FR 28
Forwarder
instruction manual

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0812481
Englanti
Introduction

The purpose of this book is to familiarize the operator with the forwarder. It is of utmost importance that the operator becomes familiar with the structures, adjustments and maintenance of his forwarder. Compliance with the advice and instructions given in this manual guarantees the best results at the lowest costs.

This manual provides descriptions of as well as operating and maintenance instructions for the forwarder. The other manuals you will find useful when using and servicing your forwarder include the instructions and spare parts catalogue for the loader, the instructions for the crane as well as the engine manual and the spare parts catalogue.

Have these manuals always in the cab, in the special pocket reserved for them, for convenient reference. If, for some reason, they are not supplied together with the forwarder, send immediately for new manuals.

Item “Technical Specifications” has a description of all the features of the forwarder. It does, however, not include retro-fitted accessories.

The Manufacturer reserves the right to modify the structure, adjustments or accessories of the forwarder as well as the service and maintenance instructions without further notice.

Sampo Rosenlew Ltd
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Safety precautions

Read carefully these instructions on safety and use before starting to operate the forwarder. The time spent becoming familiar with the instructions now will save you money or may even spare you from injury.

Before accepting the delivery of the forwarder, make sure it conforms to the delivery contract. Do not fit the forwarder with any accessories not approved of by the Manufacturer. The Manufacturer of the forwarder is not responsible for any damage or injury caused by such accessories either to people or property. If any information provided in this manual contradicts the laws and regulation of the country in which the harvester is used, local regulations are to be followed.

1. Transportation on a vehicle or by rail

Make sure you know the measurements and weights of the forwarder and the transporter. Comply with any regulations concerning transportation. Use minimum of 3 bar tyre pressure, to improve stability.

Fix the forwarder securely to the transporter using fixing points A (10 in total) which can be found in front, sides and back of the machine (Figure).

For road transport lower the crane fully and fix it to the transporter.

2. Driving in traffic

On public roads a transporter shall be used to move the forwarder.

Remember that the forwarder has articulated steering.

Test brake functions before driving on the road.

Lower the crane fully to its transport position.

Wear the safety belt.

Never drive downhill with the gear in neutral.

Only shift gear on level ground.

Never carry passengers on the harvester.

Never use the harvester for transporting goods.
3. Timber loading and transport
Get familiar with the structure of the forwarder by studying the manual before starting working. Make sure the protective guards are properly attached and in good condition.
Sound the signal to warn people around the forwarder before starting the engine.
Never use the forwarder for anything except of transporting timber.
Before starting, particularly reversing, make sure that everybody nearby is aware of your intentions.
Observe marked crane safety distance. Stop loading, if someone comes to the danger zone.
Fasten the seat belt. This is important, particularly when driving across steep terrain.
Test the brakes as soon as you start, and stop immediately if the brakes or steering operate defectively.
Never adjust the seat or joysticks while driving.
Never leave the cab while the forwarder is moving.
Never leave the engine running unattended.
Beware of the crane and the moving parts in the grapple.

In cold weather heat the oil by circulating it at low revolutions and low pressure before starting work.
Be careful on hillsides; the forwarder may overturn, particularly with the crane on the downhill side.
The forwarder cab is a safety cab.
The forwarder has two exits. The left-side door is the normal exit. The right-hand side window may be used as an emergency exit. Window can be opened by pulling the handle first downwards and then bending it to the right. Emergency exit is marked with EXIT sticker.
When the forwarder is in use, the exits must be closed. For safety reasons their construction must not be changed. When driving on frozen rivers or lakes, make sure the ice is strong enough. When driving on ice, keeping doors open helps exiting cabin.
Note the recommended safety distances when moving under power lines.
Stop the engine before cleaning or servicing the forwarder.
Stop the forwarder and the engine immediately if there is an alarm or any abnormal sounds or smells. Find out the reason for them, and solve the problem before carrying on.
If there are leaking hydraulic connections, tighten the connections and wipe the oil off the frame and underpan.
Support or lock the crane and the grapple before going beneath them.
Never clean the forwarder without proper equipment.
When leaving the forwarder, lower the crane, stop the engine, remove the ignition key, turn the master switch to its zero position and lock the door.

**SAFETY DISTANCES WHEN HARVESTING UNDER OPEN-WIRE POWER LINES**

The minimum space between the forwarder and power lines with voltage must be in accordance with the enclosed illustration, in which the danger zone is darkened.
Low-voltage power lines (230/400V) can be distinguished from high-voltage lines (over 1 kV) by the smaller insulators and the fact that there are usually 4 low-voltage lines. In case the height or voltage of the power line is difficult to estimate, the Electric Company shall be consulted.
In case of accident

If there is an accident despite all precautions, keep calm and consider carefully what to do. First try to reverse the forwarder away from the power line. If there are other people near, ask them to check that the forwarder is not stuck in the line. If the forwarder is just leaning against the lines, try to drive it away from them. Follow the advice from the people nearby. Due to their own safety, they shall stay a minimum of 20 metres away from the forwarder touching the power line.

If the forwarder cannot be driven off, and you have to leave the machine, jump down with your feet together in order not to touch the forwarder and the ground simultaneously. Do not make yourself a conductor through which electricity can pass; the real danger lies in touching the forwarder and the ground simultaneously.

Get away from the forwarder jumping either with your feet together, or with only one foot on the ground at a time. Otherwise the electric field on the ground may create a fatal electric current between your legs. You will be safe at a distance of 20 metres from the forwarder. Beware of broken power lines lying on the ground.

A forwarder touching a power line may catch fire. Leave the forwarder immediately if smoke starts coming from the tyres.

Make sure the forwarder will be guarded at a safe distance. Do not try to get on the forwarder even if the power in the power lines may seem to have gone off.

Remember that open-wire lines never have a “blown fuse”, but they are always dangerous unless made dead by an electrician. Even if the power went off, it might come back on in a while due to technical reasons. This may be repeated several times.

Contact the Electric Company and inform them about the exact site of the accident. By doing this, any risk can be eliminated and the fault repaired. Ask the Electric Company for advice and follow it. Inform them about any contact with power lines even if there was no actual damage.
4. Repair and service

- Always keep the forwarder in good condition.
- Check the condition of fast moving parts daily. Pay special attention to the transmission mechanism and the rotating parts. Replace defective parts before they become dangerous.
- Clean, repair and service the forwarder with the transmission and engine off, the ignition key off the ignition switch and main switch off.
- Do not go under the crane, especially when carrying load.
- Before welding, disconnect the battery cables, input cables of the diesel engine control unit 2 pcs, connector of the SCR-supply module (X110), all the cables to the PC processor, connector of the large wiring harness between the frames and the central unit cables of the optional fire extinguishing system.
- Disconnect the negative battery cable before you repair the engine or electrical equipment.
- Always have the earth cable of the welding set near where welding is done.
- Do not use inappropriate tools to connect and disconnect the battery.
- Do not make an open fire or smoke near the battery.
- Handle the battery acids with care.
- Do not add air in the tyres without a pressure gauge due to risk of explosion.
- Do not add coolant with the engine running.
- Do not remove the radiator cap from an overheated engine.
- Beware of hot surfaces of the engine and exhaust pipe.
- Do not refuel with the engine running.
- Do not smoke while fuelling.
- Do not adjust the hydraulic working pressure without a pressure gauge due to possible injury and damage to the components.
- When servicing the hydraulics, be aware of the high pressure in the system. Make sure there is no pressure in the system, not in the pressure accumulator, either, before disconnecting the connectors.
- Never use over-sized fuses; they involve risk of accident.
- Never start the forwarder with anything but the ignition key.
- When refitting a wheel, tighten the fixing screws to the correct torque.
- Do not make any such structural changes or additions to the forwarder that would make it less safe.
- Tow the forwarder only from designated points.
5. Local laws and regulations
Forwarder is a complex device, and dangerous if misused. User manual must always be preserved with the machine at the place reserved for it and if needed, new drivers should be instructed to operate the machine. Different countries have different safety at work and traffic regulations. Get to know the existing regulations of your area.

6. Fire safety
Two factors are needed to start a fire: flammable material and ignition. Oxygen is always available. In the forest highly flammable dust accumulates in and on the forwarder. Clean the forwarder periodically. Oil and fuel leaks also increase the risk of fire. Repair any detected defects immediately. The engine and the exhaust pipes, the electric system in case of a short circuit and overheated brakes pose a real risk of fire.

The forwarder comes with two 6-kilo hand extinguishers. They are stored at the base of the crane. The extinguishers shall be inspected every 6 months by an authorized service outlet. The forwarder may be equipped with a semi-automatic fire extinguishing system. Make sure to comply with the manufacturer’s instructions when using the system.
### Marking of danger points

Although an effort has been made to build the forest forwarder as safe to use as possible, there are certain risks involved in its use. These are to be kept in mind when operating the forwarder. The danger points have been marked on the forwarder using danger symbols. On the following page you will find the key to these symbols. The danger symbols are based on the international ISO 11 684 standard.

### Danger symbols

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<tr>
<th>Danger</th>
<th>To avoid danger</th>
<th>Symbol</th>
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<tr>
<td>Subject to danger due to insufficient information</td>
<td>Read the manual before starting the forwarder</td>
<td><img src="image" alt="Symbol" /></td>
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<tr>
<td>A raised part may fall down</td>
<td>Support raised parts before going under them</td>
<td><img src="image" alt="Symbol" /></td>
</tr>
<tr>
<td>Gap in belt drive</td>
<td>Stop the engine and remove the ignition key before removing any guards</td>
<td><img src="image" alt="Symbol" /></td>
</tr>
<tr>
<td>Getting entangled in moving parts</td>
<td>Keep at a safe distance from jointed components</td>
<td><img src="image" alt="Symbol" /></td>
</tr>
<tr>
<td>Falling of the machine or of objects handled with it</td>
<td>Keep at a safe distance from the forwarder, the crane, the head and the wood handled</td>
<td><img src="image" alt="Symbol" /></td>
</tr>
<tr>
<td>Electric shock</td>
<td>Keep at a safe distance from power lines. See the safety distances above</td>
<td><img src="image" alt="Symbol" /></td>
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<tr>
<td>Danger</td>
<td>To avoid danger</td>
<td>Symbol</td>
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</table>
| Fire                | In case of fire:  
- turn off the engine  
- turn off the main power  
- extinguish the fire  
- get help if necessary  | ![Stop Symbol] |
| Fire                | Extinguish the fire with the fire extinguisher stored under the guard marked with this sticker.                                                                                                             | ![Fire Extinguisher Symbol] |
| Service measures    | Before starting of service:  
- turn off the engine  
- turn off the main power  
- when servicing the forwarder head, remove pressure from the pressure accumulator as instructed   | ![Warning Symbol] |
| Safety belt not worn| Always wear a properly adjusted safety belt while working and driving on the road                                                                                                                              | ![Safety Belt Symbol] |
| Normal exit not available | Open the handle on the right-hand door and exit through the open door  
Before starting work make sure that emergency exit is unlocked also from the outside.                                                                 | ![Exit Symbol] |
| Pressurized oil spray | Before disconnecting hydraulic connections, let the pressure off the pressurized oil tank by opening the breather filter with a gloved hand while keeping your face far from the breather. | ![Warning Symbol] |
| Refrigerant         | Leaking refrigerant may cause frostbite                                                                                                                                                                       | ![Warning Symbol] |
Type marking

When ordering spare parts or service, always quote the type marking and number shown on the machine plate. When ordering engine parts, also quote the engine number.

Write down the serial numbers of the forwarder, engine, crane and grapple on this page (and in the spare parts list).

Forwarder serial number:

Engine serial number:

Crane serial number:

Grapple serial number:

Note! Left side of the forwarder = The side of the cab with the stairs
Right side of the forwarder = The side with the engine exhaust pipe
Technical specifications

The base forwarder with articulated steering includes: the cab, gear box, the engine, pumps and tanks on the front frame. On the rear frame: valves, loader and load space

**FR28**

### Weight
- **starting**
- **Maximum permissible weight (ROPS)**
  - Weight approx. 13000 kg
  - 20000 kg

### Main Dimensions
- **Length without crane**: 8.3 m
- **Width**: 2.7 m
- **Height in transport position**: 3.03 m
- **Ground clearance**: 0.65 m

### Engine
- **AgcoPower 49AWF**
  - Power: 124 kW/2100 rpm
  - Fuel tank: 200 l

### Transmission
- **Bogie in front and rear**
  - Two speed ranges forward and backward
    - 1st gear: 0-8 km/h
    - 2nd gear: 0-25 km/h
- Four-wheel drive possible to switch off
- Mechanical differential lock at the front and rear

### Tyres
- **Front**: 710/40-22.5, 600/50-22.5
- **Rear**: 710/40-22.5, 600/50-22.5

### Hydraulic system
- **Pump in working hydraulics**: 220 l/min & 210 bar
- **Load sensing, programmable electric joystick control**
- **Oil tank**: 125 l

### Electric system
- **Voltage**: 24 V
- **Battery**: 2 x 145 Ah
- **Charging generator**: 100 A
- **Working lights**: 19 pcs

### Crane
- **Mesera Loglift F59/F71, Kesla 600T/700T**
  - Operating range: 10 m
  - Lifting capacity (gross): 78 kNm
  - Crane weight: 1330 kg

### Grapple
- **Kesla proG25, G28**

### Brakes
- Negative parking brake, positive working- and driving brakes

### Cab
- **Safety cab (FOPS, ROPS, OPS)**
  - Noise level: 71 dB (A)
  - Windows: Hard-surfaced polycarbonate
Certificate on conformity to the EU directives

CERTIFICATE ON CONFORMITY TO THE EU DIRECTIVES

Manufacturer
Sampo-Rosenlew Ltd
Konepajärvenkatu 2A, P.O.Box 50
28101 Pori Finland

Collector of technical spec:
Jari Karén
Address:
Sampo-Rosenlew Ltd
Konepajanranta 2A, P.O.Box 50
28101 Pori Finland

Description of the machine: Forwarder FR28
• complies with the machinery directives (2006/42/EC) and requirements of the national regulations set into force by that.
• complies with the requirements specified in the following machinery directives:
  97/68/EEC directive on diesel engine exhaust fumes
  2004/108/EC directive on electro-magnetic compatibility

The machinery has been designed in conformity with the following international standards:

SFS-EN-ISO 12100  Safety of machinery. Basic concepts, general principles for design.
SFS-EN-ISO 11850  Machinery for forestry — General safety requirements

1.10.2015 Pori

Jali Prihti
CEO
Guarantee

Sampo Rosenlew Ltd, later called the Manufacturer, grants a guarantee regarding defects in the material and workmanship.

1. The guarantee period starts as soon as the forwarder has been delivered to the customer.

2. The guarantee does not cover:
   - freight and postage costs
   - transport damage
   - damage due to carelessness, misuse or injury
   - damage due to impurities in the hydraulic oil or the use of wrong type of oil
   - damage due to non-compliance with the operating instructions
   - damage due to neglected periodical maintenance procedures
   - damage caused by spare parts not approved of by the Manufacturer
   - damage due to the natural wear of parts; parts and materials likely to show natural wear, such as:
     - rubber hoses
     - light bulbs, sensors
     - chain and guide bar
     - tyres
     - belts and chains
     - windscreen wipers
     - fuel, oil, coolant and brake fluids
     - filter cartridges
     - packing and gaskets
     - electric cables
     - injection nozzles
     - windows and guards made of polycarbonate
   - damage due to measures taken by the purchaser affecting the quality and structure of the forwarder. Increasing of the hydraulic working pressure and pressure limits may cause damage;
   - bogie damages caused by usage of inappropriate bogie tracks. Some track models (especially with wide plates) can cause snow packing tightly between the tire and the track plate. In this case continuing driving too long will cause bogie housing bending and breaking the gear transmission.
   - indirect damage, such as
     - loss of output or down time
     - compensation claims submitted by a third party
     - overtime and holiday compensations
   - damage to property caused by the equipment
   - if there is a change in the ownership of the forwarder

3. When working in cold conditions, the guarantee is valid only when the outdoor temperature does not drop below -25°C.

4. Any compensation claims under guarantee shall be submitted to the Manufacturer in a complete form within two weeks of the damage.

5. The guarantee compensation is limited, and the Manufacturer shall only replace the defective component unless otherwise agreed with the customer.

6. The components replaced under guarantee are the property of the Manufacturer, and they shall be returned to the Manufacturer upon request. Otherwise they shall be scrapped.

7. The guarantee on components delivered or repaired during the guarantee period will run out at the same time as the guarantee on the forwarder.
Structure and functions of the forwarder

Structure

The Sampo FR28 forwarder has been designed to meet the demands set on the thinning of forest. It is light and easy to handle, small but with a wide operating range. It does not damage standing trees and due to its light weight, it does not cause damage to the roots. Load space capacity is sufficient for thinning harvester outputs.

The forwarder has articulated steering. The gears, engine, hydraulic pumps, oil and fuel tanks and cab are located on the front frame. The crane and loading space are located on the rear frame. The forwarder is steered and tilted by means of a joint. The loader is located as much as possible to the front frame side in order to get even weight distribution.
Cut-away picture of the forwarder

3. Drive motor  10. Intercooler
4. Traction hydraulics pump  11. Air filter
5. Working hydraulics pump  12. Engine
6. Oil tank  13. SCR catalytic converter
7. Fuel tank  14. DOC-oxidant & mixer
Operator control instruments

Equipment on the instrument panels (fig. 1)

A PC display  
B Weighing machine display  
C Ashtray  
D Drive pedal  
E Brake pedal  
F AC/Heater regulator  
G Cooler  
H Ignition, starter (and electric stop)  
I Emergency stop  
J Phone outlet

Switches on the instrument panel (fig. 1&2)

1 Turning signal  
2 Seat heating  
3 Emergency lights  
4 Emergency flasher  
5 Sound signal  
6 Brakes  
7 Frame lock  
8 Working lights + delayed light  
9 Working lights  
10 Empty  
11 Master switch  
12 Headlights, full  
13 Headlights, dipped  
14 Windscreen washer  
17 Automatic greasing
Equipment on the ceiling (fig. 3)
A) Alarm light (yellow)
B) Indoor light
C) Speaker
D) Radio
E) Engine heater display
F) PC
Vertical levers (fig. 4)

**Left**
1. Gear 1/2
2. Log gate forward
3. Log gate backward
4. Driving direction forward/backward
5. 8WD
6. Differential lock rear
7. Differential lock front
8. Windscreen wiping

**Right**
9. Parkingbrake and steps
10. Throttle, max. revolutions
11. Throttle, working revolutions
12. Throttle, idle
13. Articulated steering
14. Activation
15. SHIFT (use together when engaging differential locks)
16. Seat Lock/Unlock
17. Adjusting maximum driving speed
Crane control lever, left

- V1  Outer boom inwards
- V2  Outer boom outwards
- V3  Crane turn left
- V4  Crane turn right
- V5  Extension out
- V6  Extension in

Crane control lever, right

- O1  Crane lift up
- O2  Crane lowering down
- O3  Rotator turn left
- O4  Rotator turn right
- O5  Head open
- O6  Head closed
### Signs and symbols

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<td><img src="image" alt="Headlights, dipped" /></td>
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<td><img src="image" alt="PC" /></td>
<td>PC</td>
</tr>
<tr>
<td><img src="image" alt="Emergency exit" /></td>
<td>Emergency exit</td>
</tr>
</tbody>
</table>

Alarm symbols appear on the Iqan display.
Operation and Adjustments

After getting in the cab sit on the bench, close the door and fasten seat belt. The main power can be turned on from the cab or under the lid on the right front corner of the forwarder before getting in to the cab. Start the engine. Before starting work, you need to press the activation button next to right-hand joystick. You can then use a crane. Before driving you must release the parking brake by pressing button next to right-hand joystick. At the same time the steps rise up to driving position.

Both the brakes and the frame lock can be made to function automatically depending on the drive pedal position. When depressing the frame lock switch (fig 2, switch 7) and the working brake switch (fig 2, switch 6) in their backward position, the working brakes and the frame lock get always engaged when the drive pedal is in its up position. Correspondingly when depressing the drive pedal, the working brakes and the frame lock get disengaged. This keeps the forwarder stationary and stable when not moving, but allows nimble moving towards the next tree.

Doorswitch

When the left side door is open, the crane movements, grapple movements, frame steering and drive are switched off. Note, in this case steering does not work.

Joystick positions can be adjusted (fig. 9)

The positions of the crane joysticks and seat armrests can be adjusted at several points. To facilitate entering and leaving the cab, the joystick near the door can be turned both up/down and sideways. After adjustment it is important to lock the positions of the joystick and the armrest to prevent unwanted movements.
Seat has several adjustments (fig. 10)

1. To adjust the fore and aft position of the seat, lift lever A and move the seat in the required direction.
2. Adjust the height using forks B at the front and back of the seat.
3. Adjust the suspension using lever C.
4. Adjust the backrest angle using lever D.

Air suspended seat has more adjustments (fig. 11)

1. To adjust the fore and aft position, unlock lever A and move the seat in the required direction.
2. Adjust the height and fore/aft tilt by pressing levers B on the side of the seat and lifting/depressing the front or rear of the seat.
3. Adjust the seat suspension pneumatically by pressing button C.
4. Adjust the backrest angle using lever D.

Rotating seat

Under the seat is electrically lockable swivel frame. By pressing the button 16 (fig 4) on the right-hand joystick can lock alternately open and lock. In open position the bench can rotate into the driving and loading positions and to any point between them. When leaving the driver’s cab lock the bench towards door. Thus there is no risk that the joystick grips, for example, the jacket skirt.
Brakes while driving and harvesting (fig. 12)

The forwarder has positive hydraulic driving- and working brakes. The brakes are controlled with two pedals, one with driving direction and other one with loading direction. Brakes engage by pressing pedal. The stronger the brake pedal is pressed the stronger it brakes and keeps the machine in place.

The brakes are mainly controlled from the cab using a double-position switch (fig. 2, switch 6). Using the double-position brake switch, the brakes can be engaged or put in their automatic position hydraulically. In the up-position the brakes are always engaged, and when depressed down-position they are in automatic position. In their down-position, that is the automatic position, the brakes operate depending on the position of the drive pedal. Normally when working switch should be in its automatic position. Same goes with driving on hilly roads.

Brakes can be disengaged completely using the Iqan-display.

Hydrostatic power transmission brakes always when gear in on. That is when drive pedal is released towards up-position. Do not press the brake pedal at the same time when the parking brake is engaged. It shortens the operating life of of the brakes considerably.

Parking brake

The parking brake gets engaged automatically when the engine is switched off. Disengage parking brake before driving. After starting the engine parking brake (switch 9 next to the right joystick) must be released before you can start driving. Steps operate automatically at the same time with the parking brake. Whenever the parking brake is engaged the steps lowers down. When disengaging the parking brake stairs rise up.

Frame lock

The frame lock operates similarly to the brakes. Depending on the position of the frame lock switch, the dual-function cylinders either locks the frames together or operates in the automatic position at the same time with the brakes. With the frame lock switch (fig. 2, switch 7) in its up-position, the frame lock is always engaged and when depressed down-position, the frame lock is in automatic position. Normally the frame lock switch should be in its automatic position.
Traction transmission

Engine power is transmitted to the consecutive work and drive pumps by means of a flexi switch. From the pump to the hydraulic motor of the gear box the power is transmitted by means of liquid. The pump output is adjusted steplessly using the drive pedal. The hydraulic motor has variable displacement. It will be adjusted automatically according desired driving speed. There are two gear speed ranges, which are selected using switch 1, fig. 4. The ranges are intended for driving loaded (range 1), driving on the road with no load (range 2). Gears should be shifted on level ground without pressing drive pedal. From the gearbox power is transmitted to the wheels by means of the cardan shafts and the bogies.

The speed of the forwarder is controlled by drive pedals D, fig.1. When the pedal is not pressed, the forwarder is stationary if the gear is engaged and the engine running. Driving direction (forward/backward) is chosen by switch close to left joystick (switch 4, picture 4). Drive direction forward is selected by pushing switch forward. Correspondingly drive direction backwards is selected by pushing switch backwards. Speed is controlled by pedal. Also the engine speed (r/min) and potentiometer 17 (fig 4) near right joystick affect the speed. Potentiometer can be used to adjust maximum driving speed. It can be helpful when accurate driving is needed. Drive pedal can be pressed down and speed adjusting is made with the potentiometer. When driving in traffic, a crane must be positioned on the transport subsidy in the loading space.

A forwarder equipped with hydrostatic transmission must never be parked using only the gear, but the parking brake must always be engaged. The hydraulic motor cannot keep the forwarder stationary for a long period.

Four wheel drive

With four-wheel drive both front- and rear-wheel drive are engaged. Four-wheel drive is switched on electrically using switch 5 next to the left-hand joystick, fig. 4. The coupling shall be done with the forwarder stationary. 4WD is available on gear 1.
Differential and rear-wheel drive lock

There are sometimes situations when both the wheels on the front or rear axle do not have sufficient grip in respect to the required traction power. In this case one of the wheels stops gripping, which will further decrease the traction power. This can be avoided by engaging either the front lock using switch 7+14 (fig. 4) and/or the rear lock using switch 6+14, (fig. 4). On solid ground the locks makes turning difficult, so it should be switched off. The differential locks must be switched on when the machine is stationary and it can be used only on gear 1.
Starting of the engine (Fig. 13)

The forwarder is equipped with a safety ignition system, which prevents the forwarder from moving with the engine being started. It allows the start-up to take place only when the drive pedal is not pressed.

The engine is started using the ignition key J. Turn the key to the right to switch on the ignition. The same position also operates the engine glow. During the glow, the engine will not start, and this is also displayed on the Iqan display. When turning the ignition key farther to the right, to position HS, the engine starts.

Diesel rpm’s are selected with buttons 10, 11 and 12 next to the right-hand joystick. Pressing the button 12 the engine runs at idle. Pressing the button 11, the working revolutions are used. When pressing the button 10, the diesel engine uses full revolutions. Have the engine always idle before switching the diesel off and on. The instructions on adjusting the revolutions are available in the section Using the Iqan display.

Stopping of the engine

Before stopping of the engine, move the throttle into the idling position. The engine is stopped using the electric stopper by turning the ignition key to position 0.

When you turn the ignition key to the left of the 0 position and press it simultaneously down, the vacuum pump of the oil tank switches on automatically. This is a way to protect the environment and reduce oil waste in cases of hose breaks. The vacuum also should be used when servicing the hydraulic system. Do not try to run the machine while the vacuum pump is on since a vacuum causes cavitation and quickly damages the hydraulic pumps.
Main power switch (Fig. 14) Controls Electricity for the Whole forwarder

There is an electric main power switch to control the electrical instruments of the forwarder. It is located under the lid on the front left-hand side. There are two power switches. One is inside the cabin on the side instrument panel, and the other one next to main power switch.

When you leave the cab for an extended period of time, always switch the power off from the main switch as well. Just turning the ignition key to the 0 position leaves several electrical equipment on. This uses enough power to potentially cause the battery to empty while you are away.

Emergency stop

When the emergency stop switch (fig. 1, switch I) is depressed all the way, the diesel engine gets switched off, but there is still current in the electrical system, but the power to the joysticks and to the crane control module switches off. This engages the parking brakes. When the engine is switched off, the forwarder cannot be steered.
Working lights

You can select the number of the working lights that are on using the working light switches on the instrument panel (figure 2, switches 8 and 9). For the working lights controlled by switch 8, it is possible to use a so-called delayed light function by leaving these lights on before turning the main power switch off. Some of the forwarder’s working lights remain on to light the surroundings while you leave the forwarder. The lights switch off on their own in about 90 seconds.

Cabin temperature and Ventilation adjusting (fig.15)

The fan RPM’S adjusting from switch A
• OFF-position: Fan does not blow
• AUTO-position: Fan rpm adjusting automatically to reach chosen temperature and maintaining it automatically
• Manuallly fan rpm stays stationary as chosen

Turn switch B to adjust temperature. Turn the switch value 22 in line F to set cabin temrature in 22.

Internal air circulation is selected by a pushbutton C. Pressing the button electronically turns the flap in the fan air intake, so that the the air leaving the cabin is circulated back to the blower. This helps to maintain ventilating power in hot and cold weather.

Air conditioning can be switched ON/OFF manually by pushing button D. In this case, the fan control knob must not be in AUTO or OFF position. That is, the fan speed must be selected manually from the standard rotation speed.

Defrosting is switched on by a pushbutton E. During Defrosting fan control knob must be in the AUTO position. Heater, air conditioning and fan motor are then working together blowing warm dry air as much as possible.

Cab Fresh-air fan Provides Good Ventilation

To change the airflow direction, turn the nozzles on the panels. The fan air is filtered in from the right-hand bottom of the cab. Filter is replaced from outside the cab beneath the grill.

To keep up the fan capacity and secure the purity of the air, the filter shall be cleaned or replaced often enough to prevent impurities and fungi from clogging the filter.

Heater Provides Additional Heat from the Engine

The device will automatically adjust the water valve and the air-conditioner compressor so that the indoor temperature remains at the selected temperature.

The air in the cab is heated by a heating element in which the engine coolant circulates.

Air conditioner cools the Air in the Cab

Air Conditioning rotates refrigerant HFC R134A. The correct fill quantity is 1.7 kg.

Note! A difference of over 8°C between indoor and outdoor temperature is harmful to your health. Keep the cab door closed when the air-conditioning is on.
Towing (fig. 16) Allowed from Towing Points Only

The forwarder may be towed from designated points only. When towing, the towline is put around the pin as shown in fig. 16. The load space should be emptied before towing. With the forwarder on tow, the operator must be in the cab and the engine running to enable steering.

Unless the engine can be started, the forwarder must be towed with great care; as steering is not working. In this case, the brakes should also be released mechanically.

When towing on the road, statutory traffic regulations must be followed.
Engine, source of power
The engine is a water-cooled, four-stroke Common rail 49AWF-diesel. For a more detailed description of the engine, see the engine manual. Power is transmitted from the rear of the engine to the working hydraulics and traction transmission pumps. The front of the engine houses belt drives for the fan and the alternator generators and the AC compressor.

Suction air filter (fig. 17)
The engine suction air is cleaned by prefilter and two-part paper filter B. Air intake for the filters is located above the coolers cell. A warning text and symbol in the Iqan display indicate a blockage in the filtering system. See cleaning instructions under service and maintenance.

Fill the tank with fuel free from impurities (fig. 18)
The volume of the fuel tank is 200 litres. Use high-quality diesel oil as fuel. Check the fuel requirements in the engine manual. The fuel must be free from any impurities and water. Before refuelling, remove all impurities from around filler. Never drain a spare tank into the fuel tank, as impurities and water tend to settle on the bottom. If fuel is added from a spare tank, a funnel with a sieve must be used.

There are air bleeds on the outer rim of the filler through which air gets into the tank. Make sure these bleeds stay unblocked. Never use a filler without air bleeds.

DEF
Forwarder diesel engine is Euro Stage 4 phase, with the exhaust system SCR catalytic converter and mixing / oxidation unit DOC. In order to operate in accordance with the emission standards the SCR catalyst requires additional substance known as DEF (Diesel Exhaust Fluid). It is used in reduction of nitrogen oxide emissions from diesel vehicle exhaust. Most commonly known trademarks of DEF are AdBlue, Air1 and Greenox. For the DEF requirements, see engine manual.

AdBlue is stored in its own tank, from where it is injected into the hot exhaust gases. The heat of exhaust gases converts AdBlue to ammonia and carbon dioxide. After this the ammonia reacts with nitrogen oxides in catalyst reducing them to harmless nitrogen gas and water steam. This technology is called SCR technology (Selective Catalytic Reduction).
DEF tank is located in front of the cabin on the right side of the machine (Figure 19). The tank holds 15 liters of DEF. Normally DEF will take approximately 6-8% of the consumption of diesel fuel. In cold weather, DEF consumption is less than in warm weather. The red warning symbol on the Iqan-display indicates low DEF level. Adblue must be refuelled or engine will drop RPM’s and finally prevent use.

With the failure of the DEF system Iqan display has another warning symbol. If malfunction occurs the same power and RPM restrictions will take effect, ending ultimately prevention of the use.

Be careful when handling DEF. DEF is aggressive to some materials and corrosive to some metals. DEF becomes crystalline when in contact with air. In case of a spillage rinse with plenty of water and dry with a clean cloth.

Even small amounts of diesel fuel in DEF tank may damage the gaskets of the SCR system!

AGCO SISU POWER SCR system is durable and almost maintenance free. Only main filter change for supply module is required in normal use. AGCO SISU POWER SCR is equipped with on-board diagnostic, which will warn the operator or limit the usage of the machine if any problems (e.g. leakages or blocking of lines) occur in the system.

For the maintenance and adjustment of SCR, see engine manual.

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**Daily Checks of the Engine**

(Fig. 20) **Lubrication System**

It is of utmost importance to use correct lubricating oil types, in accordance with the load placed on the engine. See Lubrication Table under “Maintenance”. Check the oil level daily before starting; it shall be between the minimum and maximum marks on dipstick A, preferably near the maximum, fig. 20. Oil is refilled through filler B. Symbol on the iqn monitor indicates low oil pressure. Should the oil pressure warning light come on with the engine running, stop the engine immediately and find the cause for the trouble.

**Cooling System**

The engine cooling system is filled with coolant that has 40-50 % ethylene glycol in it. Do not use plain water as coolant as it damages the engine. Before refill, the engine must cool off. When refilling, remember the coolant expands considerably when it gets warm, so do not fill up the system. The coolant level is correct when the cells are clearly covered by the coolant, and the coolant level can be seen at level indicator in the middle of the expansion tank. Check the coolant level daily before starting.

The coolant temperature can be seen on the iqn monitor. It shall be between 75-95°C. A warning symbol on the iqn monitor indicates engine overheating when the temperature reaches 95°C. If the temperature starts to rise, check that the outside of the radiator is not clogged. The best way to clear blockage is to direct compressed air from the side of the fan through the radiator, or use a brush for cleaning. Always be careful not to damage the lamellas. Behind the cooler course mesh filter there is a small-holed screen. To clean it, first open the rear grille, and then lift up the screen.
Fan
Radiators for the engine coolant, intercooler, hydraulic oil, AC and fuel are located in the front of the forwarder. The fan sucks air through these cells. The fan is equipped with viscous coupling which is controlled by the temperature of the engine coolant, charge air and hydraulic oil, and status of the air conditioning. If any of the above requires cooling, fan coupling is switched on. The fan rpm is automatically increased if more cooling is required.

Fire extinguishers
The forwarder is supplied with two portable 6-kg fire extinguishers. They are stored at the base of the crane. The extinguishers shall be checked every six months by an authorised service outlet.
The forwarder may also be equipped with a semi-automatic fire extinguishing system, which shall be operated in compliance with the Manufacturer’s instructions.

Opening of the guards
Engine cover rises with help of an electrical motor. Switch for this can be found under the lid in right front corner of the forwarder.
Hydraulics

Hydraulics is divided in traction and working hydraulics. They have a joint oil tank on the front frame of the forwarder. Traction hydraulics (fig. 22) includes a suction/return filter, drive pump and drive motor. The drive pump produces pressure corresponding to the drive resistance and a volume flow corresponding to the drive pedal position. Low speeds are controlled by the drive pump. When speeding up, displacement of volume in drive motor is reduced, thus increase driving speed even more. At the same time the traction power is reduced accordingly.

A  Drive pump
B  Drive motor.
C  Suction/return filter

Working hydraulics in the basic forwarder (fig. 23) includes a work pump, load sensing directional valve and return filter. Crane movements are controlled by a load-sensing valve. The work pump produces the right pressure and output in relation to the load weight and speed.

A  Work pump
B  Directional valve
C  Return filter

It is forbidden to change the pressure in working and traction hydraulics without permission from the Manufacturer, as it may damage the forwarder and cause risk of injury to the mechanic and the forwarder operator.
The operations of the 4WD, differential locks, parking brake, automatic working brake, cabin steps and shifting gear (fig. 24) are controlled by directional valves. Differential locks, 2WD (= four-wheel drive release) and automatic working brake switch on by pressure. The parking brake is spring-loaded and is released by pressure. Either gear is selected when engine is running. Valves get operating pressure from the pressure relief valve on brake charging block.

A  directional valves: differential locks, 4WD, parking brake and cabin steps  
B  directional valves: shifting gear and automatic brake  
C  directional valve: frame lock (located in the load space)  
D  brake block

The frame lock is equipped with a dual-function cylinder. The cylinder derives its load from the return flow. When the frame lock is engaged, the directional valve closes the flow routes and the cylinder becomes locked in its place.

The basic forwarder is equipped with a separate cooler for the hydraulic oil. The cooler includes a pump and condenser. The pump receives oil from the tank as well as from leaks in the working hydraulics pump and its pumped through the condenser and the return filter back to the tank. When oil is cold, it passes the radiator through thermostat valve.

When dealing with hydraulics, uncompromising cleanliness is of utmost importance. The oils used shall comply with the Manufacturer’s instructions. Refill shall always be done through the return filter.
Electricity

Fuses
The fuses are located on the circuit board below the side instrument panel.

<table>
<thead>
<tr>
<th>Fuse</th>
<th>Amps</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>50A</td>
<td>+BAT</td>
</tr>
<tr>
<td>F2</td>
<td>125A</td>
<td>CABIN</td>
</tr>
<tr>
<td>F3</td>
<td>150A</td>
<td>GRID HEATER</td>
</tr>
<tr>
<td>F4</td>
<td>150A</td>
<td>HYDRAULIC FILL PUMP</td>
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<tr>
<td>F5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1F100</td>
<td>20A</td>
<td>Fuse, Nox sensor, waste gate</td>
</tr>
<tr>
<td>1F101</td>
<td>15A</td>
<td>Fuse, Windscren motor</td>
</tr>
<tr>
<td>1F102</td>
<td>20A</td>
<td>Fuse, Engine Cover</td>
</tr>
<tr>
<td>1F103</td>
<td>10A</td>
<td>Fuse, Hazard blinkers, blinkers</td>
</tr>
<tr>
<td>1F104</td>
<td>25A</td>
<td>Fuse, Fuel pump</td>
</tr>
<tr>
<td>1F105</td>
<td>25A</td>
<td>Fuse, start motor</td>
</tr>
<tr>
<td>1F106</td>
<td>20A</td>
<td>Fuse, Seat</td>
</tr>
<tr>
<td>1F107</td>
<td>5A</td>
<td>Diesel</td>
</tr>
<tr>
<td>1F108</td>
<td>7,5A</td>
<td>Fuse, IQAN relays</td>
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<td>1F109</td>
<td>10A</td>
<td>Fuse, Sensors</td>
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<td>1F110</td>
<td>10A</td>
<td>Fuse, IQAN MD3, XC21</td>
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<td>5A</td>
<td>Fuse, AC kompressor</td>
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<tr>
<td>1F112</td>
<td>25A</td>
<td>Fuse, Engine</td>
</tr>
<tr>
<td>1F113</td>
<td>10A</td>
<td>Fuse, Nox Sensors</td>
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<td>1F114</td>
<td>10A</td>
<td>Fuse Waste gate</td>
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<tr>
<td>1F115</td>
<td>15A</td>
<td>Fuse, Eber</td>
</tr>
<tr>
<td>1F116</td>
<td>15A</td>
<td>Fuse, Heater urea module</td>
</tr>
<tr>
<td>1F117</td>
<td>7,5A</td>
<td>Fuse, Blinker left</td>
</tr>
<tr>
<td>2F100</td>
<td>20A</td>
<td>Fuse, IQAN XC10</td>
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<td>Fuse, diesel +15</td>
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<td>10A</td>
<td>Fuse, Switch, sensors</td>
</tr>
<tr>
<td>2F111</td>
<td>7,5A</td>
<td>Fuse, fuel valve</td>
</tr>
<tr>
<td>2F112</td>
<td>20A</td>
<td>Fuse, IQAN XA2</td>
</tr>
<tr>
<td>2F113</td>
<td>10A</td>
<td>Fuse, Eber, MD3 display</td>
</tr>
<tr>
<td>2F114</td>
<td>10A</td>
<td>Fuse, vacuum pump</td>
</tr>
<tr>
<td>2F115</td>
<td>5A</td>
<td>Fuse, door switch</td>
</tr>
<tr>
<td>2F116</td>
<td>15A</td>
<td>Fuse, Blower</td>
</tr>
<tr>
<td>2F117</td>
<td>7,5A</td>
<td>Fuse, blinker right</td>
</tr>
</tbody>
</table>

Do not fit an oversized fuse as it may damage the respective electrical instrument. If a fuse blows on the same location repeatedly, find out the reason for it.
Iqan control system

The Iqan monitor consists of the following elements:
- monitor display A
- bottom F1-F4 buttons B
- OK button C and the arrow buttons above and below it D
- Menu button E at the bottom right (three horizontal lines)
- Back button F (arrow to the left)

The display brightness can be adjusted by pressing the Menu button and selecting the backlight setting.

SAFETY SYMBOLS

Various notifications and warnings can be displayed in the Iqan monitor. They appear in separate windows partly covering the basic display. The F1-F4 buttons of the display are used to select the most suitable option at the bottom of the warning window. For example, the sensor error in the picture here can be reset by selecting OK, or pressing the F1 button.
There are seven types of notifications and warnings. The type Message is the least serious and Critical is the most serious. The important notifications are always shown before the less critical ones. The following is a list of all notifications and warnings in the order of importance.
- message
- information
- confirmation
- warning
- alarm
- error
- critical

The notifications and warnings detected by the Iqan machine control system are always messages, alarms or errors. The notifications and warnings from the diesel engine and base machine are primarily information and warnings.

IQAN DISPLAY MENUS

The Iqan display has a graphical user interface and a menu structure. The menu structure is shown in figure 26.
MAIN MENU
The menus contain the base machine setup, input and output measurements, settings and module status and related logs. The menus can be accessed by pressing the Menu button (three horizontal lines). Pressing the Menu button again takes you back to the basic display.

SYSTEM INFORMATION
When you press the F4 button in the main menu, you can view system information such as the name of the software loaded in the monitor, author of the last revision and the date of the revision. By pressing F1, F2 or F3 you can view information on modules, the modem or log. The Back button takes you back to the previous page. Pressing F1 on the subpages takes you directly back to the main menu.

SETTINGS
You can change the display settings by clicking the F3 button in the main menu. Then by pressing F1, F2 or F3 you can view information on the display, date and time as well as language. The Back button takes you back to the previous page. Pressing F1 on the subpages takes you directly back to the main menu.
MEASURING
You can measure the sensors and valves connected to the Iqan control system by pressing F2 in the main menu. First, a page with different measurement groups such as crane, transmission, diesel etc. opens. The desired measurement group is selected with the up/down arrows and by pressing OK. Use the arrow buttons also to select a measurement route such as a sensor or valve. You can toggle between the raw value provided by the route and the scaled value using the F2 button. The Back button takes you back to the previous page. Pressing F1 on the subpages takes you directly back to the main menu.

ADJUSTMENTS
You can access several outputs and parameters in order to adjust them by pressing the F1 button in the main menu. First a page opens on screen with a number of adjustable groups such as diesel engine revolutions, crane adjustments, driver selection, function parameters etc. The desired adjustment group is selected with the up/down arrow buttons and by pressing OK. A lock symbol may be displayed behind the adjustment group name. This means that a password is needed for adjustments.

After selecting the adjustment group, select the desired measurement route such as a sensor or valve using the arrow buttons. Several instruments have two different directions of movement. The correct direction +/- is selected with the F3 or F4 button. The current adjustment values are displayed on the right side of the display. After you have selected the desired route and direction, press OK.
Adjusting a parameter
You are now on the page where the actual adjustment is done. You can move from one parameter to be adjusted to the next by pressing the OK button repeatedly. When you are at the parameter you want to adjust, press the up or down arrow button. The parameter value on screen changes with each time a button is depressed. You may reset to the default values at any time after the adjustment by pressing the Reset button, or F2. The Back button takes you back to the previous page. Pressing F1 on the subpages takes you directly back to the main menu.

INTERNAL DIAGNOSTICS OF THE IQAN DISPLAY
The Iqan display has its own diagnostics page showing information on the status of the display. You can access the diagnostics page by pressing the Back and the Menu buttons simultaneously while switching on the power. To exit the testing mode, switch off the power and switch it on again normally.

INSTRUMENT PANEL DISPLAY
In the middle of the instrument panel display shows the diesel engine revolutions as numerical values. On the left side is the fuel gauge. Next to fuel gauge is the coolant temperature gauge. On the right side is the gauge for Adblue. Next to that is the thermometer for hydraulic oil. Temperatures are also shown in numeric values.

When the power is on but the diesel engine off, the display shows red alarm symbols. The section Signs and symbols explains the meaning of the symbols. When the diesel engine is on, the symbols disappear from the display if the parts they refer to function correctly. A symbol that is displayed while the diesel engine is on indicates an active problem. After resetting the error message, the problem may continue to be active and the symbol remains visible indicating a problem. These problems indicated by the symbols will also activate the yellow alarm light in the ceiling of the cab. Investigate the cause of an active problem immediately and take the necessary corrective measures.

When selecting first gear, turtle symbol appears in the middle of the display indicating that 1-gear is engaged. When selecting second gear, rabbit symbol appears. Symbols indicating engaged parking brake and working brake appear below the gear symbol.

Forwarder’s dark figure is described at the bottom of the screen. Indicator lamp light in different part of the figure to indicate driving direction, differential lock mode and frame lock mode. The green arrow lights up on left side of the screen when you have selected driving forward. When reversing a green arrow to the right lights. Symbol on the left frame indicates when front differential lock is engaged. Symbol on the right frame indicates when rear differential lock is engaged. Frame lock symbol on the middle joint lights when Frame lock is engaged.

When selecting four wheel drive, 4WD- symbol appears on right frame.
The images and text at the bottom of the main display indicate the functions of the F1-F4 buttons in each display. The purpose of these submenu displays is to provide you with some of the most important facts collected on templates.

Adjustments

When pressing the F1 button in the main menu, a window opens in which you can select the crane adjustments, driver selection and function parameters.

The function parameters open a new page on which you can select the vibration filters, power limits or other parameters.

You can return to the previous page from the subpages by pressing the F4 button.

Diesel temperatures, oil pressure and operating hours

When you press the F2 button in the main display, a page opens displaying the diesel engine coolant temperature, fuel temperature, intake air temperature and oil pressure.
When you press F1, you can view the total hours, operating hours and working hours.

The total hours indicate the time that the machine power has been on. The operating hours indicate the time the diesel engine has been on. The working hours indicate the time the diesel engine’s speed has exceeded 1,200 rpm. You can return to the main display from the subpages by pressing the F4 button.

When you press F2, you can view the fuel and AdBlue consumption, as well as get access to trip-meter function. Pressing F3 button you can see the engine load percent, the battery voltage and driving speed.

**Crane measurements**

Pressing the F3 button in the main display opens a window showing the status of the crane controls. You can return to the previous page from the measurement pages by pressing the Back button.

**Adjusting the diesel engine revolution speed**

When you press the F4 button in the main display, the diesel engine revolution adjustment window opens.

In this window, you can:

- adjust the idle speed by pressing F1
- adjust working revolutions by pressing F2
- adjust full throttle by pressing F3
- return to the main page by pressing F4
Parameters in the iqan control system

The driver is able to adjust the following issues from the Iqan screen:

PV Turn  Crane turning speed adjustment
PV Lift  Crane lifting speed adjustment
PV Jib  Crane jib speed adjustment
PV Extension  Crane extension speed adjustment
PV Steering  Articulated steering speed adjustment
PV Rotator  Rotator speed adjustment
PV Grapple  Grapple open/closed speed adjustment

FP Dampening Turn  Dampening of the vibration in the crane turn. Prevents the vibration from the hand from transferring to the crane. The greater the value, the greater the hand vibration that is dampened.

FP Dampening Lifting  Dampening of the vibration in lifting. Prevents the vibration from the hand from transferring to the crane. The greater the value, the greater the hand vibration that is dampened.

FP Dampening Angle  Dampening of the vibration in the crane angle. Prevents the vibration from the hand from transferring to the crane. The greater the value, the greater the hand vibration that is dampened.

FP Dampening Extension  Dampening of the vibration in the crane extension. Prevents the vibration from the hand from transferring to the crane. The greater the value, the greater the hand vibration that is dampened.

FP Dampening Steering  Dampening of vibration in the frame steering. Prevents the vibration from the hand from transferring to the steering. The greater the value, the greater the hand vibration that is dampened.

FP Turn power limit  Deceleration of the crane turning speed to the value set with this parameter when the diesel engine revolutions decrease under load. The smaller the value the smaller the effect.

FP Lift power limit  Deceleration of the crane lifting speed to the value set with this parameter when the diesel engine revolutions decrease under load. The smaller the value the smaller the effect.

FP Angle power limit  Deceleration of the crane angle speed to the value set with this parameter when the diesel engine revolutions decrease under load. The smaller the value the smaller the effect.

FP Extension power limit  Deceleration of the crane extension speed to the value set with this parameter when the diesel engine revolutions decrease under load. The smaller the value the smaller the effect.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP Steering power limit</td>
<td>Deceleration of the frame steering speed to the value set with this parameter when the diesel engine revolutions decrease under load. The smaller the value the smaller the effect.</td>
</tr>
<tr>
<td>FP Drive power limit</td>
<td>Deceleration of the drive speed to the value set with this parameter when the diesel engine revolutions decrease under load. The smaller the value the smaller the effect.</td>
</tr>
<tr>
<td>Driver selection</td>
<td>Driver-specific settings for five different users are stored in the memory. Thus, changes made by one driver only affect the adjustments to the author, and do not change the settings made by others.</td>
</tr>
<tr>
<td>FP Idle [rpm]</td>
<td>Diesel engine idle speed</td>
</tr>
<tr>
<td>FP Working revolutions [rpm]</td>
<td>Diesel engine working revolutions</td>
</tr>
<tr>
<td>FP Full throttle [rpm]</td>
<td>Diesel engine maximum operating speed</td>
</tr>
<tr>
<td>FP Fuel pump running intermediate</td>
<td>This value provides a time after which the fuel pump is starting to move fuel from bigger tank to smaller tank.</td>
</tr>
</tbody>
</table>
Service and maintenance

Safety

Installations and adjustments may be carried out only by a person with the required skills and qualifications and the necessary knowledge of the machine in question.

Installations and adjustments as well as repairs must be carried out when the engine is stopped and the key removed from the ignition. Moving parts must be in balance and stopped, and when necessary, locked. For example, the crane and grapple may move or slide on their own over time.

Make sure that there is no stored pressure in the fluid systems before you open mechanical or hydraulic joints (pressurized oil tank, pressure batteries, AC equipment, radiator etc.)

Make sure there is no danger of injuries if you need to start the engine while performing maintenance and also after maintenance work.

Ensure that all periodic maintenance work and cleaning are performed on schedule in accordance with the instructions. This reduces the risk of danger caused by malfunctions.

Proper maintenance and service guarantee a long working life and the validity of the warranty.

General instructions:

- Make sure you are sufficiently qualified before you perform maintenance tasks. If you are not sure, have the work performed by a qualified individual.
- Familiarize yourself with the structure of the forwarder and the maintenance instructions before you start the maintenance work.
- Wear protective clothing suitable for the work.
- Use appropriate tools and other equipment.
- Handle the machine to be maintained and the substances used as instructed so that there is no danger to yourself, other people or the environment.
Service measures
daily or every 8 hours

1. **Checking of the engine oil level**
Stop the engine on level ground and wait for a few minutes. The oil level shall be between the marks on the dipstick. Fig. 27.

![Fig. 27](image)

A Oil measuring dipstick
B Oil filler
C Coolant check / refill

Note! Open the over-pressurised radiator cap with great care when the engine is hot. Never use plain water as coolant! Do not pour cold coolant into a hot engine. The coolant level shall be approx. half way up the expansion tank. Coolant is added through the expansion tank. Make sure there is anti-freeze in the radiator in the cold season.

2. **Checking of the coolant level**

3. **Checking of the hydraulic oil level**
Check the hydraulic oil level in the measuring glass on the tank with the lift cylinders in their inner position.

![Fig. 28](image)

Note! The oil level shall always be visible in the measuring glass.
Add oil using the oil refill pump (figure 28). The pump starts from switch B behind the hatch and oil is sucked into the tank through hose C. This will leave all the impurities in the filter.

4. **Checking of the oil level in the crane slewing mechanism**
Check the oil level in the crane slewing mechanism daily. Oil level must be in between the MIN and MAX levels. If necessary filling is made through upper opening in accordance with the crane manufacturer's instructions.

5. **Daily lubrication**
Lubricate the daily lubrication points in compliance with the lubrication table. See Lubrication Table.
6. Cleaning of radiator grilles
Depending on the operating environment, the radiator grilles shall be cleaned often enough to prevent the engine from overheating. Clean the rear grille and the grid using compressed air or a brush (fig. 29). When necessary, clean the oil, engine and air conditioner condensers.

Note! The rear grille must not be covered with the engine running.

7. Checking of tyre air pressure
Check the tyre air pressure and external condition visually. Use manometer if necessary. The maximum air pressure for the 710/40-22.5 tyres is 4.0 bar, the 600/50-22.5 tyres 4.3 bar.

Do not exceed the indicated pressures.

8. Checking for leakage
Check for any liquid, fluid and oil leakage.

9. Checking of connections
Check the screw and pipe connections visually.

Note! During the first operating month the tightness of the screw connections in the crane, shafts and joint shall be checked daily.

It is important to tighten the screw connections to the correct torque. The required wrench sizes and torques:

<table>
<thead>
<tr>
<th>Screw size</th>
<th>Wrench size (mm)</th>
<th>Tightening torque for screws of 8.8 strength class (Nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 6</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>M 8</td>
<td>13</td>
<td>25</td>
</tr>
<tr>
<td>M 10</td>
<td>17</td>
<td>47</td>
</tr>
<tr>
<td>M 12</td>
<td>19</td>
<td>78</td>
</tr>
<tr>
<td>M 14</td>
<td>22</td>
<td>120</td>
</tr>
<tr>
<td>M 16</td>
<td>24</td>
<td>180</td>
</tr>
<tr>
<td>M 20</td>
<td>30</td>
<td>335</td>
</tr>
</tbody>
</table>
Service measures weekly or every 50 hours

1. All daily service measures
The service measures to be taken every 50 hours include all the measures listed in service measures daily or every 8 hours.

2. Lubrication in compliance with the lubrication table
Lubricate in compliance with the lubrication table paying attention to any special instructions. See the lubrication table.

Service measures every 100 hours

1. Cleaning of engine air filter
The engine suction air is cleaned by a pre-filter and a dry paper filter of a dual-element type. Faultless functioning of the filter is of utmost importance to the long lifespan of the engine. The filter housing is located in the engine compartment. The filter housing cover is fastened with locking brackets and the filter cartridges are under the cover (fig. 30). The outer filter cartridge shall be replaced when blockage is indicated on IQAN- monitor or at least every 100 hours. The outer cartridge can also be cleaned, but no more than five times. Open the locks on the rear filter cover and twist the cartridge out of the housing. Be careful not to damage the paper. Do not remove the inner cartridge unless it needs replacing. The filter protects the suction channel against impurities during service. Blow dry compressed air (not over 5 bar) inside the filter. Great care shall be taken not to damage the filter cartridge or allow dust inside. After cleaning, check the condition of the filter. Direct a strong light from the inside. In case the outer filter cartridge is broken, it shall be replaced. The inner filter shall also be replaced as it has become dirty. Otherwise the inner cartridge is replaced after five filter services or every other year. Clean the inside of the filter housing carefully before removing the inner cartridge. When refitting the filters, make sure that the gaskets are intact, the mating surfaces clean and that the filter fits well.

When servicing the filter, check the condition and attachment of the air hoses.

Note! Never run the engine without filters.

2. Checking of battery fluid level
Clean the battery housing carefully. Check that the battery fluid level is 5-10 mm above the cells. Make sure the cable lugs are properly tightened. Remove any oxidisation with hot water. Coat the cable lugs with copper or aluminium paste.

3. Cleaning of breather on the hydraulic tank
Clean the filter and the surrounding area carefully (fig. 32).
4. Checking of the condition of traction transmission
Check the attachment of bogies. Check for leaks in hydraulic hose connections. For detailed information about service instructions and intervals of bogies and gearbox, see the separate axes manufacturer’s service manual.

5. Cleaning of cab air filter
Remove the cab fresh air filter and clean it carefully with compressed air. Replace a soiled or broken filter. The paper filter shall be replaced at least once a year.

6. Checking of light operations
Make sure the headlights, working lights, turning signals and signal lights function properly.

7. Draining of water out of water separator
The fuel pre-filter with water separator is located on the left side of the engine. Drain any accumulated water into a dish weekly. Replace the filters in compliance with the service table or more often if you suspect a clogged filter. Fault code "Fuel pressure low" usually indicates a clogged pre-filter. When changing the filter, remember to take the metal water separator plug from the old filter. Used filters are problem waste that must be dealt with accordingly. For further instructions, refer to the engine manual.

8. Checking of brake functions

9. Check Fan Belt Tightness
The engine is equipped with a spring loaded belt tensioner and the belt is of V-ribbed type (fig. 35). The tensioner tightens the belt automatically during the operation. Check the belt visually. Change a worn, oily or damaged belt.

Belt Replacing
Turn the tensioner against the direction of tightening until the belt to be loosened.
- using a 3/8 in square drive inserted into the square hole in the tensioner.
- pay attention to free rotation of tensioner roller and also the right tightness of fixing screw 48 Nm.
- fit the new belt and other loosened parts.

Make sure the engine cannot be started during belt replacing. Disconnect the battery cable before doing this job.
10. Compressor belt in the air conditioner
Check the tension of belt in air conditioner. The tension is correct when there is a deflection of 15-20 mm when pressing with your thumb. Replace worn and damaged belts (fig. 36).

11. Cleaning of polycarbonate windows
Remove any particles that may damage the window surface. Avoid using any sharp objects. Use mild and environmentally friendly detergents and plenty of water for washing.
Substances suitable for removing stains include pure isopropyl alcohol, white spirit, heptane, white gas, butyl etylene glycol, methanol, hexane and butanol. Use plenty of water for rinsing after the removal of stains.

**NOTE! Do not use other solvent substances such as gasoline for cleaning windows.**

After first 250 hours

Change the oil in the gearbox, differential, planetary drive and tandem housing (then every 2000 hours)
Service measures every 500 hours

1. All daily and weekly service measures.
The service measures to be taken every 500 hours include all the measures listed under service measures daily or every 8 hours as well as the measures listed under service measures weekly or every 50 hours and every 100 hours.

2. Changing of engine oil and filter
Keep the engine running until it warms up. Open the front underpan and drain plug A in the engine sump. Drain the oil into a pan. When all the oil has been drained, close the drain plug with a new gasket (fig. 37).
The oil filter is replaced every time the oil is changed. Clean around the oil filter. Remove the old filter using a filter key. Coat the gasket of the new filter lightly with new oil (fig. 38), and make sure the gasket surfaces are clean. Attach the filter manually. Wipe off any excessive oil. Pour new oil through the filler B to the top mark on the dipstick. Pay attention to the amount of oil poured into the filter. Acceptable oil types and amounts are given in the Lubrication Table and the Engine Manual. For further instructions, see the Engine Manual. NOTE! Only use oil recommended by the manufacturer.

3. Checking of the operations of the drive pedal
Check the operation and position of the drive pedal. The pedal shall move to its upper position as the foot is removed off the pedal. The frame lock and the brakes shall be disengaged slightly before the forwarder starts moving.

4. Use of an additional heater and air conditioning outside the heating season
The heater shall be used approx. once a month outside the heating season, too. This is done to prevent the fan motor and water pump from getting stuck. Also air conditioning must be used at least once a month.
5. Replacing of the hydraulic oil filters
Suction-/return filter is changed every 500 hours. Return filter of the working hydraulics is also changed after first 500 hours.
For more information on filter replacement, see items Service Measures Every 1000 Hours.

6. Checking of screw tightness after the first 500 operating hours
Screw tightness in the crane and joint shall be checked after the first 500 operating hours. Torque for the crane M24x2 screws in strength class 10.9 is 1000Nm and in strength class 12.9 1200Nm.

7. Adjusting the diesel engine valves
Adjust the diesel engine valves after the first 500 operating hours and then every 2000 operating hours.
For detailed information, see the engine manual.

8. Check the gearbox oil level
For detailed information, see the bogie manual.

9. Check the differential oil level
For detailed information, see the bogie manual.

10. Check the tandem housing oil level
For detailed information, see the bogie manual.
Service measures every 1000 hours

1. All service measures to be performed daily, weekly and every 100 and 500 hours
   The service to be performed every 1000 hours includes all the service measures listed under service measures daily or every 8 hours, service measures weekly or every 50 hours and service measures every 100 and service measures every 500 hours.

2. Changing of the fuel filter
   See instructions in the Engine Manual, fig. 40.

3. Draining of condensed water out of the fuel tank
   Run a little fuel from the filler at the rear of the fuel tank into a pan.

4. Changing of the hydraulic oil filter
   Change the returnfilter and breatherfilter in the working hydraulics (fig. 42).
   A  Return filter
   B  Breather
   C  Suction/Return filter 500 hours

   The hydraulic oil does not need to be drained when changing the filters. See further instructions in item SERVICE MEASURES EVERY 1500 HOURS

5. Checking condition of hydraulic hoses
   Check The condition of hoses. Replace worn out and leaking hoses to New. Replace all hoses with new ones at least once in 15 years.

6. Checking air hoses of cooler and engine
   Check hoses visually. Replce with new if needed. Engine’s cooling water hoses must be changed at least every five year.

7. Drain the parking brake housing
2. Changing of hydraulic oil and filters

Traction and working hydraulics have a joint oil tank. The oil is changed every 2000 hours. However, the first time the oil is changed after 1500 hours. Oil should be changed at least once a year. Before changing the oil, run the system until it is warm and adjust all the cylinders in their shortest position.

Oil is drained from the system by unplug- ing the drain plug at the bottom of the tank. Have a sufficiently large pan handy, as there is approx. 125 litres of oil. Clean around the filters carefully before removing them.

**Note!** The oil does not need to be drained when the filters are changed.

When changing the suction/return filter, turn the filter cover counter clockwise. fig. 45.
To change the return filters, unscrew the four fixing screws on the filter cover. (fig. 46).

Use only genuine filters and oil types in compliance with the oil table to guarantee perfect functioning. Make sure there are no impurities in the oil or the funnel.

After the oil change let the engine idle for approx. 30 minutes, during which time hydraulics must not be used. During this period the oil circulates through the filter several times and any impurities in the oil are filtered off. Monitor the oil level and check for any leakage in the filter.

There is a glass gauge on the side of the oil tank to monitor the oil level. The oil level shall be visible in the gauge window. Add oil, when necessary.

**REFILL ALWAYS THROUGH THE RETURN FILTER BY USING OIL FILLING PUMP!**

**At the base of the oil filter there is an alarm switch to indicate pressure loss through the filter. In case the alarm light is on in the cab and the oil is in its operating temperature, the filter cartridge is clogged and shall be replaced.**

**If hydraulic oil becomes over-heated**
The temperature of the hydraulic oil should not exceed 70 degrees celsius. A temperature increase of 10 degrees cuts the oil lifetime in half. When the signal light comes on, the temperature of the hydraulic oil is 90 degrees. In this case you should wait long enough to let the temperature decrease. The engine can be kept running, but unloaded. Find out the reason for the excessive oil temperature. The most common reason is blockage in the radiator and its protective screens.

**3. Checking condition of hydraulic hoses**
Check The condition of hoses. Replace worn out and leaking hoses to New. Replace all hoses with new ones at least once in 15 years.

**SERVICE MEASURES EVERY 2000 OPERATING HOURS**
1. Inspect and clean the diesel engine injectors (EEM3 service tool)
2. Changing of hydraulic oil
3. Adjust diesel engine valves
   See instructions in the engine manual.
4. Check the brake adjustment
5. Grease the slewing ring
6. Change the oil in the gearbox, differential, planetary drive and tandem housing

**SERVICE MEASURES EVERY 4000 OPERATING HOURS**
1. Check compressor clearances / check the cleanliness of the intercooler element
   For detailed instructions, see the engine manual.

**Service measures every 6 months**
1. Remove the water from the crane base.
2. The fire extinguishers shall be serviced every 6 months or more often if so stipulated in local regulations.
Service measures every 1 year

1. Changing of oil in crane slewing mechanism (fig. 47)
The oil change interval in the slewing mechanism is every 1 year in accordance with the crane manufacturer’s instructions. However, the first oil change is after 50 hours. Use oil listed in the lubrication table. Further oil change instructions can be found in the crane manual.

A  Filler hole  
B  MAX level  
C  MIN level

2. Check/ service of the automatic fire extinguishing system

If the forwarder is equipped with an automatic extinguishing system, it shall be serviced as instructed by the Manufacturer. See servicing of the fire extinguishing system in the operator manual. In some countries, an annual official inspection of the machine is required in the insurance terms and conditions.

3. Replace the main filter of SCR supply module

For detailed instructions, see the engine manual.

Service measures every 2 years

1. Replacement of the AC drying cartridge

To guarantee faultless functioning of the air conditioning, the drying cartridge needs to be replaced every 2 years.

2. Changing of engine coolant

The coolant shall be changed at least every other year to maintain its anti-corrosion properties. The cooling system is drained by opening the draining taps in the radiator water cell and on the left-hand side of the engine at the rear and by unscrewing the cap in the expansion tank. In order to drain the coolant from the heater cell, too, turn the thermostat to its maximum position.

Used coolant is problem waste, which shall be disposed of in an appropriate manner. Therefore the draining tap is equipped with connectors to which a collection hose can be attached to drain the liquid (fig. 48).

1. Radiator draining
2. Engine draining
3. Oil cooler draining
4. Bleeder plug

Note! See further instructions in the engine manual.

The dual-functioning thermostat must not be removed to reduce the temperature, as this would make most of the coolant circulate through the side circulation pipe, which reduces cooling capacity.

On models equipped with an additional heater, air shall be bled from the heater when more coolant is added. See the heater instructions!
Lubrication

Do not lubricate while the engine is running. Remove the ignition key before starting lubricating. The table below gives recommended lubricants to be used in different temperatures. The table also gives different types of air conditioning liquids, although they do not normally have to be changed.

<table>
<thead>
<tr>
<th>Recommended lubricant</th>
<th>Oil grade API</th>
<th>Viscosity SAE</th>
<th>Filling quantity l</th>
<th>Change interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine - Common Rail</td>
<td>CJ-4</td>
<td>10W40</td>
<td>15W40</td>
<td>11,5</td>
</tr>
<tr>
<td>Gearbox</td>
<td>GL-4 or MIL-L-2105</td>
<td>SAE 80</td>
<td>4,5</td>
<td>2000 h</td>
</tr>
<tr>
<td>Differential</td>
<td>GL-5/LS</td>
<td>SAE 90 (Hypoidoil)</td>
<td>11,5</td>
<td>2000 h</td>
</tr>
<tr>
<td>Planetary gear</td>
<td>GL-4</td>
<td>SAE 90 / SAE 80</td>
<td>4 liter each</td>
<td>2000 h</td>
</tr>
<tr>
<td>Bogie housing</td>
<td>GL-4</td>
<td>SAE 90 / SAE 80</td>
<td>30 liter each</td>
<td>2000 h</td>
</tr>
<tr>
<td>Bogie bearing</td>
<td>EP (Extreme pressure additives)</td>
<td>Necessary amount</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydraulics ¹</td>
<td>Teboil Shell</td>
<td>SAE 32</td>
<td>Scandic 32</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>Esso Shell</td>
<td>Tellus S4 VX 32</td>
<td>Tellus Oil TX32</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Univis 32</td>
<td>Tellus Oil TX46</td>
<td></td>
</tr>
<tr>
<td>Lubrication points</td>
<td>CB/CC</td>
<td>10W30</td>
<td>15W40</td>
<td>–</td>
</tr>
<tr>
<td>Grease points</td>
<td>Lithium grease</td>
<td>NLG 2</td>
<td>NLG 2</td>
<td>–</td>
</tr>
<tr>
<td>AC oil</td>
<td>PAG</td>
<td>500 SUS</td>
<td>500 SUS</td>
<td>1.8 dl initial fill</td>
</tr>
<tr>
<td>AC</td>
<td>HFC R134a</td>
<td>–</td>
<td>–</td>
<td>1.7 kg</td>
</tr>
<tr>
<td>Crane slewing mechanism</td>
<td>See the crane manual</td>
<td></td>
<td></td>
<td>1 Year</td>
</tr>
</tbody>
</table>

**Initial fills**

- **Engine:** Teboil Super HPD ECV 10W-40
- **Gearbox:** Teboil Hypoid oil SAE 80W-90
- **Hydraulics:** Teboil Scandic 32
- **Lubrication grease:** Teboil Multipurpose EP

The initial installation oils are those with a temperature range of -25...+30°C, switch to oil types suitable for the area where the machine is used.

**The guarantee is valid only when lubricants in compliance with the initial fill lubricants are used!**

Correct lubrication is of major importance to the perfect functioning and long working life of the forwarder, due to which the lubrication recommendations shall be followed carefully while simultaneously monitoring if any place requires more lubrication.

All the lubricants shall be free from impurities. Even the slightest impurities may cause damage. Oil fillers and nipples shall be wiped clean. Apply grease on the nipples in accordance with the lubrication table. Apply machine or engine oil to places to be oiled.
Lubrication diagrams

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Point</th>
<th>Interval (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Grapple</td>
<td>Daily</td>
</tr>
<tr>
<td>2</td>
<td>Crane</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Steering cylinders</td>
<td>50</td>
</tr>
<tr>
<td>4</td>
<td>Joint</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>Hydraulic oil change</td>
<td>2000</td>
</tr>
<tr>
<td>6</td>
<td>Frame lock</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>Engine oil change</td>
<td>500</td>
</tr>
</tbody>
</table>

Lubrication of crane and changing of oil in slewing mechanism

The lubrication points are shown in picture. The oil change interval at the base is 1 year. Hypoid oil type SAE 80W/90 is used in the slewing mechanism. See further instructions in the Crane Manual.

<table>
<thead>
<tr>
<th></th>
<th>Check lubrication system</th>
<th>0.161.1 Lincoln</th>
<th>Weekly</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Grease bearings and joints with fat press</td>
<td></td>
<td>Weekly</td>
</tr>
<tr>
<td>9</td>
<td>Grease boom extensions with spray</td>
<td>Synthetic vaseline</td>
<td>Weekly</td>
</tr>
<tr>
<td>10</td>
<td>Lubricate the chains</td>
<td>SAE 10W-40,chain lubricating oil</td>
<td>Weekly</td>
</tr>
<tr>
<td>18</td>
<td>Remove the water from the base</td>
<td></td>
<td>Twice a year</td>
</tr>
<tr>
<td>20</td>
<td>Change oil at the base</td>
<td>Hypoid oil SAE 80W-90</td>
<td>Once a year</td>
</tr>
</tbody>
</table>
Summary of periodical procedures

The summary always includes checks and service performed at shorter intervals. For more detailed crane, engine, bogie and gearbox service instructions, see the respective manuals.

Daily or every 8 hours:
1. Check the engine oil level
2. Check the radiator coolant level
3. Check the hydraulic oil level
4. Check the crane slewing mechanism oil level
5. Lubricate the points to be lubricated daily
6. Clean the coolers and the grille
7. Check the tyre air pressure visually
8. Check for any fluid and oil leakage
9. Check the connections

Weekly or every 50 hours:
1. Lubricate all the points specified in the lubrication table

Every 100 hours:
1. Clean the engine air filter (*)
2. Check the battery fluid level
3. Clean the breather area on the oil tank
4. Check the condition of the power transmission equipment
5. Clean the cab air filter
6. Check the light functions
7. Drain water out of the water separator
8. Check the brake functions
9. Check the belt tension
10. Clean the windows

 (*) or when the blockage indicator alarms

After first 250 hours
Change the oil in the gearbox, differential, planetary drive and tandem housing (then every 2000 hours)

Every 500 hours:
1. Change the engine oil and filter.
2. Check the drive pedal function.
3. Run the additional heater and air conditioning outside the heating season.
4. Replace the hydraulic oil filters after the first 500 operating hours. (Suction/Return filter change interval 500 hours.)
5. Check the screw tightness after the first 500 operating hours, particularly in the crane and the joint.
6. Adjust the diesel engine valves after the first 500 operating hours and then every 2000 operating hours.
7. Check the gearbox oil level
8. Check the differential oil level
9. Check the tandem housing oil level

Every 1000 hours:
1. Change the fuel filter (*)
2. Change the fuel pre-filter (waterseparater (*))
3. Drain condensed water out of the fuel tank minimum once a year
4. Change the hydraulic filters (**)
   Return filter
   Breather
5. Check the hydraulic hoses. Replace the hoses at least every 15 years.
6. Check the radiator and engine air hoses visually, replace if necessary.
7. Change the engine cooling water hoses at least every five years.
8. Drain the parking brake housing

(*) or when indicated by service code in the engine system
(**) or when the blockage indicator alarms

Every 1500 hours:
1. Checking condition of hydraulic hoses

Every 2000 hours:
1. Change the hydraulic oil. (First change after 1500 hours).
2. Inspect and clean diesel engine injectors (EEM service tool)
3. Adjust the engine valves
4. Check the brake adjustment
5. Grease the slewing ring
6. Change the oil in the gearbox, differential, planetary drive and tandem housing

Every 4000 hours:
1. Inspect compressor clearances / check the cleanliness of the intercooler

Every 6 months:
1. Remove the water from the crane base
2. Service the fire extinguisher

Every 1 year:
1. Change the oil in the crane slewing mechanism
2. Check/ service of the automatic fire extinguishing system
3. Replace the main filter of SCR supply module

Every 2 years:
1. Replace the AC drying cartridge
2. Change the engine coolant
Storage when not in use

In case of a longer storage, the pre-storage service is recommended. The pre-storage service can be divided into three parts, in order of performance: cleaning, checking and protection.

Cleaning:
Dirt is efficiently removed from a dry forwarder by compressed air. A high-pressure washer may also be used with caution. To reduce drying time, use warm water. Do not direct water jets at the bearings, as the packing does not hold against a strong spray of water. Apply suitable solvent on heavily greasy spots before washing. Start cleaning from the top. Clean the radiator cells by blowing air from the direction of the wings.

Checking:
Take a pen and paper and write down all the shortcomings, wears and required service measures.

Protection:
Use engine oil or special protective oil in a sprayer.

Places to be protected:
- Scratched paintwork (paint)
- Electrical connections (special protective spray)

Air Conditioning:
Clean the air conditioner condenser and vaporiser cells preferably with compressed air.

Engine:
- Clean the engine externally.
- Replace the fuel filter.
- Change the engine oils.
- Replace the engine oil filter.
- Check the anti-freezing quality of the coolant.
- Clean or replace the air filter.
- Clean the cable lugs and apply grease to them.

Electrical instruments:
Clean the battery surfaces, check the fluid level and charge the battery full.
Recommended tools and accessories

Recommended accessories
- Light bulbs
- Connection relays

General Parts
- Hexagonal screws M6-M12, the most common lengths of 16-40 mm, strength class min. 8.8.
- Hexagonal nuts M6-M12, strength class 8. A few lock nuts.
- Washers and spring washers, 6.5-13 mm.
- Spring cotters, 3-8 mm.
- Grease nipples 6 mm and 1/8”, straight and angled.
- Fuses 7.5; 10, 15; 25; 40A
Battery

The gas generated by the battery is very explosive. Avoid open fire and sparks in the vicinity of the battery.
When servicing an electrical instrument, disconnect the negative cable of the battery.

Checking of the charge state of the battery

During working the engine recharging equipment keeps the battery charged. At other times, check the state of the battery at regular intervals and recharge if necessary. An acid gauge may be used for checking. In the table below you can see the charge state of the battery compared with the acid specific weight.

<table>
<thead>
<tr>
<th>Specific weight reading</th>
<th>Charge state</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 280</td>
<td>Fully charged</td>
</tr>
<tr>
<td>1 240</td>
<td>75 % “</td>
</tr>
<tr>
<td>1 200</td>
<td>50 % “</td>
</tr>
<tr>
<td>1 160</td>
<td>25 % “</td>
</tr>
<tr>
<td>1 120</td>
<td>No charge</td>
</tr>
</tbody>
</table>

Do not leave a flat battery unused for a long time. A low-charged battery freezes easily and exposure to frost will cause extensive damage. If a recharging device is available, recharging can also be done at home.

Before starting to recharge:
• Disconnect the battery cables.
• Unplug the cells.
• Make sure the fluid level is high enough.
• Use 5-10 % of the Ah of the battery for charging current. For example: A 100 Ah battery may be recharged using 5-10 ampere current.

Cleaning of battery and other maintenance

• Clean the battery covers regularly.
• Remove any oxidisation off the battery poles and cable lugs.
• Make sure the cable lugs are properly tightened.
• Coat the outer faces of the poles and lugs with Vaseline.
• Check that the batteries are properly fastened and the poles protected.
• Check the fluid level a few times a year and before storage. Add distilled water, if necessary, up to the upper fluid level.
• NOTE! Wrong connection of either the battery or the generator will damage the generator.
• Before electrical welding, disconnect the battery and generator cables.
• Check the condition of the cable insulation and the protective cables on a regular bases and perform any necessary repairs.
Using of auxiliary battery

If additional power is needed for starting, proceed as follows:

As a source of additional power use 24 V input for example: another 24V vehicle, startbooster or two 12V batteries in series. Make sure the forwarder batteries has not frozen; a flat battery freezes in -10°C.

Follow carefully the connecting sequence given below:
1. Connect the auxiliary starting cable to the positive pole of the additional power source. Connect other end of the cable to the 30-pole of the main switch (that is +24V cable from forwarder batteries fig.49).
2. Connect one end of another auxiliary starting cable to the frame of the forwarder (same point where batteries grounding is located fig.49). Connect the last end to the negative pole of the additional power source.

Do not lean over the batteries while making the connections.
Start the engine.
Disconnect the cables in exactly the opposite order.

Installation of Additional Electrical Instruments

When installing additional electrical instruments to the forwarder, make sure the size of the charge generator is 100 A.