BELARUS
90/92

90 – 0000010 РЭ

OPERATING
MAINTENANCE
WORK-SHOP MANUAL

2008

The present operating manual has been compiled by I.N. Korobeinik, engineer of MSDB of MTW, with participation of the leading specialists of Main Specialized Design Bureau of Minsk Tractor Works RUE.

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Tractors Belarus 90/92 Operating manual.

Operating manual contains brief description and specification of tractors Belarus 90/92 manufactured by Minsk Tractor Works. Principal rules of machine operation are set forth, data on their adjustments and maintenance are provided.

The manual is intended for tractor drivers, operating Belarus tractors.

Due to policy of MTW PA aimed at constant updating of items being manufactured, changes, which are not reflected in present edition, can be made in the design of some assembly units and parts of Belarus tractor.

Some technical data and figures given in this book may differ from actual ones on your tractor. Dimensions and values of mass are approximate (given for reference). For detailed information please contact your Belarus dealer.
General note: References “left” or “right” in the present manual are made from a viewpoint of an observer, staying behind a tractor that is moving forward.

FOR THE ATTENTION OF OPERATOR!

1. Before tractor operation thoroughly study the present operating manual and strictly follow its requirements.
2. Use seasonal diesel fuel according to the manual. Reduce engine oil change intervals in half, if the diesel fuel contains up to 1% of sulfur.
3. Avoid engine idle running for more than 15 minutes.
4. Remember that engine starting is possible only when transmission lever is in its extreme left position (in on-position of I or II gear range).
5. During the tractor operation without application of rear PTO, install a shifting lever of separate dual-speed PTO drive into I position (540 rpm), lever of separate - synchronous PTO drive into neutral (center) position, and control lever into “PTO off” position (see section “Controls and Instruments”).
6. Apply synchronous drive of rear PTO, when driving speeds of tractor unit don’t exceed 8 km/h. Otherwise serious damages can occur in tractor power train.
7. Operate the tractor on direct drive only when high gear range (II range) is engaged.
8. Tractor cab is equipped with one-place seat and only operator should sit there.
9. When the tractor is shipped from the works some tractor components are placed into SPTA box, tool box or cab. You should perform their mounting on the tractor by yourself.
10. When putting new storage batteries in service remove the sealing film from air inlets and cut away bosses on polyethylene plugs.
11. Avoid tractor operation when clutch coupling is engaged or not completely disengaged.
12. When driving tractor away from rest make sure that parking emergency handbrake is released.
13. When using tractor without cardan shafts, set FDA selector lever into “forced” position.
14. Do not operate the tractor in indoor areas without required ventilation (air exchange). Exhaust gases can lead to fatal outcome.
15. It is strictly prohibited to tow the tractor with front wheels raised up. Failure to observe this rule may result in FDA drive breakdown and emergency situation.
16. It is prohibited to raise front part of tractor using towing shackle. Use the shackle for towing only.
17. The works are constantly working on tractor development. In this connection the changes, which are not reflected in the present edition, can be made in design and operating rules of its separate components.

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INTRODUCTION

Wheel universal row-crop tractors Belarus 90/92 fall into the drawbar category 1.4 and are designed for executing wide range of agricultural works ranging from tillage to harvesting and transport operations; they can be used in forestry and municipal services, construction and industry.

The present operating manual contains design features description, brief technical data, recommendations on the operation and maintenance of tractors Belarus 90/92:

BELARUS -90/92 (4x2) and (4x4) with diesel engine D243.1 (61.0 kW/2200 rpm), mechanical gearbox with reduction gear, doubling the number of gears, FDA (72-).

Re-equipment and alteration of tractor design without approval of the manufacturing works are forbidden.

Accepted abbreviations and legend

CC — clutch coupling
DL — differential lock
FDA — front driving axle
GB — gearbox
GP — glow plug
HLL — hydraulic lift linkage
HPS — Hydrostatic Power Steering
LOHE — liquid-to-oil heat exchanger
M — maintenance
OECD — Organization for Economic Cooperation and Development (OECD)
PCU — preheater control unit
PTO — power take-off shaft
RG — reducing gear
RHA — rear hitch attachment
SB — storage battery
SCU — starter control unit
TDACS — tilling depth automatic control system
TDC — top dead center of the engine piston
TSU — towing-hooking device

International symbols

The manufacturer uses standard International symbols related to the application of instruments and controls.

Symbols and their meanings are given below.


— See Manual


— Brake


— Parking brake


— Horn


— Hazard warning light


— Fuel


— Cooling liquid


— Starting preheater plug

— Engine speed


— Engine oil pressure


— Engine coolant temperature


— Off/Stop


— On/Start


— Gradual change


— Lever — down

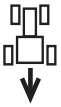

— Lever — up


— Control operating direction


— Fast


— Slowly


— Forward


— Reverse


— Battery charging


— Cab dome light


— Marker lights


— Turn signal


— Headlights High beam


— Headlights Low beam


— Operating headlights

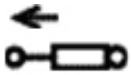

— Differential lock


— Power take-off shaft is engaged


— Front driving axle is engaged


— Fan


— Control valve spool "Lift" Position


— Control valve spool "Drop" Position


— Control valve spool "Float" Position


— Oil pressure in gearbox


— Air pressure on pneumatic system


— Air filter clogging


— Windshield washer


— Windshield wiper


— Rear screen wiper


— Tractor trailer turn signal


— Oil pressure in HPS

Section A. Safety precautions

Strict observance of safety precautions and precise abidance by tractor control and maintenance directions guarantee complete safety of its operation.

Safety requirements during tractor operation

Attention! Stay always inside the cabin in operator's seat during diesel start up and controls manipulation.

General instructions

• Carefully study operator's manual before using the tractor. Insufficient knowledge of tractor operation and maintenance may be the cause of accidents.

• The tractor can be operated only by specially trained and qualified specialists.

• If tractor is provided with seat belt, use it during operation. If tractor is not equipped with seat belt, address your dealer.

• Tractor cabin is single-seater; presence of a passenger is inadmissible.

• Keep all warning plates tidy. If plates are damaged or lost, replace them with new ones.

• Before starting the work carefully examine the tractor, trailed machine. Start the work only being sure they are fully operational. Trailed agricultural machines and transport trailers must be provided with rigid hitches, excluding their swaying and rear-end collision with the tractor during transportation.

• Before starting the engine, parking brake should be engaged, gear-change lever should be in "neutral" position, PTO lever should be in "disengaged" position.

• Before starting movement warn people around and those working on trailed machines with a horn.

• Do not leave the moving tractor.

• Before leaving the cabin disengage PTO, shut down the engine, engage parking brake, pull out starter switching key and switch off battery disconnect switch.

It is prohibited to disable the system of electrical equipment with battery disconnect switch until the engine stoppage.

• Do not operate the tractor within indoor area not properly ventilated. Exhaust gases may be the cause of fatal outcome!

• When malfunction appears immediately stop the tractor and correct the trouble.

• If engine or steering fails, immediately stop the tractor. Remember that when engine is shut down much higher effort has to be applied to the steering wheel.

• Do not work under agricultural implements lifted up. During long-term stops do not leave mounted implement in lifted position.

• If the front part of the tractor drives off the ground when mounting heavy machines and implements, install front ballast weights.

• When operating with front loader fill rear tires with liquid ballast.

• Before lifting up or lowering down mounted agricultural implement, as well as when turning, make sure that there is no danger of brushing against anybody or hit against any obstacle.

• During transport travel with attached machines or implements always use mechanism for hitch retention in the lifted position (for tractors with self-contained actuating cylinder).

• Cardan shaft, transmitting rotation from tractor PTO to working members of the unit, should be guarded.

• Make sure any additional equipment or auxiliary devices are properly installed, and that they are meant to be used with your tractor. Remember, that if not properly operated, your tractor may be dangerous both for you and other persons. Do not use equipment not intended for installation on your tractor.

• In order to avoid overturning take

care when running the tractor. Choose safe speed, corresponding to road conditions, in particular during cross-country terrain driving, driving across ditches, slopes and at sharp turns.

• When operating on slopes expand tractor wheel track to maximum.

• Do not turn sharply under full load and at high travelling speed.

• When using tractor for hauling operations:

- Increase tractor wheel track at least to 1800 mm (70");

- Interlock brake pedals, check and, if necessary, adjust brakes for synchronous action;

- Check parking brake operation;

- Check the state of light and audible alarm devices;

- Transport trailers should be provided with rigid hitches and also be coupled by means of safety chain or pull rope;

- Never move down the hill with gear disengaged (coasting). Move in one and the same gear both uphill and downhill;

- It is prohibited to operate the trailer without stand-alone brakes, if its mass exceeds the half of total actual tractor mass. The faster you move and the larger the mass being towed, the larger safe distance should be;

- Disengage FDA to avoid excessive wear of drive parts and tires;

- Do not use rear axle DL at speed over 10 km/h and when turning;

- Do not stop the tractor on slopes. If the stop is necessary, put into the 1st gear and engage the parking brake.

• When operating PTO driven equipment, after the engine stoppage before leaving the cabin and disconnecting the equipment make sure that PTO drive end is fully stopped.

• Do not wear loose clothes when operating PTO or in the vicinity of rotating equipment.

• When operating PTO driven stationary machines, always engage the parking brake and block rear wheels fore and aft. Make sure the machine is securely fixed.

• Make sure that PTO drive end guard is installed and, if PTO is not used, place the cap of PTO drive end into its position.

• Do not make cleaning, adjustment or service of PTO driven equipment with running engine.

Safety requirements during maintenance

• Never fuel the tractor with engine running.

• Do not smoke when fuelling a tractor.

• Do not fill in fuel tanks to the full. Leave some space for fuel expansion.

• Never add gasoline or other mixtures to diesel fuel. Such combinations may create enhanced inflammability or explosion hazard.

• Use summer and winter grades of fuel properly. Fill in the fuel tank at the end of each day to reduce night-time moisture condensation.

• Fill in the tractor only with oils and lubricants recommended by the works. It is **strictly prohibited** to use other lubricants!

• Perform all operations related to cleaning of engine and tractor, preparation for work, maintenance etc. with engine shut down and tractor braked.

• The cooling system is functioning under pressure, which is maintained by means of a valve installed in the filling neck cover. **It is dangerous to remove cover on the hot engine**. To avoid burns of face and hands be careful to open the plug of radiator neck on the hot engine. First, put tight cloth on the plug and put on a gantlet.

• To avoid burns take care when draining cooling fluid from the cooling system, hot oil from the engine, hydraulic system and transmission.

• Take care when handling storage batteries, as electrolyte may cause burns when splashed on skin.

• To avoid danger of explosion keep open flame sources away from engine fuel system and storage batteries.

• Keep tractor and its equipment, especially brakes and steering equipment, in operable condition for the safety of your own and people around.
• Do not make any alterations to the tractor or its individual components without approval of your dealer and manufacturing works.

Safety requirements in operating and maintaining electrical equipment

• To avoid damage of semiconductor devices and resistors take the following precautions:
- do not disconnect SB terminals with running engine. This will result in peak voltage in the charge circuit and inevitable damage of diodes and transistors;
- do not disconnect electrical wiring until the engine is shut down and all electrical switches are off;
- do not cause short-circuit due to wrong wiring connection. Short-circuiting or wrong polarity will cause damage of diodes and transistors;
- do not connect SB to the electrical equipment system until polarity of terminals and voltage is checked;
- do not check electric current ‘by spark”, as this will immediately lead to transistors’ break-down.

Hygiene requirements:

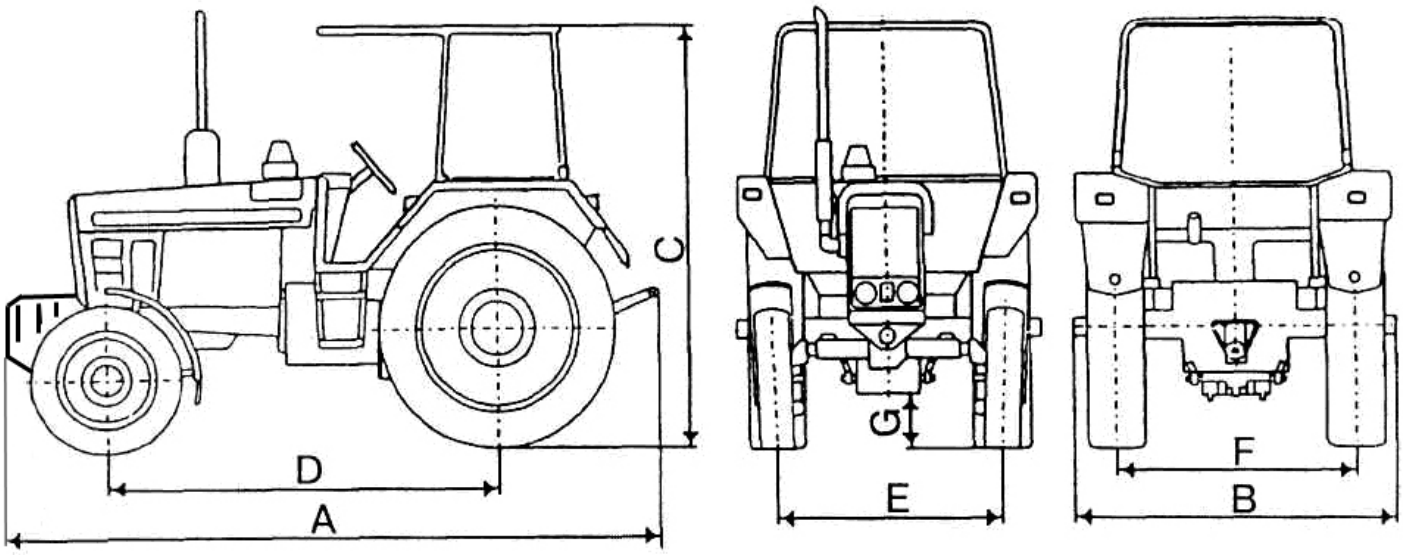
• During continuos work during the shift for over 2.5 hours, it is necessary to use individual noise protection means under GOST 12.4.051-87 (earplugs, earphones)

Fire safety requirements

• Tractor has to be equipped with firefighting equipment – a shovel and fire extinguisher. It is prohibited to operate the tractor without firefighting equipment.
• Sites of tractors’ parking and storage of fuels and lubricants must be plowed around for a 3m width at least and equipped with fire fighting means.
• Do not allow staining of collector and muffler with dust, fuel, straw, etc.
• Do not allow winding of straw on rotating parts of machines ganged up with tractor.
• When washing parts and assembly units with kerosene and gasoline, take measures to prevent inflammation of washing liquid vapors.
• Do not allow tractor operation in fire hazardous place places with hood and other protective devices being taken off the heated engine parts.
• Do not use open flame for heating oil in the engine pan and burning stains in the radiator core.
• When flame source appears, cover it with sand, canvas cloth, sacking or some other tight cloth. Use carbon-dioxide fire extinguisher. Do not pour water on burning fuel.
• Avoid highly inflammable materials close by outlet manifold and muffler when the engine is running.
• When harvesting hay or straw, working in the places with enhanced fire hazard, use at the exhaust system the spark blowouts completed with muffler or separately.

Section B. **TECHNICAL DATA**

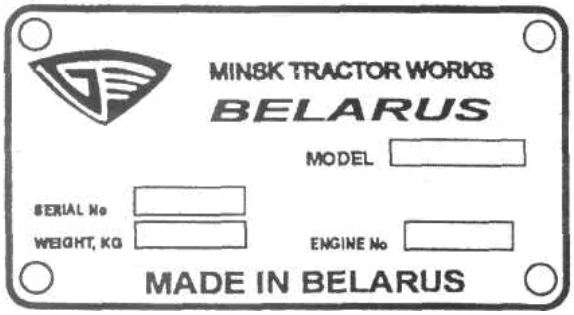
Weight and overall dimensions

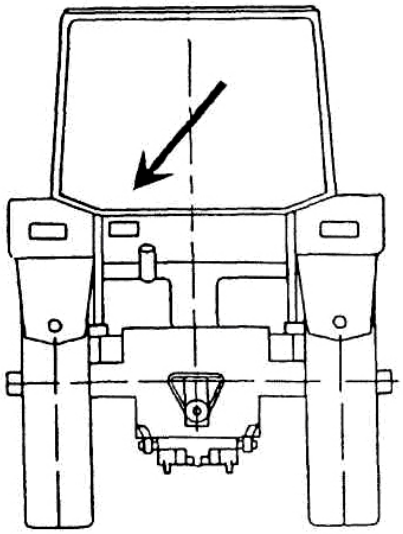


Description	90	92
A Length, mm, general (with loads) **without loads** **along wheels**	4120 3840 3650	4120 3930 3740
B Width, mm	1970	1970
C Height, mm	2780	2800
D Wheel base,mm	2370	2450
F Rear wheels span, mm	1400 - 1600	1800 - 2100
E Front wheels span, mm	1350 - 1850	1400 - 1960
G Road clearance, mm	465	465
Tire size: front wheels/rear wheels	9.00-20, 9.00R20/ 15.5R38	11.2-20, 11.2R20/ 15.5R38
Service weight, kg	3460	3690

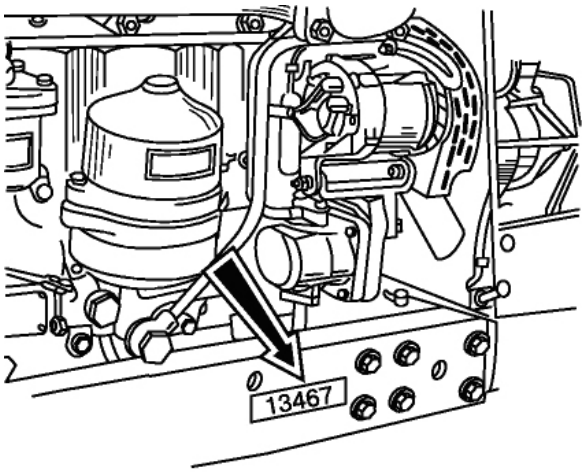
Numbering of tractor components

Tractor nameplate with serial tractor and engine numbers

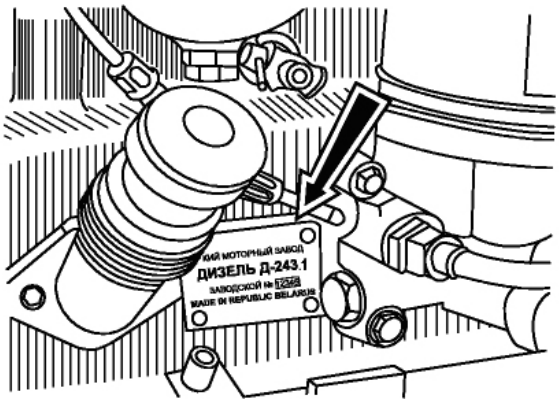




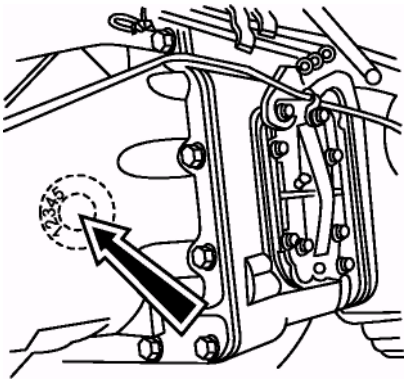
Serial tractor number is duplicated on the front right-side longitudinal (or on the right-side of front ballast loads).



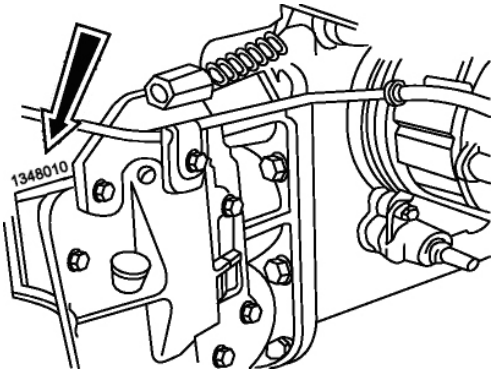
Serial diesel number (is duplicated on the name plate on the name plate of diesel fixed to the cylinder block right side.).



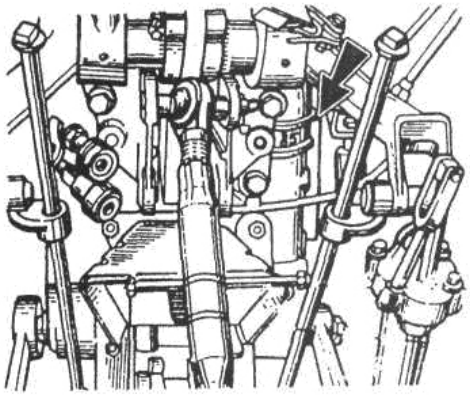
Number of clutch casing (on the right-side of the clutch casing)



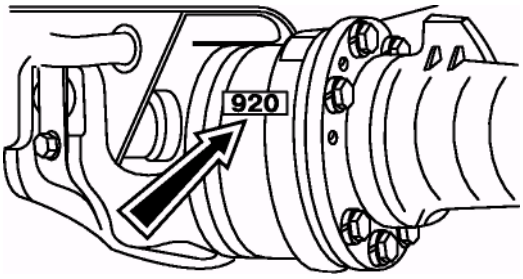
Number of gear box (on the left side of the gear box casing).



Number of transmission (on the back axle casing from behind).



Number of front driving axle (on the casing from the front).



Diesel engine

Diesel engine model	D-243.1
Type	4-stroke, in-line, with natural aspiration
Number of cylinders	4
Method of mixture formation	Direct fuel injection
Compression degree (calculated)	16
Diameter of cylinder,mm	110 (4,32)
Piston stroke,mm	125 (4,92)
Displacement volume, l	4,75 (290)
Firing order	1-3-4-2
Cooling system	fluid
Rated speed, rev/min	2200
Maximum rotational speed, rev/min	2380
Minimum rotational speed, rev/min	600
Rated power, kW	61 at 2200 revolutions per minute
Maximum torque, Nm (kgf·m)	296,9 (30,3) at 1400 revolutions per minute
Clearance between inlet and outlet valve and rocker on cold diesel, mm	0,25…0,30
Advance angle of fuel injection to UDC , degrees	20±1/16±1
Fuel injection pressure MPa (kgf/cm2)	21,6…22,4 (220…228)

Diesel fuel supply system

Type: combined, with oil cooler

Minimal oil pressure:
0,08 MPa (0,8 kgs/cm^2) at 600 rev per min.

Safe oil pressure:
0,2…0,3 MPa (2…3 kgs/cm^2).

Maximal pressure on the cold diesel: up to 0,6 MPa (6 kgs/cm^2).

Lubrication system capacity: 12 l.

Brands of motor oil:
- from -40°C to +5°C: M-8DM; M-8G$_2$, M-8G$_{2K}$ or M4$_3$/8G$_2$ (SAE-20, SAE 10W-20);
- from +5°C to +50°C: M-10DM; M-10G$_2$; M-10G$_{2K}$ (SAE-30);
- all-season oil: SAE 15W-40.

Feed system of diesel

Fuel pump: four-plunger, in-line, with booster pump.

Regulator: mechanical, all-mode.

Fuel filters: coarse filter and fine filter (disposable element filter FT 020 - 1117010).

Fuel mark: diesel: in summer L-0.2-40, L-0.5-40; in winter 3-0.2, 3-0.5.

Fuel capacity: 120 l.

Air cleaner: combined, with dry centrifugal air purification)

Oil bath capacity of air cleaner: 1,5 l.

Steering control

Hydraulic booster type: hydro mechanical

Steering gear: worm screw, helical sector and steering booster.

Pump cell: gear pump NSh10–3–Л.

Pump capacity: 21 l/min.

Maximum working pressure in the system: 9,0±0,05 MPa.

Oil grades:
- from -40°C to+5°C: M-8DM; M-8G$_2$, M-8G$_{2K}$ or M4$_3$/8G$_2$ (SAE-20, SAE 10W-20);
- from +5°C to +50°C: M-10DM; M-10G$_2$; M-10G$_{2K}$ (SAE-30);
- all-season oil: SAE 15W-40.

Adjustment revision of steering wheel:
· tilt steering wheel – from 25° to 40° with locking in 5°;
· height clearance – in the range 100 mm.

Free play of steering wheel – not more than 25°.

Diesel engine starting system

Electric starter 12 V.

Diesel cooling system

Type: enclosed, with forced fluid circulation, temperature control using thermostat Normal operation temperature from 80°C to 100°C. Cooling system capacity is 20 l.

Clutch

Type: Dry, friction, one-disk. Mechanical drive, closed-circuit

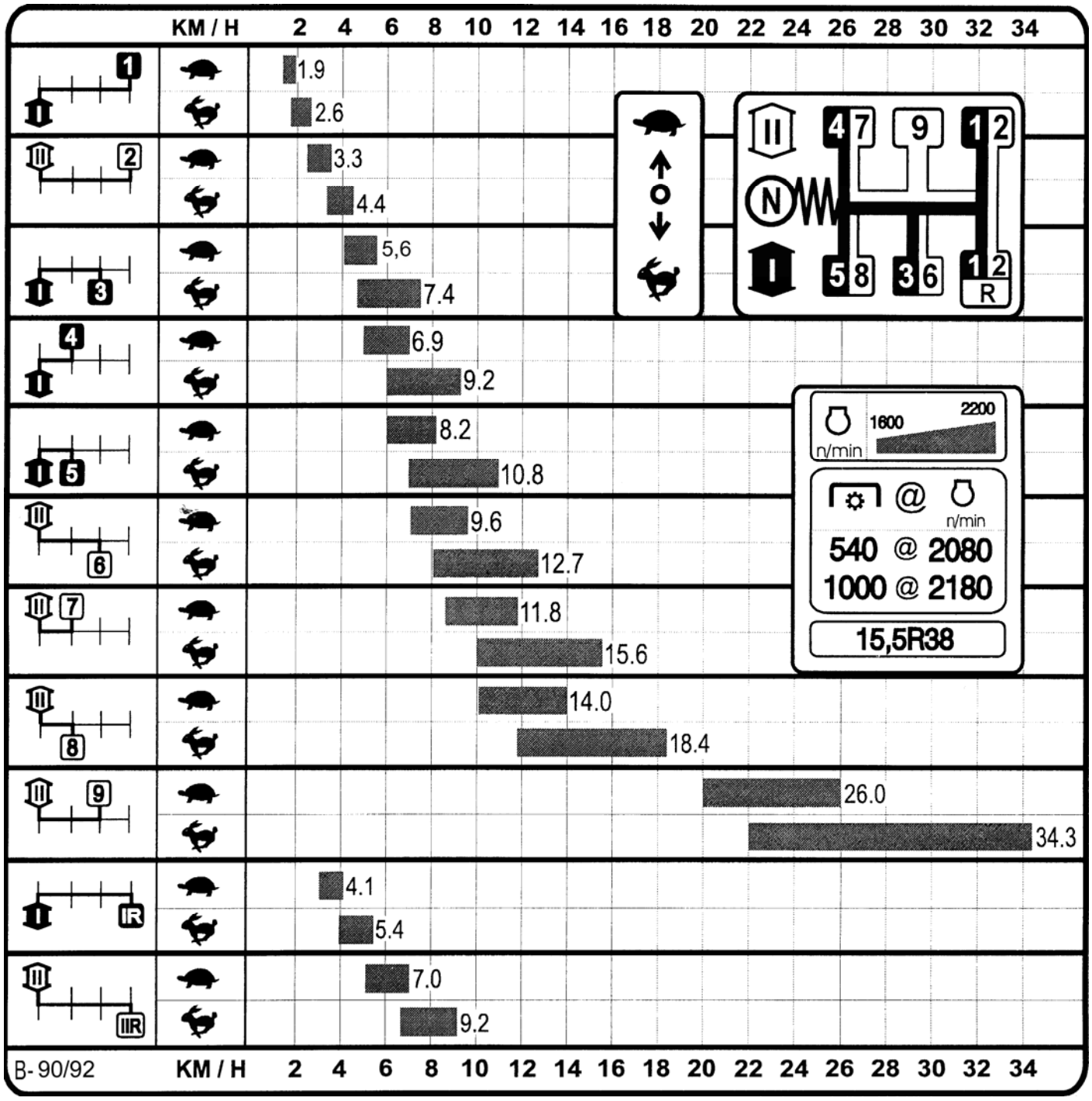
Driven disk diameter: 340 mm.

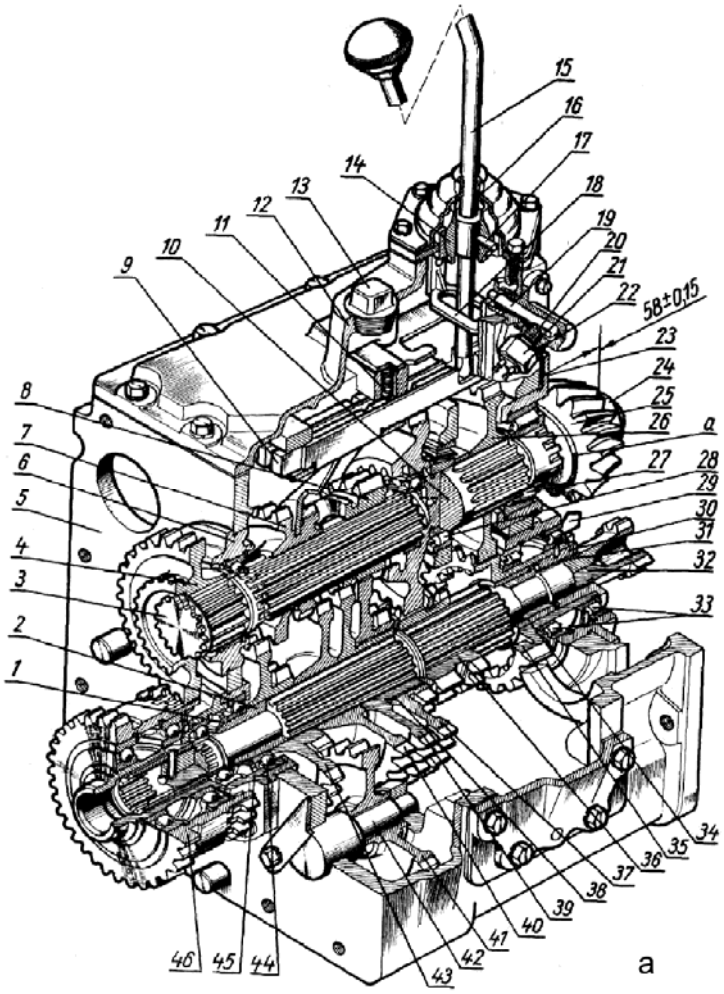
Gear box

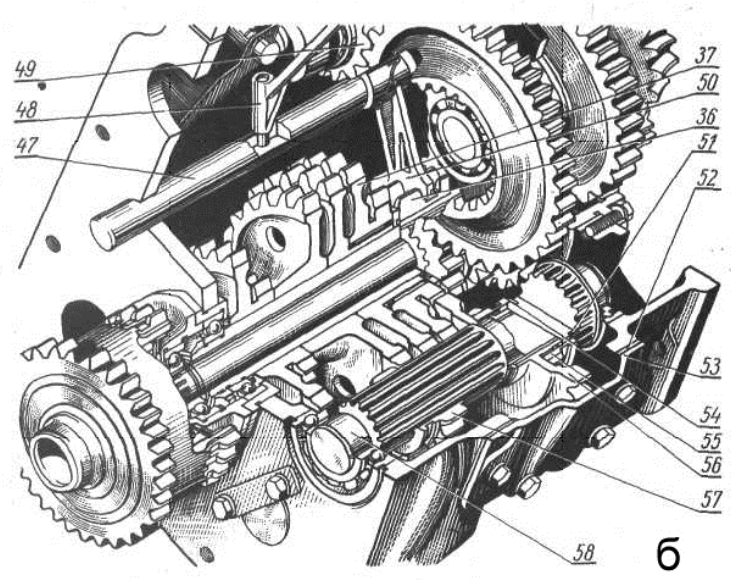
Type (basic kitting), 9/2 mechanical, back-geared.

Rated speed of tractor movement in km/h at tractor BELARUS 90/92

(with tires 15.5R38)







Picture. а, б Gear box:

1 — screw of countershaft; 2 - countershaft; 3 — main drive shaft; 4 — driven gear of back gear; 5 — gear box casing; 6 — cup of main drive shaft; 7 — sliding gear wheel of 4-5-th gears; 8 — sliding gear wheel of 3-th gear; 9 — crutch flute; 10 — main shaft; 11 — ball; 12 — deck of gear box; 13 — filler plug; 14 — trunnion ball; 15 — gear-change lever; 16 — rubber boot; 17 — pin; 18 — frame; 19 — roller of frame; 20 — ball switch; 21 — switch ВК 12 - 51; 22, 23 — adjusting shims; 24 — screw of main shaft; 25 — axle drive gear; 26 — driven gear of II gearing pass; 27, 28 — conical rolling bearing; 29 — impeller; 30 — cluster of internal shafting; 31 — bronze plug; 32 — shafting; 33 — roller bearing; 34 — bronze plug; 35 — axle drive gear of II gearing pass; 36 — axle drive gear of I gearing pass; 37 — idler gear.; 38 — roller bearing; 39 — driven gear of 3 gearing pass; 40 — driven gear of 4 gearing pass; 41 — idler gear of reverse; 42 — axis of idler gear; 43 — driven gear of 5 gearing and reverse pass; 44 — bearing; 45 — front cluster of internal shafting; 46 — idler gear of back gear; 47 — switching roller of reduction gear; 48 — lever; 49 – idler gear; 50 — plug; 51 — thrust ring; 52 — cover gasket; 53 — left cover of side door; 54 — spring ring; 55 — driven gear of speed reducer switcher; 56 — driven gear of 5 gearing and reverse pass; 57 — sliding gear of 1 gearing and reverse pass; 58 — shafting of 1 gearing and reverse pass; а — trust collar.

Back gear

Back gear of tractor is destined for additional speed line required for work with agricultural machinery.

Back gear is disposed between clutch and gear box. On the force shafting of clutch is splint mounted movable coupling gear clutch. When the gear clutch engages by means of shift mechanism with drive reduction gear, placed on force shafting, it means, that the back gear is switched on. When the gear clutch engages with driven gear 4 (pic. а), mounted on splines of main draft shaft of gear box, it means, that back gear is switched off. Both gears are in constant mesh with idler

double gear 46 (pic. a). Shifting lever of back gear is derived in the tractor cabin. By forward movement of lever the back gear is switched on, by backwards movement it is off. The lever is fixed by means of fixator.

Gear box

The gear box is intended for changing of transmission reduction ratio and provision of reverse and receiving different reversible rates of tractor motion.
In addition, the construction of gear box provides the drive of front driving axle of tractors Belarus 92, of synchronous rear and side power take-off, and provides a possibility of underspeed receiving by mounting of speed reducer.

Device and working of gear box

The gear box (pic. a, b) contains in the casing 5 located concentric among themselves main drive shaft 5 and secondary shaft 10, and parallel located countershaft 2 and shaft of the I gear and reverse gear 58.
The main drive shaft is mounted on two ball-bearings, one of them is located in the cup 6 attached to casing, and the second — in the boring of the secondary shaft leading end. On the shaft splines are mounted the driven gear of the back gear 4 and movable drive gears 8 of the III gear and 7 of the 7 IV and V gears.
On the splines of the cored countershaft 2 the driven gears 40, 43 and 39 are fast fixed. On the gear hub 39 rotates the countershaft 37. The countershaft 37 is constantly geared with gear 8, giving a possibility of switching on of hill climbing and reverse gears through the gear wheel 56, and application of reduction gear and side power take off. On the splines of the back shafting part is flexible the driving gear of I gearing pass 36.
As support of countershaft come the bearing 44 and bronze plug 34, mounted in the opening of drive gear II of gearing pass 35. The gear wheel 35, mounted in the cup on two rolling bearings 33, is provided with external and inner tooth rings, and on the after end — with clutch pins for drive of synchronous rear power take off. In the opening of gear wheel by means of pins the cluster 30 is fixed with bronze plug 31, that composes as support of internal shafting 32; from outside on the gear wheel is fixed the impeller 29 that serves for improved lubrication of gear wheels of the main gear and differential via intensive oil spattering.
The secondary shafting 10 on the front end has on the front end external and internal rings; executed together with him. As support of the secondary shafting come bearings conical rolling bearings 27 and 28, on the shafting splines are hard-mounted the driven gear II of the gearing pass 26 and the drive conical gear of the main gear 25, that is fixed from the back side with a screw 24.
By meshing of gear wheel 36 c with external ring of secondary shafting 10 I pass of gearing is switched on, that ensures I, III, IV and V forward gears and I reverse gear, the rest gears are provided with the II pass. Moving the gear wheel 36 backwards till the full engagement with the inner ring of gear wheel 35, the II pass of gearing is switched on.
By switching on the I (or II) pass of gearing the cluster gear 7 when moving forward switches V (or VIII), and when moving backwards — IV (or VII) gears. Gear wheel 8 in motion forward switches III (or VI) gears, and in motion backwards is engaged with teeth of inner ring of the secondary shafting 10, switching the direct (IX) drive.
The shafting 58 is driven through the driven gear wheel of the hill-climbing and reverse gears 56 (herewith the gear wheel 55 is connected with inner splined ring of the gear 56 and shafting 58, as showed on the picture b). When moving the sliding gear of the hill-climbing and reverse gears 57 backwards is switched on the I (or II) gear, and when moving forward — reverse gears (through gear wheels 57, 41 and 43 on the countershaft 2). The intermediate gear 41 of the reverse is rotated on the stationary axle 42 and operates with the smaller ring of gear 43.
On the exposed face of gear box coaxial with intermediate shafting the cluster 45 (pic. a), is fixed, inside of which the front bearing of internal shafting is mounted, and outside — bearings of intermediate pass gear 46. Right and left the gear box casing has hatches, that are mantled with side covers, by removal of that you can hold on inspection of gear box parts, and carry out the installation of side

power take off on the tractor, reducing gear and drive transfer box of the front axle of tractors Belarus-92.

Gear shift mechanism

On the deck of gear shift casing (pic. а) is settled the gear shift mechanism. Gear change is realized by means of plugs, connected with flash welded pads 9. There are on the top pads places are diametrical holes that include spring-mounted balls 11, insuring plug fixing in defined position and inhibiting self-coupling of gears under load.

Pass of gearing shifting is realized with lead 48, connected with bead 47, in which is fastened the plug 50, moving the gear 36. The plug pads are provided with splines that include the underside end of the shift lever 15, fixed in the cover 12 on the trunnion ball 14 by means of pin 17, that block the lever turn regarding vertical axle.

The tractor gear shifts are equipped with device, blocking the starting engine operation by any switched gearing.

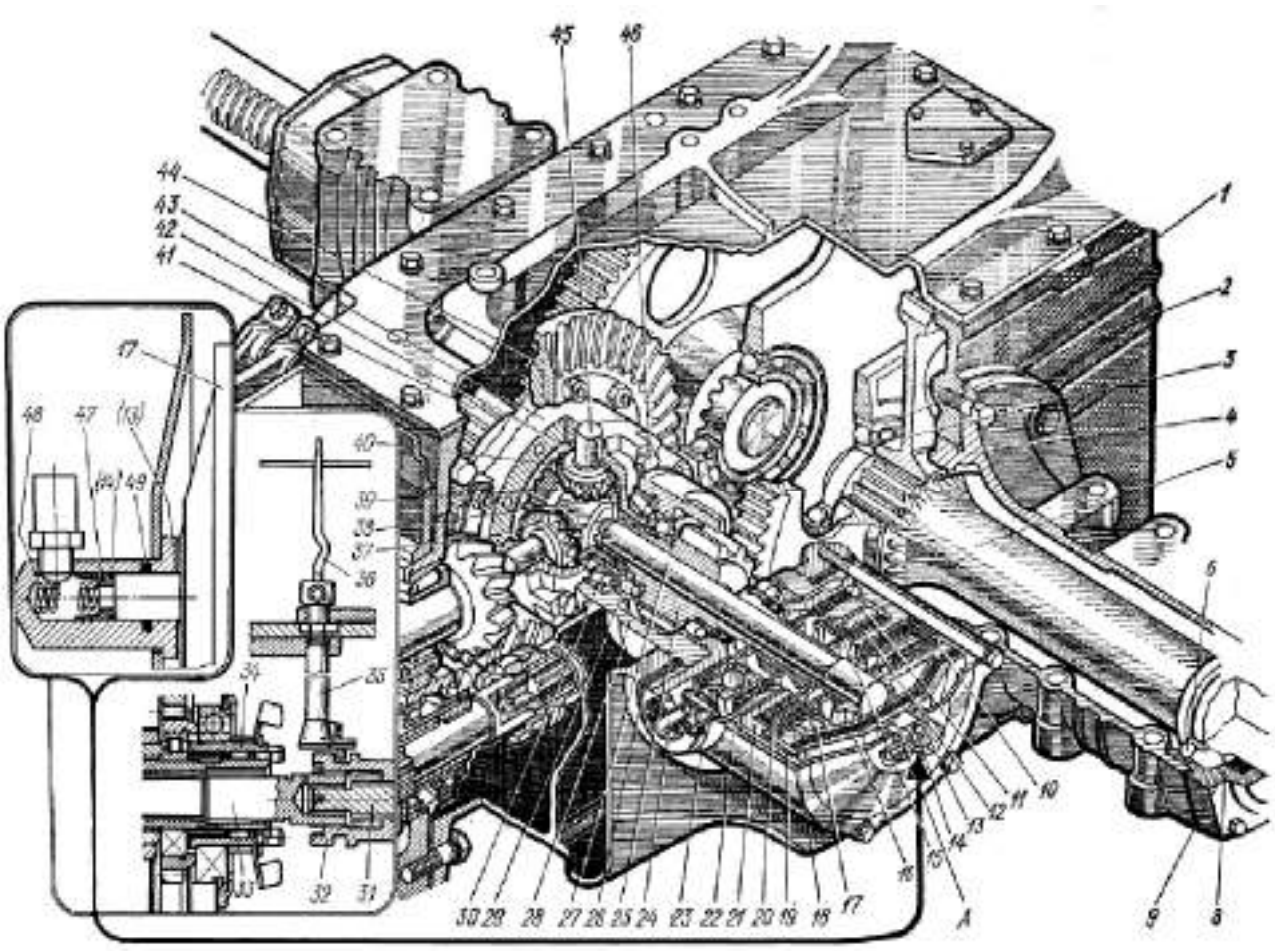
Rear axle

Main gear: couple of conical gears hooked teeth.

Differential: conical, four-satellite.

Final drive: couple of cylindrical gears.

Differential lock: hydraulically operated dry friction clutch.



Rear axle:

1 — casing; 2 — bearing (217A) of half-axle; 3 — driven gear of final drive; 4 — half-axle sleeve; 5— half-axle; 6 — bearing (217A) of half-axle; 8 — cover; 9 — collar; 10 — expansion springs; 11 — pressure plate; 12 — brake disc; 13 — adapter connector; 14 — ring; 15 — coupling spring; A — working space of lockup clutch; 16 — diaphragm cover; 17 — backing plate; 18 — pressure disc; 19 — diaphragm; 20 — spacing disk; 21 — clutch housing of GB; 22 — clutch casing of GB; 23 — brake casing; 24 — plug; 25 — left drive gear of half axle; 26 — adjusting shims; 27 — clutching axle of GD; 28 — left bearing cup; 29 —drive gear bearings of final gears; 30 — left differential bearing (7215A); 31 — crown gear shafting; 32 — clutching; 33 — inner shafting; 34 — gear of synchronous power take off; 35 — operation roller; 36 — power take off lever; 37 — half-axle gear; 38 — back-up plate of half-axle gear; 39 — differential cover; 40 — sattelite; 41 — right drive gear of final gear; 42 — ball washer of satellites; 43 — differential casing; 44 — axle driven gear; 45 — crossing; 46 — tightening bolts of differential casing; 47 — bush; 48 — spring; 49 — ring.

Brakes

Main brakes: rear wheel: double-disc, dry, with mechanical servo-drive. Disc diameter 204 mm.

Parking brake: disc, dry, with mechanical hand drive. Disc diameter: 180 mm.

Front driving axle

Type: portal, with retractable casings of conical wheel reduction gear.

Main gear: pair of conical gears with spiral teeth.

Differential type: conical, latching, limited split with frictional clutching.

Final drives: with conical wheel reduction gears.

Gear oil: Тап-15В, ТСп-15К or ТСп-10 (SAE 80W-90); ТАД-17И.

Drive: from transfer case by means of two drive shafts with intermediate support.

Power take-off operation: mechanical, with level for right hand of the operator. There are 3 running conditions:

Power take off is off;

Power take off is off/ witched automatically;

Power take off is switched on compulsory.

Power take off (PTO) drive

Type: separate, double speed and synchronous.

Master clutching: planetary reduction gear with clamping band.

Power take off operation: mechanical.

Termination point rotary speed of power take off:

Separate drive:

• 540 rev/min at 2081 rev/min of diesel engine;

• 1000 rev/min at 2302 rev/min of diesel engine.

Synchronous drive: 3,4 rev/meter of road at placing of back tyre 15,5R38 mounting.

Removable power take off shank end: according SAE with 6 and 8 splines for 540 rev/min and 21 splines for 1000 rev/min.

Direction of rotation: clockwise, while looking gear end.

Hydraulic system:

Type: universal, aggregative, with autonomous power cylinder.

Maximum hydraulic system pressure is 180... 200 kgf/cm^2.

Distributor:

valve type:

• Р80-3/1-222-3Гг (Р80-3/1-111-3Гг) — for tractors without force regulator;

Hydraulic system outlets: two side way.

Control system of back hookup has the following operating condition:

• high-altitude.

Hydraulic system oil:

• from -40°С to +5°С - М-8Г2К (SAE 15W-40); BECHEM STAROIL №32;.

• от +5°С до +50°С - М-10Г2, М-10Г2К (SAE 15W-40); BECHEM STAROIL №32;

Rear hitch attachment

Type: three-point lift linkage of cat. 2

Carrying capacity: 3200 kg across longitudinal drafts.

Electrical equipment

Tractor-system voltage: 12 V.

Power supply system: two storage batteries, 12 V each, parallel connected.

Alternating current generator

14V, power 1150 W.

Illumination and light alarm system:

- front road headlights with lower and higher light;
- front and rear operation headlights;
- front and rear lamps;
- illumination of instruments panel and license plate;

·

Pneumatic system

Compressor

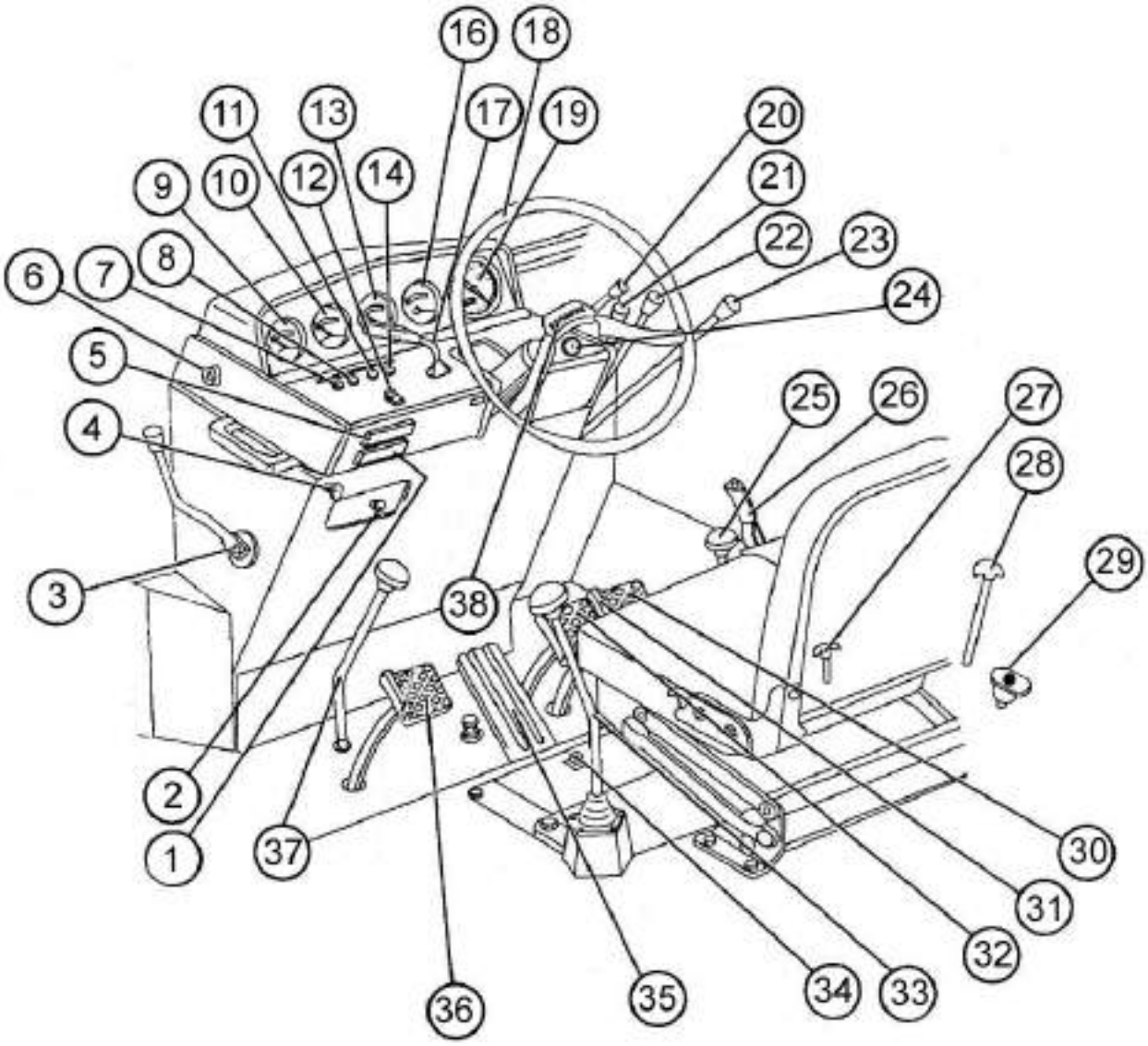
Type: one-cylinder, air-cooled.

Wheels

Front: 9,00-20 (9,00R20) with front axle, 11,2-20 (11,2R20) with FDA - 72

Rear: 15,5R38;

Section C. Controls and Instruments



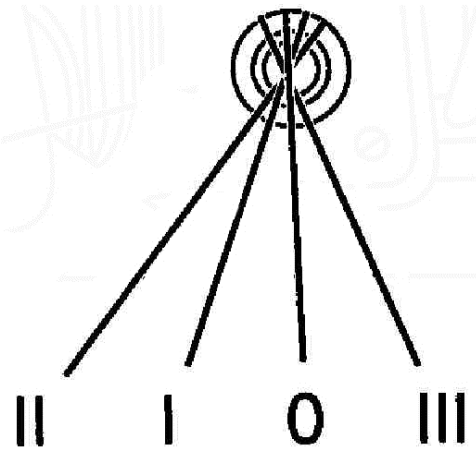
1. Bottom block of fuses;
2. Handle of diesel engine stop;
3. Lever of fuel submission control;
4. Handle of differential block control;
5. Top block of fuses;
6. Switch of alarm system;
7. Control lamp of emergency drop of oil pressure drop in diesel engine (red colour);
8. Control lamp of contamination of air filter (red colour);
9. Index of temperature of cooling liquid of diesel engine;
10. Index of pressure;
11. Control lamp of indexes of turn (green colour);
12. Central switch of light;
13. Index of level of fuel in tanks;
14. Control lamp of high beam (dark blue color);
16. Index of pressure of oil in diesel engine;
17. Multipurpose switch, (index of turns, high beam/lower beam, horn, signal system of high beam);
18. Steering wheel;
19. Tachospeedometer;
20. Handle of fixator of steering column;
21, 22, 23. Levers of hydraulic hydrosystem control;
24. Switch of starter;
25. Level of control of rear PTO. It has two positions: bottom – “PTO is switched off”, top – “PTO is switched in”.
26. Lever of control of parking brake;
27. Draft of control of transfer box;
28. Lever of control of mechanism of hitching device;
29. Switch of “weight” of storage batteries;

30, 32. Pedals of brakes;
31. Connecting rod of brake pedals;
33. Lever of switching of gears;
34. Dog of switch of PTO from independent drive to synchronous drive;
35. Pedal of control of fuel submission;
36. Pedal of control of clutch;
37. Lever of switch of lowering reducer. It has two positions:
rear – “direct gear”, forward – “lowering gear”;
38. Cover of mechanism of adjustment of height of position of steering wheel.

Important! Before starting tractor operation, study purpose and functions of controls and instruments.

Instruments and switches

Starter and instruments switch
Switch (1) has four positions:
- 0 — «it is switched off»
- I — «Instruments are included»
- II — «Starter is included» (unstable)
- III — «Feed of radio receiver» (turn of key counter-clockwise)



Self-contained instruments

Index of temperature of cooling liquid(1)

Index (1) shows temperature of cooling liquid of diesel engine in degrees. Scale has three zones:
- working – 80 - 100º C – green colour;
- warning – 40 - 80º C – yellow colour;
- emergency – 100 - 120º C – red colour;

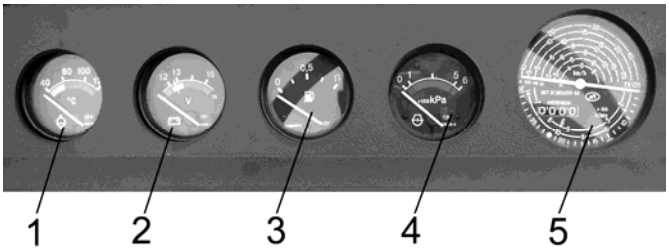
Index of fuel level (3)

Index (3) shows quantity of fuel in tank. Do not assume full bleeding of fuel tanks in order to prevent hit of air in fuel system.
Device has division:
0 – 0,5 - P

Indicator of voltage (2)

It shows voltage of storage battery at idle diesel engine, when key of switch of starter (1) is in a position «I». At diesel engine operation index of voltage shows voltage in onboard network of tractor.

Zone on scale, colour	Condition of feed system	
	At diesel engine work	At idle diesel engine
13,2 – 15,2 B green	Normal mode of charge	
10,0 – 12,0 B red	Generator does not operate	Storage battery is discharged
12,0 – 13,2 B yellow	Charge of storage battery is absent (low charge voltage)	Storage battery has normal charge
15,2 – 16,0 B red	Storage battery recharge	
12,7 – 12,0 yellow		Beginning of discharge of storage battery
White hairline in yellow zone		Nominal electromotive force of storage battery – 12,7 V



IMPORTANT! If device shows absence of charge of storage battery, check condition and tension of drive belt of fan.

Index of oil pressure in diesel engine (4)

At diesel engine work watch instrument registration. Normal pressure of oil 1...5 kgs/sm^2 (green sector of scale). **It is possible to increase pressure till kgs/sm^2** on cold diesel engine.

IMPORTANT! Do not permit diesel engine work with instrument registration in red zones of scale at nominal mode. It is too low or it is absent , stop diesel immediately, find and eliminate malfunction.

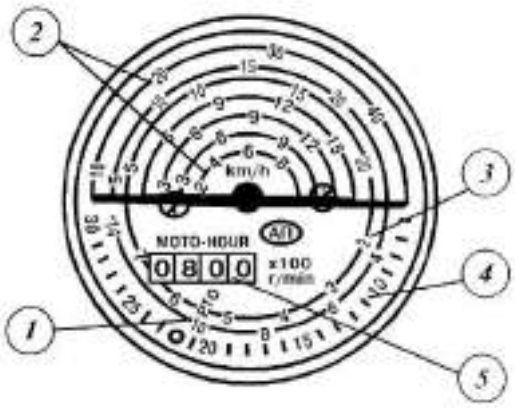
Tachospidometer (5)

1. White background — scale of speeds of tractor moves (km/h) for II, III, IV rangers (5... 16 gears) gear box.

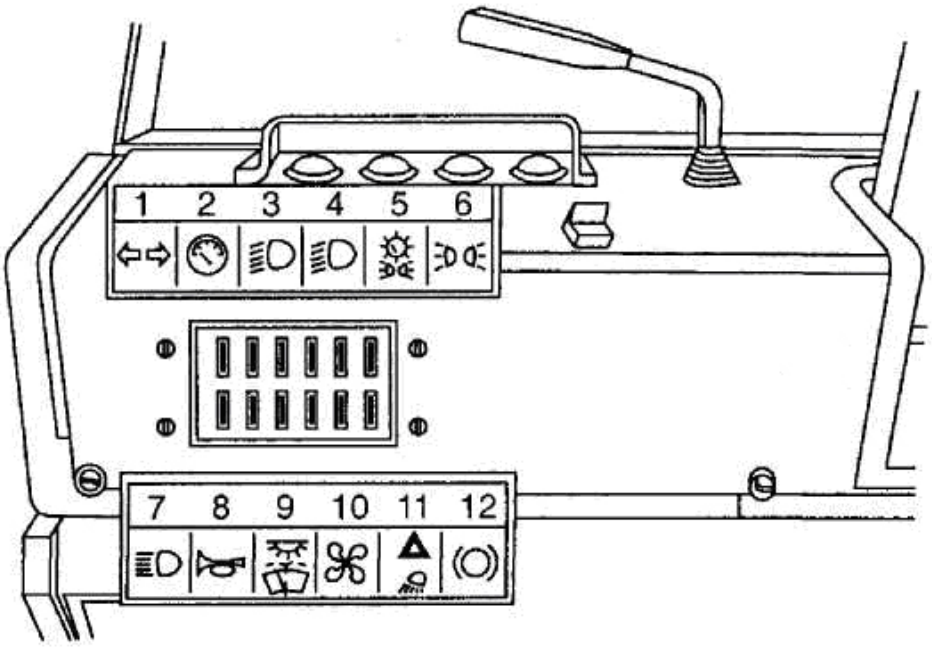
2 and 3. Green background — scale of frequency of rotation of independent rear PTO (rev/min);

4. Black background — scale of high-speed mode of diesel engine (rev/min);

5. Scale of operating time of diesel engine in motor hours.



Fuses



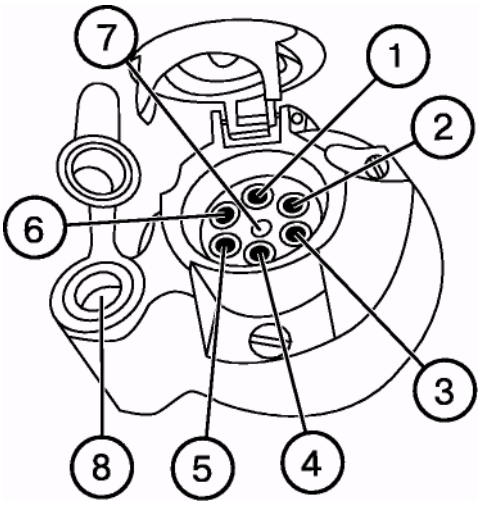
Two blocks of fuses are installed in electric chains.
12 safety locks protect from overloads the following electric chains of tractor:

1 —indexes of turns, 15 A;
2 — feed of control-measuring instruments, 7,5 A;
3 — passing light of left road headlight 7,5 A;
4 — passing light of right road headlight, 7,5 A;
5 — dimensional fires of right board, illumination of plate, illumination of devices , 15 A;
6 — dimensional fires of left board, 7,5 A;
7 — headlight of road headlights, 25 A;
8 — horn, 15 A;
9 — reserve, 25 A;
10 — reserve, 15 A;
11 — emergency light signal system, back working headlights, 15 A;
12 — stop-alarm fires, feed of portable lamp, 15 A.

Besides there is block with safety lock of 60 ampere on oil tank for protection of chain of storage battery.

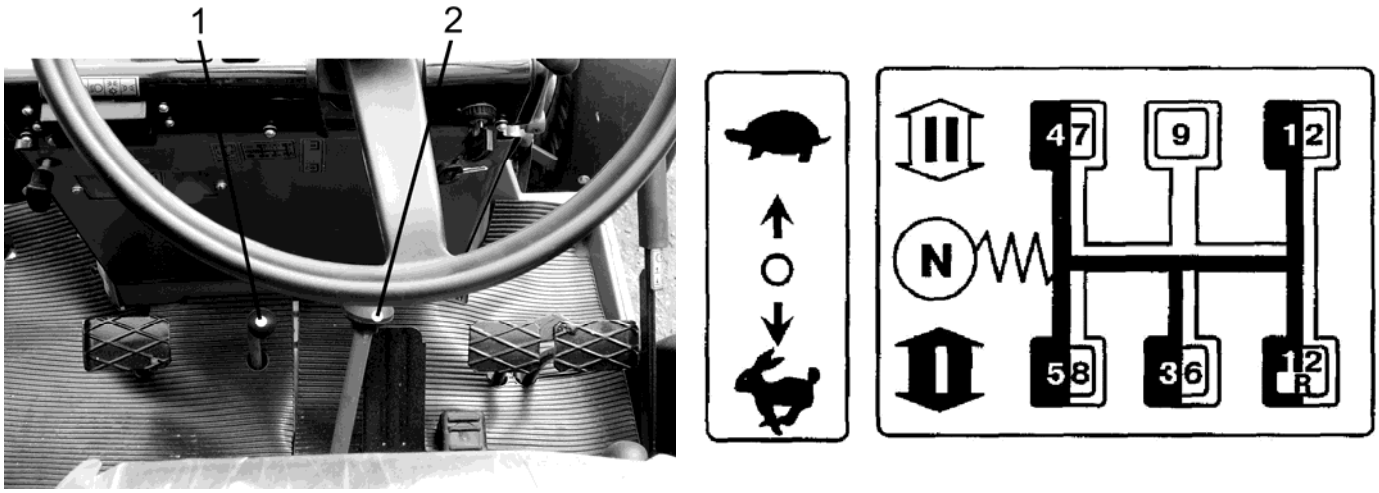
Electrical equipment connection elements

Standard seven pin socket is intended for connection of consumers of current of transport machine or hook-on agricultural instrument**. It is installed on rear support of cabin.** Pin plug of plait of wires of hook-on machines is connected to socket.



Marking of plugs of socket:
1 —Index of left turn;
2 —Horn;
3 — «Weight»;
4 —Index of right turn;
5 —Right dimensional light;
6 —Stop-signal;
7 —Left dimensional light;
8 — Connection of portable lamp and other consumers with current loading till 8 ampere.

Gear box control



Gear box - 9/2 mechanical with mechanical lowering reducer.

Switching of gears is carried out by lever (2) in accordance with scheme of switching. Before to include gear, include necessary (level).

IMPORTANT! Inclusion of ranges and gears is carried out by one lever (2), note that at the first turn it is necessary to include range (first or second).

Lever of lowering reducer (1) should always be in included in position: back — direct gear «H» or forward — low gear «L».

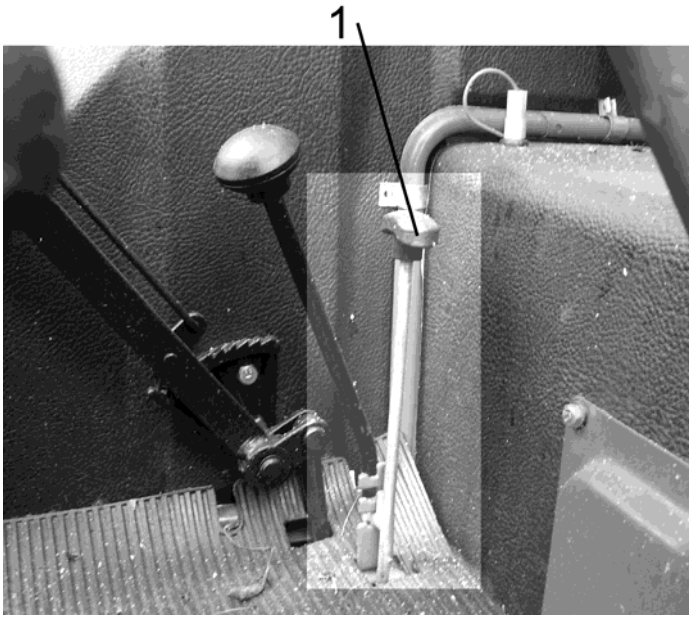
Attention: It is forbidden to use gear «R» in traction mode.

NOTE: Lever of lowering reducer does not have fixed neutral**.** Installation of lever in neutral is permitted only at diesel engine start in cold season.

Front driving axle control

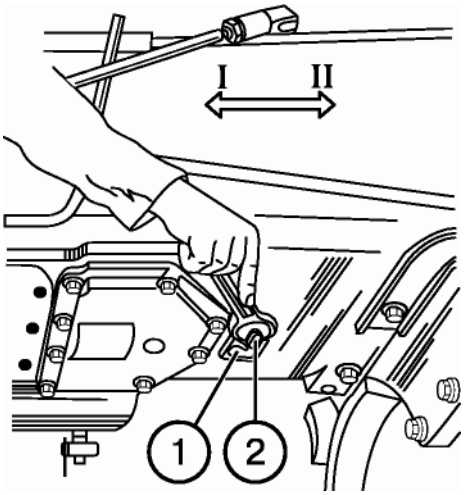
Lever of control (1) has three fixed positions:

- «Front driving axle is switched off» — extreme bottom position. Use on transport at movement on roads with firm covering;
- «Front driving axle is included compulsorily» is an extreme top position. Use this mode short-term for work on friable and damp soils and if necessary at movement by reverse.
- «Front driving axle is included (is switched off) automatically» is a middle position. Automatic inclusion of and switching off of front driving axle is carried out in this mode by means of overrunning clutch depending on slipping of rear wheels. Use this mode at various fields' works.



ATTENTION! At tractor use without crankshafts install lever control (1) in extreme top position («Front driving axle is included compulsorily»).

Selector of separate dual-speed PTO drive (2)

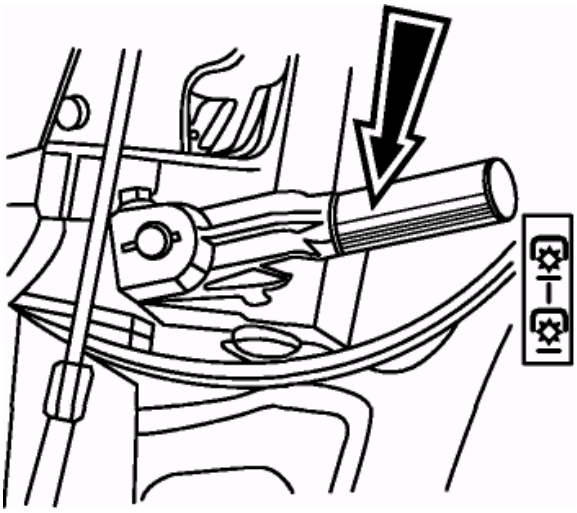


Dog (2) of independent drive of PTO has two positions:

- I — 540 rev/min — extreme anticlockwise;
- II — 1000 rev/min — extreme clockwise.

For installation of necessary speed of rotation of PTO relieve bolt (1), turn dog (2) in position «I» or «II» and tighten bolt (1).

Control of hydraulic system pump

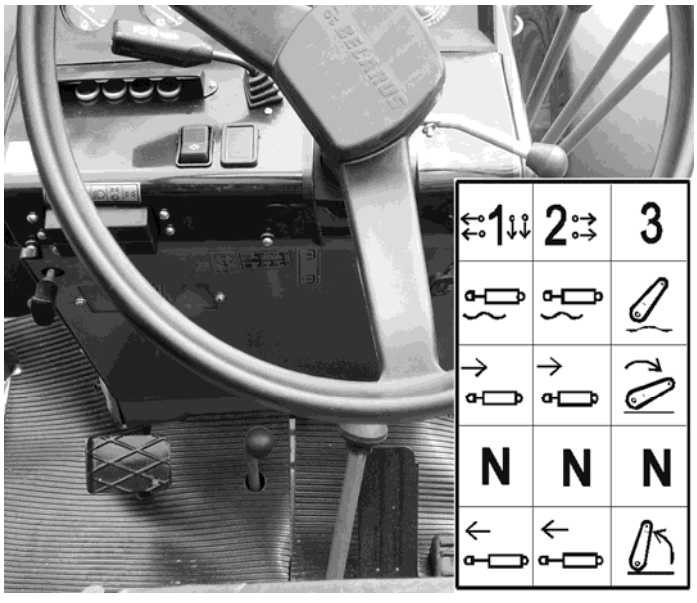


Lever of control has two positions:

- «Pump is included» — extreme upper position;
- «Pump is switched off» — extreme bottom position.

IMPORTANT! Include pump only on minimum idle turns of diesel engine. Include pump at cold start of diesel engine and switch off pump at maintenance service of tractor.

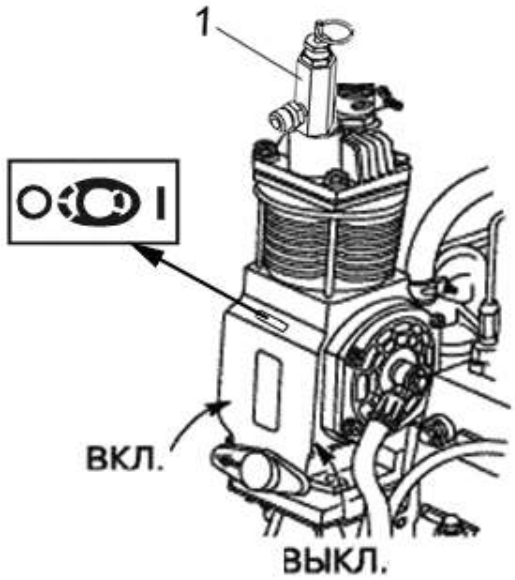
Control of hydraulic system distributor (remote hydraulic cylinders)



Each of three levers operates remote cylinders and has four positions:

- «Neutral» — bottom average position (fixed);
- «Rise» — extreme bottom position. At achievement by rod of cylinder of extreme bottom position lever is automatically comes back into position «Neutral»;
- «Compulsory lowering» — upper average unstable position between positions «Floating» and «Neutral». After release, handle is automatically returns in «neutral»;
- «Floating» — top fixed position.

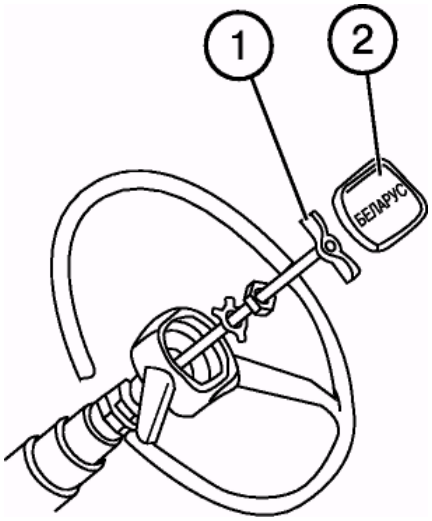
Compressor control



Handle has two positions:

- «Compressor is included» — at turn of handle in such position that hand on handle should be directed back on course of tractor;
- «Compressor is included» — at turn of handle to 180 degrees in such position, that hand on handle should be directed on course of tractor.
- Valve 1 is screwed in compressor, and it is intended for air selection of air for tires pumping, and also for another purposes, where energy of compressed air is required.

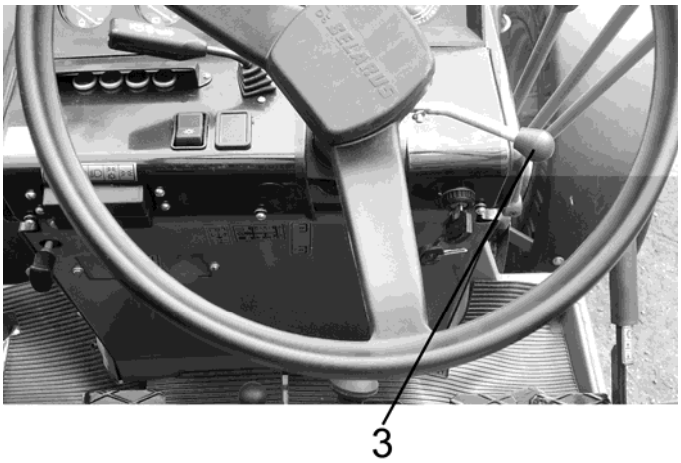
Steering wheel position change



For change of height position of wheel steering:

- Remove cover (2);
- Unscrew clip (1) on 3...5 turns;
- Move wheel in demanded position;
- Tighten clip (1) by effort of had and install cover into its place (2).

NOTE: Range of height adjustment of steering wheel is equal to 100 mm.



Steering column can bend in four various positions from 25° to 40° with interval in 5°. For inclination of steering column pull the handle of clamp (3) upwards.

“Belarus” seat

Seat of driver is single-seated and cushioning on mechanical bracket with hydraulic shock-absorber, it is fastened by four bolts to floor of cabin. It is adjusted on weight of driver within limited from 60 kg. Up to 120 kg. in longitudinal-horizontal plane within limits of ±75 мм. At correct adjustment of seat on weight of driver vibration of tractor is considerably decreases. Correctly adjusted seat should be pulled down on half of course (about 60—65 mm) under effect of weight of driver.

Attention! After performance of seat adjustments the handles (clamps) should be returned in starting position.

1 – handle of longitudinal adjustment of seat;

2 – handle of seat adjustment according to driver’s weight;

Section D. Operation Instruction

Preparation of Tractor for Operation

Preparing a new tractor to operation reactivate it, for this: • remove protective covers and caps installed on the engine,
• install radiator and cylinder block bleeders;
• fill all refillable capacities;
• unpack the muffler deposited in the tractor cab, and install it on the exhaust manifold so that exhaust nozzle of the exhaust pipe be directed forward to the tractor motion. Install tension shackle on 8…12 mm distance from the butt end of muffler nozzle. Tighten the shackle nuts with 44…56 Nm torque;
• drain the sediment from coarse and fine fuel filters and from the fuel tank;
• fill with fuel and run through the fuel supply system in order to remove air from it;
•check the tension of the fan belt;
• check and adjust air pressure in the tires;
• service accumulator battery;
• tighten the fastenings;
• inject all the oiling points;
• check and if necessary adjust toe-in of the front wheels.

WARNING! In order to avoid injury prior to staring the engine make sure that all protective fences are in place.

ATTENTION! Start from a tug of the new not run-in engine is not allowed in order to avoid intensive wear of the engine parts

Running-in

Your new tractor will work reliably and for a long time on condition of proper running-in and fulfillment of all necessary service operations in the recommended time period. In carrying out 30-running-in observe the following:

1. Constantly monitor the instrument readings, operation of the lubrication system, cooling and supply. Control oil and liquid levels in the refillable capacities.
2. Check tightening and tighten external fastening connections.
3. Running-in of the tractor should be done on easy transportation and field work (harrowing, cultivation, sowing etc.) gradually increasing load on different gears.
4. Do not overload the engine, do not allow smoking or engine rpm drop. Signs of the overload are the following: sharp rpm drop, smoking, no reaction from the engine on increased supply of fuel.
5. Work of tractor on too low gear with little load at high engine rpm would lead to excess fuel flow. Correct choice of gear for each specific operating condition would result in fuel saving and lower the wear of the engine.
6. Do the monthly servicing regularly in accordance with recommendations written in this Manual.
7. Do the technical servicing after running-in of the tractor.

Engine starting

Starting at standard conditions:

Check the level of oil in the sump of the engine, and cooling liquid in the radiator, presence of fuel in the tank.

IMPORTANT! Never start the engine with uncharged cooling system!

1. Brake the tractor with parking-brake;
2. Put the lever for switching the gears into neutral position, and the lever of reducing gear into extreme position (rear or front);
3. PTO should be switched off;
4. Switch on battery disconnect switch;
5. Put the lever of fuel supply into mid position;
6. Depress clutch pedal;
7. Turn the key of the starter switch into position II («Start») and hold it till the engine start but no longer than 15 sec. If the engine does not start restarting should be done not earlier than after 30...40 sec.
8. Release the clutch pedal. After starting the engine check the operation of all indication lamps and instrument readings (temperature of the cooling liquid, oil pressure in the engine, battery charge).
9. Let the engine work at 1000 rpm till stabilizing of oil pressure in the operating range.

IMPORTANT! You should do start of the engine and gauges control operations only seating in the operator seat.

WARNING: Never work on the tractor in closed rooms.

Starting at low temperatures (+4°C and lower)

Important! In order to avoid damage of the power train do not push or pull the tractor to start the engine from towing.

Warning:

Never use ethereal substances to ease start with installed electrical flare heater. Use of ester could lead to explosion in the intake manifold, and serious injury or traumata.

At stable low temperatures use winter types of oil in the engine slump, gearbox, and hydraulic system according to the recommendations of the present Manual.

Keep the batteries fully charged.

Use clean without additions of water winter diesel fuel.

In order to avoid breakage drain the sediment from coarse fuel filter and fuel tanks daily.

IMPORTANT! Fill the fuel tanks at the end of each working day in order to avoid formation of condensate inside the tanks.

Note: By starting of diesel engine at low temperatures can be used circulation heater for cooling system filled with antifreeze. Components of the heater can be ordered by dealer.

Starting procedure at low temperatures:

1. Shut off pressure oil pump gear of hydraulic system in order to decrease turning strength of crank shaft.
2. Perform operations 1-8, specified in clause “Starting at standard conditions”.

The beginning of tractor movement

ATTENTION! When selecting required movement speed use the gear shifting diagram.

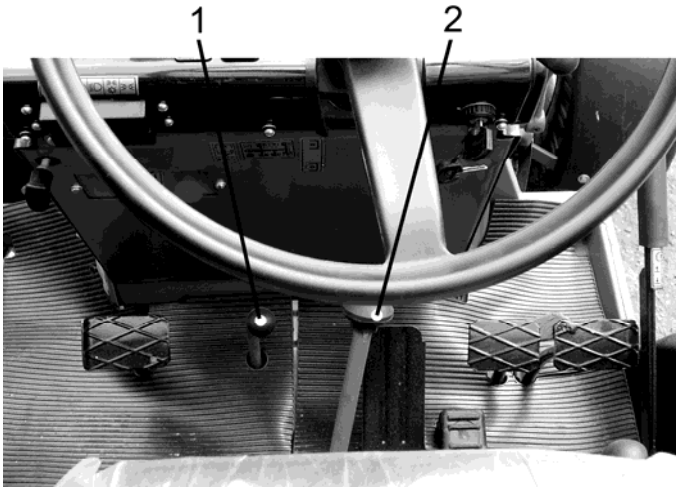
To put tractor in motion do the following:

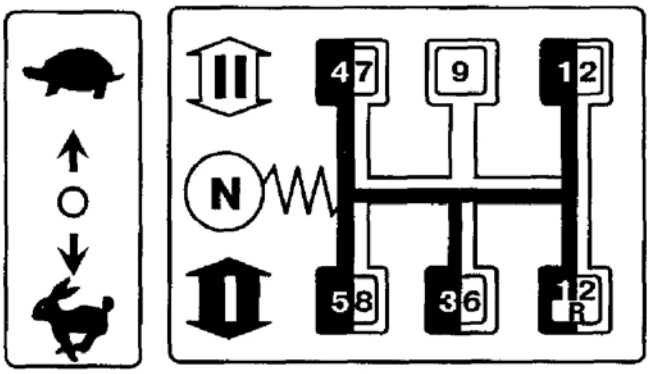
- Press clutch pedal to the full;
- Shift lever (2) to the extreme left position and pull or push it to select I or II mode, correspondingly;
- Turn lever back to “neutral” position and then further to the right, select the required gear and pull or push the lever (2) to set selected speed.
- Push or pull lever (1) to the required extreme position.*)

Disengage the parking brake and increase slightly fuel distribution, smoothly release the clutch pedal. After the movement of the tractor increase fuel distribution.
Avoid starting movement at large traction load (like deep plough in soil).

ATTENTION! Always press pedal clutch before putting on required range or gear of gear box.
Keep the foot off the clutch pedal in the process of tractor operation, as this will result in clutch slippage, overheating and ultimate failure.

*) Pull back – top gear, push forward – speed reducing for the tractors with reducing gear.





Tractor stop

To stop the tractor:

- reduce diesel crankshaft rotation speed;
- press clutch pedal;
- shift gear box levers to neutral position;
- using wheel brakes stop the tractor;
- engage the parking brake.

IMPORTANT! To stop tractor in emergency situations press at the same time clutch pedals and interlocked wheel brakes as soon as possible.

Engine shutdown

IMPOTANT! Before shutting down the diesel, lower an implement down the ground, let the diesel operate at 1000 rpm for 1-2 minutes to reduce diesel cooling fluid temperature.

To shut down the diesel:

- set lever of fuel supply control to position, corresponding to minimum frequency of diesel idle rotation;
- stop PTO and set all distributor handles to neutral position;
- lower mounted implement down the ground;
- pull the handle of the lever cable till the full stop of the diesel
- switch “the ground” off to avoid battery discharge

Hydraulic system

Hydraulic control system of rear three-point mounting implement provides system operation in depth control mode.

Depth control

When operating with mounting tilling implements they should have carrying wheel.

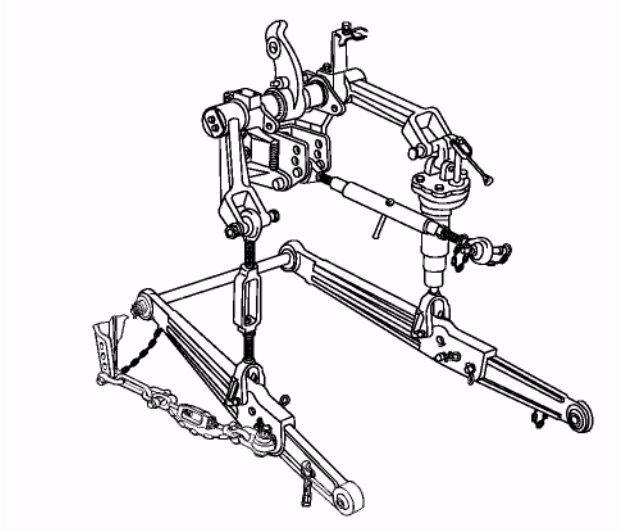
Steering

IMPORTANT! The tractors are equipped with steering booster. If the diesel engine is stopped, the pump doesn’t feed the system and it turns automatic into manual mode, in this case is needed more steering wheel effort for tractor turn.

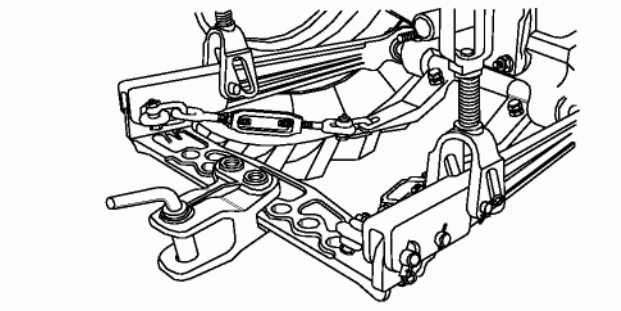
Section E. GANGING UP

Attachments for connection of agricultural machinery to tractor

(for tractors with draft control unit)

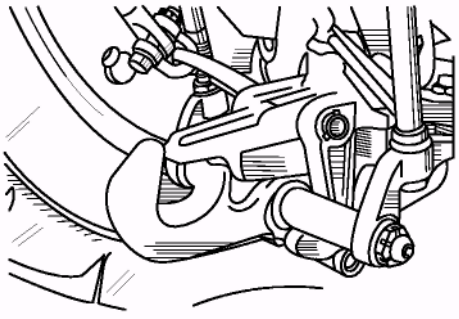


Rear three-point hitch attachment is used for coupling mounted and semi-mounted agricultural machinery, like ploughs, seeders, cultivators, sprayers, etc.



Towing-hooking device (crossbar) TSU-1Zh is used for operating trailed machinery, like potato harvester, etc. (except one-axle trailers) at speed up to 15 km/h.

ATTENTION! Never use TSU-1Zh for transportation purposes.

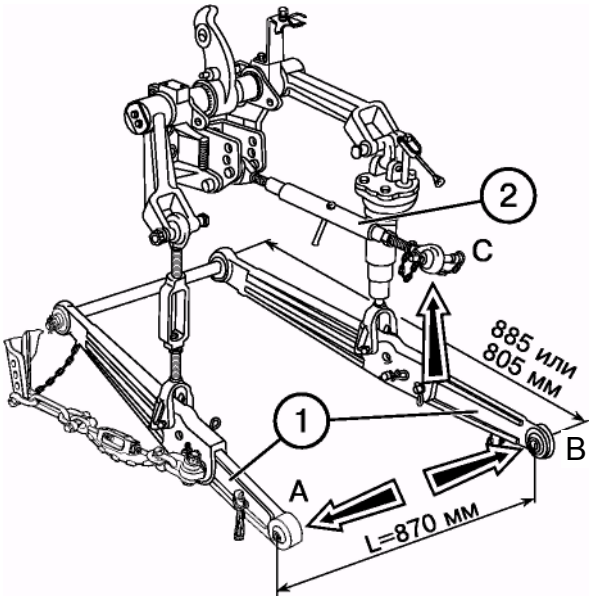


Towing-hooking device TSU-2 (hydraulic pick-up hitch) is used for operating one-axle trailers and other machines.

Rear hitch attachment

Three-point hitch attachment of 2 category provides coupling to tractor mounted and semi-mounted agricultural machinery and implements, having the following coupling elements:

- length of suspension axle «L» (distance between joints «A» and «B») equals to 870mm;
- height of machine post equals to 510 mm; 610 mm;
- diameter of pins for coupling to joints of lift links (1) equals to 28.7 mm;
- diameter of pin for coupling to top link (2) equals to 25 mm.



ATTENTION! Carefully study this section before coupling machines.

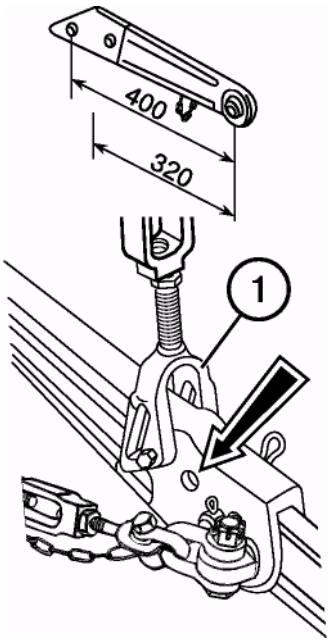
Lift links consist of two parts:

- front part or the link itself;
- rear end with ball joint. Standard length

of lift links is 885 mm.

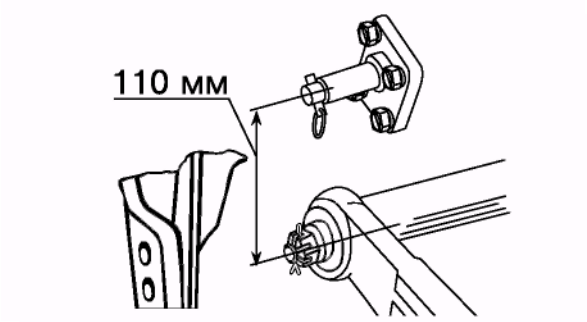
To increase the length of suspension install lift ends with bent front joints (F70-4605050-01/055-01).

To increase lifting capacity of hitch attachment replace rear ends of links (of 400 mm long) with lift ends, where the distance between joint pin and front hole is 320mm (N50-4605040A2/045A2). Total length of the lift link will be 805 mm.

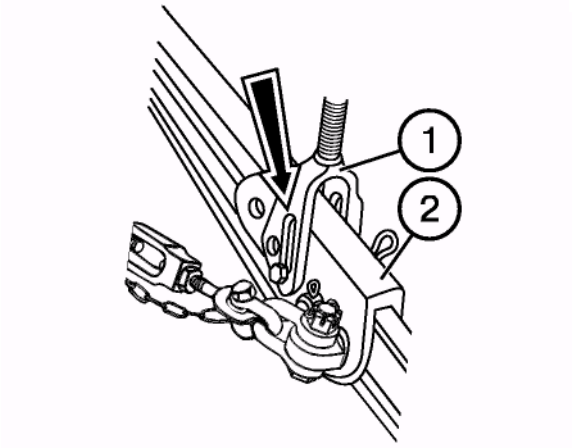


Attention! If the link length is 805mm, lifting capacity of hitch attachment will increase up to 10%, with simultaneous decrease of lift height by 10%. The same increase of lifting capacity can be provided by installation of brace(1) at additional points (lift height will decrease by 10% as well).

To increase road clearance when tilling high-stalk plants install front ends of lift links on auxiliary suspension axes, placed 110 mm above the axis of lift links. To follow field profile in lateral direction when operating wide-cut implements, connect braces (1) to lift links (2) by means of long slots.



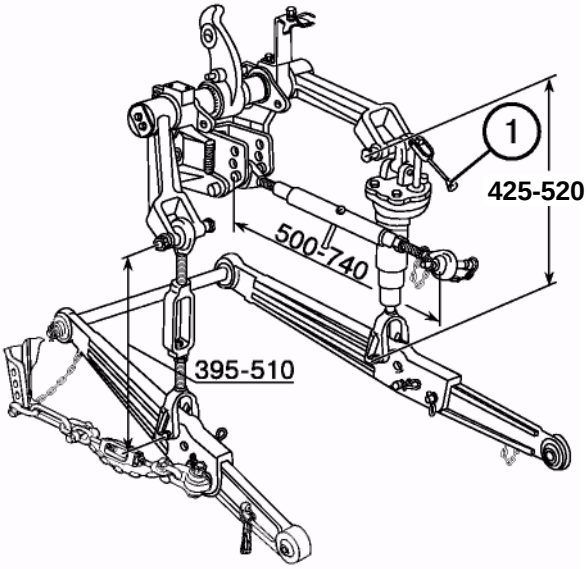
IMPORTANT! Slots of brace yoke should be behind the hole to avoid brace damage.



Top link and braces

Length of top link is adjusted within the range of 500...740mm. Length of right-hand adjustable brace can be adjusted within the range of 425...520 mm by rotating a handle (1). As dispatched from the works the length of the right-hand brace is set to standard value of 475 mm. Length of left-hand (non-adjustable) brace (4), when tractor is dispatched from the works, is also set to standard value of 475mm.

During the operational process the change of front brace length is provided within the range of 395...510 mm depending on tractor configuration and type of ganged-up machines and implements.



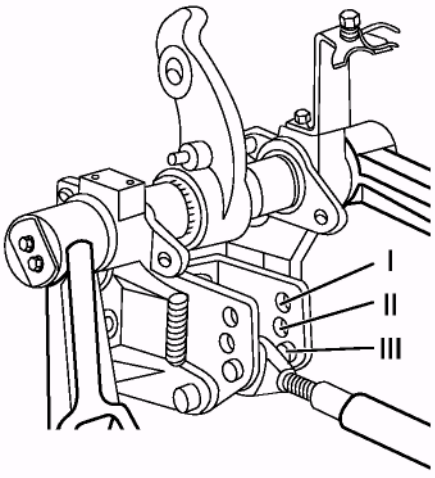
IMPORTANT! Use only right-hand brace to adjust an implement in transverse plane.

Depending on tilling depth and soil nature, set top link in one of three positions:

I —light soil and shallow tilling depth when using draft control;

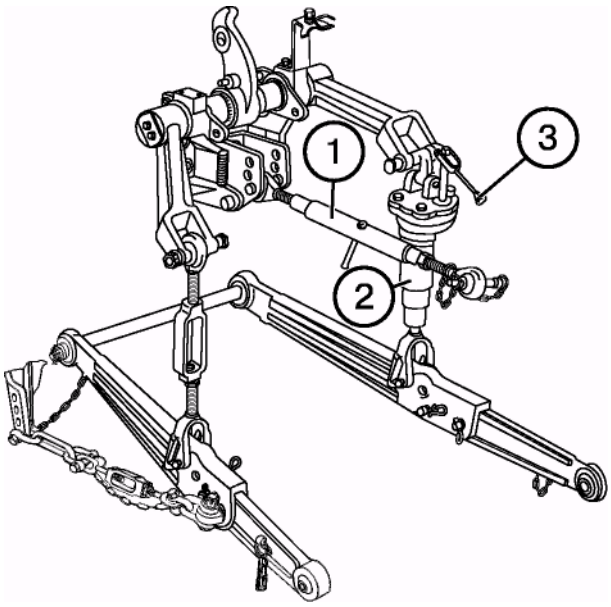
II —average soil and average tilling depth when using draft control;

III — heavy soils in case of deep tilling, as well as when using position control and without use of draft control.



Mounting machinery on tractor

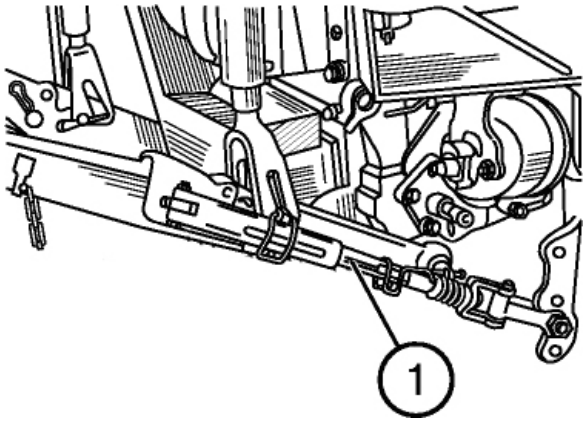
1. Before mounting machine on the tractor, first make sure there are no people in the machine mounting zone.
2. Using draft control lever (if installed), lower the hitch attachment into down position, pull tractor back and hinge the machine to lift links. Fasten the pins by cotters. Shut down the engine.
3. Extend or shorten the top link (1) and couple the hitch ball to the machine. Fasten the pin by cotter.
4. If necessary, set the top link to initial or required length.
5. If necessary, make lateral machine tilt adjustment by means of right-hand adjustable brace (2). To increase length of the brace turn lever (3) clockwise, and visa versa.
6. Before starting work make sure that:
   - Parts of the tractor are not in dangerous proximity to machine elements;
   - Top link is not in contact with PTO guard, when machine is in lowermost position;
   - Cardan drive from PTO is not too long, has no wide joints' angles, and there are no thrust forces;
   - PTO guard is not in contact with the guard of machine cardan drive.
7. Slowly lift the machine and make sure that clearances between the wheel and machine in lifted position are not less than 100 mm.
8. Check whether the side sway of lift links is sufficient and, if necessary, adjust it by means of ties.



Machines (implements) can be mounted on the tractor also by means of automatic hitch SA-1, connected to the tractor hitch attachments in three points (two rear joints of lift links and rear joint of top link).

To prevent accidental spontaneous de-coupling of the machine from the tractor, secure the automatic hitch latch with spring cotter-pin.

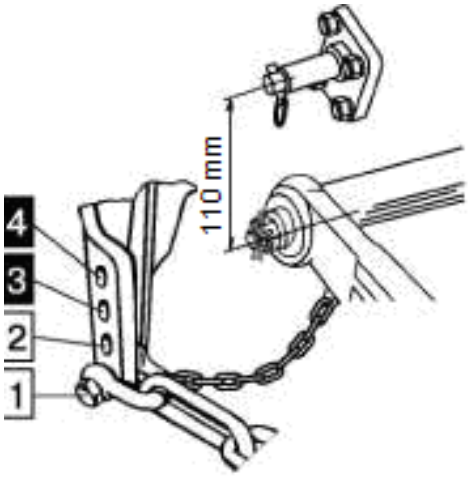
Limit (telescopic) ties (1)



Ties are used for limiting side sway of the lift links of hitch attachment both in transport and operational positions. It is of particular importance when operating on slopes, close to excavations, walls, etc.

Rear end of the tie is coupled to lift link, and the front end to the bracket in one of four positions depending on operation type:

- Position 1. Ties exclude side sway of an implement in transport position.
- Position 2. Ties exclude side sway of an implement both in transport and operational positions.

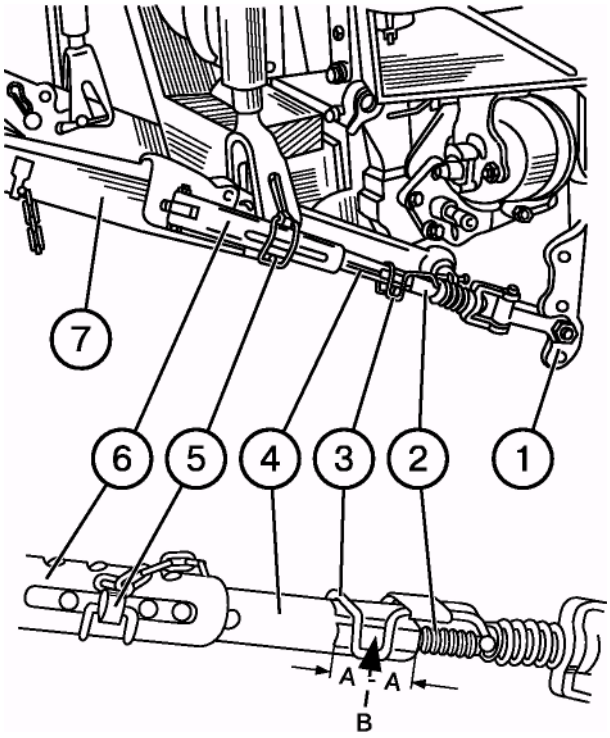


IMPORTANT! Positions 3 and 4 should be used only when lift links installed on additional suspension axes (upper axes)

- Position 3. Ties exclude side sway of an implement in transport position.
- Position 4. Ties exclude side sway of an implement both in transport and operational positions.

ATTENTION! Ties should be installed only in the second lowest holes of brackets (position 2) to avoid tie breakage.

Partial interlocking of telescopic ties



ATTENTION! Telescopic ties should be installed only in the second lowest hole.

To provide necessary lateral movement of a machine, like a plough, in operational position, make the following adjustments of a tie:

- By rotating a screw (2), set the handle (3) in the middle of flat «B»;
- Pull a cotter (5) out of the tie;
- Connect a machine to lift links (7) and lift it until it rises off the ground;
- After you have matched the holes of inner tube (4) with the slot of outer tube (6), insert the cotter (5) in the middle of the slot.

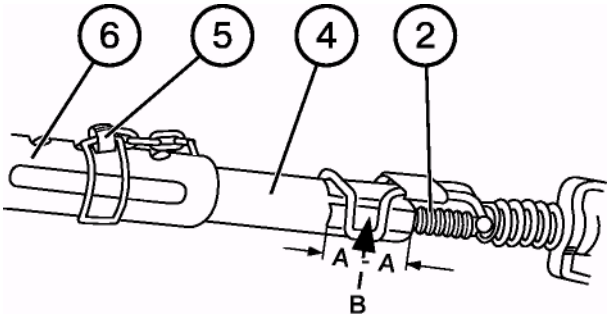
IMPORTANT! Set cotter (5) in the middle of the slot, or with minimum displacement towards the tractor. Otherwise the ties can be damaged.

Before moving in transport position lift machine into upper position and check magnitude of its side sway, which should not exceed 20 mm to each side. If necessary, adjust the sway by rotating a screw (2).

Full interlocking of ties

To fully interlock a machine, e.g. a cultivator or trailing appliance, when in operational position, adjust ties in a way similar to partial interlock, except the last operation, when you should matched the hole of inner tube (4) with the hole of outer tube (6), and then insert a cotter (5) into the holes.

Full interlock in transport position (with machine being lifted up), is made by maximum screwing-in of a screw (2) into the tube (4).



Internal ties (2)

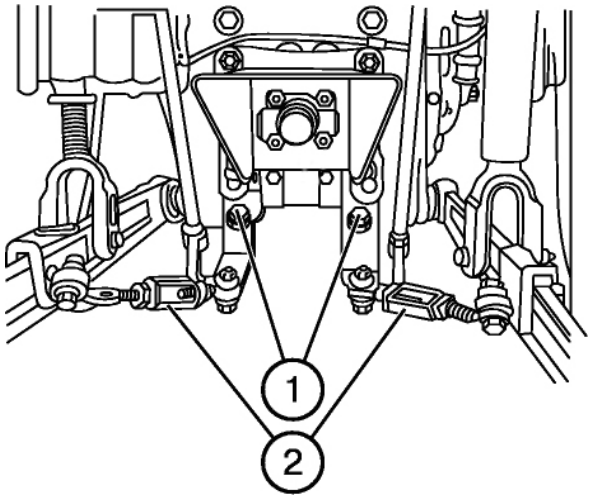
They are also used for limiting side sway of machines both in transport and operational positions.

NOTE: Telescopic ties are mounted only from the outside**.**

Partial interlock (for tillage)
Observe the following order of adjustment with a machine in operational position:

- Screw adjusting bolts (1) into brackets to the full;
- Lift the machine so that its tools couldn't touch the ground;
- Adjust the length of the right-hand brace to the required tillage depth (when operating with a plough);
- By rotating ties (2) adjust length of limiting chains, that provide machine movement in horizontal plane to 125 mm to each side from the middle position, or in accordance with machine operating manual.

When setting machine into transport position for its partial interlocking screw out the bolts (1). Maximum machine sway to both sides should not exceed 20 mm.



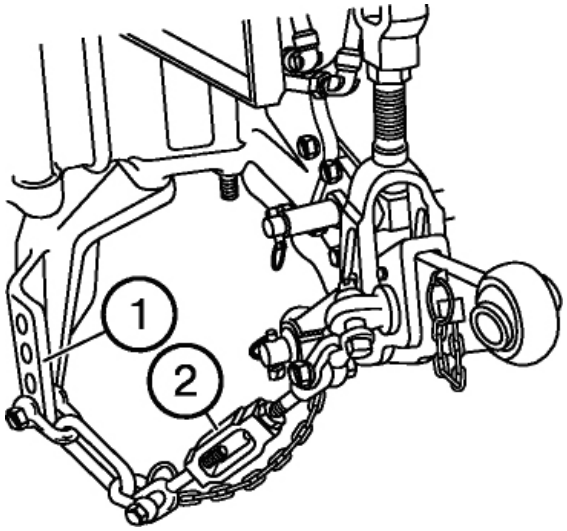
Full interlocking (for cultivation, sowing, etc.) is set in the following way:

- Screw in adjusting bolts (1) to the full;
- Shorten the ties (2) to maximum possible degree.

IMPORTANT! When changing length of the right-hand brace, do not forget to readjust the ties.

Outside chain ties (2)
Partial interlocking

Provide horizontal machine displacement in operational position by coupling limiting chains to lower holes of brackets (1) and adjusting the length of chains by means of ties (2) to obtain an implement sway to each side at least 125 mm, or in accordance with machine operating instructions.
When operating with ploughs set length of the right-hand brace to depth of tillage



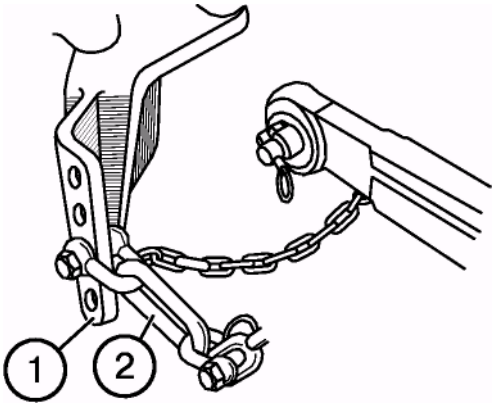
ATTENTION! Be sure to maintain degree of machine swaying at least at the range of 125 mm in order to avoid chains breaking when lifting the machine into transport position.

When setting machine into transport position tighten chains by means of ties (2). Machine can sway to both sides 20 mm maximum.

Full interlocking

To fully interlock the machine in operational position connect limiting chains (2) to the second lowest hole of the bracket (1) and shorten length of chains (2) to minimum.

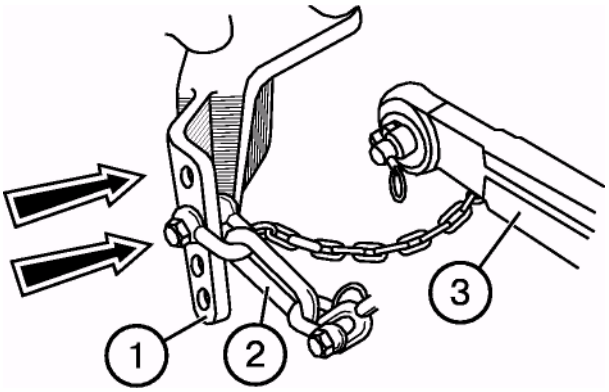
In transport position the interlocking is performed automatically.



Additional suspension axes of lift links of the hitch attachment

When cultivating high-stalk plants install lift links (3) on addition suspension axes. In this case for partial interlocking of an implement in operational position connect limiting chains (2) to the third lowest hole of the bracket (1), and for full interlocking to the fourth hole.

In transport position interlocking is performed automatically.



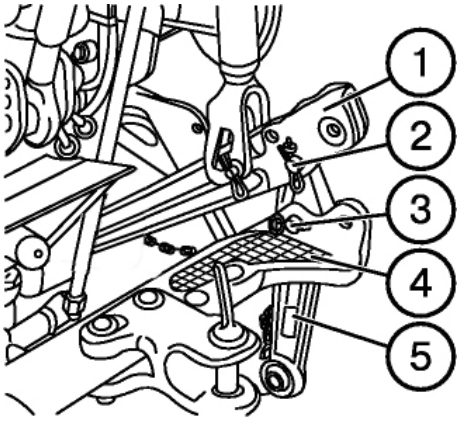
Towing-hooking device TSU-1Zh (crossbar) (4)

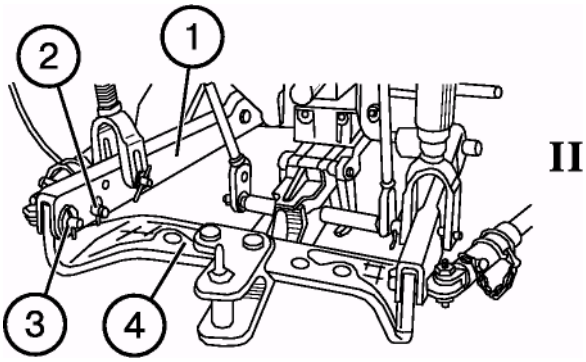
Towing-hooking device is used for hitching machines operating at speeds of up to 15 km/h. Tractors as dispatched from the works with a crossbar, installed as shown in figure 1. To re-adjust from transport (I) to operational (II) position, perform the following operations:

1. Remove the cotter and pull out an eyelet (3), then take off the crossbar (4).
2. Remove the cotter and pull out a pin (2), then take off rear ends of lift links (5).
3. Install the crossbar (4) on front ends of lift links (1), secure it with the eyelet (3) of the limiting chains, pins (2) and cotters (see fig. II).

When performing inside or outside installation of limiting chains, provide full interlocking of towing-hooking device. When installing towing-hooking device with telescopic ties, connect them to the second lowest bracket hole and provide full interlocking.

ATTENTION! It is prohibited to use yokes of the towing-hooking device for operation with trailers at speed over 15 km/h.



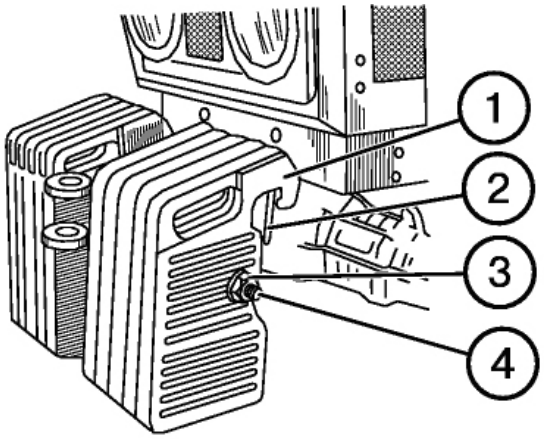


II

IMPORTANT! Make sure that towing-hooking device is secured from side sway by means of adjustment of inside or outside ties.

Front ballast weights (1)

When operating with heavy mounted machines and implements, to maintain normal tractor controllability under noticeable unloading of the front axle, install additional ballast weights (1) (10 pieces of 20 kg each). Ballast weights (1) are installed on special bracket (2), which is fastened to the front tractor beam and tied up with string (4) and nut (3).



Mechanism for hitch retention in transport position

a) Lift the hitch attachment into uppermost position by putting distributor handle into “lift” position

The stop (10) of hydromechanical valve of hydraulic cylinder must be located in extreme rear position on the hydraulic cylinder rod;

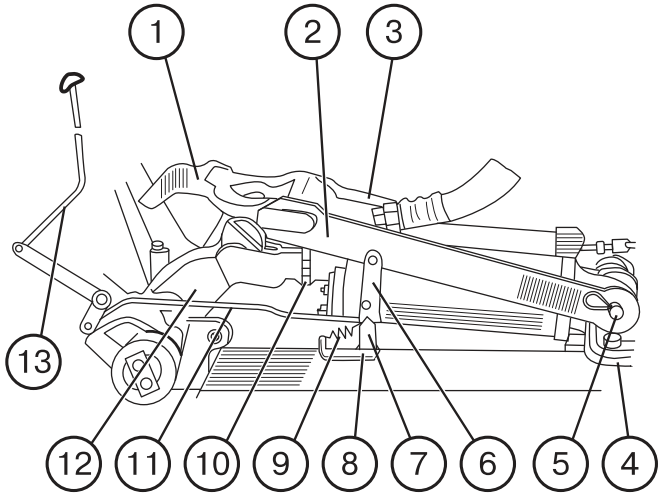
b) Lower a handle (13), and retention mechanism together with it, into bottom position;

c) Set the distributor handle into “floating” position. Pivoted lever (12) will turn under the effect of mounted implement, and a tooth should come into contact with a grip (1).

To unlock the hitch attachment act as follows:

a) lift up the hitch attachment into uppermost position by putting distributor handle into “lift” position;

b) lift up the handle (13) into uppermost position.



Hitch retention mechanism of tractor with small-size cabin:

1 — grip; 2, 3 — linkages; 4 — hydraulic cylinder bracket; 5 — axle; 6, 7 — levers; 8 — bracket; 9 — spring; 10 — stop; 11 — control linkage: 12 — pivoted lever; 13 — control handle.

Control of tractor hydraulic system and hitch attachment

Hitch attachment on tractors is controlled with extreme right-hand handle of distributor.

When operating with mounted machines, use only “lift” and “floating” positions of handle.

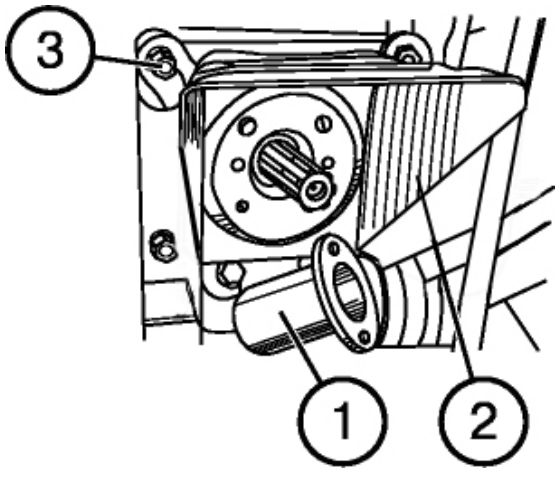
It is prohibited to set the handle into “lowering” position, when operating with mounted tilling machines!

Use “lowering” position only when operating external cylinders, installed on the machine and intended to adjust positions of working devices (reel, header, ploughshares. etc.) of harvesting, seeding and other machines. If distributor handle doesn’t return automatically to “neutral” after termination of cylinder travel, take it out manually. And vice versa, in case of premature return of the handle hold it by hand until operation is fully completed.

Special character of tractor operation with machines that require driving from rear PTO

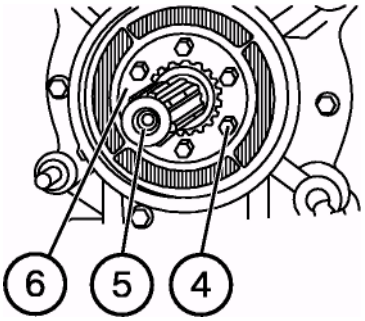
General recommendations:

a) Make sure that rear PTO control is properly adjusted before connecting machine to tractor;
b) Install and fasten securely required (6, 8- or 21-splined) PTO drive end and actuate drive of rate speed corresponding to it. Set 540 rpm for 6, 8-splined drive end, and 1000 rpm for 21-splined drive end.



To replace PTO drive end, fulfill the following operations:

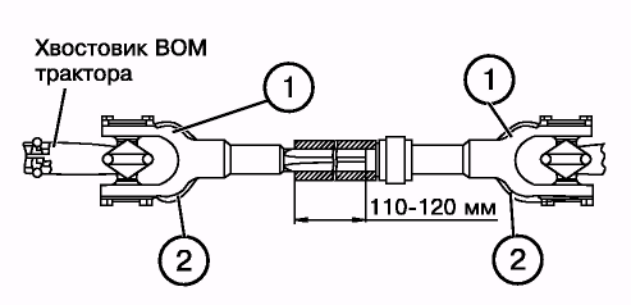
1. Screw out two bolts and remove a cap (1).
2. Unscrew four nuts (3) and remove guard (2).
3. Screw out six bolts (4), remove plate (6) and dismount the drive end (5).
4. Install another drive end into spline opening and install the plate (6).
5. Assemble remaining details in the reverse sequence.



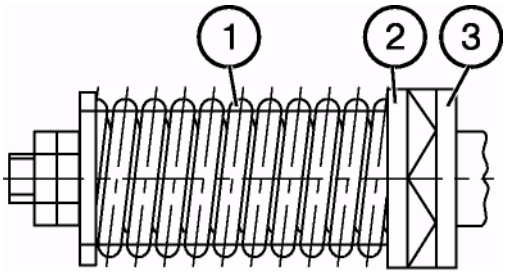
c) Lubricate the shaft and tube of cardan drive telescopic joint with solid oil. Install cardan drive joint on PTO drive end, fasten it securely in fixation groove. Make sure that eyes (2) of joint forks (1) of intermediate (telescopic) shaft lie in one plane. Failure to satisfy mentioned requirement causes cardan drive and PTO overloading;

d) Install cardan shaft guard of agricultural machine;

e) After cardan drive installation make sure that there is no thrusting of telescopic connection elements of cardan drive, when machine is in its extreme positions towards the tractor; minimum overlapping of cardan drive telescopic part should be 110-120 mm, as drive discoupling is possible if overlapping length is less.



Safety clutch spring length (1) of agricultural machine should be adjusted in such a manner to provide turnover of cam clutches (2 and 3) against each other in case of overloading. Excessive spring tightening leads to clutch malfunction and cardan drive and PTO overloading.



Actuate separate PTO drive at minimum engine speed or when the engine is shut down. Actuate synchronous PTO drive with running engine, while smoothly engaging clutch coupling.

When operating tractor without use of PTO be sure to set PTO control lever into “PTO-off” position, set shifting clutch of two-speed PTO drive into position 1 (540 rpm), and set selector lever of separate-synchronous PTO drive into middle (neutral) position.

Tractor movement with engaged synchronous PTO drive is permitted at speed not exceeding 8 km/h;

f) Disengage PTO when turning an aggregate (for trailed machines), as well as when lifting up the machine into transport position (for mounted and semi-mounted machines);

g) After machine discoupling from the tractor do not leave cardan drive joint on PTO drive end;

h) When installing power pulley, as well as driver reducing gear of special machine (cotton, excavating machine, etc.) on rear PTO cover, take care that they are aligned against drive end (inserted into Ø162mm bore on rear cover), nuts and their fixtures are securely tightened.

When operating with rotation machines for tilling:

a) Take care that protecting means are in good order operate normally;

b) Do not engage PTO when working member is lowered to the soil;

c) When tractor is moving perform smooth lowering of machine with rotating working members;

d) Do not engage PTO, when angle of refraction in one of the cardan drive joints exceeds 22 degrees;

e) When operating on stiff soils prepare cross strips for driving into the enclosure, and only after this cultivate the field longitudinally.

Operation with trailers and trailed machines

Single-axle machines like semi-trailers are coupled with tractor by TSU-2 (hydraulic pick-up hitch). Transportation of machines with the help of TSU-1Zh (crossbar) is permitted at speed up to 15 km/h, excluding the driving to the public roads, and when performing agricultural works.

ATTENTION!

Ganging-up of machines like trailers and semi-trailers with TSU-1Zh (crossbar) is strictly prohibited.

When operating with single-axle trailed machines, install additional ballast weights for additional loading of front tractor axle.

If towing device is installed on tractor, it is prohibited to couple it with semi-trailers (single-axle trailers) as well as two-axle trailers having non-standard towbars.

It is strictly prohibited to use rear lift linkage, when towing device is installed on tractor!

Trailers are operated at speeds, defined by the road conditions. It is allowed to operate with trailers 2PTS-4-887A, having body capacity of 20 and 45 cubic meters, at speeds up to 15 km/h, as they have lesser stability. To prevent damage to rear wheel fenders, avoid sharp turnings of these trailers and thrower 1RMG-4.

Hinge of trailers (2PTS-4-785A, etc.) should be secured from turning to avoid its cramping.

During the operation the fork of TSU-1Zh should be fastened on the crossbar of drawbar hitch with two pins. It is prohibited to operate with the fork, fastened with one pin.

Before operation make sure that pins and pivot bolts of drawbar hitch fork are securely fastened by cotters. Switch on all the trailer signal devices (stop-signals, turn signals, number plate light) through coupling socket, installed on the tractor.

Application of tractor auxiliary equipment

Following auxiliary equipment can be installed on the tractor: power pulley, additional ballast weights for additional loading of front axle, reducing gear, automatic hitch SA-1, spacer for doubled rear wheels installation and other equipment.

Power pulley is installed on reducer cover of rear PTO and is rotated by splined PTO drive end. To avoid PTO drive end deformation, be sure to provide body installation on four cotter pins with flange alignment in the PTO cover. Pulley engagement and disengagement is performed by PTO control lever.

Additional ballast weights with total mass of 220 or 510 kg are installed on special bracket, which fastened to tractor front beam.

Reducing gear is installed to make it possible to apply the tractor with machines, requiring underspeeds. By the means of reducing gear tractor speeds are geared down additionally in I and II gears, forward and reverse (reducing gear is optional).

To install reducing gear on tractor, implement recommendations, stated in “Technical manual for reducing gear service instruction”, attached to every reducing gear being dispatched under customer order.

IMPORTANT! After reducing gear installation on tractor, fill the power train with oil up to the level of check plug and add 10 liters more.

Tires

IMPORTANT!

1. Never exceed air pressure values in tires recommended by the manufacturer.
2. Never perform welding of disk or other kinds of repairs with tire inflated. To dismantle or repair tires address workshop with skilled personnel.

Tires used on the tractors 90/92

Tires	When mounting FDA 72	When mounting front axle
	Basic	
front	11,2 – 20;	9,00 – 20; (9,00R20)
rear	15,5R38	15,5R38

IMPORTANT! For tractors with FDA correct combination of front and rear tires should be used. Correct combination of front and rear tires provides maximum operation qualities of the tractor, increases tires' life and reduces wear of power gear components. The use of worn out and new tires, or tires with different diameter or rolling radius may result in violation of kinematical mismatch requirements and excessive wear of tires.

For normal tractor operation bring pressure in tires in accordance with given-below table. The pressure should be brought in “cold” tires. When operating with large draft forces bring pressure as for speed 30 km/h.

When executing hauling operations on the roads with hard surface increase pressure by 30 MPa.

When operating with front loader bring maximum pressure defined for the front tires.

Table of tire loads applied on tractors 90/92

Standard size of tire	Load index	Speed symbol	Volume of filling liquid, l	Allowable load, kgf (N) at pressure, MPa										
				0,08	0,1	0,12	0,14	0,16	0,18	0,2	0,22	0,24	0,26	0,28
9,00-20	112	A6		-	640	715	780	840	900	960	1020	1070	1120	-
9,00R20	112	A8		580	640	715	780	840	900	960	1020	1070	1120	-
15,5R38	134	A8	250	1420	1620	1810	1975	2120	-	-	-	-	-	-
11,2-20	114	A6		-	765	850	930	1000	1080	1145	1180 (2,1)	-	-	-

For tires with speed symbol A6 the loads are indicated for speed 30 km/h.

For tires with speed symbol A8 the loads are indicated for speed 40 km/h.

Allowable change of load on guide and driving wheels' tires depending on speed

Table

Speed, km/h	Change of load, %, on guide wheels' tires with speed symbol	
	A6 (30 km/h)	A8 (40 km/h)
10*	+50	+67
15	+43	+50
20	+35	+39
25	+15	+28
30	0	+11
35	-10	+4
40	-20	0
45	-	-7

* For tires with ply rating 6 and more internal pressure should be increased by 25%.

When using tires with ply rating 6 and more on front loaders, increase of load on tire is allowable up to 100% only in load mode.

Table

Speed, km/h	Change of load, %, on driving wheels' tires with speed symbol	
	A6 (30 km/h)	A8 (40 km/h)
10*	+40	+50
15	+30	+34
20	+20	+23
25	+7	+11
30	0	+7
35	-10	+3
40	-20	0
45	-	-4
50	-	-9

* Inside pressure should be increased by 25%.

Short-term change of load (not more that 10% of total shift time) is allowed.

Note: Change of load depending on speed is used in cases, when tires are not loaded for prolonged time at high torque. During field works and under other conditions of prolonged operation at high torque, values that correspond to speed of 30 km/h are used.

When executing hauling operations on the roads with hard surface increase pressure by 30 kPa (0,3 kg/cm2)

When doubling wheels their total load capacity should not exceed the load capacity of single tire more than 1,7 times as much.

In the case of standard conditions bring minimum allowable pressure in tires for working with trailed machine.

When operating with mounted machine bring higher pressure in tires.

When using double wheels the pressure in external tire should be 1,2 – 1,25 times lower than the internal tire.

Allowable loads on front and rear axle

Tractor model:	Allowable loads, kN	
	On front axle	On rear axle
90	17,5	50,0
92	24,0	50,0

Notes:

1. The loads on axles should not exceed the total load capacity of single tires of front and rear wheels.

2. When mounting track more than 1800 mm, the loads on axles should be reduced at 5% for every 100 mm of track increase.

Liquid ballast

Tires are filled with liquid ballast only when traction of wheels with soil is not sufficient under unfavorable conditions (over humid soil, etc.).

NOTE: It is not recommended to ballast front tires, as this makes tractor steering worse.

In winter it is recommended to use the mixture of calcium chloride with water at:

Ambient temperature, °C, up to	Amount of calcium chloride, g/l of water
to -15°C to -25°C to -35°C	200 300 435

This ensures low freezing temperature, increase of solution density and gives safe and economical ballast. If use it correct, it don't result in damage of tires, tire tubes or wheel rims.

When filling tires with liquid, the tire valve should be in the wheel crown.

In table below there are solution volumes being filled the rear tires:

Tires dimension	Volume of liquid being filled, l/tire
15,5R38	250

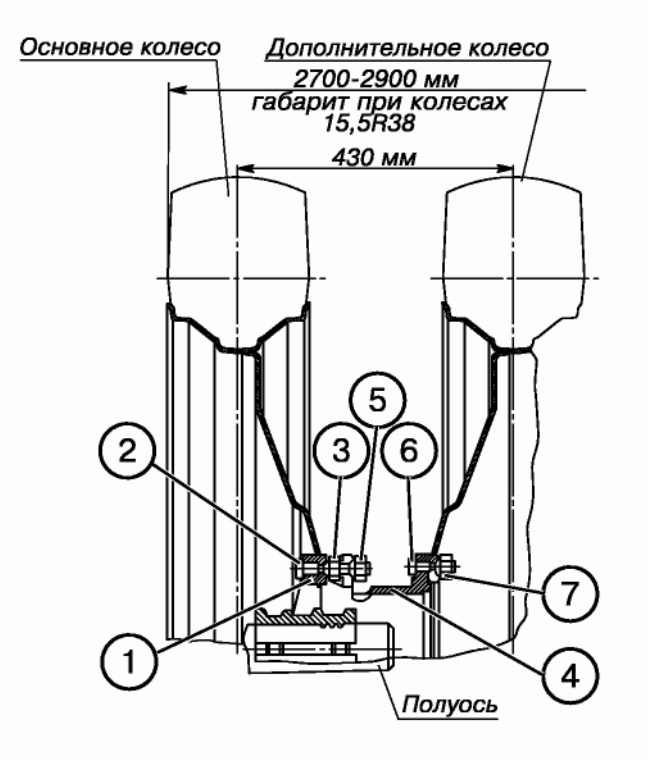
IMPORTANT! Radial tires should be filled with the liquid ballast to the volume no more than 40…50%. When filling more, air volume will be insufficient to absorb the shocks that may result in tire damage. This is due to the lower air pressure, provided for radial tires. Diagonal tires can be filled up to 70% of volume.

WARNING: When making solution, flakes of calcium chloride should be added to water and solution mixed until calcium chloride CaCl2 fully dissolves. **Never add water to calcium chloride**. Put on goggles when making solution. When solution hits eyes promptly wash them with pure water for five minutes and immediately address the doctor.

Installation of doubled rear wheels

To increase the cross-country ability on tractors, by the use of additional spacers, may be mounted the doubled rear wheels with dimension type 15,5R38. To mount an additional wheel, dismount main wheel, press out short bolts from hub (1) and press in long bolts (2), which are in spacer set. Mount the main wheel on bolts (2) and secure with nuts (3). Then put spacer (4) on the same bolts and secure it with nuts (5). Then mount additional wheel on bolts (6) of spacer and secure with nuts (7). The tightening torque of rear wheel nuts 300…350 N•m (30…35 kgf•m).

ATTENTION! Do not allow use doubled wheels to increase the drawbar tractive effort.



Section F. ADJUSTMENTS

Front track adjustment
Steering booster without hydraulic cylinder in steering linkage

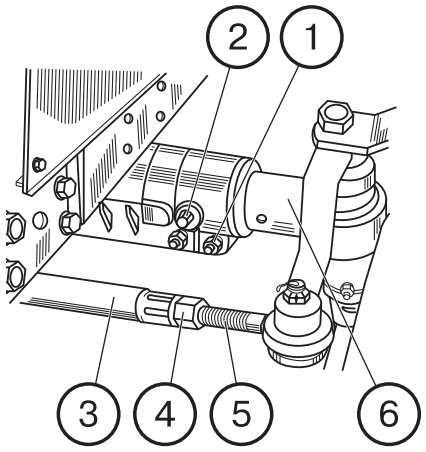
Front track can be changed in the range from 1350 to 1850 mm with intervals 100 mm at symmetric and 50 mm at asymmetric wheel arrangement. For arrangement of the required track of guide wheels perform the following operations:

a) lift the tractor front part by jack until the wheels break off the ground;

b) loosen bolts (1), take out pins (2) mountings of the retractable cams in the tube of front axle;

c) at first move the first and then the second retractable cam (6) (simultaneous change the length of steering links by turning tubes (3) in the tips (5), preliminary turning off lock-nuts (4)) at appropriate value of arrangement track and then fix cams in the tube of front axle;

d) lower the tractor down. Check toe-in and, if necessary, adjust it.



FDA with bevel gear speed reducers. Steering booster without cylinder in steering linkage

Front track is adjusted by stepless screw mechanism situated at hoses of the front axle at three intervals: 1350-1500 mm, 1500-1600 mm, 1600-1800 mm.

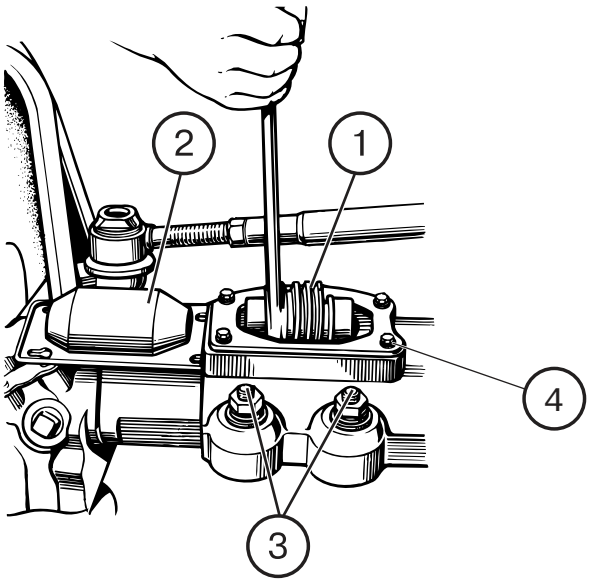
To obtain the required width of the track set the adequate relative position of wheel tread relative to the disk as is shown in the figure below.

For the wheels with constant disk offset the track is adjusted stepless in the intervals 1400...1600 mm and 1750…1950 mm.

To change the track lift the tractor head (or alternately the front wheels) providing with the gap between the wheels and ground, brake the rear wheels and then:

a) turn off bolts (4) and uncup (2);

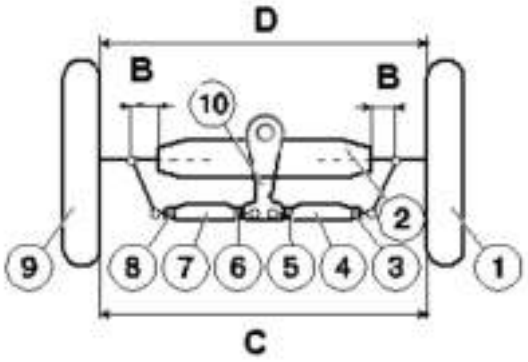
b) turning off the nuts, unclamp cotters of the hoses (3) so that provide free movement of the conical pair bodies. Turning the adjusting screw (1) by the key is provided the movement in the hoses of the front axle of final drives bodies with wheels and obtainment of the required track in the specified intervals. The rotation of the adjusting screw should be accompanied by the change of the length of steering links.



Adjustment of front wheels toe-in of the tractors with steering booster

Front wheels toe-in is adjusted at the factory in the range of 0-8 mm.
Periodically every 250 h of working and also at every change of the front track check toe-in and when is necessary adjust it. Before checking it, obligatory adjust the gaps in the bearings of the wheels and hinges of the steering links.
The adjusting of the wheels toe-in perform in the following order:

a) place the tractor at the horizontal ground with hard surface;
b) place the pitman (10) in midposition, for this, turning the steering wheel, place it in the position when the probe in the steering booster body is maximum sinked;
c) check that the conical pair bodies (for tractors with FDA) or the steering knuckles (for tractors without FDA) are moved out to length «B» from the front axle body or front axle tube correspondingly;
d) adjust the left and the right steering links by extending or shortening them to the same value, for this unscrew the lock-nuts (3, 5, 6, 8) and, turning the left and the right tubes (7, 4), set the required length;
e) determine the wheels toe-in, for this measure the distance (measurement «D») between inner flanges of wheel treads ahead (at a height of the wheel centers) and mark by chalk the measurement positions. Then go ahead at the tractor so that the marks are behind at the same height and measure the distance between marked points (measurement «C»). The second measurement should be larger than the first one;

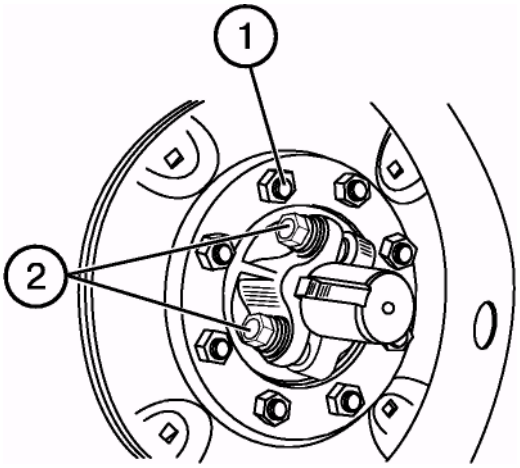


the difference between the second «C» and the first «D» measurements is equal to the wheel toe-in and should be 0-8 mm. When is necessary, adjust the toe-in by changing the length of the steering links. Extend or shorten the left and the right links to the same length;

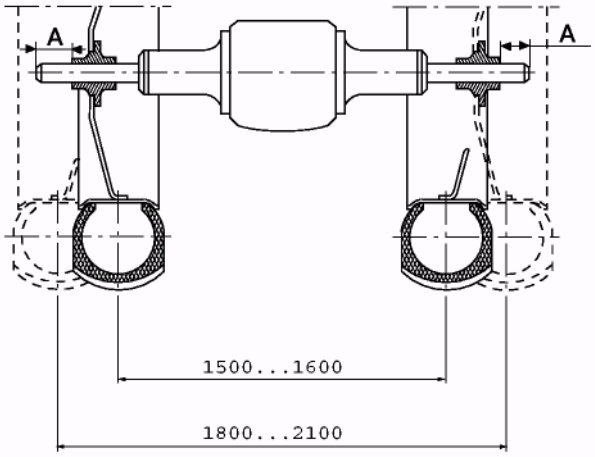
f) check the mounting of the pitman in the midposition (by probe) and the difference of the measurements «C» and «D» again;
g) after the final adjustment of the wheel toe-in, lock the tubes of the steering links.

Rear track adjustment

1. Jack up rear part of the tractor until wheels break off the ground.
2. Unscrew wheels fastening nuts (1) and dismount wheels.
3. Loosen by 3...5 turns four bolts (2) of rear wheels' hubs.
4. Move the hub to one of the sides to obtain required track width (use below-given table to determine wheels track width by measuring distance "A" from half-axle end to hub end face).
5. Torque four hub fastening bolts to 280...300 N.m (28...30 kgf/m).
6. Mount the wheel and tighten fastening nuts by the torque 210...260 N.m.
7. Repeat operations for the opposite wheel.



NOTE: Track width up to 1600 mm can be obtained without changing position of the wheel disk. To obtain wheels track of up to 2100 mm, rearrange rear wheels with hubs in assembly, as shown in the figure.



Track width, mm	Distance «A», mm
1500	50
1600	0
1800	164
1900	114
2000	64
2100	14

When rearranging the rear wheels, draw attention that the direction of the wheel rotation coincides with the direction of the pointer at the side strip.

PTO adjustment

Adjustment of rear PTO control linkage

During assembly at the manufacturer, or after repair (for example, after replacing brake bands), make adjustment of the control linkage in the following order:

1. Put eccentric axle 15 to initial position, so that flat “C” (fig. 2) is to the right vertically, and fix it with stop plate (17) and bolt (16);
2. Disconnect tie-rod 4 (fig. 1);
3. Unscrew bolt 9 to release spring 6;
   To make unit disassembly safe make sure that, when unscrewing bolt (9), upper cup (7) is in permanent contact with it until the spring unclamps fully.
4. Dismount cover of the rear axle hatch to get access to screws 13;
5. Fix lever 11 in neutral position by introducing bolt 10 (M10X60) in diameter inside lever opening, and opening in the rear axle body, corresponding to it;
6. Remove stop plate 26 (fig. 2), screw up in turn adjusting screws 21 with torque from 8 to 10 N•m, then unscrew each screw by 2 turns and it is necessary screw the screws so that screw heads are placed parallel to direct axis of the tractor;
7. Holding lever 11 in neutral position remove bolt 10 (M10×60);
8. Screw bolt 9, aiming its toe inside recess of cup cover 7 up to size "A", equal to 26^{+2} mm and fix by nut 8;
9. Shift lever 11 back to position “ON”;

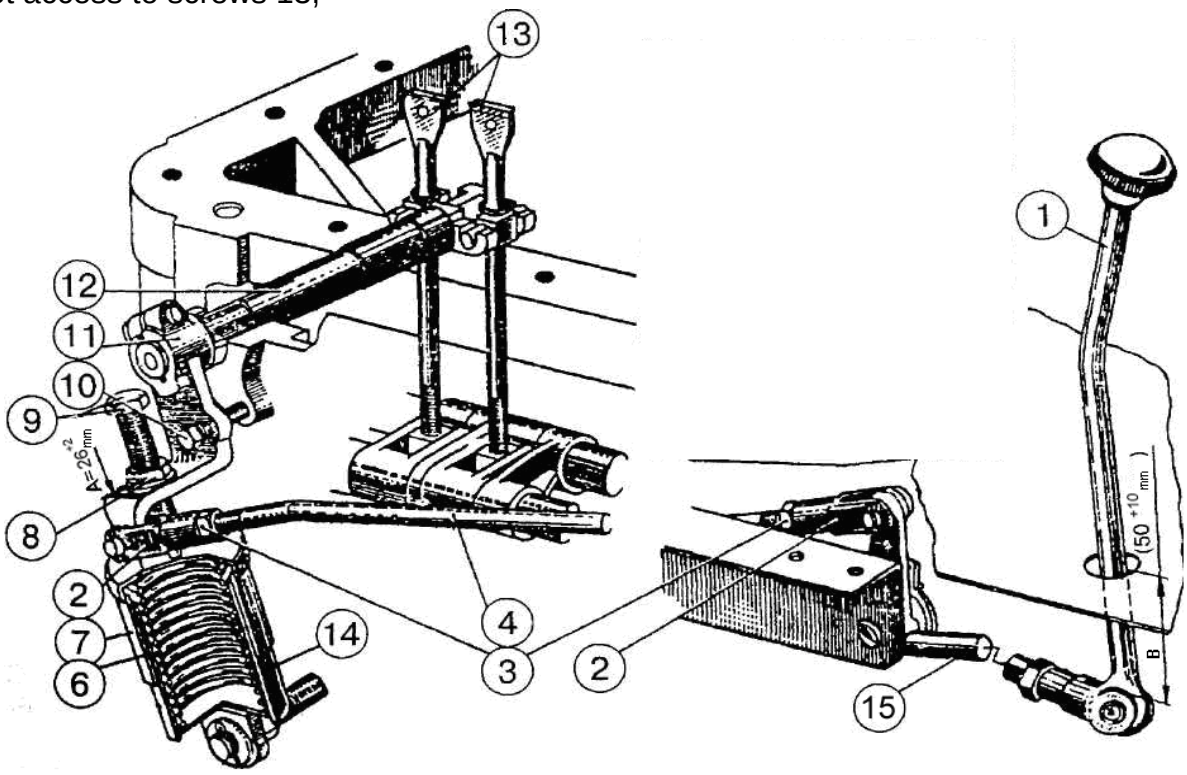


Figure 1. Rear PTO control:
I - control lever; 2 - adjusting yoke; 3,8 - nuts; 4 - tie-rod; 6 - springs; 7 - outside cup; 9 - stop bolt; 10 - adjusting bolt (for adjustment only); 11 - lever of control roller; 12- control roller; 13 - adjusting screws; 14 - inside cup; 15 - tie-rod.

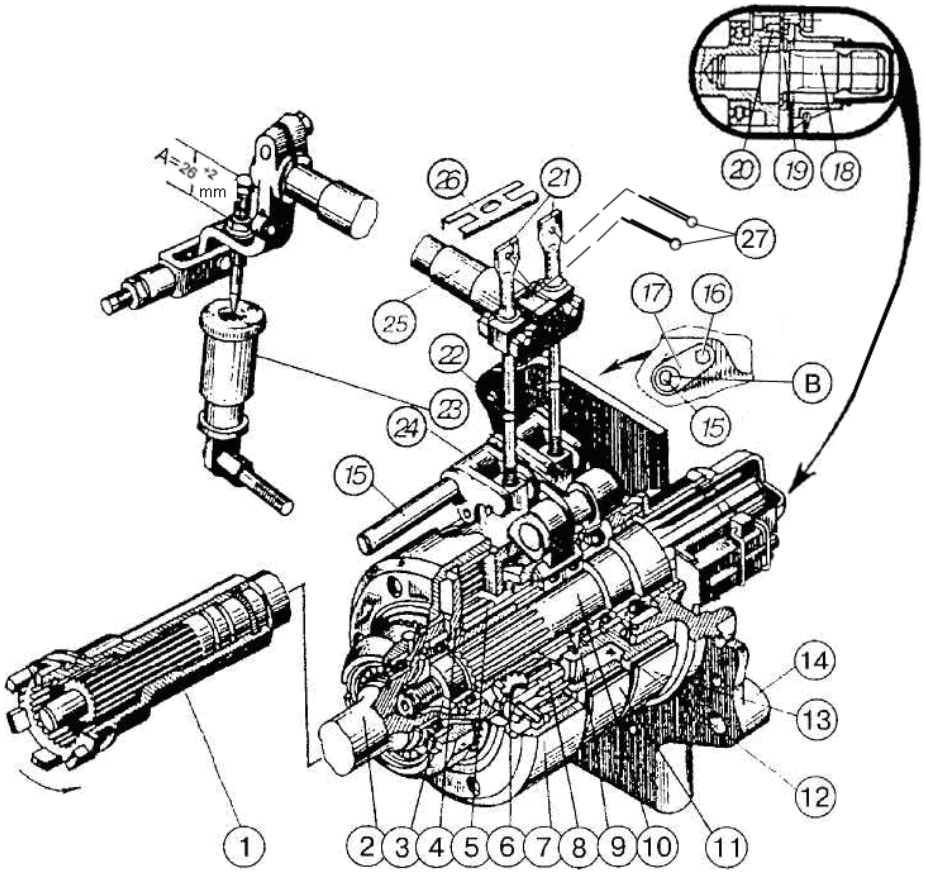


Figure 2. Rear PTO planetary reduction gear:
1 - drive switching coupling; 2 - crown pinion shaft; 3 - nut; 4 - carrier; 5 - sun pinion; 6 - satellite; 7 - crown pinion; 8 – satellite axle; 9 - brake drum; 10 - PTO shaft; 11,13- brake band; 12 - switching drum; 14 - rear cover; 15 – crank-type axle; 16 - fixing bolt of stop plate; 17 - stop plate; 18 - removable drive end; 19 - stop plate of removable drive end; 20 - drive end fixing end; 21 - adjusting screws; 22,24 - lever; 23 - spring mechanism; 25 - control roller; 26 - stop plate, 27 – cotter.

10. Mount tie-rod 4 (figure 1); changing the length of tie-rods 4 and 15 set rolling zone of lever 1 in the middle section of the control panel groove, and adjust the size B (50 $^{+10}$ mm).

Upon adjustment completion install to adjusting screws 21 the stop plate 26 and cotters 27 (figure 2), cover of rear axle hatch, cotter pin tie-rods 4 and 15 (figure 1), and bolt 9 by nuts 3 and 8.

During operation the external readjustment performs, if:

a) PTO slips;

b) when shifting control lever 1 abuts against front or rear part of control panel groove;

c) switching force on lever 1 is over 12-15 kgf ;

d) inefficient fixing of lever 1 in extreme positions, or its irregular travel when switching on and off.

Procedure of external readjustment:

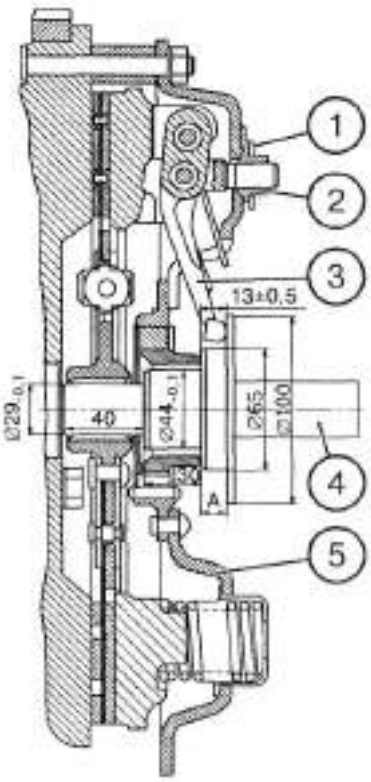
1. Take off protective covers of PTO.
2. Unscrew bolt (16), dismount the stop plate (17) from the end of eccentric axle (15) and turn the axle clockwise to choice the gap between the brake band and the drum (in this case will be impossible to turn the shank end of PTO from the hand).
3. Fix the axle by stop plate (17) and bolt (16).
4. Put the protective cover of PTO in its place.

IMPORTANT! If the brake band has gross wear, turn the eccentric axle on 180°, choosing the excessive gaps between the brake band and the drum (flat on the left). Then fix the shaft by stop plate (17) and bolt (16).

After several external adjustments eccentric axle 15 (figure 2) can adopt extreme left position (the flat “C” will be on the left in vertical position), it means that external adjustment margin is exhausted. In this case turning eccentric axle anti clockwise, put it into initial position (vertical flat on the right), after that perform adjusting operations, as described above (during assembly at the manufacturer or after PTO repair).

When adjustment is made correctly, lever 1 (figure 1) in position “on” or “off” shouldn’t reach control panel groove edge by at least 30 mm, and accurately pass through neutral position.

In some lots of tractors is possible the absence of external readjustment mechanism of control of PTO (position 15,16,17 figure 2). In this case do adjustment as shown above for adjustment of the control of PTO after repair or during assembly at the manufacturer. Tractors with small cab have the dimension "B" 50-60 mm. Efficiency of PTO brakes, absence of slippage depend only on spring mechanism, primarily on availability of free operation zones, and relative levers. PTO slippage means that spring mechanism or levers face additional hindrance when shifted, due to absence of lubrication in joints, increased staining, abutting (touch) against adjacent tractor parts, etc.



Adjustment of release levers position

After mounting the clutch on flywheel and taking off the bolts, adjust positions of squeeze levers 3 by special mandrel 4, which is based on inner diameter of splines of hub of the backing plate 5 with the stop to the end of hub. The mandrel has the end surface for the stop of release levers. The dimensions of the mandrel are in the figure. Bring by the adjusting nuts 2 the squeeze levers to the stop in the end of the mandrel and mount the lock 1.

Adjustment of trailer hook control linkage

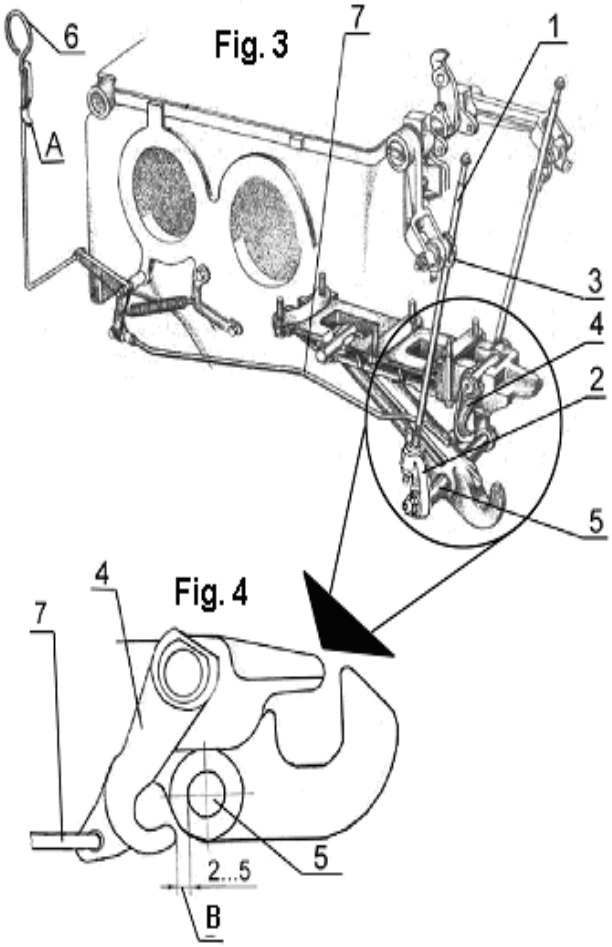


Fig. 3

Fig. 4

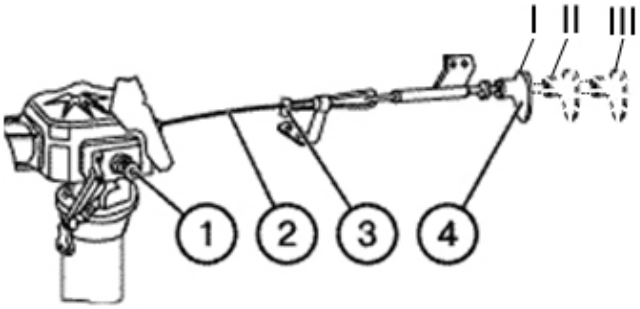
ATTENTION! Before adjusting towing coupler first of all it is necessary to unscrew screws 1 from the shackles 2 to ensure free travel of levers to avoid collapse of the pin of braces.

Perform control linkage adjustment as follows:

1. Lift levers of the hitch at maximum possible altitude and adjust by screw the length of lifting rod 1 (see figure 3): screw the screws in shackles 2 to the stop of screw heads in surface of shackles 3 and lock by lock-nuts. The pinchers 4 should pass under the axle of hook 5 and don't brush against it.
2. Raise hand lever 6 and mount element A of the catch 6 in the hole of cab floor.
3. Ensure by adjusting the length of tie-rod 7, the gap B between pinchers 4 and axle of the hook 5 during its descending and ascending (see figure 4).
4. Lift levers at upper position and descend the hand lever 6 down. The pinchers 4 should be mounted under the axle of hook.
5. Make sure that during the descent of levers the pinchers ensure the fixing of hook in operation position.

Adjustment of rear axle differential lock control

For acceptable operation of the differential lock control adjust correctly relative position of the hand lever 4 and cock 1 of the sensor of blocking, for this:



a) free end of rope 2 fix in the catch by screw 3, the end of rope should project the catch to 5-10 mm, no more;

b) mount the hand lever 4 in position I. String the rope to the beginning of the cock and fix the clutch by screws 3; bring the second catch close to the clutch and fix it by screw.

To check the correct adjustment, place the hand lever in the fixed position II, the mark on the cock 1 should coincide with the mark "on" on the cap of the skid sensor. The hand lever and the cock should return to the position I from the position II and III spring-actuated.

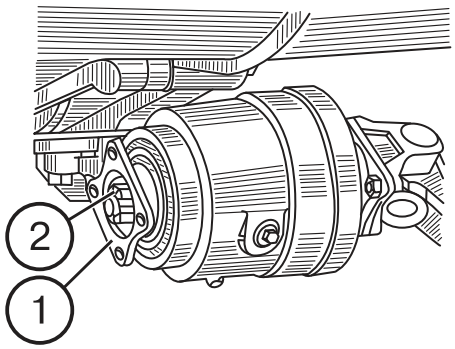
FDA cardan drive adjustment

Adjust in the cardan drive the safety clutch in the intermediate bearing and check the side play in the bearings of cardan.

Adjust the safety clutch to the torque transfer in the range 40-80 kgf•m (400-800 N•m). Adjust the clutch by tightening screws 2 of the rear shank end of the shaft of intermediate bearing till the assuring the required torque transfer.

Control periodically the side play in the bearings of universal joint cross. If back play presences, disassemble the pin hinge and check the state of the bearings and crosspieces, replace the worn-out parts. During the assembly of gland races press them to the stop in the bearing.

The cardan shaft is dynamic-balanced. Don’t make the disassembling of the cardan shaft without special necessity. If changes the parts in operation – tubes with the jaw of pin hinge and flange – balance dynamicly the ready-mounted shaft with two pin hinges by welding plates at two ends of the tube again. The imbalance should be no more than 55 g•cm. To avoid the damage of the gaskets and collapse of the bearings of the crosspieces don’t turn the cardan shafts by crow bar, keys and other accessories.



Adjustment of tapered roller bearings of directive wheels of Belarus-90 tractors

During the adjustment of bearings of guide wheels, mount axial clearance in the range 0,08-0,20 mm. Control it every 1000 h operating. For this, lift the wheel and, rocking it in the direction, perpendicular to plane of rotation, determine the gap in the bearings.

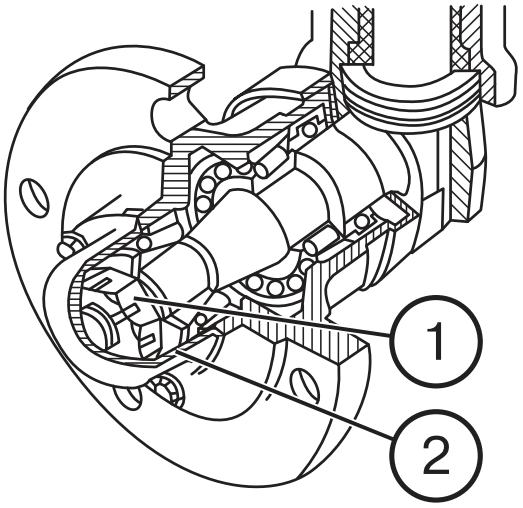
After determine the raised gap, perform adjustment as follows:

a) unscrew the bolts and take off the cover 2;

b) uncotter the castle nut 1 and turning the wheel from the hand, tight nut 1 until the appearance of raised resistance to the wheel rotation. Than unscrew the nut so to obtain the coincidence of the nearest cut of the nut with hole under cotter pin in the semiaxis;

c) check ease of wheel rotation;

d) cotter the nut, put the cap in place provisionally filling it by lubricant.



Section G. MAINTENANCE

Categories of tractor maintenance

Categories of maintenance	Interval and time to maintenance in hours of tractor operation
Maintenance when preparing the tractor for operation:	
M when preparing the tractor for running-in	Before preparation for running-in
M during running-in	M in the process of running-in
M upon completion of running-in	After 30 hours of operation
Scheduled maintenance:	
daily (DM)	8-10
Maintenance No.1 (M-1)	125
Maintenance No. 2 (M-2)	500
Maintenance No.3 (M-3)	1000
Special servicing	2000
General maintenance	If required
Seasonal maintenance (M SS and M-AW)	When changing to autumn-winter (M-AW) and spring-summer operation (M-SS)
Maintenance in special operating conditions	When preparing for operation in specific conditions
Maintenance during storage	During long-term storage

MAINTENANCE WHEN PREPARING THE TRACTOR FOR OPERATION

Maintenance when preparing tractor for running-in

- Clean the tractor off dirt and dust, remove conservation grease, if any;
- Check oil level and, if necessary, fill it in diesel casing, air purifier sump, casings of hydraulic system, casing of power gear, in steering booster casings, casing of front driving axle and in intermediate bearing;
- Grease pivot shaft bearing, pinion of the right-hand brace, bushings of rear mounting mechanism shaft;
- Check storage battery and, if necessary, clean terminals off oxides and grease them with technical petroleum jelly, clean ventilation openings, check degree of discharge;
- Check and, if necessary, adjust tension of the fan belt, tractor control mechanisms, air pressure in tires, toe-in of front wheels;
- Check and, if necessary, tighten outside threaded connections;
- Fill radiator with cooling fluid;
- Listen to engine and check readings of instrumentation for compliance with rated norms.

Maintenance during running-in:

- Control level and if necessary fill oil in diesel casing and cooling fluid in radiator;
- Control contamination level of air filter according to the control light;
- Control availability of the diesel, of operation control, illumination and alarm system, of brakes.

Maintenance upon completion of running-in (after 30 hours of tractor operation):

- Examine and wash the tractor;
- Listen to functioning of tractor components;
- Check and, if necessary, adjust tension of the fan and alternator belt, free travel of clutch and brake pedals;
- Check storage batteries and, if necessary, clean batteries' surface, terminals, wiring tips, ventilation openings in plugs;
- Change oil in diesel casing, sump of diesel air purifier, casings of power transmission, FDA and intermediate bearing;
- Grease the bearing of clutch release yoke;
- Clean centrifugal oil filter;
- Change filter element of hydraulic system;
- Rinse course diesel oil purification filter;
- Check and, if necessary, tighten outside fastenings of tractor components, including bolts of block of cylinders' heads and bolts for fixing the arm of intermediate support of gimbals gear to the clutch casing (for tractors with FDA), bolts of power transmission casings, rear wheels' hubs, rotation shaft arm, nuts of front and rear wheels;
- Check and adjust clearances between diesel valves and rockers;
- Check the level and add cooling fluid in the radiator, if necessary;
- Drain sediment from course fuel filter;
- Check and, if necessary, restore air tightness of air purifier and inlet piping of the diesel;
- Check operational capability of the engine, illumination and alarm system.

TABLE OF SCHEDULED MAINTENANCE

No.	Object of service	Check	Cleaning	Lubrication	Change	Adjustment	Drain	Washing	Notes
Daily maintenance (DM) after each 10 hours of operation									
1	Oil in engine	+							
2	Cooling fluid	+							
3	Oil in hydraulic system tank	+							
3_a	Steering	+							
Maintenance No.1 (M-1) after 125 hours of operation									
4	Oil in air purifier sump	+							
5	Oil level in FDA casings of coned pairs with bevel gear speed reducers	+							
6	Sediment from coarse fuel filter and from fuel tanks							+	
7	Generator and fan belt	+				+			
8	Wheel and hub mounting	+				+			
9	Air pressure in tires	+				+			
10	Bearing of clutch release yoke			+					
11	Storage batteries	+				+			
12	Oil level in intermediate bearing of FDA cardan drive	+							
13*	Plays of steering joints	+				+			
$13*_a$	Steering booster	+							
14*	Free travel of clutch pedal	+				+			
Maintenance No.2 (M-2) after 500 hours of operation									
15	Rotor of centrifugal oil filter of diesel		+						
16	Oil in diesel**				+				
17	Clearance in diesel engine valves	+				+			
18	Play of the steering wheel	+				+			
19	Brakes (wheel and parking)	+				+			

- Provide operation every 250 hours of operation

** When using diesel fuel " L" , that contains 1% of sulfur, the frequency of oil change in engine housing is reduced by half.

End of the table

No.	Object of service	Check	Cleaning	Lubrication	Change	Adjustment	Drain	Washing	Notes
20	Front wheels (toe-in)**	+				+			
21	Air purifier of diesel engine		+						
22	Hydraulic system filter*							+	
23	Generator		+						
24	Sediment from fine fuel filter						+		
25	Oil in transmission	+							
26	Oil in FDA casings	+							
27	Maintenance of steering gear drive	+				+			
28	Rinse oil drain filter of steering booster							+	
29	Lubricating of front axle stubs			+					
Maintenance No.3 (M-3) after 1000 hours of operation									
30	Tightening torque of cylinder head bolts	+				+			
31	Coarse fuel filter								+
32	Filtering element of fine fuel filter				+				
33	Generator	+							
34	Steering joints**	+				+			
35	Brace of lifting linkage			+					
36	Shaft sleeves of lifting linkage			+					
37	Outside bolted connections of the tractor	+							
38	Oil in casings of hydraulic assemblies				+				
39	Oil in transmission				+				
40	Oil in FDA and intermediate bearing casings				+				
41	Engine oil pre-filter		+					+	
42	Engine breathers							+	
43	Hydraulic booster setting of steering					+			

*) First renewal after 500 hours of operation, the following after 1000 hours of operation, and also at seasonal service.
**) After each 250 hours of operation.

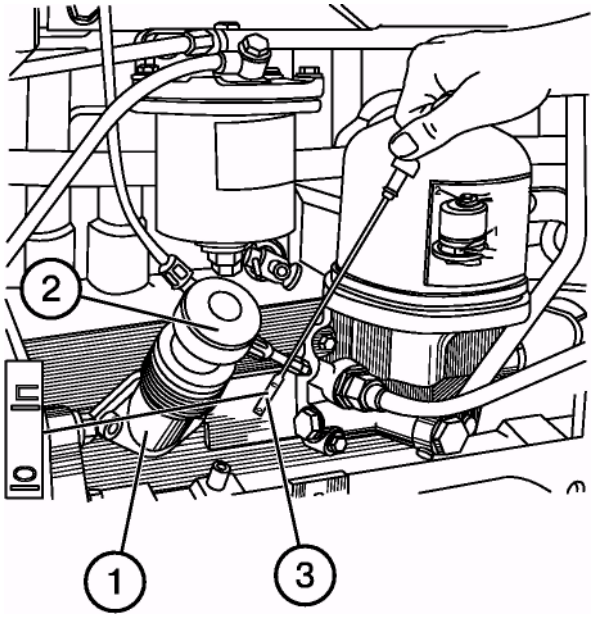
End of the table

No.	Object of service	Check	Cleaning	Lubrication	Change	Adjustment	Drain	Washing	Notes
Maintenance after 2000 hours of operation									
44	Engine nozzles	+				+			
45	Fuel pump. Advance angle of fuel injection.	+				+			
46	Fuel pump. Adjusting on stand	+				+			
47	Cooling system of engine		+					+	
General maintenance									
48	Drain valve of engine centrifugal oil filter	+							
Seasonal maintenance									

Daily maintenance (DM) after every 10 hours of operation or daily

Operation 1. Oil level in engine casing

Shut down the engine, wait for 15 minutes and check oil level. Oil level should be between lower and upper probe (3) marks. If necessary, remove cover (2) of oil filling neck (1) and fill oil up to the top mark of probe (3).

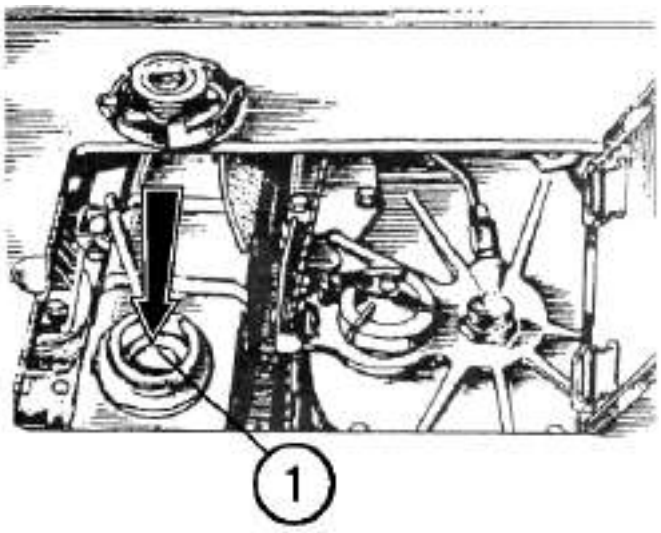


IMPORTANT! Do not operate engine with oil level below lower mark of oil gauge.

IMPORTANT! Do not fill oil above the level of oil gauge upper mark. Surplus oil will burn, making false impression of large oil consumption due to burning loss.

Operation 2. Level of cooling fluid in engine radiator

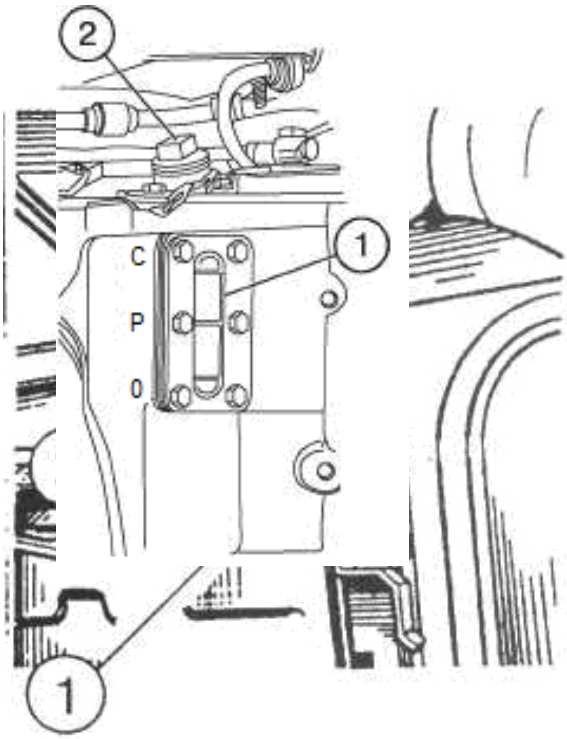
Take off the radiator plug and check level of cooling fluid, which should be 50-60 mm below the upper end face of filling neck (1). If necessary, fill fluid up to required level.



IMPORTANT! Do not allow level recession below more than 100 mm of the top end face of the filling neck.

WARRNING! Engine cooling system is functioning under pressure maintained by means of valve in the radiator plug. It is dangerous to take off plug on hot diesel. Let the engine cool down, cover the plug with thick cloth, and slowly opening the plug reduce pressure in the system before taking off the plug completely. Beware burns by hot fluid.

Operation 3. Oil level in hydraulic system tank



NOTE: Before checking oil level, put tractor on level horizontal terrain. Shut down diesel and break the tractor with parking brake.

Check oil level on oil-metering glass (1) on the left-hand side of hydraulic assemblies' casing. The level should be between marks "0" and "P". If necessary, fill oil up to mark "P" ±5mm, having unscrewed threaded plug (2).

NOTE: When machines with large oil consumption are used, fill oil up to the lever of top mark «C». All hydraulic cylinders, including rear cylinder, should have rods drawn in.

Operation 3a. Steering

Check operational capability of steering system. Look over, check aurally, test in running order.

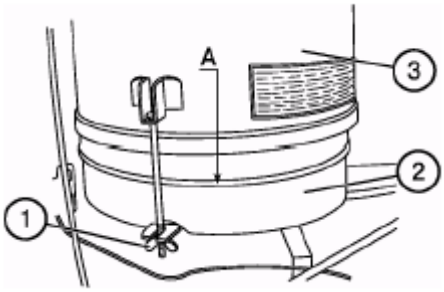
Maintenance-1 (M-1) after every 125 hours of operation

Perform operations of the previous maintenance and those given below:

Operation 4. Level and state of oil in air purifier sump of engine

Loosen two nuts (1) and take off sump (2) of air purifier(3). Check oil level in the sump, which should be at the ring belt level «A».

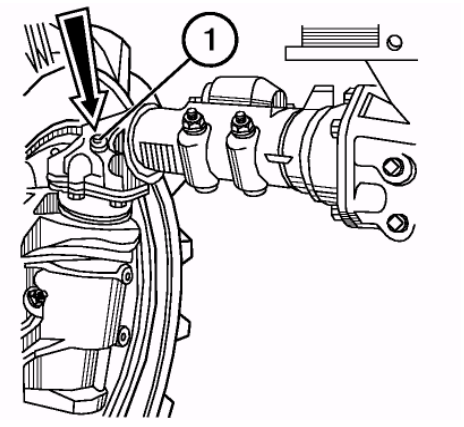
Add oil, if necessary. If oil contains dirt and water, replace oil.



ATTENTION! Do not overfill sump with oil above ring belt «A», as this may lead to oil getting inside engine combustion chamber and make false impression of excessive oil consumption due to burning loss.

Operation 5. Oil level in FDA casings of upper coned pairs with bevel gear speed reducers.

Check the oil level, which should be at lower edge of oil filler neck (1). Fill oil up, if necessary.

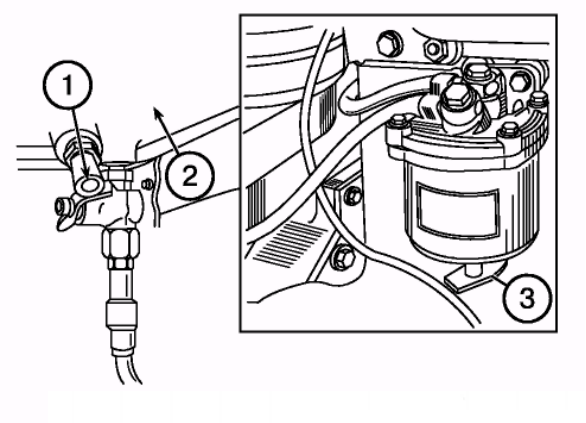


Operation 6. Draining sediment from fuel tanks and course fuel filter.

Open drain plugs (1) of fuel tanks (2) and drain plug (3) of filter.

Drain sediment until pure fuel comes out. Drain sediment in special container and dispose it correctly.

Close drain valves after pure fuel without water and dirt comes out.

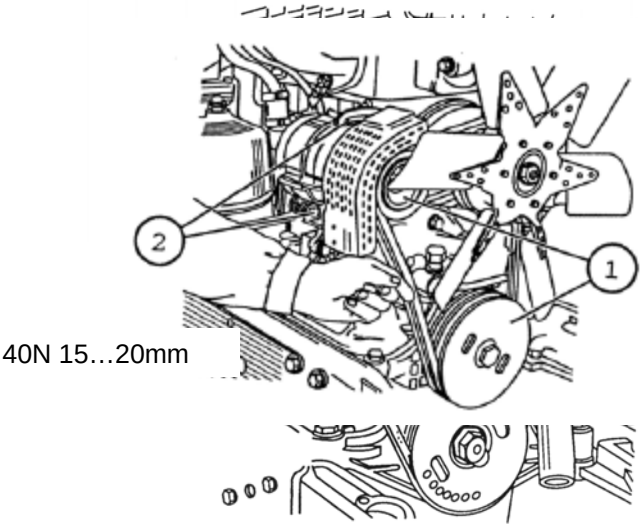


Operation 7. Checking tension of engine cooling system fan drive belt

Check the belt for signs of wear or damage. Replace it, if necessary.

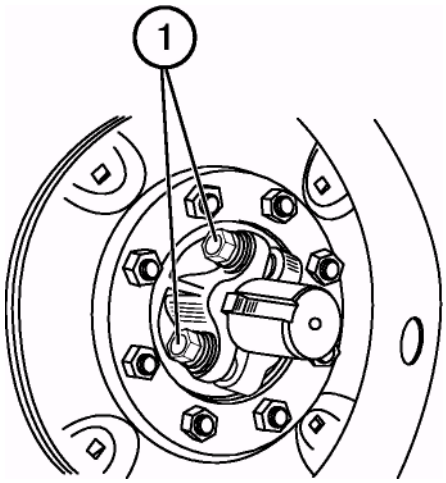
To check alternator belt tension apply force of 40 N (4 kgf) in the middle of branch between pulleys of generator and water pump (1). The sag should be in the range of 6…10 mm. If necessary, adjust belt tension by turning generator casing, having in advance loosened and then tightened generator fastening bolts.

NOTE: By installation of usual generator panel the belt tension shall be checked between pulleys of generator and crankshaft. The sag should be in the range of 15…20 mm at force of 40 N in the middle of branch.



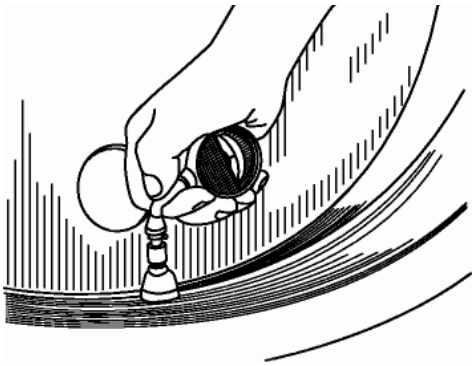
Operation 8. Rear wheel hubs.

- Check tightness and, if necessary, tighten bolts (1) fastening rear wheels' hubs (four bolts for each hub) using torque wrench. Torque should be 300…400 N/m (30…40 kgf/m).
- Check and, if necessary, torque nuts:
- Front wheels to 200...250 N/m
- Rear wheels to 300...350N/m
- Disks to rims to 180...240 N/m



Operation 9. Air pressure in tires

Check the state of tread and air pressure in tires. If necessary, adjust pressure in accordance with recommendations set forth in the present “Manual”.

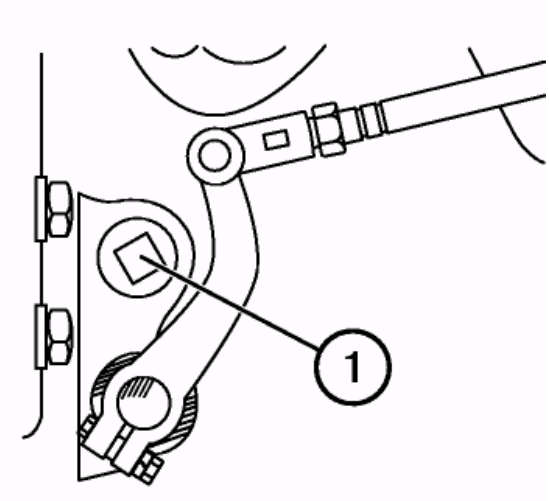


Operation 10. Lubricating bearing of clutch release yoke

Take off plug (1) on the left side of clutch casing.

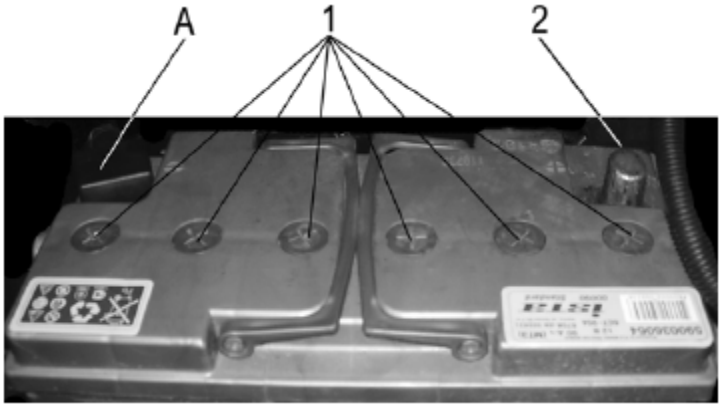
Using syringe make 4…6 injections of grease LITOL-24 via grease cup screwed in shifter casing for lubrication of squeeze bearing.

NOTE: Do not inject too much grease, as excessive grease will accumulate inside clutch casing and can get on friction surface of driven disk friction lining.



Operation 11. Storage batteries

WARNING: Batteries contain sulphuric acid, which causes great burns when in contact with skin. Beware acid getting on hands skin, in eyes, on cloths. When acid is spilled on body parts, wash them profusely with a flow of pure water. When acid gets inside, drink large amount of water or milk.



When in contact with eye mucosa, rinse it with large amount of water for 15 minutes, and then ask for medical

flame with electrolyte, as this may result in explosion. Charge batteries in ventilated rooms. Put on protective goggles and gloves when servicing batteries.

Keep batteries clean and dry.

Make sure, batteries are properly fastened. Before taking off plugs, clean adjacent surfaces.

Check level of electrolyte. It should be

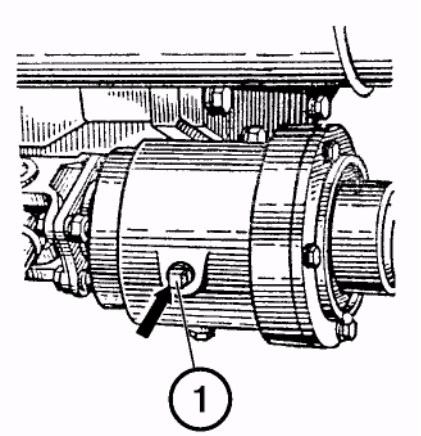
12…15 mm higher of protective mesh (or between level marks on transparent battery housing). If necessary, add distilled water.

Before adding distilled water check electrolyte density in each cell jar of the battery. If necessary, additionally charge storage batteries.

Check terminals (2) under sheathes (A) and plugs (1) for cleanness. If necessary, grease terminals (2) with technical cup grease.

Operation 12. Oil level control in intermediate bearing of FDA cardan drive.

Check oil level in intermediate bearing. Fill oil up to lower mark of filling hole, which is blanked off with plug (1), if necessary.

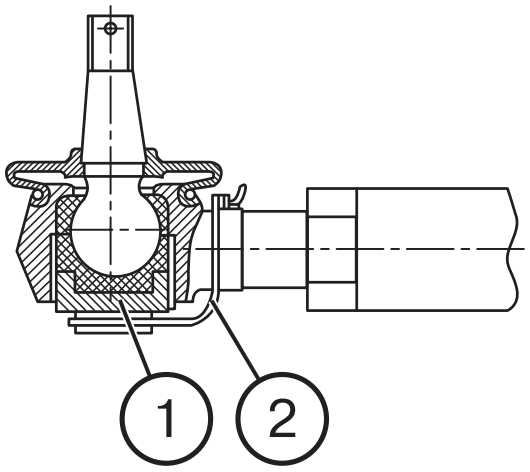


Operation 13. Checking plays of steering joints

After each 250 hours of operation check steering joints by hand force shaking or wheel turning.

To regulate steering joints, please do the following:

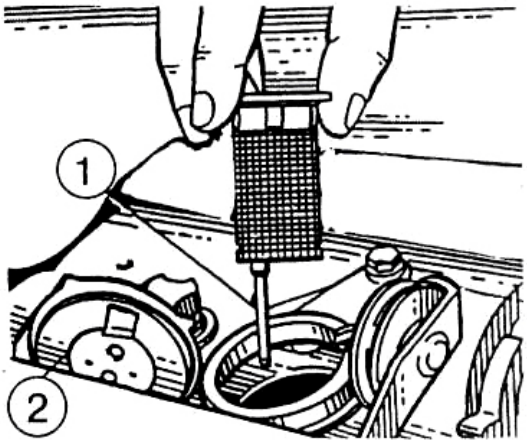
a) Take off locking wire (2) from the lug 3.
b) Screw up threaded plug (1) in a way to eliminate clearance in joint connection.
c) Lock the plug with wire.



NOTE: If backlash can not be eliminated by screwing up threaded plugs, disassembly the joint and replace worn out parts.

Operation 13a. Checking of oil level in casing of steering booster

Remove plug 2 and take off oil level gauge 1 from hydraulic booster casing. Oil should be at the upper mark of the oil level gauge 1.When low oil level, fill oil up to required level.

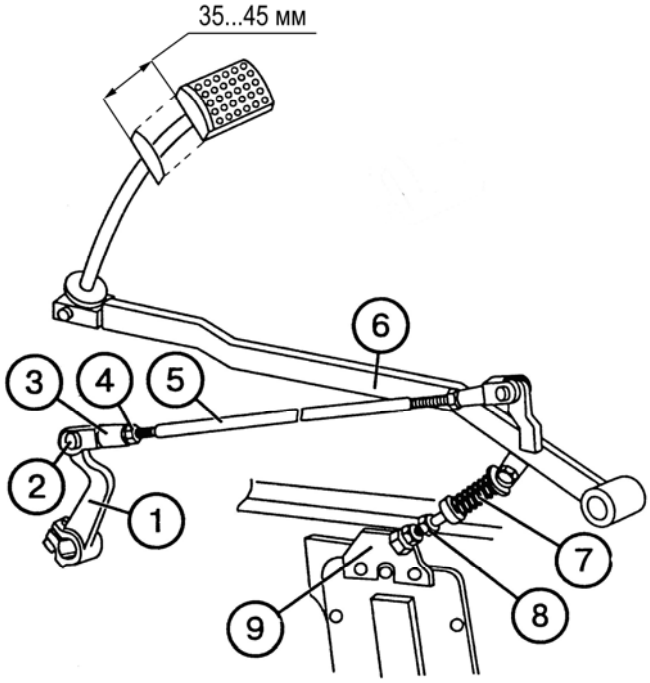


* Provide maintenance operation after every 250 hours of operation.

*Operation 14. Adjusting free travel of clutch pedal

IMPORTANT! Too great free pedal travel does not allow to fully disengage the clutch and makes gears shifting more difficult. No free travel of the pedal causes wear of friction facings and overheat of clutch components.

- To adjust free clutch pedal travel:
- Unlock and pull out pin (2), having disconnected tie-rod (5) from lever (1)
- Loose check nut (4).
- Unscrew bolt (8) so that rod of pedal (6) moved upwards to the end to cabin floor.
- Turn lever (1) anti clockwise to the end of squeeze bearing of levers.
- By rotating yoke (3), align openings in yoke and lever (1), then screw yoke in tie-rod (5) by 5…5.5 turns (i.e. shorten the tie-rod). Connect yoke (3) to lever (1) by means of pin (2).
- Assembly lever mechanism of clutch pedal in a reverse order.



IMPORTANT! Make sure, that clutch pedal reliably returns back to the end of the floor, when shifted by full travel magnitude. Otherwise adjust spring force of servo (7) with a help of bolt (8) or change position of the arm (9) by its turning toward the axle of bolts fastening.

* Provide maintenance operation after every 250 hours of operation.

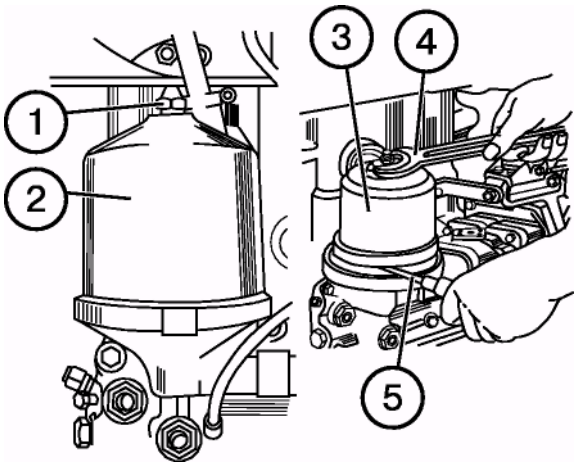
Maintenance No.2 (M-2) after every 500 hours of operation

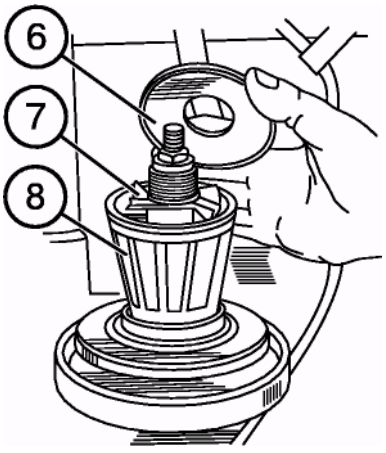
Perform operations of the previous maintenance and the following operations:

Operation 15. Centrifugal oil filter of engine

- Take off nut (1) and cap (2).
- Insert a screwdriver (5) or rod between filter casing and rotor bottom to stop rotor (3) from rotating, and turning rotor nut using key (4) take off rotor cup (3).
- Remove cover (6), impeller (7) and filtering mesh (8) of rotor. If necessary, clean and wash the mesh.
- Use non-metal scraper to remove deposits off inside walls of rotor cup.
- Clean all parts, wash them in diesel fuel and blow off with compressed air.
- Assembly the filter by performing disassembly operations in the reverse order. Before assembling cup and rotor casing, grease sealing «O»-ring with motor oil.
- Align balance marks on the cup and rotor casing. Screw in cup fixing nut with small effort until the cup fully slides on the rotor.
- Rotor should rotate free and without jamming.
- Reinstall cup (2) and torque nut (1) to 35...50 N m (3,5…5,0 kgf-m). .

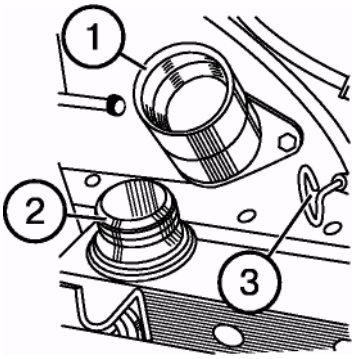
NOTE: After engine stoppage, for 30-60 seconds noise of rotating rotor should be audible. It means that filter functions properly.





Operation 16. Changing oil in engine

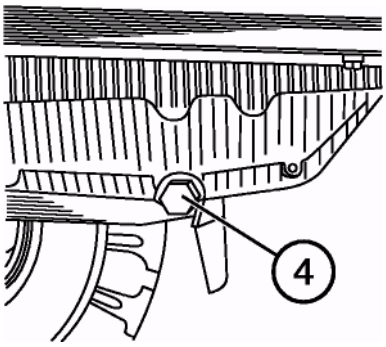
- Warm up engine up to normal operation temperature (at least 70°C).
- Put tractor on even terrain, shut down engine and engage tractor parking brake.
- Remove cover (2) of oil filling neck and unscrew drain plug (4).



ATTENTION! Be careful to avoid contact with hot oil.

Drain oil in proper container for storage of used oils.

- Put drain plug (4) in place and through oil filling neck (1) fill fresh motor oil (M-8DM, M-8G$_2$, M-8G$_{2K}$ in winter, and M-10DM, M-10G$_2$, M-10G$_{2K}$ in summer) up the top mark of oil measuring rod (3).
- Put cover (2) of filling neck in its place.
- Start the engine and let it operate for 1-2 minutes.
- In 10 minutes after engine stoppage check oil level using oil measuring rod (3).
- If necessary, fill oil up to the required level.



Operation 17. Checking clearance between valves and rockers

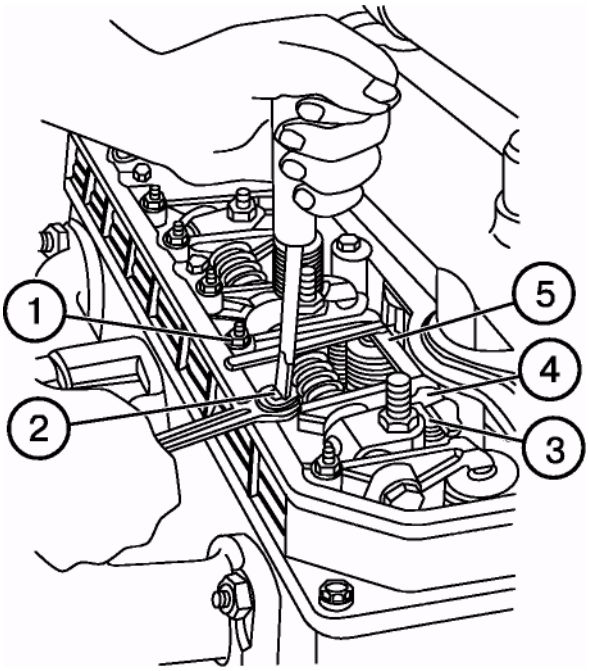
NOTE: Check clearances on cold engine, having checked in advance the tightness of cylinders' head bolts

Observe the following sequence of adjustment:

- Take off caps of cylinders' head covers and check fastening of rockers' axle posts. Torque of nuts is 60.. 90 N•m (6... 9 kgf•m).
- Turn crankshaft through until timing overlap in the first cylinder (inlet valve starts opening, and the outlet valve starts closing), and adjust clearances in valves 4, 6, 7 and 8 (counting from the fan).
- To adjust clearance loosen check nut (1) of screw (2), put probe (5) between end face of valve rod (3) and rocker pin(4), then screwing in or out screw (2) set required clearance by probe.

Value of clearance between rocker pin and end face of valve rod on cold diesel for inlet and outlet valves is shown in the table:

Belarus 90/92	
Inlet valves	Outlet valves
0,20.. .0,35	0,20.. .0,35

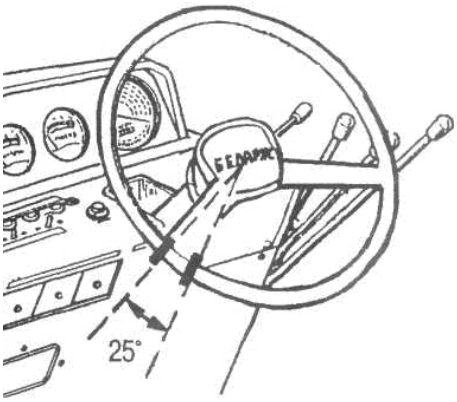


- Turn through crankshaft by 360°, having set timing overlap in the fourth cylinder, and adjust clearances in valves 1, 2, 3 and 5, as shown above.

- After adjusting clearances, tighten check nuts (1) and put removed parts in place.

Operation 18. Play of the steering wheel

With engine in operation the steering wheel play should not exceed 25°. Otherwise, check and eliminate plays in joints of hydraulic cylinders, steering tie-rod.



Operation 19. Adjustment of wheel and parking brakes. Adjustment of brake valve and pressure regulator valve of pneumatic system.

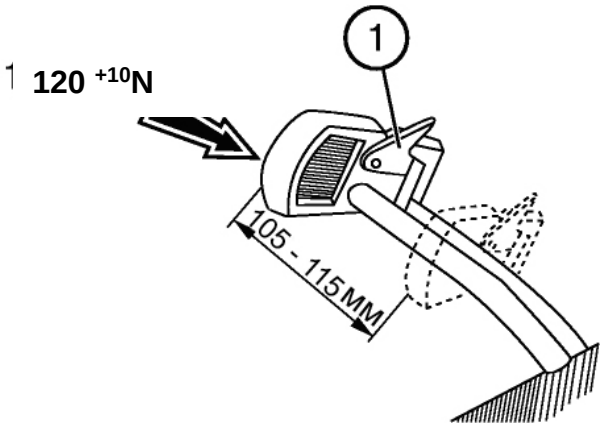
Adjust brakes in the following way:

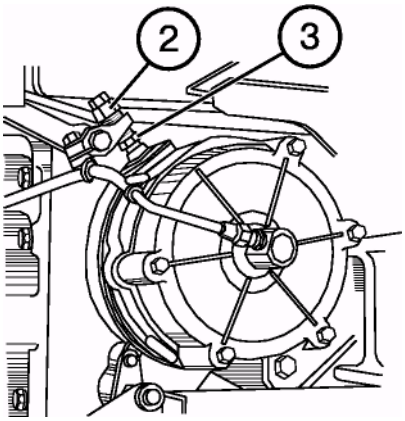
a) Loosen check nut (3) of adjusting bolts (2).

b) Screw in or out the bolt (2) so that full travel of the right brake pedal of wheel brake should be within 115...125 mm when applying effort of 120..130 N (12 kgf), and of the left brake pedal by 5-20 mm less for synchronous braking action in interlocked position. Do not allow less brakes pedal travel than is given above, because it will lead to the early wear and brakes overheating;

c) Draw up the safety nuts (3). Lock the pedal with locking bar (1) and check synchronism of right- and left-hand brakes engagement during movement (no more than 1 m according to the mark).

If grease ingress in brake, it lead to disk greasing and to decrease of force of friction between their work faces, brakes “do not hold”. In this case disassembly the brake, remove oil leak and rinse greasy disks with petrol, left them dry for 5-8 min. Adjust pedals travel after mounting.





To adjust parking brake:

Put the tractor on the even surface, shut down the diesel and lock rear wheels from front and back sides and do the following:

a) Shift lever (1) to extreme front (disengaged) position.

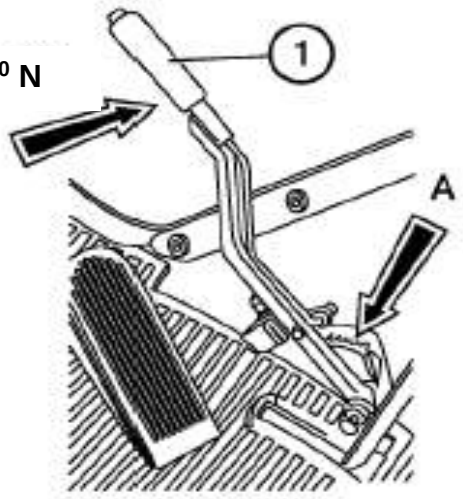
b) Loosen check nut of adjusting bolt (1) (see figure below), safety nut (7) and remove pin (5).

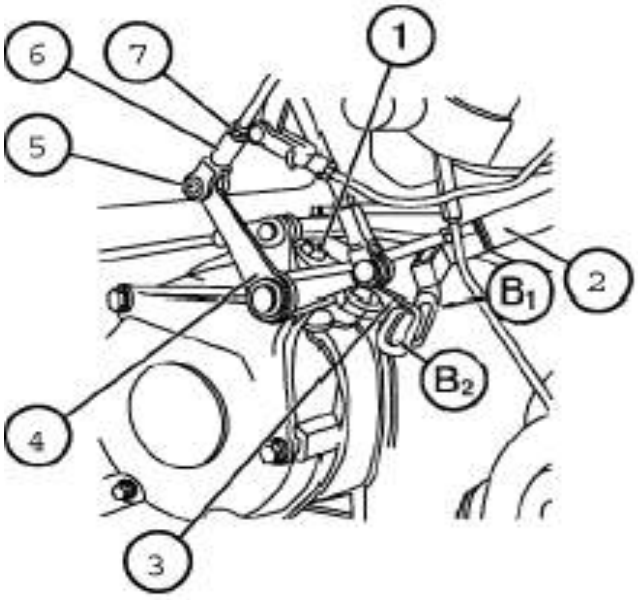
c) By screwing in or unscrewing bolt (2), find position when with effort on lever (1) equal 200 N (20 kgf), full engagement of the parking brake was achieved on the third-fourth tooth of sector (A).

d) Move lever (4) so that upper edge of groove «B_1» of lever (2) matched upper edge of groove «B_2» of lever (3) of the right brakes pedal, and then by turning of fork (6) match up holes of the lever and of the fork (6) and put in pin (5).

e) Screw in or unscrew bolt (1), so that, when pulling on the control lever with effort of 200^{+10} N, the arrestor catch should be secured in slot of the third or fourth tooth of sector (A), and the tractor should be retained on the slope of 18%. Tighten loose lock nuts after adjustment.

200 $^{+10}$ N





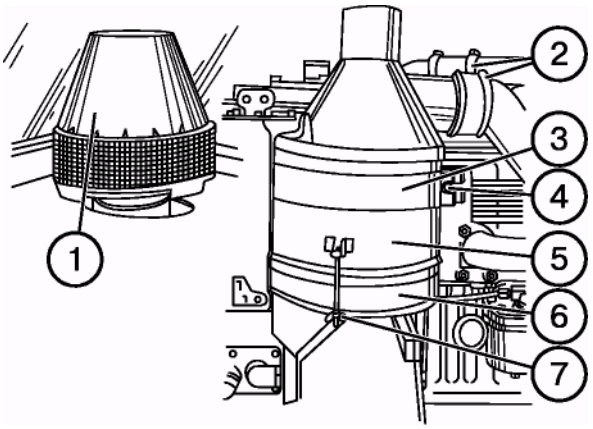
'Operation 20. Front wheels' toe-in

Toe-in of front wheels should be within 0...8 mm. If necessary, make adjustments according to recommendations given in section "Adjustments".

* Provide maintenance operation after every 250 hours of operation.

Operation 21. Checking air tightness of air purifier and inlet duct connections

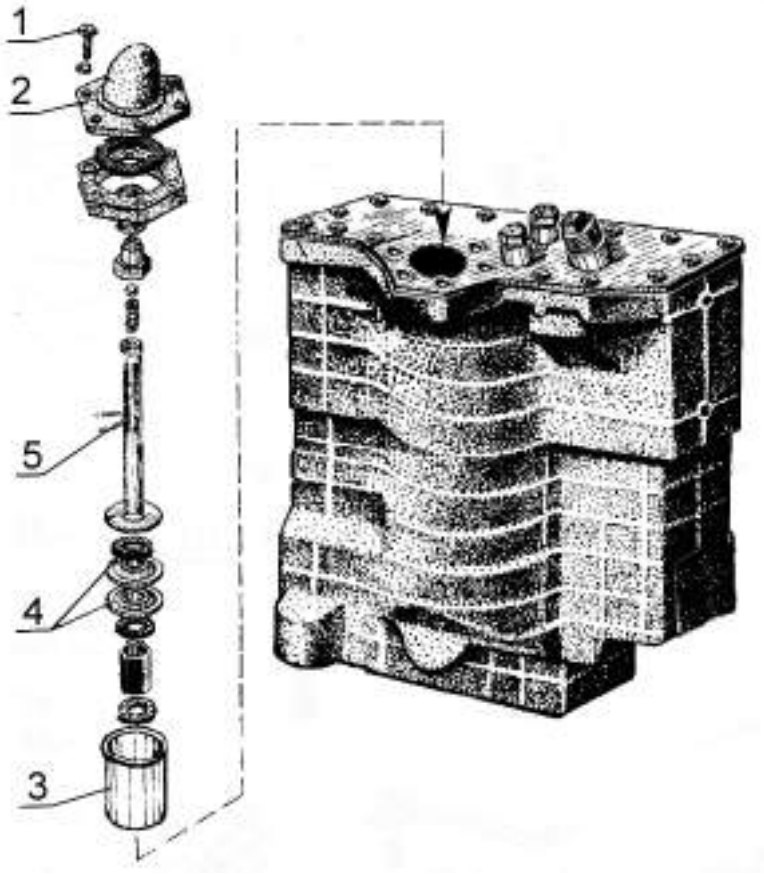
- Remove mono cyclone (1) and clean its inside surface.
- Loosen clamps (2), take off bolt (4), release clamp (3) and remove air purifier (5).
- Disassembly the air purifier, having loosened nuts (7) and removed sump (6).
- Clean inside sump cavity and fill fresh motor oil.
- Pull out three filtering elements, wash them in diesel fuel and blow them off with compressed air. Clean central pipe. Assembly the air purifier and mount on the engine.
- Check air tightness of all connections and, if necessary, tighten them. Engine operating at medium crankshaft rotation speed (1000 rpm) should stop with air inlet pipe shut.

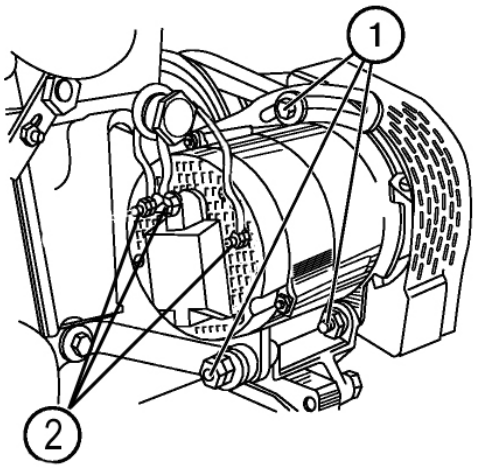


Operation 22. Wash of oil filter of hydraulic system

NOTE: Rinse the oil filter of hydraulic system in the future after every 1000 hours of operation.

- Unscrew bolts (1) and remove cover (2), take out filter casing (3) in assembly.
- For rinse of filter elements is necessary to take them out from the casing (3) by removing of the wire (5).
- Rinse filter elements in wash liquid and after rinse do the abovementioned operations in reverse.
- Mount filter in assembly in tank of hydraulic system, cover it with part (2) and tighten the bolts (1).





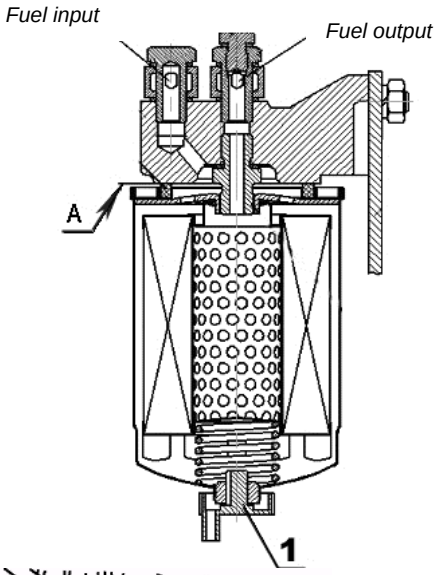
Operation 23. Cleaning the generator

Clean generator off dust and dirt. Check and, if necessary, tighten generator fixing bolts (1). Check condition and torque of generator terminal connections (2).

Operation 24. Draining sediment from fine fuel filter.

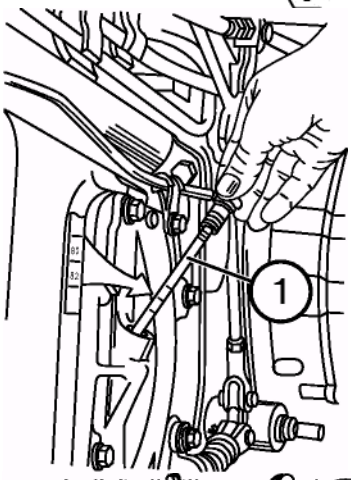
Drain sediment after every 250 operating hours.

Turn off drain plug (1) at the bottom of the fine fuel filter by 2…3 turns according to the figure and drain sediment until pure fuel appears. Turn the plug forward.

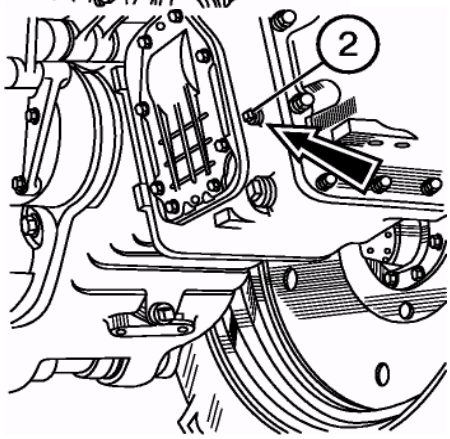


Operation 25. Oil level in transmission

Check oil level by oil-level gauge (1) on the left side of gear box casing. Normal oil level should be between the upper and lower mark of the oil gage.



NOTE: If your tractor is equipped with reducing gear, check oil level by level check plug, placed on the right side of the gear box. Normal oil level should be at the lower edge of the plug tread hole (2).



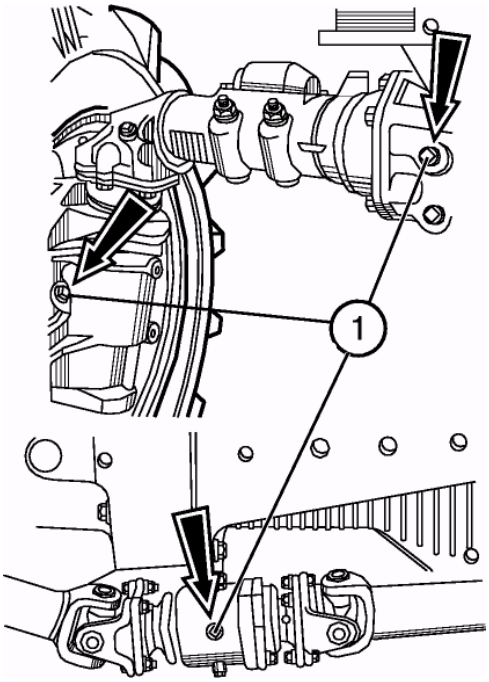
If it is necessary to correct oil level, take off the plug (3) of the upper cover of gear box and fill oil up to the required level.

Operation 26. Oil level in FDA casing.

FDA with bevel gear speed reducers

Check oil level in:
1. casings of wheel reduction gears (1) (of lower coned pairs);
2. casing of main gear (of front differential);
3. intermediate bearing of cardan shaft drive;
4. casings of upper coned pairs.

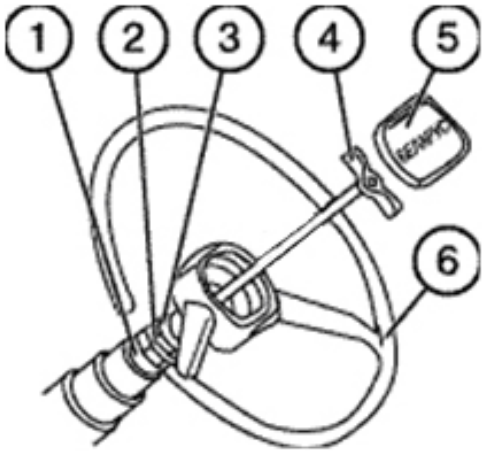
Oil level should reach lower edges of treaded check holes (1).
If it is necessary, fill oil up to the required level through check holes.



Operation 27. Maintenance of steering gear drive

Maintenance of steering gear drive consists in periodic inspection of screw joint torquing. For minimal vibration level of steering wheel adjust steering column in the following way:

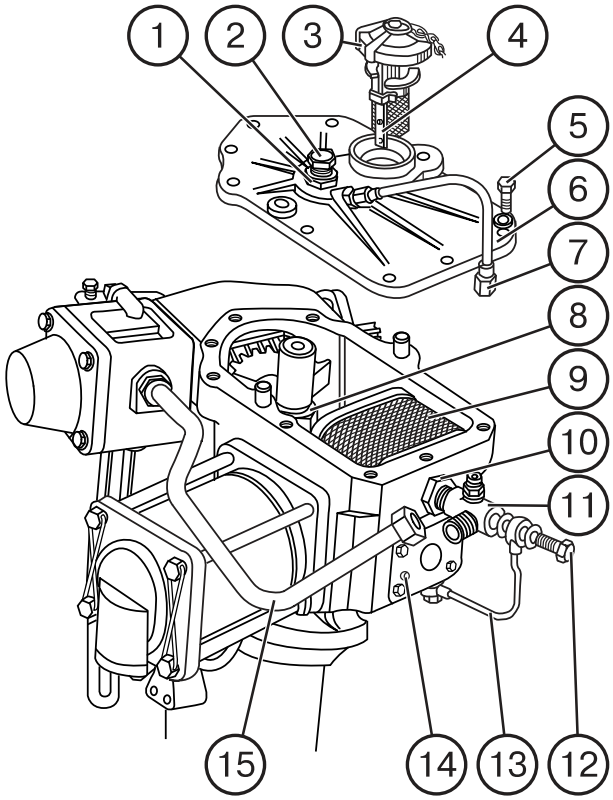
- Take off cover 5;
- Unscrew clamp 4 and remove the steering wheel 6;
- Loosen nut 3;
- Screw up a nut 2 till the contact with bush 1 so as to take up the clearances in connections;
- Unscrew nut 2 by 1.5 turns and locknut with safety nut 3.
- Install steering wheel 6, adjust high position and tighten clamp 4.



Operation 28. Rinse oil drain filter of steering booster.

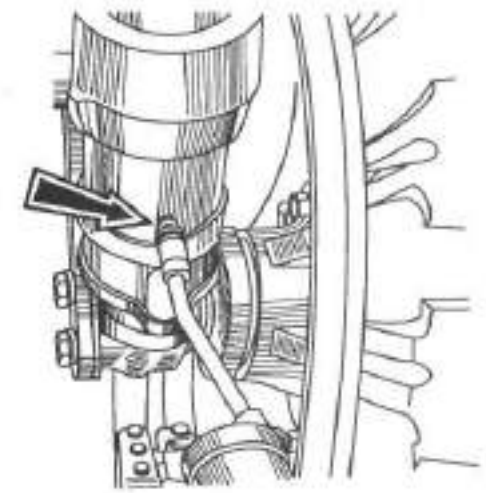
For rinse of oil filter do the following:

a) remove facing;
b) loose oil pipes 7, 13 и 15, unscrew bolts 5 from the cover 6 fastener group to the casing, using two extracting bolts take off the cover;
c) screw out reducing valve 11 and take off drain filter 9;
d) Rinse filter in wash liquid;
e) Tighten up nut 8 of the turning shaft;
f) Put filter in place and make assembly of the filter in the reverse order;
g) simultaneously adjust axial play of the steering shaft, for this purpose do the following:
loosen locknut 1 and screw down adjusting bolt 2 up to the stop into the shaft end, then unscrew by 1/8-1/10 turns and locknut with safety nut 1.



Operation 29. Lubricating of front axle stubs (Belarus 90)

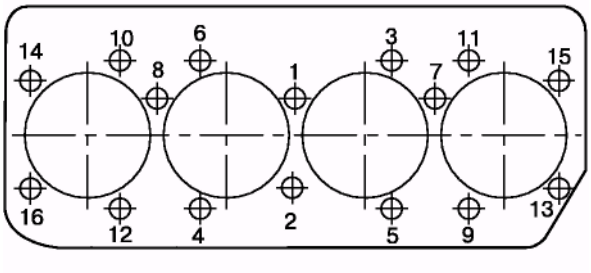
Using grease gun make 10…12 injections of lubrication grease via compression cups (one cup for each stub). Grease is “LITOL-24”.



Maintenance No.3 (M-3) after every 1000 hours of operation

Perform operations of the previous maintenance plus the following operations:

Operation 30. Tightening torque of cylinder head bolts

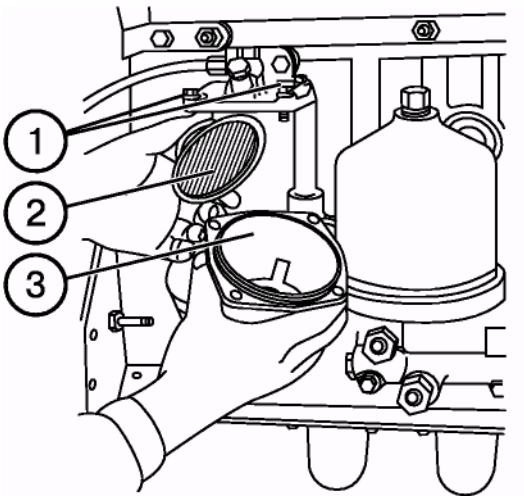


NOTE! Perform this operation only on heated engine.

Remove rockers' cover, cover of cylinder head and rockers' axle in assembly.

Using torque wrench, check and tighten cylinder head bolts in sequence shown in the figure to the right. Bolts' torque should be within 160... 180 N•m (16... 18 kgf•m).

Operation 31. Engine coarse fuel filter



Wash fuel coarse filter by performing the following operations:

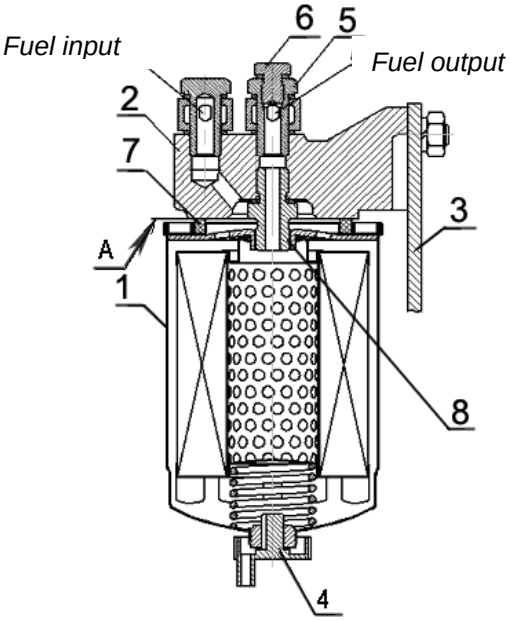
- Shut off fuel tank cock.
- Unscrew cup (3) fastening bolts (1) and pull out the cup.
- Unscrew reflector with mesh (2) and take off scatterer .
- Wash reflector with mesh, scatterer and filter cup in diesel fuel.
- Assembly filter parts in reverse order.
- Fill the system with fuel.
  Bleed the system and remove air from the fuel system, as shown below (operation 40).

Operation 32. Changing filtering element of fine fuel filter

- Life time of the filter depend on purity of the used fuel.
- Change filter according to the figure. As follows:
- - drain fuel from the filter by loosing of the plug at the bottom 4 of the filter casing.
-

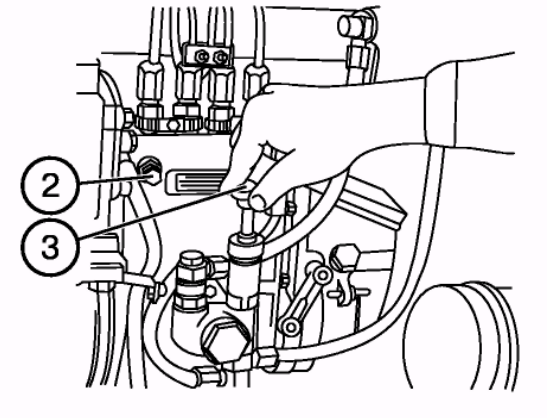
Do not let fuel spillage, drain fuel only in reservoir.

- - unscrew filter 1 from union 8 in casing 2 and install instead of it a new filter, which is delivered in assembly with gasket 7, that should be previously lubricated with motor oil;
- - after gasket (7) touches mounting pad A on the casing 2 screw filter up by ¾ turns. Install filter only by hand effort;
- - open valve of the fuel tank and fill system with fuel.



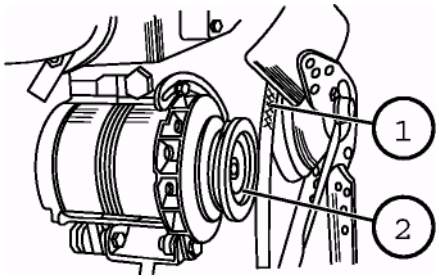
1 – filter FT020-1117010; 2 – casing; 3 – arm; 4 - plug (for drain of sediment); 5- outlet union; 6 –plug (for air input); 7 – gasket; 8 – union.

- To remove air from the system:
- To remove air from the system, loosen the plug 6, situated on the tension bolt of the outlet union, by 2..3 turns. Bleed system using manual purge pump 3, screw up plug by appearing of fuel without air bulbs.
- Loosen plug 2 on the fuel pump casing. Bleed the system using priming pump until pure fuel without air bulbs appears, at the same time screw up plug 2.
- Instead of fuel filter FT020-1117010 one may install other indecomposable fuel filters having following technical parameters and sizes:
- Sifting completeness at least 90%;
- Nominal capacity at pressure difference of 0,01 MPa at least 150 liters per hour;
- diameter - 95…105 mm;
- height – 140…160 mm;
- screw tread - M16x1,5;
- outside diameter of sealing gasket - 70…75 mm.



Operation 33. Generator

Take drive belt (1) off generator pulley (2).
Check rotation of generator rotor and plays in bearings.
If there are any plays or rotor stickings, remove generator and send to workshop for repairs.



Operation 34. Steering joints

With engine running, rotate steering wheel to both sides to check free travel and plays of joints (1) of steering tie-rod (4).

If joints have play, perform the following operations:

- Take off locking wire (3).
- Screw up threaded plug (2).
- Locknut the plugs with wire (3).

NOTE: If play can not be eliminated by screwing up threaded plugs, disassembly the joint and replace worn out parts.

'Operation 35. Lubrication of RHA right brace bearing.

Using a grease gun lubricate the adjusting gear of right brace via compression cup (one point of greasing). Make 4…6 injections with the grease gun. Grease is “LITOL-24”.

'Operation 36. Lubrication of RHA turning shaft sleeves

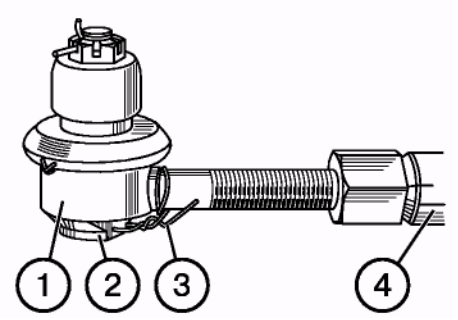
Inject two lubrication points via compression cups in hitch attachment bracket until grease will come through splits. Grease is “LITOL-24”.

Operation 37. Outside bolted connections

Check and, if necessary, tighten most critical bolted connections:

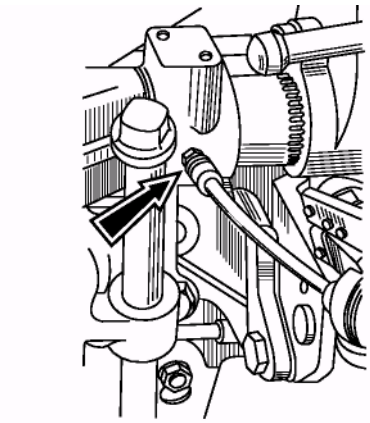
- Nuts of front and rear wheels, bolts of rear wheels’ hubs;
- Front beam – half-frame girders;
- Half-frame girders- clutch casing;
- Fittings of TSU plates;
- Engine – clutch casing;
- Clutch casing – gear box casing;

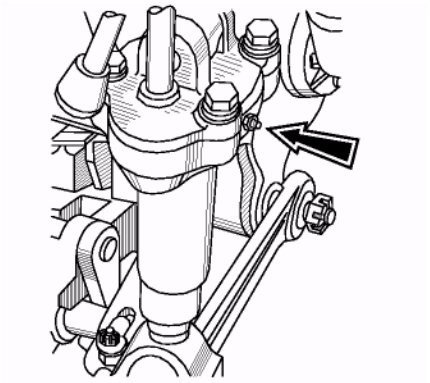
Gear box casing – rear axle housing;



Rear axle housing – RHA and TSU brackets;

Front and rear cabin supports;





Arms and pins of hydraulic steering cylinder;

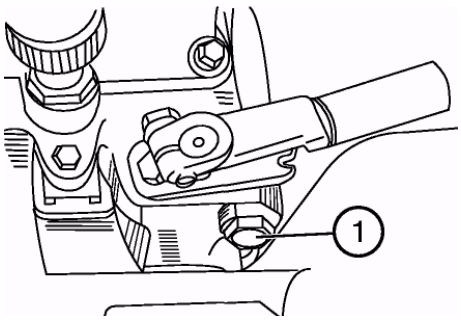
Rear axle housing – sleeves of half-axles;

FDA casing – sleeves – wheel reduction gears;

Nuts of cardan shaft flanges; nuts of FDA body wedges; intermediate bearings casing of cardan drive – clutch casing; bracket fittings of lifting TSU and hydraulic hoist.

Operation 38. Changing oil in hydraulic system

- Before changing oil warm it up in hydraulic system.
- Put the tractor on the even terrain, lower an implement and shut diesel down.
- Engage brakes and shut diesel engine down.
- Remove fill and drain plugs (1) from hydraulic tank and drain oil in special reservoir for used oil.

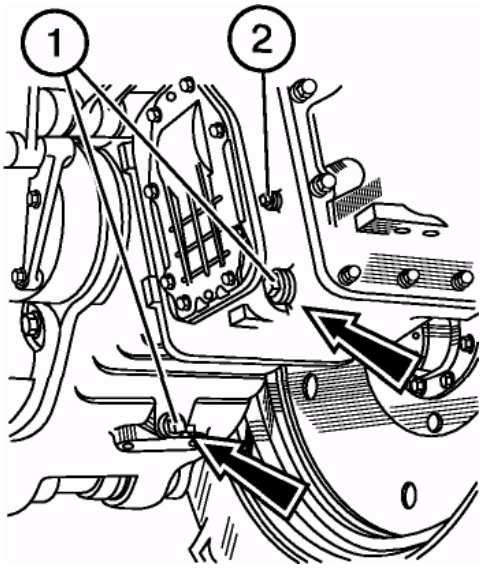


ATTENTION! Be careful and avoid contact with hot oil. Properly dispose used oil.

- Put drain plugs (1) in place and fill pure oil in system. Put fill plug in its place.

Operation 39. Changing oil in transmission

- Before changing oil warm up the transmission.
- Put the tractor on the even terrain, lower an implement and shut diesel down.
- Engage parking brake and lock wheels using wedges.
- Remove level check plug (2) and drain plugs (1) of rear axle and gear box casings and drain oil into special reservoir for used oil. Properly dispose used oil.



ATTENTION: Be careful and avoid contact with hot oil.

- Fill pure oil in transmission. Put level check plug in its place (2).

Operation 40. Changing oil in FDA and intermediate bearing casings.

FDA with bevel gear speed reducers

- Before oil changing warm it up in FDA casings.
- Put the tractor on the even terrain. Engage parking brake and lock rear wheels fore and aft using wedges.
- Remove lever check/fill plugs (1) and drain plugs (2, 3, 4) from the casings of wheel reducing gears, main gear and intermediate bearing correspondingly. Drain oil into special reservoir.

ATTENTION: Be careful and avoid contact with hot oil. Properly dispose the oil.

- Put in place and tighten fill plugs.
- Fill casings up with fresh transmission oil Tap -15V, Tsp-15K, TAD-17 or with their analogues up the lower edges of filling opening.

To drain oil from the casing of upper bevel gear and pinion:

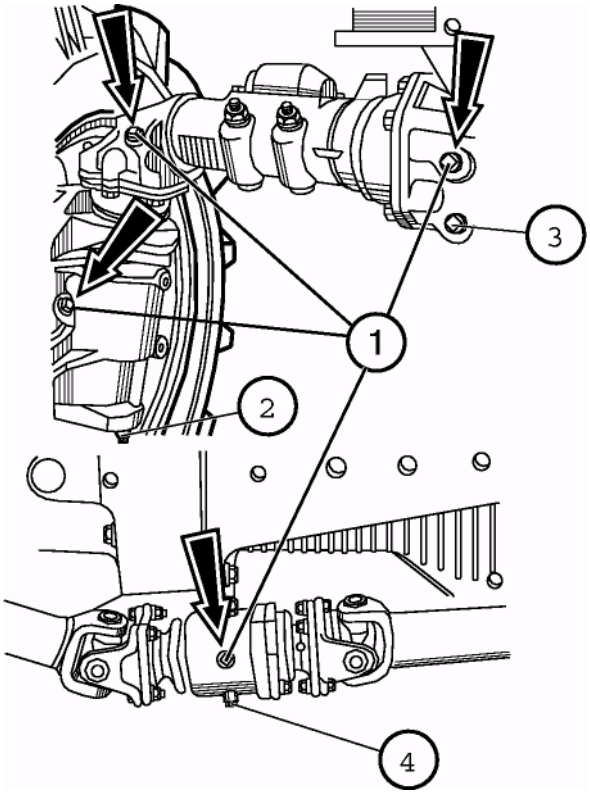
- Using lubrication gun (3) for liquid lubrication pump out part of oil via filling opening (4);

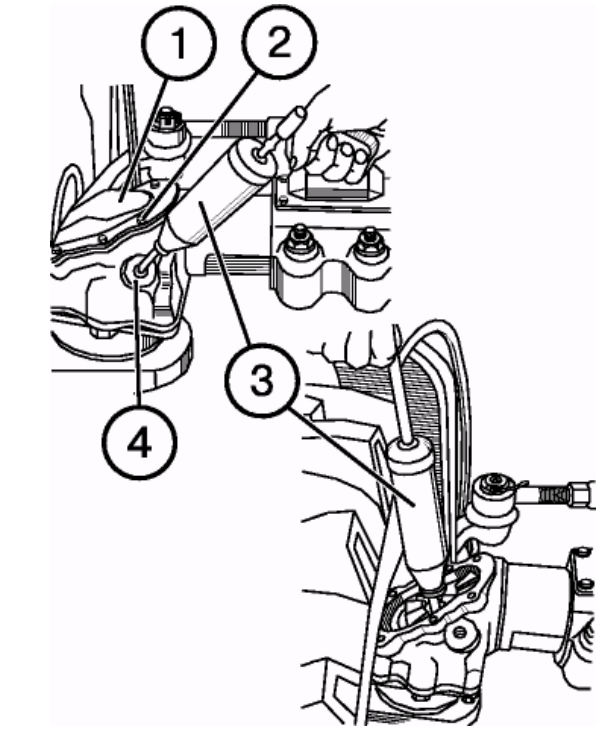
- Unscrew bolts (2), take off cover (1) and remove remaining oil;

- Reinstall cover (1) and bolt (2);

- Using lubrication gun for liquid lubrication fill the capacities of upper bevel gears and pinions with oil up to lower edge of opening (4);

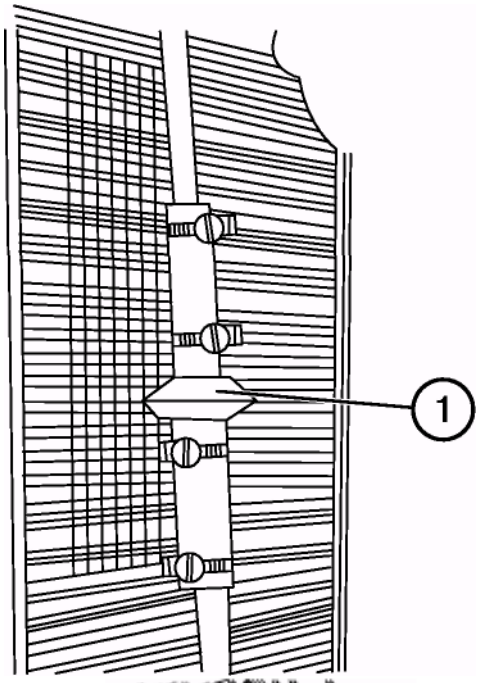
- Put in place and tighten level check/fill plugs.





Operating 41. Engine oil pre-filter

- Loosen four clamps of connecting sleeves and remove filter from oil conduit, under engine oil radiator.



IMPOTANT! Make notice of how filter was placed in oil conduit. Random filter installation is not allowed.

Wash filter in diesel fuel and blow off with compressed air in the direction of arrow imprinted on the filter housing.

Mount the filter, paying attention to its correct orientation in the oil conduit.

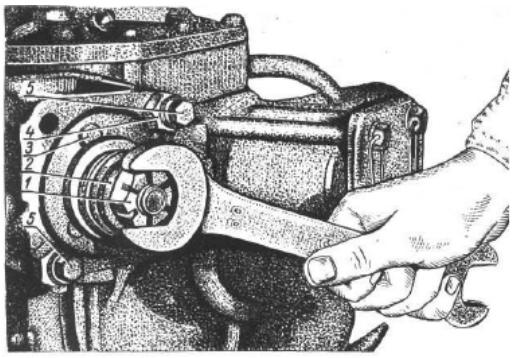
Tighten clamps of sleeves.

Operation 42. Washing engine breathers

- Unscrew bolts (1) and remove breather body (2).
- Pull the breather out of the body, wash with diesel fuel and blow off with compressed air. Pour some motor oil inside breather filter, and giving some time to drain it, put in its place.

Operation 43. Adjustments of steering booster

In hydraulic booster following elements are regulated: coupling engagement “worm and sector”, engagement “sector and rack”, tightening of the worm nut, axial stroke of turning shaft, emergency valve and also valve control of differential blocking.



1 – spherical nut; 2 – washer; 3 – slide;
4 – mounting washers; 5 – bolts.

For adjustment of engagement “worm – sector” loosen bolt 5, and input key in hub flange recess, turn hub 6 clockwise (along the tractor movement) as far as it will go, at this moment tie-rod arm should be in middle position, then turn hub contra clockwise by 10-12 mm to outside diameter of the flange. Tighten bolt 5, crank up the engine and make sure, that there are no jamming, when rotate steering wheel to both sides against to the stop.

If it is necessary, increase clearance in engagement by turning hub contra clockwise until jamming disappears.

For adjustment of engagement “sector- rack” reduce thickness of shim washer set 24 under the flange of limit stop 23 until between stop and rack appears 0,1 – 0,3 mm clearance. By clearance control press rack to the sector.

Using spherical worm nut 30 can be tightened end-thrust bearings 28. Correct tightening of end-thrust bearings is the most important factor for normal operation of hydraulic booster. Excessive nut tightening can cause warp of valve core and non-uniform turn effort. Before tightening nuts, bolt on distribution block, but previously shim washers under bolt heads in thickness of head flange (Fig. 117). Tighten worm nut to 2 kgf•m (20 N-m), unscrew it by 1/12—1/10 turns until the hole in the worm matches locknut pin hole and then fasten nut by cotter. Unscrew two tension bolts from distributor block to the casing, put cover and fix reliably distributor block.

For adjustment of axial stroke of turning shaft 21 loosen check nut 12, screw adjusting bolt 10 against the stop into the shaft end, then unscrew by 1/8 — 1/10 turns and locknut with safety nut.

For adjusting of emergency valve attach to discharge manifold or to valve cover instead of plug 1 manometer with gauge face not less than 100kgf/cm2 (10 MPa). Turn steering wheel against the stop, let diesel operate at maximal speed and turn regulating screw 3 until manometer indicate pressure 88 kgf/sm2 (8.8 MPa). After valve adjusting locknut the cap with wire. Perform adjustment at the oil temperature 50±5°C.

Check free travel of the steering wheel, when diesel is in operation on tractor parking. Free travel in this case should not exceed 20°. At increased free travel check plays in steering gear connections, screw nuts of tie-rod arm, of sector and pivoted levers, adjust joints of steering link, check tightening of the worm nut, of engagements “worm- sector”, “sector – rack” and axial stroke of hydraulic booster turning shaft.

Special maintenance

After every 2000 hours of operation

Operation 44. Checking engine nozzles

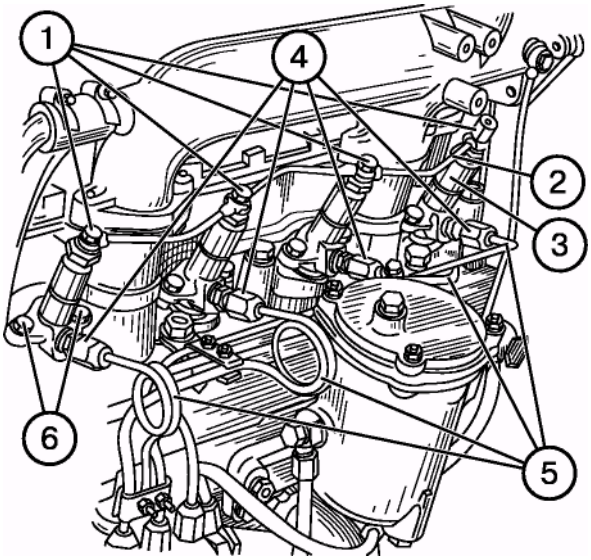
IMPOTANT! Nozzles should be cleaned and adjusted in specialized workshop of the dealer.

WARNING: Diesel fuel is sprayed under high pressure and can cause serious trauma if nozzle spraying is checked by hand. Use for this purpose paper or carton. Wear protective glasses. Before connecting or disconnecting of fuel lines shut down diesel for pressure relief. Before diesel start tighten all connections of fuel lines. By hand skin contact with fuel immediately apply to the medical assistance, otherwise blood poisoning is possible.

NOTE: It is convenient to have spare set of nozzles, checked and adjusted to be quickly installed on the engine.

Take off and replace nozzles, having performed the following operations:

- Before disconnecting or loosening of any parts of the fuel system, thoroughly clean adjacent operation surface.
- Unscrew nuts (4) and disconnect high-pressure fuel lines (5) from nozzles (3) and fuel pump.



- Take off fuel lines (5).
- Unscrew four bolts (1) of the drain duct and take off drain fuel line (2). Sort out sealing copper washers (two washer per each “banjo” bolt).

Unscrew nozzles fixing bolts (6) and take off nozzles (3).

- Send nozzles to dealer’s workshop for servicing.
- Put checked, cleaned and adjusted nozzles in the reverse order.
- Bleed the system.

IMPOTANT! Use new copper washers during each mounting of nozzles.

Operation 45. Advance angle of fuel injection

Adjusting advance angle of fuel pump injection should be within 19° - 21° till UDC (D-243).

Advance angle should be checked and adjusted in specialized workshop of the dealer.

IMPOTANT! Adjustment of fuel equipment by tractor operator (owner) is considered as grounds for cancellation of manufacturer's warranty obligations.

Operation 46. Adjusting of the fuel pump on stand

Fuel pump should be adjusted by dealer in specialized workshop using special equipment.

Operation 47. Washing engine cooling system.

To wash the system use solution of 50-60 grams of soda ash per one liter of water. Observe the following order of washing:

- Fill radiator with two liters of kerosene and fill the system with prepared solution;
- Start the engine and let it operate for 8-10 hours, then drain solution and rinse the cooling system with pure water;
- Check if radiator core is clean. If necessary, wash the radiator and blow off the core with compressed air (blowing direction – from the engine side).

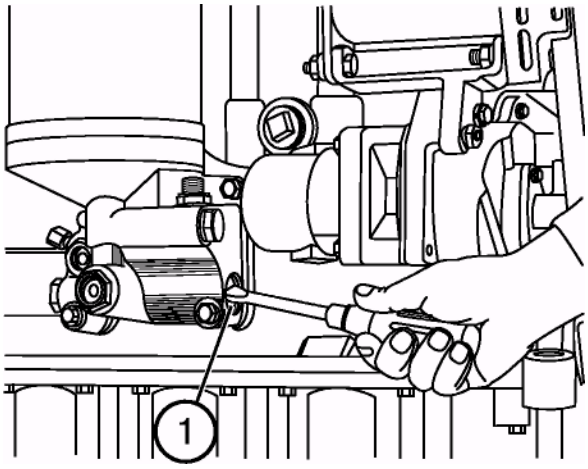
ATTENTION! Radiator clogging, insufficient tension of the fan belt, contamination inside cooling system may lead to engine overheating and failure.

General maintenance

Operation 48. Adjusting drain valve of engine centrifugal oil filter

If during engine operation in nominal conditions and at normal temperature (80...100°C) oil pressure drops below 0.1 MPa, shut down the engine and correct the defect.

One of the methods to raise pressure is adjustment of drain valve of the centrifuge. To this end remove threaded plug (not shown), and adjust oil pressure by screwing the adjusting screw (1) into the body with a screwdriver. If this method will not correct the defect refer to the deal.



Seasonal maintenance

Combine seasonal maintenance with regular maintenance operations

Substance of works	
During transition to autumn-winter season (with settled average daily temperature below + 5° C)	During transition to spring-summer season (with settled average daily temperature above + 5 °C)
Change summer oil grades for winter grades (see lubrication table): In engine casing In the case of hydraulic assemblies and HS. In the transmission case In FDA case In steering booster casing In reduction gear casings of FDA rear axle-drives In intermediate bearing of FDA drive Change grease in front wheel hubs Change grease in steering joints Fill the engine cooling system with antifreeze fluid, having in advance washed the cooling system Remove cardan shafts and check flange tightness on the shafts of transfer gear in axial direction, intermediate bearing tightness and axle drive gear tightness (for the tractors with FDA). Adjust axial plays by nuts tightening.	Change winter oil grades for summer grades In engine casing In the case of hydraulic assemblies and HS. In the transmission case In FDA case In reduction gear casings of FDA rear axle-drives In intermediate bearing of FDA drive In steering booster casing

Tractor maintenance in special operating conditions

When operating the tractor under special conditions (at lower temperatures, in the desert, on sand and boggy soils, rocky terrain), specified intervals and scope of maintenance are preserved.

On top of that, below-listed works are introduced additionally or performed more frequently.

When operating the tractor in desert, on sandy soils, at high temperatures and dust.

Use enclosed method of filling the engine with oil and fuel. Change oil in the air purifier sink after each three shifts.

During M-1 check:

- Engien oil, no mechanical impurities are allowed in oil. If necessary, replace;
- Central air purifier pipe (the pipe should be clean). Wash and service the air purifier after each 20 hours;
- Wash with stream of water or blow off with air the water radiator core. Radiator should be clean with no traces of oil on its surface. During M-2 wash fuel tank plug.
-

When running the tractor at low temperatures, make pre-start engine heating up to 20-30 °C. At the end of the shift fill tanks with fuel (at temperature below 30°C use arctic fuel). Fill the cooling system with antifreeze fuel.

When running the tractor on rocky soils and in highlands.

During shift-time visual examinations check driving gear and other tractor components for possible damages, as well as tightness of engine casing plugs, rear axle and FDA, fastening of driving wheels. Check air tightness of the radiator plug of the engine cooling system.

in highlands operation conditions to avoid disturbance of engine functioning, make adjustment of the fuel pump with a view to reduce its capacity in the following range:

At elevation of 1500-2000 m above see level reduce capacity by 10%;

- at 2000-2500 m — by 15%;
- at 2500-3000 m — by 20 %;
- operation at elevation over 3000 m is not recommended.

Tractor maintenance when preparing it for storage, during storage and removal from storage

Tractor maintenance in such cases should be carried out according to regulations given in section “Tractor storage”

LUBRICATION TABLE

Description of the assembly units and lubrication points	Description, brand and standard designation to greases and lubricating fluids				Number of lubrication points
	Lubricant during the operation at temperature		Filling when operating, l	Lubrication when storing (to 6 months)	
	from -40ºC to +5ºC	from +5ºC to +50ºC			
Engine case	**Motor oil:**				1
	Basic		12,0	12,0	
	M-8DM	M-10DM			
Steering booster body	**Duplicating**				
	M-8G$_{2K}$, M-8G$_2$	M-10G$_{2K}$, M-10G$_2$	6	6	
Air cleaner pan	Resettled and pre-filtered used motor oil		1,5	1,5	1
	Basic				
Power train body (transmission)	Transmission oil Tap-15V*; TSp-15K; TSp-10	TSp-15K	40	40	1
	Duplicating				
	TAD-17i	TAD-17i			
Upper conical pair bodies of reduction gears of FDA	**Basic**				
	Tap-15V	TSp-15K	0,25	0,25	2
Intermediate bearing of FDA drive	Tap-15V	TSp-15K	0,15	0,15	1
	Duplicating				
Bodies of final drive reduction gear of FDA	Transmission oil TAD-17	Transmission oil TAD-17			
	-//-	-//-	1,8	1,8	2
FDA body					
Upper conical pair bodies of reduction gears of FDA	The same	The same	1,6	1,6	1
Intermediate bearing of FDA drive	-//-	-//-	0,25	0,25	2
Drive pulley	-//-	-//-	0,15	0,15	1
	-//-	-//-	0,50	0,50	1

*At the temperature from -15ºC to -20ºC dilute up to 30% of filling volume by spindle oil AU GOST 1642-75 or industrial oil I-12A GOST 20799-75. At the temperature up to -55ºC dilute up to 15% of filling volume by winter diesel fuel.

Description of the assembly units and lubrication points	Description, brand and standard designation to greases and lubricating fluids			Number of lubrication points
	Lubricant	Filling when operating, l	Lubrication when storing (to 6 months)	
Oil tank of hydraulic system	Hydraulic oil BECHEM Staroil HLP TU RB 903.201.042 – 05 ADDINOL Hydraulikol HLP – 32 TU RB 903.201.044. – 05 TNK Hydraulic HLP – 32 TU 236.915.052 - 08	17,5	-//-	1
Clutch release fork bearing	Basic lubricant: “Litol-24” Duplicating lubricant: “Bechem” LCP-GM multipurpose plastic	4-6 squirt injections (0,02)	-//-	1
Gear wheel of adjustable cross stay	-//-	0,005		1
Pivoting shaft bushings of rear hitch attachment	The same	Till lubricant appears from the clearances (0,01)	-//-	2

Refill capacities, l

Engine cooling system	20
Engine lubricating system (including oil cooler)	13,3
Transmission bodies	40
FDA body with bevel gear speed reducers	1,6
Reducing gear body with bevel gears (either)	1,8
Oil tank of hydraulic system	17,5
Fuel tank	127
Intermediate bearing body of FDA cardan drive	0,15
Steering booster body	6,0

Adjusting characteristics of fuel pumps 4UTNI and 4UTNI-T on stand

Table 1

Description of characteristic	Unit measure	4UTNI D-243.1
Angle of commencement of fuel delivery by section on the meniscus to upper dead point of tappet (on cam profile)	degree	57±1
Rated speed of the pump camshaft	rpm	1100±5
Cyclic fuel delivery at rated speed	mm^3/cycle	70±1,4
Rotation frequency when regulator taking effect	rpm	1115-1125
Irregularity in fuel delivery between sections at rated frequency, no more	%	6
Rotation frequency appropriate to the engine idle running	rpm	1160
Cyclic delivery at maximum idle speed, no more	mm^3/cycle	22,5
Irregularity in fuel delivery between sections at maximum idle speed, no more	%	35
Rotation frequency appropriate to the maximum torque	rpm	800…850
Rotation frequency appropriate to the shutdown of corrector	rpm	1030-1090
Cyclic fuel delivery at pump camshaft speed 80-100 rpm, no less	mm^3/cycle	140
Head pressure of fuel pump at the camshaft rated speed	MPa (kgf/cm^2)	0,07-0,13 (0,7-1,3)
Rotation frequency appropriate to the total automatic trip of fuel delivery through the nozzles, no more	rpm	1250

Section H. POSSIBLE MALFUNCTIONS AND REMEDIES

MALFUNCTION, SYMPTOM	REMEDY
ENGINE	
Engine doesn't start	
Air in the fuel system	Bleed the system using manual fuel priming pump. If necessary, remove air inflow. Take off fuel pump from diesel and send it to repairs.
Engine doesn't develop power	
There is no full fuel feeding because of disarrangement of tie-rod of control fuel pump. Filtering element of fuel fine filter is clogged. Nozzles are fault. Wrong advance angle of fuel injection. Air cleaner of engine is clogged.	Adjust control tie-rods. Replace filtering element. Detect fault nozzles, wash and adjust them. Set the recommended advance angle of injection. Carry out the maintenance of air cleaner.
Engine run at idle speed unstably	
Ingress of air to fuel system. Spring of free running in fuel system is not adjusted. Fuel pump is faulty.	Remove air from fuel system. Adjust spring of free running (for diesel with fuel pump 4UTNI o 4UTNI). Take off fuel pump from the engine and send it to repairs.
Engine smokes in all operation modes	
A. Exhaust tube exudes black smoke	
Engine air purifier is clogged. Needle of nozzle diffuser is hung. Bad quality of fuel. Faulty fuel pump.	Make air purifier maintenance. Find out faulty nozzle, wash o replace diffuser, adjust the nozzle. Substitute fuel for recommended fuel. Dismount fuel pump from the engine and send it to the workshop for repair.
B. Exhaust tube exudes white smoke	
Engine is not warmed up. The gaps aren't adjusted between valves and rockers. Water entrapped in fuel. The setting of fuel injection advance angle is disturbed.	Warm up the engine, during the operation maintain coolant temperature in the range 75... 95 °C. Adjust gaps. Replace fuel. Set the recommended fuel injection advance angle.

Continuation of table H-1

MALFUNCTION, SYMPTOM	REMEDY
C. Exhaust tube exudes blue smoke	
Oil in the combustion chamber due to wear of sleeve-piston group parts. Excessive oil in engine casing.	Replace worn out parts of sleeve-piston group. Drain excessive oil, having set level by the upper mark of oil-measuring rod.
Engine overheats	
Cooling fluid boils in radiator.	Clean the radiator from mud and dust, when is necessary clean cooling system from scale, adjust fan belt tension.
Fuel injection by nozzles has become worse.	Find out fault nozzles, wash, clean and adjust.
Engine suddenly stops	
Fuel is not supplied.	Check if there is fuel in the tank, serviceability of fuel lines, filters and booster pump.
Oil pressure on the warmed up diesel is below allowable value	
Faulty pressure indicator or sensor. Faulty pump of lubricating system of engine. Oil level in engine casing is below allowable. Sticking of bleed valve of centrifugal oil filter. Extreme wear of crankshaft neck – bearings junction.	Replace. Default or replace the pump. Fill oil to the upper mark of oil-measuring, rod. Wash the valve and adjust pressure. Send engine for repair.
POWER TRAIN **CLUTCH** **Clutch doesn't transfer full torque**	
No free travel of the pedal. Worn out driven disc linings.	Adjust free travel of the pedal. Replace lining or ready-mounted driven disk.
Oiling of driven disks' lining	Remove causes of getting oil in dry clutch section and, if necessary, replace friction lining or disks in assembly.
Clutch doesn't go off fully	
Increased free pedal travel.	Adjust free pedal travel.
Wrong adjustment of position of release lever.	Adjust position of release levers according to present manual.
Oil in dry section of the clutch body	
Wear of the cup, sealing the crankshaft.	Replace cap.
Wear of gaskets of clutch body.	Replace gaskets.
MAIN GEAR OF REAR AXLE **High noise in bevel gear and pinion**	
Adjustment of tooth action of pinions of main gear and bearings of differential is disturbed.	Adjust gears meshing and the gap in bearings.

Continuation of table H-1

MALFUNCTION, SYMPTOM	REMEDY
BRAKES **Poor brakes operation (brakes do not hold)**	
Disturbed adjustment of brakes control. Oiling or wear of brake disks' lining.	Adjust brakes control. Eliminate oil leaking. If is necessary, replace disks.
REAR PTO **Rear PTO doesn't transmit full torque (skids)**	
Disturbed control adjustment due to considerable wear of friction lining of brake bands, or some other reason.	Adjust PTO control mechanism.
FRONT DRIVING AXLE **Front axle, during skidding of rear wheels, doesn't engage automatically at forward running of tractor**	
Wear parts of freewheeling clutch of transfer box.	Replace freewheeling clutch.
Jamming grooves of exterior race of freewheeling clutch are contaminated by oil oxidation products and wearing parts.	Take off the clutch and wash clutch parts.
Springs of pressed roller mechanism are deformed.	Replace springs.
Safety clutch in intermediate bearing doesn't transfer the required torque.	Adjust clutch to transfer torque 40. ..80 kgf•m (400. .. 800 N•m) by drawing up a nut tight of flange from the side of transfer box.
Wearing driven and driving disks of safety clutch.	Replace disks.
Disk springs lost elasticity or are crashed.	Replace springs.
Toe-in of control transfer box has increased length.	Adjust toe-in length as shown in section F: «Adjustments».
Fast wearing and tire separation of front wheels	
Air pressure mismatch in tires of front and rear wheels to the recommended norms.	To prevent failures maintain air pressure in tires of front and rear wheels according to the recommended norms.
Disturbed adjustment of toe-in. FDA is engaged permanently because of failure or jamming in transfer box control.	Adjust. Check the work of forced engage of FDA. Adjust control mechanism of transfer box.

Continuation of table H-1

MALFUNCTION, SYMPTOM	REMEDY
STEERING	
«Difficult» steering	
Oil foaming in amplifier system: a) insufficient quantity of oil in amplifier body;	Check oil level, if is necessary, add to required level
b) ingress of air to system	Check suction line and eliminate leakage
Disturbed adjustment of safety clutch	Adjust valve
High oil leak in pump	Replace pump
Jamming in gearing worm-sector	Adjust gearing
High vibration of steering wheel	Screw circular nut to contact with bush, unscrew it on 1,5 revolution and lock
High instability of front wheels	
Nut gripping of worm is unfastened	Screw nut with torque 2 kgf-m (20 N-m), unscrew it on 1/12—1/10 revolutions to overlap the cut in nut with hole in worm under cotter pin
High play in conical bearings of front wheels or hinges of tie-rod of steering, front wheel toe-in is disturbed	Adjust
Nut gripping of fixing of pitman of sector or pivot arm are unfastened	Screw nuts
Increased axial movement of pivoting shaft	Adjust axial movement of shaft by the bolt
High free travel of steering wheel (more than 25°)	
Increased gap in gearing worm-sector	Adjust gap
High play in junctions of cardanic clutch of steering wheel	Replace wear parts
Nut gripping of worm is unfastened	Screw nut with torque 2 kgf-m (20 N-m), unscrew it by 1/12—1/10 revolutions to overlap the nut cut with cotter pin passage in worm

Continuation of table H-1

MALFUNCTION, SYMPTOM	REMEDY
HYDRAULIC LIFT LINKAGE	
No lift of mounting or load-carrying capacity dropped dramatically.	1. Low oil level in the tank – add oil to level. 2. Air leak on pump admission line – eliminate air leak (oil foaming). 3. Hanging of overflow valve of distributor (take off valve parts, wash and put them in place).
Drop of the load-carrying capacity during oil warming up. During cooling-down the load-carrying capacity recovers.	Wearing or failure of oil pump – replace pump.
High oil warming in hydraulic system	1. Insufficient quantity of oil in hydraulic system body (add oil to the mark “П”). 2. Handle of distributor is in position «lift» (return handle in position «neutral», define and eliminate the cause of jamming). 3. Pump lost productivity (replace pump).
Spontaneous implement dropping	1. Oil leak on gaskets of piston of hydro cylinder (replace gasket). 2. Pilot-operated check valve of distributor is leaky (wash or replace pilot-operated check valve).

Continuation of table H-1

MALFUNCTION, SYMPTOM	REMEDY
ELECTRICAL EQUIPMENT	
Storage battery has low charge degree	
Low level of voltage being regulated.	Replace generator voltage regulator.
Slippage of drive belt of generator.	Adjust tension of drive belt.
High contact resistance between storage battery terminals and wiring tips due to loosening and oxidation.	Dress connection terminals, tighten and grease non-contact elements with technical vaseline. Tighten fastening of “SB” switch and “ground” junction.
Faulty storage battery.	Replace the battery.
SB "boils" and requires frequent topping up of distilled water	
High level of voltage being regulated.	Replace generator voltage regulator.
Faulty SB.	Replace
Starter is not actuated and engine crankshaft doesn’t turn through	
One of cable terminals which goes to the storage battery is disconnected.	Tighten surely the terminals of SB.
Strong oxidation of cable terminals and terminals of storage battery.	Dress battery and cable terminals, oil non-contact elements with technical vaseline.
Actuated locking mechanism of starting of diesel or switch is fault.	Place the lever of gearbox in extreme left position and replace the switch.
Small starting torque of starter because of discharging of storage battery.	Charge SB.
Fault starter.	Dismount starter and send it to the workshop.
Generator doesn’t develop full power	
Slippage of driving belt of generator.	Adjust.
Fault generator.	Dismount generator and send it to the workshop.
Generator noise	
Slippage or excessive tension of fan belt.	Adjust.
Wear of bearings.	Dismount generator and send it to the workshop.

Section I. TRACTOR TRANSPORTATION AND TOWING

Tractors are transported by railroad, motor vehicles, on trailers, as well as by towing or under its own power.

While in transit:

- Shift GB levers to the first gear;
- Engage reducing gear;
- Engage parking reserve brake;
- Fasten tractor to platform with 6 mm thick wire, chains, braces.

During tractor loading/unloading use lifting mechanisms with load-carrying capacity of at least 10 ton-force.

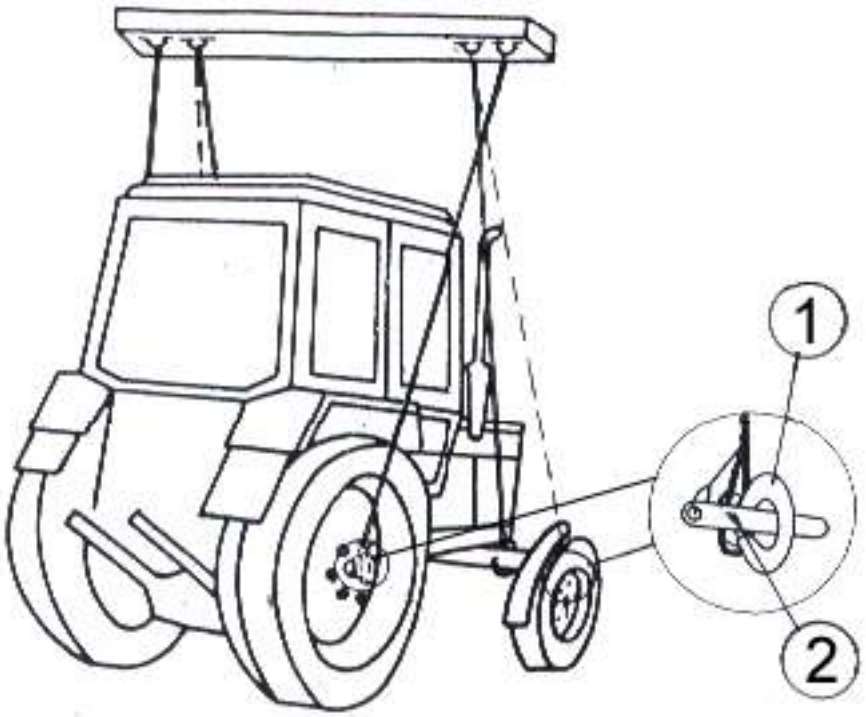
Tie steel ropes down to front axle beam or eye-bolt (1) and rear axle eye-bolt (1), as shown in the diagram below. When steel rope is fastened to eye-bolt (1), put load-gripping mechanism around eye-bolt body and fix it with lock (2) via eye-bolt.

The lug fixed to front ballast weights and weight arm is provided for connecting towing steel rope.

Observe traffic regulations while towing tractor.

Attention! When lifting tractor by eye-bolts, it can move forward (backwards) up to 1.5 m. .

Don't use towing shackle to lift tractor.



Section J. TRACTOR STORAGE

It is necessary to store tractors in enclosed areas or under coping according to the recommendations of GOST 7751-85.

If indoors premises are not available, tractors may be stored on outdoor special sites, with obligatory preservation, sealing and components dismounting, that require warehousing.

Put tractors in the inter-shift storage, if their operation is interrupted for up to 10 days, short-term storage if duration of idle interval is from ten days to two months, and long-term storage if interruption of use lasts for over two months. Start preparation for short-term storage straight after works completion, and for long-term storage – not later than ten days after works termination. Before putting to storage, check technical state of the tractor. It must undergo scheduled maintenance.

Technological maintenance when preparing tractor for long-term storage includes:

-cleaning and washing, dismounting and preparing for storage tractor components subject to storage in specially equipped warehouses; sealing of openings and cavities from ingress of moisture and dust; tractor and its components' preservation; putting tractor on supports (plates).

After operation tractor is cleaned off dust, mud, oil leaks, vegetation and other remains. Components where water is not allowed (generators, relays, etc.), are protected with sheathes. After tractor is cleaned and washed, it is blown off with compressed air to remove moisture. Damaged painting is restored by putting varnish and paint coating or protective grease.

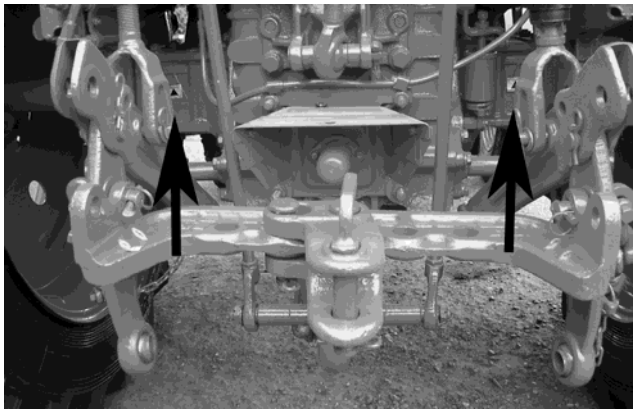
Painting should be performed according to GOST 6572-91.

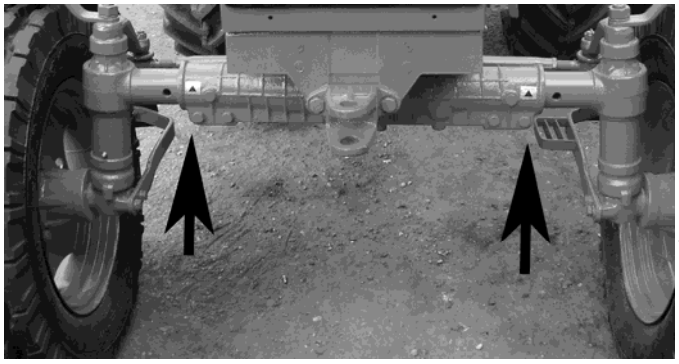
In case of long-term outdoor storage, electrical equipment, components made of rubber, polymer materials and textile hoses of hydraulic systems, etc, are dismounted, prepared for storage and sent to ware house. Fastening parts of dismounted tractor components are reinstalled. Electrical equipment (headlights, generator, starter, storage batteries) are cleaned, blown with compressed air, terminals are coated with protective grease.

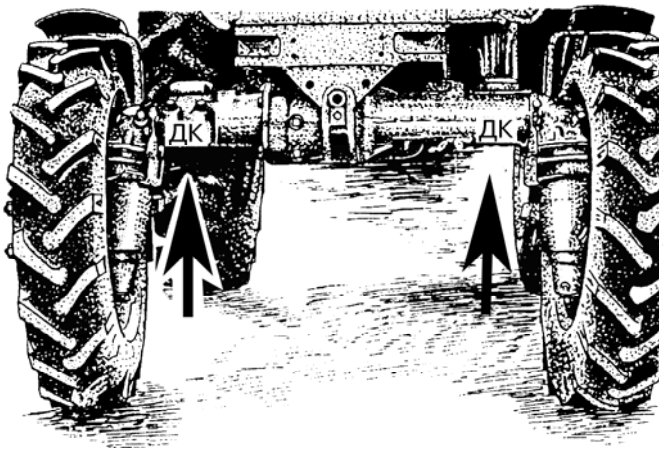
When putting tractor in long-term storage, remove scale and wash diesel cooling system, lubricate all tractor assemblies according to the lubrication chart. Drain oil and fill fresh oil with additives to the control level in diesel casing, air purifier sump, cases of gear box, rear and front axles, wheel reduction gear, intermediate supports, oil tank of the hydraulic system. Run tractor in for 10-15 minutes. Drain cooling fluid out of the cooling system, and cabin cooling and air heating system. Drain fuel out of the fuel system, rinse inside tanks' surfaces with inhibitor lubricants and tightly close filling necks. Use preservation mixture to preserve fuel system and diesel cylinders. Put storage batteries in long-term storage after conducting control-training cycle in accordance with GOST 9590-76. Exposed joints, threaded connections, steering trapezoids, grooved surfaces of PTO drive end and gimbal gears, extended sections of cylinders' and suspensions' rods, mechanisms for adjusting wheels span of front and rear wheel should be preserved. Tightly cover fuel tank filling neck, diesel breathers' openings, transmission, hydraulic systems, diesel exhaust pipe and inlet air purifier pipe, relative openings after starter removal, and other cavities, through which atmospheric precipitation may get inside inner cavities of tractor assembly units, with covers, polyethylene film sacks or other special accessories. Shift levers and pedals to position excluding spontaneous switching of tractor units and assemblies.

Pneumatic tires may be stored in the unloaded state outdoors on tractors put on supports. Jack up tractor to unstuck tires from bearing area on 8-10 cm. Place supports under arms of semiaxlis of rear

axle, front axis or arms of final drive of FDA (see figure, positions are shown by arrows).







Tires' surfaces are coated with protective substance. Pressure in tires during indoors and outdoors storage should be reduce down to 70% of the rated value. Exterior surfaces of the hydraulic system flexible hoses are cleaned off mud and oil. Hoses may be kept on the machine. In this case they are coated with protective substance or wrapped with insulating material (wax paper, polyethylene film, etc). All openings, slots, cavities (filling necks of tanks, and transmission, reduction gears, openings of hydraulic systems' breathers, engine exhaust pipe and others), through which atmospheric precipitation can get inside tractor cavities, are tightly covered with covers or stopper plugs. To provide free water drain from the cooling system and condensate, leave draining fixtures open. Cabin hoods and doors should be closed.

Maintenance during storage includes checking if machines are properly placed on supports (plates) (absence of cocking), completeness, air pressure in tires, air tightness, state of anticorrosion coatings (protective grease, paint integrity, absence of corrosion (integrity and strength of sheathes and covers). Detected defects should be corrected.

Tractor technological maintenance when removing from storage includes taking off supports, cleaning and, if required, depreservation of tractor, its components, reinstallation of dismounted components, tools, removal of sealing fixtures, checking operation and adjustments of tractor and its assemblies.

Requirements for machine storage between the shifts

Tractor may be stored on storage yards, and inter-shift storage grounds, or directly on works execution sites. All openings, through which atmospheric precipitation can get inside tractor cavities, should be tightly covered. Storage batteries should be switched off.

Requirements for short-term machine storage

Put tractor in storage in complete without dismounting parts and assembly units.

Disconnect storage batteries. Electrolyte level and density should correspond to recommendations for storage and maintenance of storage batteries. If tractor is stored at low temperatures or over one month, storage batteries are dismounted and sent to warehouse.

Requirements for outdoors long-term storage

Engine preparation for putting in long-term storage includes preservation of surface of parts inside an engine (inside preservation) and washing the cooling system, sealing of inside surfaces, preservation of outside unpainted engine surfaces (outside preservation), and if hood is not provided, engine packing with polymer film sheath. Preservation of empty fuel tanks includes the use of volatile inhibitors. Air purifier is cleaned and washed, and sump is filled with operation preservation oil.

Threaded connections of mounting mechanism, steering trapezoids, hydraulic systems and so on are cleaned and greased.

Preservation

Preservation provides provisional anticorrosion protection of tractor assemblies and systems from ambient exposure in the process of tractor transportation and storage.

Tractor surfaces subject to preservation are cleaned from mechanical staining, degreased and dried up. Unpainted inside and outside galvanized surfaces, specific assemblies of tractor and cabin are conserved with corrosion-proof oil RUST BAN 397. SUMIDERA 397. Material consumption is 0.02-0.03 kg per tractor.

Tractor surfaces subject to preservation are cleaned from mechanical staining, degreased and dried up. Unpainted inside and outside galvanized surfaces, specific assemblies of tractor and cabin are conserved with corrosion-proof oil RUST BAN 397. SUMIDERA 397. Material consumption is 0.02-0.03 kg per tractor.

Preservation of fuel tank inside surfaces is carried out by sputtering after their manufacture and before coating with preservation oil RUST BAN 335. ML -5888, instruments panel – after assembly by sputtering corrosion-proof oil RUST BAN 397, SUMIDERA 397 on inside panel surfaces. PTO drive ends are preserved by greasing with corrosion-protective oil RUST BAN 335, ML -5888. Material consumption is 0.1 kg per tractor.

Some assemblies (monocyclone, necks of radiator and fuel tank, breathers, cylinders' rods) are sealed with polyethylene sheathes. Consumption of material is 0.66 kg per tractor.

Materials used provide protection of tractor and its assemblies for the period of storage and transportation within one year.

Before putting tractor into operation remove polyethylene sheathes, clean outside tractor surfaces off preservation material using cloth soaked in solvent under GOST 3134-78.

Outside tractor and its assemblies preservation is made by lubrication of surfaces using brush or sputtering by means of paint sprayer.

Inside tractor preservation is carried out by filling cavities with preservation mixture and subsequent engine operation.

Depreservation

Depreservation method is chosen depending on preservation materials used. Surfaces under preservation have to be wiped with cleaning cloth soaked with low-viscous oils, solvents, or washed away with washing water-soluble detergents. Sealed assembles should be stripped off insulation materials (film, paper). Inside surfaces under preservation need no depreservation.

Represervation

Tractor represervation is carried out in case conservation defects are detected in the process of storage or upon expiration of protection life.

During tractor operation and inter-shift, short-term and long-term storage, means and methods of preservation, storage conditions are chosen by an enterprise, that maintains tractor in compliance with GOST 7751-85. Inside surfaces may also be preserved with general-purpose

preservation grease KS-U according to Specifications TU RB 600125053.019-2004. During outdoor storage specific surfaces are preserved with grease «BELA-KOR» grade A according to TU-RB 600125053-020-2004.

Putting tractor into operation after long-term storage

Remove grease off surfaces under preservation. Dismount protective covers, plugs, special accessories and reinstall earlier removed parts. Before mounting parts clean them off grease and dust. Drain sediment out of all vessels, fill them with operation fluids and, if necessary, top up to control level.

Lubricate all tractor mechanisms according to lubrication chart. Fill fuel tanks with fuel. De-preservation of the fuel system and diesel cylinders is made by starting diesel. Fill the system with cooling fluid. Carry out scheduled maintenance. Turn through diesel crankshaft without supply of fuel by several turns and, making sure crankshaft rotates properly, start diesel for 5-10 minutes, gradually bring crankshaft rotation speed from minimum to rated value. Run in tractor for 15-20 minutes. Correct detected faults.

Safety requirements in preservation

The preservation production process, comprising surfaces preparation, deposition of preservation materials, paper marking and cutting, packing, can be performed only by persons who arrived at the age of eighteen, underwent medical examination, introduction briefing on labor and fire safety, primary briefing on the working place. Preservation remises and sections should be separated from other production premises and equipped with plenum-exhaust ventilation. Materials used for preservation are combustible substances with flash temperature from 170 to 270^{o}C, and should comply with state standards, technical specifications and have quality certificate.

Conservation materials being supplied should bear label with material description. Perform preservation operations in special clothes and footwear and use individual protection means. When performing preservation operations, observe personal hygiene rules, dry clean special clothes in time, don’t wash it in emulsions, solvents, kerosine. By the degree of impact on human organism preservation materials are related to moderately dangerous, so use recommended individual protection means while handling materials.

In case of prolonged exposure of skin to preservation oils, greases and liquids, it can be injured. White spirit vapors in small concentrations act as weak drug. Large concentration may lead to poisoning. Anticorrosion paper contain corrosion inhibitors causing irritation and inflammation of skin, mucous of nose and eyes. Before starting work put on cotton overalls, robe or apron, make ready individual protection means depending on work conditions and toxicity of substances used. Grease hands with protection paste (creme) and put on cotton and rubber gloves. Before performing work, safe conditions of which are not known, demand to be briefed on safety engineering regulations.

Section K. TRACTOR DISPOSAL

When disposing tractor upon expiration of service (operation) life, it is necessary to:

- Drain and in the established order send for processing oils from engine lubrication system, body of rear axle and wheel reduction gear, gear box, front driving axle, reduction gears of final front wheels gears, hydraulic system oil tank;
- Drain cooling fluid from engine cooling system and put it in special storage reservoirs;
- Drain diesel fuel from fuel tank and put it in special storage reservoirs;
- Drain sediment from fuel coarse and fine filters;
- Drain electrolyte from tractor SB, put it special storage reservoir and send for processing in the established order;
- Make complete tractor disassembly into parts, having sorted them out into non-metal, steel, cast iron, non-ferrous and precious metals, and send them for processing in the established order;
- Dismounting of parts and assembly units, maintenance of air conditioning system should be carried out by specially trained personnel using equipment for servicing freon refrigerating machines.

- During maintenance and regular servicing, fuel and lubricants subject to change and, if necessary, parts and assembly units, should be sent for processing, having sorted them out into groups of materials.

Annex L. Wiring diagram

List of wiring diagram elements

Symbol	Description	Quantity	Notes
BK1	Sensor of coolant temperature indicator	1	
BP1	Sensor of engine oil pressure indicator	1	
BN1	Sensor of fuel level indicator	1	
E1, E2	Road headlight	2	
E3, E5	Operation headlight	2	
E4	Number plate light	1	
EL1, EL2	Lamp A12-45+40	2	Available in E1, E2
EL4…EL8	Lamp A12-1	5	Available in P2… P6
EL9, EL12, EL13, EL15, EL16, EL18	Lamp A12-21-3	6	Available in HL5… HL8
EL10, EL11, EL20	Lamp A12-5	3	Available in HL5, HL6, E4
EL14, EL17	Lamp A12=10	2	Available in HL7, HL8
EL19, EL21	Lamp AKG12-55-1	2	Available in E1, E2
EP2...EP6	Lamp holder with plug	5	Available in P2…P6
F1...F3	Fuse blocks	3	
G1	Generator	1	
GB1, GB2	Storage battery 12V	2	
HA1	Horn	1	
HL1	Lamp of pilot light of long-distance beam	1	
HL2	Lamp of blinkers pilot light	1	
HL3	Lamp of pilot light of impurity of air purifier filter	1	
HL4	Lamp of pilot light of emergency oil pressure in engine	1	
HL5, HL6	Front headlight	2	
HL7, HL8	Rear headlight	2	
K1	Starter relay	1	
K2	Starter block relay	1	
KH1	Flasher unit	1	
M1	Starter	1	
P2	Tachospeedometer	1	
P3	Indicator of engine oil pressure	1	
P4	Fuel indicator	1	
P5	Voltage indicator	1	

P6	Indicator of engine coolant temperature	1	
QS1	Battery disconnect switch	1	
SA1	Multifunction switch under steering	1	
SA2	Switch of starter and instruments	1	
SA3	Main light switch	1	
SB1	Start interlock switch	1	
SB2	Alarm signaling switch	1	
SB3	Stop-light switch	1	
SP1	Sensor of clogging of air purifier filter	1	
SP2	Sensor of engine emergency oil pressure	1	
XA9.1	Trailer socket	1	
XP1.1...XP1.3	Pluggable shoe, single-contact	3	
XS1.1...XS1.3	Seat shoe, single-contact	3	
XS2.1, XS2.2	Seat shoe, two-contact	2	
XS3.1	Seat shoe, three-contact	1	
XS4.1	Seat shoe, four-contact	1	
XS5.1	Seat shoe for relay, five-contact	1	
XS6.1	Seat shoe, six-contact	1	
XS8.1	Seat shoe of alarm signaling switch, eight-contact	1	
XS8.2	Seat shoe of key switch, eight-contact	1	
XP12.1	Plug, twelve-contact	1	
XP15.1	Plug, fifteen-contact	1	
XS12.1	Plug socket, twelve-contact	1	
XS15.1	Plug socket, fifteen -contact	1	
XT2.1, XT2.2	Junction block, two terminals	2	
XT3.1	Junction block, tree terminals	1	
XT4.1	Junction block, four terminals	1	

Electric connecting diagramm of tractor 90/92