



Instruction Manual

Alfa Laval Toftejorg™ TZ-67



Covering:
Standard machines
Machines delivered with ATEX/IECEX Certification in accordance with Directive 2014/34/EU
First published: January 1, 1988

ESE01796-EN13 2019-07

Original manual

The information herein is correct at the time of issue but may be subject to change without prior notice

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1 EC/EU Declaration of Conformity

The Designated Company

Alfa Laval Kolding A/S

Company Name

Albuen 31, DK-6000 Kolding, Denmark

Address

+45 79 32 22 00

Phone No.

hereby declare that

Tank Cleaning Machine

Designation

Alfa Laval Toftejorg TZ-67


Type

From serial number 2019-0001 to 2030-99999

is in conformity with Machinery Directive 2006/42/EC and the following harmonized standard is used:
DS/EN ISO 12100:2011 Safety of Machinery - Risk Assessment

is in conformity with (Ex / ATEX) Directive 2014/34/EU and the following harmonized standards are used:
EN ISO 80079-36:2016, EN ISO 80079-37:2016, DS/EN ISO/IEC 80079-34:2011, Annex A, paragraph A.5.3 Rotating machines

EC Type Examination Certificate no. Baseefa10ATEX0188X and IECEx BAS xx.xxxxX

Marking:  II 1G Ex h IIC 85°C... 175°C Ga
II 1D Ex h IIIC T85°C... T140°C Da

*The QAN (Quality Assurance Notification) is carried out by SGS Fimko Oy, Särkiniementie 3, Helsinki 00211, Finland. Notified Body No. 0598.
EU Type Examination Certification is carried out by SGS Fimko Oy, Särkiniementie 3, Helsinki 00211, Finland. Notified Body no. 0598.
IECEx Certificate of Conformity is carried out by Baseefa Ltd., Rockhead Business Park, Staden Lane, Buxton, Derbyshire SK17 9RZ, United Kingdom. IECEx Accepted Certification Body (ExCB).*

The person authorised to compile the technical file is the signer of this document.

Global Product Quality Manager
Pumps, Valves, Fittings and Tank Equipment

Title

Lars Kruse Andersen

Name



Signature

Kolding

Place

2019-07-01

Date (YYYY-MM-DD)

This Declaration of Conformity replaces Declaration of Conformity dated 2018-10-01



2 Safety

Unsafe practices and other important information are emphasized in this manual.

Warnings are emphasized by means of special signs.

Always read the manual before using the tank cleaning machine!

2.1 Important information

WARNING

Indicates that special procedures must be followed to avoid serious personal injury.

CAUTION

Indicates that special procedures must be followed to avoid damage to the tank cleaning machine

NOTE

Indicates important information to simplify or clarify procedures.

2.2 Warning signs

General warning:



ATEX/IECEx warning:



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3.1 Introduction

This manual has been prepared as a guide for installing, operating and maintaining your Alfa Laval Toftejorg tank cleaning machine. Should you require further assistance, our Technical Sales Support department and worldwide net of sales offices will be pleased to help you. Please quote the type, article and serial numbers with all of your enquiries; this helps us to help you. The type and serial number are placed on the gear house of the tank cleaning machine.

Get the best and most economical performance from your tank cleaning machine. Insufficient preventive maintenance means poor performance, unscheduled stops, shorter lifetime and extra costs. On the contrary, good preventive maintenance means good performance, no unscheduled stops and superior total economy

Warning:



Before installing the machine and setting it into operation, carefully read the General safety and installation instructions (page 11) and the specific conditions for safe use in accordance with ATEX/IECEX Directive 2014/34/EU (page 13) and take all necessary precautions according to your application and local regulations.

NOTE

The illustrations and specifications contained in this manual were effective at the date of printing. However, as continuous improvements are our policy, we reserve the right to alter or modify any unit specification on any product without prior notice or any obligation.

The English version of the instruction manual is the original manual. We make reservations in regard to possible mistranslations in language versions of the instruction manual. In case of doubt, the English version of the instruction manual applies.

3.2 Intended use

The end-user should verify:

- that the tank cleaning machine is in conformity with respect to tank, vessel or container size in which it is used.
- that the construction materials (both metallic and non-metallic) are compatibility with product, flushing media, cleaning media, temperatures and pressure under the intended use.

The tank cleaning machine is intended for use in closed tank, vessel or container. If used in open environment see 4.3 General safety and installation instructions.

To ensure the self cleanability and drainability the machine must be installed in vertical position.

3.3 Patents and trademarks

This Instruction Manual is published by Alfa Laval without any warranty. Improvements and changes to this Instruction Manual may at any time be made by Alfa Laval without prior notice. Such changes will, however, be incorporated in new editions of this Instruction Manual.

Alfa Laval Kolding A/S. All rights reserved.

The Alfa Laval logotype is a trademark or a registered trademark of Alfa Laval Corporate AB. "Toftejorg" is a trademark or registered trademark of Alfa Laval. Other products or company names mentioned herein may be the trademarks of their respective owners. Any rights not expressly granted herein are reserved.

3 Introduction

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3.4 Marking

Alfa Laval tank cleaning machines are all marked to allow for recognition of type of machine, machine name, serial number and manufacturing address. The marking is placed on the gear house of the tank cleaning machine.

Rotary Jet Head
"TZ-xx"
s/n.: yyyy-xxxxx
Alfa Laval, DK-6000 Kolding, Albuen 31
CE
"TZ-xx": TZ machine type

Serial number explanation:

Machines supplied with or without standard documentation:

yyyy-xxxxx: serial number

yyyy: year

xxxxx: 5 digit sequential number

3.5 ATEX/IECEx marking


The Alfa Laval Toftejorg TZ-67 is certified as category I component. The ATEX certification is carried out by the Notified Body SGS Fimko Oy, who has issued the certificate no. Baseefa10ATEX0188X.

The IECEx certification is carried out by the Certification Body SGS Baseefa Ltd., who has issued the certificate no. IECEx BAS xx.xxxxX.

Note

Explosion protection type is constructional safety "c".

The marking on the ATEX/IECEx certified Alfa Laval Toftejorg TZ-67 is as follows:

Rotary Jet Head
"TZ-xx"
s/n.: yyyy-xxxxx
Alfa Laval, DK-6000 Kolding, Albuen 31
 II 1G Ex h IIC 85°C...175°C Ga
II 1D Ex h IIIC T85°C...T140°C Da
CE 0598 Baseefa 10ATEX0188X IECEx BAS 19.0087X
"TZ-xx": TZ machine type

Serial number explanation:

Machines supplied with or without standard documentation:

yyyy-xxxxx: serial number

yyyy: year

xxxxx: 5 digit sequential number

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3.6 ATEX/IECEx temperature class and code

The maximum surface temperature depends mainly on operating conditions which are the temperature of the cleaning fluid and the ambient temperature.

Group II EPL Ga

The gas temperature class is corrected with a safety margin of 80% due to a requirement for Group II EPL Ga equipment. The gas temperature class depends on the cleaning fluid temperature or the ambient temperature, whichever of the two is the highest.

Table for determining temperature class (gas atmospheres)		
Temperature Class	Cleaning fluid Temperature, T_p (°C)	Ambient temperature, T_{amb} (°C)
85°C (T6)	$\leq +68^\circ\text{C}$	$\leq +68^\circ\text{C}$
100°C (T5)	$\leq +80^\circ\text{C}$	$\leq +80^\circ\text{C}$
135°C (T4)	$\leq +108^\circ\text{C}$	$\leq +108^\circ\text{C}$
175°C	$\leq +140^\circ\text{C}$	$\leq +140^\circ\text{C}$

Group III EPL Da

The dust temperature class depends on the cleaning fluid temperature or the ambient temperature, whichever of the two is the highest. No dust layer is considered.

Table for determining temperature class (dust atmospheres)		
Temperature code	Cleaning fluid temperature, T_p (°C)	Ambient temperature, T_{amb} (°C)
T85°C	$\leq +85^\circ\text{C}$	$\leq +85^\circ\text{C}$
T100°C	$\leq +100^\circ\text{C}$	$\leq +100^\circ\text{C}$
T135°C	$\leq +135^\circ\text{C}$	$\leq +135^\circ\text{C}$
T140°C	$\leq +140^\circ\text{C}$	$\leq +140^\circ\text{C}$

Example of gas class determination

Cleaning fluid temperature is 67°C and ambient temperature is 75°C.
Gas class = T5

ATEX/IECEx marking on the equipment:



II 1G Ex h IIC 85°C...175°C Ga
II 1D Ex h IIC T85°C...T140°C Da

3.7 Quality system

The Alfa Laval Toftejorg tank cleaning machines are produced according to Alfa Laval Kolding's ISO 9001 international Standard certified quality system.

4 Installation

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4.1 General description

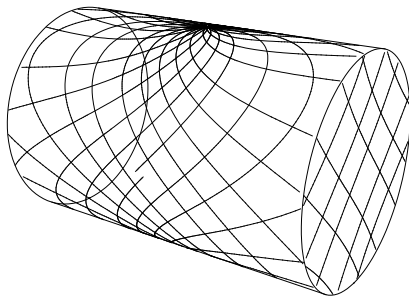
The Toftejorg TZ-67 is a media driven and media lubricated tank cleaning machine. As it is self lubricating, there is no lubricating substances such as oil grease etc. in the machine which needs to be regularly changed.

For use in explosive hazard zones the ATEX/IECEX version can be used, provided it is installed according to safety instructions in local regulations.

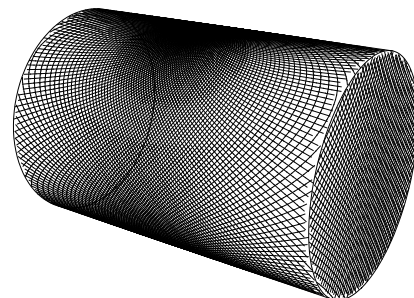
4.2 Functioning

The flow of the cleaning fluid passes through a guide and a turbine, which accordingly is set into rotation. The turbine rotation is through a gearbox transformed into a combined horizontal rotation of the machine body and a vertical rotation of the nozzles.

The combined motion of the machine body and the nozzles ensures a fully indexed tank cleaning coverage. After $5 \frac{5}{8}$ revolutions of the Hub with nozzles ($5 \frac{3}{8}$ revolutions of the machine body) one coarse cleaning pattern is laid out on the tank surface. During the following rounds, this pattern is repeated 7 times, each of which is displaced $\frac{1}{8}$ of the mesh in the pattern. After a total of 45 revolutions of Hub with nozzles (43 revolutions of the machine body), a complete cleaning pattern has been laid out, and the first pattern is repeated.



First cycle



Full pattern

The speed of rotation of the turbine depends on the flow rate through the machine. The higher the flow rate the higher the speed of rotation will be. In order to control the RPM of the machine for a wide range of flow rates, the efficiency of the turbine can be changed (100% and 0% Turbine/Inlet guide).

Apart from the jet flow through the nozzles, fluid is leaking through the top of the machine, at the hub and through the bottom cover. The leakage between the moving parts at the top and at the hub are cleaning the gabs and thus preventing build-up of material that might cause the friction. The flow through the bottom cover is due to the fact that the machine is media lubricated and that accordingly a flow through the gearbox is needed.

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4.3 General safety and installation instructions

The tank cleaning machine should be installed in a vertical position (upright or upside down). It is recommended to install a filter with mesh size of max. 3 mm in the supply line in order to avoid large particles to clog inside the machine. Before connecting the machine into the system, all supply lines and valves should be flushed to remove foreign matter.

NOTE

The machine shall be installed in accordance with national regulations for safety and other relevant regulations and standards. In EU-countries the complete system must fulfil the EU-machine Directive and depending of application, the EU-Pressure Equipment Directive, the EU-ATEX/IECEX Directive and other relevant Directives and shall be CE-marked before it is set into operation.

Warning:



Precautions shall be made to prevent starting of the cleaning operation, while personnel are inside the tank or otherwise can be hit by jets from the nozzles.

For information on use in potential explosive atmospheres see paragraph 4.4 Specific conditions for safe use in accordance with ATEX/IECEX certification page 13.

To protect your tank coating it is recommended to mount bumpers on the tank cleaning machine.

The machine as delivered has been tested at the factory before shipping. For transportation reasons, the nozzles have been screwed off after the test. In order to secure the nozzles against falling off due to vibrations and other external strains it is important that the nozzles are tightened properly after mounting. If not, the nozzles may be blown off during tank cleaning and cause severe damage on tank, valves and pump. This is especially important if machines are fixed installed in tanks and vessels within the transportation sector in trucks, railcars and onboard ships.

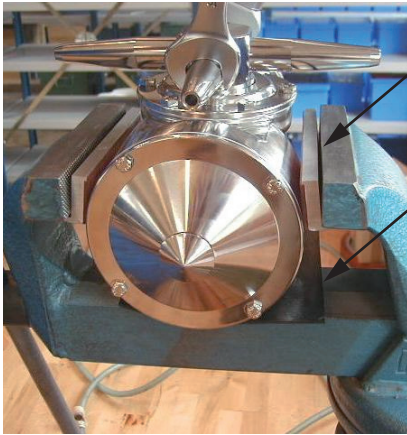
Normally, it is sufficient to tighten the nozzles with the specified torque. However, depending on the application and local policies an extra securing may be preferred.

Subject to the intended use, environment and any inhouse user requirements or policies, a liquid threadlocker such as Loctite No. 243 or equivalent could be used. Other methods could be acceptable and subject to customer preference. For detailed instruction on pre-cleaning and application of the product carefully follow the instruction on the used locking system.

4 Installation

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1. Clamp machine firmly in a vice. Protect machine with rubber pad under the machine and use rubber jaws on the vice. Mount jaws upside down to ensure firm grip on the machine. Set torque wrench at the specified tightening torque.
2. Hold one nozzle with flat spanner to counteract while tightening the opposite nozzle with the torque wrench.



Rubber jaw mounted upside down

Protect with rubber pad

Recommended tightening torque: 40 Nm



3. Check that the machine is in operating condition by inserting 3/16" hex Screwdriver (tool No. TE134A) in screw in top of Turbine shaft and easily turn Turbine shaft clockwise. If any resistance is recognised, the machine should be disassembled to localise the cause.
-

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4.4 Specific conditions for safe use in accordance with ATEX/IECEx certification

Directive 2014/34/EU

NOTE

Explosion protection type is constructional safety “c”.

Warning: Operated in a hazardous area



The unit may be operated in a hazardous area only when completely filled with cleaning fluid/steam. If a medium other than the cleaning fluid/steam is passed through the equipment the flow must not be high enough to cause the equipment to operate.

Warning: Operating guidance



The unit shall be operated in line with guidance provided by IEC/TS 60079-32-1 for tank cleaning.

Warning: Temperature class and ambient temperature range



The maximum surface temperature depends mainly on operating conditions which are the temperature of the cleaning fluid and ambient temperature. The temperature class and ambient temperature range are shown in paragraph 3.6 ATEX/IECEx temperature class and code, page 9.

Warning: Max. permitted temperature



When working:
The maximum permitted cleaning fluid temperature and ambient temperature is 95°C.
When not working:
The maximum permitted ambient temperature is 140°C.

Warning: Draining using compressed air



Draining using compressed air must not be done in ex classified zone.
Draining using compressed air is possible in non ex classified zones (see page 17).

Warning: Earthing



All metal and other conductive or dissipative material should be connected to earth with the exception of very small items.
For further information see IEC/TS 60079-32-1:2013 Explosive atmospheres – Part 32-1: Electrostatic hazards, guidance. With focus on clause 6.2.3, 7.2.1, 7.3, 7.9.2, 13.

Warning: Earthed when in use



The unit must be effectively earthed at all times when in use.

4 Installation

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4.4 Specific conditions for safe use in accordance with ATEX/IECEx certification

Warning: Max. permitted steaming temperature

The maximum permitted steam temperature through the machine and ambient temperature is 140°C.



Warning: Steaming tanks larger than 100 m³

Tanks with capacities larger than 100 m³ that could contain a flammable atmosphere should not be steam cleaned, as steam cleaning tanks produces an electrostatically charged mist. Tanks smaller than 100 m³ may be steam cleaned.

For further information see IEC/TS 60079-32-1:2013 Explosive atmospheres – Part 32-1: Electrostatic hazards, guidance. With focus on clause 7.10 and 8.5.



Tank size information

The tank cleaning machine has been certified by accredited notified body and can operate in tanks having an enclosed volume up to 100 m³ as long as all ATEX/IECEx warnings in the instruction manual are complied with.

General guidelines for tanks larger than 100 m³:

Tanks larger than 100 m³ must not be steam cleaned – See guide IEC/TS 60079-32-1:2013 clause 7.10.5 and 8.5

To use the unit in tanks larger than 100m³ is possible under certain conditions.

It is necessary to know the current factors such as tank size, cleaning solvent and product.

Additives can be used in the cleaning solvent, or, for example, the tank can be filled with nitrogen. The basic guidelines are described in the guide IEC/TS 60079-32-1:2013.

It must be ensured that the equipollently bonding of all conductive metal objects is in accordance with national regulations for use.

The cleaning fluid conductivity must correspond to the products in the group “High conductivity”, cf. IEC/TS 60079-32-1:2013 clause 7.1 and 7.2.

High conductivity	> 10 000 pS/m
Medium conductivity	between 25 × εr pS/m and 10 000 pS/m
Low conductivity	< 25 × εr pS/m

For liquids with a dielectric constant of around 2, (e.g. hydrocarbons), these classifications reduce to:

High conductivity	> 10 000 pS/m
Medium conductivity	between 50 pS/m and 10 000 pS/m
Low conductivity	< 50 pS/m

Following a guidance document such as IEC/TS 60079-32-1:2013 to establish safe use of machinery and process is the users own responsibility and is not covered by the ATEX/IECEx certification for this unit except for tanks up to 100 m³. For further information see IEC/TS 60079-32-1:2013 Explosive atmospheres – Part 32-1: Electrostatic hazards, guidance with focus on clause 7.1.3, 7.1.4, 7.2.1, 7.2.4.

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4.4 Specific conditions for safe use in accordance with ATEX/IECEx certification

Warning: Process generated electrostatic



The user must address the electrostatic hazards generated from the process of the equipment in accordance with guidance document IEC/TS 60079-32-1:2013.

Warning: Electrostatically charged liquid



Liquids can become electrostatically charged when they move relative to contacting solids or the spraying of liquids can also create a highly charged mist or spray. The liquid must be made electrically conductive by additives or otherwise.

For further information see IEC/TS 60079-32-1:2013 Explosive atmospheres – Part 32-1: Electrostatic hazards, guidance. With focus on clause 7.1.3, 7.1.4, 7.2.1, 7.2.4.

Warning: Appropriate cleaning fluid



The cleaning fluid should be appropriate for the application (e.g. so no chemical reaction can take place between the cleaning fluid and the residue of process fluid/powder/compound which can generate heat or a hybrid mixture).

Chemical reactions in Zone 20 - Hybrid mixtures:

End-user must ensure that the cleaning fluid used does not create a hybrid mixture according to IEC 60079-10-1:2015 Annex I.1 in connection with powder / dust residues in the tank in zone 20.

This should ensure that the atmosphere does not change to a classification that lies outside the machine's certified scope. When the machine is used for cleaning tanks containing potentially flammable dust atmospheres, and a potentially flammable fluid is used as the cleaning fluid then an assessment of the hybrid mixture shall be undertaken by the user, prior to operation.

For further information see IEC 60079-10-1:2015 Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres. With focus on clause 3.6.6 and Annex I – Hybrid mixtures.

Warning: Fluid pressure



The maximum permitted cleaning fluid pressure is 12 bar.

In addition to the above mentioned precautions relating to Directive 2014/34/EU, the Safety Precautions on page 16 must be observed.

5 Operation

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5.1 Normal operation

Cleaning Media

Use only cleaning media compatible with stainless steel AISI 316/AISI 316L, PFA, A4, ACO212CF and PEEK. Please note that PEEK is not resistant to concentrated sulfuric acid. Normal detergents, moderate solutions of acids and alkalis will be acceptable. Aggressive chemicals, excessive concentrations of chemicals at elevated temperatures as well as hydrochlorides should be avoided. If you are in doubt, contact your local Alfa Laval sales office.

Pressure

Avoid hydraulic shocks. Increase pressure gradually. Do not exceed 12 bar inlet pressure. Recommended inlet pressure appears from Technical Data (page 34). High pressure in combination with high flow rate increase consumption of wear parts. High pressure also reduces the cleaning effect.

Draining using compressed air

If the machine is drained using compressed air, then the compressed air pressure must not cause the machine body rotation to exceed 1.5 rpm (corresponding to approx. 40 sec. per rev of the body) in order to avoid risk of machine breakdown.

Draining should always be done inside the tank.

See paragraph 4.4 Specific conditions for safe use in accordance with ATEX/IECEX certification (page 13).

Steam cleaning

If steam cleaning is done through the machine, the steam pressure must not cause the machine body rotation to exceed 15 rpm (corresponding to approx. 4 sec. per rev of the body) in order to avoid risk of machine breakdown. See paragraph 4.4 Specific conditions for safe use in accordance with ATEX/IECEX certification (page 13).

Temperature

The maximum recommended cleaning fluid is 95°C. The maximum recommended steam temperature is 140°C. The maximum ambient temperature is 140°C.

See paragraph 4.4 Specific conditions for safe use in accordance with ATEX/IECEX certification (page 13).

After use cleaning

After use flush the machine with fresh water. Cleaning media should never allow to dry or settle in the system due to possible "salting out" or "scaling" of the cleaning media. If cleaning media contains volatile chloride solvents, it is recommended **not to flush with water** after use, as this might create hydrochloric acid.

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5.2 Safety precautions

The machine is intended for use inside a tank only. As peak velocity of main jets reaches 40 m/sec., the Alfa Laval Toftejorg TZ-67 must not be operated in open air or when tank is open.

Warning:



Hot chemicals and steam under pressure may be used for cleaning and sterilising. Protect against scalding and burning. Never tamper with or try to open clamps or other connections while system is in operation. Make sure that system is depressurised and drained before disassembly.

The cleaning jets impinging the tank surface are a source of noise. Depending on pressure and distance to the tank walls, noise level may reach up to 85 dB.

Warning:



Tanks may contain poisonous/hazardous products or products which represent an environmental or safety risk. Never open tank and dismount the machine without checking previous tank contents and necessary precautions.

See also 3.6 ATEX/IECEx temperature class and code, page 9.

6 Maintenance

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6.1 Service and repair of ATEX/IECEX certified machines

Warning:



All service and repair of ATEX/IECEX certified machines can be performed by Alfa Laval Kolding A/S, Denmark, or by an Alfa Laval service center approved by Alfa Laval Kolding A/S.

Changes to the machine are not allowed without approval by the person responsible for the ATEX/IECEX certification at Alfa Laval. If changes are made – or spare parts other than Alfa Laval original spare parts are used - the EC Type Examination certification (the ATEX/IECEX Directive) is no longer valid.

In order to ensure compliance with the ATEX/IECEX regulations and keep the machine ATEX/IECEX certification valid, the service or repair must be performed by an authorized person with knowledge of the ATEX/IECEX requirements and regulations. All spare parts must be original Alfa Laval spare parts and the repair or service must be done according to the instructions in this manual.

If a customer wishes to carry out service or repair himself, it is the responsibility of the repair shop to ensure that the ATEX/IECEX requirements are met in any way possible. After performing service or repair, the repair shop thus carries the full responsibility for traceability of all relevant documents in order to ensuring the retention of the ATEX/IECEX certification of the machine.

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6.2 Preventive maintenance

In order to keep your tank cleaning machine servicing you as an efficient tool in your tank cleaning operations, it is essential to maintain its high performance by following a simple preventive maintenance programme, which will always keep your tank cleaning machine in good condition.

Good maintenance is careful and regular attention!

The following recommended preventive maintenance is based on tank cleaning machines working in average conditions. However, you will appreciate that a tank cleaning machine, which has a rough and dirty job to do, will need more frequent attention than one working in ideal conditions. We trust that you will adjust your maintenance programme to suit.

Always use only proper tools. Use Toftejorg TZ-67 standard tool kit. Never force, hammer or pry components together or apart. Always perform all assembly/disassembly steps in the order described in this manual.

Never assemble components without previous cleaning. This is especially important at all mating surfaces. Work in a clear well lighted work area.

Note: Recommended tightening torque for all screws: 4-5 Nm.

Every 300 working hours

1. Disassemble machine as described on the following pages.
2. Clean material build-up and deposits from internal parts with Scotch-brite, S-Ultrafine, eventually chemical cleaner and fine abrasive cloth.
3. Check Slide bearings (position 28 on the cross sectional drawing, page 40) for wear. If hole is worn oval to max. diameter more than 10.4 mm, Slide bearings should be replaced. If end face of Slide bearing is worn more than x mm into Slide bearing, it should be replaced.

Under Turbine shaft:	x = 1.5 mm
At Horizontal shaft:	x = 0.5 mm

4. Check Collar bushes (10) in Gear frame. If holes are worn oval to max. diameter more than 13.4 mm, Collar bush should be replaced. How to replace Collar bushes, see page 30.

Note: Timely replacement of Slide bearings and Collar bushes will prevent costly damage to the gear box.

5. Check Worm wheels (11 and 33). If extremely worn, they should be replaced.
6. Check Main bush (5). If worn it should be replaced.
7. Assemble machines as described in the following pages.
8. Check that the machine is in operating condition by inserting Hex Screw-driver (tool No. TE134A) in screw in top of Turbine shaft and easily turn Turbine shaft clockwise. If any resistance is recognised, the machine should be disassembled to localise the cause.

Apart from the parts specifically mentioned above, all the remaining wear parts should regularly be inspected for wear. Which parts that are wear parts appear from Reference Lists of Parts, page 40.

6 Maintenance

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6.3 Top assembly

Disassembly

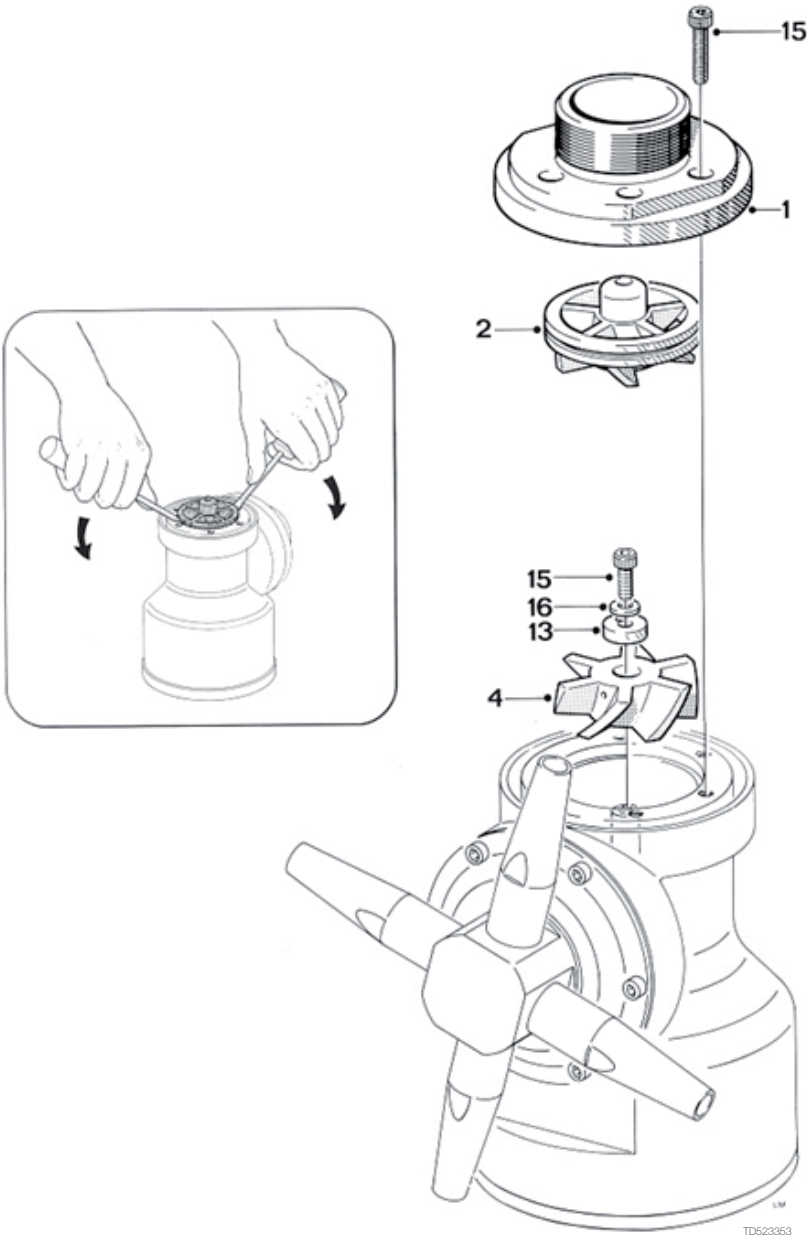
1. Remove Screws (15). Loosen with Key (tool No. TE134) and unscrew with Screwdriver (tool No. TE134A).
2. Lift off Nipple (1).
3. Remove Guide/Guide ring (2). The Guide has a groove in the outer diameter. The Guide is easily lifted out of the Stem by means of two ordinary Screwdrivers inserted into the groove.
4. Remove Screw (15), Spring washer (16) and Washer (13). To secure Impeller against rotation, insert carefully Screwdriver (tool no. TE134A), through Impeller (4) into a hole in the Stem.
5. Pull off Impeller (4).

Reassembly

1. Reinstall Impeller (4). Make sure that Impeller is correctly rotated to be pushed onto Turbine shaft. Do not try to hammer Impeller in position, as this will damage Slide bearing under Turbine shaft.
2. Mount Washer (13), Spring washer (16) and Screw (15) and tighten. To secure Impeller against rotation insert carefully Screwdriver (tool No. TE134A) through Impeller (4) into a hole in the Stem.
3. Reinstall Guide /Guide ring (2).
4. Mount Nipple (1). Make sure that it is in correct position over Guide/Guide ring (2). Rotate Nipple to align holes in Nipple and Stem.
5. Mount Screws (15) with Screwdriver (tool No. TE134A). Tighten with Key (tool No. TE134).

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Top Assembly



6 Maintenance

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6.4 Bottom assembly

Disassembly

1. Turn machine upside down.
2. Remove Screws (15) and Spring Washer (16) from Bottom cover (30).
3. Remove Bottom cover (30).
4. Remove Screws (15) in Bearing cover (14). Carefully push out Turbine shaft (6) from opposite end. Do not try to hammer out Turbine shaft, since this can damage Slide bearing.
5. Remove Screws (15) and Spring Washers (16) along the circumference of Gear frame (29). Turn Gear frame about 1 cm (1/2"). Draw out Gear Subassembly (holes in Gear frame are excellent for holding Gear Subassembly).

Reassembly

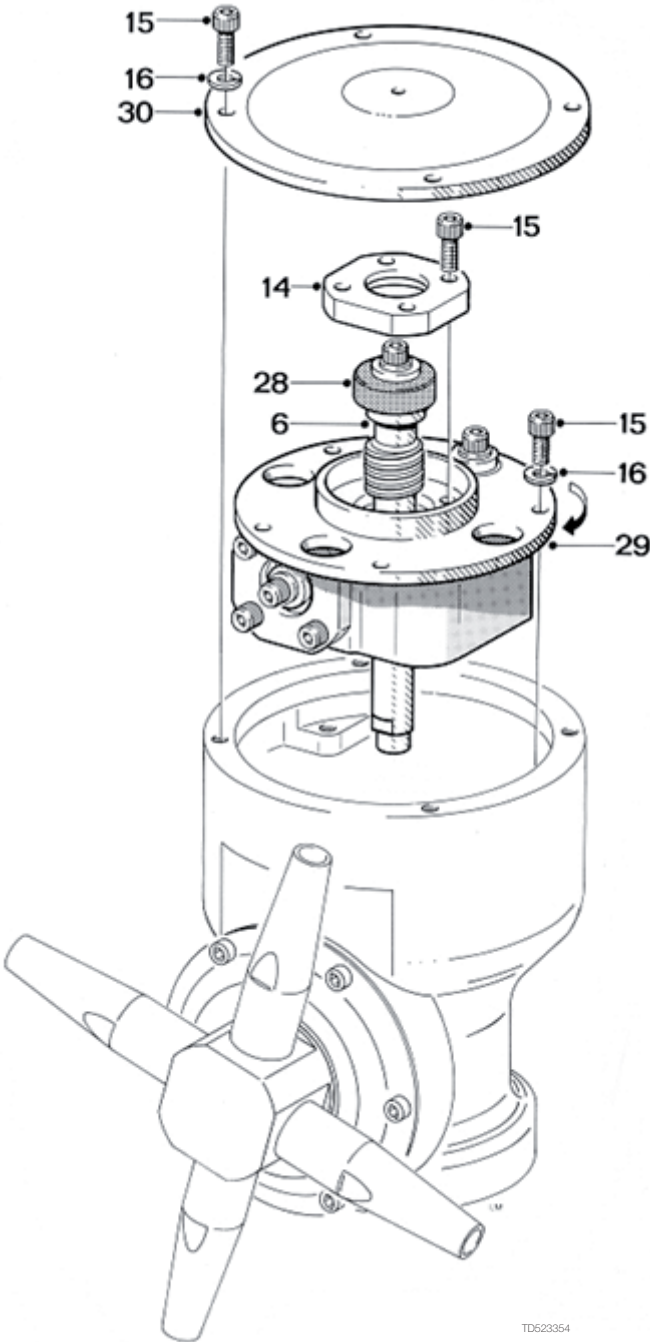
1. Reinsert Gear subassembly in bottom of machine body. Turn Gear Frame (29) to align holes in Gear frame and 3/16" threads in body. Mount Spring washers (16) and Screws (15) along circumference of Gear frame (29). Tighten screw crosswise.

<p>Note: To secure meshing between Gear wheel (7) and Pinion (9). It might be necessary to rotate slightly either the whole Gear Subassembly or the Gear wheel.</p>
--

2. Reinsert Turbine shaft (6) with Slide bearing carefully through Gear wheel (7). Push carefully Slide bearing (28) into position. Mount Bearing cover (14) with Screws (15). Tighten crosswise.
3. Place Bottom cover (30).
4. Mount Spring washers (16) and Screws (15) and tighten crosswise.

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Bottom Assembly



TD523354

6 Maintenance

TZ-67

6.5 Hub Assembly

Disassembly

1. Remove Nozzles (20). Nozzles are untightened with a wrench on the faces of the Nozzles.
2. Remove Screws (16), and Spring washers (16) and Hub cover (19).
3. Draw out Hub (21) together with Ball retainer with balls (24) and Bevel gear (18).
4. Remove Lipseal (22) and check for wear. If the Lipseal is worn, it has to be replaced.

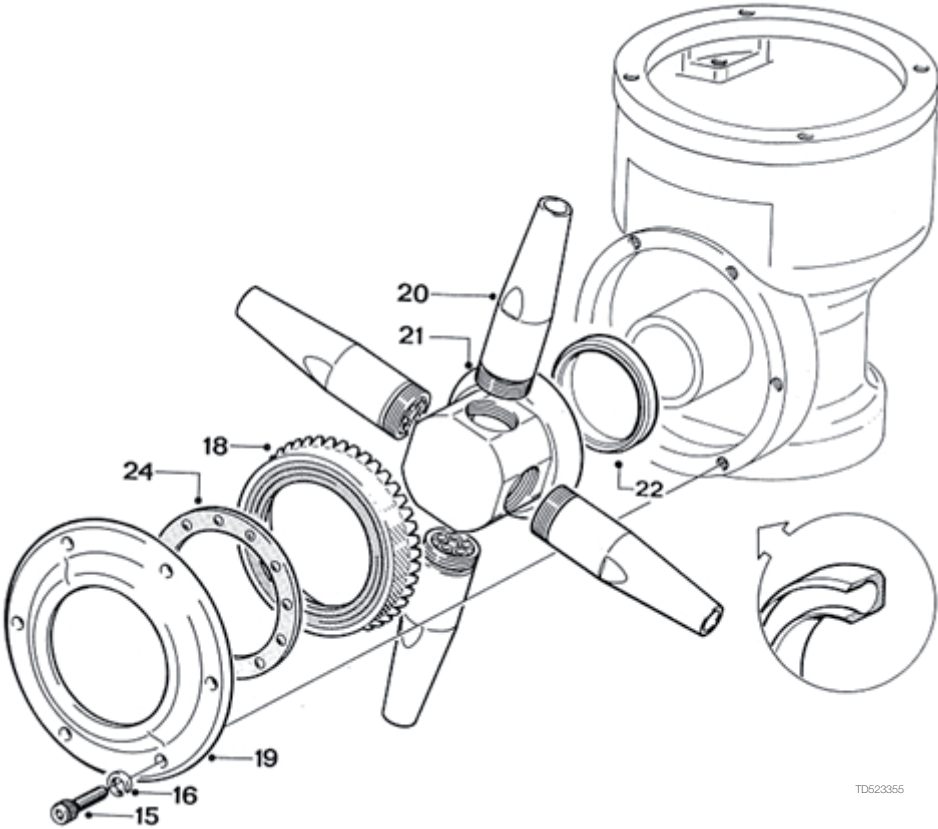
<p>Note: If Ball races in Hub cover (19.1) and in Bevel gear (18.1) are extremely worn, they should be replaced as well as the Ball retainer with balls (24). How to replace Ball races see page 31).</p>
--

Reassembly

1. Mount the Lipseals (22).
2. Slide on Hub (21). Reinsert Bevel gear with race (18) and Ball retainer with balls (24).
3. Mount Hub cover with race (19), and set with Spring washers (16) and Screw (15).
4. Screw on Nozzles (20) and tighten with wrench. If desired, secure with liquid threadlocker Loctite no. 243 or equivalent.

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Hub Assembly



TD52355

6 Maintenance

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6.6 Stem Assembly

Disassembly

1. Place machine in upside-down position.
2. Remove Screws (15) in Gear wheel (7). To prevent rotation of Stem (3) mount two screws in two holes opposite one another in BIG end of Stem. Place Stem in a vice held by the heads of the two screws.
3. Draw out Gear wheel with ball races (7) and Ball retainer with balls (24).
4. Push out Stem (3).
5. If worn, press out Main bush (5).

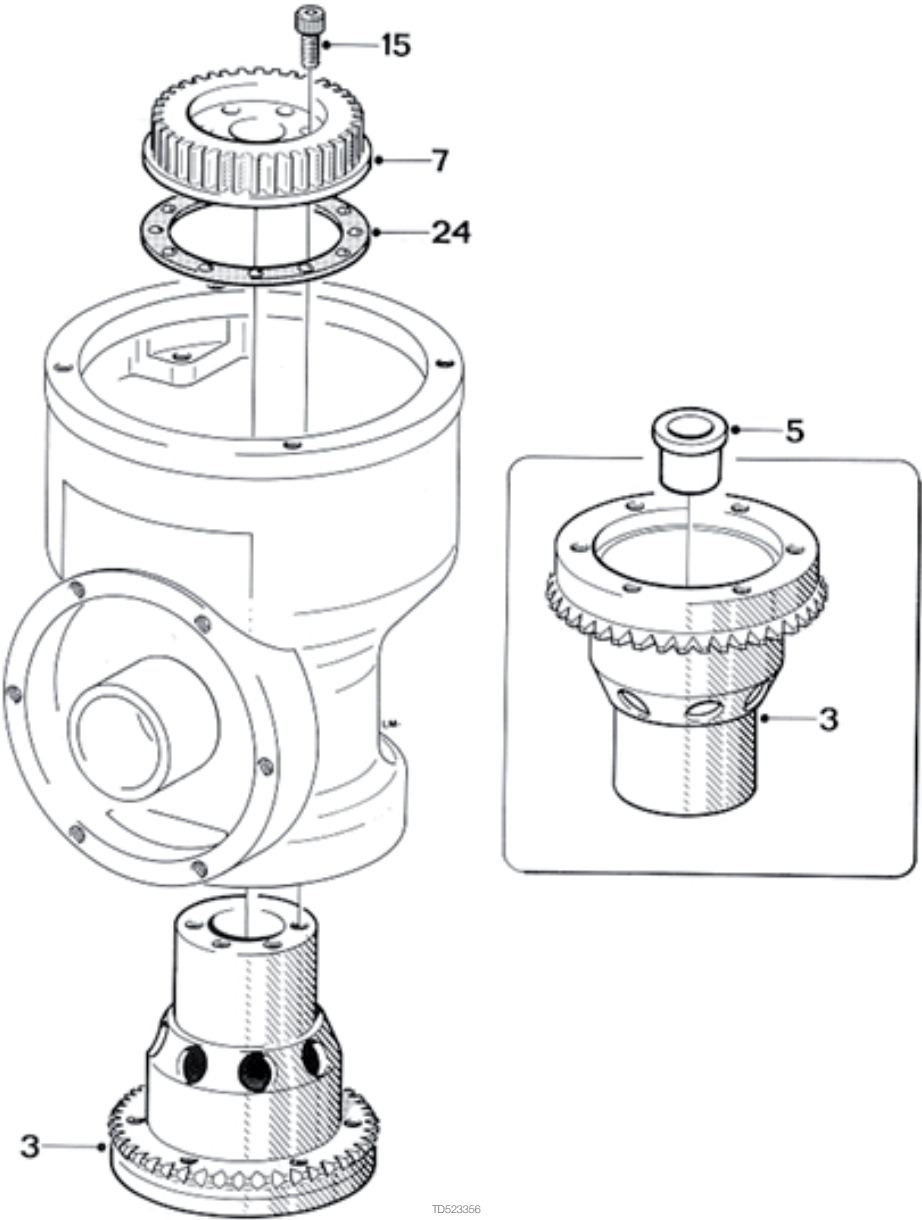
If Ball races in Body (26.3) and on Gearwheel (7.1) are extremely worn they should be replaced together with Ball retainer with balls (24). How to replace Ball races see page 31

Reassembly

1. If replaced press Main bush (5) into Stem (3).
2. Push Stem into Body. Turn machine upside-down.
3. Place Ball retainer with balls (24) and Gear wheel (7) into Body on Ball race. Rotate Gearwheel to check free rotation. Mount Gearwheel with Screws (15) and tighten crosswise. To prevent rotation of Stem (3) mount two screws in two holes opposite one another in BIG end of Stem. Place Stem in a vice held by the heads of the two screws.

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Stem Subassembly



TD623366

6 Maintenance

TZ-67

6.7 Gear Subassembly

Disassembly

1. To make a backstop, remount Turbine shaft (6) with Slide bearing (28) into Gear frame (29). Mount Bearing cover (14) with Screws (15).
2. Hold Turbine shaft (6) against 1st stage Worm wheel (33) with one hand and loosen Screws (15) in Pinion (9) and Horizontal shaft (27) with the other hand.
3. Remove Screws (15) in Bearing cover (14) and take out Turbine shaft (6).
4. Draw out Horizontal shaft (27) and 1st stage Worm wheel (33) after removal of Screw (15), Spring washer (16) and Washer (13).
5. Draw out Pinion (9) and 2nd stage Worm wheel (11), also freeing Journal (12) after removal of Screw (15), Spring washer (16) and Washer (13).
6. Remove Bearing cover (14) and Slide bearing (28) after removal of Screw (15).
7. Remove Screw (15), Spring washer (16), Washer (13) and Slide bearing (28) from Turbine shaft (6). Use faces on Turbine shaft to hold against rotation.

Warning:



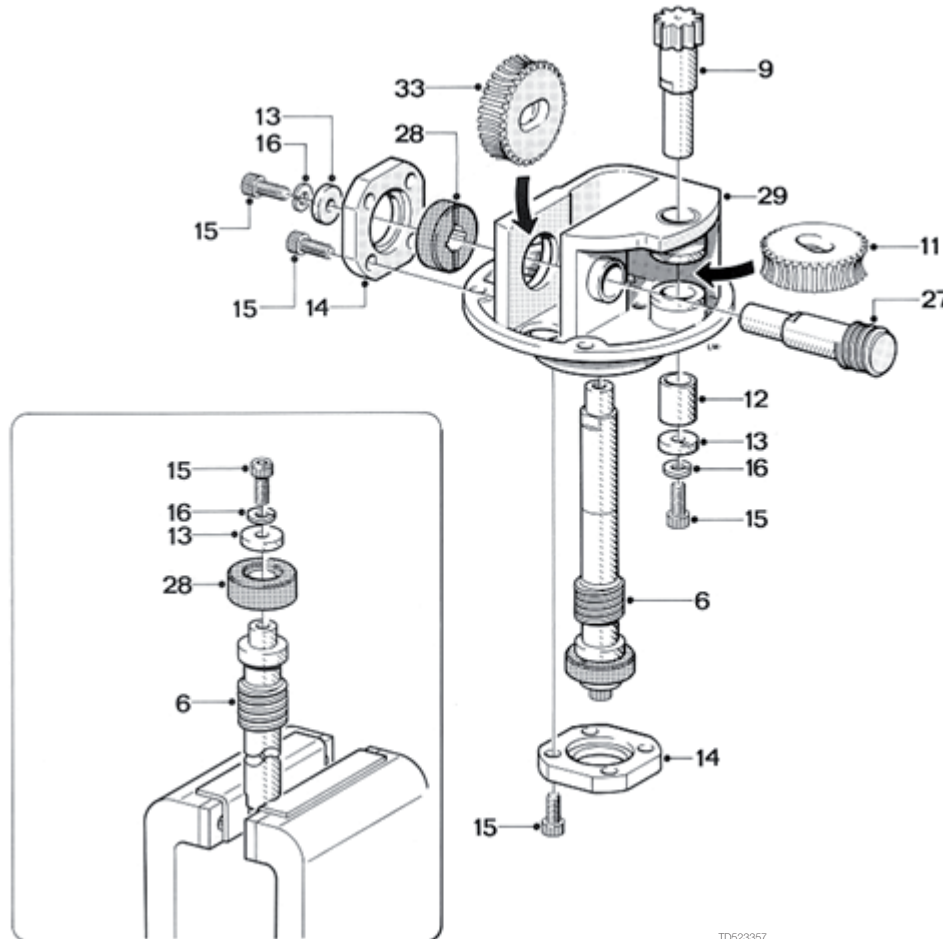
Do not destroy driver faces on Turbine shaft. Use only proper tools providing a firm grip such as a wrench or a vice.

How to replace Collar bushes (10), see page 30.

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Reassembly

1. Mount Slide bearing (28) carefully on Turbine shaft (6) and secure with Washer (13), Spring washer (16) and Screw (15). Hold Turbine shaft in a vice or with wrench on driver faces and tighten.
2. Push Slide bearing (28) for Horizontal shaft (27) into Gear frame (29) and fix Bearing cover (14) with Screws (15). Tighten crosswise.

Gear Subassembly

TD523357

3. Insert 2nd stage Worm wheel (11), Pinion (pos 9) and Journal (12). Mount Washer (13), Spring washer (16) and fix with Screw (15). Check rotation.
4. Insert 1st stage Worm wheel (33) and Horizontal shaft (27). Mount Washer (13), Spring washer (16) and fix with Screw (15). Check rotation.
5. Reinstall Turbine shaft (6) in Gear frame as mentioned under Disassembly, point 1..
6. Hold Turbine shaft (6) against 1st. stage Worm wheel and tighten Screws (15) in Horizontal shaft (27) and Pinion (9).
7. Remove Turbine shaft (6) with Slide bearing (28) before Gear subassembly is inserted in machine body.

6 Maintenance

TZ-67

6.8 Replacement of collar bushes

Replacement of Collar Bushes

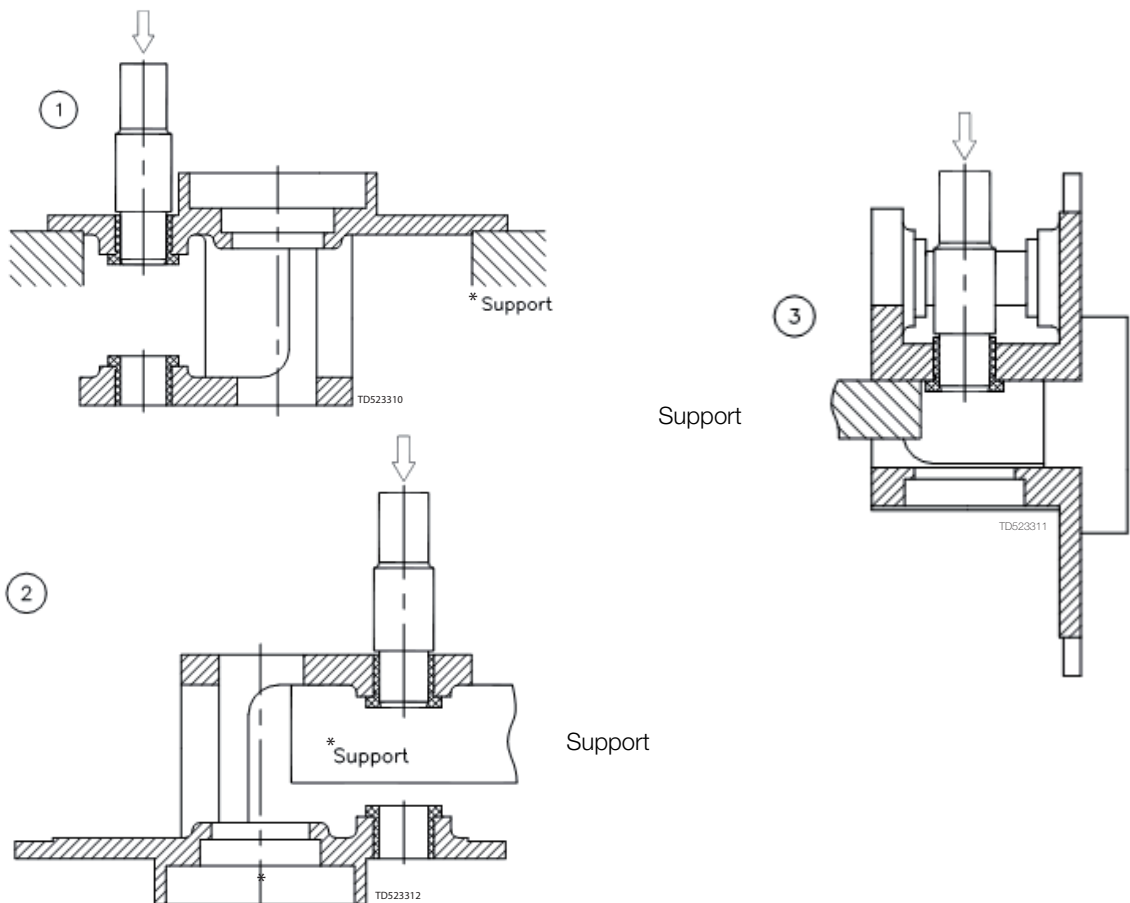
1. Place Gear frame (29) upside down with a firm support under the flange. Use for instance jaws of a vice. Do not clamp on machined surfaces. With Pusher (tool No. TE81B033, see page 43) knock out Collar bush.
2. Turn Gear frame to upright position and hold over support such as flat steel bar clamped in a vice. Knock out Collar bush with Pusher.
3. Turn Gear frame 90° and hold over support. Knock out collar bush with Pusher.
4. Clean holes and push in new Collar bushes into Gear frame.

Warning:



To avoid risk of deforming Gear frame, it is utmost important that it is supported while the Collar bushes are being knocked out.

Removal of Collar bushes.



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6.9 Replacement of ball races

In body

1.
 - A. With big end downwards knock several times Body with bearings (26) hard against firm wooden support until Ball race (26.3) drops out.
 - B. If it is not possible to knock out Ball race in this way, it is necessary first to screw out Main collar lower (26.2) – see page 32. Carefully push off old Ball race without damaging Main collar lower. Use mandrel and firm support. Before mounting of new Ball race, Main collar lower (26.2) must be remounted into Body – see page 32.
2. Clean surfaces and place Ball race (26.3) on Main collar lower (26.2). Press by hand as long as possible. By means of a tube mandrel or if desired wooden block, carefully hammer Ball races home.

Ball races must not project over end face of Main collar lower. To avoid tilting mandrel must push along the whole circumference of Ball race. Do not damage surface of Ball race.

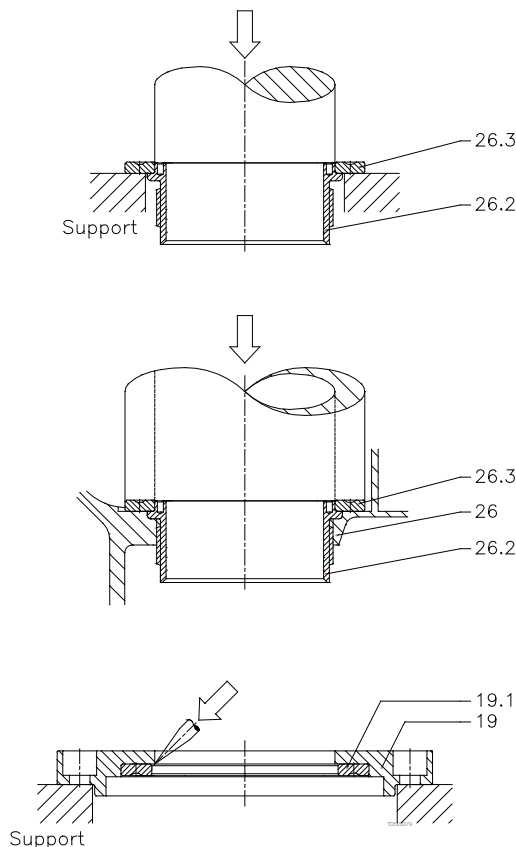
On Gear wheel

1. Place Gear wheel with ball race (7) on support. Support only under Ball race (7.1). With mandrel press off old Ball race.
2. Clean surfaces and press on new Ball race. Ball race must be pressed fully home on Gear. Press parallel. Use press or vice. Do not damage surface of Ball race.

In Hub cover

1. Place Hub cover with ball race (19) on support. Carefully knock out old Ball race by means of small mandrel or if desired screwdriver. Knock several times around the circumference to avoid tilting.
2. Clean surfaces and press in new Ball race. Ball race must be pressed fully home. Press parallel. Do not damage surface of Ball race.

Replacement of Ball races



6 Maintenance

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6.10 Replacement of main collars

Although normally exposed to very limited wear, it is possible to replace Main collars (26.1 and 26.2) in Body. The procedure to do this is described below.

Main collar upper

1. Place Body (26) in a vice upright position. Do not clamp on machined faces. Insert tool (see page 43) into Main collar upper (26.1). Unscrew Main collar.
2. Carefully clean thread and recess in Body. Do not damage special thread in Body. Recess must be absolutely clean.
3. Make sure that new Main collar is clean and free from impurities.
4. Screw in new Main collar. Attention should be given to make sure that thread is in correct engagement before screwing in Main collar.
5. Tighten Main collar fully home and tighten up.
6. Check that Main collar is fully home: install Stem, Ball retainer with balls and Gear wheel (see page 26). Check that there is sufficient axial clearance to allow for free rotation of Stem.

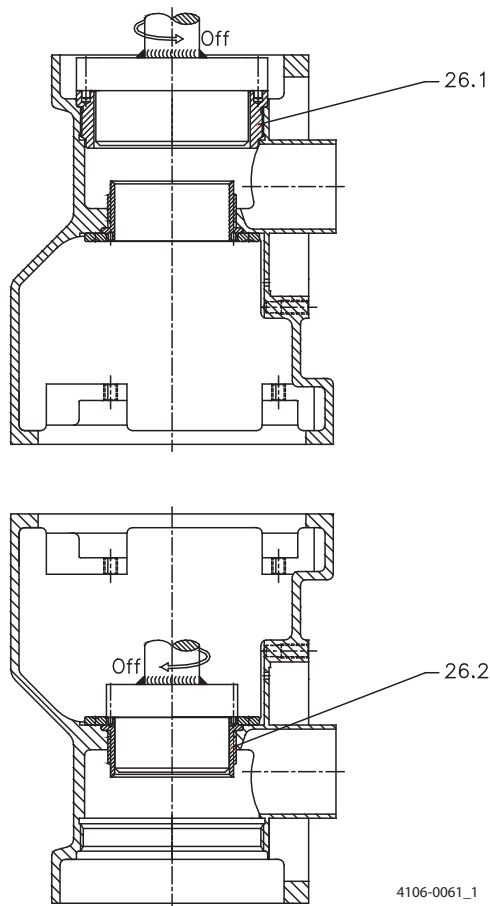
Main collar lower

1. Place Body in a vice in upside down position and repeat procedure described above.

Warning: Thread on Main collar lower is left-handed.



Replacement of Main Collars



TZ-67

Slow rotation or failure of machine to rotate

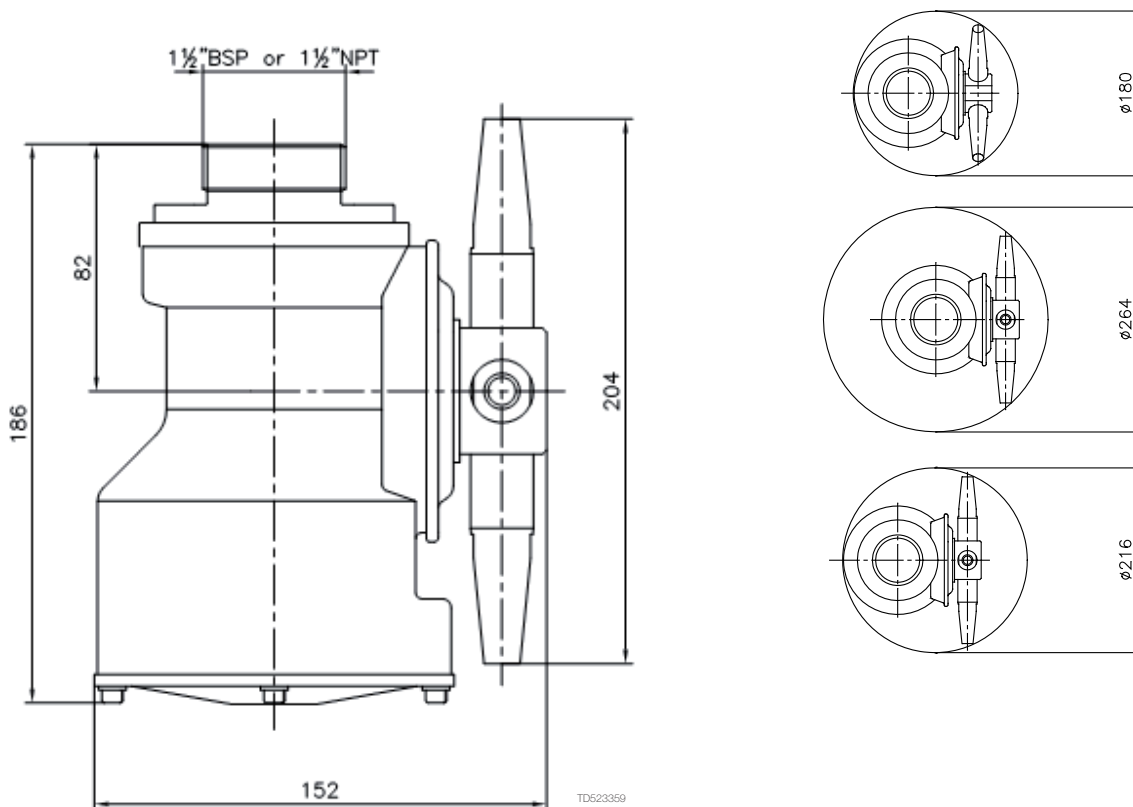
Possible Causes	Action
No or insufficient liquid flow	<p>a). Check if supply valve is fully open</p> <p>b). Check if inlet pressure to machine is correct</p> <p>c). Check supply line and filter for restriction/clogging</p> <p>d). Remove Nozzles and check for clogging. If blocked, carefully clean Nozzle without damaging stream straighteners and Nozzle tip.</p> <p>e). Remove Flange/Nipple, Guide and Impeller (see page 20) and check for clogging in Impeller area.</p> <p>If large particles repeatedly get jammed in the machine, install filter or reduce mesh size of installed filter in supply line.</p>
Foreign material or material build-up	<p>Insert hex Screwdriver in Screw in top of Turbine shaft and easily turn Turbine shaft clockwise. If any resistance is recognised, disassemble machine in order to localise the cause.</p> <p>Remove Guide and Impeller (see page 20) and remove foreign material.</p> <p>Remove Turbine shaft (see page 22) and clean Main bush.</p> <p>Remove Flange/Nipple and Hub Subassembly (see page 24). Clean teeth on Stem and Bevel gear.</p> <p>Remove Gear Subassembly (see page 28). Check free rotation of Stem.</p> <p>Remove Stem (see page 26). Remove foreign material/material build-up on Stem and inside Main collars. Clean Ball races and Ball retainer with balls. Also clean main bush.</p> <p>Remove foreign material from Gearbox. Check rotation of shafts. If restriction is recognized, disassemble gearbox (see page 28) and remove material build up, especially on 2. Stage Worm wheel and mating Collar bushes.</p> <p>Disassemble Hub Subassembly (see page 24). Remove foreign material inside Hub. Clean Ball races and Ball retainer with balls. Also clean nose of Body.</p>
a). Impeller jammed	
b). Turbine shaft sluggish in Main bush	
c). Bevel gears jammed	
d). Stem jammed/sluggish	
e). Gearbox jammed/sluggish	
f). Hub jammed/sluggish	
Wear	
a) Slide bearings	See page 19.
b) Main bush	See page 19.
c) Worm wheels	See page 19.
d) Collar bushes	See page 19.
e) Turbine shaft	Check clearance in Main bush and in Slide bearing. Transverse movement should not exceed 0,5 mm. Also inspect Worm wheel for wear.
f) Horizontal shaft	Check clearance in Collar bushes. Transverse movement should not exceed 0,5 mm. Also inspect worm for wear.
Mechanical defects	
a). Worm wheels. Teeth broken	Replace Worm wheel.
b). Worm wheel can rotate on Horizontal shaft/Pinion due to damaged driver faces.	Replace Worm wheel.
c). Damaged teeth on gear	Inspect teeth on Stem and Bevel gear for deformation. Mount Bevel gear and Stem in Body (see page 24 and 26). Hold Body in upside down position and rotate Hub to check that Bevel gears can work together. If damaged: Replace Stem and/or Bevel gear.

8 Technical data

TZ-67

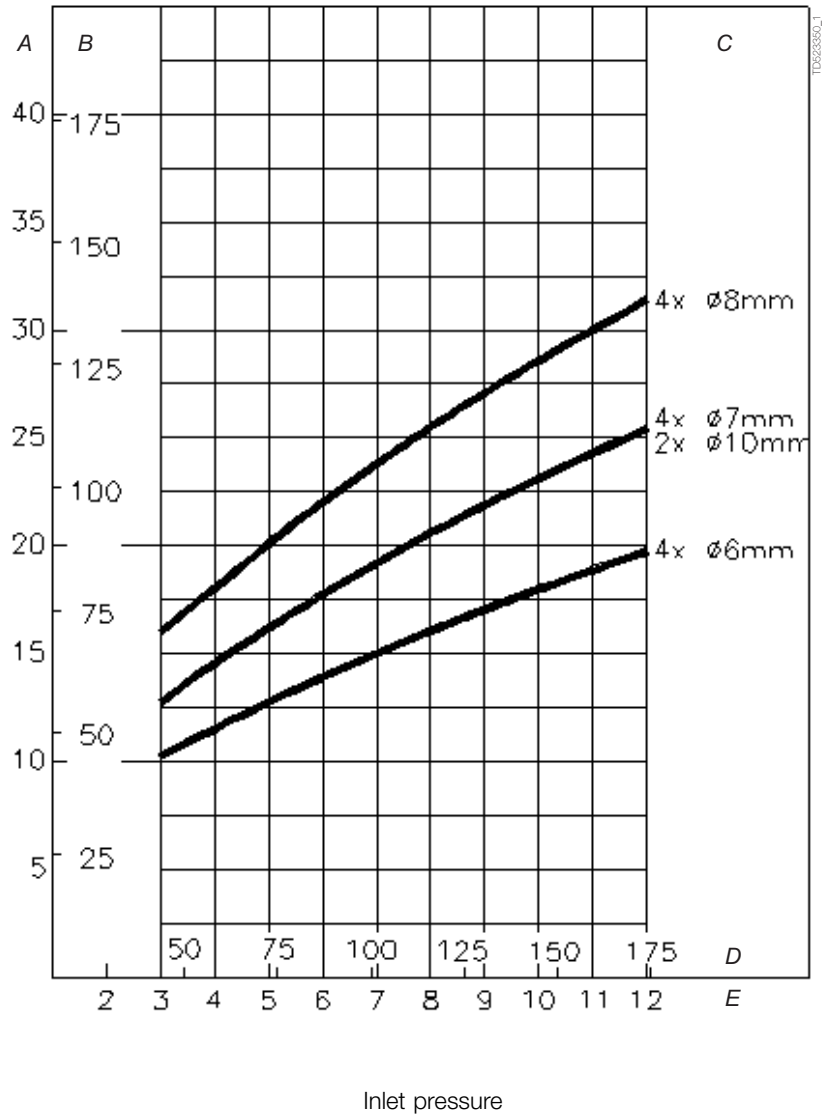
Weight of machine:	6.5 kgs (14,3 lb)
Working pressure:	2-12 bar (30-175 psi)
Recommended inlet pressure:	3-8 bar (45-120 psi)
Working temperature max.:	95°C (200°F)
Ambient temperature:	0 - 140°C (95°C - 140°C when not operated)
Materials:	Stainless steel AISI 316/AISI 316L, PFA, A4, ACO212CF, PEEK, PA6G

Principal dimensions in mm



TZ-67

Flow rate



A: m³/h

B: USgpm

C: nozzle sizes

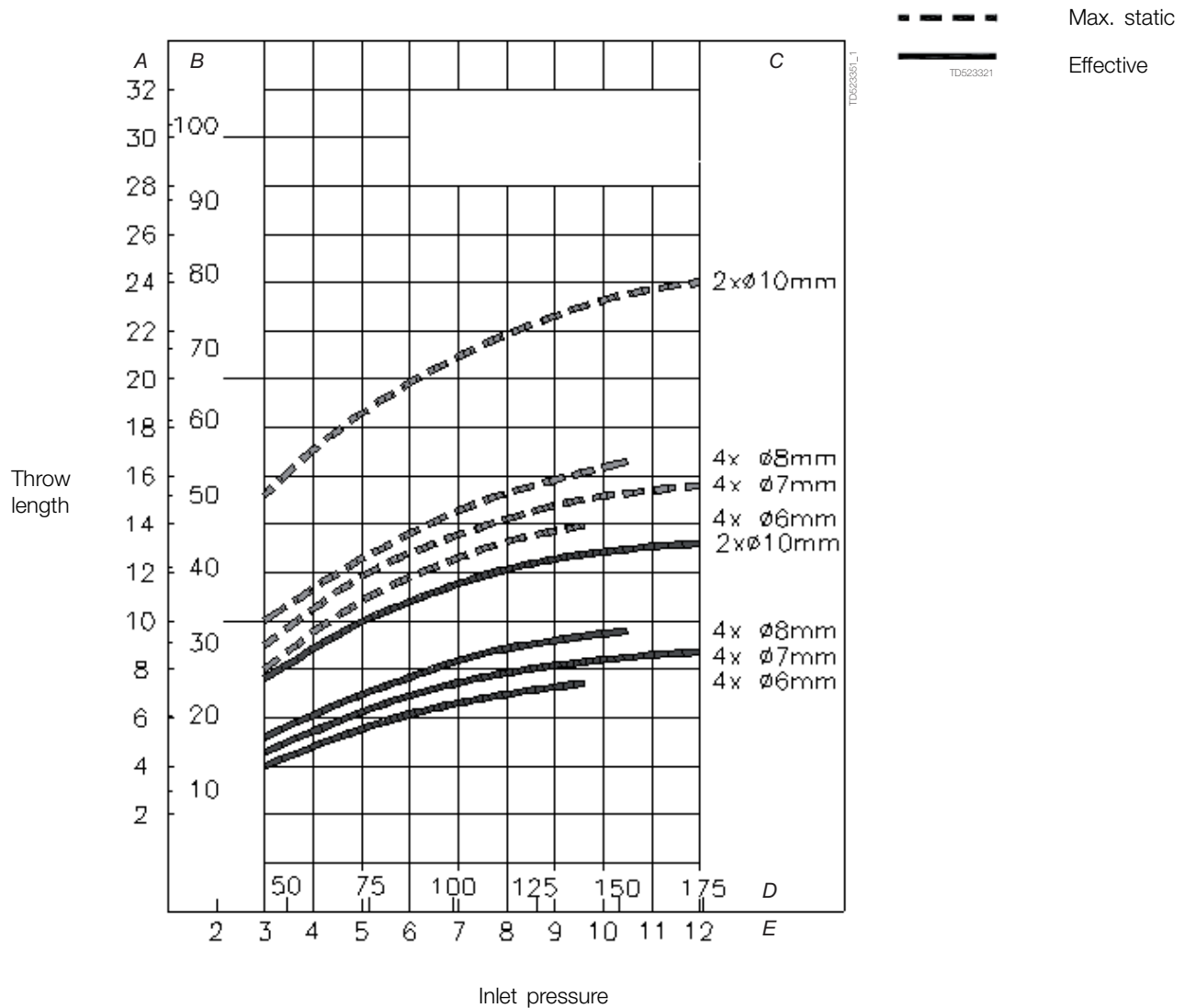
D: psi

E: bar

8 Technical data

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Throw length



A: m

B: ft

C: nozzle sizes

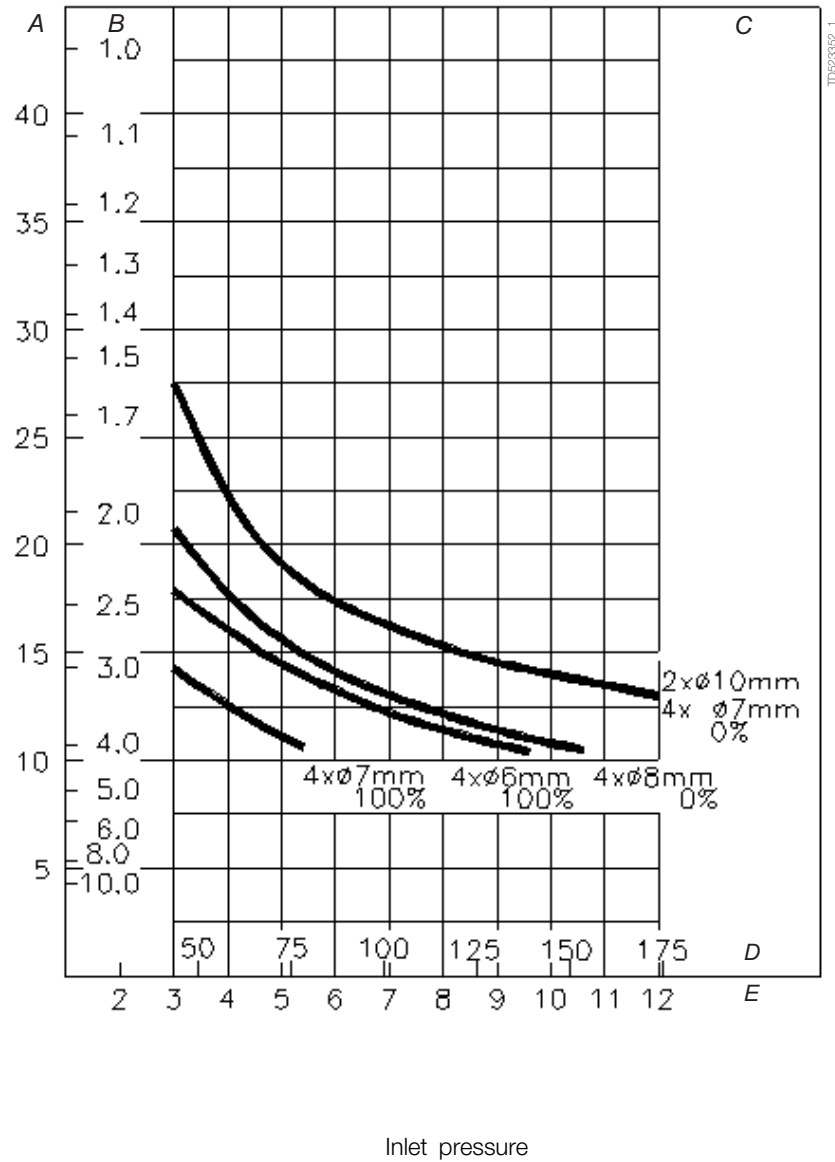
D: psi

E: bar

Note: Throw lengths are measured as horizontal throw length at static condition. Vertical throw length upwards is approx. 1/3 less. Effective throw length is defined as impact centre of jet 250 mm water column (50 lbs/sq.ft). Effective throw length varies depending on jet transverse speed over surface, substance to be removed, cleaning procedure and agent. The inlet pressure has been taken immediately before the machine inlet. In order to achieve the performance indicated in the curves, the pressure drop in the supply lines between pump and machine must be taken into consideration.

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Cleaning Time, f. complete Pattern (=8 cycles)



A: min. B: RPM of machine body C: nozzle sizes D: psi E: bar

9 Product programme

TZ-67

9.1 Standard configurations

Standard Configurations for Toftejorg TZ-67

Connection	Turbine/ Inlet Guide	Nozzles (mm) (1/2" thread conn.)	Article No.
Thread 1 1/2" NPT, Male di: ø38mm	100%	4 x ø6	TE21C108
		4 x ø7	TE21C110
	0%	4 x ø7	TE21C128
		4 x ø8	TE21C130
Thread: 1 1/2" BSP, Male di: ø38mm	100%	4 x ø6	TE21C208
		4 x ø7	TE21C210
	0%	4 x ø7	TE21C228
		4 x ø8	TE21C230

Connection	Turbine/ Inlet Guide	Nozzles (mm) (1/2" thread conn.)	Article No.
Thread 1 1/2" NPT, Male di: ø38mm	50%	2x ø7	TE21C108
	100%	2x ø8	TE21C110
	0%	2x ø10	TE21C128
Thread: 1 1/2" BSP, Male di: ø38mm	50%	2x ø7	TE21C208
	100%	2x ø8	TE21C210
	0%	2x ø10	TE21C228

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9.2 Standard options


Special options are available with hub deflector for direction of cleaning 180° upwards or downwards:

180° upwards: Standard article No. 04
 180° downwards: Standard article No. 03

Connection	Turbine/ Inlet Guide	Nozzles (mm) (1/2" thread conn.)	Article No. ATEX certified machines
<u>Nipple:</u> 1 1/2" NPT, Male di: ø38mm	100%	4 x ø7	TE21C110XX
		4 x ø8	TE21C112XX
	0%	4 x ø8	TE21C130XX
		2 x ø10	TE21C132XX
<u>Nipple:</u> 1 1/2" BSP, Male di: ø38mm	100%	4 x ø7	TE21C210XX
		4 x ø8	TE21C212XX
	0%	4 x ø8	TE21C230XX
		2 x ø10	TE21C232XX

9.3 Available add-ons

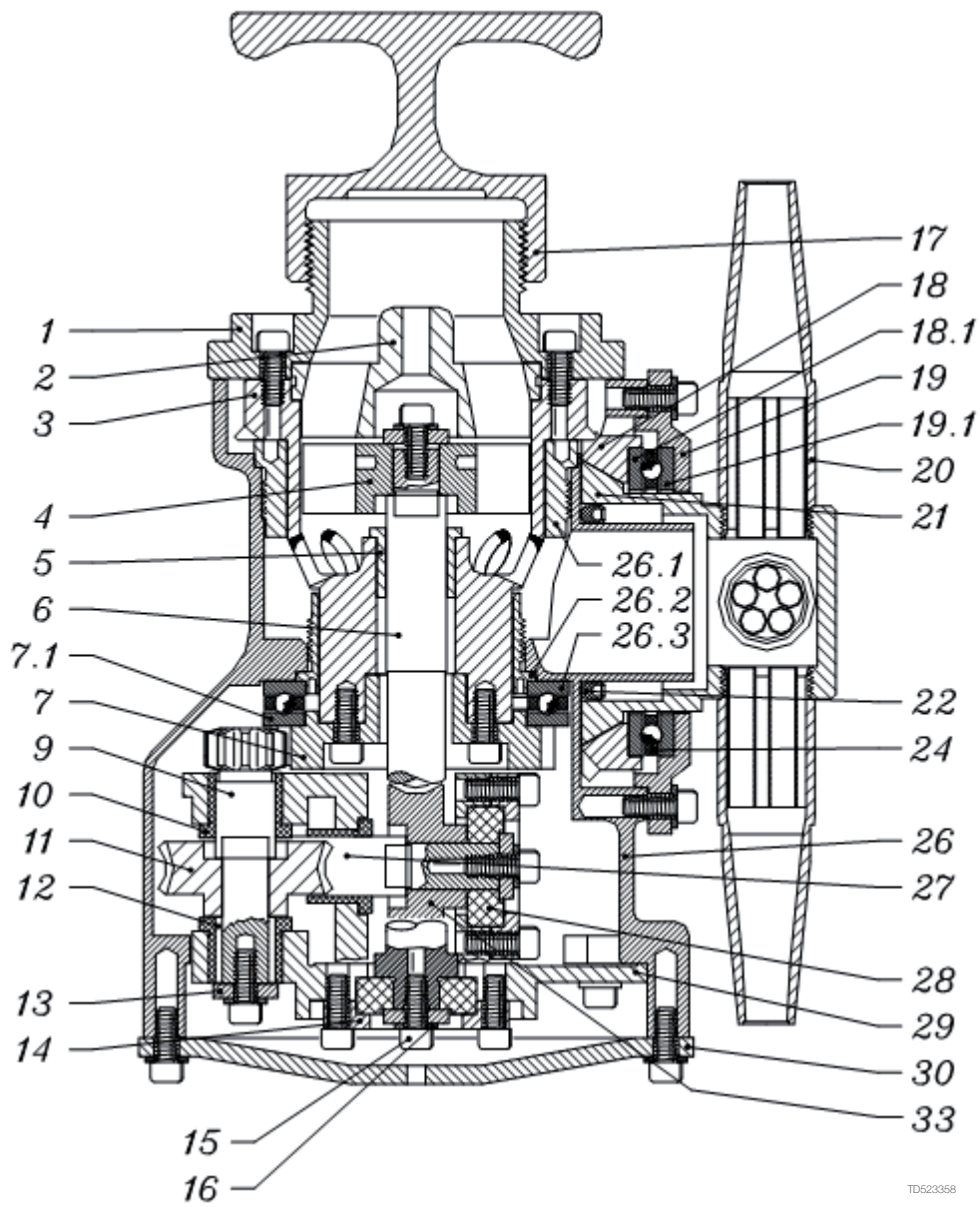
TE21CXXX70:	ATEX/IECEX
TE21CXXX73	ATEX/IECEX machines with hub deflector 180° downwards
TE21CXXX-74	ATEX/IECEX machines with hub deflector 180° upwards

Explanation to Add-ons		
ATEX/IECEX		ATEX/IECEX includes: ATEX/IECEX certified machine for use in explosive atmospheres. Category 1 for installation in zone 0/20 in accordance with directive 2014/34/EU. II 1G Ex h IIC 85°C...175°C Ga II 1D Ex h IIC T85°C...T140°C Da

10 Parts list and drawing, service kits and tools

TZ-67

10.1 Alfa Laval Toftejorg TZ-67



10 Parts list and drawing, service kits and tools

TZ-67

Parts list

Pos.	Qty	Denomination
1	□	1 Nipple
2	□	1 Guide
	□	1 Guide ring
3		1 Stem
4		1 Impeller
5	△◇	1 Main bush
6	△	1 Turbine shaft
7		1 Gear wheel w. ball race
7.1	△	1 Ball race
9		1 Pinion
10	△◇	3 Collar bush
11	△◇	1 Worm wheel w. reinforcem.
12		1 Journal
13		4 Washer
14		2 Bearing cover
15		38 Screw
16		18 Spring washer
17		1 Handle
18		1 Bevel gear w. ball race
18.1	△	1 Ball race
19		1 Hub cover w. ball race
19.1	△	1 Ball race
20	□	4 Nozzle
20.1		2 Plug
21		1 Hub
22	△◇	1 Lip seal
24	△	2 Ball retainer w. balls
26		1 Body
26.1	△	1 Main collar upper
26.2	△	1 Main collar lower
26.3	△	1 Ball race
27	△	1 Horizontal shaft
28	△◇	2 Slide bearing
29		1 Gear frame
30		1 Bottom cover
33	△◇	1 Worm wheel w. reinforcem.

Service kits

Denomination	Item no.
◇ MINOR service kit	TE55H000
△ MAJOR service kit	TE55H010

Configuration according to delivery note/order.

Please note that some of the polymer parts are in PEEK, which is not resistant to concentrated sulfuric acid.

Parts marked with ◇ are included in the Minor service kit: TE55H000

Parts marked with ▲ are included in the Major service kit: TE55H010

The machine can be delivered with ATEX/IECEx certification.

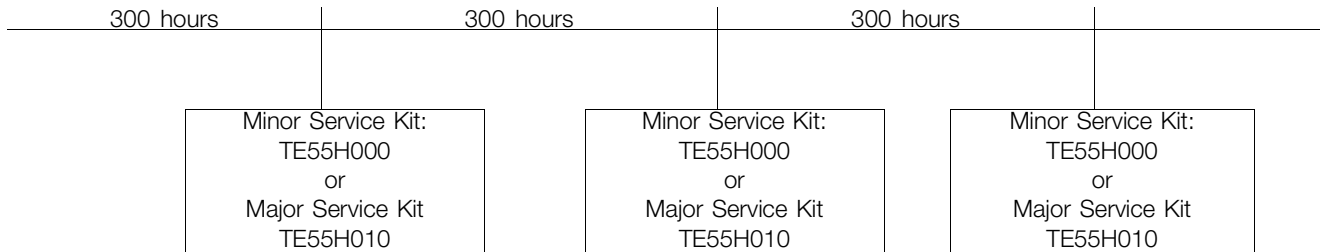
See page 39 for more information on available add-ons.

Please refer to the Spare Part Manual for information on item numbers and materials. The Spare Part Manual is available from the online Alfa Laval product catalogue Anytime or the Close at hand spare part catalogue.

10 Parts list and drawing, service kits and tools

TZ-67

10.2 Service kits



Please refer to the Spare Part Manual for information on item numbers and materials. The Spare Part Manual is available from the online Alfa Laval product catalogue Anytime or the Close at hand spare part catalogue.

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10.3 Tools

Standard Tool kit for Toftejord TZ-67, Article No. TE81B050

Tool No.	Description	No.
TE134	Hex Key for Screw	1 pcs.
TE134A	Hex Screwdriver for Screw	2 pcs.

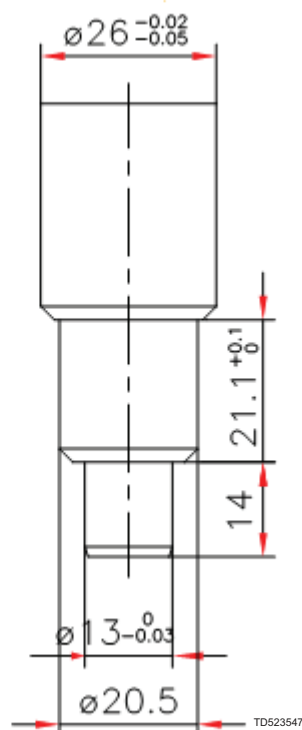
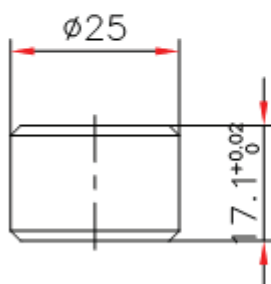
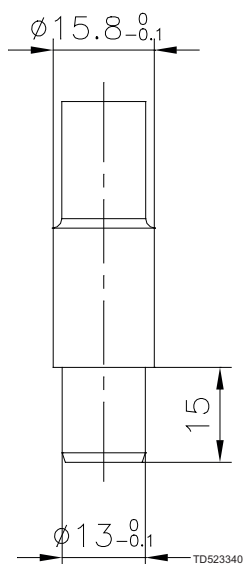
Available on request:

Tool No.	Description
TE81B033	Pusher for 1½" collar bush
TE81B034	Fixture set f. Collar bush

Sketch of tools for replacement of Collars bush:

TE81B033: Pusher for 1½" Collar bush

TE81B034: Fixture set f. Collar bush

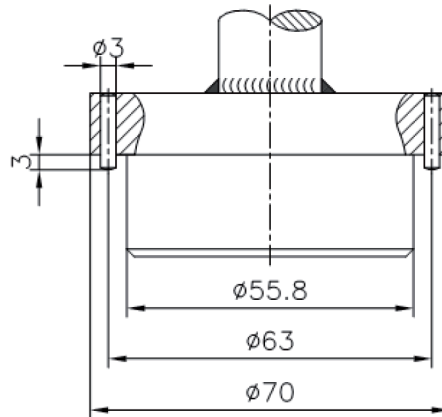


10 Parts list and drawing, service kits and tools

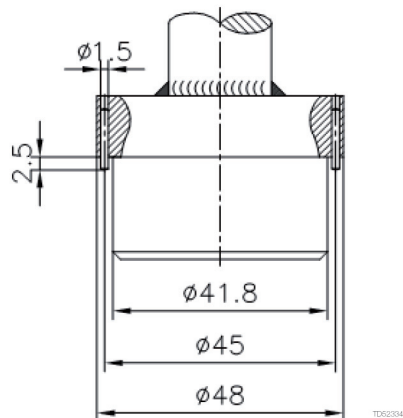
TZ-67

Sketch of tools for replacement of Main collars

TE81B129: Tool for upper collar



TE81B130: Tool for lower collar



TD622341

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11.1 Service and repair

Upon every return of a product, no matter if for modifications or repair, it is necessary to contact your local Alfa Laval office to guarantee a quick execution of your request.

You will receive instructions regarding the return procedure from your local Alfa Laval office. Be sure to follow the instructions closely.

11.2 How to order spare parts

On the parts drawings as well as on all instruction drawings, the individual parts have a position number, which is the same on all drawings. From the position number, the part is easily identified in the parts list, page 40.

Individual parts should always be ordered from the parts list, page 40. Item number and denomination should be clearly stated.

Please refer to the Spare Part Manual for information on item numbers. The Spare Part Manual is available from the online Alfa Laval Product catalogue Anytime or the Close at hand spare part catalogue.

Please also quote the type of machine and serial number. This will help us to help you. The type and serial numbers are stamped on the body of the tank cleaning machine.

11.3 How to Contact Alfa Laval Kolding A/S

For further information please feel free to contact:

Alfa Laval Kolding A/S

31, Albuen - DK 6000 Kolding - Denmark

Registration number: 30938011

Tel switchboard: +45 79 32 22 00 - Fax switchboard: +45 79 32 25 80

www.toftejorg.com, www.alfalaval.dk - info.dk@alfalaval.com

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