

Amarillo<sup>®</sup> Gear Company

USER MANUAL

Gearbox Service Unit  
GSU110 2.0

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# 1. GENERAL INFORMATION

## 1.1 Introduction

Oil contamination causes approximately 80% of all oil system failures. Contamination takes the form of insoluble materials such as metals, dust particles, sand and rubber, oil degradation products such as varnish, resin and oxidation residues and water. The smallest particles, (below 5 µm), free water and deposits from oil degradation products are often responsible for defects.

These contaminants influence equipment reliability and service life, and nearly 100% of all problems related to contamination of oil and other fluids can be prevented.

The Gearbox Service Unit is used for oil maintenance. It is generally used as an off-line filtration system in continuous operation.

Applying a Gearbox Service Unit to your system will give you the benefit of increased uptime of production machinery and extended service life for system components, by effectively reducing oil contamination from:

- Insoluble particles
- Oil degradation products and oxidation by-products
- Water

## 1.2 Symbols and signs used in the documentation

Within this manual, safety instructions are marked with safety symbols. This general hazard symbol below highlights information which non-compliance with, could cause a risk to personal safety.



### **DANGER**

**DANGER** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury



### **WARNING**

**WARNING** indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



### **CAUTION**

**CAUTION** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.



### **NOTE!**

Point out generally important information.

## 1.3 Health and Safety

### 1.3.1 Notes, warnings and cautions



**NOTE!**

Before installing the Gearbox Service Unit, ensure personnel transporting and installing it are qualified and have read and fully understood this instruction manual.



**NOTE!**

Installation of the electrical power supply must only be carried out by qualified personnel. Relevant requirements from national standards concerning electrical installation must be applied.



**NOTE!**

Do NOT attempt to repair or disassemble the Gearbox Service Unit or any of its components within the warranty period, unless special permission has been granted in writing by the supplier (with the exception of dismantling for replacement of filter elements). Failure to seek the said permission will cause the warranty on the said parts to be void.



**NOTE!**

Use only original spare parts.



**NOTE!**

Do NOT clean the Gearbox Service Unit by using a pressure washer. Use a general purpose cleaner only.



### **DANGER**

#### **EXPLOSIVE ATMOSPHERES**

→ The Gearbox Service Unit must not be used in ATEX characterized areas.



### **DANGER**

#### **COMPRESSED AIR OR GASES**

Pressurising any part of the Gearbox Service Unit with compressed air or other compressed gases may lead to explosion, causing death or serious injury.

→ Leak testing of the Gearbox Service Unit must only be carried out with atmospheric air at a pressure of less than 0.5 bar.



### **WARNING**

#### **HAZARDOUS VOLTAGE**

Contact may cause electric shock or burn.

→ Turn off and lock primary and control circuit power disconnecting switch before installing or servicing.

→ Keep all panels and covers securely in place.



## WARNING



### ELECTRICAL SHOCK

Different electrical potential between adjacent machinery may cause electrical shock.

→ The Gearbox Service Unit must be supplied from the same electrical source as any machinery connected or adjacent machinery must be inter-connected by an equipotential bonding wire.



## WARNING



### SLIPPERY FLOOR

Oil spillage may cause injury.

→ Always clean up spilled oil and repair leaks.



## WARNING



### HOT SURFACES

Piping and filter housing may contain hot oil.

Contact may cause burns.

→ Allow to cool before servicing.



## WARNING

### TRANSPORTATION

→ Use only approved lifting gear.



## WARNING



### SKIN CONTACT WITH OIL

Skin contact with oil can cause allergic reactions.

→ Wear suitable gloves, chemical resistant disposable clothing and goggles when servicing or repairing.



## CAUTION

### HIGH AMBIENT TEMPERATURES

High ambient temperature may cause malfunction of the electrical components.

→ Do NOT expose the Gearbox Service Unit to ambient temperatures higher than stated in this instruction manual.



### CAUTION

#### HIGH FLUID TEMPERATURES

Excessive fluid temperatures may decompose sealing and hose components.

→ Do NOT expose the Gearbox Service Unit to fluid temperatures exceeding design temperature as stated in this instruction manual.



### CAUTION

#### UNINTENDED OPERATION OF SHUT-OFF VALVES

Unintended operation of manually operated shut-off valves may disturb the safe and correct functioning of the Gearbox Service Unit or the machinery connected.

→ Manually operated shut-off valves must be secured against unintended activation during operation.



### CAUTION

#### UNINTENDED DRAINAGE OF MACHINERY MAIN SYSTEM OIL RESERVOIR

Erroneous operation, component failure or leaks may drain the main system oil tank.

→ User must install necessary equipment or apply procedures to monitor oil level in the main system oil tank.



#### NOTE!

Never use tapered thread when connecting the Gearbox Service Unit, due to risk of cracks in the material.



#### NOTE!

Never use fittings or pipes made of copper, copper alloys or with a galvanized surface due to risk of accelerating oil degradation.



#### NOTE!

All types of oil are potential threats to the environment and as such they must NOT be drained into ordinary sewers or dumped. Always check that all oil-carrying components are sealed and do not leak before operating the Gearbox Service Unit.



#### NOTE!

Service life can be shortened if exposed to severe vibrations. Install vibration dampers if relevant.



#### NOTE!

On completion of installation or service, all safety and protective equipment must be re-installed and made operative again prior to restarting the machine. Never disable, modify, or by-pass any safety locks.

## 1.4 Intended use and limitations

- The Gearbox Service Unit must NOT be used for other fluids or machinery than intended for at the time of acquisition from Amarillo® Gear Company. For other application please contact Amarillo® Gear Company
- The Gearbox Service Unit System must NOT be used onboard aircrafts.
- The Gearbox Service Unit must NOT be used for any liquids used in the direct processing of foods.



### NOTE!

Type of filter element is always selected to match the specific application and oil type.

## 1.5 Functional description

### 1.5.1 The Gearbox Service Unit

The main components of the Gearbox Service Unit are:

- A gear pump with electrical motor
- Motor starter
- Filter housing
- Sampling point
- Pressure gauge
- Connections for inlet and outlet
- Drain valve

For specific details please refer fig. 1.1

### 1.5.2 The Gearbox Service Unit Filter element

- The filter element is the active filter media that maintains the oil by continuously removing particles, oil degradation products and water from the oil.

### 1.5.3 Principle of operation

The Gearbox Service Unit takes suction from the oil system, preferably the lowest point of the oil tank. After passing through the filter element from the outside and inwards, the oil is returned to the system via the outlet connection of the Gearbox Service Unit.

## 1.6 Filter performance

To maximise the performance of your Gearbox Service Unit it is important that it is in continuous operation and is serviced by applying both of the following routines

### 1.6.1 Filter element change based on service time – 12 months

The Gearbox Service Unit Filter element will retain oil degradation products and oxidation by-product to a level, at which it becomes saturated. It is not possible to indicate this saturation, since it has insignificant influence on the pressure drop across the filter element.



### NOTE!

In order to maintain optimal filter performance, the filter element must be changed at least once per year.



### 1.6.2 Filter element change due to high pressure – 1.8 bar

As particles are deposited in and on the Gearbox Service Unit Filter Element and water is absorbed the flow resistance increases causing increased pressure drop across the filter element. The flow resistance is monitored by the pressure gauge.

If the Gearbox Service Unit Filter System is fitted with a minimess test point, connect pressure gauge to the minimess test point located on top of the filter housing and read the pressure.



**NOTE!**

**In order to maintain optimal filter performance, the filter element must be changed before the pressure reaches 1.8 bar.**

### 1.6.3 Technical specifications

#### Gearbox Service Unit

Motor	Type: 1-phase motor with squirrel cage Voltage: 1x120V Frequency: 60Hz Design speed: 1650 min <sup>-1</sup> Protection class:IP55
Oil pump	Gear wheel type PV4 Nominal flow: 300 l/h Pressure relief valve diff. setting: 2.8bar
Filter element	Type: Filter element B27/27 Filtration grade: 3µm absolute Typical pressure drop at 20°C, new element: <0,3 bar Max storage time: 12 month, with undamaged package
Filter housing	Material: Cast iron Surface protection: Norsok
Filter unit	Connections Inlet: ¾" Outlet: ¾" Design temperature: 80°C Design pressure: 4 bar Ambient temperature: 40 °C Weight: 40 kg Colour: RAL 6024 (Traffic green)

**Table 1.1 Technical data Gearbox Service Unit**



- | Pos. | Description            |
|------|------------------------|
| 1    | = Gearbox service unit |
| 2    | = Pump                 |
| 3    | = Motor single phase   |
| 4    | = Pressure gauge       |
| 5    | = Top nut              |
| 6    | = Air vent screw       |
| 7    | = Pressure switch      |
| 8    | = Sampling point       |
| 9    | = Manual motor starter |
| 10   | = Cable with UL plug   |
| 11   | = Drain valve          |

**Fig. 1.1 Gearbox Service Unit**

## 2 Installation

### 2.1 General

The Gearbox Service Unit must be mounted on a correctly dimensioned bracket capable of carrying the filter system and keeping it in a fixed position under all conditions. The installation must allow for safe maintenance of the Gearbox Service Unit, e.g. replacement of filter elements.

The Gearbox Service Unit must be connected to the main system by independent suction and return lines. The filter suction line should be connected to the lowest and most contaminated position, e.g. the drain plug of the system tank. The filter return line should be led back into the tank close to the suction pipe of the system pump, and preferably below the oil surface to minimise splashing and reduce oxidation of the oil.

In order to facilitate service of the Gearbox Service Unit, it is advisable to install ball valves on suction and return lines.



**NOTE!**

**Installation must always be carried out by qualified personnel.**

### 2.2 Taking delivery of a Gearbox Service Unit

#### 2.2.1 Unpacking

Check that the package is undamaged.

#### 2.2.2 Inspection upon receipt

Check that the Gearbox Service Unit and all accessories are undamaged. If damage is found, a damage report should be sent to the company responsible for the shipping (include photographs if relevant). Batch number of the Gearbox Service Unit must be included in the damage report.

#### 2.2.3 Storage until installation



**NOTE!**

**If the Gearbox Service Unit is not to be installed immediately after delivery, the filter must be stored in its original delivery packaging and in acceptable conditions. A dry storage room with a relative humidity not exceeding 60% is considered acceptable.**



**NOTE!**

**Outdoor storage under cover is accepted only for a short time and requires adequate protection against all harmful impacts of the climate.**



**NOTE!**

**The Gearbox Service Unit must be handled with care, do not drop and protect against mechanical damage.**



**NOTE!**

**Keep the filter element packaging intact until installation!**

## 2.3 Installation

It is the customer's responsibility that the Gearbox Service Unit is installed correctly.

Inlet and outlet connections		Top Nut		Pressure gauge		Air vent Screw	
Thread size	Tightening torque [Max. Nm]	Filter type	Tightening torque [Max. Nm]	Thread size	Tightening torque [Max. Nm]	Thread size	Tightening torque [Max. Nm]
3/4"	70	Gearbox service unit	90	1/4"	25	1/4"	10
3/4"	70						

### 2.3.1 Piping

Mount the Gearbox Service Unit to the bracket, using class 8.8 bolts or higher. To ensure that the oil filter system will stay in place even when vibrations occur, apply glue to bolts.



**NOTE!**

**Only use fittings with cylindrical thread in filter or pump.**



**NOTE!**

**Never use galvanized or copper fittings/pipes when installing the Gearbox Service Unit.**

Inner diameter of connections pipes must be at least 3/8" and as short as possible. In order to avoid large pressure drop, the inner diameter of the pipes must be increased if the length of pipes is more than 3 metres.

Suction head must be above -0.5 bar gauge.

Discharge head must be below 0.5 bar.



**NOTE!**

**In order to avoid damage of the pump, make sure all pipes are free of metal particles and other solvents before connecting the filter system.**

Hoses suitable for use with the system fluid can be used instead of pipes. When using hoses for the installation, they must comply with the same specification as for pipes.

If the Gearbox Service Unit is to be installed in a site where frequent low temperature can influence fluid characteristics, we recommended insulation of pipes.

### 2.3.2 Electrical connection



**WARNING**



**ELECTRICAL SHOCK**

**Make sure that the power supply is safely disconnected before carrying out any wiring work!**

→ **Work on electric equipment must only be carried out by qualified personnel!**

Verify that system voltage matches equipment voltage ratings before connection. Refer to the name-plate on the control panel when sizing power supply wire.

Voltage (AC/DC) tolerance is +/- 5%

Frequency tolerance is +/- 2%

Connect the electric motor power supply as shown in the wiring diagram in this instruction manual. It is the customer's responsibility that the electrical equipment is connected with a cable of the correct dimension and that the electric equipment is properly protected.



### WARNING

#### OVERHEATING OF MOTOR

Overheating of the motor is a potential fire risk.

- Protection of motors against overheating must be provided as either over-temperature protection by connecting thermistors or overload protection by means of thermal overload relay.



### WARNING



#### ELECTRICAL SHOCK

Different electrical potential between adjacent machinery may cause electrical shock.

- The Gearbox Service Unit must be supplied with power from the same source as the adjacent machinery or connected by an equipotential bonding wire.



#### NOTE!

When connected ensure that the motor has the same direction of rotation as the arrow on the fan cover. Continuous operation with wrong rotation causes no flow in the system and damage shaft seal of pump.

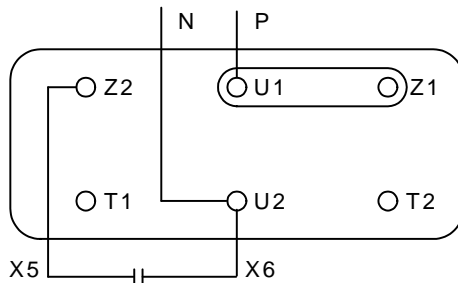


Fig. 2.1 Wire connection for motor

## 3 OPERATION

### 3.1 Starting the filter system

1. Open inlet and outlet valves (if fitted).
2. Check that the drain valve is closed
3. Start the pump
4. If the filter is equipped with a vent screw on the top of the filter housing,
  - a. Open vent screw immediately after the pump has been started
  - b. Close the vent screw as soon as liquid appears
  - c. Vent the filter again after approximately one hour of operation
5. If the filter is fitted with automatic de-aerator:
  - a. Observe that the venting process is correctly stopped
6. Check for leaks

Refer fig. 1.1

### 3.2 Normal operation and service

Pressure drop across the filter element varies with the oil viscosity, but is usually <0.3 bar. However, it is not unusual for the pressure to be somewhat higher during the first hour of operation until temperature and flow conditions have stabilized.

It is crucial for the Gearbox Service Unit performance that it is in continuous operation, and that the condition of the filter element is maintained and monitored by applying **both** of following routines.

#### 3.2.1 Filter change based on service time – 12 months

The Gearbox Service Unit Filter Element will retain oil degradation products and oxidation by-product to a level at which it becomes saturated. It is not possible to indicate this saturation, since it has insignificant influence on pressure drop across the filter element.



**NOTE!**

**In order to maintain optimal filter performance, the filter element must be changed at least once per year.**

#### 3.2.2 Filter change due to high pressure – 1.8 bar

As particles are deposited in and on the Gearbox Service Unit and water is absorbed the flow resistance increases causing increased pressure drop across the filter element. The flow resistance is monitored by the pressure gauge.

If the Gearbox Service Unit is fitted with a minimes test point, connect pressure gauge to the minimes test point located on top of the filter housing and read the pressure.



**NOTE!**

**In order to maintain optimal filter performance, the filter element must be changed before the pressure reaches 1.8 bar.**

### 3.3 Stop

Stop the pump and close the inlet and outlet valves (if fitted).

For service or repair, safely disconnect the power supply for the filter system.

Make sure that the power supply cannot be unintended connected.

For additional safety, a pressure relief valve is integrated in the pump to protect the Oil maintenance unit.

### 3.3.1 Replacing the filter element

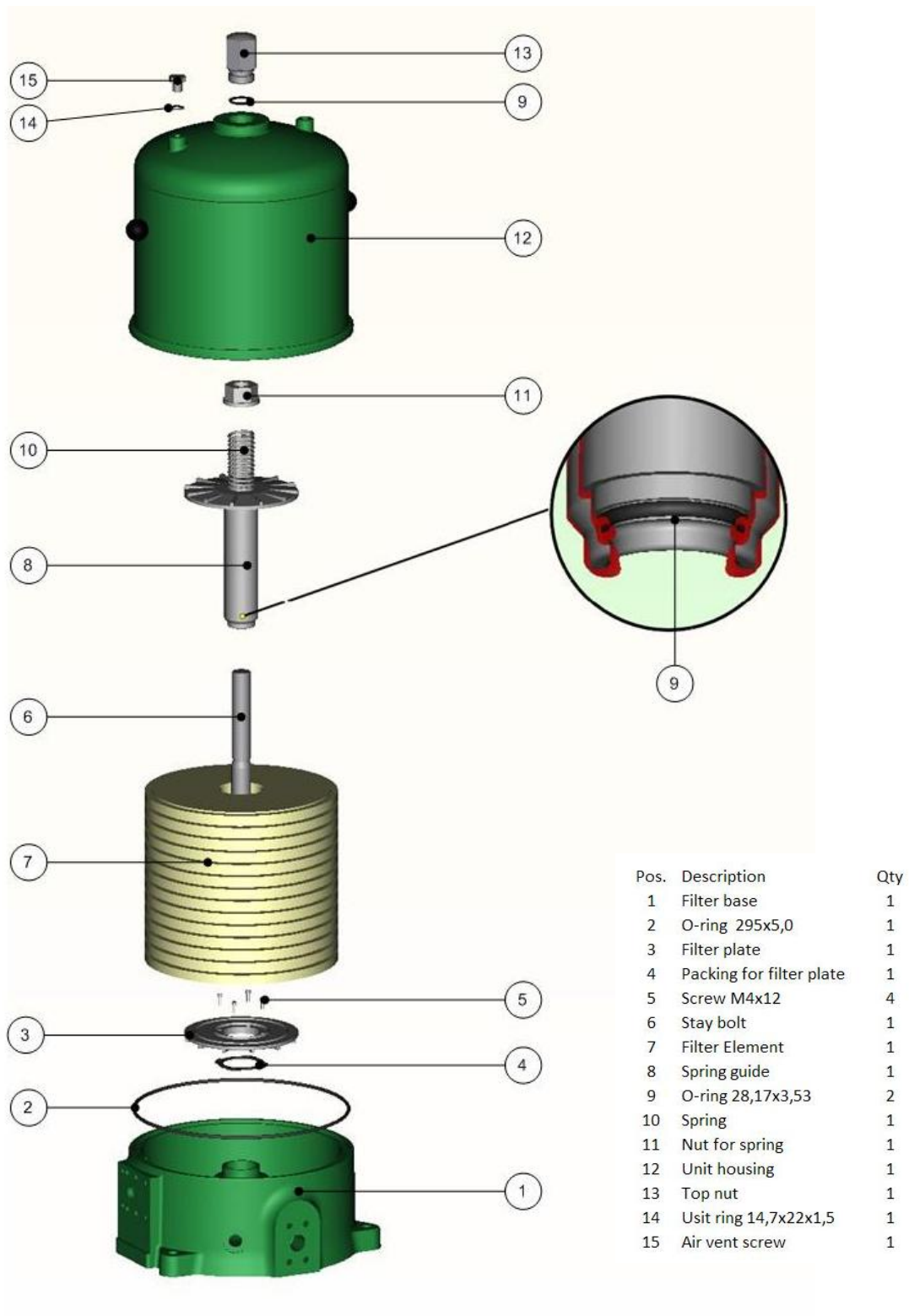
1. Stop pump by turning off power. Isolate from external system by closing inlet and outlet valves
2. Safely disconnect the power supply
3. Open drain valve and allow filter to drain into a container
4. When filter is drained, unscrew the top nut and lift off filter cover/filter housing
5. Unscrew spring nut and remove spring and spring guide
6. Lift filter element, using the Gearbox Service Unit Filter Element Extractor
7. Clean all parts and inside of filter base with lint free rags or paper towels
8. Replace O-rings and seals
9. Place new filter element in housing
10. Check that o-ring inside the spring guide is placed correctly in groove
11. Mount spring guide and spring



#### **NOTE!**

**Take care not to damage o-ring on thread of stay bolt when mounting spring guide.**

12. Mount spring nut and tighten by hand until it touches spring guide disc. Apply an additional 4 turns with a spanner to settle element
13. Check that O-ring at filter base is placed correctly. Mount filter cover/ filter housing
14. Place top nut seal, mount top nut and tighten with a torque wrench to 70 or 90 Nm
15. Put filter back into service by applying the same procedure as described in chapter 3



**Fig. 3.1 Exploded view Gearbox Service Unit**



## 4 Maintenance

### 4.1 Preventive Maintenance

The design service life of the Gearbox Service Unit is 20 years.

The following service intervals are based on continuous operation of the filter system.

Service parts and recommended service intervals		
Service parts	Frequency of replacement/ design service life	Instruction
Filter elements	Every year or when pressure reaches 1.8 bar	See Filter Element Replacement Guide
Set of O-rings and seals for filter housing	At every filter element replacement	See drawing
Pump	5 years	See drawing
Electrical motor	5 years	See spare part list

**Table 4.1 Service parts and intervals**

Check of all electrical connections for tightness should be done every year including a visual check of the components.



**NOTE!**

Depending on operation conditions and used medium pumps with radial shaft seals may have slight leakage.



**NOTE!**

Service life can be shortened if exposed to severe vibrations

## 4.2 Trouble Shooting

Trouble	Cause	Solution
High pressure	Filter clogged by particles and/or water	Replace filter elements (see "Filter Element Replacement")
	Oil viscosity too high	Check oil temperature. Check condition of preheater controls, if installed. Install preheater kit to reduce oil viscosity.
	Valve closed in return line	Check main system line
	Dimension of pipes/hoses too small	Replace with correctly dimensioned pipes/hoses
Pressure gauge does not indicate pressure	Filter pump not running	Start pump
	Pressure gauge faulty	Replace pressure gauge
	Oil level in system tank below pump suction level	Refill oil in system tank and check suction pipe is correctly fitted (lowest possible point)
	O-rings, guides, spring guides or spring nut have not been placed correctly or are damaged	Check O-rings, guides and nuts have been placed correctly and are not damaged. Replace damaged parts.
	Wrong rotation direction of motor	Change rotation direction of motor
	Bypass valve stuck open (in pump)	Dismantle and clean bypass valve
Pump shaft seal leaking	Dry running of pump	Replace shaft seal or replace with new pump
	Sudden pressure raise in the oil system	Replace shaft seal or replace with new pump

**Table 4.2 Trouble shooting**



Trouble	Cause	Solution
Gearbox Service Unit stopped	Motor protection triggered	Reset and restart. If the motor protection trips again, find cause and remedy   <b>CAUTION</b>  <b>Do not change motor protection relay setting!</b>
	Pressure too high	See under “high pressure”.
	No-flow in system	Check that in- and outlet valves are open. Clean suction strainer. (if fitted)
Motor protection triggered	Pump blocked	Check if pump can be turned by hand: - If pump cannot be turned by hand, check pump for damage  If necessary replace pump
	Motor windings defect	Replace motor
	Motor overheated	Motor has been overloaded Check if pump is blocked  Replace motor
Oil temperature too high	Temperature setting too high	Adjust setting to lower temperature.
Oil temperature too low	Temperature setting too low	Adjust setting to higher temperature.
	Cold oil	Apply heat to the storage tank. Insulate storage tank and piping. Install extra preheater kit.
	Preheater not turned on	Turn on preheater. Observe if preheater on lamp is lit If preheater on lamp is not lit, high temperature cut-out has been activated.
	High temperature cut-out	Reset high temperature cut-out thermostat. (Press red button on cut-out thermostat inside top of heating element).
	Preheaters fouled	Remove preheater and clean.
	Preheater faulty	Replace preheater.

Table 4.2 Trouble shooting

## 5 End of life cycle

### Introduction

When the Gearbox Service Unit has reached the end of its service life, dismantle and scrap it in accordance with the local regulations.

### 5.1 CAUTIONS



#### CAUTION

##### HAZARDOUS WASTE

The Oil maintenance unit contains oil and sludge which are hazardous to the environment

→ The drained oil, the used Oil maintenance unit and the used cartridge are hazardous waste and must be handled in accordance with local regulations



#### CAUTION

##### ALLERGIC REACTION

Oil and sludge remains may cause allergic reactions

→ Use protective clothing and gloves when handling

### 5.2 Material content

Below is a list of material for the individual parts and components of the Oil maintenance unit:

Part	Material
Gearbox Service Unit	Steel and cast iron
Pump	Steel, cast iron and aluminium
Electrical motor	Semi finished steel plate, grey cast iron, steel, copper and aluminium
Seals	Viton
Pressure gauge	Plastic, steel and silicone

**Table 5.1 Material content**