

SAMPO ROSENLEW



SR1066

Harvester

Instruction manual

Sampo Rosenlew Ltd
P.O.Box 50
FI-28101 PORI, FINLAND
www.sampo-rosenlew.fi

Englanti
9/2012
0812352

Introduction

The purpose of this book is to familiarize the operator with the forest harvester. It is of utmost importance that the operator becomes familiar with the structures, adjustments and maintenance of his harvester. 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 forest harvester. The other manuals you will find useful when using and servicing your forest harvester include the instructions and spare parts catalogue for the harvester head, the instructions for the harvesting computer, the instructions for the crane, the instructions for the base machine control system 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 harvester, send immediately for new manuals.

Item "Technical Specifications" has a description of all the features of the forest harvester in accordance with the delivery contract. It does, however, not include retro-fitted accessories.

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

Sampo Rosenlew Ltd

Table of contents

Introduction	3
Safety precautions	5
Marking of danger points	10
Type marking	12
Technical specifications	13
Certificate on conformity to the EU directives.....	14
Guarantee	15
Structure and functions of the forest harvester.....	16
Cut - away picture of the forest harvester.....	17
Operator control instruments.....	18
Signs and symbols	25
Operation and Adjustments.....	26
Hydraulics	36
Electrical instruments	38
Parameters in the IQAN control system.....	42
Service and maintenance.....	52
Lubrication	63
Summary of periodical procedures.....	65
Storage when not in use	66
Recommended accessories.....	67
Hydraulic diagram.....	68
Electric diagram	70

Safety precautions

Read carefully these instructions on safety and use before starting to operate the harvester. 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 harvester, make sure it conforms to the delivery contract. Do not fit the harvester with any accessories not approved of by the Manufacturer. The Manufacturer of the forest harvester 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.

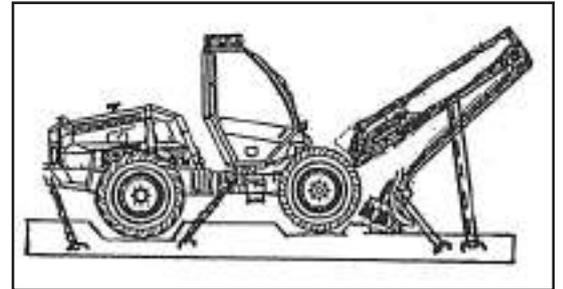
1. Transportation on a vehicle or by rail

Make sure you know the measurements and weights of the harvester and the transporter. Comply with any regulations concerning transportation.

Use increased tyre pressure, minimum of 3 bar to improve stability.

Fix the harvester securely to the transporter.

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 harvester.

Remember that the harvester has articulated steering.

Test brake functions before driving on the road.

Wear the safety belt.

Never drive downhill with the gear in neutral.

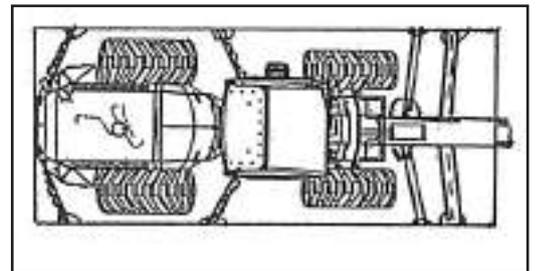
Only shift gear on level ground.

Never carry passengers on the harvester.

Never use the harvester for transporting goods.

If the harvester fault diagnostics detects a malfunctioning brake or drive pedal, the driver can still drive the harvester in for a service, but at a low speed and with slow crane movements.

Binding harvester
Slow vehicle sign



Danger zone for Crane and harvester head 60m

3. Forest harvesting

Get familiar with the structure of the forest harvester by studying the manual before starting harvesting.

Make sure the protective guards are properly attached and in good condition.

Sound the signal to warn people around the harvester before starting the engine.

Never use the forest harvester for anything except harvesting of trees.

Manual feeding of trees into the harvester head is forbidden.

Before starting the engine and moving, make sure nobody is standing too near.

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 harvester is moving.

Never leave the engine running unattended.

Beware of the crane and the moving parts in the harvester head.

In cold weather heat the oil by circulating it through the harvester head, too, at low revolutions and low pressure before starting work.

Drive carefully on hillsides; the harvester may overturn, particularly with the crane on the downhill side.

The forest harvester cab is a safety cab.

Never saw with the guide bar towards the cab. A loosened saw chain is dangerous and may hurtle through the window.

The harvester has two exits. The left-side door is the normal exit. The right-hand side window may be used as an emergency exit when the lock has been opened.

Always before getting in the cab, open or ensure from the outside that the lock on the right-side door is unlocked.

When the harvester is in use, the emergency 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. In this case beware of tight curves that may cause rear tire to hit the door

Note the recommended safety distances when harvesting under power lines.

Stop the engine before cleaning or servicing the harvester.

Stop the harvester 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 with harvesting.

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 harvester head before going beneath them.

Never clean the harvester without proper equipment.

When leaving the harvester, lower the crane, stop the engine, remove the ignition key, lock the door and turn the master switch to its zero position.

SAFETY DISTANCES WHEN HARVESTING UNDER OPEN-WIRE POWER LINES

The minimum space between the harvester and power lines with voltage must be in accordance with the enclosed illustration.

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 four low-voltage lines. A bundle assembled aerial cable shall be treated the same way as an open-wire cable.

In case the height or voltage of the power line is difficult to estimate, the electrical 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 harvester away from the power line. If there are other people near, ask them to check that the harvester is not stuck in the line. If the harvester 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 harvester touching the power line.

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

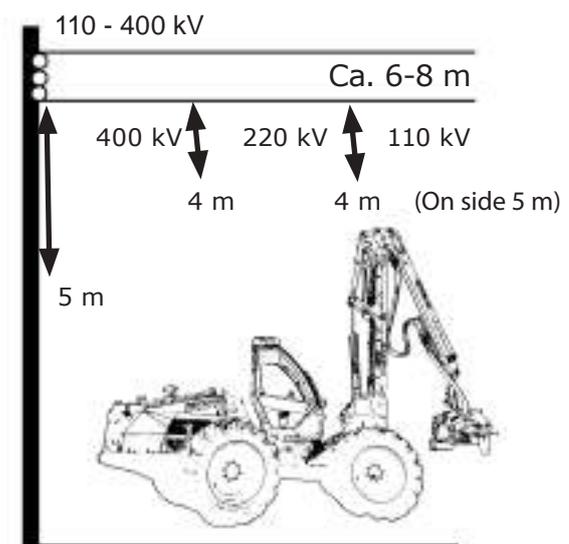
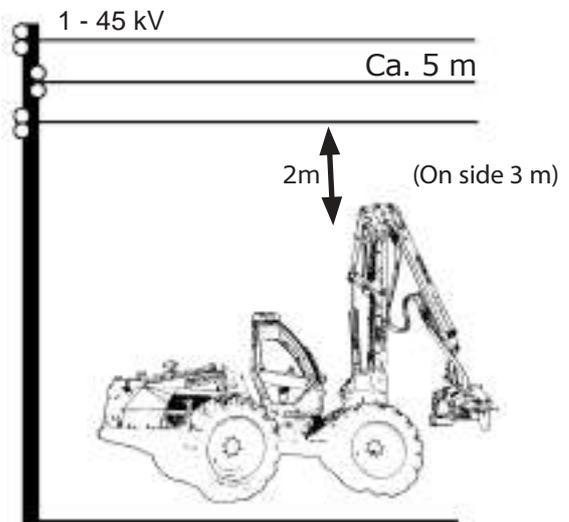
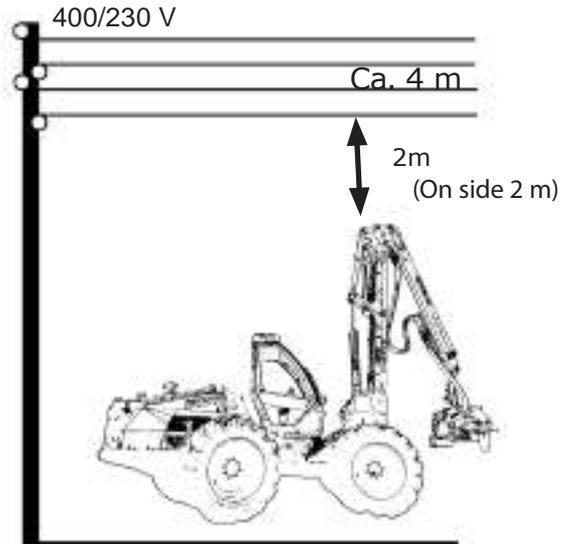
Get away from the harvester jumping either with your feet together, or with only one foot on the ground at a time. Otherwise the electric field on the ground may create a fatal electric current between your legs. You will be safe at a distance of 20 metres from the harvester.

Beware of broken power lines lying on the ground.

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

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

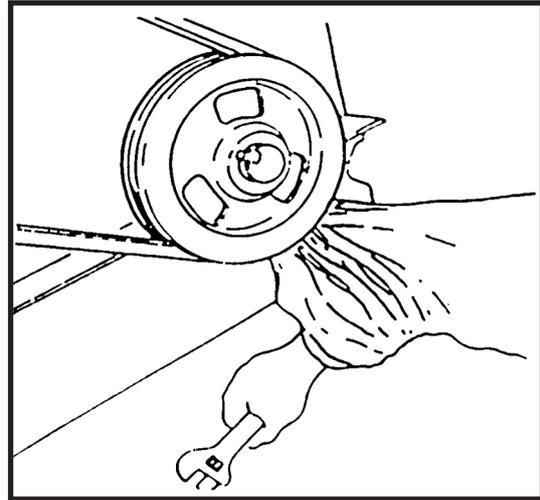
Remember that open-wire lines never have



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 electrical 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 harvester in good condition.

Check the condition of fast moving parts daily. Pay special attention to the transmission mechanism and the rotating parts in the harvester head. Replace defective parts before they become dangerous.

Clean, repair and service the harvester with the transmission and engine off and the ignition key off the ignition switch and main switch off.

The harvester head has many danger points. Read the harvester head manual to familiarize yourself with them. On some models turning of the measuring wheel by hand makes the knives, tracks and rolls close. This is extremely dangerous if the engine is running or there is pressure in the hydraulic accumulator of the harvester head. Do not go near the harvester head, particularly the knives, tracks and rolls, with the engine running.

Before welding, disconnect the battery cables, input cable of the diesel engine control unit (the left hand side cable under the cover of the control unit attached to the engine), all the cables to the PC processor, the cables of the measuring device head module (MCC) and the cab MCI module, connector of the large wiring harness between the frames and the central unit cables of the optional fire extinguishing system.

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 especially 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 head pressure accumulator, either, before disconnecting the connectors.

Never use over-sized fuses; they involve risk of accident.

Never start the harvester 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 harvester that would make it less safe.

Tow the harvester only from designated points.

5. Local laws and regulations

Before driving the harvester on a public road, make sure that harvester is correctly equipped and applies to the local regulations and laws given for such a vehicle.

Machine operator have to be trained to drive and use harvester safely.



This symbol in The manual refers to a special risk involved in taking a certain measure, due to which extra caution shall be practised.

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 harvester. Clean the harvester 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 harvester comes with two 6-kilo hand extinguishers. They are stored above the rear wheel inside the side guard that opens rearwards. The extinguishers shall be inspected every 6 months by an authorized service outlet.

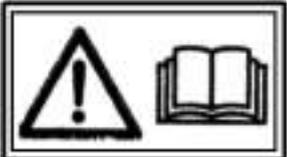
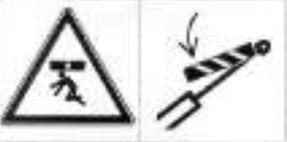
The harvester may be equipped with a semi-automatic fire extinguishing system. Make sure to comply with the manufacturer's instructions when using the system.

Marking of danger points

Although an effort has been made to build the forest harvester as safe to use as possible, there are certain risks involved in its use. These are to be kept in mind when operating the harvester.

The danger points have been marked on the harvester 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

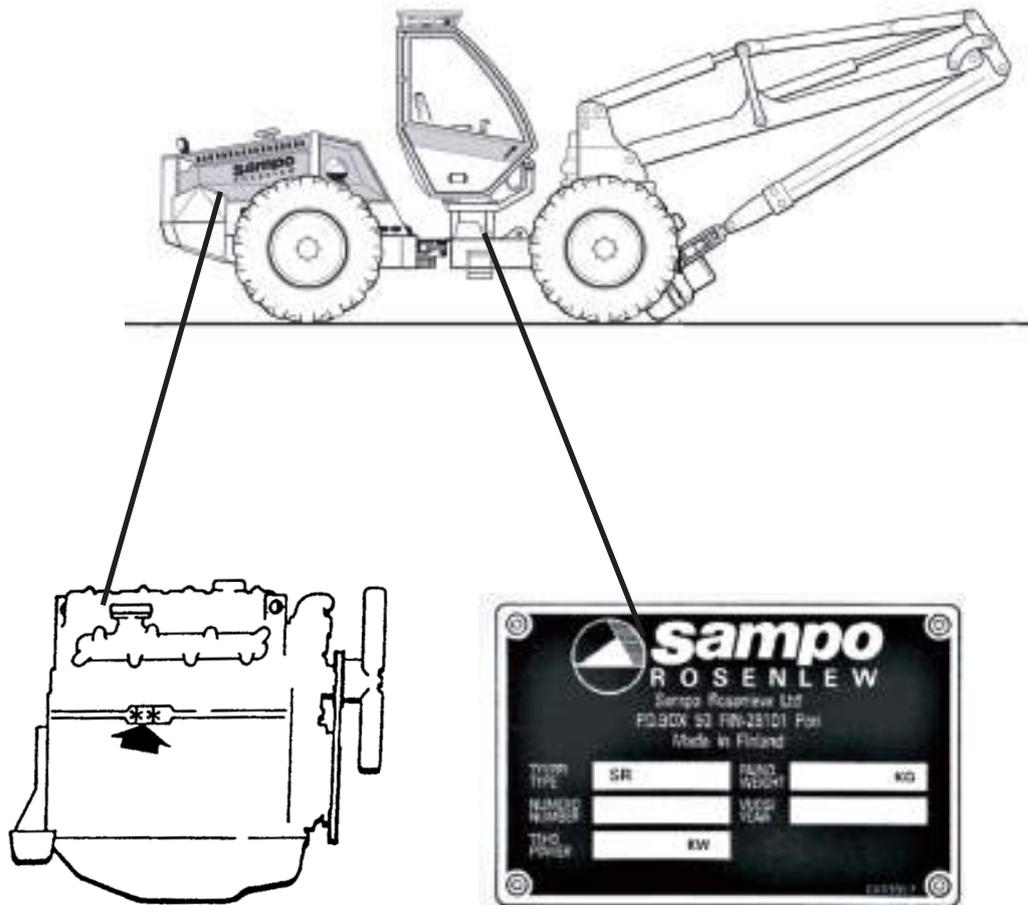
Danger	To avoid danger	Symbol
Subject to danger due to insufficient information	Read the manual before starting the harvester	
A raised part may fall down	Support raised parts before going under them	
Gap in belt drive	Stop the engine and remove the ignition key before removing any guards	
Getting entangled in moving parts	Keep at a safe distance from jointed components	
Falling of the machine or of objects handled with it	Keep at a safe distance from the harvester, the crane, the head and the wood handled	
Electric shock	Keep at a safe distance from power lines. See the safety distances above	

Danger	To avoid danger	Symbol
Fire	In case of fire: - turn off the engine - turn off the main power - extinguish the fire - get help if necessary	
Fire	Extinguish the fire with the fire extinguisher stored under the guard marked with this sticker.	
Service measures	Before starting of service: - turn off the engine - turn off the main power - when servicing the harvester head, remove pressure from the pressure accumulator as instructed	 
Safety belt not worn	Always wear a properly adjusted safety belt while working and driving on the road	
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.	
Refrigerant	Leaking refrigerant may cause frostbite	

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 harvester head and the engine on this page (and in the spare parts catalogue).



Fill in the serial numbers of the crane and the harvester head

Engine number

Note! Left side of the forest harvester = The side of the cab with the stairs
Right side of the forest harvester = The side with the side instrument panel

Technical specifications

The base forest harvester with articulated steering includes: the cab, gear box, crane valves, and crane on the front frame, the engine, pumps and tanks on the rear frame.

SR1066

Weight	Working weight. 14,000 kg
Maximum permissible weight (ROPS)	16,000 kg
Main Dimensions	
Length without crane	5.9 m
Width	2.6 – 3.0 m
Height in transport position	3.5 m with cab tilt 3.15 – 3.6 m with a fixed cab
Ground clearance	0.6 m
Outermost turning radius (with 600-mm tyres)	4.72 m
Engine	Agco SisuPower 66 CTA-2V
- power	125 kW//2,200 rpm
- fuel tank	330 l
Transmission	
Traction hydraulics pump	155 l / min & 420 bar
Rear wheels get the oil from the working pump	
Rear wheels with hub motors and speed reduction gear	6,370 cc
Front axle drive motor in the gearbox	90 cc
Three speed ranges forward and backward	1st gear 0-4.5 km/h 2nd gear 0-7.4 km/h 3rd gear 0-17 km/h
At the front hydraulically controlled mechanical differential lock	
Tyres	
Front	600/65 – 34 or 700/55 - 34
Rear	600/65 – 34 or 700/55 - 34
Hydraulic system	
Pump in working hydraulics	418 l/min / 2,200 r/min & 250 bar
Load sensing, programmable electric joystick control (IQAN)	
Oil tank	220 l
Electric system	
Voltage	24 V
Battery	2 x 145 Ah
Charging generators	2 x 100 A
Working lights	20
Crane	e.g. Foresteri H1395 / H13105
Operating range	9.5 – 10.5 m
Lift gross	154 kNm
Crane weight	1,900 / 1,980 kg
Harvester head	e.g. Keto 51 – 150, Foresteri 20 – 25 with a 2- or 3-hose hydraulic system
Max. delimiting diameter	350 - 550 mm
Weight max	900 kg
Brakes	
At the front hydraulically & mechanically controlled drum brakes and a separate parking brake	
At the rear negative multi-disc brakes	
Cab	Quiet safety cab (FOPS, ROPS, OPS)
Noise level	71 dB (A)
Windows	Lexan Margard polycarbonate
Harvesting computer	Mitron IT or PC, EPEC a 4-wire CAN route

Certificate on conformity to the EU directives

CERTIFICATE ON CONFORMITY TO THE EU DIRECTIVES

Manufacturer

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

Collector of technical spec:

Jari Karén
Address:
Sampo-Rosenlew Ltd
Konepajaranta 2A, P.O.Box 50
28101 Pori Finland

Description of the machine: Forest harvester SR 1066

- 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:

97/68EEC directive on diesel engine exhaust fumes
89/336/EEC 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 14861 Forest machinery Self propelled machinery - Safety requirements
EN-ISO 14982-1998 Electromagnetic compatibility.
Test methods and acceptance criteria.

29.12.2009 Pori

Jari Prihti



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 harvester 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 harvester. Increasing of the hydraulic working pressure and pressure limits may cause damage;
 - 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 harvester
3. When working in cold conditions, the guarantee is valid only when the outdoor temperature does not drop below -25oC.
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 harvester.

Structure and functions of the forest harvester

Structure

The Sampo 1066 forest harvester has been designed to carry out later thinning and partly also final felling.

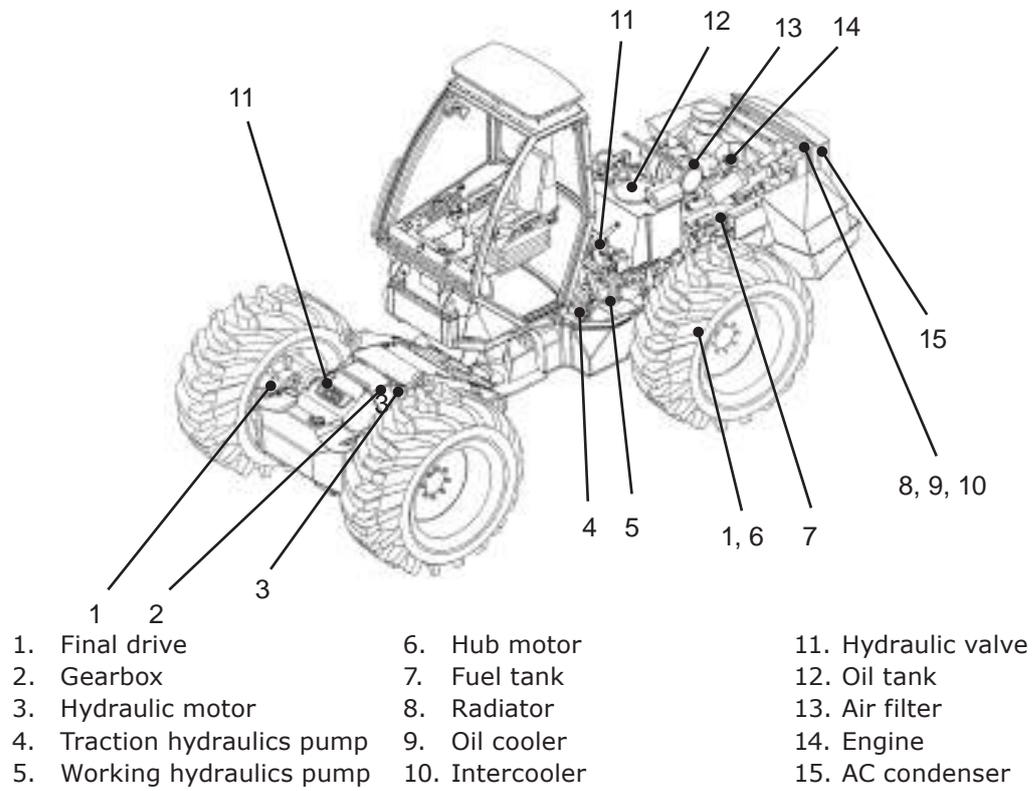
The forest harvester has articulated steering. The crane, gearbox and cab are located on the front frame. The engine, hydraulic pumps and oil and fuel tanks are on the rear frame. The harvester is steered and tilted by means of a joint. The inner rims of both the front and rear tyres go along the same tracks. The harvester is extremely nimble as the turning angle of the frame joint is 50° and the turning radius only 4.7 m. Depending on the tyres, the width varies between 2.5 – 3.0 m. Although the harvester properties have been designed for different types of thinning, it has sufficient capacity for final felling as well.

Harvester head

The harvester head cuts and fells the tree. After that the tree is delimbed and cut into a pre-set length. Due to the large working pump 1,400-1,500 RPM are enough. Too high working revolutions are heavy on petrol. The Sampo harvester is supplied with alternative harvester heads. 3-hose system in hydraulics and the CAN route with its easily detachable connectors used in controlling of the head make it easy to change heads. There are also different harvesting computers to choose from. The basic version is either the EPEC 4W30 or 4W50 (both with cubic volume calculation). When necessary, an on-board computer with a GPS and a data transfer function can be selected.

For further harvesting instructions, consult the harvesting computer and harvesting head manuals.

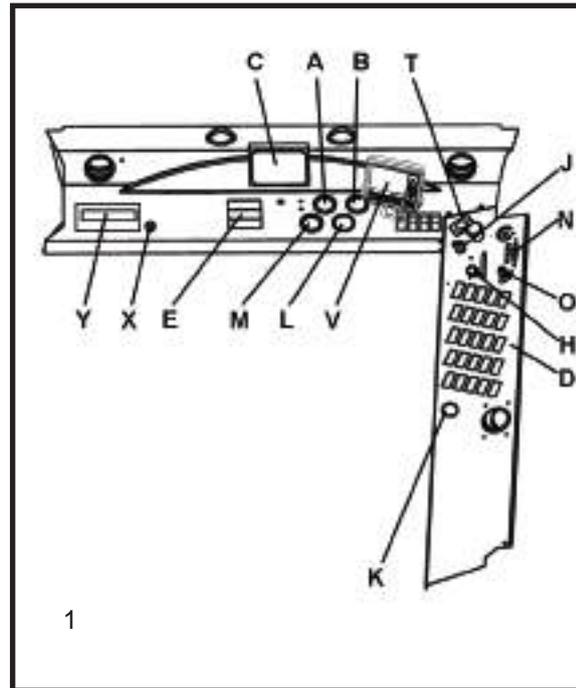
Cut - away picture of the forest harvester



Operator control instruments

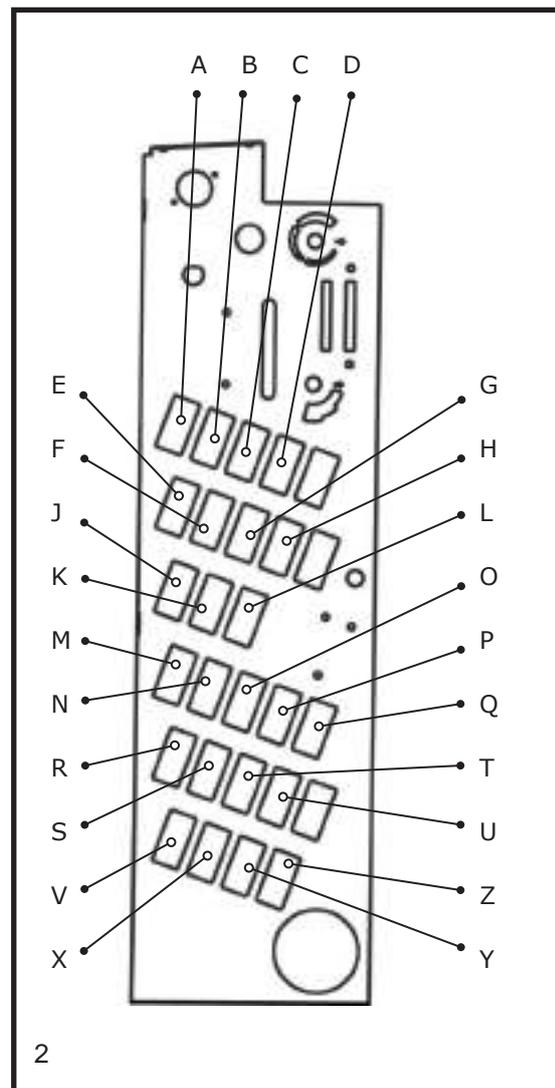
Equipment on the instrument panel (fig. 1)

- A Engine thermometer
- B Thermometer for hydraulic oil
- C Harvesting computer display
- D Programming wheel of the harvesting computer
- E Signal lights
- H Throttle lever
- J Ignition, starter (and electric stop)
- K Emergency stop
- L Hour gauge
- M Fuel gauge
- N Heater thermostat
- O Fan speed regulator
- T Phone outlet
- V IQAN system display
- X AC regulator
- Y Engine heater display



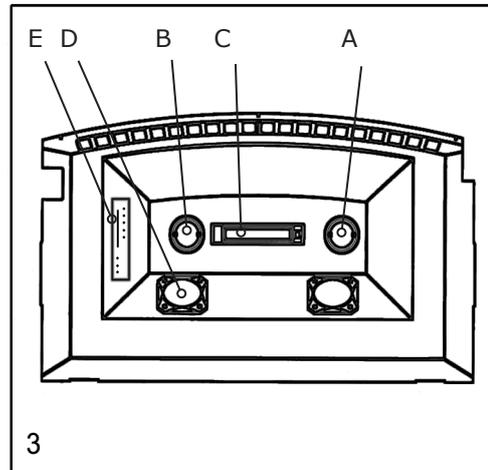
Switches on the instrument panel (fig. 2)

- A Alarm reset
- B Frame lock
- C Working brakes
- D Parking brake
- E Sound signal
- F Windscreen wiper
- G Windscreen washer
- H Glow signal light
- J Harvesting computer
- K Headlights
- L Seat heating
- M Working lights, general
- N Working lights, additional
- O Working lights, doors
- P Emergency flasher
- Q Engine diagnosis switch & alert light
- R 4WD
- S Differential lock
- T Dip switch
- U Turning signal
- V Cab tilting automation
- X Cab manual drive forward/backward
- Y Cab manual drive left/right
- Z Master switch



Equipment on the ceiling (fig. 3)

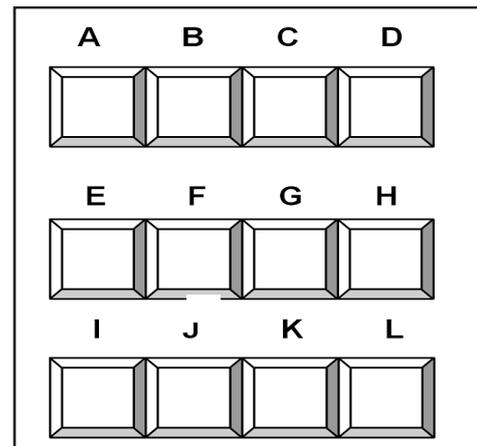
- A) Alarm light (yellow)
- B) Fire extinguishing system light (red)
- C) Indoor light
- D) Speaker
- E) Radio



Signal lights (fig. 4)

The harvester has signal lights to indicate:

- A) lowering of engine oil pressure
- B and C) lowering of charge
- D) turning signal on
- E) overheating of hydraulic oil
- F) overheating of engine
- G) blocked air filter in engine
- H) high beam on
- I) blocked suction / return filter in hydraulic oil
- K) blocked return filter in hydraulic oil
- L) level of hydraulic oil



When the signal light comes on, it indicates the location of the operation or malfunction.

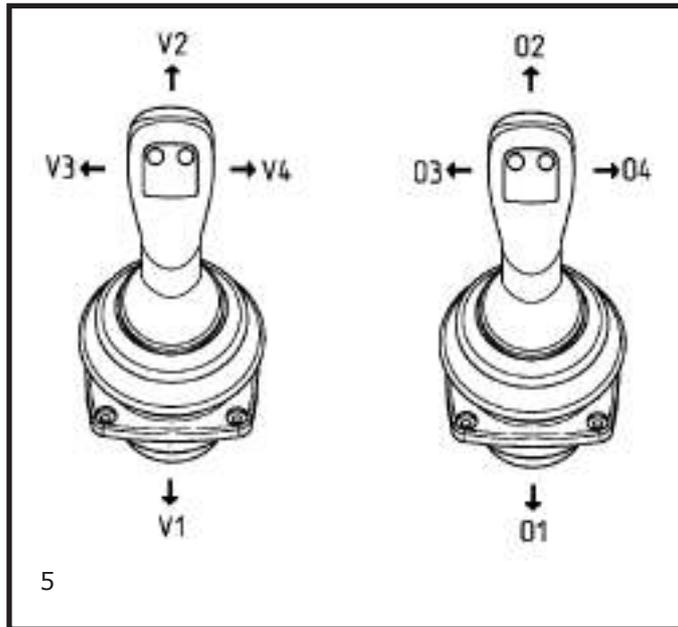
Vertical levers (fig. 5)

Crane control lever, left

- V1 Outer boom inwards
- V2 Outer boom outwards
- V3 Crane turn left
- V4 Crane turn right

Crane control lever, right

- O1 Crane lift up
- O2 Crane lowering down
- O3 Frame steering left / rotator turn
- O4 Frame steering right / rotator turn



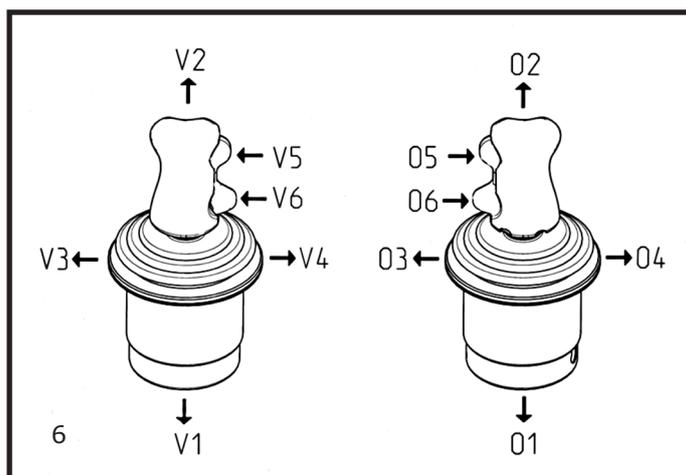
Mini levers (fig.6)

Crane control lever, left

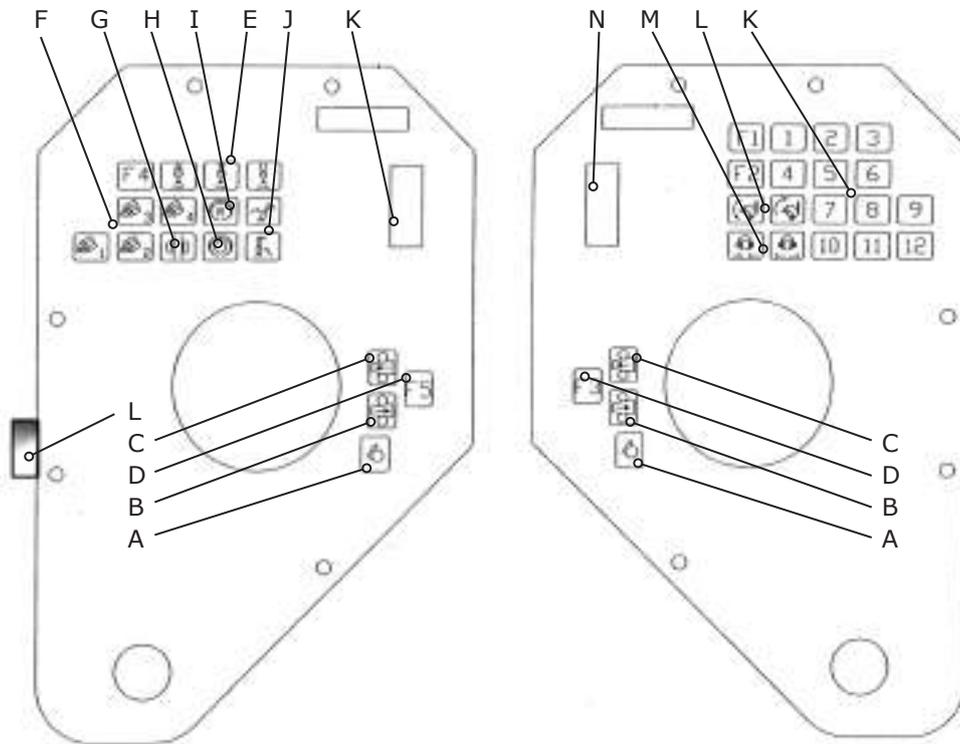
- V1 Outer boom inwards
- V2 Outer boom outwards
- V3 Crane turn left
- V4 Crane turn right
- V5 Crane extension in
- V6 Crane extension out

Crane control lever, right

- O1 Crane lift up
- O2 Crane lowering down
- O3 Frame steering left / rotator turn
- O4 Frame steering right / rotator turn
- O5 Head open / up
- O6 Head closed / down



Switches on the push button boards on mini joysticks (fig. 7)



7

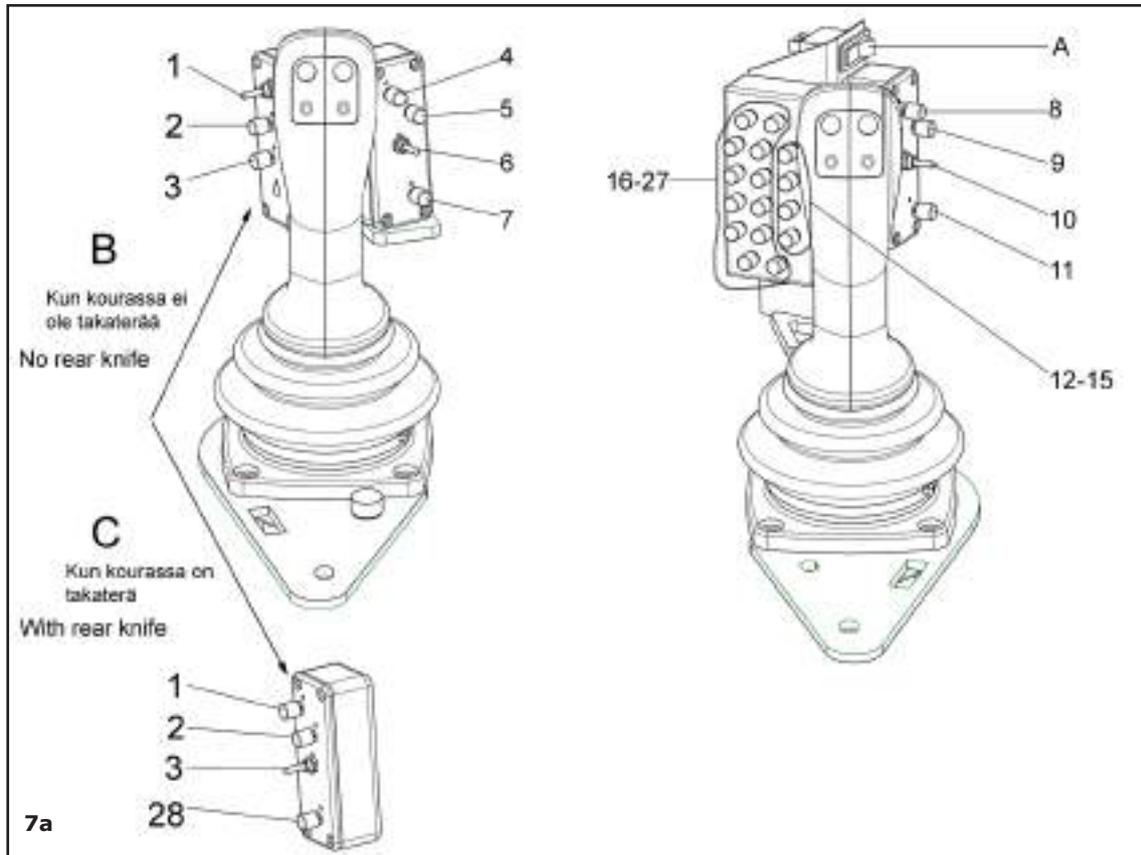
Left-side push button board

- A Saw
- B Feed forward
- C Feed backward
- D Vacant
- E Colour marking and stump treatment
- F Tree species
- G Opening of tracks
- H Opening of knives
- I Opening of rear knife
- J Crane tilt forward/backward
- K Selection of driving direction
- F4 Driving backwards (when button depressed)

Right-side push button board

- A Saw
- B Feed forward
- C Feed backward
- D Vacant
- K Pre-set measurements
- L Harvester head up / down
- M Harvester head open / closed
- N Harvesting/driving switch

Joystick switches on vertical levers with Motomit harvesting computer (fig. 7a)



Vertical lever switches when the harvester head does not have a rear knife B.

- 1 Tilt up / down
- 2 Knives open
- 3 Tracks / rolls open
- 4 Slow feed forward
- 5 Slow feed backward
- 6 Driving direction
- 7 Programmable (urea)
- 8 Fast feed forward
- 9 Fast feed backward
- 10 Head open / closed
- 11 Saw
- 12-15 Programmable (tree species 1-4)
- 16-27 Programmable (preset)
- A Drive / harvest switch

Vertical lever switches when the harvester head has a rear knife C.

- 1 Knives open
- 2 Tracks / rolls open
- 3 Tilt up / down
- 28 Rear knives open

Functions displayed on this list are usually programmed in the programmable switches. However, it is possible to tailor the programming for each customer.

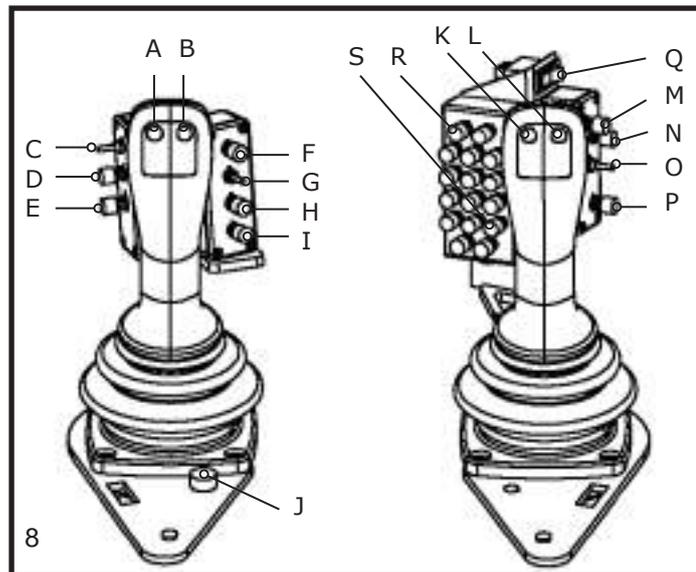
Joystick switches on vertical levers with Epec harvesting computer (fig. 8)

Left-side joystick

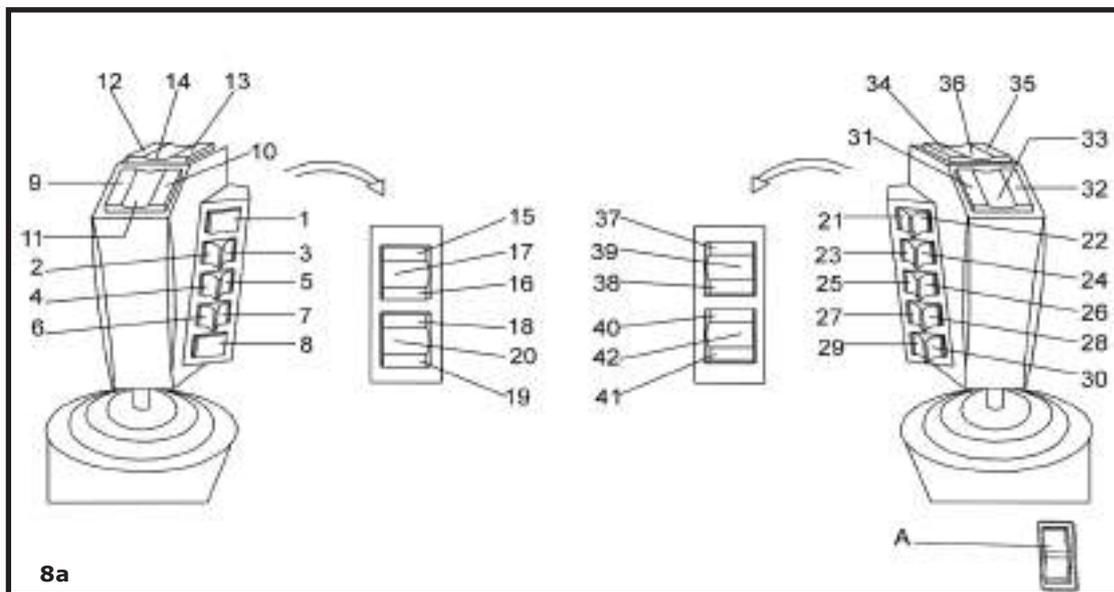
- A Extension out
- B Extension in
- C Harvester head up / down
- D Opening of knives
- E Opening of tracks or rolls
- F Saw
- G Driving direction (forward in the mid position)
- H One wipe of the windscreen
- I Stump treatment
- J Driving speed adjustment

Right-side joystick

- K Crane tilt table forward
- L Crane tilt table backward
- M Feed forward
- N Feed backward
- O Harvester head open / closed
- P Rear knife
- Q Harvest / drive switch
- R Pre-set measurements
- S Tree species



Joysticks switches on the EME levers (fig. 8a)



Left-side joystick

- 1 Saw
- 2 Programmable (tree species 1)
- 3 Programmable (tree species 2)
- 4 Programmable (tree species 3)
- 5 Programmable (tree species 4)
- 6 Driving direction backwards
- 7 Driving direction forward
- 8 Single wipe
- 9 Feed backward
- 10 Feed forward
- 11 Vacant
- 12 Slow feed backward
- 13 Slow feed forward
- 14 Vacant
- 15 Tilt up
- 16 Tilt down
- 17 Vacant
- 18 Crane extension in
- 19 Crane extension out
- 20 Vacant

Right-side joystick

- 21 Programmable (quality 1)
- 22 Programmable (quality 2)
- 26 Programmable (quality 3)
- 24 Programmable (quality 4)
- 25 Programmable (quality 5)
- 26 Programmable (quality 6)
- 27 Programmable (color test)
- 28 Programmable (shift)
- 29 Programmable (new frame)
- 30 Programmable (reset)
- 31 Head open
- 32 Head closed
- 33 Vacant
- 34 Knives open
- 35 Tracks / rolls open
- 36 Rear knife open
- 37 Programmable (up)
- 38 Programmable (down)
- 39 Programmable (cross-cutting length)
- 40 Boom front tilt back
- 41 Boom front tilt front
- 42 Vacant
- A Drive / harvest switch

Signs and symbols

Glow		Hour gauge	
Suction filter		Pressure filter	
Return filter		Hydraulic oil level	
Hydraulic oil temp.		Fuel	
Seat heating		Windscreen washer	
Ignition lock		Diesel engine stop	STOP
Oil pressure		Charge	
Engine revolutions		Gear diagram	
Sound signal		Turning signal	
Working light		Windscreen wiper	
Phone		Parking light	
Fan		Air conditioning	
Rotating flasher		Emergency flasher (red symbol)	
Heat alarm for coolant		Headlights, dipped	
Headlight, full		Indoor light	
Brake		Joint lock	
Differential lock, front		Air filter	
4WD		Harvesting computer	
Headlights		Emergency exit	
Engine diagnosis light (orange symbol)			EXIT
Master switch (electric)			

Operation and Adjustments

The harvester functions have been divided into two different functioning environments: harvesting in forest and longer-range driving. The difference between these operating environments is in automation. With the harvesting / driving switch (keyboard or on instrument panel (EME)) in the harvesting position, the harvester head can always be rotated using the right-side joystick with the drive pedal in its mid position. When depressing the drive pedal, the right-side joystick starts to steer the frame thus enabling a quick and efficient change from harvesting to driving towards the next tree.

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 B) and the working brake switch (fig 2, switch C) in their forward position, the working brakes and the frame lock get always engaged when the drive pedal is in its mid position. Correspondingly when depressing the drive pedal, the working brakes and the frame lock get disengaged. This keeps the harvester stationary and stable during harvesting, but allows nimble moving towards the next tree.

Doorswitch

When the left side door is open, the crane movements, frame steering, drive and head movements are switched off. **Note**, in this case steering does not work and some models of harvesting heads may move back to the resting position, in other words close.

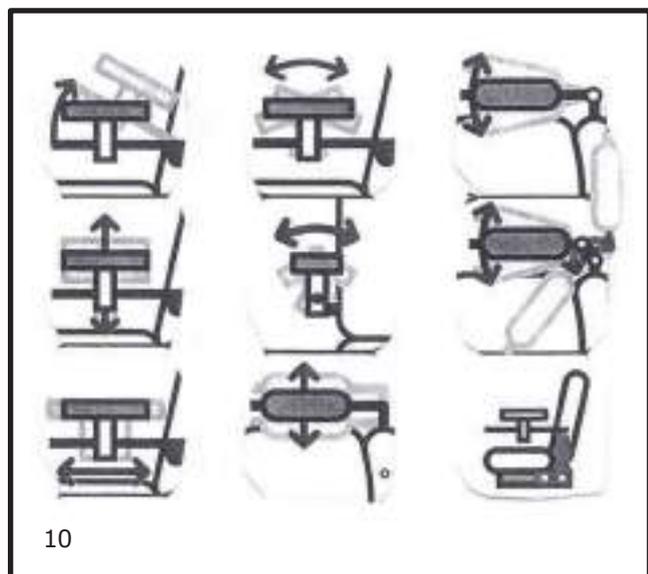
After disconnection by the door switch harvester head is reset back to functional status as follows:

- Press ENTER from the Harvesting computer
- Select the service menu, and then press ENTER
- Click Reset, and then press ENTER
- Select the switch on harvester head current menu and then press ENTER
- Close the head, and then press ENTER
- Press the ESC button twice

The printer of the harvesting computer has its own power switch. Turn it on when you want to print. When printing, the printer must be horizontally positioned.

Joystick positions can be adjusted (fig. 10)

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 side-ways. After adjustment it is important to lock the positions of the joystick and the armrest to prevent unwanted movements.

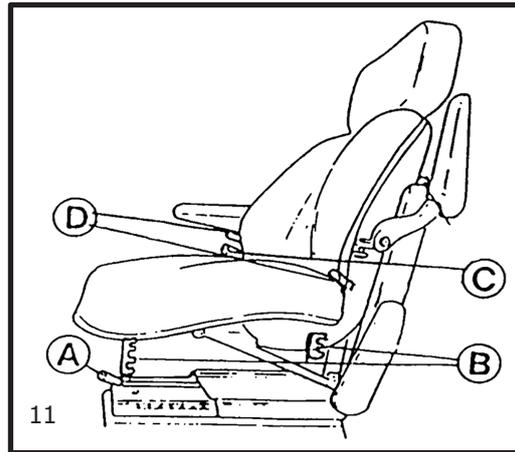


Seat has several adjustments (fig. 11)

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. 12)

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.

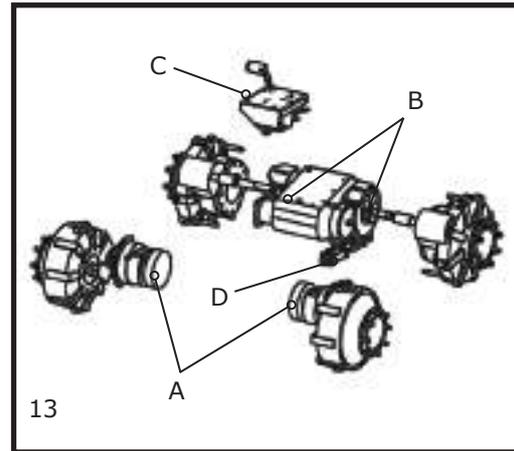


Brakes while driving and harvesting (fig. 13)

The rear wheels of the harvester have negative hydraulic multi-disc brakes A. Braking power is generated by springs, and the brakes are released hydraulically.

The front axle has disc brakes B, which operate on the front wheels through the drive shafts. Disc brakes can be used both hydraulically and by means of the brake pedal.

With the gear engaged, hydrostatic drive transmission automatically brakes when the drive pedal goes toward its mid position.



A triple-position switch in the cab (fig 2, switch C) mainly controls the brakes. It controls the working brakes both at the front and rear. Using the switch the brakes can be engaged, disengaged and shifted to their automatic position hydraulically. In their mid position the brakes are always engaged, and when depressed all the way back they are always disengaged. In their forward position, that is the automatic position, the brakes operate depending on the position of the drive pedal.

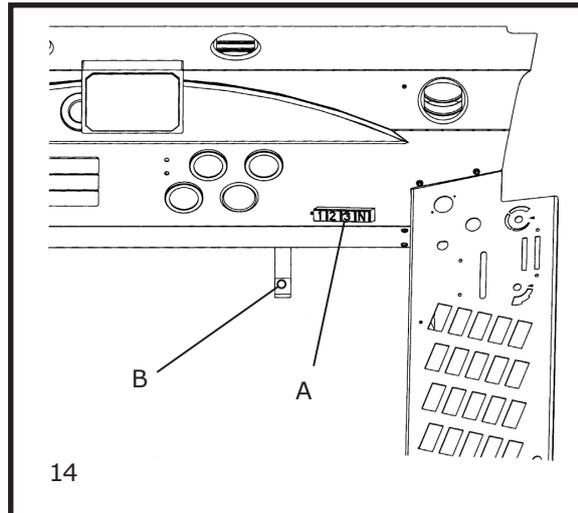
In normal harvesting or when driving on hilly roads, the brake switch should be in its automatic position.

In the cab there is also brake pedal C, which can be depressed to generate braking power on the brake discs comparable to pedal power. When slight braking power is generated at the front either by the brake pedal or hydraulically, the rear brakes get engaged. Therefore depressing the brake pedal generates the same braking power as hydraulic braking.

For safety reasons both the front and the rear working brakes get engaged if the engine stops unintentionally, e.g. due to overload. This happens even with the brakes in their off position. The spring-loaded brakes at the rear become engaged automatically as there is no driving power to engage the brakes. The pressure in the hydraulic accumulator keeps the front brakes engaged, if the engine stops unintentionally. The front working brakes do not remain engaged if the engine is switched off using the ignition key. The reason for this is to prevent the harvester from rolling downhill in case the hydraulic accumulator becomes discharged during long-term parking. If this were not the case, the harvester could be parked on such steep ground that even the front working brake were needed to keep the harvester stationary. With the hydraulic accumulator becoming discharged in the long term, the braking power of the front working brake decreases, and the harvester can roll downhill.

Parking brake (fig 14)

Parking brake D is operated using a dual-position switch (fig 2, switch C). The parking brake engages the spring-loaded hand-brake in the front axle gearbox and the spring-loaded working brakes at the rear. The harvester cannot be driven with the parking brake on. This prevents the parking brake from being engaged unintentionally. The parking brake gets engaged automatically when the engine stops or is switched off. At the same time the rear working brakes get engaged to function as a parking brake. Switching off of the engine disengages the front working brakes.



Frame lock

The frame lock operates similarly to the working brakes. Depending on the position of the frame lock switch, the dual-function cylinders lock the frames together, allow them to rotate independently of each other, or operate in an automatic position in the same manner as the brakes. With the frame lock switch (fig 14, switch A) in its mid position, the frame lock is always engaged, and when depressed backward, the frame lock is disengaged. Normally when harvesting, the frame lock switch should be in its automatic position, i.e. in its front position.

Traction transmission

Engine power is transmitted to the consecutive work and drive pumps by means of a torsional coupling. From the pump to the hydraulic motor of the gearbox on the front axle power is transmitted by means of closed loop hydraulics. From the gearbox power is transmitted to the front wheels by means of drive shafts and final drives.

The gearbox has three speed ranges (1, 2, 3) and neutral (N). The gear is selected using push buttons A (fig. 14). 1st gear (button 1) is intended for harvesting, 2nd gear (button 2) for driving in the forest and 3rd gear (button 3) for driving on the road. Gears should be shifted on level ground with drive pedal B in its up position. When shifting gear, the harvester must be stationary and the working brakes engaged using switch C, fig. 2. The parking brake should be disengaged. When these conditions are met, the gear is changed first into neutral and then into the selected gear. The IQAN display will say: "Gear in neutral! Select gear" for as long as the gear is in neutral. This is to inform the driver in case the selected gear does not get engaged immediately. As soon as the selected gear is engaged, the message on the IQAN display will disappear, and the symbol light of the selected gear will come on next to the gear selection buttons. For safety reasons, with no gear engaged, all the brakes get engaged automatically, i.e. the front working and parking brakes and the rear working brake. At the same time the rear motor hydraulic lines get closed even with only the front-wheel drive on. This provides the rear with hydraulic braking power whenever the gear is not engaged.

The harvester is driven using drive pedal B. The harvester starts moving when the drive pedal is pressed, and accelerates speed when the pedal is pressed more. Fault diagnostics monitors the drive pedal condition constantly. If a pedal defect is detected, the IQAN display will say: "Drive pedal do not work properly. Do you want to drive to service?" A YES answer, i.e. pressing of F1 on the display, will make the harvester move at a low speed and the display will say: "Limb mode" Now driving speed and crane movements are very slow. A NO answer, i.e. pressing of F2, will show "Drive pedal not functioning properly" on the display. However, this does not prevent working. Ensure you are aware of any risk caused by the defect and find out the reason for it.

A separate switch is used to select the driving direction. On models with vertical levers this switch is on the left-side joystick (fig. 8, switch J). On models with mini levers this switch is on the left-side push button board (fig. 7, switch K). On models with EME levers the driving direction selector is on the left-side joystick (fig. 9, switch 15-16). When driving in traffic, the harvester head should be kept close to the harvester and tied up. The harvesting computer should be switched off in case of unintended crane movements.

A forest harvester equipped with hydrostatic transmission must never be parked using only the gear, but the parking brake that is engaged automatically when power is switched off must be used. Hydraulic motors alone cannot keep the harvester stationary for a long period.

Four-wheel drive

The rear wheels have hydraulic hub motors connected to reduction gears. Oil to them comes from the working hydraulics pump through the valves on the front wall of the oil tank. The angle sensor on the middle joint is used in valve control.

4WD is switched on electrically using switch V on the right-side instrument panel, (fig. 2). The coupling shall be done with the harvester stationary. 4WD can only be used in 1st gear. Front-wheel drive is always on with the gear engaged.

For safety reasons the rear hydraulic lines get closed if the engine stops unintentionally, e.g. due to overload. This will happen even with the 4WD switched off. This provides the rear with hydraulic braking power although there is no traction power.

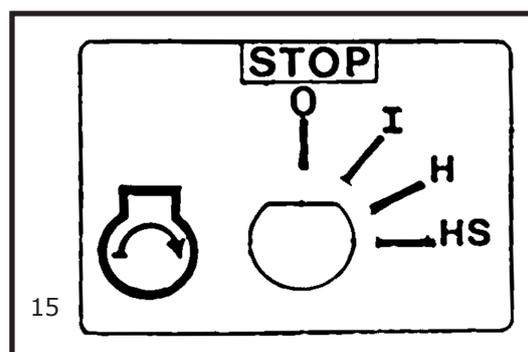
When towing the harvester, four-wheel drive must be off and the engine running to allow the wheel motors to be disengaged. Short-distance towing at a low speed is permitted if the engine and the drive pump cannot be kept running. In such a case the brakes should be released mechanically.

Starting of the engine (fig. 15)

The engine is started with the ignition key. Turn the key to the right to switch on the ignition and turn on the alternator and oil pressure lights. When turning the ignition key farther to the right, to position HS, the engine starts. Position I can also turn on the glow signal light to indicate that the pre/post heater (the glow) is working to facilitate cold starting of the engine. The length of the glow operating time depends on the outdoor temperature.

With the throttle (fig. 1, part H) in its rear position, the engine runs at full revolutions.

The harvester is equipped with a highly safe starting system that checks the brake functions and prevents the harvester from moving when the engine is started. It allows starting only with the drive pedal not pressed and the brakes on. During starting crane and cab movements as well as driving are prevented. If the drive pedal is pressed or the brakes are not on with the ignition key in its HS (starting) position, the text "When starting, brakes have to be on and drive pedal not pushed" will be displayed on the IQAN. When the conditions are met, the engine will start. With the brakes engaged as required, the brake pressure switch must switch itself on. If this is not the case, the IQAN will display "Front brakes are not on or do not work Do you want to drive to service in limb mode?" A YES answer, i.e. pressing of F1 on the display, will make the harvester move at a low speed and the display will say: "Limb mode". Now driving speed and crane movements are very slow. A NO answer, i.e. pressing of F2, will show "Front brakes do not work" on the display. Now crane and cab movements are prevented, and the harvester cannot be driven until the power has been switched off and the testing procedure restarted.



Differential lock

There are sometimes situations when one of the front wheels does not have sufficient grip in respect to the required traction power. This can be avoided by engaging the differential lock inside the gearbox using switch X (fig. 2). The lock at the front is 100% mechanical. On solid ground the lock prevents turning, so then it shall be switched off. With 4WD engaged, the rear wheels always have a hydraulic (not 100%) lock on.

Stopping of the engine

Before switching off the engine, move the throttle into the idling position. The engine is switched off using the electric stopper by turning the ignition key to position 0. Beware of the movements of the harvester head when you switch off the diesel engine. When the power is switched off, the harvester head controls switch off as well and the head may return to its resting position from certain functions. These kinds of functions include, for example, Head closed and Tilt down, depending on the type of the head. The harvester heads often also contain pressurized batteries, potentially causing there to be enough power left for head movements even after the power has been switched off. When finishing working it is recommended to turn off harvesting computer and PC. In this case there is no danger that even accidental use of harvesting head would cause unwanted movements in restarting.

Electric master switch

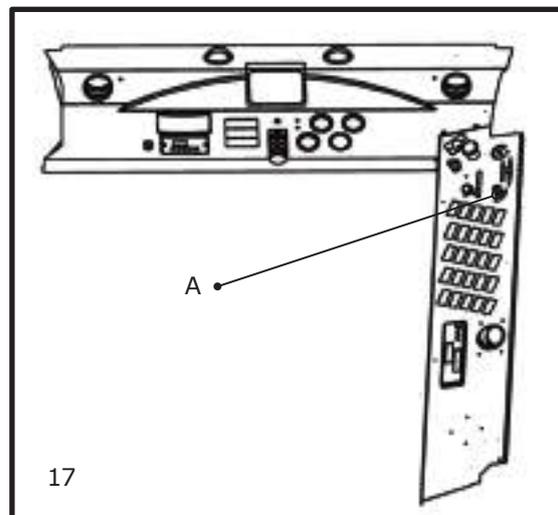
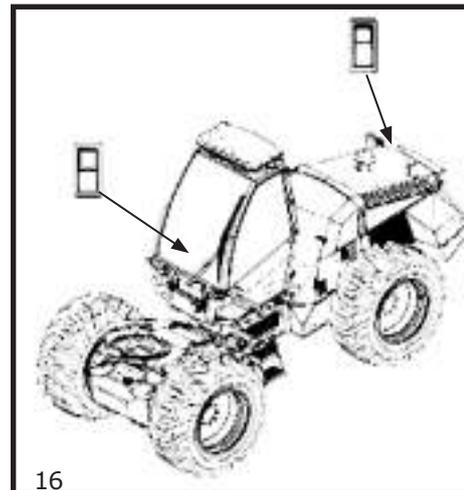
There is a master switch to control the electrical instruments of the harvester. The electric current to the whole harvester can be switched off using switch Z, fig 2. The right-hand side additional fuel tank has a similar switch (fig. 16). Make it a habit to switch off the main power when leaving the harvester.

Emergency stop

When the emergency stop switch (fig. 1, switch K) is depressed all the way, the diesel engine gets switched off, but there is still current in the electrical system. This engages all the brakes, i.e. the rear brake and the working and parking brakes at the front. Remember that when the engine is switched off, the harvester cannot be steered, and the braking power of the front working brake decreases little by little. Parking brakes will of course stay on until the harvester is re-started.

Cab fresh-air fan provides good ventilation.

The 3-speed fan is started using switch A (fig. 17). To change the airflow direction, turn the nozzles on the panels. The fan air is sucked in from the rear bottom corner of the cab through filters. The outer-most filter is of a coarse mesh type, and the inner one is the actual fresh air filter. To keep up the fan capacity and secure the purity of the air, the filters shall be cleaned or replaced often enough to prevent impurities and fungi from clogging them. In dusty conditions it is necessary to clean the coarse mesh filter several times a day.



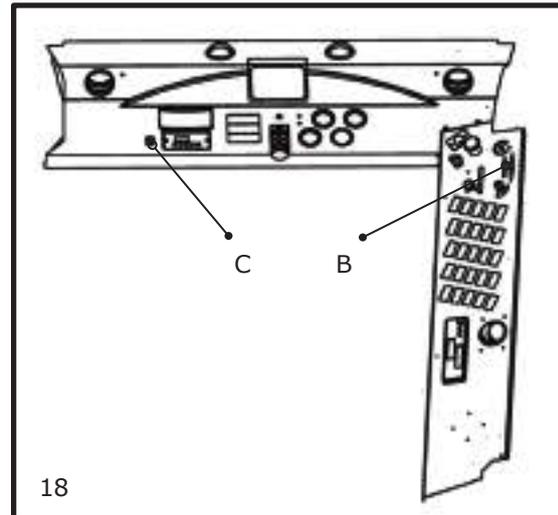
Heater provides additional heat from the engine

The air in the cab is heated by a heating element in which the engine coolant circulates. Push lever B forward to increase the amount of coolant circulating in the element. This will increase the temperature in the cab.

Air conditioner (fig. 18)

Air conditioner cools the air in the cab. The cab is equipped with an air conditioning system.

Turn switch C (fig. 18) to the right to switch on and regulate the air conditioner. 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. Keep the heater regulator lever in its cold position, i.e. the water circulation off.



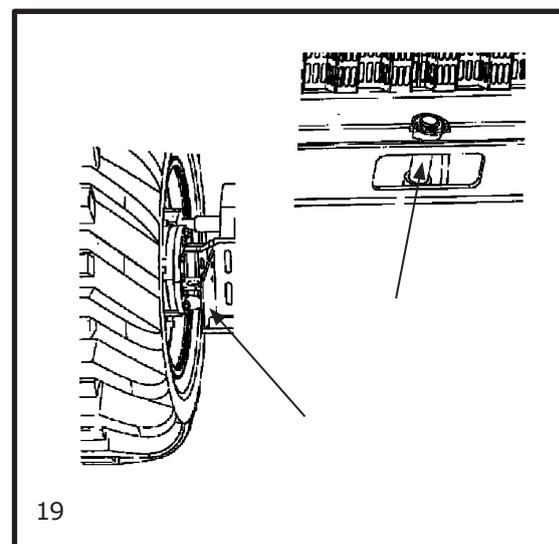
The alarm light on the ceiling flashes and there is a sound on the instrument panel if the engine oil or hydraulic oil temperature increases too much. Hydraulic oil temperature is monitored in the oil tank and in the closed loop drive hydraulic motor housing. The alarm light also flashes if the oil pressure decreases or the hydraulic oil filter becomes clogged. The flashing light can be reset, but a small signal light will stay on. The light will also flash when power is switched on to check the signal light function. When the alarm light starts flashing, find out the reason for it immediately and carry out any necessary repairs.

Towing (fig. 19)

Towing is allowed from towing points only. The harvester may be towed from designated points only. When towing backward, the towline is put around the pin as shown in fig. 19. When towing forward, there are holes as shown in fig. 19 near the reduction gear. With the harvester on tow, the operator must be in the cab and the engine running to enable steering. Four-wheel drive must be off.

Unless the engine can be started, the harvester 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

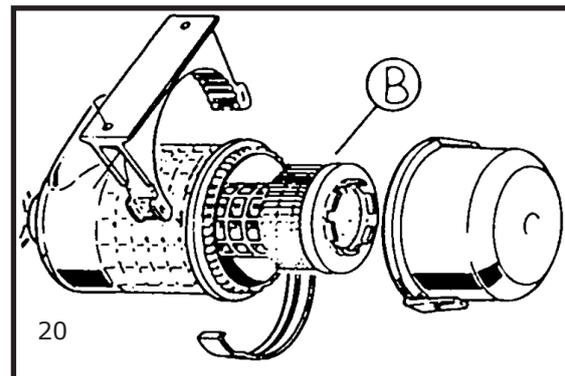
The engine is a water-cooled, four-stroke, Common Rail diesel. For a more detailed description of the engine, see the engine manual.

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. 20)

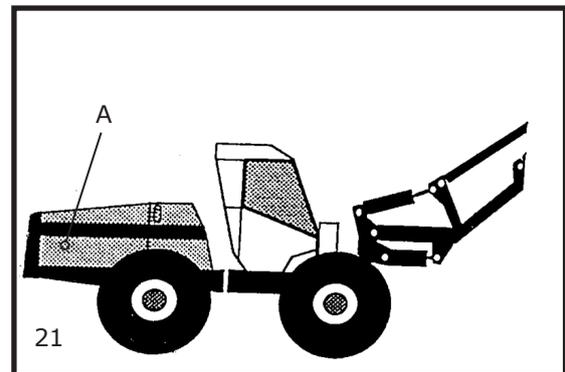
The engine suction air is cleaned by prefilter and two-part paper filter B. If the filter is clogged, signal light G (fig. 4) will come on on the front instrument panel. Clean or replace the filter. See cleaning instructions under service and maintenance.

The prefilter is inside the filter cartridge and it is continually drained by means of an exhaust fume ejector.



Fill the tank with fuel free from impurities (fig. 21)

The volume of the fuel tank is 330 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 A. 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.

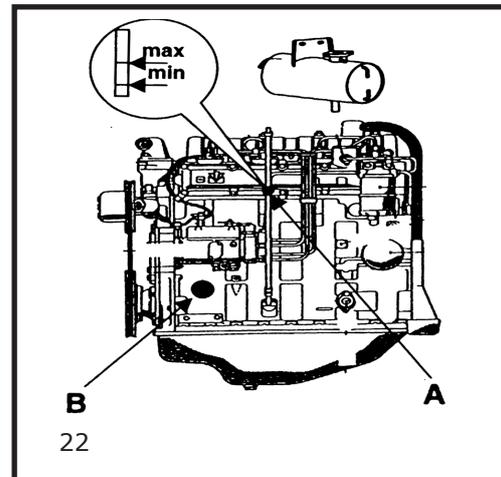


DAILY CHECKS OF THE ENGINE

Lubrication system (fig. 22)



It is of utmost importance to use correct lubricating oil, 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. 22). Oil is refilled through filler B. A warning light on the instrument panel 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 be cooled 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 the bottom of the level indicator hose on the expansion tank. Check the coolant level daily before starting.

The coolant temperature can be seen in the gauge on the instrument panel. It shall be between 75-95°C. A warning light on the instrument panel 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 turn the rear cog to its down position and then lift up the screen.

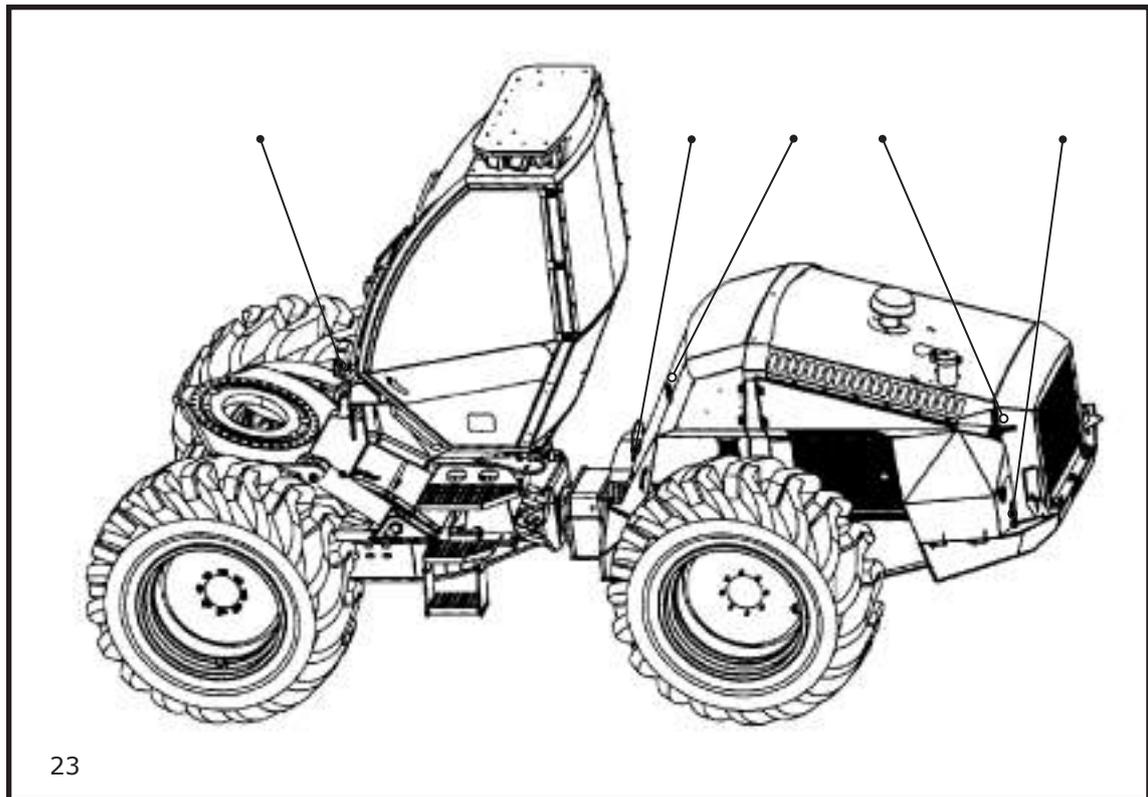
Fire extinguishers

The harvester is supplied with two portable 6-kg fire extinguishers. They are located above the rear wheel inside a side guard that opens backwards. The extinguishers shall be checked every six months by an authorised service outlet.

The harvester 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

The movable guards of the forest harvester are equipped with quick-release locks. The guards can be locked placing an ordinary padlock in the hole for the quick-release lock.



Hydraulics

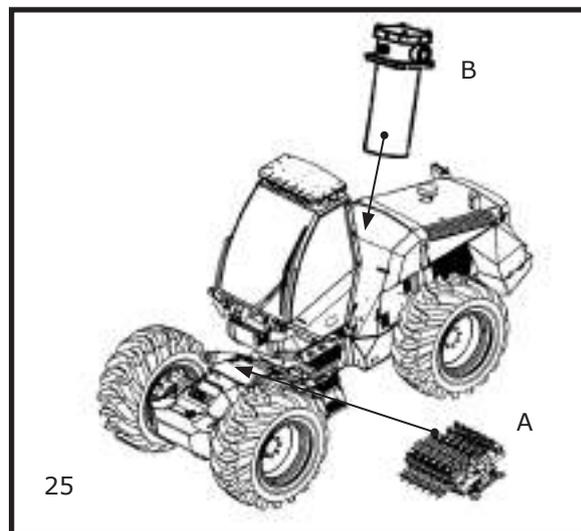
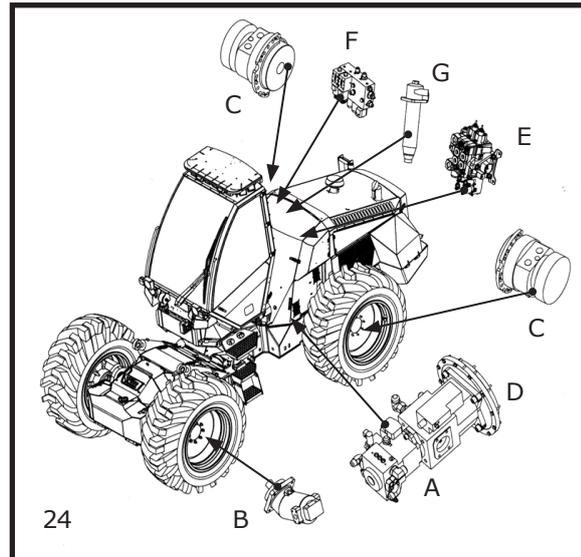
The harvester has both open and closed hydraulic circuits. They have a joint oil tank on the rear frame of the harvester.

The closed hydraulic circuit in front-wheel-drive (fig. 24) has a suction / return filter, a drive pump and a hydraulic motor at the front.

The drive pump produces a pressure corresponding to the tractive resistance and an oil flow corresponding to the drive pedal position.

The open hydraulic circuit in rear-wheel drive comprises the same pump as in working hydraulics, a 2-segment mobile directional valve and the rear wheel hub motors. Additionally there are separate pilot valves for the disengagement of 4WD and a pressurization block to prevent cavitation. When using four-wheel drive, the valves direct the right amount of oil to each rear wheel. When using front-wheel drive, the rear motors are disengaged.

- A Closed circuit pump
- B Hydraulic motor at the front
- C Hub motors
- D Open-circuit pump
- E Rear-wheel drive directional valve
- F Cavitation prevention valve
- G Suction / return filter



Working hydraulics in the base harvester (fig. 25) uses the above-mentioned open-circuit pump, a load-sensing directional valve and a return filter. Crane movements are controlled by a load-sensing valve. The work pump produces the right pressure and output in relation to load weight and speed. This enables fast and precise movements in every circumstance. Magnetic valves in the cavitation prevention block and adjustable pressure limits are used in the pressurization of the harvester head.

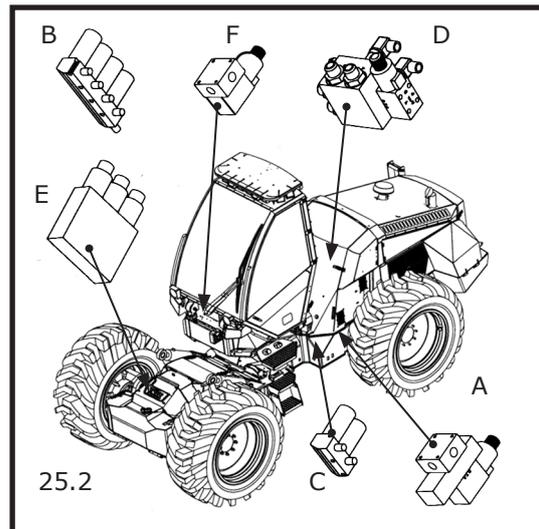
- A Crane directional valve
- B Return filter

It is forbidden to change the pressure settings in working and traction hydraulics without permission from the Manufacturer, as it may damage the harvester and cause risk of injury to the mechanic and the harvester operator.

Directional valves control the functions of the frame lock (A), brakes (F, C), differential lock (B), 4WD disengagement (D), crane turn brake (B) and gear shift (E) (fig. 25.2).

The frame lock is equipped with a dual-function cylinder. The cylinders are cross-connected and linked to the low-pressure cooling oil line. When the frame lock is engaged, the directional valve closes the flow ways and the cylinders become locked in their place.

The gear shifting mechanism takes the working pressure from the working hydraulics pump through a pressure reducer valve. The rest of the operating devices mentioned above take their driving force from the drive pump feed pressure.



There is a separate hydraulic pump to cool down the hydraulic oil besides the closed circuit feed pump output used for cooling. These oils are directed through a thermostat valve to an oil cooler. From there the cooled oil goes to the suction / return filter from where some oil is sucked by the closed circuit feed pump and some return to the tank. When oil temperature is below 38°C, the oil does not circulate through the cooler.

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.

Electrical instruments

The control of the base harvester is based on the IQAN machine control system. It also conveys what diesel speed is required and provides diesel sensor data. In the control of the harvester head a specially developed harvesting computer is used with different on-board computer applications.

The engine is equipped with an alternator generator.

NOTE! With the engine running, the master switch must not be turned on, and the ignition key must not be turned in the 0 position if there is a separate stop lever in the harvester.

Fuses

Fuse Box 1

1F1 Turning signal left	7.5 A
1F2 Turning signal right	7.5 A
1F3 Parking lights	7.5 A
1F4 Gauge lights	7.5 A
1F5 Headlight left, dipped	7.5 A
1F6 Headlight right, dipped	7.5 A
1F7 Headlight left, full	7.5 A
1F8 Headlight right, full	7.5 A

Fuse Box 2

2F1 Radio, indoor light, EHS	15 A
2F2 Working light relays	7.5 A
2F3 24 plug outlet, emergency flasher	10 A
2F4 Rotating flasher	10 A
2F5 Turning signal	7.5 A
2F6 Windscreen wiper	15 A
2F7 Brakes, frame lock, CTA control	15 A
2F8 Safematic greasing system	15 A

Fuse Box 3

3F1 Fan, AC compressor	25 A
3F2 Sound signal	10 A
3F3 Seat heating, compressor	10 A
3F4 Main relays, measuring device, iqan control	7.5 A
3F5 Gauges, warning lights	7.5 A
3F6 PC	10 A
3F7 Fire extinguishing	10 A
3F8	

Fuse Box 4

4F1 Working lights, crane	25 A
4F2 Working lights, front, down, right and left (add. light)	25 A
4F3 Working lights, cabin roof	25 A
4F4 Working lights, cabin roof	25 A
4F5 Working lights, cabin roof	25 A

4F6 Working lights, cabin roof	25 A
4F7 Working lights, door, right and left	25 A
4F8 Working lights, (additional lights)	25 A

Fuse Box 5

5F1 Main current, K3 + 15	25 A
5F2 Working lights, front, down right and left	25 A
5F3 Main current, K7 + 15	15 A
5F4 Main current, ignition lock + 30	25 A
5F5 Air-conditioning	10 A
5F6 Harvesting computer	10 A
5F7 Cab, X39:1	
5F8 IQAN XP-A0	20 A

Fuse Box 6

6F1 main fuse, IQAN control, fuel pumps and valve	25 A
6F2 IQAN XY2-A1	20 A
6F3 IQAN XP-A1, additional amplifier module	20 A
6F4 Vacuum pump	7.5 A
6F5 Cab, X39:2	
6F7 Hydraulic filler pump solenoid	15 A
6F8 Cab, X39:3	

Fuse Box 7

7F1 Plug, cab front	10
7F2 PC pre-heating	5 A
7F3 Fuse	
7F4 Fuse	
7F5 Fuse	
7F6 Fuse	
7F7 Fuse	
7F8 Harvesting computer + 30 Dasa	10 A

Fuse Box 8

8F1 Fire extinguishing	10 A
8F2 Fuse IQAN MD3	3 A
8F3 Engine comp. service light	5 A
8F3 Engine heater add. water pump	10 A
8F5 Fuel filler pump plug	20 A
8F6 Engine heater fan	15 A
8F7 Engine heater	15 A
8F8 Engine heater timer	5 A

Fuse Box 9

9F2 hydraulic motor sensor rpm	1 A
9F3 CTA ignition key +15	5A
9F4 fuel transfer pump	10A
9F6	
9F8 fuel sensor	2A

Fuse Box 10

10F1 IQAN XA2:A0	20A
10F2 IQAN LX0-LX1 levers	3A
10F3 IQAN MD3 display +15	3A

Fuse Box 11

11F1 X31:1	3A
11F2 crane move end slow	3A
11F3 IQAN XA2:A1	20A

Fuse Box 12

12F1 EHS gearbox control unit	2A
12F2 EHS gearbox control unit	15A

Fuse Box 13

13F1 Glow	150A
-----------	------

Fuse Box 14

14F1 PC	15A
14F2 Printer	7.5A
14F3 phone/Sunit modem	7,5 A

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.

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 harvesting 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.

Specific weight reading	Charge state
1 280	Fully charged
1 240	75 % "
1 200	50 % "
1 160	25 % "
1 120	No charge

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. Recommended recharging interval is 6-10 weeks.

Cleaning of battery and other maintenance

Clean the battery cover regularly.

Remove any oxidation off the battery terminals and cable lugs.

Make sure the cable lugs are properly tightened.

Coat the outer faces of the terminals and lugs with Vaseline. Check that the battery is properly fastened and the terminals protected. Make sure the rubber mat is on the battery.

Check the fluid level a few times a year and before storage. Add distilled water, if necessary, up to the upper fluid limit.

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 repair or replace any necessary parts.