

COMBI JET
CD 4504 / CD 5406 / CD 5408



Instruction manual



Read these instructions carefully. If you follow the instructions given, YOU can expect good results along with a good economic return from YOUR choice of machine.

If carefully operated, adjusted and maintained, the machine will meet all reasonable demands made on it and will give YOU reliable service in years to come. Should YOU need further instructions which are not included in this manual, or require the help of experienced service personnel, we advice YOU to contact one of our local representatives, which also will have spare parts in stock.

It has always been the ambition of **Kongskilde Industries A/S** to constantly improve its products. Consequently, in the interest of product improvement, no specification is final or binding and we reserve the right to alter the design of new machine series and equipment without previous notice.

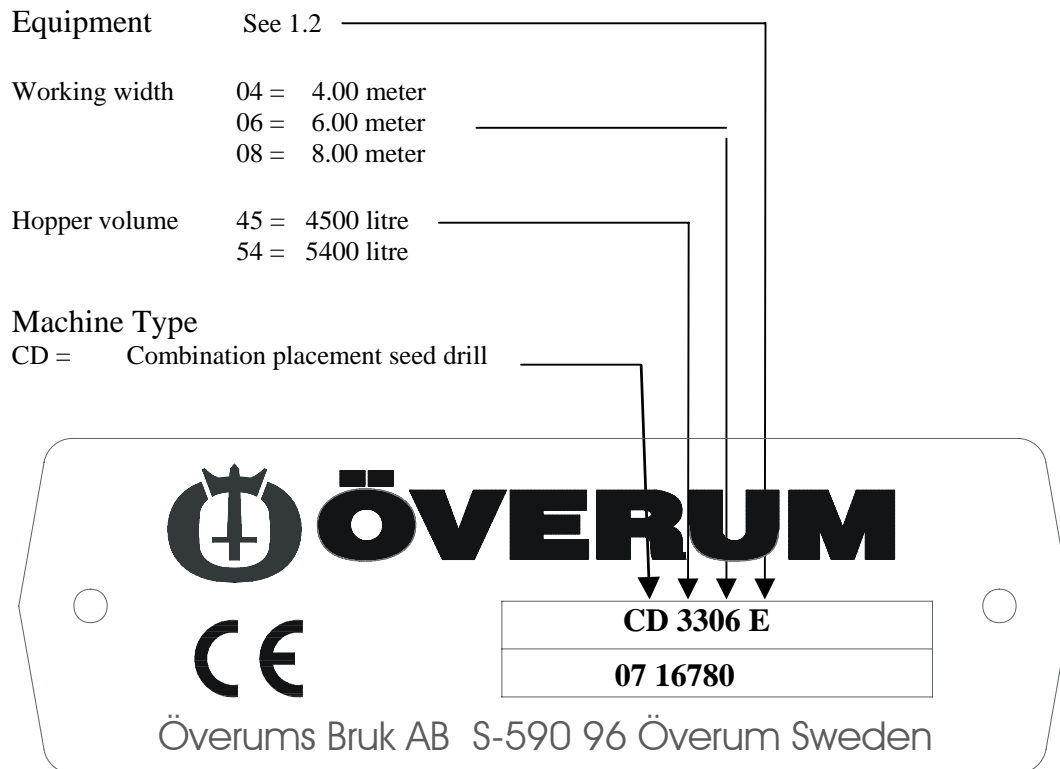


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1. IDENTIFICATION OF MACHINE

1.1 Type designation, manufacturing (serial number) plate



1.2 Equipment

- E = Electronic control system "TRAM" and direct connected hydraulics
- T = Electronic control and manoeuvre system "TRONIC"
- S = Levelling board (clod crusher)
- TH = TRONIC system and Electric controlled hydraulic system



COMPLETE THE SIGN BELOW WITH THE DESIGNATION AND THE SERIAL NUMBER OF YOUR MACHINE:

2. DESCRIPTION OF FUNCTION

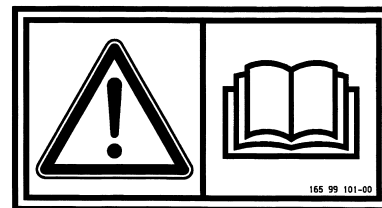
The machine is designed for transporting, seeding and broadcasting of seed and fertilizer. The metering system is ground driven via a drive-roller going against the right hand wheel. The output rate of seed/fertilizer can be stepless adjusted with the Vario K gearbox

The metering is done by "toothed" nylon feed rollers that rotates in rubber feed gates. From the feed gates the seed/fertilizer falls down into the ejectors where an airstream from the PTO-driven fan takes over and transports the seed/fertilizer through the seed hoses down into the coulters which places the seed/fertilizer at the desired depth.

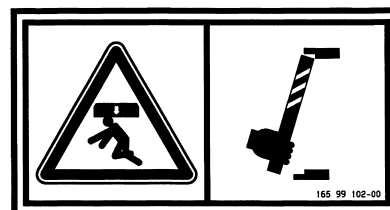
3. SAFETY PRECAUTIONS AND WARRANTY CONDITIONS

3.1 Warning symbols

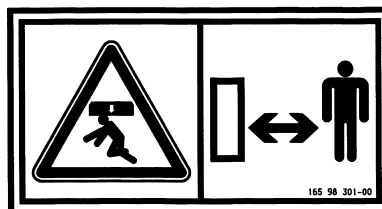
These symbols can be found in this Instruction Manual and on the machine. It is a warning that personal injuries can occur unless the safety precautions given are followed. Avoid accidents by following these safety precautions. Carefully read through this Instruction Manual and observe the warning text given here and on the machine. These warnings however, do not exempt the operator from the responsibility to observe relevant statutory or other national regulations dealing with road safety or labour safety issues.



Never walk under a raised side section unless it is properly secured or attempt to work under the coulter beam unless it is locked with the yellow safety catches.



Ensure that no person is on, underneath or in the hazardous area of the machine, during seeding or transport.



Avoid leaking pressurised fluids. They can cause severe injuries. Always depressurise the system before a pipe, union or hose is loosened. Remember to retighten all connections prior to pressurising the system.



Rotating shafts can cause severe personal injuries. PTO-shaft guards must always be mounted. Never attempt to connect, disconnect or adjust a PTO-driven machine until the PTO-shaft has stopped rotating.



Never run the fan at a higher rpm than it is supposed to run at.



All protective covers must be in place when the machine is in operation.

Prior to transport driving the side sections must be folded and secured. The drive roller cylinder must also be secured.



3.2 The warranty conditions will be invalid if

- The hopper is loaded with more than the maximum load
- The machine is used in obviously unsuitable conditions.
- The machine has been used for other purposes than seeding or spreading of seeds or fertilizer.
- The given recommendations in this book have not been followed.
- The machine is being abused or malfunctions due to lack of regular maintenance

4. TECHNICAL DESCRIPTION

4.1 Connecting the machine to the tractor



Note! Placement of the bolts

Drawbar

The cross shaft (see figure) is connected to the tractor's lower links. The stabilisers of the lower links must be in fixed position. Adjust the cross shaft in the height position which places the machine as horizontal as possible.

Power take-off (PTO) shaft

CD 4504	is equipped with 540 r.p.m PTO shaft as standard
CD 5406 / 5408	is equipped with 1000 r.p.m PTO shaft as standard

The PTO-shaft must be connected with the overrunning clutch joint towards the fan. Check that the axle halves do not bottom out when the shaft is horizontally. If they do bottom out, both shaft halves must be shortened equally. The front axle should overlap according to below.

540 rpm PTO-shaft at least 1/3 of the length.

1000 rpm PTO-shaft at least 2/3 of the length.

The PTO-shafts are balanced. The front shaft can therefore only be mounted in one position on to the splines of the rear shaft.

Adjust the height of the lower links so that the PTO-shaft is horizontal in between tractor and fan.



The stabilisers of the lower links must be in fixed position.

Lock the lever for the lower links so that it can't be operated when the PTO shaft is mounted.

Connection to the tractor

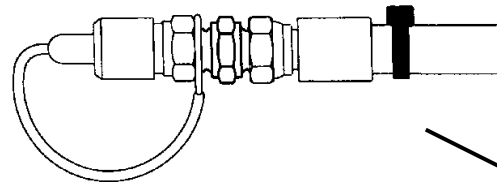
Direct connected hydraulics

For machines equipped with direct connected hydraulics, the tractor must be equipped with the following hydraulic outlets.

**Double acting
hydraulic outlet**
3 pcs.

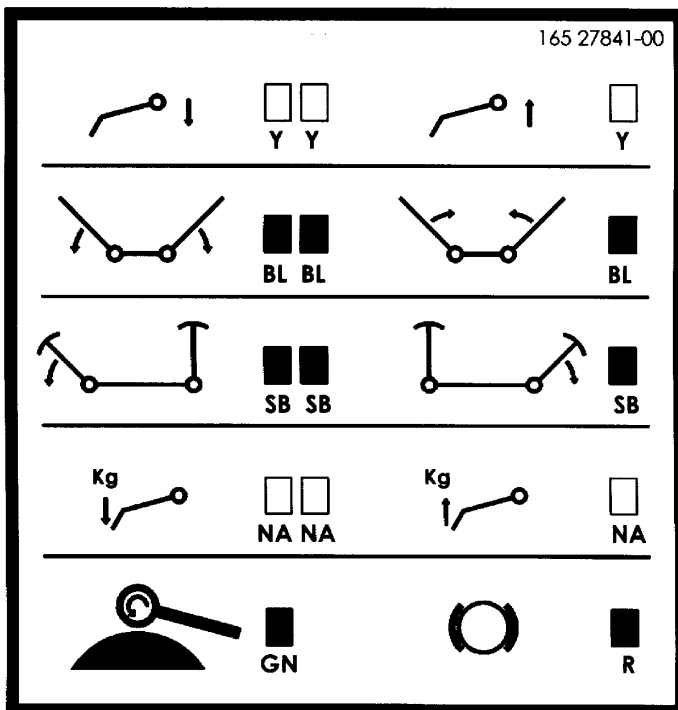
**Oil-return
inlet (to tank)**
1 pcs

All hydraulic hoses are equipped with quick couplers type Aeroquip 1/2". To simplify the connection all hoses are marked with colour (see below).



The hydraulic hoses are marked with one or two coloured straps.

Symbols for direct connected hydraulic system



Yellow on hoses to coultter unit.

Blue on hoses to side sections.

Black on hoses to markers.

White on hoses to coultter pressure adjustment.
(Hydraulic coultter pressure adj. is optional extra)

Green return hose to tank.
Red on hose to hydraulically operated brakes.

This decal is mounted on the fan housing.

Electrically controlled hydraulic system

The 3/4" return hose must be connected to a return-oil inlet which is direct connected with the tractor's oil reservoir.
The 1/2" pressure hose should be connected to a single acting outlet on the tractor.
For manoeuvring, see the "TRONIC" instruction manual.

Electrical system

The electrical system is divided in two separate circuits - control equipment and running lights.

TRAM Electronic control system

Connect the 3- pole EURO connector to the tractor and the coaxial cable to the control box in the tractor cab see wiring diagram page 38



3-pole EURO connector

TRONIC - Electronic control and manoeuvre system

Connect the 3-pole EURO connector to the tractor and the coaxial cable to the manoeuvre box in the tractor cab.
See separate Instruction Manual for TRONIC.

Running lights

Connect the seven (7)-pole connector to the tractor.

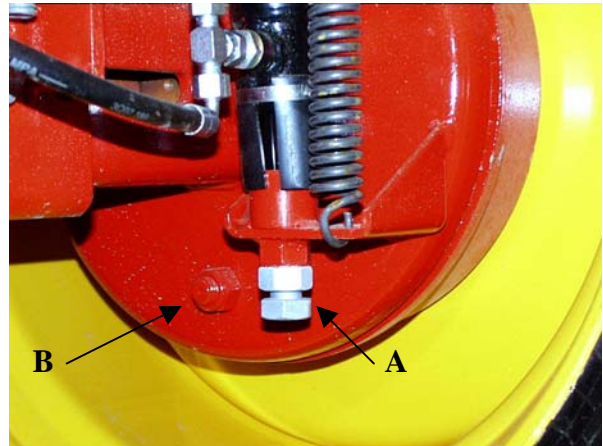
4.1.1 Wheel equipment

Wheels Minimum tire inflation pressure with maximum load and with a maximum speed of 25 km/h (16 mph)

				Strait coulter	Disc coulter
CD 4504	Tire dim.	600 x 26.5	=	50 kPa (0.5 bar)	50 kPa (0.5 bar)
CD 5406	Tire dim.	800 x 30.5	=	60 kPa (0.6 bar)	70 kPa (0.7 bar)
CD 5408	Tire dim.	800 x 30.5	=	70 kPa (0.7 bar)	80 kPa (0.8 bar)

Hydraulic brakes

As an option, the machine can be equipped with a braked drive wheel shaft. The braking action being achieved by means of a single acting hydraulic cylinder on each wheel. Both hydraulic cylinders are connected to a single-acting hydraulic outlet from the tractor.



Adjustment of hydraulic brakes

1. Raise the wheel.
2. Tighten the adjusting screw **A** until the wheel is locked.
3. Loosen the adjusting screw until the brake is released and loosen the screw a further turn.
4. Check that the stroke of the hydraulic cylinder does not exceed 40 mm when braking.
If the stroke is excessive, the brake shoes may also be adjusted at the lower attachment point by tightening the nut **B** on the lower half of the plate.

4.1.2 Hopper / Chassi

The hopper is entered via the sieves



Chassi

The chassi can be adjusted to three different positions (the wheel axle) in order to give more or less space between ground and the chassi.



4.2 Hydraulic system

The machine is available with two different hydraulic systems:

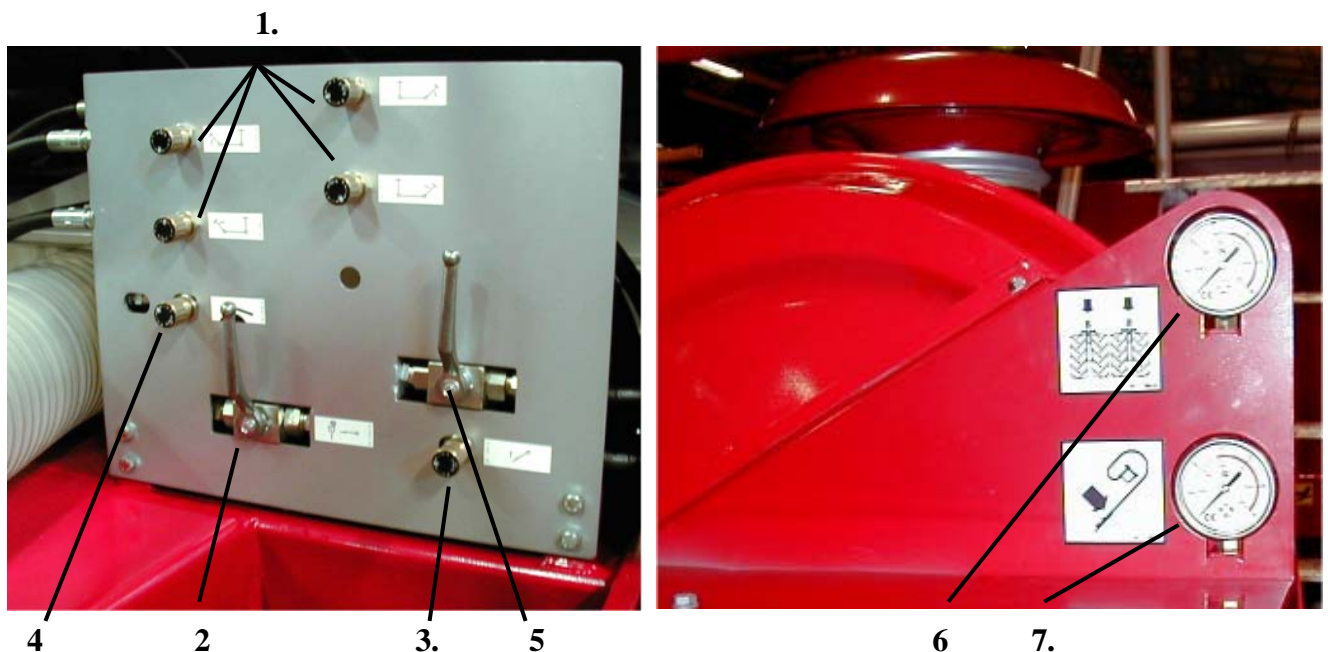
- Direct connected hydraulic system where the different functions are connected directly to the hydraulic outlets on the tractor. For connection to the tractor, three double-acting outlets and one return inlet is required.
- Electrically controlled hydraulic system consists of a valve block controlled by electromagnets and manoeuvred with TRONIC. For connection to the tractor one single acting outlet and one return oil inlet is required.

4.2.1 Direct connected hydraulic system

The hydraulic system consists of : Hydraulic cylinders, hydraulic hoses, one electrically controlled drainage valve, sequence valves, and adjustable restrictor valves.

Coulter beam, side sections, markers and drive roller are operated by hydraulic cylinders which are connected with hydraulic hoses direct to tractor's hydraulic outlets and are manoeuvred by the tractor's control levers.

Location of adjustable restrictors etc.



1. The adjustable restrictor non return valves: Adjusts the speed of the markers.
2. Shut-off valve: Locks the levelling board in top position (for transport).**
3. The adjustable restrictor non-return valves: Adjusts the lifting speed of the levelling board.**
4. The adjustable restrictor non-return valves: Adjusts the lifting speed of the drive roller.
5. Shut-off valve: When the valve is opened the levelling board can be operated up/down separately from the coulter beam.**
6. The pressure gauge: Indicates the working pressure (load) on the inner wheel packer. working pressure 10-12 Mpa. *
7. The pressure gauge: Indicates the working pressure (load) on the levelling board. working pressure 5-8 Mpa.**

* Only on machines equipped with inner wheel packer.

** Only on machines equipped with levelling board.

See hydraulic diagrams page 41-44.

4.2.2 Electrically controlled hydraulic system, TRONIC

The pressure hose should be connected to a single acting outlet on the tractor. For the function of the hydraulic valve block, it is important that there is as little backpressure as possible in the system. Therefore, we use a ¾" return hose that must be connected to a return-oil inlet which is direct connected with the tractor's oil reservoir. If the tractor is missing a return inlet as per above, one must be mounted.

Both the pressure and the return hose are equipped with Aeroquip male quick couplers standard SS 3275 (½" and ¾").

In order to protect the hydraulic valve block, following must be followed:

When connecting: Always connect the return hose first, then the pressure hose.

When disconnecting: Always disconnect the pressure hose first.

For manoeuvring, see the "TRONIC" instruction manual.

By pressing down and turning (half a turn) on the knob mounted on top of the by-pass valve, you have adapted the machine for closed centre tractor hydraulic system.



The adjustable restrictor non-return valves: Adjusts the lifting speed of the drive roller.

4.2.3 Operating

Operating from transport to working position

- Lift the coulter beam to top position, activate the side sections so that the mechanical transport locks can be released.
- Release the mechanical transport lock for the side sections (coulter unit and levelling board) and drive roller, unfold the side sections when the coulter unit is in top position.
- If the machine is equipped with levelling board, switch over the diverter valve, so that the working pressure of the levelling board can be adjusted.
- Lower the coulter unit so that the coulter points are just above ground and start the fan, turn the drive roller and make sure that seed/fertilizer is distributed through all coulters.
- Unfold the markers (safety release device).

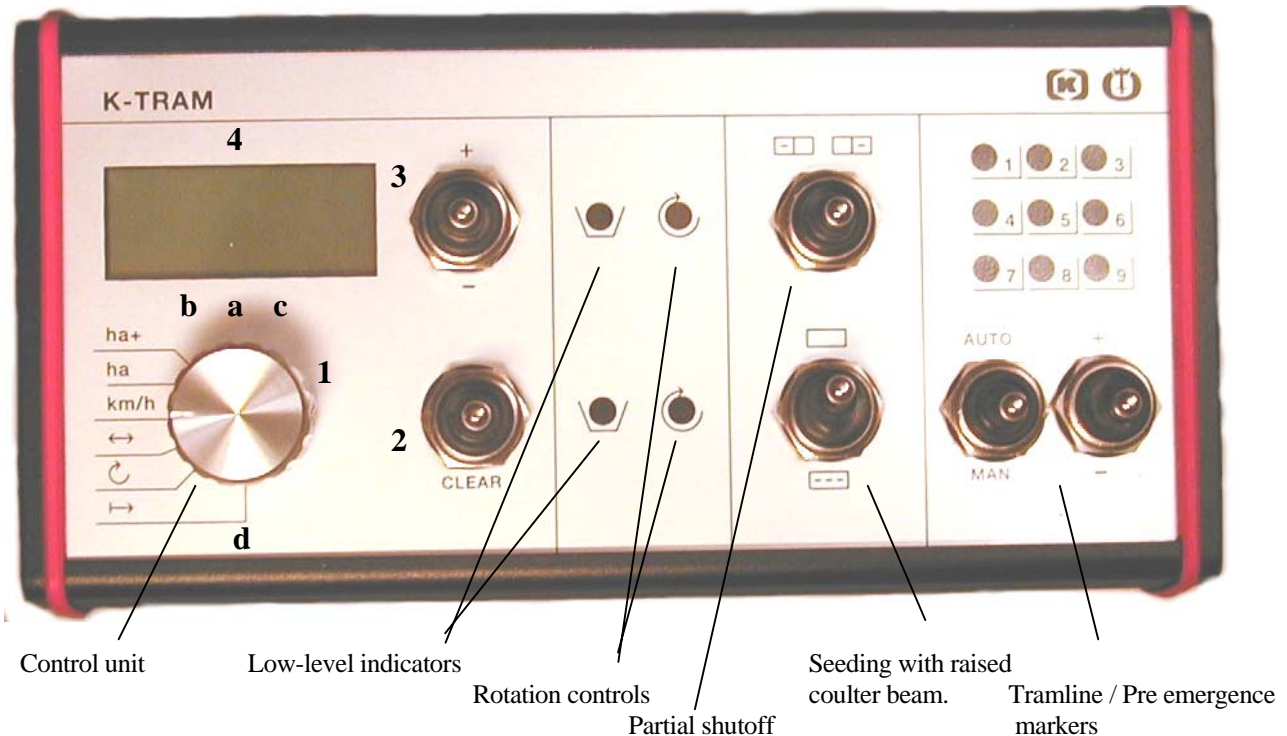
Operating from working position to transport

- Release the working pressure of the levelling board and switch the diverter valve over.
- Fold the markers (safety release device)
- Lift the coulter beam to top position.
- Fold the side sections.
- Secure the drive roller with the mechanical lock and check the transport locks for the side sections.
- Lower the coulter beam to transport position.
(Electrically controlled diverter valve are only mounted on machines with direct connected hydraulic system)

4.3 Control Equipment

4.3.1 Electrical control equipment TRAM

TRAM electronic control system consists of two units, one manoeuvre/control unit and one machine/intelligence unit. The communication and the power feed between the two units are done through a coaxial cable. The machine unit is power feed from the tractor. See wiring diagram page 39.



Functions



By setting centre switch **1** into different positions, respective functions will be shown on the display **4**.

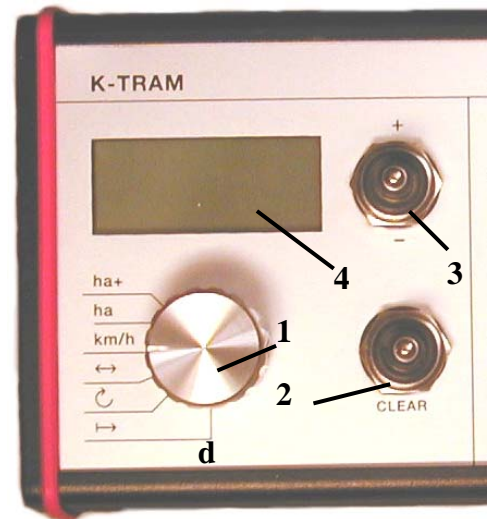
- ha+ = Part acreage ha, (000.0-999.9)
- ha = total areal, when zeroing ha, also ha+ will be zeroed (000.0-999.9)
- km/h = Forward speed, km/h (with one decimal)
- ↔ = Working width m (Note ! two decimals)
- ⦿ = Factor for drive
- a - Machine type.
- b - Partial working width, m (Note ! two decimals)
- c - Partial working width, m (Note ! two decimals)
- d - Distance covered, m (0000-9999)

- 1** Centre switch shows actual function on the display.
 - 2** Clear button zeros out actual function (depress for a few seconds)
 - 3** Adjustment button adjust the value of the actual function
 - 4** Display
- NOTE! Never use clear button 2 when in position a,b,or c.

Calibration of hectare meter

In order to obtain a correct reading of the acreage, the machine's hopper must be half loaded during the calibration and the inflation pressures in tires and drive roller must be correct.

1. Measure a distance of 100 m in a field.
2. Turn centre switch **1** to position , enter the base factor 1000. (The value can be altered with the adjustment button **3**.)
3. Turn centre switch **1** to position d (straight down).
4. Drive up to the start position.
5. Zero set the display by depressing the clear button **2**
6. Drive the distance the 100m with the drive roller engaged. If the distance now shown on the display corresponds with the measured distance the drive factor is correctly calibrated. If not go on with item 7.
7. Turn centre switch **1** to position , adjust the factor up or down with adjustment button **3**
8. Turn centre switch **1** to position d - read off.
9. Repeat item 7. and 8. until the distance driven in position d corresponds with the measured distance. Always use the lowest factor, which gives the correct measured distance.



NOTE! It is only necessary to drive the distance once.

Tramline equipment

There are three different position possibilities to operate the Tramline and the pre-emergence markers, "Off", "Auto" and "Man".

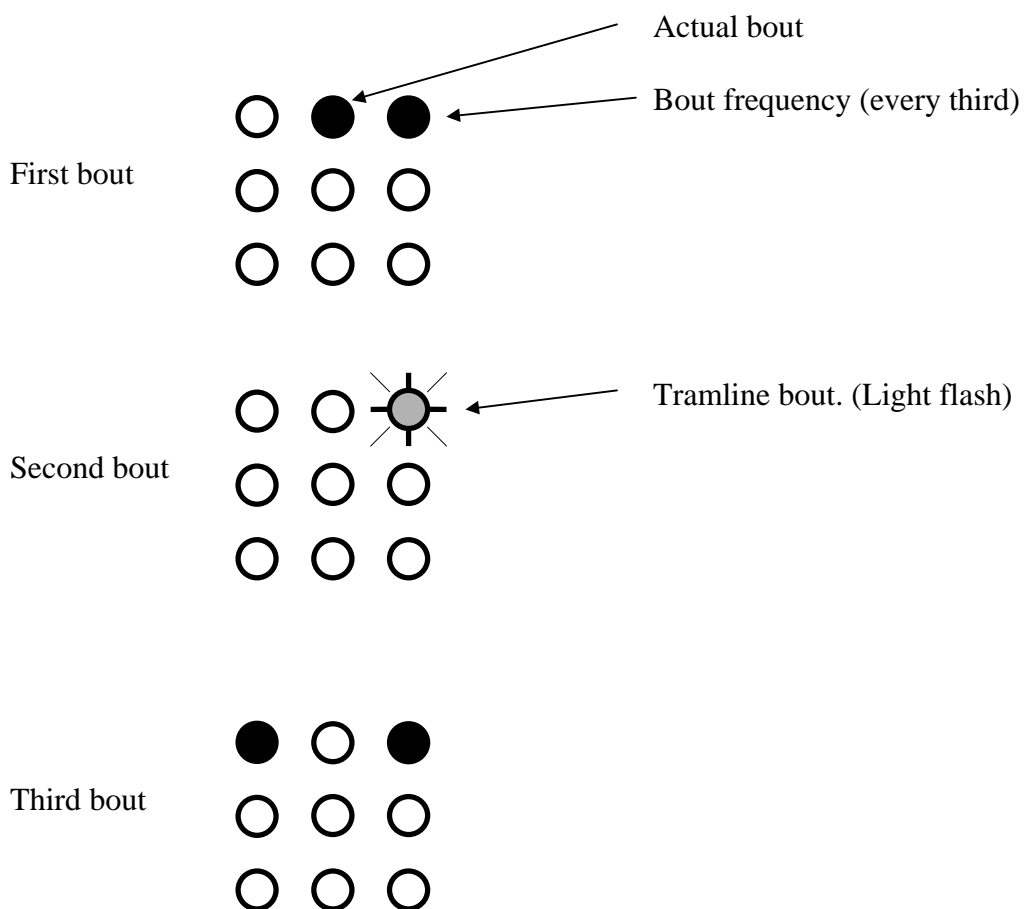
NOTE! All changes to the tramline and pre-emergence marker should be done with the coulter beam raised.

- Set the Position Switch 5 to "OFF"**. Switch in middle position (Automatic tramline function disconnected. This is indicated by a red light in pos. 9).
 - In this position you set with adjustment button **6**, in which bout the tramline is to be made. The set bout frequency is indicated with a constant green light (1-8).
- Set the Position Switch 5 to "Auto"** (Automatic tramline function connected).
 - In this position you set the actual bout, with adjustment button **6**, forward or backward. Actual bout position is also indicated with a constant green light (1-8).
 - Actual bout will automatically change every time the coulter beam is raised. When actual bout advances to the pre-set desired bout, both green lights will be on the same number and the light will flash, instead of being constant. This indicates that the tramlines are activated.
- Set the Position Switch 5 to "MAN"** (Automatic tramline function disconnected).
 - Move adjustment button **6** to + (upward) = tramline/pre-emergence marker will be activated.
 - Move adjustment button **6** to - (downward) = tramline/pre-emergence marker will be disconnected.



NOTE! All manoeuvring of the tramline/pre-emergence marker should be made with the **coulter beam raised!** Activating and disconnecting of the tramline/pre-emergence marker takes approximately 10 seconds!

Example: Tramlines in every third bout



And so on.

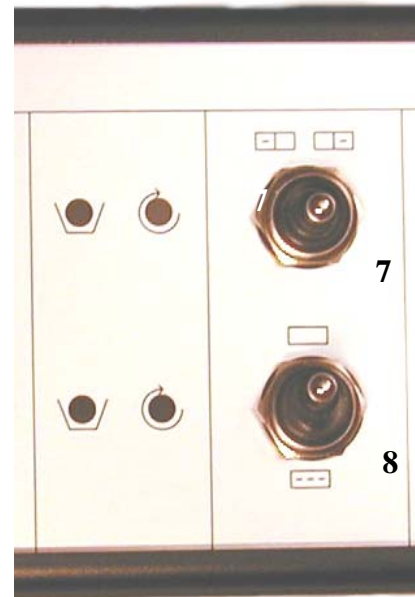
By setting the position switch **5** to "OFF" you can raise and lower the coulter beam without any changes to the tramline position. By re-setting the position switch **5** to "AUTO" the automatic tramline function will continue.

If the actual bout light should accidentally be forwarded, it can be backed up with adjustment button **6** (position switch **5** in "AUTO").

Rotation control

Rotation control is monitored on the fan and on the feed shafts. The control system is activated when the forward speed exceeds 3 km/h.

The fan not rotating is shown by a code on the display and by an audible signal. Feed shaft not rotating is shown by a code on the display and by an audible signal and the green light will go out.



Code on display	Reason
-----------------	--------

E 01	Feed shaft 1 not rotating
E 04	Feed shaft 2 not rotating
E 06	The fan is not rotating

:	(flashing)	Hopper empty (one sensor)
:	(constant)	Hopper empty (two sensors)

NOTE!

All audible alarms will sound for approximately 10 seconds and then be silent.

Low-level indicator

Two low level sensors can be connected . Low level is shown by a code on the display and by an audible signal. The green will also go out.

Partial shut off

Partial shutoff is activated by switch 7 and the shutoff is for half working with right or left hand side. Rotation control as above will be activated. (electrically partial shutoff clutches are extra equipment)

Seeding with raised coulter beam (broadcasting)

Seeding with raised coulter beam is activated by setting switch 8 downwards to pos. This position is also be indicated with an audible signal.



Description of sensors

<u>Sensor for</u>	<u>Type</u>	<u>Reacts for</u>	<u>Adjustment distance</u>
Hectare meter	Magnet (non-touch)	Magnetism	4-5 mm
Feed shafts	Magnet (non-touch)	Magnetism	4-5 mm
Fan	Magnet (non-touch)	Magnetism	4-5 mm
Coulter beam	Position switch	Mechanical movement	
Low-level	Capacitive	All materials	

Adjustment of machine type

The machine type is shown on the display, when the centre switch is in pos. **a** (straight up).

The machine type can be adjusted according to the table below with adjustment button **3** up or down. To avoid accidental changes of the machine type, the tramline adjustment button **6** must be activated and held downwards to (-) before the machine type can be altered with the adjustment button **3**

When a machine type is set, the working width (↔) and partial working widths (pos. b and c) are also automatically changed.

Table: Machine values

Machine type	Partial working with with	Partial working with with	Working width	Factor*
a	b	c	↔	⌚
MD 0000	02.00	02.00	04.00
MD 0000	03.00	03.00	06.00
MD 0000	04.00	04.00	08.00

*Fill in your own calibrated value.

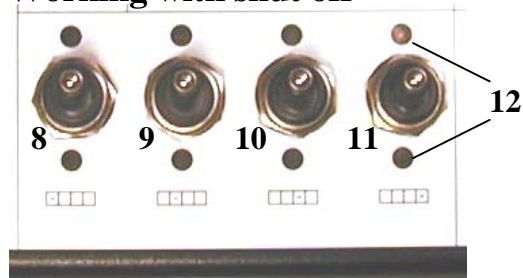
Machined equipped with Electrical half working with shut off.

(accessories)

Machines that have four electrically controlled feed shaft clutches is equipped with the TRONIC controlbox in order to make it easy to use the half working with shut off.



Working with shut off



- 8** Left section Fertilizer
- 9** Left section Seed
- 10** Right section Seed
- 11** Right section Fertilizer
- 12** Indicating lights

Partial shutoff makes it possible to shut off sections on the machine independently of each other. Up to four (4) partial shutoffs can be done. The number of illuminated lights show how many partial shutoffs can be done on the machine.

During driving a green light indicates that the feed shaft is rotating. A red light, the warning light* and the audible signal indicates that the feed shaft is stationary.

See instruction manual for TRONIC for further information

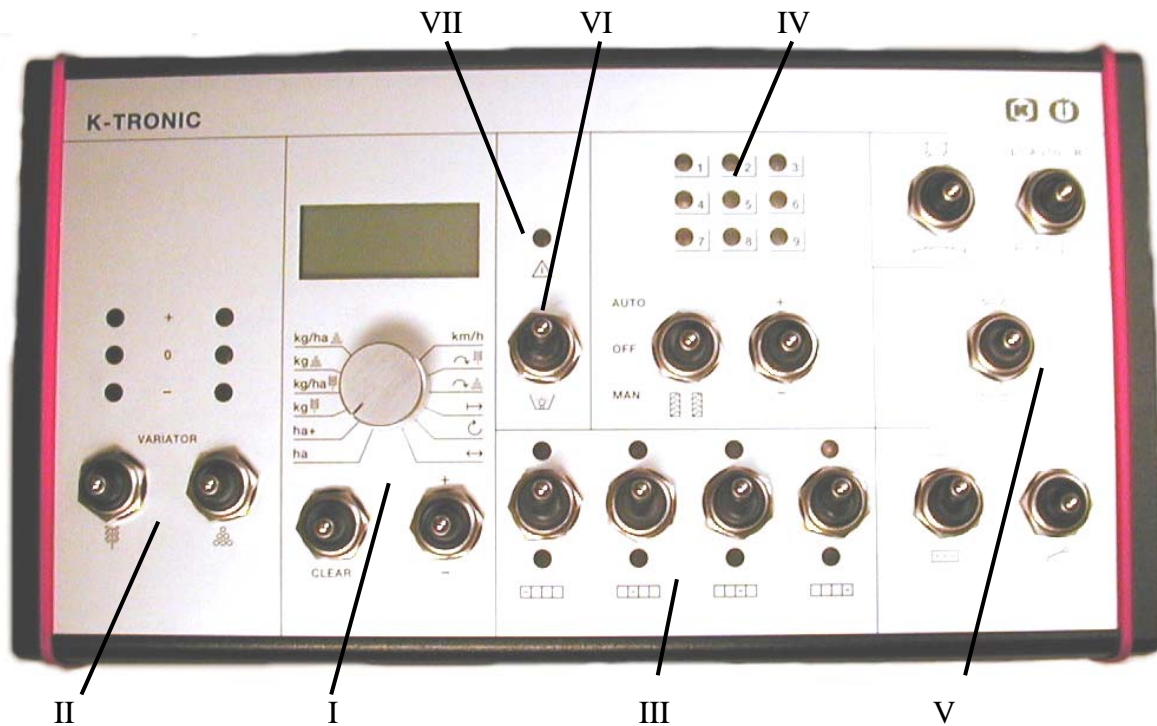
4.3.2 TRONIC - Electronic monitoring and control system

This system consists of two units: one **manoeuvre/control unit** and one **machine/intelligence unit**.

The manoeuvre unit is to be mounted in a suitable place in the tractor.

The communication and power feed between the two units is done through a **coaxial cable**.

For functional description and instruction see separate Instruction Manual "TRONIC"



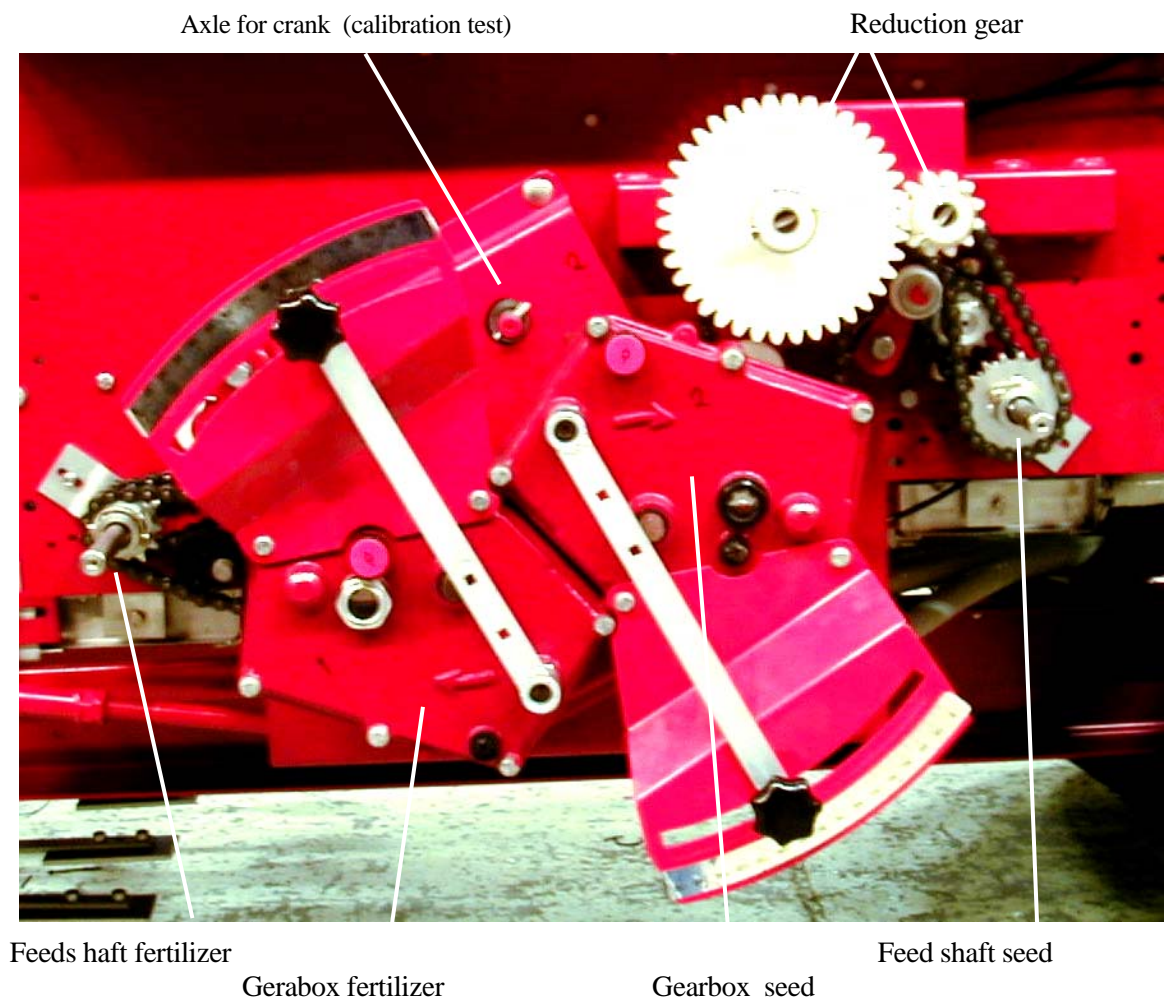
- I - Control unit
- II - Gearbox controls
- III - Partial shutoff (working width)
- IV - Tramline- and pre-emergence marker
- V - Electrically controlled hydraulics and foam marker
- VI - Switch for extra mounted hopper lights
- VII - Warning light

4.4 Drive for the metering system

The drive system consists of:

- Drive roller and chain transmission
- Gearboxes for adjustment of output rates for seed and fertilizer.
- Reduction gear for seeding "low rates"
- Clutches for partial shut off of working width
- Transmission and assembling parts

Drive system with gearbox and chains



4.4.1 Drive roller

The drive roller should preferably run as close to the centre of the wheel as possible. This to give the drive roller a smooth run. Mowing the machine's right hand wheel alters the position of the drive roller.

Drive roller inflation pressure = 150 KPa (1.5 bar)

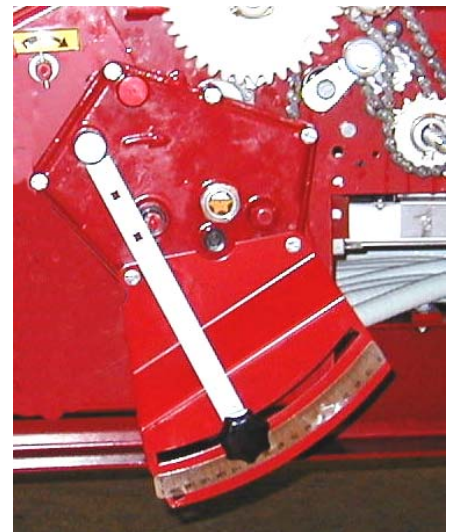


The pressure of the drive roller against the drive wheel is adjusted with the tension bolt in the end of the spring. Basic setting of the spring tension: Adjust with the nut so that all play between the tension bolt and the spring is gone. Then tension the spring by turning the nut at least 20 complete turns.

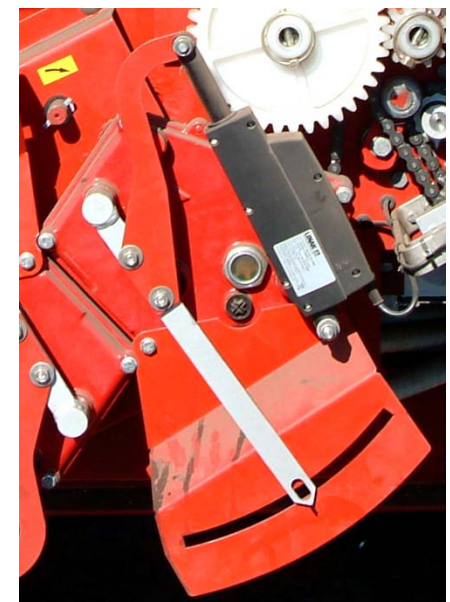


4.4.2 Gearbox

The desired seed rate is set by turning the lever on gearbox. The scale on the gearbox is marked from 0 to 150. This is done after a relevant calibration test.



Machines equipped with TRONIC have an electrically controlled gearbox. Adjustment of the gearbox can be done from the driver seat in the tractor cab both during seeding and at standstill. For functional description and instruction see separate Instruction Manual "TRONIC"

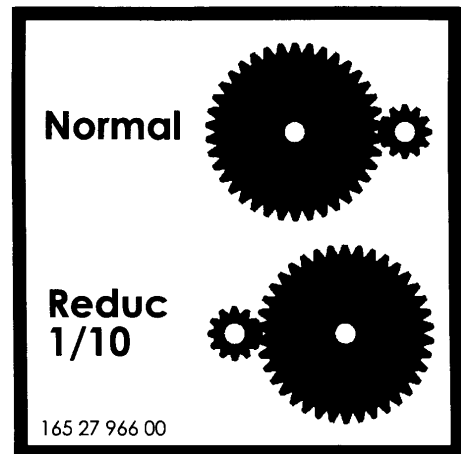


4.4.3 Reduction gear

When seeding a very low rate with a low gearbox setting, the reduction gear should be used. By switching place (to reduction position) with the two plastic sprockets, a reduction of the feed shaft speed is achieved.

The reduction makes it possible to use a higher gearbox setting which it is easier to adjust the correct desired output rate.

Gearbox setting in normal position	Gearbox setting in reduc. 1/10- position
1	10
2	20
3	30
4	40
5	50
6	60
7	70
8	80
9	90
10	100
11	-
12	-



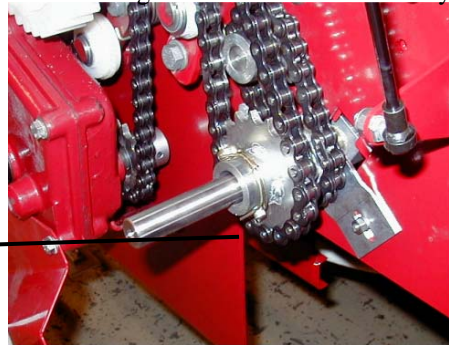
4.4.4 Partial shut off, half working width

Mechanical half working with shut off

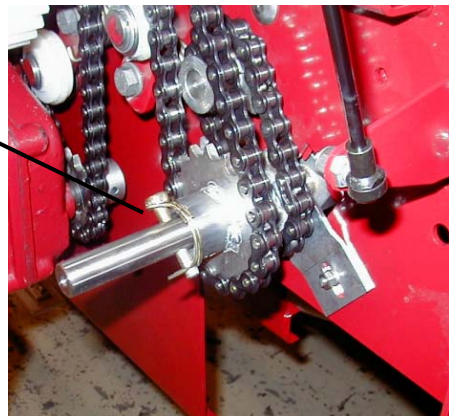
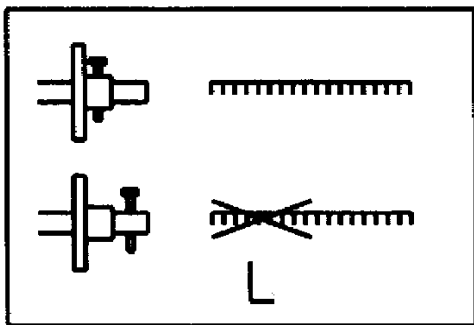
The feed shaft is divided in two halves that make it possible to shut off the half working with. This is done manually by moving the lock pin in the hub of the feed shaft sprocket

The feed shaft on the left hand side can be shut off this is done by moving the lock pin.

1. Feed shaft in normal position



2. Feed shaft in half working width position



Electrical half working with shut off (Accessorie)

Electrically controlled feed shaft coil clutch for half working width shut off, controlled from the manoeuvre box in the tractor cab.

Left or right hand side can be shut off.

Agitator shaft

Feed shaft clutch



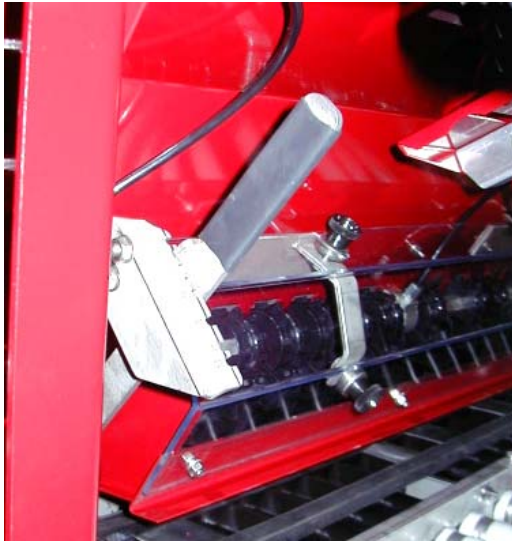
4.5 Distribution (metering) system

The metering from the hopper is by studded (nylon) feed rollers that rotate in adjustable rubber feed gates. From the feed gates the seed falls down into the ejectors from which it is transported through the seed hoses down to the coulters via a flow of air provided by the power take-off driven fan.

4.5.1 Feed gate adjustment

The lever can adjust the distance between the feed gate and the feed roller.

The size of the opening does slightly affect the amount of seed/ fertilizer being metered out. The opening should be adjusted so that seed or fertilizer can pass freely without being crushed or stacked.



Basic adjustment of the feed gates

Basic adjustments	Position
Grains and Rapeseed	2
Peas	5
Fertilizer	2-4

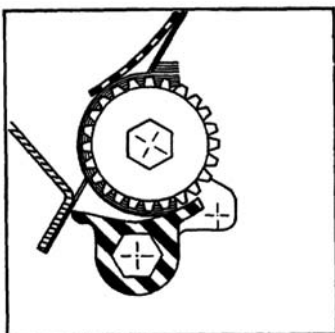
4.5.2 Reducing inserts

When very small seed rates are being sown, the seed sometimes runs through the teeth of the feed rollers entirely by gravity. This makes it difficult to achieve an accurate distribution rate. Fitting reducing inserts around the feed rollers can eliminate this problem. This insert reduces the distributed amount with approx. 75%. To facilitate the fitting of the reducing inserts, the feed gates should be opened as much as possible. To fit a reducing insert, place its open part over the feed roller and push it into the position as shown in the figure. When all of the inserts have been fitted, close the feed gates again and set the lever to position 2.

After the inserts have been fitted, check that the feed rollers can rotate easily. If not, this may be due to burrs on the teeth of the feed rollers, possibly due to drilling peas. These burrs should be polished off. A special cleaning tool is available. See Extra Equipment.

If the feed shaft moves sluggishly when drilling treated seed, this can be because the dressing with which the seed has been treated has formed a coating between the reducing inserts and the feed rollers. Cleaning is then necessary. **When the seeds are heavily coated, it may be better to operate the machine without reducing inserts.**

Reducing insert



When ending up at very low gearbox setting, first step is to use the **reduction gear**

4.5.3 Calibration test

Start the calibration with a static test.

For machines equipped with TRONIC see separate Instruction Manual

Static test

1. Set the drive roller in disengaged position.
2. Set the gearbox lever to a setting according the distribution table, (if for low seed rates, set the reduction gear in reduction position).
3. Set the feed gates to the desired position for the seed/fertilizer.
4. Fill the hopper.
5. Lower the loading ramps to test position and put the test troughs in place.
6. Place the crank on the drive shaft and turn counter clockwise at least 20 turns in order to get the seed/fertilizer homogeneously packed around the feed rollers. Check that the seed/fertilizer passes freely between the feed rollers and the feed gates. If necessary adjust the feed gates.
7. Empty the test troughs back into the hopper and put them back into test position.
8. Turn the crank counter clockwise the amount of turns as per the table below. Weigh the amount of seed and multiply the weight with the multiplication factor as per the table below. The received amounts are in kg/ha.
9. Adjust the gearbox lever to the desired output rate use the distribution table as a guide.
10. Check by repeating the static test items 7 – 9, to the desired output rate is obtained.
11. Reset the machine to normal working position.

Machine	CD 4504	CD 5406	MD 5408
Machine working width in metre	4.0	6.0	8.0
Amount of turns with the crank	30	20	15
Multiplication factor	100	100	100

When drilling small amounts of seed it is preferable to turn the crank the double amount of turns and multiply the weight by 50.

As a complement to the static test a field test could preferably made.

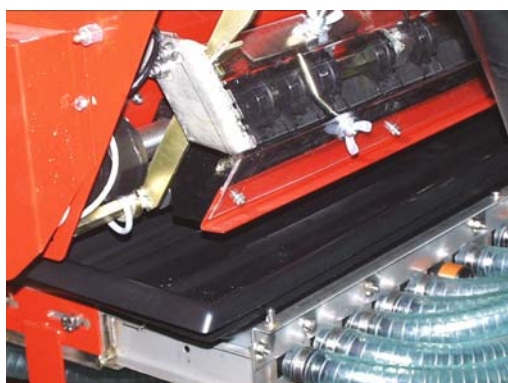
Calibration test



Crank in test position



Lever to set the loading ramps for test or seeding.



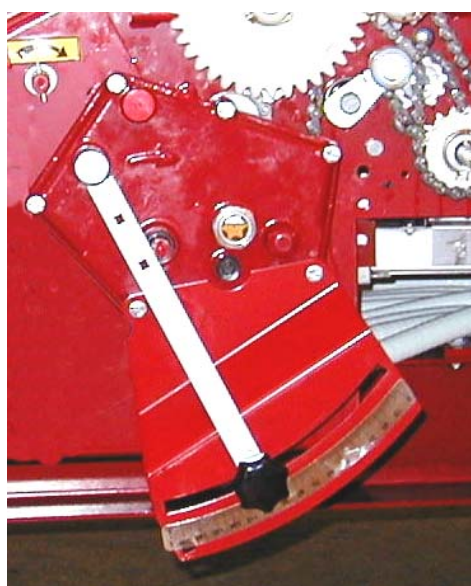
Rear test trough in test position.



Loading ramp in seeding position



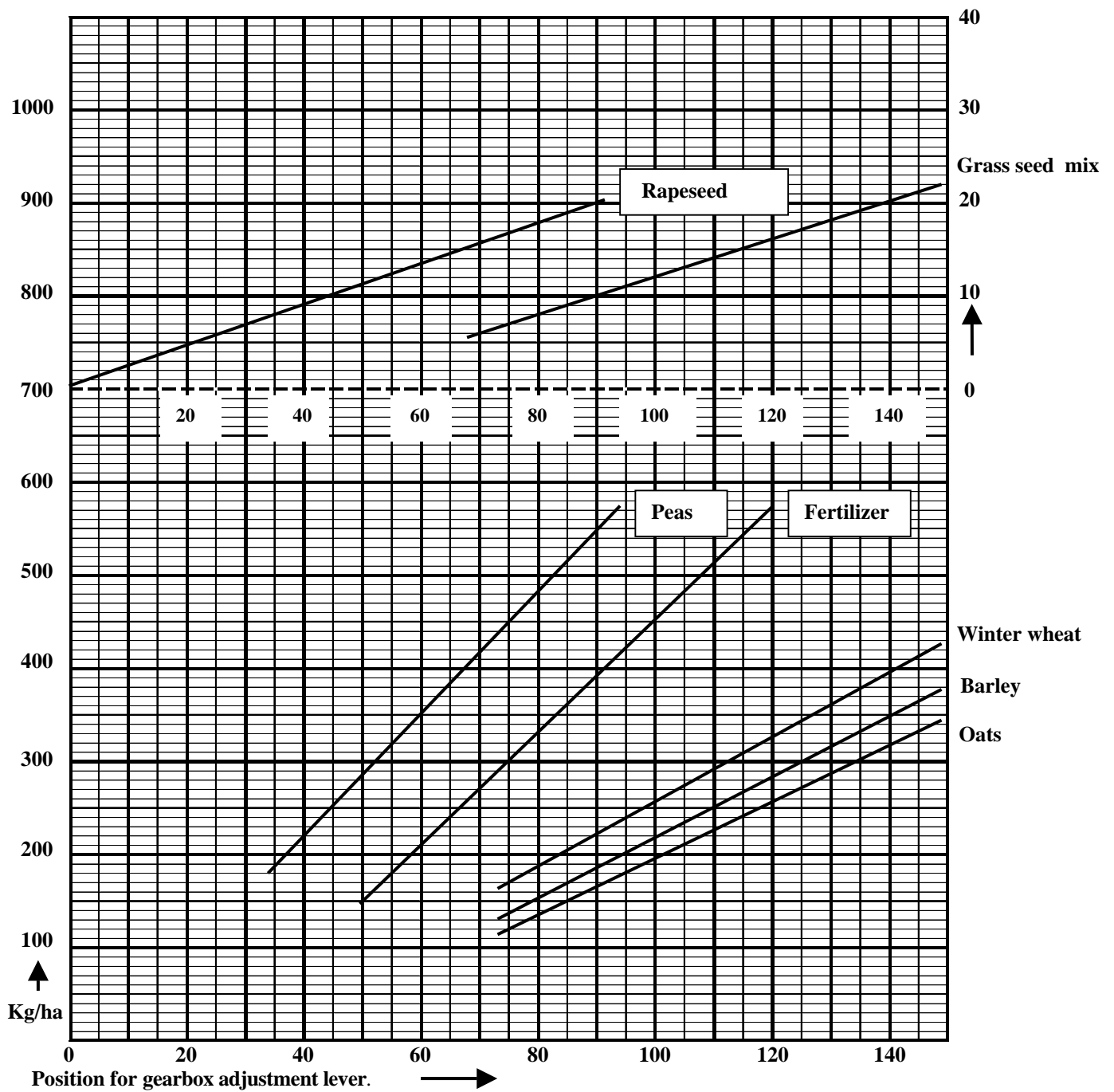
Test troughs locked with rubber strap when the machine is in normal seeding position.



Gearbox with adjustment lever.

DISTRIBUTION TABLE

Reduction gear in
reduction position



It is not possible to draw up a distribution table that is entirely accurate since the seed may show differing volume weights, the distribution table should therefore be regarded as approximate

To make sure that the machine is feeding out the required quantity of seed a calibration test should be carried out.

Field test

To be done after approx. a hectare of seeding. Check the inflation pressures in the tires of both the machine and the drive roller prior to the field test.

1. Calibrate the hectare meter according to the TRAM Control System.
2. Prepare the machine for a calibration test (see Static test item 1-7).
3. Zero set distance covered on the TRAM-display position d. (centre switch straight down).
4. Engage the drive roller and drive until the test troughs are filled with a weighable amount (Note! Let the fan run during the field test.)
5. Weigh the amount of seed and read of the distance covered on the display.
6. Calculate according to the formula below.

$$\frac{\text{Weight in trough, kg}}{\text{Working width m x distance covered}} \times 10000 = \text{kg/ha}$$

Example: For a machine with 6m working width.

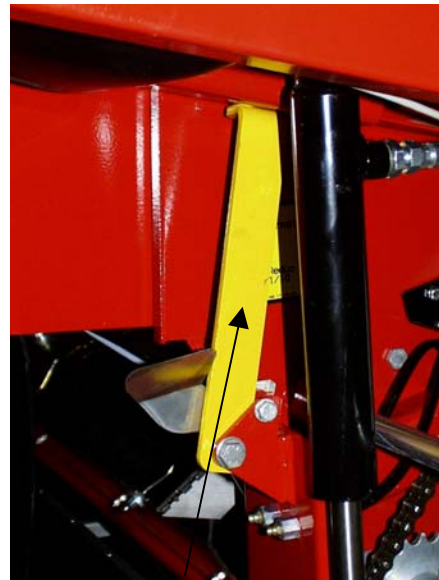
$$\frac{7 \text{ kg}}{6.00 \text{ m x } 60 \text{ m}} \times 10000 = 194 \text{ kg/ha}$$

7. Adjust the gearbox to the desired output rates.
8. Check by repeating the field test items 3-6 that the desired output rate is obtained.
9. Reset the machine to normal working position.

4.6 Coulter unit

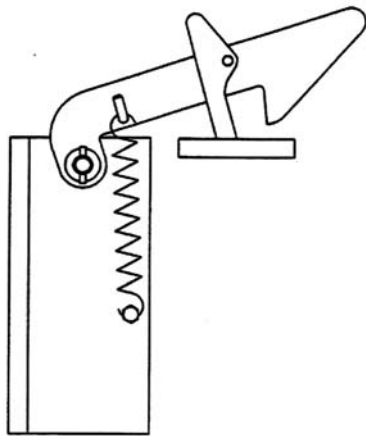
4.6.1 Transport driving

1. Lift the coulter unit to top position
2. The side sections must be folded and secured.
3. Drive roller cylinder must be secured.
4. Lower the coulter unit to (bottom) transport position
5. Maximum speed in transport 25km/h

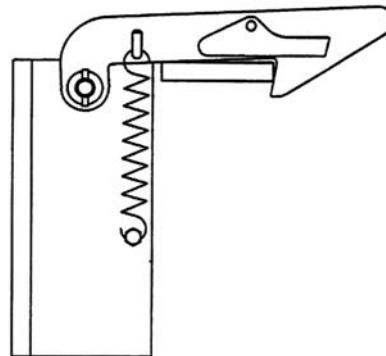


Mechanical lock for side sections on MD machines

Mechanical lock for drive roller

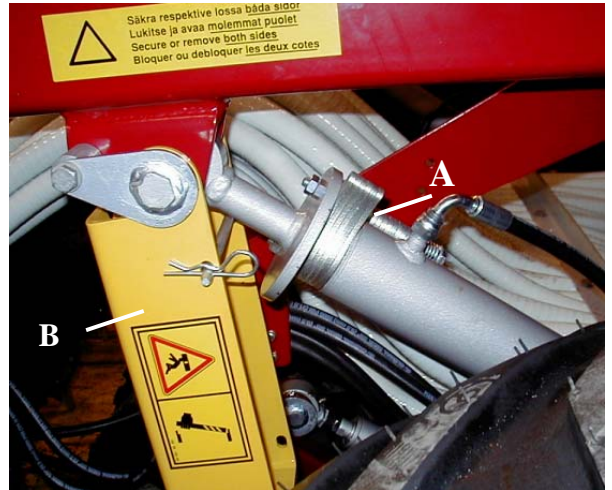


Lock for the side sections in opened position



Lock for side sections in locked position

4.6.2 Adjustment of coulters beam on CD machines



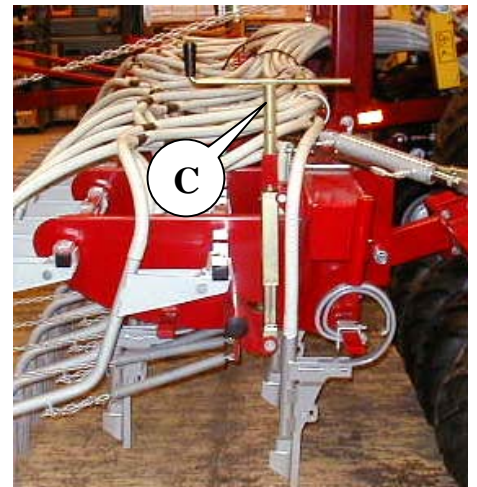
Depth adjustment fertilizer coulters

Increasing or decreasing the numbers of spacers A that are placed over the piston rod adjusts the working depth of the fertilizer coulters. Adjust when the coulters beam is in top position.
Both sides must be adjusted to the same depth (number of spacers).
One spacer alters the depth by apr. 10 mm

Prior to work under the coulters unit, the lifting cylinders must be secured with the locking bars B.

Depth adjustment, seed coulters

The depth is adjusted in sections with the crank C with the coulters beam raised.
(NOTE! The coulters beam are divided into 2 sections)
The depth (pressure) can also be individually adjusted by the springs with chains that are mounted on the seed coulters arms. For example, this makes it possible to increase the pressure on coulters running behind in the wheels tracks of the tractor.



Machines equipped with hydraulic coulters pressure adjustment
There are the cranks replaced by hydraulic cylinders.
The coulters pressure can then be adjusted during seeding from the tractor using a double acting valve.



NOTE! Always check that the seed are placed at the desired depth

4.6.3 Coulters and following harrow

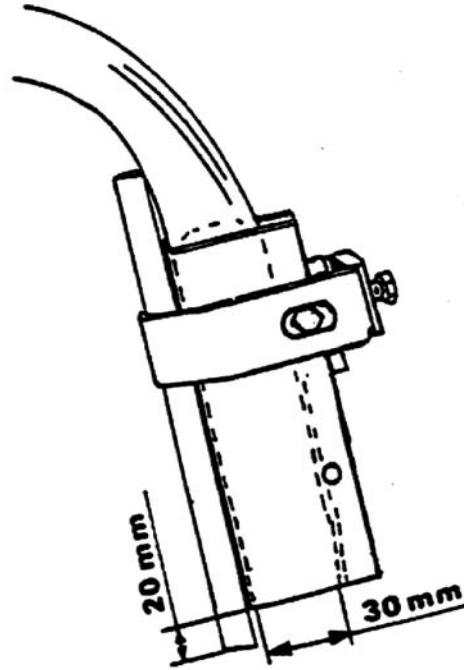
Adjustment of coulters points (wear steels)

The seed coulters have an adjustable reversible and exchangeable coulters point (wear steel). When basic adjusted, the coulters point works 20 mm below the coulters. Adjust the coulters points when the 20 mm distance has decreased to 5-10 mm. When the coulters is used below above given measurement, there may be excessive wear on the coulters side plates.

The coulters point is locked with a bolt, tightening the clamp. Check that the bolt is correctly tightened.

Guide plate

The guide plate on the coulters arm is bent forward. This in order to guide the seed close to the coulters point. Check that the distance between the guide plates and the coulters points are 30 mm. If the distance is too big the seed will end up shallower. If the distance is too small there is a risk of coulters plugging



Disc coulters

Depth control on the disc coulters is ensured by a 40 mm wide packing wheels following each coulters.

The drilling depth is adjusted in 5 mm intervals using a series of holes and an easily controlled spring-loaded pin.



NOTE! Always check that the seed are placed at the desired depth

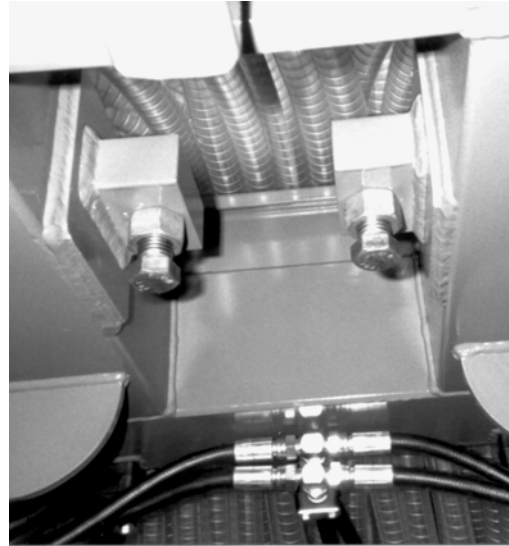
Fertilizer coultter



The front of the wearing points is made out of coromant, that protects the point from wear.

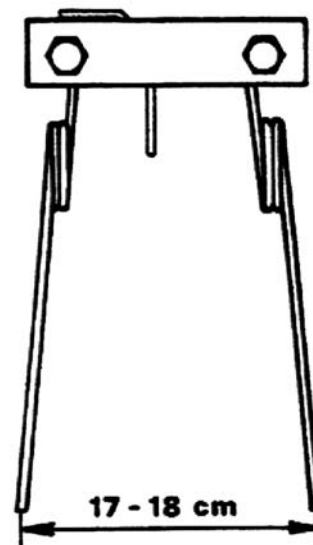
Adjustments of side sections

The side sections are adjusted with the two setscrews shown on pictures above, adjust the side sections so that they are parallel with the ground.



Adjustment of light following harrow

The pins on the following harrow must be adjusted (according to the figure). After adjustment, tighten the bolts correctly.



Adjustment of heavy following harrow

The following harrow type max flow has curved pins.

Adjustment screw used to set the pressure against the ground



The angle against the ground can be changed by altering the position of the pin in the series of hole.



4.6.4 Markers – Basic adjustment

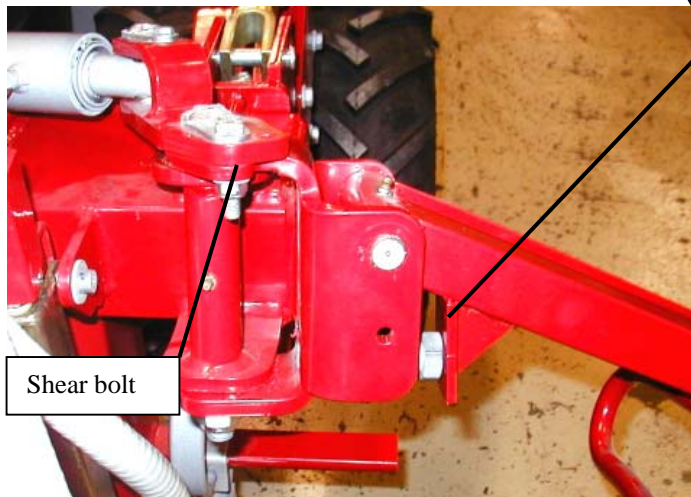
The working depth of the markers should be as shallow as possible, but they should make a clear mark in the ground. The depth is adjusted with the nuts on the marker mountings, see below. The marking effect of the discs can also be adjusted by rotating the marker axles in the marker arms after first loosening the screws.



Lever used to reset the safety release device and to set the markers to transport position.

The length of the marker arms is adjusted by pushing the marker axles complete with disc in or out of the marker arms.

Markers for 6m and 8m coulters beams



Nuts for adjustment of depth

Shear bolt

Markers for 4m-coulter beam

Adjustment for centre marking

Since the coulters are mounted asymmetrically, the length of the markers must be set differently on the right and left hand side for drilling at 25 cm and 50 cm row spacing.

NOTE! Always check the adjustment in the field!

Safety release device CD 5406 CD 5408

The outer end of the markers incorporates a safety release device. The trigger force should be 400 - 450 N at the marker discs when this is extended to 165 cm from the joint of the safety release device.

Safety release device CD 4504

A shear bolt M10x50 10.9 protects the markers

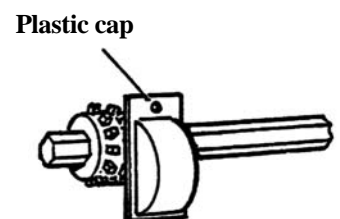
4.6.5 Row spacing 25 or 50 cm

Row spacing

For 12,5 cm row spacing, all coulters are in use. For 25 cm spacing all of the rear coulters are in use. For 50 cm spacing, every other rear coulters is in use.

Covering the corresponding feed rollers with a plastic cap should close the other rear coulters.

Note! The markers have to be adjusted to the new row spacing.



4.7 Operating the inner wheel and wing packer

Inner wheel packer

The Combi Jet CD can be equipped with inner wheel packer to ensure recompaction of the soil between the two large transport wheels. The system consists of two double wheels pressurised by a hydraulic accumulator. The two double wheels can move relatively to each other. The pressure on the inner packer is set when the outer wings are folded out to working position and the hydraulic lever is kept in this position, the working pressure on the packer is shown on the pressure gauge mounted on the fan housing (suitable working pressure 10-11 Mpa). The pressure is released when the side sections are lifted to **transport position** when the side wings are folded. The inner wheel packer and the side wings are locked by a pilot check valve during drilling and transport driving.

The machine can be equipped with wing packer to ensure recompaction of the whole working with.



Inner wheel packer

Tyre inflation pressure

240 kPa 2,4 bar

Wing packer

The cranks set the recompaction of the soil. After adjustment check so that the side wings of the coulter beam is parallel with the ground.

The folding cylinders on the side wings are pressurised with the same accumulator pressure as the inner wheel packer.

See hydraulic diagram page 44



5. ADVICE AND USEFUL OPERATIONAL POINTS

- Make a calibration test in order to assure that correct amount is being metered out.
- **When starting:** The fan is to be started first. In order to avoid damage to the universal joints on the power take-off shaft as well as unnecessary wear on the fan belts, the power take-off should be engaged at low engine rpm. The engine rpm can then be increased progressively until the power take-off shaft is running at normal rpm (540 rpm or 1000 rpm). The metering system can now be engaged. If the metering system is engaged before the fan is started, the fertilizer/seed will accumulate in the ejectors, which may cause blockages.
- **When stopping:** First lift the coulter beam that automatically disconnects the metering system, then the fan can be disconnected.
(Note! Lower the rpm of the fan prior to the power take-off being disconnected.)
- When the hopper is filled and the machine is ready for work: Start the fan, turn the drive roller and check that seed/fertilizer comes out of every coulter in use.
- The headlands should be at least 24 metre wide.
- At all times during driving (working) all safety guards must be correctly mounted.
- The first run (bout) on the headland should be driven around in the corners of the field. **Note!** Drive in left-hand direction (counter clockwise). This due to that the drive roller is driven from the machine's right hand wheel.
- The working pressure on the levelling board can also preferably be operated from a valve with float position on the tractor, then the working pressure can be set to zero when the lever is in float position. If the machine is equipped with direct connected hydraulics.

6. MAINTENANCE

New machine: When the machine has been in operation a couple of hours, check that all bolts and nuts still are correctly tightened. Especially the bolts holding the wheels and the drawframe/drawbar.
Continue to check this in regular intervals.

6.1 Emptying, cleaning and storage

Cleaning of the metering system. Clean by hosing down with water.

NOTE! The fan must be running.

If the hopper is not empty, the metering system can be blown clean with compressed air.
When cleaning with water, allow the machine to dry thoroughly before it is used again.



Emptying shutter

After finished work

- Empty the machine. The most of the left over seed/fertilizer can be emptied through the emptying shutter and the remaining through the test troughs after the feed gates have been fully opened.
Note! Lower the loading ramps and mount the test troughs prior to opening the feed gates. When the hopper is empty, start the fan to blow out the leftover seed/fertilizer, which remains in the system.
- Clean the machine from dirt and left over seed/fertilizer by hosing down with water. Note! The fan must be running. If compressed air is used when drying the machine, the drying time will be reduced.
NOTE! Do not aim high-pressurised water at:
 - Bearings or feed shaft bearings
 - Electrical sensors or electrical junction boxes
 - The plastic guide plates that are mounted in the loading tubes
- Check and lubricate all lubrication points according the Lubricating Instructions.
- Check and retighten all bolts and nuts.

The machine should be kept under cover in a dry place and with the tarpaulin on to prevent foreign objects entering the hopper.

Use a wet cloth and dish-washing liquid when cleaning the control box.

Cleaning the air system in the loading ramps

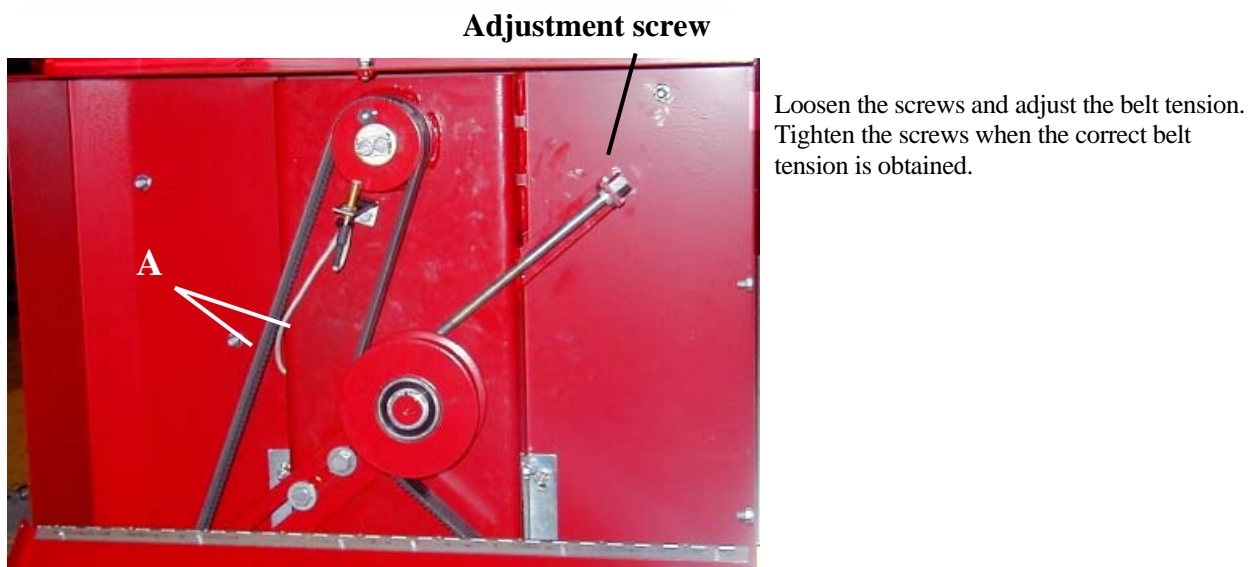
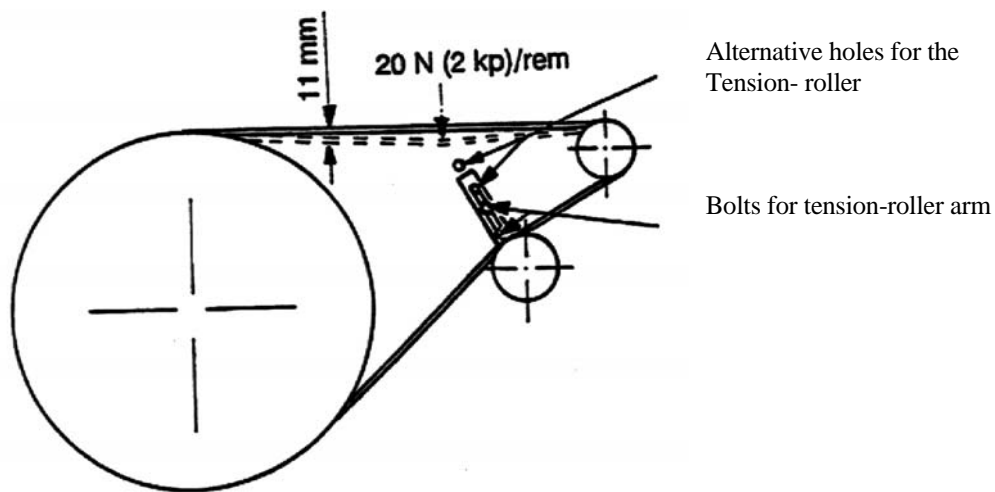
Blockage in the system can occur due to leafs, straws or similar being sucked in through the fan and then getting stacked in the loading tubes (ejectors) that then stops the airflow. Cleaning can be done when the cover plates in the front of the loading ramps have been removed.

Note! Be careful, not to damage the ejectors.



6.2 Fan belt tension

Retighten the fan belts after a few hours of operation. Check the fan belt tension at least every hundred (100) hour of operation.



NOTE! The bolts for the tension-roller arm can be moved to the alternative holes if needed.



Never run the fan with higher rpm than what it is equipped for (540 rpm, 700 rpm or 1000 rpm)

6.3 Tightening torque's

Tightening the bolts

Bolts of quality 8.8, 10.9 and 12.9 are used on the machine. When replacing these bolts, ensure that the same quality bolts and nuts are used. The following tightening torque should be used for the different bolts:

It is easier to tighten bolts and nuts to correct tightening torque, if they are lubricated with oil.

Tightening torque's		Torque			
Quality	Size	Dry bolts and nuts		Bolts and nuts lubricated with oil	
8,8	M12	81	Nm	70	Nm
8,8	M16	197	Nm	170	Nm
8,8	M18	275	Nm	236	Nm
8,8	M20	385	Nm	330	Nm
8,8	M24	665	Nm	572	Nm
8,8	M30	1310	Nm	1127	Nm
10,9	M12	114	Nm	98	Nm
10,9	M16	277	Nm	238	Nm
10,9	M20	541	Nm	465	Nm
10,9	M24	935	Nm	804	Nm
10,9	M30	1840	Nm	1582	Nm
12,9	M16	333	Nm	286	Nm
12,9	M20	649	Nm	558	Nm
12,9	M24	1120	Nm	963	Nm

Always keep the nuts and bolts on the machine properly tightened

6.4 Lubrication instruction

Lubrication points	Lubricant and method				Lubrication intervals			5406 5408	4504
	Packing with grease		Pressure greasing		Daily	100 ha	Once per season	No. of lub points	No. of lub points
	Ball-bearing grease	Heat resist. b-bearing grease	Ball-bearing grease	Oil					
Hitch* 1 Phloem hitch					X			4	4
PTO shaft** PTO shaft PTO shaft guard			X X		X	X		2 4	2 4
Hydraulic cylinder 2 Coultter unit			X			X		8	8
Coulter unit Marker arms 3 Side sections/ coulter beam			X X			X X		6 12	6 12
Others 4 Feed shaft bearings 5 Bearings swing arm 6 Drive chains 7 Tensioning roller plastic 8 Reduction gear 9 Wheel hubs 10 Air distributor bracket	X		X X X	 X X X		X X X	 X X X X	13 2 10 6 2 2 4	13 2 10 6 2 2 4
Levelling board Hydraulic cylinders Bearings			X X			X X		8 2	8 2

** The telescopic axle and tube of the power take-off shaft must always be kept clean and well lubricated with grease to facilitate axial movements, even under load (pressure).

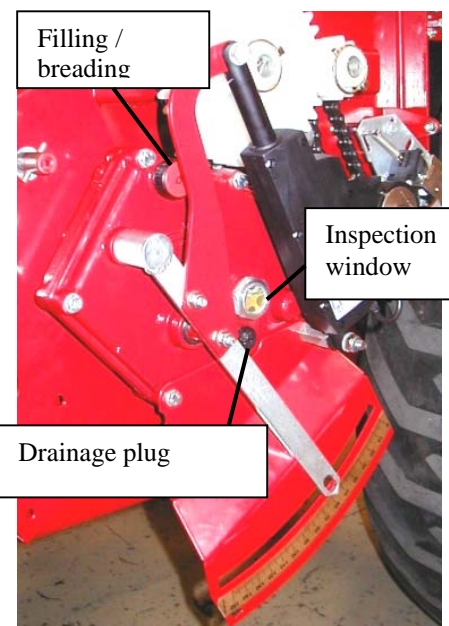
Check the oil level in the gearbox, it should reach up to the centre of the inspection window.

Example on suitable transmission oil

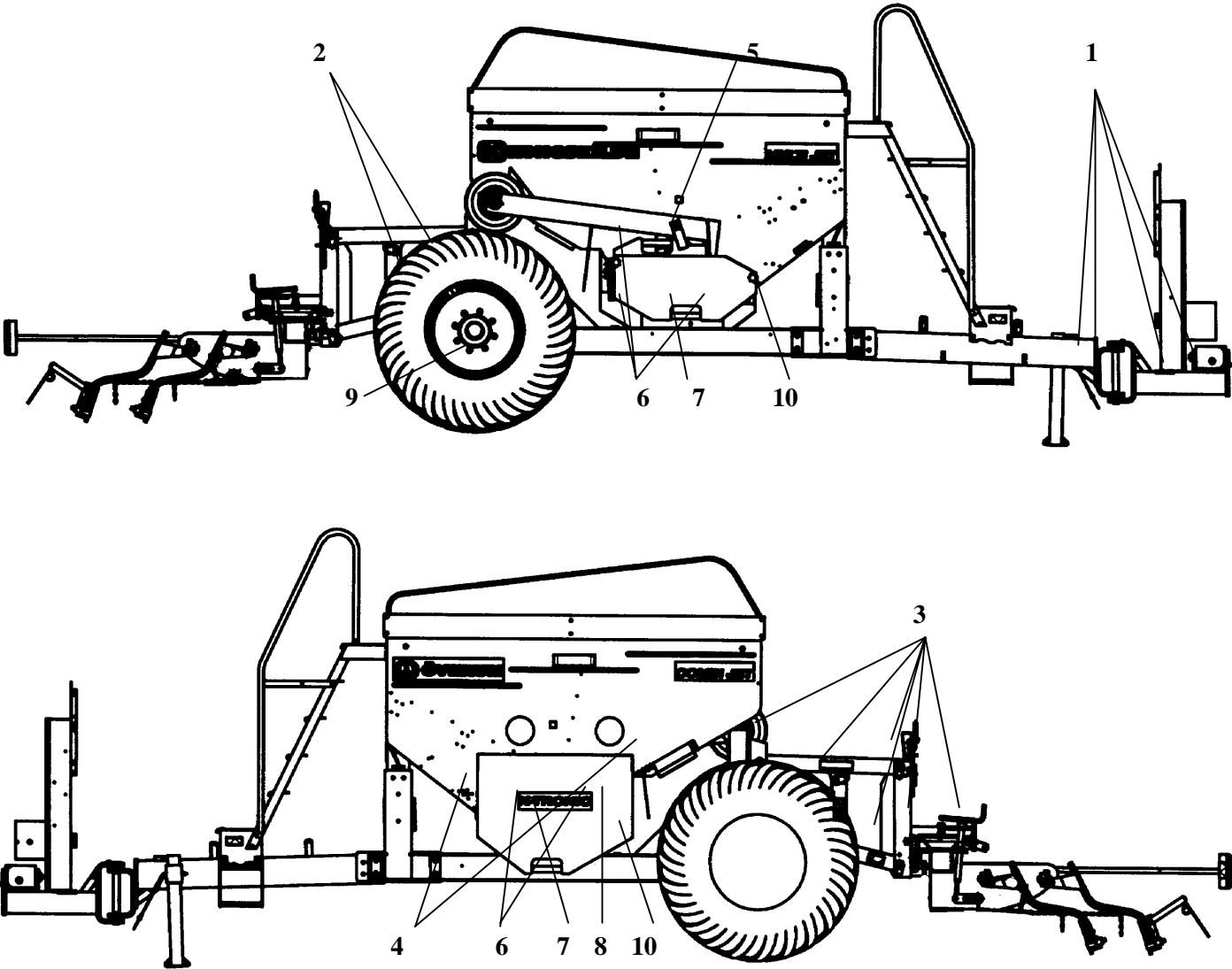
MOBIL Mobil DTE 25 **SHELL** DONAX TM
BP Energol GR-XP 46 **TEXACO** Rando oil HD 46

The oil in the gearbox should be changed every 500:working hour

NOTE! Make sure that the rubber parts (feed gates, air hoses, drive belts, etc) do not come into contact with oil or grease.



6.4.1 Lubrication points as per Lubricating Instruction



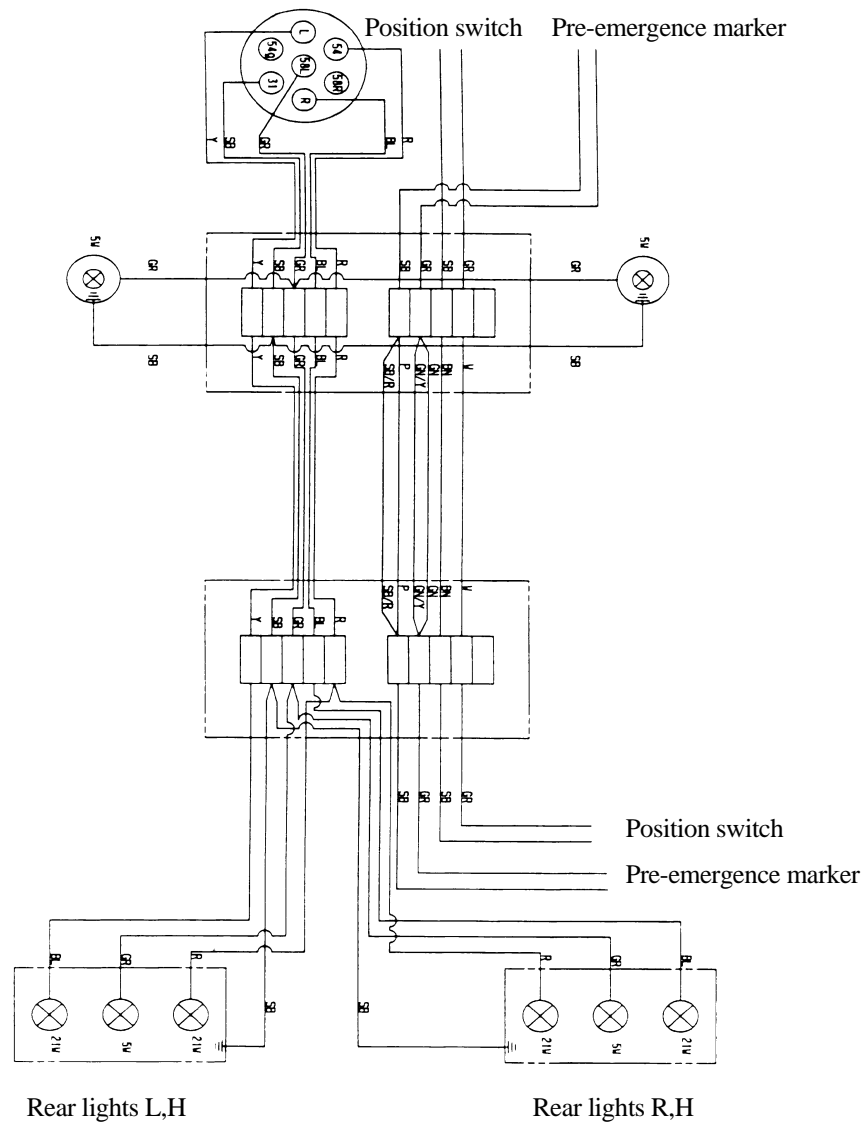
7. WIRING AND HYDRAULIC DIAGRAMS

7.1 Wiring diagram –Running lights

The electrical system is divided in two separate circuits, control system and running lights.

Note! The wires for the position limit switch and pre-emergence marker are included in the system for running lights circuit.

The rear- and side marking lights are standard on all machines and they are connected according to international standard (see wiring diagram below).



7.2 Connection of the power fed TRAM

Functional description

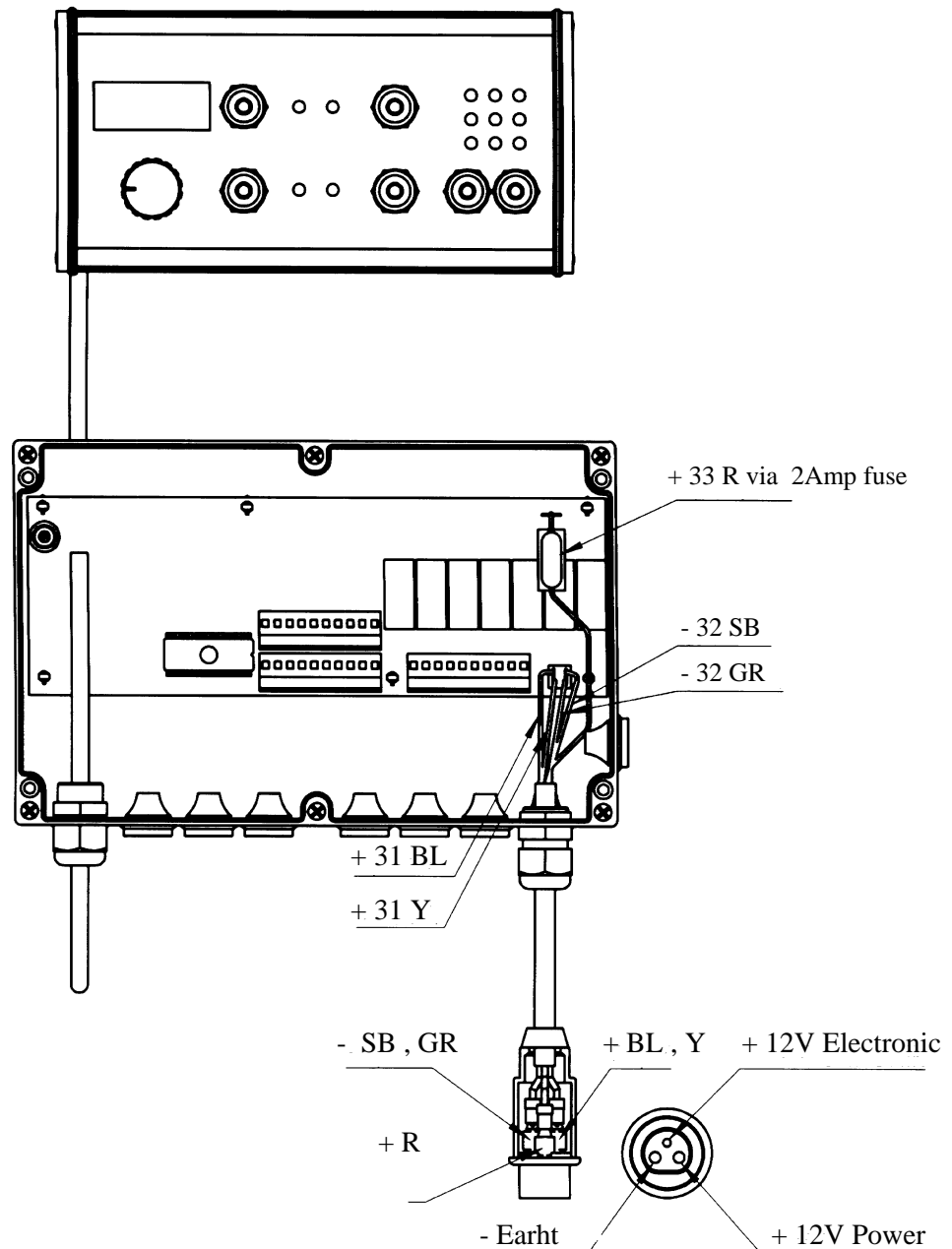
TRAM is an electronic **control** system.

The system consists of two units; one **manoeuvre/control unit** and one **machine/intelligence unit**.

The manoeuvre unit is to be mounted in a suitable place in the tractor cabin.

The communication and the power feed between the two units are done through a **coaxial cable**.

When disconnecting the machine from the tractor: Always disconnect the power fed from the tractor prior to the coaxial cable. When the 12 V power is disconnected the actual hectares reading , etc. is saved in the machine/intelligence unit. A 2 Amp fuse placed in the machine unit protects the printed circuit board.



7.3 Wiring diagram machine / Intelligence unit TRAM

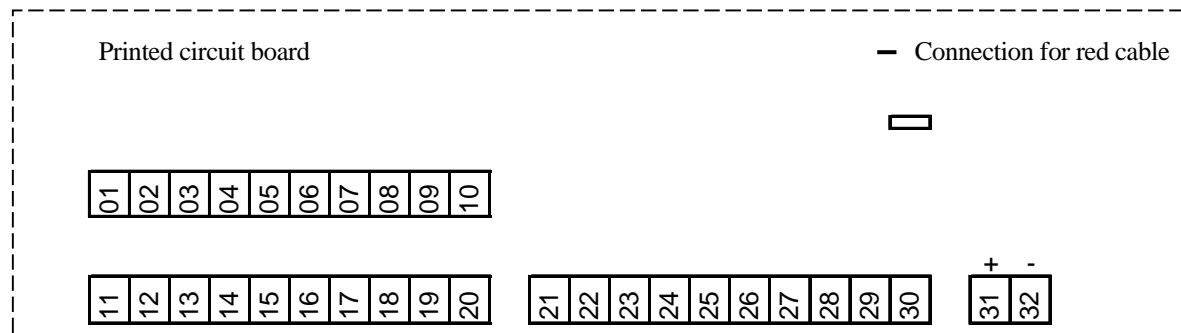
The sensors on the machine should be connected according to the diagram below

INGOING

FUNCTION	+ NO	- NO	SIGNAL
Drive roller Sensor		2 BL	1 BN
Feed shaft , Front 1	11 BN	12 BL	
Feed shaft , Rear 2	19 BN	20 BL	
Fan sensor		10 BL	9 BN
Level sensor Fertilizer	18 BN	17 BL	16 W
Level sensor Seed	13 BN	15 BL	14 W
Position limit switch		7 SB	6 GR
Switch for Diverter valve	31 SB	32 GR	

OUTGOING

FUNCTION	+	-
Drain valve ,Drive roller	21 SB	22 GR
Drive roller, Switch	21 SB	22 SB
Partial Shut off, LH	23 BN	24 BL
Partial Shut off, RH	25 BN	26 BL
Tramlines	28 BN	27 BG
Pre-emergence marker	30 SB,R	29 GR,BL
Diverter valve		32 GR
12 V power	31 BL, Y	32 GN,W
12 V electronics	Fuse R	32 SB



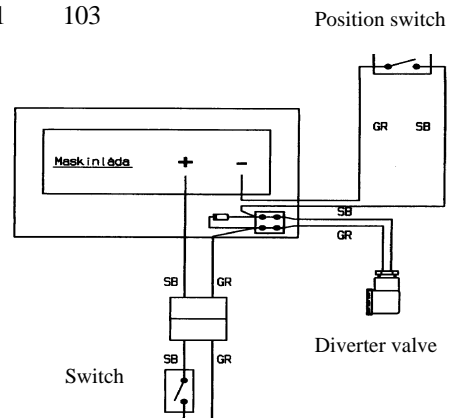
Wiring diagram –Electrical diverter valve for Multi Flex levelling board

Connection in Machine /Intelligence unit

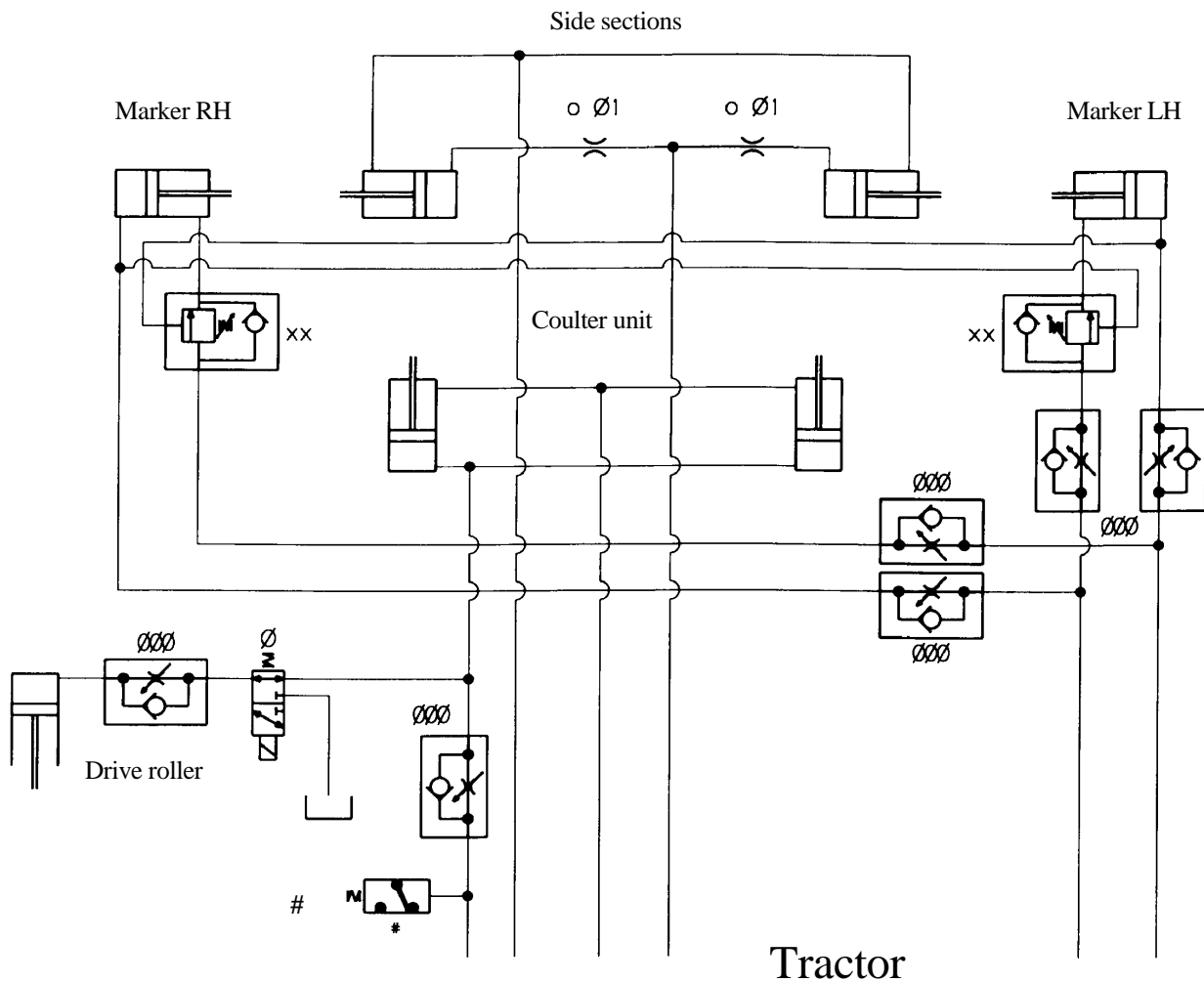
TRAM
TRONIC

+ -
31 32
101 103

Wire Colours	
SB	= Black
W	= White
R	= Red
BL	= Blue
Y	= Yellow
GN	= Green
GR	= Grey
BN	= Brown
P	= Pink



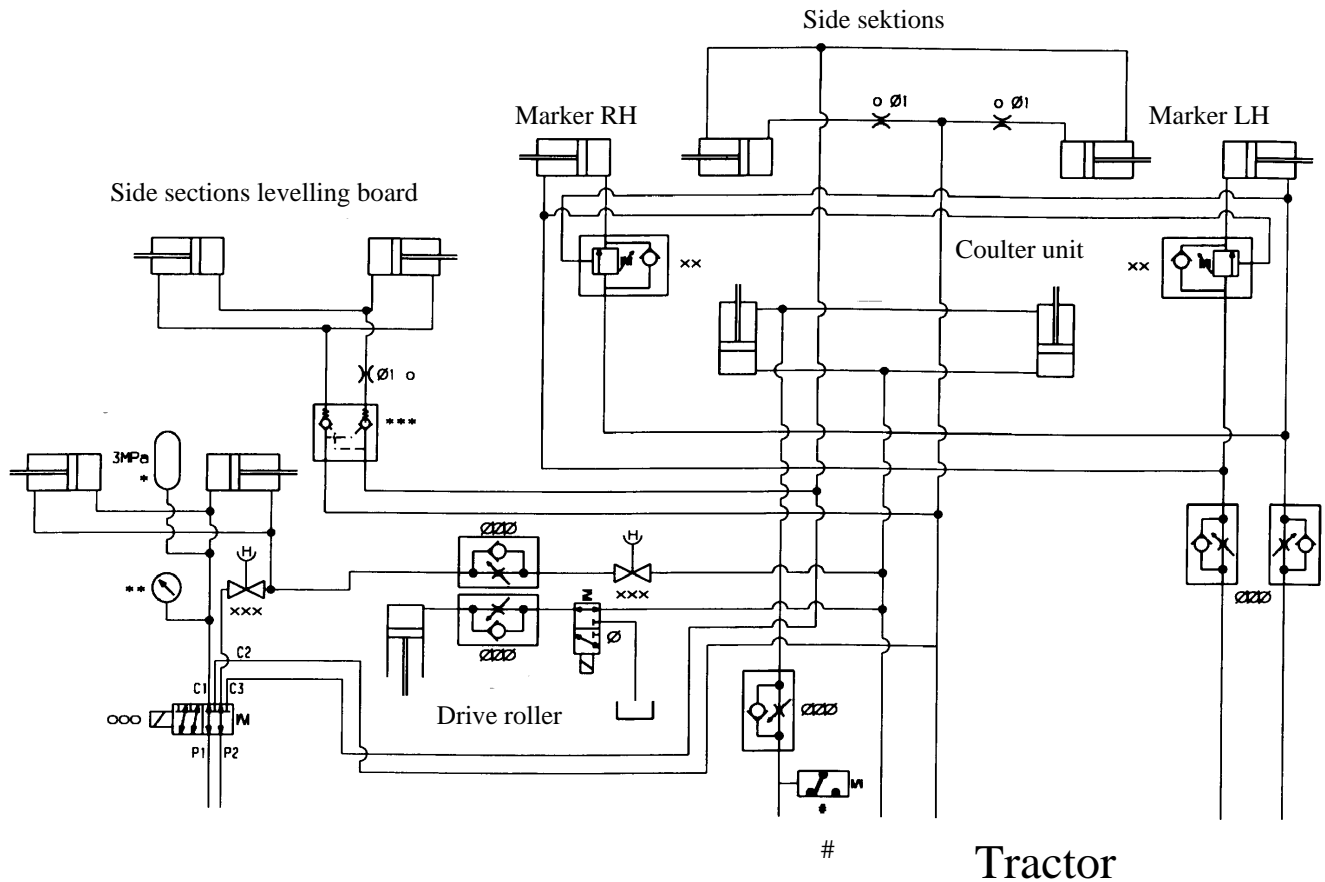
7.4. . Direct connected hydraulic system CD 4504E / CD 5406E / CD 5408E



Functional description

- Ø The **electrically controlled drainage valve**: Always drains the oil from the drive roller during seeding and allows for seeding (broadcasting) with raised coulter beam..
- xx The **sequence valves**: Controls the markers switching function, one marker goes in before the other one can go out.
- *** The **adjustable restrictor non return valves**: Adjusts the speed of the side sections, markers and drive roller.
- o **Restrictor** controls the speed of the side sections when folding / unfolding.
- # **Pressure sensor** gives signal to the drainage valve for the drive roller and to the tramline equipment. when the coulter unit is lifted

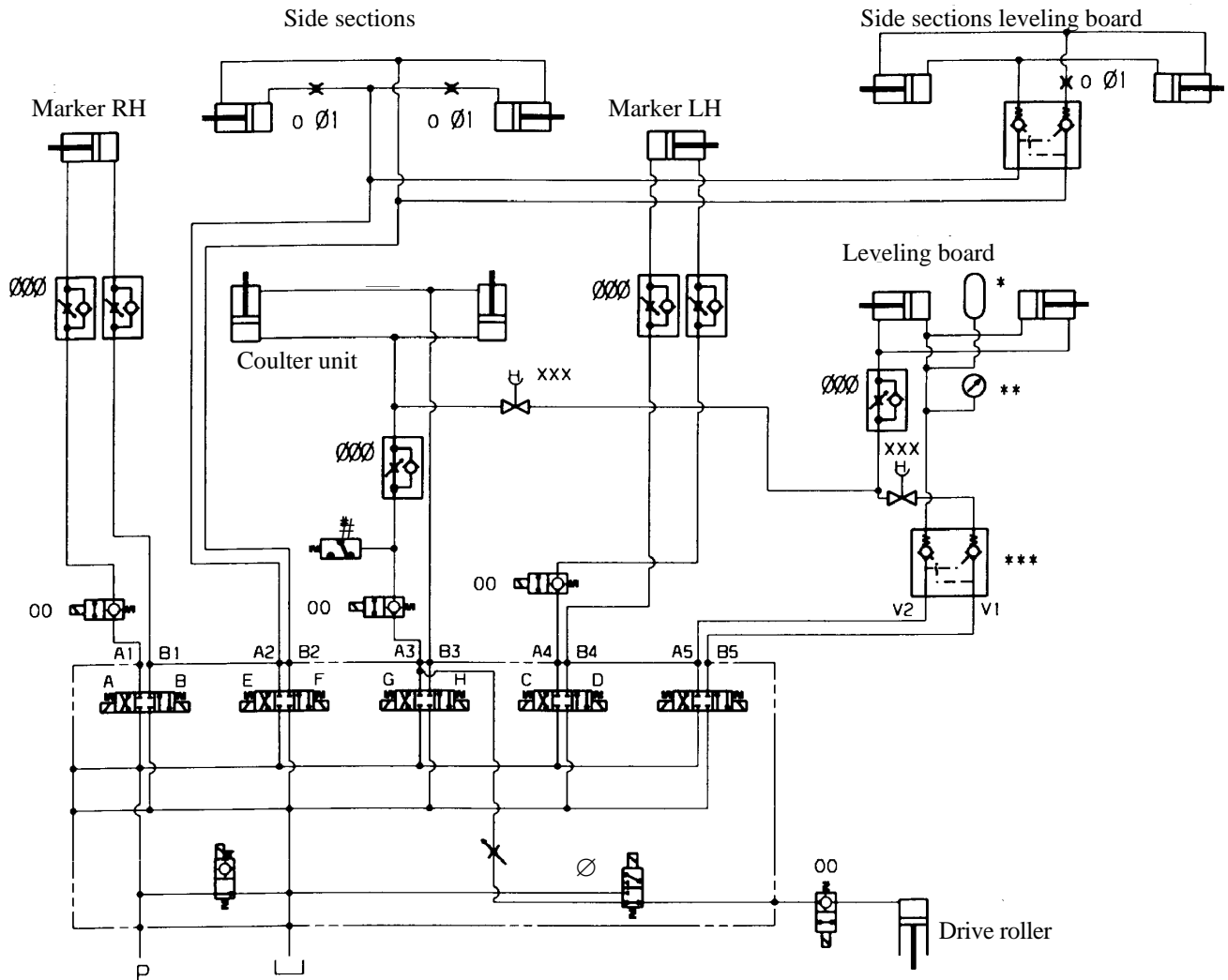
Direct connected hydraulic system CD 4504 ES / CD 5406 ES / CD 5408 ES



Functional description

- Ø The **electrically controlled drainage valve**: Always drains the oil from the drive roller during seeding and allows for seeding (broadcasting) with raised coulter beam..
- ØØØ The **adjustable restrictor non return valves**: Adjusts the speed of the side sections, markers and drive roller.
- xx The **sequence valves**: Controls the markers switching function, one marker goes in before the other one can go out.
- xxx The **shut-off valves**: Locks the levelling board for transport. It also makes it possible to operate the levelling board separately
- * **Accumulator**: Protects the levelling board.
- ** The **pressure gauge**: Indicates the working pressure (load) on the levelling board. Normal working pressure 5- 8 Mpa.
- *** The **back check valve**: Locks the side sections of the levelling board in working position.
- o **Restrictor** controls the speed of the side sections when folding / unfolding.
- ooo The **diverter valves**: Is used to switch function, between side sections and working pressure on the levelling board.
- # **Pressure sensor** gives signal to the drainage valve for the drive roller and to the tramline equipment. when the coulter unit is lifted

7.5 Electrically controlled hydraulic system CD 4504 THS / CD 5406 THS / CD5408 THS

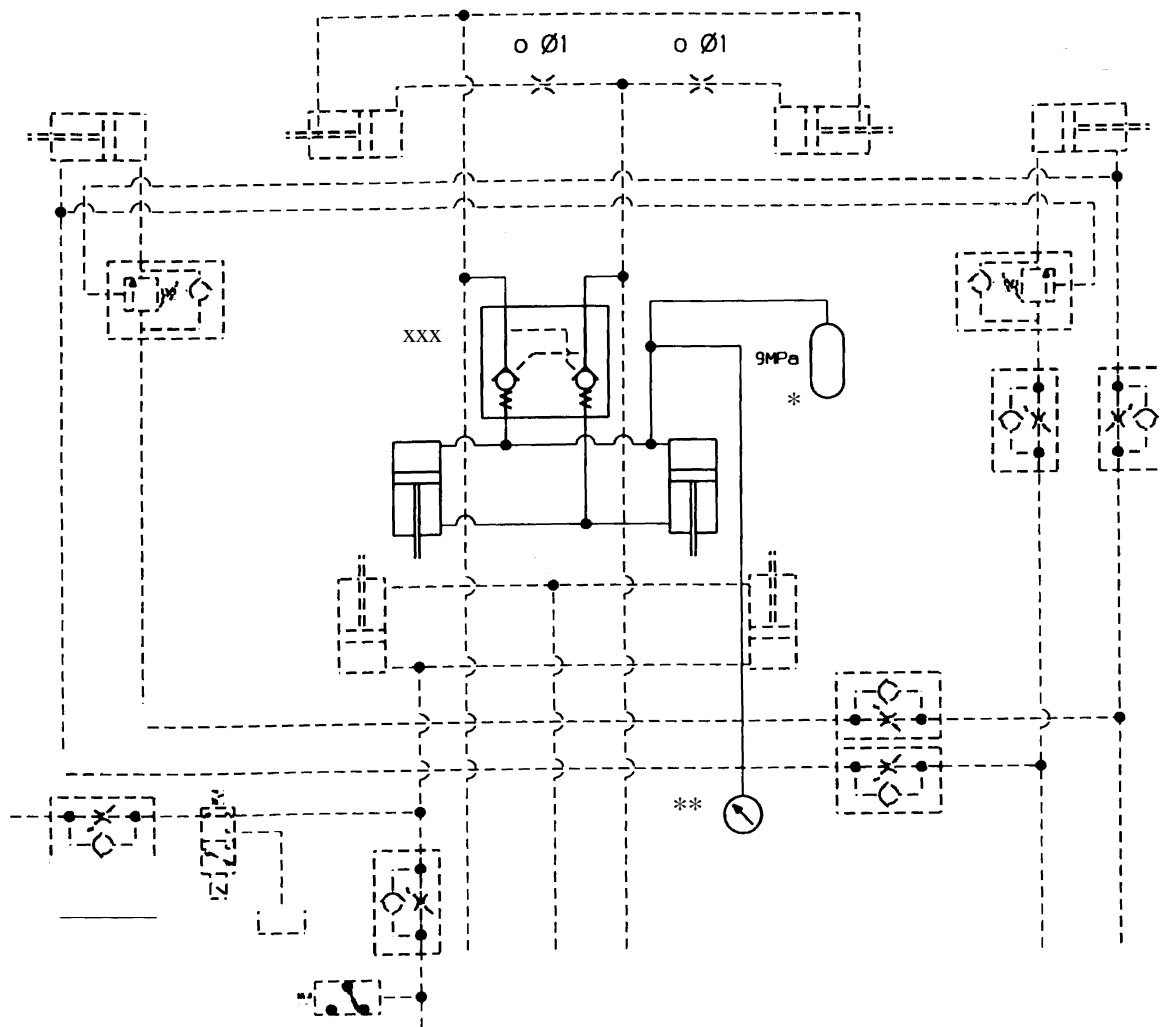


Tractor

Functional description

- Ø The **electrically controlled drainage valve**: Always drains the oil from the drive roller during seeding and allows for seeding (broadcasting) with raised coulter beam.
- ØØØ The **adjustable restrictor none return valves**: Adjusts the speed of the side sections, markers and drive roller.
- xxx The **shut-off valves**: Locks the levelling board for transport. It also makes it possible to operate the levelling board separately.
- * **Accumulator**: Protects the levelling board.
- ** The **pressure gauge**: Indicates the working pressure (load) on the levelling board. Normal working pressure 5- 8 Mpa.
- *** The **back check valve**: Locks the side sections of the levelling board in working position.
- o **Restrictor** controls the speed of the side sections when folding / unfolding.
- oo The **lock valve**: Locks the corresponding function.
- # **Pressure sensor** gives signal to the drainage valve for the drive roller and to the tramline equipment. when the coulter unit is lifted

7.6 Hydraulic diagram inner wheel and wing packer



Functional description

- ** **The pressure gauge:** Indicates the working pressure (load) on the inner wheel packer. Normal working pressure 10-11 Mpa.
- * **Accumulator:** Protects the inner wheel packer.
- xxx **The back check valve:** Locks the working pressure in the system when drilling and locks the inner wheel packer in raised transport position.

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