OPERATING MANUAL
FOR THE

etor 50-Super
TRACTOR
(valid for tractors from production No. 11331)

1963
PREFACE

The Zetor 50 Super tractor belongs to the class of tractors with a higher performance. It is a general-purpose tractor which can be suitably applied both for heavier agricultural work, for transport purposes, and for civil engineering. The higher operating speed contributes substantially to adhering to agricultural time limits and the advantageous economical operation factors decrease agricultural production costs.

The operation of our tractor is safeguarded by good maintenance service; our specialists are at your disposal at any time with advice and help. The spare parts are interchangeable since they are made in the same way as the parts fitted on the actual tractor. The economy of operation of the tractor depends to a considerable extent on the quality of the care and maintenance of the vehicle. By perfect operation and maintenance, with frequent checks, you will be able to maintain the maximum operating efficiency of the tractor and prolong its useful life.

This manual acquaints the user of the Zetor 50 Super tractor with its basic methods of operation and maintenance.

By acting in accordance with all our instructions you will secure troublefree operation of the tractor and its maximum useful life.

For repairs use original Zetor 50 Super parts only!

In your enquiries and orders for spares always state the Serial Number of the tractor.

The Serial No. of the tractor is on the steering column.

The Serial No. of the engine may be found on the crankcase.
I. MAIN TECHNICAL DATA

Main Dimensions
Maximum length of standard tractor ................................ 3400 mm
Maximum length with three-point suspension ...................... 3570 mm
Height to upper rim of steering wheel ............................. 1800 mm
Minimum clearance (below gearbox) .................................. 450 mm
Width at maximum wheel track ....................................... 2185 mm
Width at minimum wheel track ....................................... 1875 mm
Wheel base ........................................................................ 2200 mm
Wheel track of front wheels — adjustable ......................... 1280 mm, 1440 mm, 1600 mm, 1760 mm
Wheel track of rear wheels — adjustable ......................... 1380 mm—1820 mm
Distance of centre of gravity from rear axle (tractor with hydraulic equipment) .................. 665 mm
Height of centre of gravity above ground ......................... 780 mm
Minimum radius of turning .............................................. 3000 mm

Weights
Weight of tractor without hydraulic equipment, additional weights and fillings ................ 2430 kg
Service weight, i.e. filled with oil, fuel and water, without weights ........................................... 2600 kg
Service weight with hydraulic equipment, without weights ......................................................... 2811 kg
Dry weight of tractor with hydraulic equipment .................. 2641 kg
Weight of additional weights without water in rear tyres .................. 160 kg, 560 kg, 400 kg or 800 kg
Additional water filling in rear tyres ......................... 370 kg
Load of front axle ......................................................... 1080 kg
Load of rear axle (with tyres) .......................................... 1738 kg

Hydraulic Power-lift
Technical Data Description
The hydraulic equipment is of single-acting type with a four piston oil pump.
Maximum lifting power at point of suspension .................. 1200 kg
Maximum working pressure ......................................... 120 atm.
Average lifting velocity ............................................. 0.17 m/s
Distance from ground to point of suspension — minimum 250 mm
Distance from ground to point of suspension — maximum 855 mm
Distance of point of suspension from driving wheel axis 945 mm

II. TECHNICAL CHARACTERISTIC OF TRACTOR

Engine
Four cylinder Diesel, OHV system with cylinders in line, stroke 120 mm, bore 105 mm, displacement of cylinders 4160 cu. cm.
Maximum engine power output (with accessories, i.e. D.C. generator, fan, water pump) at 1650 r.p.m.: according to DIN-50 H.P.; without accessories according to SAE-52 H.P.
Cylinder heads: individual for each cylinder.
Fuel injection system: direct injection into combustion pockets in pistons.
Fuel injection order: 1, 3, 4, 2.
Fuel consumption: 185±5 g/H. P./hr.
Lubricating oil consumption: 1.5 g/H. P./hr.

Clutch
The clutch is double, dry, located on the engine flywheel. Plate diameter for travel — 350 mm, for agricultural drive 280 mm.

Gearbox
The gearbox is equipped with normal and reduced speeds. It has four forward speeds and one reverse speed.
Speeds with tyres 14—28, effective radius 650 mm, r.p.m. of engine 1650:
Without reduction
Speed Reduction Speed
ratio in km/hr.
1st 87.40:1 4.66
IInd 45.70:1 8.92
IIIRD 26.30:1 15.5
IVth 15.38:1 26.6
Reverse 87.40:1 4.66

When using reduction: 1:4.10

Speed ratio in km/hr.
1st 359 :1 1.18
IInd 187.5:1 2.25
IIIRD 108 :1 3.93
IVth 63 :1 6.73
Reverse 359 :1 1.18

Front Axle
The front axle consists of two half-axles sprung by a leaf spring.

Differential and Rear Axle
The differential is of bevel type with four satellites.

Steering
Steering is effected by a steering nut and worm, tie-rods and joints.

Drive Shaft
Shaft for driving agricultural implements: 540 r. p. m. at 1560 r. p. m. of engine (572 r. p. m. at 1650 r. p. m. of engine).
Height of the drive shaft above ground is 580 mm.

Brakes
Two foot brakes, claw type, dia. 220 mm, width of lining 80 mm.
Hand-operated band-type brake, dia. 250 mm, width of lining 50 mm.

Connecting Traction Equipment
Traction hook on front axle — permissible maximum traction weight 500 kg.
Sprung traction hook on rear gearbox wall for hitching trailers, seed drills, etc. Its height may be adjusted from 650 to 750 mm in three steps of 50 mm each.

Rims and Tyres

Front Wheels

The disk as well as the rim form one integral unit which is attached to the front wheel hub.

Rim: 5—20.

Low-pressure type: 6.50—20.

Rear Wheels

The rear wheels are divided, connected with screws.


Low-pressure tyre: 14—28 with air tubes for filling with water.

Electrical Equipment

D.C. generator Pal DGM 55.02 — 150 W/12 V, two-coil relay 150 W/12 V Pal, type 02-9403.51.

Starter Pal Magnetron 12 V — 4 H.P., type 02-9145.02.

Storage battery, lead 6 St 155 voltage 12 V, capacity 155 Ahr with microporous separators.

Further electrical equipment: 2 front headlamps, parking, braking, end, and direction lights, remote control of lights, hooter, servicing socket, socket for attaching trailer and rear headlamp for night labour.

III. GENERAL DESCRIPTION OF TRACTOR

General

The Zetor 50 Super tractor is of frameless design, the front axle bracket, engine housing, clutch housing and gearbox forming the supporting body of the tractor.

The tractor is fitted with a double clutch which consists of the travel clutch and of the drive shaft clutch. The gearbox is equipped with four forward speeds and one reverse speed. In front of the gearbox the reduction is fitted by means of which it is possible to obtain reduced speeds.

The tractor is equipped with a traction hook for farm implements, with a fixed drawbar, a front hook and a perfectly sprung seat for the driver, as well as with a drive for agricultural and auxiliary machines. It has complete electrical lighting. The perfect design of the tractor guarantees efficient and reliable service for all heavy agricultural and forestry jobs. It is of advantage and very economical not only for agricultural jobs, but also for all types of haulage work in any kind of ground. It will master reliably all tasks which it is impossible to carry out with lighter tractors.

Timing Mechanism

The valves are suspended in the cylinder heads and are operated by rocker arms. The latter are driven by tappets (lifters) and the camshaft which is located in the upper right-hand part of the crank case. Each valve is provided with two springs.

The air cleaner (Fig. 1)

Is of cyclone type with an efficiency of 99 per cent, and is situated on an oval shaped suction chamber attached to the fan cover lid. It consists of a cyclone type precleaner (1) and an oil-bath air cleaner (2). The incoming air enters tangentially the precleaner shell through two inlet openings (3) which are protected by a removable filtering element (4). Coarser dust particles are driven by centrifugal force into a dust collector (5) and settle in a bowl. The air current enters through the suction chamber (6) into the inlet throat of the
central oil duct in the wall of the crank case, and from here it goes through the individual ducts to the main crankshaft bearings and through the openings drilled in the latter to the connecting rod bearings. The oil mist caused by the atomization of the connecting rod bearing oil, then lubricates the cylinder liner walls and the bushes taking the piston pins. From the central lubricating duct the oil is led through further passages to the camshaft bearing. Through pipe the oil is introduced into the cylinder heads to lubricate the rocker arms and valves. The oil flows down the tappet (lifter) holes and lubricates at the same time the valve lifters.

During operation the oil pressure is checked by a pressure gauge that is led into the main oil duct. The second filter is used for the fine oil filtration; from this filter the oil is introduced into the bottom engine cover.

**Cooling System**

The water cooling system is of the forced circulation type. The water content in the cooling system is 19 litres. The pump is fitted on the front wall of the crank case together with the fan. It is thoroughly sealed against penetration of the cooling liquid. The pump as well as the fan are driven by a single V-belt. To shorten the warming-up period, the circuit is fitted with thermal regulator. The cooling liquid temperature control functions as follows: the thermal regulator closes the water flow into the radiator so that the water circulates from the engine through the water pump and back into the engine. When the cooling liquid reaches a higher temperature, the thermal regulator opens the water entry into the radiator, so that regular circulation is achieved. The engine - radiator - pump. When the cooling liquid acquires too high a temperature, i.e. above 107° C, pressure relief valve opens, the valve being situated in the inlet plug of the radiator.

During cold weather the temperature of the cooling liquid may be increased also by means of the radiator louver which is operated by a chain from the driver's seat. The temperature of the cooling water is checked by a thermometer which is located on the instrument panel and leads into discharge pipe emerging from the cylinder heads.

**Fuel System**

The fuel oil is pumped from the fuel tank by the fuel transport pump through the double fuel filter into the fuel injection pump which forces the fuel through injection pipes into the injectors, latter injecting the fuel into the combustion compartments in the pistons. The mechanical engine speed (output) regulator is situated in a box which is integral with the fuel injection pump body. The fuel charge is regulated by a hand-operated lever under the steering wheel, or by a foot pedal which is connected with the lever of the manual fuel control.

The Motorpal PV 4B 8P 115e 1419 fuel injection pump has four cylinders and a constant beginning of fuel injection. The fuel injection pump is connected by a cross coupling with the drive from the gears situated under the front engine lid. The fuel injection pump is fitted with accessory equip-
ment to facilitate starting of the engine. In order to increase the engine output in the lower and medium speed range, the fuel injection pump is provided with a correcting device. The mechanical centrifugal output regulator (governor) begins to shut down the fuel injection when the speed of 1650 r.p.m. is exceeded, and completely cuts off the fuel at the engine speed of 1800 r.p.m.

Clutch
(Fig. 41 enclosed)

The clutch is of dual type and consists of the travel clutch and the drive shaft clutch. On depressing the clutch pedal first the travel clutch is disengaged and then the drive clutch.

Front Axle

The front axle is formed by two half-axles which are pivot-mounted in the front axle bracket. It is sprung by a leaf spring mounted in the half axle arms, retractive extensions enable the wheel tread to be varied. The wheels run in taper roller bearings and are secured by a castellated nut with a splits pin.

Gearbox
(Fig. 41 enclosed)

The gearbox has four forward speeds and one reverse speed. Torque is transmitted from the travel clutch shaft, on which the clutch is mounted, to the drive shaft (27). From the drive shaft the torque is transferred by constant engagement gears (28) onto the layshaft onto which gears are keyed which transfer the torque onto the driven shaft of the gearbox. On this shaft are mounted sliding gears which are shifted by means of shifter forks by the gear shift lever (19) which passes through the instrument panel.

In the rear part of the clutch housing is the reduction for reduced speeds which is formed by double gear (16) pivoted on the reduction pin and by the reduction sliding gear which is controlled by a self-contained lever (18). When this lever is engaged, motion is transferred from the travel clutch shaft over the reduction gear (16) and the reduction sliding gear onto the drive shaft. Through the constantly engaged gear (28) the torque is transmitted onto the layshaft and in turn onto the driven shaft, and through the pinion (37), the crown wheel (38) and the differential (39) onto the rear half-axle with the aid of spur gears (40, 41). The torque transmission with different engaged speeds is shown in Table I.

Steering

Steering is effected by means of the steering nut and worm which run in an oil bath and are housed in the steering box. The movements to the front wheels are transmitted with the steering wheel, worm, mechanism and leverage by means of tie rods individually to each wheel.

Brakes

The differential spline shafts house the brake drums. Inside the drums are foot brake shoes actuated by two pedals. An engaged catch on the pedals makes it possible to brake both rear
wheels simultaneously (Fig. 2). When the catch is disengaged, the brake is applied individually to each wheel. On the outer face of the brake drums are situated the hand brake bands actuated by the hand brake located on the left hand side of the driver's seat. A slotted segment fitted on the gearbox is employed for adjustment of the foot brakes (Fig. 3/1). The segment is mounted on a shaft at the end of which the brake lock is fitted. By rotating the segment the play in the brake jaws is adjusted.

Instrument Panel
(Fig. 4)

The instrument panel is situated in front of the driver. It carries the operating and control equipment.

Switch-box (1)

The switch-box serves for connecting the electrical circuits.

Engagement of key:
position "0" - lighting of D. C. generator pilot light
position "1" - remain connected appliances from position "0"
light up: parking lights, tail lights
position "2" - remain connected appliances from positions "0" and "1", are switched on dip-lights
position "3" - remain connected appliances from positions "0" and "1", are switched off dip-
lights, long-range headlamps and the long-range pilot light are switched on.

Note: The horn and the stop lights are connected directly in the circuit.

**Oil Pressure Gauge (4) and Water Thermometer (5)**
For lighting up the dials both instruments are fitted with bulbs 12 V-1.5 W.

**The starter push button-type switch** (located on the switch for hot plugs). If the switch for hot plugs (2) is mounted on special request, the starter push-button is not supplied.

**The function of the switch for the hot plugs (2)**
Position "0" - off
1. "1" - heater plug on
2. "2" - starter circuit switched on.

**Heater Plug Pilot Light (3)**
This takes the form of a control resistance connected in series with the heater coils. It is situated next to the heater plug switch on the instrument panel. On switching over to position "2" the heater plug pilot light is extinguished.

**Contact plug for inspection lamp (8)**

**Ammeter (10)**
For lighting up the dials this instrument is fitted with the bulb 12 V-1.5 W (on special order).

**Air pressure gauge (9)**
For lighting up the dials this instrument is fitted with the bulb 12 V-1.5 W (on special order).

**Complex Panel Instrument (7)**
The motion is transmitted onto the tachometer from the drive shaft of the fuel injection pump and the compressor.

Pos:
1. Scale for engine speed (r.p.m.)
2. Scale for speed of agricultural machinery drive (r.p.m.)
3. 1st speed in km p.h.
4. 2nd speed in km p.h.
5. 3rd speed in km p.h.
6. 4th speed in km p.h.
7. Smaller red figures give the speed at reduced gear ratios in km p.h.
8. Counter of engine-hours (1 engine-hour = 100,000 engine revolutions)
9. Charging pilot light lights up on inserting the key into the switch-box and must be extinguished as soon as the engine has been started up. Should it light up during travel, it is an indication that there is a fault in the D.C. generator and that the latter does not charge.
10. Long-range headlamps pilot light
11. Direction lights pilot light
12. Pilot light without function (free)

**Electrical Equipment**

**Fuse Box**
The first fuse box has 8 poles and is mounted underneath the instrument panel. The second fuse box has 6 poles and is mounted on the radiator bracket.

**Headlamps**
The headlamps are each provided with two bulbs, one of which has two filaments 12 V—35/35 W for long-range lights and diplights. The second bulb is for parking lights, 12 V—1.5 W.

**D.C. Generator**
The dynamo is of the shunt type, fully enclosed, surface cooled, voltage 12 V, and output 150 W. The voltage regulator maintains a constant voltage of the charging current.

**Engine Starter**
The engine starter is fully enclosed, voltage 12 V, output 4 H.P. The driving pinion is brought into mesh by the coil of a solenoid switch, the main starter circuit being simultaneously closed. The starter bearings are self-lubricating.

**Stop Light and Tail Light**
The stop light is fitted with two G 12 V/5 W bulbs. The tail light has one Sulfit 12 V/5 W bulb.

**Direction Indicators**
The direction indicating lights are situated on the rear mud guards and are fitted with the one filament bulbs 12 V, 35 W. They are controlled by the direction indicator switch (6) mounted on the instrument panel.

**Hooter**
The hooter is electric — 12 V, type FGI 01-9416.04, controlled by a push-button situated in the centre of the steering wheel.
Socket for Trailer Lights

The socket for lighting up the trailer is located underneath the floor in the rear part of the tractor.

Rear Headlamp

The rear headlamp is attached to the driver's seat and is used for lighting purposes during night work. It is fitted with a 12 V/25 W bulb.

Seat

The seat is of a bowl shape and is perfectly sprung with the aid of a parallelogram and four tension springs. By means of these springs the seat may be adjusted in accordance with the driver's weight in the range of 40 to 120 kg. To prevent the seat from vibrating when travelling over uneven ground, it is fitted with two friction shock absorbers, the friction plates of which are provided with a teflona lining. The seat itself has a cover of porous artificial leather with a rubber mattress insert. To ensure complete comfort of the driver, the seat is supplemented with a removable upholstered backrest.

Differential Gear Lock

The differential gear lock is fitted on the right hand differential shaft. It serves to eliminate spin of one of the rear wheels. By operating the lock, i.e. by moving the lever on the right hand side of the driver, both differential shafts are coupled into a unit, so that the differential is put out of action and the rear wheels are driven at the same speed. The differential gear lock is automatically put out of operation by a spring mounted in the lock head.

Traction and Pivot Slat

The traction and pivot slat serves for the suspension of pulled implements. It can be adjusted into seven positions. The height of the traction slat above ground is 420 mm with 14–28 tyres.

Drive Shaft

The motion of the shaft is derived through the constant engagement gear (Fig. 41/16) from the shaft of the machinery drive clutch (41/14) onto the machinery drive shaft (41/42), in the rear part of which is located the shaft take-off. It is operated by the slotted clutch (Fig. 41/43) over a small hand lever situated underneath the driver's seat.

Bonnet, Mud Guards

The bonnet has an attractive finish and is of stamped design. The insulating wall divides the space between the storage battery and the engine. It forms a thermal insulation and at the same time also serves as structural support for the fuel tanks. The rear wheel mud guards protect completely the driver from mud and dust.
IV. TECHNICAL MAINTENANCE OF TRACTOR

The technical maintenance of the tractor must be carried out after the lapse of the specified periods of time and in the specified quality. Together with inspections of the tractor carry out also maintenance work on the employed agricultural implements since the quality of the work done depends not only on the good condition of the tractor, but also on the condition of the implements.

In the case of a new machine or after a complete overhaul, when running in, it is necessary to carry out all the specified technical maintenance operations with special care, since correct running-in of the tractor increases considerably its useful life.

For the Zetor 50 Super tractor there are the following types of technical inspection:

Shift technical maintenance: daily, carry out after 8—10 hours of operation.

1st stage of technical inspection (P I): carry out after 60 hours of operation (fuel consumption 400 litres).

Attendance of the tractor: after 300 hours of operation (fuel consumption — 2000 litres).

2nd stage of technical inspection (P II): carry out after 600 hours of operation (fuel consumption — 4000 litres).

3rd stage of technical inspection (P III): carry out after 900 hours of operation (fuel consumption — 6000 litres).

Shift Technical Maintenance — Daily

This is carried out after 8—10 hours of operation and included the following:
1. Cleaning the tractor and agricultural implements.
2. Lubrication of the tractor in accordance with the lubricating chart and instructions.
3. Checking of oil the crankcase; if necessary, topping up to the upper gauge mark of the gauge.
4. Cleaning the air precleaner bowl.
5. Replenishing fuel supplies.
6. Topping up water in the radiator — best with rain water to a height of 3 cm below the filler.
7. Checking of belt tension for fan and D. C. generator.
8. Checking tightness of fuel and oil piping, cleaners, connections of radiator and engine, drain cocks, and plugs.
10. Checking condition and active of hand brake.
11. Checking of tyre pressure.
12. Checking of steering lever ball pins, front axle mounting, attachment of front wheel hub screws, attachment of screws of rims and additional weights.
13. Checking of nuts and bolts on the connections of the individual tractor parts — connection of engine with gearbox, etc.
15. Checking of electrolyte level of the storage battery is to be carried out in summer.
17. Checking of engine run — operation regular, function of D. C. generator and voltage regulator, oil pressure in engine.
18. Rectification of any faults which may have been found.

1st Stage of Technical Inspection (P I) — after 60 hours

Carry out shift maintenance (items 1—17) and the following:
19. Lubrication in accordance with the lubricating chart.
20. Cleaning of all filters (page 21).
21. Cleaning of fuel filters (page 24) and sedimentation bowl.
22. Checking of bearing play of front wheel hubs.
23. Checking of toe-in of front wheels.
24. Checking of hand brake adjustment.
25. Checking, if necessary, adjustment of clearance between levers and sleeve of the clutch disengagement. Adjustment of the clutch pedal free travel.
26. Checking and topping up of storage battery with distilled water (during winter season).
27. Checking and, if necessary, cleaning of the radiator plates to remove outside contamination, and topping up of the radiator with water up to the lever of the overflow pipe (in a dusty environment check the cleanliness of the radiator plates daily).
28. Cleaning of the oil-bath air cleaner (in a dusty environment daily).

Attendance of Tractor after every 300 Hours of Operation (0)

Carry out shift maintenance (item 1—17) P I (item 19—28) and the following:
30. Checking of collector assembly of D. C. generator (carbon, carbon springs, and commutator). We advise that this be carried out in a specialized repair shop.
31. Topping up of D. C. generator ball bearings with lubricating grease.
32. Tightening up of cylinder heads.
33. Checking of valve clearance.
34. Checking of water pump tightness.
35. Cleaning of fuel injectors, adjustment of pressure and correct fuel dose (we advise having this operation carried out in a specialized shop).
36. Flushing of engine.

2nd Stage of Technical Inspection (P II) — after 600 hours

Carry out shift maintenance (item 1—17), P I (item 19—28), attendance
37. Lubrication in accordance with the lubricating chart.
38. Flushing of cooling system.
39. Reversing of front wheel tyres on their rims to ensure uniform wear.
40. Flushing of fuel tank.
41. Lubrication in accordance with the lubricating chart.
42. Checking of wear of pistons and cylinder liners.
43. Checking of condition and wear of piston rings; if necessary, their replacement (clearance in locks larger than 2 mm).
44. Grinding of valves.
45. Checking of tightness of screws of main and connecting rod bearings (using torque wrench).
46. Replacing of gasket underneath cylinder heads.
47. Cleaning of piston, cylinder heads, and exhaust muffler to remove carbon.
48. Checking of condition of brake linings, cleaning, and adjusting their setting.
49. Replacing of packing of the water pump.
50. Cleaning of strainer of the engine oil pump.

Note: Items 42–45 and 47, are carried out by a specialized shop. Once a year have the D. C. generator and starter thoroughly inspected in a specialized shop.

Service and maintenance

General Remarks

For securing correct and troublefree operation of the tractor it is necessary to act according to the service and maintenance instructions. You will thus avoid loss of time and money, and secure in the Zetor 50 Super tractor a reliable and highly economical help for agricultural and forestry work.

For servicing the tractor use always trade-mark oils and lubricating greases.

Use of Grease Gun

For lubricating the grease nipples use a grease gun which should be filled with clean grease. Introduce the grease gun spout into the cleaned grease nipple, and by applying hand pressure to the handle, press the grease into the nipple. The movements with the grease gun are continued until new clean lubricating grease appears in the spaces between the lubricating faces. The lubricating table for the whole tractor is given at the end of the book.

Use of Detergent and Mineral Oils

The makers employ exclusively detergent oils in accordance with the Lubricating Table which is enclosed at the end of the Handbook. The oils employed correspond approximately to the current classification Grade Premium (oils with antioxidants) or to the type HD. For this reason we recommend to respect the following principles:

1. Never mix detergent oils with nondetergent oils.
2. When changing over to engine lubrication using non-detergent (purely mineral) oil, as well as detergent oil, it is necessary to drain the old oil from the engine and to flush the engine with flushing oil in accordance with the instructions.

Should your oil suppliers of the classification Grade Premium, type HD and Grade Regular (purely mineral oil, nondetergent) specify a different procedure, it is advisable to act according to their instructions.

Maintenance Hints for the Running-in Period of the Tractor

When running-in the tractor it is necessary to pay greater attention to the carrying out of technical maintenance in order to prolong the useful life of the tractor. After 30 working hours carry out in its full extent, apart from the specified shift technical maintenance, the technical inspection of the first degree. Tighten the engine heads, carry out the valve adjustment, and check thoroughly all connections and the tightness of screws and bolts.

Change of Oil

Carry out the first change of oil after 25 working hours (consumption 160 litres of Diesel oil); the second change after 45 hours (consumption 260 litres of Diesel oil). During each of these changes of oil flush the engine with oil. Change the oil in the clutch housing and gearbox after 200 working hours (consumption of 1,280 litres of Diesel oil) and clean the housing and box with flushing oil. Further changes are carried out in accordance with the Lubrication Table.

Engine

Always top up the oil, while the engine is in standstill, up to the upper gauge mark on the dipstick.

Change the oil immediately after stopping the engine, while the oil is warm. Drain the oil by means of the drain plug at the bottom of the crankcase.

In order to adhere to the specified oil changing periods, it is necessary to watch the engine-hour counter. On each “Attendance of the Tractor after 300 Operating Hours” flush the engine with flushing oil in order to remove all contamination inside the engine. After filling 6 litres of oil into the crankcase (it is necessary to remove the filtering inserts), start up the engine and let it run for 10—15 minutes at low revolutions (600 r. p. m.). Then drain thoroughly the oil also from the oil filters. Fill the crankcase with fresh engine oil.

During each change of oil in the engine it is also necessary to clean the oil filters. Rinse the undismantled insert of the first oil filter (Fig. 5/1) using a small brush dipped in petrol or fuel oil, and dry it thoroughly. Having cleaned the insert, make sure for the meshes not to be stopped up. Sli-
the lubricating circuit the specified pressure (2.5–3 atm.) which is controlled by a pressure-reducing valve on the first oil filter while the oil is warm.

Adjust the specified pressure (Fig. 5) as follows: screw off the covering nut on the pressure-reducing valve and loosen the retaining nut. By loosening the screw the pressure is decreased. By tightening the pressure is increased. After having finished the adjustment, retighten the retaining nut and screw on the covering nut.

Adjustment of Valve Clearance
(Fig. 6)

After dismantling the valve cover turn the engine with the hand crank until it is found that the inlet valve begins to open the air entry into the inlet duct, whereupon turn the engine by one more revolution. Then check with a clearance gauge the clearance between the seating surface of the valve stem. The clearance must be checked with the engine cold.

Clearance of inlet valve 0.2 mm, Clearance of exhaust valve 0.3 mm

Should the actual clearance not comply with the specified dimensions, proceed as follows:

1. Loosen the retaining nut of the adjusting screw.
2. By screwing the adjusting screw in or out set the specified clearance and retighten the retaining nut.

Proceed in the same manner when checking and adjusting the valve clearance in the other cylinder heads.

Air Cleaner

In the interest of a long useful life and guaranteed full engine output it is necessary to carry out regularly maintenance work on the air cleaner.

Cyclone type pre-cleaner: remove the drain plug so that the coarser sediments may fall out of the sedimentation bowl of the pre-cleaner. Owing to the fact that atmospheric moisture enters also this space during operation, it is necessary to use a piece of wire to rake out the partially clustered dust in the sedimentation bowl.

Oil bath air cleaner: Screw off the butterfly nut and dismantle the cleaner. Rinse the cleaner shell, the cleaner insert and the blade distributor with the impact plate thoroughly in petrol or Diesel oil. Before reassembling dry thoroughly and fill the bowl with oil up to the specified limit. During the assembly process make sure that the lid gasket is fitted correctly. Then secure the whole air cleaner to the intake chamber and tighten thoroughly.

Make sure that the protective assembly around the intake slots of the cyclone type pre-cleaner is not stopped up with dirt; this would decrease the quantity of incoming air and the engine output would suffer.

Note:

When cleaning the oil bath air cleaner with petrol make sure that especially the cleaner insert (Fig. 1/9) is thoroughly dried, otherwise serious engine trouble may be expected.

Fuel System

Top up the tank with properly filtered fuel, always at the end of the shift.

Fuel Injection Pump

The fuel injection pump is filled with oil through an opening closed by a bleeding plug (Fig. 7/1), to which is
attached a dipstick indicating the minimum and maximum oil levels.

Regulator Housing (Fig. 8)

The regulator (governor) housing is filled with oil through an opening in the upper lid (1), a checking (2) and drain plug (3) is provided on the rear wall of the regulator housing.

Fuel Filters

Sedimentation-type pre-filter: Remove the glass bowl and wash the filtering element thoroughly in Diesel oil or petrol. After loosening the retaining nuts of the central bolts, remove the filter bowls and wash thoroughly the inserts of both filters in Diesel oil or in petrol. Reassemble the well dried inserts into the cleaned bowls and tighten thoroughly.

Note:

On reassembling make sure that the gasket of the filter bowls is undamaged and elastic. After 300 operating hours change the inserts.

Bleeding the Fuel System

It is necessary to bleed the fuel system:

a) after cleaning the fuel filters,
b) after emptying the fuel tank,
c) should the fuel cock not be open
when starting the engine (be exhausting fuel from the manifold and filters air enters the fuel system)
and when repairing the fuel system.

If the fuel system has not been bled, starting of the engine is made more difficult, the engine runs irregularly, and it may be even impossible to start the engine at all.

When bleeding the fuel system, proceed as follows: open the fuel cock (Fig. 9) and loosen the stirrup of the sludge basin of the sedimentation type pre-cleaner, so that this basin fills with Diesel oil without any air bubbles. Fix the basin by tightening the stirrup. Loosen the bleeding screws of the fuel filters (Fig. 10) and proceed to pump manually until Diesel oil without air bubbles flows out. Then tighten the screws.

Adjust the acceleration lever to the full fuel supply and loosen the bleeding screws of the fuel injection pump (Fig. 7/2). Continue to pump manually until only Diesel oil without air bubbles escapes around the screw. Tighten the right hand screw, keep on pumping for a while, and then tighten the left hand screw. After this operation continue to turn the engine, employing the accessory equipment on the fuel injection pump, until upon touching the fuel injection pipe the pressure is fell and grating sounds hear which accompany the injection of Diesel oil into the combustion space.

Adjusting Beginning of Fuel Injection

If the beginning of fuel injection into the combustion space is adjusted incorrectly (should be 17° before the top dead centre position of the piston), the motor does not run in a satisfactory manner (see Defects in operation, page 39).

Adjustment of the correct beginning of fuel injection is carried out as follows: make sure that the gauge-mark on the bearing lid of the fuel injection pump and on the driven part of the coupling (Fig. 11) coincide with one another. At this instant the first pumping piston of the fuel injection pump is in the position which corresponds to the beginning of the fuel injection. Mean-while the piston of the first cylinder of the engine should be 17° before top dead centre position at which fuel injection into the cylinder occurs. If the gauge-mark on the adjustment indicator does not coincide with the gauge mark on the fly-wheel, it is necessary to carry out an adjustment of the adjustable part of the pump drive coupling. The coupling has on its circumference a scale (Fig. 11) each di-
justable part of the pump drive coupling must be rotated in the direction of the engine.

Having carried out this preliminary adjustment, screw the capillary tube (Fig. 12) on the pipe union of the first element of the fuel injection pump. By turning over the engine, using the starting crank, (the decompression pedal must be depressed), transport the fuel into the capillary tube, and in the course of further cranking, observe carefully the fuel level in the tube; the instant the level moves, check whether the gauge-mark on the fly-wheel coincides with the gauge-mark on the adjustment indicator. Should the gauge marks not coincide, it is necessary to limit this difference by adjusting the adjustable part of the pump drive coupling (Fig. 11/1).

Note:
Direction of rotation of fly-wheel when viewing from the front of the tractor is in the clockwise direction.
The beginning of injection of the other elements is adjusted at the factory in relation to the first element.

Fuel Injector
a) Checking of injector pressure using pipe with pressure gauge (Fig. 13).

Instead of the injectors pipe connect to the fuel injection pump an auxiliary pipe with a pressure gauge. To its other end attach the injector to be tested without the upper covering nut, and adjust maximum fuel delivery. Keep turning the engine using the starting crank; by turning the adjusting screw to the left the pressure in decreased, by rotating it to the right it is increased. Keep on adjusting until at the instant of injection the pressure gauge reads a pressure of 145 atmospheres. After having achieved the required pressure, tighten the retaining nut, thread on the gasket, screw on and firmly tighten the upper cover nut. Fit the injector back into the engine.

b) Checking cleanliness of jet
1. Dismantle the injector from the head.
2. Loosen the pressure pipe cap nut on the fuel injection pump.
3. Rotate slightly the pressure pipe outside the tractor and retighten the nut.

4. Fit onto the pipe the injector to be tested.
5. By turning the engine using the hand crank (the decompression pedal must be depressed), make sure that fuel streams out of all openings. Should some opening be blocked, clean it (Fig. 14).

c) Rapid determination of faulty jet
With the engine operating, loosen successively the cap nuts on the fuel injection pump. If this changes the operation of the engine, then the respective injector is in good order. If the operation of the engine does not change, this indicates that the jet is
ways (Fig. 15). Then retighten the nut thoroughly so that the D. C. generator does not work loose.

Fig. 14

completely faulty and it should be cleaned or replaced.

Cooling System

Fill the radiator always with clean soft (rain) water to a height of 3 cm below the filler.

Check the tension of the V-belt which drives the fan with the water pump and D. C. generator. If the V-belt is not sufficiently tensioned, slip occurs, the fan and water pump lose speed which in turn reduces the water cooling capacity in the radiator and also slows down the water circulation. The maximum permissible V-belt sag when applying average finger pressure is 15 mm. Otherwise it is necessary to carry out an adjustment by loosening the D. C. generator lattice (1) nut and sliding out the D. C. generator side-}

Fig. 15

Cleaning of Radiator

During operation the radiator gets choked up with boiler scale which reduces the efficiency of the cooling system and causes overheating of the engine. For this reason it is necessary to carry out at regular intervals, i.e. after 600 operating hours, cleaning of the radiator to remove sedimented boiler scale.

Carry out the cleaning operation as follows: drain the water from the radiator and engine and fill the radiator with a solution of 750 g of caustic soda and 250 g of kerosene for 10 litres of water. Leave the solution to act for 8 or 10 hours. After this period drain the solution and several times flush the whole cooling system with clean water while the engine is running (on draining the water must be warm).

Dual Clutch

In order to guarantee correct function of the travel and drive clutch, it is necessary to check its function from time to time (Fig. 16).

The free travel of the clutch pedal should be 15±5 mm. If this specified free travel is not maintained, it is necessary to adjust it by shortening the clutch tie-rod — Fig. 16 — (free travel is reduced), or by lengthening the clutch tie-rod (free travel is increased). On the travel of the clutch pedal depends directly the clearance between the disengaging levers and the disengaging bearing sleeve, which must be respected. If there is no free travel of the pedal, the clutch slips at increased tractor pull, the tractive effort of the tractor is reduced, although the revolutions are increased.

If the engine clutch is not thrown out entirely, it is impossible to shift without noise.

Adjustment of the disengaging levers should be carried out in a qualified repair shop.

Gearbox

The moving parts of the gearbox are splash-lubricated. Easy gear shifting is determined by the tension of the springs which act on the retaining taper rollers which mesh with the segments in the gear shifting rods.

Steering Unit

The oil is filled into the steering gear housing through an opening in the steering column which is closed by a plug. Check from time to time the free travel of the steering wheel. Its correct value is 30°.

If the clearance is larger than 30°, the necessary adjustment must be car-
The clearance of the front wheel bearings are carried out as follows:

1. Lift the front axle bracket with a lifting jack in such a way that the wheels are free to rotate.
2. If an axial clearance is ascertained on the wheel circumference by applying hand pressure, the latter must be eliminated by tightening the bearing nut, having first removed the lid and pulled out the split pin.
3. After the clearance has been adjusted the wheel must rotate freely, and during this process the bearings must have almost no clearance.
4. After having carried out the above adjustment, fill the bearings with lubricating grease and secure the nut with a split pin.

**Brakes**

**Hand Brake**

During adjustment of the hand brake the rear part of the tractor is lifted up. The free travel of the hand brake should be in the range of three teeth on the ratcheted wheel.

Should the braking action be non-uniform, adjust the braking intensity on the right hand side of the tractor (Fig. 18). Loosen the retaining nut of the adjustment screw and with the aid of the adjustment screw, set the beginning of the braking action.

The uniformity of the braking effort on both sides is ascertained by adjusting the lever of the hand brake into the position where it is just about to brake, and, by rotating the wheels, finding out whether both wheels revolve with the same resistance.

If the left hand braking band has been worn to a larger extent, proceed as follows:

On the right hand side of the brake (Fig. 18) free and screw out the cistellated nut (1) and remove the regulating sleeve (2). Drive out the hand brake shaft and on the left hand side rotate gently the control sleeve (Fig. 20/1) in the grooves in such a way as to obtain improved braking action.

After sliding in the regulating sleeve (Fig. 18/2) on the right hand side even out the braking intensity by means of adjustment screws.

**Checking Brakes during Travel**

Run the tractor up to a speed of 15—20 km/hr and stop it suddenly with the aid of the hand brake. The tractor should stop without changing its direction of travel. Should it deviate to the right or to the left, an adjustment of the braking intensity must be carried out.

**Foot Brake Adjustment**

For safety reasons it is necessary that, with connected braking pedals, the tractor stop without changing its original direction of travel. The adjustment of even braking intensity is carried out according to the same swing of both ped-
dals. The free travel of the pedal from the depressed position (beginning of braking) to the floor should be 30 mm. If this clearance is not the same for both pedals, adjustment is carried out with the aid of the tie rod, the latter being shortened or lengthened (Fig. 19). If there is no possibility of screwing the tie rod out any further, screw it in partly and carry out the adjustment by rotating the movable segment (Fig. 21) by means of which the basic distance of the jaws from the drum is adjusted.

**Fig. 21**

Direction of travel

Free the segment retaining screw and proceed as follows:

**Right Hand Brake**

To achieve smaller braking efficiency slide out the adjustment lever in direction 2; to achieve larger braking efficiency slide out the adjustment lever in direction 1 (Fig. 21).

**Left Hand Brake**

To achieve smaller braking efficiency slide out the adjustment lever in direction 1 and to achieve larger braking efficiency in direction 2 (Fig. 21). The segments are deflected up to the position of the required foot pedal setting. After having carried out the adjustment, lock the position of the segments.

Having carried out this rough adjustment, finish the setting with the aid of the brake tie rods (Fig. 19).

**Checking Foot Brakes during Travel**

Proceed in the same way as for the hand brake. In this case it is necessary, however, for the brake pedal catch to be engaged.

**Filling of Tyres with Water**

The weight of the tractor may be increased without the use of extra weights by filling the inner tubes with water. This measure removes the hard manual work necessary for fitting the cast iron weights. A further advantage of this measure may be seen in the fact that the tyres, the inner tubes of which are filled with water, are subject to smaller stresses than tyres with fitted with extra extra weights.

**Actual Filling**

Necessary tools and accessories:

- a) jack for lifting the rear wheels;
- b) rubber hose with an inside dia. of 13 mm (length according to need);
- c) filling water valve (Fig. 22)

**Fig. 22**

**Filling procedure**

a) Unscrew the air part of the inner tube valve (Fig. 23).

b) Screw onto the bottom part of the inner tube valve the water valve body, having first removed from it the rubber hose.

c) Onto the water valve body screw the upper part of the inner tube valve with the filling hose in position, and connect the other end of the hose to the filling source, i.e. directly to the water tap or to a funnel, can, etc., situated in an elevated position. Cans are generally used for filling with an anti-freeze mixture. Turn the wheel so that the valve is in its top position (Fig. 23). Keep on filling the inner tubes until the liquid starts to escape through the filling water valve hose (Fig. 24).

d) After having filled the inner tubes with water, unscrew again both parts of the filling water valve and pump up the inner tubes with air to the specified pressure, which is necessary to check with the pressure gauge. Having pumped up the tyres and checked the pressure, never forget to close the valve by
screwing on the protective valve cap.

Procedure for Letting Water out of Inner Tubes

a) Unscrew the air part of the inner tube valve. Take care — the water will squirt out! As in the course of letting out the water a vacuum may occur in the tube, thus preventing free water discharge, it is necessary to turn the wheel from time to time so that the valve reaches its upper position. Thus air enters the tyre and equalizes the vacuum.

b) The water residue which remains in the inner tubes may be removed with the aid of the filling water valve, i.e., screw onto the bottom part of the inner tube valve the water valve body, Part No. 17.8553, and insert the rubber hose again.

Screw onto the filling water valve body the air part of the inner tube valve. Pump air into the inner tube until the liquid ceases to flow out from the inner tubes through the hose in the body, i.e., until the air pressure in the inner tubes expels the liquid through the water valve hose (Fig. 25).

c) Having emptied the inner tubes, screw out the water valve, screw back onto the bottom part of the inner tube valve the air part of this valve, and pump up the tyres again with air to the specified pressure.

Do not forget to screw on the protective valve caps!

Antifreeze Filling

When there is a danger of frost, the inner tubes must be filled with an antifreeze mixture. As the antifreeze liquid for filling tyres we generally recommend a solution of calcium chloride $\text{CaCl}_2$ in water. In a concentration of 20 per cent and a density of 1.18 (22° Bé) this prevents freezing up to $-19^\circ\text{C}$ and in a concentration of 30 per cent, density 1.29 (32° Bé) up to a temperature of $-55^\circ\text{C}$.

Although this solution is not dangerous (it behaves similarly as a domestic salt solution), the following precautions are necessary:

1. When dissolving it is necessary to add the flakes or the calcium chloride solution into the water, never the other way round.
2. By dissolving of the calcium chloride the solution is heated up. Before filling it is necessary to let the solution cool.
3. Neutralize the acidity of the solution by adding 1 per cent of quicklime (by weight of the calcium chloride).

4. Do not permit the solution to come into contact with metal, especially with the electrical equipment of the tractor. This would lower the corrosion resistance of the metals. The solution has a high electrical conductivity. The metal of the inner tube valve will not be damaged by the solution.

5. This antifreeze solution must not be used for the radiator.

6. It is advisable to wash off spilled solution drops on the metal parts as well as on clothing.

Fig. 25

Voltage Regulator

If the voltage regulator is out of order, call in a specialist to carry out the repair. Any unauthorized interference may damage and destroy not only the voltage regulator, but also the D.C. generator.

6 St 165 Storage Battery

Operating and Maintenance Instructions for the special 6 St 165 Storage Battery

Storage battery 6 St 165, tension 12 V, is provided with microporous separators.

Spare storage batteries are supplied uncharged and dry. They must be stored in a special dry room with an even temperature within the limits of $+15^\circ\text{C}$ to $+30^\circ\text{C}$.

Technical Data

The normal discharge current for a 20 hour period of discharge up to a final voltage of 10.5 V of the battery is 8.2 Amps.

The charging current for the first charge (putting into operation) for a period of 50 hours is 10 Amps.

The normal charging current (charging outside the tractor) for a period of 13 hours is 16.5 Amps.

The maximum permissible current for the D.C. generator and voltage regulation 2.4—2.6 V per cell (i.e. 14.4 to 15.6 V for battery) is 82 Amps.

The charging voltage for charging the battery outside the vehicle must be adjustable within the limits of 2.1 V and 2.8 V per cell.

The electrolyte density for a fully charged and properly maintained sta-
rage battery at a temperature of 25° C is 1.28, i.e. 32° Bé — in the tropics 1.23, i.e. 27° Bé.

Putting Storage Battery into Operation

1. Remove the inserts which may be underneath the plugs, or remove the tape blinding the vent holes in the plugs. The new, not yet charged storage battery must be filled with chemically pure sulphuric acid of a density 1.28 (32° Bé) and 1.23 (27° Bé) for tropical regions, i.e. up to a height of 15 mm above the upper rim of the plates. The acid temperature should not exceed 25° C.

2. The storage battery is left to rest for 3—5 hours so that the plates get thoroughly soaked in acid. If the electrolyte level sinks, top up with the same type of acid.

3. The storage battery must under all circumstances be connected only to a direct current source, whereby the positive pole of the battery is connected with the positive, and the negative pole of the charging source.

4. For the first time the storage battery is charged with a 10 Amp. current for about 50 hours until the electrolyte density reaches 1.28, voltage 2.5—2.6 V per cell, and does not change within a further charging period of 2 hours.

5. If at the end of the charging operation the acid has a higher density than 1.28, it is adjusted by the addition of distilled water to the proper density and level.

6. Before fitting a storage battery thus charged for the first time to tractor which will not be put into immediate operation (e.g. transport on railway cars) it is recommended to discharge it with normal discharge current to 1.75 V per cell (10.5 V for the battery), and then to charge it again, using normal charging current, for about 13 hours to the fully charged condition. Never discharge the storage battery to more than 10.5 V.

7. After having finished charging, wipe the storage battery dry and secure it thoroughly to the vehicle (pole of storage battery is grounded).

8. Apart from the above described normal charging when putting the storage battery into operation, it is possible to carry out shortened charging, i.e. 18 Amps. for a period of 12 hours. This shortened charging is intended for rapid putting of the tractor into operation, provided that the tractor operates continuously, i.e. that the battery will be charged and discharged. As a matter of principle, this method of charging must not be employed for storage batteries which will not be used immediately on tractors in operation, or for batteries which are more than three months old. On the first possible occasion carry out normal charging in accordance with article 6.

Care and Maintenance of Special 6 St. 165 Storage Battery

1. The storage battery must be inspected at regular intervals, regardless of the way the vehicle is used, even though there is no apparent fault of the battery. During this inspection it is necessary to check the electrolyte density (1.28, in the tropics 1.23) and the voltage of the battery. If necessary, top up the electrolyte with distilled water; the electrolyte level must be 15 mm above the upper rim of the plates. This inspection is necessary every day in summer and every week in winter.

2. The storage battery voltage must be measured under load. If no special voltmeter with an inserted loading resistor is provided for this purpose, check the voltage after switching on all the vehicle lights and leaving them on for about 1 minute; the engine must, of course, be at rest. When checked in the above way the fully charged cell has a voltage of about 2.1 V per cell and the whole storage battery 12.6 V. A storage battery which has been discharged to the permissible limit has a cell voltage of 1.8 V.

The following mutual relation exists between the voltage and the density of the electrolyte:

<table>
<thead>
<tr>
<th>Density Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully charged</td>
</tr>
<tr>
<td>Discharged</td>
</tr>
</tbody>
</table>

The voltage is, of course, measured when taking load from the storage battery.

The density is based on a temperature of 25° C.

3. If on checking the storage battery it is found that the total voltage, provided the electrolyte level is correct, is 10.8 V, the battery must be charged outside the vehicle.

4. When charging outside the vehicle, normal charging current is used for a period of about 13 hours. The charging voltage must be adjustable within the range of from 2.1 to 2.8 V per cell (12.6—16.8 V for the battery). The storage battery is fully charged when:

a) the acid density in all cells reaches the value of 1.28 and does not change within two hours,
b) the cell voltage (measured on load) reaches 2.6—2.7 V and does not change within two hours of further charging,
c) when in all cells the positive as well as the negative plates gas.

If during charging the electrolyte temperature reaches 40° C, it is necessary to reduce the charging current or interrupt the charging and allow the storage battery to cool down. At the same time it is necessary to respect the specified Amp-hours for charging.

5. If the storage battery is out of service, top it up every month for about 2—3 hours with normal charging current. Every three month discharge it down to 1.75 V per cell (10.5 V for the battery) with normal discharge current and charge it again with normal charging current to the fully charged condition. The storage battery must never be left to stand without electrolyte or in a discharged condition, since it may be damaged in this way.

It is recommended to carry out charging and discharging every third month even in the case of a storage battery which is in actual service.

6. Special attention and continuous inspection are necessary for the storage
battery during frosty weather (atmospheric temperature falls below 0°C) when it is loaded to a greater extent by using lights and by more difficult engine starting; in this period, on the other hand, the tractor travels less than in summer, so that the storage battery is charged to a smaller extent. During low temperatures the storage battery will supply only part of its capacity, whereas the requirements for starting current under these conditions are considerably higher. Apart from that, in the winter period, the discharged battery is endangered by freezing of the electrolyte, since the temperature at which the electrolyte freezes depends on its density. Electrolyte with a density of 1.28 in a fully charged storage battery freezes only at a temperature of -58°C, whereas the electrolyte in a discharged battery with a density of 1.14 freezes at -11°C. Therefore in winter the storage battery must not be allowed to become discharged.

If the vehicle is not used during the period of frosts, it is advisable to dismantle the storage battery, charge it, and store it in a room with a constant temperature (minimum around +5°C).

7. The surface of the storage battery must be clean and dry, the plugs properly tightened, and their vent holes free of all contamination, so that gassing is facilitated. Clean the poles with hot water and impregnate them with lubricating grease or thick oil. Contaminated connections limit the passage of current and are the source of faults.

8. During the charging process do not approach the storage batteries with a naked flame and do not disconnect the batteries from the charging source with the current on, since there is danger of the sulphuric acid vapours exploding.

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V. DEFECTS IN OPERATION AND THEIR RECTIFICATION

General

The cause of defects is generally to be found in neglect of the operating and maintenance instructions. Through normal wear, which manifests itself mainly by increasingly noisy operation and reduced output, defects may occur, if no attention is paid to this fact.

Instructions for Rectifying Faults:

1. Repair every fault, even the most minute one, at once; if this proves impossible, then at least at the end of the daily shift.

2. Defects which the driver is unable to remedy himself must be repaired in a specialized repair shop.

When repairing defects it is necessary to act according to a certain plan and to try to find the cause of the defect on the basis of certain signs before actually starting to dismantle some part of the tractor.

Easier and more rapid determination of the cause of a defect is greatly aided by a perfect knowledge of the design of the whole tractor and the function of its individual parts. In ascertaining the cause it is necessary always to proceed from the simplest possibility to the more complicated one.

Engine Defects

It is impossible to start the engine

Cause:

1. Fuel injection pump does not transport fuel, since:
   a) fuel cock is closed
   b) no fuel in fuel tank
   c) fuel filters strongly contaminated
   d) air has entered the fuel system
   e) pistons of fuel injection pump worn

Remedy:

Open fuel cock
Top up fuel supply
Clean fuel filters (see page 24)
Bleed fuel system (see page 24)
Carry out replacement in workshop; inspect fuel filters; if necessary, replace the inserts.

Adjust lever for full delivery, or use extra starting equipment if necessary

2. Throttle lever not adjusted for full fuel delivery

3. Fuel injection pump injects too late or too soon:
   a) tappet roller worn owing to insufficient lubrication
   b) cams of fuel injection pump cam shaft worn

Repair in specialized shop
Repair in specialized shop
c) incorrectly adjusted injection advance
   Note: By specialized is also meant a service repair shop.

**Engine Runs Irregularly**

**Cause:**
a) air in fuel piping
b) fuel piping tightening nuts are loose (especially on fuel injection pump)
c) one of injector jets stopped up
d) expansion valve untight
e) broken expansion valve spring
f) broken fuel injection pump piston spring

**Remedy:**
Bleed fuel system (see page 24)
Tighten nuts
Check (page 27) and clean (page 28)
Replace in specialized shop
Change in specialized shop
Change in specialized shop

**Engine Output Is Insufficient**

**Cause:**
a) one of the jets is blocked up
b) injectors are badly adjusted
c) pumps injects too soon, engine runs hard
d) pump injects late — engine smokes
e) faulty function of jet (bad atomization)
f) pump pistons are worn
g) broken fuel injection pump piston spring
h) insufficient compression pressure — there is offered a little resistance when turning the engine by means of the hand crank:
   1. incorrectly adjusted valve clearance
   2. knocked out valve seats
   3. a cylinder head gasket is faulty

**Remedy:**
Check or replace
Have checked in specialized shop
Adjust pump to correct injection advance (page 25)
Replace jet
Have repaired in specialized shop; clean fuel filters
Repair in shop
Adjust correctly (page 23)
Have repaired in specialized shop
Replace gasket — in place of damaged gasket head covered with smoke

**Engine Knocks Strongly and Regularly**

**Remedy:**
a) fuel injection pump injects too soon
Adjust pump to specified injection advance (page 25)
b) incorrectly adjusted valve clearance (valves knock in seats)
Adjust to specified clearance replace
Repair in shop

**Engine Smokes (black smoke)**

**Remedy:**
1. Fuel injection pump supplies too much fuel:
   a) travel of control rod too big
   b) bad injector atomization
2. Jets are plucked up
3. Faults in engine:
   air cleaner is blocked up

**Defects in Lubricating System**

**Defect:**
Pressure-gauge does not indicate

**Cause:**
a) Defect of pressure-gauge
b) too little oil in crankcase
c) leak in lubricating circuit piping
da) defect of oil pump
e) quite stopped-up oil filter

**Remedy:**
Repair in specialized shop
Top up (gauge)
Check piping connections
Repair in specialized shop
Clean (page 21)

**Pressure sufficient at higher engine speeds, insufficient at lower speeds**

**Cause:**
a) defect of pressure-gauge
b) reduction valve not tight

**Remedy:**
Repair
Take out, clean, repair
Defects in Electrical Equipment

Cause:  
1. D.C. generator does not charge  
(charging pilot light on also at higher speeds)  
2. Starter does not work  
3. Some appliance does not function  

Remedy:  
1. Have repaired in shop  
2. Have repaired in shop  
3. Check appropriate fuse  
   If fuse is in order, check with appliances for bulbs condition of bulb. If the fault is not found even here, have electrical equipment seen to in specialized shop.

Defects of Hydraulic System

When working with the hydraulic equipment, two main defects may occur which can be remedied without the help of a specialized repair shop.

1. Hydraulic equipment does not lift at all  
   Cause:  
   Too little oil (up to tractor production No. 19528 in the hydraulic lift box, from tractor production No. 19529 in the gear box — the oil filling in the gear box and hydraulic power lift box is common)  
   Dirt underneath safety valve  
   Choked strainer  
   Fatigued safety valve spring  
   Oil pump drive not connected  

   Remedy:  
   Top up  
   Clean  
   Clean  
   Replace  
   Throw in both the small levers for the pump drive (Fig. 32, 33)  
   Clean  
   Replace  

2. Hydraulic equipment lifts slowly and with small power  
   Cause:  
   Dirt in safety valve  
   Somewhat fatigued safety valve spring  
   Low operating pressure  

   Remedy:  
   Clean  
   Replace  
   Adjust pressure (page 55)
Checking of New Tractor

Before actually beginning to run-in the tractor, check the accessories and carry out an external inspection of the whole tractor. While checking the completeness of the accessories, check not only the number of tools and spare parts, but also their condition (unprotected parts must have a coat of protective paint or be treated with preservation grease). In carrying out an internal inspection make sure whether the tractor is fitted out as specified in the acceptance protocol, and that no part of the tractor shows any sign of damage.

After this inspection prepare the tractor for work as follows:

1. Lubricate thoroughly all lubricating points and check the oil level according to the lubricating chart and maintenance instructions.
2. Fill the fuel tank with pure Diesel oil, fill the radiator with water, and check the pressure in the tyres.

Running-in of Tractor

In order to prolong the useful life of your tractor, to ensure a minimum fuel consumption, and secure troublefree operation, it is necessary to run-in the tractor perfectly.

Running-in is carried out for a period of 60 hours. First carry out running-in of the unloaded tractor for a period of 20 hours, using all the speeds, including the reduced speeds. In doing this check the function of the hydraulic equipment and of the drive shaft. On the road use higher and in the field lower speeds.

Carry out running-in of the loaded tractor by means of gradual loading. It is best to use light agricultural implements (harrow, sowing machines), on the road, using a partially loaded trailer (half the tractor pull).

Preparing Tractor for Travel

Before beginning work with the tractor, check the amount of fuel, water, and oil, and carry out a detailed inspection of the whole tractor: in doing so tighten especially the wheel screws, make sure of the perfect condition of steering tie rods and pins and of the correct function of all brakes; check the tyre pressure.

Starting the Engine

Before starting up make sure that the gear shifting lever is in neutral position, that the auxiliary drive levers are disengaged (compressor, power take-off shaft), and that the hand brake is in its operating position.

Adjust the fuel control hand lever for maximum delivery and depress the decompression pedal. Insert the switch key into the switch box. Facilitate the starting by depressing the clutch pedal and by using the correction starter (Fig. 26). After having carried out these functions, depress the starter push-button, after the first turns of the engine, release the decompression device lever and after the engine starts release the starter push-button. Since the tractor is provided with a switch for hot plugs (on special order), all the functions are carried out in the same way as when starting the engine by means of the starter push-button, with the difference that the lever of the switch for the hot plugs is turned to position "1" and left glowing in this position for 1 minute. After having carried out the glowing, the lever is changed over to position "2".

Note:

Before using the extra starting equipment adjust the fuel control hand lever to the maximum delivery.

Do not start continuously for longer than 10 seconds!

If you do not succeed in starting the engine the first time, repeat the whole procedure again after 30 seconds. After having started, let the engine warm up at 700 to 800 r. p. m. for a period of 1 minute, then at 1,200 r. p. m. so that the oil flows in a sufficient volume to all the lubricating points.

The water thermometer must show a minimum of 40° C. Check on the pressure gauge the correct oil pressure, which should be 2.5—3 atmospheres for a warmed up engine.

Note:

If the oil pressure gauge reads 1 atmosphere, in a worn-out engine 0.5 atm., the engine lubrication is still sufficient.

Never allow the tractor to move until the engine has been thoroughly warmed up — without load at least to 40° C — with load at least to 60° C.

While warming up the engine make sure that the engine operates regularly, without knocking and excessive noise.

Operating Tractor during Travel

The control assembly of the whole tractor is shown in Fig. 27. During travel all pedals and levers may be comfortably operated from the driver's seat. It is also easy to check all instruments situated on the instrument board.

Starting Tractor Moving

The tractor is ready for travel only when the engine has been warmed up, and emits a regular sound.

When putting the tractor into motion proceed as follows:

Reduce the medium engine speed to no-load speed. Depress the clutch pedal to the second resistance position and engage the appropriate speed, which must be done without the slightest effort. Provided the tractor is standing on level ground, free the hand brake: if the tractor is standing up hill, release
the brake and simultaneously engage the travel clutch.

If it proves impossible to engage the speed, this means that the gears are standing tooth against tooth. Therefore engage the clutch again, disengage it again, and engage the speed, whereupon slowly release the clutch and increase the engine speed until the tractor gets into continuous motion.

Putting the tractor into motion with driven agricultural implements:

Having fully depressed the clutch pedal engage the drive shaft in such a way that the lever situated in front of the driver's seat (Fig. 32) is turned in forward direction. After gradually releasing the clutch pedal and effecting a slight increase of engine speed, the driven agricultural implements are set into motion; check for correct operation.

Control of Fuel Supply

The throttle may be controlled by a hand lever (Fig. 27/6) or by a foot pedal (Fig. 27/4). When driving along roads use the pedal and when working in the field the hand lever.

Checking Water Temperature

While the tractor is operating, the water temperature is controlled automatically by a thermal regulator and manually by radiator shutter.

Note:

The overpressure valve of the radiator lock makes possible to reach the temperature to 107° C without exerting any influence upon the tractor operation. This device enables to make use of tractors even when the atmosphere temperature is higher. The optimum operating temperature is 90—95° C.

Maintain the operating temperature of the engine according to our instructions!

Travel and Selection of Speeds

Having started the tractor moving, further speeds are engaged in the following way:

Reduce the engine speed, depress the clutch pedal, disengage the gear, then wait for a while and engage the next speed; then engage continuously the clutch. The individual speeds must be engaged without noise and continuously. This may be mastered after short practice in handling and mutual cooperation of the respective pedals and the gear shifting lever. The changeover from higher to lower speeds is recommended with the use of „intermediate gas”, i.e. reduce speed, disengage the clutch, disengage the previous speed, engage the clutch, increase speed (depending on the actual speed of travel), disengage the clutch, and introduce a lower speed. The reduction is engaged by means of a lever which is situated on the gearbox lid (Fig. 27/8).

Reduced speeds are employed for jobs which require slow travel. Never use reduced speeds to achieve an increasedtractive pull, since the gears of the reduction are not designed for largetractive pulls.

The clutch is used only for engaging the various speeds and in the case of sudden braking. Never reduce the speed of the tractor or overcome increased resistance by letting the clutch slip. While driving, do not keep your foot on the clutch pedal! The drive clutch for agricultural implements is used to disconnect this drive.

The advantage of the dual clutch lies in the fact that, e.g. when working with the moving machine, the latter becomes overloaded, whereupon the travel clutch is disengaged, the moving machine is freed without interference on the part of the driver, and by engaging the travel clutch again, the tractor continues to operate.

Select the appropriate speed in accordance with the type of job the tractor is called upon to do. Such a speed may be considered economical at which the tractor is still capable of
developing the necessary tractive effort for the job in hand. The minimum operating speed slight load - 1,000 r.p.m. with considerable load - 1,300 r.p.m.

When working in the field, use the same speed for putting the tractor into motion as that which will be employed for the actual work.

When driving along roads, use the foot throttle control. In the field adjust the engine speed with the hand lever, thus being able to concentrate more fully on the operation of the implements.

When driving uphill, engage before the beginning of the climb such a speed which will enable the tractor to overcome the slope without difficulties.

For going downhill use the same speed as you would use to overcome the slope in the opposite direction. When going downhill, use the brakes as well as the engine for braking. Should it become necessary to brake the tractor quickly, disengage the clutch and simultaneously depress completely the brake pedal. During short stops of the tractor do not switch off the engine, but let it run at no-load. Frequent starting leads to wear of the storage battery and the starting equipment. Should one of the rear wheels slip when operating in the field or in heavy ground engage the differential gear lock (Fig. 27/9); on freeing the lever, the differential gear lock is automatically disconnected.

When turning the tractor, it is absolutely necessary to have the differential gear lock disconnected.

To secure the smallest radius of rotation when working in the field, brake somewhat the rear wheels, i.e. depress the foot brake (the foot brake ratchet must be slid out — Fig. 28) on the side to which you are turning.

When travelling with a trailer, the driver must at all times consider the overall length of the group; the trailers go through curves with a smaller radius than the pulling vehicle.

Stopping vehicle: Reduce the speed, depress the brake pedal, then the clutch pedal, and brake to a complete standstill. The whole braking process must be uniform. After stopping, secure the vehicle by means of the hand brake and transfer the gear shifting lever to neutral. Do not stop the engine immediately, but let it run for 1—2 minutes at a low speed, which facilitates gradual cooling. Stop the engine by adjusting the throttle control lever to zero position.

To prevent air from entering the fuel system, leave the fuel cock open on stopping (if not for a long period of time).

Change of Front and Rear Wheel Track

The front wheel track can be adjusted in three ranges (Fig. 31) as follows:
1. Insert a lifting jack underneath the front axle bracket and lift the front part of the tractor so that the wheels do not touch the ground.
2. Loosen screws M 18 (1) which secure the steering arms (2) to holders (3), and then lift out the arms from the grooves in the holders.
3. Rotate the steering arms along the pivot pins until the pointer (4) is transferred to the gauge-mark which corresponds to the respective setting of the wheel track. Secure this position by tightening the screw (1).
4. Loosen the screw which retains the position of the adapter (Fig. 29/1).

5. Loosen the nuts (5) of the tightening bolts and slide out the adapters into the selected position.
6. Retighten the bolt (29/1) as well as the tightening bolt nuts (5).

When changing the wheel track on a tractor on which the toe-in of the wheels has not been damaged by a crash, do not touch the steering rods.

To check the toe-in of the front wheels, use the tip of pointer (4) on the left and right hand steering arm. This must correspond to the appropriate setting of the wheel track, i.e. when the wheel track is adjusted to 1280 mm, it points to the first gauge-mark in the direction of travel, and for further wheel tracks it points successively to further gauge-marks in backward direction.

Check the front wheel toe-in by means of the adjustable gauge on the largest rim diameter in accordance with Fig. 30. If the toe-in does not correspond to the given limit (8—10 mm) even if pointer (4) has been properly adjusted (as a result of a crash or by
Pumping Tyres

Pump the tyres to the specified pressure.

Front tyres: for ploughing and road transport to 2.75 atmospheres.

Rear tyres: for ploughing and road transport to 1.5 atmospheres.

A pressure reduction when ploughing increases the adhesion of the wheels. Insufficient pumping, however, reduces the useful life of the tyres.

Operation in winter

To secure smooth operation in winter, especially in the period of heavy frosts, it is necessary in the first place to prepare the vehicle thoroughly for the cold season. Extra careful attendance and maintenance of vehicle as well as correct engine start and driving technique are essential.

Having stopped the engine cover the engine radiator or the whole engine so that gradual cooling is secured.

Starting Engine at Low Temperatures

When going over to operation under low temperature conditions, it is necessary to replace summer oil with winter oil. It is advisable to fill the cooling system with an antifreeze mixture, having previously cleaned the radiator to remove mineral sediments. Crank manually the engine several times, having simultaneously disengaged the decompressor, used the extra starting equipment set the throttle lever for maximum fuel delivery, and pressed down the clutch pedal. At temperatures —15°C and less drain the oil from the engine, before starting, heat up the oil to 70°C and pour it into the crankcase. Flush the radiator with warm water, first, however, of a maximum temperature of 60°C. Only then may the water temperature be higher. The drain cocks must be left open until warm water flows out through them. Then proceed to carry out the normal starting operations. Pour warm water through the radiator even at temperatures of —5°C, if the starting equipment (storage battery, correction starter) is not entirely in order.

 involuntarily shortening or lengthening of one or both steering rods), it is necessary to adjust the steering rod length and thus also the toe-in.

Carry out a change of the steering rod length as follows: Loosen the nuts (6) and rotate the steering rod to the right when shortening, or to the left when lengthening. Having carried out this adjustment, tighten the nuts thoroughly.

Change of Rear Wheel Track: (can be adjusted to 4 positions)

First lift the back axle of the tractor by means of a lifting jack. Then loosen the screws in the hub and shift the wheel to the required track according to the gauge-marks in the half-axle shaft.

Then thoroughly tighten and secure the screws. The gauge-marks in the half-axle shaft correspond to the gauge marks for track adjustment on the front axle.

When changing the last two tracks, it is necessary to turn the divided disc. If the wheels are fitted with extra weights, these must be dismantled before attempting to change the wheel track.
VII. SPECIAL ACCESSORIES OF TRACTOR

General

At the request of the purchaser the following specialized accessories of the tractor can be supplied: hydraulic equipment with three-point suspension for suspending carried implements, compressor with air cleaner and tyre-pumping equipment, belt pulley located on the rear wall of the gearbox, cab for the driver, double fitting of rear wheels, extra weights for rear wheels, semi-tracklayer (description, operation and maintenance in special handbook), pneumatic brakes (description, operation and maintenance in special handbook), front mud guards, bottom exhaust, ammeter, air pressure gauge (will be supplied with pneumatic equipment), ploughing wheels.

Hydraulic Power-lift

The hydraulic equipment is situated on the upper part of the gearbox. The pump is driven from the drive shaft and is put into operation by a lever on the hydraulic equipment lid (Fig. 33/1).

Operation of Hydraulic Equipment (Table II)

The pump is connected. Control lever (1) shifts from position C to position A — implement is lowered. The gate valve (28) is in position according to Fig. 1 (suction openings closed, so that the pump works under no-load conditions).

The weight of the carried implements displaces the oil by means of the piston through pressure pipe (29) and oil distributor (15) into delivery pipe, it flows through open drain passage of distributing gate valve (Fig. 1) which leads to the gearbox.

Action of hydraulic equipment with control lever (1) in position B.

By shifting control lever (1) to position B, manual adjustment tie-rod (22) slides the gate valve into position according to Fig. III, so that the suction passages are open and the pump forces oil through delivery pipe into oil distributor (15), while through pressure pipe oil (29) the oil is driven underneath the piston which is lifted by the oil pressure and transfers its movement through piston rod (25) and piston rod lever (23) onto upper shaft (11), on which, in grooves, the arms of the hydraulic equipment are fitted.

As soon as the piston reaches the position corresponding to position B, the automatic control tie-rod (3) which is attached to piston rod lever (23) moves in downward direction and slides the gate valve out to the position according to Fig. II, so that the pump does not supply any more oil and the piston remains at the point to which the control lever in position B corresponds. This position control facilitates adjustment of the working implements to the position required for each particular job. On the hydraulic equipment lid a safety valve (12) is situated which, on stopping of piston rod lever (23), opens an oil passage directly into the lid of the hydraulic equipment.

Hydraulic power lift distributor with anti-skid device

Hydraulic power lift distributor serves for distributing the pressure oil:
1. to the hydraulic inner periphery,
2. to the anti-skid device,
3. to the outer periphery.

The principle of the anti-skid device consists in relieving and transferring a portion of the plough weight (from 50 to 75 per cent) to the tractor rear wheels. Relieving is effected in such a way that only some of the oil which is regulated by a handwheel, located on the hydraulic power lift distributor, is allowed to pass under the hydraulic power lift piston.

Outlets for the outer periphery serve for the application of implements and machines which have their own hydraulic periphery. The first outlet (Fig. 34/4) serves for oil waste from the outer periphery to the hydraulic power lift box, the second outlet (Fig. 34/5) serves for the pressure oil supply to the outer periphery.

On the hydraulic power lift distributor, the reduction valve is located, by means of which the pressure in the hydraulic periphery is set and which effects simultaneously the function of a relief valve, as it opens admission directly to an area in the hydraulic power lift cover, when the pressure increases above the permissible limit (120 atm.). On the distributor there is also a taper valve for adjusting the relieving force. Adjusting of the taper valve is carried out by a handwheel (Fig. 34/B).

Controlling the hydraulic power lift distributor is carried out by a small lever (Fig. 34/A) which is located on the distributor body. The function of the hydraulic power lift distributor at the individual positions of the distributor lever is as follows:

position "1" — the inner periphery is connected (the control proper of the lifting and lowering of the implements is carried out by the small lever for hydraulic power lift control — Fig. 33/2);
position "2" — the anti-skid device is connected;
position "3" — the outer periphery is connected.

The application of the anti-skid device when ploughing

The plough is connected to the three-point suspension and the hydraulic power lift disconnecting lever (Fig. 33/2) is shifted to position "lowered". The distributor control lever "A" (Fig. 34) is shifted from position "1" (basic position when lowering the implements) to position "2" and the hydraulic power lift disconnecting lever is shifted to the position "lifted". Now the oil pressure for the anti-skid
device is adjusted (to be carried out always at the beginning of ploughing). The adjustment of the pressure is effected by screwing in the handwheel "B" (Fig. 34), this increasing the oil pressure under the hydraulic power lift piston. As soon as the pressure attains such a magnitude that the plough starts to lift, the handwheel is turned by one turn back (back turning is to be carried out according to the plough weight).

At the turning point, the distributor control lever "A" is to be shifted to position "1", this resulting in the plough lifting. Lowering the plough into engagement is carried out by shifting the hydraulic power disconnecting lever (Fig. 33/1) to the position "lowered" and the anti-skid is put in operation by shifting the distributor control lever to position "2" and by shifting the hydraulic power lift disconnecting lever to the position "lifting".

To adjust the pressure in the hydraulic periphery:
1. screw off the reduction valve cap nut (Table II, pos. 8),
2. screw off the cap nut of the outer pressure oil outlet,
3. screw a pressure-gauge onto the pressure oil outlet,
4. adjust the distributor lever and the hydraulic control lever into position C — lifted,
5. the pressure-gauge will indicate the oil pressure. If it is less (more) than 120 atmospheres, tighten (loosen) the reduction valve set screw.

**Operation of Hydraulic Equipment**

The lever for engaging of clutch of machinery drive shaft (Fig. 32) push out in the forward direction. The pump is put into operation by means of a lever situated behind the driver's seat (Fig. 33/1). The actual lifting and lowering operations can be accomplished comfortably by means of a lever from the driver's seat (Fig. 33/2). With the aid of an adjustable stop on the lever segment the depth of lowering of the implements can be adjusted according to need.

**Instructions for Hitching Carried Plough**

With ploughs of Czechoslovak manufacture it is always necessary that the depth of the ploughing control wheel run along the ground. The width of plough engagement is determined by rotating slightly the cranked axle so that the crawl of the last plough share leans more against the wall of the furrow.

The upper tie-rod is used to adjust the horizontal position of the plough, i. e. so that all shares plough to the same depth.

Adjustment of the horizontal plane in the lateral plough axis is carried out with the aid of the crank of the right hand suspension tie-rod housing; according to the type of soil, the shares are placed more or less on the cutting edge.

Should the hydraulic system not be in use, switch off the hydraulic pump drive.

**Three-point Suspension (Fig. 35)**

The three-point suspension is made up of two implement tie rods (3) which are situated on the rear half-axle sleev-
ves. The right-hand suspension tie-rod can be adjusted with the aid of a crank. The third suspension point is formed by strut tie-rod (1) mounted on a ball pin in the hydraulic equipment lid. The length of the strut tie-rod can be adjusted from the driver's seat. All tie-rods run in ball pins so that lateral swings are facilitated, the latter being limited by locking chain (2).

During transport the implements are locked by means of a chain which is hung onto a pin mounted in the hydraulic equipment lid.

Compressor

The compressor is of the single-cylinder type, stroke 40 mm, bore 60 mm, cylinder capacity 113.1 cu. cm. The piston is fitted with two packing rings and two oil control rings.

The compressor is fitted to the compressor drive housing. It is driven by a gear mounted on the fuel injection pump drive shaft. The compressor head can be removed, and is fitted with two automatic valves; one is a suction valve, the other a delivery valve; the aspirated air is cleaned by passing through an air cleaner. The compressor is lubricated automatically from the crankcase.

Tyre Filling Equipment

The intaken air passes from the compressor into the tyre-filling equipment which at the same time acts also as an oil separator and air cleaner. Into the head a valve is screwed which, on an increase of pressure to 10 atmospheres, exhausts the excess air. In the bottom part of the tyre-filling equipment is situated a drain screw for draining water and oil.

Maintenance

The compressor parts can be exchanged. We advise ordering the suction and delivery valve as a unit (tapped valves and seats).

When using the compressor, drain regularly once a week the sediments from the tyre filling equipment (Fig. 36/1) by loosening the drain screw (2). Every six months change the cleaner insert. The only defect of the compressor and the tyre-filling equipment is leakage of air through the safety valve, which is caused by a leaky safety valve.

Remedy of Defect:

Unscrew and remove the spring and steel ball and clean everything thoroughly. If air keeps on escaping through the safety valve, it is necessary to tap the seat by topping the ball lightly with a copper pipe. If the surface of the ball is damaged, replace it with a new one.

Compressor Operation

The compressor is put into operation by a lever (Fig. 36/3).

Switch the compressor on or off only with the engine at a standstill — maximum 500 r. p. m. of the engine.

Before filling the tyres drain the dirt by screw (4) and screw it back. Screw off the wing nut (2) and screw on the hose, after which you can start pumping the tyres.

Belt Pulley

(Fig. 37)

Technical data:

- diameter 250 mm
- width 160 mm
- peripheral speed at engine speed: 1650 r. p. m. = 17 m/s
- 1450 r. p. m. = 15 m/s
- height above ground 600 mm.

The belt pulley is mounted on the rear gearbox wall.

The belt pulley can be set up in two positions (in accordance with the required direction of rotation) which are always spaced 180° from one another (Fig. 38). The rotation of the pulley is derived from the drive shaft through a bevel gear. The pulley design has been adapted in such a way that the pulley may be supplied in two alternatives:

1. Belt pulley with drive shaft (Fig. 37/A).
2. Belt pulley without the drive shaft (Fig. 37/B).

Work with Belt Pulley

The pulley can be employed to drive various agricultural machines up to the full output 46 H. P. Before starting work it is necessary to station the tractor in such a direction that the tractor pulley is in line with the pulley of the driven machine. The belt must be clean and free of oil stains, otherwise slipping may occur. The belt pulley is put into operation by disengaging the drive shaft clutch, and with the lever at the driver's seat the drive shaft and thus also the pulley are started up.

Maintenance

After every 60 hours of operation check the height of the oil level (the control and simultaneously filling opening is situated in the side wall of the pulley housing). Fill the pulley housing in winter as well as in summer with 2.5 liters of oil PP7 (SAE 90).

Once a year drain the oil, flush the housing, and fill it with fresh oil (the draining opening is situated in the bottom wall of the gearbox housing).

Triangle

The triangle is a suspension diagonal secured between the implement tie-rods on the tractor and the hydraulic equipment. It is used for suspending pulled implements.

Extra Weights

In order to increase the weight of the tractor, extra cast iron weights may be fitted to the rear wheels. Each weight weights about 40 kg. They may be ordered in the following alternatives: 160 kg, 560 kg, 400 kg, 800 kg.

Double Fitting of Rear Wheels

The double fitting of the rear wheels serves to reduce the specific pressure when using the tractor on ground with a smaller carrying capacity. Fit tyres with dimensions of 13—28.

Cab for Driver

The cab is of all-metal construction and affords the driver a good overall view. Its design facilitates easy dismantling from the tractor.

Rear Half-axle Housing

The rear half-axle housing is employed for safety reasons during operation of the tractor. It is fitted to the front part of the half-axle shaft.
### Accessories of the Zetor 50 Super Tractor

1. Spanner 7 open, double-ended
2. Spanner 9–10 open, double-ended
3. Spanner 11–12 open, double-ended
4. Spanner 14–17 open, double-ended
5. Spanner 19–22 open, double-ended
6. Spanner 24–27 open, double-ended
7. Spanner 30–32 open, double-ended
8. Socket wrench 9–10, double-ended
9. Socket wrench 14–17, double-ended
10. Socket wrench 19–22, double-ended
11. Socket wrench 24–27, double-ended
12. Wrench stick dia. 5
13. Wrench stick dia. 8
14. Wrench stick dia. 10
15. Wrench stick dia. 12
16. Box wrench with handle for drain screw of crank case
17. Nut brace 24 for fitting front disc
18. Assembly lever for tyres, shorter
19. Assembly lever for tyres, longer
20. Screw driver 4 mm with handle
21. Screw driver 8 mm with handle
22. Spanner 32 for tightening rear wheels screws
23. Pair of combination pliers 180
24. Two-spindle lifting jack 4 tons with extension piece
25. Complete hose for filling tyres
26. Locksmith’s hammer 500 g with handle
27. Monkey wrench 208, length 250
28. Grease gun 200
29. Starting crank
30. Fitting lamp with bulb
31. Gauge for measuring fuel quantity
32. Special spanner, double-ended
33. Cleaning needle holder
34. Cleaning needle 1.25
35. Cleaning needle 0.24
36. Rod-type pressure-gauge up to 3.2 atmospheres
37. Water valve
38. Tool chest
39. First aid kit

### Standard Spare Parts

- 4 jets DO 120 S 625–07
- 1 pressure pipe for first cylinder
- 1 pressure pipe for second cylinder
- 1 pressure pipe for third cylinder
- 1 pressure pipe for fourth cylinder
- 2 cylinder head gaskets
- 1 radiator enclosure gasket
- 4 fuses 8 Amps
- 1 fuel tank lid gasket
- 2 water hose strips
- 2 packing rings 12×16
- 1 spare key to switch-box
- 1 set of spare bulbs
- 8 packing rings for valve covers
- 4 packing rings underneath injectors

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Operating Manual for the Zetor 50 Super Tractor
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Engine lubrication

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4 Timing gear lubrication pipe
5 Double oil cleaner
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7 Oil gauge for checking
8 Filling and bleeding neck
9 Inlet oil passage
10 Drain passage
11 Inlet passage from the 1st cleaner to central passage
12 Clean oil drain passage
13 Oil passage to camshaft
14 Oil inlet for timing gear lubrication

Fig. 40
V — Drain opening
K — Control opening
The figures in circles denote filling (lubricating) openings.
<table>
<thead>
<tr>
<th>Pos.</th>
<th>Lubricating point</th>
<th>No. of lubricating points</th>
<th>Type of lubrication</th>
<th>Oil capacity in litres</th>
<th>Lubrication after 8 – 10 hours of operation (shift)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>1</td>
<td>Front axle</td>
<td>6</td>
<td>Grease</td>
<td>Grease</td>
<td>Automobile grease No. 00</td>
</tr>
<tr>
<td>2</td>
<td>Front axle pin</td>
<td>1</td>
<td>Grease</td>
<td>Grease</td>
<td>Automobile grease No. 00</td>
</tr>
<tr>
<td>3</td>
<td>Steering — tie-rods</td>
<td>4</td>
<td>Grease</td>
<td>Grease</td>
<td>Automobile grease No. 00</td>
</tr>
<tr>
<td>4</td>
<td>Crankcase</td>
<td>Filling opening and check gauge</td>
<td>M 9 A</td>
<td>M 4 A</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>Hydraulic equipment arm shaft</td>
<td>2</td>
<td>M 9 A</td>
<td>M 4 A</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>Three-point suspension</td>
<td>3 cylindrical pins</td>
<td>Grease</td>
<td>Grease</td>
<td>1 filling of grease gun</td>
</tr>
<tr>
<td>7</td>
<td>Water pump</td>
<td>1</td>
<td>Grease</td>
<td>Grease</td>
<td>Automated grease No. 4</td>
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<tr>
<td>8</td>
<td>Fuel injection pump</td>
<td>Filling and simultaneously control opening</td>
<td>M 9 A</td>
<td>M 4 A</td>
<td>20</td>
</tr>
<tr>
<td>9</td>
<td>Speed regulator</td>
<td>Filling opening, control opening</td>
<td>M 9 A</td>
<td>M 4 A</td>
<td>20</td>
</tr>
<tr>
<td>10</td>
<td>Oil-bath air cleaner</td>
<td>Control opening</td>
<td>M 9 A</td>
<td>M 4 A</td>
<td>20</td>
</tr>
<tr>
<td>11</td>
<td>Clutch housing</td>
<td>Control opening</td>
<td>P P 7</td>
<td>P P 7</td>
<td>90</td>
</tr>
<tr>
<td>12</td>
<td>Clutch release bearing</td>
<td>Grease</td>
<td>Grease</td>
<td>Grease</td>
<td>7</td>
</tr>
<tr>
<td>13</td>
<td>Clutch shaft</td>
<td>Filling and simultaneously control opening</td>
<td>P P 7</td>
<td>P P 7</td>
<td>90</td>
</tr>
<tr>
<td>14</td>
<td>Steering</td>
<td>Filling and simultaneously control opening</td>
<td>P P 7</td>
<td>P P 7</td>
<td>90</td>
</tr>
<tr>
<td>15</td>
<td>Gear shifting lever</td>
<td>Grease</td>
<td>Grease</td>
<td>Grease</td>
<td>Automated grease No. 00</td>
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<tr>
<td>16</td>
<td>Brake pedals</td>
<td>Grease</td>
<td>Grease</td>
<td>Grease</td>
<td>Automated grease No. 00</td>
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<tr>
<td>17</td>
<td>Clutch pedal</td>
<td>Grease</td>
<td>Grease</td>
<td>Grease</td>
<td>Automated grease No. 00</td>
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<tr>
<td>18</td>
<td>Differential gear lock</td>
<td>Grease</td>
<td>Grease</td>
<td>Grease</td>
<td>Automated grease No. 00</td>
</tr>
<tr>
<td>19</td>
<td>Brake lever</td>
<td>Grease</td>
<td>Grease</td>
<td>Grease</td>
<td>Automated grease No. 00</td>
</tr>
<tr>
<td>20</td>
<td>Gearbox</td>
<td>Filling opening, control opening</td>
<td>P P 7</td>
<td>P P 7</td>
<td>90</td>
</tr>
<tr>
<td>21</td>
<td>Hydraulic equipment box</td>
<td>Filling and control opening</td>
<td>P P 7</td>
<td>P P 7</td>
<td>90</td>
</tr>
</tbody>
</table>

**Lubrication at the 1st stage of technical inspection — after 60 hours of operation (including shift lubrication)**

<table>
<thead>
<tr>
<th>No. lubricating points</th>
<th>Type of lubrication</th>
<th>Oil capacity in litres</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Crankcase</td>
<td>M 9 A</td>
</tr>
<tr>
<td>8</td>
<td>Fuel injection pump</td>
<td>M 9 A</td>
</tr>
<tr>
<td>9</td>
<td>Speed regulator</td>
<td>M 9 A</td>
</tr>
<tr>
<td>10</td>
<td>Oil-bath air cleaner</td>
<td>M 9 A</td>
</tr>
<tr>
<td>11</td>
<td>Clutch housing</td>
<td>P P 7</td>
</tr>
<tr>
<td>12</td>
<td>Clutch release bearing</td>
<td>Grease</td>
</tr>
<tr>
<td>13</td>
<td>Clutch shaft</td>
<td>P P 7</td>
</tr>
<tr>
<td>15</td>
<td>Gear shifting lever</td>
<td>M 9 A</td>
</tr>
<tr>
<td>16</td>
<td>Brake pedals</td>
<td>P P 7</td>
</tr>
<tr>
<td>17</td>
<td>Clutch pedal</td>
<td>P P 7</td>
</tr>
<tr>
<td>18</td>
<td>Differential gear lock</td>
<td>Grease</td>
</tr>
<tr>
<td>19</td>
<td>Brake lever</td>
<td>P P 7</td>
</tr>
<tr>
<td>20</td>
<td>Gearbox</td>
<td>P P 7</td>
</tr>
<tr>
<td>21</td>
<td>Hydraulic equipment box</td>
<td>Grease</td>
</tr>
</tbody>
</table>

**Lubrication at the 2nd stage of technical inspection — after 600 hours of operation (including shift lubrication and 60 hours)**

<table>
<thead>
<tr>
<th>No. lubricating points</th>
<th>Type of lubrication</th>
<th>Oil capacity in litres</th>
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</thead>
<tbody>
<tr>
<td>21</td>
<td>Hydraulic equipment suspension box</td>
<td>P P 7</td>
</tr>
</tbody>
</table>

**Lubrication after 6 months of operation (including shift lubrication)**

<table>
<thead>
<tr>
<th>No. lubricating points</th>
<th>Type of lubrication</th>
<th>Oil capacity in litres</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Steering</td>
<td>P P 7</td>
</tr>
<tr>
<td>11</td>
<td>Clutch housing</td>
<td>P P 7</td>
</tr>
<tr>
<td>20</td>
<td>Gearbox</td>
<td>P P 7</td>
</tr>
<tr>
<td>25</td>
<td>Hydraulic equipment box</td>
<td>Grease</td>
</tr>
</tbody>
</table>

**Lubrication at the 3rd stage of technical inspection — after 900 hours of operation (including shift lubrication and 60 hours)**

<table>
<thead>
<tr>
<th>No. lubricating points</th>
<th>Type of lubrication</th>
<th>Oil capacity in litres</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Fuel injection pump</td>
<td>M 9 A</td>
</tr>
<tr>
<td>9</td>
<td>Speed regulator</td>
<td>M 9 A</td>
</tr>
<tr>
<td>24</td>
<td>Suspension hook</td>
<td>Grease</td>
</tr>
</tbody>
</table>