ALFA-LAVAL

Decanter Centrifuge NX 418

OM OM 8212 E

OPERATOR'S MANUAL

OPERATION
SERVICE
MAINTENANCE

Descriptions of Additional Parts or Optional Equipment which are not to be delivered with your machine may be found in volume OM. The Operator's Manual is not to be seen as a book that describes the parts belonging to a particular machine. The Order Acknowledgement and the Packing List accompanying the shipment specify the parts and equipment included in the supply of your decanter.

Alfa-Laval reserves the right to amend any part of volumes OM, ID and/or SP without prior notice. No sketch or drawing reproduced in any of the three volumes is binding upon Alfa-Laval.

Sketches and drawings may differ from the parts on your decanter in some details which we reserve the right to alter without giving prior notice or issuing new sketches or drawings.

SAFETY PRECAUTIONS

Your Alfa-Laval decanter is engineered and manufactured to perform its designated tasks effeciently and safely when used in the appropriate way. Nevertheless, being a high-speed machine, it demands care and understanding.
Unsafe practices in maintenance and operation can create conditions which are hazardous to both personnel and property.

No manufacturer can foresee every situation that may arise, but many potential hazards will be avoided if the rules specified below are strictly followed:

DO NOT:

allow personnel to dismantle, clean, assemble, operate, or maintain the decanter until they have read the OM volume, i.e. "Operator's Manual", and understood safety requirements.

operate the decanter until it is properly mounted.

operate the decanter unless the cover is closed and clamps and clamping devices are properly tightened.

operate the decanter if abnormal noise or vibration is observed.

attempt to assemble or dismantle the decanter while the drum is rotating.

attempt repairs to the decanter until the fuses in the electrical switch have been removed or the switch has been locked in the OFF position.

clean the drum parts with fluids that may be corrosive to the particular materials used to construct the drum.

shut down the decanter for any extended period of time without disconnecting the electricity to the motor.

DO NOT:

store aprons, wrenches, or other foreign objects inside the drum casing of a decanter that is not in use.

attempt to make welding, machining or any other field repairs on any of the drum parts: ask your Alfa-Laval Service centre for assistance if any such repair is needed.

heat the drum casing or any moving part of the decanter with an open flame.

interchange drum parts between two or more decanters; each drum is balanced as a complete unit by Alfa-Laval (Exception: Conveyor).

use improper or makeshift tools (proper tools for the decanter are supplied on request).

leave drum idle for any length of time with corrosive liquid inside.

leave drum idle without turning it by hand once every week to prevent flattening of bearings.

fill the gearbox with too much oil - follow the directions given under "Information on Lubrication" in this volume.

OPERATOR'S MANUAL OM

The technical documentation related to the decanter is contained in three volumes:

1. INSTALLATION DATA	Volume ID
2. SPARE PARTS	Volume SP
3. OPERATOR'S MANUAL	Volume OM

1. VOLUME ID, **Installation Data**, will be delivered prior to installation of the machine, to facilitate preparations for installation. It gives information on

- piping dimensions;
- electical connections;
- space requirements, i.e distance from walls and other machinery necessary for operation, opening, dismantling and assembly, minimum height to lifting tackle hook, etc.;
- dimensions and weights of machine parts.

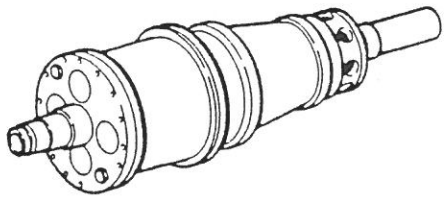
Volume ID also contains a dimension drawing and a wiring diagram.

2. VOLUME SP is a **Spare Parts Catalogue** containing exploded views which show the relative placing of all parts in the same order as they are fitted in the machine. Illustrating the parts in this way makes the catalogue a great help when dismantling and assembling the machine. Lists opposite each exploded view describe in 5 or 6 languages the parts comprised by the respective drawing number and state the index number as well as the article number of each part.

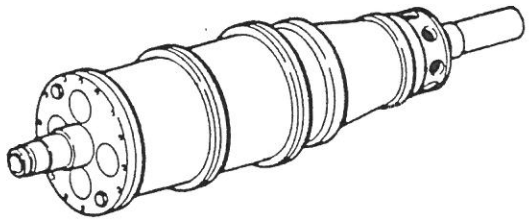
3. VOLUME OM, **Operator's Manual**, describes the machine and its functioning. It gives operating instructions as well as directions for cleaning, lubricating, dismantling, repairing, and assembling the decanter, and states the safety precautions to be followed when the decanter is operated or repaired.

The manual covers three decanter models which are much alike, differing from each other only in machine length and capacity, i.e. the volume created per hour.

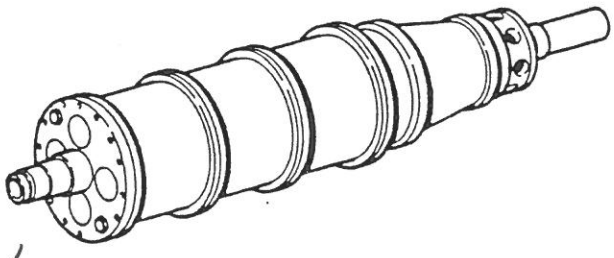
All three models have conocylindrical drums with one conical section and one, two or three cylindrical sections, as follows:



Type NX 414: one cylindrical section.



Type NX 416: two cylindrical sections.



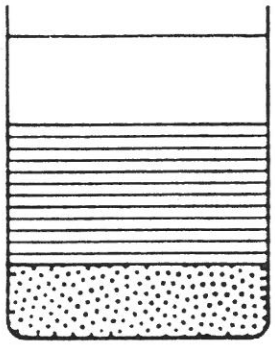
Type NX 418: three cylindrical sections.

PRINCIPLES OF SEPARATION

Basic Principles

The purpose of the separation may be:

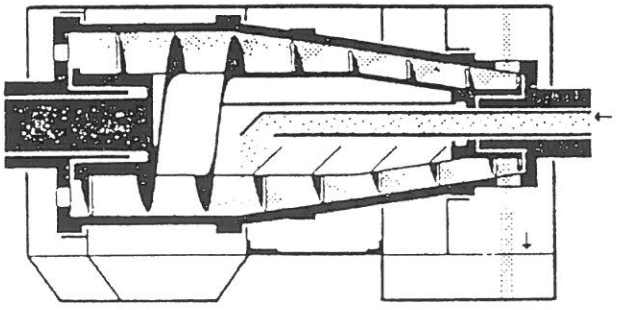
- to separate solid particles from a liquid
- to separate two mutually insoluble liquids of different density.



Separation by Gravity

A liquid in a vessel will clear slowly as the heavy particles in the liquid mixture sink to the bottom under the influence of gravity.

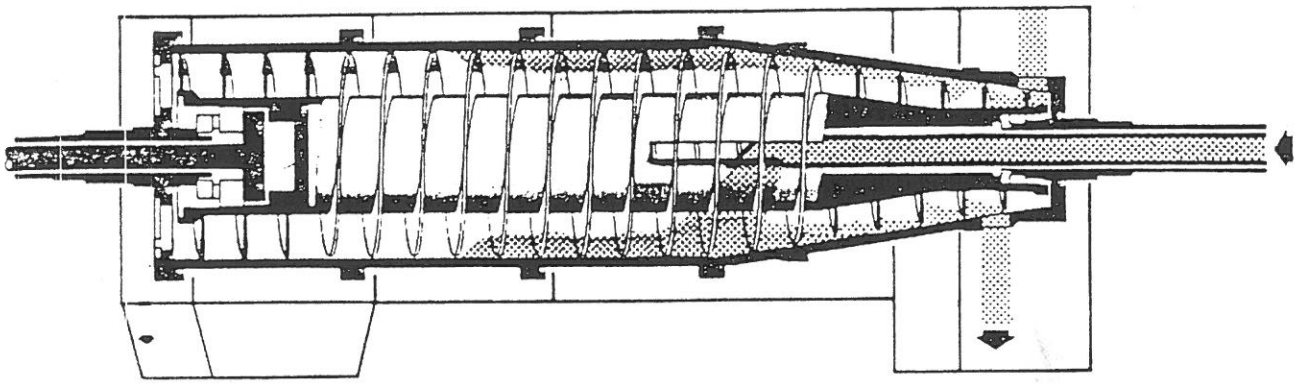
The result is various layers of separated liquid and sediment, the lightest liquid on top and the heaviest sediment on the bottom. After removal of the separated contents the vessel must be refilled wit. liquid mixture.



Centrifugal Separation

If the separation tank rotates at high speed, the solids-liquid mixture will be separated by centrifugal force. The faster the rotation, the greater the force. Separation and sedimentation that would take many hours in a gravity field can be accomplished in a matter of seconds by centrifugal force. If the vessel is provided with arrangements for supplying the liquid mixture and removing the separated liquid and sediment, the whole process can be made continuous. That is exactly what happens in a decanter centrifuge.

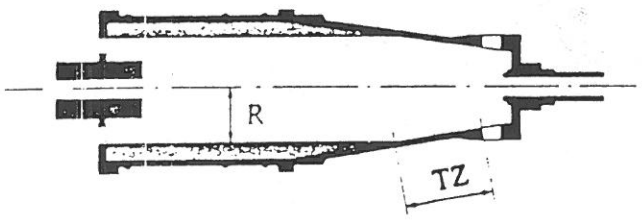
THE DECANTER CENTRIFUGE



Alfa-Laval has developed a range of decanters capable of performing a wide variety of separation duties.

A decanter is a solid-drum screw-conveyor centrifuge. Through a central feed pipe the process liquid is fed into the horizontal, rapidly rotating drum, which is driven by an electric motor. Inside the drum where the mixture is continuously separated under influence of centrifugal force, a screw conveyor rotates at a speed reduced by a gear to a little lower than speed of the drum. Being of higher density, the solids settle on the drum wall and form a sediment layer, the heavy phase, and the clarified liquid forms a layer, the light phase, inside the sediment layer. The flights of the rotating screw conveyor push the the solids to the conical end of the drum, where they are pressed through the dry beach, TZ, to the discharge openings in the narrow end of the drum cone. The clarified liquid is discharged into an outlet housing via level regulating disks in the large end piece of the drum.

Some process media contain erosive particles and may subject the screw conveyor to wear. The edges of the conveyor flights are therefore protected by a special wear-resistant material.

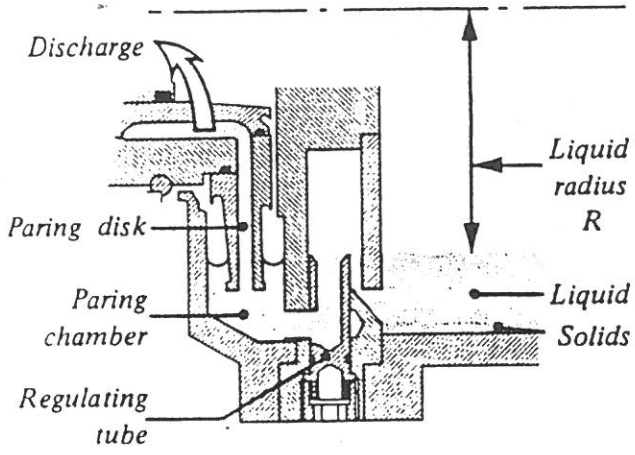


The Dry Beach. Level Regulating Disks.

The TZ starts from the point on the inside of the conical section of the drum where the cone narrows to a radius less than the indside radius of the liquid layer, and it ends at the solids discharge openings. The solids are lifted out of the liquid and pushed up the slanting wall of the TZ before leaving the drum.

The length of the TZ varies according to the depth of the liquid layer. The longer the radius, R, from the drum centreline to the outmost point on the liquid discharge opening, the lower the liquid level and consequently the longer the dry beach. The radius can be adjusted to suit the properties of the process liquid by means of regulating disks. For details about the regulating disks fitted on your decanter, see next page.

Regulating Tubes:



Outlets: The conveyor carries the solids - the heavy phase - to the discharge ports in the conical section of the drum.

The clarified liquid - the light phase - leaves the drum through the hole in the end of the regulating tube. The liquid streams out of the holes in the sides of the tubes (see sketch above) into the paring chamber where it is caught by the paring disk and discharged through the outlet pipe on top of the decanter (see sketch of decanter on page 5).

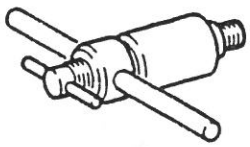
The liquid radius R is determined by the length of the regulating tube. The longer the tube, the shorter the liquid radius.

The basic and exchangeable pieces of the regulating tube: The regulating tube consists of two parts: a lower part - the basic piece - closed in the end, but with holes in the side, and an upper part - the exchangeable piece - which is made in 15 different lengths. The parts are screwed together. The table on this page specifies the article Nos. for the exchangeable pieces and the corresponding liquid radii. The liquid radius is engraved in each tube. The article No. of the basic piece is 6120.4538-01.

Some decanters may have other types of regulating tubes.

It is important that all tubes fitted have the same radius. See Spare Parts Catalogue, page 9.25.

Changing the regulating tubes: To change the regulating tubes use the extractor (6120.4276-80).

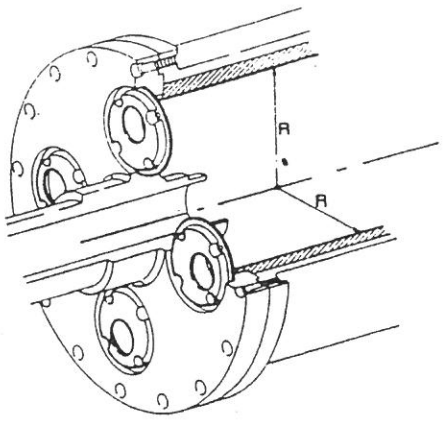


Extractor
6120.4276-80

Remove the screw plug. Screw in the extractor by turning the small handle. Pull tube out by turning large handle while small handle is fixed.

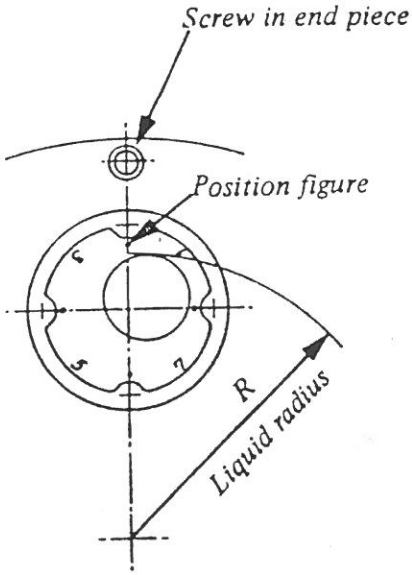
Regulating Tube Exchangeable Piece Article No.	Liquid Radius R mm
6120.7536-69	99
6120.7536-70	100
6120.7536-01	101
6120.7536-02	102
6120.7536-03	103
6120.7536-04	104
6120.7536-05	105
6120.7536-06	106
6120.7536-07	107
6120.7536-08	108
6120.7536-09	109
6120.7536-10	110
6120.7536-11	111
6120.7536-12	112
6120.7536-14	114

Regulating Disks



Regulating disk 6120.4243-01

Your decanter is fitted with regulating disks of the type shown above.



The disks can be placed in 8 different positions that are numbered from 1 to 8. Odd position numbers are indicated by digits, the even numbers by dots between the digits - see sketch above.

Use the position figure nearest to the screw in the end piece and look for it in the table to find the liquid radius. In this case the position figure opposite to the screw in the end piece is 2. From the table below the radius 149.5 mm can be read.

Regulating Disk 6120.4243-01	
Position Figure	Liquid Radius, mm
5	132.3
4	134.0
6	137.3
3	141.4
7	145.6
2	149.5
8	152.3
1	153.8

To get a new set of regulating disks, 4 disks must be ordered.

The same setting of all four disks is important. Check setting before closing cover !

The radius for the regulating disk setting made by our factory is indicated on the Data Sheet in the front of this book. See also the Spare Parts Catalogue, page 9.2.

SAFETY REGULATIONS

In all decanters the drum rotates at a very high speed normally between 50 and 100 revolutions per second. Very great forces are accumulated and it is therefore essential that **both** the directions concerning assembly of parts, starting, stopping and overhaul, and the safety precautions given on page 2 are followed strictly.

OPERATION

General conditions: Depending on the design of the machine the small sunwheel of the gearbox is arranged to be either fixed or rotating. Operation according to one of these alternatives is described on the following pages.

If the sunwheel is fixed, an overload guard mounted on the frame is used, see description on page 13.

When the small sunwheel rotates, two overload guards are generally provided: one mechanical and one electrical. The mechanical guard consists of a GS coupling which is described on page 13.

Descriptions of different ways to rotate the sunwheel and the arrangement with fixed sunwheel are given on page 7.

Sound and Vibrations: In spite of the most accurate balancing there is always a negligible imbalance in a rotating body. As the drum and the coveyor are two separately balanced units rotating at different speeds, the negligible imbalance of each unit will coincide, and a momentary increase of sound and vibration occurs in the machine. The time between the moments when this happens is dependent on the difference in drum and coveyor speed. The higher the differential speed the shorter the intervals, and vice versa. Increased imbalance caused by wear and/or accumulation of solids will increase the amplitude of sound and vibration.

A practical tip: The conveyor's differential speed can be found by counting these vibrations for exactly one minute.

Vibration sensor: The machine can be equipped with a vibration sensor to protect it against damage due to heavy vibration.

Running with rotating small sunwheel: If the drum speed is altered, but the speed and direction of rotation of the small sunwheel are unaltered, the difference between the drum speed and conveyor speed will change.

The speed of the small sunwheel - and in some cases even the direction of rotation - can be changed while the machine is running, if it is equipped with a variator drive for the small sunwheel.

If the machine has an independent electric motor with belt drive to the small sunwheel and reversing its direction of rotation is wished, the sunwheel motor and the decanter main motor must be stopped and both motors be at rest before alteration of the direction of rotation is performed.

OPERATION WITH ROTATING SUNWHEEL

Rotating Sunwheel Systems. Overload Guard.

Different systems for rotating the small sunwheel can be provided, see page 7: Gearbox and Conveyor.

All rotating sunwheel systems (except the hydraulically driven one) are equipped with a mechanical overload guard: a GS coupling. For the description of the GS coupling, see pages 13 and 14.

Preparations to be made for starting the decanter:

Sludge deposits in drum: A drum that has not been cleaned but left clogged by sludge after operation must be cleaned before being restarted, for the following reason:

- If the drum is uncleaned, the GS coupling will trip as soon as the decanter is started.

Sludge deposits left in an idle drum after previous operation may have been displaced, which may give rise to exceptional load conditions at the next runup.

If necessary, clean the drum by flushing with water or by screwing out the sludge or solids, as described on page 11.

Before starting, check that:

- the cover and bottom of the collecting vessel are free from sludge deposits
- the process liquid is supplied from the correct tank
- discharge valves, if fitted, are open
- the drum is easily rotated by hand with the GS coupling in operative position.
- the limit switch works: trip it by hand by pressing the lower part of the tiltable contact piece upwards to release the microswitch. Now it should not be possible to start the main drive and sunwheel drive motors, or the feed pump either (if the control circuits to the motors of decanter and of pump are connected in series).

After checking:

- Close cover and clamp it with the cover bolts
- Reset the limit switch to operative position by pressing down the lower part of the contact piece until it clicks into place on the microswitch.

Starting:

- Set switch MAIN POWER on panel to "ON"
- Release EMERGENCY STOP (in most cases: pull out the EMERGENCY STOP knob).
- Start decanter motor and sunwheel motor
- Wait 3 minutes for the decanter to attain full speed.
- Run decanter on water for a while to ensure all pipework is tight. If the decanter vibrates, filling the drum and then stopping the flow is recommended.
- Close water valve.
- Open feed valve.
- Start belt conveyor or other transport means for discharged sludge or solids.
- Start feed pump.

Not all processes are alike. Some of the following tips may be useful:

- Warm the drum, if necessary, by supplying auxiliary liquid, for instance water of the same temperature as that of the process liquid, before turning on the process liquid.
- Shut off the feed and let the decanter run without feed for a few minutes before supplying the process liquid again, so that a sludge coating is formed in the drum.
- The power consumption is higher during acceleration than in normal operation.

Running:

Check particularly that:

- pressure, temperature, and throughput are steady
- there is no oil leakage from the gearbox
- there is no increase in vibration
- no abnormal leakage occurs at the axial seals (if any).

Axial seals (if any): If a so-called spurt leakage occurs at a seal, the cause may be a broken axial seal ring or a broken O-ring.

If so, stop the machine as soon as possible and change the damaged part.

Overload: If the conveyor is overloaded the GS coupling will trip. Proceed as follows:

- Stop the feed of process liquid immediately (if not stopped automatically).

It is advisable to replace this feed by a sludge-free auxiliary liquid, e.g. water, until the drum has stopped rotating.

- Check that the motors have been switched off.
- When the drum has stopped rotating, reset the GS coupling to operative position. **This must N O T be attempted when the drum is** rotating.

The cause of the overload may be:

- The throughput is too high in relation to the sludge content
- irregular feed
- The properties of the sludge (Prestraining the process liquid before feeding it to the decanter may be necessary). Clean the drum.

Cleaning an overloaded drum in the assembled state:

- Be sure the drum has stopped rotating.
- Close any discharge valves provided under the funnels.
- Check that the GS coupling is in operative position. If not, reset it.
- The first possibility is then supplying an ample amount of water, preferably hot and with an admixture of solvent, if necessary, into the feed pipe. Rotate the drum by hand in the direction of rotation while supplying water.
- If supplying hot water through the inlet pipe proves unsuccessful, another possibility is to inject water at high pressure, or steam, through the discharge bushings. This can also be done alternately by using the conveyor to screw out the sludge mass (see below).

If the sludge is fed to a drier or the like after the decanter, precautions must be taken to avoid feeding water to downstream equipment.

- If the GS coupling trips repeatedly when the drum is manually rotated, the sludge is so hard that the drum must be dismantled for removal of the sludge.

Any damaged parts must be changed before the machine is restarted.

- In many cases it is possible to screw out the sludge from the drum by hand, using the sunwheel belt pulley to operate the conveyor.

Never use tools when turning the sunwheel. The gearbox might be exposed to torques exceeding the maximum limits given on page 7.

Vibrations: If vibrations occur while drum rotates (during start, operation, and rundown) liquid must be supplied to the machine to soften vibrations.

Stopping and Cleaning:

- Before stopping, flush out with water of suitable temperature, possibly with an admixture of a suitable solvent. Flush while the machine is running.

- When the flushing is finished, switch off the motor. Do not shut off the flushing liquid feed until the drum has stopped rotating. (For paring disk machines: Continue flushing, but with restricted volume of liquid, so that the paring disk can discharge the liquid even with the continuously decreasing number of revolutions as the machine runs down.

- Liquid often escapes through the sludge discharge bushings. Take precautions to avoid liquid being fed to downstream equipment such as sludge drier or the like.

- When the drum has stopped, shut off the liquid supply.

- Open the cover of the collecting vessel.

- If necessary, drain the drum through the two plugged holes in the end piece facing the gearbox.

  Do not forget to fit and tighten the plugs again after draining.

- Check that the flushing had the intended effect, for instance by trying whether the drum is easily rotated by hand with the GS coupling in operative position.

  If not, clean the drum thoroughly (wit.. water or steam, by screwing out the sludge - see previous page), and do it immediately after stopping, because it is easier to remove fairly moist and soft deposits than to remove deposits hardened for some time in an idle machine.

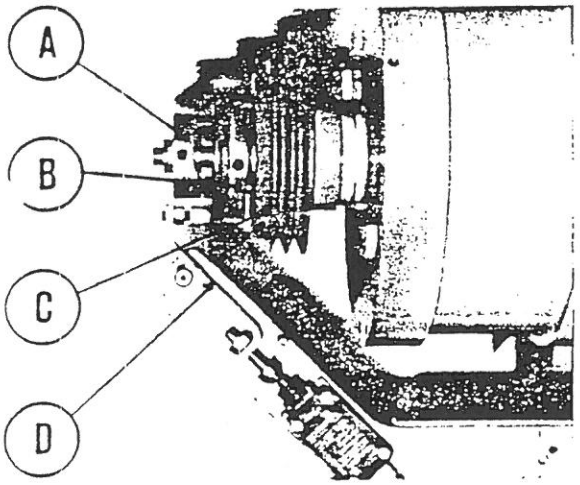
If cleaning as outlined above proves unsuccessful:

- The drum must be dismantled for cleaning

- Clean the cover and bottom of the collecting vessel.

Overload Guard: The GS Coupling. The GS coupling is a spring-loaded coupling connecting the belt pulley to the sunwheel shaft. The torque on the sunwheel shaft is proportional to the load on the conveyor during discharge of sediment from the drum. An increased load on the conveyor will - if the load exceeds the maximum permissible torque on the sunwheel (see page 7) - cause the GS coupling to disengage.

Functioning of the GS coupling:



The GS coupling

The overload guard consists of four interacting parts:

The driver A fastened to the sunwheel shaft.
The GS coupling B.
The belt pulley C.
The tiltable contact piece D at the limit switch.

The driver (A) has on the inner side three slopes and three depressions for three balls.

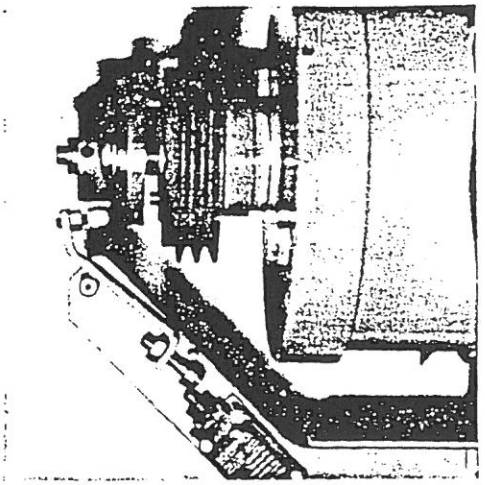
The GS coupling (B) has three balls fastened to the side facing the driver. The GS coupling is constantly pressed toward the driver by the built-in spring, with the three balls resting in the depressions in the driver.

The heads of the three screws in the belt pulley (C) act as cams that mesh with holes in the GS coupling.

The pulley is joined to the sunwheel shaft by the parts A, B, and C connected as described above.

The contact piece (D) keeps the limit switch in "on" position.

Overload:



GS coupling in disengaged position

An overload - a torque exceeding the limits given on page 7 - will cause the GS coupling to disengage.

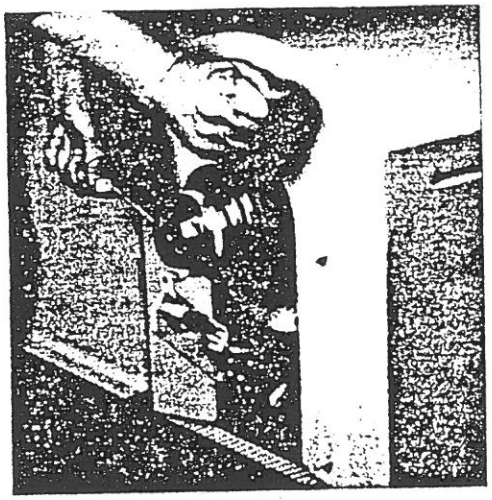
The excessive torque forces the three balls out of the depressions and down the slopes in the driver.

The GS coupling moves axially toward the driver, actuating the tiltable contact piece.

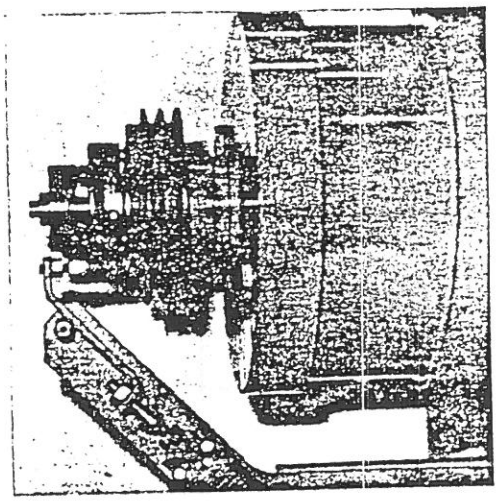
The tilting contact piece disconnects the power to the motors of the decanter, of the small sunwheel, and of the feed pump.

After some minutes the decanter will stop.

Resetting the GS Coupling:



Resetting the GS coupling



GS coupling reset into operative position

1. Eliminate the cause of the overload - that is: Clean the drum. See page 11.

2. Use the two steel bars supplied with the tools to reset the GS coupling, see picture above.

3. Using the bars as handles, turn parts A and B into place. Check that screwheads mesh with holes. When correctly engaged, the coupling will assume the operative position as shown on the picture.

4. Remove the two bars.

5. Reset the limit switch by pressing down the lower part of the tiltable contact piece until it clicks into place on the microswitch.

6. Start the decanter.

Maintenance: Keep the parts of the GS coupling clean to ensure proper function.

With the tiltable contact piece in operative position (see item 5 above) the head of the screw at the upper end of the tilting arm must rest 1 mm from the GS coupling.

In disengaged position the GS coupling has moved 5 - 6 mm axially and tilted the contact piece.

MAINTENANCE

TOOLS

Tools are not included in the standard decanter supply. To facilitate dismantling and assembly of the decanter. Alfa-Laval can supply a set of special tools as specified in the Spare Parts Catalogue (Volume SP).

It will be found helpful if the workshop servicing the decanter is equipped with the following normal hand tools:

- 2 screwdrivers, width 5 and 9 mm
- 1 hammer with plastic head
- 2 or more pairs of snap ring pliers, inside and outside type
- 1 set of hexagon keys, 1.5 - 10 mm
- 1 set of spanners, 10, (12), 13, 17, 19, and 24 mm.

Alfa-Laval can supply these hand tools too, see the Spare Parts Catalogue.

LUBRICATION

Bearings and Gearbox: Before starting a new decanter for the first time, the bearings must be lubricated and the oil level in the gearbox must be checked - see lubrication table on next page.

Lubricate the bearings once a week if

a) operating temperature is higher than 80°C (175°F)
b) the machine is continuously operated for two or three shifts
c) the process medium is agressive.

The temperature of the bearings will be higher than normal after greasing, but it will return to normal after a short time.

Oil and Grease: Keep lubricating oil and grease in a dry and cool place, and close cans and containers to protect the lubricants from dust and moisture.

When changing from one type of grease to another, press in enough of the new grease to displace all the old grease from the bearings and lubricating circuits in the system. Continue until only new grease comes out of the hole opposite the nipple.

Lubrication Table: When cleaning and overhauling, always follow strictly the directions for lubrication briefly outlined in the table on next page and given more fully on the following pages.

Indication	Cause	Remedy
Machine vibrates	1. Moderate vibrations normally occur at the critical number of revolutions during runup and rundown periods.	None.
	2. Drum out of balance due to: bad cleaning - wrong assembly - level regulating disks or tubes not at same setting - drum assembled with parts from different drums - conveyor worn out.	Stop immediately and establish cause. Changing certain parts means that the whole drum must be rebalanced.
	3. Vibration damping rubber washers have lost elasticity.	Renew rubber washers regularly every two years.
	4. Foundation too weak.	Reinforce foundation.
	5. Bearing worn out or damaged.	Locate and change defective bearing.
Speed too high	1. Wrong transmission ratio.	Stop immediately. Check that motor belt pulley is correct for motor speed.
	2. Wrong motor speed.	Stop immediately and provide a motor with correct speed.
	3. (At D.C.). Starter or excitation winding defective.	Repair or change.
	4. (At D.C.). Mains voltage too high.	Check mains voltage.
Speed too low. Runup time too long.	1. Wrong transmission ratio.	Stop immediately. Check that motor belt pulley is correct for motor speed.
	2. Voltage drop in mains.	Check mains voltage.
	3. Bearing worn out or damaged.	Locate and change defective bearing.
	4. Motor connected to wrong voltage.	Check rated voltage of motor.
	5. Motor defective.	Change or repair motor.
	6. Drum braked by sludge remaining in vessel cover from previous run.	Clean cover.
	7. Other machine defects.	Stop immediately. Check that drum can be rotated by hand. Locate defect.
Starting current too low	Ammeter reading wrong.	Check starting current. Change or repair ammeter.
Starting current too high	1. Ammeter reading wrong.	As prescribed above.
	2. Motor defective	Change or repair motor.
	3. Bearing worn out or damaged.	Locate and change defective bearing.
	4. Drum braked by sludge remaining in vessel cover from previous run.	Clean cover.
	5. Other machine defects.	Stop immediately. Check that drum can be rotated by hand. Locate defect.
Runup time too short (starting current too high)	1. Motor connected to wrong voltage.	Check rated voltage of motor.
	2. Star-delta starter switches too soon from star to delta connection.	Adjust the time relay.

Indication	Cause	Remedy
Machine stops	Generally more than two successive (accomplished) starts have been performed, causing overheating of motor (thermo-contacts in motor have cut out).	Let motor rest for approx. one hour.
Noise from gearbox	1. Oil quantity wrong. 2. Gear worn. 3. Bearing worn out or damaged.	Check quantity and quality. Change - it is best to have this done by an authorized ALFA-LAVAL workshop. Change - it is best to have this done by an authorized ALFA-LAVAL workshop.
Poor clarification	1. Throughput too high. 2. Liquid level located too far from axis of rotation (liquid radius too large). 3. Unsuitable separation temperature. 4. Level regulating disks or tubes at different settings.	Reduce rate of feed. Adjust to a smaller radius by changing the setting of the level regulating disks or tubes. (Possibly procure regulating disks allowing a smaller liquid radius). Remedy. Remedy.
Sludge not fed out	1. Sludge coating in drum not formed. 2. Wrong liquid level (liquid radius too large).	See starting instructions on page 10. In difficult cases consult an ALFA-LAVAL representative. Decrease the liquid radius successively until sludge is discharged.
Sludge wet	Liquid level located too near axis of rotation (liquid radius too small).	Adjust to a larger radius by changing the setting of the level regulating disks or tubes. (Possibly procure regulating disks allowing a larger liquid radius).
Overload guard trips	Accumulation of sludge in drum is too large. The cause may be: • bad cleaning after previous run. • irregular feed • throughput too high in relation to the sludge content • the properties of the sludge. • tripping torque too low	Stop the machine and clean the drum. The feed flow or the concentration of sludge in the process liquid can be regulated by an automatic device keeping the load on the conveyor constant and reducing the risk of overload. Consult an ALFA-LAVAL representative. Prestraining the process liquid may be necessary before feeding it to the decanter. Increase the torque: See page 14.

Lubrication Table

What to lubricate: / When to lubricate:	Main Bearings	Angular Contact Ball Bearing Roller and Needle Bearings for Conveyor. Gearbox Ball Bearing.	Gearbox
At first running	While running, as soon as machine has reached working speed.	Before starting the machine for the first time.	Check that gearbox is filled with the right quantity of oil. (no leakage during transport). See oil label at plug. If necessary, supply oil.
Lubricating intervals	Every 450 hours When assembling after cleaning or repair.	Every 300 hours When assembling after cleaning or repair. Before operating machine if it has been idle for 150 hours or more.	After the first 150 working hours, then every 750 hours. Check oil level now and then between oil changes.
Lubricants used, standard machines	Chevron Polyurea EP Grease 2	Chevron Polyurea EP Grease 2	Chevron Universal Gear Lubricant 85W/90 MIL-L-2105B
Lubricants used, machines with paring disk	Esso Carum 330 Grease	Esso Carum 330 Grease	Chevron Universal Gear Lubricant 85W/90 MIL-L-2105B

Grease and gear lubricants can be supplied by Alfa-Laval. See Spare Parts Catalogue, page 7.4:

Chevron Polyurea
EP Grease 2, 5 kg, Article No. 6120.3671-01

Chevron Universal
Gear Lubricant, 5 litres, Article No. 6120.3671-04

The following types of grease can be substituted for the types mentioned above if they are not available:

For standard machines: Mobilux 2 Grease

For machines with paring disks: Mobilux 2 Grease or Shell Alvania R2 Grease.

Esso Carum 330 Grease is officially approved for food industry applications in the U S A.

INFORMATION ON LUBRICATION

Main Bearings: Approx 150 g of grease per bearing is normal when lubricating after 450 hours' operation, and after cleaning and repairs.

Press in grease until it appears at the hole in the bearing housing cover.

Ball and Roller Bearings: The angular contact ball bearing for the conveyor and the roller bearing between the conveyor and the end piece facing the gearbox are both in the same lubrication circuit; so is the gearbox ball bearing facing the drum.

The nipple is located at the end piece pivot (or for machines with axial seals at the fat valve disk).

Press in grease until it comes out through the hole opposite the nipple.

In the gearbox cover there is a hole where the grease usually appears first. However, grease must come out of the hole opposite the nipple. For new machines this will happen after 10 - 30 seconds, but as long as no grease flows out, it is important that the supply of grease is continued.

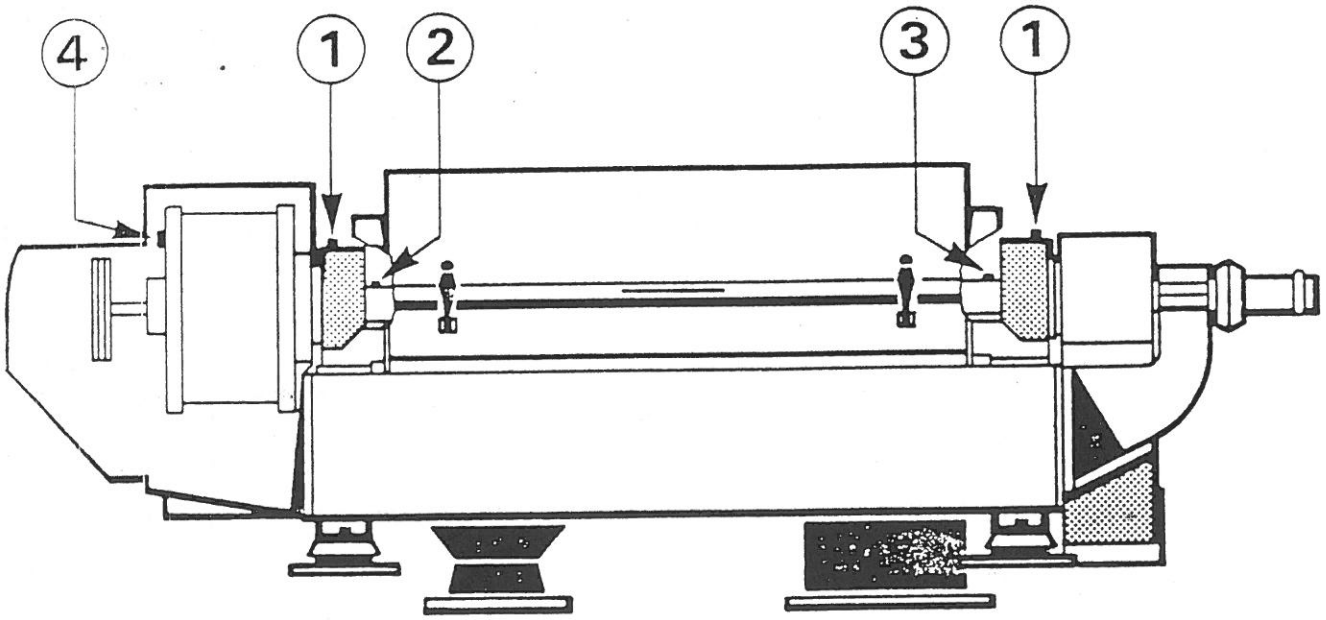
If no grease comes out of this hole after a while, the hole at the gearbox must be closed temporarily by a finger and the pressing be continued until grease, as was expected, escapes from the right hole.

If this turns out to be impossible, the lubricating groove is clogged up.

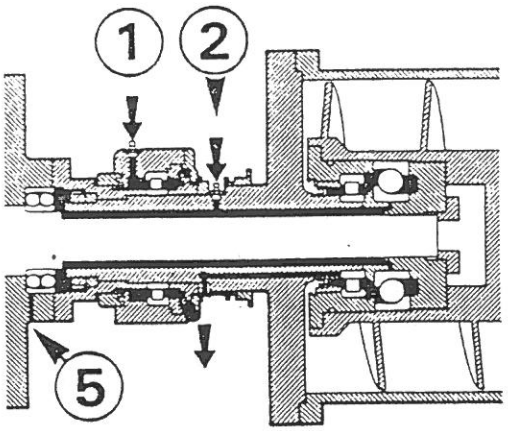
Needle Bearing between conveyor and end piece facing inlet: Press grease into the nipple at the end piece pivot (or at the fat valve disk, if machine has an axial seal.)

Press until grease comes out of the hole opposite the nipple.

Grease Nipples and Oil Plugs

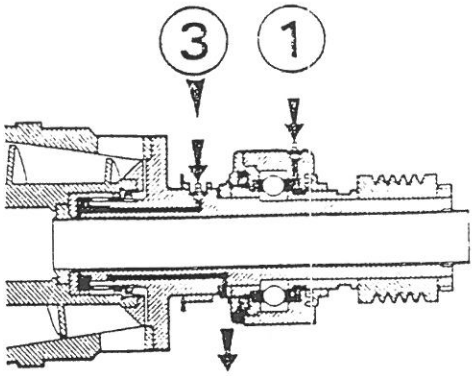


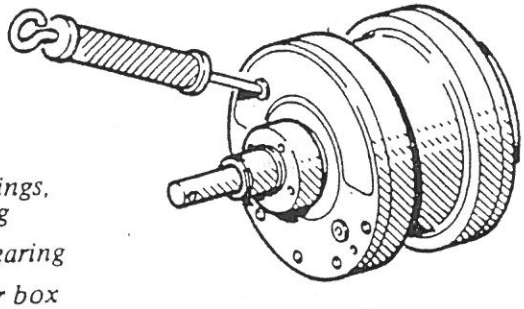
1. *Main bearings*
2. *Ball and roller bearings, gearbox ball bearing.*
3. *Conveyor needle bearing*
4. *Oil filling plug, gearbox*

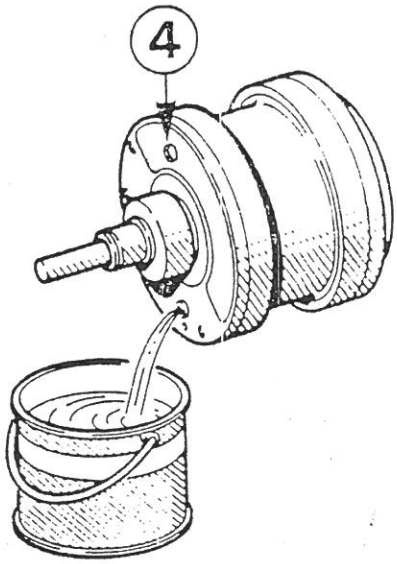


MACHINES WITH PARING DISK:

Nipple 1 in the gearbox end is placed at the side of the bearing housing, not on top of it.
Nipple 2 is placed at outer rim of the large end piece.







1 *Main bearings*
2 *Ball and roller bearings, gearbox ball bearing*
3 *Conveyor needle bearing*
4 *Oil filling plug, gear box*
5 *Escape hole in gearbox*

When lubricating nipple 2, grease must come out opposite to the nipple. Close hole 5 with a finger until grease escapes from the correct hole (see page 17).

Gearbox: The gearbox cover has two holes for draining and filling of oil.
Some gearboxes have four holes. Use the two outer holes as described below.

Oil Drainage:

Turn gearbox until both plugs are positioned vertically in line.

Place an empty tin under gearbox and remove upper and lower screw plugs while oil is still warm, and let it run out and drip for 15 minutes.

Clean screw plugs.

Oil Change:

Drain off oil as described above.

Fit lower plug. Use oil syringe to inject about 1 litre (1 quart) of same oil as used for lubrication.

Fit upper plug and flush gear by rotating the gearbox by hand at highest possible speed to make flushing efficient.

Remove both plugs and drain gear completely.

Refill 2.5 litres (0.55 Imp. gallons) of new oil - see page 16.

Oil Level:

All new machines have a gearbox provided with a label indicating the oil level: Place the arrow on the label so that it points vertically upwards. The indication marks at the filling hole show the required oil level.

For machines without this label but with four plugs: Place all four plugs vertically in line. The oil level must reach the upper of the inner holes.

GENERAL INFORMATION ON DRUM

Functioning: Satisfactory functioning cannot be ensured unless the parts in contact with liquid are carefully cleaned before assembly. This applies particularly to O-rings, seal rings, sliding surfaces, guiding and contact surfaces, and threads. Also take care not to make burrs on the metal parts when handling them.

Check that ends are smooth on screws used for pressing parts apart.

Exchange of Parts: Each drum assembly is balanced as a unit and will be out of balance if any of the parts is exchanged.

The complete decanter manufacturing serial number is stamped in the main parts of each decanter to prevent confusion, for instance when a plant consists of more than one machine of the same type.

The separately balanced conveyor can be exchanged by the customer's own service people.

Guide Marks: When assembling, make sure that drum parts are placed in the position defined by the guide marks (AA, BB, CC). Be careful not to damage the guide marks when handling the parts.

O-rings, Seal Rings, and Gaskets: Check O-rings, seal rings, and gaskets for defects and make sure that the corresponding grooves and sealing surfaces are well cleaned.

After fitting, check
that the ring lies properly (not twisted) in the groove,
that it fills the groove evenly all round.

It is important that lip seal rings are turned the right way - see sketches or descirptions.

Corrosion and Erosion: Aggressive liquids as well as liquids containing very hard particles can cause corrosion and erosion damage.

Consult an ALFA-LAVAL representative.

REMOVING AND DISMANTLING THE DRUM. DISASSEMBLY AND ASSEMBLY.

General Conditions: Use the special tools to dismantle and assemble the drum. The exploded views in the Spare Parts Catalogue (Vol. SP) serve as a guide to the order of assembly.

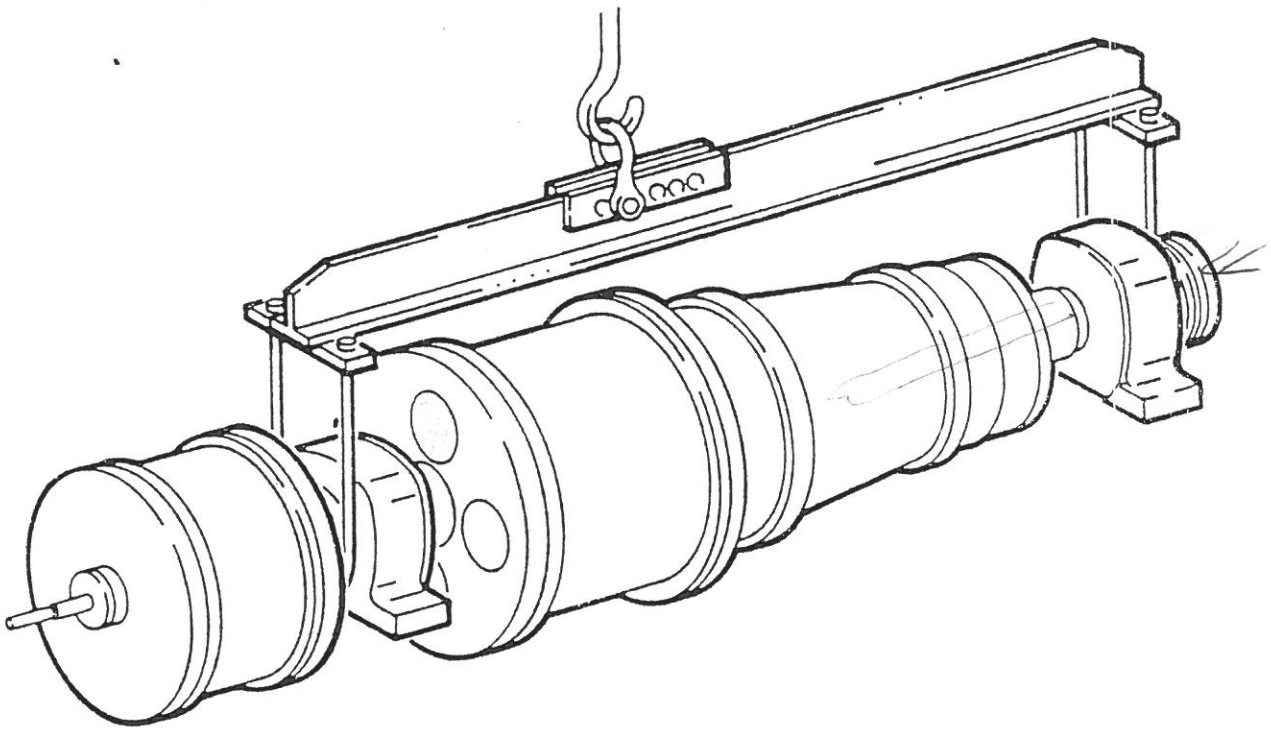
Place the parts on a clean, soft surface.

The following text describes the complete dismantling and assembling of the drum. For removal of only a single part it will of course not be necessary to go through the whole procedure. By way of example, the gearbox need not be removed from the end piece to renew an internal part of the drum.

Please Note: Each bearing housing has been individually fitted into place in the machine and then fixed in this position. Before removing the bearing housings the first time from the drum, mark each housing as well as its position on the frame in order to avoid confusion when mounting the housings again.

Never shift bearing housings from one machine to another.

Lifting out the Drum



Note that the drum must be at rest before dismantling is started.

The drum can be lifted out after removal of the following parts:

Paring tube (if any), gearbox guard, belt guard, feed pipe and belts.

Remove plastic caps covering nuts on guide pins at the bearing housings. Turn nut clockwise as if fastening it. This will pull guide pin out of its conical hole. Remove guide pins with nuts still on. Now loosen and remove screws fastening the bearing housings to the frame.

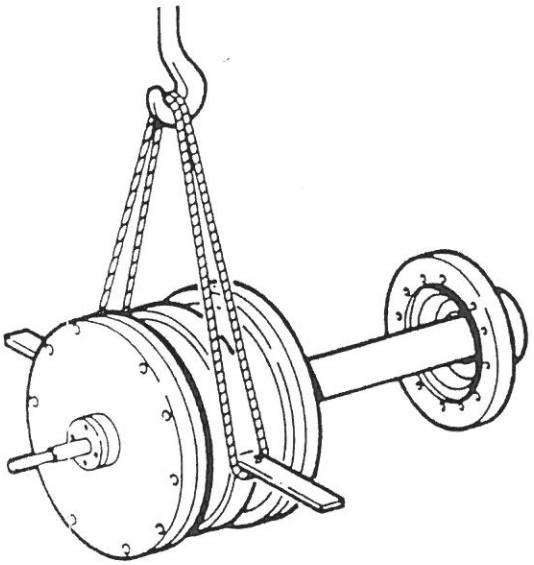
Place the stirrups of the lifting yoke around the drum - the widest stirrup around the flange facing the gearbox and the other stirrup around the groove in the deflector on the inlet side.

Fasten the stirrups to the yoke, and hook the lifting hook into the yoke eye located nearest to the gearbox.

Carefully lift the drum/gearbox unit and clamp it in the drum holder.

Removing and Mounting the Gearbox:

When removing or mounting the gearbox:



Clamp the holder around the gearbox and sling it to the lifting-tackle hook.

To avoid bending strain in the drive shaft ball bearings the gearbox must hang by the lifting tackle when the drive shaft is pulled out of or pushed into the drum.

Removing:

1. Remove the gearbox guard.

2. Remove the two screw plugs from the drum flange facing the gearbox (see item 4 below).

3. Remove the screws that fasten the gearbox to the drum.

4. Put two of these screws into the holes for the screw plugs (or use the screw plugs, if not removed) and tighten them to press the gearbox off the flange, first ascertaining that they have smooth ends and thus will not scratch the corresponding surface on the gearbox.

5. Screw in the screw plugs again so that their ends are inside the flange surface.

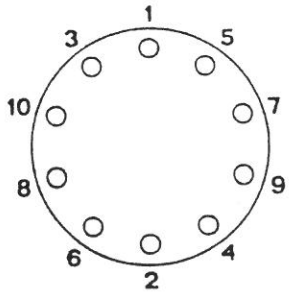
6. Pull out the gearbox.

Mounting:

1. Check the drive shaft entry seat in the drum. The ball bearing holder of the drum accomodates the splines that engage the splines of the drive shaft.

If the drive shaft has been twisted owing to overload, dismantle the drum and examine the splines of the ball bearing holder.

2. Push the drive shaft into the drum while aligning splines by turning gearbox or small sunwheel shaft. Fasten the gearbox.



Tighten the screws firmly and uniformly all around.

3. If the oil has been drained: supply fresh oil.

4. Fit and secure the gearbox guard.

Disassembling the Gearbox End of the Drum:
(See figure 3 on next page)

1. To facilitate work, place the drum in a drum-holder. Remove the 16 screws (29) holding end piece to drum. Back the end piece off the drum, using the four screw plugs(28) as jackscrews. With drum in vertical position, the end piece can be lifted with the lifting tool(53.3401-80) - see figure 1.

Is the gearbox not to be removed, clamp the holder around the gearbox - see page 21 - and use a sling to lift gearbox and end piece from the drum.

Care should be taken to protect the roller bearing inner race (31) and the lip seal ring (30).

For machines with paring disk: Remove the 8 screws holding the cover for the paring disk to the end piece. Use the four screw plugs in the cover as jackscrews, loosen the cover and use the screw holes to reach the 8 screws holding the end piece to the drum. Tilt cover, and by two fingers pick up each screw when loosened. Turn cover to get to next screw until all eight screws are out. Continue dismantling as described, using the screw plugs (28) as jackscrews.

2. Release lock washer (2) by opening bent tab and remove round nut (1), using the pin spanner.

3. If necessary, remove the flange (5) facing gear box, using the puller. Figure 2 illustrates flange removal. Do not use hammer. Severe imbalance will be the result owing to gearbox runout.

4. The bearing housing (12), roller bearing outer race with rollers (13), and spacing ring (15) can be removed by hand. Being press-fitted, the roller bearing inner race cannot be removed unless the special puller ring (6120.7374-80) is used.

Place the puller ring round inner race, push it in as far it will go, and tighten the four screws.

Now use the puller as shown in figure 2 and pull off the puller ring with inner race.

A flange puller tool can also be used to remove the inner race. Attempting to remove the inner race by cutting or wedging is likely to cause unrepairable damage to the precision finished surfaces of the end piece. Before refitting a new inner race, heat the race in an oil bath having a temperature of approx. 80°C (175°F).

Article No. for
Drum Holder:
NX414: 52.9844-81
NX418: 53.3443-85

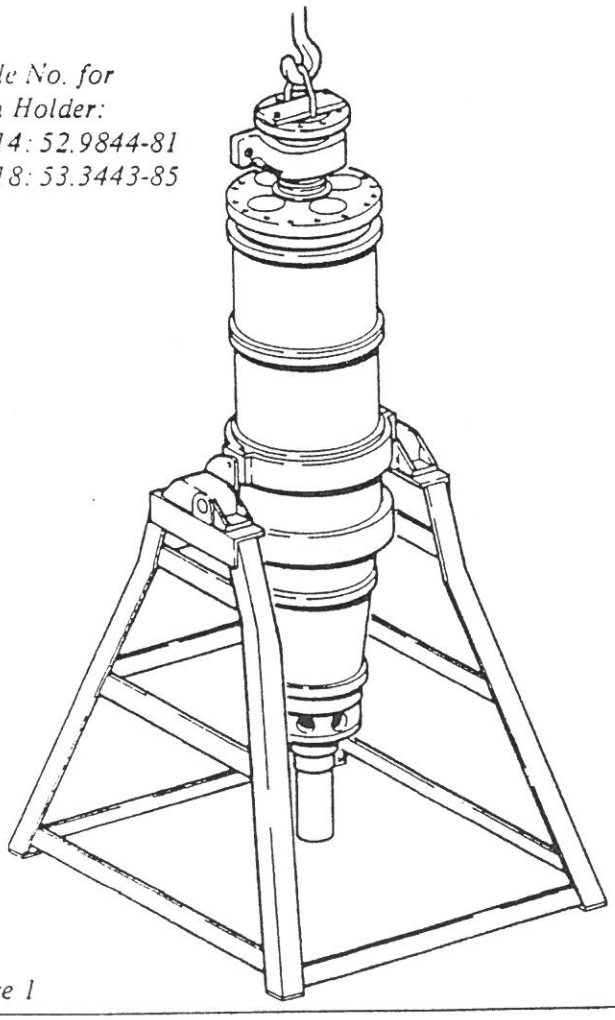
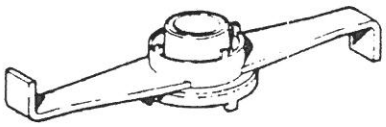
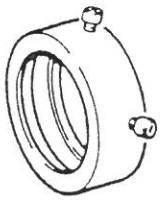


Figure 1



Pin Spanner (6120.6186-80)



Puller Ring (6120.7374-80)

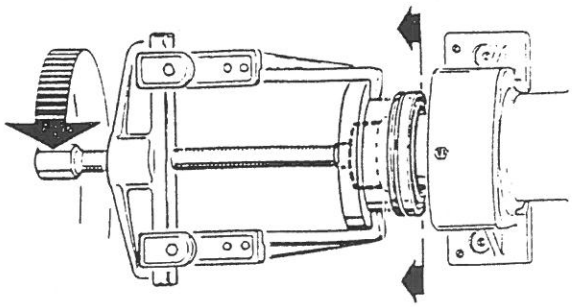
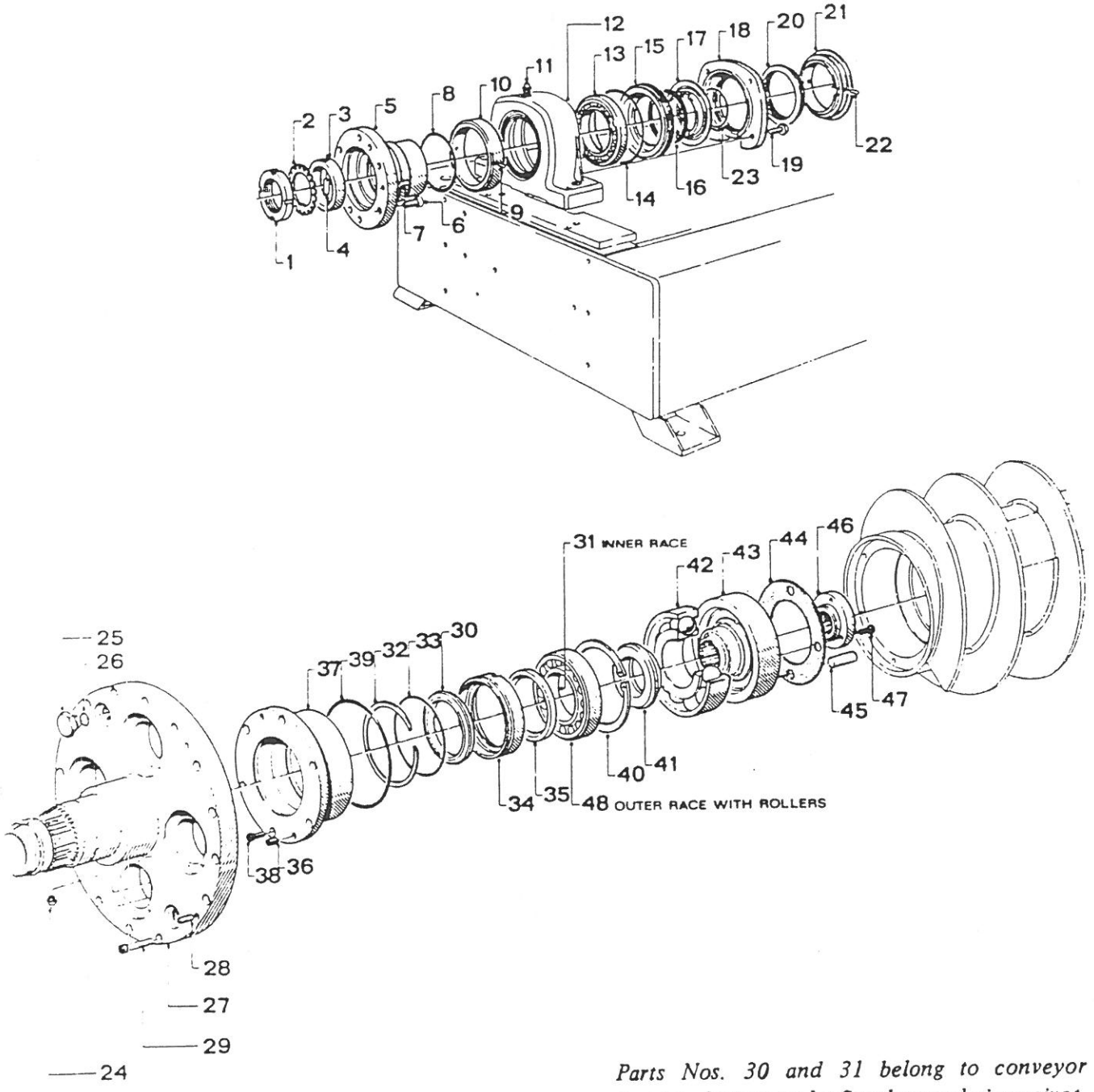


Figure 2



Parts Nos. 30 and 31 belong to conveyor bearing, but are to be fitted on end piece pivot. See Assembling the Gearbox End of the Drum, page 25, item 1. In axial-flow conveyors parts are a little different.

Figure 3

5. The grease valve disk (17) is removed after removal of the bearing inner race. If the grease valve disk and end piece seize, remove the disk by using the puller as shown in figure 4. The claws of the tool to rest against the bearing housing cover (18).

Note! If the disk is seized, damage may occur to the cover if excessive force is applied.

Reassemble the housing and cover, then pull off cover, housing, and disk together.

For paring disk machines: Pull off inner race of roller bearing and wear ring together.

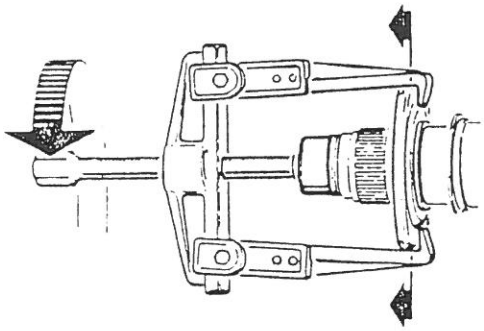


Figure 4

Assembling the Gearbox End of the Drum (Fig. 3 shows the sequence for assembling the parts):

1. The lip seal ring (30) of the large conveyor bearing must be fitted on the end piece pivot before mounting the roller bearing inner race (31). Apply ball bearing grease to the lip of the lip seal ring. Open side of ring to face against end piece.

Heat the roller bearing inner race in an oil bath of 80°C (175°F) before fitting it to the inner pivot. Push it in as far it will go.

Now fit the parts of the drum bearing to the outer pivot. Parts 21, 20, 18, 17, 16, and the inner race of the roller bearing (13) are placed on pivot in the order mentioned. Heat inner race in oil, 80°C (175°F), before fitting.

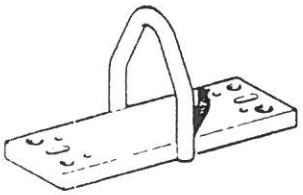
Fit remaining parts, lubricate rollers on outer race (13) with grease before fitting. When all bearing parts and the bearing housing are fitted, fit the gear flange as described in items 4 to 8, page 32.

2. When operating, the drum expands axially. The pillow block facing the gearbox allows this movement if the deflector has been adjusted as prescribed on page 34.

3. Fasten the 2 set screws (9) of the labyrinth ring (10).
(On some decanters the labyrinth ring is not fitted. Instead, the gear flange has a labyrinth in the end).

Disassembling the Large Conveyor Bearing:
(Refer to figure 3, page 23, for identification of parts).

1. Place the drum, without the large end piece, vertically in the drumholder and use the lifting tool to lift the conveyor straight up out the drum. Handle the conveyor carefully and do not damage the protruding tube. When lowering the conveyor, hold up the small end in order not to damage the tube. Protect the guiding surface at the end of the tube.



Holes made to fit all conveyors. Use screws: 6119.4001-23, M10x140 for axial-flow conveyors, otherwise 6119.4001-07, M8x100

Lifting tool

Dismantling and assembly of the bearing must be done with the conveyor lying flat, as it will not stand steady on its end.

2. Prior to disassembly, index the bearing holder flange and the conveyor edge with a centre punch to facilitate alignment when re-assembling flange and edge.

3. Remove the screws (38) and screw plugs (36) from the bearing holder (37). Back off the bearing holder by screwing two of the removed screws (38) into the screw plug threads, see figure 5 on this page. (Or use the T-handle screw to remove the entire assembly at one time - see item 4 below). The O-ring (39), snap ring (40), and roller bearing outer race with rollers (48) can now be removed. The snap ring (32), seal lining (34), O-ring (33), and lip seal ring (35) may also be removed for inspection.

If you need to remove the outer race and rollers of the roller bearing (48) and find it stuck in its seat, remove the two snap rings (32, 40) and the seal lining (34). Then tap the race out with a piece of pipe.

The seal lining (34) has an inner cylindrical sliding surface that the sealing lip of the end piece seal ring (30) slides on. If this surface shows deep wear traces, change the seal lining.

4. Using the T-handle screw (53.3453-81), back out the thrust ring (41), angular contact ball bearing (42), ball bearing holder (43), shim (44), and ejector disk (46), and maybe even the bearing holder (37) if not already removed - see item 3 on this page. Inspect the parts and replace, if necessary.

Figure 5 below illustrates the large conveyor bearing and the procedure for removing parts.

5. The T-handle screw does not fit bearings in axial-flow conveyors. Use the two jackscrews (Article No. 6119.4003-26, M8 x 100) for these conveyors, and back out the bearings.

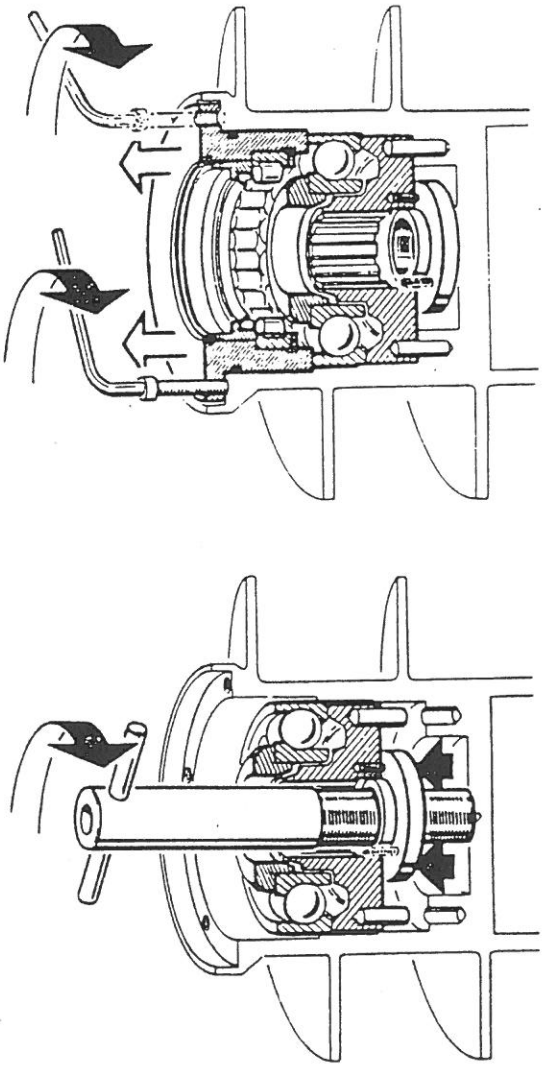


Figure 5

Assembling the Large Conveyor Bearing:
(Assemble the parts in the sequence shown in figure 3)

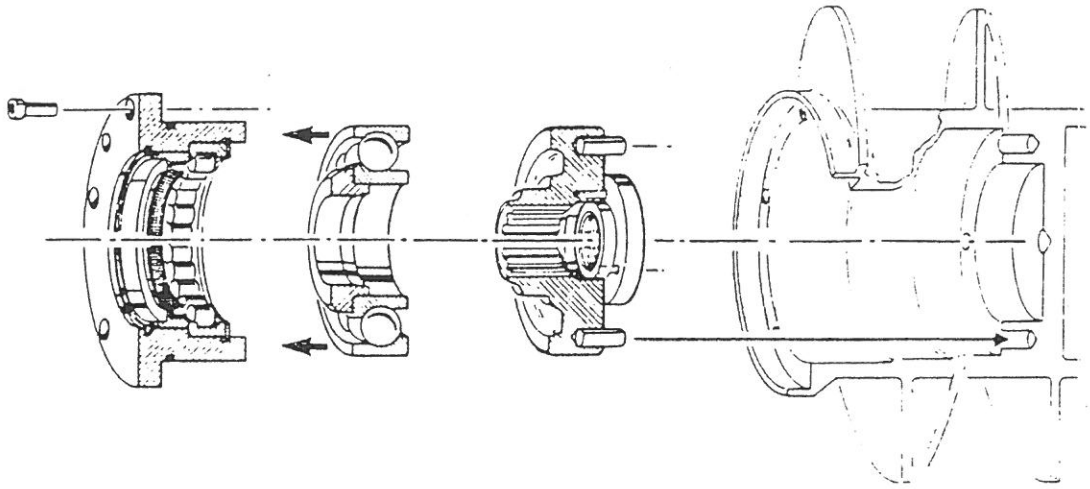


Figure 6

1. Fill the ball bearing holder (43) with ball bearing grease before installing the angular contact ball bearing. Be sure the narrow shoulder of the outer race (42) faces outward toward the gearbox end. See arrows in figure 6. If the ball bearing holder (43) cannot be pushed into its seat by hand, use a pipe for a drift and tap it in gently, carefully aligning its guide pins with the holes. Be sure the bearing holder bottoms out.

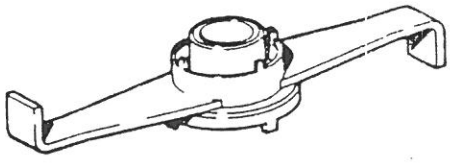
2. Assemble the parts in the bearing holder (37) in the following order (see figure 3):

a. Roller bearing outer race (48) with rollers.
b. Snap ring (40) facing roller bearing.
c. Lip seal ring (35) in seal lining. Be sure the lip seal is turned outward. See figure 6.
d. O-ring (33) in groove of seal lining (34).
e. Seal lining (34) in bearing holder (37).
f. Snap ring (32) facing seal lining (34).
g. O-ring (39) in groove of bearing holder (37).

Apply ball bearing grease to the sealing lip of the seal ring. Apply enough grease around the seal lining for the annular space between the lip seal ring of the lining and the part of the end piece (27) to be filled with grease when final assembly is carried out.

Disassembling the Feed End of the Drum:
(For illustrations, refer to figure 9, page 28)

1. Release the lock washer (39) by opening bent tab and remove the round nut (40), using the pin spanner. Remove the V-belt pulley (37). The puller shown in figure 7 may be needed to remove the pulley.



Pin spanner

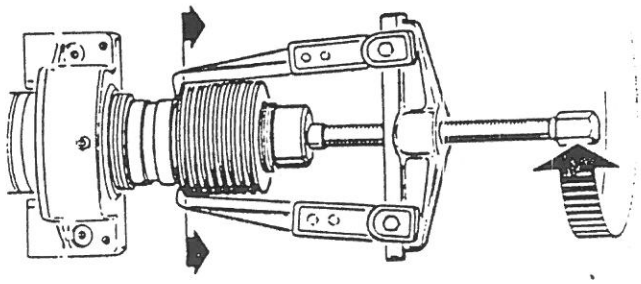


Figure 7

2. Remove the screws (24) of the bearing housing cover (25) and loosen the screws (35) of the labyrinth ring (34). Remove the bearing housing (32) and labyrinth ring (34).

3. Remove the bearing housing cover (25), grease valve disk (27), spacing ring (29), ball bearing (31), and spacing sleeve (36) with the puller as shown in figure 8. The claws of the puller should rest against the bearing housing cover.

Difficulties in removing these parts indicate that the spacing sleeve (36) has seized. If so, pull the spacing sleeve off by inserting the puller claws in the groove of the spacing sleeve.

4. Loosen the three set screws (13). Remove the thrust collar (12). Then use the special puller ring to remove the needle bearing inner race (7b), (see **Disassembling the Gearbox End of the Drum**, page 22, item 4).

5. Remove the screws (18) holding the end piece (19) to the drum. Remove the two screw plugs (16). Back off the end piece by screwing two of the removed screws (18) into the screw plug threads (or use the two screw plugs (16) as jackscrews).

Care should be taken to protect the needle bearing (7a, b) and the lip seal rings (8, 14).

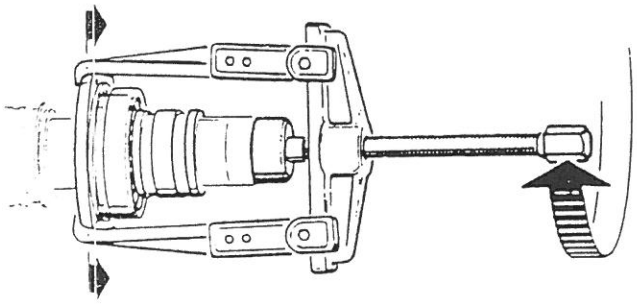
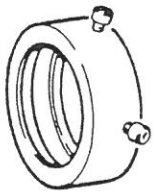
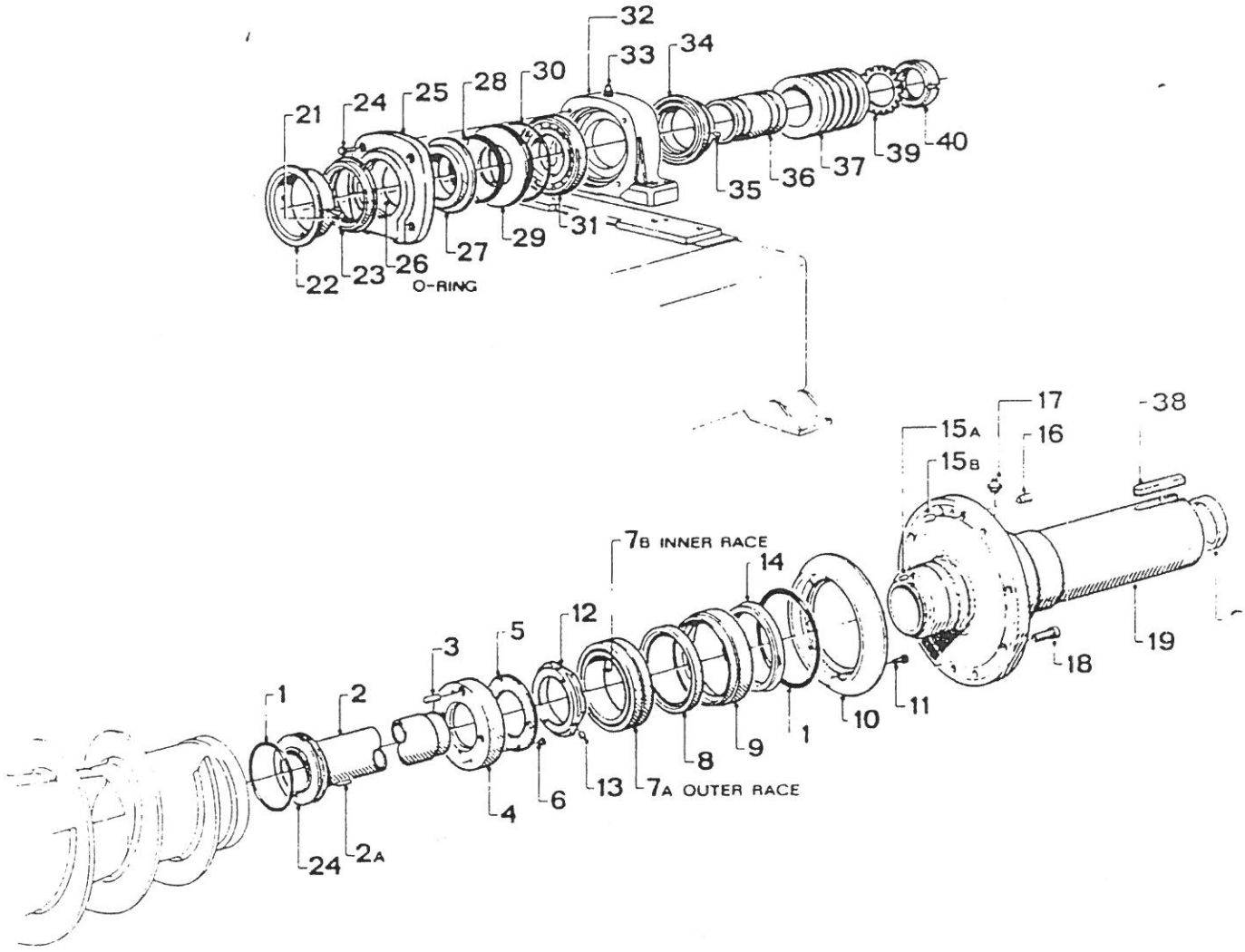


Figure 8



Puller ring



Parts Nos. 12, 13, 7b, and 14 belong to conveyor bearing but are to be installed on end piece pivot. See Assembling the Feed End of Drum, items 1 and 2.

Figure 9

Assembling the Feed End of the Drum:
(see figure 9)

1. Apply ball bearing grease to the sealing lip of the lip seal ring (14) or fit a new ring, if worn. Be sure the lip faces the right way. Apply grease to the new ring.

2. Heat the needle bearing inner race (7b) in an oil bath having a temperature of 80°C (175°F) before fitting it on the end piece pivot. Fit thrust collar (12) and tighten the three set screws (13).

3. Heat pillow block ball bearing (31) in oil having a temperature not exceeding 80°C (175°F) before fitting it on the end piece outer pivot. Allow to cool, then lubricate the ball bearing with grease of the type stated on page 16. For inspection and exchange of bearings, see page 41.

Disassembling the Small Conveyor Bearing:
(see figure 9)

1. The bearing parts are mounted in the end of the conveyor, see figure 10. Take off the lock ring (10) after removing the screws (11) holding it to the conveyor. Not all lock rings are tapered as shown in figure 10, but they are removed likewise.

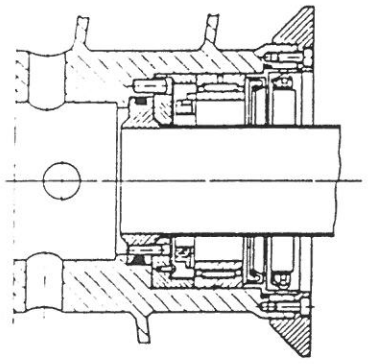


Figure 10

2. Using the jack screws, ease out the puller disk (4), shim (5), needle bearing outer race with needles (7a), lip seal ring (8), and seal lining (9) as shown in figure 11.

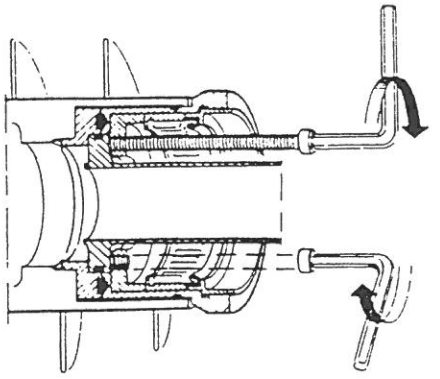


Figure 11

3. If necessary, the protecting tube (2) can be removed. Inspect parts carefully, and replace them if required.

4. The seal lining (9) has an internal cylindrical surface that the sealing lip of the end piece slides on. If this surface shows deep traces of wear, exchange the seal lining.

Assembling the Small Conveyor Bearing:
(see figure 9)

1. If the protecting tube (2) has been removed, fit a new O-ring (Pos. 1b, article No. 22.3412-69). Apply grease to the O-ring before fitting it. Fit the protecting tube in the conveyor.

2. Fit the puller disk (4). Observe alignment of the pin (2a) on the protecting tube flange, at the same time observing alignment with the pin (3) in the conveyor.

3. Install the needle bearing outer race with needles (7a). Apply grease to the bearing before installing.

Secure the race by means of Locktite. Be sure that no Locktite enters lubricating holes by applying Locktite only to the outer half of the surface, see figure 12.

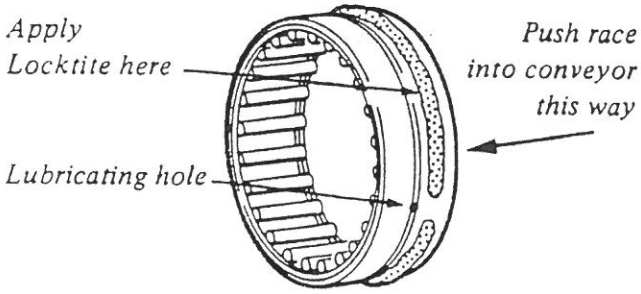


Figure 12

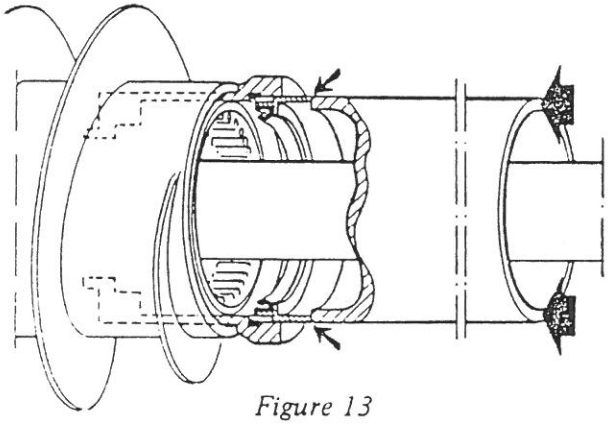


Figure 13

4. Fit an O-ring (1a) in the groove inside the conveyor. Apply grease to the O-ring before fitting it.

5. Fit a new lip seal ring (8) in the seal lining (9). Be sure that the sealing lip faces the right way (open side of ring toward the needle bearing).

6. Fit the seal lining (9), pressing it evenly and straight into its seat in order not to damage the O-ring. Using a piece of pipe with the same outer diameter as that of the seal lining and with bevelled end plane might help. See fig. 13.

7. Fit the tapered lock ring (10). Fit and tighten the screws (11).

8. Apply grease to the sealing lip of the lip seal ring. Apply enough grease for the annular space between the lip seal ring and the end piece to be entirely filled when assembling the parts.

Inserting the Conveyor into the Drum:

See item 2 on page 32.

Disassembly and Assembly of the Drum:

The drum itself ought not to be taken apart. However, if it should be necessary to do so, it is essential that the cylindrical sections are reassembled in their original order (NX 416/418) and the right way round; otherwise the drum will get out of balance.

Markings on the flanges (AA, BB, CC) indicate the sequence.

Screws: According to their length the screws are divided into 3 groups, each used to join various parts of the drum unit:

Long screws: For fastening the large end piece to the drum.

Short screws: For fastening the small end piece to the drum.

Medium length screws: For joining sections of the drum itself.

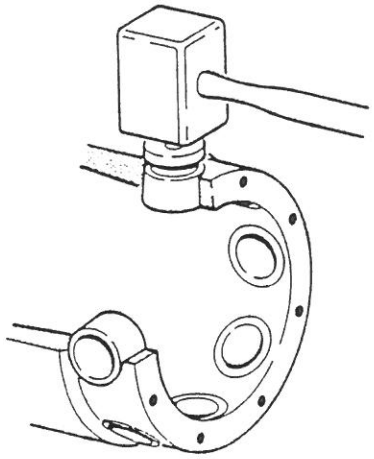
Lubricating and tightening the screws:

Apply castor oil or ball bearing grease to the screw threads.

Fit the screws two at a time in diametrically opposed holes, tightening them to at least half the specified torque and placing each opposite pair in the holes farthest away from the previous pair. Then tighten all the screws to 17 kpm (123 lb.ft) in the same sequence, i.e. in diametrically opposed pairs, each succeeding pair farthest away from the preceding pair.

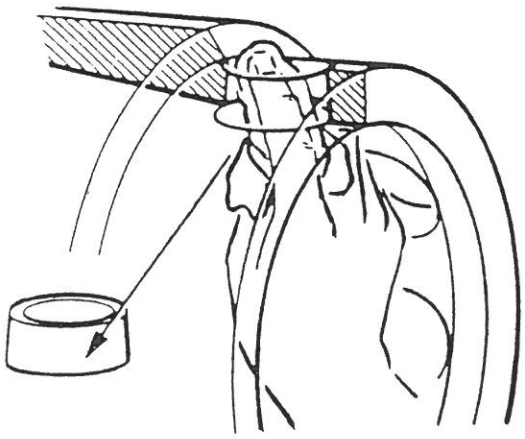
Finally, check that the screws are correctly tightened all the way round.

Discharge Bushings: Refitting of new sludge discharge bushings is done while the small end piece and the conveyor are separated from the drum.



Use the drift (7.3029-00) and a soft hammer to force out the old bushings. Hold a hand under the bushing - or place some rags in the drum - to prevent the loosened bushing and the drift falling out of the hole in the conical part of the drum from damaging the inside of the drum.

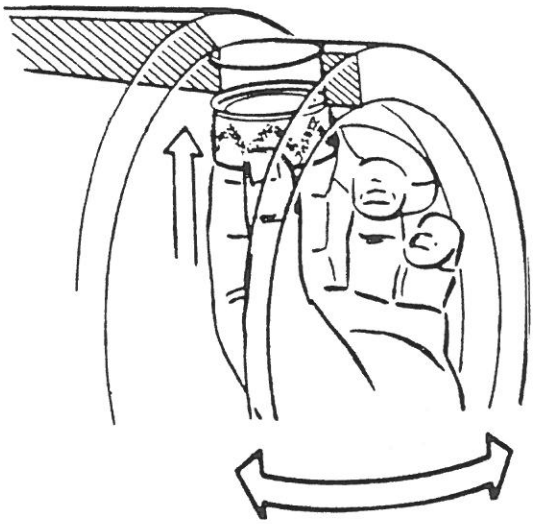
Fitting the Discharge Bushings:



1. Wipe off oil and grease from the external surface of the discharge bushing and from its seat in the drum.

2. Clean both surfaces carefully of old Loctite, using a clean, spirit-moistened cloth.

3. Apply, in zigzag, a thin layer of Loctite 270 to the cleaned surface of the discharge bushing.



4. Insert the bushing into the seat. Holding it as shown in the above sketch, turn bushing to and fro until it is felt to be "floating", then press the bushing into place without using any tools.

Hardening Time:

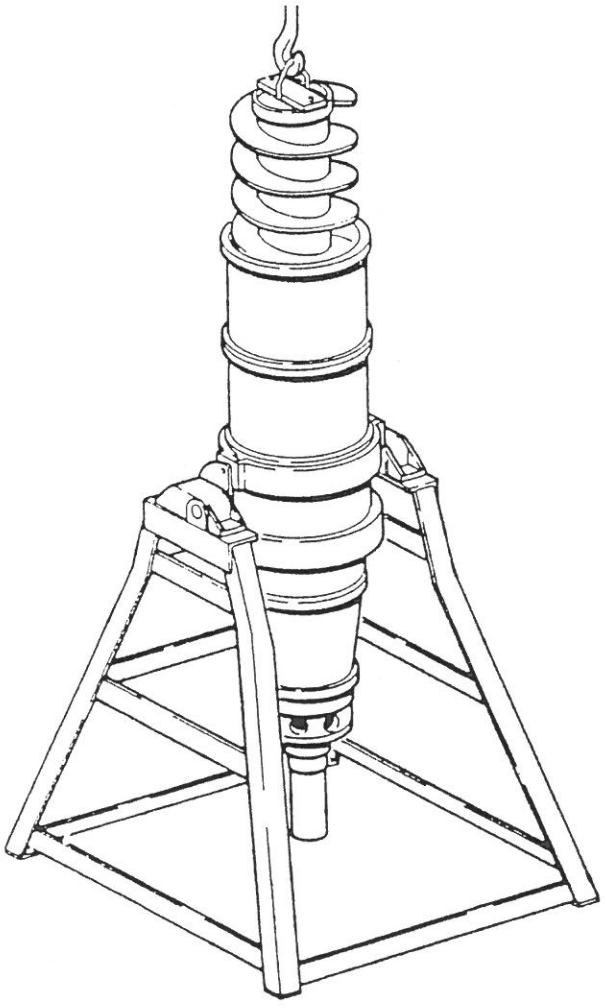
Handling strength:	after 20 minutes.
Maximum strength:	after 3 hours.

Assembling Drum and Conveyor:

1. Fasten the small end piece to the drum.

2. Insert the conveyor in the drum. Before mounting, lubricate the cylindrical guiding surface on the protruding end of the protecting tube.

The conveyor must be inserted with the drum vertical - and preferably, fixed in the drum holder.



3. Fasten the large end piece to the drum.

4. Refit the gear flange, if it has been removed. First carefully clean all traces of oil, grease, and dirt off the bearing surfaces on the gear flange and large end piece. Use a pocket-knife or the like to scrape off - with utmost care - residues of old Locktite.

5. Using a clean, spirit-soaked cloth, clean the bearing surfaces carefully.

6. Apply an even coat of Locktite 225/222 to the bearing surfaces of one of the parts.

7. Mount the gear flange on the large end piece, tighten round nut and secure with the lock washer.

8. Locktite Hardening Time:

2 hours at 20°C (68° F).

9. Place the drum unit on the frame and fasten the bearing housings to the frame - see description on page 34.

10. Check radial and axial runout of the gear flange as described and as shown in figure 14 on page 34.

Fitting a New Conveyor: If the conveyor is changed, the space between the conveyor fligths and the concical section of the drum and the axial clearance between the drum and the new conveyor must be adjusted.

1. Dismantle both end pieces.

2. Place the conveyor in the drum so that it touches the cone.

3. Measure the distances a, b, d, and e as shown on the sketches.

When measuring the distance "b", proceed as follows (see figure 3 page 23): The lip seal ring (30) of the large conveyor bearing must be fitted on the end piece pivot before mounting the roller bearing inner race (31). Apply ball bearing grease to the lip of the lip seal ring. Open side of ring to face against end piece.

Heat the roller bearing inner race in an oil bath of 80°C (175°F) before fitting it to the inner pivot. Push it in as far it will go. Let race cool 5 minutes, then place the end piece, for instance on two wooden boxes or the like, with the outer pivot pointing down, the inner pivot pointing upwards.

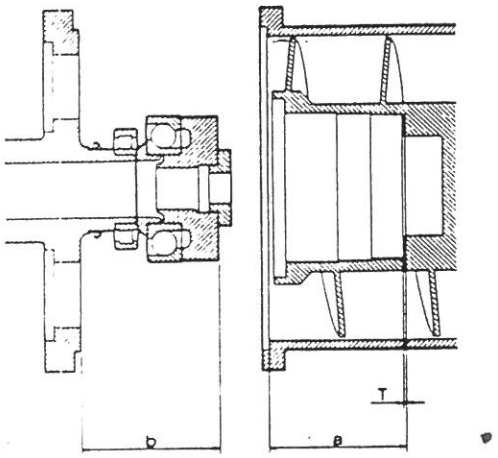
On top of the inner race now fastened to the pivot place the supporting ring (41), the ball bearing (42), and the ball bearing holder (43) - all placed the same way as when later fitted in the conveyor. Now measure the distance "b" from inside the large end piece to the outside of the ball bearing holder - see sketch.

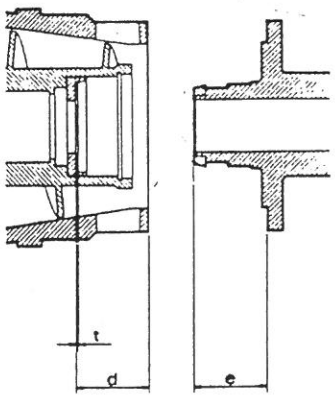
Before measuring the distance "e" at the small end piece, place the thrust ring (12) at the inner pivot (see figure 9, page 28). Fasten the three set screws (13). Make sure the screws enter the groove in the pivot.

4. Calculate the difference a - b and find, by means of table 1, the adjusting washer or washers to be placed at position T between conveyor large end bore and bearing arrangement.

5. Calculate the difference d - e and find, by means of table 2, the adjusting washer or washers to be placed at position t between conveyor small end bore and bearing arrangement.

6. When drum and conveyor and both end pieces are assembled, check axial play of conveyor. Move the flight at one of the sludge ports with a piece of pipe or a large screwdriver. Take care not to damage the flight and its wear protection layer and the edges of the discharge bushing. Measure the movement at the protecting pipe at the inlet. The axial play must be between 0.6 mm and 2.0 mm.





Difference (a - b) mm	Adjusting Washer Article No.	T mm
1.6 - 2.5	None	0
2.6 - 3.5	1 x 6120.6106-01	1
3.6 - 4.5	1 x 6120.6106-02	2
4.6 - 5.5	1 x 6120.6106-01 1 x 6120.6106-02	3
5.6 - 6.5	2 x 6120.6106-02	4

Table 1

Difference (d - e) mm	Adjusting Washer Article No.	t mm
0.0 - 0.4	1 x 6120.6299-01	1
0.5 - 0.9	1 x 6120.6299-02	1.5
1.0 - 1.4	2 x 6120.6299-01	2
1.5 - 1.9	1 x 6120.6299-01 1 x 6120.6299-02	2.5

Table 2

Inserting the Drum in the Machine:

Tilt the holder to bring the drum into the horizontal position.

Place the stirrups of the lifting yoke around the drum.

Attach the stirrups to the lifting yoke.

Hook the lifting hook into the yoke eye located farthest away from the gearbox.

Make sure that the surfaces of the bearing housings in contact with the frame and the corresponding frame surfaces are perfectly clean.

Lower the drum/bearing housing unit carefully into the machine.

Line up unit in its exact position by visually sighting through the taper pin holes.

Insert the taper pins of the bearing housings with gentle taps - no hard blows - and tighten the nuts - no tools. Put plastic caps on top of the nuts to secure them from being "tightened" - this will pull pins out.

Fasten the bearing housings, not forgetting the spring washers.

Runout:

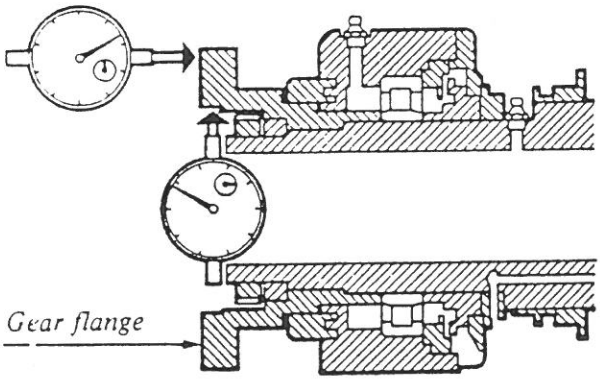


Figure 14

Measure the radial and axial runout of the flange surfaces in contact with the gearbox - see above figure.

Neither the radial nor the axial runou must exceed 0.02 mm. If larger, trace and remedy the cause of the error. Too much runout will result in bad running and cause harder wear on the machine.

Mount the gearbox to the drum - see page 21

Deflector:

The deflector at the end piece facing the gearbox must be fitted with allowance mad for the axial expansion of the operating drum.

Adjusting the Deflector:

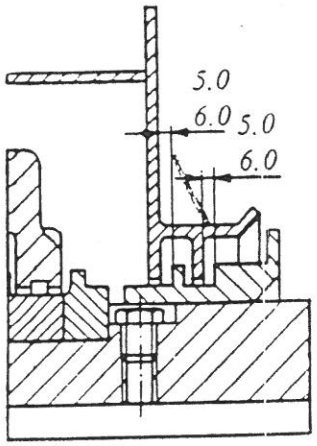


Figure 15

Adjust according to measurements in above illustration, using modelling clay to measure the gaps. When deflector adjusted, fasten the two set screws.

Fit the belts and adjust tension - see page 42.

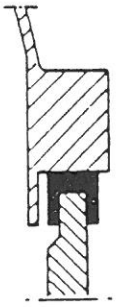
Feed Pipe:

Fit the feed pipe. Make sure that the inner mouth of the feed pipe is directed downward.

COLLECTING VESSEL

Renewal of Gaskets between Cover and Collecting Vessel:

Gasket Design:



Gasket fastened to rim of collecting vessel

inding Agent for Cementing Gasket to Vessel (or cover):

3M Fastbond 10 Contact Cement.

xicity: The cement is classified as toxic (contains toluene solvent).

The solvent irritates eyes, mucous membranes, and skin. Use protective gloves.

After skin contact wash with soap and water. Avoid direct inhalation of the vapour and provide good ventilation.

Fire Hazard: Containing volatile and inflammable solvents, the cement belongs to the category classified as very hazardous in respect of fire.

Existing fire safety regulations must be followed for transport, storage, and use.

Make sure the ventilation is satisfactory and the cement is not applied near an open flame.

Storage: The most suitable storing temperature is 15 - 25°C (59 - 77°F).

Long storage at higher temperature may slightly increase the viscosity.

Removal of Gasket Cemented with Fastbond 10:

Spray toluene from a clean oil can direct on the cement bond in order to separate the surfaces a little.

Continue spraying the cement bond while slowly pulling away the gasket until it comes loose. Do not pull too hard or too quickly.

Removal of remaining cement is not necessary. Let the solvent dry completely and apply fresh Fastbond 10 as explained below.

Preparation of the Contact Surfaces: To obtain a good cement bond the contact surfaces must be clean, smooth and dry.

Dirt, dust, oil, loose paint, grease etc. must be removed.

Clean the contact surfaces of the collecting vessel with solvent.

Cemeting the Contact Surfaces:

Applying: Put Fastbond 10 cement in an even coat on both surfaces to be joined together.

Drying: Let the cement dry for about 10 minutes.

If the surfaces are completely covered by a bright film after drying, sufficient cement has been used.

Joining: When the cement is completely dry, fit the contact surfaces together. Use a pressing roller or the like.

CLEANING

The machine must be cleaned at certain intervals. How often the drum needs to be stopped, dismantled, and cleaned must be learned by experience. It depends, among other things, on the type of sludge contained in the process liquid.

Parts	Cleaning Agents
All bearings, oil grooves, centre holes of end pieces, exterior of protecting tube and all other parts in contact with lubricants.	Cleaning kerosene, white spirit, mineral spirit or other solvent with equivalent properties. Benzine or trichlorethylene may also be used, be used, but if so, the cleaning should be done in the open air owing to risk of explosion when using benzine, and because trichlorethylene gives off poisonous vapours, especially with open flame or hot objects present.
Parts in contact with liquid or sludge.	Hot water, possibly mixed with detergent. If the deposits are difficult to remove in this way, the parts can normally be cleaned with a soda or trisodium phosphate solution, or with any current technical defatting agent on an alkaline basis, concentration 1 % approx. If this method fails too, an authorized ALFA-LAVAL representative should be consulted on the choice of solvent.
Seal rings, O-rings.	With a cloth, possibly moistened with a suitable cleaning agent.

OVERHAUL

The time intervals stated below relate to continuous operation. Intervals can be extended if the number of hours in operation has been less than stated in the table.

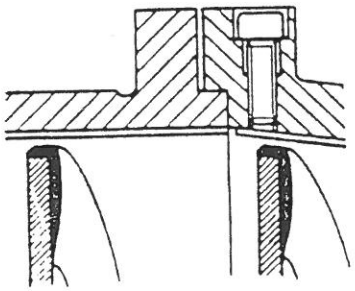
Every day (24 hours)	**Operation Check:** Machine run. Power consumption. Observation of discharged liquids.	Temperature. Throughput. Pressure.
Every two weeks (300 hours)	**Drum:** Lubrication of conveyor bearings (see page 16).	**Overload Guard** (non–rotating small sunwheel): Check release mechanism.
Every three weeks (450 hours)	**Drum Bearings:** Lubrication (see page 16).	
Every month (750 hours)	**Gearbox:** Change of gear oil (see page 16).	**Drum:** Check tightening of round nuts at belt pulley and indside gear flange.
Every two months (1500 hours)	**Lip seal rings:** Check them and exchange if necessary.	**Vibration damper screws:** Check tightness.
Every six months (4500 hours)	Cleaning and lubrication. Bearings.	Corrosion and other material attacks. Conveyor wear.
Every year (9000 hours)	**Frame:** Touch up the paint. Check elasticity of vibration dampers and mounting of machine.	**Motor:** Check condition.

Certain bearings need to be lubricated before operation if the machine has been idle for at least 150 hours - see page 16.

Checking the Conveyor Wear: The scraping edge of the conveyor is subjected to wear as the conveyor transports the solids towards the narrow end of the drum. The rate of wear depends on the type and particle size of the solids. Wear will reduce the solids handling capacity and thus the separating result.

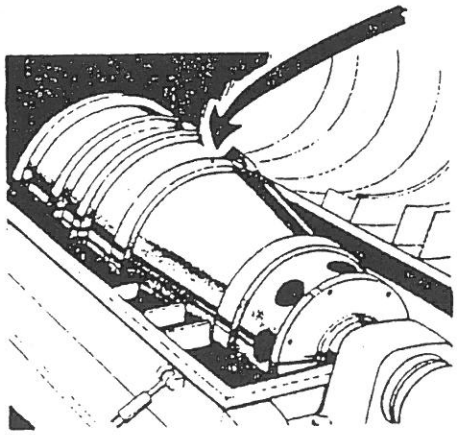
Far advanced wear - i.e. 5 mm radially or more - will also cause high repair costs. It is therefore necessary to check the wear regularly and observe how rapidly it progresses.

Normally the heaviest wear on the scraping edge occurs in the zone where the the conical and cylindrical sections of the drum meet.

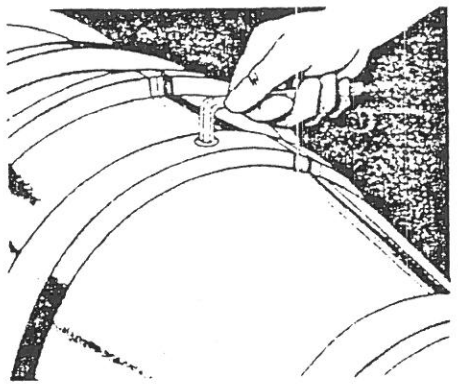


It is possible to measure the wear in this zone without dismantling the drum. In the flange of the conical section there is a hole (plugged with a screw) through which measurements can be made with of a caliper gauge. See below.

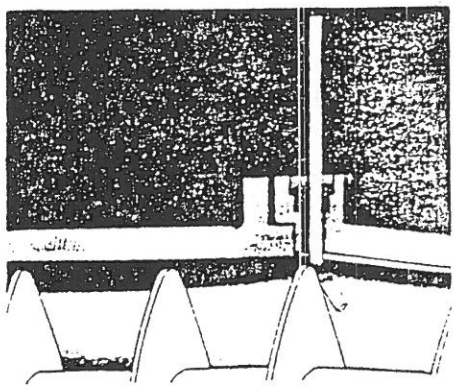
Measuring the wear:



1. Open the cover and rotate the drum by hand until the gauge hole in the flange at the conecylinder transition is uppermost.

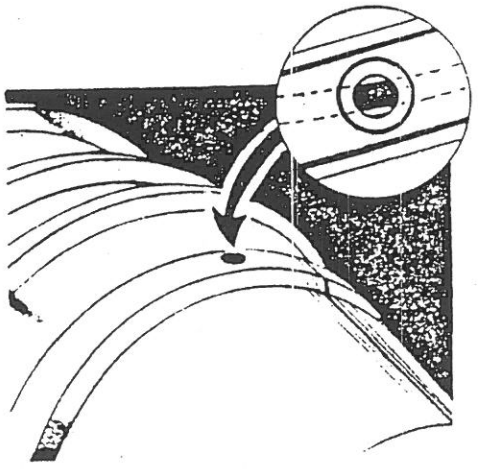


2. Remove the screw plug and clean the hol

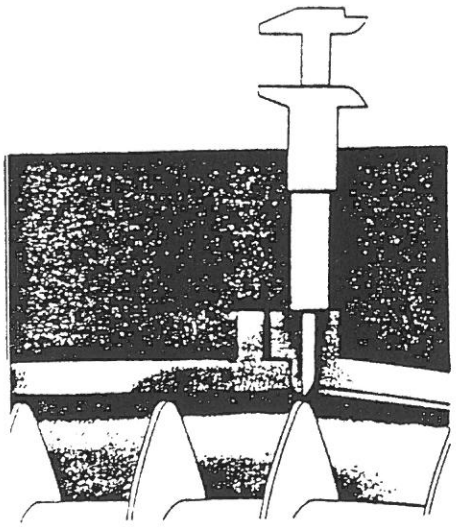


3. Align the conveyor flight with the gau hole by turning the small sunwheel o gearbox.

A wooden taper inserted in the hole mig help to indicate when the flight is lined u

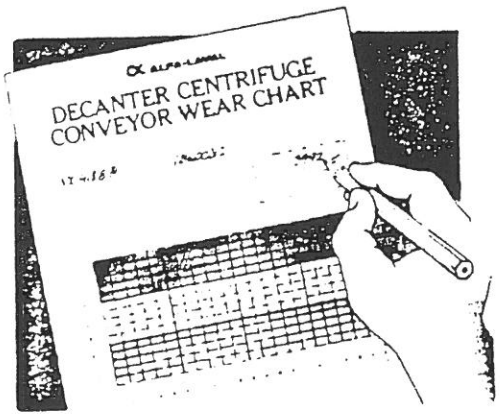


Or look through the hole and check when flight can be seen.



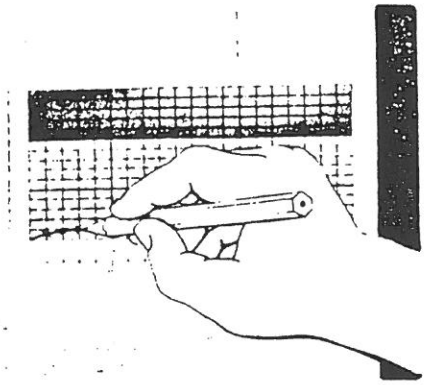
4. Insert a caliper gauge in the hole and measure the depth. Measure to the **highest** point on the edge of the flight.

Please Note: The caliper gauge must always face in the same direction when measuring.

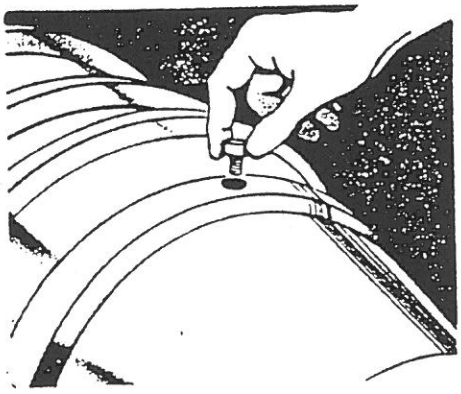


5. Make the first **measurement when the conveyor is new, before it has been operated.** This is your calibration measurement. Make a note of it on the wear chart on next page.

6. Repeat the procedure after every 100 hours' operation. To find the wear, subtract the original calibration reading from the latest reading.

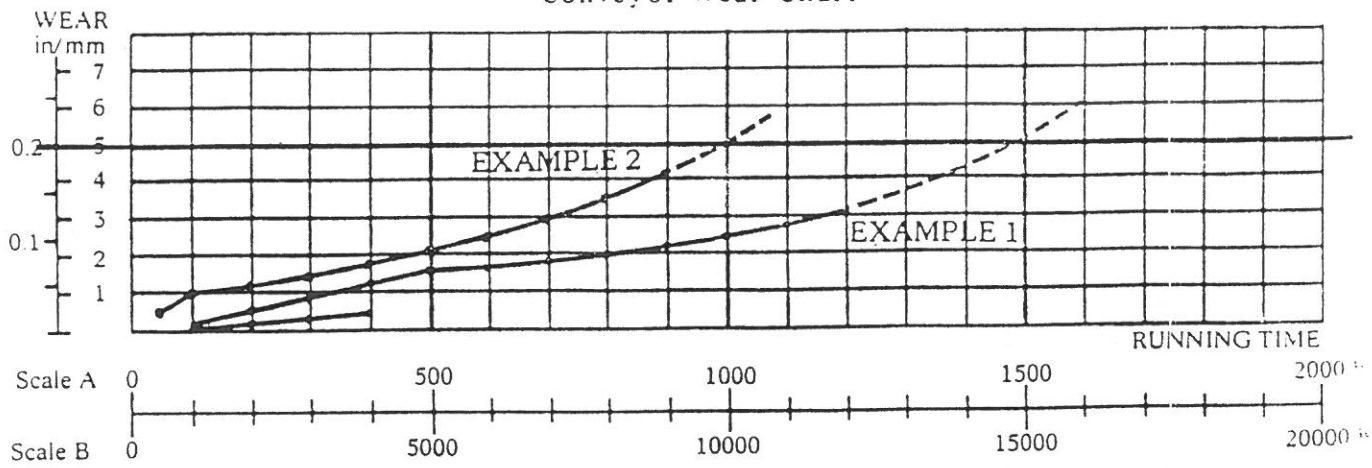


7. Plot the readings on the wear chart (see next page).



8. **Do not forget to replace the plug!**
Lubricate it first with castor oil or ball bearing grease, and tighten to a torque of 22 Nm (2.2 kpm, 16 lb.ft).

Conveyor Wear Chart



How to use the chart:

1. Measure for calibration before the conveyor is run for the first time and enter the calibration reading in the box above the chart.
2. Consult your Alfa-Laval service representative about the acceptable limit of wear for the duty in question. Mark the limit by drawing a line across the chart (at 5 mm in example above).
3. Measure every 100 hours and plot the readings on the chart according to Scale A (0-2000 hours).
4. If wear is less than 1 mm (0.04") after 400 hours, shift to Scale B (0-20000 hours) and measure wear every 500 or 1000 hours.
5. By extrapolating from the plotted curve you will be able to predict approximately when the conveyor will need servicing.

Example 1:

Wear is just over 1 mm (0.04") after 400 hours. Continue to measure every 100 hours. After 1200 hours, extrapolation indicates that the acceptable limit of wear (in this case 5 mm) will be reached at about 1500 hours.

Note the characteristic profile of the wear curve: first a linear rise until the conveyor is run in, then a period of stability and finally a progressive increase in the rate of wear.

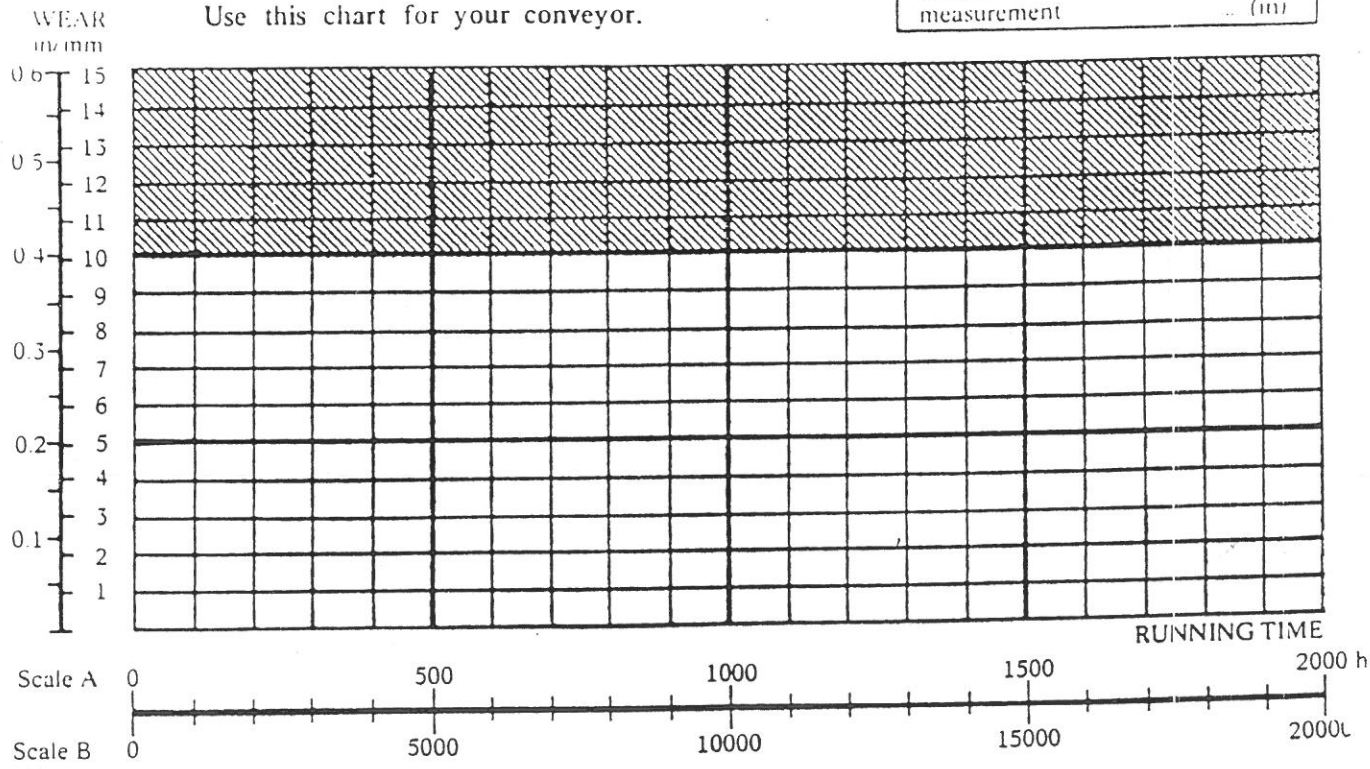
Example 2:

Wear is only 0.5 mm (0.02") after 400 hours. The frequency of measurement can now be reduced to 1000 hours (Scale B).

After 9000 hours, extrapolation indicates that the acceptable limit of wear will be reached at about 10000 hours.

Use this chart for your conveyor.

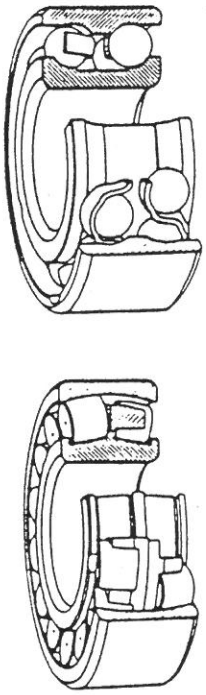
Calibration measurement	mm (in)



Additional copies of Conveyor Wear Chart are forwarded on demand.

MAINTENANCE

Bearings (ball bearings and roller bearings etc.):



Note the following directions for inspection and exchange of bearings:

- Leave the bearing in its wrapping until ready to fit.

- A new bearing is covered with grease. Leave the grease untouched.

- If a bearing is heated in oil before mounting, the oil temperature must not exceed 80°C (175°F).

  As soon as the bearing is thoroughly warm, remove it from the oil bath.

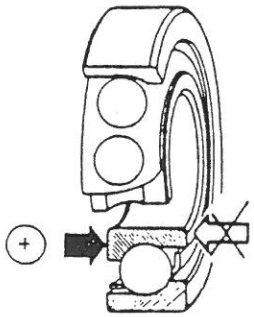
- A bearing should never be forced on to a shaft by blows applied to the outer race, nor into a housing or seat by pounding on the inner race.

- A bearing which has been taken out of the machine must be replaced.

- Make sure that no impurities (burrs) get into the bearing during mounting or afterwards. Never spin an ungreased bearing.

  Never blow a bearing with compressed air.

Single-row Angular Contact Ball Bearings:



In a single-row angular contact ball bearing each ball race has a high and a low shoulder. It is essential to fit the bearing the right way round, as an axial load on the low shoulder would damage the bearing.

In SKF bearings an impressed mark ⊕ indicates the side of the inner ball race on which the axial load should act.

V-belts: New belts can be fitted only after the feed pipe has been removed.

Move the motor on its slide rails, pushing it towards the machine so that the belts can be placed in the pulley grooves by hand. Never force the belts into place with tools or the like.

Align the motor belt pulley with the machine belt pulley.

Check that the motor is not pulled askew and that the belt pulleys are in line with each other so that the belts run straight.

Tighten the belts as described on the next page.

Fasten the belt guard and the feed pipe.

Belt Tension: It is important that the belts are correctly tensioned. If a belt is too loose it will slip on its pulley and quickly wear out; if it is too tight it will cause wear on the bearings.

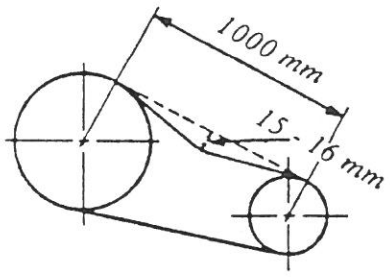
Proceed as follows to get the correct tension:

1. Take up the slack at the top. Adjust the distance between centres to a light tension and rotate the drive parts a few turns by hand.

2. Adjust the distance between centres until all belts lie well.

Start the motor and run the drive parts for some minutes so that the belts can seat themselves in the grooves.

3. Stop the motor and adjust the distance between centres until all belts lie evenly and are properly tightened.



Depression between pulleys:
15 - 16 mm per 1000 mm distance between shaft centres. (5/8" per 40" shaft distance).

In a new machine the belts should be retensioned after some time. After this, further tightening will mostly be unnecessary, as the length of the belts remains practically constant. When exchanging belts, never force them over the side of the pulley, but always loosen the motor mounting first.

Check the belt tension from time to time.

Cleaning: The working life and proper functioning of the belts depend to a high degree on how they are cared for.

Oil and grease will soon perish and ruin them.

Oily or greasy belts can be suitably cleaned with a rag soaked in some grease-dissolving agent such as petrol or trichloroethylene.

Exchange: When one or more of the belts are worn out, put on a complete new set of belts.

Storage: If the machine is taken out of operation for some time, the belts should be removed from the pulleys and stored hanging - not rolled up - in a cool, dark place.

Spare belts in sets should be stored in the same way.

Belt Pulley with "TAPER-LOCK" Bushing:

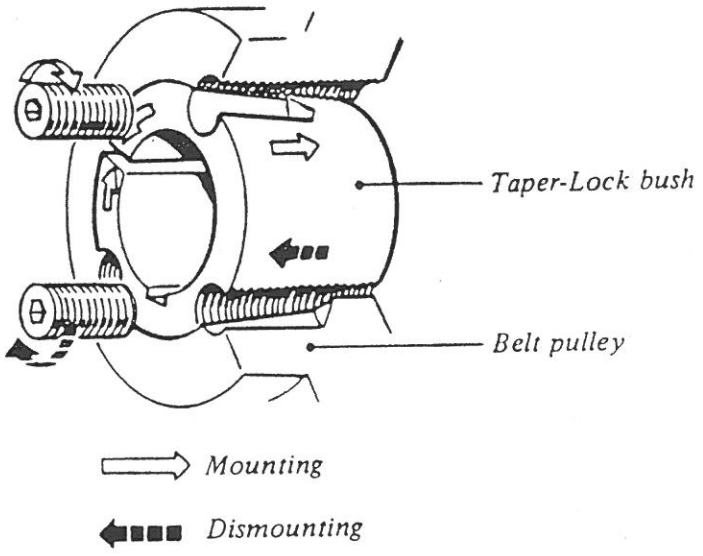
The sketch on next page shows the hub of a belt pulley fitted with a "Taper-Lock" bushing.

The split bush is cylindrical on the inside and tapered on the outside, in which there are two semi-cylindrical dead-end holes (in larger bushes three) and one semi-circular threaded through hole.

The bore in the belt pulley hub has the same taper as the clamping bush. In the hub bore, facing the dead-end holes of the bush, are two semi-cylindrical threaded through holes and, facing the threaded hole of the bush, a semi-cylindrical dead-end hole.

When mounted, screws placed in the threaded bores of the hub will press the clamping bush into the tapered bore of the hub. Being split, the bush will clasp the shaft with increasing force as the screws are tightened. When the bush is pressed far enough into the hub bore, it will clamp the shaft with the same force as if mounted with an interference fit.

Belt Pulley with "TAPER–LOCK" Bushing



Mounting (upper half of figure):

Carefully clean the parts.

Put the bush into the hub and align the holes.

Place the screws in the threaded holes of the belt pulley hub.

Push the unit on to the shaft and align it axially.

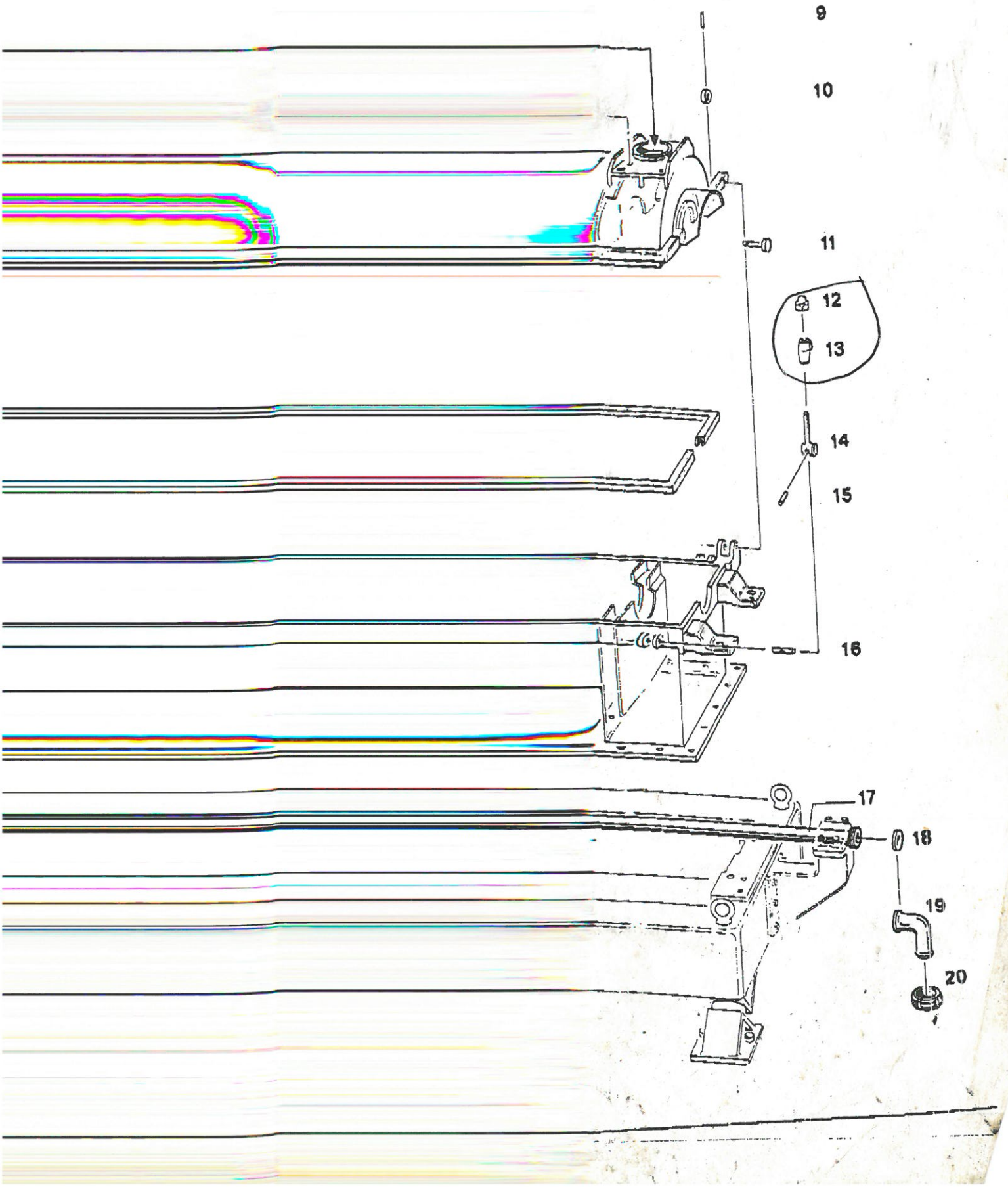
Tighten the screws alternately, using a hexagon key. Tighten until the Taper-Lock bush is pressed in far enough.

Dismounting (lower half of figure):

Remove the screws and place one of them in the threaded hole of the Taper-Lock bush.

Tighten the screw until the bush comes loose.

The belt pulley can be pulled off by hand.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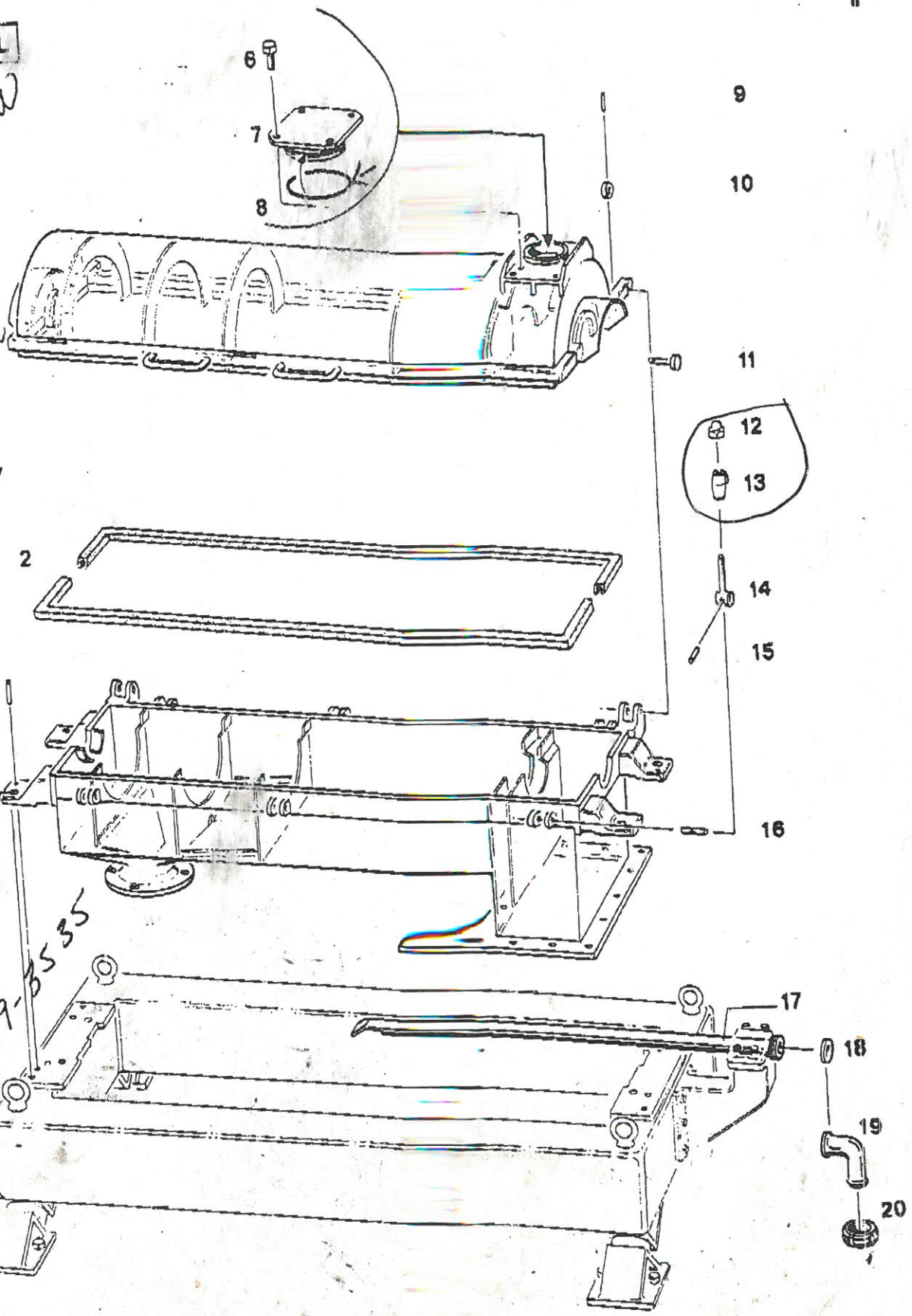
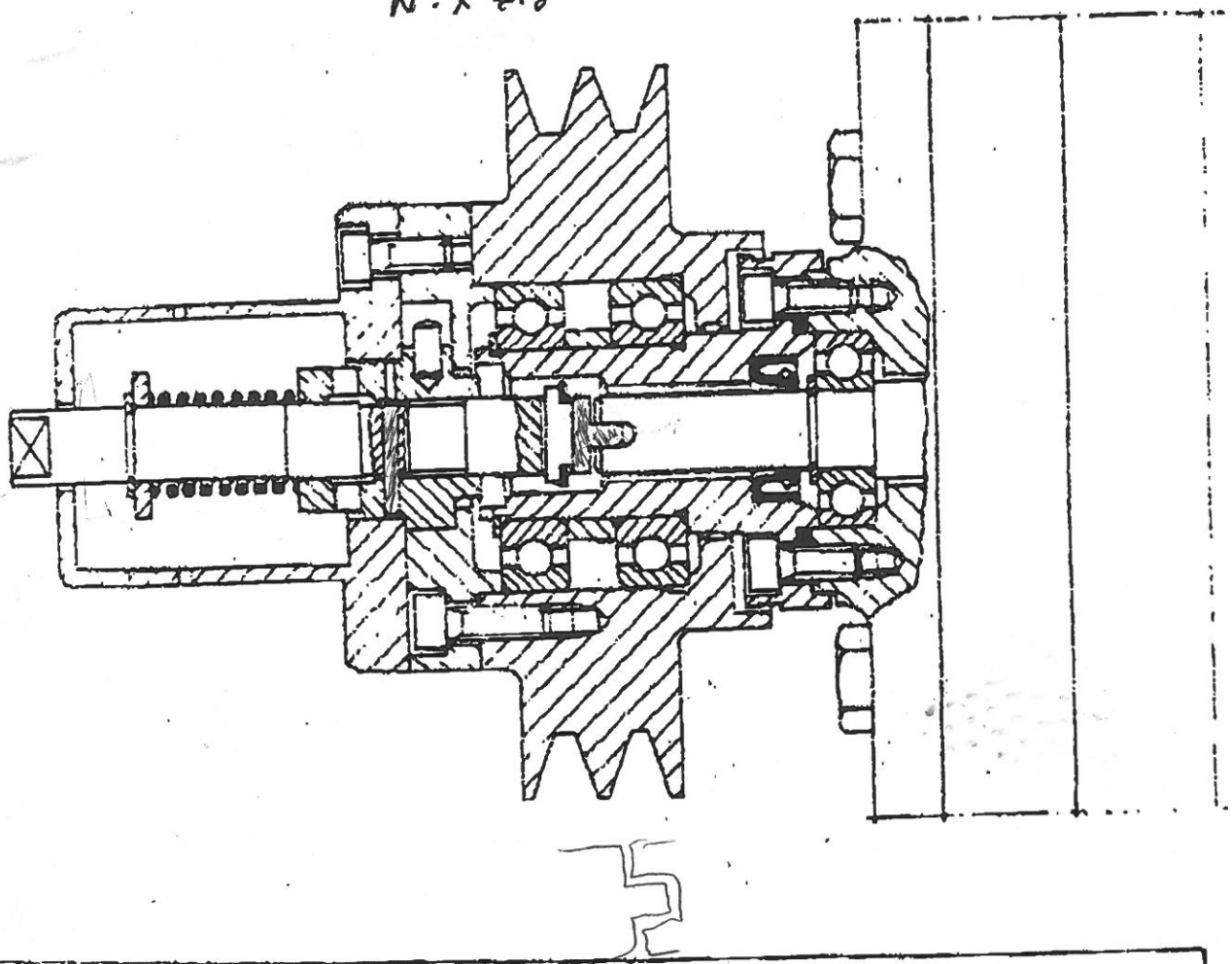
ALFA-LAVAL



Mr Jean Duchesneau
re your leaking
for cover gasket
for item # 2
or item # 8
Regards
Diane.
Ph. 416-297-
6303
FAX 416-299-3535

GEAR BOX with SHEAR PIN COUPLING and DEVICE FOR DRIVING the SMALL SUN WHEEL

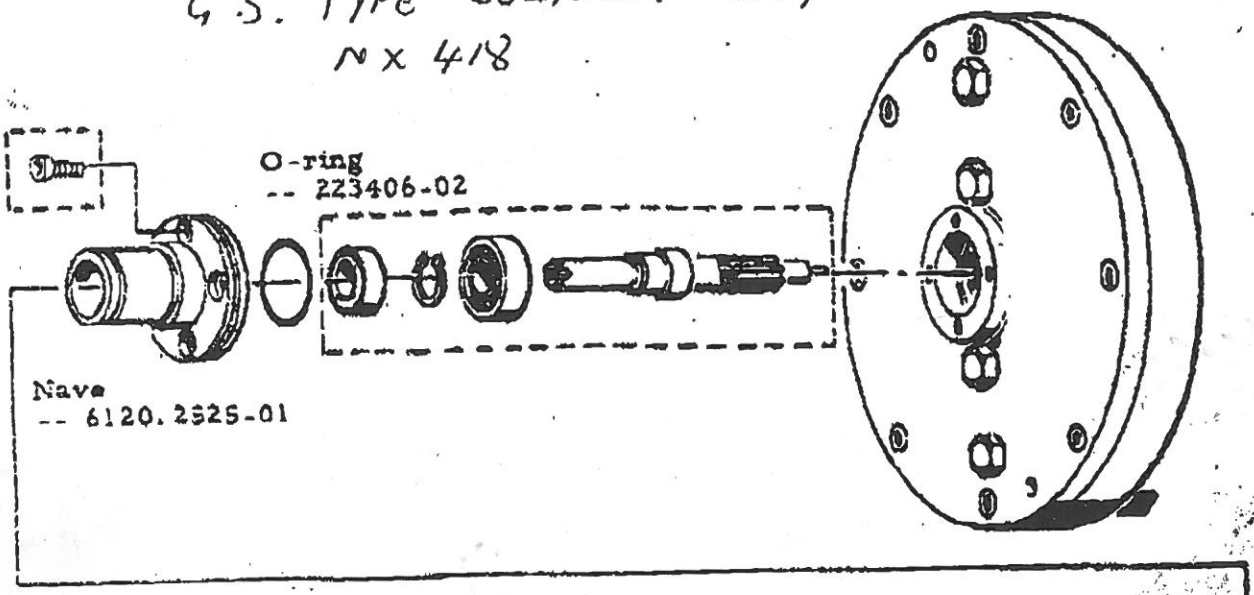
G.S. Type Coupling on City St Thomas
N.X 418

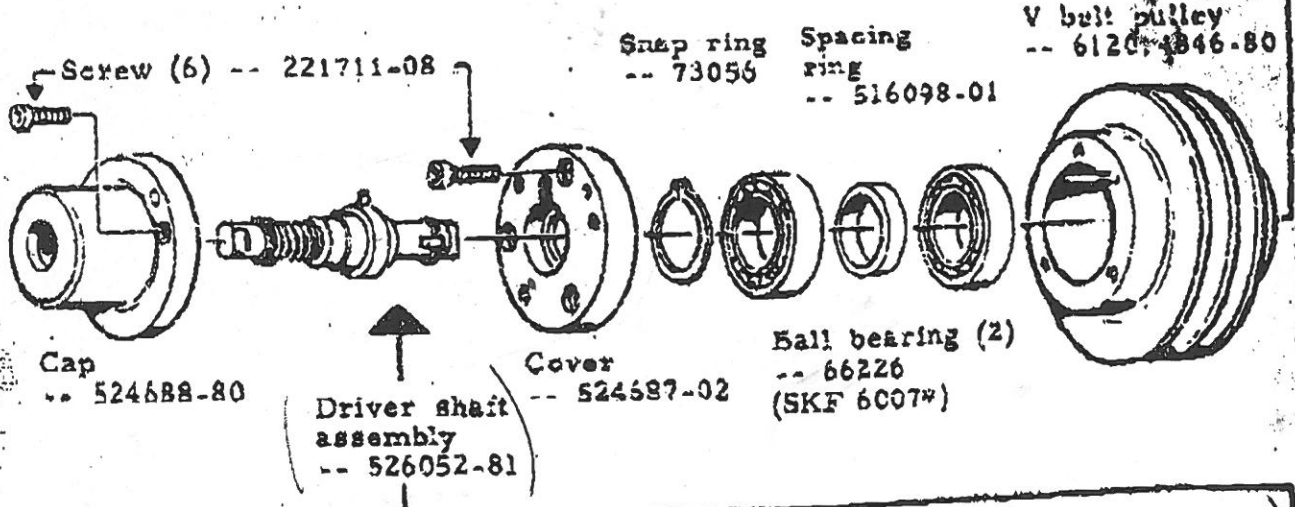


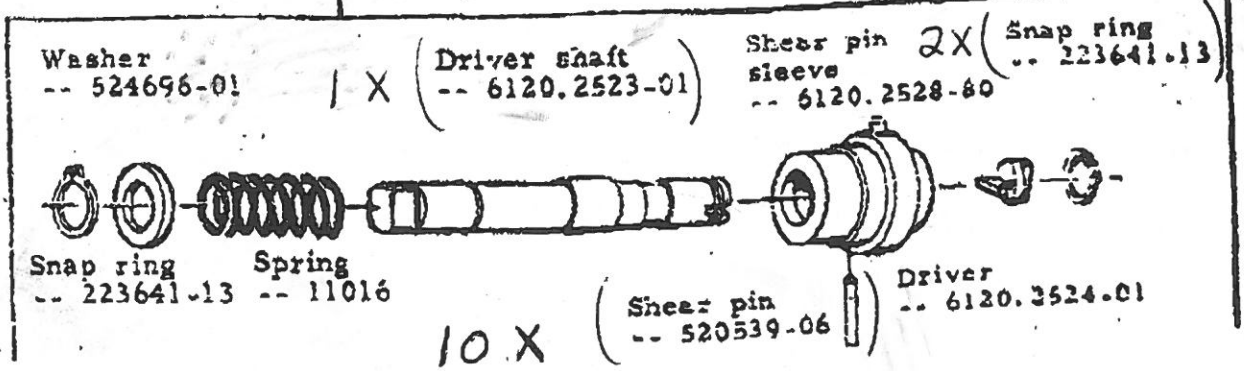
Part number	Complete gear box with shear pin coupling and device for driving the small sun wheel
518032-86	Comprising: Gear box No. 518032-82 excl. of packing No. 66220 and sealing cover No. 66219. Unit comprising shear pin coupling and device for driving the small sun wheel -- 518032-87. Parts -- see next page.

SHEAR PIN COUPLING and DEVICE FOR DRIVING the SMALL SUN WHEEL -- 518032-87

G.S. TYPE COUPLING CITY ST THOMAS
NX 418







* or equivalent bearing of another make.

TIGHTENING OF SCREWS

Tightening all screws with the right torque is important.
The table indicates the torques for metric and UNC thread.

Metric Thread			
	Quality Class 8.8 TORQUE		
mm	kpm	Nm	lb.ft
3	0.12	1.2	0.87
4	0.28	2.8	2.02
5	0.56	5.6	4.05
6	0.95	9.5	6.87
7	1.57	15.7	11.35
8	2.29	22.9	16.56
9	3.35	33.5	24.22
10	4.53	45.3	32.75
12	7.86	78.6	56.83
14	12.60	126.0	91.10
16	19.20	192.0	138.80
18	26.80	268.0	193.80
20	37.50	375.0	271.10
22	50.70	507.0	366.60
24	64.80	648.0	468.50

UNC Thread			
	Quality Class D 80 TORQUE		
Inch	kpm	Nm	lb.ft
1/4"	1.17	11.7	8.46
5/16"	2.37	23.7	17.14
3/8"	4.18	41.8	30.22
7/16"	6.67	66.7	48.22
1/2"	10.10	101.0	73.00
9/16"	14.40	144.0	104.10
5/8"	19.90	199.0	143.90
3/4"	35.00	350.0	253.10
7/8"	51.30	513.0	370.90
1"	76.80	768.0	555.30

VIBRATION SENSOR

The Vibration Sensor (optional extra equipment):

The machine can be equipped with a vibration sensor to protect it against damage due to heavy vibration.

The vibration sensor - the vibraswitch - protects the machine by cutting off the power supply to the decanter motor and the feed pump if the decanter begins to vibrate excessively. The control panel - or the motor starter - must be provided with a terminal for the vibraswitch.

Highest permissible vibration level = 1.0 g above the normal vibration level.

Being erected on vibration dampers, the decanter deflects greatly during starting and stopping, but these oscillations are so soft that they will not influence the vibraswitch.

The vibraswitch is reset manually by pressing the reset button - see sketch below. (The built-in reset coil of the sensor not to be connected).

Adjusting:

First remove the cover of the vibraswitch.

1. **Zero vibration point of sensor with non-operating machine.** The adjustment is made with the machine not operating. Turn the adjusting screw counter-clockwise two turns and press the reset button.

Then turn the adjusting screw slowly clockwise until the armature trips and actuates the switch. This is the zero vibration point, or actuating point, of the sensor with the machine not operating.

Mark out this position with a line right before the adjusting screw pointer.

2. Normal vibration level with operating machine. The adjustment must be made during normal operation. Turn the adjusting screw - see sketch below - **counter-clockwise** one turn and press the reset button. If now the vibraswitch is not retained in the reset position, turn the adjusting screw **counter-clockwise** another turn or two, so that the vibraswitch remains in the reset position when the reset button is pressed.

Then turn the adjusting screw slowly clockwise until the armature trips. Mark out this position with a line right before the adjusting screw pointer.

The difference between the two actuating points in steps 1 and 2 is the normal vibration level during operation expressed in scale divisions. One scale division, i.e. the distance between two scale lines, is 0.1 g, one full turn is 1.0 g.

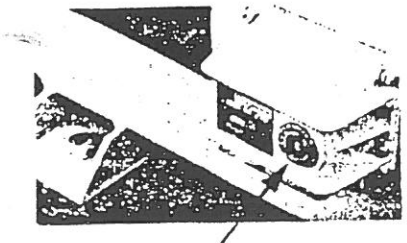
3. Setting of highest permissible vibration level. The adjustment must be made during operation.

The highest permissible vibration level should be 1.0 g greater than the normal vibration level during operation. Thus, turn the adjusting screw **counter-clockwise** one full turn from the point where actuation occurs according to step 2.

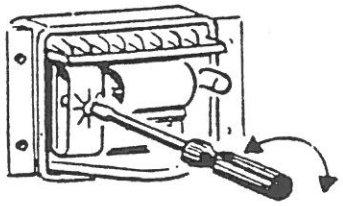
Finally, put on the cover and fasten it with the screws.

Note! Readjustment may be required if the vibraswitch shuts off the power supply because the building begins to vibrate considerably when the machine is operating.

Quantity	Part	Article No.
1	Vibraswitch model 366	53.0307-01
4	Screws	6119.4100-67
4	Washers	6119.4400-06
4	Spring washers	6119.4430-06



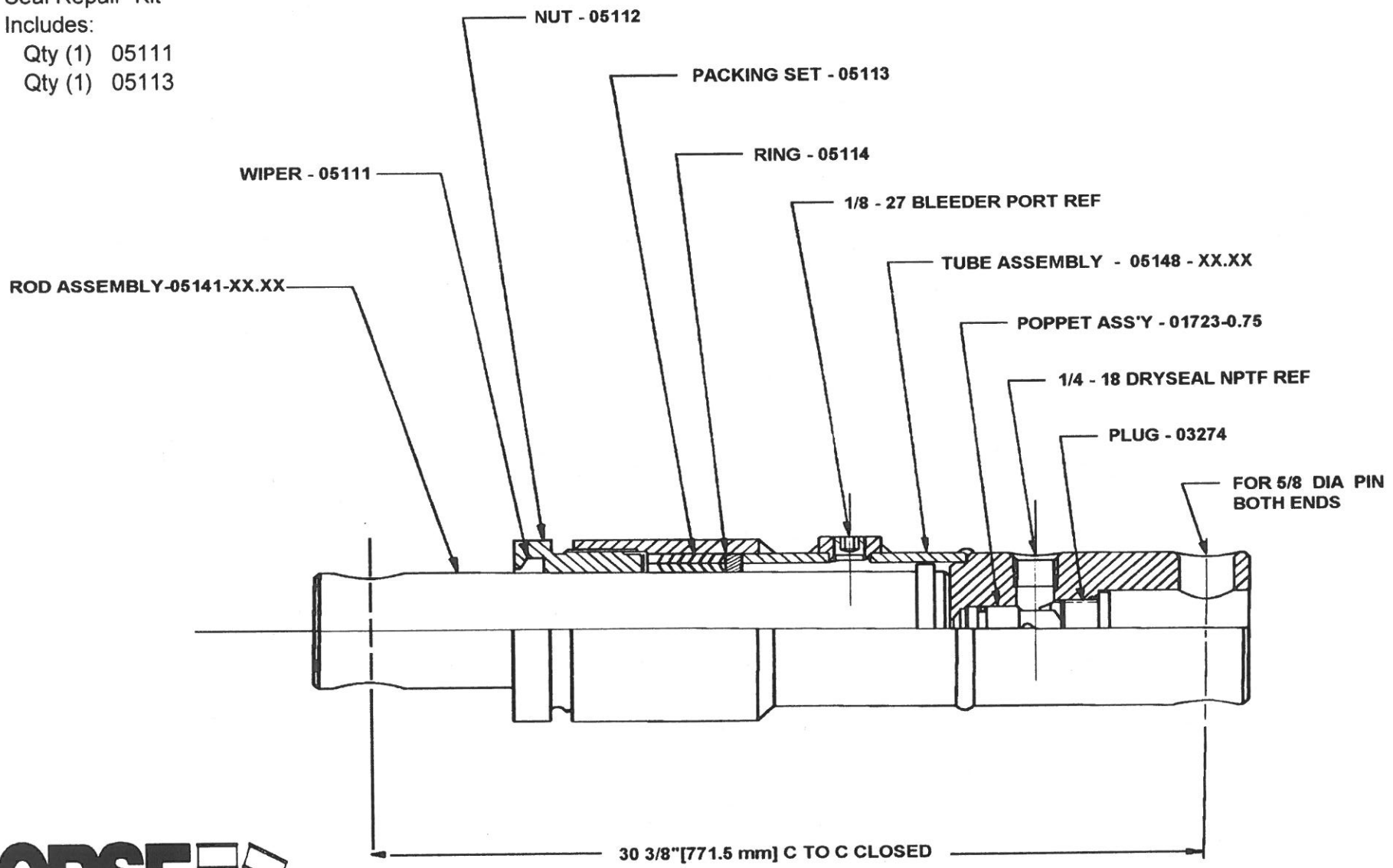
Reset button



Adjusting screw

MORSE PART #780-P FOR 400 SERIES
STARTING WITH SERIAL #1088

Part #25117-P
Seal Repair Kit
Includes:
Qty (1) 05111
Qty (1) 05113



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