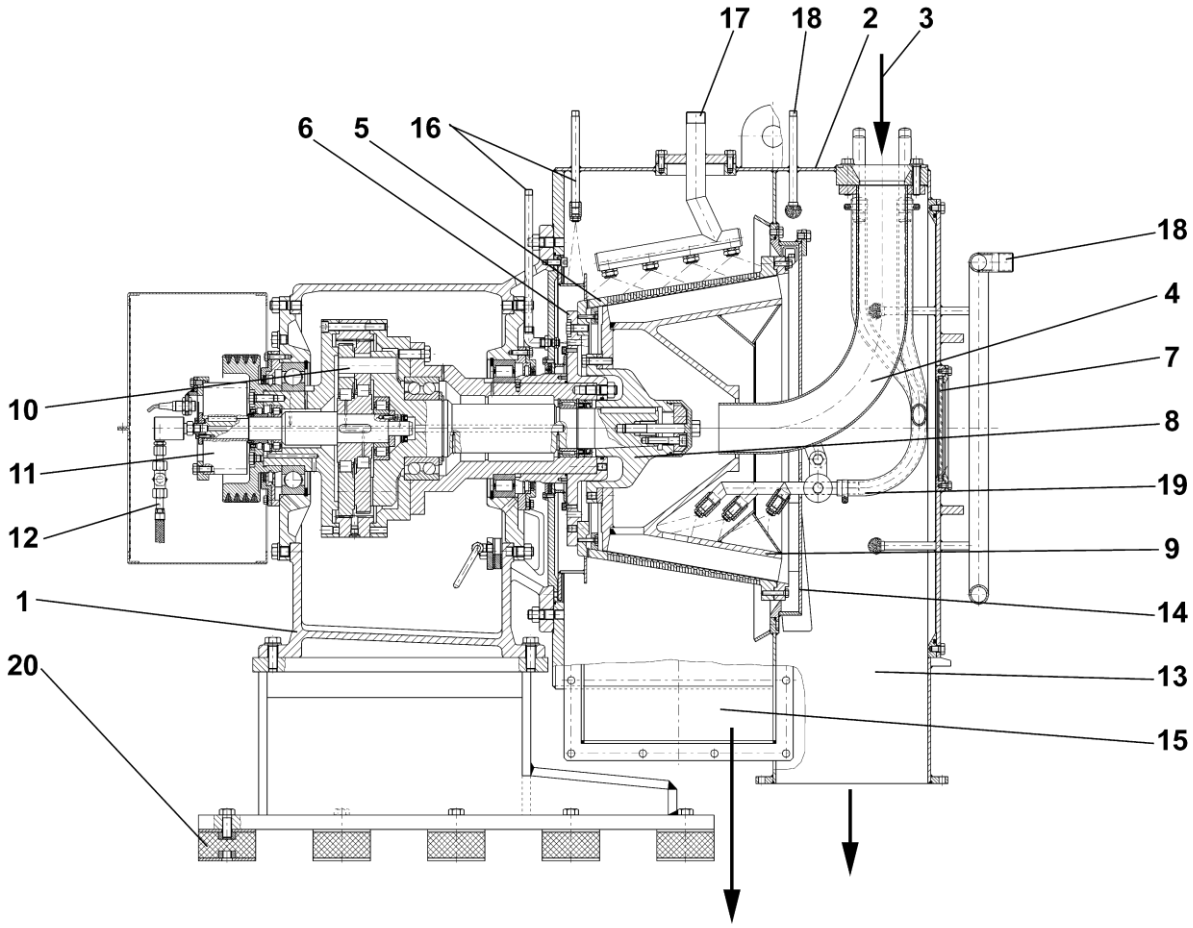
1	Gearbox	4	Drum drive
2	Hollow shaft	5	Gearbox input shaft
3	Output shaft		

The drive area contains all drive components (gears, motors and bearings). All bearings and the gearbox are lubricated via the oil circulation system.

A generously dimensioned gearbox guarantees a constant rotational speed difference between worm and rotary drum and thus consistent results.

Usually the machine is equipped with an overload protection in order to protect the gearbox and the rotating components against damage.

4.2 Overview of subassemblies



1 Bearing housing
2 Product housing
3 Suspension feed
4 Inlet pipe
5 Rotary screen drum
6 Drum hub
7 Inspection glass
8 Worm hub
9 Worm
10 Gearbox
11 Overload protection
12 Oil feed
13 Solid matter discharge
14 Discharge gutter
15 Filtrate discharge
16 Rinsing of filtrate space
17 External cleaning of the drum
18 Rinsing of solid matter space
19 Washing pipes interior of the worm
20 Rubber buffer

4.3 Materials

The parts in contact with the product are made of special steel 1.4571 / 81 for normal applications. If necessary, a highly wear-resistant coating can be applied to the worm volutions.

Alternatively, higher material grades up to Hastelloy or Titanium can be used depending on the process.

4.4 Specific auxiliary and special equipment

For example:

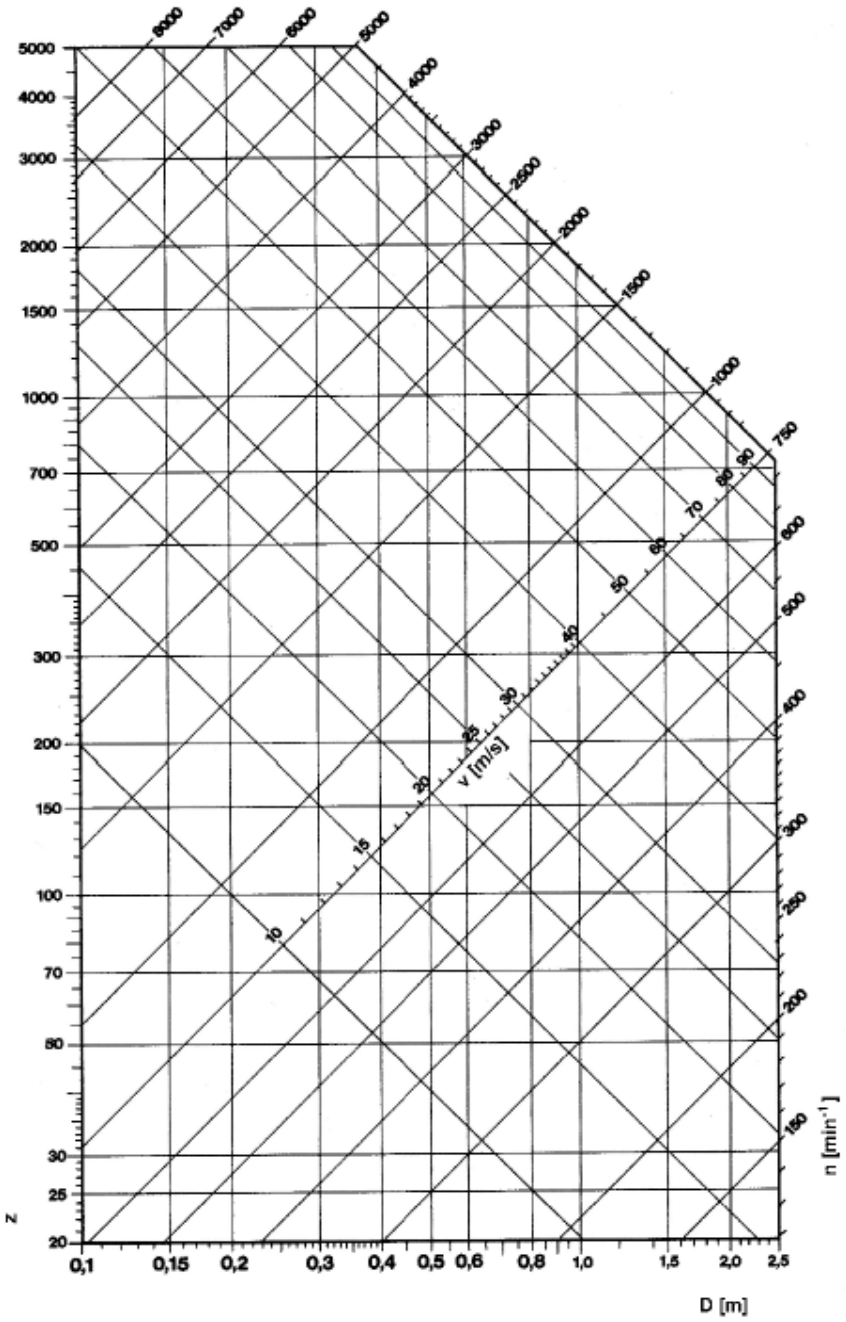
- Rinsing ring pipe and washing devices
- Wear protection for the rotating parts inside the product space
- Discharge gutter with scraper knife to avoid incrustation or adhesion of the product
- PT 100 to monitor the bearing temperature
- Gastight process space sealing
- Filtrate cyclone with or without gas return feed
- Solids discharge via the collecting chute
- Material feed via feed worm
- Material washing unit
- Separate washing liquid discharge
- Food design
- CIP (cleaning in place), including special rinsing pipes, special nozzles and, if necessary, a drag drive unit.
- ATEX design for application in explosion protection zones

  In accordance with EU directives on explosion protection, all Siebtechnik centrifuges can be equipped with an ATEX package to correspond to the hazard zones.
- Further special versions on inquiry

4.5 Centrifuge characteristics and circumferential speed

The centrifugal acceleration is conventionally not expressed as absolute value in m/s² but as multiple of the gravitational acceleration, the so-called centrifugal or centrifugal factor (z).

The most commonly used centrifugal factors, referred to the large drum diameter, are between 500 and 1500 times of the gravitational acceleration and depend on product and machine size.



v = circumferential speed [m/s]
D = diameter [m]
n = rotational speed [rpm]

z = centrifugal factor (multiple of gravitational acceleration)

4.6 Drive and gearbox

Centrifuges are driven by A.C. motors via a V-belt. The centrifuge speed can be modified if the motor belt pulley is exchanged.

Do not exceed the maximum permissible speed (see chapter 1.2 Centrifuge data sheet and name plate)

Reducing gears generate the low differential rotation speed Δn and the high conveying torque of the worm.

If the drum speed is higher than the eccentric shaft speed, the value of the differential rotation speed turns positive; this means the worm rotates slightly faster than the drum. In this case, this is said to be a leading worm.

In contrast to this, the value of the differential rotation speed is negative if the drum speed is lower than that of the eccentric shaft; this means the worm rotates slightly slower than the drum. In this case, the worm is said to be lagging.

The differential rotation speed with the eccentric shaft at standstill results directly from the transmission ratio and the drum rotational speed; exchanging some gearbox parts can vary the transmission gear ratio and accordingly, the differential rotation speed.

$$\Delta n = \frac{n_{Tr}}{i}$$

To ensure a precise tuning of the centrifuge at high rotational speeds, the eccentric shaft is driven in this case. If the gearbox type is the same, the main motor drives the eccentric shaft via a second motor belt pulley.

Accordingly, the differential rotation speed in case of double transmission is calculated as follows:

$$\Delta n = \frac{n_{Tr} - n_{Exz}}{i}$$

The eccentric shaft of the gearbox can be locked or be driven, too.

The worm's rotational speed, n_{worm}, results from the following three factors:

- Transmission gear ratio, i
- Eccentric shaft speed, n_{Exz}
- Drum speed, n_{Tr}

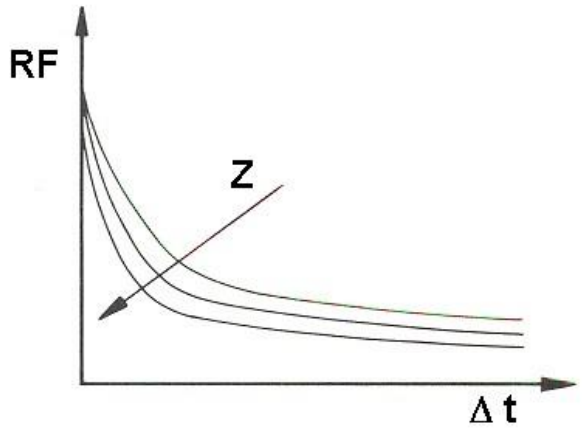
$$n_{worm} = n_{Tr} + \frac{n_{Tr} - n_{Exz}}{i} = n_{Tr} + \Delta n$$

4.7 Residual moisture

The residual moisture depends on the following influence factors:

- Grain size, grain size distribution, grain fracture
- Grain shape and surface structure of the solid matter
- Permeability of the solid matter layer on the conical drum section
- Viscosity
- Adhesion characteristics between solid matter and liquid
- Feed concentration
- Inclination of the cone
- Retention time
- Centrifugal factor
- Layer thickness of the solid matter on the conical drum section

As the retention time **Δt** increases, the residual moisture **RF** initially decreases fast but then only slowly so that very long retention times do not result in any economic advantage but on the contrary limit the throughput without necessity.
If the centrifugal factor **z** increases, the graph largely maintains its shape but is shifted towards lower residual moisture and shorter retention time. The zone of transition between steep decrease and flat branch indicates which retention time should be selected.



At the same time, the parameters wear, grain fracture and loss of fine particles must be considered, too.

Very coarse incompressible solids facilitate filtration so that the residual moisture increases only slightly when the layer thickness increases.

In contrast to this, very fine-grained solid matter has such a high filtration resistance that any increase in the layer thickness will cause a considerable rise in the residual moisture due to the longer filtration distance if this is not compensated by a longer retention time.

4.7.1 Retention time of the solid matter

The worm volutions can be designed with very low pitch, e.g. with two volutions around the worm body, or with very high pitch, e.g. with only 1/3 volution. If theory is simplified by the assumption that the solid matter moves axially across the screen, which is admissible in almost every case, Δn the retention time Δt of the solid matter in the centrifuge drum can be derived from the number of volutions (w) and the differential rotation speed as follows:

$$\Delta t = 60 \frac{w}{\Delta n}$$

Δt = Retention time [s]
w = number of volutions
Δn = Differential rotation speed in RPM [min-1]

The retention times used in practice range from 1 to 5 seconds.
The retention time remains constant and is independent of the amount of solid matter fed in.

4.8 Ventilation, pressure compensation and air recirculation

Via the air or gas delivery slope of the centrifuges, an overpressure is generated in the filtrate space. The filtrate fog can be pressed through every suitable opening, thus, moistening again the solid matter already centrifuged.

Either a pressure difference of approx. 1 mbar (=10 mmWS) develops between filtrate and solid matter space, i.e. there is a slight overpressure within the filtrate space of approx. 1 mbar!

If it should be impossible to lead the air flow generated in the filtrate space outside, an air recirculation is required in the solid matter space of the product housing.

To achieve effective ventilation of the liquid compartment, at least one large-dimensioned venting nozzle must be installed on top, or even better a filtrate cyclone that is open on top and situated at the filtrate discharge, to separate fine droplets.

Gases and vapours can be extracted directly and separately. This prevents moistening of the centrifuged solid matter.

The air is recirculated via a filtrate cyclone with pressure compensation taking place between the filtrate and solid matter space and preventing penetration of the moisture fog into the solid matter space.

If the centrifuge is a gastight model (version K), special shaft seals may cause internal pressures of up to 0.45 bar within it.

4.9 Worm gap towards the drum

If spacer discs are inserted between worm hub and hub, the worm can be shifted axially which varies the gap between the conveying volutes and the conical drum section.

Caution! For safe operation of the screen worm centrifuge, the gap is adjusted to 1.5‰ to 2‰ of the large drum diameter. Smaller gaps are admissible only after a joint risk assessment and consultation with SIEBTECHNIK.

A narrow gap offers advantages in terms of conveyance for fine-grained products.
In addition, the conveying edges of the volutes should be sharp, relief-ground and not worn out or round.

4.10 Sealing

The protruding design requires that only one part rotating at high rotational speed, namely the neck piece of the drum hub, has to be sealed against the rear wall of the product housing.

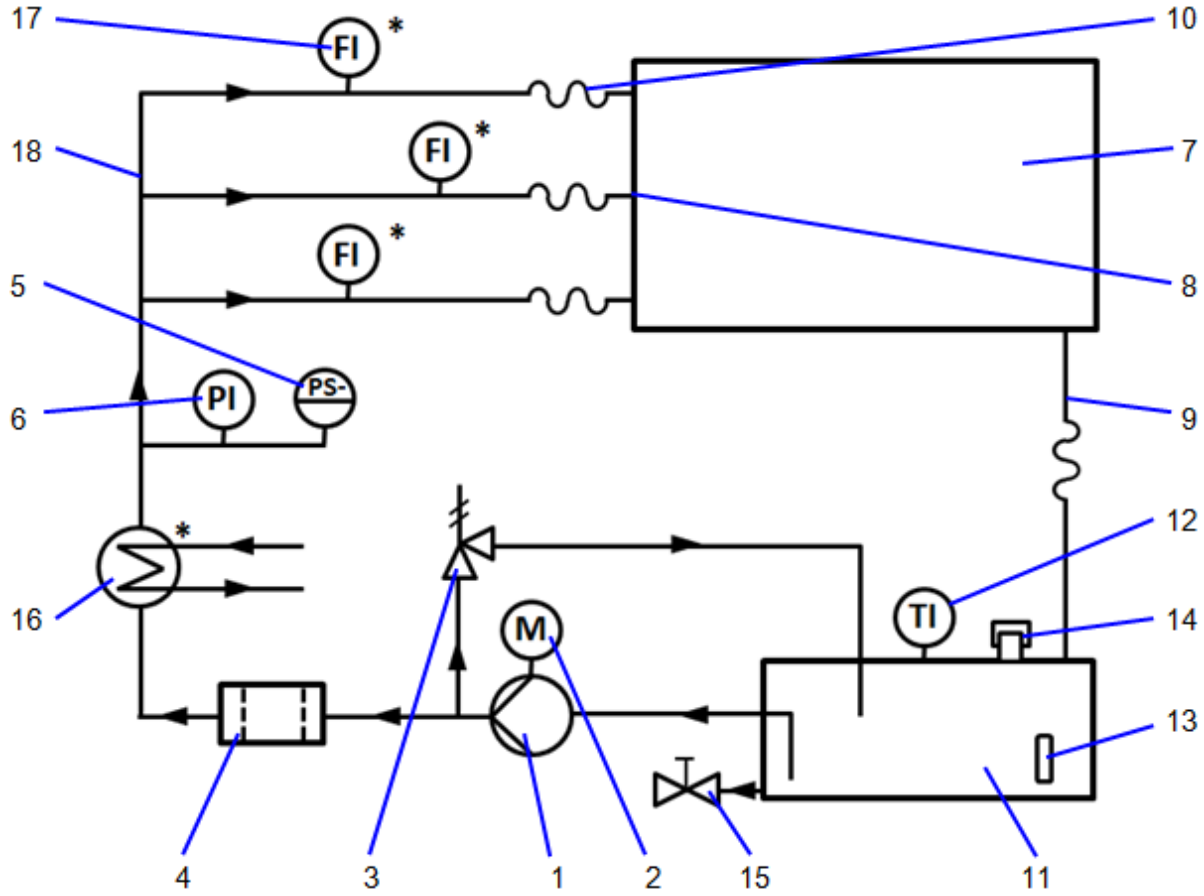
The absolute rotational speed of the worm hub may be even higher. But thanks to the low differential rotation speed between worm hub and drum hub, this sealing point can be mastered easily with standard shaft sealing rings.

The neck of the drum hub requires the use of non-contact labyrinths because the circumferential speed is high and there is the risk of impairment by the product.
If the production system is self-contained, then contacting seals like chamber packings or axial face seals need to be used.

4.11 Machine lubrication

The base frame or bearing housing acts not only as the bearing support but also as an oil tank. An oil pump unit conveys the oil from here into the oil supply line.
This pressure line supplies the gearbox and antifriction bearings through individual throttling ports with oil.

4.11.1 Hydraulic system



1	Lubricating oil pump
2	Oil pump motor
3	Pressure adjusting valve
4	Oil filter
5	Pressure monitor
6	Oil pressure gauge
7	Machine (gearbox / bearing)
8	Oil inlet
9	Oil return flow
10	Flexible oil hose
11	Oil tank
12	Oil temperature
13	Oil inspection glass
14	Feed opening / ventilation
15	Oil drain
16	Oil cooler*
17	Flow indicator*
18	Distribution to the individual lubricating points (bearing, gearbox)*
*	optional / depending on type of machine and equipment

4.12 Dehydration

4.12.1 Layer thickness

The dehydration process commences at the instant when the solid matter cake of has formed. Dehydration of grainy solid matters is performed by filtration. Sufficiently large particle diameters and appropriate centrifugal forces permit dehydration by spontaneous discharging of the liquid from the cake capillary system and, as far as possible, by the filtering away of the cuneal and film liquid adhering to and enveloping the particles of solid matter.

The grain size and consistency of the solid matter substantially determine the extent to which the layer thickness affects the residual moisture.

4.13 Washing the solid matter

If a solid matter is not only to be dried but also to be cleaned of any original liquor or foreign substances sticking to it, washing spaces close to the rotary screen drum allow spraying washing liquid onto the solid matter layer.

The employed screen elements are special perforated plates with aperture diameters between 0.08 and 1 mm and a thickness between 0.3 and 1.5 mm, or wedge wire screens with different profiles and slot widths between 0.1 and 0.4 mm.

There are two requirements for these screen elements that are contradictory:

- To prevent that penetrated fine particles jam and clog the apertures but are ejected instead, the apertures should widen soon towards the outside. In this respect, the ideal aperture design would have razor-sharp edges and the widest possible opening angle.
- On the other hand, the apertures must not widen excessively if the screen surface wears out because otherwise, the separation result would change, i.e. too much solid matter would be contained in the filtrate. In this respect, parallel aperture wall faces would be ideal.

The compromise that needs to be found between these extreme demands depends on many factors, like grain size range, abrasion attack, adhesive properties of the solid matter, liquid portion or feed concentration, and requirements for the separation result.

The compromise to be found in a specific case must ensure that the screen element will keep clear during continuous operation as the centrifuges operate continuously.

- The production cannot be interrupted due to regular reverse flow rinsing processes or the replacement of filter layers that are required on machines which work discontinuously.
- The discharge area of the screen depends on spacing and dimensions of the apertures and ranges between 4% and 10%.

Since the filtration resistance in the solid matter is in most cases higher than the residual flow resistance the liquid must overcome on its way to the one or other screen aperture, the size of the discharge area is of minor importance to the residual moisture. In combination with aperture shape and aperture size, the discharge area of the screen is however decisive for the amount of fine particles entering the filtrate and which quantities of liquid can be separated in the feeding zone, i.e. it determines the swallow volume of the machine.

4.14 Solid matter discharge

Crystals that could be smashed by the impact onto the housing wall, or solids that tend to adhere, are caught in a gutter, which surrounds the drum discharge and are discharged tangentially downwards through a gutter aperture. Metal wings fixed to the drum, which rotate at high rotational speed in the internal space support the flow of solid matter by their ventilating effect.

But the discharge gutter would clog despite the high rotational speed and the flat angle of impact if a product is sticky.
Therefore, the machine must be operated without discharge gutter in such cases and the solid matter space needs to be lined with PTFE or similar suitable material to avoid caking deposits and machine jamming.

On the screen part of the centrifuge, the liquid will drag along a certain fraction of the very fine particles which may be desired in some production processes involving crystallisation because the fine particles act as seed on recirculation and because the dried product is coarser and better pourable.
In other cases, the solid matter contents are returned into the suspension feed.

However, targeted sizing is not possible in the centrifuge.

If solid particles of different sizes are compared where the smaller particles have half the diameter of the big ones, the surface of the smaller particles will be twice as large as that of the big particles although the volume is the same.

Thousand crystals with a diameter of 0.1 mm have even ten times the surface of one crystal with a diameter of 1 mm.

Due to their large surface, very fine particles will bind particularly much liquid and deteriorate the residual moisture that can be achieved.

If a solid matter is provided in two fractions with significantly differing grain sizes, it may be economical to discharge the very fine particles along with the filtrate and process them in another way so that the coarser solid particles will contain so little residual moisture that they can be stored and possibly even packed as a finished product without need for further dehumidification.

The centrifuge is to discharge the supplied solid matter despite fine-grained constituents without significant screening loss at the lowest possible residual moisture.
To this end, the following conditions should be given if possible:

- highest possible feed concentration
- low rotational speed, tuned to the required residual moisture
- thick layer on the screen element
- small screen apertures
- optimised discharge area of the screen

The higher the feed concentration is, the better will the process efficiency of the screen worm centrifuge normally be because small suspension volumes with high solid content require a minimum of acceleration energy and a maximum discharge rate of solid matter can be achieved.

4.15 Overload protection

The centrifuge will hardly ever suffer overloads during the processes, which usually run continuously with a uniform product flow. Nevertheless, the maximum permitted suspension flow must not be exceeded.
However, faults may occur during restarting after production stops if the machine is jammed due to insufficient rinsing, or due to a feed flow surge.

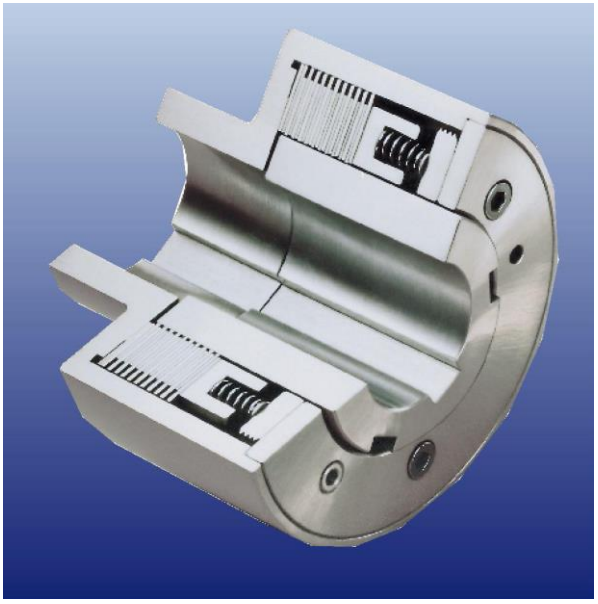
In order to protect the gearbox from such overloads, the machine is equipped with an overload protection mechanism.

Once the machine is at a standstill, the cause of the overload must be investigated and rectified.

4.15.1 Functional description for friction clutch

The clutch consists of an external part, which is seated on an internal part so that in the case of slipping both parts are able to move relative to each other.
Axially adjacent lamellae are present inside the clutch and alternately engage in toothings on the outer part and on the inner part and are pressed against each other by axially acting springs.

When making adjustments the spring force of the clutch (see chapterl ***1 Data sheet)*** is dosed such that the lamellae slide relative to each other only as from a certain threshold torque.



4.15.2 Overload detection by pilot pump

For machines with fixed gear input shaft, a second oil pump is connected here.

If, in the event of overloading, the overload clutch slips, the gear input shaft and thus the second oil pump rotates. The second oil pump returns part of the oil flow to the bearing housing resp. the oil tank via a bypass line.
As a result, the pressure in the oil line, which is detected by the oil pressure switch, decreases, and the signal "overload" is generated.

This signal causes closing of the inlet valve and shutdown of the drive.

To compensate for short-term unfavorable production conditions or faltering product transport, the signal "overload" can be smoothed with a delay of some seconds.

5. Delivery, transport and storage

5.1 Checking the delivery for completeness

Siebtechnik machine supplies are packed individually.

After you have received the delivery, immediately check whether the scope of delivery complies with the shipping documents.

You must report any damage suffered in transit to SIEBTECHNIK without delay. Otherwise any and all claims under the warranty will be forfeited.

Complain about:

- visible transport damage immediately to the supplier
- visible defects / incomplete delivery immediately to Siebtechnik

Check the delivery for any possible transport damage. If any transport damage is found, immediately report it to the transport company or Siebtechnik. Observe Chapter *5 Delivery, transport and storage.)*

If the package is damaged to the point that damage to the goods is to be expected, remove the package in the presence of a representative of the transport company.

Ensure that a commissioning is not provided if due to a possibly existing transport damage, the proper operation of the machine may be endangered.

5.2 Transportation

The following notes will help to transport the machine safely.

When working with SIEBTECHNIK machines and plants, you must observe Chapter 3 *Safety.*

Observe the national and international regulations for lifting loads!

Only use ropes, suspension materials and hoisting gear of adequate load bearing capacity. Always take into account the dead weight of the machine (see Chapter *1 Datasheet*).

Caution: Danger to life and danger of injury from tilting or falling loads! Make sure that nobody is standing under suspended loads or is working there.

Make sure that nobody is standing under suspended loads or is working there.

Observe the icons for storage and transportation according to instructions applied to the package.

Observe attachment points on the machine and, if available, at the packaging.

Commission only experienced personnel with suspending loads and directing crane drivers! The directing person must be positioned within the field of view of the operator or be in voice contact with him.

Lift the machine at the provided attachment points (see installation plan in Chapter *11 Drawings and chapter 5.2.1 Attachment points and transport lock*).
Attachment at other points is not permitted, as this can result in significant damage.

You must ensure that the machine is properly attached and secured so that it cannot lead to any danger.

For transport purposes, remove all process media.

5.2.1 Attachment points and transport lock

Lift the machine at the provided attachment points (see installation plan in Chapter *11 Drawings and chapter 5.2.1 Attachment points and transport lock*).
Attachment at other points is not permitted, as this can result in significant damage.

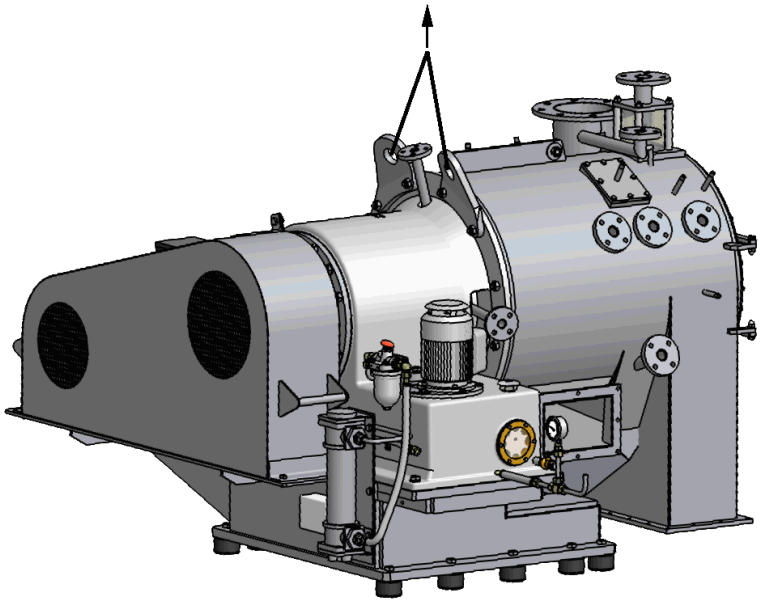
Observe that other eyebolts may be available, e.g. on V-belt protector and product housing, that are only to be suitable for transporting the component.
These assembly eyebolts only serve for mounting or dismantling the component and are only designed to carry the weight of the component. If you suspend the complete machine from these points, damage to the machine will be inevitable.

Use transport locks, if available

Note that possibly available transport locks may only be removed or disabled immediately before the commissioning.
For additional transports, you must use or enable the transport locks again.

5.2.2 Transportation sketch

A special transport lock is not provided for this centrifuge type.



Sketch machine transport

5.3 Transport package

The machine packaging depends on the transport route and the size of the machine. If not contractually agreed otherwise, the packaging complies with the packaging directives according to ISPM (International Standards For Phytosanitary Measures).

If the machine is delivered in a crate, note the instructions regarding a lifting of the machine according to the European standard.

During the disposal of packages, mind the relevant laws, regulations and instructions regarding the disposal measures and routes of disposal applicable to the law of waste disposal.

5.4 Storage

If you do not commission the machine immediately or decommission it for a longer period, you must protect it.
Therefore, always observe our storage recommendations. Improper storage may cause considerable damages.

Siebtechnik accepts no liability for any defects caused by improper storage.

5.4.1 General storage recommendations

- Protect the machine against influence of the weather (moisture, dust, strong temperature fluctuations, corrosive gases) and vibration.
- Never leave the machine outdoors and unprotected.
- If possible, store the machine in dry and clean rooms, isolated against externally generated vibrations.
- Safeguard machines or components to be stored against shifting and falling over.
- Store the machine in the packed state (as far as possible packed airtight in film with added desiccant).
- Checking the delivery for completeness Ensure a sufficient circulation of air by putting spacing wood in-between.
- Regularly replace the absorbent agent.
- Protect plastic parts (e.g. gaskets) against environmental influence (UV radiation) to prevent rapid ageing. Aged parts must be replaced with new ones before commissioning. Experience has shown that the overall service life of plastic parts is limited.
- Use transport or storage locks if available.
- If applicable, relax the drive belts and protect the V-belt pulley disks against corrosion.

Observe the additional care instructions in Chapters 5.4.2 - 5.4.4

5.4.2 Storage after use:

- Clean and dry the machine thoroughly prior to every storage placement. Remove all product residues and caking deposit. Rinse and dry the interior space thoroughly, which is in contact with the product.
- Only pack dry machines and machine components.
- Preserve all bearing points (and if necessary, the gearbox) of the machine with corrosion protection oil (e.g. Aral Resilan M 46).

Observe the storage recommendations specified in Chapter 5.4.1.

5.4.3 Corrosion recommendations

- In case of an extended storage period, use foil to cover or heat-seal the machine as airtight as possible.
- An additional housing may have to be provided for protection against mechanical influence.
- Add a drying agent for dehydration.
- Choose a suitable film material and amount of desiccant according to the length of the storage time. (up to 12 months – PE film; up to 24 months – aluminium coated film)
- Check the corrosion protection annually, replace, if necessary.
- Preserve all bearing points (and if necessary, the gearbox) of the machine with corrosion protection oil (e.g. Aral Resilan M 46).

Observe the storage recommendations specified in Chapter 5.4.1.

Observe the care instructions for your type of machine or design, see Chapter 5.4.4 Care instructions for stored machines!

5.4.4 Care instructions for stored machines

If you store the machine for an extended period or shut it down for a longer period, the bearings may corrode and therefore be destroyed at the contact points under the influence of moisture.

Due to microscopic movements caused by vibration, surface damage is produced at the point-like contact surfaces between rolling elements and running tracks; this can lead to premature bearing failure due to material fatigue.

In order to reduce this risk, you should turn the rotating parts of the machine by hand through approx. ten revolutions at least once per month. This will change the contact points of the bearings and redistribute the lubricant.

In the case of longer storage periods, the grease service life is decreased. In case a storage period exceeds 12 months, check the condition of the grease.

Check the corrosion protection annually, replace, if necessary.

Provide a respective opening in the package to enable a turning of the rotating parts at regular intervals. After turning, close the film again in this region by weld sealing or bonding to prevent ingress of air or moisture.

Rotor sets/gearboxes must be stored in suitable storage blocks such that the drum is locked and the gearbox input shaft can be turned.

Note that the main bearings must not be used as supporting points for interim storage.

5.4.5 Care instructions for attachment components

Pay attention to the storage regulations for the supplied attachment components, e.g. motors, pumps etc. in chapter 13 Supplier documentation.

Non-compliance with these storage instructions can lead to irreparable damage.

5.5 Measures to be taken before recommissioning

If machine parts are stored, including ball bearings or similar, you must flush the bearing points sufficiently with operating lubricants to remove remaining anti-rust oil prior to the commissioning.

Never use anti-rusting oils in operation under load!

During a recommissioning, take note of abnormal noises, vibrations or unusually high operating temperatures.

If irregularities occur, notify SIEBTECHNIK immediately.

Check all plastic parts before commissioning (e.g. gaskets), because environmental influences (UV radiation) can make them age rapidly. Replace aged parts with new ones. Experience has shown that the overall service life of plastic parts is limited.

Check flexible connections (hose lines) for damages and age. Observe the hose line instructions.

5.6 Care and storage of the devices

You have received devices together with the machine that will be urgently needed later on during transport, inspection, maintenance and servicing. Take good care of these devices and keep them near the machine so that they will always be on hand.

5.7 Storing gearbox (as spare part)

In order to protect the gearbox as best possible for **up to 12 months** during the storage period it is necessary to observe the following:

- Protect the gearbox against influence of the weather (moisture, dust, extreme temperature fluctuations, direct sunlight, corrosive gases) and vibration.
- Never leave the gearbox unprotected outdoors.
- If possible, store the gearbox in dry and clean rooms, isolated against externally generated vibrations.
- Secure the gearbox against slips and drops.
- Gearbox must be stored in packed condition.
- Check packaging and preservatives regularly and after 3 months at the latest.
- Protect plastic parts (e.g. seals) against environmental influence (UV radiation) to prevent rapid ageing. Aged parts must be replaced with new ones before commissioning. Experience has shown that the overall service life of plastic parts is limited.
- Use transport or storage locks if available.

Notes on the gearbox type and version can be found in Chapter *1 Datasheet* and/or in Chapter *12 Part list*.

5.7.1 Cycloid gearbox

5.7.1.1 Corrosion protection for fully assembled cycloid gearbox

External surfaces such as uncovered connection seats and/or mounting surfaces are protected with corrosion protection oil, e.g. Castrol product 498/1.

All internal gearbox components are preserved during assembly with Castrol product 492/49-1.

It is recommended to turn the gearbox input shaft a few revolutions every 2-3 months in order to distribute the corrosion protection oil across the contact surfaces of the moving internal gearbox components.

The gearboxes are packed in airtight film. To turn the gearbox input shaft, the packaging is to be opened briefly and afterwards resealed or welded in airtight condition.

Check all plastic parts before commissioning (e.g. seals) because environmental influences (UV radiation) can make them age rapidly. Replace aged parts with new ones. Experience has shown that the overall service life of plastic parts is limited.

Avoid damage to the sealing lips of the shaft sealing rings by applying potential bondings on the running fit; to do this, manually turn the gearbox input shaft several times before commissioning.

Component parts are preserved with corrosion protection oil Castrol product 498/1 and packed with oil paper in airtight film pouches.

Avoid blending corrosion protection oils to prevent the risk of premature ageing and/or deterioration of the protection properties.

5.7.1.2 Long-term storage of cycloid gearboxes (> 12 months)

Note that the storage period begins with the delivery of the gearbox from the manufacturer.

During a storage period of 12 – 36 months, the gearbox input shaft is to be additionally turned once a year by a quarter of the gear ratio and at the same time rinse the gearbox with corrosion protection oil.

Check the corrosion protection measures after a 12 month storage period.
If a lack of corrosion protection agent is determined, all of the corrosion protection must be removed, surfaces treated with an appropriate solvent and newly preserved with Castrol Product 498/1.

After a storage period of 36 months, the gearbox must undergo a manufacturer's audit.

6. Mounting and Installation

The work described here gives an overview of which measures you, as the owner of a centrifuge, must carry out in order to be able to mount and install the machine in a perfect manner and in one continuous operation.

Please also observe the supplier's regulations (see chapter *13 Sub-Supplier documentation*).
You must comply with the regulations contained in the chapter *9 Electrics* for the electrical control systems and connections.
We recommend that you arrange for the final check of the centrifuge installation to be carried out by a SIEBTECHNIK specialist.

In addition to using the correct tools and equipment, the selection of suitable personnel is also a decisive factor in ensuring that assembly work is carried out correctly and is not interrupted. Only qualified and trained personnel may carry out work on the centrifuge.

6.1 Erection and required space

Check the intended site for the centrifuge carefully with regard to its suitability for the set-up and operation of the centrifuge with its auxiliary installations:

- Load capacity of the ground
- Impairments of adjacent components e.g. through vibrations caused by the centrifuge or with regard to the electromagnetic compatibility (EMC).
- Interference with the centrifuge originating from adjacent plant sections (e.g. vibrations, EMC)
- Environmental conditions

For information about the centrifuge or dynamic loads during operation, refer to the installation plan in chapter ***11 Drawings and 1 Data sheet***.

Please note that you need a certain amount of free space for maintenance work on the centrifuge.

Free space is needed for:

- The assembly or disassembly of rotating parts
- The assembly or disassembly of the drive motor
- Centrate- / Filtrate discharge and its associated ventilation
- Work on the drive side
- Assembly or disassembly of the hydraulic unit
- Lifting components

The amount of free space required for the assembly or disassembly of components can be taken from the installation plan, which is to be found in the chapter Drawings.

Please consider in your planning that a hoisting gear may be required for the assembly and disassembly of centrifuge components. Information for component weights see chapter *1 data sheet.*

6.2 Substructure

Detailed information and instructions for the design of the substructure are not a subject of these operating instructions. The execution and planning depend on the conditions on site and the requirements (e.g. with regard to building execution and statics) resulting from the planned installations as well as the technical construction and statutory building requirements.

Please consult the installation plan (see the chapter ***11. Drawings***) and the ***1. data sheet*** for the load specifications. This description assumes that the substructure for accommodating the centrifuge has already been constructed in compliance with the provided installation plan and that the stipulated construction plans for creating the substructure are available.

For the dimensioning of the substructure and the directly and indirectly connected platform structures, a static calculation only is insufficient. The permissible vibration amplitudes can be selected according to the DIN 4150 preliminary standard. An insufficiently dimensioned substructure can lead to damage. SIEBTECHNIK does not assume any warranty for these damages. The risk is borne solely by the operator.

6.3 Set-up of the centrifuge

For information on the dimensions of the centrifuge, the position of the support points or dynamic loads during operation, please refer to the installation plan in chapter ***11. Drawings***.

Please note that the following preparations must be made before mounting the centrifuge:

- Connections for the power supply of the motors (see circuit plans)
- Connections for the supply with materials and utilities (e.g. rinsing and washing solutions)

6.4 Assembly at the installation site

Take all necessary occupational safety precautions prior to the start of work.

During all work, it is essential to comply with the instructions in Chapter *3 Safety* and in Chapter *8.1 safety information and rules of conduct for assembly work*. Siebtechnik provides no warranty for damage incurred through failure to comply with the stipulated safety instructions. The risk is borne solely by the user.

6.4.1 Transport of the centrifuge

Transport the centrifuge to the erection place, thereby complying with all precautionary and safety measures in *Chapter 5 Transport and Storage.*

Lift the centrifuge only at the attachment points provided for this purpose! Observe the information in the installation plan in *Chapter 11 "Drawings"* and the transport provisions in Chapter *5.2 "Transport".*

6.4.2 Vibrating elements

To reduce vibration and noise transmission to the environment, the centrifuge must be set up on vibrating elements. For the type, number and position of the vibrating elements please refer to the installation plan in Chapter ***11 "Drawings"***.

Depending on the design of the centrifuge, the vibrating elements are manufactured as rubber buffers or spring elements.

Use only the vibrating elements and mounting parts included in the delivery. Vibration mounting elements from other sources could under some circumstances modify the constructional properties of the plant and lead to considerable defects for which SIEBTECHNIK cannot accept any responsibility.

Mounting parts for the connection between the vibrating elements and the substructure are not included in the scope of delivery since they depend on the envisaged design of the substructure.

To install the centrifuge on spring elements, execute the following work steps:

- Provide the required mounting parts for the connection of the vibrating elements and the substructure.
- Mount the vibrating elements on the substructure. For the arrangement and dimensions, please refer to the installation plan of the centrifuge and the construction plans of the substructure.
  - The correct positions of the individual spring elements are indicated by markings.
- Lift the centrifuge with a crane and align the centrifuge such that it can be placed on the intended contact points of the vibrating elements. Pay attention to aligning the drill holes for the fastening screws!
- After the centrifuge has been correctly placed, bolt together the vibrating elements and the centrifuge with the supplied mounting parts.

Pay attention to ensure that the centrifuge is properly attached and secured such that it cannot pose any hazard.

- Earth the centrifuge.

Earthing operations may only be carried out by an electrician.

The vibrating elements are assembled correctly if they are able to oscillate freely horizontally and vertically.
Check the position and alignment of the centrifuge. The deviation in height, measured at the four corner points, must not exceed 5 mm.

6.5 Connecting the centrifuge

Detailed information and instructions regarding the scope and execution of these assembly works is not subject of these operating instructions. Proceed according to the instructions, drawings and plans which have been drawn up for the plant.

The following connecting lines must be installed including the appropriate shut-off and regulating valves as well as the display and control elements:

- Make sure that the product supply, filtrate/centrate discharge and solid matter discharge are not effected by means of firmly connected pipelines but are flexible via compensators, rubber aprons, flat rubber pieces or the like.
- Take care that the supplied oil-resistant rubber hose is used to connect pipelines, pressure gauge and pressure monitor. The configuration of the oil circuit monitoring can be found in chapter 11.2.1 List of motors and instruments. Prior to the final connection, the pipelines must be deaerated!
- Connections (optional):
  - Washing devices
  - Rinse water
  - Labyrinth
  - Shaft feedthrough/sealing
- Connections for oil cooler
- For further connecting tasks, e.g. for external oil cooler, bearing monitoring, etc., see the Chapter ***13, Suppliers documentation***.

Make sure that the centrate and/or filtrate discharge is sufficiently deaerated.

Ventilation should be provided directly at the filtrate/centrate outlets or the solid matter space.

- A cyclone may be required with air recirculation from the filtrate/centrate discharge into the solid matter space.

For specifications of the appearance and location of the connections as well as the dimensions and installation of the connecting lines, please consult the Chapter ***11 Drawings*** in the installation plan and the drawings and plans for the plant.

Some special aspects require attention when planning and carrying out the assembling and connecting work:

The material of the connection lines must be resistant against:

- the occurring temperatures.
- the occurring pressures.
- the respective media to be transported.

The centrifuge oscillates in its elastic bearing, therefore all connections must be flexible and provide adequate play for movement (vertical and horizontal 30 mm each).
With rigid connections of the lines to the centrifuge these oscillations would be transferred to these lines, entailing a danger of breakage and impairing the effectiveness of the vibration isolation.

6.6 Supply of the feed material

The product is fed into the centrifuge through an inlet pipe of a filling worm and openings at the small diameter of the worm body. The largest liquid fraction is flung off at the small diameter. The worm transports the solid matter from the small to the large diameter of the drum where the dehumidification - and product rinsing if required - takes place.
The various fluid streams from the main dehumidification and rinsing zone can be drained away individually or together via single or double cyclones.
With adequately large cross sections the fluid can also be drained away directly.
There is a relatively small loss of solid matter which can be further minimised by returning the screening filtrate to the feed. The worm flings off the dehumidified solid matter over the edge of the drum directly into the product housing or specifically into a collecting chute.

The centrifuge is relatively insensitive to small fluctuations of fill-in. However, optimum power, optimum process technology results and maintenance-free continuous operation can be achieved only if the feed flow is constant in terms of suspension quantity and properties (grain structure, solid/liquid ratio, temperature, viscosity etc.).

Mount the feed devices and the connections for the supply of the feed material. To avoid clogging, the control elements like valves and slides must be set so that they are at least "half" open during operation. Please consult the chapter 11. ***Drawings*** of the installation plan for the connecting dimensions of the centrifuge.

Later, the suspension pipeline must respond with a rapid shutoff by means of a suitable shutoff device if the centrifuge has to process a fault condition signal during operation.

If a filling worm is used as a feeding device, it must be supported by suitable lifting devices until it is finally fixed.

6.7 Solids discharge

If the centrifuged solid matter is desired to drop in hoppers, the centrifuge can be erected directly above the hopper; otherwise, a discharge funnel must be installed below the centrifuge that directs the solid matter onto a belt conveyor or similar for removal.

Assemble the connections for the solid matter outlet line according to the installation plan.

The discharge funnel should **not**, as far as possible, be connected rigidly to the solid matter shaft of the centrifuge, but instead with the help of compensators, because this additional weight could affect the static and dynamic forces of the centrifuge. For information about static or dynamic forces, please refer to the datasheet and the ***installation plan*** in Chapter ***11 Drawings!***

If it is not possible to avoid a rigid connection, the weight of the discharge funnel should not exceed 3% of the static weight of the centrifuge!

The installation for passing on the centrifuged solid matter must be arranged in such a way that no congestion can occur.

To prevent the caking deposit from congestion or solid matter jams, the discharge funnel's angle of slope in the transition region between solid matter discharge and the centrifuge to the discharge flange must be adapted to the repose angle of the solid matter!

If solid matters tend to form incrustations, it is recommended to fasten the discharge funnel so that it can be removed easily for purposes of cleaning, or to install suitable cleaning apertures.

The discharge funnel may also be equipped with a suitable bagging appliance if the solid matter is to be packaged directly downstream of the centrifuge.

If the solid matter subsequently needs to be thermally dried, an intermediate bunker is not necessary when continuously operating dryers are used, e.g. also when drying is performed in a stream of warm air, since the solid matter is discharged then from the centrifuge in a fully continuous process.

When conveying the centrifuged solid matter away with a conveyor belt or similar device, it is advisable to provide electric interlocking of the conveyor belt or similar device with the drive and main motor of the centrifuge and the filling feeder such that the entire plant is switched-off in the case of failure of one plant component.

Provide good ventilation of the product housing.

Make sure that the solids discharge provides a sufficient free motion (2-3 cm at least) and is not fastened rigidly to the housing.

You must ensure that the separated solid matter quantity will be discharged reliably and that no reverse congestion will occur.

6.8 Liquid drainage and ventilation

Assemble the connections for the liquid discharge according to the installation plan.

Piping for liquid drainage should ***not***, as far as possible, be connected rigidly to the centrifuge housing, but instead with the help of compensators, because this additional weight could affect the static and dynamic forces of the machine. For information about static or dynamic forces, please refer to the datasheet in ***Chapter 1*** and the ***installation plan*** in Chapter ***11 "Drawings"!***

If it is not possible to avoid a rigid connection, the weight of the discharge funnel should not exceed 3% of the static weight of the centrifuge!

Provide good ventilation of the product housing.

Ventilation should be provided directly at the filtrate/centrate outlets or the solid matter space.

- A cyclone may be required with air recirculation from the filtrate/centrate discharge into the solid matter space.

Ensure that the separated liquid flow will be discharged reliably and that no reverse congestion will occur.

6.9 Washing and rinsing

The housing of the centrifuge is provided with washing and rinsing devices. Their design may vary depending on the application.

- Mount the flexible feed lines with their shutoff and regulating valves according to the installation plan and the additional instructions, drawings and plans.

For information about throughputs, necessary operating pressures, appearance and position of the connections as well as the dimensions and installation of the connecting lines, please refer to the installation plan in Chapter *11 "Drawings"* and the drawings and plans of the plant.

The liquids must be free from suspended and solid matter and chosen to be compatible with the production process and the materials of the centrifuge.

The lines and connections must be designed for the intended volume flows and operating pressures!

6.9.1 Shaft feedthrough/sealing

It is essential to prevent any contamination when installing the feed lines for pipes, measuring and control elements.

6.9.2 Preliminary drainage gutter (optional)

Optionally, a static preliminary drainage facility can be installed in order not to unnecessarily load the capacity of the centrifuge with excessive quantities water.

Install the preliminary drainage gutter according to the separate installation plan and the assembly drawing.

6.10 Electrical connections

In this section it is assumed that the centrifuge control system has already been installed and the electrical connections to the centrifuge now have to be made.

Caution: Danger of electrocution! All electrical connections may be made only by an electrician.
SIEBTECHNIK accepts no liability for any damage resulting from failure to comply with the regulations or rules of conduct.

For the equipment of your centrifuge please refer to the parts list and ADI list.

Integrate the centrifuge into your system control. Please refer to chapter ***11.2 ADI documentation.***

The following components must be electrically connected:

- Centrifuge motor(s)
- Additional units for suspension, solid matter and centrate / filtrate
- Pressure monitor according to chapter ***11.2 ADI-Documentation***
- Door locking system (if provided)
- Other monitoring devices according to chapter ***11.2 ADI-Documentation***

Please refer tot he Chapter 9 Electrical system for more details.

6.11 Lubricating oil

The centrifuge is delivered with the hydraulic system completely installed.

- Mount the connections for the cooling water inlet and outlet pipes according to the installation plan in Chapter ***11 "Drawings"***.
- Integrate the lubricating oil monitoring into your system control. Observe chapter **11.2 ADI-documentation** and chapter **9.3 Monitoring of the lubricating oil supply**
- Fill the oil tank as specified in the Chapter ***8.6 "Lubrication"***. For the quantity and quality of the oil, please refer to the ***datasheet*** in Chapter 1***.***

6.12 Assembly of motors and V-belts

SIEBTECHNIK supplies the centrifuges complete with motors. For details regarding the supplied motors, please refer to Chapter ***1 "Datasheet"*** and Chapter ***13 "Supplier documentation"***.

On request by the customer the centrifuge can also be delivered without the motors. Agree the motor data with SIEBTECHNIK prior to procurement. You find necessary data for the selection of the drives in Chapter ***1 "Datasheet"***.

The drive motors must comply with the technical data of the datasheet and must be designed as three-phase squirrel cage motors.

On account of the large moment of inertia of the rotating parts, a thermally delayed overcurrent relay for heavy starting must be provided for the rotor motor.

Design the connection cables with a length which makes it possible to place the dismantled motor next to the centrifuge without disconnecting the connection cables.

Install the motors as described in Chapter ***8.8 "V-belt".***

6.12.1 Assembly of V-belt pulleys and V-belts.

Install the V-belt pulleys and V-belts as described in Chapter ***8.8 "V-belt".***

Please note that there is a high risk of crushing when working on V-belts and their associated pulleys. Therefore secure the rotor against turning as appropriate.

6.12.2 Final assembly and check of rotational direction

- Tighten up the motors and their mounting plates.
- Establish the electrical connection of the motors according to Chapter ***9 "Electrical system"***.

Upon completion of the work, install the protective hoods for the drive.

Check the rotational direction of the motors and observe the switching sequence of the motors according to Chapter *7.4.1 "Switching on the centrifuge for the test run"*

- For checking the rotational direction, let the respective motor run for a short while.
  - Check that the direction of rotation is correct.
  - If the rotational direction is wrong: Correct it and check again.

Pay attention to the rotational direction arrows on the centrifuge to ensure the correct rotational direction.

Choose the rotational direction of the oil pump motor such that the motor rotates clockwise when viewed from the blower side.
Make sure that the oil pressure is built up when the motor is switched on.

7. Commissioning

This chapter describes the procedure for commissioning and the recommissioning of the centrifuge.

The goal of an initial commissioning procedure is to get the centrifuge ready for operation after assembly. Also after dismantling or after major modernisation or repairs, the procedure is the same as during the initial commissioning.

Commissioning of the centrifuge is the responsibility of specialist personnel! Commissioning or recommissioning after major modifications of the centrifuge must be officially accepted by an expert. Should you have questions please contact SIEBTECHNIK or the approved technical supervisory organisation.

In this chapter it is assumed that the centrifuge has been mounted, installed and electrically interlocked in accordance with regulations. Knowledge of the control system of the centrifuge and its switching behaviour is required for carrying out the commissioning procedure.

The following checks and adjustment work must be carried out before the initial commissioning, and also after all major maintenance operations and repairs and after every lengthy standstill. All faults determined in the course of this work must be remedied (see Chapter 10 *Trouble shooting*).

Carry out all required workplace safety measures before commencing the commissioning procedure and instruct your operating and maintenance personnel to document the checks.

Always perform a trial operation during a commissioning. This trial operation is first carried out without load and then under production conditions.

The procedure for making the centrifuge ready for operation also includes execution and proper documentation of all statutory stipulated tests and checks.

During all work, it is essential to comply with the instructions in Chapter *3 Safety* and in Chapter *8.3 Safety information and rules of conduct for assembly work*.
Siebtechnik provides no warranty for damage incurred through failure to comply with the stipulated safety instructions. The risk is borne solely by the user.

In the case of EMERGENCY shutdown of the centrifuge, the centrifuge rotor requires up to 60 minutes to come to a standstill, depending on the frame size and loaded condition.
For specifying the run-down time of the centrifuge, you can use the warm run-down time of the machine specified during the factory acceptance test (see chapter *14 Final quality inspection*).
When the machine is locked automatically, at least the 1.5-fold time and the specification in the logic diagram (see chapter 11 *Drawings*) must be observed.

7.1 Measures during a shutdown of the centrifuge

Inform the plant management of the intended measures. If the centrifuge is part of a larger plant, inform the personnel on the control stand of the plant of the intended measures to be taken.

Switch on the plant only if a corresponding instruction is given in the text. Secure the switches to prevent unintended switch-on, e.g. as key-operated switch or with covers which can be locked.

Note that the oil supply system must be filled before commissioning of the centrifuge. All required specifications on the scope of the work to be carried out as well as quantity and quality of the hydraulic oils can be found in chapter *8.6* Lubrication.

7.2 Checks prior to commissioning

Carry out all the checks quoted in the following check list before the centrifuge is put into operation.

Inform yourself of the location, appearance and function of the operator control and indicator elements for the plant as well as the control system and its switching behaviour.

- Find out where the switch for emergency shutdown is located and ensure that this switch is always freely accessible!
- Check that all tools, auxiliary equipment or any other foreign bodies have been removed from the centrifuge.
- Check that all transport locks have been removed.
- Check that all bolts and screws have been tightened up.
- Check that the V-belts have been tensioned correctly. See chapter **6. *Erection and installation***.
- Check the oil level in the inspection glass at the bearing housing (filling level up to the half of the inspection glass)
- Fill the hydraulic pump of a pusher centrifuge from size Ø530 with oil (see chapter 8.12.7 Filling the hydraulic pump with oil).

- Check that all protective fittings and devices are available and in proper working order.

Caution: All protective devices and fittings serve for your personal protection and therefore should never be rendered inoperative. SIEBTECHNIK is not liable for any injuries of persons or damage of equipment resulting therefrom. The corresponding risk is carried solely by the owner.

- Check that all measuring, checking, regulating and interlocking instruments are connected and in good working order.
- Check that all feed and drain lines are flexible, secure and have been connected in accordance with the regulations.
- Check that the filtrate line is free and that no plugs discs or other devices have been forgotten.
- Check that the facility for feeding the process material and for removing the solid matter of the filtrate and that the rinsing and washing device are firmly seated and not damaged.
- Check that the external connections and lines of the rinsing and washing devices are properly connected, firmly seated and not damaged. Depending on the type and on the composition of the fluid, uncontrolled chemical reactions could impair production, the work environment or the general environment.
- Check that the stipulated rinsing fluid is available. The rinsing fluid must be free from suspended and solid matter and chosen to be compatible with the production process and the materials of the centrifuge. Observe the specifications for the intended use of the centrifuge.
- Check that the electrical connections are properly established and that the lines are connected correctly, firmly seated and not damaged.
- Check the external connections and lines of the chamber packing for firm fit and damage.
- Check that the centrifuged solid matter can exit the centrifuge in a reliable manner and that any solid matter transportation facilities which may be included are effectively integrated into the centrifuge interlocking system.
- For gastight centrifuges with inertised process system, check that adequate inert gas is being fed in.
- Check the fastening and fit of the electrical drives and their connections. If the drives were delivered by SIEBTECHNIK, a simple check is required whether parts have loosened or shifted during transportation or installation.
- Check that the direction of rotation of the drive motor corresponds with the direction of revolution of the centrifuge (see chapter ***6***. ***Erection and installation).***
- Check that after switching on the oil pump motor the lubricating oil pressure rises to 0.5-0.6 bar (this does not apply to pusher and sliding centrifuges).

- Check the level of the hydraulic oil **before** switching on the power supply (SHS only).
  - An oil level up to the upper edge of the inspection glass is required.
- Check that the centrifuge starts only when the oil pressure has already risen to 0.5 bar, and that the centrifuge drive switches off as soon as the oil pressure drops below 0.4 bar (this does not apply to pusher and sliding centrifuges).
- Check that the cut-out device for the suspension feed closes quickly as soon as a warning signal is issued by the centrifuge.
- Check that the main motor(s) is/are switched off as soon as a switch-off signal comes from the centrifuge.

Get all damage and defects possibly found remedied immediately by specialist personnel. Such damage and defects can constitute a danger for body and life of the operator or other persons and can impair the machine and other equipment. The operating authority (owner) is solely responsible for any injuries of persons and damage to equipment resulting herefrom.

7.3 Check of the running characteristics

The following checks and adjustments must be made inside the centrifuge. They must be carried out before the first commissioning as well as after every major maintenance overhaul and repair and every lengthy shutdown period.

The centrifuge gives rise to dangers against which the personnel, the plant and the centrifuge must be protected.

Make sure that

- the plant is switched off and secured to prevent unexpected switch-on (e.g. with a key-operated switch or covering which can be locked),
- all inlets for washing and rinsing fluids as well as the material to be processed must be blocked or shut off,
- all measures for workplace safety have been complied with (see chapter **3** ***Safety***).
- Open the front cover of the product housing and check the interior of the centrifuge drums and screen elements. Thereby make sure that the screening elements are correctly attached! When recommissioning, it is additionally necessary to check for wear (abrasion).
- Remove foreign objects and contamination inside the centrifuge. Clean the screening elements.

Make sure that the centrifuge is freely movable on the rubber buffers of the base frame.

Sufficient lubrication is required to check that the centrifuge rotor runs smoothly.

Switch on the oil pump according to chapter ***7.4.1 Switching on the centrifuge for the test run.*** First let the oil pump run for 10 minutes. Then check whether the centrifuge rotor can be turned by hand (running clearance).

Take appropriate measures to ensure that nobody can be injured by the rotating rotor.

Please note that the required starting torque is rather high, because the entire rotor is turned as well as the drive. The drum must be turnable and run freely after overcoming the initial resistance! If the centrifuge drum does not turn freely, the cause must be eliminated before switching on the machine. Possibly foreign objects or residues are the cause.

- Check the position and fastening of all internal fittings (like washing and rinsing devices, screens and filters, material supply and material discharge, etc.)
- Check the position of all internal fittings also with a freely turning centrifuge rotor.

Thereby particular attention is required to check the condition and attachment of the rotating parts. The large dynamic forces, when acting on inadequately attached parts, can cause considerable damage and danger for body and life of the operator and other persons as well as impairing the machine and other equipment.

- Lock the front cover of the product housing according to the instructions.

Get all damage and defects possibly found remedied immediately by specialist personnel. Such damage and defects can constitute a danger for body and life of the operator or other persons and can impair the machine and other equipment. The operating authority (owner) is solely responsible for any injuries of persons and damage to equipment resulting herefrom.

7.4 Test run without product

Before the initial commissioning and any subsequent recommissioning after maintenance or repair work, the centrifuge must be checked out in a test run. The trial operation serves to check for operational readiness of the plant for operation and for production optimisation. A trial operation may only be performed under the responsibility and control of specialist personnel!
The checks prescribed in the section ***7.2 Checks prior to commissioning*** must be carried out before each test run. After initial commissioning all of the centrifuge functions should be inspected at short regular intervals.

Trial operation must first of all be carried out in the unloaded running state of the centrifuge and serves to check the readiness for operation of the

plant and for optimising the production result. Therefore turn off all material supplies.

Should your process system produce explosive gases or vapours, then the system must also be inertised for the test run.

7.4.1 Switching on the centrifuge for the test run

Check the filling level and the temperature of the lubricating oil before switching on the centrifuge. A minimum temperature of 10°C is required in the oil tank, otherwise special antifreezing oil must be used. Alternatively, or additionally, the oil should be heated. This can be achieved by operating the oil cooler with hot water.

Observe the information in the logic diagram (chapter 11.2 Drawings and lists)

When the electrical interlocking of the centrifuge and its peripheral units has been properly installed, the centrifuge can only be switched on with the following switching sequence:

- Switch on the plant control and the power supply for the drive motor.
- Switch on the removal units for the solid matter and the filtrate
- Switch on the centrifuge motors according to the sequence given in the table ***Switching sequence for switching centrifuge motors***.

Switching on the centrifuge **Switching sequence when switching centrifuge motors:**			
	Oil pump (only lubrication)	**Drum drive**	**Solid matter transport, that is eccentric shaft drive, translatory motion, vibration**
Decanting centrifuge, screen worm centrifuge, with single drive	**1**	**2**	**-**
Decanting centrifuge, screen worm centrifuge with 2 motor drive and leading worm	**1**	**2**	**3**
Decanting centrifuge, screen worm centrifuge with 2 motor drive and lagging worm	**1**	**2** (short backward feed)	**3** (short backward feed)
Turbo-Cascade	**-**	**1**	**-**
Vibrating centrifuge	**1**	**2**	**3**
Pusher centrifuge	**-**	**2**	**1** (+ ext. cooling)

Switching off the centrifuge **Switching sequence when switching centrifuge motors:**			
	Oil pump (only lubrication)	**drum drive**	**Solid matter transport, that is eccentric shaft drive, translatory motion, vibration**
Decanting centrifuge, screen worm centrifuge, with single drive	**2**	**1**	**-**
Decanting centrifuge, screen worm centrifuge with 2 motor drive and leading worm	**3**	**1**	**2**
Decanting centrifuge, screen worm centrifuge with 2 motor drive and lagging worm	**3**	**2** (short backward feed)	**1** (short backward feed)
Turbo-Cascade	**-**	**1**	**-**
Vibrating centrifuge	**3**	**2**	**1**
Pusher centrifuge	**-**	**1**	**2** (+ ext. cooling)

According to the circuit plan, the motor for the lubricating oil pump must be operated first. As soon as an oil return flow is present at the inspection glass and the oil pressure is at least 0.4 bar, the motor for the drum drive and subsequently the motor for the solid matter transport can be switched on.

When the motor for driving the drum is properly interlocked, it can only be switched on when the electric pressure monitor reports sufficient oil pressure (except SHS) and indicates operational readiness. The start-up time of the centrifuge can be from 5 to 55 seconds, when switched on directly, and depends on the size of the equipment, the operating speed and the installed motor rating.

The start-up time is considerably longer when using a frequency control facility.

As the centrifuge must be checked when idling, the suspension line must not be opened.

Check the direction of rotation of the hydraulic motor (for pusher centrifuges only):

Switch on the centrifuge and check if the pressure rises in the hydraulic system of the centrifuge.

If the pressure does not rise immediately, the direction of rotation of the hydraulic pump drive motor is not as specified. In this case switch off the centrifuge immediately! Get the fault rectified by a specialised electrician.

The hydraulic system of the centrifuge is equipped with a safety valve (pressure limiting valve) which has been adjusted in the factory. Do not make any unauthorised changes of this setting. The operating pressure of the hydraulic system adjusts automatically.

The translatory motion of the centrifuge drum starts after a brief delay. This is performed automatically both for the mechanical and for the electronic control system.

If the stroke stops in one of the end positions when switching on the electronic control system, swap the two proximity switches.

7.5 Checks during the test run

- **Pay attention to noises!** If any grinding, knocking or impact noises can be heard, the centrifuge must be shut down immediately and the cause must be remedied (see chapter ***10 Trouble shooting*****).**

If noises occur as a result of the centrifugal motion, product conveyor or translatory motion, switch off the centrifuge and, complying with all safety precautions, check the interior of the centrifuge for traces of abrasion or wear.

- Check the areas of the hydraulic system accessible to you for leakage (pressure lines at pusher centrifuges or lubricating oil lines at other machines).

Leaks in the hydraulic system / lubricating oil system might cause operational disturbances! Therefore operation of the centrifuge must not be commenced until the causes have been remedied!
Remove immediately the leaked oil (if necessary bind it with suitable materials) and dispose of it properly. Avoid skin contact with the oil! Notify the supervisory personnel or the plant management.

- Check the oil temperature throughout the trial run.
- If necessary, switch on the cooling of the oil circuit.

Note the specified limit values for the oil temperature in Chapter 8.6.5 *Lubrication!*

- Check the connections and the cooling circuit for the oil for leaks.

Leakage within the cooling system can impair the function of the hydraulic system and thus cause operational disturbance!
The centrifuge must not be operated until the leaks have been remedied!

7.5.1 Checking the centrifuge rotor

In the case of suddenly occurring unbalance or running noises, switch the centrifuge off immediately! Do not operate the centrifuge again until the causes have been determined and remedied!

- Check the direction of rotation of the centrifuge drums. The correct rotation direction of the centrifuge is marked with an arrow on the bearing housing. Switch on the rotor drive motor briefly for checking.
- If the direction of rotation is not as specified, switch off the drive motor of the rotor immediately!
- Get the fault rectified by a specialised electrician.

- Check the running characteristics of the centrifuge rotor and thereby pay particular attention to check whether the maximum permitted rotational speed (see chapter ***1 Datasheet*** and ***Limit values***) and vibration velocity are exceeded. If a higher vibration level occurs during the test run, the cause must be eliminated (see chapter ***10 Trouble shooting***).

7.5.2 Vibration

7.5.2.1 Vibration limit values

The following vibration limit values apply for **SIEBTECHNIK machines**:
(the effective vibration velocity is measured here)

Preliminary alarm:	$v_{rms\ Alarm}$	=	12 mm/s or
	$v_{rms\ Alarm}$	=	15 mm/s (applicable for pusher centrifuges only)
Switchoff:	$v_{rms\ max}$	=	18 mm/s

A factory-mounted vibration monitor (optional) is set to the values specified above.

If the limit value of $v_{rms\ Alarm}$ is permanently exceeded, the product supply must be switched off and the machine must be rinsed thoroughly.

If, after cleaning, the vibration level does not significantly fall below the permitted limit value of $v_{rms\ Alarm}$ specified above, the machine must be switched off and an inspection must be performed to determine the cause.

A timer for delayed switch-on of the vibration monitoring can be provided to make unproblematic start-up of the machine possible.

Make sure that the maximum permitted vibration velocity $v_{rms\ Alarm}$ is not exceeded.

7.5.2.2 Effective vibration velocity

According to the type of centrifuge, the size of the machine and its rotational speed, the effective vibration velocity (sum of the vibration) of a clean, intact centrifuge amounts to 1-5 mm/s **when running idle**.

If a higher vibration level occurs during the test run, the cause must be eliminated (see chapter ***10 Trouble shooting***).

Vibrating screen centrifuges, in which axial vibration is deliberately produced for the transportation of solid matter, are an exception to this rule.

According to deployment conditions, the effective vibration velocity during production is 1-12 mm/s (expect for vibrating centrifuges) and 1-15 mm/s for pusher centrifuges.

In the case of suddenly occurring unbalance or running noises, switch the centrifuge off immediately! Do not operate the centrifuge again until the causes have been determined and remedied!

7.5.3 Oil temperature

Observe the temperature development during the test run. Depending on the rotational speed, type of seal and environmental influences, the centrifuge reaches a consistently steady temperature after about three to four hours running time. The **Final Check report** (chapter 14.3) gives you a reference value for the amount by which the steady state temperature in the test run exceeds the ambient temperature.

If the centrifuge is not equipped with an automatic monitoring device for the temperature of the oil, check the temperature of the oil at regular intervals according to the operating conditions.

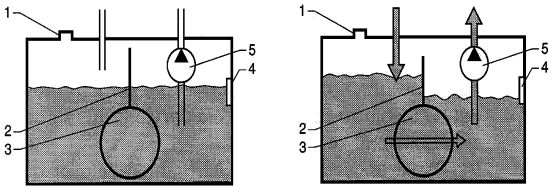
Note the specified limit values for the oil temperature in Chapter 8.6.5 *Lubrication!*

7.5.4 Hydraulic system (pusher centrifuge only)

Check the level of the oil.

If leaks of the hydraulic system can be ruled out, a gradual reduction of the liquid level display of the hydraulic oil during operation does not constitute a malfunction. This reduction is conditioned by the construction (see the sketch).

1. Ventilation
2. Separating wall
3. Oil cooler
4. Oil level indicator
5. Hydraulic pump



When the centrifuge is switched off, the original liquid level indication must reappear after a brief period of time. Otherwise a fault exists which needs to be rectified.

Check for leaks in all accessible sections of the hydraulic system and of the cooling system.

Leakage within the cooling system can impair the function of the hydraulic system and thus cause operational disturbance! Therefore the centrifuge may not be operated in this state!

Remove the escaped hydraulic oil (if necessary bind it with suitable materials) and dispose of it properly. Avoid skin contact with the hydraulic oil! Notify the supervisory personnel or the plant management.

7.5.5 Leakage (oil, liquids, gas)

Check all connections and circuits to make sure that they are not leaking. If leakage occurs it must be eliminated.

Leaks might cause operational disturbances! Therefore operation of the centrifuge must not be commenced until the causes have been remedied! Immediately remove the escaped liquids (if necessary bind it with suitable materials) and dispose of these properly.

7.5.6 Oil pressure

The operating pressure in the hydraulic system is limited by the safety valve which has been preset in the factory. Do not make any unauthorised changes here. The corresponding pressure sets itself automatically. For information concerning checking of the oil pressure, please consult the Chapter ***8.6.2 Operation, maintenance and servicing; lubrication; oil pressure.*** This does not apply to centrifuges with an oil immersion bath system.

7.5.7 Oil condition

If the oil visible through the inspection glass is discoloured or foaming, then an oil change must be carried out.

7.5.8 Switching off the centrifuge after the test run

Because the suspension feed remains closed for the test run, the otherwise important first step of shutting it off does not apply here.
The centrifuge motor must be switched off according to the sequence given in the table Switching sequence for centrifuge motor.

Observe the information in the logic diagram (chapter 11.2 Drawings and lists)

7.5.9 Running down the centrifuge

While the centrifuge is running down and the rotational speed is decreasing, particular attention must be paid to the following aspects.

Noises as a symptom of possible faults stand out particularly clearly at low rotational speeds and at low noise level.

When running out, each centrifuge passes through the range of its natural frequency, which depends, among other things, on the size and design of the centrifuge. This produces a pronounced movement of the centrifuge in the vertical and horizontal planes for a short period. Checks must be made whether sufficient free space is available for this movement.

Never switch on again directly after having switched off, because the main drive motor (which is still hot) can be damaged by the high starting loads (risk of burning out the insulation). SIEBTECHNIK accepts no liability for resulting damage. The corresponding risk is carried solely by the owner.

7.5.10 When the centrifuge has come to a standstill

Observe the information in the logic diagram (chapter 11.2 Drawings and lists)

If your centrifuge is equipped with a circulating oil lubrication, switch off the oil pump motor as soon as the centrifuge has come to a standstill and the respective time lag relay has elapsed.

Turn off the drain units for the solid matter and the filtrate.

Finally check that the entire installation consisting of the centrifuge and its peripheral units is functioning properly and is interlocked.

We recommend that you carefully record and document all test runs and their results.

If all specified operating parameters are constantly complied with over a lengthy period of time, the trial run can be performed under production conditions.

7.6 Commissioning with product

The following prerequisites must be fulfilled before charging the centrifuge with feed material:

- Checks prior to commissioning
- Test run without product
- Check of the fill level and temperature of the hydraulic oil
- The centrifuge rotor has been running for at least 10 minutes to achieve an adequate rotational speed for a smooth distribution of the feed material.

The centrifuge is therewith ready for commissioning with product, thereby complying with all required regulations and safety measures (see Chapter *3 Safety* as well as Chapter *7 Commissioning and 8.3 Safety information and rules of conduct for assembly work*).

During the trial run, particularly during the run-in or start phase, stronger unbalance may occur because the feed material first has to become distributed evenly.
A delay of the onset of vibration monitoring can be provided for this phase.

In the case of unusual noise, longer periods of unbalance (as from approx. 2 minutes) or strong vibrations, switch off the centrifuge. Notify the supervisory personnel or the plant management.

Check the operating behaviour of the drums in full load operation (maximum supply of the feed material) with regard to:

- Compliance with the maximum permitted rotational speed (see Chapter ***1 Datasheet***)
- Compliance with the standard data for the smoothness of running (analogous to the already described check in idle state),
- Compliance with the permitted loading of the drum (see Chapter ***1 Datasheet***)

Check all connections, pipe unions and lines with regard to leaks.

If leaks occur, switch off the centrifuge immediately! Remove the escaped hydraulic oil (if necessary bind it with suitable materials) and dispose of it properly. Avoid skin contact with the hydraulic oil!
Notify the supervisory personnel or the plant management.

Please bear in mind that the substances in the suspension which is to be separated and the utilised auxiliary materials can give rise to dangers (see Chapter *3 Safety)*.
It is mandatory to comply with the applicable national regulations. SIEBTECHNIK accepts no liability for damage resulting from failure to comply with these measures.

7.6.1 Switching on the centrifuge for commissioning / production

Provide reliable inerting of the system in an explosion protected plant (see chapter Inerting)
In other process systems without explosion protection it may suffice to provide the shaft seals with air. The same standard values as for inert gas apply for volume currents.

Then proceed in accordance with the following steps:

- Switch on the drain units for the solid matter and the filtrate.
- Switch on the centrifuge motors according to the sequence given in the table Switching sequence for centrifuge motors and wait until the nominal rotational speed is reached.
  The hydraulic system adjusts automatically to the operating pressure defined in the design.
- The translatory motion of the centrifuge drums starts (at pusher centrifuges only).
- If provided: Open or switch on the heating lines and wait until the desired temperature level is reached.
- If provided: Commissioning the water cooling system

High temperatures can cause burns.

- If provided: Open the rinsing supply connections for cleaning the sealing area, the hub area and the drum.
- If provided: Open the washing connections for washing the product.
- Charge the centrifuge with suspension. It is essential to make sure that the suspension flow rate is slowly increased to the rated value and that the suspension cannot squirt into the centrifuge abruptly or abnormally thickened.

Observe the information in the logic diagram (chapter 11.2 Drawings and lists)

7.6.2 Checks in the production state

Carry out the checks according to section 7.5 .

7.6.3 Quantity loading

Check that the amount of suspension fed in and the amount of solid matter contained therein correspond to the contractually agreed values.

The centrifuge may be loaded at a lower level. Vibrating screen centrifuges are an exception to this because they are subject to uneven solid distribution and unbalance with partial loadings below 20%. Overloading is generally not permitted.

7.6.4 Electric power consumption

Check the main motor power consumption relative to quantity loading.

Too great a level of power consumption endangers your motor and is an indication of:

- a centrifuge overload
- machine damage
- product cake deposits with sliding braking effect (see chapter ***10 Trouble shooting***)
- a blockage by solid matter
- a filtrate blockage

7.6.5 Draining off solid matter and filtrate

Check that solid matter and filtrate are being drained off evenly, so that the centrifuge can be continually available for production and no blockages and damage can arise.

7.6.6 Inerting, rinsing and washing systems

Check that the facility for inerting the system, the heating or cooling systems, the rinsing and washing systems are all functioning correctly.

7.6.7 Separating performance

Check the separating performance!

Higher levels of residual moisture in the solid matter or a higher solid content in the filtrate indicate:

- too great loading quantity
- Changed product properties / process parameters
- centrifuge contaminated by dirt
- Wear (see Chapter ***10 Trouble shooting***)

7.6.8 Switching off the centrifuge after production

Observe the run-down time of up to 50 minutes! Never grasp into the interior of the centrifuge as long as the centrifuge rotor or other rotating parts are moving.

Observe the information in the logic diagram (chapter 11.2 Drawings and lists)

You must proceed in the following sequence:

- Close the suspensions feed
- Thoroughly rinse of the processing space of the centrifuge, possibly also employing the rinsing connections which might not have been used during normal production operations. This is essentially necessary because some products have a tendency to cake or harden and could thus block the centrifuge.

If a rinsing device is used for the solid matter space and the rinsing fluid must not come into the solid matter shaft, provide a suitable diverting device.

- Close all supply connections for washing, rinsing, heating and cooling.
- Switch off of the centrifuge motors according to the sequence given in the table “Switching sequence for centrifuge motors”. (see Chapter ***7.4 Test run without product***)
- While the centrifuge is running down and the rotational speed is decreasing, particular attention must be paid to the following aspects:
  - Noises, as a symptom of possible faults, stand out particularly clearly at low rotational speeds and at a low noise level.
  - When running out, each centrifuge passes through the range of its natural frequency, which depends, among other things, on the size and design of the centrifuge. This produces a pronounced movement of the centrifuge in the vertical and horizontal planes for a short period. Checks must be made whether sufficient free space is available for this movement.

Never switch on again directly after having switched off, because the main drive motor (which is still hot) can be damaged by the high starting loads (risk of burning out the insulation). SIEBTECHNIK accepts no liability for resulting damage. The corresponding risk is carried solely by the owner.

- As soon as the centrifuge has come to a standstill and the corresponding timer relay delay has elapsed, switch off the oil pump motor.
- Switch off the drain units for the solid matter and the filtrate.
- Shut off the gas connections

8. Operation, maintenance and servicing

This chapter summarises the measures for maintaining the proper functioning and safety of the centrifuge.
The tasks which must be carried out on a regular basis are explained.

Your observations and notes during maintenance and inspections are a source of valuable experiences on rinsing intervals, lubrication intervals and the service life of individual components.
Work out your plans on the basis of these experiences, which will then establish maintenance, inspection and preventive servicing routines which are specifically adapted to your particular machine usage.

During all work, it is essential to comply with the instructions in Chapter *3 Safety* and in Chapter *8.1 Safety information and rules of conduct for assembly work*. Siebtechnik provides no warranty for damage incurred through failure to comply with the stipulated safety instructions. The risk is borne solely by the user.

All faults which have been established during the inspection or maintenance work, in test runs or during operation, are to be eliminated immediately and without any delay.

After maintenance and servicing and prior to the recommissioning of the centrifuge, always perform the checks and test runs specified in chapter *7 Commissioning*.

We recommend that you record the following data regularly in the form of a report:

- Characteristic data of your process parameters and your product
- Charging quantity
- Separating performances
- Rinsing modes
- Electric power consumption
- List of performed inspections
- Inspection record
- Replacement of wear parts
- Faults
- Repairs

The use of an operating hours meter is recommended for precise recording of the service life of individual wear parts.

8.1 Safety information and rules of conduct for assembly work

8.1.1 Notes and Rules

When working with SIEBTECHNIK centrifuges, all rules of conduct and safety regulations contained in these operating instructions must be complied with.

It is mandatory to comply with the following rules of conduct and instructions in the course of your daily work with the centrifuge:

- Observe the instructions of Chapter ***3 Safety***.
- This work may only be carried out by trained personnel instructed in this type of work. Persons under the age of 18 may not work on the centrifuge.
- Secure the workplace against ambient dangers and bear in mind that more space in required in the vicinity of the centrifuge.
- Cordon off the working area and keep emergency exits clear. Whenever you carry out any work, make sure that unauthorised personnel have no access to the work area and that all protective devices, including the electrical interlocking, are functioning.
- Place all required tools, devices, hoisting gears, suspension material, cleaning agents and drawings ready.
- Before commencing the tasks, check the load-bearing capacity of the utilised handling equipment
- Secure disassembled components against slipping and falling over.
- Correct disposal of all wastes (e. g. operating materials, cleaning agents, residues). Comply with the national regulations.

The machine must be switched off and have come to a standstill (visual inspection) before commencing any mechanical work on the centrifuge. Observe the instructions in Chapter *7 Commissioning.*

Observe the run-down times. Example Machine rotor: Depending on the size and the loading condition, run-down times of up to 50 minutes might be required

For specifying the run-down time of the centrifuge, you can use the warm run-down time of the machine specified during the factory acceptance test (see chapter *14 "Final quality inspection"*).
When the machine is locked automatically, at least the 1.5-fold time and the specification in the logic diagram (see chapter 11 *Drawings*) must be observed.

Check whether EMERGENCY STOP control units are available and where they are located and make sure that they are freely accessible.

It is imperative that you ensure that there is a clean working environment. Contamination can penetrate into components such as e.g. bearings, gearboxes etc. and damage or destroy them.

Secure the rotor of the machine against moving. Due to asymmetricaly adhering product residues, the rotor can be set in motion by its weight force. Even a very slow rotating component can be very dangerous due to the inertia and can cut off your fingers, for example.

8.1.2 Personal Protective Equipment

Make sure that the maintenance personnel are wearing the necessary protective equipment.

8.1.3 Power supply

Interrupt the power supply.
Ensure in any case that the centrifuge cannot be switched on inadvertently.

In some installations, switch-on is possible at the centrifuge or from the measuring station. Please make sure that possibly fatal remote switching cannot occur inadvertently.

8.1.4 Pressure, temperature, centrifuged material residues

Danger due to pressure in the processing space!

Make sure that the processing space is pressureless before you start assembly work.

During the processing of hazardous substances and high processing temperatures, take appropriate protective measures and inform your personnel with regard to possible risks.

It might be necessary to flush centrifuge, bins, tanks or lines with suitable cleaning agents or protective gases! Ensure that all dangerous substances have been rinsed away before you start any assembly work.
Rinse only while the centrifuge is running.
Convince yourself that the following sources of danger are switched off, closed and secured after the rinsing operations:

- Suspension feed
- Centrifuge motor
- Gas, steam, rinsing and washing connections
- Drain units for solid matter and filtrate

Observe the special safety precautions for the use and disposal of auxiliary materials!

8.1.5 Special tools

For all assembly work, use suitable special tools and the devices possibly included in the scope of delivery.
Further information is contained in the Chapters *11 Drawings* and *12 Part lists*.

8.1.6 Component weights and stability

Always bear in mind the dead weight of components, as well as their installation weight, which may be up to 50% higher, and the possibly unfavourable working posture and grip security. Use suitable lifting tools for protection, even during assembly work.

Secure disassembled components against slipping and falling over.

8.1.7 Test run

After maintenance and servicing and prior to the recommissioning of the centrifuge, always perform the checks and test runs specified in chapter *7 Commissioning*.

8.2 Rinsing / Cleaning

For most products, regularly cleaning the product space and the screen elements is a prerequisite for the separating process remaining constant.
For this purpose, cleaning devices are installed in the centrifuge, which are operated either continuously (e.g. in case of chamber packing seals) or in intervals (if required, in case of solid matter space rinsing) depending on the individual case.

Indicators for the actuation of the rinsing elements are e.g.:

- Increased residual moisture
- Increased machine vibrations

Due to the product the cleaning will be done by build-in cleaning devices or manually with an opened product space.

8.2.1 Rinsing

Depending on the individual case, the installed cleaning devices can be operated continuously (e.g. when chamber pack seals are used) or at intervals (e.g. for flushing the solids chamber).

Depending on the process system, continuous feed of rinsing fluid, e.g. at labyrinths, in the area of the hub and at the drum, can be a hindrance.

Further information on the start-up and shutdown sequences and on the rinsing of the centrifuge are contained in the attached logic diagram (Chapter *11 Drawings and Lists*).

Rinsing intervals and detergent quantities for cleaning the centrifuge must be optimised by the operator.
Record the required data and ensure that your personnel is informed about and observes the results. SIEBTECHNIK provides no warranty for damage resulting from incorrect personnel briefing on this.

8.2.2 Manual cleaning

Depending on the product and operating mode, manual cleaning may be required.

Open the product housing and clean the product space of the machine with suitable means.

During all work, it is essential to comply with the instructions in Chapter *3 Safety* and in Chapter *8.1 Safety information and rules of conduct for assembly work*.

The machine must be switched off and have come to a standstill (visual inspection) before commencing any mechanical work on the centrifuge.

Make sure that the centrifuge cannot be switched on unintentionally.

Secure the rotor of the machine against rotation.
Due to asymmetrically adhering product residues, the rotor can be set in motion by its weight force.
Even a very slow rotating component can be very dangerous due to the inertia and can cut off your fingers, for example.

For all work, use suitable special tools and any devices supplied. Observe the instructions in chapter *8.1.5 Special tools.*

8.3 Disuse of the rinsing spaces

If your centrifuge (except for a pusher centrifuge) is equipped with rinsing spaces intended for continuous rinsing of the product and these are not used continuously, there is a risk that solid matter deposits will build up leading to unbalance and vibration.

As the operator, ensure that the centrifuge is kept clean by means of targeted monitoring and, if appropriate, a rinsing interval.

8.4 Maintenance intervals / Maintenance schedule

The following inspections, measurements and measures must be carried out at regular intervals.

Observe the instructions on handling the machine in Chapter *7 Commissioning.*

During all work, you must pay attention to the instructions contained in Chapter 3. *Safety* as well as in Chapter *8.1 Safety information and rules of conduct for assembly work.* Siebtechnik provides no warranty for damage incurred through failure to comply with the stipulated safety instructions. The risk is borne solely by the user.

Before starting the maintenance work, the machine and the installation site must be cleaned thoroughly.

The adjustment, maintenance and inspection tasks and scheduled dates stipulated in the operating instructions, including the stipulations for replacing components and sub-assemblies, must be complied with and performed by specialist personnel.

SIEBTECHNIK does not provide any warranty for damage incurred through failure to comply with the stipulated maintenance intervals. The risk is borne solely by the user.

Observe the maintenance instructions for the supplied attachment components in chapter 13 Supplier documentation.

Maintenance schedule **Closely structured maintenance work must be carried out additionally to the inspection activities to be carried out at greater intervals** **Activity**	**daily**	**weekly**	**monthly**	**every six months**	**annually**	**every two years**	**every three years**
Check of separating performance	■						
Uniformity of product flow	■						
Rinsing Centrifuge	■						
Cleanliness of the solid matter housing and solids shaft	■						
Operating state of the centrifuge	■						
Checking the cleanliness of the atmospheric space between the processing space and the storage facility – Only dry cleaning, if required	■						
Checking the circulating oil lubrication or thrust hydraulics for pusher centrifuges	■						
Checking the sealing medium flow rate at the chamber packing	■						
Checking the inert system	■						
Checking the washing and rinsing fluid	■						
For DZ, DZS and DZSG from size 10 check the bearing temperature at the primary reduction gearing	■						
Checking the oil level and oil colour		■					
Checking the oil filter for contamination		■					
For H 170, H 200 and SBD 140: Relubricate the main bearings with 1 g of antifriction bearing grease each.			■				
For DZ, DZS and DZSG from size 10: Regrease the pedestal bearings of the primary reduction gearing with 15 g of rolling bearing grease.			■				

Maintenance schedule **Closely structured maintenance work must be carried out additionally to the inspection activities to be carried out at greater intervals** **Activity**	**daily**	**weekly**	**monthly**	**every six months**	**annually**	**every two years**	**every three years**
Check for attachment and state of wear (if present): (scraper knife, collecting chute, screening elements, solid matter housing (impact zone)), If necessary, adjust the interval depending on the product.			■				
Check the filtrate for contamination with oil			■				
Check the V-belts and V-belt pulleys			■				
Check of the wear condition (in the case of extremely abrasive solid matter, if present) (drum, worm, screen elements, clamp ring), If necessary, adjust the interval depending on the product.			■				
Flanges and rocker arms of the HD or HDS clutch, if installed, must be checked for wear and replaced if necessary.			■				
Remove the oil sample from the drain tap, and if appropriate, drain any water from the oil sump				■			
Checking, adjusting and / or replacing, if appropriate, the pusher segments or sealing rings between the drums (only for pusher centrifuges)				■			
Checking of the hydraulic hose lines (only for pusher centrifuges)				■			
Checking the centrifuge in it's operating state for proper occupational safety of the machine by a competent person.					■		
Check and, if required, replacement of the V-belts					■		
Replacing the lubricating oil and the oil filter cartridge (except for pusher centrifuges)					■		
Replacing the oil filter cartridge (only for pusher centrifuges with sizes above dia. 530 mm (20.87 in))					■		
Checking the hydraulic hoses for the lubricating oil supply					■		
Checking the safety-related parts of the control system (more frequently, if necessary), see ***chap. 9.2 or 13***					■		
For DZ, DZS and DZSG from size 10: Exchange of the rolling bearing grease in the bearings of the primary reduction gear					■		

Maintenance schedule **Closely structured maintenance work must be carried out additionally to the inspection activities to be carried out at greater intervals** **Activity**	**daily**	**weekly**	**monthly**	**every six months**	**annually**	**every two years**	**every three years**
Changing the hydraulic oil (only pusher centrifuges), Attention: first change after 9 months							
Cleaning the oil intake strainer (pusher centrifuges up to size dia. 500 mm (19.67 in))							
Replacing the hydraulic hose lines (only for pusher centrifuges)							
Checking the centrifuge in it's dismantled state for proper occupational safety of the machine by a competent person.							
For drums with ceramic or rubber lining or carbide bushings at the outlet opening: Check the carrier material for corrosion, e.g. by migration behind, diffusion, etc., adjust the interval if necessary depending on the corrosion stress.							

Specific instructions for the individual maintenance work tasks are found in the following chapters.

8.4.1 Daily maintenance

The operating behaviour of the centrifuge must be checked during daily rounds.

Pay particular attention to the following aspects:

- Check the separation results of the centrifuge
  - An increase in residual moisture can be caused by a blockage in the screen element (if provided).
  - An increase of the solid matter content in the filtrate can be caused by damage or wear of the screen element (if provided).

Regular checks of the separating performance provide important information on the condition of the screen element (in the case of screen centrifuges). See Chapter *10 Trouble shooting*.

- Check the uniformity of the product flow (e.g. suspension feed, solid matter discharge, filtrate / centrate discharge)
- Check the rinsing of the centrifuge, see Chapter ***8.1 Rinsing / Cleaning*** and ***8.2 Disuse of the rinsing spaces***
- Check the washing and rinsing fluid
- Check the cleanliness of the solid matter housing and of the solid matter shaft

- Check the operating state of the centrifuge:
  - Noises
  - Vibration
  - Temperature
  - Electric power consumption
  - Leakage
- Check the cleanliness of the atmospheric space between the process room and the storage facility.
  - Only dry cleaning, in order to prevent liquid from entering the lubricating oil or product space / sealing of the housing.
- Check the temperature of the counter bearings on machines of types DZ, DZS and DZSG from size 10 (see chapter ***8.6.9 Maintenance of primary reduction gearing on DZ, DZS and DZSG***).
- Check the circulating oil lubrication or thrust hydraulics for pusher centrifuges (SHS):
  - Cleanliness
  - Pressure
  - Temperature
  - Oil return flow
  - Leakage
  - Stroke rate for pusher centrifuges)
- Check the flow rate of the sealing medium at the chamber packing
- Check the inertisation (if present)

8.4.2 Weekly maintenance

- Check the oil level and oil colour
- Check the oil filter for contamination:
  - Edge filter: Turn the cleaning head to comb the edges free in this manner.
  - Cartridge filter: Check the differential pressure or the contamination indicator.

8.4.3 Monthly maintenance

- Check the following items for attachment and state of wear (if present). If necessary, adjust the interval depending on the product:
  - Scraper knife
  - Collecting chute
  - Screening element
  - Solid matter housing (impact zone)
- Check the filtrate for contamination through oil
- Check the V-belts and V-belt pulleys
- Regrease the pedestal bearings of the primary reduction gearing of machines of types DZ, DZS and DZSG from size 10 with 15 g of rolling bearing grease. (see ***chapter 8.6.9 Maintenance of primary reduction gearing of DZ, DZS and DZSG***).

- Lubricate the main bearings
  - For H 170, H 200 and SBD 140: Relubricate the main bearings with 1 g of antifriction bearing grease each.

For extremely abrasive solid matter:

- Check the state of wear (if present). If necessary, adjust the interval depending on the product:
  - Rotor (drum, worm)
  - Screen elements
  - Clamp ring
- Check the flanges and rocker arm of any HD or HDS clutch installed for wear and replace them if necessary.

8.4.4 Maintenance every six months

- Check and / or adjust the pusher segments or sealing rings between the drums (only for pusher centrifuges). Replace them, if necessary.
- Remove an oil sample from the drain tap.
  - Let any present water drain from the oil sump.
  - Check the condition of the oil.
- Check the hydraulic hose lines (only for pusher centrifuges).

8.4.5 Annual maintenance

- The centrifuge must be inspected annually in its operating state, if necessary at shorter intervals (e.g. in the case of severe corrosion or abrasion) for proper occupational safety of the machine by a competent person.
- Perform an oil change (except for pusher centrifuges).
- Check the V-belts. Replace them, if necessary.
- Replace the oil filter cartridge (only for pusher centrifuges with sizes above dia. 530 mm (20.87 in))
- Check the hydraulic hose lines for the lubricating oil supply and observe the service life for hydraulic hose lines.
- All safety-related parts of the control system must be checked for proper functioning. The entire shutdown chain must be considered. The check must be carried out more frequently if necessary. See ***chapter 9.2 Integrity of safety-related parts of control system*** and ***chapter 13 Supplier documentation***.
- For machines of types DZ, DZS and DZSG from size 10, replace the roller bearing grease in the pedestal bearings of the primary reduction gearing (see chapter ***8.6.9 Maintenance of the primary reduction gearing for DZ, DZS and DZSG***).

8.4.6 Two year maintenance

- Replace the hydraulic oil (only for pusher centrifuges).
  - The first replacement of the hydraulic oil must be performed after 9 months.
- Cleaning the oil intake strainer (only for pusher centrifuges up to size dia. 500 mm (19.67 in))
- Replace the hydraulic hose lines (only for pusher centrifuges).

Documentation on creating an inspection book can be found in Chapter 1 Technical Data or 1.3 et seq. Regular checking of the centrifuge / inspection book

8.4.7 Three year maintenance

- The centrifuge must be inspected at least once every three years in its dismantled state, if necessary at shorter intervals (e.g. in the case of severe corrosion or abrasion) for proper occupational safety of the machine by a competent person.
- In the case of drums with ceramic or rubber linings or carbide bushings at the outlet opening, the carrier material must be checked for corrosion due to e.g. back migration, diffusion, etc. The interval must be adjusted if necessary depending on the corrosion stress. If necessary, the interval of the inspection must be adjusted depending on the corrosion stress.

It should be noted that the corrosion occurs on the inside of the drum under the lining and is therefore not immediately visible. The inspection can be carried out using ultrasound, for example, without having to remove the lining. If necessary, contact SIEBTECHNIK if you need assistance.

Wear or corrosion can damage the drum of your centrifuge. A failure of the drum due to wear or corrosion can have consequences for life and limb in addition to damage to the centrifuge.

8.5 Inspection

At regular intervals, the centrifuge must be checked for its occupational safety according to relevant national regulations.
Applicable in Germany is the Occupational Safety Directive, realised with the German Statutory Accident Insurance (DGUV) regulation 100-500 (previously German Trade Association Regulation (BGR) 500).

According to these regulations a centrifuge must be inspected annually in its operating condition and at least once every three years in its dismantled state, if necessary at shorter intervals (e.g. in the case of severe corrosion or abrasion) for proper occupational safety of the machine by a competent person.

Replacement rotors must be included in the statutory recurrent (annual or every 3 years) check. At the 3-year check replace the gaskets and bearings in the centrifuge.

Particular attention must be paid to the rotating parts, which are subject to high levels of both dynamic stress and exposure to particular risks from corrosion and abrasion.

The results of the checks must be documented according to relevant national regulations.

Documentation on creating an inspection book can be found in Chapter 1 Technical Data or 1.3 et seq. Regular checking of the centrifuge / inspection book.

8.6 Lubrication

Centrifuges are fast running highly loaded machines which require continuous good lubrication in order to sustain their high performance.

Please refer to the parts list, the ADI list and the P&ID for the equipment of your centrifuge. Required supplier documentation can be found in chapter 13.

Therefore pay due attention to the lubrication of your centrifuge.

Observe the applicable safety regulations for utilisation, transport and storage of lubricating oils. Waste oil must be disposed of in compliance with the regulations.

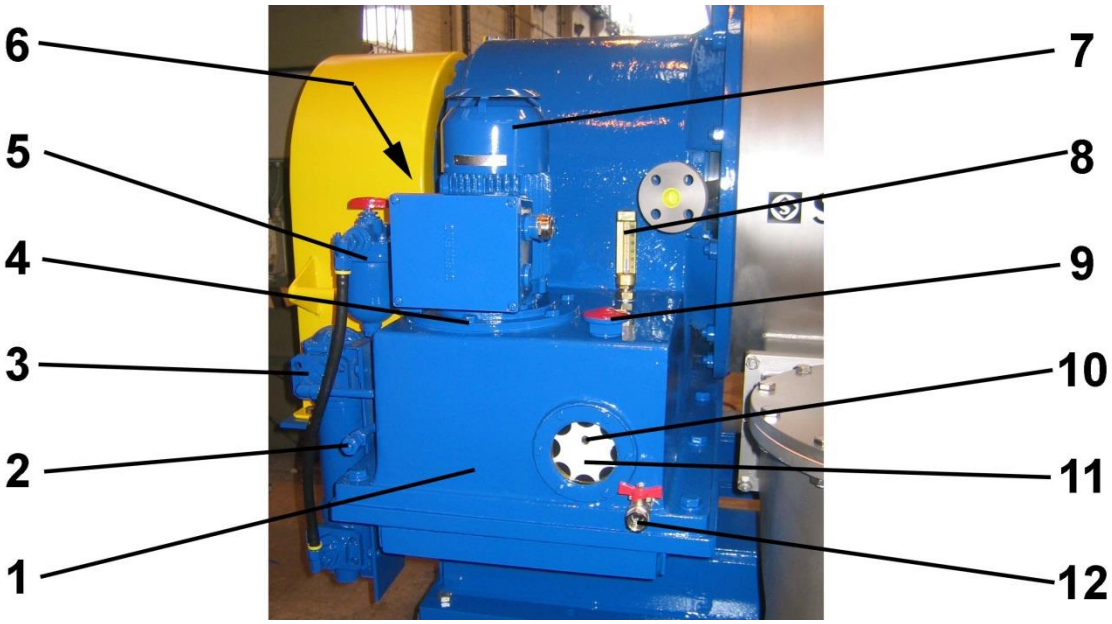
The centrifuge rotor is equipped with oil circulation lubrication for gearbox and all bearings. Oil tank, oil pump and oil filter are arranged in a separate hydraulic unit.

The oil pump feeds the oil through an interposed overflow valve and an oil filter into the interior of the screen worm centrifuge. For further details please refer to the P&ID in Chapter **11 Drawings.**

In centrifuges with a primary reduction gearing, the bearings of the primary reduction gearing must be lubricated with rolling bearing grease**.**

8.6.1 Set up

The lubrication is set up as follows:



Beispiel: Conthick mit folgenden Bauteilen:

1 Bearing housing / oil tank
2 Connection of pressure gauge / pressure switch
3 Oil cooler
4 Pump housing
5 Oil filter
6 Set screw
7 Pump motor
8 Oil thermometer
9 Tank venting / air filter
10 Oil return flow
11 Inspection glass
12 Oil drain valve

An oil inspection glass is fitted to the bearing housing. It allows to watch the oil level inside the oil space, but also the return oil from the needle roller bearing that is farthest from the pump, and from the main bearing on the product side! For further details, refer to the hydraulic diagram in Chapter ***4 Machine description.***

The lubricating oil is in the bearing housing. For the oil quantities, please see the centrifuge datasheet. The oil inspection glass should be at least half up to max. ¾ filled. For observing the oil return line, the latter must lie approx. 10 mm above the oil level in the oil inspection glass.

The oil tank vent is protected against dust from the environment by means of a dust filter.

The oil level inside the tank should reach up to the middle of the inspection glass, or slightly higher. The oil is conveyed into the centrifuge at a feed pressure of 0.5 to 1.5 bar and distributed to the individual lubricating points by means of several throttling ports.

8.6.2 Oil change intervals

The first oil change is to be carried out after 1000 operational hours.

Thereafter further oil changes are recommended at intervals not longer than 8800 operating hours. Oil changes are necessary more frequently if the oil condition deteriorates, e.g. by dirt accumulation.

Check the oil regularly for its quality (see Chapter *8.6.4 Oil purity*).

The bearings of the electric motors have been filled with grease in the factory. Relubricate according to the instructions of the motor manufacturer.

8.6.2.1 Motors and pumps

Observe the lubrication instructions for motors, pumps etc. in chapter *13 Supplier documentation*.

8.6.3 Oil type

High quality EP-gear oils CLP according to DIN 51517 or also high quality hydraulic oils H-LP according to DIN 51524 must be used as lubricants for our centrifuges:

The required kinetic viscosity is specified in the datasheet (see Chapter ***1 Technical Data***).

Release list for oils		
Manufacturer	**Gear oils**	**Hydraulic oils**
Aral	Degol BG	Vitam GF
BP	Energol GR-XP	Energol H LP
Esso	Spartan EP	Nuto H
Shell	Omala Oil	Tellus H-LP
Mobil	Mobilgear 6xx	Mobil DTE 2x

Half or fully synthetic oils are advantageous and preferable if agreed.

If the machine is used to process edibles, the employed lubricant must be qualified for food processing and coincidental contact with edibles. The oil properties in the above table must nonetheless be ensured.

Such oils are e.g. ARAL Eural Hyd or Mobil DTE FM or equivalent oils.

8.6.4 Filling in the oil

In order to fill the machine with oil after an oil change or after commissioning, remove the tank vent / oil filter (see cap. 8.6.1). The hydraulic oil can then be filled in through this opening. Pay attention to cleanliness while filling. When the entire quantity of oil has been filled in, mount the tank venting lid again to prevent contamination of the oil.

8.6.5 Oil pressure / Oil flow

The oil pressure is only displayed visually and is not used to control the machine.

The oil flow is used to monitor the lubrication of the machine. If the oil flow falls below a minimum limit value, the drive or main motor and the product supply are switched off. The limit values are given in the instrument list.

The limit values depend on the gearbox type and size or the lubrication point. You will find them in the following table. You can find out which gearbox is installed in your machine in ***chapter 1.2 Data sheet***.

Lubrication point	Oil flow. (switch-off value)	Cold setting value ** Oil flow
Cyclo gearbox size 216	0,5 l/min	1,0 l/min
Cyclo gearbox size 610 to 618	0,5 l/min	1,0 l/min
Cyclo gearbox size 619 to 622	0,7 l/min	2,0 l/min
Cyclo gearbox size 623 to 624	1,2 l/min	2,5 l/min
Planetory gear	2,0 l/min	2,5 l/min
Main bearing gearbox side*	1 l/min	2,0 l/min
Main bearing inlet side*	1 l/min	2,0 l/min

* For machines without overhung bearings, the main bearings are also integrated into the circulating oil lubrication system as additional lubrication points and, if necessary, supplied with a separate line.

** When (re)starting the machine, the oil flow must be adjusted with cold oil (room temperature approx. 20-25°C). For this purpose, an adjustment valve is installed in each

lubricating oil line upstream of the flow meter. As the oil warms up during operation, the oil flow rate changes.

Depending on the existing operating conditions, the amount of oil flowing into the centrifuge may fluctuate. In any case, the oil pump is designed for a higher flow rate. The oil pressure is kept approximately constant via the overflow valve, with the excess oil quantity flowing back directly into the oil tank.

Notes on the overflow valve can be found in chapter 13 Supplier documentation.

8.6.6 Cleanliness of the oil

Watch the visible oil properties through the inspection glass and take oil samples from the drain valve of the oil tank at regular intervals (see Chapter ***8 Maintenance***).

Discolouration and solid matter residue indicate that abrasion has taken place at the bearings and seals.
Turbidity and foaming indicate ingress of water, acid, alkali or solvents.

If you detect any contamination of the oil, the oil must be replaced immediately, and it may be necessary to dismount, check and clean all parts which come into contact with the oil. At the same time, check also the corresponding seals (rotor sealing ring, shaft sealing ring, chamber packing etc.) between centrate space and oil space for any damage and replace them if necessary.

Determine and remedy the causes giving rise to contamination of the oil

8.6.7 Oil temperature and Limit values

Pay attention to the oil temperature in your centrifuge. The viscosity and loading capability of the lubricating film reduce with rising oil temperature. Higher oil temperature increases the rate of ageing.

In normal operation the temperature of the oil in the oil tank should not exceed the room temperature by more than 40°C. If the operating temperature is higher than this, a lubricating oil with higher viscosity and possibly an oil cooler are required. The maximum permissible oil temperature in the oil tank can be taken from the ADI.

8.6.8 Oil pressure gauge

If the filter clogging indicator changes from green to red, the oil filter must be replaced. See chapter 13. supplier documentation. A dirty oil filter can be the cause of a drop in oil pressure.

Pressure drop or rise can also be caused by dirt accumulation or binding of the piston in the overflow valve. In this case clean the entire overflow valve.

8.6.9 Oil return from needle bearing and product side main bearing

At least a few drops of oil must escape from the line in the oil sight glass. Otherwise there is a risk that the bearings of the screen screw centrifuge will be damaged due to lack of oil. If no return flow can be observed at this point, the centrifuge must be switched off or remain switched off under all circumstances.

Possible causes of faults and countermeasures:

- Oil temperature less than 0° C (32°F).
  - The oil is to be warmed up (eg. through an optional oil heater)
- Oil supply line or control line to oil sight glass is blocked.
  - Lines must be checked and cleaned.
- Foreign bodies have clogged oil holes or oil distribution grooves within the gearbox.
  - The gearbox must be removed, carefully cleaned in benzine (do not use cleaning wool!) and reassembled.

8.7 Drive

This chapter describes the general relationships between the drive variants, power consumption and rotational speed monitoring.

The centrifuge has three kinds of power supply requirements:

- Idle running power on rotor and gearbox input shaft drive to overcome the friction in bearings and seals and the ventilation resistance.
- Accelerating power supply for the rotor for accelerating the fed-in suspension to the speed of the centrifuge.
- Conveying power for the continuous axial displacement of the solid matter by means of the feed worm.

The sum of these individual performances constitutes the total required drive power. Since this sum is constituted by individual powers with individual causes, it is impossible to conclude e.g. the quantity of suspension, solid matter or worm torque directly from the current consumption of the main motor. Conclusions would only be possible and admissible if all other influence factors remain constant.

The electrical installation and connections of the motor and monitoring devices to the control system must be carried out according to the wiring diagram provided with the motor and the VDE or local electrical regulations.

The drum speed (and possibly the differential rotation speed) and thus, the centrifuge factor can be modified by changing the V-belt pulley combinations.
It is advisable to use a frequency converter if the rotational speed has to be changed frequently.
The centrifuge is delivered with the optimum V-belt pulleys for the particular application.

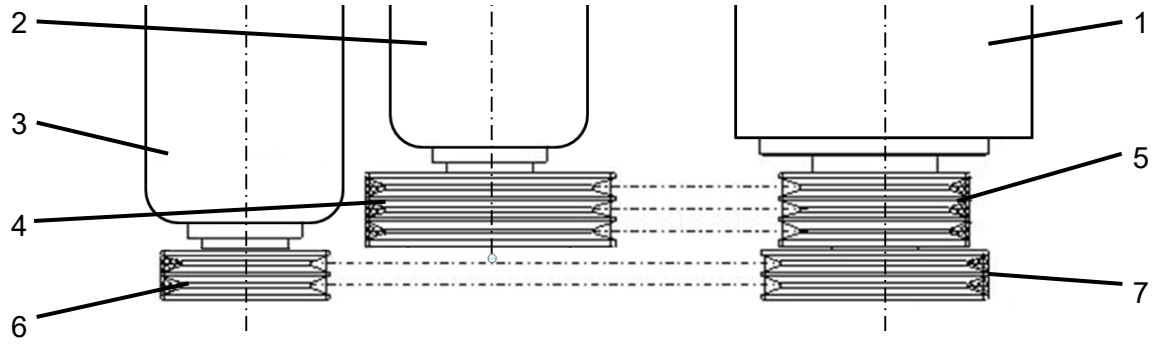
Do not exceed the maximum permissible speed (see chapter 1.2 Centrifuge data sheet and name plate)

8.7.1 Motor / drive concept - double drive with two motors

Using two variable drives, always acting on the gearbox housing or the gearbox input shaft, residence time and centrifugal factor can be controlled independently from each other

One of the two drives will always act as a brake. The released braking energy can be fed back to the mains (power recovery) or directly be made available to the other drive unit. When dimensioning the "driving" drive, both the centrifuge power consumption and the braking power must be considered.

This type of drive is frequently equipped with a double frequency converter control system.



1 Machine
2 Drive motor
3 Drive motor gearbox input shaft
4 V-belt pulley drum motor
5 V-belt pulley drum machine
6 V-belt pulley gearbox input shaft motor
7 V-belt pulley gearbox input shaft machine

For detailed information about the drive motor, please refer to the documentation enclosed in Chapter *13 Supplier documentation.*

Pay attention to the correct sense of machine rotation when making the electrical connections of the motor. An arrow on the machine's bearing housing indicates the correct sense of rotation.

In order to protect the drive motors, always operate them with an overload protection circuit-breaker!

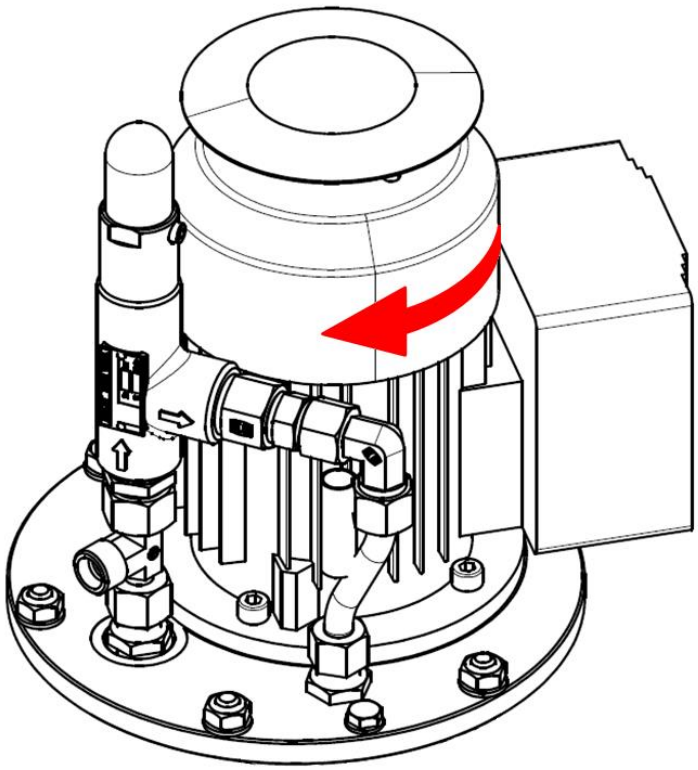
If the drive motors are operated via double frequency converter control, it is there that the overcurrent shutdown can be integrated.

8.7.2 Oil pump motor

The centrifuge is equipped with a circulating oil lubrication system to ensure an optimised lubrication.

The oil pump motor drives the oil pump, conveying the oil through respective lines to the lubricating points.

For detailed information about the oil pump motor, please refer to the documentation enclosed in chapter *13 Supplier documentation.*



For the connection of the motor, mind the rotational direction.
For operating the oil pump, the oil pump motor, viewed from the motor fan, must rotate clockwise.

8.7.3 Overload protection (friction clutch)

If the torque required to convey the product in the machine exceeds a given torque, the overload protection on the gearbox input shaft will respond.

An explanation of the overload protection's functioning can be found in Chapter ***4 Machine Description***.

For overload detection, the rotational speeds of the overload protection and the gearbox input shaft are measured and compared. If a rotational speed difference is detected, the signal "Overload" is generated. This signal ensures the closing of the inlet valve and a disconnection of the drive.

The oil pump will run on for a while to keep up the oil supply of the bearings.

The overload clutch is set in the factory to the required torque. See Chapter *1 Datasheet.*

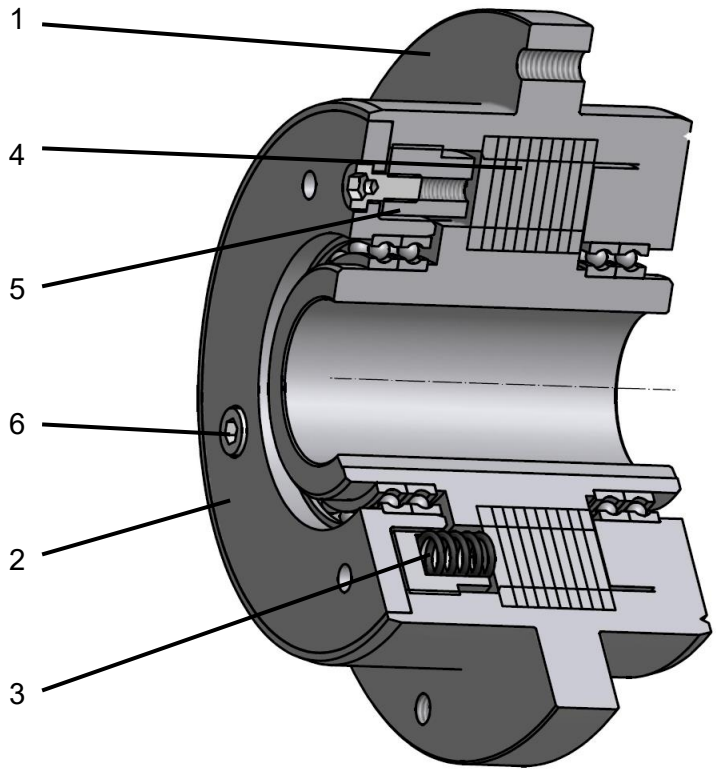
Any subsequent work requires the disassembly of the V-belt protection.

Properly secure the machine against unintentional restart.

8.7.3.1 Setting and checking of the overload clutch

To check the torque of the overload clutch you have to disassemble it:

- Disassemble the oil feed
- Slacken the V-belt of dismantle it, if necessary.
- Disassemble the overload clutch with lever flange or V-belt pulley
- Detach the lever flange or the V-belt pulley from the overload clutch to avoid damaging it.
- Fix the overload clutch with the flange (1) so that it is locked against distortion (e.g. turning lathe with arrested spindle)



Overload clutch

1	Flange	4	Lamellae
2	Centring bush	5	Spring package
3	Spring	6	Hexagon socket head cap screw

Checking the torque

- Insert a stub shaft with a parallel key into the overload clutch.
- Check the torque by means of a torque spanner at the inserted stub shaft.

As soon as the clutch starts to slip, the nominal torque is reached.

Setting of the torque

- Undo the locking of the centring bush (2) by opening the hexagon socket head cap screws (6).
- Adjust the slipping torque by turning the spring package (5).

The spring package (5) will be entrained by the lock screws (6) when turning the centring bush (2).

Increasing the tension (by clockwise rotation) of the springs (3) results in a higher slipping torque, while decreasing the tension (by anti-clockwise rotation) leads to a lower slipping torque at the lamellae (4).

- Lock the spring package (5) again with the centring bush (2) by tightening the lock screws (6).
- Check the slipping torque once more.

Installation of the friction clutch

- Remove the stub shaft with a parallel key from the overload clutch
- Assemble the lever flange or V-belt pulley, respectively
- Place the overload clutch with lever flange or V-belt pulley upon the gearbox input shaft of the machine and secure it there
- Lock the lever flange or put on the V-belt and tighten it properly.
- Assemble the oil feed

The friction clutch works independent of the rotational direction.

8.7.4 Modification of the speed

The rotational speed can be modified by exchanging the V-belt pulleys.

A "double drive" arrangement allows modifying drum speed and differential rotation speed independently.

If the motor is revved up (e.g. by using a frequency converter), the differential rotation speed will show a linear increase whereas the residence time will show a linear decrease. The centrifugal factor increases by the square.

The rotational speed may only be changed in consultation with Siebtechnik.

Note that the maximum permitted rotational speed must never be exceeded.

8.8 V-belt

The centrifuge is equipped with multiple groove V-belt pulleys and must therefore be fitted with equal length V-belts. The V-belts delivered by SIEBTECHNIK permit combination in sets without any problems.

Before commencing work, take all required measures for occupational safety (see Chapter 3*. Safety and 8.3 Securing the centrifuge for assembly procedures*). SIEBTECHNIK accepts no liability for any damage resulting from failure to comply with the regulations or rules of conduct.

Ensure in all cases that the centrifuge cannot be switched on inadvertently.
Make sure that the maintenance personnel cannot come into contact with residues of dangerous material to be centrifuged or be exposed to danger from process pressure or process temperature.
Make sure that the maintenance personnel are wearing the necessary protective equipment.

8.8.1 Installation and replacement of V-belts and pulleys

Always use only the V-belt pulleys and V-belts specified in the parts list and pay attention to fulfilling the following requirements:

- the correct profile
- sorted as sets of equal length from one manufacturer
- electrical conductivity
- use of high-quality V-belts

The V-belt pulleys must be free from burrs, rust and dirt.

- Mount the V-belt pulleys to the machine and motors according to the drawings and part lists (refer to Chapters ***11 "Drawings"*** and ***12 "Part lists"***).
- Loosen the clamping screws of the motor mounts such that it is possible to move the motor.
- Move the motor in a position to fit the V-belts loosely.

Please note that there is a high risk of crushing when working on V-belts and their associated pulleys.
Therefore secure the rotor against turning as appropriate.

Do not force the V-belts over the lips of the pulleys.

- Align the motors and their respective V-belt pulley to the corresponding machine V-belt pulley with the aid of a long ruler.
- Tension the V-belts by tightening the clamping screws and thus moving the motor.
- Tighten up the motors and their mounting plates.

Correct belt tension is decisive for the functioning of the drive and the service life of the V-belt.

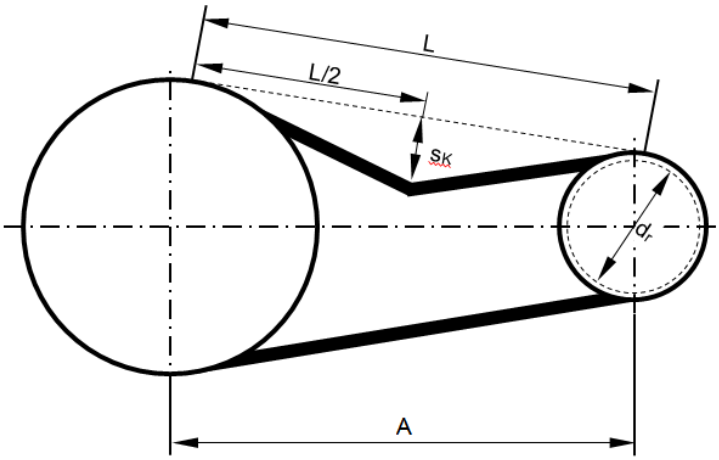
Ensure correct alignment when changing a V-belt pulley to change the rotational speed. Incorrectly aligned V-belt pulleys cause high flank wear and undue running noise.

Do not exceed the maximum permissible speed (see chapter 1.2 Centrifuge data sheet and name plate)

8.8.2 V-belt tension

Please note that there is a high risk of crushing when working on V-belts and their associated pulleys. Therefore secure the rotor against turning as appropriate.

The belt tension can be checked with a tension measuring device or spring balance:



A Axial spacing [mm]
d_r Directional diameter of the small V-belt pulley [mm]
L Span [mm]
s_K Indentation depth [mm]

Guide diameter of the small V-belt pulley

8.8.2.1 Calculation of the necessary indentation depth

The indentation depth for the V-belts is 15mm (0.59 in) per 1000mm (39.37 in) span.

Since the span of most of the machines does not exactly correspond to these 1000mm (39.37 in), the relating necessary indentation depth needs to be calculated.

- Tension the V-belts.
- Measure the span of the V-belts L [mm]
- Calculate the necessary indentation depth:

s_{Kerf} [mm] = L [mm] x 0.015

For HSG vibrating centrifuges, 20mm (0.79 in) per 1000mm (39.37 in) span must be used for calculations of the necessary indentation depth:

s_{Kerf} [mm] = L [mm] x 0.020

8.8.2.2 Measurement of the deflection force K

- Determine the datum diameter of the small V-belt pulley dr [mm]
- Place a straight edge ruler on the V-belt pulleys.
- Place the belt tension measuring device in the middle of the span and vertically on the straight edge ruler.
- Read the deflection force K [N/ Lb] for the necessary indentation depth of the V-belt s_{Kerf} [mm / in].

8.8.2.3 Check of the V-belt tension

- Compare the reading of the deflection force K [N / Lb] with the values in the table for the belt profile of the relevant belt type and for the datum diameter of the small V-belt pulley.

The reading of the deflection force K [N / in] must be between K_{min} and K_{max}.

Change the axial spacing until the correct deflection force K is reached.

Check the belt tension again after about 24 hours of operation. Thereafter check it, and adjust it if necessary, at regular intervals.

Please note that V-belts which are tensioned too tightly place unnecessarily high loads on the bearings!

For initial installation, multiply the tabulated values for K_{min} and K_{max} by 1.3 as a precaution against early slackening of the V-belt tension.

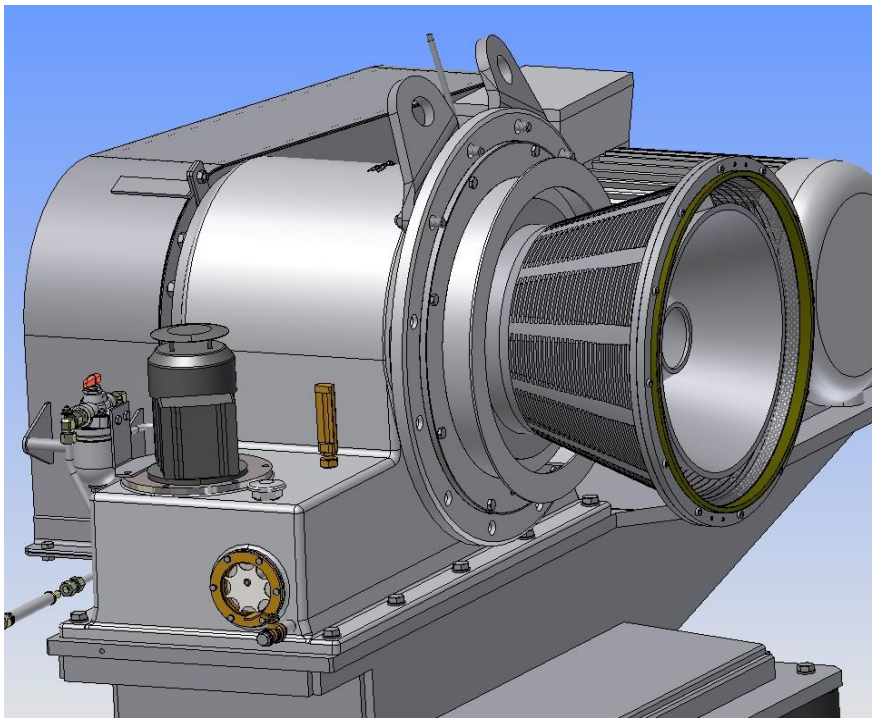
8.8.2.4 Deflection force K (table)

Deflection force **K** [N]																
	XPZ		**XPA**		**XPB**		**XPC**		**SPZ**		**SPA**		**SPB**		**SPC**	
d_r	K_{min}	K_{max}	K_{min}	K_{max}	K_{min}	K_{max}	K_{min}	K_{max}	K_{min}	K_{max}	K_{min}	K_{max}	K_{min}	K_{max}	K_{min}	K_{max}
[mm] / [in]	[N/Lb]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]
40 / 1.6																
45 / 1.8																
50 / 2	12/ 2.7	16 / 3.6														
56 / 2.2	13 / 2.9	18 / 4														
63 / 2.5	15 / 3.4	20 / 4.5	14 / 3.1	20 / 4.5					9 / 2	13 / 2.9						
71 / 2.8	16 / 3.6	21 / 4.7	17 / 3.8	23 / 5.2					11 / 2.5	15 / 3.4						
80 / 3.1	17 / 3.8	23 / 5.2	20 / 4.5	27 / 6.1					12 / 2.7	17 / 3.8						
90 / 3.5	18 / 4	24 / 5.4	23 / 5.2	31 / 7					14 / 3.1	19 / 4.3	14 / 3.1	20 / 4.5				
100 / 3.9	19 / 4.3	25 / 5.6	25 / 5.6	33 / 7.4	29 / 6.5	39 / 8.8			15 / 3.4	21 / 4.7	17 / 3.8	23 / 5.2				
112 / 4.4	19 / 4.3	26 / 5.8	27 / 6.1	36 / 8.1	34 / 7.6	45 / 10.1			16 / 3.6	22 / 4.9	20 / 4.5	26 / 5.8				
125 / 4.9	20 / 4.5	27 / 6.1	28 / 6.3	38 / 8.5	38 / 8.5	51 / 11.5			17 / 3.8	23 / 5.2	22 / 4.9	30 / 6.7				
140 / 5.5	20 / 4.5	27 / 6.1	30 / 6.7	40 / 9	42 / 9.4	56 / 12.6			18 / 4	24 / 5.4	24 / 5.4	32 / 7.2	27 / 6.1	37 / 8.3		
160 / 6.3	21 / 4.7	28 / 6.3	31 / 7	42 / 9.4	46 / 10.3	62 / 13.9	56 / 12.6	75 / 16.9	19 / 4.3	26 / 5.8	26 / 5.8	35 / 7.9	32 / 7.2	43 / 9.7		
180 / 7.1	21 / 4.7	29 / 6.5	33 / 7.4	44 / 9.9	49 / 11	66 / 14.8	63 / 14.2	84 / 18.9	20 / 4.5	26 / 5.8	28 / 6.3	38 / 8.5	37 / 8.3	49 / 11		
200 / 7.9			33 / 7.4	45 / 10.1	52 / 11.7	69 / 15.5	69 / 15.5	92 / 20.7	20 / 4.5	27 / 6.1	30 / 6.7	40 / 9	40 / 9	53 / 11.9		
224 / 8.8			34 / 7.6	46 / 10.3	54 / 12.1	72 / 16.2	75 / 16.9	100 / 22.5	21 / 4.7	28 / 6.3	31 / 7	41 / 9.2	43 / 9.7	57 / 12.8	53 / 11.9	71 / 16
250 / 9.8					57 / 12.8	75 / 16.7	80 / 18	106 / 23.8			32 / 7.2	43 / 9.7	46 / 10.3	60 / 13.5	61 / 13.7	80 /18
280 / 11					59 / 13.3	78 / 17.5	85 / 19.1	112 / 25.2			33 / 7.4	44 / 9.9	48 / 10.8	63 / 14.2	68 / 15.3	89 / 20
315 / 12.4					61 / 13.7	80 / 18	90 / 20.2	118 / 26.5			34 / 7.6	45 / 10.1	51 / 11.5	66 / 14.8	75 / 16.9	97 / 21.8
355 / 14					63 / 15.2	82 / 18.4	94 / 21.1	123 / 27.6					53 / 11.9	68 / 15.3	81 / 18.2	104 / 23.4
400 / 15.7							99 / 22.2	127 / 28.5					55 / 12.4	71 / 16	87 / 19.6	110 / 24.7

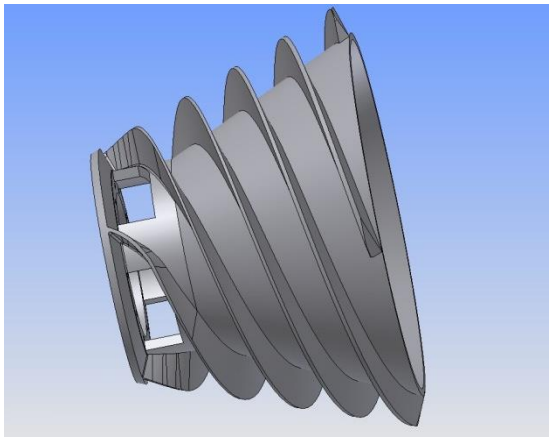
Deflection force **K** [N]																
	XPZ		**XPA**		**XPB**		**XPC**		**SPZ**		**SPA**		**SPB**		**SPC**	
d_r	K_{min}	K_{max}	K_{min}	K_{max}	K_{min}	K_{max}	K_{min}	K_{max}	K_{min}	K_{max}	K_{min}	K_{max}	K_{min}	K_{max}	K_{min}	K_{max}
[mm] / [in]	[N/Lb]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]
450 / 17.7							103 / 23.1	132 / 29.7					57 / 12.8	72 / 16.2	92 / 20.7	115 / 25.8
500 / 19.7							107 / 24	135 / 30.3					59 / 13.3	74 / 16.6	96 / 21.6	119 / 26.7
560 / 22							112 / 25.2	139 / 31.2							99 / 22.2	129 / 29
630 / 24.8															103 / 23.1	132 / 29.7
710 / 28															106 / 23.8	135 / 30.3
860 / 33.9															110 / 24.7	137 / 30.8

8.9 Rotating parts

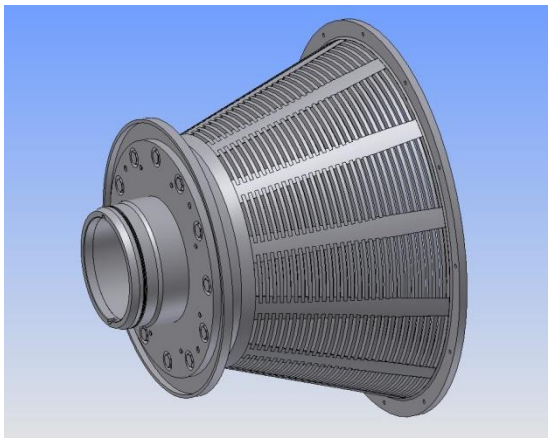
Rotating parts play a central role in a centrifuge. Together with the discharging device they implement the functional principle of the machine.
The suspension fed into the machine must be accelerated to the corresponding rotational speed, dehydrated, transported and discharged again.
In order to achieve good separation of the solid and liquid material, screening elements adapted to the particular application are incorporated and require corresponding care and maintenance. Wear or damage of the screening elements or parts of the rotor participating in the transport of the product impairs the separating performance of the centrifuge.
It is therefore essential that the operator pays due attention to proper maintenance of these parts.



Bearing housing with screen drum and worm



Scraping worm



Screen drum with drum flange

The large centrifugal forces which appear impart a further significance to these parts concerned with the technical safety aspects. This implies that damaged parts or, for example, parts of the rotor weakened by corrosion must be replaced immediately with new parts.

Before commencing work, take all necessary precautions for work safety (see the chapter *2 Safety* and in the chapter *Operation, maintenance and repairs* as well as in section *8.3 Securing the centrifuge for installation tasks*). SIEBTECHNIK accepts no liability for damage resulting from failure to comply with the regulations or behavioural instructions.

Ensure in any case that the centrifuge cannot be switched on inadvertently.

Preclude that the maintenance personnel can come into contact with residues of dangerous material to be centrifuged or is exposed to danger from process pressure or process temperature.

Make sure that the maintenance personnel is wearing the necessary protective equipment.

In some installations, switch-on is possible at the centrifuge or from the measuring station. Please make sure that possibly fatal remote switching cannot occur inadvertently.

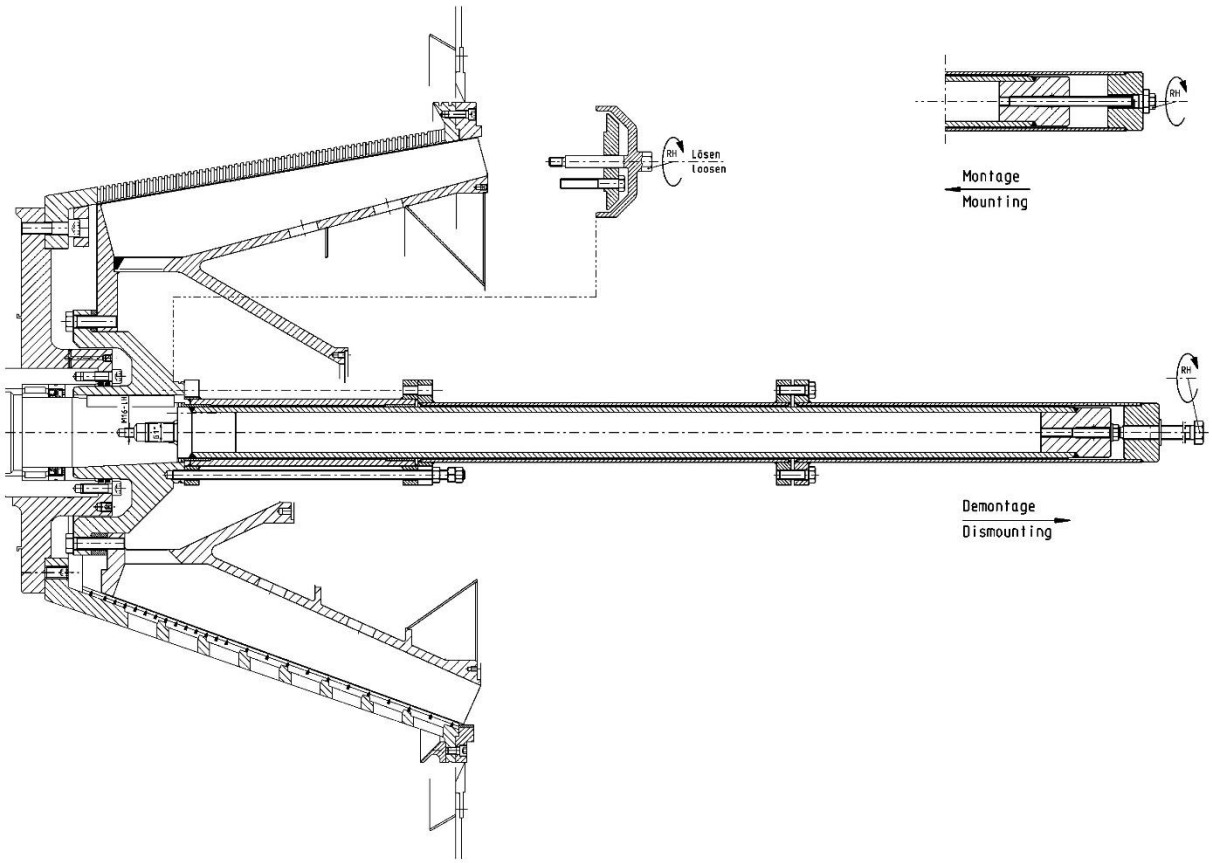
Secure the rotor of the machine against moving. Due to asymmetricaly adhering product residues, the rotor can be set in motion by its weight force. Even a very slow rotating component can be very dangerous due to the inertia and can cut off your fingers, for example.

8.9.1 Removal and assembly of the worm complete with worm hub

The disassembly of this unit is a prerequisite for:

- Work on the screen coating
- Removing the drum and drum flange
- Work on the seals within the processing space
- Disassembly of the gearbox
- Work on the main bearing assembly
- Access to process space seal, gearbox and main bearing

Use the equipment and drawings provided for the worm assembly.



Removal of the worm complete with worm hub

- Inlet pipe or feed worm and any washing pipes, if present, must be removed.

First secure the filling worm with a suitable hoist before unscrewing it for removal. Store the filling worm in a stable position until it is reinstalled.

- Clearing vanes and solid matter discharge gutter (if present) must be removed.
- The worm hub is chucked on a conical seat on the driven shaft and must be pulled off this conical seat.

Prior to this, use a feeler gauge to measure the existing gap between worm and screening element and document the result.

- Remove the cover from the worm hub.
- Secure the central guide pipe of the jig to the drive shaft and push the guide pipe firmly onto the shaft, so that the plane surfaces lie firmly on top of each other.
- Lubricate the guide pipe with a thin oil film.
- Mount the withdrawal device according to the drawing and start the withdrawal.

If the worm hub should not detach from the conical seat on the driven shaft despite a tensioned withdrawal device, do not increase the pretension any further. The withdrawal device could suffer damage. Usually, an axially directed blow onto the end of the device will resolve the problem.

Be careful when pulling out the worm, it may have sharp edges and burrs due to wear. Risk of cuts!

- Remove crank winch
- While it is hanging from the hoisting gear, slide the worm over the end of the guide pipe and place it on a wood pallet.

Measure and document the thickness of the conical gap adjusting ring which is located between worm hub and worm and determines the gap width between worm and conical drum section.

If you use withdrawal screws to remove the worm hub from the worm in order to modify the gap between worm and conical drum section, make sure to dress all imprints of the withdrawal screws on the worm or on the

conical gap adjusting rings carefully so that the end faces will come to make contact smoothly after the reassembly.

Imprints, burrs or dirt residues on this face will inevitably affect the true running accuracy of the worm and cause the centrifuge to vibrate.

Take this opportunity to examine the worm for wear and corrosion, and enter your inspection findings into the check book for centrifuges. If necessary, clean the space between worm shaft and hollow shaft of the gearbox. The packing rings on the worm hub (if present) can be exchanged on this occasion.

Assembly of the worm complete with worm hub

Make sure that the thickness of the conical gap adjusting ring that you have selected will provide the desired gap width.

Attention! For safe operation of the screen worm centrifuge, the gap is adjusted to 1.5‰ ... 2‰ of the large drum diameter. Smaller gaps are admissible only after a joint risk assessment and consultation with SIEBTECHNIK.

If a new screening element is installed, its thickness may deviate from that of the screening element used previously. In such a case, the dimensional difference of the new screening elements needs to be considered.

- Before reassembling worm, worm hub and conical gap adjusting rings, check once more whether all end faces are clean and show no imprints or burrs.
- Bolt worm, the selected conical gap adjusting rings and worm hub together.
- Check whether the packing rings on the worm hub (if installed) are in good condition or need to be replaced.
- Attach the withdrawal pipe to the worm hub and mark the position of the key groove so that you can identify the groove position later when you insert the worm.
- Make sure that the conical bore and the key groove in the worm hub are clean.
- Attach shackle bolt and tie bolt (if required) to the worm.
- Secure the central guide pipe of the insertion and withdrawal device with central thread to the driven shaft and push the guide pipe firmly onto the shaft, so that the end faces lie firmly on top of each other.
- Make sure that the conical seat of the driven shaft is clean.
- Make sure that the key in the driven shaft is present and clean.
- Lubricate the guide pipe with a thin oil film.

- Rotate the driven shaft until the key of the conical seat points upwards.
- Lift the assembly consisting of worm, worm hub and withdrawal pipe with a hoisting gear, push the withdrawal pipe onto the guide pipe and slide the unit as far as possible into the product housing.
- Take care that no product residues fall onto the conical seat.
- Slide the assembly slowly into the drum.
- When the worm hub has been pushed onto the conical seat of the driven shaft:
- Remove the crank winch
- Complete the lifting device according to the drawing.
- Chuck the worm assembly with the central screw onto the conical seat.
- Remove the jig
- Clamp the worm hub firmly onto the conical seat, using the final fixing cover, and close the hub area carefully with the sealing cover (if installed).
- Use the feeler gauges to check the gap between worm and screening element along the entire circumference.
- Try to rotate the worm with abrupt powerful movements so that it moves with respect to the drum to an extent corresponding to the gearbox backlash to see whether the worm runs unhindered or whether it is jammed with respect to the drum.
- Rotate the worm with mounted V-belts by several turns and check whether worm and drum run unhindered and perform the desired mutual relative movement.
- Complete the centrifuge.
- Clean and prepare the jigs for storage, and then store them carefully.

At oil and/or process temperatures above 50°C, it may happen that the special steel worm hub slides a bit further onto the cone due to thermal expansion and axial conveyance feed.
If this happens, the bolts of the clamping plate lose part of their pretension and should be tightened again after approximately one day of operation.

8.9.2 Screening elements

The service life of the incorporated screening elements depends on the processed product. Deteriorating separation results and increasing vibration of the machine could be an indication that the screening elements are worn out.

According the characteristics of the solid matter, two different screening elements may be used:

- The **screening plates** are wearing parts which do not possess enough inherent strength for accepting high levels of centrifuge operation, and for this reason they are built into a stable drum.
- The **wedge wire basket** consists of inner axially aligned and profiled wires that are welded to cross bars. The wire-to-wire distance corresponds to the screening gap. There are different profiled wire geometries available; the aperture angles range from 8° to 20°. The cross bars run on the outside in circumferential direction and are called "Q bars". After installation, the wedge wire basket rests on the drum, i.e. on the drum support ribs.

Take this opportunity to examine the drum and product housing for wear and corrosion, and enter your inspection findings into the check book for centrifuges.

Use the equipment and drawings provided for replacing the screening element.

In this chapter, the assumption is made that the drum has been uninstalled and that there are good conditions for careful and clean working.

Examine the old screening element and draw up a report on your findings and the service life achieved by the element. Document also the date of installation of the new element, the specifications and the installation condition!

8.9.2.1 Sheet metal screen change:

Due to the small plate thickness, the screening plates are very susceptible to damage. Make sure that the screening plates are stored and transported carefully and are not damaged by bends, imprints or dents.

The lips of the screening edges are sharply edged! Always wear protective gloves when handling screening plates.

Screening plates have an operating side (equalling the inner side, often ground and smooth) and an outer side; the apertures widen towards the outside. Whenever you install screening plate segments, take care not to mismatch the two sides! If you should invert the position, with the widening apertures pointing inward, solid particles will jam in the apertures immediately on production start and the screening plate will clog.

Disassembly of the screening plate

- To replace the screening plates, welded including flanged edge, first of all dismount the housing lid, the inlet pipe, the solid matter discharge gutter and the mounting lid on the product housing.
- The fixing nuts of the holding basket can be removed through the mounting ports.
- Remove the holding basket from the centring device, using the forcing threads in the drum flange.
- The holding basket can then be pulled out by hand.
- Dismantle the clamp ring to take out the worn screening plate.
- Clean-off product residues from the holding basket.

In SIEBTECHNIK centrifuges different types screening plates are used:

- Screening plate welded to a cone (with and without flange)
- Screening plate as a sheet metal (sheet section), which has to be processed to a cone.

Preparing a screen sheet cone

- Straighten one side of a screen plate panel.
- Place the screen plate, overlapped to the cone in the drum, so that the straightened side is visible.
- The screen sheet cone should have a clearance of 12-15 mm at the small diameter of the drum. It must not contact the flange or the transition radius of the drum.
- If necessary shorten the screening plate at the small diameter with the help of a sheet metal shear.
- Insert the lap plates loosely.
- Mark the screen plate for cutting with the straightened side at the overlap.
- Remove the lap plates.
- Remove the screening plate.
- Shorten the screen plate in accordance with the marking.
- Place it the screen plate, molded to the cone into the drum above a drum rip.
  - Screen plate edges must meet.
- Install the screen plate as indicated in the following section.

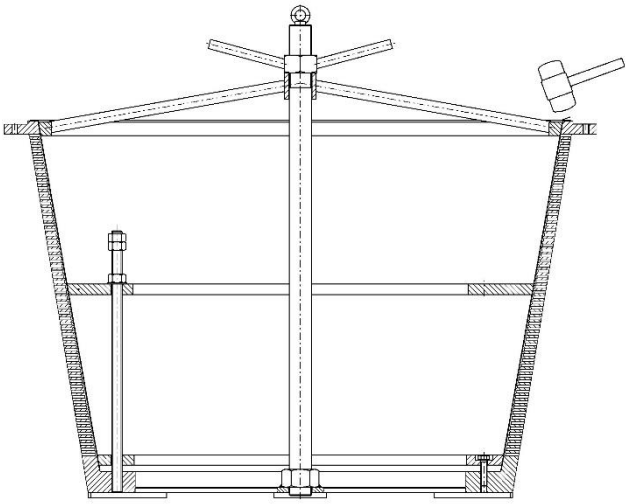
Assembly of the screening plate

- Push the screen sheet cone into the drum.
- The screen sheet cone should have a clearance of 12-15 mm at the small diameter of the drum. It must not contact the flange or the transition radius of the drum.
  - The drum must be completely covered, that no product can pass next to the screen plate.
- If necessary shorten the screening plate at the small diameter with the help of a sheet metal shear.
- Insert the lap plates loosely.
- Now the screening plate still projects out too far axially at the large diameter of the drum. Mark the required lap allowance of 6-8 mm projection (depending on the machine size) and cut off the material beyond the marking.
- Loosely screw in the screws for the lap plates.
- Avoid knocking dents into the screening plate.
- Lay on the clamp ring and loosely screw in the 3 - 4 screws of the clamp ring.
- Make sure that the lap plates still lie loosely in the screening plate cone, and with the help of the clamp ring and the 3 - 4 screws press the sheet metal cone cautiously and axially into the drum.

Take care that no dents are formed when pressing in axially.

- Check whether the screening plate is everywhere in contact with the drum. To this end, tap with your fingertips against the screening plate.

- Now first of all clamp the upper lap plate on the large diameter and then the small lap plate. For very large drums with a nominal diameter of 1000 mm there is a third medium lap plate.
- It is essential to keep to the sequence large/medium/small when clamping to avoid dents produced by thrust stress of the sheet metal.
- Now remove the clamp ring. The screen sheet cone is held in the clamped state by the lap plates.
- With a plastic hammer bend over the axially projecting lap allowance of the screening plate outwards at the large diameter, so that the sheet edge lies against the face side of the drum.



- For lapping make outward pulling hammer blows in the bending direction. Avoid hammer blows in the direction of the sheet edge, which would apply thrust stress to the screening plate and could dent it.
- Mount the clamp ring.
- Remove the lap plates and clamping devices.
- Mount the locking ring on the small diameter (if it exists).

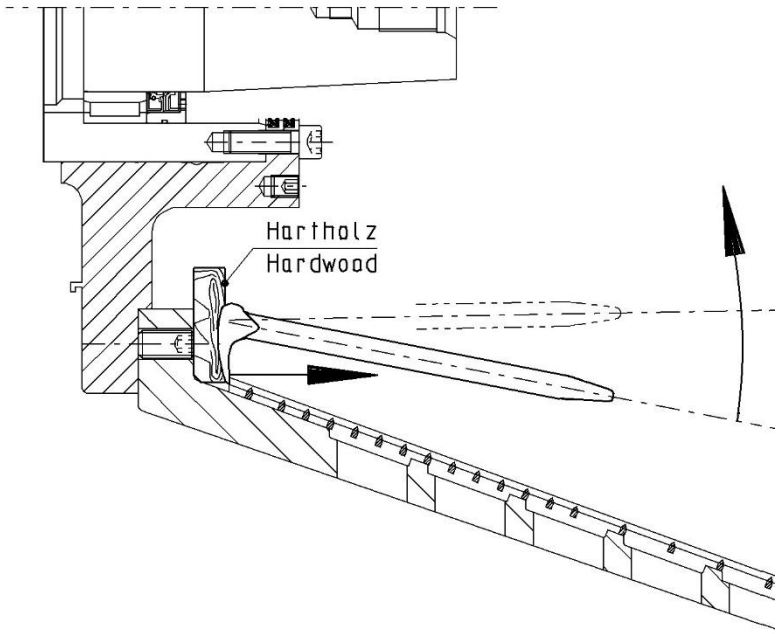
Check whether the screening plate makes contact with the drum everywhere. To this end, tap with your fingertips against the screening plate.

Avoid knocking dents into the screening plate.

8.9.2.2 Wedge wire basket changing

Wedge wire baskets are elastic and provide little stiffness by themselves. Therefore, transport, rotate and hoist them with due care.

- To replace the wedge wire basket, first of all take off the case lid, inlet pipe, solid matter discharge gutter and the mounting lid on the product housing.
- Normally the wedge wire basket can be pressed out of the holding basket in the axial direction after removing the clamp ring. This requires gentle levering movements on the wedge wire basket using simple tools through the mounting ports of the product housing. Clean the holding basket before mounting the new wedge wire basket. Push-in the new wedge wire basket and attach it by screwing down the clamp ring.



- The holding basket must be taken out if, because of product deposits or severe wear, the wedge wire basket cannot be removed as described above.
- The fixing nuts of the holding basket can be removed through the mounting ports. Use the forcing thread in the flange of the drum to release the holding basket from the centring device. The holding basket can then be pulled-out by hand together with the wedge wire basket.
- After taking out the old wedge wire basket and cleaning the holding basket, screw-attach the latter again to the drum.
- The new wedge wire basket can then be pushed-in and fixed with the clamp ring as described above.

- The wedge wire basket is made of several flat segments welded together. After forming the segments to the conical wedge wire basket, the transverse rods run deviating from the specified circumferential direction in the form of arches which lie in regions on the supporting ribs of the drum after mounting the wedge wire basket in the drum.
- Check the gap between the worm and the wedge wire basket all round with a feeler gauge. Depending on the machine dimensions, the gap should be set to 1.5 to 2 ‰ of the large drum diameter.

The wedge wire basket must not pressed into the drum with force because this could deform and damage basket, drum and clamp ring.

- Finally record the following:
  - Specification of the screening element
  - Installation date
  - Assessment of the mounted state

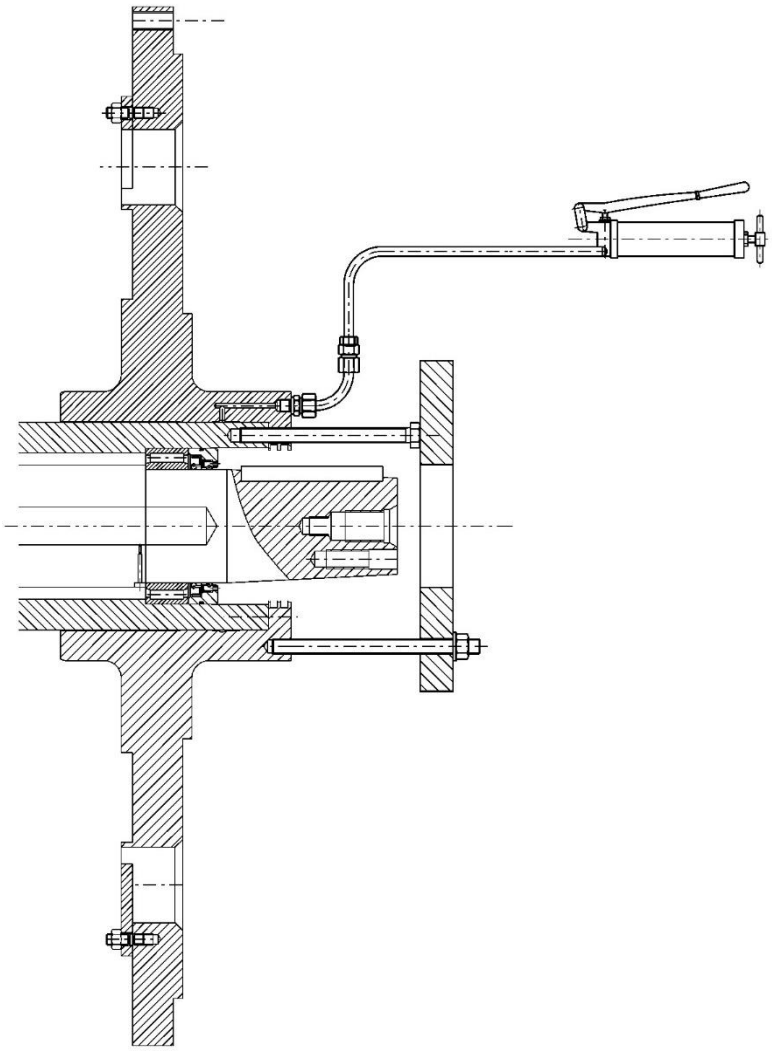
8.9.3 Disassembly and fitting of the drum complete with drum hub

The disassembly of this unit is a prerequisite for:

- Work on the seals within the processing space
- Disassembly of the gearbox
- Work on the main bearing assembly
- Access to process space seal, gearbox and main bearing

Use the equipment and drawings provided for the drum assembly

Take care that the screening element is not damaged during all work on the drum.



8.9.3.1 Disassembly of the drum complete with drum hub

Studs or bolts and nuts connect the drum hub with the hollow shaft of the gearbox. After the bolts or nuts have been removed, the drum hub can be withdrawn from the hollow shaft in two ways:

- Withdrawal of the drum hub using the assembly jig
    - After the assembly jig has been fitted as shown in the drawing, both the hub and the drum can be pulled off by means of the central bolt located at the end of the jig.

The withdrawal force is in this way transmitted to the worm shaft and the axial bearing of the worm shaft. In order not to damage the bearing, the work must be carried out sensitively and without resorting to the use of the hammer.

The drum hubs of bigger centrifuges may feature two short step seats on the hollow shaft. During all assembly processes, oil must be pumped between them. This widens the hub and facilitates the sliding and withdrawal action since the surfaces are lubricated.

- Pulling off the drum hub using withdrawal screws

    - In the drum hub, there are forcing threads present on the hollow shaft diameter. The drum hub can be withdrawn using forcing bolts that press against the abutting face of the hollow shaft or against the borehole end of the threaded holes. As several forcing bolts are available for use, a higher pulling force can be brought to bear in this way.

Only use withdrawal screws which have a rounded front face.

Screw the assembly jig on shortly before the withdrawal process is finished. Finish the withdrawal process only with the assembly jig.
In this way, the heavy drum is safely supported by the guide pipe and will not drop into the product housing. Support the end of the guide pipe with a crank winch before pulling the heavy drum out of the product housing.
Follow the work steps in chapter *Removal and assembly of the worm including worm hub.*

Take this opportunity to examine the drum unit and product housing for wear and corrosion, and enter your inspection findings into the check book for centrifuges.

8.9.3.2 Fitting the drum complete with drum hub

- Secure the central guide pipe of the jig to the drive shaft and push the guide pipe firmly onto the shaft, so that the plane surfaces lie firmly on top of each other.
- Secure the pull-off tube which acts as slide to the drum hub.
- Make sure that the mating surfaces of the drum hub and hollow shaft and the front faces are clean and free from scoring, burrs and scratches.
- Oil the throat of the drum hub so that it can easily slide into the seal of the processing space later on..
- Using hoisting gear, raise the drum unit onto the oiled guide pipe and, without putting any strain onto the guide pipe, feed the unit as deeply as possible into the product housing.
- Depending on dimensions and weight of the centrifuge, the end of the guide pipe needs to be supported with a crank winch before the load is lowered onto it because otherwise, the guide pipe could break off under the load.

Push in the drum unit slowly and carefully until it is just short of the hollow shaft. Make sure that you place your fingers and thumbs on the inside of the drum when pushing it in, so as to prevent them from being crushed at the dividing wall of the product housing.

- Use long guide bolts when pulling the drum hub onto the hollow shaft.

Finish off the procedure for pulling on the drum slowly and carefully, make sure that the throat of the drum hub slides smoothly into the seal of the processing space in the process.

- Finally, secure the drum hub.
- Remove the jigs
- Check that the drum turns freely by hand. A certain amount of resistance can be caused by new seals.
- Check that the gap between the drum and the dividing wall of the product housing is uniform and that the drum runs precisely true.
- Clean and prepare the jigs for storage, and then store them carefully.

8.10 Bearing

All main bearings employed in the centrifuge are continuously lubricated with fresh oil by the oil circulation lubrication. The bearings themselves do not require any particular maintenance. However, sufficient lubrication of the bearings must be ensured (see chapter ***8.6 Lubrication***).

We recommend precautionary replacement of the bearings within the scope of a complete inspection of the machine. The fits of the bearing seats in the bearing housing should thereby be checked too.

Take all necessary occupational safety precautions prior to the start of work. It is essential to comply with the instructions in Chapter *3 Safety* and in Chapter *8.1 Safety information and rules of conduct for assembly work*. SIEBTECHNIK accepts no liability for damage resulting from failure to comply with the regulations or rules of conduct.

8.10.1 Disassembling the bearings

- Before the bearings can be disassembled, the gearbox must be removed first (see chapter ***8.12 Gearbox***).
- Then, remove the bearing caps from the housing or the bearing flange that remained on the gearbox.
- Now, you can withdraw the bearings or bearing rings.

Take care to apply the withdrawal forces directly to the affected component but in no case to the drive shafts or output shafts of the gearbox because otherwise, the bearings in the gearbox could suffer damage.

Use the withdrawal devices possibly supplied by the manufacturer.

8.10.2 Assembly of the bearings

Assemble the bearings in the reverse order of disassembly.

Before mounting the internal bearing rings on the gear shafts, heat them up to approx. 100°C in an oil-bath or by means of induction.

8.11 Seals

Various sealing locations must be taken into consideration in the centrifuge:

- Product area to atmosphere (shaft sealings)
  - Contact between internal centrifuge atmosphere and external environment atmosphere is prevented.
  - Escaping of solid material, filtrate or steam is blocked.

- Stock points to environment or to product area (shaft sealings)
  - Oil leckage outwards or into the produkt area is prevented
  - Infiltration of the centrifuging material into the stock point is prevented

- Static sealing areas between housing parts and covers and connections

Before commencing work, take all necessary precautions for work safety (see the chapter *2 Safety* and in the chapter *Operation, maintenance and repairs* as well as in section 8.1 Securing *the centrifuge for installation tasks*). SIEBTECHNIK accepts no liability for damage resulting from failure to comply with the regulations or behavioural instructions.

Ensure in any case that the centrifuge cannot be switched on inadvertently.
Make sure that the maintenance personnel cannot come into contact with residues of dangerous material to be centrifuged or be exposed to danger from process pressure or process temperature.
Make sure that the maintenance personnel is wearing the necessary protective equipment.

In some installations, switch-on is possible at the centrifuge or from the measuring station. Please make sure that possibly fatal remote switching cannot occur inadvertently.

A clean working environment is mandatory. Contamination can penetrate into the seals and damage or destroy them.

8.11.1 Labyrinth-sealing

In case of no overpressure or low pressure in the process system and no harmful products are processed and vapours or gases must not be pressed outside or also air must not be pressed into the process area, open labyrinth sealing with different geometry can be used.

If there is a washing connection installed at a labyrinth, use washing water at any rate. It is not allowed to use salted water, which causes salt encrustations damaging the bearing sealing.

In most cases it is sufficient to make a short washing process at the end of a shift. A continuous washing is rather damaging than useful.

It is only allowed to wash while running the centrifuge.

8.11.2 Static sealings

Housing cover and other static parts are executed as paper- or o-ring sealings. The sealing materials are chosen according to process case.
For the food field PTFE-sealings are predominantly used.

Due to the cold flow behavior of PTFE seals, regular monitoring of the seal and a regular tightening of the screw is required.

8.11.3 Shaft sealing rings

Sealing rings in the product area:

In the spacing between the rotating parts (e.g. drum and worm hub) shaft sealing rings in special type of construction are used, which prevent a pollution of the bearing. Because of the low relative motion of the parts to each other it is not necessary to use a complex chamber packing (see chapter ***8.11.4 Chamber packing***). Sealing materials are adapted to the installing situation and stability standards etc.

Sealing rings outside the product area:

Should an open labyrinth for bearing protection not be sufficient or possible, the bearings will be protected against fouling with shaft sealing rings.

While installing the sealing ring act with caution! Otherwise the seal of the ring could be damaged.

8.11.4 Chamber packing

The chamber packing rings, which are made of a chemically highly inert carbon/PTFE combination, seal the product space on the bearing side against the external environment. In the gastight version of the centrifuge this permits pressures of up to p_{max}= 200 mbar ≡ 0.2 bar possible in special design up to 0.5 bar. For maintenance of seal effect the chamber packings must be fed either with a sealing liquid or gas dependent on the process.

Every single ring consists of tree segments pressed on the rotating part by a spiral spring.

Operation of the centrifuge without sealing medium reduces the sealing effect of the chamber packing and can destroy it by penetration of product particles.
The size of the volume steams depends on the pressure difference, the state of corrosion of the sealings, quantity and arrangement of the sealing rings and also on the state of concentricity of the sliding surfaces.

The sealing medium is led into the chamber between the first and second ring of the process space side. It serves for three purposes:

- The continuous flow of sealing medium into the process space prevents leakage flow of process gas to the exterior in the opposite direction.
- The sealing medium inertises the process space.
- The sealing medium prevents ingress of product into the chamber packing and thus keeps it clean and functioning.

A prerequisite for permanently reliable functioning of the chamber packings is adequate flow rate of the sealing medium. This is ensured only when the sealing medium enters the chamber packing with an excess pressure of 0.3 bars above the process pressure.

In some cases a separate gas pipe is used for a preinertisation, which must be shut after finishing the preinertisation. Take care, that the gas flow through the sealings for the continuous inertisation of the process area is sufficient.

In order to prevent the escape or too much sealing medium towards the atmospheric side, sealing grease or sealing fluid can be fed into another chamber located further towards the outside, depending on the seal design and process compatibility.
In normal case overlapped mortised chamber packing rings for the sealing to the atmosphere side are used.

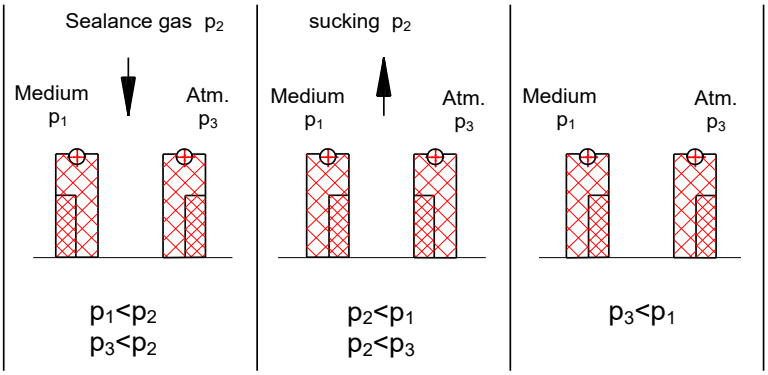
Segment rings with axial passing joint (radially cutted):

The inner diameter of new segment rings of this design is a little smaller than the shaft or the bushing. During mounting the joints faintly open, until the segment ends are lying together like arches after some time of running in. Then the segments have less friction at the sealing area to the shaft.

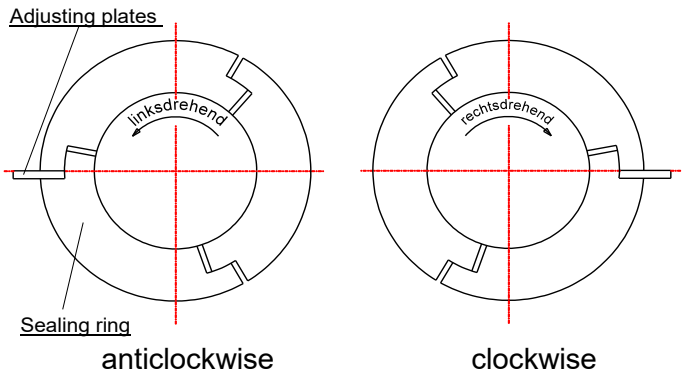
Overlapped mortised chamber packing rings

The segment end covers themselves with much reserve space into the circumferential direction. If corrosion arises at the contact surface or the sealing ring, the three segments move together bit by bit and are permanently lying at the shaft embraced by a spiral spring.

While mounting overlapped mortised chamber packing rings take care, that the sealing ring plug will be installed at the side, which is averted from the higher ***pressure***:



If chamber packing rings with adjusting plates are used, in the bottom housing half adjusting slots on both sides are installed.
Dependent on the rotating direction of the shaft in the housing the adjusting plates must lie as follows:



If there are no sealing rings with adjusting plates, you can find anti-twist devices in the form of a small bolt or a grub screw at the side of the housing chamber.

8.12 Gearbox maintenance

This chapter describes the most important and generally valid work steps for the removal or fitting of your gearbox.

The gearbox in your centrifuge has the following important tasks:

- Generation of the differential rotation speed between screen drum and worm;
- Transmission of the high torque required for the conveyance of solid matter by the worm in the centrifugal field of the drum.

Detailed information on the design of your gearbox is provided in the following chapters:

- 1 Datasheet
- 11. Drawings
  - Gearbox drawings
  - Sectional drawing
- 12 Part lists

Take all necessary occupational safety precautions prior to the start of work. It is essential to comply with the instructions in Chapter *3 Safety* and in Chapter *8.1 safety information and rules of conduct for assembly work*. SIEBTECHNIK accepts no liability for damage resulting from failure to comply with the regulations or rules of conduct.

Before commencing work, keep the sectional drawing of your machine at hand and make yourself familiar with the special equipment of your centrifuge. This applies especially to the areas of the seals between product housing and bearing housing.

You must collect the remaining oil quantities from the gearbox housing and dispose of them according to regulations.

Take care to apply the withdrawal forces directly to the affected component but in no case to the drive shafts or output shafts of the gearbox because otherwise, the bearings in the gearbox could suffer damage.

8.12.1 Removal of the gearbox

For removing the gearbox the following working steps are required:

- Remove the V-belt protection, V-belt, oil pipe and oil feed head
- Remove the speed sensors and their support arms (if installed)
- Remove the overload protection as well as
  - Clutch arm (in case of single drive)
  - V-belt pulley (in case of double drive)
- Remove the worm complete with worm hub
- Remove the drum complete with drum hub

Possibly it will be necessary to disassemble the product housing before removing the rotating parts.

- Mount the withdrawal device for the gearbox on the drive unit side (only on H 700 to H 1000) and attach the carrying segment of the device to the rear bearing cap.

Later, when the gearbox is pulled out of the bearing housing, the NU type main bearing on the product side is divided in a way that the inner ring slides in axial direction out of the rolling elements of the bearing.

- Check whether there is a bearing bush beside the inner bearing ring on the hollow shaft of the gearbox that might not fit through the rolling elements of the bearing. Strip this bearing bush off (if installed).
- Mount the guide pipe to the output shaft.
- Loosen the bolts of the big bearing cap on the drive unit side.
- Attach a hoisting gear to the bearing cap if no withdrawal device is available.
- Pull the gearbox carefully out of the bearing housing.
- Slide the inner ring of the main bearing carefully and slowly out of the rolling elements, using the guide pipe.
- Deposit the gearbox horizontally on an adequate support - secured to prevent rolling - to ensure that the bearing cap is clear.

Make sure not to damage protruding gear shafts.

- Finally, V-belt pulleys, bearing caps and the main bearings can be disassembled.
- Clean gearbox and gearbox housing.
- Inspect all components.

8.12.2 Installing of the gearbox

To install the gearbox, you must work through the steps listed in 8.12.1 in reverse order.

Make sure that the oil discharge bores in gearbox and gearbox housing or bearing housing are clear.

8.13 Thread connections

8.13.1 Tightening torque

Tightening torques for fixing screws for various materials and strength classes in Newton meter / foot pounds :

	M5	M6	M8	M10	M12	M14	M16	M20	M22	M24	M30
A4-50	2,8 2,1	4,8 3,6	11 8,1	23 17,0	39 28,9	64 47,4	100 74,0	195 144,3	270 199,8	340 251,6	690 510,6
A4-70	5,7 4,2	9,7 7,2	23 17,0	47 34,8	80 59,2	125 92,5	205 151,7	400 296,0	550 407,0	690 510,6	1400 1036,0
A4-80	6,9 5,1	11 8,1	28 20,7	57 42,2	95 70,3	155 114,7	250 185,0	490 362,6	670 495,8	800 592,0	1700 1258,0
1.0570	4,1 3,034	7 5,18	17 12,58	34 25,16	58 42,92	90 66,6	145 107,3	290 214,6	400 296	500 370	1000 740
1.4301	2,6 1,9	4,4 3,3	10 7,4	21 15,5	37 27,4	59 43,7	90 66,6	185 136,9	250 185,0	320 236,8	640 473,6
1.4306	2,4 1,776	4,1 3,034	10 7,4	19 14,06	34 25,16	54 39,96	85 62,9	170 125,8	230 170,2	290 214,6	590 436,6
1.4401	2,7 2,0	4,7 3,5	11 8,1	22 16,3	38 28,1	62 45,9	95 70,3	190 140,6	260 192,4	330 244,2	680 503,2
1.4404	2,5 1,9	4,3 3,2	10 7,4	21 15,5	36 26,6	58 42,9	90 66,6	180 133,2	240 177,6	310 229,4	630 466,2
1.4410	6,6 4,9	11 8,1	27 20,0	55 40,7	90 66,6	150 111,0	240 177,6	470 347,8	650 481,0	800 592,0	1650 1221,0
1.4435	2,5 1,9	4,3 3,2	10 7,4	21 15,5	36 26,6	58 42,9	90 66,6	180 133,2	240 177,6	310 229,4	630 466,2
1.4439	3,7 2,7	6,4 4,7	15 11,1	30 22,2	53 39,2	85 62,9	135 99,9	260 192,4	360 266,4	460 340,4	900 666,0
1.4462	5,3 3,9	9,1 6,7	22 16,3	44 32,6	75 55,5	120 88,8	195 144,3	380 281,2	520 384,8	660 488,4	1300 962,0
1.4470	5 3,7	8,5 6,3	20 14,8	41 30,3	70 51,8	110 81,4	180 133,2	350 259,0	490 362,6	610 451,4	1250 925,0
1.4501	6,2 4,6	10 7,4	25 18,5	51 37,7	85 62,9	140 103,6	220 162,8	440 325,6	600 444,0	750 555,0	1500 1110,0
1.4517	5,5 4,1	9,5 7,0	23 17,0	46 34,0	75 55,5	125 92,5	200 148,0	390 288,6	540 399,6	680 503,2	1350 999,0
1.4529	4 3,0	6,8 5,0	16 11,8	33 24,4	57 42,2	90 66,6	145 107,3	280 207,2	390 288,6	490 362,6	950 703,0
1.4539	2,9 2,1	5 3,7	12 8,9	24 17,8	41 30,3	67 49,6	105 77,7	205 151,7	280 207,2	360 266,4	700 518,0
1.4550	2,7	4,5	11	22	38	61	95	190	260	320	660

	2,0	3,3	8,1	16,3	28,1	45,1	70,3	140,6	192,4	236,8	488,4
1.4571	2,7	4,5	11	22	38	61	95	190	260	320	660
	2,0	3,3	8,1	16,3	28,1	45,1	70,3	140,6	192,4	236,8	488,4
1.4580	2,9	4,9	11	23	40	65	100	200	280	350	700
	2,1	3,6	8,1	17,0	29,6	48,1	74,0	148,0	207,2	259,0	518,0
1.4581	2,5	4,2	10	20	35	56	90	175	240	300	610
	1,9	3,1	7,4	14,8	25,9	41,4	66,6	129,5	177,6	222,0	451,4
2.4610	3,5	5,9	14	28	49	75	125	240	330	420	850
	2,6	4,4	10,4	20,7	36,3	55,5	92,5	177,6	244,2	310,8	629,0
2.4819	3,7	6,4	15	30	53	85	135	260	360	460	900
	2,7	4,7	11,1	22,2	39,2	62,9	99,9	192,4	266,4	340,4	666,0
3.7035	3,4	5,7	14	27	48	75	120	240	330	410	800
	2,5	4,2	10,4	20,0	35,5	55,5	88,8	177,6	244,2	303,4	592,0
3.7065	4,9	8,3	20	40	69	110	175	340	480	600	1200
	3,6	6,1	14,8	29,6	51,1	81,4	129,5	251,6	355,2	444,0	888,0
3.7105	4,3	7,4	18	35	61	95	155	310	420	530	1050
	3,2	5,5	13,3	25,9	45,1	70,3	114,7	229,4	310,8	392,2	777,0
SAF2507	6,6	11	27	55	90	150	240	470	650	800	1650
	4,9	8,1	20,0	40,7	66,6	111,0	177,6	347,8	481,0	592,0	1221,0
5.6	3,1	5,3	12	25	43	70	110	215	290	370	750
	2,3	3,9	8,9	18,5	31,8	51,8	81,4	159,1	214,6	273,8	555,0
8.8	5,5	9,4	22	45	75	125	195	380	520	660	1300
	4,1	7,0	16,3	33,3	55,5	92,5	144,3	281,2	384,8	488,4	962,0
10.9	7,2	12	30	59	100	160	260	500	690	850	1750
	5,3	8,9	22,2	43,7	74,0	118,4	192,4	370,0	510,6	629,0	1295,0
12.9	8,7	14	36	70	120	195	310	600	800	1050	2100
	6,4	10,4	26,6	51,8	88,8	144,3	229,4	444,0	592,0	777,0	1554,0

The torques are applicable for hexagon head screws according to ISO 4014 (DIN 931) and ISO 4017 (DIN 933) as well as for hexagon socket head cap screws according to ISO 4762 (DIN 912). Application for expanding screws is not permitted!

The installation conditions and the procedure for tightening the screws must be taken into consideration:

A friction coefficient values of μ = 0,12 for carbon steel, μ = 0,19 for stainless steel, μ = 0,22 for titanium must be ensured as friction factor at the thread or nut (lubricated with grease or adhesive); screw head dry!

Screws for mounting drum bottoms on hollow or pusher shafts of pusher centrifuges must be tightened with 1.15 times the specified torque.

When mounting screw connections with NORD-LOCK washers torque recommendations above are also to be used.

Tightening torques for mounting V-belt pulleys with taper lock bushings in Newton meter / foot pounds :

Taper-Lock-Type	1008	1108	1210	1215	1310	1610	1615	2012	2517	3020
Wrench size	3	3	5	5	5	5	5	6	8	8
Tightening torques	5,7 4.2	5,7 4.2	20 14.8	20 14.8	20 14.8	20 14.8	20 14.8	31 22.9	49 36.3	92 68

Taper-Lock-Type	3030	3525	3535	4030	4040	4535	4545	5040	5050
Wrench size	8	10	10	12	12	14	14	14	14
Tightening torques	92 68	115 85.1	115 85.1	172 127.3	172 127.3	195 144.3	195 144.3	275 203.5	275 203.5

8.13.2 Handling of thread connections made of stainless steel

Note that thread connections made of stainless steel have an increased tendency to seize the thread.

Provide all thread connections made of stainless steel with a mounting paste before assembly.

For lubrication a mounting paste that is NSF-H1 listed and approved for occasional food contact can be used.

When thread connections are to be secured, this is to be ensured by using screw locking means, e.g. Loctite.

8.13.3 Thread connections for regular use

Threaded connections for regular use made of stainless steel must be regularly lubricated during use.

8.14 Electrical system

Caution: Danger of electrocution!
All work performed on electrical connections may only be carried out by a qualified electrician. All required tasks may be carried out only when there is no voltage connected to the machine.

Also observe the instructions specified in Chapter 3. *Safety*.

A maintenance overhaul of the electrical system comprises the following tasks, such as:

- Inspection of the proximity switches (e.g. overload protection, rotational speed)
- Checking the oil supply (not with Turbo Cascades C)
- Checking the vibration monitor
- Checking the overspeed shutdown system (during the frequency converter operation)
- Visual and functional check of the centrifuge control system (control cabinet, control panel, etc.)
- Checking the electrical connections of the machine (drive motors, hydraulic system and filling device as well as sensors, level monitors, heaters, inert system, door locking system, further special accessories, etc.)
- Checking the interlocking circuits (integration of the centrifuge control system in the plant control system)
- Connections for earthing / equipotential bonding

Also comply with the operating instructions and data sheets of the auxiliary aggregates in *Chapter 13. Supplier Documentation*.

9. Electrical equipment, control system

Please consult the part list as well as the ADI list for the equipment of your centrifuge.

Include the centrifuge into your plant control system. See the instructions in Chapter ***11.2 ADI Documentation.***

The following components must be electrically connected:

- Drive motor(s)
- Hydraulic / lubricating oil pump motors
- Vibration monitoring
- Speed monitoring
- Temperature monitoring
- If necessary, monitoring of the shaft sealing
- Monitoring of the lubricating oil supply (except for SHS or machines without circulating oil lubrication)
- Pusher control unit (for pusher centrifuges SHS)
- Additional equipment according to the part list as well as the list of motors and instruments
- Auxiliary aggregates for suspension, solids and filtrate
- Interlocking of the centrifuge drive with the plant aggregates

Caution: Danger of electrocution! All work performed on electrical connections may only be carried out by a qualified electrician. All required tasks may be carried out only when there is no voltage connected to the machine.
SIEBTECHNIK accepts no liability for any damage resulting from failure to comply with the regulations or rules of conduct.

9.1 Motors

SIEBTECHNIK supplies the centrifuges complete with motors. For details regarding the supplied motors, please refer to Chapter ***1 Datasheet***, Chapter ***11.2 ADI Documentation*** and Chapter ***13 Supplier documentation***.

If due to the contractual agreements the machine is delivered without motors, you will find necessary data for the selection of the drives in Chapter ***1 Datasheet,*** Chapter ***11.2 ADI Documentation.***

The drive motors must comply with the technical requirements and be designed as three-phase squirrel cage motors.

On account of the large moment of inertia of the rotating parts, a set-up for the heavy start-up must be provided for the drive motor. A frequency converter may possibly be provided for starting up and operating the machine.

Interlock the motors such that they can be switched on and off only with the correct switching sequence. See the switching sequence table for switching centrifuge motors, *Chapter 7.4.1*.

Possibly a motor must be dismounted, e.g. for maintenance work, and then be deposited next to the centrifuge. For this, provide a sufficiently long connection cable so that the motor will not have to be disconnected

9.1.1 Rotational direction of the motors

When connecting the motors (drive motor / oil pump motor / hydraulic motor) observe the directional arrow at the motor as well as at the machine and/or the instructions in Chapter *6 Installation* and *7 Commissioning*.

9.2 Integrity of safety-related parts of the control system

According to the centrifuge standard DIN EN 12547 safety-related parts of control systems must be designed in accordance with EN ISO 13849 or EN 62061.

Siebtechnik selects sensors and devices with which a cut-off according to the respective safety level can be made.
In case of a control system provided by Siebtechnik, these requirements have been met.

If the control system is to be integrated by the customer, the operator will have to verify that the required safety level is observed. In case of non-observance, the CE conformity of the centrifuge will expire.

All safety-related components must be included in the interlocking of the machine.

As the operator of the centrifuge, you must check the functionality of the safety-related parts of the control system at regular intervals. In doing so, the entire shutdown chain must be considered. For details on how to carry out and how often to check the parts supplied by SIEBTECHNIK, see *chapter 13 Supplier documentation*.

9.2.1 Vibration and speed monitoring

According to the risk assessment the vibration and speed monitoring is classified as safety-related components.
The safety level required for this monitoring is PLr = d or SIL 2.

Usually, SIEBTECHNIK centrifuges are set up in processing plants assessed according to IEC 61508. Here, the sector application standard EN 62061 applies to the machines.

Monitoring	**Required safety level**	**Risk to be avoided**
Vibration (max)	SIL 2	Irreversible injury or death due to damage / fracture of the rotor and the resulting hurling of parts and/or product.
Rotational speed (max) Or rotational speed "0"	SIL 2	Irreversible injury or death due to damage / fracture of the rotor and the resulting hurling of parts and/or product. Prevent the exceedance of the max. rotational speed. Or reliable detection of the machine's standstill.

9.2.1.1 Monitoring of the operating speed

When idling, the drive motor is running at a higher rotational speed than under full load. When determining the operating points of the machine, this must be taken into account for the cut-off of the speed monitoring.

9.2.2 Monitoring of the shaft sealing

The requirement to monitor the shaft sealing may have various reasons.

- The ignition hazard assessment may reveal that the required safety level for the monitoring of the shaft sealing is PLr = d or SIL 2.
- Owing to a risk assessment on the operator side, a safe shaft sealing may be required for the processing of other (e.g. dangerous, toxic) products, too.

Usually, the shaft sealing is designed as a chamber packing with (inert) gas admission.

Other shaft sealing designs must be monitored analogously.

Monitoring	**Required safety level**	**Risk to be avoided**
Flow rate of the sealing medium into the shaft sealing Differential pressure within the shaft sealing to the processing space	SIL 2	Leaks of the shaft sealing **Scenario 1.1:** Emergence of product from the machine Generation of an explosive atmosphere outside the machine **Scenario 1.2:** Infeed of product into the machine Generation of explosive atmosphere within the machine Possibility of an explosion Irreversible injury or death **Scenario 2:** Emergence of dangerous product Irreversible injury or death

9.3 Monitoring of the lubricating oil supply

For monitoring purposes, machines with circulating oil lubrication are equipped with flow meters for the lubricating oil supply system of bearings and gears. If the lubrication fails, bearings and/or gears of the machine will be damaged.

Even if only one minimum flow is undercut, the machine must be switched off (machine stop).

For machines equipped with an oil pressure switch, the minimum oil pressure must be included in the interlocking system.

Ensure the specified limit values in the list of motors and instructions in Chapter *11.2 ADI Documentation*.

Depending on the equipment of your centrifuge, further information can be found in Chapter *13 Supplier documentation*.

9.4 Pusher control unit (for SHS pusher centrifuges)

SHS pusher centrifuges may have been equipped with an electric pusher control to be connected by the customer.

If the translatory motion fails or in case of a fault within the control system, the machine must be switched off (machine stop). For this, the pusher control unit generates a fault signal.

9.5 Additional equipment

The machine may be equipped with additional equipment parts / instruments / aggregates. These are specified in the part list or the list of motors and instruments (ADI). In case of faults, signals or achieved limit values they must be switched off. Usually, limit values are specified in the list of motors and instruments (ADI).

In case the limit values are reached / exceeded, the machine must be switched off (machine stop).

9.6 Auxiliary aggregates for suspension, solids and filtrate

For the safe operation of the centrifuge it is necessary that solids and filtrate can drain away freely or must be discharged. The suspension feed also depends on the operating condition of the centrifuge.

9.6.1 Suspension feed

The suspension feed must only be active when the centrifuge has reached its operating speed.

To avoid flooding the machine, the suspension feed must be closed automatically and quickly when the centrifuge is switched off or fails.

The start-up time in the case of a direct switch-on of the motor is 5-55s, depending on the machine size, rotational speed and motor power rating. The start-up time may take several minutes (start-up ramp) when utilising a frequency control unit.

During the rinsing process, ideally the suspension feed should be switched off, in order to increase the cleaning effect.

If in order to be rinsed, the centrifuge is moved to a different operating point (e.g. speed reduction), the suspension feed must be switched off.

9.6.2 Discharge aggregates for solid matter and filtrate

When these aggregates have stopped, the suspension feed to the centrifuge must not be capable of being switched on.

The suspension feed to the centrifuge must be switched off automatically when one or both of these aggregates fail(s).

Where filtrate and solids run off under the influence of gravity, it must be ensured at all times that the outlets are always clear, and a congestion is prevented. Otherwise, the suspension feed to the centrifuge must be switched off.

9.7 Interlocking of the centrifuge with plant aggregates

In order to operate the centrifuge, the surrounding plant sections must be integrated into the plant control system.

The operation of the centrifuge requires a functioning periphery; without it the centrifuge is not able to function at all or only to a limited degree and thus must not be operated.

Ensure compliance with the specified limit values in the list of motors and instruments in Chapter *11.2 Electrical System / ADI Documentation*.

In Chapter *11.2 Electrical System / ADI Documentation* you can find additional circuit diagrams, terminal plans and/or functional sequence plans / logic diagrams providing further information.

Depending on the equipment of your centrifuge, further information can be found in Chapter *13 Supplier documentation*.

In accordance with the Machinery Directive all machines must be equipped with one or several EMERGENCY STOP command devices, in order to avoid any imminent or occurring danger.

Exempted are e.g. machines where the risk cannot be reduced by the EMERGENCY STOP command device.

For the operation of a centrifuge, it is not necessary to install an EMERGENCY STOP command device, because due to the long run-down time of the rotor the hazard cannot be eliminated immediately.

Depending on the construction and plant integration, an EMERGENCY STOP command device may be meaningful.
This must be proven by means of a risk assessment carried out by the operator.

9.7.1 Machine stop (emergency stop, trip signal)

During operation, dangerous operating conditions may occur requiring the immediate switch-off of the machine.

Criteria for an immediate switch-off:

- Overspeed
- Vibrations (max. value exceeded)
- Shaft sealing no longer ensured

These criteria require an immediate, safe switch-off of the machine.

Moreover, the following plant section must also be switched off immediately:

- Suspension feed

The lubricating oil supply system should still be operated.

9.7.1.1 Switch-off devices of the surrounding aggregates

When the centrifuge is switched off by a machine stop, the product space may be cleaned during the discharge.
Here, based on a risk assessment of the operator, the hazards caused by cleaning must be taken into account.
Hazards caused by cleaning agents may have to be considered.

Shortly before the standstill of the centrifuge at the latest (at approx. 100-200 rpm), the cleaning and the surrounding aggregates must be switched off, such as:

- Electrically controlled valves for automatic cleaning of the centrifuge (if present)
- Discharge aggregate for the solid matter, e.g. feed worm, belt conveyor
- Discharge aggregate for the filtrate, e.g. pump

Further components must be integrated in the interlocking system, depending on the equipment of the machine or the plant.

9.7.2 Plant stop (emergency stop)

When the plant is stopped (emergency stop), the machine and the periphery are switched off completely.

- Drive motor(s)
- Hydraulic / lubricating oil pump motors
- Machine control system
- Shaft sealing, if required
- Pusher control unit (for pusher centrifuges SHS)
- Additional equipment according to the part list as well as the list of motors and instruments
- Feed of material to be centrifuged
- Electrically controlled valves for automatic cleaning of the centrifuge (if present)
- Discharge aggregate for the solid matter, e.g. feed worm, belt conveyor
- Discharge aggregate for the filtrate, e.g. pump

Further components must be integrated in the interlocking system, depending on the special equipment.

The lubricating oil supply system should still be operated. A complete switch off, however, including the lubricating oil supply system may be required for safety reasons. Damage to the machine due to insufficient lubricating oil supply is unlikely, since residual oil remains at the bearings as well as within the gear, and the machine will come to a stop without braking, after a brief removal period without load.

This type of switch-off is not part of the machine's normal operation. The integrity of the machine or its components is not ensured in this case.

After such a switch-off, the machine must undergo a thorough check. During restart, especially the bearing and gear temperatures as well as the noise generation must be monitored.

10. Trouble shooting

This chapter is provided as help for remedying functional disturbances.

Fault	Cause	Remedy
Machine switch-off Monitoring devices for protecting the machine are installed on the machines for switching it off automatically. When the machine has switched off automatically, it must be determined which monitoring device has initiated the shutdown.	monitoring of the overload protection	• check machine • clean machine / rotor manually • remove product deposits • check rinsing intervals • check rinsing • increase rinsing volume
	speed monitor	• check v-belt pulley diameter with data sheet of the machine • check tensioning of the v-belts • check motor control system • check speed monitoring device • reset failure monitoring device

Fault	Cause	Remedy
Machine switch-off Monitoring devices for protecting the machine are installed on the machines for switching it off automatically. When the machine has switched off automatically, it must be determined which monitoring device has initiated the shutdown.	Monitoring oil circuit Oil pressure or oil flow too low (Design and limit values according to ADI list chapter 11. drawings and lists)	• check oil piping • check oil pump • check oil pump motor • check electrical connection of oil pressure monitor • check electrical connection of oil pump motor • check electrical network of oil pump motor • repair / replace oil pump • repair / replace oil pump motor • check oil tank level • reduce oil tank level to normal level • check seal of oil pump • replace oil pump seal
	actual rotational speed differs too much from the setpoint speed	• check v-belt pulley diameter with data sheet of the machine • check motor control system • check speed monitoring device • reset failure monitoring device
	rotational speed too high	• check v-belt pulley diameter with data sheet of the machine • check motor control system • check speed monitoring device • reset failure monitoring device

Fault	Cause	Remedy
Machine switch-off Monitoring devices for protecting the machine are installed on the machines for switching it off automatically. When the machine has switched off automatically, it must be determined which monitoring device has initiated the shutdown.	filtrate congestion	• remove filtrate blockage • check inspection intervals • check cleaning intervals • reset failure monitoring device
	slipping v-belts	• check tensioning of the v-belts • replace v-belts • reset failure monitoring device
	rotational speed monitor is adjusted incorrectly, the centrifuge might be switched off already during the start-up phase	• check tensioning of the v-belts • adjust speed monitoring device • reset failure monitoring device
	solid loading too high	• reduce solid feed
	product cake deposits	• remove product deposits • check rinsing intervals • check rinsing • increase rinsing volume
	product congestion	• remove product deposits • check rinsing intervals • check rinsing • increase rinsing volume

Fault	Cause	Remedy
Machine switch-off Monitoring devices for protecting the machine are installed on the machines for switching it off automatically. When the machine has switched off automatically, it must be determined which monitoring device has initiated the shutdown.	main motor	• check electrical connection of main motor • check electrical network of main motor • repair / replace main motor
	oil pump motor	• check oil pump • check oil pump motor • repair / replace oil pump • repair / replace oil pump motor
	door interlocking system	• check electrical connection of door interlocking system • check electrical interlock of door interlocking system • repair / replace door interlocking system
	Oil level monitoring (optional, see ADI list chapter 11. drawings and lists)	• check oil level • fill oil tank to normal level • check electrical connection of oil level monitor • check electrical interlock of oil level monitor
	downstream aggregates which are integrated in the centrifuge interlocking system	• check downstream aggregates • check electrical connections of downstream aggregates • check interlock connections of downstream aggregates • repair / replace downstream aggregates

Fault	Cause	Remedy
Machine switch-off Monitoring devices for protecting the machine are installed on the machines for switching it off automatically. When the machine has switched off automatically, it must be determined which monitoring device has initiated the shutdown.	fill level indicator in the filtrate tank	• check fill level in the filtrate tank • reduce fill level in the filtrate tank to normal level • check electrical connection of level monitor • check electrical interlock of level monitor • repair / replace level monitor
	belt conveyors for solid matter transport	• check electrical connection of belt conveyors • check electrical interlock of belt conveyors • repair / replace belt conveyors
	rotary air locks	• check electrical connection of rotary air locks • check electrical interlock of rotary air locks • repair / replace rotary air locks
Main motor power consumption too high	feed quantity too high	• reduce feed quantity
	product cake deposits in the centrifuge (e.g. behind the drum hub)	• remove product deposits • check rinsing intervals • check rinsing • increase rinsing volume

Fault	Cause	Remedy
Main motor power consumption too high	product blockage on the solids side	• remove product blockage • check rinsing intervals • check rinsing • increase rinsing volume • check solids discharge of the rotor • check inspection intervals • check cleaning intervals
	filtrate congestion	• remove filtrate blockage • check inspection intervals • check cleaning intervals
	blockage between the drum and the feed pipe	• remove product blockage • check rinsing intervals • check rinsing • increase rinsing volume • check solids discharge of the rotor • check inspection intervals • check cleaning intervals
	rotating parts rubbing on the labyrinths or dividing walls	• check space between rotating and idle components • prevent rubbing between components

Fault	Cause	Remedy
Main motor power consumption too high	phase failure in the main motor	• check electrical connection of main motor • check electrical network of main motor • repair / replace main motor
	damage to the main motor	• check electrical connection of main motor • check electrical network of main motor • repair / replace main motor
Power consumption of the oil pump motor too high	oil pump motor or oil pump faulty	• check oil pump • check oil pump motor • repair / replace oil pump • repair / replace oil pump motor
	failure of one phase	• check electrical connection of oil pump motor • check electrical network of oil pump motor • repair / replace oil pump motor
	motor flooded with oil	• clean oil pump motor • check oil tank level • reduce oil tank level to normal level • check seal of oil pump • replace oil pump seal

Fault	Cause	Remedy
Power consumption of the oil pump motor too high	suction tube clogged	• clean suction tube • clean oil pump • check oil tank for dust
	overflow valve jammed	• repair / replace overflow valve
Oil loss	pipelines, pipe unions, flexible connections leaking	• check all leaking parts • repair / replace leaking parts • retighten bolts and connectors
	defective cover seals	• repair / replace defective seals
	labyrinth, gaskets, O-rings defective	• clean labyrinths • repair / replace defective gaskets / O-rings
	labyrinth damaged	• repair / replace labyrinths
	drainage bores clogged	• clean drainage bores of labyrinths
	labyrinth mounted incorrectly – the drainage bores must face downwards	• remove labyrinth and mount correctly
	radial shaft sealing rings and/or running surfaces defective	• check / clean running surfaces • clean sealing rings • replace sealing rings • repair / replace running surfaces (bushing, running part)

Fault	Cause	Remedy
Oil loss	seals with respect to the product space defective (shaft sealing rings).	• check running surfaces • clean running surfaces • clean sealing rings • replace sealing rings • repair / replace running surfaces (bushing, running part)
Oil contamination Oil may be discoloured or foaming.	labyrinth on the drive unit side leaking (pay attention there to environmental influences such as dust, splashing water, etc.)	• replace oil • avoid splashing water coming into the hydraulic circuit • avoid dust coming into the hydraulic circuit • clean venting filter element of oil tank
	seal of cover and bolts that locate the worm hub or drum hub is leaky	• check covers and bolts of worm hub / drum hub • check seals • replace oil
	metal abrasion (hydraulic system- or bearing damage)	• check hydraulic system • check oil cooler • check oil tank • check bearing condition • repair / replace bearing • check gear • repair / replace gear • replace oil

Fault	Cause	Remedy
Oil contamination Oil may be discoloured or foaming.	burnt oil (hydraulic system - or bearing damage)	• check hydraulic system • check oil cooler • check bearing condition • repair / replace bearing • replace oil
	leak in the oil cooler: Cooling water could here be penetrating into the oil circuit	• check oil cooler • repair / replace oil cooler • replace oil
Oil temperature too high In normal operation the temperature of the oil in the oil tank should not exceed the room temperature by more than 40°C. If the operating temperature is higher than this, a lubricating oil with higher viscosity and possibly an oil cooler are required. Even then, the oil temperature in the oil tank should not exceed 80°C to max. 90°C.	ambient temperature has increased	• reduce ambient temperature • increase cooling water flow (if oil cooler is present) • reduce cooling water temperature (if oil cooler is present) • install oil cooler (if no oil cooler is used)
	product temperature has increased	• reduce product temperature • increase cooling water flow (if oil cooler is present) • reduce cooling water temperature (if oil cooler is present) • install oil cooler (if no oil cooler is used)
Oil temperature too high In normal operation the temperature of the oil in the oil tank should not exceed the room temperature by	oil cooler (if present) is not functioning	• check oil cooler • repair / replace oil cooler
	cooling water flow rate too small	• increase cooling water flow

Fault	Cause	Remedy
more than 40°C. If the operating temperature is higher than this, a lubricating oil with higher viscosity and possibly an oil cooler are required. Even then, the oil temperature in the oil tank should not exceed 80°C to max. 90°C.	cooling water is too hot	• reduce cooling water temperature
	mechanical fault in the machine	• check machine • repair machine
	heat up due to increased friction at the seals when product deposits have taken place there	• clean seals • check rinsing intervals • clean / check machine
	furring in oil cooler	• clean oil cooler • replace oil cooler
Vibrations unusually strong vibrations higher than about 10 - 12 mm/s	wear of screen element	• replace screen element
	partial blocking of screen element	• remove clogging • replace screen element • revise cleaning procedure • revise rinsing interval
	concentration fluctuations in the suspension	• take care for constant centrifuge feed
	fluctuating feed flows	• take care for constant centrifuge feed
	width deviation of one or more of the V-belts	• replace v-belts (use v-belts sorted according size)

Fault	Cause	Remedy
Vibrations unusually strong vibrations higher than about 10 - 12 mm/s	unbalance due to deposits in the machine	• clean machine • clean rotor • revise cleaning procedure • revise rinsing interval
Vibrations unusually strong vibrations higher than about 10 - 12 mm/s	foreign bodies in the feed zone	• remove foreign bodies • avoid input of foreign bodies
	clogging at the discharge	• remove clogging • revise cleaning procedure • revise rinsing interval
	intermittent charging of the centrifuge, e.g. by screw conveyor	• take care for constant centrifuge suspension supply
	poor accuracy and running precision of rotating parts after shop repairs	• assemble rotating parts accurately • clean contacting surfaces before assembly
	inadequate dynamic balancing of rotating parts during shop repairs	• rotating parts to be balanced adequately
	loose bolt connections / lost screws	• tighten / replace bolts / screws • check connections for failures
	unbalance at the motor and/or motor v-belt pulley	• balance v-belt pulley • balance motor

Fault	Cause	Remedy
High noise Help for finding the cause: Because sound is disseminated into the metallic components, the cause of noise can often only be more precisely located with the aid of a stethoscope. Some kinds of machine damage can be located more easily when the centrifuge is running down than when it is running at high operational speeds.	rubbing of components	• check space between rotating and idle components • prevent rubbing between components
	loosened bolted connections	• tighten / replace bolts / screws • check connections for failures
	roller bearing damage	• replace roller bearings
	gear damage	• replace / repair gear
	motor damage	• replace / repair motor
	Hydraulic aggregate defective	• replace / repair oil pump
	faulty lube oil pressure limiting valve	• replace / repair valve
	impact of separated solid matter on the housing wall (normal)	• no remedy possible
Increased residual moisture content in solid matters	screen element is partially contaminated, e.g. by caking deposits	• clean screen element • replace screen element • revise cleaning procedure • revise rinsing interval

Fault	Cause	Remedy
Increased residual moisture content in solid matters	screen element is partially clogged, e.g,. if the edges of the worm volutions have become round due to wear and the solid particles are pressed into the apertures	• clean screen element • replace screen element • check worm • repair / replace worm • revise cleaning procedure • revise rinsing interval
	screen plate has been incorrectly fitted with the drive side (stamped surface) facing outwards	• replace screen element
	replacement screen elements have insufficient free screening surface area, e.g. insufficient swallow volume for the liquid feed-in rate	• replace screen element
	openings of a new screen element are too fine and/or the aperture geometry is unsuitable, e.g. ridged	• replace screen element
	flow quantities (suspension and/or solids and/or liquid) have increased and become larger than the optimum settings and separating output specifications of the centrifuge	• reduce flow quantities
	average grain size of solid matter has become smaller	• rechange average grain size of the solid matter • reduce differential speed • increase machine speed (if possible)

Fault	Cause	Remedy
Increased residual moisture content in solid matters	suspension is squirted over the screening element towards the solid matter space	• reduce suspension feed • reduce amount of liquid in suspension • clean screen element • replace screen element • check worm • repair / replace worm • revise cleaning procedure • revise rinsing interval
Increased residual moisture content in solid matters	surface structure of solid matter has been modified	• rechange surface structure of solid matter • reduce differential speed • increase machine speed (if possible)
	viscosity of the liquid has increased in response to lowering of the process temperature	• rise process temperature to higher level
	amount of washing fluid has increased	• reduce amount of washing fluid
Loss of solid matter into filtrate has increased	screening element is worn out or damaged	• replace screen element
	opening of a separating groove of a screening plate in segment form	• check correct insertion of screen element • replace screen element
	rotating ring of a wedge wire basket at the small diameter outside does not lie in the corresponding drum inside surface, so that suspension can flow around the drum end.	• check correct insertion of screen element • replace screen element

Fault	Cause	Remedy
Loss of solid matter into filtrate has increased	open screening area of a new screening element is too large	• replace screen element
	gap between the dividing wall and the rotor has enlarged, thus enabling sprayed grains to gain access to the filtrate space from the solid matter space	• replace / repair product housing / dividing wall
	differential speed too high therefore turbulences preventing a rapid sedimentation	• reduce differential speed
	average grain size of the solid matter has become smaller	• rechange average grain size of the solid matter • reduce differential speed • reduce sump level • increase machine speed (if possible)
	solid content in the suspension has decreased (poorer thickening), so that the relatively larger quantity of liquid takes in more fine grains	• reduce liquid part of the feed to the machine • rise solid part of the feed
	changes in density of liquid and/or solid matter	• rechange density of liquid and/or solid matter to specified values
	flow quantities (suspension and/or solids and/or liquid) have increased and become larger than the optimum settings and separating output specifications of the centrifuge	• reduce flow quantities
	decreasing process temperature causes higher viscosity of the liquid - therefore less separation of fine particles from the liquid	• rise process temperature to higher level

Fault	Cause	Remedy
Filtrate leakage on processing space labyrinth and/or at dividing wall	Wear and tear at the sealing gaps	• reduce pressure inside product housing • connect the product housing of the machine to a generously dimensioned ventilation system leading outside located right on the filtrate connecting piece (in open systems) • install a generously dimensioned gas return feed from a filtrate cyclone back into the solid matter housing • clean the gas return feed from filtrate cyclone back into the solid matter housing
	Labyrinth chambers contaminated	• clean labyrinth chambers and shafts
	Excess pressure in the filtrate space too great, so that filtrate vapours escape through sealing gaps.	• reduce pressure in filtrate space

Fault	Cause	Remedy
Gas leakage in gastight machines	seals for flanges, door, windows and/or wipers defective	• check tightening of screwed covers / flanges • check surface conditions for seals • clean sealing surfaces • check seals • revise seals
	flexible connections for suspension, filtrate, washing fluid and/or solid matter defective	• check tightening of screwed connections / flanges • check surface conditions for seals • check sealing surfaces • check flexible connections • revise flexible connections
	shaft seals defective or dirty	• check tightening of screwed connections / flanges • check surface conditions for shaft seals • check sealing surfaces • check shaft seals • revise shaft seals
	sealing gas flow rate too low	• check tightening of screwed connections / flanges • check surface conditions for shaft seals • check sealing surfaces • check shaft seals • revise shaft seals • check connections for sealing gas • check piping for sealing gas for clogging / crushing

11. Drawings and lists

11.1 Drawings

The item numbers specified in the drawings are contained in the subassembly parts lists of the centrifuge!

The following documents are included in the scope of delivery of this documentation:

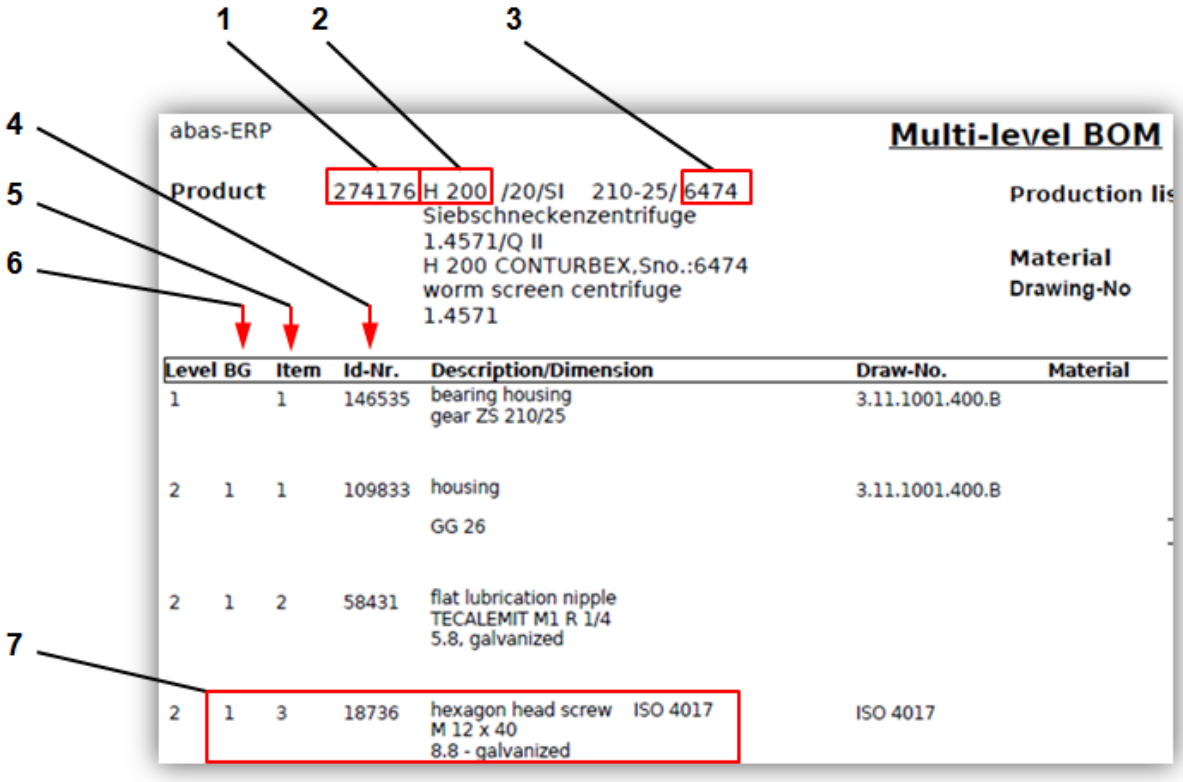
12. Spare and wear parts lists

The spare and wear part list in the appendix of these operating instructions informs about drawing and identification numbers of all applied components.
Our parts list is devided into assembly groups, which are devided again in position numbers.

These assembly group numbers as well as the position number you can also find in our drawings.

To avoid queries and for a quick handling of your concerns, we beg you to give us following data of your centrifuge in every correspondence:

- Machine type
- Machine number
- Identification number
- Identification number and position number of the required part



Information about the machine		**Information on spare or wear part**	
1	ID-No. Machine	4	ID-No. of spare part
2	Machine type	5	Position number of spare part
3	Machine number	6	Number of the assembly group (BG) of spare part
		7	Example spare part

Example [7]: Component 1/3 = Id-No. 18736 hexagon head screw M12x40

13. Sub-Suppliers Documentation

To below mentioned components we have added in this chapter detailed documentation and data sheets of sub-suppliers.

These components can also be found in the parts list and drawings.

The documentation is available in the corresponding directory on the supplied data medium.

14. QM-Documentation