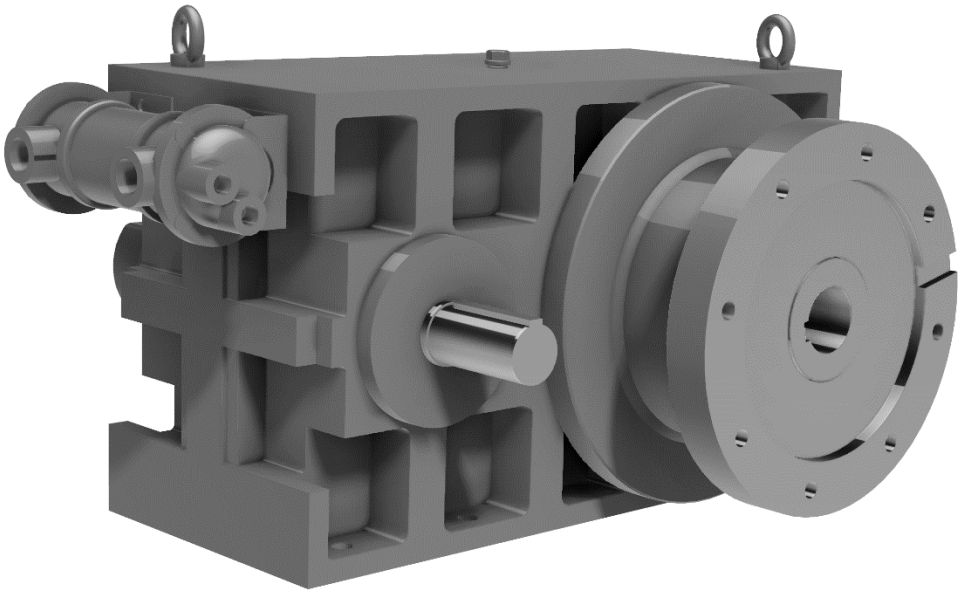
DAE MODEL
EXTRUDER GEARBOX
OPERATING MANUAL



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1. How to Use This Manual

1.1 General Information

This operating manual provides general information and safety guidelines. It is the responsibility of the buyer, machine builder, installer and user of the Dişsan product to make sure that all the proper safety rules and operating instructions have been read and understood.

This operating manual should be kept in close proximity to the area where the gearbox operates and should be reachable at all times. Before starting-up the gearbox, please read this manual carefully and follow the instructions strictly. Failure to follow instructions may result in voiding your warranty.

1.2 Safety and Information Symbols

Please pay attention to the safety and information symbols below.

Danger ! - Can cause severe or fatal injuries

Warning ! - Can damage the gearbox or environment

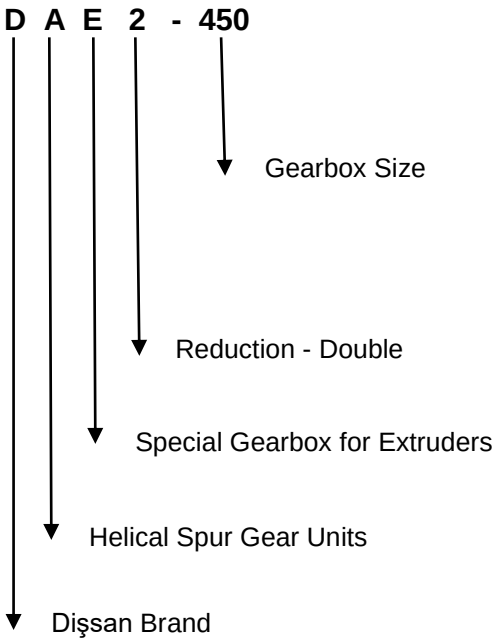
Note ! - Important Information

2. Gearbox Type Definitions

2.1 Type Definitions

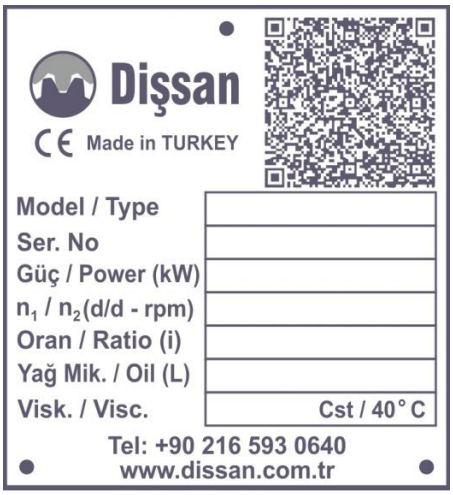
DAE2	Double Reduction, Helical Spur Gear Units, for Extruders

2.2 Type Definition Example



2.3 Nameplate Definitions

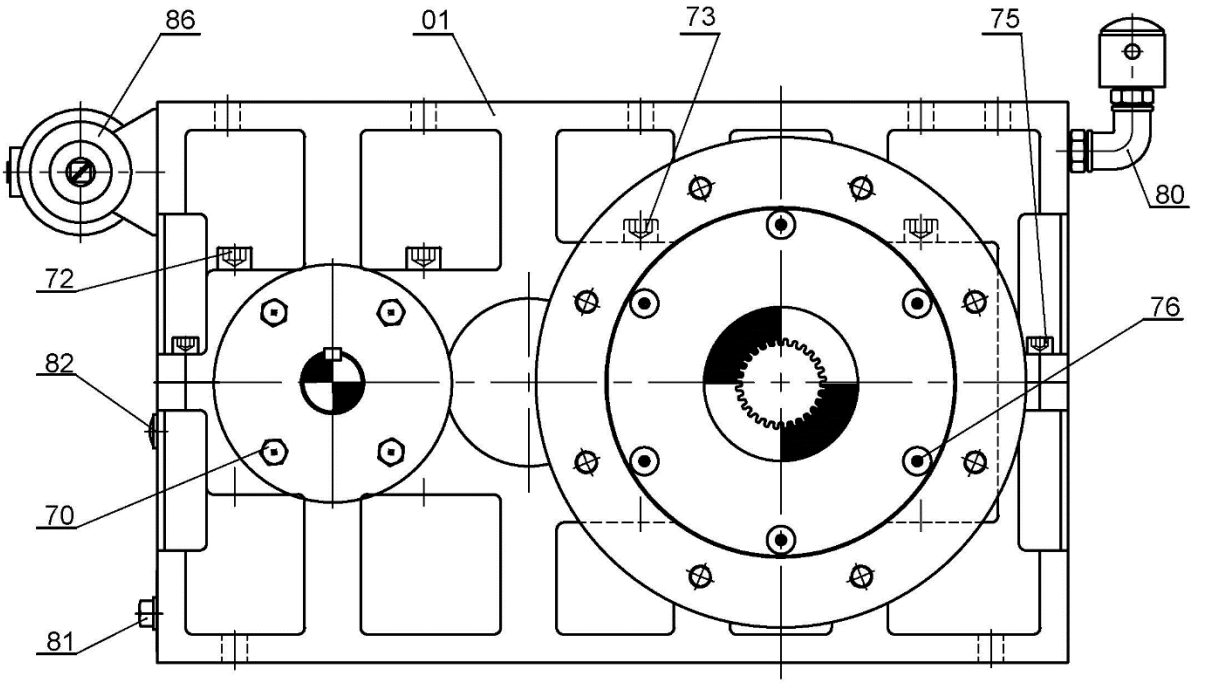
The nameplate identifies the type of product and its features. Therefore, nameplates must not be removed, should be kept intact and legible. Please state the serial number on the nameplate when ordering spare parts for the gearbox.

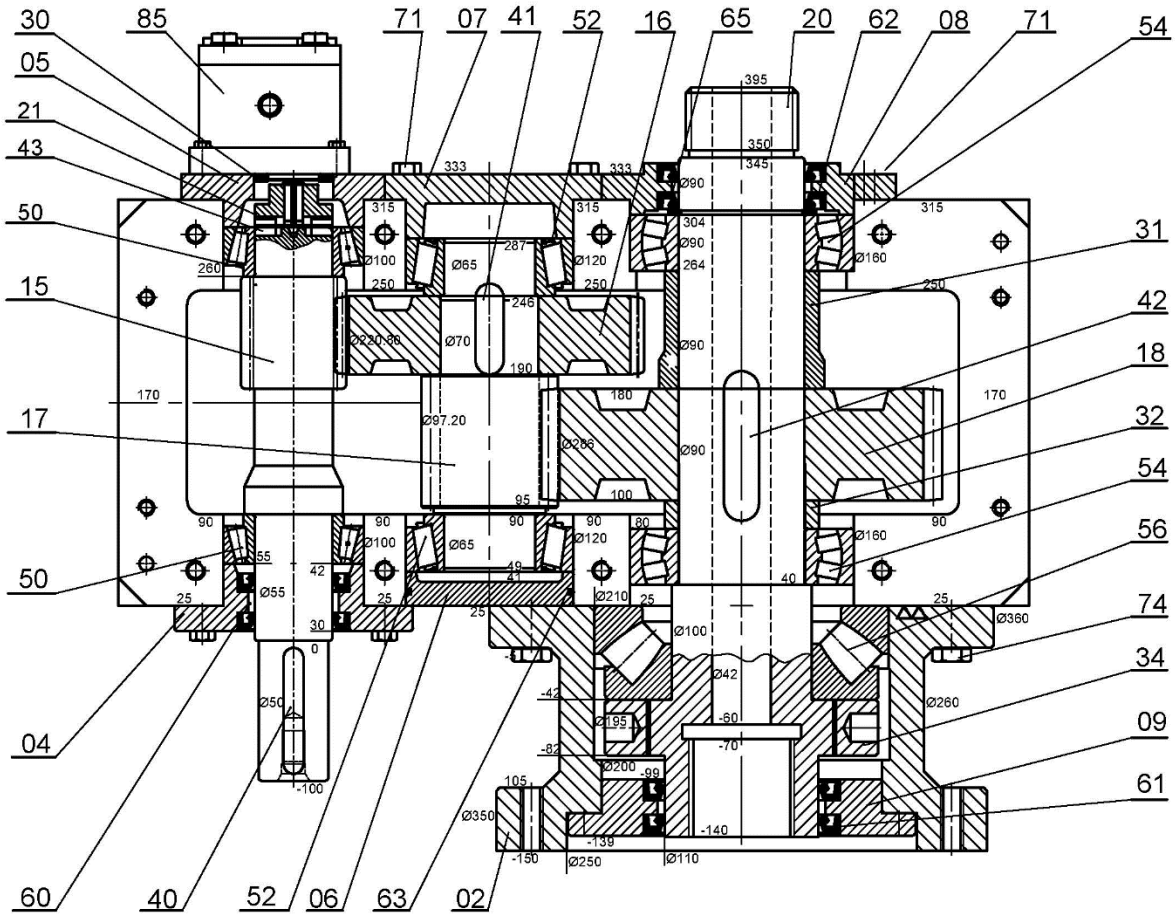


Type	: Gearbox Type and Size
Ser.No	: Serial Number
Power (kW)	: Motor Power
n_1/n_2 (rpm)	: Input and Output Speeds
Ratio (i)	: Reduction Ratio (n_1: n_2)
Oil (L)	: Oil Amount
Visc	: Oil Viscosity

3. Part Lists

3.1 DAE Model





DAE Part List

Part No	Pieces	Part Definition
01	1	Housing
02	1	Output Flange
04	1	Input Shaft Cover
05	1	Cover
06	1	Plug
07	1	Cover
08	1	Output Shaft Cover
09	1	Output Shaft Cover
15	1	I. Stage Pinion Gear
16	1	I. Stage Gear
17	1	II. Stage Pinion Gear
18	1	II. Stage Gear
20	1	Output Shaft
21	1	Pump Adapter Part
30	1	Pump Adjustment Ring
31-32	2	Ring
34	1	Nut
40	1	Key
41	1	Key
42	1	Key
43	2	Key
50	2	Bearing
52	2	Bearing
54	2	Bearing
56	1	Bearing
60	2	Oil Seal-Viton
61	2	Oil Seal-Viton
62	2	Oil Seal-Viton
63	1	O-Ring
65	1	Circlip
70	8	Hexagon-Head Bolt
71	8	Hexagon-Head Bolt
72	4	Countersunk Head Bolt
73	4	Countersunk Head Bolt
74	8	Hexagon-Head Bolt
75	4	Countersunk Head Bolt
76	6	Countersunk-Head Bolt
80	1	Oil Fill and Breather Filter
81	1	Oil Drain Plug
82	1	Oil Level Indicator
85	1	Pump
86	1	Exchanger

4. Safety Instructions

The following safety instructions are important to prevent loss of life, injuries and property damage. The operators must ensure that the basic safety rules are read and adhered to.

Incorrect installation, improper use of the product, failure to follow safety warnings, removal of the protective covers of the gearbox can cause serious injuries and property damage.

All work involved in the transportation, connection, commissioning and maintenance of any Dişsan product must be carried out by qualified and responsible technicians that have read the instructions in this manual.

Before starting up the gearbox, objects around the product that may cause injury must be removed. The propeller that is connected to the input shaft of the gearbox can cause injuries. Keep enough distance from the propeller to avoid accidental contact.

If the gearbox is damaged, do not install the product without consulting Dişsan.

Gearboxes are designed for use in industrial machines and applications. The gearbox should only be used within permitted ranges indicated in the catalogue and nameplate of the product. Using the gearbox outside the permitted ranges would result in voiding the warranty.

The gearboxes comply with the requirements of the directive 2006/42/EC. The machines and machine parts that will be connected to the gearboxes should also comply with 2006/42/EC standards.

Standard gearboxes are suitable for operation in ambient temperatures between -5° C and +40° C. If the ambient temperature is outside this range, you should consult Dişsan for necessary measures before ordering.

Touching hot surfaces may cause burns. If the temperature of the gearbox rises above 60° C during operation, do not touch the gearbox housing without appropriate safety equipment such as gloves to prevent burning.

Oils can be harmful to health and environment. Intensive contact with oil can lead to skin irritations. Avoid intensive contact with oil and clean skin thoroughly after contacting. The used oil should be disposed according to local regulations.

The transportation, installation, mounting, de-mounting and maintenance of the gearbox should be performed only when the system is turned off. All necessary precautions should be taken to prevent accidental operation of the gearbox.

5. Transportation and Storage

5.1 Transportation

When accepting the delivery of the gearbox, check that the product is complete and undamaged. If damage is detected, you should immediately inform the shipping company and Dişsan. The damaged gearbox should not be operated unless approval is taken from Dişsan that the damage has no effect on the operation.

Ensure that adequate safety measures are taken to protect operators from injury during transportation. The operators should not stay under the lifting equipment and the gearbox during transportation. Standing under the gearbox can lead to death.

When lifting up the gearbox use the eyebolts. Tighten the eyebolts before using. The eyebolts are suitable to handle only the gearbox weight. Do not attach additional loads.

Always use sufficiently rated handling and lifting equipment. The equipment should be appropriate to handle the gearbox weight.

The gearbox should be handled and landed to the ground at low speed. If the gearbox falls or crashes to the ground, the gearbox could be damaged. If the input or output shafts of the gearbox get a knock, this can damage the shafts and gears inside the gearbox.

5.2 Storage

The connection surfaces and shaft ends of the gearboxes are covered with anti-corrosion grease before delivery. If the gearbox is stored with packaging, the anti-corrosion grease will be effective for two years. If the gearbox will be stored longer than two years, the grease should be reapplied.

If the gearboxes will be stored between nine months and three years, long-term storage instructions should be followed.

<u>With Packaging:</u>

- Avoid direct exposure to sun, rain and snow. Store in a location free from shock and vibration.
- Humidity in the storage area should not exceed 50%. A moisture indicator should be placed near the gearbox.
- The ambient temperature should be between -5° C and +40° C.
- The packaging and moisture indicator should be checked regularly.
- Reapply the anti-corrosion grease to flange connections and shafts after two years.
- If these conditions are met, the gearboxes can be stored up to three years.

Without Packaging:

- Avoid direct exposure to sun, rain and snow. Store in a location free from shock and vibration.
- Humidity in the storage area should not exceed 50%. A moisture indicator should be placed near the gearbox.
- The ambient temperature should be between -5° C and +40° C.
- The storage area should be free from dust, dirt and insects.
- Moisture indicator should be checked regularly.
- If these conditions are met, the gearboxes can be stored up to two years.

6. Installation

6.1 Before Starting Installation

Make sure that the gearbox is not damaged during transportation or storage. If the gearbox is damaged, do not install the gearbox without consulting Dişsan.

The installation must be carried out by qualified and responsible technicians who have read the instructions in this manual.

Make sure that you have all the equipment necessary for installation; set of wrenches, torque wrench, shims, spacing rings, lubricant, bolt fixing compound etc.

Before starting installation make sure that the input and output shafts are free of oil and dust. The anti-corrosion grease that was applied for protection should be removed with an appropriate solvent. **The solvent should not touch the seals and painting of the housing.**

For connecting the gearbox, use bolts with quality class 8.8 or higher.

The gearboxes should only be mounted using the foot connection points indicated by Dişsan.

If you would like to paint the gearbox, make sure that no paint or thinner touches the shaft seals, plastic parts, breather plugs, pipes and nameplates. Otherwise, these parts might get damaged and the nameplate might get illegible.

6.2 Shaft Tolerances

Hole tolerances of solid input shafts:

Solid Shaft (Ø ≤ 50 mm)	ISO k6
Solid Shaft (Ø > 50 mm)	ISO m6

Hole tolerances of hollow output shafts:

Output shaft holes are machined to ISO H7 tolerance.

6.3 Mounting Position

DAE model gearboxes are especially designed for extruders. The gearboxes can operate in horizontal or vertical mounting position. The mounting position should be specified at the order. The gearboxes are assembled with the oil level indicator, oil fill and breather plug and oil drain plug installed in their proper locations according to the specified mounting position.

If the gearbox is not mounted in the position for which it is designed, it may not receive proper lubrication and may be damaged. Consult Dişsan prior to changing the mounting position of the gearbox.

Oil level indicator, breather plug and oil drain plug should be reachable at all times for regular controls and maintenance activities.

6.4 Checking the Oil Level

Check if the oil level is suitable for the mounting position as described below.

- After placing a container under the oil level plug / indicator, remove the plug carefully. If the oil level is adequate, there should be small amount of oil leakage.
- If there is no leakage, fill in more oil as described below:
  - Obtain one of the proper oil types recommended in the oil chart in this manual (Page 15)
  - Remove the breather filter and fill in oil through a cone filler, while the oil level plug is open.
  - When oil starts to come out from the opening, affix the plug again.
  - Continue to fill in a small amount of oil, until the oil level reaches approximately the midpoint of the oil level plug / indicator.
  - Put on the breather filter back to its place.

Oil level can be controlled also electronically through an oil level switch. If specified in order, the oil level switch can be mounted to the gearbox.

6.5 Foot Connection Bolts and Tightening Torques

Connection Bolts:

Gearbox Size	Bolts
DAE2 - 225	M12
DAE2 - 250	M14
DAE2 - 280	M16
DAE2 - 320	M16

DAE2 - 360	M16
DAE2 - 400	M20
DAE2 - 450	M20
DAE2 - 500	M24
DAE2 - 560	M24
DAE2 - 630	M30
DAE2 - 700	M30
DAE2 - 800	M36

Tightening Torque:

Bolt / Nut	Tightening Torque - Nm (Class 8.8)
M12	58
M14	94
M16	140
M20	270
M24	480
M30	970
M36	1680

6.6 Starting Operation

Before starting operation make sure that the oil level is sufficient according to the mounting position.

7. Maintenance and Inspections

Below maintenance instructions must be followed to ensure efficient and long-life operation of the gearbox.

7.1 Preparing for the Maintenance and Inspections

Before starting any maintenance work, disconnect the gearbox from power supply and take necessary precautions to prevent un-intentional re-start. Inform all responsible parties and operators about the maintenance.

Hot gearbox surfaces and hot oil may cause burns. Let the gearbox cool down before starting your work.

7.2 Maintenance and Inspection Periods

Item for Maintenance & Inspection	Period
Oil level check	Daily
Oil quality check	Every 3,000 hours of operation (at least every six months)
Oil change*	First oil change: after 1000 hours of operation Following oil changes: For mineral oils; every 5,000 hours of operation (at least every year) For synthetic oils; every 15,000 hours of operation (at least every three years)
Visual inspection of the seals for oil leakage from breather filter, covers, housing and lubrication system	Daily
Bearing noise check	Every 3,000 hours of operation (at least every six months)
Replace oil seal	Every 25,000 hours of operation (at least every five years)

- For normal working conditions, +60° C oil temperature is taken as reference. Oil change intervals depend on the oil temperature in operation.

7.3 Checking the Oil Level

- After placing a container under the oil level plug / indicator, remove the plug carefully. If the oil level is adequate, there should be small amount of oil leakage.
- If there is no leakage, fill in more oil as described below:
  - Obtain one of the proper oil types recommended in the oil chart in this manual (Page 15)
  - Remove the breather filter and fill in oil through a cone filler, while the oil level plug is open.
  - When oil starts to come out from the opening, affix the plug again.
  - Continue to fill in a small amount of oil, until the oil level reaches approximately the midpoint of the oil level plug / indicator.
  - Put on the breather filter back to its place.

7.4 Checking Oil Quality

- Open the oil drain plug carefully and let some amount of oil pour out.
- Visually check if there is extreme contamination.

7.5 Changing the Oil

Hot oil may cause burns. Let the gearbox and oil cool down before starting your work.
Avoid intensive contact with oil and clean skin thoroughly after contacting.

- Place a container under the oil drain plug.
- Remove the oil drain plug, breather filter and oil level plug.
- Drain the oil fully.
- Put the oil drain plug back to its place.
- Obtain one of the proper oil types recommended in the oil chart in this manual (Page 15)
- Fill in fresh oil through the opening after the removal of the breather filter, with the help of a cone filler.
- When oil starts to come out from the oil level plug, affix the plug again.
- Continue to fill in a small amount of oil, until the oil level reaches approximately the midpoint of the oil level plug / indicator.
- Put on the breather filter back to its place.

8. Lubrication

8.1 Oil Types

Gear Oils

Only CLP-type lubricants conforming to DIN 51 517-3 standards can be used in Dişsan gearboxes. The lubricant must contain additives that provide corrosion protection, oxidation resistance and wear prevention.

Poly-Alpha-Olefin (PAO) Based Synthetic Gear Oils

PAO-based synthetic gear oils have very high viscosity indices. A very low pour point means they can be used effectively in cold climates where mineral lubricants cannot be deployed, while a high oxidation resistance means they are also viable for use in tropical climates unlike mineral lubricants. They can be used in gearboxes with helical spur gears or helical bevel gears. These are recommended for all gearboxes whether vertical or horizontal, pressure-lubricated or oil bath-lubricated. These lubricants are also recommended for slide and ball bearing mechanisms.

Contrary to PAG-based synthetic lubricants, PAO-based synthetic lubricants may be mixed with mineral lubricants. They are compatible with all paints, oil gaskets and seals used in gearboxes. Gearboxes that have been filled with mineral oils before may be drained and refilled with PAO-based oils without any cleaning necessary. Viscosity grade must be selected based on gearbox type and ambient conditions. The viscosity grade is indicated on the plate affixed to the gearbox.

The minimum requirements of the PAO-based synthetic gear oil to be used are indicated in the table below.

Properties	Standards
Viscosity Index	ASTM D 2270
Pour Point, °C	ASTM D 97
Flash Point, °C	ASTM D 92
Rust Protection	ASTM D 665
FZG Friction Wear	ISO 14635-1 A/8.3/90
4 Ball EP Test, kgf	ASTM D 2783

Mineral Gear Oils

These are high-quality paraffinic lubricants that contain extreme pressure additives as well as additives to protect against rust, corrosion, wear, foaming and oxidation. They may be used in gearboxes with helical spur gears or helical bevel gears that work under extreme pressure and loads. These are recommended for all gearboxes whether vertical or horizontal, pressure-lubricated or bath-lubricated, as well as for slide and ball-bearing mechanisms.

The minimum requirements of the mineral oil to be used are indicated in the table below.

Properties	Standards
Viscosity Index	ASTM D 2270
Pour Point, °C	ASTM D 97
Flash Point, °C	ASTM D 92
Rust Protection	ASTM D 665
FZG Friction Wear	ISO 14635-1 A/8.3/90
4 Ball EP Test, kgf	ASTM D 2783

8.2 Oil Temperatures

PAO-based synthetic gear oils have a wider operating temperature range and higher viscosity index values than mineral oils.

Operating temperature range of mineral oils: -10°C and +70°C (burst: +90°C)
Operating temperature range of PAO-based synthetic oils: -20°C and +90°C (burst: +110°C)

8.3 Oil Life Guideline

The cleanliness of the oil affects the reliability of the operation and the life of the oil and the gearbox. Therefore you must ensure that the oil in the gearbox is clean. If there are any doubts about gear oil cleanliness, conduct an oil analysis and decide whether the oil must be replaced depending on its results.

The initial oil change should take place after 1000 hours of operation.

- PAO-based synthetic gear oil change interval: 3 years or 15,000 hours of operation
- Mineral gear oil change interval: 1 year or 5,000 hours of operation

Note: The above values assume an average oil temperature of 70°C. Actual oil lives may be shorter or longer. As a general rule, oil life decreases by half for every additional 10°C of operating temperature above 70°C.

All Dişsan gearboxes are factory-filled with Mobil-branded gear oils. Dişsan recommends draining the factory-filled oil after the first 1000 hours of operation, and refilling with Mobil SHC Gear series lubricants with viscosity values as indicated on the plates affixed to the gearbox. Changing between oil brands is not recommended as different brand oils may not be compatible. If changing the brand is unavoidable, the gearbox must be thoroughly flushed. Dişsan shall accept no liability for incompatibility between oil brands.

8.4 Recommended Oils

PAO Based Synthetic Gear Oil Chart

Oil Name /Type	Lubrication Method	Viscosity Class	Brand
Mobil SHC Gear 150	Spray with Oil Pump	ISO VG 150	Mobil
Mobil SHC Gear 220	Splash	ISO VG 220	
Mobil SHC 629	Spray with Oil Pump	ISO VG 150	Mobil
Mobil SHC 630	Splash	ISO VG 220	
Omala S4 GX 150	Spray with Oil Pump	ISO VG 150	
Omala S4 GX 220	Splash	ISO VG 220	
Alphasyn T 150	Spray with Oil Pump	ISO VG 150	Castrol
Alphasyn T 220	Splash	ISO VG 220	
Enersyn EP – XF 150	Spray with Oil Pump	ISO VG 150	bp
Enersyn EP – XF 220	Splash	ISO VG 220	

Mineral Gear Oil Chart

Oil Name /Type	Lubrication Method	Viscosity Class	Brand
Mobilgear 600 XP 150	Spray with Oil Pump	ISO VG 150	Mobil
Mobilgear 600 XP 220	Splash	ISO VG 220	
Omala S2 G 150	Spray with Oil Pump	ISO VG 150	
Omala S2 G 220	Splash	ISO VG 220	
Alpha SP 150	Spray with Oil Pump	ISO VG 150	Castrol
Alpha SP 220	Splash	ISO VG 220	
Energol GR- XP 150	Spray with Oil Pump	ISO VG 150	bp
Energol GR- XP 220	Splash	ISO VG 220	

8.5 Oil Fill Quantities

	Oil Quantity (Liters)		
Model	**Horizontal Mounting**	**Vertical Mounting (With Pump)**	**Vertical Mounting (Without Pump)**
DAE2 - 225	6	6	8
DAE2 - 250	8	8	10
DAE2 - 280	11	11	14
DAE2 - 320	15	15	20
DAE2 - 360	21	21	27
DAE2 - 400	30	30	40
DAE2 - 450	42	42	55
DAE2 - 500	58	58	75
DAE2 - 560	80	80	105
DAE2 - 630	110	110	140
DAE2 - 700	150	150	195
DAE2 - 800	210	210	270

* The oil fill amounts in above table are approximate values. Gearbox should be filled with oil up to the midpoint of the oil level indicator.

9. Troubleshooting Guide

All operations must be carried out by qualified and responsible technicians who have read the instructions in this manual. During warranty period, Dişsan should be informed before any operation on the gearbox. Any operation conducted without priorly consulting Dişsan will void the warranty of the gearbox. Only oil changes can be carried out without informing Dişsan.

If any malfunction is detected, system must be stopped and should not be restarted before the problem is eliminated.

Malfunction	**Possible Causes**	**Remedies**
Gearbox temperature gets above 60°C	Oil level might be too low or too high. Oil type might be not adequate.	Check the oil level from the oil level indicator. And Oil type from oil chart (Page 15)
	Oil may be contaminated	Change the oil

Unusual noise comes from the gearbox	- Bearings may be damaged due to insufficient oil. - The gears might be broken or damaged.	- Check oil level. If the problem persists after correcting the oil level, send the gearbox to service. - Send the gearbox to service.
Oil leakage – from seals	Seals may be damaged.	Change the damaged seals.
Oil leakage – from breather filter	Oil level might be too much. Oil may be expanded due to extreme heat.	Check and correct the oil level. If extreme heat persists, send the gearbox to service.
Oil leakage – from oil drain or oil level plugs	The plugs may not be tight enough. Plugs may be crushed and damaged.	Tighten the plugs. If oil leakage persists, change the damaged plugs and wrap with teflon and tighten.
Oil leakage – from housing	Housing may be broken or cracked.	Send the gearbox to service.
Oil leakage – From covers	Cover bolts may be loose. Sealing liquid may be damaged.	Check and tighten the bolts. Disassemble the cover, clean and put new sealing liquid. Assemble the cover and tighten the bolts.

Instructions for Changing the Oil Seals:

- Place a suitable container under the oil drain plug of the gearbox housing.
- Unscrew the oil drain plug and allow the oil to drain into the container.
- After the oil is fully drained, remove the cover of the oil seal.
- While taking out the seal avoid any damage to metal surfaces.
- Check if there is any damage on the metal surfaces of the cover where the seal is placed. If there is no damage, you may continue the process. If there is damage, change the cover with a new one.
- After taking out the seal, clean up the area. Make sure there is no dust or silicon residuals left on the metal surfaces.
- Check the new seal to ensure it has no damage.
- Place the new seal with the help of a ring with the same size as the seal. Hammer the four corners of the ring to put the seal in its place thoroughly.
- If you cannot find a suitable ring, you can use a metal stick to help you place the seal. Be careful not to damage the seal.

- Put the cover back in place. Avoid any damage to the seal spring. While placing the cover, apply grease oil to the gearbox shaft to ease the process
- Refill the gearbox with the same oil or with fresh oil up to the level suitable according to the mounting position. Make sure to use correct oil type as indicated on the gearbox nameplate or the oil chart in this manual (Page 15).

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