INSTRUCTION FOR ROTARY ATOMIZER

TYPE F35

WITH
ATOMIZER WHEEL AND
LIQUID DISTRIBUTOR

Please read the safety, installation, operation, maintenance and service instructions provided in this instruction thoroughly. All plant personnel must be familiar with these instructions. Failure to follow these instructions may result in injury, fatal accident and plant damage.

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Please visit our web site at: www.gea.com

Original instructions.

This instruction includes illustrations which may differ from the state of the product.

V12

NOTICE

The information contained in this instruction is subject to change without notice.

IF PROBLEMS OCCUR

If you suspect a problem with this Rotary Atomizer, check with the contents of this instruction prior to rectification.

If you are unable to solve the problem despite all efforts, refer to GEA Process Engineering A/S.

THIS INSTRUCTION

This instruction is a part of the atomizer instruction manual and is integrated into GEA Process Engineering A/S Plant Instruction Manual.

In order to allow and promote the correct use of the atomizer, the descriptions in the different sections relating to essential activities shall be strictly followed. This will secure user's safety, reduce the risk of damage to the Rotary Atomizer and consequent malfunction or inefficient operation.

USERS GUIDELINES

This instruction is divided into ten sections. Sections 1 to 9 primarily deals with the essential information for the user of this atomizer. Each section comprises sub-sections, refer to the table of contents.

Due to several feature combinations relating to atomizer wheel, liquid feed distributor, auxiliary equipment and monitoring system, a comprehensive spare parts list is prepared on each atomizer. The spare parts quotation with a list of recommended spare parts is forwarded as stated in section 8.1.

A list of figures concludes this instruction in section 10.

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1. GENERAL

1.1 Scope

The objective of this instruction is to assist the plant personnel engaged in the installation, maintenance and daily operation of the Rotary Atomizer. This instruction specifies the general requirements pertaining to the installation, operation, maintenance, inspection and service. It is therefore extremely important that all plant personnel are familiar with these instructions.

1.2 Markings

The information provided on the name plate should be used as reference when contacting GEA Process Engineering A/S.

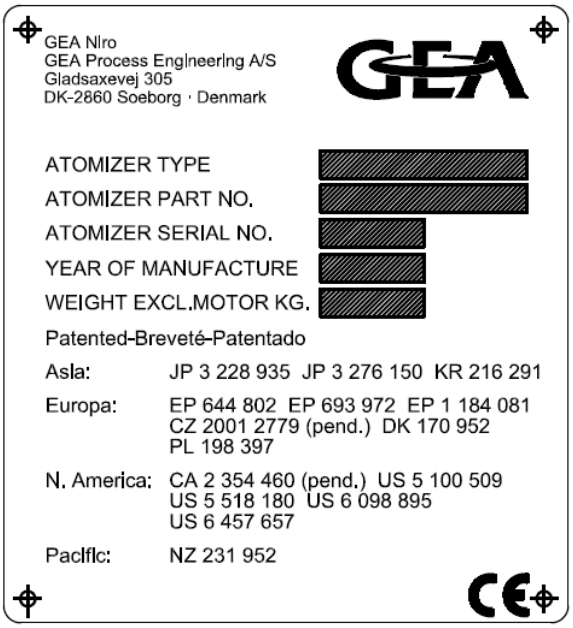
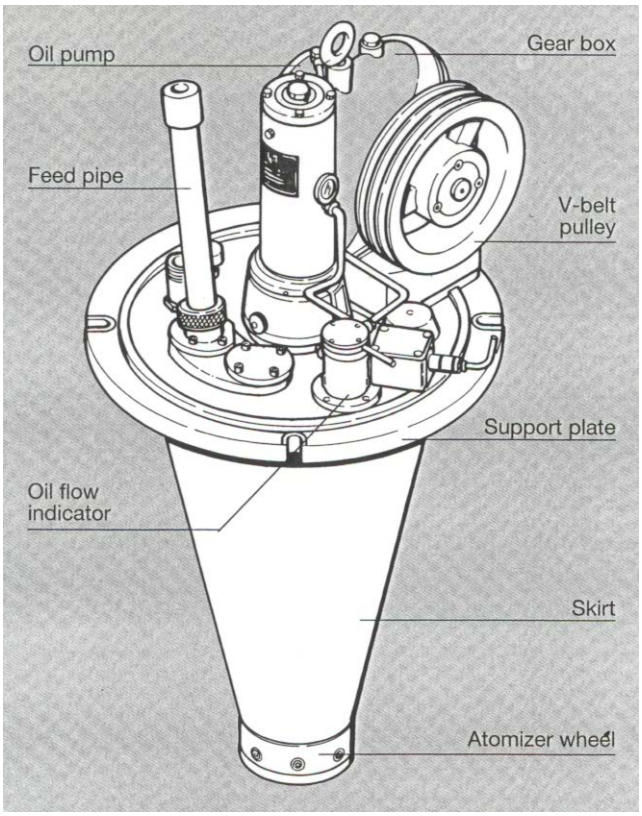


Fig. 1 A Specimen of The Name Plate



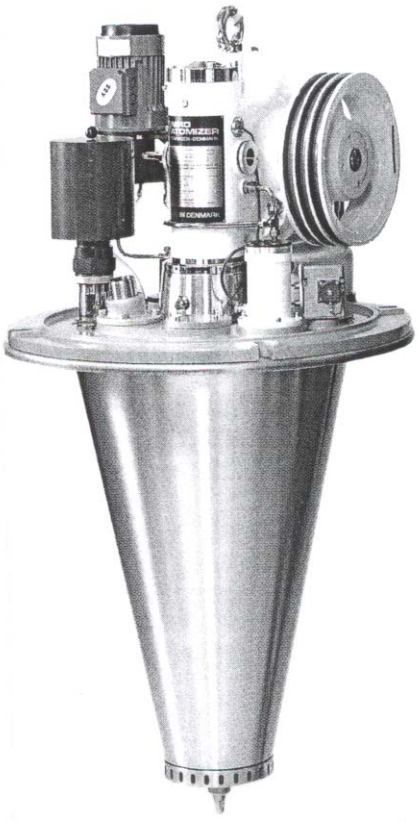


Fig. 2 A Typical F35 Atomizer

1.3 Protection of the Atomizer

During transportation of the atomizer, the atomizer wheel and the liquid distributor are separately packed. In order to protect the spindle, a protection pipe is mounted. Once the atomizer is unpacked and positioned on the atomizer service stand, the protection pipe must be removed prior to mounting the liquid distributor and the wheel.

During transportation or longer standstill period of the plant, it is recommended to remove the wheel, dismantle the liquid distributor and reinstall the protection pipe of the atomizer spindle.

1.4 Wheel Safety

It is strongly recommended that careful monitoring and observation of the atomizer wheel against extensive wear and corrosion is carried out at the plant site. For recommendations of the atomizer wheel service intervals, refer to **'ATOMIZER WHEEL SAFETY DIRECTIVE' (0003-0011).**

GEA Process Engineering A/S offers a certified wheel service programme in support of the preventive maintenance, refer to '**MAINTENANCE PROGRAM FOR ATOMIZER WHEEL' (6000-0002).**

1.5 Maintenance Tools and Accessories

The tool box containing all the essential tools facilitates the assembling and dismantling of the atomizer, atomizer wheel and liquid distributor. For any assembling or dismantling work, it is recommended to use only genuine tools supplied.

1.6 Safety Warnings

1.6.1 General

This atomizer is a high speed machine. When in operation, do not touch, perform service or maintenance.

Before starting the atomizer ensure correct oil level.

Incorrect motor rotation will result in severe atomizer damage. Always ensure that atomizer wheel rotates counter clockwise seen from above.

The atomizer must never be lifted from its operating position, unless the atomizer wheel has come to a complete standstill.

1.6.2 Operation

Never operate the atomizer at speeds higher than those specified or recommended by GEA Process Engineering A/S.

The operation of the atomizer is limited to atomization of specific liquid feeds in the GEA spray dryer.

Never operate the atomizer out of its normal operating position, for instance, when placed on the atomizer service stand.

1.6.3 Atomizer Wheel

Never exceed the max. RPM stamped at the bottom of the atomizer wheel.

The Atomizer wheel and liquid distributor parts are manufactured with precision. Never attempt an atomizer wheel repair. Atomizer wheels are stamped: "Never machine or weld any part of wheel"

Never operate the atomizer wheel when it might be only partially assembled (i.e., without upper plate or with loose screws).

Do not apply anti-seize compounds containing copper on the screws or any other part. The copper may create potentially dangerous corrosion in the atomizer wheel, particularly in the threaded holes of the intermediate part. Use exclusively the Molykote compound from the tool box.

1.6.4 Service and Maintenance

Service and maintenance of the atomizer shall only be performed by personnel skilled in the maintenance of industrial machinery, and who are familiar with the contents of this instruction.

For safe atomizer operation, use only genuine spares and replacement parts supplied by GEA Process Engineering A/S.

Use only the approved cleaning liquids for cleaning the atomizer wheel or other parts (i.e., water, dilute organic acids and CIP liquids recommended for stainless steel surfaces). When in doubt, consult GEA Process Engineering A/S. Under no circumstances use liquids containing chlorine.

2. DESIGN AND FUNCTIONAL DESCRIPTION

The Rotary Atomizer comprises the basic atomizer, atomizer wheel and the liquid distributor.

2.1 Rotary Atomizer

Refer to Fig. 3 and 4

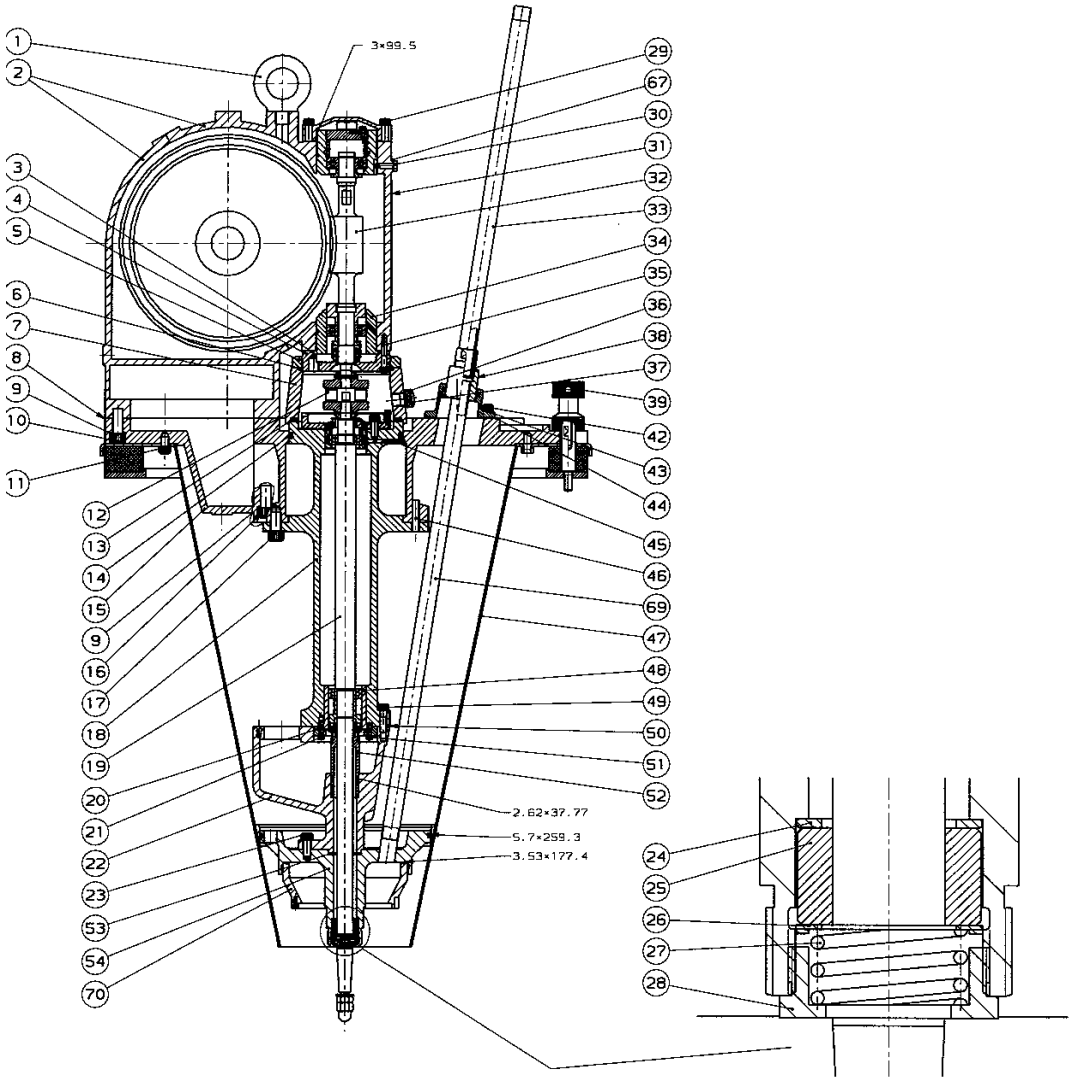


Fig. 3 F35 Basic Atomizer

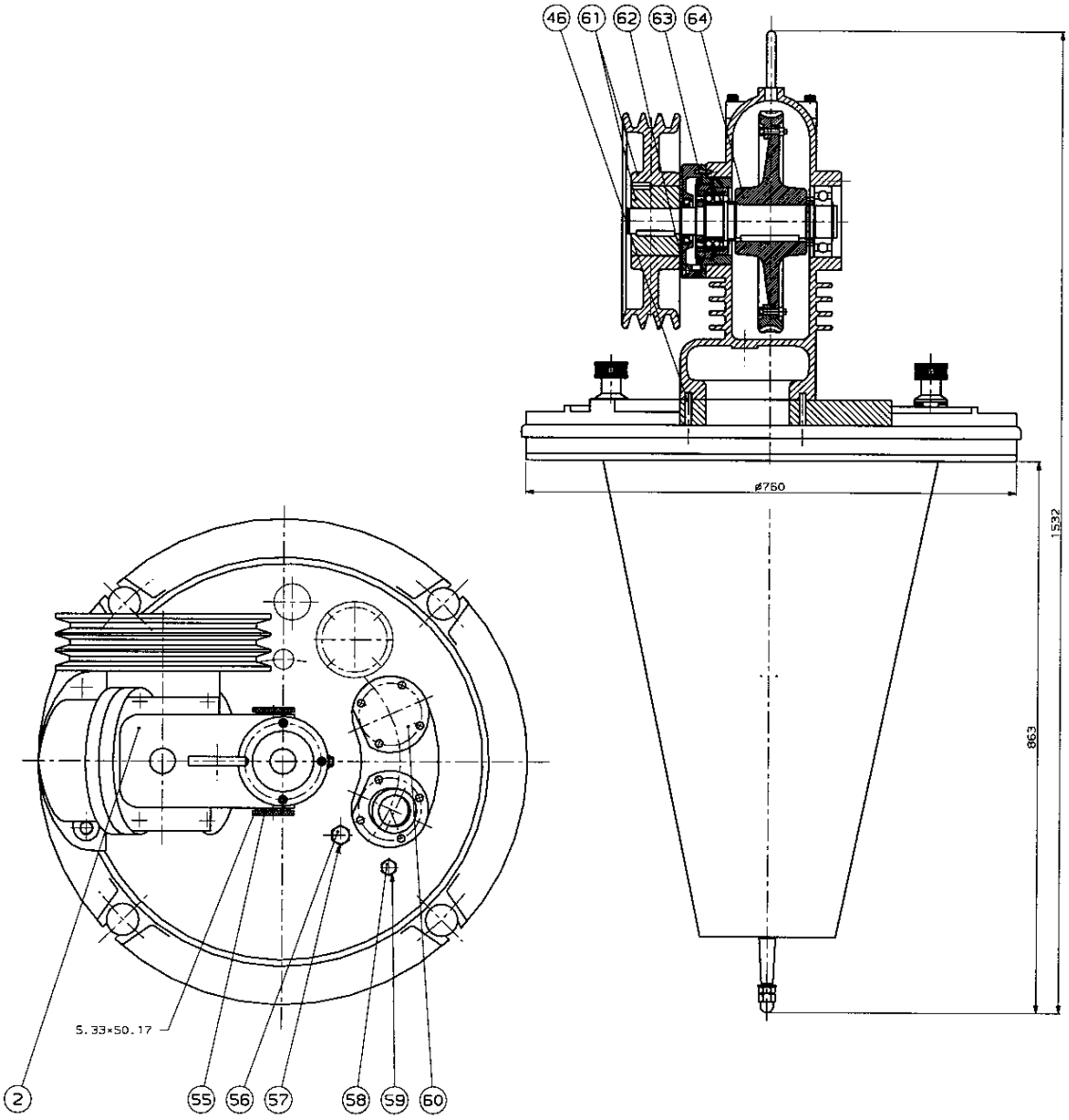


Fig. 4 F35 Basic Atomizer

The basic atomizer consists of an upper part, intermediate supporting plate, a lower part and a monitoring system.

The upper part comprises the gearbox with lubrication system and the upper oil sump. The atomizer is powered by a 4-pole foot-mounted motor, separately mounted on a bracket. The power is transmitted from the motor to gearbox input shaft via V-belt drive with belt guard. The atomizer speed can be altered by exchanging **only the motor V-belt pulley.**

The gearbox contains the worm gear. The worm gear wheel on the horizontal gearbox input shaft runs in a cylindrical and a spherical roller bearing and drives the worm gear shaft, which is coupled to the vertical spindle. The spindle is designed to run between the first and second critical speed.

The built-in oil pump for the forced feed lubrication oil system is driven by the horizontal gear input shaft. The oil pump draws the oil from the lower and upper oil sump. The oil passes through the filter and nozzles, thus lubricating the worm gear and ball bearings. A separate oil pump driven by a separate electric motor is required for cases, when the atomizer speed is below 10,000 RPM, with infinitely variable atomizer speed (frequency converter) and with reverse atomizer rotation.

The supporting plate serves the purpose of supporting the atomizer in air disperser of GEA spray dryer. The supporting plate is equipped with a vibration damper.

The lower part of the atomizer comprises the spindle, support for the spindle ball bearings, lower oil sump, feed pipe bracket and the conical skirt. The spindle runs in special high speed ball bearings. The guide bearing for the lower part of the spindle is made of antimony-impregnated carbon and is self-lubricating. It supports the flexible spindle when it runs through its first critical speed during start-up and shut-down of the atomizer.

The flexible spindle design is adopted to compensate against irregularities in feed supply and minor irregular build-up in the atomizer wheel. These situations cannot be avoided in industrial operations. Such irregularities create imbalance, which to some extent is immediately corrected by the deflection of the flexible spindle.

The feed is introduced through one or two (depending on application and capacity) 3/4” feed pipes to the liquid distributor, which ensures a uniform distribution of feed to the atomizer wheel.

Cooling air for the lower internal parts of the atomizer is introduced through a 2” pipe connection on the supporting plate.

All parts of the atomizer exposed to feed or product are made of AISI 316 or other corrosion resistant material. However, the spindle is made of special stainless steel.

The standard monitoring system comprises:

Low oil flow alarm
High oil level alarm (lower sump)
Flooding (feed or water) alarm
Spindle vibration alarm (optional extra)
Ammeter for atomizer motor
Running hour meter
Tachometer (optional extra)

The tachometer is supplied only in case of variable atomizer speed. Ammeter and running hour meter are included in the control system as standard accessories.

The spindle vibration monitoring is offered as an optional extra. The monitor activates an alarm on detecting abnormal product build-up in the atomizer wheel or imminent bearing failure. At excessive vibration conditions, the atomizer motor is shut down preventing damage to the atomizer spindle.

2.2 Atomizer Wheel

2.2.1 Types and Codes

In order to comply to the process and/or product requirements, the rotary atomizer is equipped with either a channel type (for non-abrasive products) or an insert type (for abrasive products) wheel. The standard diameter of the wheel is 210 mm (8.27”). Following are the standard wheel types and codes:

1. Non-Abrasion Resistant Wheels

   Type CH16: Curved high channel; number of channels: 16
   Type CL16: Curved low channel; number of channels: 16
   Type SH36: Straight high channel; number of channels: 36
   Type SL24: Straight low channel; number of channels: 24

2. Abrasion Resistant Wheels

   Type AM8: Abrasion resistant, medium; number of inserts: 8
   Type AX8: Abrasion resistant, heavy; number of inserts: 8

Wheel Specification

Examples: CL16 - 210 or AX8 - 210

Wheel type: CL or AX
Channels: 16 or 8 (Inserts)
Wheel diameter: 210 mm

The above types and codes are for guidelines only. For the valid wheel specification, refer to the documents compiled in the atomizer instruction manual.

2.2.2 Design Description

The wheels are designed to withstand the very high centrifugal forces during rotation. Due to the elasticity of the wheel material, distortion can take place during rotation. For this reason, wheel must never be rotated above its stated maximum speed limit.

The maximum RPM is stated on the assembly drawing and stamped at the bottom of the wheel.

The wheel must be securely fastened to the spindle and a 3 mm (0.12”) clearance between the skirt and wheel must be maintained.

1. Non-Abrasion Resistant Wheels, Channel type

Straight channels

Refer to Fig. 5 and 6

A multipurpose wheel with channels handling non-abrasive liquid feed is fabricated in two parts. The straight channel wheels are used in cases where fine atomization is

required and where there is no specific requirement of bulk density in the final product. In case of liquid feeds that are corrosive but not abrasive, a suitable corrosion resistant material can be selected.

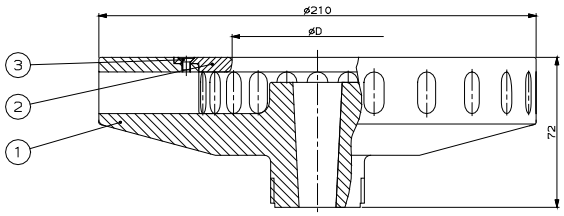


Fig. 5 Channel Type Wheel, SL24-210

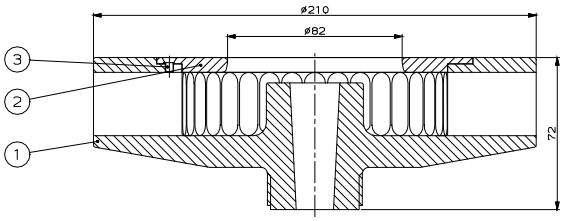


Fig. 6 Channel Type Wheel, SH36-210

Curved channels
Refer to Fig. 7 and 8

The curved channel wheels are used in cases where higher bulk density is required in the final product. The curved channel wheels produces higher bulk density (higher than on a straight channel wheel) only in case of organic products.

In case of liquid feeds that are corrosive but not abrasive, a suitable corrosion resistant material can be selected.

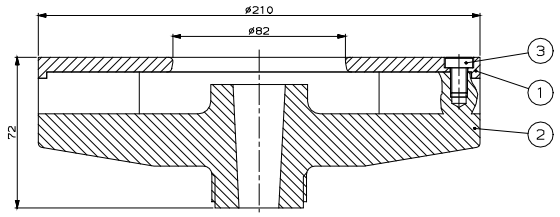


Fig. 7 Channel Type Wheel, CL16-210

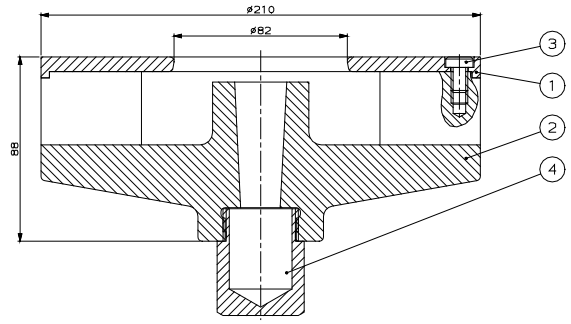


Fig. 8 Channel Type Wheel, CH16-210

2. Abrasion Resistant Wheels, Insert type

Refer to Fig. 9 and 10

In order to handle abrasive feeds, the cylindrical wheel part is equipped with abrasion resistant bushings and a base plate. In case of liquid feeds that are corrosive, a suitable corrosion resistant material can be selected.

The patented abrasion resistant atomizer wheel design comprises the following main parts:

Primary components
Upper part
Lower part

Replaceable wear components
3. Centre cone
5. Bottom plate
6. Inserts

5 and 6 are abrasion resistant

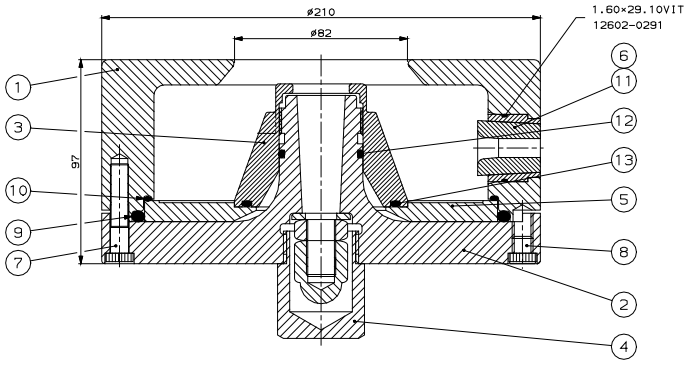


Fig. 9 Abrasion Resistant Wheel, AM8-210

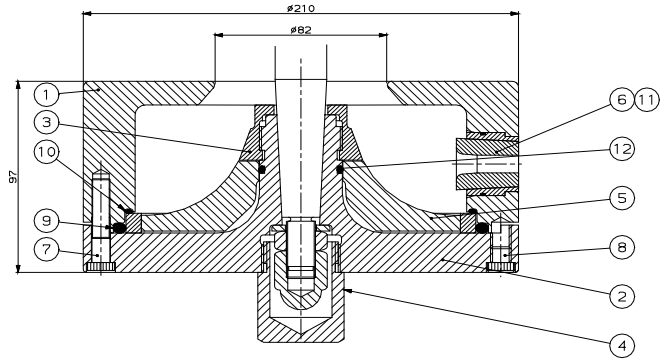


Fig. 10 Abrasion Resistant Wheel AX8-210

The principle of the patented abrasion resistant wheel design is as follows:

Parts exposed to abrasion from feed are abrasion resistant and replaceable. The inner surface of the intermediate part, which is also exposed to contact with the feed, is protected against abrasion by a layer of feed solids, formed by the unique principle of inwards protruding inserts. During operation a layer of feed solids will settle on the inside wall to a thickness determined by the length of the protrusion, consequently the **abrasion** will take place on the sedimented layer itself and not on the inside wall of the wheel.

The lifetime of the replaceable abrasion-resistant components is however dependent on the nature of the feed stock being atomized and **it is important for the user to establish the approximate lifetime by frequent inspections during the first time of operation.**

On the trailing edge of the inserts a radial groove will develop. These grooves must not be allowed to deepen beyond the point where approximately 3 mm (0.12”) wall thickness still remains.

If the feed slurry penetrates the wall of the inserts, the intermediate part of the wheel will be damaged beyond repair within a few hours of operation. When the groove has reached the maximum depth, the inserts must be turned or replaced as described in section 9.2.2.

NOTE
The most severe abrasion often takes place in the middle section of the inserts and is not easily seen from outside or from inside of the wheel. Refer to Fig. 11.

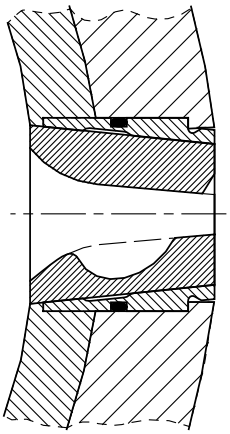


Fig. 11 Abrasion of Inserts

Bottom plate, AM8-210

The wear of the plate often appears as a circular groove. The plate is plasma coated with 0.5 mm (0.02”) chrome oxide. The extent of any wear shall be established through frequent inspection. If required, the plate must be replaced as described in section 9.2.2.

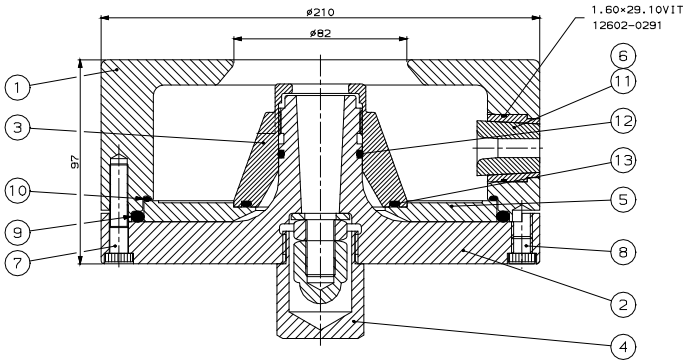


Fig. 9 Abrasion Resistant Wheel, AM8-210

Bottom plate, AX8-210

The wear of the plate often appears as a circular groove. The depth of the wear should not be allowed to exceed a point leaving approximately 3 mm (0.12”) plate thickness. At this point the plate must be replaced as described in section 9.2.2.

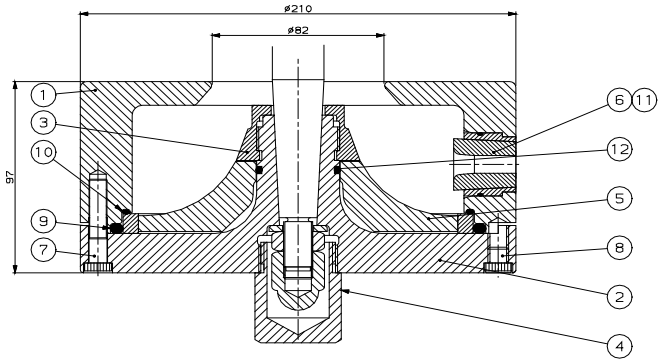


Fig. 10 Abrasion Resistant Wheel AX8-210

2.3 Liquid Distributor

2.3.1 Types

In order to comply to the process and/or product requirements, the rotary atomizer is equipped with one of the following types of liquid distributor:

Type VS : Volute distributor, single
Type VSW : Volute distributor, single with safety water arrangement
Type VT : Volute distributor, twin
Type VTW : Volute distributor, twin with safety water arrangement

Refer to Figures 12, 13, 14 and 15

The liquid distributor types are selected based on the specified application and capacity requirements. The selection of types with wheel safety water arrangement depends on the type of wheel, inlet drying air temperature and the peripheral speed of the wheel.

For the valid type of the liquid distributor, refer to the documents compiled in the atomizer instruction manual.

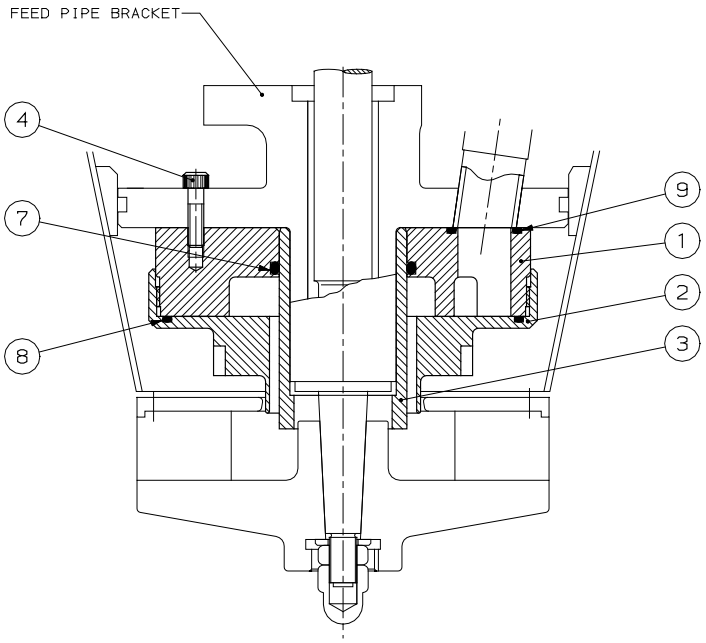


Fig. 12 Liquid Distributor, Type VS

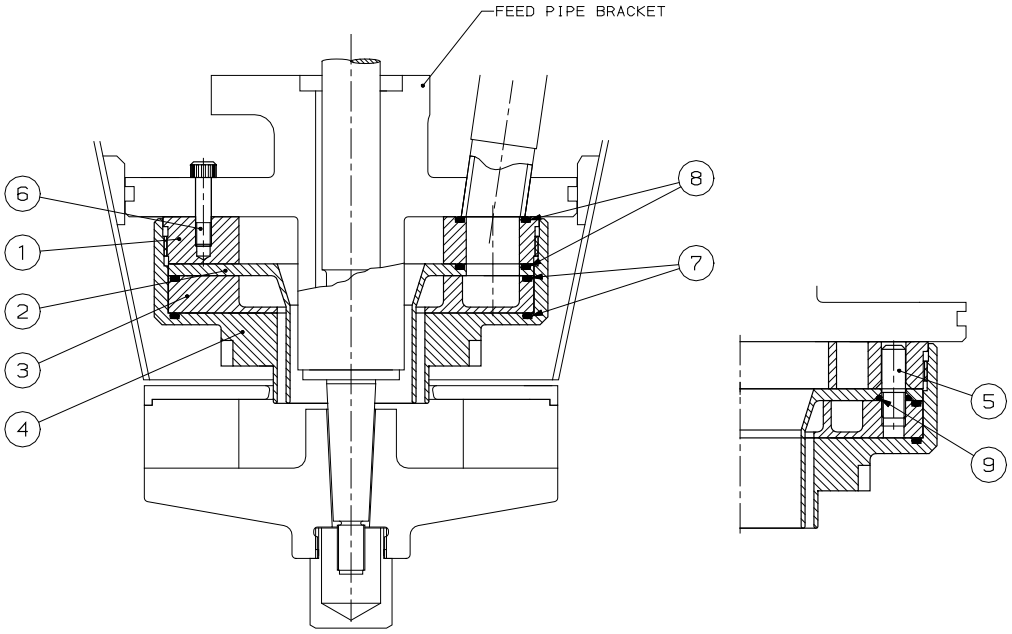


Fig. 13 Liquid Distributor, Type VT

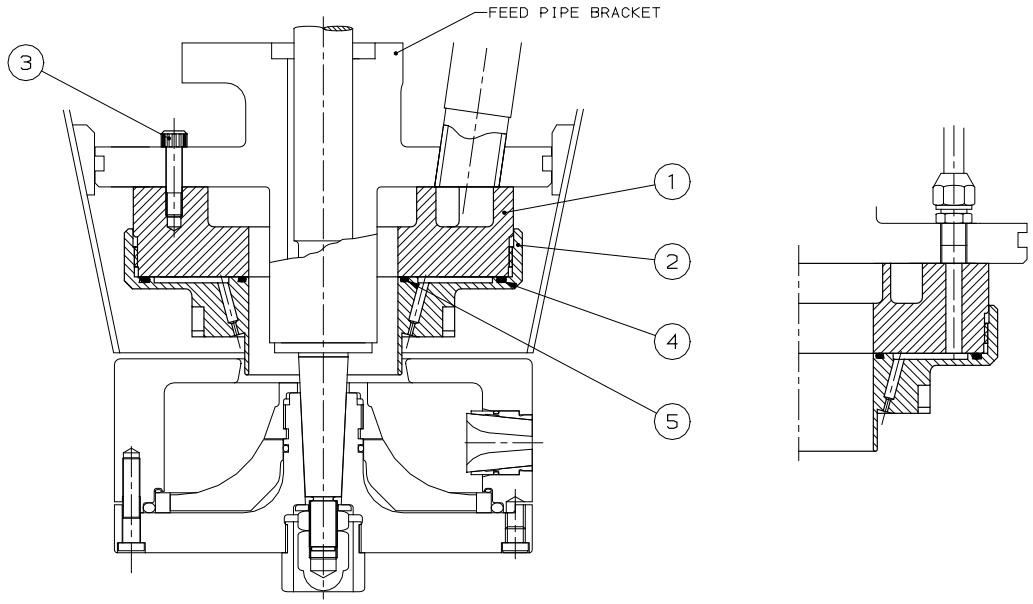


Fig. 14 Liquid Distributor, Type VSW

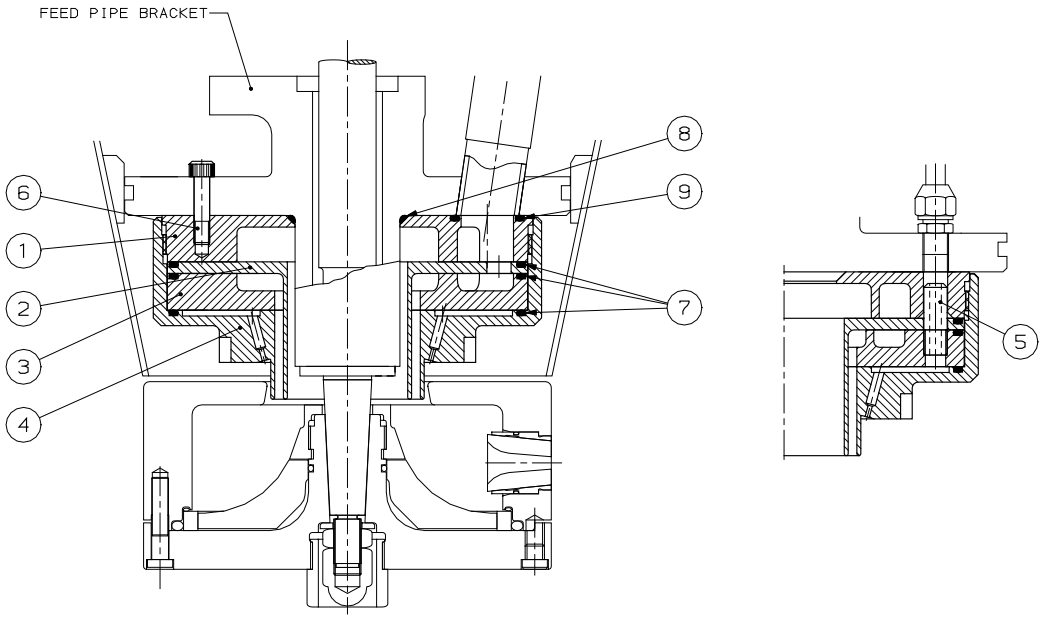


Fig. 15 Liquid Distributor, Type VTW

2.3.2 Design Description

The liquid distributor is mounted around the base of the spindle in close proximity to the wheel and is designed for the uniform distribution of the liquid feed into the wheel. The size is determined by the actual specified feed flow.

Higher feed flow may cause overflow and will result in improper atomization. Furthermore, the feed may enter the guide bearing area leading to spindle vibrations. In case the feed flow continues towards lower oil sump, it will contaminate the lubrication system causing damage to the gears. The liquid feed pressure in the feed line just before the atomizer should be in the range of 0.3-0.8 barg (4.4-11.6 psig).

3. TECHNICAL DATA

3.1 Motor

4-pole, (1460 RPM at 50 HZ, 1750 RPM at 60 HZ) foot mounted, execution B3 (Horizontal Shaft) installed on a separate bracket.

3.2 Power Consumption

Max. 24 kW (33 hp) (inclusive of idling losses)

3.3 Transmission

V-belts, section C, 3 pieces
V-belt pulley atomizer: Diameter 315 mm (12.4”)

3.4 Gear

Worm gear, transmission ratio 1:10; Make: HOLROYD

TOTAL RATIO	SPINDLE RPM		MOTOR V-BELT
V-belt drive and worm gear	50 Hz	60 Hz	Pulley Dia. mm
5.07	7400	8850	160
5.38	7850	9400	170
5.70	8300	10000	180
6.08	8900	10650	190
6.32	9250	11050	200
6.74	9850	11800	212
7.08	10350	12400	224
7.47	10900	13050	236
7.92	11550	13850	250
8.40	12250	14700	265
8.89	13000	15550	280
9.51	13900		300
10.00	14600		315
10.63	15500		335

3.5 Spindle RPM

Counter clockwise rotation seen from above.
Max. 15,550 RPM
Min. 7,400 RPM

3.6 Noise Level

The sound pressure level (SPL) in the surroundings of an atomizer exceeds 70 dB(A) and this depends mainly on:

atomizer wheel RPM
atomizer load
motor size and type
surroundings of the atomizer

At normal operating conditions, the SPL at a distance of 1 meter from F35 atomizer is measured to 93 dB(A). This figure however shall be taken as guidelines. A deviation up to 5 dB(A) or more may be expected depending on the above mentioned conditions.

3.7 Weight

Atomizer weight (exclusive of motor): 410 kg (905 lb)

4. AUXILIARY EQUIPMENT AND MONITORING SYSTEMS

In order to comply to the process and/or product requirements, the rotary atomizer is equipped with different auxiliary and monitoring systems. These standard features are represented by identification codes, which are mentioned on the name plate. A brief description of these standard features and their selection criteria are outlined in this section.

4.1 Basic Atomizer, Feed Pipe System

■□□□-□□-□□□□□

Feed pipe identification code: **A,E,G or L** (one pipe), **B,F,H or M** (two pipes)

The F35 atomizer is equipped with one or two 3/4" feed pipe depending on the specified feed rate and feed properties. The feed pipe(s) terminate in the liquid distributor below the feed pipe bracket.

Feed pipe connections

Codes **A** and **B :** ¾" BSP thread
Codes **E** and **F :** Welded, pipe dia. 26.9 mm.
Codes **G** and **H :** Quick coupling (CAM-LOCK type) for ¾" hose or ¾" BSP thread.
Codes **L** and **M :** 1" Sanitary ISO 2852 coupling. Pipe dia. 25.6 mm.

4.2 Air Cooling System

□■□□-□□-□□□□□

Identification code: **V,** if selected
Identification code: **O,** if not selected

In case the drying air inlet temperature to chamber exceeds 250°C (482ºF), a forced air cooling of the atomizer lower part (venting of skirt) is required. Cooling air supplied by a venting fan prevents the atomizer parts from overheating and the air is released to atmosphere.

Cooling air rate (code V): 250 kg/h, max. temperature 40°C (104ºF) and min. Pstat. 150 mm WG (6" WG) at inlet to atomizer.

Cooling air and air to wheel rate (code V+ NP or FP): 250 kg/h, max. temperature 40°C (104ºF) and min. Pstat.150 mm WG (6" WG) at inlet to atomizer.

4.3 Wheel Safety Water System

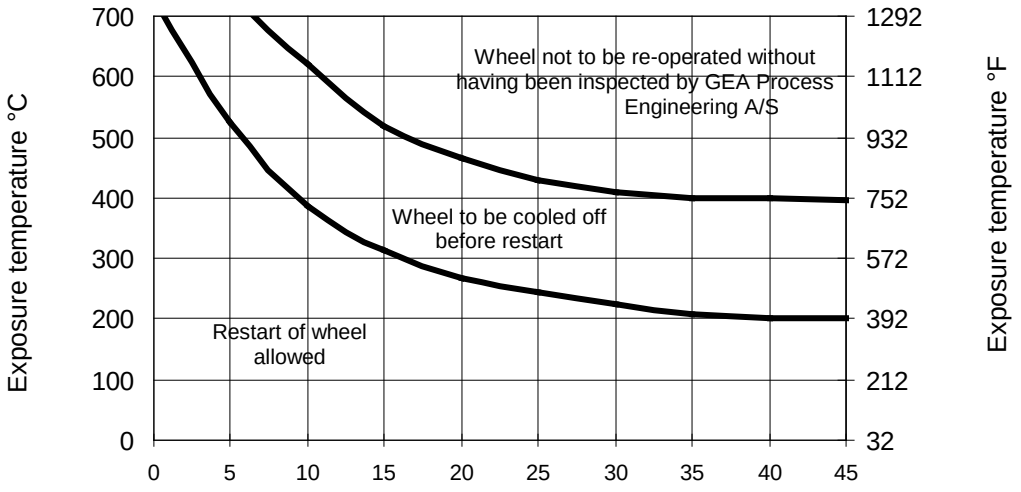
□□■□-□□□-□□□□□

Identification code: **W,** if selected
Identification code: **O,** if not selected

Depending on the type of wheel, air inlet temperature to chamber, wheel material and peripheral speed, a safety water system is required to prevent the wheel from overheating in case of sudden feed or water failure.

When selected, the wheel water is supplied to atomizer through a separate pipe and a water flow rate of 120 litres/h, 1 barg (14.5 psig) at inlet to atomizer is required. A safety water valve will open under the condition that the drying air inlet temperature is higher than 200°C (392ºF), atomizer is operating and the supply of feed/process water to atomizer is below a certain value.

If the water flow is not established complying to the above mentioned conditions, the alarm will be activated.



Wheel Temperature Exposure Diagram

CAUTION
If the atomizer wheel has been exposed to higher temperatures for longer periods of time due to combinations of high temperature and failing wheel safety water, the rules as presented on the diagram must be followed. In case of any doubt, let GEA Process Engineering A/S to perform a wheel inspection for safety reasons. Refer to wheel safety section 1.4.

4.4 Lubrication System

□□□■-□□-□□□□

Identification code: **O** (built-in lubrication oil pump system)
Identification code: **P** (Separate lubrication oil pump system)

For spindle revolution greater than 10,000 RPM, the built-in oil pump is driven by the gear input shaft. The oil pump provides app. 1.2 litres/min. at 1,500 RPM (spindle RPM: 15,000).

For spindle revolution less than or equal to 10,000 RPM, variable speed and reverse rotation, a separate oil pump with 0.37 kW (0.5 hp), 4 pole flange motor is installed. The oil pump provides app. 2.5 litres/min. at a counter pressure of 1 bar (14.5 psi).

4.4.1 Oil Grade and Specification

Due to high operational speed and heavy gear forces, oil grade must comply to DIN 51524 Part 2: H-LP.

Specifications

Viscosity, ISO VG	68
Viscosity index, ISO 2909, min.	100
Kinematic viscosity, ISO 3104 at 40°C (100°F)	68 cSt
Kinematic viscosity, ISO 3104 at 100°C (212°F)	(7) cSt
Flame point, PMMC, min.	150°C (300°F)
Pour point, ISO 3016, max.	-30°C (-22°F)
FZG gear test, DIN 51534, min. value	10

4.4.2 Recommended Oil Types

NOTE
Over the years, GEA Process Engineering A/S has obtained good results within many different industries of using the oil brands and types mentioned below. However, it is the responsibility of the enduser of the atomizer that the oil selected comply with the above specification and that the oil is compatible with the production environment and process conditions under which the atomizer is operating. If your preferred brand is not on this list, please consult GEA Process Engineering A/S.

SHELL	Tellus S 68
Mobil Oil	DTE 26
BP	Energol HLP HM 68
ESSO	Nuto H 68
Statoil	Hydraway HM 68
Chevron	Hydraulic EP 68
Castrol	Hypsin AWS 68
Q8	Haydn 68
Texaco	Rando HD-C 68

4.4.3 Food Grade Oils

NOTE
The food grade oil mentioned below are approved by USDA as H1.
Over the years, GEA Process Engineering A/S has obtained good results within many different industries of using the oil brands and types mentioned below. However, it is the responsibility of the enduser of the atomizer that the oil selected comply with the above specification and that the oil is compatible with the production environment and process conditions under which the atomizer is operating. If your preferred brand is not on this list, please consult GEA Process Engineering A/S.

SHELL	Cassida fluid HF 68
Mobil Oil	DTE FM 68
Texaco	Cygnus Hydraulic 68

4.4.4 Oil Filling

On delivery, there is no oil filled in the atomizer lubrication system, except a thin layer to protect against rust formation during transportation and storage.

CAUTION
The oil (and funnel, if used) must be absolutely clean. Even a slight impurity in oil can cause operational breakdown.

Remove the plug (1-Fig.17) or (52-Fig.19) and fill the oil while checking with dip stick (13-Fig.17) or (4-Fig.19) the correct oil level. There are two markings showing the maximum and the minimum oil level. Whenever the oil reaches the lower marking of the dip stick, the oil must be refilled. An app. 5.5 litres of oil is required for the first time filling.

Prior to start-up, 0.1- 0.2 litre oil is filled in the coupling guard (7-Fig.3) through hand screw port (37-Fig.3). Whenever the atomizer is started after a longer stationary period, repeat this operation.

4.4.5 Replacement of Oil

After 2000 operational hours of the atomizer, the oil must be replaced.

4.4.6 Draining of Oil

Place bucket under drain plugs (1-Fig.17) or (49 and 50 Fig.19) provided at the lower part of the gear box and the oil sump. Remove the draining and filling plug to facilitate draining. Reinstall the plugs after draining.

4.4.7 Functional Description, Built-in Oil Pump System

Identification Code: **O**

NOTE: Reference to other figures will be mentioned as (Pos. No.-Fig. No.)

The schematic flow diagram (Fig.16) identifies the parts, components and accessories of the lubrication system. The oil flow directions are marked and controls are shown. During operation, there is a vacuum of app. 0.9 bar (13 psi) prior to filter at lower sump and a pressure of 0.5-1.5 barg (7.3-21.8 psig) prior to oil control unit. The oil pump at 1,500 RPM (Spindle RPM:15,000) normally provides a flow of 1.2 l/min.

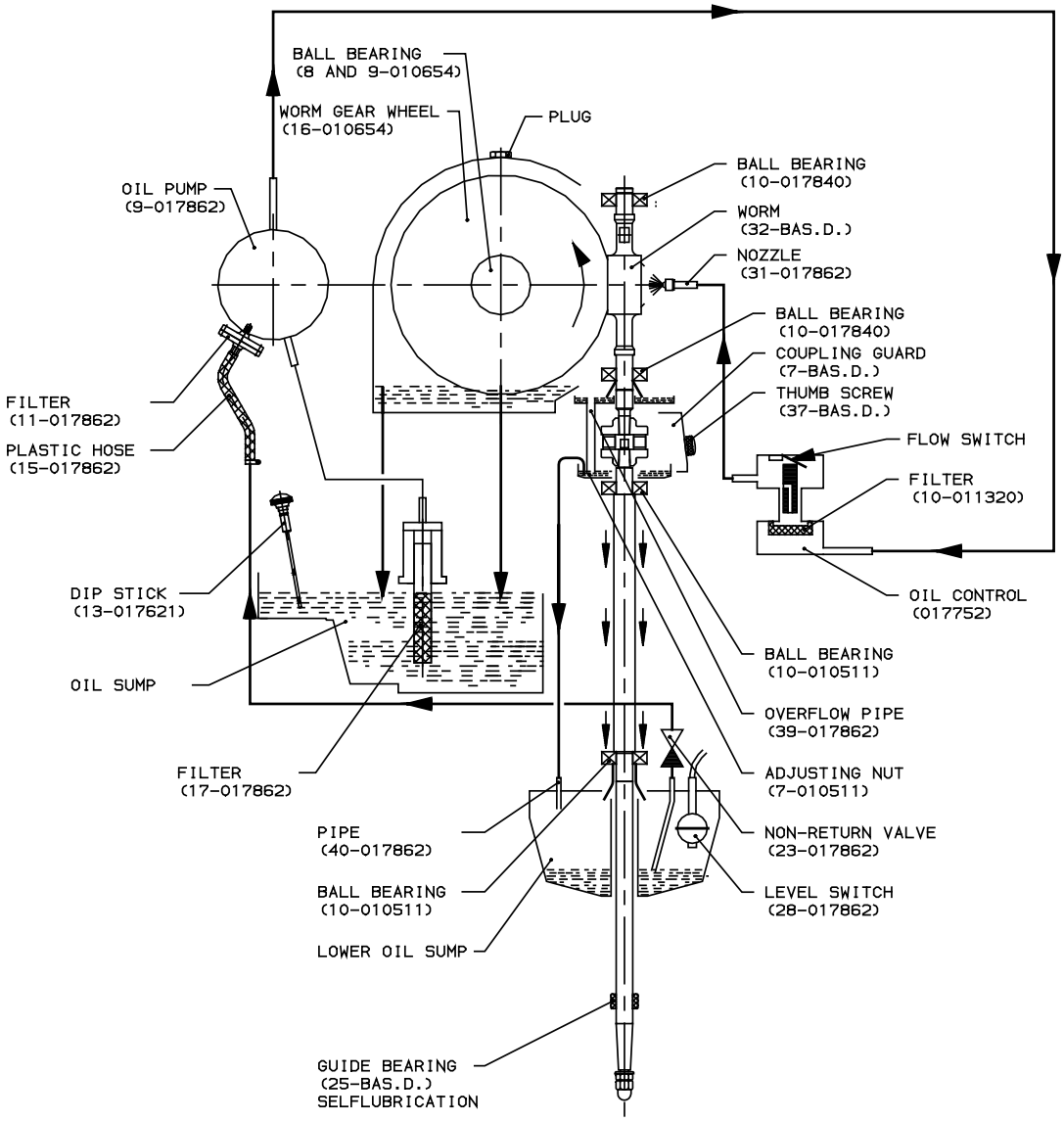


Fig. 16 Built-in Lubrication system
Schematic Flow Diagram

Description
Refer to Fig. 17

The oil pump (9) has two suction branches and one pressure branch. The one suction branch draws oil from the upper oil sump (15-Fig.3) through the filter (17) and the suction pipe (12). The other suction branch draws oil from the lower oil sump (22-Fig.3) through the suction pipe (24), non-return valve (23), suction pipe (22), plastic hose (15) and the filter (11).

Under normal operation, the oil flow can be observed through the plastic hose (15), which indicates the suction from the lower oil sump. From the pressure branch, the oil passes through the pressure pipe (3) to the oil control unit (33) and to nozzle (31) through pressure pipe (32). The oil hits the mesh between worm (32-Fig.3) and the worm wheel (16-Fig.24).

The oil level in the gearbox is kept constant by means of two overflow pipes (29) and (30), ensuring the worm wheel immersed in oil and causing splash of oil inside the gearbox. The ball bearings (10-Fig.25), (8-Fig.24) and (9-Fig.24) are lubricated through the oil mist created by nozzle.

The oil flows partly via the overflow pipes (29) and (30) back to the oil sump and partly through the ball bearing (10-Fig.25) via the oil pipe (39) to the adjusting nut (7-Fig.25). From here the oil flows by two ways to the lower oil sump.

Part of the oil flows through the holes in the cover (8-Fig.25) and bearings (10-Fig.25) to the lower oil sump. Surplus oil flows through the gaps in adjusting nut (7-Fig.25) and through the overflow pipe (40) to the oil sump.

The guide bearing is of the self- lubricating type, hence no oil lubrication required.

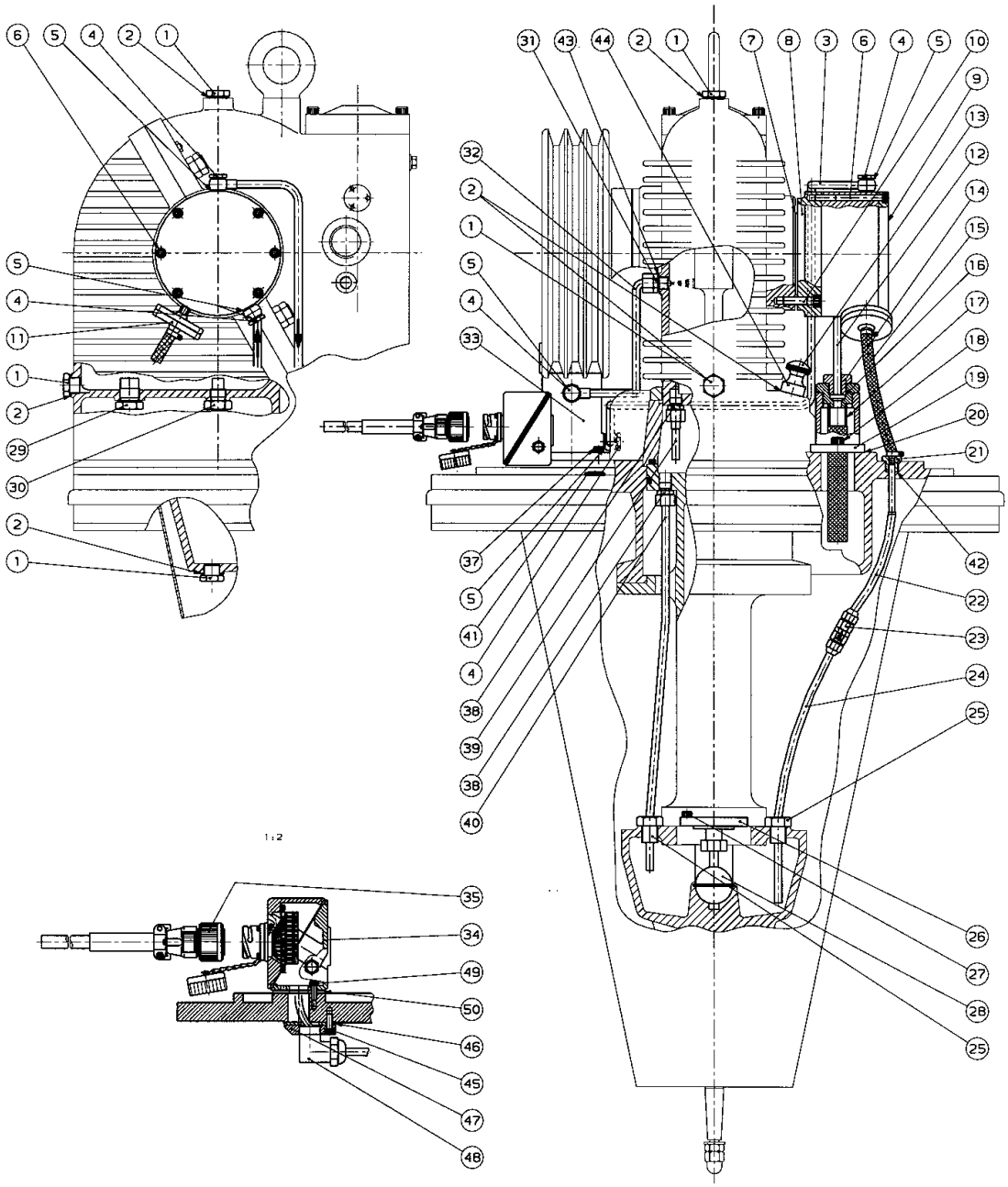


Fig. 17 Built-in Oil Lubrication System

4.4.8 Functional Description, Separate Oil Pump System

Identification Code: **P**

NOTE: Reference to other figures will be mentioned as (Pos. No.-Fig. No.)

The schematic flow diagram (Fig.18) identifies the parts, components and accessories of the lubrication system. The oil flow directions are marked and controls are shown. The duplex gear pump driven by a separate 0.37 kW (0.5 hp), 4-pole motor provides an app. pressure of 1.0-2.0 barg (14.5-29 psig) prior to oil control unit (Fig.20). The pump capacity is app. 2.5 l/min. at a counter pressure of 1 bar (14.5 psi).

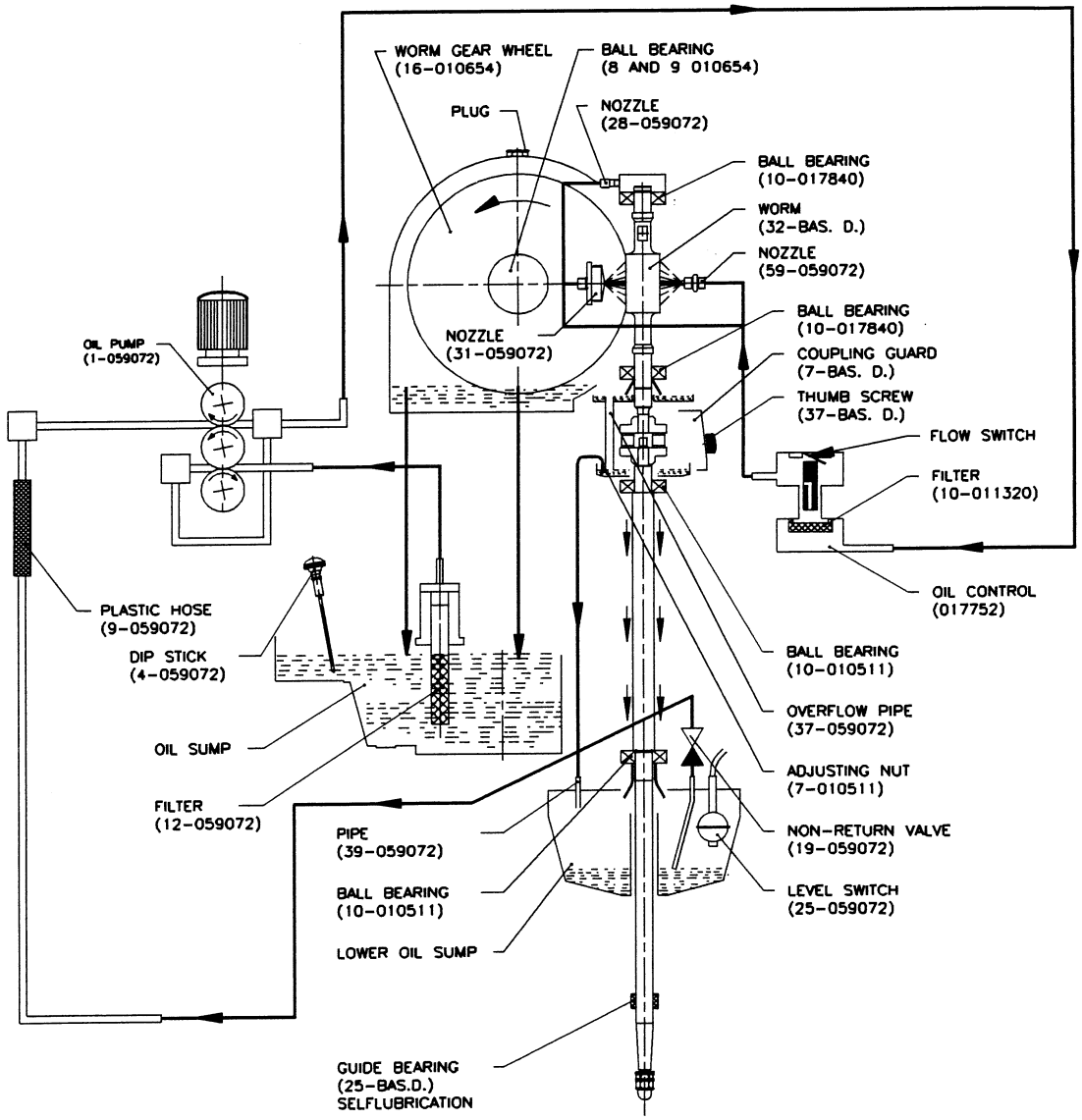


Fig. 18 Separate Oil Pump
Schematic Flow Diagram

Description
Refer to Fig. 19

Inlet A
Oil is drawn from the upper sump on the supporting plate (15-Fig.3) through a filter (12) and suction pipe (5) to the oil pump.

Inlet B
Oil is drawn from the lower sump (22-Fig.3) through the suction pipe (20), non-return valve (19), suction pipe (18) and the transparent plastic hose (9) to the oil pump. Oil (oil and air) can be observed through the plastic hose during normal operation indicating the suction from lower sump.

Outlet C
Oil passes through a pipe below the oil pump. The oil passes through a pressure pipe (54) to the oil control unit (Fig.20). Further it passes through pipes (62), (60), (61), (32) and (29) to the nozzles (59), (31) and (28). The oil from nozzles (59), (31) lubricates the mesh between the worm gear and worm wheel. The oil from nozzle (28) lubricates the ball bearing (10-Fig.28).

The oil level in the gearbox is kept constant by means of overflow pipes (46) and (47), thus ensuring the worm wheel immersed in oil and causing splash of oil inside the gearbox. The ball bearings (10-Fig.25), (8-Fig.24) and (9-Fig.24) are lubricated through the oil mist created by nozzles.

The oil flows partly via the overflow pipes (46) and (47) back to the upper oil sump and partly through the ball bearing (10-Fig.25) via pipe (37) to the adjusting nut (7-Fig.25).

The oil flows in two ways to the lower oil sump. Part of the oil flows through the holes in cover (8-Fig.25) and through the bearings (10-Fig.25) to the lower oil sump. Surplus oil flows through the gaps in the adjusting nut (7-Fig.25) and overflow pipe (39) to the oil sump.

The guide bearing is of the self- lubricating type, hence no oil lubrication required.

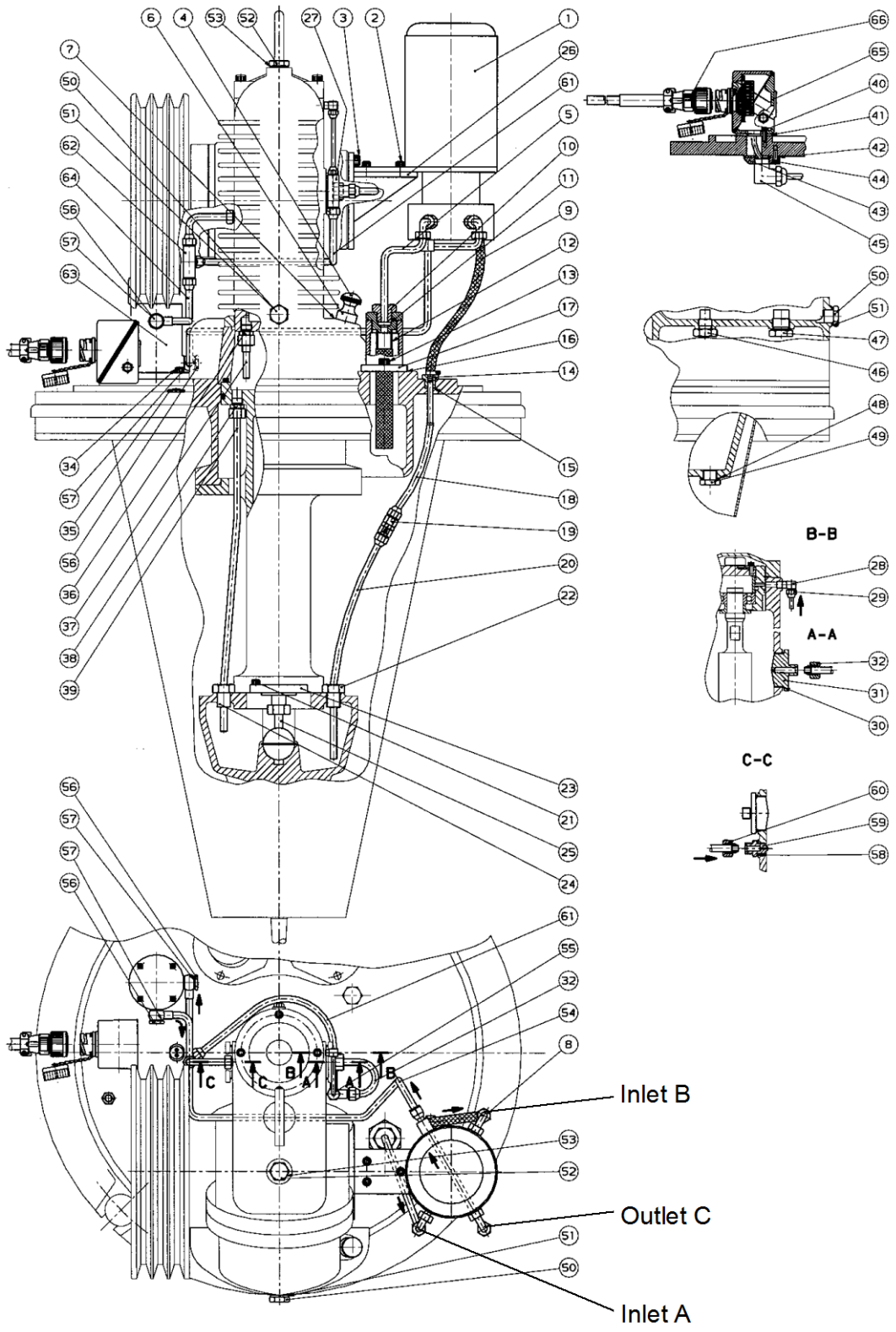


Fig. 19 Separate Oil Pump Lubrication System

4.4.9 Oil Flow Control Unit

Refer to Fig. 20
The oil flow control unit is mounted on the intermediate supporting plate of the atomizer. It controls the lubrication of the gear wheels and bearings. The oil enters from the lower part, passes through filters (9) and lifts the piston (6) thus opening the discharge port.

Under normal flow the oil flow keeps the piston lifted and the magnetic switch activated showing no alarm on the control panel. In case the flow decreases, the piston will slide down and the magnetic switch will be deactivated. This will immediately activate an alarm on the control panel.

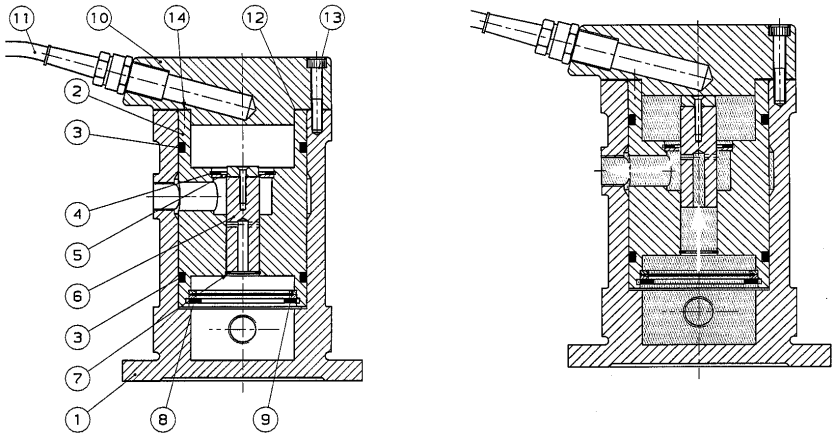


Fig. 20 Oil Flow Control Unit

4.4.10 Oil Filters

Refer to Fig. 20
The oil flow control unit consist of two strainers that requires cleaning. The cleaning of built-in strainers (9) requires dismantling of the oil control unit as follows:

Remove the screws (13) and withdraw the inner part. Remove the circlip (8) and strainers. After cleaning the strainers in petrol or paraffin oil, the oil control unit shall be reassembled as mentioned above, but in reverse order.

On the built-in oil pump lubrication system, a filter is provided on the suction line (11-Fig.17). This filter shall be cleaned during oil replacement in petrol or paraffin oil. During reassembling of the filter, it must be ascertained that no leaks occur, as it will effect the proper suction of oil from the lower oil sump (22-Fig.3).

On the upper oil sump of both the systems, a filter (17-Fig.17)/(12-Fig.19) is provided in the suction line from the oil sump. This filter shall be cleaned during oil replacement in petrol or paraffin oil. Dismantling is done by unscrewing the flange (19-Fig.17)/(17-Fig.19).

4.4.11 Lubrication Monitoring System

□□□□-□□□-■□□□□

Identification Code: **S**

Low Oil Flow Alarm

Under normal flow the oil flow keeps the flow piston lifted and the switch activated showing no alarm in the control panel.

High Oil Level Alarm

The lower oil sump that is continuously scavenged by the oil pump is equipped with a float level switch. In case the oil pump fails in keeping this reservoir empty, the float will activate the built-in switch resulting in activation of alarm on the control panel. Refer to section 8.5.2.

4.4.12 Flooding Indicator System

For immediate detection of leaks in the pit surrounding the intermediate supporting plate, a liquid indicator is mounted.

The liquid indicator consists of two electrodes, which will short circuit, if covered by (conductive) liquid. A special liquid indicator is available for non- conductive liquids. A short circuit (exceeding 25 k Ohm) activates an alarm via relay at the instrument panel, provided the control panel is equipped with the optional accessories. In case of leakage in the feed line, the alarm will be activated. Refer to section 8.5.2.

CAUTION: In case of flooding, keep the cooling air fan running.

4.5 Air to Wheel System

□□□□-□□□-□□□□■

Identification codes: **FS** or **FP** (Food)
Identification codes: **NS** or **NP** (Non- Food)

In case the atomizer air cooling system code V is selected, Codes FS, FP and NS cannot be used. In case of code NP is selected, a common fan serves to cover the codes V and NP.

In order to prevent the formation of deposits in atomizer wheel and/or to improve the product quality, air to wheel is determined depending on the product and/or process requirements. The air is emitted into the drying chamber.

Air to wheel, pressure (code **FP** or **NP**): 250 kg/h, max. 40°C (104ºF) 150 mm WG (6” WG) at inlet to atomizer.

Air to wheel, suction (code **FS** or **NS**): 150 kg/h

4.6 Sealing Air to Spindle System

Considering the product and/or process requirements, air is supplied either by suction or pressure. The sealing air is emitted into the chamber in both cases. The sealing air to spindle system prevents air borne oil droplets from the lubrication system to mix with the feed due to vacuum created by the rotation of the wheel.

Identification Codes & Air rates

S: Suction air
Air rate (code S): 5 kg/h

P: Pressurized air
Air rate (code P): 5-30 kg/h

NOTE
The air rates stated above are approximate figures and are based on the differential air pressure across the atomizer inlet at the supporting plate and the drying chamber.

Air rates and pressure

The pressure at the inlet to atomizer shall be kept as low as possible (Max. 250 mm WG (10” WG)) due to the following reasons:

The sealing air to spindle is connected to a region just above the guide bearing and passes through the guide bearing assembly into the chamber via the atomizer wheel. The amount of air passing through depends on the condition of the guide bearing.

Depending on the differential air pressure, part of the sealing air to spindle flows upward through the spindle labyrinth and into the gearbox. Thus a high sealing air pressure will create overpressure in the gearbox and may lead to oil leakage. It is therefore important to optimise the sealing air pressure adjustment during the initial operation of atomizer. This will prevent creating overpressure in the gearbox.

4.7 Additional Features

4.7.1 Lubrication Monitoring System

□□□□-□□□-■□□□□

Identification code: **S**

Refer to section 4.4.11

4.7.2 Spindle Vibration Monitoring system

□□□□-□□□-□■□□□

(Optional extra)
Identification code: **V**

The spindle vibration monitoring system comprises the probe and oscillator integral with the atomizer and the monitor box and interlock system outside the atomizer. As a standard the atomizer will be equipped with the Schenck system.

Vibrations in the atomizer are defined as cyclical motion of the spindle in relation to the surrounding components and can be caused by several mechanisms in the atomizer. The vibrations are measured as variations of the gap between the spindle and the end of probe installed in the lower part of atomizer.

When the level of vibration exceeds the pre-set limit value 1 (set to 0.4 mm (0.016”) peak to peak) an alarm will appear. If it continues and rises above the pre-set limit value 2 (set to 0.5 mm (0.02”) peak to peak), the atomizer must shutdown automatically. The adjustments are carried out by GEA Process Engineering A/S prior to delivery. A separate technical instruction **6000-0001** is compiled in the atomizer instruction manual.

CAUTION
The above function must be secured through interlocks in the control panel.

4.7.3 Tachometer System

□□□□-□□□-□□■□□

(Optional extra)
Identification code: **T**

The tachometer is mounted as a standard equipment on atomizer with variable speed. The signal from the probe is transmitted through the multiple wire cable common with the lubrication monitoring system. The probe is mounted in a support and the two notches on the spindle generate the signal. The gap between the probe and the spindle can be adjusted with screws and must be 0.5 mm (0.02”).

A speed transmitter is required for transmitting the signal to the speed indicator/tachometer in the instrument panel.

4.7.3.1 Frequency Converter

(**Optional extra)**

Motors for atomizer with variable speed shall be AC induction motors using electronic frequency converter equipment. The converter shall be mounted within a motor control centre located indoors.

The frequency converter of this atomizer is programmed especially to operate in the range of 7,400-15,550 RPM. The parameters limiting the maximum and the minimum rotational speed must not be changed under any circumstances. Furthermore, there shall not be any possibility to adjust the RPM range from 0 to 7,400, i.e., the atomizer during start-up remains stable at minimum 7,400 RPM. The set values are stated on the supplied configuration sheets.

CAUTION
The set values are not the same as factory-set values. In case of repair of the frequency converter, it is extremely essential that the programme of the frequency converter must be checked and corrected. The atomizer operational speed must not be lower than 7,400 RPM or exceed the maximum 15,550 RPM under any circumstances.

4.7.4 Moistening Water Equipment □□□□-□□□-□□□■□

Identification Code: **W**

Depending on the process and/or product requirements and in order to prevent deposits between the atomizer wheel and liquid distributor, a water pipe connection can be provided. A water rate of 5 to 50 kg/h at 1 barg (14.5 psig) pressure will be required at the inlet of the atomizer.

4.7.5 Wet Cleaning Equipment □□□□-□□□-□□□□■

Identification Code : **C**

Depending on the process and/or product requirements and in order to facilitate cleaning of feed pipe system, a cleaning adapter replacing the liquid distributor is provided.

5. SETTING UP

5.1 Unpacking

The atomizer must be stored under dry and clean conditions when it arrives at the plant site. Place the box in the horizontal position and remove the lid and one side of the box. Remove the minor components, if any, prior to hoisting the atomizer out of the wooden crate.

Install the supporting ring on the air disperser as stated in section 5.5 and place the atomizer on the service stand. Clean the atomizer and remove any surface coatings. The protective pipe shall remain in place. The wooden box should be stored for any future transportation or long time storage of the atomizer.

The atomizer wheel is separately packed in a wooden box when it arrives at the plant site. The liquid distributor may either be separately packed and placed in the atomizer wooden box or packed and placed in the atomizer tool box.

5.2 Mounting of Liquid Distributor on Atomizer

A general mounting instructions based on the standard liquid distributors design is described in this section. Once the atomizer is positioned on the service stand, unscrew the protection pipe of the spindle and store it for later use. The valid documents compiled in the atomizer instruction manual shall be consulted prior to mounting the liquid distributor.

5.2.1 Liquid Distributor, Type VS

Refer to Fig. 12

NOTE
The upper volute (1) is duly aligned with feed inlet hole and is permanently mounted on the feed pipe bracket at GEA Process Engineering A/S workshop.

Installation Procedure

Step 1
Ensure that the protection pipe (3) is secured in position with duly mounted O-ring (7).

Step 2
Mount O-ring (8) on the outer liquid distributor (2) and tighten it with a special spanner from the tool box.

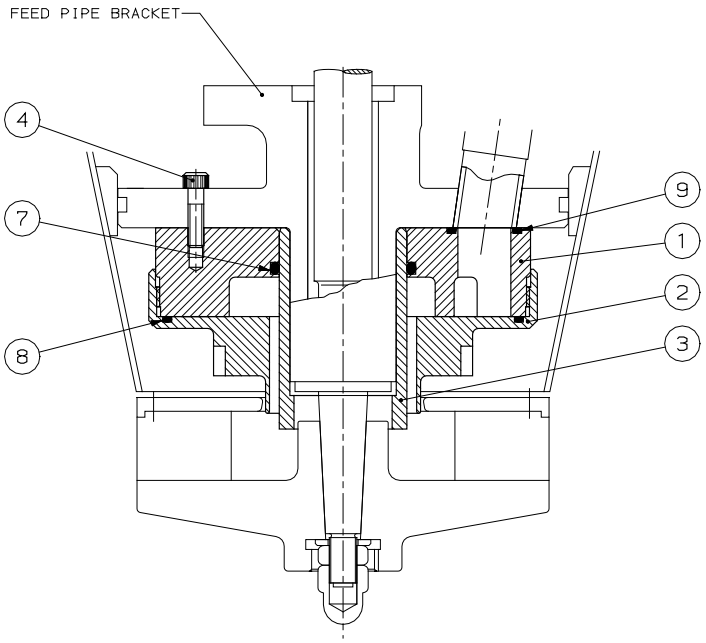


Fig. 12 Liquid Distributor, Type VS

5.2.2 Liquid Distributor, Type VT

Refer to Fig. 13

NOTE
The upper volute (1) is duly aligned with feed inlet hole and is permanently mounted on the feed pipe bracket at GEA Process Engineering A/S workshop.

Installation Procedure

Step 1
Mount O-ring (7) on the distributor (4). Screw tight the guide pin (5) permanently on lower volute (3) and place it in the distributor (4). Mount the O-ring (9) around guide pin, O-ring (8) on the inner distributor (2). Place the whole assembly in the lower volute (3).

Step 2
The whole assembly to be installed on upper volute ensuring that the guide pin settles in upper volute (1). Tighten the distributor (4) manually on the upper volute (1). Finally tighten the outer liquid distributor (4) with a special spanner from the tool box.

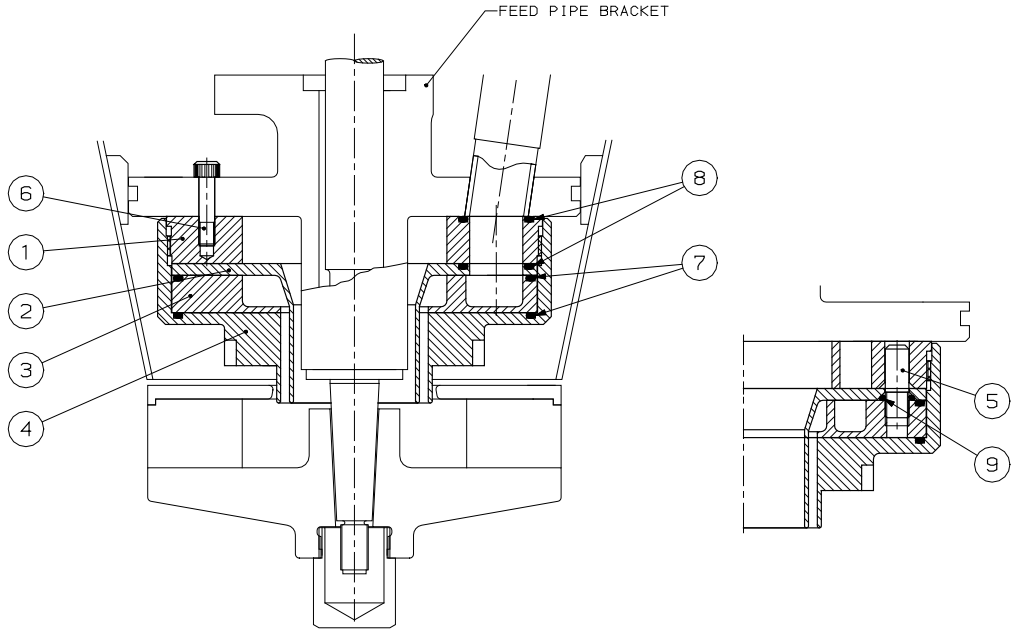


Fig. 13 Liquid Distributor, Type VT

5.2.3 Liquid Distributor, Type VSW

Refer to Fig. 14

NOTE
The upper volute (1) is duly aligned with feed inlet hole and is permanently mounted on the feed pipe bracket at GEA Process Engineering A/S workshop.

Installation Procedure

Mount O-ring (4) on the outer liquid distributor (2) and tighten it with a special spanner from the tool box.

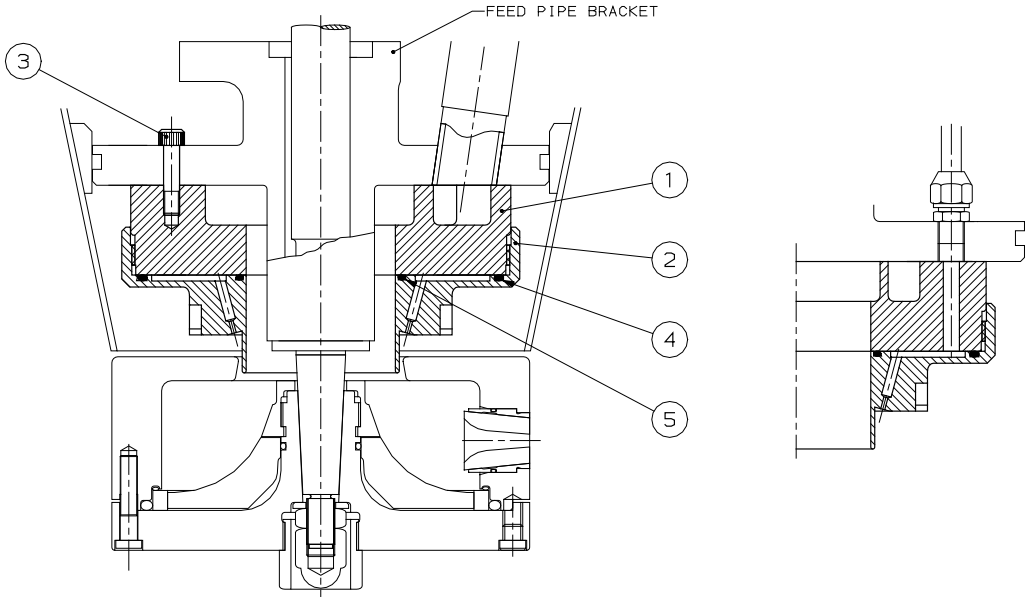


Fig. 14 Liquid Distributor, Type VSW

5.2.4 Liquid Distributor, Type VTW

Refer to Fig. 15

NOTE
The upper volute (1) is duly aligned with feed inlet hole and is permanently mounted on the feed pipe bracket at GEA Process Engineering A/S workshop.

Installation Procedure

Step 1
Mount O-ring (7) on the distributor (4). Screw tight the guide pin (5) permanently on lower volute (3) and place it in the distributor (4). Mount the O-rings (7) on the inner distributor (2) and lower volute (3). Place the whole assembly in the lower volute (3).

Step 2
The whole assembly to be installed on upper volute ensuring that the guide pin settles in upper volute (1). Tighten the distributor (4) manually on the upper volute (1). Finally tighten the outer liquid distributor (4) with a special spanner from the tool box.

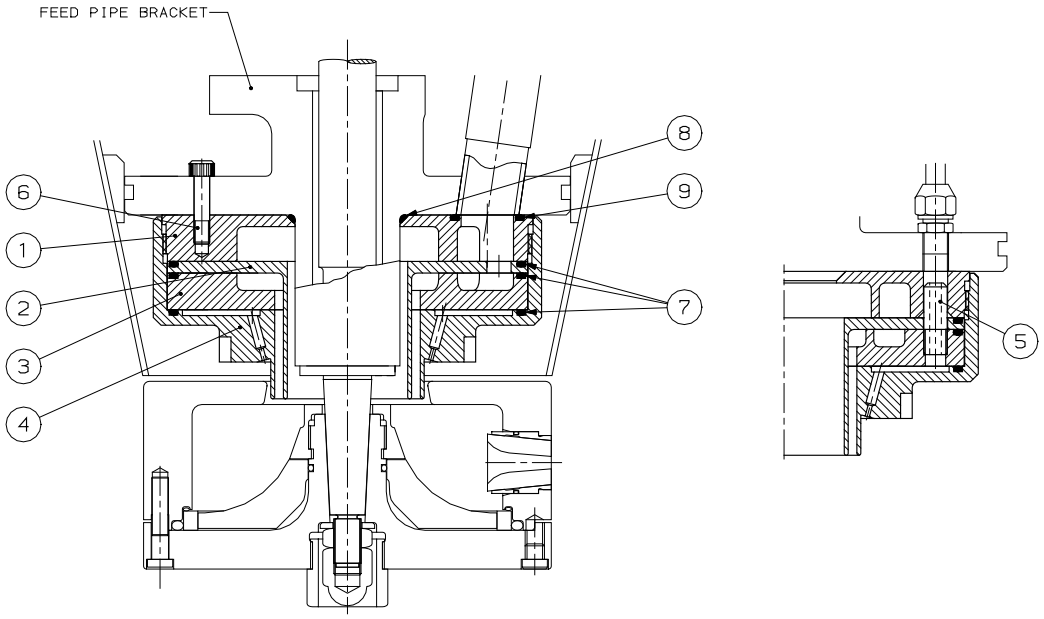


Fig. 15 Liquid Distributor, Type VTW

5.3 Mounting of Wheel on Atomizer Spindle

A general mounting instructions based on the standard wheel design is described in this section. The valid documents compiled in the atomizer instruction manual shall be consulted prior to mounting the wheel.

Installation Procedure

Step 1
The taper part of the spindle shall be cleaned thoroughly. Ensure that the wheel and the spindle are at the same temperature.

Step 2
Apply a thin film of Molykote anti-seize compound to the taper part of the spindle and **remove it completely** with a non-fluffy cloth ensuring no visible layer of Molykote. Mount the wheel on the spindle and secure it with the retainer nut. Hold the wheel with holding device from the tool box and tighten the nut. Finally mount the protection nut.

CAUTION
Ensure that the clearance between atomizer skirt and wheel is approximately 3 mm (0.12”).

The recommended torque values for tightening the wheel nuts are: 70 Nm (52 ft·lbf) in case of standard spindle material, while 65 Nm (48 ft·lbf) for Hastelloy material.

5.4 Oil Filling

Follow the instructions stated in section 4.4.4.

5.5 Installing Atomizer

Installing vibration damper arrangement
Refer to Fig. 21

Place the steel ring (6) on the air disperser flange and secure it with 4 guide pins (4). Install the vibration damper (5).

NOTE
After positioning the atomizer in place, install the rubber ring (3) with washers (2) on both sides. Finally tighten the finger nuts (1).

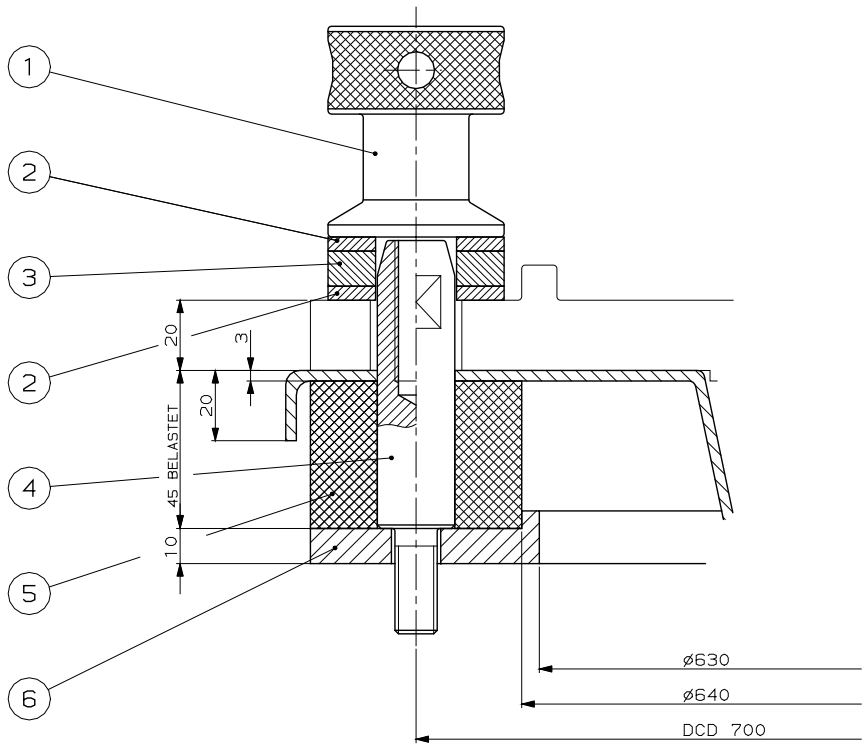


Fig. 21 Atomizer Vibration Damper Arrangement

5.5.1 Installation of Motor Bracket and Belt Guard

Due to the design limitations, the motor bracket arrangement is installed separately. The first time installation is normally handled by GEA Process Engineering A/S at site. Figure 22 shows a standard mounting arrangement of F35 atomizer motor bracket with a DAR type air disperser.

Refer to Fig. 22
Following steps will ensure the correct alignment of pulleys and motor bracket:

Step 1
Place the atomizer supporting flange on gas disperser centre part. Mount the four guide pins and the centre part of gas disperser in the housing. Install the atomizer on the centre part of gas disperser.

Step 2
Turn the atomizer and gas disperser centre part to the correct position angle. The centre part of gas disperser is fixed to housing with guides, which are welded to gas disperser housing. The atomizer is turned slightly counter clockwise until it stops. This eliminates clearance between cut outs in the atomizer supporting plate and guide pins.

Step 3
The atomizer is fixed to the centre part of gas disperser with four knurled bolts. The centre part is fixed to the housing with screws or wedges. The motor bracket with mounting beams and motor with pulley is positioned on the gas disperser housing. The pulleys on motor and atomizer must be positioned parallel in the same plan. Use a straight edged plate for alignment.

Step 4
The lower belt guard and the guide plate for upper belt guard must be mounted before the mounting beams are welded to the gas disperser housing. The belts will be at app. 30° angle with vertical. The mounting beams are welded to the gas disperser housing. Belts and upper belt guard are mounted and the belts are tightened by moving motor guide upwards along the motor bracket.

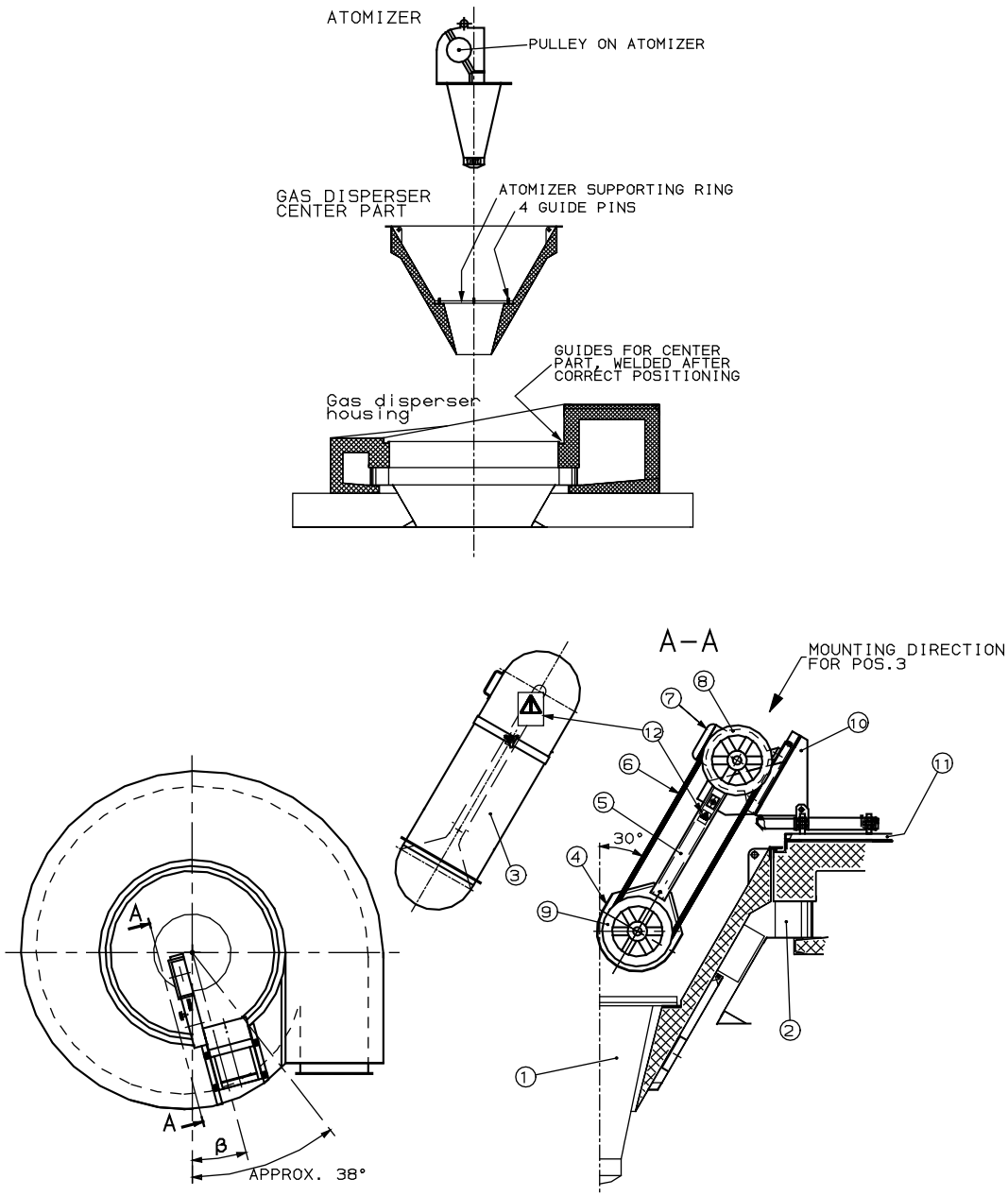


Fig. 22 Atomizer Motor Bracket Arrangement

5.5.2 V-Belts and Pulley with Taper-lock Bushing

Assembling

Ensure that the mating surfaces are thoroughly clean. Insert the bushing in pulley ensuring that the holes are aligned. Lubricate the threading and points of grub screws and place the screws loosely in holes threaded in hub.

Clean the shaft and mount the pulley and bushing as one unit and locate it at the desired position. Tighten the screws gradually and alternately with Allen key. The tightness of the screws to be checked after some interval.

Dismantling

Slacken the two screws and remove one. Insert this screw in the jacking off hole. Tighten the screw until bushing is loosened in the pulley. Remove the assembly from the shaft.

Tension of V-Belts

Tension the belt until a load of 2 kg (4.4 lb) at the centre causes a deflection of app. 5 mm (2”). If belts are too tight, the bearings will be damaged. If too slack, belts will wear too quickly.

CAUTION
The belt guard must be mounted prior to start-up of the atomizer and must remain mounted during operation.

6. INITIAL START-UP

Before the initial start-up, it is mandatory that the procedures and activities outlined in sections 4 and 5 are completed and verified by the plant supervisor.
Refer to safety warnings stated in section 1.6.
Never operate the atomizer without the wheel installed.
The initial start-up must be limited to idling conditions i.e. no water or liquid feed supply to atomizer.

6.1 Checklist for Connections and Settings

Before the initial start-up of atomizer, following checks are essential for safety:

- Liquid distributor and the wheel are mounted as stated in section 5.2.
- The atomizer is filled with oil of quality stated in section 4.4 and that the oil level is correct.
- In case of separate oil pump, check that the motor rotates in the correct direction and is interlocked with the atomizer motor. In case of pump motor failure, the atomizer motor must stop.
- Feed pipe(s) connection(s) are properly tightened.
- Wheel safety water hose is connected and water supply available, if applicable.
- All cooling air hoses are connected and fans are functional.
- The electrical cables for monitoring system are connected.
- The electrical cables of oil pump (if separate) and atomizer motor are connected.

6.2 Safety Instructions

Check that the;

- Vibration monitoring system (optional) is correctly mounted and operational in accordance with the separate instructions. Also refer to 4.7.2.
- Tachometer (optional) is correctly mounted and operational in accordance with the separate instructions. Also refer to 4.7.3.
- Lubrication monitoring system is correctly operational in accordance with this instruction. Refer to 4.4.11.
- The frequency converter (optional) is locked in the speed range. Refer to 4.7.3.1.

Start the atomizer by pushing the start button.
The built-in oil pump will immediately secure the lubrication of gears and bearings. In case of separate lubrication pump, it will start immediately to secure the lubrication of gears and bearings.

Finally check and inspect:

- Correct atomizer rotation (counter clockwise seen from above)
- Oil pump rotation (if separate)
- No alarm or visual warning signals on lubrication or other monitoring system
- Level of noise and vibration
- Proper functioning of air cooling system

The atomizer is now ready for continuous operation.

7. OPERATION

7.1 Normal Start-up and Shutdown

The normal start-up, operation and shutdown of the atomizer is integrated with the GEA spray dryer. In order to ensure the reliability in operation, the atomizer lubrication and monitoring system shall be given proper attention as outlined in this instruction. Furthermore, for enhancing the operational performance of the atomizer, inspection, service and maintenance shall be performed as stated in this instruction.

During the initial start-up of the atomizer, vibrations of short intervals may appear in the range of the first critical speed, which is below the min. RPM of the spindle. These vibrations are of no importance, as they only occur at speeds below the operational speed. However, if the vibrations continue above the critical speed i.e., the operational RPM, the atomizer must be stopped immediately and the causes shall be investigated and rectified.

During normal start-up of the dryer, water is evaporated to stabilise the different plant operational parameters. The same is also valid prior to plant shutdown. Instead of liquid feed, water is evaporated for 5-10 minutes prior to stopping the atomizer. This will ensure cleaning of the liquid feed pipe, liquid distributor and the atomizer wheel.

7.2 Emergency Shutdown or Power Failure

An emergency shutdown of the plant is normally activated due to critical and unacceptable deviation in the operation of the plant. When activated, the complete plant will stop functioning due to interlocks.

Before any restart of the plant, the atomizer must be removed from its operational position and must be placed on the service stand. Inspection and cleaning to be performed as stated in this instruction.

Prior to reinstalling the atomizer in the dryer, ensure that the cause(s) for emergency stop has been investigated and the necessary action has been taken. The above mentioned activity should be repeated in case of power failure.

NOTE
Voltage drop-out

At voltage drop-out less than 0.2 second, it is allowed to restart the atomizer motor automatically. Intervals greater than 0.2 second should be interpreted in the same way as a thermal drop-out of the atomizer motor.

8. SERVICE AND MAINTENANCE

8.1 Spare parts

All parts of the atomizer are manufactured with precision. Only genuine GEA Process Engineering A/S spare parts must be used. Subsequent to commissioning of the atomizer, a spare parts quotation is submitted by GEA Process Engineering A/S's Spare part's department. Always maintain a complete set of recommended spare (especially wear) parts on hand.

When ordering spare parts, please state the plant order number, type and serial number of atomizer (see name plate), and Pos. number/Part number of the parts required. Refer to the drawings and parts lists compiled in the atomizer instruction manual.

8.2 Maintenance tools and accessories

The drawing and parts list of the tools and accessories are compiled in the Instruction Manual.

8.3 Regular Maintenance

8.3.1 Inspection of Guide Bearing

Refer to Fig. 3

The self-lubricating guide bearing (25) supporting and limiting the deflection of the flexible spindle wear out after some time due to atomizer rotation through its first critical speed. Thus a regular inspection of the guide bearing is very important.

During normal operation the carbon bearing follows the small radial movements (0.1-0.3 mm (0.004-0.012”) peak to peak) of the flexible spindle. This is possible due to the clearance of 0.5 mm (0.02”) between the bore in the feed pipe bracket and the outer diameter of the guide bearing.

The minor radial movements of the spindle are dampened by the spring positioned below the guide bearing. The spring also keeps the guide bearing upwards against the recess of the bore. Always ensure that the spring is in good condition. This can be done by comparing the length/height with a new spring.

The clearance between the bore of the guide bearing and the spindle is 0.1 mm (0.004”). In order to monitor the extent of wear in bearing, a test piece (Aluminium) from the tool box should be tried into the guide bearing. The immediate replacement is required if it passes through the guide bearing.

The guide bearing should be dismantled as follows:

Remove the spring retainer (26) with the special key from the tool box. Remove spring (27), washer (28), guide bearing (25) and the washer (24). A slight tapping on the spindle may facilitate its removal. After the replacements follow the above procedure in reverse order to reassemble the parts.

NOTE:
Monitoring the extent of wear in the bearing is the most appropriate way to establish the proper function of the atomizer with respect to the spindle vibrations. The guide bearing is of the self-lubricating type, hence it shall be inspected every time the wheel is dismantled.

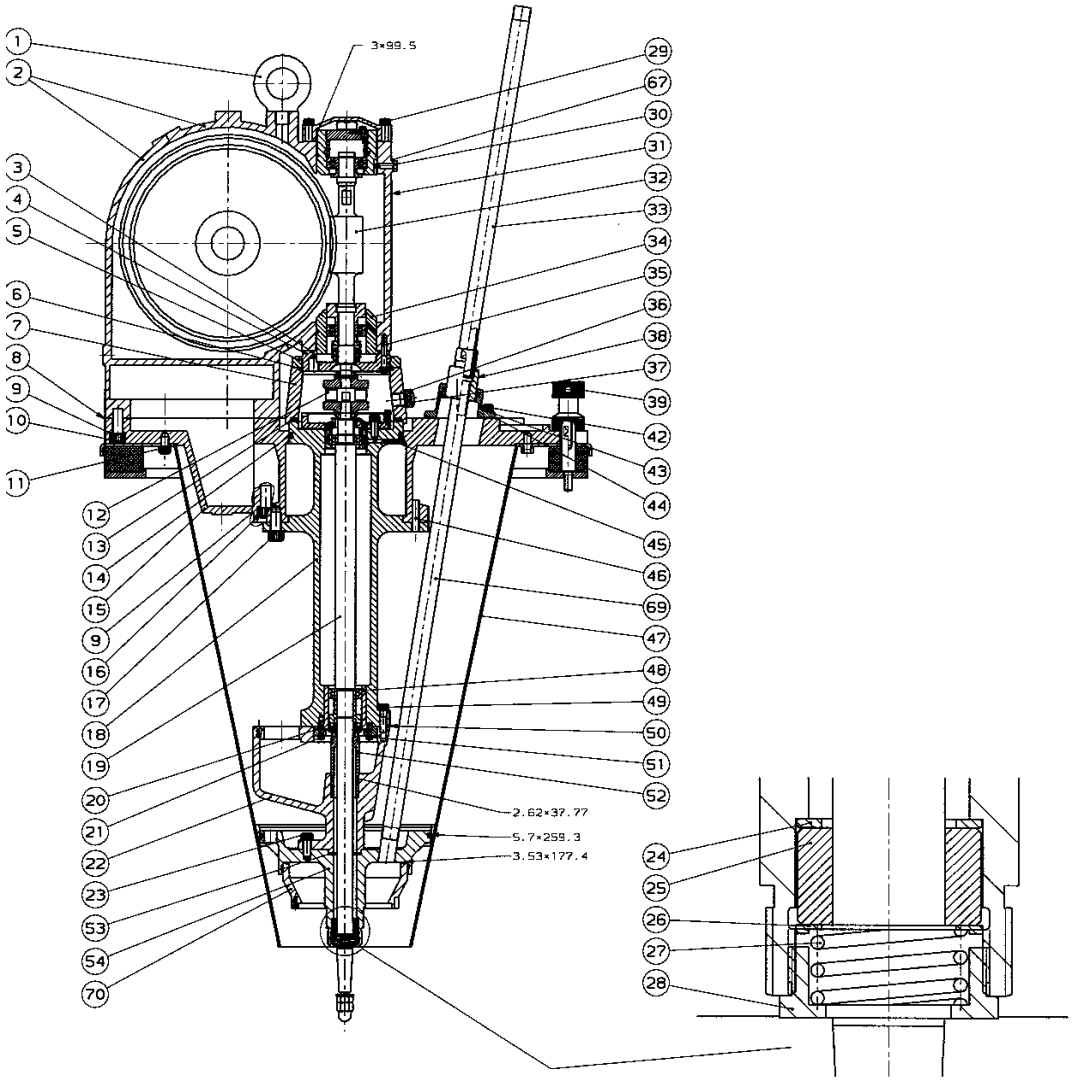


Fig. 3 F35 Basic Atomizer

8.3.2 Inspection of Atomizer Wheel And Liquid Distributor

Depending on product and/or process requirements the atomizer wheel and liquid distributor are normally cleaned after every production stop. Atomizer operating with a dirty wheel or liquid distributor will always cause operational disturbances.

NOTE
In case of abrasion resistant wheels

During operation a layer of feed solids will settle on the inside wall to a thickness determined by the length of the protrusion, consequently the abrasion will take place on the sedimented layer itself and not on the inside wall of the wheel. This layer shall only be removed in case of replacement of inserts or when it is required due to vibrations.

For dismantling and assembling refer to section 9.2. Also refer to sections 1.4 and 1.6.3.

8.4 Preventive Maintenance

8.4.1 General Instructions

The spindle requires special attention with regard to eccentricity. The maximum allowable eccentricity of the spindle is 0.10 mm (0.004") measured at the tapered end, when supported and rotated horizontally at its bearing points.

For dismantling and assembling of spindle refer to sections 9.4 and 9.5.

In order to avoid any damage to the spindle, care shall be taken to avoid hitting the wheel during removal and mounting of the atomizer. Spindle protection pipe shall always be mounted when moving the atomizer away from the plant site.

8.4.2 Time Table -Maintenance Programme

The following time intervals for maintenance programme are recommended for the preventive maintenance of atomizer wheel, liquid distributor, guide bearing and rotary atomizer.

After hours of operation	To be carried out	Refer to
24	Visual inspection. Check oil level.	Section 6 Section 4.4.4
200	Inspect guide bearing. Clean atomizer wheel and liquid distributor.	Section 8.3.1 Section 8.3.2
2000	Replace lubrication oil and oil filter.	Section 4
6000	Replace all bearings.	Section 9.5
12000	Dismantle atomizer completely. Inspect and clean all components. Replace worn parts.	Section 9.4 Section 9.5

NOTE
The above time intervals for the preventive maintenance are based on ideal conditions of operation. The user shall determine these intervals through frequent inspection during the first year of operation.

NOTE
The lubrication system shall receive primary and careful attention and it is recommended to adjust the time table, especially for the replacement of oil and oil filters based on the experience gained during the first year of operation.

8.5 Operational Disturbances and Trouble Shooting

8.5.1 General Instructions

To ensure a continuous reliable operation, the atomizer must be protected against unforeseen events and unauthorised handling. For the safety protection of the atomizer, the monitoring system transmit alarm signals in case of deviations from the normal operational situation. In case of critical deviations, the interlock system must trip the atomizer.

The causes of the operational disturbances around atomizer may be related to the wheel or liquid distributor. However, the guide bearing must always be checked and inspected as stated in section 8.3.1. Other causes can be related to the vibration alarms (optional extra) due to following reasons:

- Presence of deposits between the rotary (wheel) and the stationary (liquid distributor) parts.
- Liquid distributor partially clogged and requires dismantling and cleaning.
- Wheel not fastened correctly and requires remounting
- Atomizer wheel out of balance and requires dismantling and cleaning.
- Insufficient atomizer cooling air.

In order to reduce the possible causes of alarm, the operational and maintenance personnel shall always ensure the proper maintenance of indication lamps and cables, and plugged-in monitoring connections.

8.5.2 Monitoring System Transmitting Alarm

- Low Oil Flow Alarm
  Action: Shutdown the atomizer.

CAUSES	REMEDY
Oil filter in the oil flow control unit clogged. Nozzle clogged.	Dismantle and clean the nozzles or strainers in oil control unit.
Low oil level due to leakage in the lubrication system.	Rectify the leakage in the lubrication system.
Oil pump defective.	Replace the pump. It is recommended to forward the defective pump to GEA Process Engineering A/S for repair.

- High Oil Level Alarm (lower sump)
  Action: Shutdown the atomizer.

CAUSES	REMEDY
The suction pipe leaking or oil pump defective.	Rectify the leakage or replace the oil pump.
The lower oil sump filled with product.	Check the lower oil sump for any presence of product. In case the product is found, the whole lubrication system has to be cleaned.

- Flooding Alarm
  Action: Shutdown the atomizer.
  Close all valves on liquid supply system to atomizer and shutdown the feed pump.

CAUSES	REMEDY
Feed pipe leaking with water or feed.	Tighten or repair feed pipe/water pipe.

- Vibrations Alarm **(Optional extra)**
  Refer to section 4.7.2
  Action: Shutdown the atomizer.

CAUSES	REMEDY
Wheel not fastened properly.	Check assembly.
Spindle deformed.	Check eccentricity of the spindle. Replace spindle and bearings in case the eccentricity is higher than 1 mm (0.004").
Liquid distributor partially clogged.	Dismantle and clean. Check product screen.
Irregular feed flow to atomizer wheel.	Check feed system, pumps, valves, feed tank, filter etc.
Worn or damaged spindle bearings.	Replace bearings.
Guide bearing worn out or spring below guide bearing compressed or guide bearing retainer loose or damaged.	Inspect and replace.
Atomizer wheel out of balance.	Dismantle and clean atomizer wheel. Check product screens.
Atomizer wheel worn.	Replace the atomizer wheel.

- Oil Observed in Atomizer Wheel
  Action: Shutdown the atomizer.

NOTE: No alarm or interlocks available for this symptom.

CAUSES	REMEDY
O- ring (2.62x37.77) at labyrinth (52-Fig.3) is damaged. Air to spindle clogged with powder.	Replace the O-ring. Clean the air to spindle system. Check the air pressure and reduce, if required.

NOTE
For each listed symptom mentioned above, more than one solution is usually possible. The first solution stated is the most probable correction action for the symptom. However, if that solution does not solve the problem, perform the solutions in the order they appear until the problem is solved.

9. DISMANTLING, ASSEMBLING AND REPLACEMENT OF MAIN PARTS AND COMPONENTS

9.1 General Instructions

All parts, components and accessories must be treated with extreme care during dismantling or assembling of the atomizer. Always place the components on clean cloth, plastic foil, corrugated cardboard or similar. Do not clean components with cotton waste. Instead use non- fluffing cloth.

When tapping on a component is required, use only a soft hammer. Never apply diametrical force to ball bearing housings in a vice or a similar holding tools. All bearings are highly precision bearings. All parts of the wheel and liquid distributor are manufactured with precision. Even the slightest force can deform these precision parts.

Always apply clean oil to bearings and their housing prior to assembly. All O-rings and gaskets involved during dismantling should be replaced. For proper dismantling and assembling, use only the genuine tools supplied.

CAUTION
Subsequent to repositioning the atomizer in the air disperser/chamber, always turn the wheel by hand to ensure that it rotates freely.

9.2 Atomizer Wheel and Liquid Distributor

The following examples on different standard wheels are mentioned as a guideline to facilitate the dismantling, assembling or replacement of parts and components. For the valid wheel type, refer to the documents compiled in the atomizer instruction manual.

9.2.1 Atomizer Wheel, Non-Abrasion Resistant

Refer to Fig. 5, 6, 7 and 8

- De-mounting of Wheel from Atomizer Spindle

Apply holding device on the wheel. Unscrew the protection cap followed by the nut holding the wheel. Apply the wheel puller from the tool box, hold the wheel with the holding device and carefully withdraw the wheel from spindle.

- Dismantling and Assembling the Wheel

The dismantling of the upper and lower part is normally required for removal of deposits, inspection and cleaning. Remove screws (3) for dismantling the two parts.

Remove the sediments and clean wheel parts. Examine the surface finish for any corrosion or erosion. Reassemble the lower and upper parts with screws (3). Ensure that the match marks on the upper and lower part are in line when assembled.

- Mounting of Wheel on Atomizer Spindle

Apply a thin layer of Molykote anti-seize compound to the taper part of the spindle and **remove it thoroughly** with a non-fluffy cloth leaving no visible layer of Molykote. Mount the wheel on the spindle and hold the wheel until it is secured in position. Hold the wheel with holding device from the tool box and tighten the nuts. Finally mount the protection cap. Also refer to section 5.3.

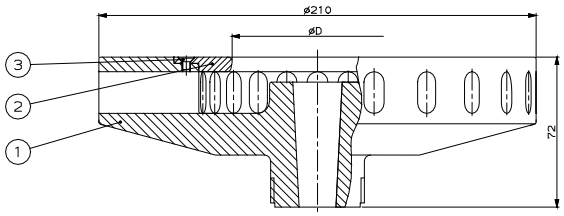


Fig. 5 Channel Type Wheel, SL24-210

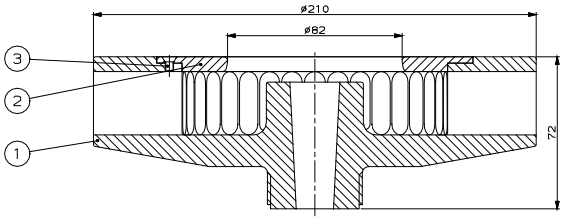


Fig. 6 Channel Type Wheel, SH36-210

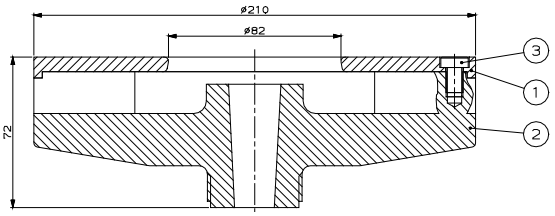


Fig. 7 Channel Type Wheel, CL16-210

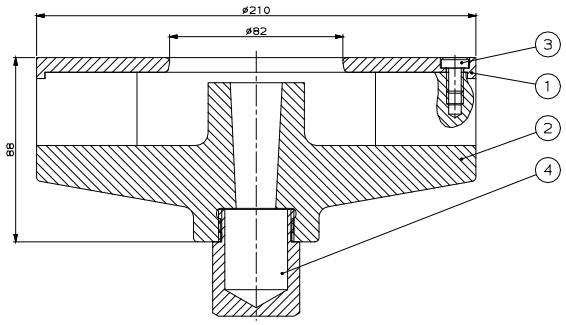


Fig. 8 Channel Type Wheel, CH16-210

9.2.2 Atomizer Wheel Abrasion Resistant

Refer to Fig. 9 and 10

- Demounting of Wheel from Atomizer Spindle

Apply holding device on the wheel. Unscrew the protection cap followed by the nut holding the wheel. Apply the wheel puller from the tool box, hold the wheel with the holding device and carefully withdraw the wheel from spindle.

- Dismantling of Wheel and Inspection

The dismantling of the wheel parts are either required for removal of deposits and cleaning or replacement of parts (i.e. inserts or bottom plate).

Step 1
Remove the long screws (7) and short screws (8). Apply two long screws similar to (7) in the holes for short screws and dismantle the lower part (2).

Step 2
Unscrew the centre cone (3) and remove the bottom plate (5). Remove the inserts from the upper part by using the Mandrel provided in the tool box.

Step 3
Remove the sediments and clean the wheel parts. Examine the inserts and bottom plate for abnormal wear.

- Turning or Replacement of Inserts

If the inserts are worn leaving less than 3 (0.12”) mm of remaining wall thickness, turn the inserts through 90°- 120° or 180°. The number of possible turns depends on the width and shape of the actual wear track. Before reinstalling the inserts in the wheel, clean the holes and apply a thin layer of Molykote compound to the inserts.

When the tracks are worn out, the inserts must be replaced with new ones.

CAUTION
When replacing individual inserts, ensure that the wheel is kept in symmetrical balance. Always replace diametrical opposite pairs. Ensure that there is no weight difference due to wear or due to material with different wear resistance present on opposite pairs.

CAUTION
Always replace O-rings when turning or replacing inserts. Prior to replacing, all contact surfaces and grooves of O-rings must be cleaned thoroughly. Use only the Molykote compound from the tool box.

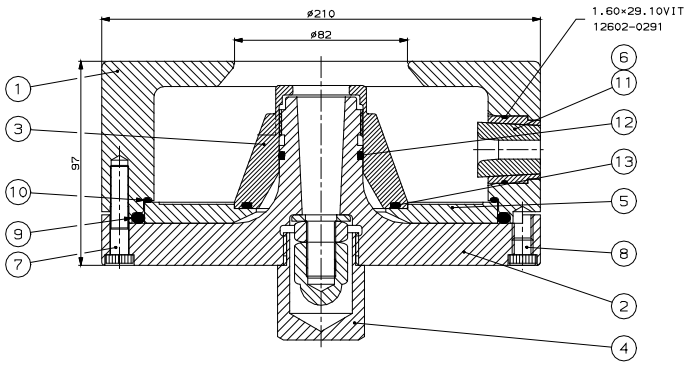


Fig. 9 Abrasion Resistant Wheel, AM8-210

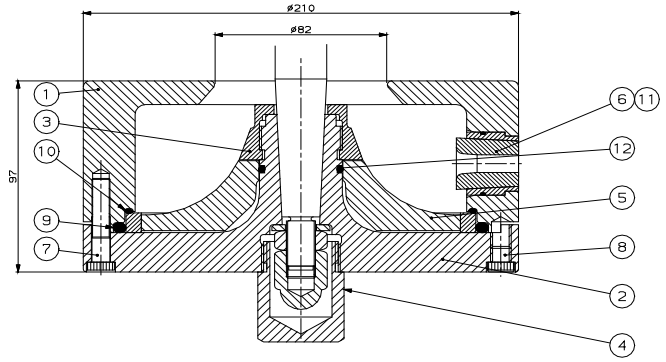


Fig. 10 Abrasion Resistant Wheel AX8-210

- Replacement of Bottom Plate

Wheel type AM8-210
If the wear resistant bottom plate shows any visible sign of wear on the surface of the chrome oxide layer, it must be replaced.

Wheel type AX8-210
If the wear resistant bottom plate is worn out below its minimum thickness of approximate 3 mm (0.12”), it must be replaced. In case it complies to the minimum thickness requirement, it may be reused.

- Assembling of Wheel Parts

Step 1
Replace O-rings (9), (10), (12) and (13)(AM-wheel) and position the bottom plate on the lower part. Screw tight the centre cone (3) in position.

Step 2
Assemble the lower part and upper part with long screws (7). Torque to 25 Nm (18.5 ft·lbf). Mount the two short screws (8). Ensure that the match marks on the upper and lower part are in line when assembled.

- Mounting of Wheel on Atomizer Spindle

Apply a thin layer of Molykote anti-seize compound to the taper part of the spindle and **remove it thoroughly** with a non-fluffy cloth leaving no visible layer of Molykote. Mount the wheel on the spindle and hold the wheel until the washer and retainer nut are securely in position. Hold the wheel with holding device from the tool box and tighten the nut. Finally mount the protection cap (4). Also refer to section 5.3.

9.2.3 Liquid Distributor

Dismantle the liquid distributor from atomizer as stated in section 5.2, but in reverse sequence. Remove the deposits and clean the parts. The parts to be inspected for any wear/corrosion and if required to be replaced. Reassembling on the atomizer as described in section 5.2.

9.3 Atomizer Motor Bracket and Belt Guard

Refer to section 5.5.1

9.4 Dismantling and Assembling of Atomizer

NOTE
Reference to figures other than stated under steps are mentioned as
(Pos. No.-Fig. No.)

9.4.1 Atomizer Dismantling Procedure

Step 1
Refer to Fig. 3

Disconnect the auxiliary and monitoring systems. Shut-off the power to atomizer motor and remove the power cable. Dismantle the belt guard and remove the belts. Lift the atomizer and carefully position it on the service stand.

NOTE:
Check the distance between atomizer wheel and skirt and record it for later use.

Dismantle the atomizer wheel and liquid distributor as stated in section 9.2. Dismantle the guide bearing as stated in section 8.3.1.
Remove screws (11) and withdraw the skirt (47).

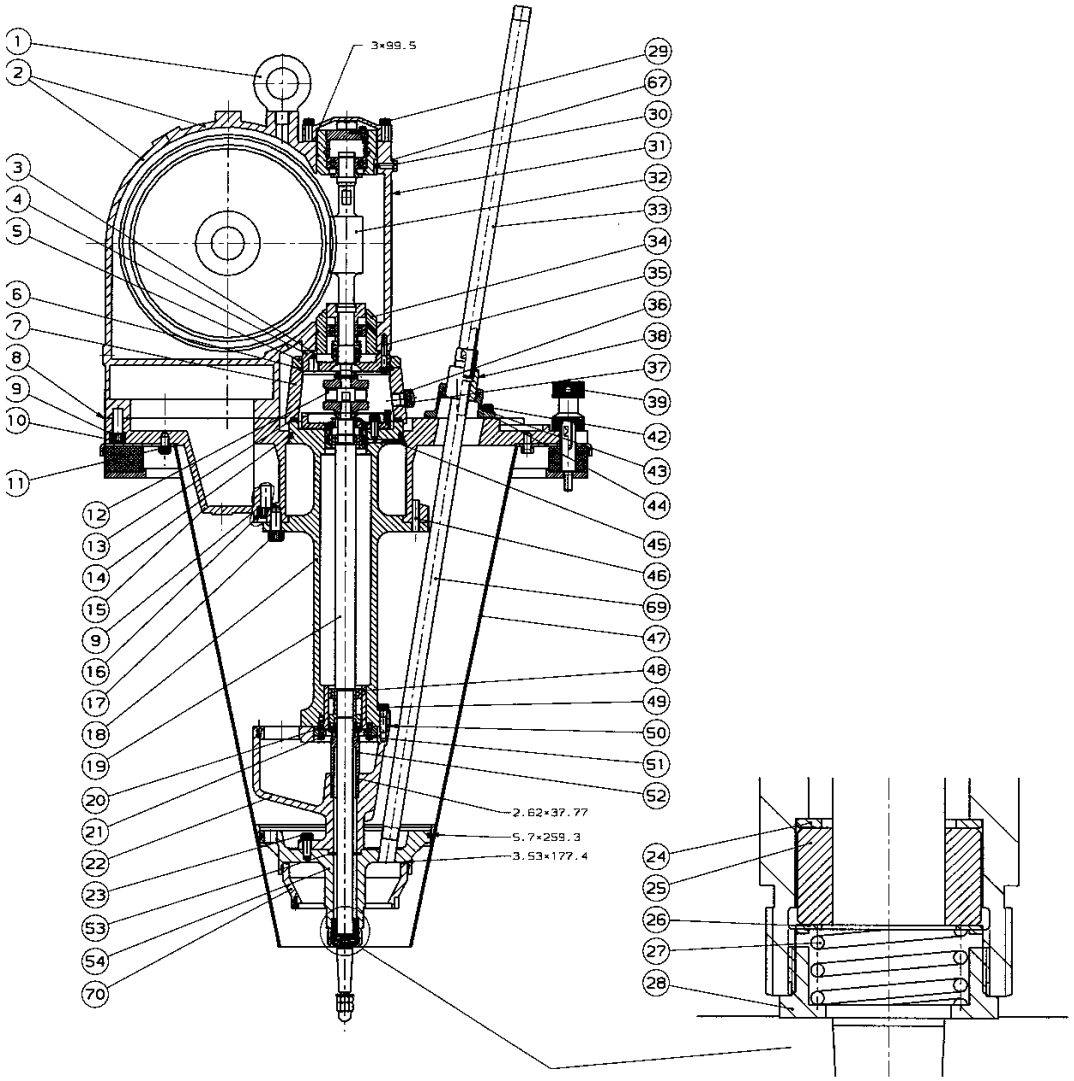


Fig. 3 F35 Basic Atomizer

Step 2
Refer to Fig. 3

Unscrew nut (5) and dismantle the coupling guard (7). Remove screws (29) and lift the worm (32) along with the upper coupling part as much as possible by turning the adjusting nut (1-Fig.28).

Step 3
Refer to Fig. 3

Remove oil pipe (39-Fig.17). Remove two screws (3-Fig.27) and lift the cover (2-Fig.27). Unscrew (15-Fig.25), lower the spindle (19) and lower coupling part (6-Fig.25) as much as possible by turning the adjusting nut (7-Fig.25). Press it downwards until the coupling parts are disengaged.
Remove the coupling parts (12).

Step 4

Refer to Fig. 23

Remove the two dowel pins (6) by tightening the nuts. Remove nuts (5) and lift the gearbox carefully by a manually operated hoist.

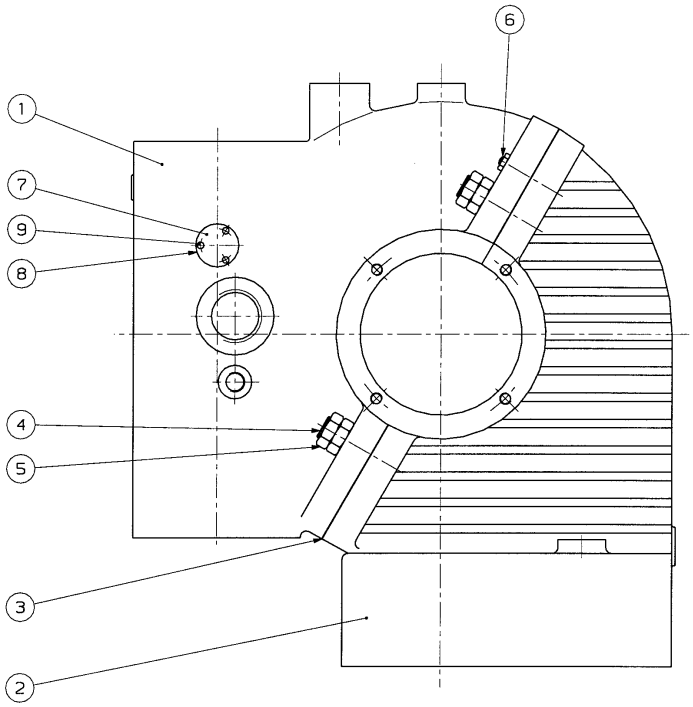


Fig. 23 Gear Box Assembly

Step 5
Refer to Fig. 24

Remove the screws and dismantle cover (12). Remove the cylindrical guide screw (MSP 6x25) from the housing and lift worm wheel (16) complete with shaft, bushing and bearings.

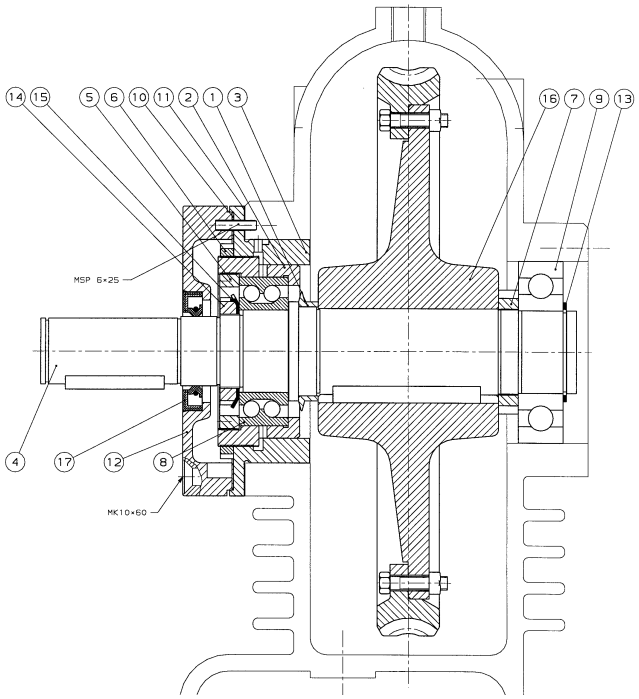


Fig. 24 Worm Wheel Complete Assembly

Step 6
Refer to Fig. 25

Lift the spindle complete assembly by pulling coupling part (6). A slight stroke with soft hammer may be applied, if required.

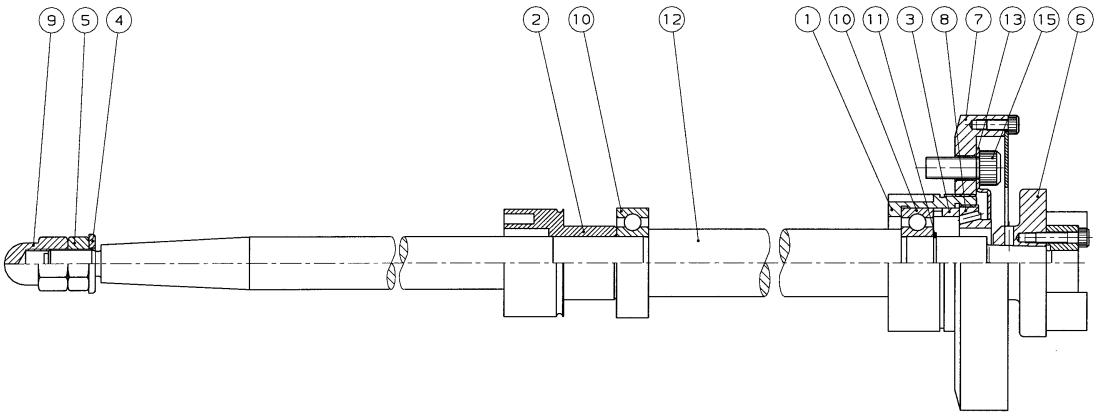


Fig. 25 Spindle Complete Assembly

Step 7
Refer to Fig. 3

Remove the adjusting nut (1-Fig.28), screws (35), (30) and take out the worm complete (32) downwards. A light stroke with soft hammer may be applied, if required.

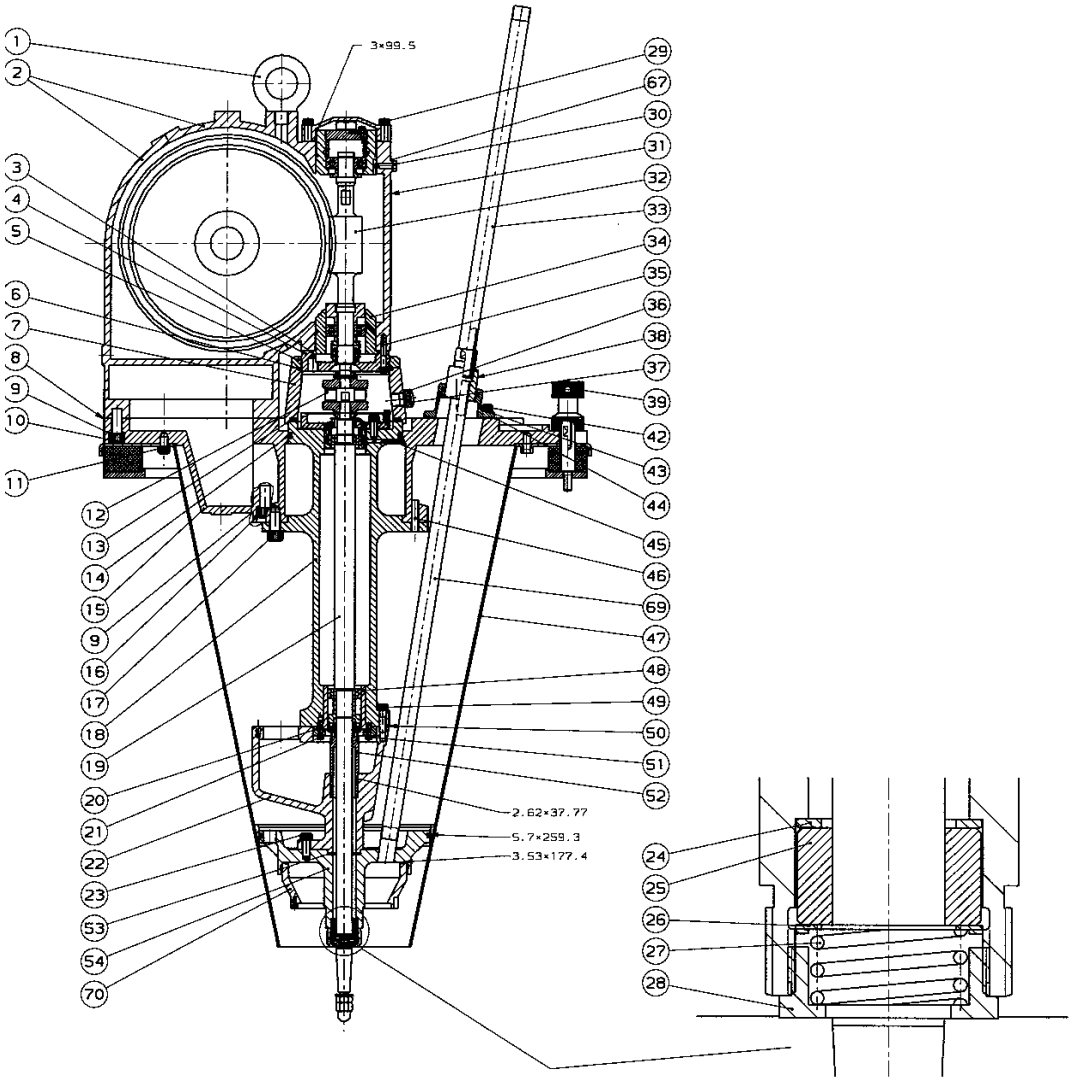


Fig. 3 F35 Basic Atomizer

Step 8
Refer to Fig. 3

Remove screws (42), cover plate (43) and gasket (44). Remove screws (23). Disconnect feed pipe (69) and bracket (54) from lower part (22).

Remove screws (49) and dismantle lower oil sump (22). Remove screws (21), distance ring (20), lower bearing bushing (48). Withdraw labyrinth (52) along with O-ring (2.62 x 37.77).

Remove screws (10), (16) and dismantle the gear box (2-Fig.23) along with the upper oil sump (15).

NOTE
Refer to section 9.5 for further dismantling and replacement of main components.
All dismantled parts must be cleaned with a proper solvent suitable for cleaning the machine parts. A thorough inspection of all parts with regard to surface finish, wear and corrosion shall be performed.

Subsequent to reassembling, all moving parts shall be lubricated with clean oil.

CAUTION
It is recommended to replace all 0.3 mm (0.012") oaken cork gaskets. A set is provided in the toolbox. Due to centre distance, the Gearbox (3-Fig.23) must be provided with 0.3 mm (0.012") oaken cork gasket. Always maintain a set of these gaskets in stock.

9.4.2 Atomizer Assembling Procedure

CAUTION
It is recommended to replace all gaskets, O-seals and O-rings. A set is provided in the toolbox. Always maintain a set of these gaskets in stock.

Step 1
Refer to Fig. 3

Install gear box (2-Fig. 23) along with upper oil sump (15). Replace gasket (8).
Install lower bearing bushing (48) and distance ring (20).
Replace O-ring (2.62 x 37.77) and install the labyrinth (52).
Install feed pipe bracket along with feed pipe (69).

Step 2
Refer to Fig. 3
Install worm complete assembly in the gear box and tighten the screws (35). Lift worm and screw on the adjusting nut (1-Fig.28). The screw (30) to be engaged in the slot of bushing (2-Fig.28).

Install spindle complete assembly. Note that the slot in bushing (1-Fig.25) corresponds to pin (45). Press down the spindle to the bottom.

Step 3
Refer to Fig. 24

Install the complete worm wheel assembly in gear box housing. Install the guide screws (MSP 6x25) through bushing (2). The bushing (2) to be kept at about 2 mm (0.08") from the contact surface of gasket (11). Lower the upper part (1-Fig.23) slowly into its position.

The assembly is facilitated by turning the worm wheel and at the same time pushing the bushing (2) into its position, ensuring that the screw and the worm wheel are properly engaged. The nuts (5-Fig.23) are slightly tightened and the dowel pins (6-Fig.23) are knocked in position.

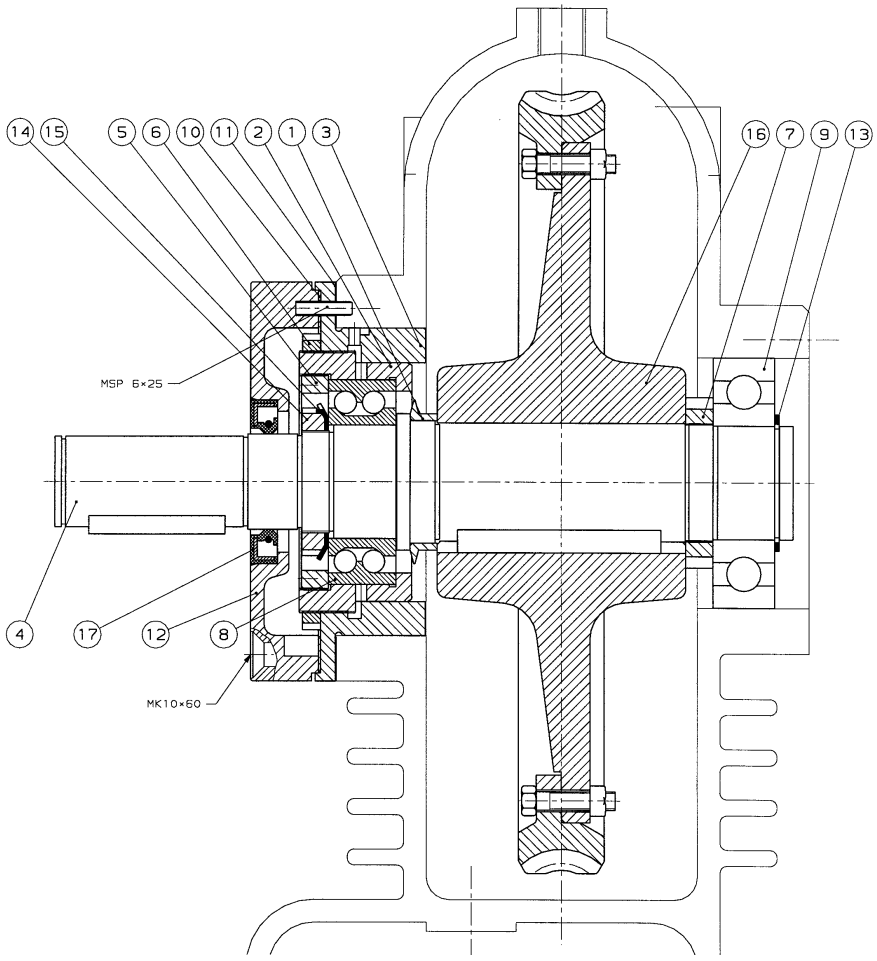


Fig. 24 Worm Wheel Complete Assembly

Step 4
Refer to Fig. 3

Mount the 8 coupling inserts (12) in lower coupling part. Adjust nut (1-Fig.28) and ensure the coupling parts are safely engaged. Recheck that the coupling blocks remain in position.

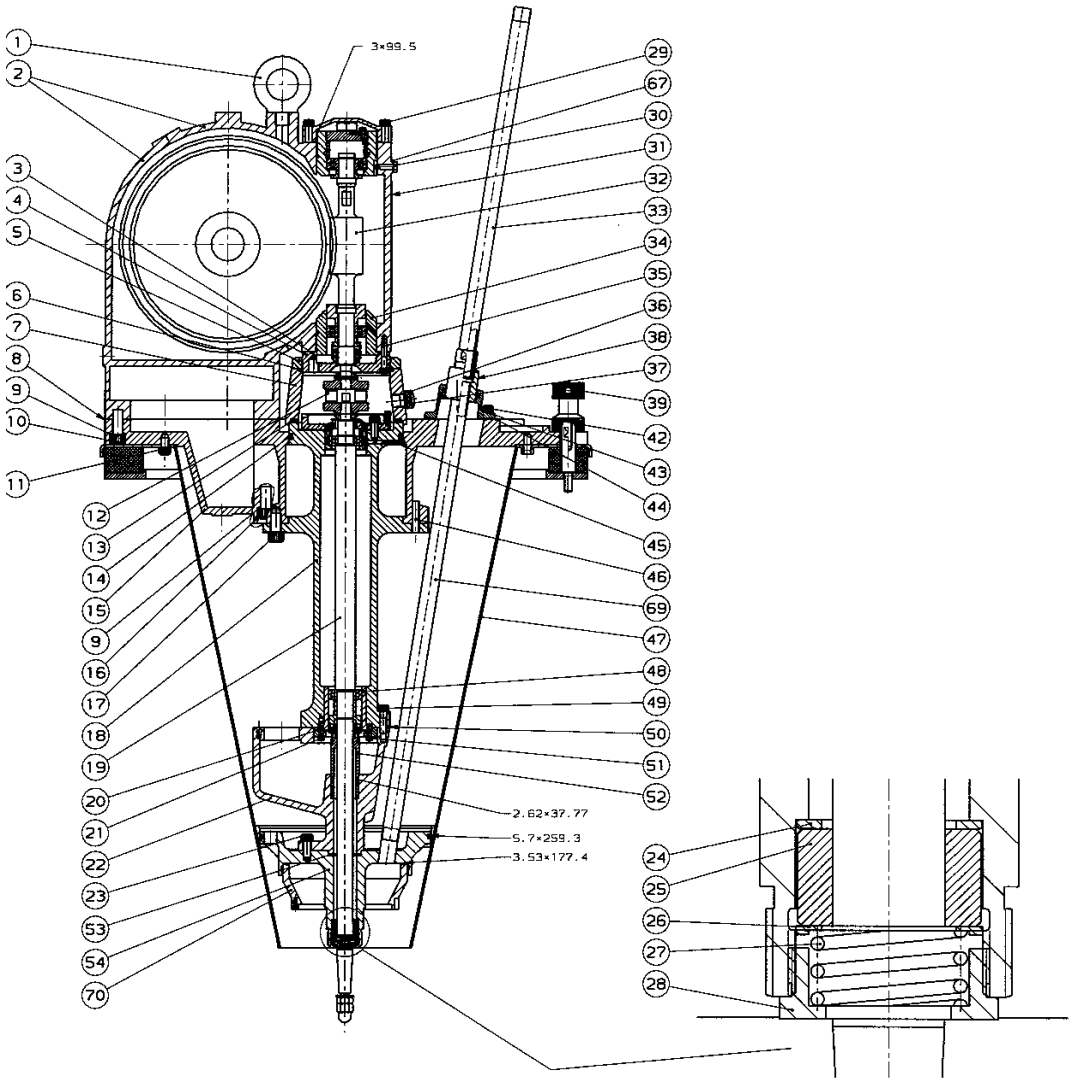


Fig. 3 F35 Basic Atomizer

Step 5
Refer to Fig. 25

Install the spindle complete assembly. Install the skirt (47-Fig.3) and the wheel provisionally. Lift the spindle by turning the adjusting nut (7) ensuring that it rotates freely. By turning the nut (7) the distance between the wheel and skirt to be maintained at app. 3 mm (0.12”). Tighten the four screws (15) with locking plate (13).

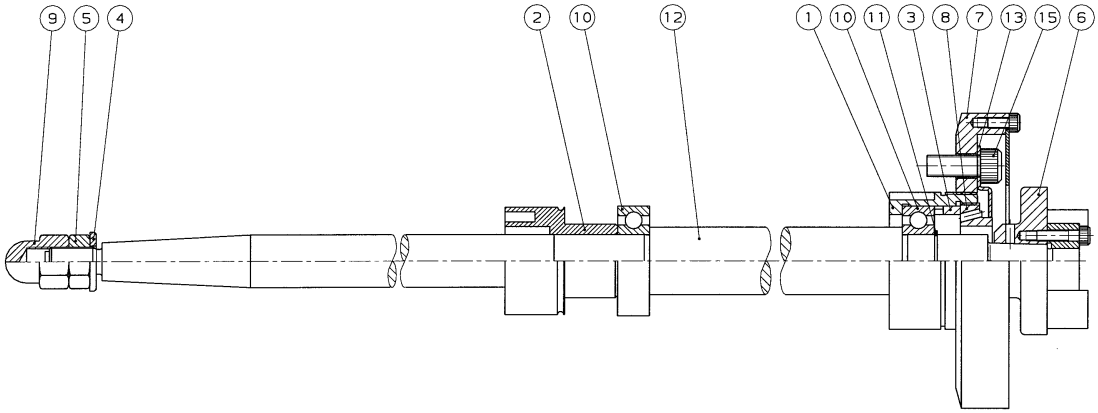


Fig. 25 Spindle Complete Assembly

Step 6
Refer to Fig. 24

Adjustment Procedure of Worm Wheel

The centre of the worm wheel (16) must be exactly aligned with the centre of the worm (32-Fig.3).
In case of replacement of worm wheel (16), bearings (8 and 9) or adjusting bushing (2) the alignment between the worm shaft and the worm wheel must be adjusted as follows:

Secure the position of the bushing (3) by mounting the two Allen screws (MC 10x20) from the toolbox. Turn the adjusting bushing (2) in counter clockwise direction using the spanner from the toolbox, until the backlash between the worm and worm wheel disappears. Mark the bushing (3) and the adjusting bushing (2) for their positions (refer to Fig. 26 left).

Turn the adjusting bushing (2) clockwise (about one turn) until the backlash between the worm and worm wheel disappears. Set a mark on the bushing (3) in line with the mark on the adjusting bushing (2) (refer to Fig. 26 centre).

Turn the adjusting bushing (2) counter clockwise until the mark is exactly between the two marks on the bushing (3) (refer to Fig. 26 right). Tighten the ring nut (6). Make sure that the adjusting bushing (2) do not move when tightening the ring nut.

Remove the two Allen screws (MC 10x20) and install the cover (12).

Tighten the nuts and counter nut (5-Fig.23).

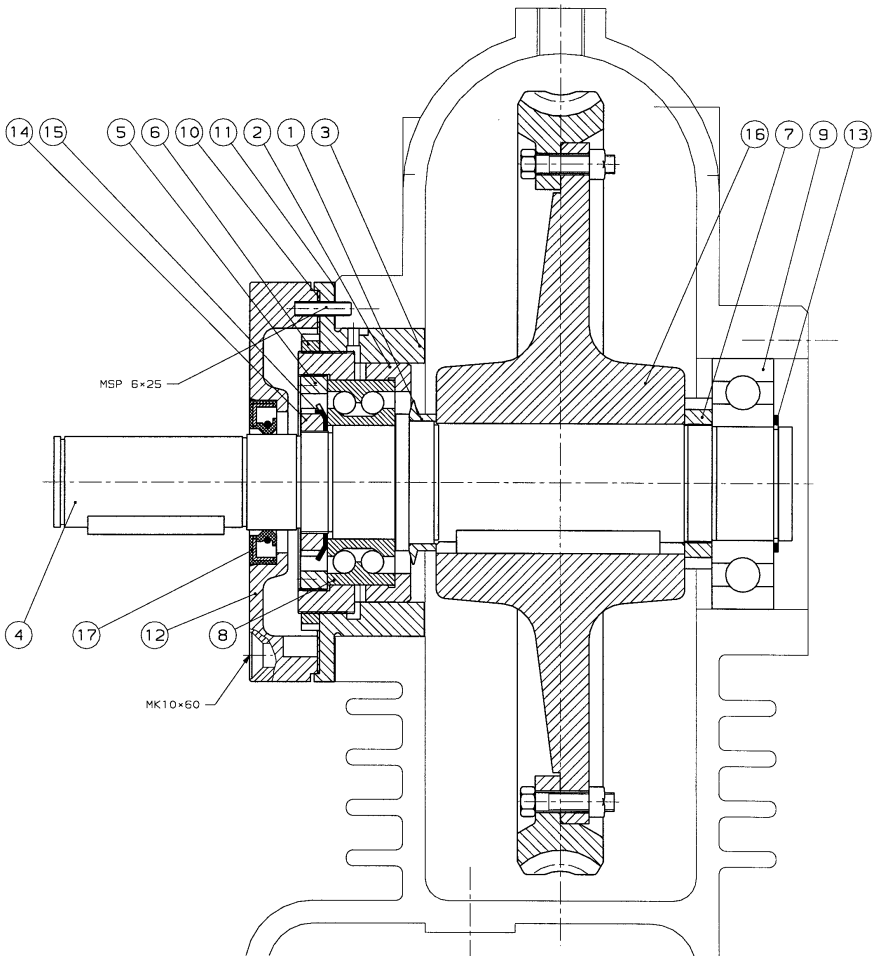


Fig. 24 Worm Wheel Complete Assembly

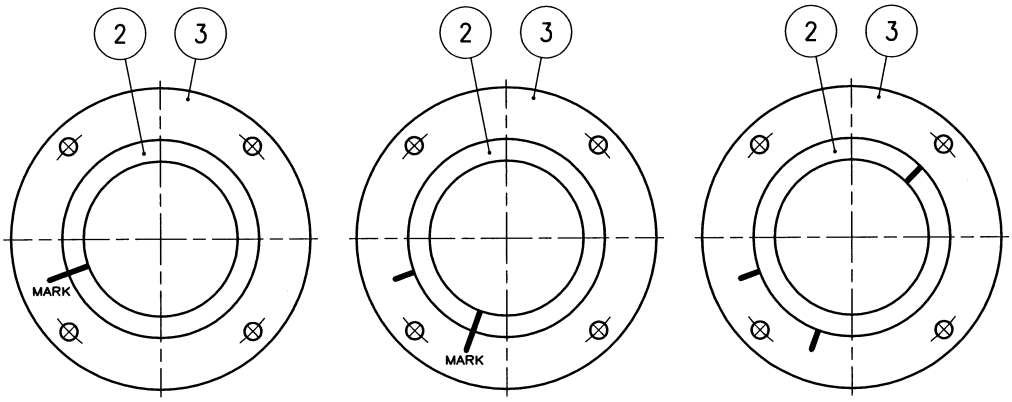


Fig. 26 Adjusting Horizontal Position of Worm Gear Wheel

Step 7
Refer to Fig. 3 and 27

Install the cover (2-Fig.27), oil pipe (39-Fig.17) and the screws (3-Fig.27).

By turning the adjusting nut (1-Fig.28), worm (32) can be lowered until the distance between two coupling halves (6-Fig.25) and (3-Fig.28) is about 3 mm (0.12”).

Tighten the screws (29) and lock screws (30). Before the cover is placed, it is recommended to lubricate the spindle bearing as stated in section 4.4.4 by pouring about 0.1-0.2 litre of oil down under the cover.

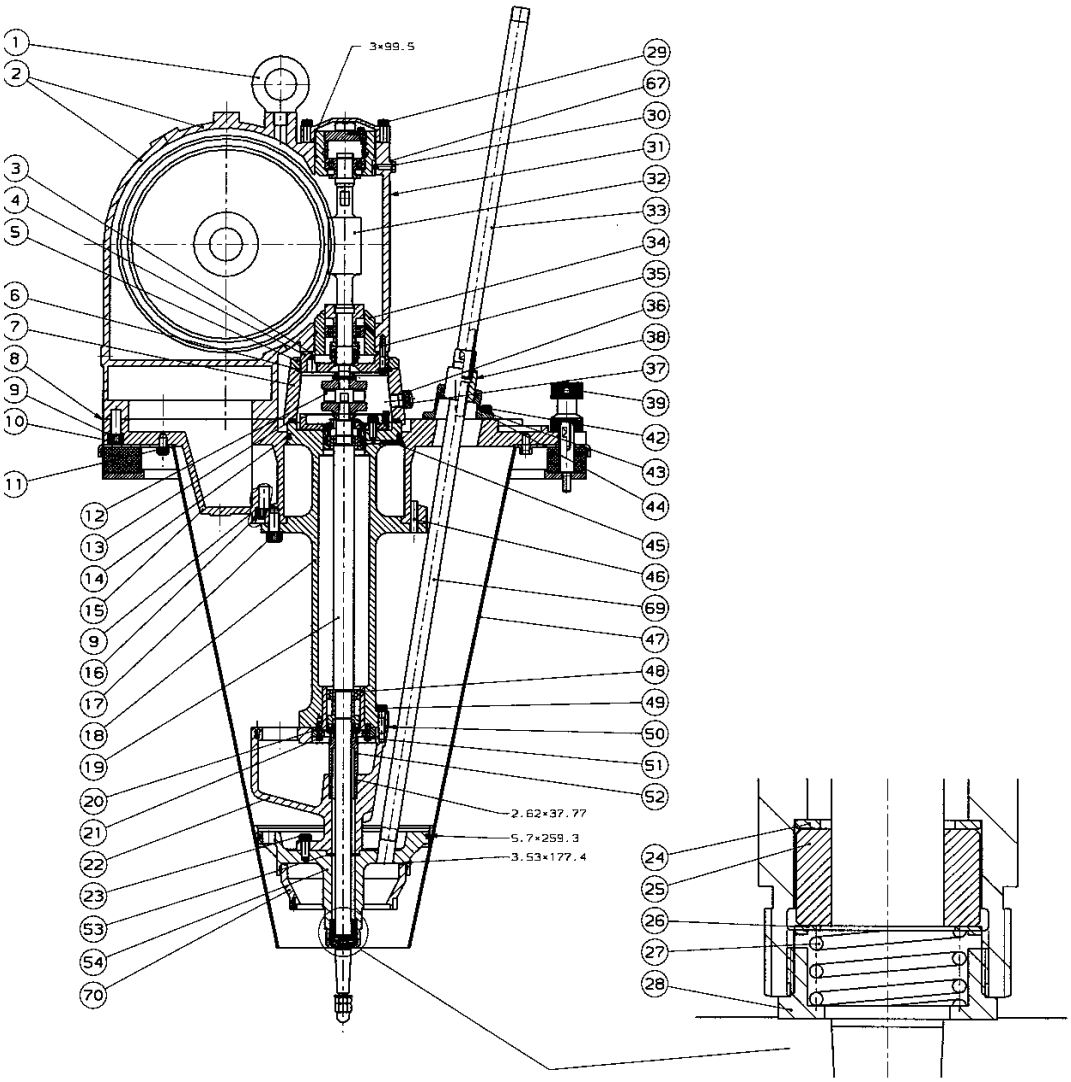


Fig. 3 F35 Basic Atomizer

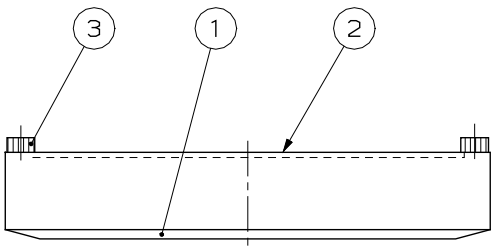


Fig. 27 Adjusting Nut With Cover

Step 8
Built-in oil pump
Refer to Fig. 17

The flange (8) is mounted with screws (10). The conical part of the coupling is placed in the pump (9). Install the pump and make sure that the driver is connected with the worm wheel shaft (4-Fig.24). Tighten the screws (6). Mount the lubrication system.

Installation of guide bearings as stated in section 8.3.1.
Install liquid distributor and atomizer wheel as stated in this instruction.

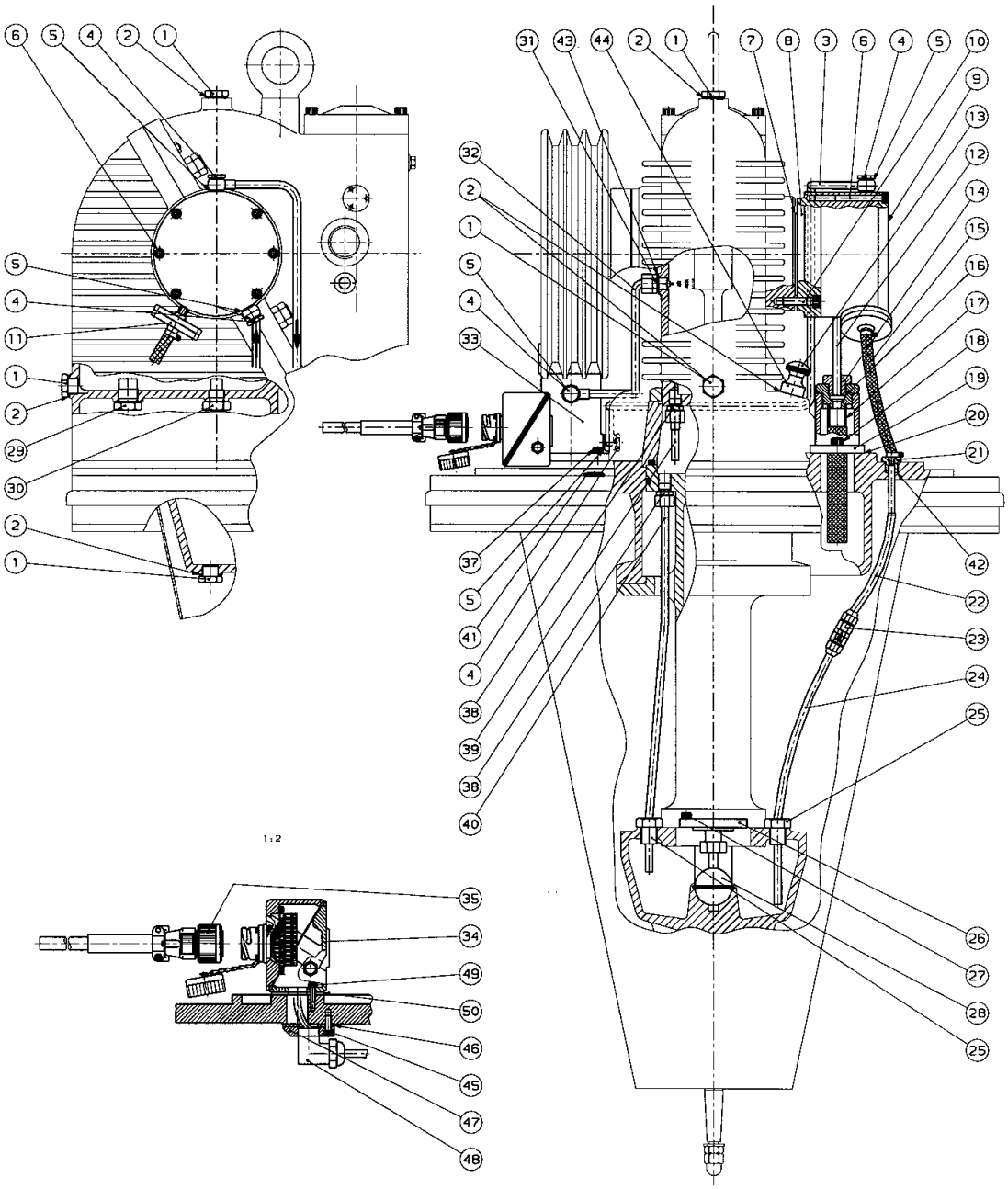


Fig. 17 Built-in Oil Lubrication System

Step 9

Prior to positioning the atomizer in air disperser, ensure that the guide bearings, liquid distributor and the wheel is reinstalled in accordance with the instructions. Refer to section 4.4.4 for oil filling.

Carry out the V- belts alignment prior to mounting the belt guard. Finally connect the auxiliary and monitoring system.

CAUTION
Subsequent to reoperation of the atomizer, always follow the instructions stated in sections 5, 6 and 7.

9.5 Replacements

9.5.1 Spindle or Spindle Bearings

Refer to Fig. 25

CAUTION
Bearings withdrawn must never be reused. Prior to mounting a new bearing, it must be preheated in a clean oil at max. 100°C (212ºF). The temperature must not exceed 110°C (230ºF) as this will effect the quality of hardness and long service life.

However, the oil deflectors and labyrinths must be preheated in clean oil at max. 150°C (302ºF) prior to assembly.

The bearings must be replaced after 6000 hours of operation.

Dismantling Procedure

Step 1
Withdraw lower part of the coupling (6) after removing the conical pin.

Step 2
Unscrew the adjusting nut (7) and remove cover (8). Withdraw bushing (1), remove circlip (11) and withdraw upper bearing (10).

Step 3
Withdraw lower bearing (10) and labyrinth (2).

CAUTION
For withdrawing use only the puller with extension pipe from the toolbox.

NOTE
The coupling is mounted on the spindle and a hole for the conical pin is drilled and reamed, in case the coupling (6) or the spindle (12) requires replacement. The coupling is then withdrawn and burrs are removed.

Assembling Procedure

Step 1
Prior to mounting the bearings (10) on spindle (12), preheat the bearings in clean hot oil at max. 100°C (212ºF) and labyrinth (2) at max. 150 °C (302ºF). Mount the lower bearing (10) and labyrinth (2) while still hot.

Step 2
Mount the bushing (1) followed by upper ball bearing (10) while still hot. Mount the circlip (11). Position the bushing (1) and mount distance bushing (3) prior to tightening the cover (8).

Step 3
Mount the adjusting nut (7). Position coupling (6) and mount conical pin.

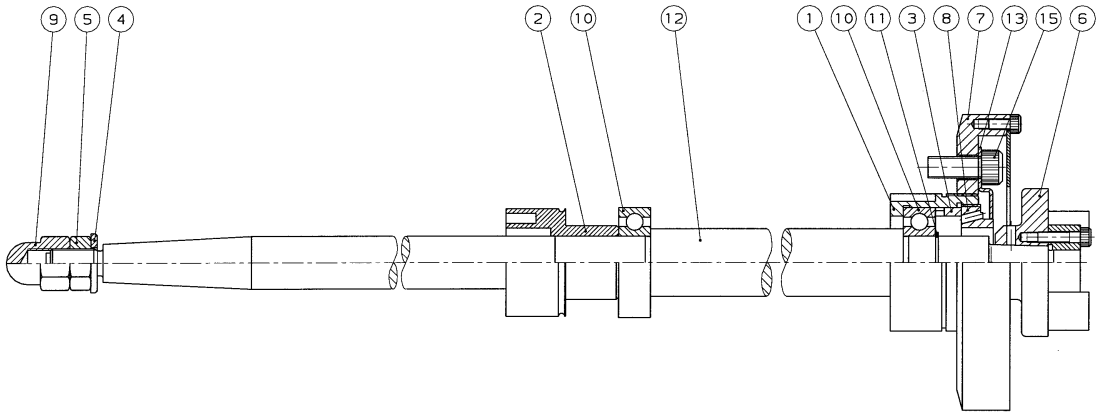


Fig. 25 Spindle Complete Assembly

9.5.2 Worm or Bearings on Worm

Refer to Fig. 28

CAUTION
Bearings withdrawn must never be reused. Prior to mounting a new bearing, it must be preheated in a clean oil at max. 100°C (212ºF). The temperature must not exceed 110°C (230ºF) as this will effect the quality of hardness and long service life.

However, the oil deflectors and labyrinths must be preheated in clean oil at max. 150°C (302ºF) prior to assembly.

The bearings must be replaced after 6000 hours of operation.

Dismantling Procedure

Step 1
Dismantle cover (5) and distance bushing (4). Press bushing (2) downwards and remove circlip (11). Withdraw bearing (10) and sling ring (9), if required.

Step 2
Remove conical pin and the coupling part (3).
Refer to Fig. 3: Remove cover (4), bushing (34) and circlip (11).

Step 3
Withdraw labyrinth (7), ball bearing (10) and sling ring (6), if required.

NOTE
For replacement of coupling or worm, refer to Note in section 9.5.1.

Assembling Procedure

Step 1
Prior to reassembling the bearings (10), sling ring (6) and labyrinth (7), preheat in clean oil at max. 100°C (212ºF). However the sling ring (9) will require a max. temperature of 150°C (302ºF).

Step 2
Mount sling ring (9) and ball bearing (10) while still hot. Mount circlip (11) and distance bushing (4). Install cover with lock screws.

Step 3
The sling ring (6), ball bearing (10) and the labyrinth (7) are to be mounted while still hot. Insert circlip (11).

Refer to Fig. 3
Mount the bushing (34) on the bearing and cover (4) on the shaft. The coupling part (3) is positioned followed by mounting the conical pin.

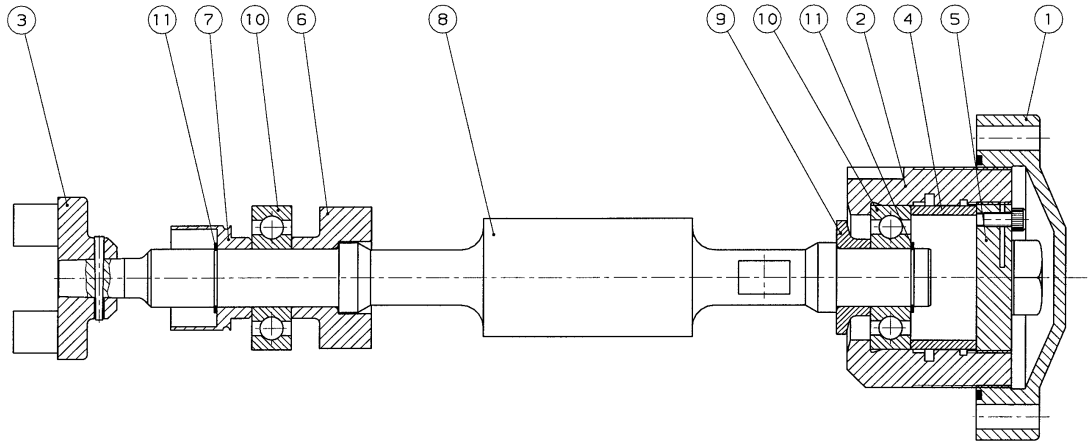


Fig. 28 Worm Complete Assembly

9.5.3 Worm Wheel, Worm Wheel Shaft or Bearings on Worm Wheel Shaft and Adjustments

Refer to Fig. 24

CAUTION
Bearings withdrawn must never be reused. Prior to mounting a new bearing, it must be preheated in a clean oil at max. 100°C (212ºF). The temperature must not exceed 110°C (230ºF) as this will effect the quality of hardness and long service life.

However, the oil deflectors and labyrinths must be preheated in clean oil at max. 150°C (302ºF) prior to assembly.

The bearings must be replaced after 6000 hours of operation.

Dismantling Procedure

Step 1
Remove lock nut (14) and lock washer (15). Remove the bushing (3) with ball bearing (8) and bushing (2). After removing the nut (5) the bearing (8) can be withdrawn.

Step 2
Remove the circlip (13) and withdraw bearing (9). Remove the nut (7), worm wheel (16) and dismantle sling ring (1).

Assembling Procedure

Step 1
Place the bearing (8) in bushing (2) and mount the nut (5). Prior to mounting on the shaft, preheat in clean oil at max. 100°C (212°F) and mount while still hot. Mount the lock nut (14) secured by lock washer (15).

Step 2
Place the sling ring (1) and mount the worm wheel (16) on the shaft. Tighten the nut (7). Preheat the bearing (9) at max. 100°C (212°F) in clean oil and position it on the shaft secured by circlip (13).

Step 3
Adjustment of Worm Wheel
Refer to section 9.4.2, step 6

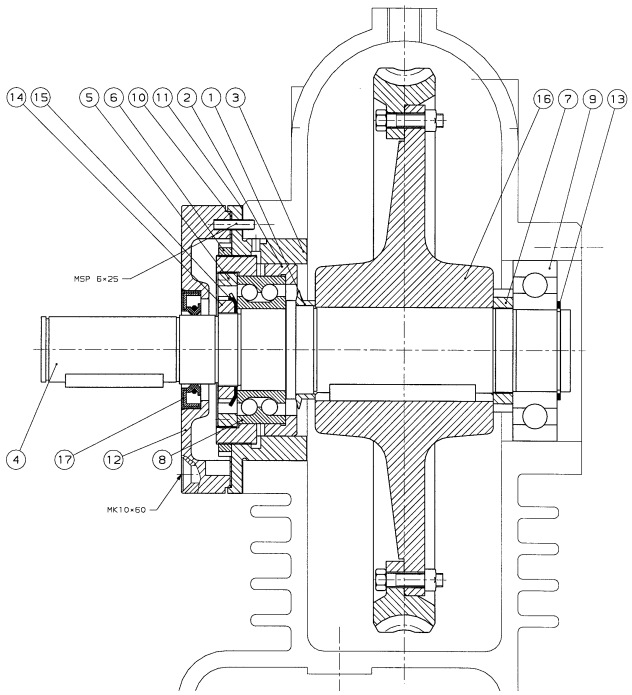


Fig. 24 Worm Wheel Complete Assembly

10. LIST OF FIGURES