MTZ
1220.1 / 1220.3

1220.1 – 0000010 OM

OPERATOR'S MANUAL

2010

In view of constant upgrading of produced goods, the construction of some units and parts of tractor may undergo changes which are not reflected in present edition.

Some technical data and illustrations given in this book may differ from those on your tractor. Dimensions and weights are approximate (advisory). For detailed information please consult your MTZ Dealer.

TABLE OF CONTENTS

Section A. **INTRODUCTION**

The present operator's manual is designed for studying the structure, operation rules and maintenance of tractors MTZ-1220.1/1220.3.

Read this manual carefully and fulfill requirements set forth in this manual.

Failure to follow this instruction can lead to operator's injury or a breakdown of a tractor.

Operation of a tractor, its maintenance and repair shall be carried out only by employees, familiar with all of its parameters and characteristics and informed about necessary safety requirements to prevent casualties.

In connection with constant development of the tractor some changes, which are not depicted in the present manual, can be introduced in the structure of certain units and parts.

Long-term and reliable tractor performance is secured in the case of proper operation and timely maintenance.

Any arbitrary changes made by a consumer release the manufacturer from responsibility for possible further injuries to the operator and tractor breakdown.

Tractors "MTZ -1220.1/1220.3" are universal wheeled tractors of the 2nd draw-bar category with 4x4 wheel arrangement and designed for multiple agricultural operations with mounted, semimounted, trailed implements, and for loading and unloading and hauling operations.

Tractors "MTZ -1220.1" is a basic model with diesel engine D-245.2S2 with rated power of 90 kW.

Tractors "MTZ -1220.3" is a modification with diesel engine D -245.2S2 with rated power of 90 kW, muffler on the right side of cab column.

TO OPERATORS ATTENTION!

The tractor must be run-in for 30 hours. It is recommended to load a diesel engine only up to 80% of the rated power until the first MS-1 (in 125 hours).

2. Your tractor is equipped with range-type gearbox. In addition the ranges are shifted with toothed couplings, and gears within each range are shifted by virtue of synchronizers.

To throw into the range proceed as follows:

- Depress the clutch pedal and await complete tractor stop;
- Throw into the required range smoothly, without jerks, using the range engaging lever;
- Smoothly release the clutch pedal.

To change geasr proceed as follows:

- Depress the clutch pedal;
- Shift the gearshift lever smoothly, without sharp jerks, and hold it in depressed position until the gear is completely actuated;
- Smoothly release the clutch pedal.

You can change the gears in motion within the range only during the hauling operations on the hard-surface and dirt roads. *Never attempt to change the gears in motion*

when a tractor unit is used in the cross-country conditions (arable fields, peat beds, sandy soil etc.) because sudden stop of the tractor-machine unit can occur. Cross the mentioned sections with previously selected gear.

Failure to comply with the stated operation rules will cause quick wearing out of gear splines and tooth-type couplings as well as synchronizers impairment

Attention! If you hear skirr when shifting ranges and gears with the clutch pedal being depressed, immediately turn to a repair shop for malfunction repair.

3. Observe the rules of PTO switch. When switching PTO move control lever smoothly with 2…4 sec. hang-up in the centre of motion from neutral position to PTO switch in order to prevent shaft breaking, reducer gears breaking and tail breaking of PTO.
4. When adjusting operating and parking brakes make sure that the ground is horizontal, the engine is not running, rear wheels from front and back are supported by wedges to exclude accidental movement of the tractor.

Adopted abbreviations and symbolic notations.

AB — accumulator battery;
RADL — rear axle differential lock;
PFE — paper filter element;
TDC — engine piston top dead center;
PTO — power take-off shaft;
PIS — power intake shaft;
HLL — hydraulic lift linkage;
HSU — hydrostatic steering unit;
SMS — shift-time maintenance service;
SPTA — spare parts, tools and accessories;
RHL — rear hitch linkage;
IVR — integral voltage regulator
SFE — safety filter element of engine air cleaner;
GB — gearbox;
TMU — tractor-machine unit;
CC — clutch coupling;
MS — maintenance service;
THM — towing hitch mechanism;
MFE — main filter element of engine air cleaner;
FDA — front driving axle;
HACS —hydraulics automated control system
SM — season maintenance;
VFL — volatile flammable liquid
CAC — engine charge air cooler;
TC — engine turbocharger.

International Symbols

Manufacturer uses standard international symbols regarding instruments and operating controls.
Symbols with their meaning are given below.

 — see operators manual

 — brake

 — parking brake

 — horn

 — alarm signaling

 — fuel level in the tank

 — coolant

 — starting preheater plug

— engine speed

 — engine oil pressure

 — engine coolant temperature

 — off/stop

 — on/start

 — continuous change

 — lever — down

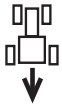
 — lever — up

 — control operating direction

 — fast

 — slow

 — forward

 — reverse

 — battery charging condition

 — cab dome light

 — marker lights

 — turning signals

 — headlights main beam

 — headlights lower beam

 — working headlights

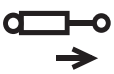
 — differential lock

 — PTO engaged

 — FDA engaged

 — fan

A4


— control valve spool “lift” position


— control valve spool “drop” position


— control valve spool “float” position


— oil pressure in gearbox


— air pressure in pneumatic system


— air filter impurity


— windshield washer


— front windscreen wiper


— rear windscreen wiper


— trailer turning signal


— oil pressure in HPS

—

Section B. **Safety Requirements**

SAFETY REQUIREMENTS

Strict observance of safety precautions and exact complying with the rules of tractor control and its maintenance secure absolute safety of its operation.

General instructions

1. Study this operators manual attentively before operating the tractor. Poor knowledge of the tractor operation and service may lead to accidents.
2. Only specially trained and skilled operators, who have passed accident-prevention and fire safety briefings, are allowed to operate the tractor.
3. If tractor is equipped with safety belt use it during the operation. If tractor is not equipped with safety belt, contact the dealer.
4. Do not take a passenger into the cab, if additional seat and hand rails are not installed. There is no any other safe space for a passenger in the cab!
5. Keep all warning plates clean.
6. Replace any damaged or missing warning plate.
7. Carefully inspect the tractor, trailed machine, mounted implement and hitch before commencement of operations. Before starting operations make sure that they are in good order. Trailed agricultural machines and transport trailers should have rigid hitches, preventing their swaying and rear-end collision with the tractor during a hauling.

Safety measures during tractor operation

Warning! Do not ever start the engine while being outside the operator's workplace. Always stay in the cab in the operators seat when starting the engine or operating the controls.

7. Before starting the engine, make sure that the parking brake is applied, the PTO control lever is in «Disengaged» position, the gearshift and range selector levers are in «Neutral» position. Make sure the gearbox pump drive shifter is in «Engine-Driven» position.
8. Always stay in the operators seat when starting the engine or operating the controls.
9. Before starting motion, warn the people around and those working on the trailed machines with the horn.
10. Do not leave the tractor in motion.
11. Before leaving the cab do not fail to disengage the PTO, stop the engine, apply parking brake and remove the switch key.
12. Do not operate the tractor indoors without proper ventilation. The exhaust gases may cause fatal outcome!

13. Stop the tractor immediately if the engine or steering system fails. Remember, that with the engine shut down you will have to apply much more forces to the steering wheel in order to control the tractor.
14. Do not work under raised agricultural implements. Do not leave mounted implement in raised position during long-term stops.
15. If the tractor front part rises off the ground when heavy implements are mounted at the rear hitch linkage mechanism, install the front ballast weights.
16. When operating with front loader, fill rear tires with liquid ballast and adjust a maximum wheel turning angle to 30° at the most.
17. Before lifting or lowering a mounted agricultural implement, and when turning, make sure in advance there is no danger of contact with anyone around or interference with some obstacle.
18. During transportation with implements and accessories coupled, mechanism for fixing of attached parts in raised position must be used (for HLL without hydraulically operated lift).
19. Cardan shaft, transmitting rotation from the tractor PTO to the implements of the unit, should be fitted with appropriate guards.
20. Make sure of proper mounting of any additional equipment or auxiliary device and make sure they are designed for use with your tractor.

    Bear in mind that your tractor, when improperly employed, may be dangerous both for you and for the people around. Do not use implements, which are not designed for installation on this tractor.
21. To prevent tractor roll-over, be careful during the driving the tractor. Select a safe speed, corresponding to the road conditions, especially during cross-country driving, driving over ditches, slopes and sharp turns.
22. When working on hillsides, increase tractor wheel tread to maximum width.
23. Avoid making sharp turns at full load and at high travel speed.
24. When using the tractor for hauling operations, follow the rules:
    - Increase wheel tread to 1600 mm (64'') at least;
    - Interlock the brake pedals, check and, if necessary, adjust the brakes for simultaneous action;
    - Check the parking brake performance;
    - Check condition of the light and audible signaling devices;
    - Cargo trailers must be fitted with rigid hitches as well as be connected with safety chain or rope;
    - Never travel downhill "free wheel" with transmission in neutral position or clutch disengaged. When traveling downhill use the same gear as you would when going uphill;
    - Never use a trailer without independent brakes, if its gross weight exceeds the half of the tractor total actual mass. The faster you move and the more load you tow, the longer safety distance must be;
    - Disengage the FDA to avoid extensive wearing out of drive components and tires;
    - Do not use the RADL at speed exceeding 10 km/h and while turning.
    - Do not stop the tractor on the slopes. If it's necessary to stop,

engage the 1st gear and apply the parking brake.

25. When you use PTO-driven equipment, stop the engine and make sure that PTO drive end has stopped completely, before you leave the cab and uncouple the equipment.
26. Do not wear loose clothes when operating the PTO or when you are in the vicinity of the rotating equipment.
27. When working with stationary machinery driven from the PTO, do not fail to apply the parking brake and block the rear wheels of the tractor from the front and rear sides. Also make sure the machine is secured in its place.
28. Make sure the guard of the PTO drive end is installed, and if the PTO is not used, shift the PTO mode control switch into mid-position.
29. Do not carry out cleaning, adjustment and maintenance of the PTO-driven equipment when the engine is running.

Safety measures during tractor maintenance

30. Never refuel the tractor when the engine is running.
31. Never smoke while refueling the tractor.
32. Never fill the tank fully. Leave place for fuel expansion.
33. Never add petrol or mixtures to the diesel fuel. Such combinations may enhance the fire or explosion hazard.
34. Use properly summer and winter fuel grades. Fill in a fuel tank at the end of each day to minimize night water condensation.
35. Perform all operations, relating to engine and tractor cleaning, preparation for work, maintenance, etc., when the engine is shut down and brakes are applied.
36. The cooling system operates under pressure, which is maintained by the valve installed in the filler cap. It is dangerous to remove the cap when the engine is hot. To avoid face and hands burns be careful while opening radiator filler cap when the engine is hot. Put close cloth on the cap and take on a glove in advance.
37. To avoid skin burns, be careful when draining cooling liquid or water from the cooling system, hot oil from the diesel, hydraulic system and transmission.
38. Be careful when servicing storage batteries, because electrolyte causes burns if it comes into contact with the skin.
39. To avoid danger of explosion keep any type of open flame away from engine fuel system and storage batteries.
40. Keep the tractor, its equipment, especially brakes and steering control, in operable state in order to ensure your own safety and safety of people around.
41. Do not make any alternations in the tractor or its separate components without consulting your dealer and or manufacturing works. Otherwise the tractor will be deprived of after-sales service.
42. To avoid the fuel splash-out while refueling the tractor by mechanized method, remove the screen filter from the fuel tank filler neck. Screen filter is designed only for manual refueling of the tractor in the field.
43. Refuel the tractor using only oils and lubricants recommended by the manufacturing works. It is *strictly forbidden* to use other lubricants!

Safety requirements during operation and maintenance of electrical equipment

44. To avoid damaging the semiconductor devices and resistors, comply with the following precautions:
    - Do not disconnect the storage battery while the engine is running. This will cause a peak voltage in charging circuit and lead to immediate damage to the diodes and transistors;
    - Do not disconnect electric wires until the engine is stopped and electric switches are in the “OFF” position;
    - Do not cause a short circuit by the wrong connection of electrical wires. A short circuit or reverse polarity will cause damage to the diodes and transistors;
    - Do not connect a storage battery into the electrical equipment system until it has been checked for correct voltage and terminals polarity;
    - Do not check for current flow by means of spark test as it will immediately result in transistors breakdown;
    - It is prohibited to switch off the battery disconnect switch when the engine is running;
    - It is prohibited to operate the tractor without storage battery.

Hygienic requirements

- Daily fill the thermos with fresh clean drinking water;
- First-aid kit should be completed with bandages, iodine tincture, ammonia spirit, borated petrolatum, sodium carbonate, menthol valerate and analgin;
- Use cab natural ventilation or cab air heating and cooling unit according to operation conditions.
- If the time of continuous tractor operation during a work shift exceeds 2,5 hours it’s necessary to use personal noise protection equipment according to GOST 12.4.051-87 (earplugs, antiphons).

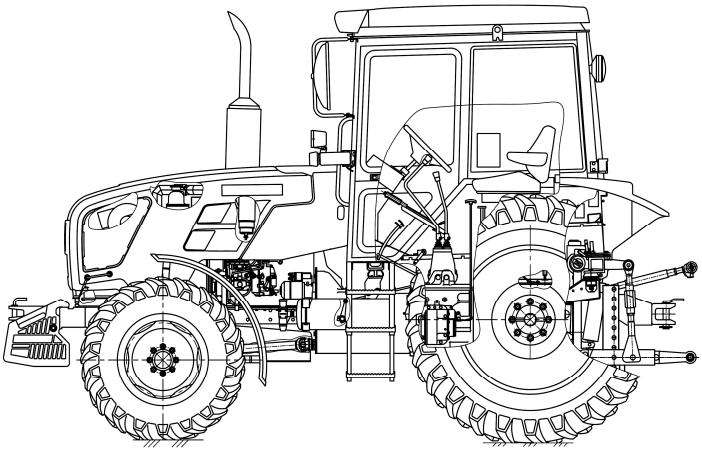
Fire safety requirements

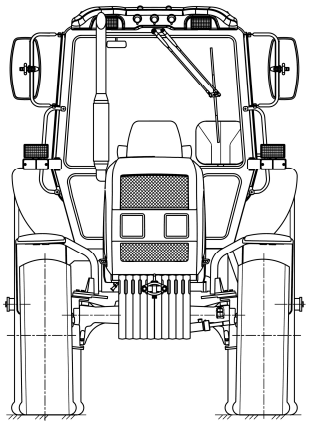
1. The tractor should be equipped with firefighting equipment – shovel and fire-extinguisher. It’s prohibited to operate the tractor without fire-extinguishing means.
2. Never refuel the tractor when the engine is running.
3. Do not smoke while refueling the tractor.
4. Never fill the tank fully. Leave place for fuel expansion.
5. Never add petrol or mixtures to the diesel fuel. Such combinations may enhance the fire or explosion hazard.
6. Places of tractors parking, storage of fuel and lubrication materials should be plowed around with a strip having at least 3 m width and provided with fire-extinguishing means.
7. Refuel the tractors with fuel and lubrication materials by mechanized method with the engine shut down. Use lighting at night. It is not recommended to fill in fuel tanks with the help of buckets.
8. When performing repair operations in the field with the application of electro-gas welding clean parts and assembly units from plant remains.
9. Prevent collector and muffler pollution with the dust, fuel, straw, etc.
10. Prevent straw reeling on the rotating parts of machines aggregated with the tractor.
11. When washing parts and assembly units with kerosene or gasoline take

measures to prevent the flaming of the washing liquid fumes.

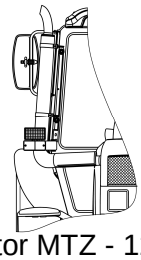
12. Do not operate the tractor in the fire dangerous areas when the bonnet and other guard devices are taken off the engine heated parts.
13. Do not use open fire for heating up the oil in the engine pan, when filling in fuel tanks, and for burning off the contaminant pollution of the radiator core.
14. When the fire seat occurs cover it with sand or with canvas cloth or other close cloth. Use the carbon-dioxide fire extinguisher. Do not extinguish burning fuel with water
15. See that there are no flammable materials near exhaust manifold and muffler when the engine is running.

Section C. **TECHNICAL DATA**





Tractor MTZ - 1220.1



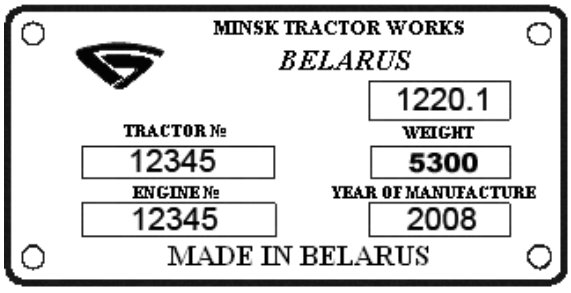
Tractor MTZ - 1220.3
Muffler on the right side of cab column, for the rest see “MTZ - 1220.1”

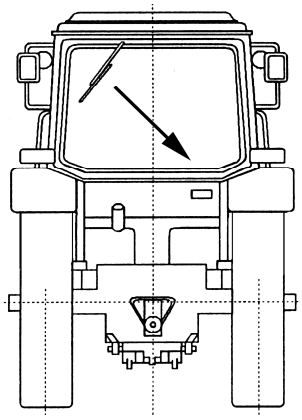
Weights and dimension:

Parameter	Value
Length with ballast weights and linkage to a tractor in transport position, mm	4600±50
Width over semiaxles ends, mm	2250±10
Height over cab, mm	2890±50
Wheelbase, mm	2550±30
Agricultural clearance under axle tubes, mm (not less than)	630
Road clearance (on tires of basic configuration), mm, not less than	450
Tractor structural weight, kg	4850±100
Tractor operating weight, kg	5500±100
Tractor maximum operating , kg	8800

Serial numbers of tractor constituents

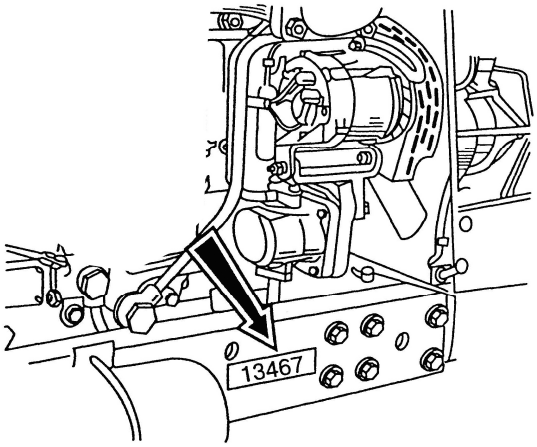
Tractor identification plate indicates tractor serial number and diesel engine serial number.



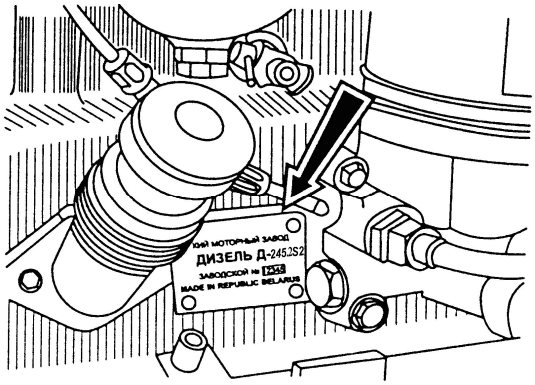


C2

Tractor serial number is duplicated on the right sidemember.



Diesel engine serial number is also indicated on the engine identification plate located on the left side of cylinders block.



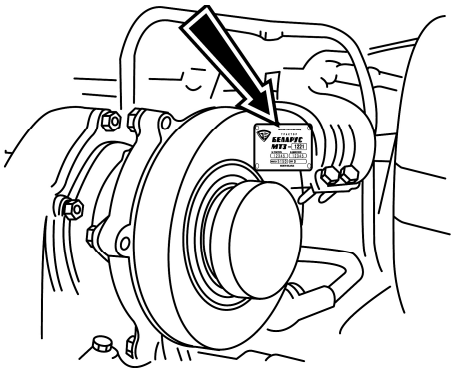
MINSK TRACTOR WORKS

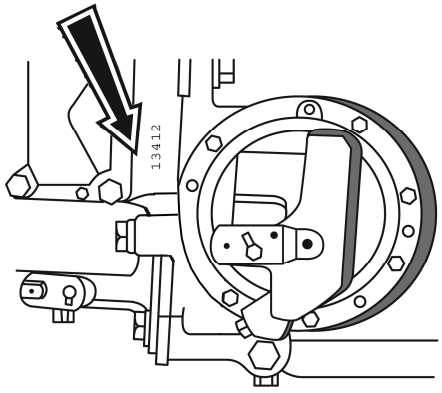
DIESEL ENGINE D-245.2S2

SERIAL № 12345

MADE IN THE REPUBLIC OF BELARUS

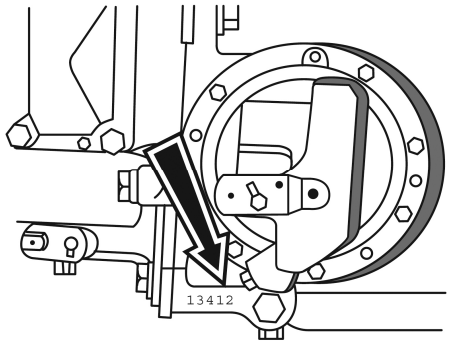
Diesel engine turbocharger identification number



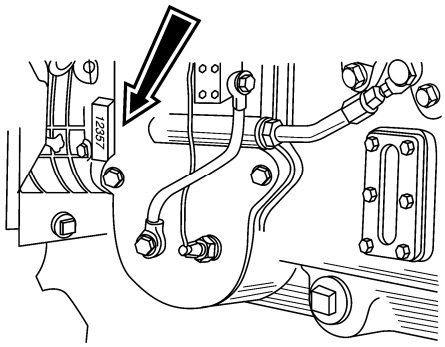


Clutch coupling housing number

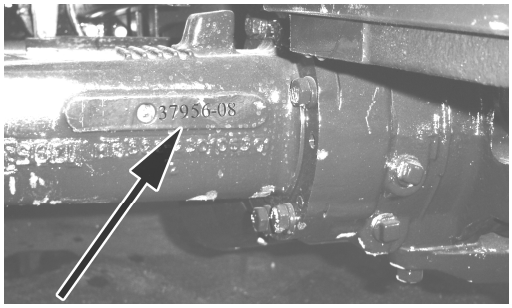
Gearbox identification number
.



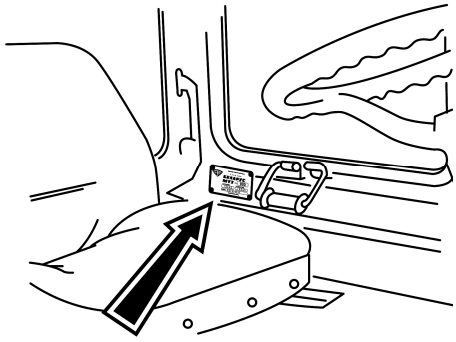
Transmission identification number



Front driving axle identification number



Cab serial number



C4

Diesel engine

Engine model	D-245.2S2
Manufacturer	OAO Minsk Motor Plant
Type	Four-cycle, turbo-charging with after-cooling
Number of cylinders	4
Fuel injection system	direct injection
Compression ratio (calculated)	17±1
Cylinder bore, mm	110
Piston stroke, mm	125
Displacement, l	4,75
Firing order	1-3-4-2
Cooling system	liquid
Rated speed, rev/min	2200
Maximum no-load speed, rev/min	2420
Minimum idle speed, rev/min	800±50
Rated power, kW	90
Peak torque, Nm	490
Specific fuel consumption at operating power, g/(kW·h)	$254{,}0^{+12{,}7}_{-5{,}1}$
Clearance between rocker shaft striker and intake valve stem end when diesel engine is cold, mm	$-\,0{,}25^{+0{,}05}_{-0{,}10}$
Clearance between rocker shaft striker and exhaust valve stem end when diesel engine is cold, mm	$-\,0{,}45^{+0{,}05}_{-0{,}10}$
Fuel injection lead angle up to top dead center (TDC), degrees	3,5±0,5

Diesel engine fuel system

Fuel pump
Type: four-plunger, in-line with priming pump:

PP4M10Pli – 3704 (of the company MOTORPAL, Czech Republic) or 773.1111005 –07T (of OAO YAZDA, Russian Federation).

Regulator: mechanical, centrifugal, variable speed, direct acting type, with automatic fuel supply increase at engine start.

Injectors: 455.1112010-50 or 172.1112010-11.01

Air cleaner

With paper filter elements.

Turbocharger

radial inward turbine and radial-flow compressor, assembled on one shaft.

C14 type of the company CZ ("Turbo"), Czech Republic. Installation of foreign producers turbochargers is possible.

CAC is of radiator type, installed in front of water radiator. It is designed for cooling of air charges inside the diesel engine intake manifold.

Engine cooling system

Type: liquid, closed with positive liquid circulation, temperature control, thermostatic regulator. Normal operating temperature from 85ºC to 95ºC.

Engine lubrication system

Type: Combined, with oil-to-water heat exchanger.

Oil purification: full-flow with exchangeable filter (indecomposable n-type)
Min oil pressure: 0.08 MPa at 600 rpm.

Working pressure between 0.25…0.35 MPa.

Max.pressure at cold engine: up to 0.6 MPa.

Engine Starting System

24 V starting motor, rated power 4.0kW or 4.5 kW

Starting aid:
Heating plugs, rated voltage 23V or 11V.

Generator

AC, rated voltage 14V, power 1.15 kW.

Clutch coupling

Type: Dry friction, double-disk spring loaded clutch

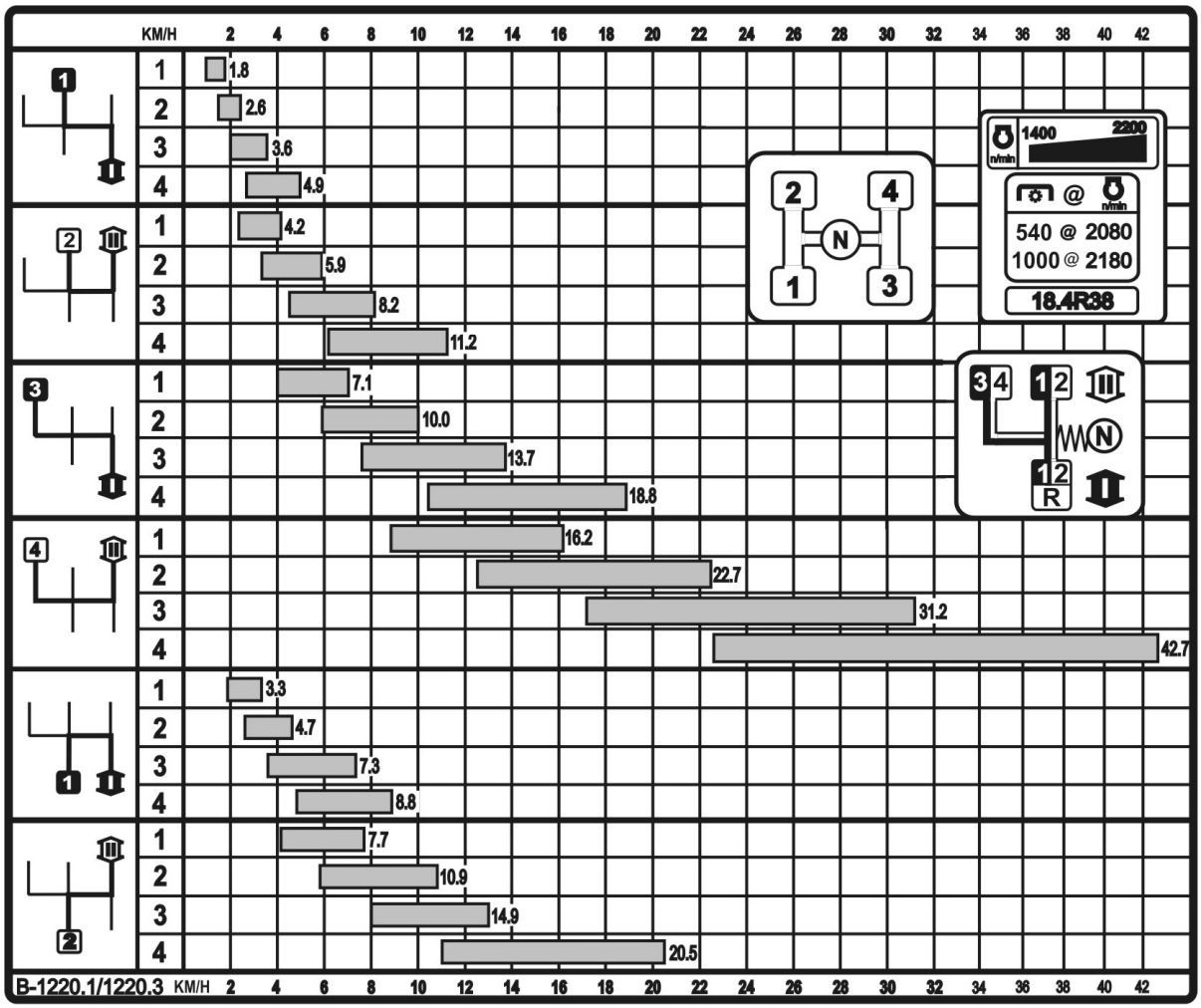
C6

Gear box

Type: 16/8, mechanical, step-by-step, ranged with constant-mesh gears. Shifting of four gears in each range of forward and reverse movement is carried out via synchronizers.

The Table below is placed in the right part of the cab window,

Note – A gearbox 24/12 can be installed in your tractor optionally. In this case a Table with corresponding series of speeds will be in the cab window.



Tractor design travel speeds with rear wheels 18.4R38

Rear axle

Main gear: a pair of bevel gears with spiral tooth.

Final drives: a pair of spur gears for each sideboard.

Rear-axle drives: planetary type.

Differential lock: Oil-actuated friction clutch

Brakes

Service Brakes: on rear wheels: two-disk or three-disk, dry with mechanical servo drive. Disk diameter: 204 mm (or eight-disk, operating in oil sump (option)

Parking brake: On rear wheels through differential lock on final drives and rear-axle drives. Dry-disk type with mechanical hand control. Disk diameter: 180 mm (or 4-disk, operating in oil sump (option))

Front driving axle

Type: two-point, beam-type
Main gear type: bevel gears with spiral tooth.

Differential type: self-locking, excessive friction
Final gears type: planetary
Drive gear type: built in GB single parallel-shaft reduction gear unit with hydraulically operated multiplate clutch; cardan shaft.

Hydraulic distributor of FDA control: hydraulically operated, spool-type, electrically controlled

PTO drive

Type: independent, two-speed and synchronous

Drive clutch: Planetary reduction gear with band brakes

Drive: electrohydraulic

PTO end speed:

Independent drive

I — 540 rpm; N=60 kW,
II — 1000 rpm; N=90 kW.

Synchronous drive

4,18 rev/meter of travel when fitted with tires 18,4R38.

PTO shaft end extension: SAE standard 6-spline for 540 rpm and 21-spline for 1000 rpm.

Rotation: Clockwise

Steering

Type: hydrostatic (H.S.).

Feed pump: NSH14, gear-type, left-handed rotation.

Volume constant — 14 cm^3/rev.

Metering pump type — gerotor type

Volume constant – 160 cm^3/rev.

Relief valve pressure— 14 MPa (140 kgf/cm^2).

Antishock valves pressure — 20 MPa (200 kgf/cm^2).

Actuating mechanism: one hydraulic bilateral cylinders.

Bore — 63 mm,

Cylinder stroke— 200 mm

Steering wheel range of adjustment:

- in angle of slope - from 25° to 40° with fixation in four positions,
- in height – along steering shaft axle, stepless 100 ±200 mm

Backlash in the steering wheel – max. 25°, when feed pump is in operation

Hydraulic lift linkage (HLL)

Type: unit-principle with hydraulic lift device (with two plunger cylinders) It

provides 4 control modes of agricultural implements position:

• height control mode;

• power control mode;

• position control mode;

• combined (mixed) control mode.

Outlets: 3 pairs and one drain line (rear).

Oil feed pump

Type: gear-type. Pump capacity — not less than 56 l/min at 2100 rpm.

Distributive valve: hydraulic spool-type РП70-1221 or RS-213 «МІТА», 3-section with fixation of spools in “float” position. It has the following positions: “Up”, “Neutral”, “Down” and “Float”.

Hydraulic lift distributor:
820-4634010. hydraulic spool distributor
Cylinder: piston cylinder
(2 pcs.) — bore 90 mm,
stroke — 220 mm.

Rear lift linkage:

Type: swinging four-bar linkage of category II

Lifting capacity of rear lift linkage on suspension axis is not less than 4500 kg.

Electrical equipment

Voltage of on-board power system: 12V

Power system: two accumulator batteries12 V each, with capacity 88 A•h or 90 A•h .

Lighting and light alarm system:

- front driving lights with high/low beam;
- front and rear work lights;
- front and rear lamps;
- dash board light and rear registration plate light;
- hazard warning lights;
- lights of “road-train” sign (optional).

Power consumers connection: multi-pin composite plug.

Test instruments

Instrument cluster, integrated display and control lamps blocks.

Other equipment:

Front and rear window wipers; windshield washer; dome light.

Pneumatic system

Compressor

Type: single-cylinder, air-cooled

Trailer brakes control

Type: pneumatic, single-wire, locked with tractor service brakes (option – two-wire).

Wheels

Tyres (main modification)

Front:

M 420/70R24 or 14,9R24;

On order: 11.2R24.

Rear:

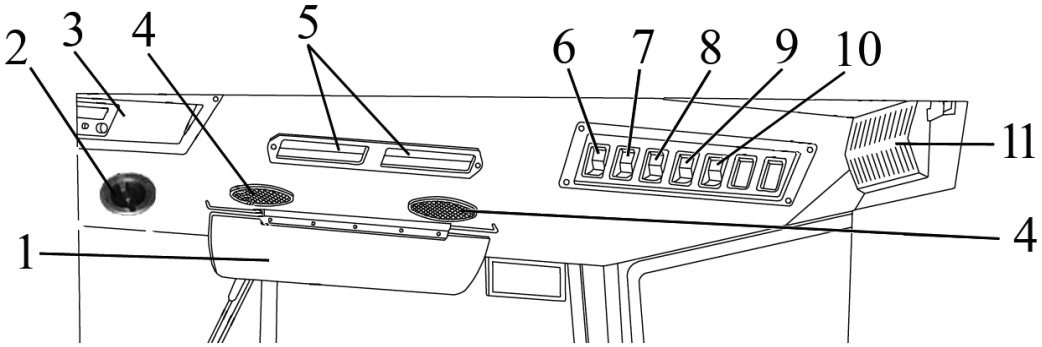
Main: 18,4R38;

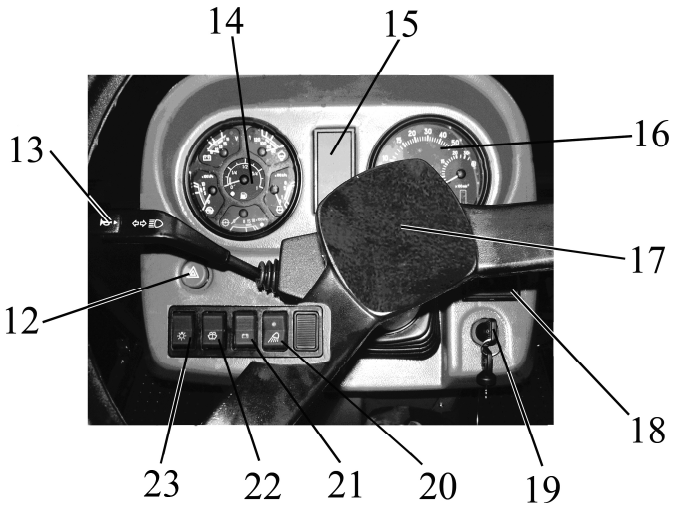
On order: 16.9R38, 11.2R42.

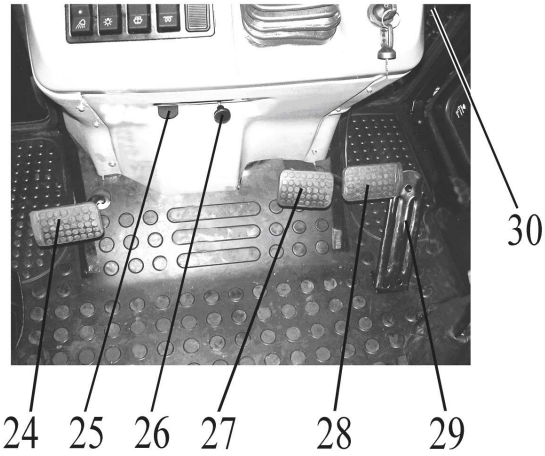
Wheel Track:

- front wheel track 1535, 1635, 1700, 1800, 1850, mm, 1950; 2020; 2120.
- rear wheel track 1450...2200 mm.

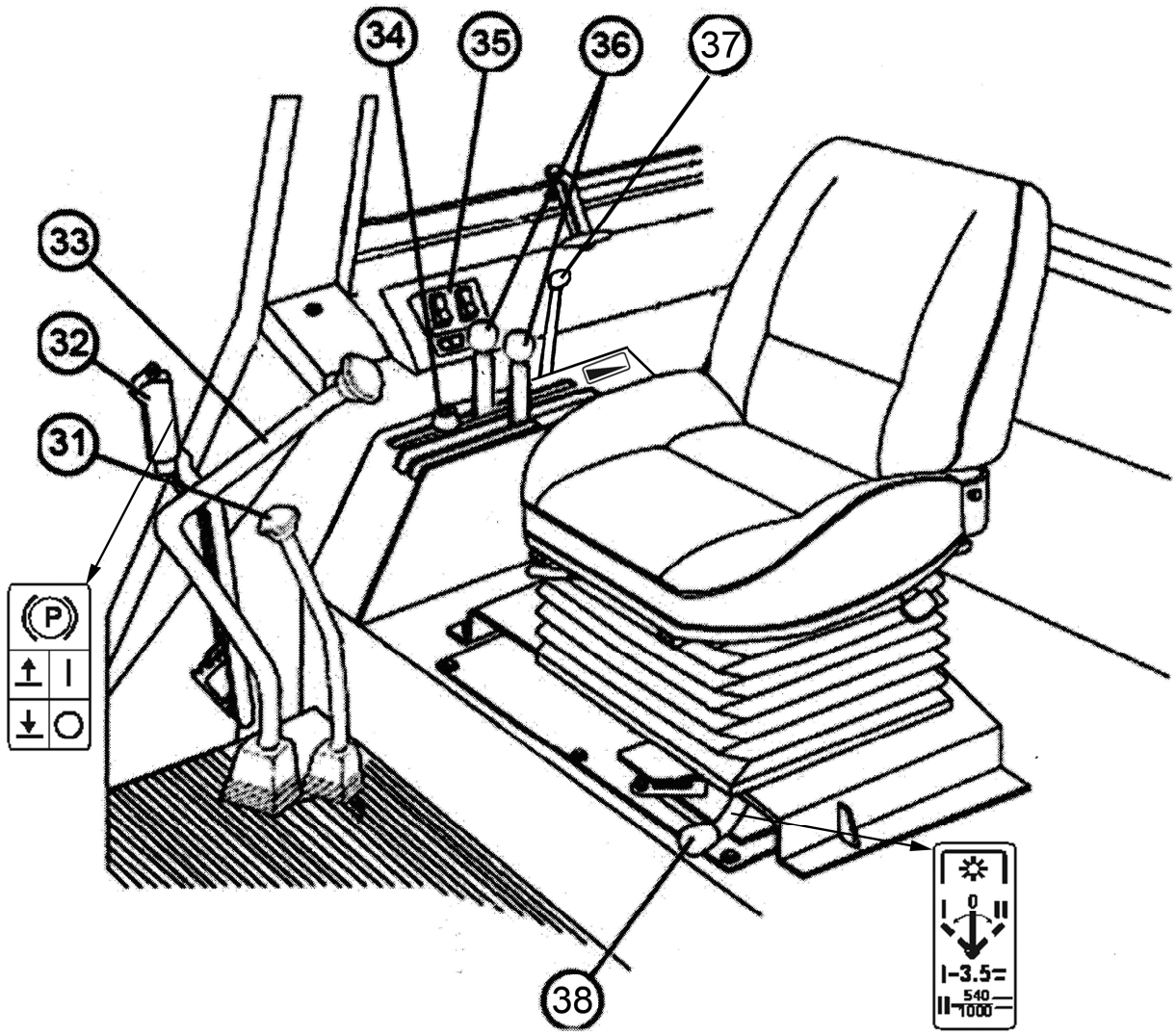
Section D. **OPERATION CONTROLS AND INSTRUMENTS**







1. Sunscreen;
2. Heater control valve operating handle;
3. Radio-receiving set (if any);
4. Air distributors of cab ventilation and heating system;
5. Recirculation shutters;
6. Front windscreen wiper switch;
7. Cab fan and heater switch;
8. Rear working lights switch;
9. Front working lights switch;
10. Road-train sign lighting switch;
11. Cab light switch;
12. Emergency control lamps switch;
13. Steering-wheel-mounted multifunction switch (turn, turn indicators, upper/lower beam);
14. Instrument cluster;
15. Control lamps block;
16. Integrated indicator;
17. Steering wheel;
18. Integrated indicator program console;
19. Starter and instruments switch;
20. Front working lights switch on cab grab-handles;
21. AB remote cut-off;
22. Windscreen washer switch;
23. Main light switch;
24. Clutch pedal;
25. Diesel engine stop lever;
26. Steering column inclination control;
27. Brake pedal
28. Right brake pedal
29. Fuel feed control pedal
30. Hydraulic output control levers



31. GB range selector lever;
32. Parking brake lever;
33. Gear-change lever;
34. Governor control lever stop bumper ором;
35. FDA, rear axle differential lock and PTO control arm;
36. Tillage depth adjustment levers
37. Fuel feed control lever
38 Power take-off shifter arm (independent - synchronous)

Important: Before starting tractor operation study the purposes for which the controls, instruments and functions may be applied.

The given information will facilitate studying of controls and instruments for tractor safe operation.

D3

Starter and instrumentation switch

Switch (1) has four positions:

- 0 – “Off”;
- I –"Instruments, control lamps block, heating plugs are on”;
- II – “Starter On” (not fixed position);
- III – “Radio receiver ON” (key is turned counter-clockwise).

IMPORTANT! Starter restarting may be possible "0”.

In order to shift starter and instruments switch into position “III’, it it necessary to sunk the key into switch slightly and then turn it counterclockwise.

Instrument board switches

1 – main light switch, has three positions:

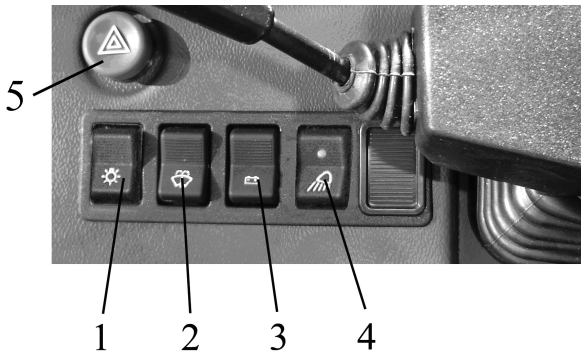
- “Off” (upper part of the button is sunk, position **I**);
- “Front and rear marking lights, number-plate light, board gauges light, and additional lamps on the trailed machine are on” (middle position, **II**);
- “All consumers of position **II** and road lamps are on” (lower part of the button is pressed up to the stop, position **III**).

2 – windscreen washer switch. Windscreen washer is switched on by single pressing to the button.

3 – remote AB switch. AB is switched by single pressing to the remote AB switch button, and it is switched off by pressing the same button again.

4 – shut-off switch for front working lights, installed on front light brackets. By pressing button 8 two working lamps, (installed on front light brackets) and indicator light, built-in the button.

By pressing the emergency light alarm button 5 the emergency light alarm is engaged. The indicating lamp blinks simultaneously with alarm flashing light. Emergency light alarm is disengaged by pressing the same button again.



1 - main light switch; 2 - windscreen washer switch; 3 - remote AB switch; 4 - shut-off switch for front working lights, installed on front light brackets.

Instrument cluster

Instrument cluster includes six gauges with five signal lamps.

Scale indicating fuel volume in the tank (1) has divisions 0–1/4–1/2–3/4–1**.** A signal lamp (1.1) (orange color) is built in the gauge scale, which lights up when fuel volume in the tank drops below 1/8 of the total tank volume.

ATTENTION: do not let the tank become empty (the gauge pointer is in the zone of orange color)!

Scale indicating air pressure in pneumatic system (2) has three divisions:

- working – from 500 from 800 kPa (green);
- emergency (two) — from 0 to 500 kPa and from 800 to 1000 kPa (red).

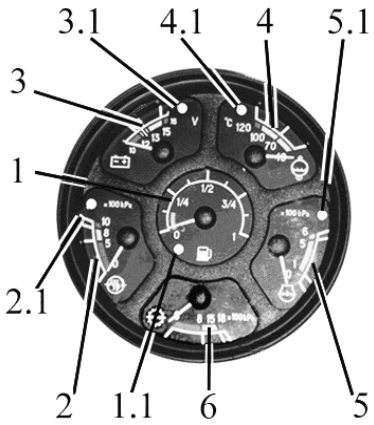
A signal lamp (2.1) (red), is built in the gauge scale, which lights up when the pressure in pneumatic system loss reaches 500 kPa.

Voltage gauge (3) indicates accumulator batteries voltage with the engine stopped when the key of starter and instruments switch (1) is set in position “I”. With the engine running the voltage gauge indicates voltage on generator terminals. An indicating lamp (3.1) of red color is built in the scale of voltage gauge. It is used only with 24V starting system. It indicates the process of the additional battery charge with 24V – it checks the workability of the voltage converter.

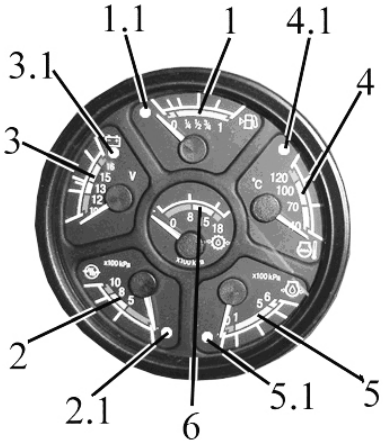
Zone on the voltage gauge scale, color	States of power supply system	
	with the engine running	with the engine stopped
13,0 – 15,0 V green	normal mode of charge	
10,0 – 12,0 V red	the generator is out of order	accumulator battery discharged
12,0 – 13,0 V yellow	No AB charge (low charging voltage)	AB has a normal charge
15,0 – 16,0 V red	AB recharge	
white line in the yellow zone		Rated AB electromotive force is 12,7 V

IMPORTANT! if the voltage gauge (3) indicates absence of AB charge, check the state and tension of the generator drive belt.

ATTENTION! When emergency temperature indicating lamp or emergency oil pressure in the diesel engine indicating lamp is



Variant 1



Variant 2

Scale indicating diesel engine coolant temperature (4) has three zones:

- engine warm-up — 40 - 70°C, yellow;
- working — from 70 to 100° C - green;
- emergency — from 100 to 120° C - red.

Emergency engine coolant temperature indicator lamp becomes on when coolant temperature exceeds 105 °C.

Scale of oil pressure gauge in the engine lubricating system (5) has three zones:

- working — from 100 to 500 kPa - green;
- emergency (two) — from 0 to 100 kPa and from 500 to 600 kPa (red);

Indicator lamp 5.1 “Emergency oil pressure in the engine” responses at values of 100 kPa and less.

IMPORTANT! when the cold engine is started the pressure can be 600 kPa and higher.

Scale of oil pressure gauge in the transmission hydraulic system (6) has three zones:

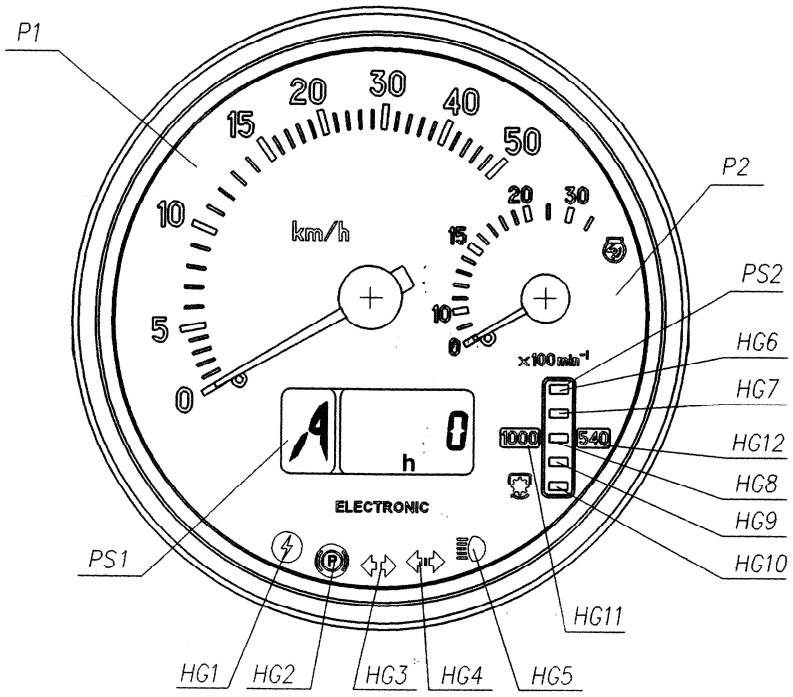
- working — from 800 to 1500 kPa - green;
- emergency (two) — from 0 to 800 kPa and from 1500 тодо 1800 kPa - red.

D5

on, stop the engine, find and eliminate failure!

Integrated indicator AP80.3813 (1)

Integrated indicator (hereinafter referred to as II) and control console (hereinafter referred to as CC) controls operational parameters of systems and assembly units of tractors “MTZ” and deliver data on malfunctions or failures of a system to the operator.



The ID includes indicators and pilot lights, recording the following parameters:

P1 – Speed indicator (pointer indicator));

P2 – Engine rotational speed indicator (pointer indicator);

PS1 – Liquid crystal display, multifunction display (detailed description and operation principle; PS1 see. below)

PS2 – PTO rotations indicator (indicator lamp);

HG1 – Alarm of the overvoltage in the tractor on-board power system (red);

HG2 – Parking break engagement indicating lamp (red);

HG3 – Tractor turn indicator pilot lamp (green);

HG4 – Trailer turn indicator pilot lamp (green);

HG5 – Upper beam switching on indicator (blue);

HG6, HG10 – PTO speed scale segments (yellow);

HG7… HG9 – PTO speed scale segments (green);

HG11, HG12 – PTO speed scale range signaling devices (yellow);

Principle of operation and purpose of indicators on integrated indicator.

P1 – speed indicator - shows travel speed of the tractor in graph form.

The indicator is operated by signals from pulse transducers of toothed gears speed of final drives of tractor’s left and right rear wheels. Speed is indicated by the signal from the

transducer installed on the final drive gear of the wheel rotating with the lowest speed. In case of absence of a signal, there will not be any speed readouts (see below for more details).

Readouts range from 0 to 50 km/h.

P2 – engine rpm indicator – shows engine shaft speed of the tractor in graph form.
The indicator is operated by a signal from generator phase winding.
Engine rpm range from 0 to 3500 (rpm).

PS2 – PTO speed indicator – shows power take-off shaft rpm on the light indicator.

The PTO speed indicator operates from a frequency signal produced by recalculation from the engine speed with an input value of the “KV2” ratio (see below) different from “0”, herewith a value of the ZV ratio equal to “0” must be input (see below).

When the II is on (check of the device operability is described below) and the engine is running (a message of “engine speed” is transmitted from the ECU), the designations of the “540” and “1000” scales are illuminated simultaneously.

Informative:

the lower segment of the PTO scale (with consideration to the “KV2” ratio) is indicated when the engine speed achieves 1400-1500 rpm or higher.

Depending on the engaged PTO speed mode (540 or 1000), the illuminated scale segments designate PTO speeds as specified in Table 3.

Table 1.1

Values of scale segments response “1000” (rpm)	Location of the segment in the scale	Values of scale segments response “540” (rpm)
1150	HG6	650
1050	HG7	580
950	HG8	500
850	HG9	420
750	HG10	320

PS1- multifunctional display (MD) is an LCD displaying:

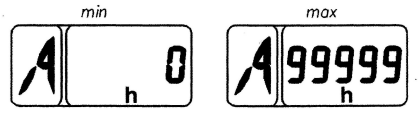
LCD informative fields

1. digital designation of the gearbox shifter (figures of 0 to 6) or a letter designation of the reducer shifter position (letters L, M, H, N).
2. current numerical value of one of the parameters of the tractor systems.

The integrated display receives information about the gearbox shifter position from the transmission control unit (if the complex electronic control system is available) or from the range reducer control unit (if available). This parameter is displayed in the “1” informative field (Figure 1.6). When control units are not available or are not connected, or a wire is broken, the “1” informative field displays an “A” letter.

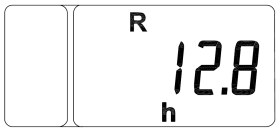
The “2” informative field displays the following parameters:

1. Total astronomical service hours of the engine.



The counter operates with the engine running.
The indication range is 0 to 99999 service hours of the engine.
In case of power supply interruption the counter saves the information on total service hours.

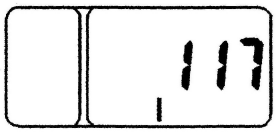
2. Service hours over the set period:



In this mode astronomical service hours of the engine is displayed over the set period of time passed from the previous setting of the parameter to zero.

Setting to zero algorithm includes choosing of a specified mode, pushing and holding for seconds of “Mode” key until the counter readouts are set to “0”.

3. Volume of fuel remaining:



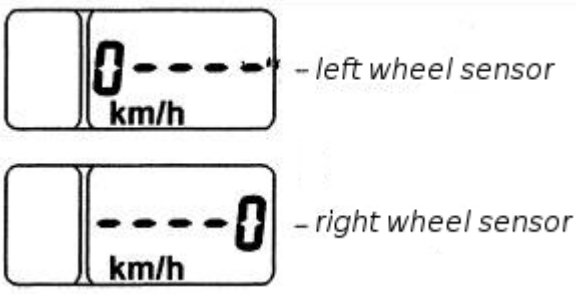
In this mode, the current fuel volume in the tank is displayed in liters.
This mode is available only when the tractor stands still.

Note – tractors “MTZ-220.1/1220.3” are equipped with two fuel volume sensors:
- there is one frequency fuel volume sensor (FFVS) inside a fuel tank under a cab.
- there is another modified frequency fuel volume sensor (MFFVS) inside a fuel tank on a frame.

Data on total volume of fuel in the fuel tanks comes from a MFFVS to an indicator.

NOTE. Switching between display modes **“**Total astronomical service hours of the engine**”** and “Volume of fuel remaining“ is shall be carried out by “Mode” key on the control console (2).

3. Diagnostics of speed sensor operability and connection:



When no signal arrives from the speed sensors for 10 to 12 seconds, the LCD screen shows a message of a “0” figure specifying the location of the faulty sensor (left or right).

4. Diagnostics of frequency-type fuel volume sensor operability (FFVS):

When no frequency signal arrives from the FFVS for 2 seconds, the LCD screen of the II shows a “FUEL” message;

D9

Each failure message (**Example:** 0----, FUEL, C-BUS) is displayed on the LCD screen by priority independently of the information displayed. Sequentially pressing the "Mode" button must browse through the messages alternately. When the last message is shown and the "Mode" button is pressed again, the LCD screen switches to the display mode as per the cycle of the previously specified working parameters.

Failure messages are displayed on the LCD screen each time the device is turned on, till the reason of the failure is eliminated.

IMPORTANT: When the II is turned on, the MD shows information in the indication mode that had been selected before the II was turned off last time.

Indicating lamp operation principles

HG1 – tractor on-board circuit high voltage indicator. Goes on when the tractor electrical system supply voltage exceeds 19 V and goes off when the supply voltage is reduced to 17 V;

Herewith, the II is completely turned off and restores its operability when the voltage drops to the rated voltage of the on-board circuit

HG2 – parking brake engagement indicator:

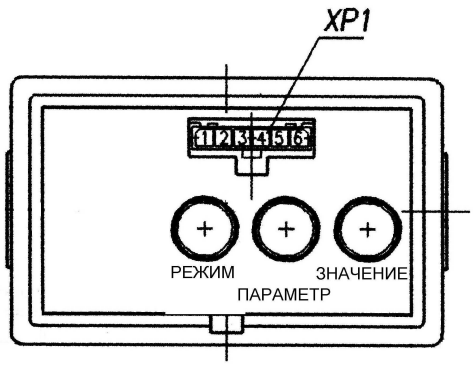
The parking brake indicator blinks with the frequency of 1 Hz when the parking brake sensor goes off;

HG3, HG4 – tractor and trailer turn indicator.

Blinks when the right or left turn indicator is turned on by the under steering multifunctional switch 14 or when the alarm signaling switch is turned on.

HG5 – headlight upper beam indicator pilot lamp. Goes on when the upper beam indicator pilot lamp is switched on**.**

Note! Indicators are switched on and off synchronous with changes of system sensors state.



Integrated indicator control console AP80.3709 (2). II programming.

The programming console allows for manually programming the indicator with the "Parameter" and "Value" buttons, changing the display mode of parameters shown on the LCD.

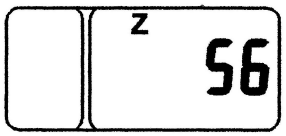
The front face of the console has a diagnostic socket **XP1** that allows for automatic programming (reprogramming) the ID with a special device (if available). If no special device is available, reprogramming is performed with the above mentioned buttons.

II programming algorithm is as follows:

1. When the "Parameter" button is pressed for the first time, the LCD switches to the mode of viewing the programmed parameter and its numerical value. When the button is pressed repeatedly, the parameters are alternated cyclically.

2. When the “Value” button is pressed repeatedly, the numerical value of the set programmed parameter is changed.
3. When neither the “Parameter” nor “Value” button is pressed for 7.0 seconds, the mode is exited automatically.
When exiting the mode, the parameter values selected with the “Value” button are stored.

List of programmed ratios(graphic examples of parameter presentations and their values in the programming mode):



“Z” parameter

Z is the number of teeth of final shaft gears of the driving wheels (right and left), at which the travel speed (rotation speed) sensors are installed.

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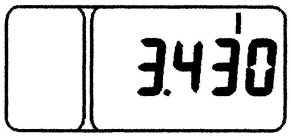
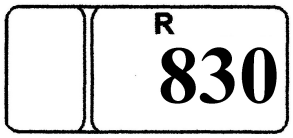


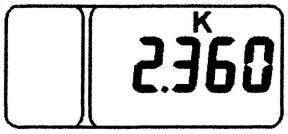
“I” parameter

I is the gear ratio multiplier of the wheel-hub drive;

“R” parameter

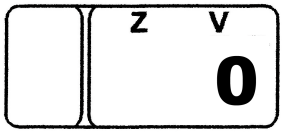


R is the rear wheel rolling radius, mm (is the value for tires 18.4R38. If other tire types are installed, set the “R” value corresponding to the rolling radius of the installed tires);



“K” parameter
K is f generator drive transfer ratio;

“KV2” parameter
KV2 is the PTO gear ratio;



“ZV” parameter
ZV is the teeth number of the PTO speed sensor gear;

“V” parameter

V is the fuel tank volume, (l).

Also, when the “Parameter” button is pressed in the programming mode, the list of programmed parameters contains an independent “T” parameter of precise readout of the astronomic service hours of the engine. This parameter cannot be modified, it is the precise number (to 1/10 of an hour) of engine service hours.

Attention!

1. During operation, it is allowed to modify the value of the parameters
   - “wheel rolling radius R” which is determined based on the tires installed on the tractor by measuring the distance from the wheel center to the reference surface.
2. **You mustn’t** modify the entered values of all other parameters!

When the instrument scale illumination is on (position II “Instrument panel illumination, parking lights ON” and position III “Consumers of the position II, front headlights, and parking lights ON”) the brightness of the MD screen of the PTO indicator segments is automatically reduced.

IMPORTANT! Upon each connection to a power supply In II check of point indicators and PTO shaft indicator scale segments functions is carried out. At this time the pointers deviate from start marks and appear to come over the first digitized scale marks (over “5” for speed and over “10” for rpm), and all PTO scale’s segments and symbols “540’ and “000” .

Windscreen washer switch (1)
When the key (1) is pressed the windscreen washer is turned on.

Cab fan and heater switch (2)
After pressing button (2) a fan of cab heating and ventilating system is on.
Switch has 3 positions:
1 – “Switched off” (top of the button is sunk as much as possible);
2 – “Mode of light air feed is engaged”,
3 – “Mode of coarse air feed is engaged”.

Rear working lights switch (3)
After pressing button (3) rear working lights and indicator light, built-in the button are on.

Front working lights switch (4)
After pressing button (4) front working lights and indicator light, built-in the button are on.

Road-train sign lighting switch (5)
After pressing button (5) three orange lamps, installed on the front part of a cab roof and indicator light, built-in the button, are on.

Radio switch (if any)
1. – Volume of sound switching on/off;
2. – Radio tuning

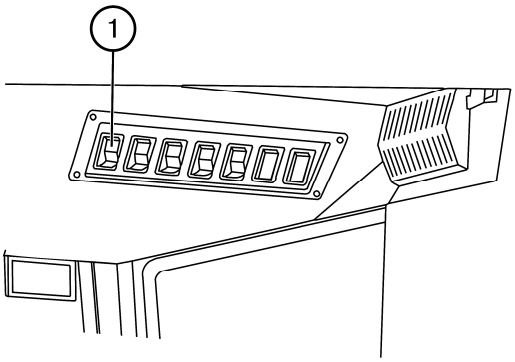
Note: Radio can only be switched on in positions I or III of the starter switch key.

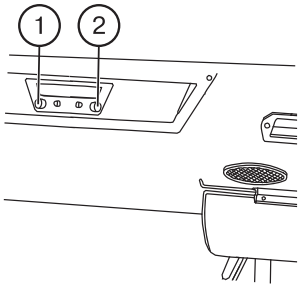
Air-conditioner control (if it is installed instead of fan-heater)

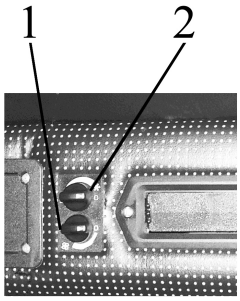
Climatic installation control console has switches (1) and (2).

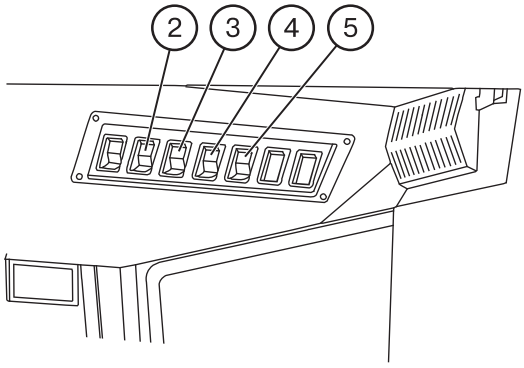
1 – Air flow adjustment switch;

2 – Air-conditioner switch and refrigerating output adjustment.

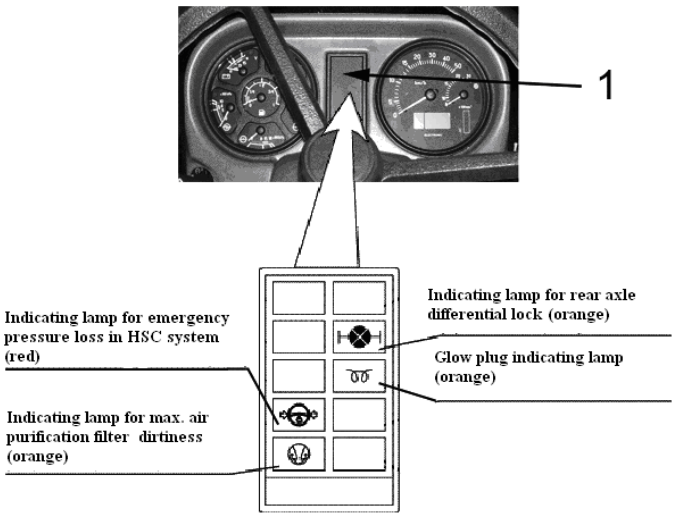






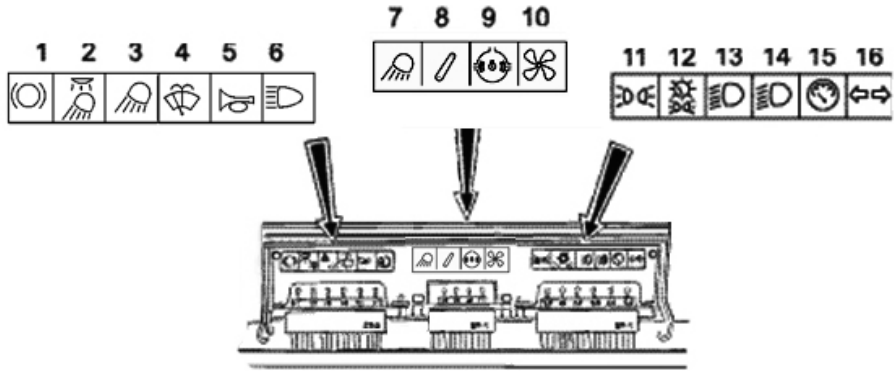


Indicating lamp block (1)



Fuses

D13



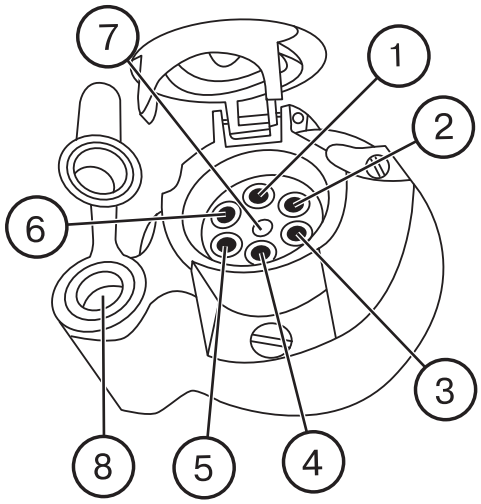
Three electrical circuit fuse blocks are mounted inside an instrument board. In order to access the fuses unscrew 2 screws and open instrument board cover.

Sixteen fuses protect the following tractor electric circuits from overloads:

1. Stop signal (15 A);
2. Cab dome light, rear working lights and road-train sign lamps (15 A);
3. Emergency alarm lamp (15 A);
4. Front and rear windows wipers and windscreen washer (25 A);
5. Audible alarm (15 A);
6. Working headlight (25 A);
7. Front working lights (25 A);
8. Fan-heater, PTO shaft control systems, rear axle differential lock engagement system and FDA drive control system (25 A);
9. Power supply to consumers, working after switching the starter and instruments into position “I” (25 A)
10. Air-conditioner control (if installed optionally instead of heater fan) (25 A).
11. Left marker lights (7,5 A);
12. Right marker lights and instrument board highlighting (15 A);
13. Left road lamp lower beam (7,5 A);
14. Right road lamp lower beam (7,5 A);
15. Instruments, speed sensors power supply (7,5 A);
16. Turn signal relay, qlow plugs block power supply, qlow plug relay winding (15 A)

Electric equipment connector components

A combined multipin socket is designed for connecting the trailer electrical equipment or electrical equipment of trailed agricultural implement and service lamp. It is installed on the cab's rear support. A plug of the wire bundle of the hitched machines and a plug of service lamp are connected to the socket.



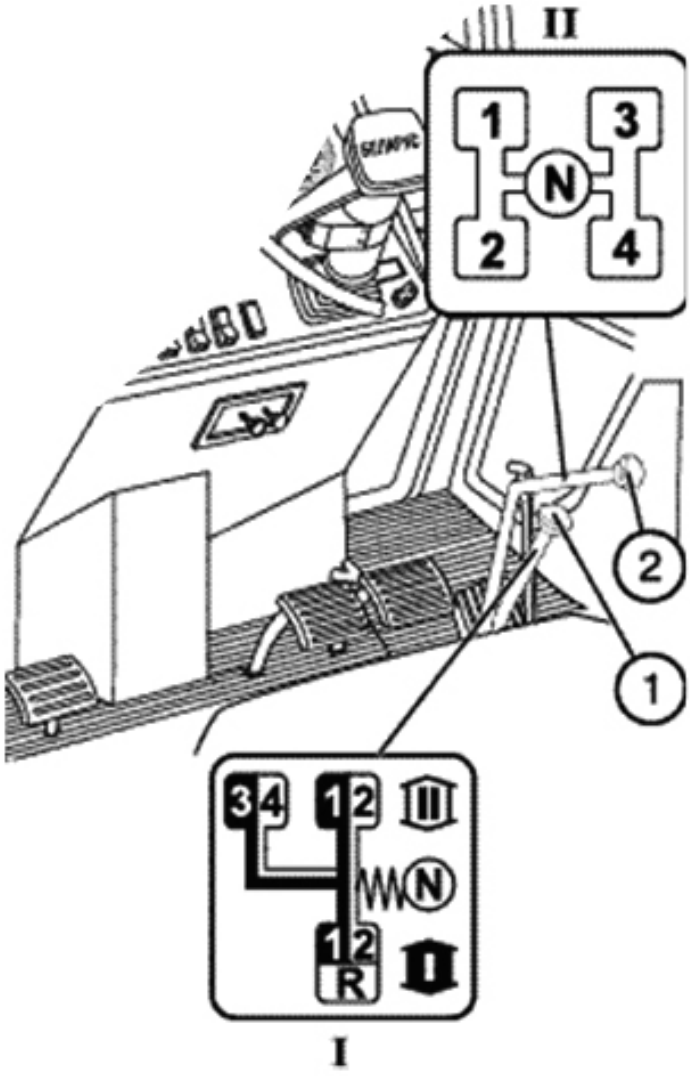
Socket connection terminal marking:

1 – Turn indicator, left;
2 – Horn;
3 – "Ground";
4 – Turn indicator, right;
5 – Right clearance light;
6 – Stop light;
7 – Left clearance light;
8 – Female connector for service lamp or other consumer (up to 8A).

D15

Gearbox control (16F+8R)

The gearbox is controlled by two levers: a lever of ranges shifting (1) and a lever of gears shifting (2).
Select the required ranges and gears in accordance with the shifting patterns I and II as shown on the figure below.



IMPORTANT! In order to shift the gear correctly smoothly, without jerks, move the gear shifting lever (2) in accordance with the pattern (see the figure above) and keep it pressed until the gear is switched.

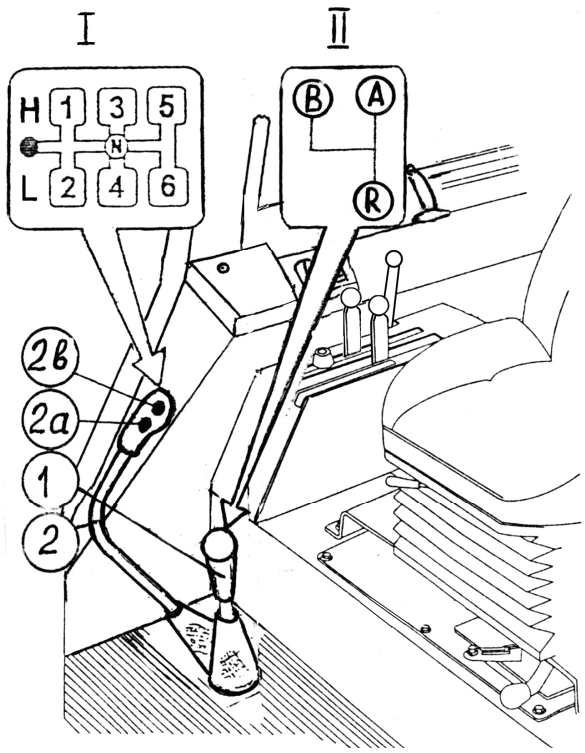
Gearbox control (24F+12R) (if installed)

Gears shifting lever (2)

The shifting pattern is shown in the figure on the right (pattern I).

“On” button (2а) of gearbox reducer low gear (L).

On” button (2в) of gearbox reducer high gear (H).



Ranges shifting lever (1)

The shifting pattern is shown in the figure on the right (pattern II).

A – two low ranges of forward motion;

B – two high ranges of forward motion;

R – two ranges of reverse motion;

H –high pass of gearing;

L – low pass of gearing.

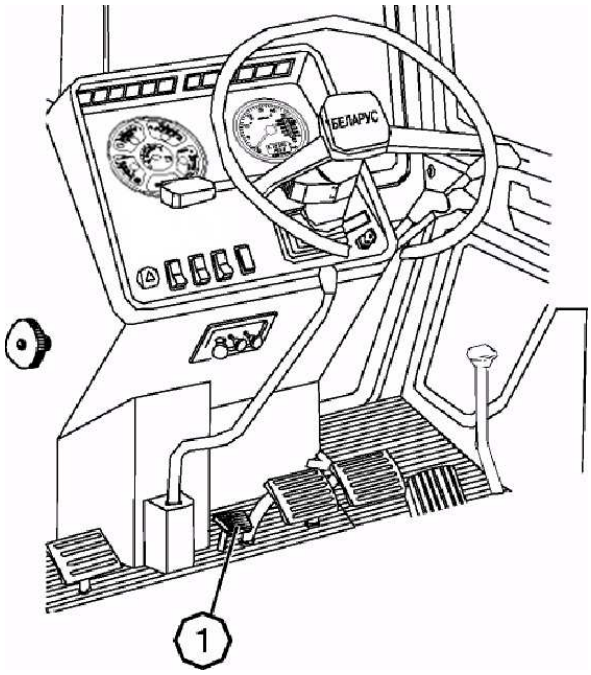
Control of the rear axle differential lock

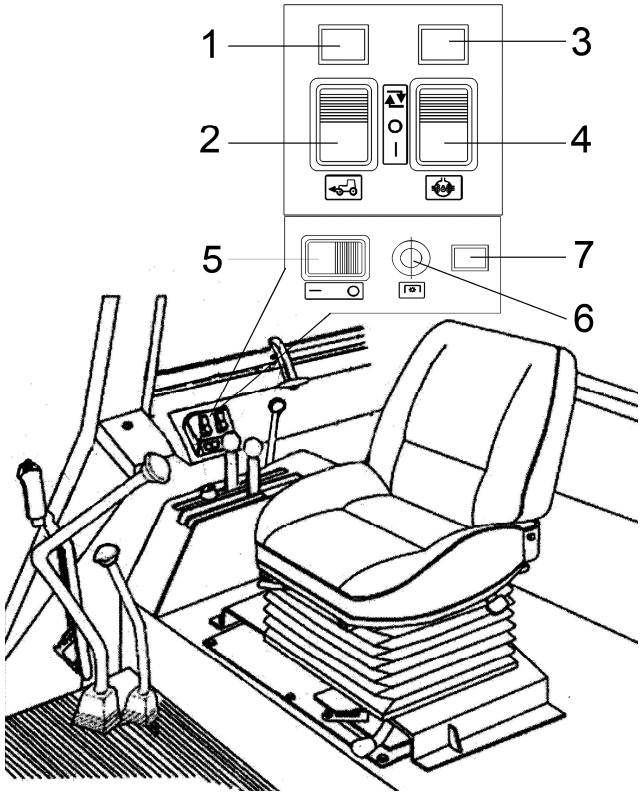
The rear axle differential lock is controlled by the button (4), located on the dashboard near FDA control button (2).

Three position button (4) has the following positions:

- "Automatic locking" — on pressing the upper part of the button (fixed position);
- "Differential lock is switched off — middle position (fixed);
- "Forced blocking" — on pressing the lower part of the button (unfixed). When the button is released it automatically switches to the middle position ("Differential lock is switched off").

On switching on the differential lock alarm lamp (3) lights up, which goes off when the differential lock switches on automatically and when the button (4) is put in the middle position.





Important! Engage the forced differential lock only shortly to overcome road obstacles and carry out the field and transportation works.

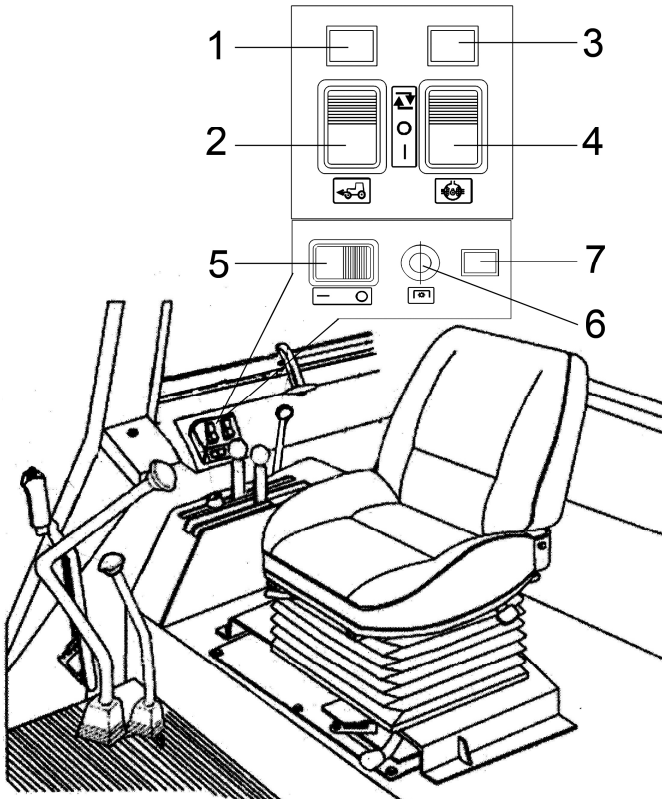
Warning: Do not use the differential lock at the speeds exceeding 10 km/h and when turning the tractor. Otherwise the tractor control becomes difficult, power transmission is quickly worn out, the safety is endangered.

FDA drive control

FDA drive is controlled by the button (2), located on the board above the right control unit. The button (2) has three fixed positions:

- "FDA is automatically "on" — on pressing the upper part of the button;
- "FDA is "off" — middle position of the button;
- "Forced FDA engagement" — on pressing the lower part of the button.

On engaging FDA drive the alarm lamp (1) lights up. The lamp goes out on putting the button (2) in the middle position and in the moment of switching off the drive in the automatic mode.



Attention!

1. Operating on the roads with hard surface switch off the FDA (middle position of the button (2) in order to prevent tyres and drive parts from increased wear.
2. Use the forced FDA engaging mode shortly only to overcome obstacles.
3. It is categorically forbidden to operate in the mode of forced FDA engagement when the speed is over 15 km/h.
4. It is categorically forbidden to use FDA in the mode of automatic engagement by the reverse motion.

Note: A braking relay is installed in the electrical line of FDA drive control, it ensures automatic switching on of FDA when pressing synchronized pedals of tractor brakes.

Rear PTO engagement

In order to engage PTO press key (5) to the left up to the stop, then press key (6) and release it, then indicator lamp (7) (yellow) will light up indicating PTO shaft engagement.

In order to disengage PTO shaft press key (5) to the right, indicator lamp (7) will go out, indicating PTO shaft disengagement.

ATTENTION!

Disable PTO shaft drive if it is not used.

Before starting diesel engine ensure, that key (5) and button (6) of PTO shaft switching on and off are in the position “PTO off” (indicator lamp (7) is off).

Disable drive while deenergizing control system (failure of generator, belt breakage and etc.) in order to exclude premature failure of PTO reducing gear elements.

Independent and synchronous PTO drives

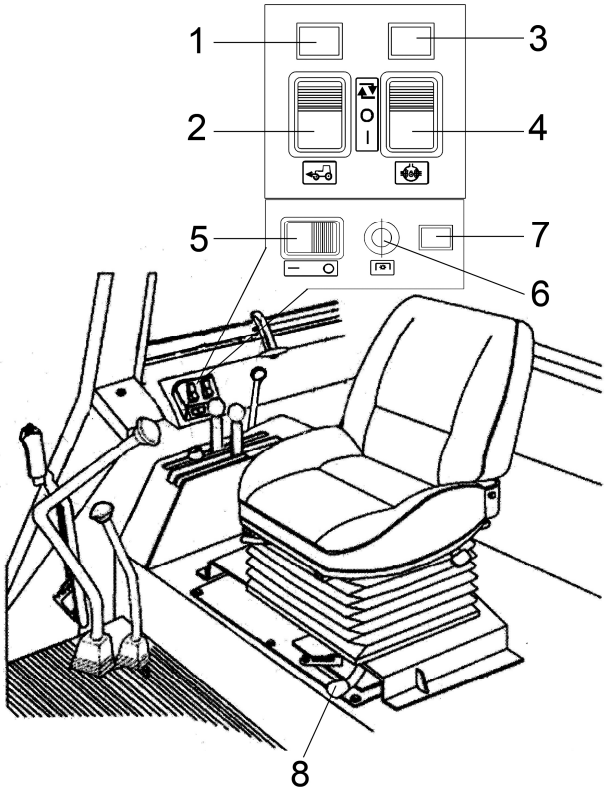
The lever (8) has three positions:

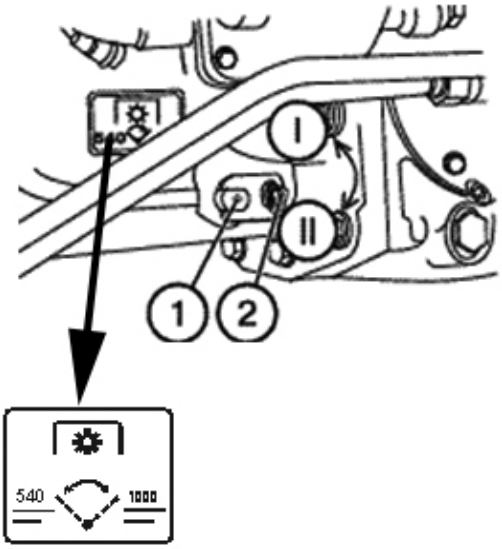
- “Independent drive is engaged” — extreme right position;
- “Synchronous drive is engaged — extreme left position;
- “Disengaged” — middle position.

Engage the synchronous PTO drive only at low gears on minimum engine idle speed doing the following:

- Start the engine and set the minimum idle speed;
- Press home the clutch pedal and engage I or II gear;
- Release the clutch pedal slowly and simultaneously turn the lever (8) in the extreme left position.

Important! Use the PTO synchronous drive only at low gears at tractor motion speed not higher than 8 km/h. Otherwise tractor power train may get seriously damaged.





Speed switch of independent PTO drive

Independent drive lever (1) has two positions:

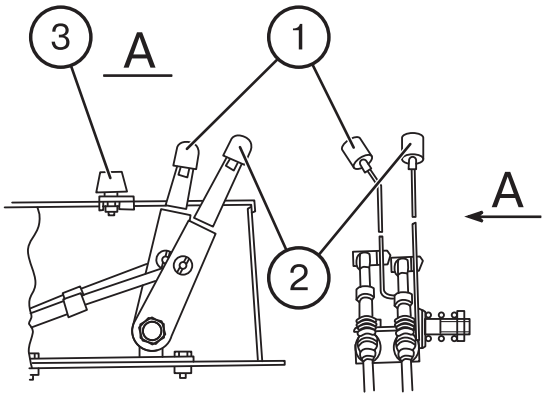
I — 540 rpm — extreme, contraclockwise;

II — 1000 rpm — extreme clockwise.

To set a required PTO speed release the bolt (2), turn the lever (1) and tighten the bolt (2).

D21

Hydraulic lift linkage control with hydraulic lift



The hydraulic lift linkage is controlled using two control levers (1) and (2), located on the right control board inside the cab.

The draft control lever (1) is the nearest to the operator's seat and has the following positions:

- Extreme forward — maximum depth of ploughing (“9”).
- Extreme rearward — minimum depth of ploughing (“1”). Full range of the lever's positions is denoted with number from “1” to “9”.

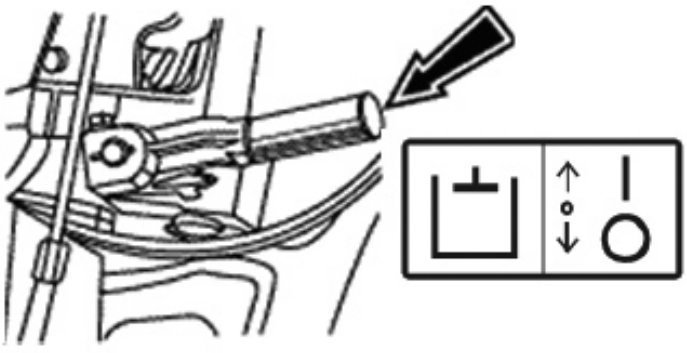
The position control lever (2) has following positions:

- Extreme rearward (“1”) — transport position of rear lift device.
- Extreme forward (“9”) — minimum height of the implement above the ground.

The maximum lifting height of the implement using the lever (2) is eliminated by adjustable stop (3).

Note: The mixed control is carried out by means of the limitation of the tillage depth using the lever (2) during draft control operations.

Hydraulic system pump control



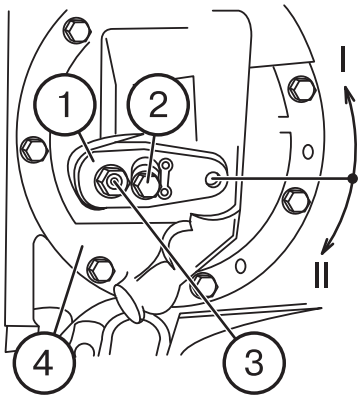
The control lever has two positions:

• “The pump is engaged” – upper position;

• “The pump is disengaged” – lower position.

Important! Disengage the pump at cold start or maintenance. Engage the pump at the engine minimum idle speed only.

Gearbox oil pump control



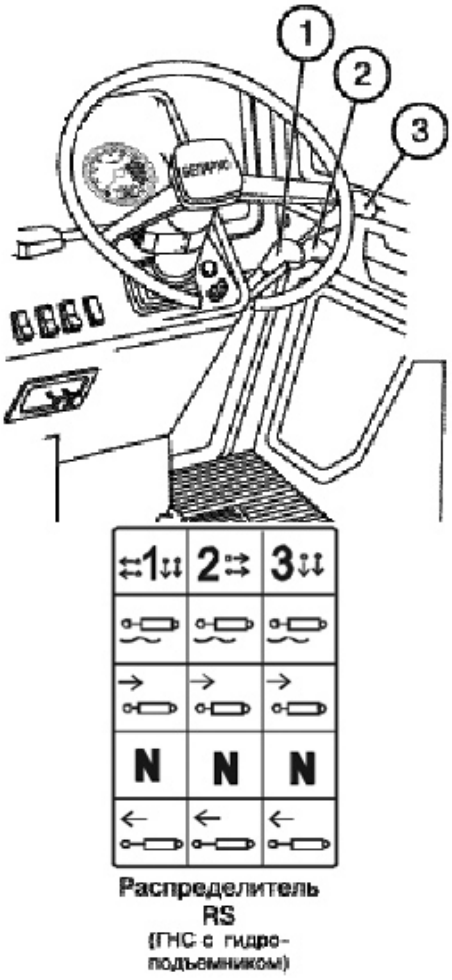
The gearbox oil pump control lever (1) can have two fixed positions:

I — "Pump drive from engine" (normal operating position) — the lever (1) is turned counterclockwise (when looking at GB from the left tractor side) relative to the axis (3) until the lower edge of the lever slot stops and is fixed by the bolt.

II — non-working position.

Important! Set the lever (1) in the position II when there is a necessity to remove and to mount the assembled GB pump drive (4) and then fix the lever (1) in the position I again.

Hydraulic system distributor control



Each of the three remote levers (1, 2, 3), controls the remote cylinders and has four positions:

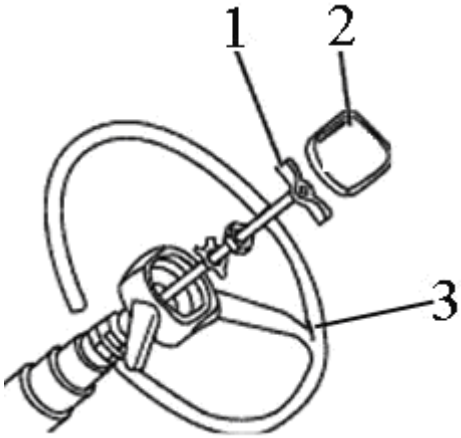
- "Neutral" — low middle (fixed);
- "Lift" — low (non-fixed); after releasing the lever returns to "neutral";
- "Positive lowering" — upper middle (non-fixed) between the "float" and "neutral". After releasing the lever returns to "Neutral";
- "Float" — upper (fixed)

D23

Changing of steering wheel position

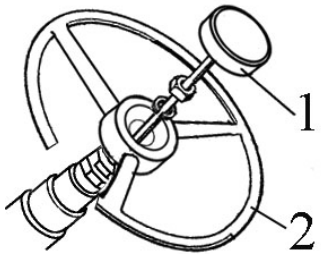
To adjust the height of the two-arm steering wheel, proceed as follows:

- Remove the cover (2);
- Unscrew the clamp (1) for 3…5 turns;
- Set the steering wheel 3 in the required position;
- Tighten the clamp (1) manually and fix the cover (2) back.
- Steering wheel height adjustment range is 100 mm.

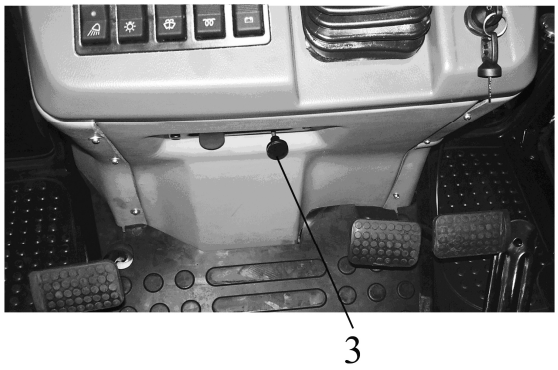


To adjust the height of the tree-arm steering wheel, proceed as follows:

- Unscrew the clamp (1) for 3…5 turns;
- Set the steering wheel 2 in the required position;
- Tighten the clamp (1) manually
- Steering wheel height adjustment range is 100 mm.

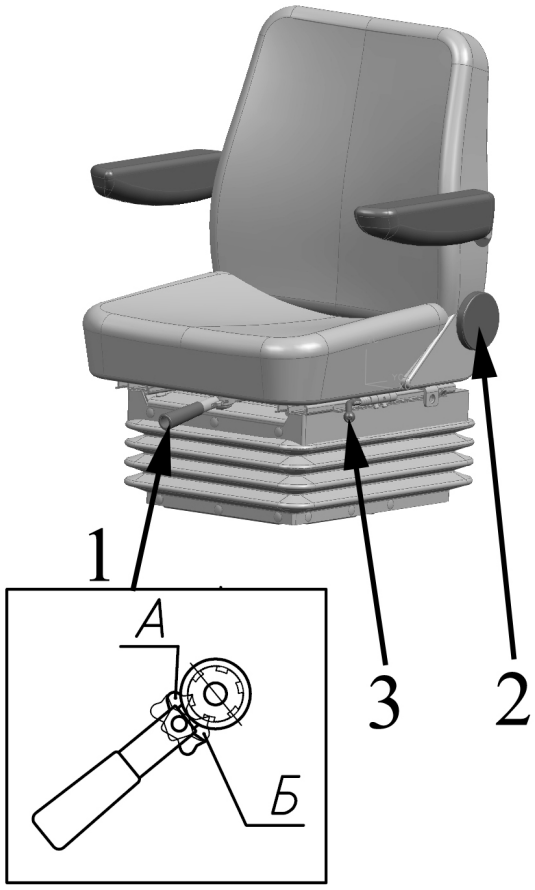


The steering column can tilt to four different positions from 25° to 40° relative to horizontal line in increments of 5°). In order to tilt the steering column, pull the handle (3) on.



Seat “MTZ”

The seat has the following adjustments**:**



Adjustment **according to the operator's weight** is carried out by means of lever 1**.** To adjust the seat for a bigger weight it is required to shift the pawl of the lever 1 into position “А” and tighten the springs with a reciprocal movement. To adjust the seat for a smaller weight it is required to shift the pawl into position “Б” and release the springs with a reciprocal movement.

Adjustment of the backrest tilt angle is adjusted by means of a handwheel 2. To increase the backrest tilt angle it is necessary to turn the handwheel clockwise, to decrease it – contraclockwise.

Longitudinal adjustment is carried out by means of a lever 3. To move the seat forward-backward it is required to pull the lever 2 up, move the seat and then release the handle. The seat will automatically get fixed in a required position.

Height adjustment. The seat has three height positions: “lower”, “middle” and “upper”. To move the seat from the “lower” position to the “middle” position or from the “middle” position to the “upper” one it is required to lift the seat up smoothly till the arresting stop goes off (a specific click is heard). To move the seat from the “upper” position into the “lower” one it is necessary to lift the seat up against the stop with an abrupt movement and let it down.

NOTE! It is impossible to move the seat from the “middle” position to the “lower” one.

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D25

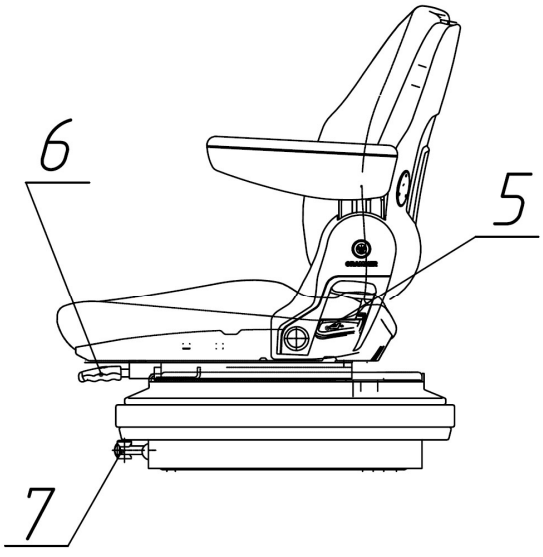
In case a **Grammer seat** is installed in a tractor, adjustment according to the operator's weight is carried out by means of a lever 7. To adjust the seat for a bigger weight it is necessary to turn the handle clockwise. To adjust the seat for a smaller weight, turn the handle contraclockwise.

Longitudinal adjustment is carried out by means of a lever 6, which shall be pushed to the right up to the stop and after which the seat may be moved forward or back. Height adjustment has three height positions. To increase seat height manually displace the seat successively upward (until you hear specific click indicating fixation). To reduce the seat height it is necessary to lift the seat up against the stop with an abrupt movement (from the upper position of height adjustment) and let it down to the lower position. Adjustment of the backrest tilt angle is carried out by lever 5. To change the backrest tilt angle it is necessary to raise the lever up to the stop, chose the required backrest tilt angle and releasing the lever, fix it in the required position.

5 – adjustment of the backrest tilt angle;

6 – longitudinal adjustment;

7 – adjustment according to the operator's weight.



Cab heater fan control

To turn on the heater conditioner, proceed as follows:

1. After refilling the cooling system with antifreeze agent, start the engine and let the engine work at medium speed to have the antifreeze agent in the cooling system warmed up to 50 to 60°C, after that open the heater valve by turning lever 1 of the heater counterclockwise up to the stop. If a heater valve is installed outside a cab, turn a lever 1a. Then increase the engine speed and let it work for 1 to 2 minutes, slightly open a plug 5 of a drain valve cock on the right side to ensure that cooling agent circulates through a heat exchanger. The heat exchanger must start warming up. The coolant level in the diesel heat exchanger of the engine cooling system will drop at that

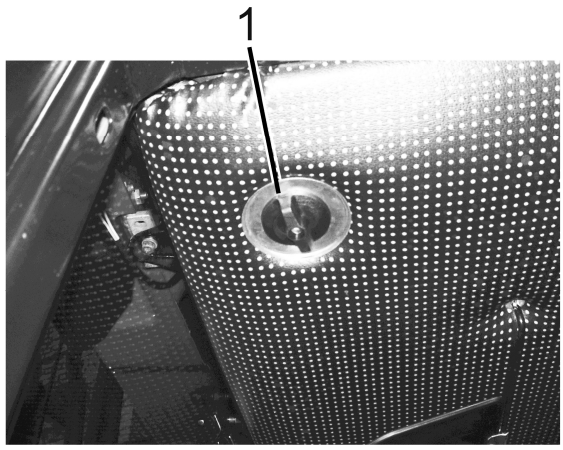
2. Add coolant to the diesel heat exchanger to the required level (50…60 mm below top edge of filler neck).

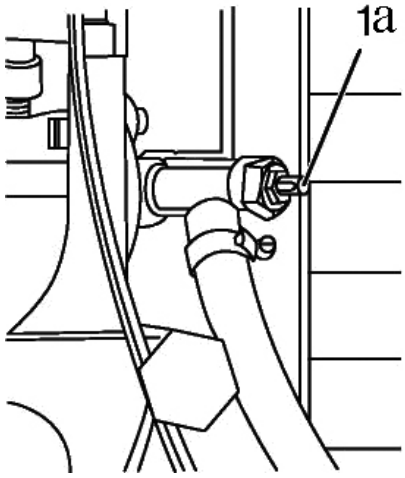
3. Engage heater fan with switch 3 and direct the air flow via air distributors 4.

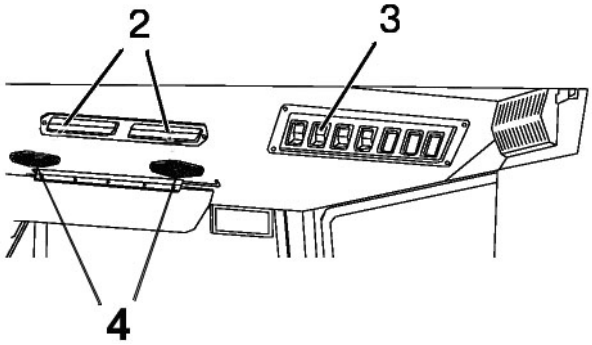
4. with the recirculation shutters 2, the quantity of fresh air delivered into the cab can be adjusted.

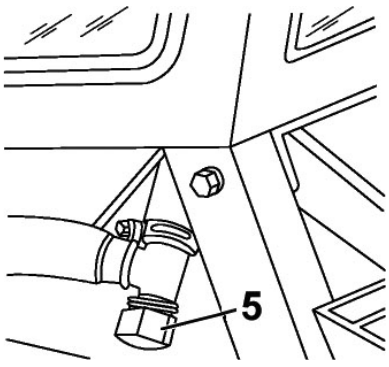
5. To drain the coolant from the heating system there is drain plug 5 on the left and right sides of a cab. After the coolant is drained, it is necessary to blow the system off with compressed air after closing a valve cylinder block and turning off plugs 5. Tighten the plugs after blowing off.

ATTENTION: heater control valve shall be closed for system operation in ventilation mode during a warm season.









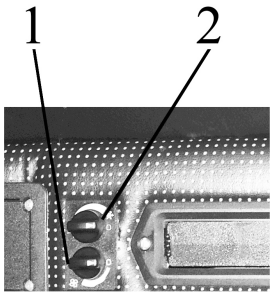
D27

Cab air conditioning and heating system

If it is installed instead of a heater fan

Climate system control in air conditioning mode

The climate system control panel is in the central part if cab upper panel. Control console has the switches (1) and (2)



By means of air flow switch (1) you can change air consumption by means of fan operating speed change. By means of air flow switch (2) you can change temperature of the air coming from cool and dehydrated air deflector in air conditioning mode.

ATTENTION: air conditioner can be turned on and operate only when the engine is running

To turn on the conditioner, proceed as follows:

- turn the switch (2) (Figure 2.7) clockwise by 180°C to the beginning of the blue scale;

- - then turn the switch (1) to one of the three marked positions (the fan impeller has three speeds). In 3-5 minutes, use the switch (2) to adjust the desired temperature in the cab;

- with the shutters located on the upper panel, near to the operator's head, the mix of external and recirculating air can be adjusted;

To turn off the air conditioner turn both switches (1) and (2) counterclockwise to “0”.

ATTENTION: when working in the cooling mode, the heater valve must be closed to prevent simultaneous operation of the air heating and cooling systems.

Climate system control in heating mode

ATTENTION: REFILL THE ENGINE COOLING SYSTEM ONLY WITH AN ANTIFREEZE AGENT.

For efficient operation of the heating system, observe the following recommendations:

1. After refilling the cooling system with antifreeze agent, start the engine and, without opening the valve, let the engine work at medium speed to have the antifreeze agent in the cooling system warmed up to 70 to 80°C, after that open the valve, increase the engine speed and let it work for 1 to 2 minutes to have the heat exchanger filled with the agent. Make sure that the antifreeze agent is circulating through the heater. The heat exchanger must warm up. The coolant level in the heat exchanger of the engine cooling system will drop at that;

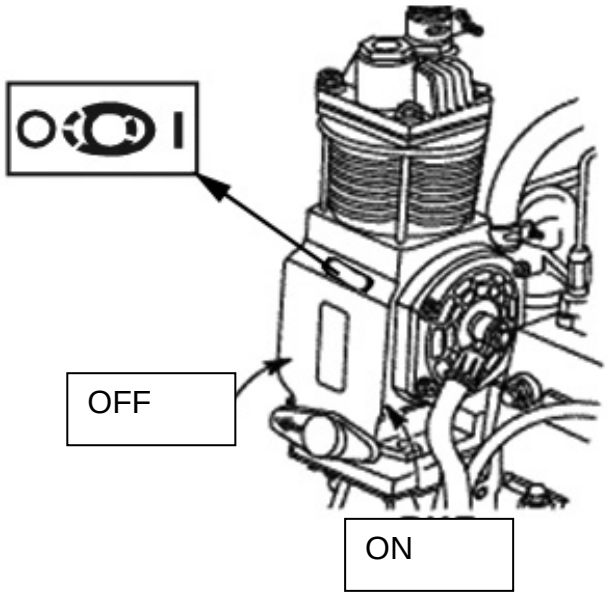
2. Add coolant to the diesel engine heat exchanger to the required level (to the MAX. mar on the expansion tank);

3. To have the cab quickly warmed up, turn on the heater fan and open the recirculation shutters;

4. To discharge the coolant from the engine heater and cooling system, install the tractor on an even surface. Remove the extension tank plug of the engine cooling system, open the valve on the cylinder block of the engine and remove the heater hose from the heater valve.

ATTENTION: when working in the heating mode, the switch 2 must be fully off to prevent simultaneous operation of the air heating and cooling systems.

Pneumatic system compressor control



The handle of compressor control has two positions:

- “Compressor ON” – when turning the handle so that the arrow on the arm is directed backwards to tractor motion;
- “Compressor OFF” – when turning the handle so that the arrow is directed forward to tractor motion.

CONSTRUCTION AND OPERATION OF TRACTOR COMPONENTS

The Engine Feed Circuit consists of an air-cleaner, air-delivery conduit, induction/ exhaust manifolds, turbocharger, exhaust muffler, fuel tanks, coarse and fine fuel filters, fuel pump, injectors as well as fuel-injection (high-pressure) and delivery low-pressure) pipelines.

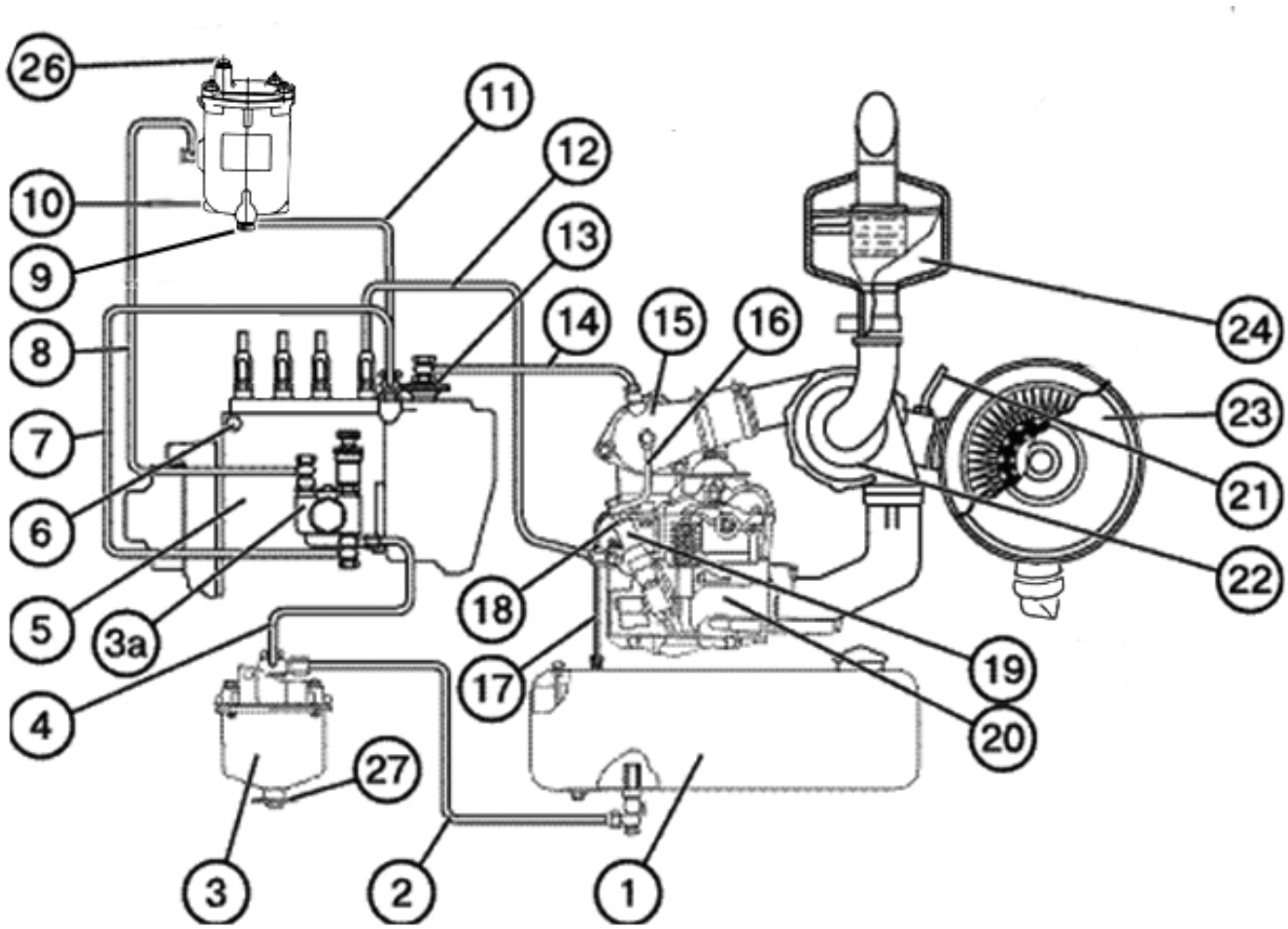


Fig D-1. Feed system diagram

1 – fuel tank; 2 – connecting pipe from the fuel tank; 3 – coarse fuel filter; 4 – connecting pipe from the coarse fuel filter; 5 – fuel pump; 6 – plug to bleed air from the fuel pump head; 7 – fuel offtake pipe from the lower-pressure chamber to the fuel-lift pump; 8 – pipe to deliver fuel from the fuel-lift pump to the fine fuel filter; 9 – sludge draining plug; 10 – fine fuel filter; 11 - fuel offtake pipe from the fine filter to the lower-pressure chamber of the pump; 12 – fuel injection pipe; 13 - pneumatic adjuster; 14 –pipe of air delivery from air-delivery conduit downstream the turbocharger to the pneumatic adjuster; 15 – induction manifold; 16 – fuel overflow pipe; 17 – fuel drain pipeline; 18 – fuel overflow pipe; 19 – injector; 20 – cylinder head; 21 – air-cleaner clogging indicator pipeline; 22 – turbocharger; 23 – air-cleaner; 24 – exhaust muffler26 – air-bleeding plug; 27 – plug to drain sludge.

D2

Air purifier (fig. Д-2) of **Donaldson** company of dry type using one paper filtering element. It has three stages of cleaning. The first stage - inertia air cleaning (in-built monocyclone). It is carried out inside the air purifier at the cost of centrifugal forces, emerging by air spiral rotation with relation to the axis of the case (1) of the air purifier. Dust is discharged through a rubber cap (5), mounted on the cover (4) of the air purifier, as the engine is stopped and started, at the cost of excess pressure, emerging inside the air purifier. The second and third stage is dry cleaning with the main (6) and control (7) paper filtering elements. Air is fed through the air intake (3). The air is delivered to the turbocharger through the air pipeline by means of a delivery pipe 2.

Fine fuel filter (fig. Д-1) has a replaceable paper filtering element. The filtering element is mounted in the filter housing.

The fine fuel filter is intended for multiple usages subject to regular replacement of filter elements and rubber gaskets and observance of the operating instructions.

To bleed air from the engine fuel feed circuit, the filter bowl is provided with a plug (26), refer to Figure below.
The fuel is injected into the cylinders by the closed-type injectors (19) with five-bore nozzles.

The diesel fuel injection (high-pressure) pump is of in-line four-plunger type providing the metering of fuel by changing the fuel-feed end point.The pump is provided with a pneumatic anti-smoking adjuster and driven off the crankshaft through valve control gearing.

The fuel pump forms an integral unit with a fully-variable all-speed governor and a piston-type fuel-booster pump.

Mechanical centrifugal all-speed direct action **regulator** with automatic increasing of fuel feed during diesel engine start.

The Coarse Fuel Filter with a screen filter element cleans the fuel from mechanical impurities and water. The sludge is drained from the filter through a draining plug located in the bottom part of the bowl housing.

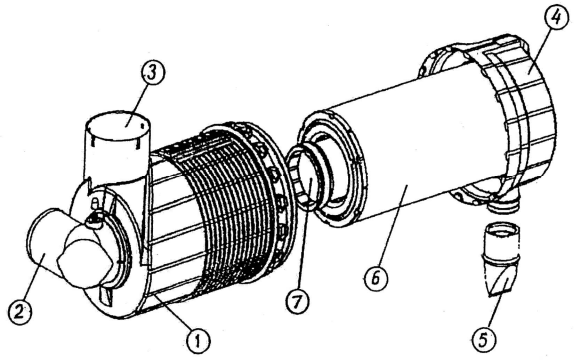


Fig. E-2. Air purifier: 1-housing; 2-delivery pipe; 3-air intake; 4-cover; 5-rubber cap; 6-main paper filterung element (MFE); 7-control paper filtering element (CFE). .

The **Fuel-Booster Pump** (3a) is mounted on the fuel injection pump body and driven by the camshaft eccentric.
For bleeding the air from the feed system, a hand- operated piston-type lift pump is provided, and the plugs serve for bleeding the air from the fuel-pump head The fuel supply is controlled by means of the pedal and lever.
The fuel pump parts are lubricated from the engine lubrication system

Turbocharger

The turbocharger serves for charging air into the engine cylinders using the energy of exhaust gases. It consists of a centrifugal one-stage compressor (2) and a radial centripetal turbine (7).

The turbine wheel (7) is cast of a refractory nickel allow and welded to the rotor shaft (12). The compressor wheel (2) is an aluminium alloy casting and is attached on the rotor shaft by means of a special nut (3).

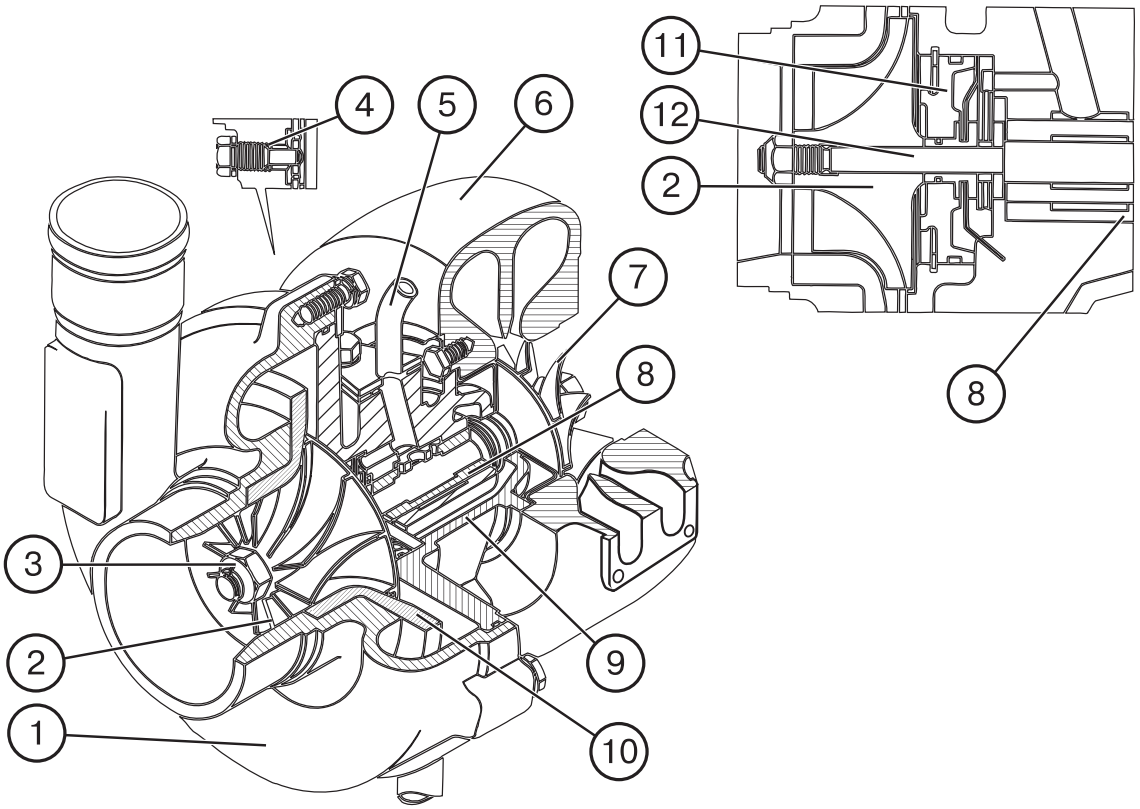


Fig. D-3. Turbocharger

1 — compressor housing; 2 — compressor impeller; 3 — special nut;
4 — retaining holdfast; 5 — oil pipeline with mounting flange; 6 — turbine housing; 7 — turbine wheel ; 8 — bearing; 9 — intermediate body; 10 — diffuser; 11 — disk; 12 — shaft

The principle of operation of the turbocharger is as follows. The exhaust gases from the cylinders enter the gas-turbine chamber from the exhaust manifold. Expanding, the gases rotate the turbine wheel together with its shaft, on the other end of which the compressor impeller is fitted.

From the turbine gases are discharged into the atmosphere through the exhaust pipe.

The excess air pressure downstream the compressor under engine design condition should be 0.05…0.08 MPa (0.5…0.8 kgf/cm^2).

D4

Installation of charged air cooler (CAC)

The charged-air cooler 5 is mounted in front of the water radiator (14) and is linked to the turbocharger (15) and engine intake manifold (16) through the system of air pipelines (1,4,10) and pipes (3,5,11).

The CAC is an air heat exchanger, consisting of a core as finned aluminum pipes, tanks and connection tubes. Air is delivered to the CAC from the turbocharger, cooled inside it to improve power-efficient and ecological parameters of the engine and further comes to the engine air intake.

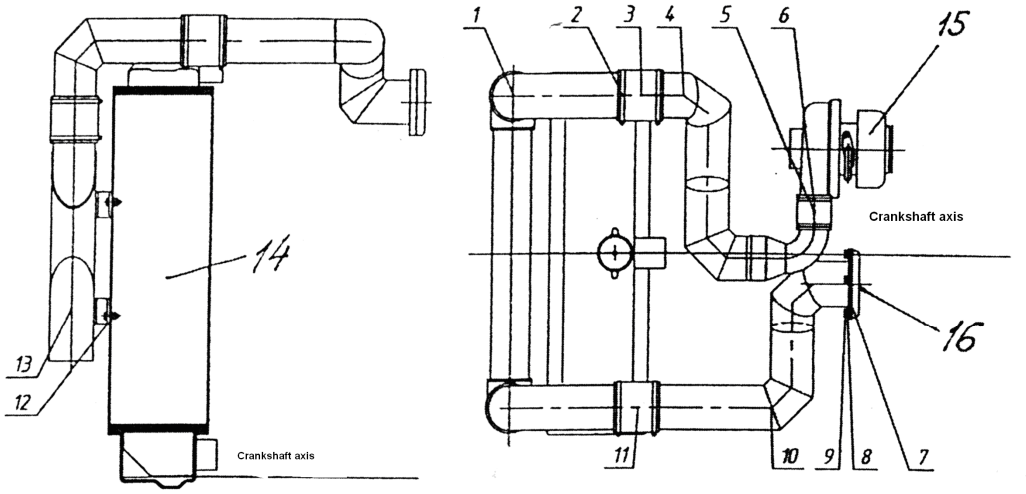


Fig. D-4. CAC installation:

1,4,10 – air pipeline; 2,6 – clamp; 3,5,11 – pipe; 7 – seal; 8 – washer; 9 – bolt M8x16; 12 - nut; 13 – cooler (CAC); 14 – water radiator; 15 – turbocharger; 16 – diesel engine intake manifold.

The engine lubricating system is combined (Fig.D5): some parts are force-lubricated; others are splashed lubricated. The bearings of crankshaft and cam shaft, bushing of intermediate gear, crankshaft rod bearing of compressor, valves drive mechanism (rocking arms) and turbocharger shaft bearing are lubricated by the oil pump under pressure. Sleeves, pistons, piston pins, barbells, pusher, cam shaft claws and fuel pump drive are lubricated by spraying.

The full-flow oil filter with complete filter element and liquid-oil heat exchanger is installed to diesel engines Д-245.2S2. The plan of lubricating system is on figure Д-5.

The oil pump takes oil from the crankcase 1 through the oil Figk-up 8 and delivers it through passageways in the cylinder block to liquid-oil heat exchanger, and then to a full-flow oil filter where oil is purified from foreign substances, wear products and oil decomposition products through heating and oxidation.

The purified oil comes from the oil filter to the oil pipeline of the diesel engine.

The overflow (reducing) valves are installed:

- in the housing of the liquid-oil heat exchanger - 11 (actuation pressure – $0{,}15^{+0.05}$ MPa);

- in the oil filter - 13 (actuation pressure – $0{,}15 \pm 0.02$ MPa);

During diesel engine start with cold oil, when the oil flow resistance in the liquid-oil heat exchanger exceed 0,15…0,2 MPa, overflow valve opens and oil is delivered to the oil filter, bypassing the liquid-oil heat exchanger. When the resistance in the oil filter is 0,13…0,17 MPa, the oil filter overflow valve opens and oil comes to the oil pipeline, bypassing the oil filter. The overflow valves are not regulated.

The safety regulated valve 14 is installed to the filter housing. It is used to maintain the oil pressure in the main oil pipeline within the range 0,25...0,35 MPa. The surplus oil is delivered through the valve to the diesel engine crankcase.

In case of excessive clogging of filter paper, when oil filter resistance exceed 0,13...0,17 MPa, the oil filter overflow valve also opens and oil comes to the oil pipeline, bypassing the oil filter.

The plug of the reducing valve must not be turned off at the operating diesel engine.

Oil is delivered from the main pipeline of the diesel engine through passageways in the cylinder block to all crankshaft main bearings and camshaft necks. Then oil comes from main bearings through passageways in the crankshaft to all rod bearings. Oil is delivered from the first main bearing trough the special passageways to the intermediate gear bushings and fuel pump drive gear and the fuel pump.

The parts of the valve mechanism are lubricated with oil, which comes from the rear bearing of the camshaft through the passageways in the block, cylinder head, drilled hole in the IV. rocking arm shank to the body cavity of the rocking arm axle and through the opening to the rocking arm bushing from which it comes to the adjusting screw and barbell.

Oil is delivered to the compressor from the main pipeline through the drilled holes in the cylinder block and special oil pipeline. From the compressor oil is drained to the diesel engine crankcase.

Oil comes to the bearing unit of the turbocharger through the pipe at the oil filter housing outlet. From the bearing unit of the turbocharger oil is delivered through the pipe to the oil crankcase.

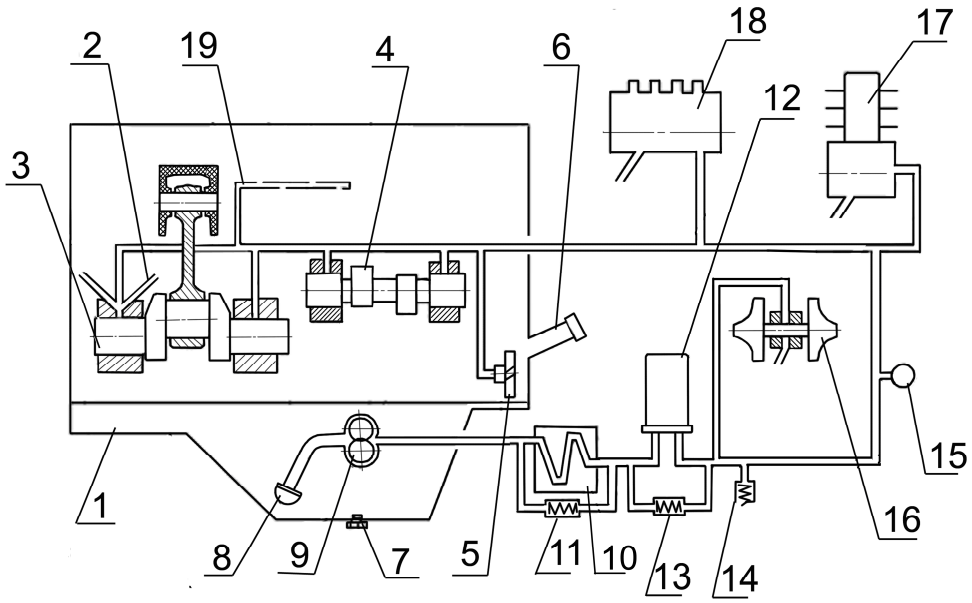


Fig. D-5 The lubrication system diagram:

1 – crankcase; 2 – piston cooling jet; 3 – crankshaft; 4 – distribution camshaft; 5 – intermediate gear; 6 – oil throat; 7 – oil crankcase plug; 8 – oil Figk-up; 9 – oil pump; 10 – oil-to-fluid heat exchanger; 11 – transfer valve; 12 – oil filter; 13 – transfer valve; 14 – relief valve 15 – pressure sensor; 16 – turbocharger; 17 – compressor; 18 – fuel injection pump; 19 – oil passageway of the rocking arm axle масляный канал оси коромысел.

D6

The Engine Cooling System (Fig. Д-6) is of a closed liquid-type with forced circulation of the fluid from the centrifugal pump. The water pump is rotated with V-belt fromt the crankshaft pulley. The lubricant Lithol-24 is put to the bearing hole of the pump during the montage. The lubrication of the bearings during the operation is not needed.

The coolant temperature is monitored by means of the remote temperature indicator, which is installed to the cylinder head. Further, the sensor of the emergency coolant temperature light is installed in the thermostat cover.

The operation of the diesel engine is forbidden when the emergency coolant temperature light in the cooling system flashes. The coolant temperature in the cooling system is to be maintained within the range 85º C …95º C. The thermostat with opening temperature of the main valve 87±2 °C serves for fast heating of the diesel engine after start and automatic temperature regulation at various loads and ambient temperatures.

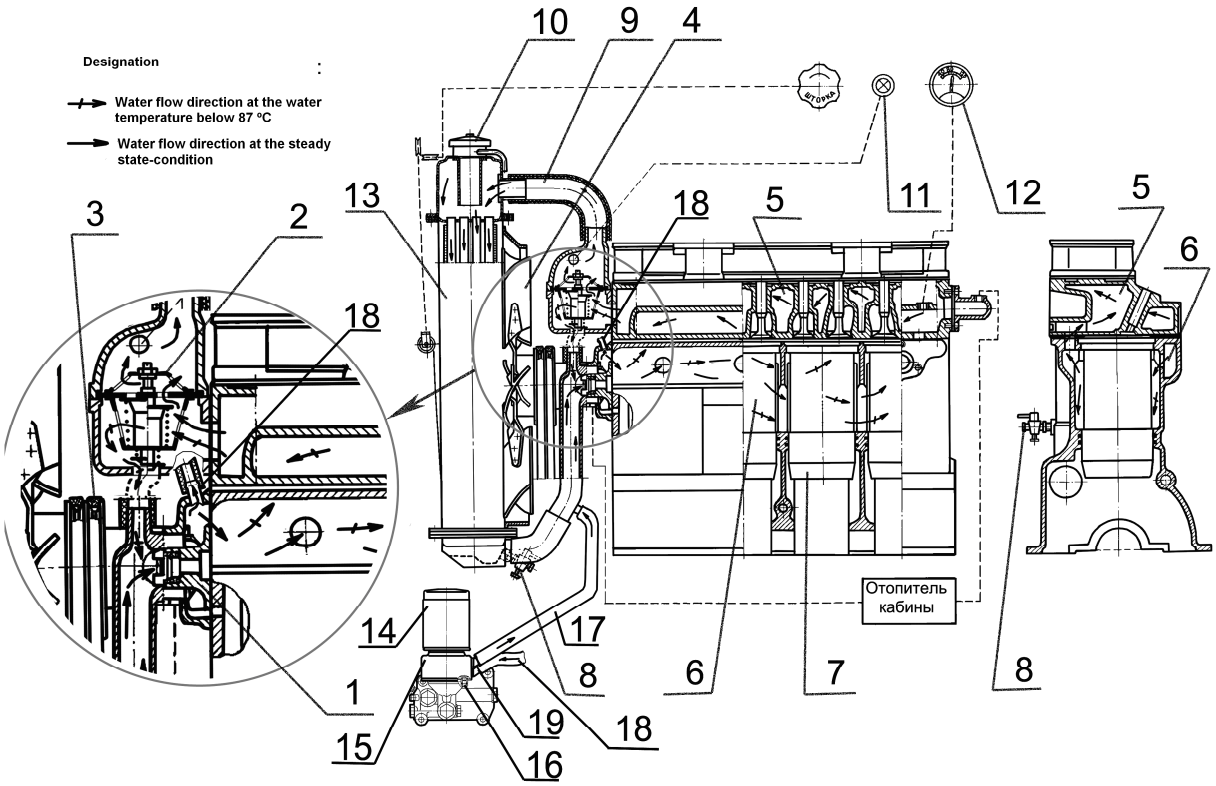


Fig. D-6 Engine cooling system diagram:

1- water pump; 2 thermostat; 3 – water-pump drive belt ; 4 – fan; 5 – cooling jacket of cylinder head; 6 – cooling jacket of cylinder block; 7 – cylinder block sleeve; 8 –coolant drain tap; 9 – branch pipe; 10 – filler neck plug;

11 – a coolant temperature warning lamp; 12 - engine coolant temperature indicator; 13 – cooler;

14 – oil filter; 15 – oil-to-fluid heat exchanger ;16 – coolant drain plug; 17 – coolant drain branch pipe; 18 – coolant inlet branch pipe.

Electric Equipment and Starting System

The electric equipment aggregates installed on the engine, include the alternator with the capacity of 1150 W and voltage of 14 V.

, which is non-contact five-phase like poles electrical machine with one-way electromagnetic excitation, integral rectifier block and integral voltage regulator. The generator is driven by V-belt from the crankshaft pulley.

The diesel engine is started by electrical starter (voltage 24 V, power 5,5 kW). Remote starter actuation, with electromagnetic relay and starter switch.

For better diesel engine start at the lower temperatures remote glow plugs are used in the cylinder head of the diesel engine. These plugs heat draw-in air in the cylinders.

Pneumatic system compressor

The diesel engine is equipped with the piston one-cylinder single-stage compressor, which is installed in the flange of the distributor valve cover and is driven by drive gear of the fuel pump. This compressor is a part of the pneumatic system of the tractor.

D8

Power transmission

The power transmission comprises clutch, gearbox, FDA drive, FDA and rear axle. It serves for torque transfer from diesel engine camshaft to the front and rear wheels.

Clutch

The clutch (Fig. Д-10) of the tractor consist of the clutch coupling (elements 1, 3, 5, 7-10, 12-14, 24-28 Fig. Д-10) and clutch housing (elements 6, 15-23 Fig. Д-10).

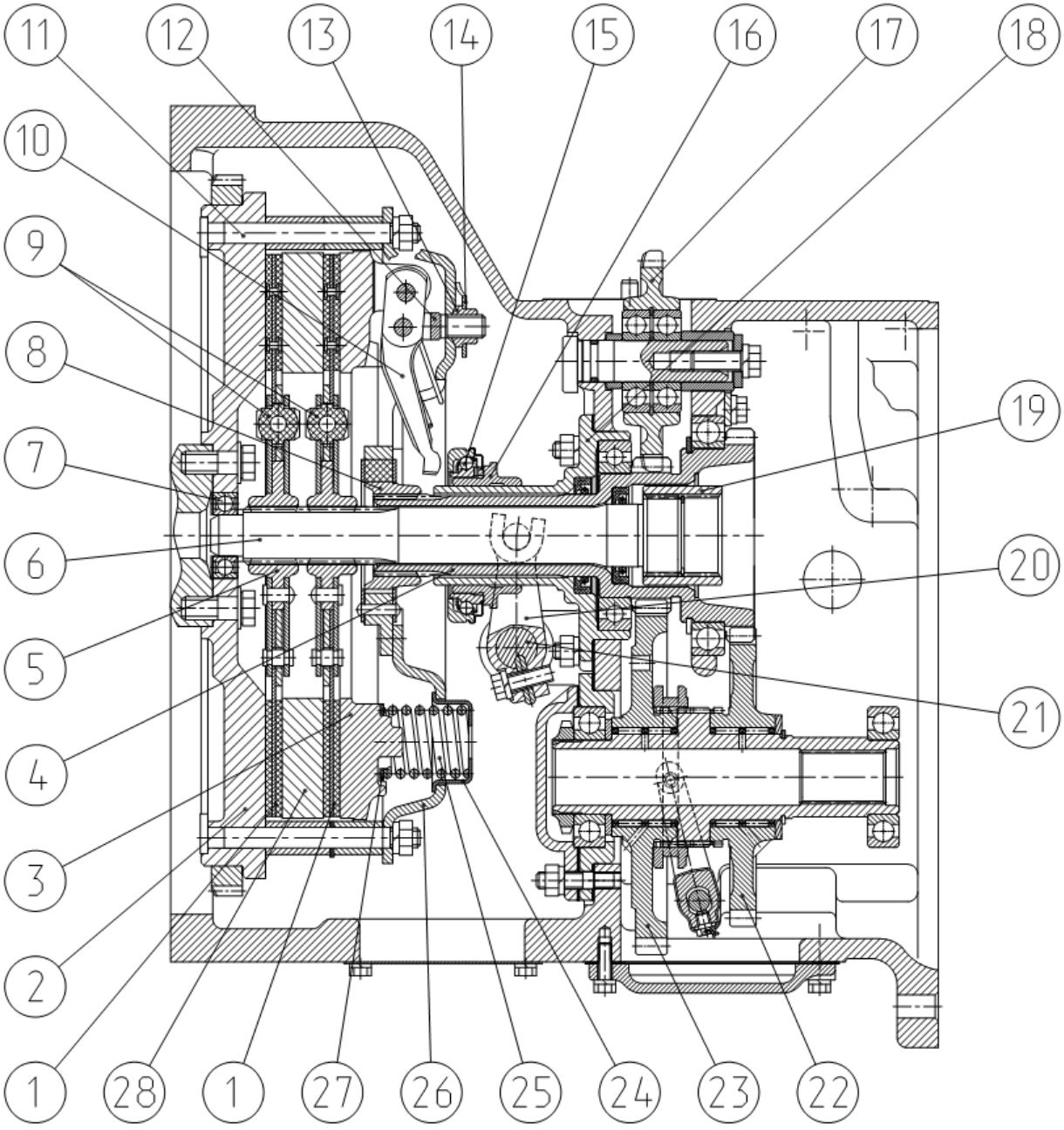


Fig. D-10. Clutch:

1 – driven disk; 2 - flywheel; 3 – pressure disk; 4 – shaft of PTO shaft drive and HS of lift linkage; 5 - hub; 6 – power shaft; 7 - bearing; 8 - hub; 9 - torque vibration damper; 10 – release lever; 11 - pin; 12 - fork; 13 – adjusting nut; 14 – lock plate; 15 – throw-out bearing; 16 - shifter; 17 – drive gear of HS lift linkage; 18 – shifter bracket; 19 – coupling bushing; 20 - fork; 21 – control shifter; 22, 23 –driven gear of PTO shaft drive; 24 - cage; 25 - spring; 26 – back plate; 27 – insulation gasket, 28 – center plate.

A dry-friction double-disk spring-loaded clutch coupling is mounted on the engine flywheel 2. The clutch driving part is a flywheel (2), a pressure plate (3) and a center plate (28), which are fixed to the flywheel pins (11) with tangential plates. The clutch driven part consists of two driven plates (1) with torque vibration dampers (9), which are installed on the power shaft (6). Nine springs (25) provide for a required compression force of friction surfaces of driving and driven clutch parts for torque transfer from the engine to the transmission.

The release levers (10) rest on the forks (12) fixed on the back plate by means of adjusting nuts (13), locked by the lock plates (14).

Clutch control (MTZ-1221.2/1221.3)

The clutch is disengaged by stepping on the clutch pedal (1) (Fig.D-11) which acts through the linkage (1), (5), (8) onto the retractor (16) (Fig. D-10) and the throw-out bearing (15).

When the pedal (1) is released (Fig.D-11), the clutch is engaged by the pressure springs (25) (Fig.D-10). The spring (10) of the servounit (Fig.D-11) makes the clutch engagement easier and always presses the lever (9) (Fig.D-11) against the cab floor when the clutch is engaged.

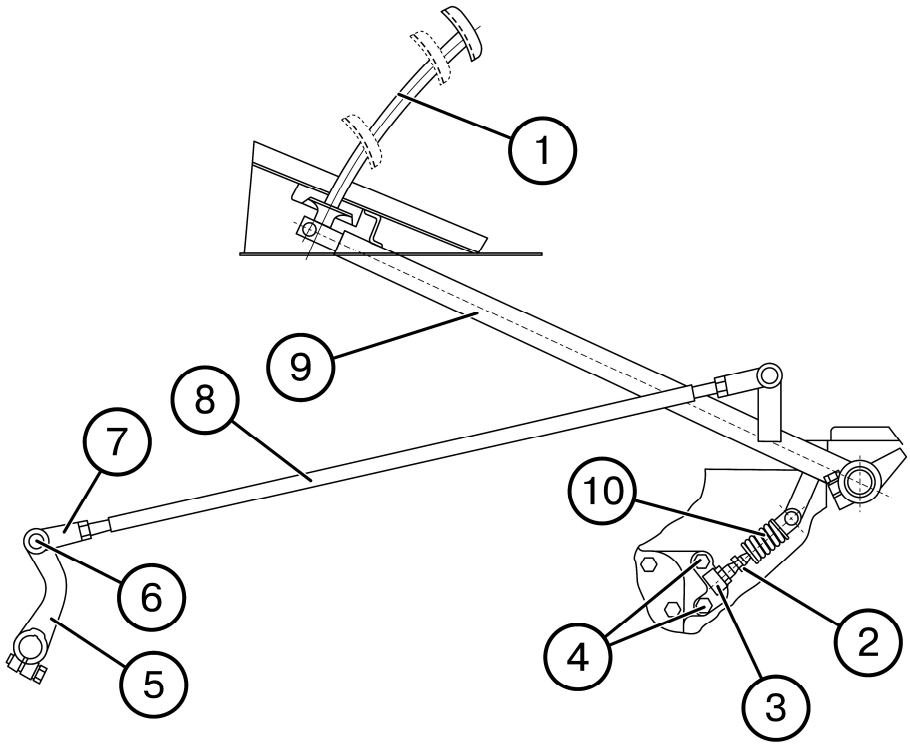


Fig. D-11. Clutch control:

1 – pedal; 2 – servounit adjusting bolt; 3 – bracket; 4 – fastening bolt; 5 – lever; 6 – pin; 7 – fork; 8 – rod; 9 – lever; 10 – servounit spring.

Clutch Housing

The **clutch housing** accommodates the drives of the independent PTO, HLL pump and a pump of the transmission hydraulic system.

GEARBOX (GB) (16F+8R)

The gearbox (D-12, D-14) - 16/8, is a mechanical fixed-ratio constant-mesh transmission, with 4 forward ranges and 2 backward ranges, with intra-range shift of gears by means of synchronizers. It provides 16 forward speeds and 8 reverse speeds as well as driving of the front drive axle and the synchronous PTO. The gearbox consists of gearbox housing, a drive gear assembly, shaft of reduced speeds and reverse, gear cluster, secondary shaft, control mechanism and hydraulic system

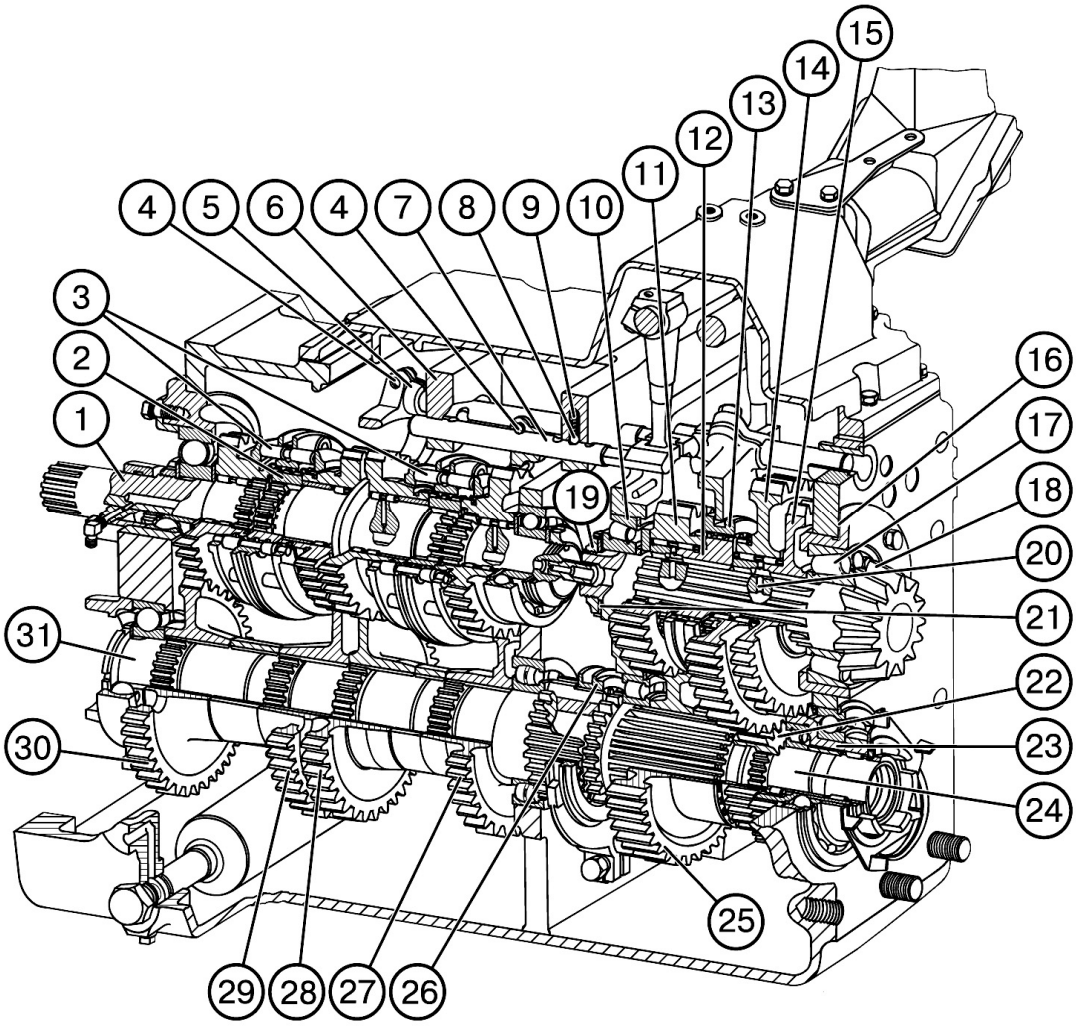


Fig.D-12 GEARBOX

1 – primary shaft; 2, 20 — bushings, 3 — synchronizer; 4 — fork; 5, 7 — dogs; 6 — fork body; 8 — ball; 9 — spring; 10, 17 — bearings; 11, 14, 15, 22, 23, 25, 27, 28, 29, 30 — pinions; 12 — semi-coupling; 13, 26 — toothed couplings; 16, 21 — adjusting shims; 18 — secondary shaft; 19 — nut; 24 — gear-cluster shaft; 31 — intermediate shaft.

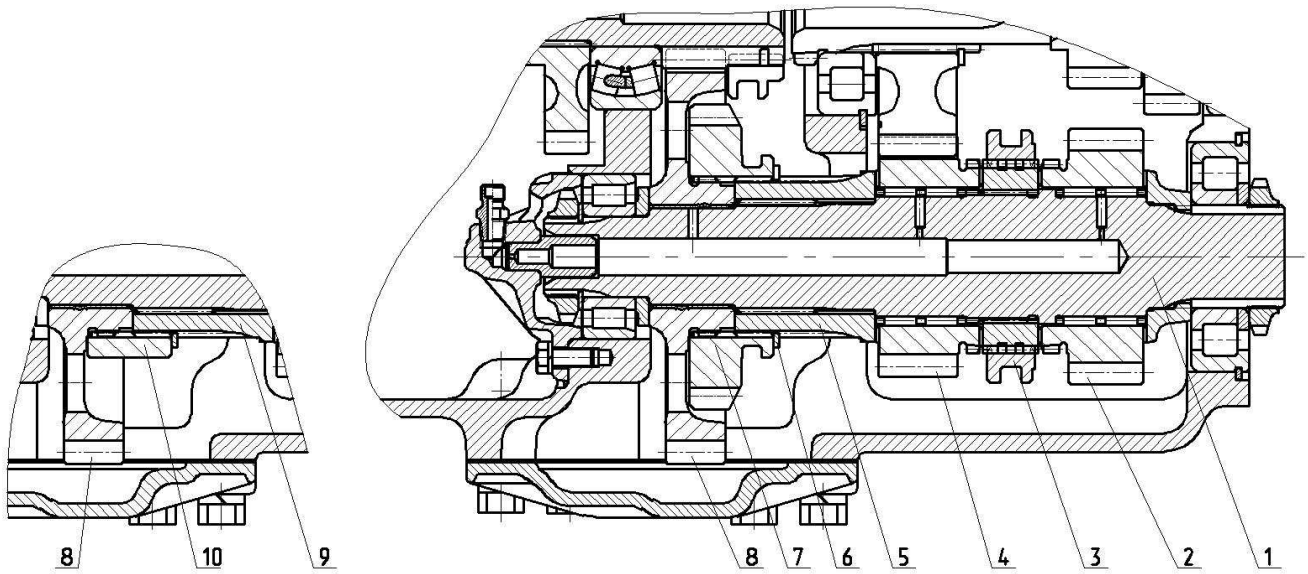


Fig. D-12.2. Shaft of downshift gears:
1 – primary shaft; 2, 4, 7, 8 – gears; 3 – coupling; 5, 9, 10 – bushings; 6 – retaining ring

The drive gear assembly consists of a primary shaft (1) (Fig.D-12.1) with free-installed pinions supported in needle bearings Two bushings (2) are splined on the shaft. The bushings carry cone synchronizers (3). The driven gears (27, 28, 29, 30) are fitted on the intermediate shaft (31) installed in the housing in two bearings with a slight pre-load.

The pinions (22) and (25) are installed on the splines of the gear-cluster shaft (24). The back mount of the shaft is located in the gear hub (23) of the synchronous PTO drive.

The secondary shaft (18) is supported in the housing in tapered bearings (10) and (17).

The driving pinion (24) of the front drive axle is fixedly fitted on the shaft with a driven gear (15) supported in bearing on the pinion hub, semi-coupling and bushing with a driven gear installed thereon. The pack of parts on the shaft is tightened up with the nut (19).

The gear (4) of the 1st and 2nd ranges and the gear (2) of the reverse are fitted on the shaft of downshift gears and reverse (1) (Fig. E-12.2). The gear (8) is mounted on the shaft by means of a bronze bushing. Depending on the standard equipment of the gearbox, the design of the shaft of downshift gears differs as follows:

1) if the gearbox provides for the possibility of installation of the speed-reduction gear, the splined bushing (5) is fitted with the speed-reduction gear wheel (7) connected with the splines of the gear (8) and fixed by means of the retaining ring (6) on the bushing (5);
2) if the gearbox does not provide for the possibility of installation of the speed-reduction gear, the splined bushing (9) is fitted with the bushing (10) connected with the gear (8) through the splines and fixed by means of the retaining ring (6) on the bushing (9).

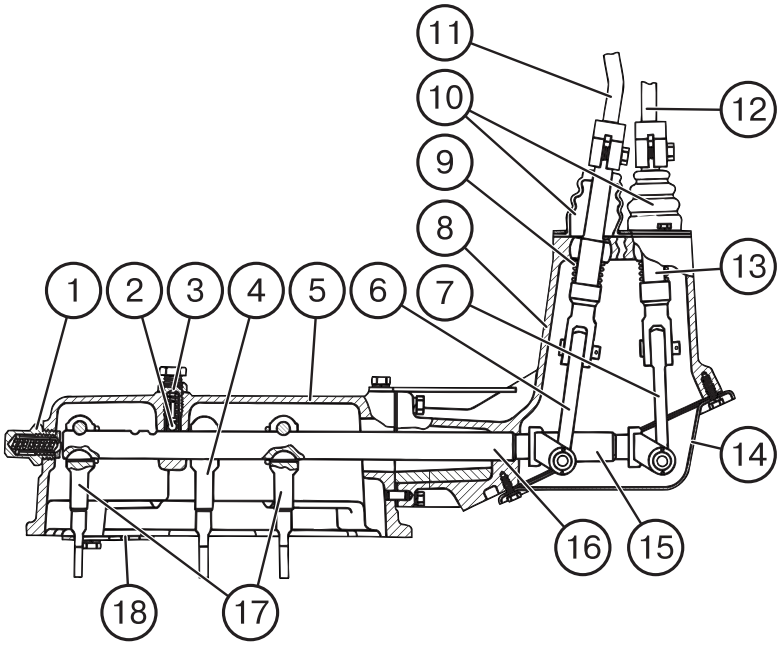


Fig. D-13. Synchronized Gearbox Control

1 – limiter; 2 — ball; 3 — spring; 4 — lever; 5 — cover; 6, 7 —levers; 8 — housing; 9 — sphere; 10 — boot; 11 fork; 12 — selector fork; 13 — spring; 14 — cover; 15, 16 — shafts; 17 — lever; 18 - link.

GB control mechanism

The GB control mechanism (Fig. E-13) comprises the gear-shift and speed-range change-over mechanisms. The gear-shift mechanism is installed in the fork member (6) (Fig. E-12) and in the casings (5) and (8) (Fig. E-13). The engagement is achieved through the lever (7), shaft (15) and arm (4). The dogs (5) and (7) are installed in the fork member (6) (Fig. E-12) with the forks (4) fixed thereto. To exclude simultaneous engagement of two speeds, the locking balls are located between the dogs (5) and (7). To hold the forks (4) in the neutral and engaged positions, the spring-loaded ball-point locks (8) are provided.

The speed-range change-over mechanism consists of a fork (11) of the range change-over handle, lever (6), shaft (16) and arms (17) located in the bodies (5) and (8) as well as parts installed in the transmission gearbox casing.

The toothed couplings (13, 26) (Fig. E-12.1) and (3) (Fig. E-12.2) are moved by forks (1, 4, 14) (Fig. E-14) attached on the dogs (2, 5, 15), respectively. The toothed couplings (13, 26) (Fig. E-12.1) and (3) (Fig. E-12.2) are fixed in neutral and engaged positions by the parts (8, 11, 12) (Fig. E-14).

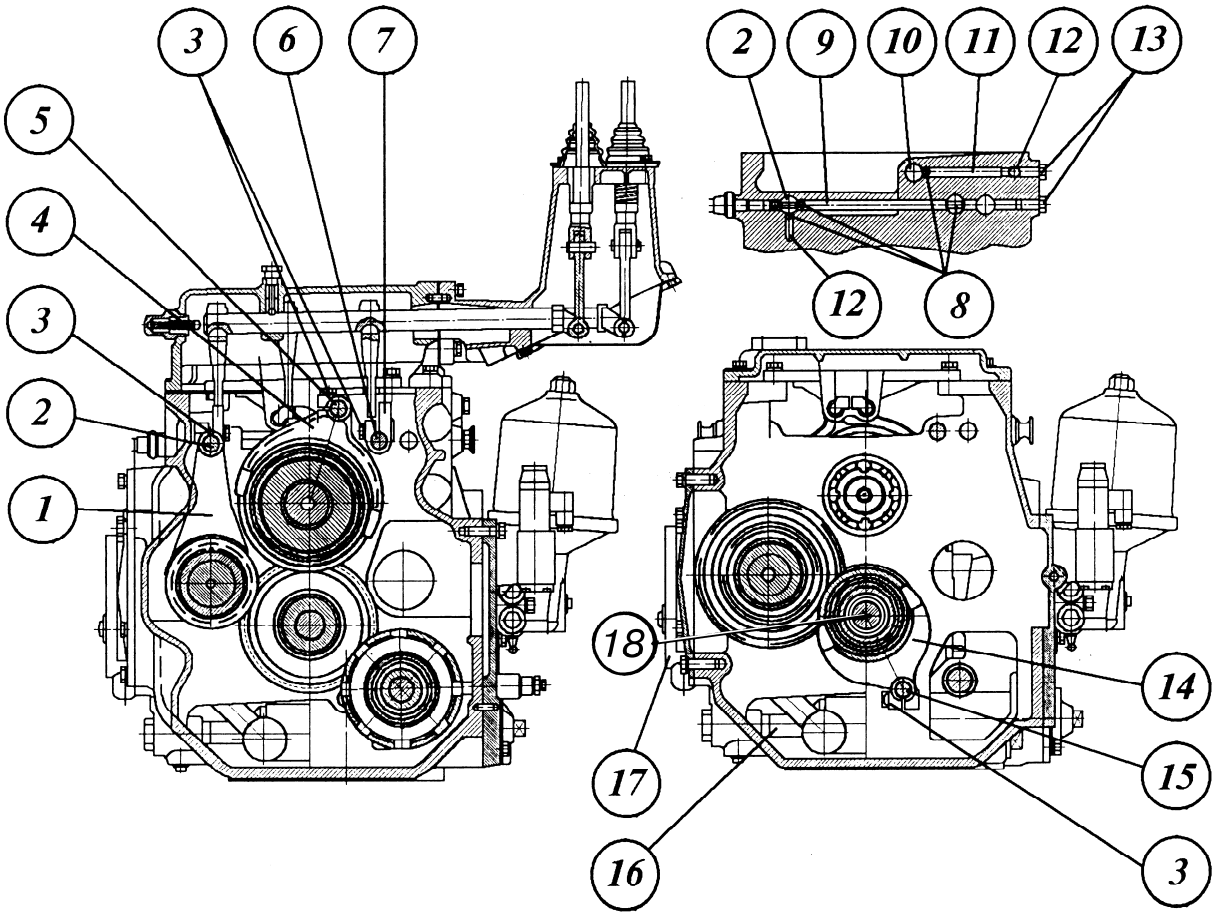


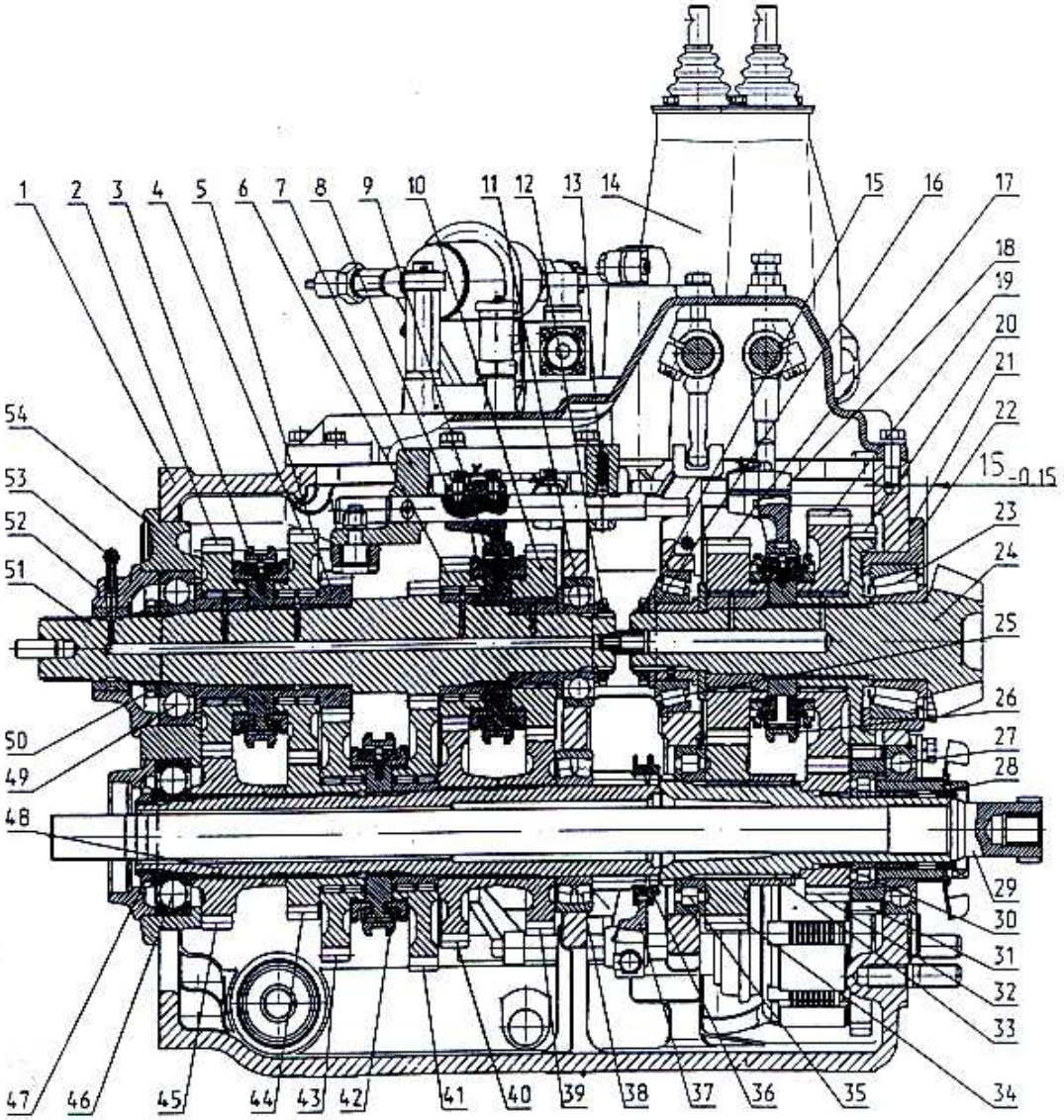
Fig.D-14. Gearbox:

1, 4, 14 – forks; 2, 5, 6, 10, 15 – dogs; 3, 13 – bolts; 7 – dog; 9 – pin; 11 – lock; 12 – spring; 8 – ball; 16 – filter; 17 – pump casing; 18 – inner shaft.

To exclude simultaneous engagement of the two toothed couplings (26) (Fig. E-12.1) and (3) (Fig. E-12.2) the locking balls (8) (Fig. E-14) are installed in holes in the GB casing (Fig. E-14).

D14

Gearbox (24F+12R) (optionally) The gearbox consists (Fig. D-15.1) - mechanical, fixed-ratio, range-type - of a transmission assembly, a shaft of reduced gears and reverse, a secondary shaft supported in bearings in the housing as well as a control mechanism and hydraulic system units.



Longitudinal section of the gearbox:

1 – housing; 2, 4, 5, 6, 10, 17, 19, 20, 31, 32, 34, 39, 40, 41, 43, 44, 45 – gears; 3, 9, 26, 42 – synchronizers; 7 – fork box; 8, 18, 37 – forks; 11, 23, 25, 27, 28, 30, 35, 38, 46, 49 – bearings; 12, 15, 47, 50 – nuts; 13 – ball-point lock; 14 – control mechanism; 16, 21 – adjusting shims; 22 – bearing seat; 29 – independent PTO drive shaft; 33 – gear cluster shaft; 36 – toothed coupling; 48 – intermediate shaft; 51 – primary shaft; 52 – lubricant feed sleeve; 53 – oil pipeline;

The **speed-gear assembly** is mounted on the cover (54) and consists of the primary shaft (51) with driving pinions (2, 4, 6, 10) mounted in needle bearings riding thereon. These pinions ensure engagement of the 5th, 6th, 3rd and 4th gear, respectively. The driving pinion of the 1st gear is made integral with the shaft (51) and the driving pinion of the 2nd gear is fixed rigidly on the shaft. The needle bearings are force-lubricated through the oil pipeline (53) and holes drilled in the shaft. The male splines of the shaft carry two inertia-type synchronizers (4) and (9); the latter effect engagement of the 5th, 6th, 3rd, and 4th gears. The primary shaft rests on ball bearings mounted in the cover (54) and casing (1).

The intermediate shaft (48) carries the press-fitted driven pinions (54, 40 and 39) of the 5th, 6th, 3rd and 4th gear, respectively. The driven pinions (43 and 41) of 2nd and 1st gears, respectively, rest on needle bearings. An inertia-type synchronizer (42) to help engagement of the 1st and 2nd gears.

The downshift and reverse gear shaft 3 (see Fig. E-15.2) is mounted in the body (4) and rests on bearings (1 and 12). The shaft also carries a driven pinion (10) which is coupled to the shaft through bushings (9), forward driving pinion (8) and reverse pinion (5) running in needle bearings. These pinions are coupled with the shaft through a toothed coupling (6). Bushing (16) which sits on male splines of the shaft is locked on the shaft by means of a retaining ring (7).

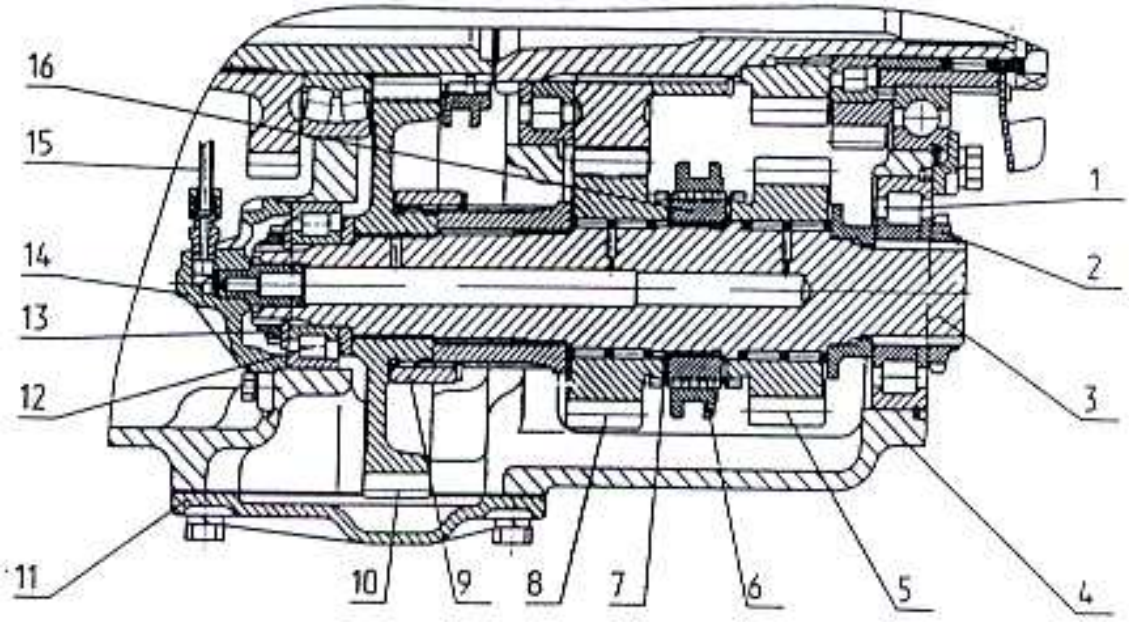


Fig. D-15.2 Downshift and reverse gear shaft:

1, 12 – bearings; 2, 13 – nuts; 4 –casing; 5, 8, 10 –pinions; 6 – toothed coupling; 7 – retaining ring; 9 – bushing; 11 – cover; 14 – oil delivery cup; 15 – oil pipeline; 16 – bushing

D16

The **gear-cluster shaft 33 (see Fig. E-15.1)** is installed in the casing (1) and rests in bearings (27) and (35). Gears (32) and (34) are splined-mounted on the shaft and locked with retaining rings. The PTO driven pinion (31) is mounted on the shaft in roller bearings (28) and (30).

The **secondary shaft 24 (see Fig. E-15.1)** is installed in the body (1) in tapered bearings (23) and (25). The bearings are adjusted by shims (16), while the position of the shaft bevel pinion relative to the body end-face (size $15_{-0.15}$) is adjusted through selection of the adjusting shims (21). The FDA and synchronous PTO drive pinion (20) and the synchronizer (26) boss are rigidly fixed on the shaft. The driven pinions (17) and (19) rest in needle bearings; the latter are force-lubricated through the holes drilled in the shaft. The shifting between the pinions is made with the locked-on-dog fork (18) by means of the synchronizer (26). The dog is installed in a recess in the casing (1) and fixed with a ball-point lock.

The sets of components on the primary, intermediate, secondary as well as down-shift-and –reverse gear shafts are tightened up by nuts (12, 15, 47 and 50).

Transmission Gearbox Control Mechanism

The transmission gearbox mechanism comprises a gear-shift mechanism and a speed-range change-over mechanism with an electro-hydraulic system of change-over between high “H” and lower “L” stages of the GB reduction gear.

The **gear-shift mechanism (Fig. E-15.3)** is mounted in the speed-gear assembly, fork member (7) and the control mechanism (14) cover (see Fig. E-15.1).

The cover (54) (Fig. E-15.1) houses the dogs with shifting forks of 1st, 2nd and 5th, 6th gears fastened thereto. The dogs are fixed in the cover with ball-point locks. The position of forks on the dogs is adjusted by means of tapered screws

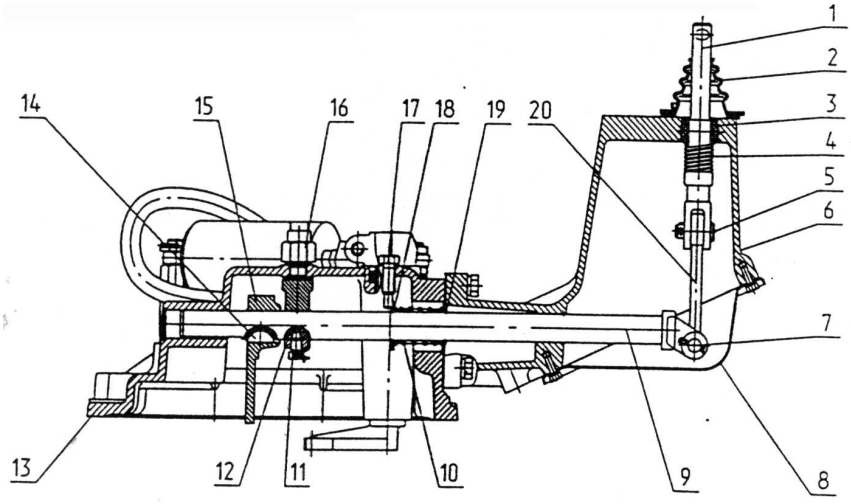


Fig. D-15.3. Gear-shift mechanism:

1 – fork; 2 – boot; 3 – sphere socket; 4 – spring; 5, 7 – pins; 6 – casing; 8 – cover; 9 – shaft; 11 – bolt; 12 – bushing; 13 – cover; 14 – key; 15, 20 – levers; 16 – pick-up; 17 – screw; – 18 – washer; 19 – retaining ring

Three dogs, a fork (8), ball-point lock (13) and parts of the two gear engagement lockout mechanism are installed in the fork assembly (7). The member is attached to the transmission gearbox casing (1).

The shaft (9) with the arm (15) and bushing (12) fitted thereon is installed in the supports of cover (13) and casing (6) (see Fig. E-15.3). The two bushings (18) and spring (10) are installed between the retaining rings (19). The bushing end-faces abut the screw (17) and the casing (6) end-face. This arrangement serves to set the gear-shift lever to neutral. The shaft (9) is coupled with fork (1), with the gear-shift lever fixed thereto through the pins (5 and 7) and lever (20). The fork (1) is located in the casing (6), in the sphere socket (3) and spring-loaded with the spring (4).

The **speed range change-over mechanism (Fig. E-15.4)** is installed in the transmission gearbox casing (1) and cover of the gear-shift mechanism (14) (see Fig. E-15.1).

In the casing (1), the fork (37) for changing-over the toothed coupling (36), the fork for changing-over the toothed coupling (6) (see Fig. E-15.2) and the fork (18) for changing-over the synchronizer (26) (see Fig. E-15.1) are mounted on the dogs. The dogs are locked in the body with ball-point locks.

In the control mechanism (Fig. 15.4), the shaft (9) together with arms (10) keyed thereto rests in the supports of cover (12) and housing (18). The shaft (9) is locked with a ball-point lock (14) and is connected to fork (1) with attached speed-range change-over lever by means of pins (5 and 7). The fork (1) is located in the casing (18), in the sphere socket (3) and preloaded with spring (4).

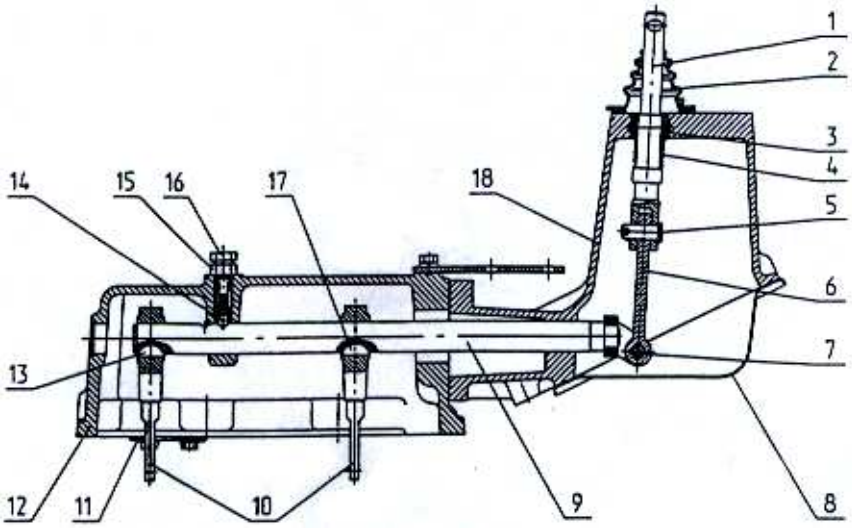


Fig. D-15.4. Speed-range change-over mechanism:

1 – fork; 2 – boot; 3 – sphere socket; 4 – spring; 5, 7 – pins; 6, 10 – levers; 8 – covers; 9 – shaft; 11 – link; 13, 17 – keys; 14 – ball-point lock; 15 – nut; 16 – bolt; 18 – casing.

D18

The **high-to-low reduction gear stage switch-over mechanism of the transmission gearbox** (Fig. E-15.5) is mounted on the gear-shift mechanism cover and consists of a cylinder (11) fixed on the axle (12), pusher (7) and lever (5) mounted on the roller (4). The fork (16) is connected with the lever (5) by means of the pin (6). The lever of the roller (4) meshes with the dog of the fork (18) (Fig. E-15.1) and forces the synchronizer (26) coupling to move as the roller rotates. The position of lever (5) is adjusted by changing the length of the pusher (7) with further locking by a check-nut (8). The cylinder (11) communicates with the hydraulic system through an electro-hydraulic valve (14). The sensor (15) connects the valve (14) to the electric circuit when the gear-shift lever is in its neutral position, only. The drawn-in position of the cylinder corresponds to the lower “L” stage of the transmission gearbox reduction gear. Pressure-sensitive pick-ups (10) serve to indicate the engaged state of the reduction gear.

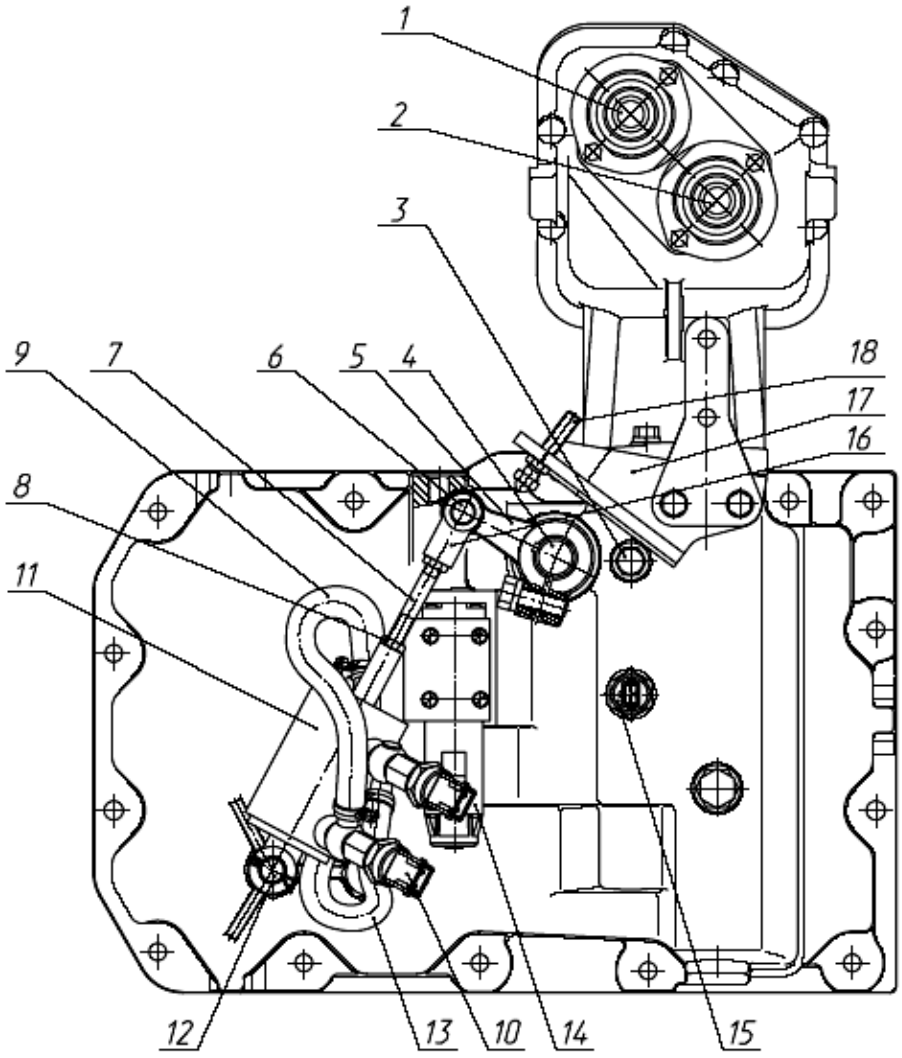


Fig. D-15.5. High-to-low reduction gear stage switch-over mechanism:

1 – gear-shift fork; 2 – speed range change-over fork; 3 – bolt; 4 – roller; 5 – lever; 6 – pin; 7 – pusher; 8 – check-nut; 9, 13 – oil pipelines; 10 – pressure-sensitive pick-up; 11 – hydraulic cylinder; 12 – axle; 14 – electro-hydraulic valve; 15 – sensor, 16 – fork, 17 – bracket, 18 – adjusting screw.

Transmission Gearbox Reduction Gear Control System

The electro-hydraulic control system (Fig. E-15.6) involves a control panel (1) located in the tractor cab to the right of the driver, a gear-shift and reduction gear stage switch-over lever (3), GB neutral pickup (5), sensors (7 and 8) mounted on the reduction gear switch-over hydraulic cylinder (11) (Fig. E-15.5), electro-hydraulic distributor (6) located atop of the transmission gearbox cover, and connecting cables (4) with terminal blocks (9). The system is supplied with power from the on-board power system through a fuse block (2). Voltage is applied following the engine start-up.

The handle of the lever (3) contains the pushbuttons (10 and 11) and indicators (LEDs) (13, 12) to signal the high or low reduction gear stage ON-state, respectively.

The panel (1) contains also the indicators (15 and 14) to signal the ON-state of the high or low reduction gear stage and reduction gear control relay.

The system allows the reduction gear stages to be switched over when the lever (3) is in its neural position only (contacts of the transmission gearbox neutral position pickup (5) are closed).

Signals are applied to sensors (13, 12) and (15, 14) from respective pressure-sensitive pickups (8, 7).

Following the engine start-up, the default setting is the reduction gear low stage ON. In this case, the LED indicators (13, 15) should be on.

Switch over to the reduction gear high stage is to be effected by depressing the pushbutton (11). Now, the LED indicators (13, 15) should go off, while LEDs (12, 14) turn on.

Switching over from high to low stage is achieved be depressing the pushbutton (10).

The control system circuit diagram for the GB reduction gear, DL and FDA control is given at the end of the “Manual”.

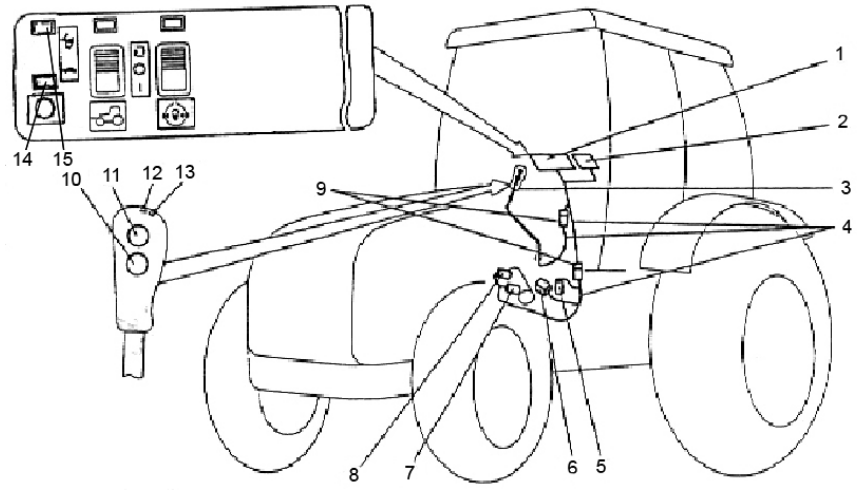


Fig. D-15.6

1 – control panel; 2 – fuse box; 3 – gear-shift and reduction gear stage switch-over lever; 4 – connecting cables; 5 – transmission gearbox neutral position pickup; 6 – reduction-gear electrical distributor; 7 – higher stage pressure pickup; 8 – lower stage pressure pickup; 9 – terminal blocks; 10 – lower stage switch-on pushbutton; 11 – higher stage switch-on pushbutton; 12 – higher stage LED indicator; 13 – lower stage LED indicator; 14, 15 – pilot lamps.

ATTENTION! The reduction gear stages shall be only changed-over from the lower stage to the higher one and vice versa when the tractor is fully stopped.

D20

Engine Starting Interlock

As a precautionary measure against the engine starting when the range is switched on, the tractor is equipped with a special interlock device (Fig. E-15.7). The interlock consists of a switch (8) located in the transmission gearbox casing on the left side, balls (6) and pins (7, 7a).

On switching the range on, the interlock mechanism opens the switch contacts and breaks the circuit of the starter intermediate relay (1).

The shims (9) are provided to adjust the instant of contact opening (9).

ATTENTION! Before proceeding to starting the engine, set the transmission gearbox speed-range change-over lever to its neutral position!

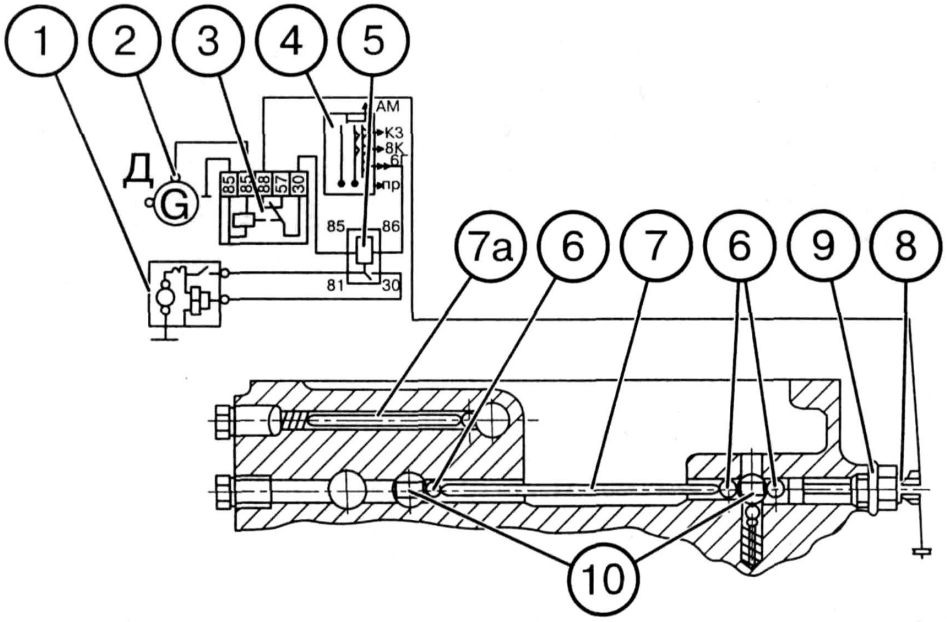


Fig. D -15.7. Diagram of interlocking the engine starting:

1 – starter; 2 – alternator; 3 – interlock relay; 4 – starter switch; 5 – starter relay; 6 – interlock mechanism balls; 7 – pin; 7a – lock; 8 – unlock switch; 9 – adjusting shims; 10 – range switch-over dogs

Rear Axle

The rear axle (Fig. E-16) consists of the final drive, differential assembled with a hydraulically-driven friction clutch used for locking, hub drives located in the rear axle housing, and the will transmission assemblies located in the half-axle housings.

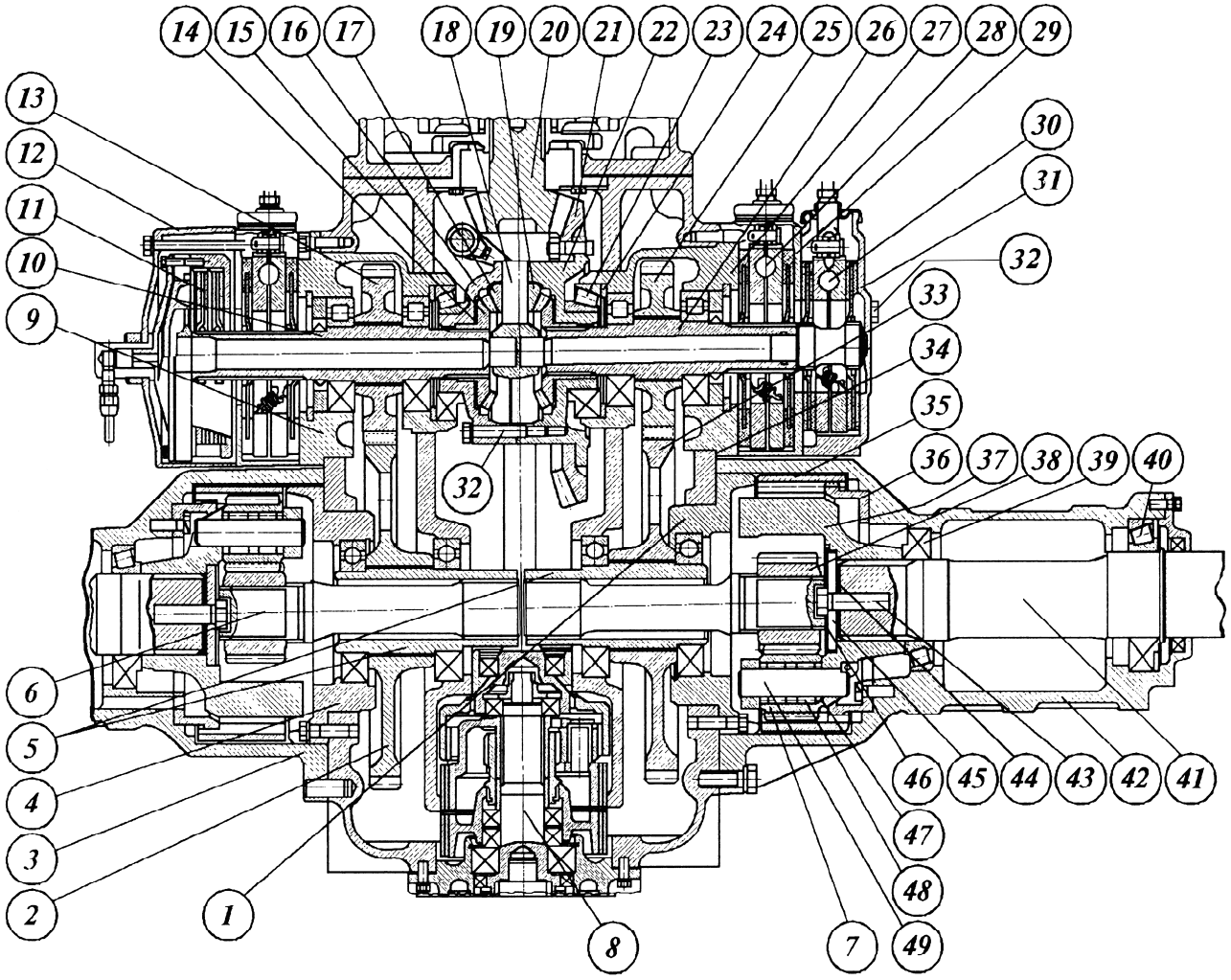


Fig. D-16. Rear axle:

1, 4, 9, 27 – bearing bodies; 2 – hub-drive gear; 3 – left-hand half-axle housing; 5 – hub-drive gear bushings; 6 – torsion bar; 7 – differential pinion; 8 – PTO; 10 – left-hand hub-drive pinion shaft; 11 – differential lock clutch; 12 – differential lock housing; 13 – hub-drive pinion; 14 – half-axle gear bearing washer; 15 – half-axle gear; 16 – differential cover; 17 – differential pinion; 18 – differential spider; 19 – spherical washer; 20 – final drive pinion; 21 – final drive gear; 22 – differential case; 23 – bearing; 24 – thrust ring; 25 – hub-drive pinion; 26 – right-hand pinion shaft; 28 – service brake; 29 – service brake housing; 30 – parking brake; 31 – parking brake housing; 32 – bolt; 33 – hub-drive gear; 34, 44 – adjusting shims; 35 – crown gear; 36 – crown gear hub; 37 – cage; 38 – sun gear; 39, 40 – bearings; 41 – half-axle; 42 – right-hand half-axle; 43 – bolt; 45 – thrust washer; 46 – arresting plate; 47 – washer; 48 – rollers; 49 – differential pinion axle.

Final Drive

The final drive of a bevel circular-arc teeth type consists of a final-drive bevel pinion (20), which is integral with the transmission gearbox secondary shaft, and a final drive gear (21), the latter being bolted to the differential case (22).

Differential

The differential of the closed lockable bevel-pinion type consists of the case (22) and cover (16) fastened together by means of the bolts (32), four differential pinions (17) together with spherical washers (19) and two thrust washers (14). The differential case is installed as an assembly in the rear-axle housing in two roller bearings (23). To lock the differential, the hydraulically-controlled friction multiple-disk clutch (Fig. E-17) which interlocks the cross and the differential pinions with the left-hand half-axle gear of the differential.

Hub Drives

The hub drives consist of two pairs of straight spur pinions and gears (13, 2) and (25, 33) (Fig. E-16).

The hub-drive pinions (13, 25) are mounted in the splines of shafts (10, 26) which are running in roller bearing bodies. The differential is locked axially by means of the bearings (23).

The shafts (10) and (26) link the half-axle gears (15) with the hub-drive pinions and the brake disks through their spline joints.

The hub-drive gears (2, 33) are mounted on splined bushings (5) which are mounted on ball bearings.

The adjusting shims (34) with the thickness of 0.2 mm and 0.5 mm are inserted between the flanges of the bearing bodies (9, 27) and the rear axle housing for adjustment of the axial clearance in the bevel roller bearings (23) and backlask in the final drive pinion-to-gear (20), (21) pair. The bevel roller bearings shall be so adjusted that the torque needed for turning the differential would be 5 to 8 N-m. The backlash in the final drive shall be within the range 0.20…0.55 mm.

Wheel Transmissions

The wheel transmissions are made up of two straight-spur planetary trains, located in the half-axle housings (3, 42), torsion bars (6) made with splines which link the hub-drive gears (2, 33) with the above-mentioned planetary trains through splined bushings (5).

The planetary train consists of a fixed crown gear (35) mounted on the boss (36) and bolted to the housing (42); carrier (37); sun gear (38) seated on the splines of torsion bar (6) and four differential pinions (50) running on the rollers (48) of the axles (49).

The half-axle bearings (39, 40) are adjusted by formation of stocks of shims (44) with the thickness of 0.2-mm and 0.5 mm.

Differential Lock Clutch and Three-Disk Service Brake

The multiple-disk hydraulically controlled differential lock clutch (1) (Fig. E-17) is located in casing (8) which is bolted to the rear axle housing through the housing of the left-hand three-disk brake and the bearing body. The three-disk dry service brake housing (17) contains the brake disks (16), pressure disks (13), intermediate disk (11), balls (15) and brake release springs (not shown).

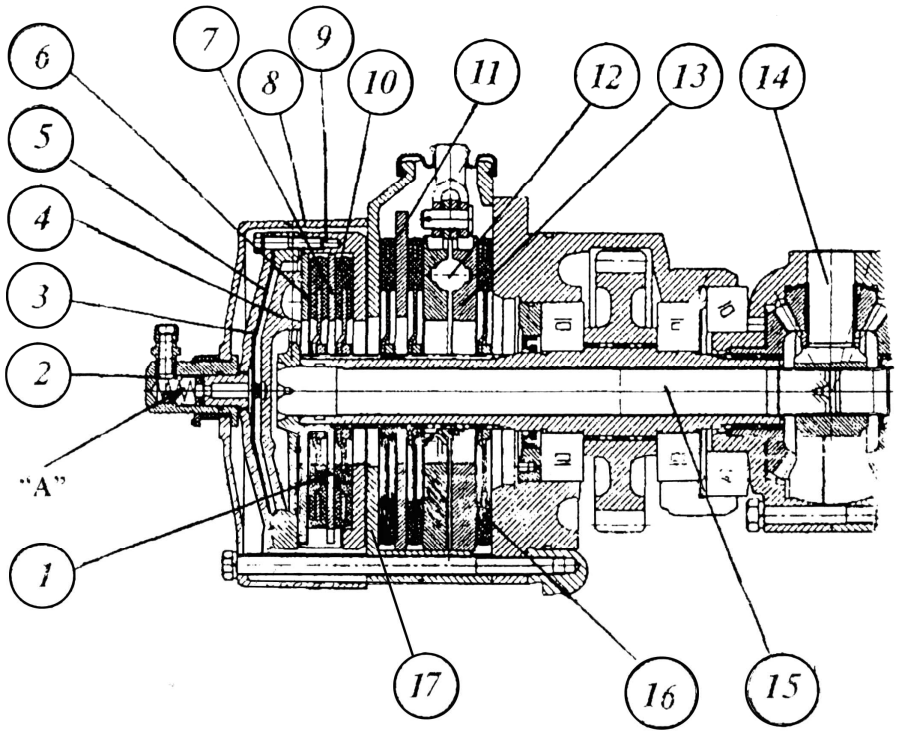


Fig. D-17. Differential lock clutch:

1 – lock clutch; 2 – adapter; 3 – diaphragm cover; 4 – pressure disk; 5 – diaphragm; 6 – release disk; 7 – intermediate disk; 8 – housing; 9 – clutch body; 10 – locking; 11 – brake intermediate disk; 12 – ball; 13 – pressure disk; 14 – differential spider; 15 – lock-up shaft; 16 – brake disk; 17 – left-hand three-disk brake housing.

The clutch consists of lock-up shaft (15) which is spline-coupled with the differential spider (14), body (9), pressure disk (4), release disk (6), diaphragm (5), cover (3), adapter (2) and disks (10) spline-mounted on the left-hand wheel transmission pinion.

Under the action of oil delivered under pressure to the rod-end chamber “A” from the ADL control hydraulic system, the diaphragm (5) in conjunction with the pressure disk (4) moves and presses disks (10) against the bearing surfaces of the clutch body (9), intermediate disk (7) and release disk (6) so that the differential (the differential spider with the left-hand half-axle gear) gets locked. When the front wheels turn to a certain degree from the straight-line motion, the rod-end chamber “A” opens to the discharge line, and the differential unlocks.

Automatic Differential Lock-Up (ADL)

The ABD feature is designed to improve the tractor traction and adhesion properties and off-road capability. It consists of a two-disk hydraulically operated lock-up clutch (Fig. E-17) and an electro-hydraulic control system. The latter ensures two operation modes: “automatic” and “forced”.

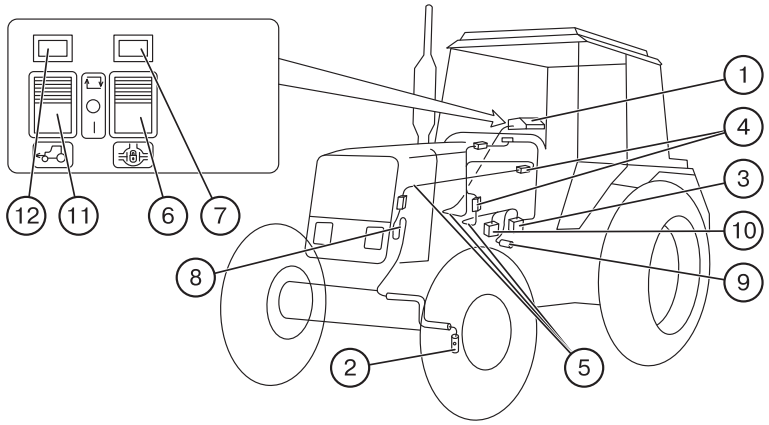


Fig. D-18. Rear axle differential lock and FDA drive control system:

1 – control panel; 2 – steering wheel turning angle sensor; 3, 10 – control electro-hydraulic distributors for the DL and the FDA drive, respectively; 4 – terminal blocks; 5 – connecting cable; 6 – DL control key; 7, 12 – indicator lamps; 8 – loop; 9 – automatic FDA drive control sensor; 11 – FDA drive control key

The electro-hydraulic DL control system of the rear axle (Fig. E-18) is composed of a panel (1), turning angle sensor (2) of steering wheels; installed on the left-hand FDA reduction gear, DL control electro-hydraulic distributor (3) located on the right-hand GB cover and coupled through an oil pipeline with the DL clutch, and connecting cables (5) with terminal blocks (4). The system is supplied with power from the on-board electrical circuit via a safety fuse in the fuse box installed in the dashboard. The system is powered after starting the engine. The key (6) for controlling the DL control and DL indicator lamp (7) are installed on the panel (1) face. The latter is located over the right-hand side tractor control panel.

How to Use the Rear Axle DL Control Key (6)

1. When performing jobs with great amount of relative slippage of the rear wheels, depress the upper part of the key (6) (fixed position), thus, activating the automatic mode of differential lock-up. Now the electromagnet of the DL control electro-hydraulic distributor (3) is energized, the electro-hydraulic distributor spool valve moves and disconnects the lock clutch from the discharge line and connects it with the feed port. Then, the lock-up clutch operates and interlocks the differential and the rear wheels. The differential is unlocked automatically when the steering wheels turn to a certain degree.
2. If a short-time interlocking of the rear wheels is necessary, including occasions of turning, press the lower part of the key (6) and hold it in this depressed position. When released, the key (6) returns to its middle, fixed position, and differential interlock unlocks.

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Service Brakes (MTZ-1221.2/1221.3)

The tractor is equipped with three-disk dry brakes of an increased standard size. The disks of the left- and right-hand brakes (2) (Fig. E-20) are spline-mounted on the rear axle hub drive pinions. The brakes consist of housings (1), friction disks (2), pressure disks (4), balls (5) and contraction springs (6).

The brake actuator is of mechanical type. Each brake is activated by a separate pedal (23).

To brake both wheels at the same time, interlock of the pedals with a latch strip (24). When the right-hand brake pedal is depressed, the stop-signal lamps light up.

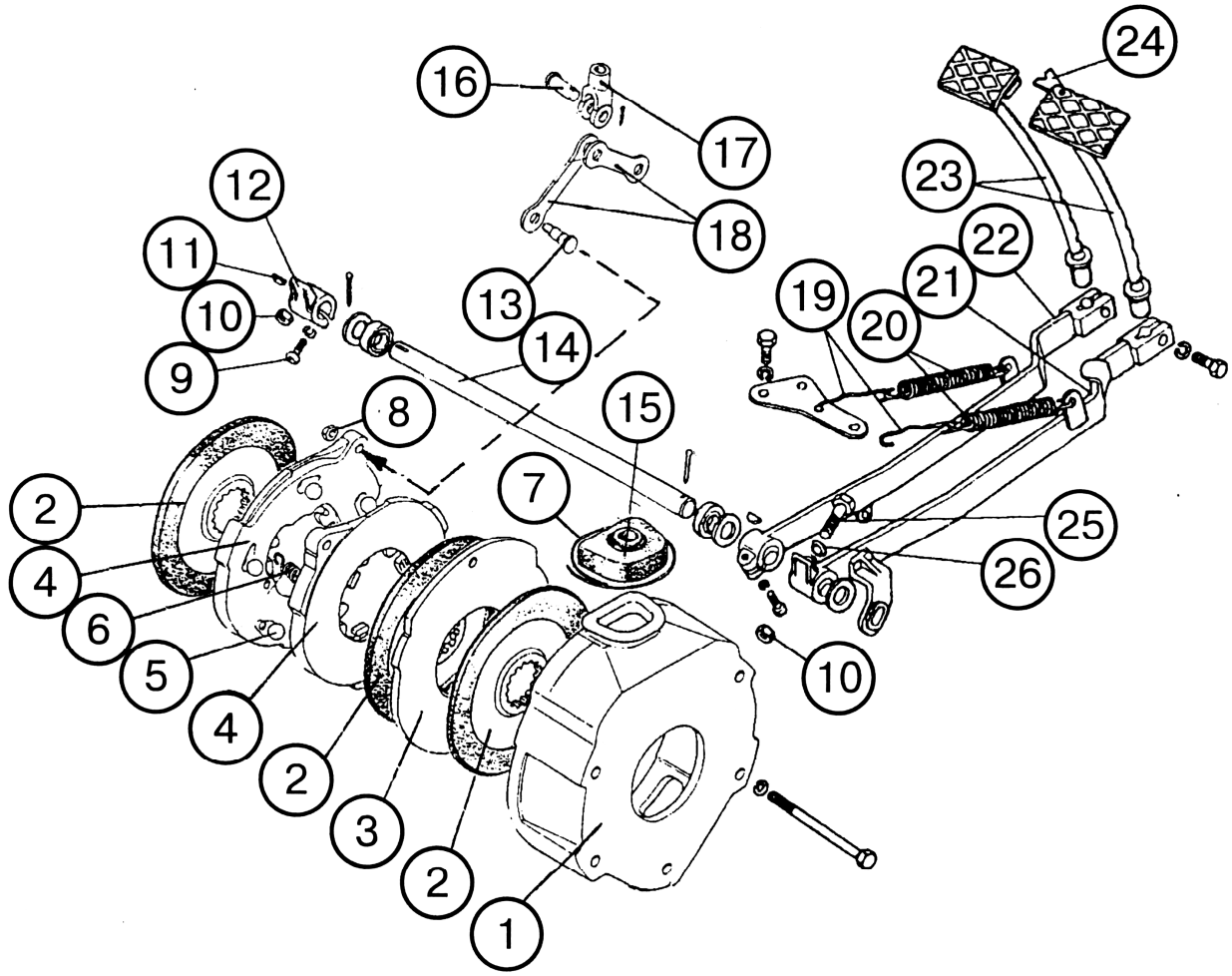

Fig. D-20. Service brakes and their controls (exploded view):

1 – housing; 2 – brake disk; 3 – intermediate disk; 4 – pressure disk; 5 – ball; 6 – spring; 7 – wire; 8 – nut; 9 – bolt; 10 – check nut; 11 – key-tongue; 12 – lever; 13 – pin; 14 – axle; 15 – boot; 16 – pin; 17 – fork; 18 – tie-rod; 19 – hooks; 20 – contraction spring; 21, 22 – lever; 23 – stem with pad (pedal); 24 – latch strip; 25 – adjusting bolt; 26 – spherical washer

D26
Parking brake

The tractor is equipped with a dry two-disk parking brake of reduced standard size (with the diameter of 178 mm), attached to the housing of the right-hand service brake. The brake disks (5) (Fig. E-21) are mounted on the splines of the shaft (3) located inside the right-hand hub-drive pinion shaft and is connected to the rear-axle differential spider.

The parking brake is applied with the help of lever (11) placed on the right-hand wall of the cab. The lever is locked when set to work by means of a stop catch (12) on the toothed sector (13).

With the parking brake applied, the differential spider interlocks with the rear axle housing through the shaft (3), pressure disks (2), brake disks (5), and casing (18).

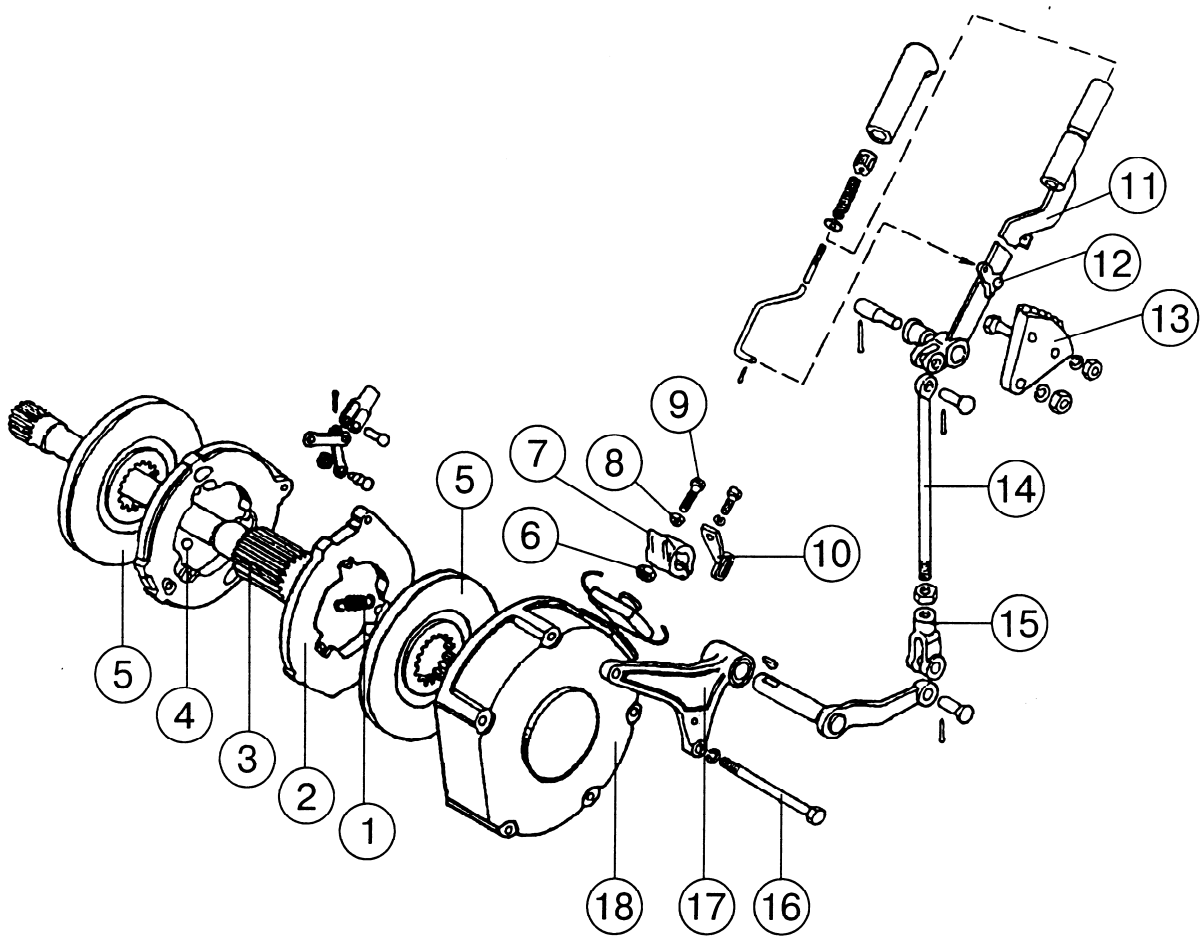

Fig. D-21. Parking brake structure and control:

1 – spring; 2 – pressure disk; 3 – shaft; 4 – ball; 5 – brake disk; 6 – check-nut; 7, 11 – lever; 8 – spherical washer; 9 – adjusting bolt; 10 – brake cock drive lever; 12 – stop catch; 13 – sector; 14 – tie-rod; 15 – fork; 16 – bolt; 17 – bracket; 18 – case

“Wet” Brakes and Rear Axle Differential Lock Clutch (Option)

The tractors can be equipped with multiple-disk service and parking brakes operating in an oil bath.

The rear axle differential lock clutch is mounted in the brake casing and shares a common oil bath; therefore it also made as a “wet” one.

The arrangement of the brakes and lock clutch is shown in Fig. E-21.2.

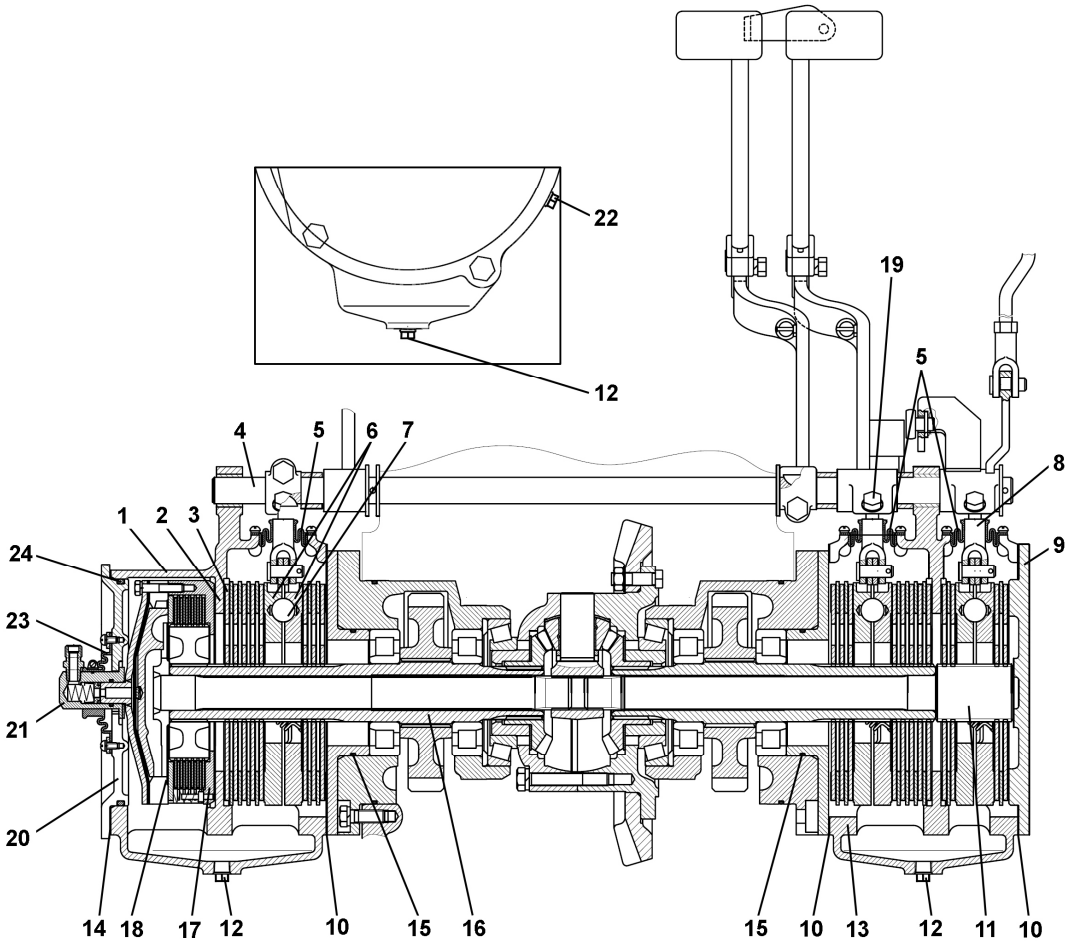

Fig. D-21.2. “Wet” brakes and differential lock

1 – brake casing; 2 – friction disk; 3 – intermediate disk; 4 – pedal axle; 5 – protective boot; 6 – pressure disk; 7 – ball; 8 – parking brake; 9 – cover; 10 – gasket; 11 – parking brake shaft; 12 – drain plug; 13 – brake casing; 14 – gasket; 15 – O-ring; 16 – final drive pinion; 17 – lock clutch; 18 – boss; 19 – adjusting bolt; 20 – cover; 21 – adapter; 22 – inspection and filler plug; 23 – sealing boot; 24 – O-ring.

D28

Service brakes

The service brakes are of 8-disk type. The friction disks (2) are installed in splined ends of the hub drive pinions (16). The pressure disks (6) are similar in design to those used in dry brakes, but with a reduced angle of gradient for balls, to ensure the required force of compression of the packs of the friction and intermediate packs.

Attention! The pressure disks of dry and "wet" brakes have the same physical and fixing dimensions, but they are not interchangeable. It is strictly prohibited to install the disks designated for dry brakes on "wet" brakes or vice versa. Otherwise, the safety of tractor operation could be substantially jeopardized.

The intermediate disks (3) are fixed from turning in their cases (1, 13) by means of shoulders made over the outer profile. The leak-proofness of the oil baths is ensured by the O-rings (15, 24), gaskets (10, 14) and rubber boots (5, 23). The cases are provided with inspection (22) and drain (12) plugs.

Parking Brake

A 4-disk parking "wet" brake (8) is installed in the same case as the multiple disks service brake. Its components are unified with those of the service brake.

Differential Lock "Wet" Clutch

The lock-up clutch (17) comprises six disks with brake ceramic-metal linings fitted on the splined boss (18) connected with the hub drive pinion (16). A pack of six friction and five intermediate disks is compressed as oil under pressure is fed to the diaphragm space. The frictional torque developed thereby ensures interlocking of the rear axle differential. The clutch is made in a single case with the service brake. It shares a common oil bath with the brake and is sealed by means of the cover (20) and special corrugated boot (23) slipped over the adaptor (21) which delivers oil to the head space of the diaphragm.

Brake Actuators

The service and parking brake actuators are of mechanical type and consist of the leverage and pedals.

The actuators of service and parking brakes of "wet" type are fundamentally the same as those used in dry brakes on a respective tractor model.

Pneumatic equipment

Single-line pneumatic drive of trailer brakes

The tractors can be equipped with the single-line and double-line pneumatic drive of the trailers brakes, fitted up with the brakes pneumatic drive.

The pneumatic drive is used for tyre and other goals, where the energy of compressed air is required.

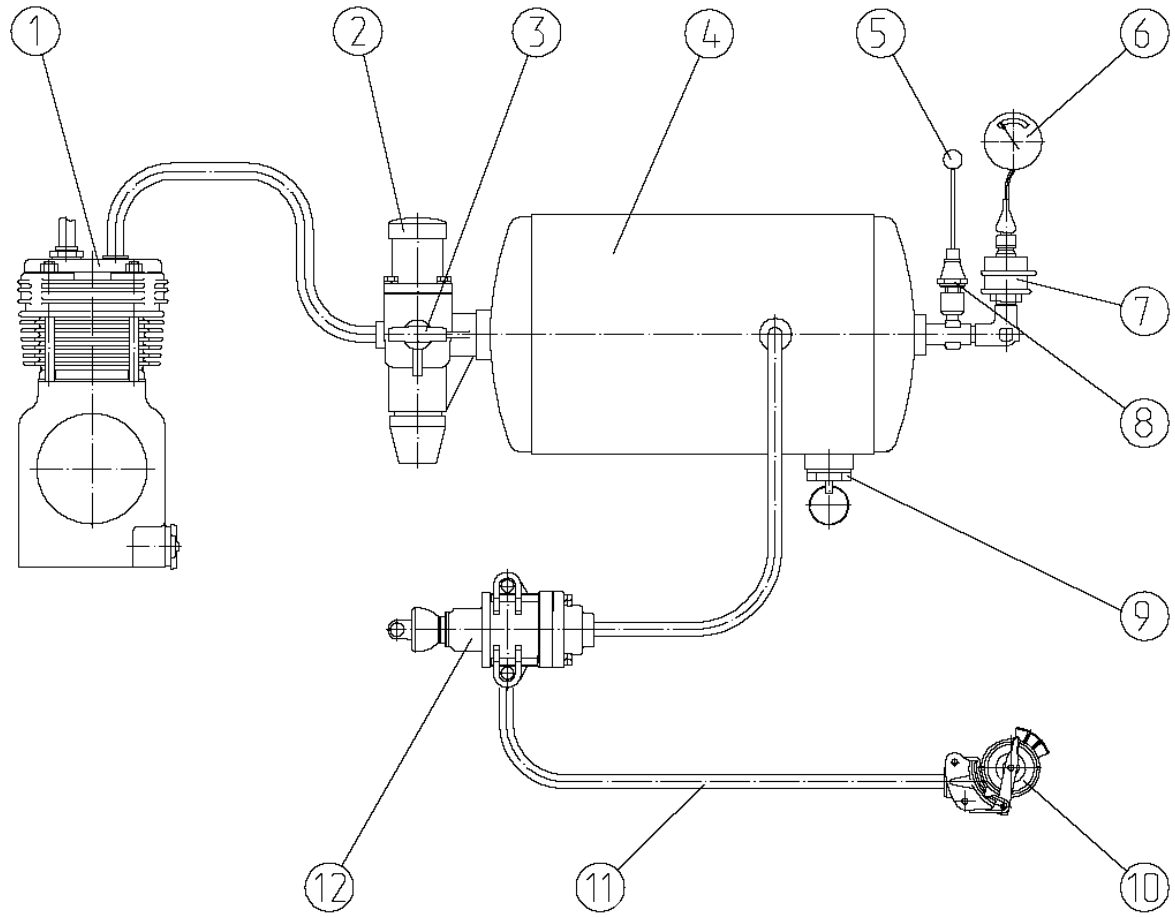

Fig. D-21.4. Double-line pneumatic actuator of the trailer brakes

1 – compressor; 2 – pressure regulator; 3 – air bleeder valve; 4 – air bottle; 5 – emergence pressure indicator light; 6 – pressure indicator; 7 – pressure sensor; 8 – emergence pressure sensor; 9 – condensate drain cock; 10– coupling heads; 11 – control duct; 12 – brake valve.

Air intake into the pneumatic drive is made through the engine inlet duct. Air is compressed in the compressor (1) and, then, fed to the air bottle (4) via a pressure regulator (2). The latter helps to maintain the required pressure in the bottle. Compressed air is supplied from the air bottle to the brake valve (13) and into the feed duct (12) with a coupling head (a red lid) which is permanently under pressure. The brake valve (13) is connected with the coupling head (10a) (with yellow lid) through the control duct (11). There is no pressure in this head.

The trailers' and farm machinery brakes are controlled in two modes: direct and automatic.

In case of use of the trailer with double-line pneumatic actuator, the coupling heads of the trailer are connected to those (10) (with a red lid) and (10a) (with a yellow lid), i.e. to the feed duct (12) and to the control duct (11). Here compressed air is fed continuously to the trailer

through the fed duct (12). On stepping the brake pedals or applying the parking brake, compressed air is delivered to the trailer through the brake valve (13) and control duct (11). The air distributor on the trailer operates to feed the compressed air from the trailer bottle into the brake chambers that causes the braking of the trailer.

The **direct brake control** is achieved through the pressure increase in the control duct (11) up to 6.5…8.0 kgf/cm^2 when braking the tractor. As this takes place, the feed duct (12) remains under pressure, and compressed air supply to the trailer's pneumatic system is still retained.

The **automatic brake control** (automatic braking) is effected due to a pressure drop in the trailer feed duct in case of rupture of the coupling and detachment of the trailer.

The coupling ducts are fitted with coupling valve-type heads (10) at their ends. The valve of the coupling heads prevents the exit of air when the pneumatic drive is used with no trailer attached (for example, when inflating tyres) and in case of emergence detachment of the trailer. On coupling the duct of the tractor with that of the trailer, the coupling head valve opens to ensure the passage of compressed air from the tractor's pneumatic drive to the trailer. The connecting ducts should be couple together at zero pressure in the tractor air bottle (4).

The air pressure in the bottle (4) is monitored by the air pressure indicator (6) and red indicator lamp of air emergency pressure (5) (installed in the dashboard), air pressure sensors (7) and air emergence pressure sensor (8).

The air bottle (4) is provided with the cock (9) for draining condensate. To drain condensate move the pusher ring aside and upwards.

The air intake from the pneumatic actuator (for inflating the tyres, etc.) is performed through the air bleeder valve (3) of the pressure regulator (2).

Double-Line Pneumatic Actuator of the Trailer Brakes

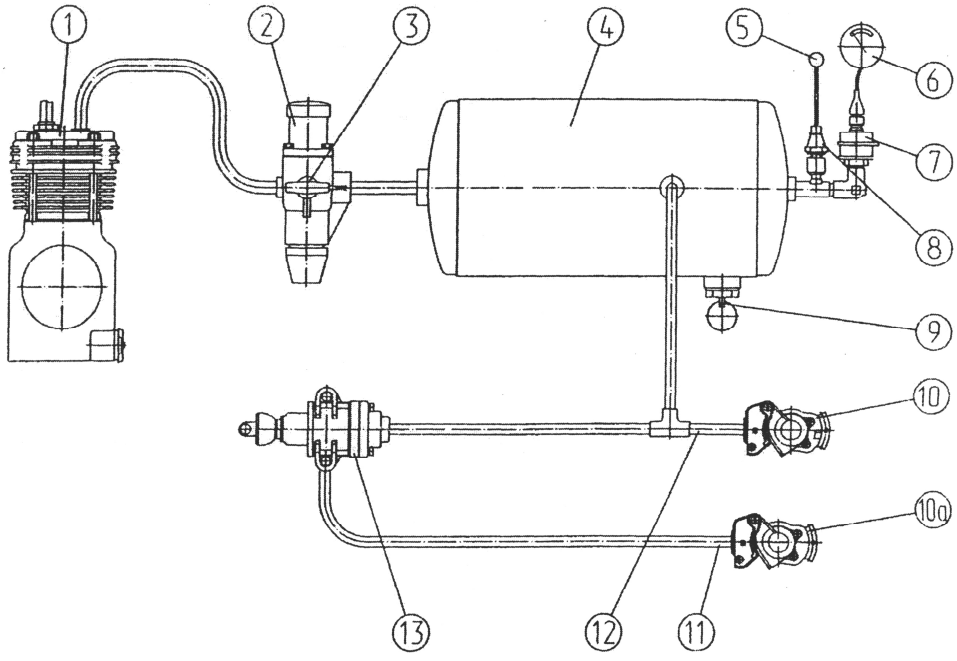

Fig.D-21.4. Double-line pneumatic actuator of the trailer brakes

1 – compressor; 2 – pressure regulator; 3 – air bleeder valve; 4 – air bottle; 5 – emergence pressure indicator light; 6 – pressure indicator; 7 – pressure sensor; 8 – emergence pressure sensor; 9 – condensate drain cock; 10, 10a – coupling heads; 11 – control duct; 12 – feed duct; 13 – brake valve.

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Air intake into the pneumatic drive is made through the engine inlet duct. Air is compressed in the compressor (1) and, then, fed to the air bottle (4) via a pressure regulator (2). The latter helps to maintain the required pressure in the bottle. Compressed air is supplied from the air bottle to the brake valve (13) and into the feed duct (12) with a coupling head (a red lid) which is permanently under pressure. The brake valve (13) is connected with the coupling head (10a) (with yellow lid) through the control duct (11). There is no pressure in this head.

The trailers' and farm machinery brakes are controlled in two modes: direct and automatic.

In case of use of the trailer with double-line pneumatic actuator, the coupling heads of the trailer are connected to those (10) (with a red lid) and (10a) (with a yellow lid), i.e. to the feed duct (12) and to the control duct (11). Here compressed air is fed continuously to the trailer through the fed duct (12). On stepping the brake pedals or applying the parking brake, compressed air is delivered to the trailer through the brake valve (13) and control duct (11). The air distributor on the trailer operates to feed the compressed air from the trailer bottle into the brake chambers that causes the braking of the trailer.

The **direct brake control** is achieved through the pressure increase in the control duct (11) up to 6.5…8.0 kgf/cm^2 when braking the tractor. As this takes place, the feed duct (12) remains under pressure, and compressed air supply to the trailer's pneumatic system is still retained.

The **automatic brake control** (automatic braking) is effected due to a pressure drop in the trailer feed duct in case of rupture of the coupling and detachment of the trailer.

The coupling ducts are fitted with coupling valve-type heads (10) at their ends. The valve of the coupling heads prevents the exit of air when the pneumatic drive is used with no trailer attached (for example, when inflating tyres) and in case of emergence detachment of the trailer. On coupling the duct of the tractor with that of the trailer, the coupling head valve opens to ensure the passage of compressed air from the tractor's pneumatic drive to the trailer. The connecting ducts should be couple together at zero pressure in the tractor air bottle (4).

The air pressure in the bottle (4) is monitored by the air pressure indicator (6) and red indicator lamp of air emergency pressure (5) (installed in the dashboard), air pressure sensors (7) and air emergence pressure sensor (8).

The air bottle (4) is provided with the cock (9) for draining condensate. To drain condensate move the pusher ring aside and upwards.

The air intake from the pneumatic actuator (for inflating the tyres, etc.) is performed through the air bleeder valve (3) of the pressure regulator (2).

D32

Rear PTO

The rear PTO is provided with the two-speed independent (540 and 1,000 rpm) and synchronous (4.18 revolutions per metre en route) drives.

The **independent drive** is provided from the bearing disk of the clutch via a two-speed PTO drive reduction gear, inner GB shaft (18) (Fig. E-14), drive shifting clutch (27) (Fig. E-22) onto the crown gear shaft (26) of the PTO epicyclical reduction gear.

The **synchronous drive** is provided via the shift clutch (27) which couples the epicyclical reduction gear shaft (26) with GB pinion.

The epicyclical PTO reduction gear is located in the rear axle housing and consists of the crown gear (22) coupled with shaft (26), three satellites (23) on axles (21), cage (25) and sun gear (24).

The sun gear (24) is connected with the engagement drum (17) through a spline joint. The drum is connected to shaft (20) and forms, together with the brake band (16), an engagement band brake.

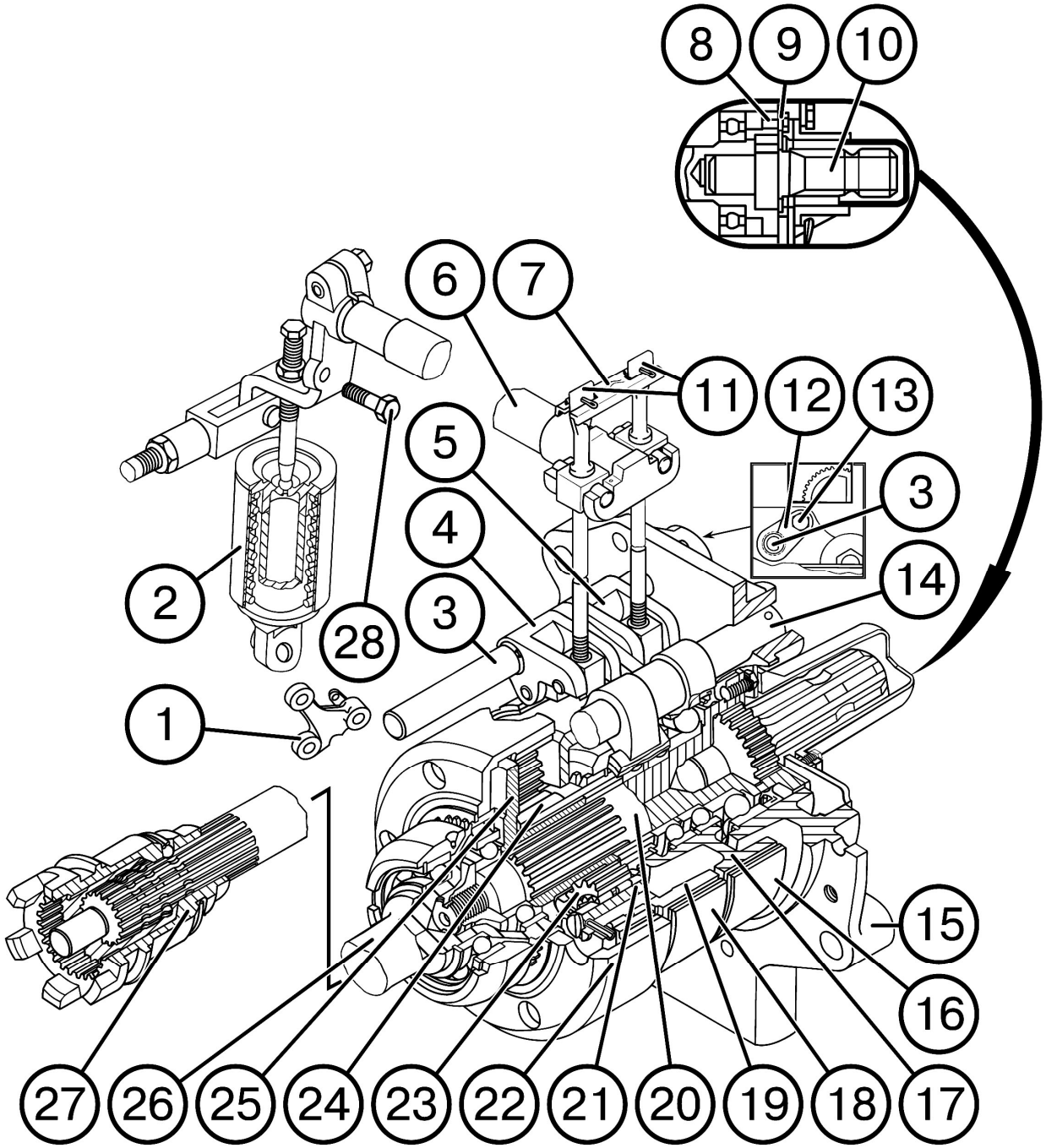
The cage (25) is made integral with the brake drum (19) connected with the shaft (2) and forms, together with the brake band (18), an engagement band brake.

The inner bore of the shaft (20) houses replacement PTO end-pieces (10) – 8 spline (540 rpm) or 21 spline (1000 rpm). The roller (3) of movable ends of the brake band has an eccentric with lever (5) to effect adjustment of the clearance in the band brakes from outside, by simple rotation of the roller (3).

The rear axle casing houses two adjusting screws (11). These are connected to the control roller (6) and levers (4), (5).

The **PTO is engaged** when the brake band (16) is tensioned and the brake band (18) is released. In this case, the engagement drum (17) and the sun gear (24) connected thereto are brought to rest. Rotational motion is transferred from the crown gear (22) to the cage (25) and PTO shaft (20) through satellites (23) running about the stopped sun gear (24).

The PTO is disengaged when the brake band (18) is tensioned and the brake band (16) is released. In this case the PTO replacement end-piece is brought to standstill (10).



Pic. D-22. Rear PTO epicyclical reduction gear:

1 – bracket; 2 – hydraulic cylinder; 3 – eccentric axle; 4, 5 – lever; 6 – control roller; 7 – stop plate; 8 – end-piece fixing bolt; 9 – replacement end-piece stop plate; 10 – replacement end-piece; 11 – adjusting screws; 12 – stop plate; 13 – stop plate fixing bolt; 14 – axle; 15 – rear cover; 16, 18 – brake bands; 19 – brake drum; 20 – PTO shaft; 21 – satellite axle; 22 – crown gear; 23 – satellite; 24 – sun gear; 25 – cage; 26 – crown gear shaft; 27 – drive independent/synchronous shift clutch

D34

Front PTO control mechanism

The front PTO is controlled by means of the electro-hydraulic system.

The electric part of the front PTO control system is incorporated in the integrated system for controlling the real axle DL (differential lock), FDA (front driving axle) drive and front PTO. It consists of the switch (3), pushbutton (4), pilot lamp (5) and relay, which are arranged in the control panel (2) (fig. E-23) located in the cab to the right from the operator and interconnected by means of the cab bundle (1) (that of the integrated system for controlling the DL, FDA and front PTO) according to the attached electric diagram. This bundle is connected with the transmission bundle (6) (that of the integrated system for controlling the DL, FDA and front PTO), which is connected, in turn, to the electro-hydraulic distributor (7) for switching on the front PTO drive.

The system if supplied with power from the on-board power system according to the attached electric circuit diagram. The supply voltage is applied to the system after starting the engine.

The electro-hydraulic distributor (7) controls the oil flow delivered to the hydraulic cylinder of the control mechanism of the band brakes of the front PTO epicyclical reduction gear. The switch (3) has two fixed positions:

- Engagement of the front PTO drive (press the smooth portion of the switch);
- Disengagement of the front PTO (press the corrugated portion of the switch).

To engage the drive of the front PTO, it is necessary to set the switch (3) to the position “Engagement of the front PTO drive” with the engine running and then press the pushbutton (4) for starting the front PTO and release the same. When doing this, the contacts of the relay in the control panel (2) get closed and the electromagnet of the electro-hydraulic distributor (7) is energized, the slide of the electro-hydraulic distributor (7) moves and oil is delivered to the rod-free cavity of the hydraulic cylinder for controlling the front PTO, and the rod cavity is connected with the drain.

The engagement of the front PTO drive is signaled by means of the pilot lamp (5) (fig. E-23).

To disengage the front PTO, it is necessary to set the switch (3) to the position “Disengagement of the front PTO (press the corrugated portion of the switch). When doing this, the contacts of the relay in the control panel (2) get open, the electromagnet of the electro-hydraulic distributor (7) is de-energized, the slide returns to the initial position, the rod-free cavity of the hydraulic cylinder is connected with the drain, oil is delivered to the rod cavity, the front PTO drive is disengaged and the pilot lamp (5) goes out.

When stopping the engine, the front PTO is disengaged automatically. Therefore, to engage the front PTO drive after the next starting of the engine, it is necessary to press the pushbutton (4) (repeat the operations for engaging the PTO).

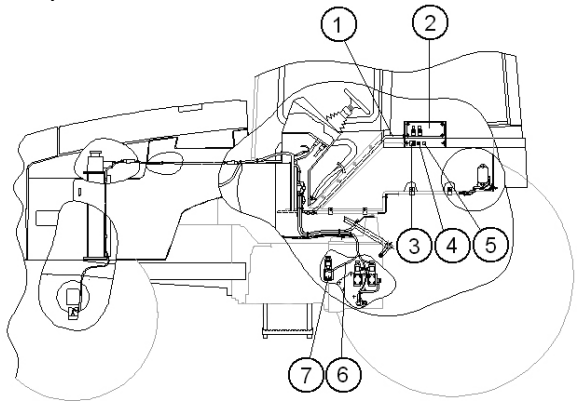


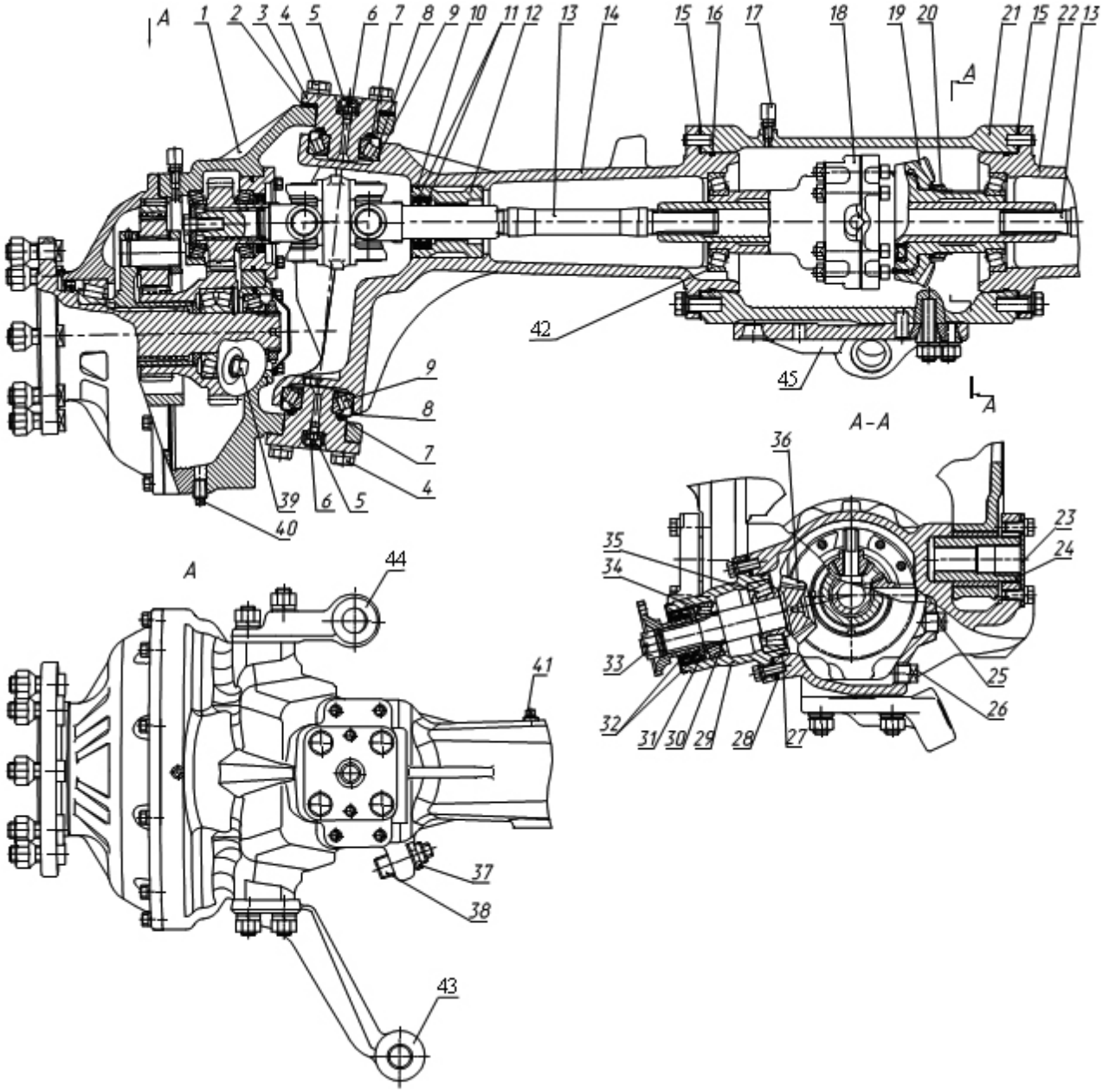
Fig. D-23. Front PTO control mechanism.

1 – bundle; 2 – control panel; 3 – switch; 4 – pushbutton; 5 – pilot lamp; 6 – bundle; 7 – electro-hydraulic distributor

Front driving axle

The front driving axle (FDA) is intended for transmitting the torque from the engine to the front steerable wheels of the tractor. It consists of the final drive, differential and wheel reduction gears.

Its final drive is a pair of conical gears with the helical tooth. The design of FDA with two-speed planetary cylindrical reducing gears of final drives is given on Fig. Д-24.



1 – driven bevel gear; 2, 15, 28 – adjusting shims; 3 – steering knuckle pivot spindle; 4 – bolt; 5 – cap; 6 – lubricator; 7, 10, 16, 27 – rubber ring; 8 – sleeve; 9, 34, 35 – taper roller bearing; 11, 32 – collar; 12 – fixture; 13 – half-axle shaft; 14 – left-hand housing; 17 – breather; 18 – differential; 19 – driven bevel gear; 20 – nut; 21 – FDA casing; 22 – right-hand housing; 23 – washer; 24 – pivot; 25 – plug; 26 – draining plug; 29 – driving gear carriage; 30 – adjusting washers; 31 – wiper ring; 33 – nut; 36 – driving bevel gear; 37 – locknut; 38 – screw; 39 – filling plug; 40 – draining plug, 41 – filling plug, 42 – lubricator.

Fig. D24 – FDA with two-stage planetary-cylindrical reduction of final gear

D36

The driving gear (36) of the final drive is mounted in the carriage (29) on two taper roller bearings. The tightness in the bearings is adjusted by means of adjusting washers (30), after which they are tightened by means of the nut (33). The driven gear (19) is fitted on the splines and centring spigot of the differential casing (18) and locked against axial displacement by means of the nut (20).

The final drive mesh is adjusted by means of the adjusting shims (28), (15) placed between the flange of the driving gear carriage and FDA casing as well as between the left- and right-hand housings and FDA casing, respectively. Before adjusting the mesh, the differential bearings shall be adjusted by means of the shims (15).

The left-hand (14) and right-hand (22) housings connected with the FDA casing (21) by means of bolts form the front axle beam. The FDA casing is provided with a breather (17) maintaining the normal pressure in the cavity of the axle and final drive beam.

The axle beam is filled with oil to the lower edge of the filling opening through the plugs (41) installed in the housings (14) and (22). To drain oil from the axle beam, screw out the draining plug (26) located in the FDA casing. Oil shall be fed through the opening in one of housings until the lubricant in another housing reach the lower edge of the filling opening. The FDA shall be filled with oil on a horizontal surface.

The FDA casing (21) is connected with the beam by means of the pivot (24), on which the axle with the wheels can swing in the cross plane while deflecting to the angles limited by the stops of the ribs in the housings (14) and (22) when they contact the tractor beam. The pivot is locked against axial displacement by means of the washer (23). The pivot is greased through the lubricator (42).

The opening for the plug (25) serves for checking the adjustment of the final drive mesh.

Oil leakage from the cavity of the final drive and axle beam is prevented by using the collars and rubber rings placed in the fixtures, housings and driving gear carrier.

To prevent the oil upthrust upstream the collar of the driving gear, the latter's splined end is fitted with the wiper ring (31) with spiral groves cut over the outer diameter of the ring. A slide bearing with crossed grooves is mounted in the fixture (12).

The housing (21) of the front driving axle is connected with the beam by two hollow axes (24), on which the axle with the wheels can swing in the diametral plane being deviated by angles limited by rib stop in the arms (14) and (22) in case of their contact with tractor beam. Axes are limited against axial displacement by plates.

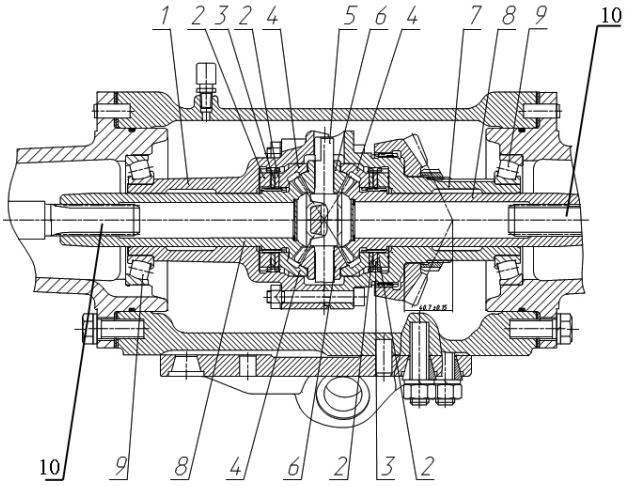
Differential

The differential is self-locking, with increased friction. The casing (1) and cover (7) of the differential bolted together contain the two pairs of satellites (6) on floating pins (5), axle-shaft gears (8), pressure cups (4) as well as driving (2) and driven (3) friction disks.

The self-locking differential connects automatically both the axle shafts and excludes separate skidding of the wheels that increases the tractive force of the front wheels. The locking takes place when the front axle is engaged. At that moment, the satellite shafts turn under load and move over the bevel slots in the casing and cover of the differential, respectively, by the value of the clearances between the friction disks. From the pins, the force is transmitted to the satellites which, in turn, transmit it through their beads to the cups, and the latter press the friction disks against one another until they rest against the walls of the casing and cover of the differential. The driving plates having the outer teeth are in mesh with the teeth of the casing and cover of the differential and the driven plates (through their inner teeth) – with the axle shaft gears. The friction force of the pressed together disks unites the axle-shaft gears and casing with the cover of the differential into a whole while locking in such a way the differential.

When the front axle is engaged and the external forces exceed the friction forces in the friction disks during the turning of the tractor, the friction disks will skid.

The differential is installed in the two taper roller bearings in the housings of the front axle beam. The bearings of the differential are adjusted by means of the shims 15 (see Figure "FDA").



1 – differential casing; 2 – driving plate; 3 – driven plate; 4 – pressure cup; 5 – satellite shaft; 6 – satellite; 7 – differential cover; 8 – axle-shaft gear; 9 - taper roller bearing.10 – semi-axis shaft.

Fig.D-25. Differential

Wheel reduction gears of planetary spur-gear type

Wheel reduction gears of planetary spur-gear type are intended for transmitting and increasing the torque from the FDA differential at various angles of turning of the front steerable driving wheels.

The reduction gears are mounted in the casings (35) and connected with the axle beam by means of spindles (3) (see Figure “FDA”) and can turn relatively to the FDA beam on the two bearings (9). The spindles are connected with the wheel reduction gear casing by means of the bolts (4). The screw (38) and locknut (37) serve for adjusting the angle of turn of the wheel reduction gears.

The pivots (3) are lubricated through lubricators (6) mounted on the pivots. The lubricators are protected against penetration of dirt by means of rubber caps (5). To protect the pivot bearings from dirt, the sleeves (8) with sealing rubber rings (7) are installed in the housings of the axle beam. The pivot bearings (9) are adjusted by means of the shims (2) located under upper spindles (3).

The wheel reduction gear (1) consists of a doubled joint, spur-gear and planetary drives, levers for controlling the turning of the front wheels.

The doubled universal joint (24) (see Figure “Wheel reduction gears”) is connected with the FDA differential by means of half-axle shaft with splined ends (13) (see Figure “FDA”) from the one side and with the driving gear (17) from the other side (see Figure “Wheel reduction gears”) of the spur-gear drive.

The driving gear is mounted on the two taper roller bearings (18). One of them is installed in the counterbore of the reduction gear casing (35) and another – in the carrier (22). The doubled universal joint is fixed in the pinion by means of the washer (15) and bolt (14) with a bent-out plate.

The bearings (18) are adjusted by means of the shims (21) which are placed between the carrier and the reduction gear casing.

The driving gear of the wheel reduction gear is in mesh with the rear block (driven gear of the spur-gear drive) (34) the second crown of which is a sun gear or driving part of the planetary series. The driven part of the planetary series connected with the tractor wheel is the wheel flange which is spline-connected rigidly with the cage (5) by means of three satellites (11), while the epicyclic gear (12) serves as a braked gear perceiving the reactionary torque.

The epicyclic gear is mounted in the reduction gear and fixed against turning by three pins (13). An additional gasket is placed between the cover and casing of the reduction gear. The sun gear is mounted on the wheel flange, on the two-row taper bearing (33) which is fixed from the one side by

means of the thrust ring (36) being in contact with the cage and from the other side – by means of two locking rings (31, 32).

The satellites rotate on the shafts (7) mounted in the counterbores of the cage (5). The cylindrical rollers (8) serve as satellite bearings. One race of the rollers is the ground surface of the shaft (7) and another is the ground internal surface of the satellite (11).

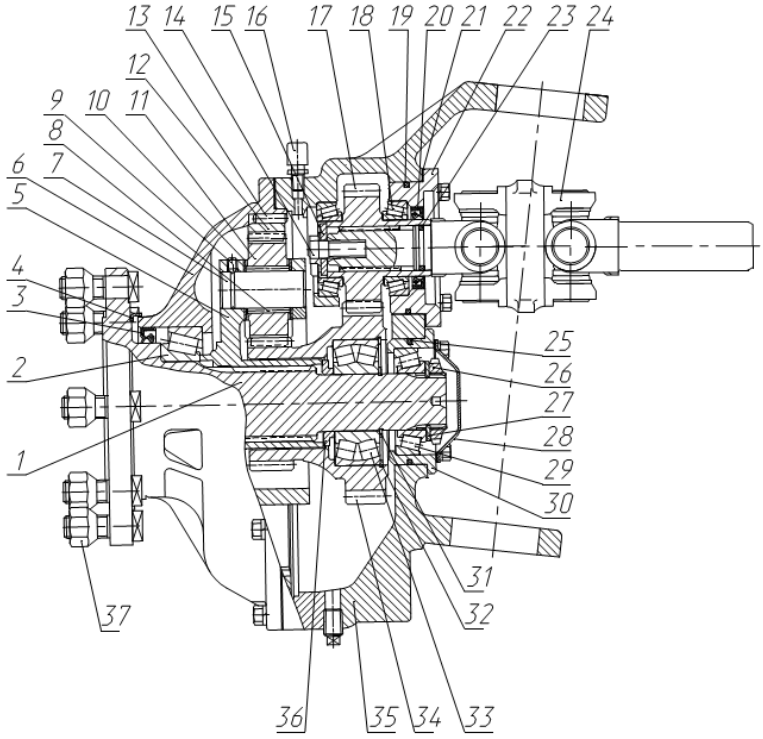
The satellites and rollers are kept from displacement in the axial direction by the washers (10). The force fit in the connection of the cage with the shaft is used for keeping the satellite shafts from the axial displacement. The screw (9) turned into the grove of the shafts serves for checking the correctness of the press-fitting and additional fixation.

The wheel flange is mounted in the two roller bearings. One of them is mounted in the reduction gear cover (6) and the other – in the carrier (30) which is installed in the counterbore of the reduction gear casing, closed by means of the cover (28) and fastened to it by means of the bolts. An additional gasket is inserted between the carrier and the cover.

The bearings are adjusted by tightening the nut (26). The washer (27) is placed between the bearing (29) and the nut (26). To prevent the nut from turning out, the nut shoulder is punched in the slot of the wheel flange.

The reduction gear casing shall be filled with oil to the lower edge of the filling hole, into which the plug (39) is inserted (see Figure “FDA”). To drain oil, unscrew the draining plug (40).

The internal cavity of the wheel reduction gear is sealed by means of the collars (3) (see Figure “Wheel reduction gears”) and (20). The mud trap (4) is installed for preventing the penetration of mud to the working edges of the collar (3). The counterbores of the steering knuckle and splines of the doubled universal joint shall be sealed by means of rubber rings (19, 23, 25). For maintaining the normal pressure in the reduction gear cavities, the reduction gear casing is provided with a breather (16).



1 – wheel flange; 2, 18, 29 – taper roller bearing; 3, 20 – collars; 4 – mud trap; 5 – cage, 6 – reduction gear cover; 7 – satellite shaft; 8 – rollers; 9 – screw; 10 – thrust washer; 11 – satellite; 12 – epicyclic gear; 13 – pin; 14 – bolt; 15 – washer; 16 – breather; 17 – driving pinion; 19, 23, 25 – rubber ring; 21 – adjusting shims; 22 – driving pinion carrier; 24 – doubled universal joint; 26 – nut; 27 – washer; 28 – cover; 30 – carrier; 31, 32 – locking ring; 33 – two-row taper roller bearing; 34 – gear block; 35 – reduction gear casing; 36 – ring; 37 – wheel nut.

Fig.D-26. Wheel reduction gears of planetary spur-gear type

Cardan shaft

The cardan shaft is intended for transmitting the torque from the GB to the FDA.
The cardan shaft consists of a tube (2) and two hinges (1), (3) (Fig. Д-27) with the cross bar running in needle bearings (6). The needle bearing cages are locked with retaining rings (7); the cross bars trunnions are provided with edge-joint packings (4) and self-tightening collars (5).

The cardan shaft in assembly is dynamically balanced.

To ensure against winding of straw-stemmed crops on the cardan shaft when harvesting, a special enclosure is provided.

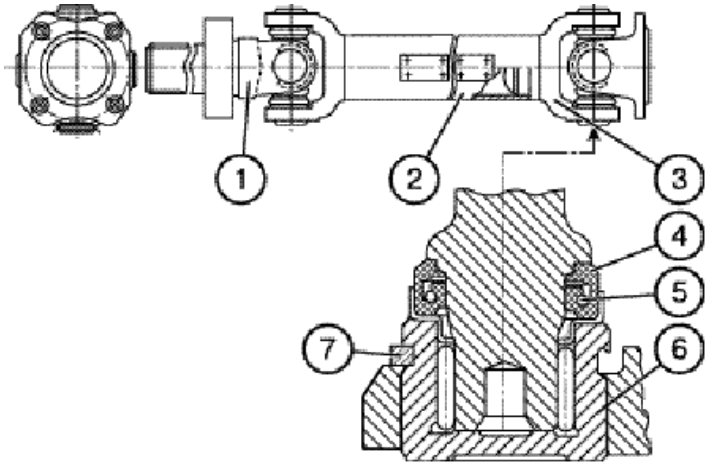


Fig. D-27. Cardan shaft:

1, 3 — cardan hinges; 2 — cardan shaft tube; 4 — edge-joint packing; 5 — collar; 6 — needle bearing; 7 — lock ring

Electro-hydraulic control of FDA drive

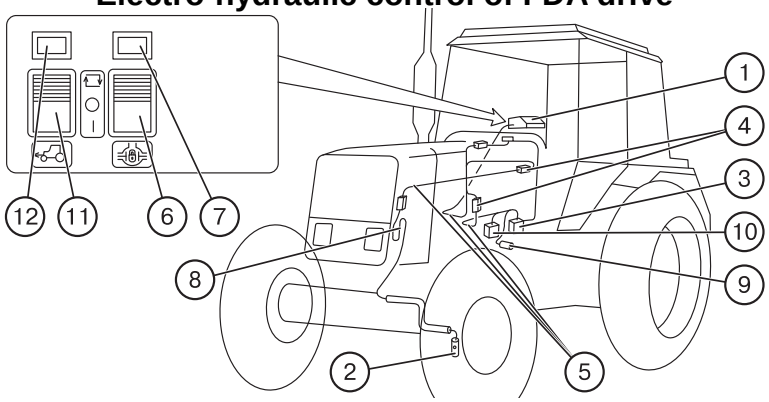


Fig.D-28. Rear axle differential lock-up (DL) and FDA drive control system:

1 – control panel; 2 – steering wheels turning angle sensor; 3, 10 – control electro-hydraulic distributors for the DL and the FDA drive, respectively; 4 – terminal blocks; 5 – connecting cable; 6 – DL control key; 7, 12 – indicator lamps; 8 – loop; 9 – automatic FDA drive control sensor; 11 – FDA drive control key.

The electro-hydraulic control system of the rear axle (Fig. E-28) consists of the panel (1), automatic control sensor (9) FDA reduction gear, FDA drive clutch control electro-hydraulic distributor (10) located on the right-hand GB cover and connecting cables (5) with terminal blocks (4). The system is supplied with power from the on-board power system via a safety fuse in the fuse box installed in the dashboard. The system is powered after starting the engine. The key (11) of the FDA drive control and the FDA drive engagement indicator lamp (12) are in-

stalled on the panel (1) face. The latter is located over the tractor right-hand side control panel.

Note: A braking relay is provided in the FDA drive control electric circuit. It ensures the automatic engagement of the drive when stepping on the interlocked service-brake pedals.

How To Use the Front Driving Axle Control Key (11)

1. When performing jobs with great extent of slippage of front wheels, press the upper part of the key (11) having activated the automatic FDA drive control mode. When it will be done, the automatic control is exercised depending on tractor slippage, which is sensed by sensor (9) of automatic control. When rear wheels are slipping, the sensor (9) closes contacts and energizes the electromagnet of the control electro-hydraulic distributor (10). When slipping intensity drops, the sensor (9) beaks contacts to de-energizing the electromagnet and disengage the FDA drive, respectively.
2. If the job requires operation with forward and reverse moves, with the FDA engaged all the way through, depress the lower part of the key (11). To disengage the FDA drive, press the key (11) to its middle position.

ATTENTION!

1. When reversing, NEVER engage the automatic FDA drive control mode; use the forced drive only. Use the forced drive mode of the FDA for short-run jobs only: to clear an obstacle or when running the tractor in reverse.
2. Be sure to disengage the FDA when on surfaced roads to avoid accelerated wear of the front wheel tyres, drive parts and FDA.

Hydraulic Lift Linkage (HLL)

The HLL is intended for controlling and operating the tractor aggregated with mounted, semi-mounted and pull-type agricultural machines and implements attached to the rear hitch linkage (RHL).

The hydraulic system is composed of controls, an oil tank with filter, oil, pump, two- or three-section flow-through distributor, hydraulic power lift and power lift drive.

The **operating controls** of the hydraulic system (7), (8) (Fig. E-29) are located in the tractor cab, with the exception of the pump engagement handle (the design is left unchanged) and additional position control handle (8a) (Fig. E-29) located on the rear of the tractor on the hydraulic power lift.

Control of External Loads – these are three handles of the flow-through distributor located on the right-hand side of the steering wheel (the design is left unchanged).

Positions of the handle (from bottom to top) are: “Lift”, “Neutral”, “Drop” and “Floating”.

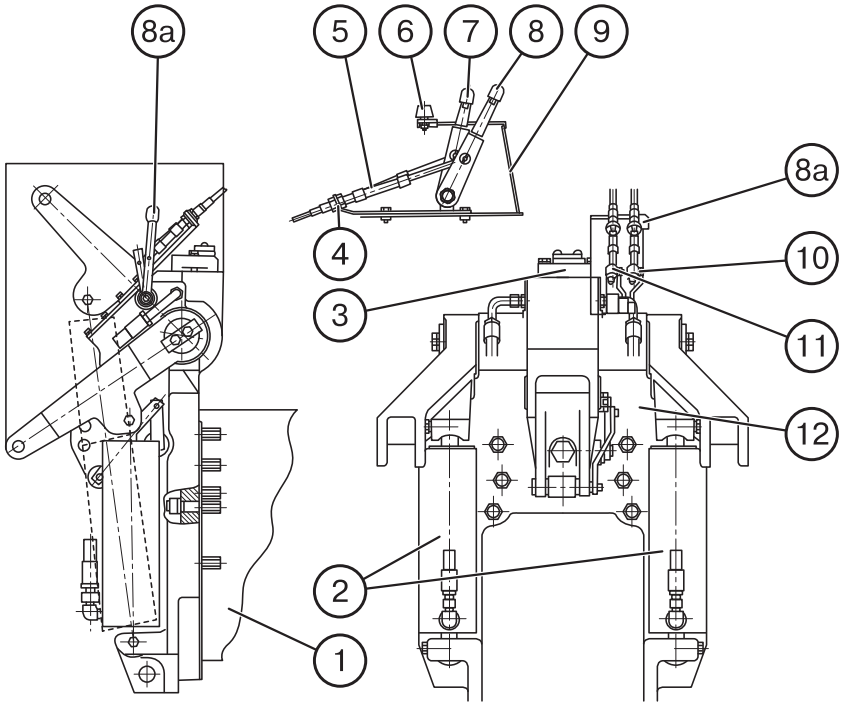


Fig.D-29. Hydraulic power lift of the HLL (monoblock):

1 – rear axle casing; 2 – power ram cylinders; 3 – regulator-distributor; 4 – brackets; 5 – position (10) and draft (11) lever control ropes; 6 – adjustable RHL travel limiter; 7 – draft control handle; 8 – position control handle; 8a – additional position control handle; 9 – right-hand side control panel; 10 – position lever; 11 – draft lever; 12 – casing.

The **draft control handle** (7) (Fig. E-29) is located on the right-hand control panel (9), the first from the operator's seat. The operational range of the handle positions is marked with digits from 1 to 9 that corresponds to the entire span of ploughing depths from minimal to maximal ones, respectively.

The **position control handle** (8) (Fig. E-29) is located next to the draft control handle (7). Its operating range is marked with the same digits which cover RHL positions from the upper transport position down to the lowermost position, respectively.

The **additional position control handle** (8a) (Fig. E-29) is located on the rear of the tractor on the hydraulic power lift. Pulling this handle towards the operator standing behind the tractor and looking along the tractor forward travel lifts the RHL and pushing the same from the operator lowers the RHL.

The RHL travel limiter (6) is located in the slot of the right-hand side panel, in which the position control handle (8) moves.

The positions of the oil tank, oil pump filter and the distributor to control external loads are unchanged. The distributor is of a sectional flow-through type; it has priority in control over the hydraulic power lift.

Hydraulic Power Lift (Fig. D-29, E-30)

The hydraulic power lift (Fig. E-29) is installed on studs, on the rear wall of the rear axle casing (1) and consists of a control unit and a regulator-distributor (3) built in a single casing (monoblock) which houses two hydraulic single-acting power cylinders (2).

D42

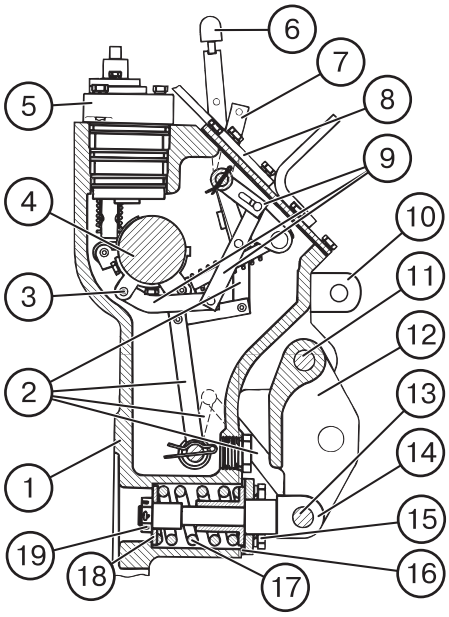


Fig.. D-30. Hydraulic power lift construction:

1 – monoblock; 2 – draft sensor leverage; 3 – position sensor; 4 – RHL lifting levers shaft; 5 – regulator-distributor; 6 – position lever; 7 – draft lever; 8 – lid; 9 – position sensor leverage; 10 – lifting levers; 11 – shackle axle; 12 – draft sensor coupling link; 13 – pin; 14 – draft sensor rod; 15 – cover; 16 – adjusting shims for draft sensor spring; 17 – draft sensor spring; 18 – dish; 19 – nut

The control unit is mounted in the monoblock (1) (Fig. D-30) and consists of a position sensor in the form of a bracket attached to shaft (4) of the RHL lift levers (10); draft sensor involving the coupling link (12) mounted on axle (11) in the monoblock (1) and coupled with rod (14) on pin (13). The spring (17) preloaded by the nut (19) is fitted on the rod (14). Through a leverage system (9) the position sensor (3) is connected to position handle (6). The pin (13) of the rod (14) is coupled with draft handle (7) through leverage (2).

The control unit operates as follows: **When the position control is used**, the draft handle (7) (Fig. D-30) should be shifted to its foremost position, in the direction of the tractor forward travel. Further control of the hitch linkage is achieved by means of the position lever (6) (Fig. D-30) and handle (7) via ropes (5) (Fig. D-29). When moving the lever (6) backward, the hitch linkage is lifted and then moving the lever (6) forward, the hitch linkage is lowered. This adjusting process is performed by means of the regulator-distributor built in the monoblock (1) and controlled be means of the position sensor (3).

When the draft control is used, the position handle (6) should be shifted to its foremost position, in the direction of the tractor forward travel, corresponding to the bottom position of hitch drop links. The draft control handle (7) is set to the required ploughing depth; further the process of adjustment is fulfilled by the built-in regulator-distributor (5) under control of the draft sensor.

Using the position control handle (8) (8) (Fig. D-29) for limiting the ploughing depth when operating in the draft control mode makes it possible to achieve the **combination adjustment.**

The **Regulator-Distributor** (5) built-in into the monoblock (1) is an adjusting element of the hydraulic power lift. It is a slide-valve gauge whereby the operating position like “Lift”, “Drop”, “Neutral” and RHL automatic control can be achieved.

The hydraulic power lift drive (Fig. D-29) consists of a bracket (4) with the draft (7) and position (8) handles mounted on it. The latter are connected to the draft (11) and position (10) levers, respectively, by means of two-way ropes (5). The control levers are locked by spring-loaded friction disks.

Hydraulic System Operation

The hydraulic system for controlling the three-point RHL is equipped with the regulator-distributor built in the monoblock. The regulator-distributor provides the system in the following modes:

- draft control;
- position control;
- combination control.

The efficient use of these modes depends on the machines to be ganged and agrotechnical conditions.

Position control

Provides for precise and sensitive control of the mounted equipment such as sprayer, land leveller, etc. above the ground. The position control can be used with land-treatment machines, semi-mounted ploughs with extendible cylinders, etc.

However, this adjustment type is not recommended for use on uneven fields. The position control on a field with uneven surface can cause shocks caused by quick vertical movements of the coupling arrangement.

Draft control

It is the most suitable mode for operation with mounted or semi-mounted implements, the work members of which are deepened into the soil. The system is sensitive to the draft variations (caused by the variations of the soil resistance depending on the depth of the soil treatment) through the central connecting rod of the central rod of the hydraulic lift linkage. The hydraulic system respond to these variations by lifting or lowering the implement so that the draft would be maintained at a constant level. The system responds to the compression and tension forces in the central rod, i.e. it is a double-action system.

HLL Operation

The HLL is controlled by means of two handles located on the right-hand control panel in the cab:

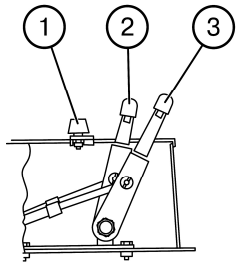
- draft control handle (2); and
- position control handle (3).

Position control

1. Set the draft control handle (2) to the foremost position in the direction of the tractor travel.
2. Set the necessary height on the implement above the soil by means of the position control handle (3).

The digit “1” on the control panel corresponds to the transport position of the RHL and the digit “9” – to the minimum height of the implement above the soil.

If it is necessary to restrict the maximum lifting height (for example, due to the possibility of breakage of the parts of the rear axle), set the maximum lifting height by means of the handle (3) and move the adjustable stop (1) to the latter.



Draft control

Use this method of adjustment when working with the mounted implements (ploughs, cultivators). Move the draft control handle (2) to the foremost position in the direction of the tractor forward travel (digit “9” on the control panel).

Connect the implement to the RHL by means of the position control handle (3).

On entering the furrow move the handle (3) to the foremost position and adjust the desirable soil treatment depth by means of the handle (2).

On leaving the furrow and subsequent entering the same (when performing the tillage), use the position control handle (3) without touching the draft control handle (2).

If it is impossible to achieve the constancy of the soil treatment depth due to unevenness of the soil density, limit the maximum depth by means of the position control handle (3) (combination control mode) having memorized the respective digit on the control panel.

D44

Hydraulic lilt linkage based on the electro-hydraulic regulator of the RHL control

The tractor is equipped with two Ц 90x220 vertical hydraulic cylinders built in the lift (without regulator) controlled from the electro-hydraulic regulator. The schematic hydraulic diagram of he hydraulic system with the electric-hydraulic regulator of the RHL control in shown in Fig. E-31.

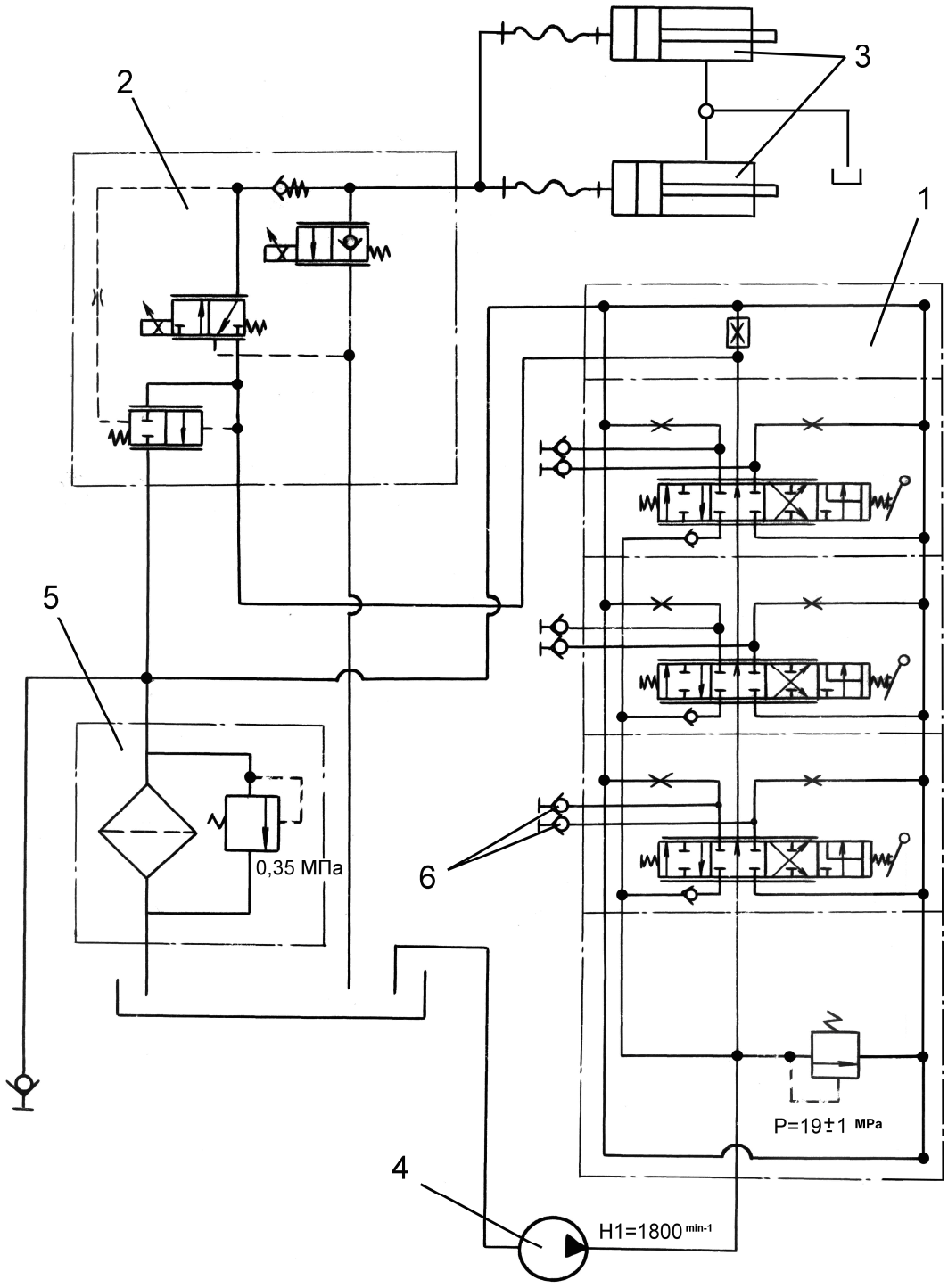


Fig. D-31. Schematic hydraulic diagram

1 – RS 213 “Mita” hydraulic distributor; 2 – EHR5-OC electro-hydraulic regulator; 3 – Ц80x220 hydraulic cylinders; 4 – НШ32-3 pump; 5 – drain filter; 6 – quick-connection couplings.

The functions of control of the RHL and hydroficated working members of the external consumers are implemented in the new hydraulic system (Fig. E-32) at the cost of the electro-hydraulic block (3) mounted on the oil tank (1). The lever control of the distributor (2) and НШ32-3 the gear pump are similar for all the versions of the above hydraulic systems

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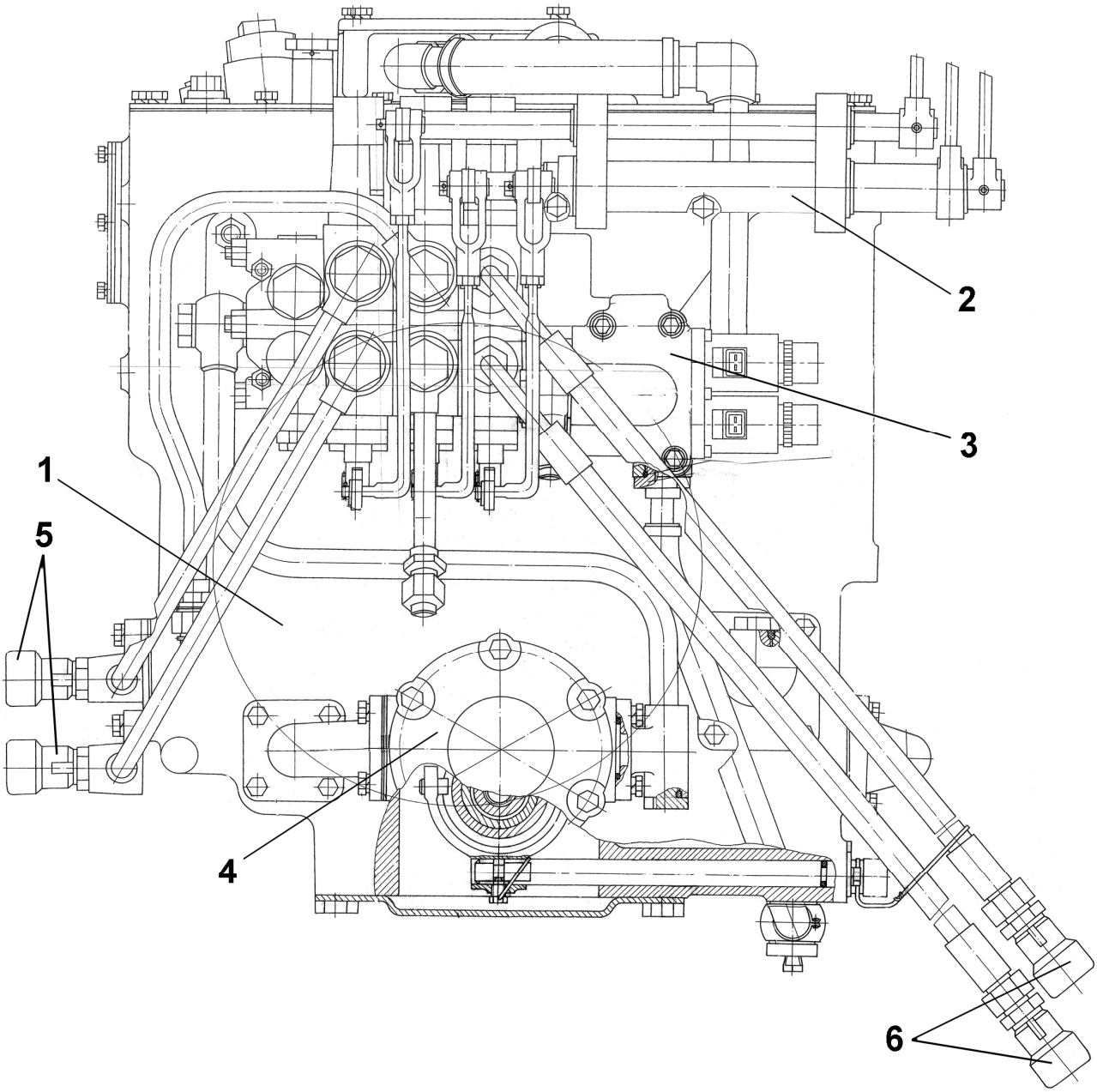

Fig. D-32. Casing of the hydraulic units assembled with the other ones

1 – oil tank; 2 – distributor control; 3 – electro-hydraulic unit (RS 213 “Mita” + adaptor + EHR5); 4 – НШ32-3 pump; 5, 6 – side leads.

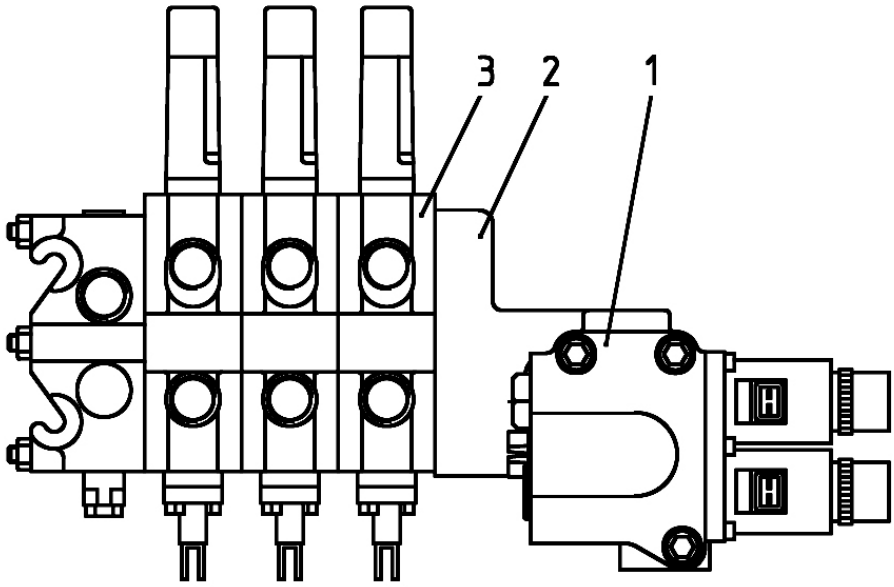

Fig. D-33. Electro-hydraulic unit

1 – EHR5-OC electro-hydraulic regulator; 2 – adaptor plate;

The electro-hydraulic unit (Fig. E-33) consists of distributing sections of the RS213 “Mita” distributor manufactured in Finland, EHR5-OC electro-hydraulic regulator manufactured by the Bosch Company (Germany) and adaptor plate (2) manufactured by the MTZ.

The construction arrangement of the EHR5-OC electro-hydraulic regulator is shown in Fig. E-34.

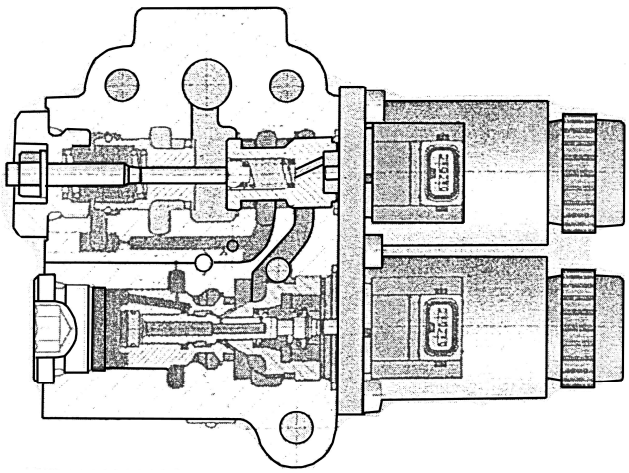

Fig. D-34. EHR5-OC electro-hydraulic regulator

The EHR5-OC electro-hydraulic regulator (Fig.-34) is controlled by two proportional magnets with th use of the electronic RHL control system (see Fig. D-37)

Electronic RHL control system

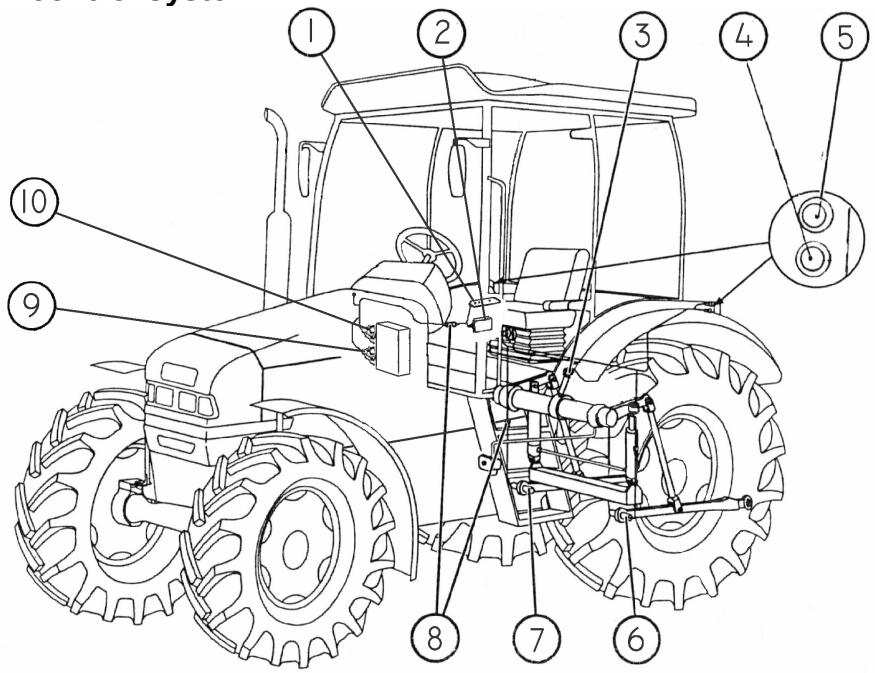

Fig. D-35. Electronic RHL control system

1 – RHL control panel; 2 – electronic unit; 3 – RHL position sensor; 4 – button for remote control of lowering the RHL; 5 – button for remote control of lifting the RHL; 6 – left-hand force sensor; 7 – right-hand force sensor; 8 – connecting cables with electric connectors; 9 – solenoid valve for lowering; 10 – solenoid valve for lifting.

The electronic part of the regulator control includes the following components:

- RHL control panel (1);
- Buttons (4, 5) for remote control of the RHL;
- Electronic unit (2);
- Force sensors (6, 7);
- RHL position sensor (3);
- Solenoid valves for lifting (10) and lowering (9);
- Connecting cables with electric connectors (8).

The electronic part of the system operates as follows. On turning the key switch of the starter and instrumentation to the position “Instrumentation energized”, the power supply voltage is fed from the electric equipment system through an single-terminal block with violet wire (on the right side under the dashboard) to the electronic unit 2 of the system. The electronic unit polls the sensors and system control components and, after analysis, gives necessary commands to the regulator solenoids. The system is controlled either from the control panel 1 located in the tractor cab or by means of the remote control buttons 4 and 5 located on the fenders of the rear wheels.

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RHL Control Panel

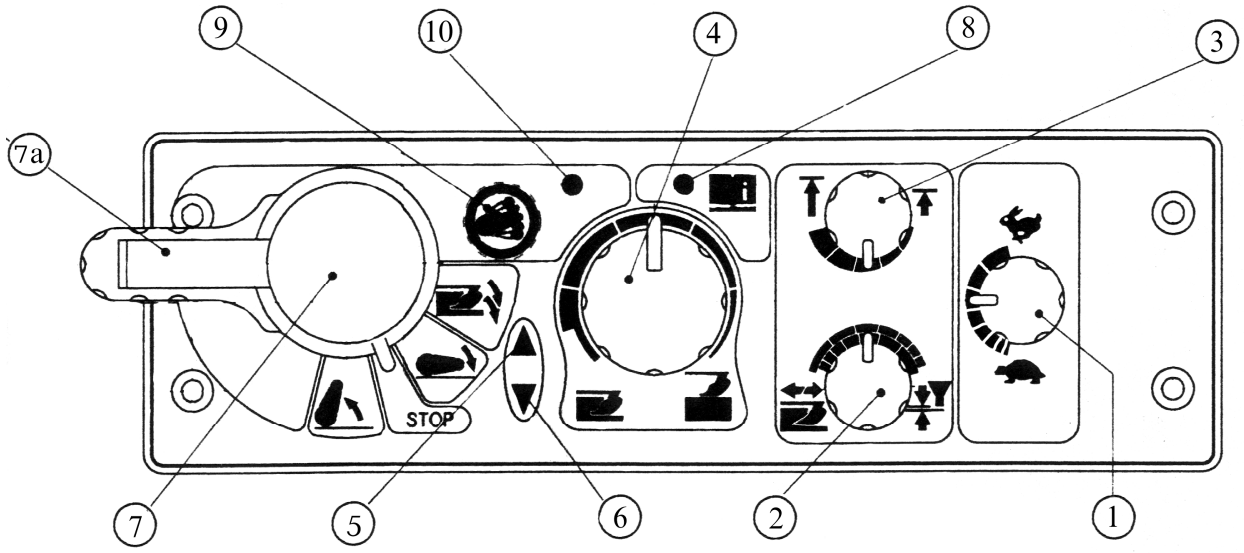

Fig. D-36. RHL control panel

1 – lowering speed control handle (clockwise – quicker, anti-clockwise – slower); 2 – handle for selecting the control method (clockwise – position one, anti-clockwise – draft one, intermediate – combination control); 3 – handle for control of limitation of the hitch linkage lifting (clockwise – maximum lifting, anti-clockwise – minimum lifting); 4 – handle for controlling the soil treatment depth (clockwise – less depth, anti-clockwise – more depth); 5 – hitch linkage lifting indicator (red); 6 – hitch linkage lowering indicator (green); 7 – hitch linkage control handle (upwards – lifting, downwards – lowering, when pressing the handle more in the bottom position – deepening the implement during the soil treatment, intermediate position – disabled); 7a – interlock switch (transportation) – mechanic interlock of the handle (7) in the top position by shifting the switch to the right; 8 – diagnostic alarm (see “Fault Diagnostics”), 9 – damping button, 10 – damping indicator.

The procedure of control of the rear hitch linkage is as follows:

- depending on the character of job, set the control method by means of the handle (2) (Fig. D-36);
- set the treatment depth and height of the implement lifting in the transportation position by means of the handles (4) and (3), respectively.
- to lower the hitch linkage, shift the handle (7) to the bottom fixed position. In this case, the indicator (6) goes out.

When performing the job, it is necessary to set the optimum conditions of operation of the mounted implement:

- combination of the control methods by means of the handle (2);
- lowering speed by means of the handle (1);
- soil treatment depth by means of the handle (4).

In case of the draft control, the system limits automatically the correction frequency to Hz in average.

In case of intense heating of the hydraulic system oil, the correction frequency should be reduced by shifting the handle (2) to the position method of control and the handle (1) – towards the turtle.

In case of raising ("popping") of the agricultural implement when passing through the pressed soil areas gashes, deepen the agricultural implement by pressing the handle (7) more downward. On releasing the handle (7) it will return to the fixed position of lowering. When it will be done, the agricultural implement reaches to mode of the preliminary specified depth set by the handle (4).

To raise the agricultural implement, shift the handle (7) to the upper position. When lifting the implement, the indicator (5) lights up.

ATTENTION! To avoid the failure of the HLL pump, it is prohibited to operate the tractor unless the indicator (5) goes out after lifting the implement.

It is necessary to know the following peculiarities of starting the work with the rear hitch linkage control system:

1. On starting the engine, the diagnostic indicator (8) lights up to indicate the serviceability and locking of the control system;
2. To unlock the system, it is necessary to set the handle (7) once to the working position (lifting or lowering). When it will be done, the diagnostics indicator (8) shall go out.
3. After unlocking the system when switching on the same for the first time, the automatic limitation of the speed of lifting of the rear hitch linkage is provided for the safety reasons. Setting the lever (7) to the "Lifting" position repeatedly disables the limitation of the lifting speed.
4. The lifting and lowering of the rear hitch linkage by means of the remote control buttons on the fenders of the rear wheels can be performed in any control modes (the handles can be set to arbitrary position). In this case, the cab control system is blocked.

WARNING: When using the remote control units, never stand between the tractor and the implement ganged. To avoid accidents, it is strictly prohibited to use the buttons of mechanical movement of the regulator solenoid valves.

The work with the control system shall be started in the sequence described in paragraphs 2 and 3.

ATTENTION! To avoid more deepening of the agricultural implement, in case of emergency stop of the tractor the control handle (7) shall be set to the "Neutral" position. After starting the movement, shift the handle to the "lowering" position (the agricultural implement will e deepened to the preliminarily set depth).

In addition to the above functions, the electronic control system of the RHL is provided with the "damping" mode (damping of oscillations of the mounted agricultural implement in the transportation mode).

The damping mode shall be enabled in the following order:

- Set the handle (7) to the "lifting" position (when it will be done, the RHL will be lifted to the top position and disengaged automatically);
- Press the "Dampind" button (9) (when it will be done, the RHL will be lowered from the top position by 3% from the full stroke of the RHL).

ATTENTION!

1. The "Damping" mode can be only enabled, when the handle (7) is set to the "Lifting" position.

2. When performing he field works (ploughing, cultivation, etc.), the "Damping" mode shall be disabled.

Fault Diagnostics

The BOSCH electronic hydraulic control system is provided with the self-testing capability and issues the code information to the operator by means of the diagnostics indicator (8) (Fig. E-35b) on the RHL control panel. In case of absence of faults, the indicator is illuminated continuously after starting the engine. After upward or downward manipulations of the RHL control handle (7) (Fig. E-35b), the indicator is switched off. On shifting the control handle downwards, the green indicator (6) (Fig. E-35b) of lowering the RHL lights up; on shifting the same upwards, the red indicator (5) (Fig. E-35b) of lifting the hitch linkage lights up.

Should there be some faults in the system (after starting the engine) the diagnostics indicator starts to issue the code information about the fault and, if necessary, the operation of the system is locked.

The fault code is issued as a two-digit number, the first digit of which is equal to the number of indicator blinks after long pause and the second one – to the number of indicator blinks after short pause. For example, long pause – three blinks of the indicator, short pause – six blinks of the indicator. It means that in the system there is a fault under the code “36”. Should there be several faults, the system indicates the fault codes one after another with separating them with a long pause.

All the faults are divided into the three groups: complex, medium and light.

On detecting ***complex*** faults, the control is ceased and the system is switched off. The system cannot be controlled from the control panel and remote control buttons. The diagnostics indicator issues the fault code. After elimination of the fault and starting the engine, the operation of the system is resumed.

In case of ***medium*** faults, the control is ceased and the system is locked. The system cannot be controlled from the main control panel, but can be controlled from the remote control buttons. The diagnostics indicator issues the fault code. After elimination of the fault and starting the engine, the operation of the system is resumed.

In case of ***light*** defects the diagnostics indicator issues the defect code. The system is not locked and can be controlled. After elimination of the defect, the diagnostics indicator goes out.

When the system detects a fault, proceed as follows:

1. Stop the engine;
2. Set the controls on the main control panel as follows

(Fig. E-35b):

- handle (7) for controlling the hitch linkage – to the “off” position;
- handle (3) for controlling the lifting limitation – to the “minimum lifting” position;
- handle (4) for controlling the soil treatment depth – to the “minimum depth” position;
- handle (1) for controlling the lowering speed – to the medium position;
- handle (2) for controlling the “draft – position” mode – to the medium position.

3. Start the engine and, if there are no defects, proceed to work. If the defects have not been eliminated, perform the system diagnostics and eliminate the faults.

The possible defects and methods of their check-up are given in the table below.

The connection diagram of the RHL control system is shown in Fig. E-37.

ATTENTION!

1. The electric connectors of the control system of the hitch linkage shall be only disconnected when the engine is stopped

2. 2. The specified voltage values shall be measured when the engine is running with observing the safety precautions for working with energized electric appliances.

3. 3. The contact numeration in the bundle connectors is indicated on the parts of the connector bodies

List of possible defects and methods of their check-up

Defect code	Defect description, possible cause	Defect check-up method
Complex defects		
11	Fault in the circuit of control the solenoid valve for lifting. Open circuit in the winding of the electromagnet (10) or in the electromagnet control bundle (Fig. D-37).	Disconnect the bundle from the electromagnet and check the electromagnet for open circuit by means of a tester. The electromagnet resistance shall not exceed 2…4 Ω. If the electromagnet is free of fault, check the electromagnet control bundles for mechanical damage and check the wire from the electromagnet connector terminal to the terminal (2) of the 25-contact connector of the electronic unit for breakage by means of a tester.
12	Fault in the circuit of control the solenoid valve for lowering. Open circuit in the winding of the electromagnet (9) or in the electromagnet control bundle (Fig. D-37)	Disconnect the bundle from the electromagnet and check the electromagnet for open circuit by means of a tester. The electromagnet resistance shall not exceed 2…4 Ω. If the electromagnet is free of fault, check the electromagnet control bundles for mechanical damage and check the wire from the electromagnet connector terminal to the terminal (14) of the 25-contact connector of the electronic unit for breakage by means of a tester.
13	Fault in the circuit of control the solenoid valve for lowering or lifting. Short circuit in one of electromagnets or between the electromagnet control wires in the bundle (Fig. D-37)	Disconnect the bundles from the electromagnets and check the electromagnets for short circuit by means of a tester. The electromagnet resistance shall not exceed 2…4 Ω. Alternatively, measure the electromagnet consumption current when applying the voltage of 6 V to the electromagnet. The current shall not exceed 3.2 A. Disconnect the connector from the electronic unit and check the terminals (2) and (14) for short circuit (when doing this, the electromagnets shall be disconnected).
14	Fault in the control circuit of the solenoid valves for lowering and lifting. Wire breakage in the electromagnet control bundle (Fig. D-37).	Check the system bundles for mechanic damages. Disconnect the connectors from the electronic unit and electromagnets and check the wire from the terminal (6) of the electronic unit connector to the terminals of connectors of the electromagnets. Check the presence of the supply voltage on the terminal (5) of the electronic unit connector (when doing this, the engine shall be running). If the voltage is absent, check the reliability of connection in the single-terminal block with violet wire on the right under the dashboard and fuse. The fuse is located in the medium fuse block on the dashboard. The voltage is applied to the fuse after turning the switch of the starter and instrumentation to the “instrumentation energized” position.
15	Fault of the remote control	Check the bundles from the remote control buttons

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Defect code	Defect description, possible cause	Defect check-up method
	buttons. Short circuit between the wires or locking of one of the remote control buttons. In this case, the hitch linkage begins move up- or downwards immediately after starting the engine (Fig. D-37)	for mechanical damage. Disconnect each button in turn until the defect is eliminated. When disconnecting the buttons, the engine shall be stopped. If the defect does not disappear when the buttons are disconnected, it is necessary to disconnect the connector from the electronic unit and check the terminals (10) and (12), (20) and (12) for short circuit by means of a tester.
16	Electronic unit fault. Stabilized supply voltage of the control panel is below the required level. Possibly, short circuit in the connectors of the sensors of force and RHL position due to penetration of water into the connectors (Fig. D-37)	Disconnect the main control panel from the common bundle. Measure the stabilized power supply voltage on the contacts (6) (minus) and 4 (plus) of the control panel connector, which shall be 9.5-10 V (after turning the switch of starter and instrumentation to the "instrumentation energized" position). In case of missing or insufficient supply voltage, it is necessary to check the reliability of connection of the electronic unit connector. Disconnect in turn the sensors of force and RHL position.
22	Fault of the position sensor. Breakage of the sensor wire or the sensor is not connected or not adjusted (Fig. D-37)	Check: • the reliability of connection of the electric connector to the position sensor (3) (Fig. E-35c); • the bundle connected to the sensor for mechanical damage; • the correctness of setting the RHL eccentric, i.e. in case of maximum lowering of the RHL, the sensor shall be pressed to the minimum extent and vice versa; • the correctness of adjustment of the position sensor (if the defect becomes apparent when the RHL is in the bottom position, the sensor shall be screwed in and it becomes apparent when the RHL is in the top position, the sensor shall be screwed out). The adjustment shall be performed when the RHL is in the top position.
Medium defects		
23	Control panel fault. The potentiometer (4) of the soil treatment depth (Fig. D-37)is faulty.	Check the reliability of connection of the connectors of the control panel and electronic unit as well as check the bundle for mechanical damage. Check the output voltage according to the electric diagram.
24	Control panel fault. The potentiometer (3) of the top RHL position (Fig. D-37)is faulty.	Check the reliability of connection of the connectors of the control panel and electronic unit as well as check the bundle for mechanical damage. Check the output voltage according to the electric diagram.

Defect code	Defect description, possible cause	Defect check-up method
28	Control panel fault. The RHL control lever (7) (Fig. D-37)faulty.	Check the reliability of connection of the connectors of the control panel and electronic unit as well as check the bundle for mechanical damage. Check the output voltage according to the electric diagram.
31	The right-hand force sensor is faulty. Cable breakage or shirt circuit in the sensor (Fig. D-37)	Check the connection of the cable to the force sensor and check the cable for mechanical damage. Overload of the force sensor is also possible.
32	The left-hand force sensor is faulty. Cable breakage or shirt circuit in the sensor (Fig. D-37)	Check the connection of the cable to the force sensor and check the cable for mechanical damage. Overload of the force sensor is also possible.
Light defects		
34	Control panel fault. The RHL control rate potentiometer is faulty (Fig. D-37)	Check the reliability of connection of the connectors of the control panel and electronic unit as well as check the bundle for mechanical damage. Check the output voltage according to the electric diagram.
36	Control panel fault. The potentiometer of combination of the ploughing modes (draft-position) is faulty (Fig. D-37)	Check the reliability of connection of the connectors of the control panel and electronic unit as well as check the bundle for mechanical damage. Check the output voltage according to the electric diagram.

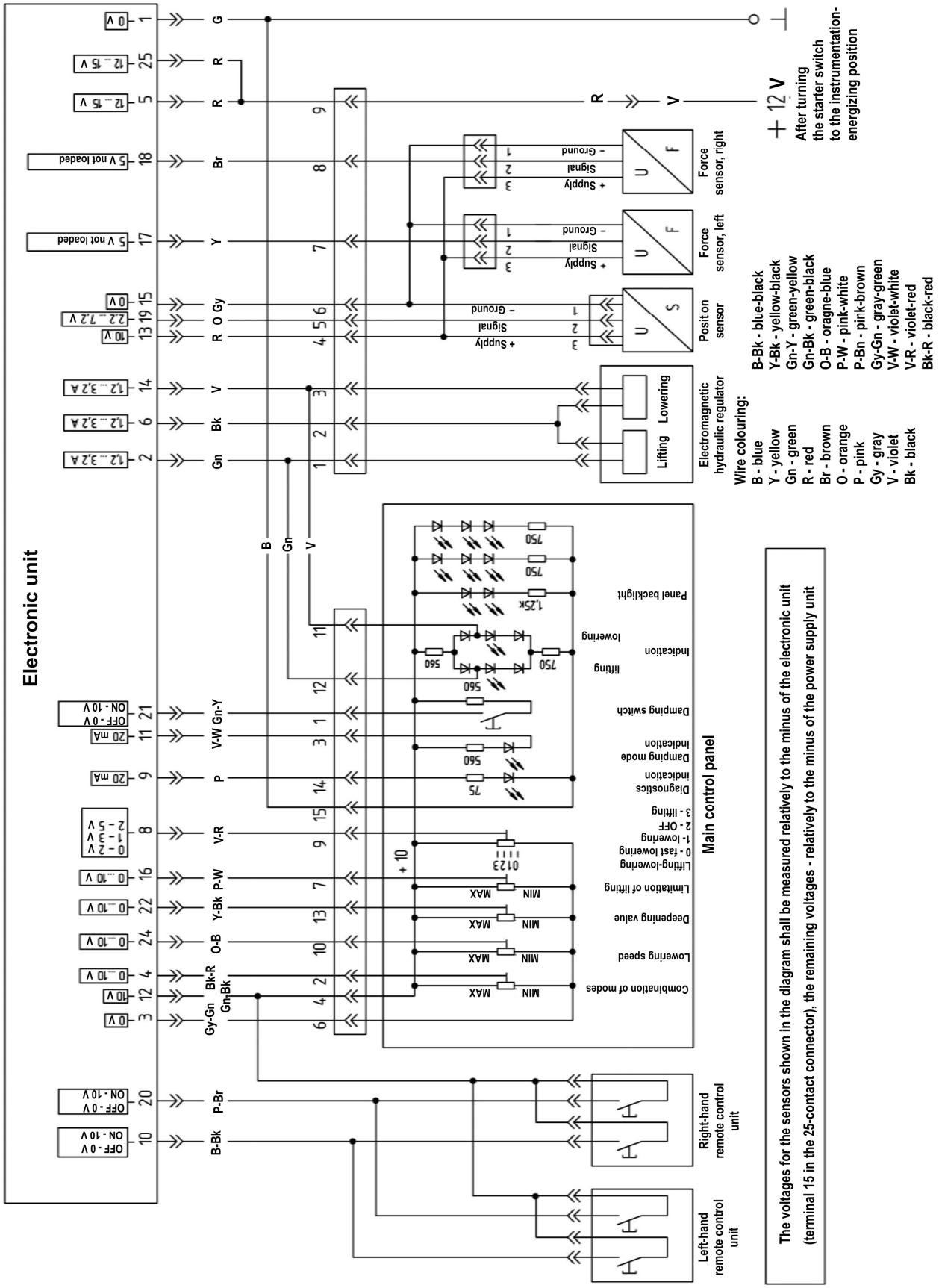


Fig.D-37. Electric connection diagram of the RHL control system

Rear Hitch Linkage (RHL)

The second-category three-point hitch linkage with the third-category connecting points serves for ganging the mounted and semi-mounted agricultural machines and implements with the following coupling members:

- the length of the suspension axle "**A**" (conventional distance between the joints of the lower rods) is 870/1010 mm, respectively, for the 2nd and 3rd category;
- the diameter of the holes of the rear joints of the lower connecting rods is equal to 37.4 mm.
- the diameter of the pin of the upper rod is 31.75 mm.

ATTENTION! Prior to ganging the machines, read carefully this section.

The tractor is equipped with the one-piece connecting rods (1) with the length of 885 mm and the upper rod (2) with the third-category joints. For operation with the second-category machines, the SPTA kit of the tractor contains the adaptor bushings (3) for the lower rods for the suspension axle of the implement ∅28 mm and adaptor bushings and fingers ∅22 mm and ∅25 mm for connecting the upper rod to the implement.

Upper rod and angle braces

The length of the upper rod (2) is adjustable within 500...740 mm by means of the handle (3).

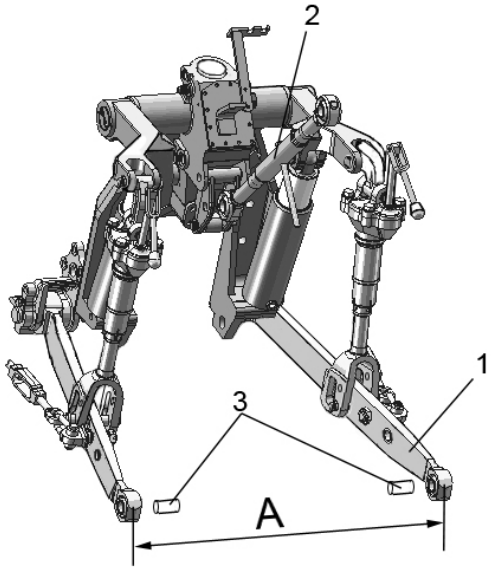
The RHL is provided with two gear-type (adjustable) angle braces. Their length can vary within 580...665 mm by rotating the handle (1).

When the tractor is shipped from the manufacturer, the length of the both angle braces is set to the standard value of 640 mm.

To facilitate the change of the angle brace length, their fork is provided with two holes for setting the pin.

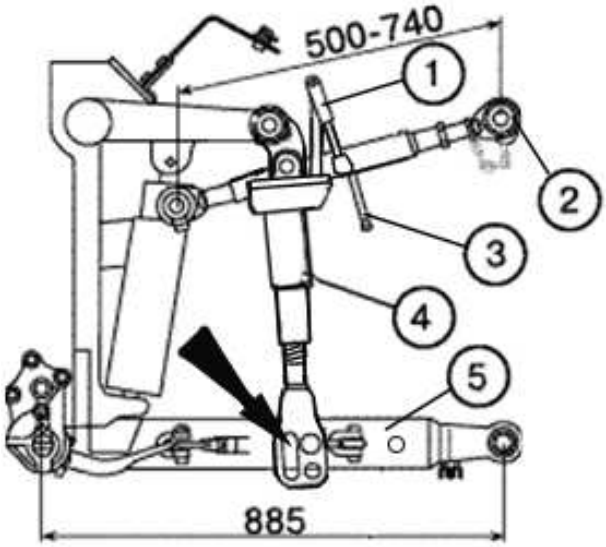
IMPORTANT! Adjust the position of the machine by means of the right-hand angle brace only.

To follow the relief of the field area to be treated when working with wide-cut machines and to avoid damage of the angle braces, connect the angle braces (4) with the lower rods (5) through the slots (indicated by an arrow).



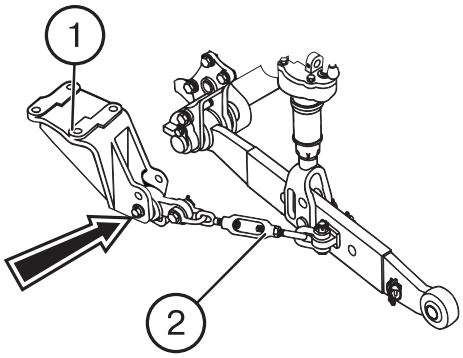
IMPORTANT! When doing this, the slots of the angle brace fork shall be behind the hole as seen in the direction of the tractor forward travel to avoid the damage of the angle brace.

To increase the RHL carrying capacity, the forks of the angle braces and the tie-link ear can be repositioned by one hole backwards. In this case, the length of the tie-links shall be increased by inserting an additional shackle from each side.



D56

Partial locking

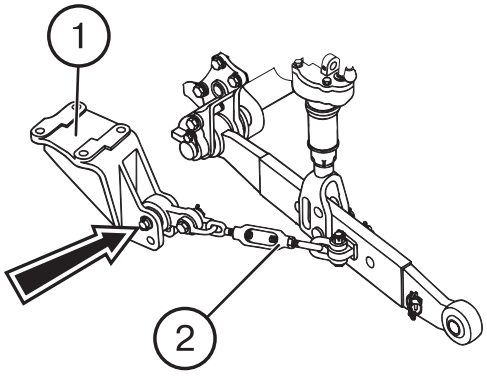


The horizontal movement of the implement in the working position shall be provided by connecting the tie-links to the lower holes of the brackets (1) and adjusting the length by means of the tie-links (2) to ensure the implement swinging to each side by at least 125 mm or in accordance with the operating manual for the implement.

When working with ploughs, adjust the length of the right-hand tie-link to the treatment depth.

ATTENTION! The implement swinging amplitude shall be obligatorily ensured to be at least 125 mm to avoid breakage of the tie-links when lifting the implement to the transportation position.

Full locking

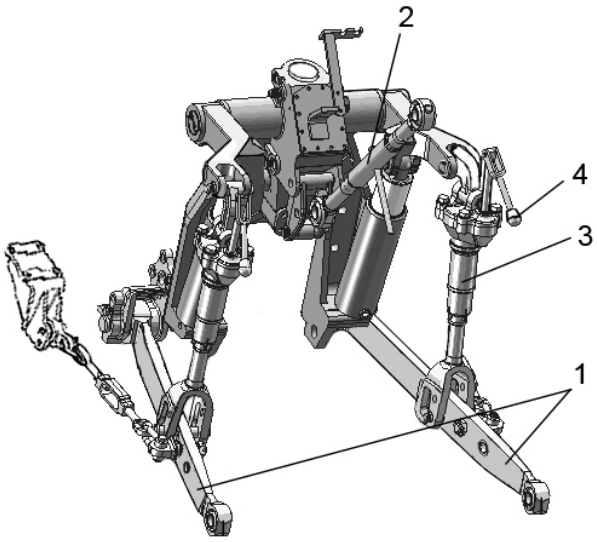


To provide the full locking of the implement in the working position, connect the tie-links (2) to the upper hole of the bracket (1) and reduce their length as much as possible having ensured the implement swinging within 20 mm to both sides.

Mounting the agricultural implements onto the tractor

The most kinds of equipment can be mounted on the tractor by performing the following operations:

1. Lower the hitch linkage to the bottom position. Align the axles of joints of the lower rods (1) and pins of the implement and attach the implement to the lower rods. Lock the pins with cotter pins. Stop the engine.
2. Lengthen or shorten the upper rod (2) and connect the same to the implement by means of the rear joint pin. Lock the pin with a linchpin with a ring.
3. If necessary, adjust the upper rod to the initial or required length.
4. If necessary, adjust the sideways tilt of the implement by means of the right-hand angle brace (3). To increase the angle brace length, turn the handle (4) clockwise and vice versa.
5. Attach the necessary remote mount equipment.
6. Prior to beginning the work, check to make sure that:
   - the parts of the tractor is not in dangerous vicinity of those of the implement;
   - the upper rod is not in contact with the PTO enclosure when the implement is in the bottom position;
   - the cardan drive from the PTO is not too long with large joint angles and there are no thrust forces;
   - the PTO is not in contact with the cardan drive of the machine;
   - lift slowly the implement and check the presence of the clearances between the tractor and the implement in the lifted position;
   - check the presence of the required side swinging of the lower rods and adjust it be means of the tie-links, if necessary.



IMPORTANT! When mounting the mounted or semi-mounted equipment on the tractor or when hitching the trailed equipment to the tractor by means of the draft hitch, make sure that there is a sufficient clearance between the implement and the tractor.

CAUTION! Some mounted or semi-mounted equipment can touch the cab and damage the same. It could cause the breakage of the cab glasses and injure of the operator. Check the presence of a sufficient clearance (at least 100 mm) between the implement lifted to the top position and the tractor cab.

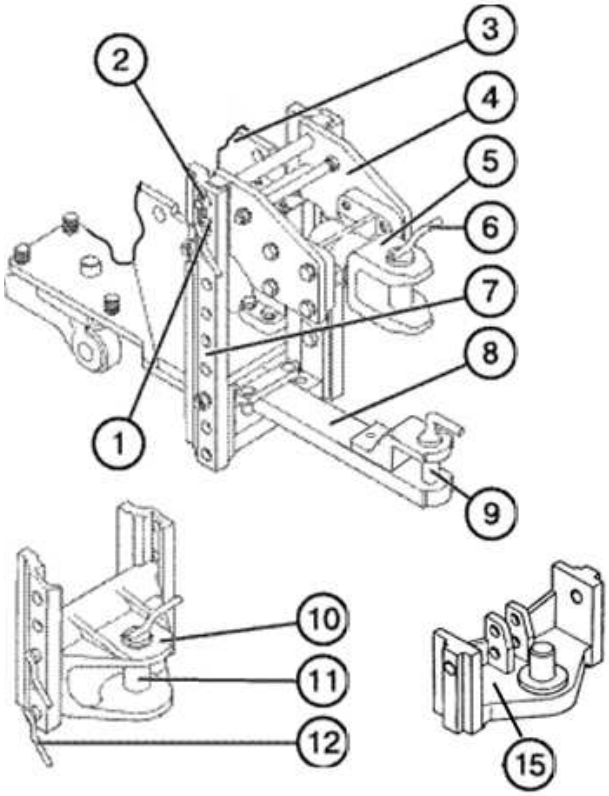
D58

Universal traction-hitch mechanism

The towing arrangement for working with two-ale trailer consists of the towing jaw (5) with the pivot (6). The jaw body is connected with the plates (4) which enter the slot of the guiding side pieces (3, 7) and fixed by means of four pins (12). The pins are locked by means of a linchpin (2) and stopped by the ring (1). The height of the towing jaw with the body can be varied by repositioning the same on the holes in the side pieces (3, 7).

The towing jaw (10) with the pivot (11) is intended for work with semi-trailers. The hitch pin (python) (15) can be also used for this purpose.

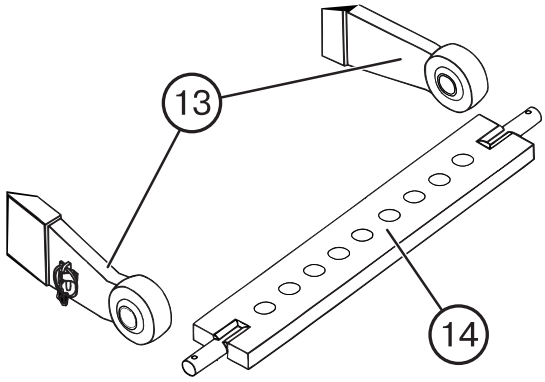
The drawbar (8) with the pivot (9) is intended for hitching the semi-trailed and trailed agricultural machines to the tractor.



Crossbar (single) (14)

The crossbar complies with international standards and is intended for hitching the trailed and semi-mounted machines to the tractor.

It is mounted onto the RHL suspension axle (rear joints of the lower rods (13)) and connected with the machines having a fork instead of loop and makes it possible to improve the manoeuvrability of machine-tractor aggregate.



Coupling hook

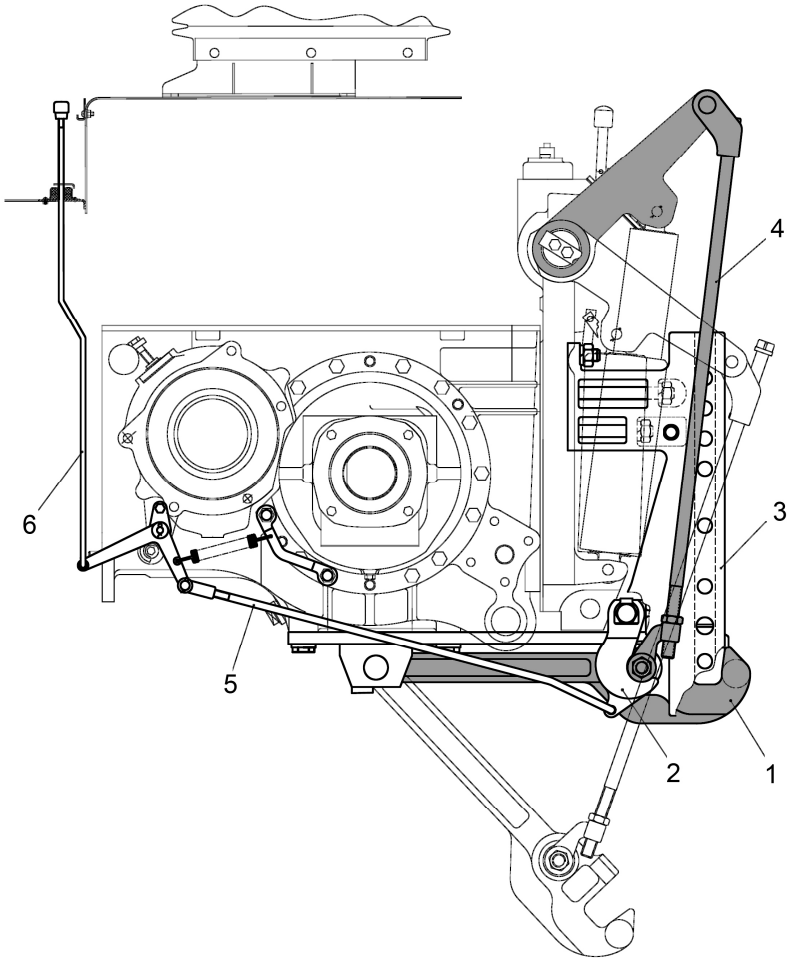


Fig. D-38a. Coupling hook

The coupling hook (hydroficated) is intended for working with semi-trailers and agricultural machines based on them. It is mounted on the tractor with the lift-type guides of the traction-hitch mechanism. It can be delivered complete with the towing jaw intended for working with trailers and trailed agricultural machines.

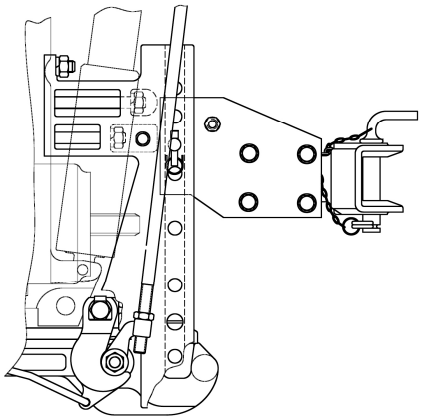


Fig. E-38a. Coupling hook
Variant with towing jaw

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Adjustment of the hydroficated hook control mechanism and peculiarities of adjustment with the electro-hydraulic regulator of the RHL control

ATTENTION! Prior to beginning the work with semi-trailers as well as prior to each adjustment of the position sensor (in case of mounting of the EHR) determining the position of the lift levers (1) and (2) (see Fig. E-38), it is necessary to turn out the screws (3) (see Fig. E-39) from the shackles (4) to ensure the free travel of the levers to avoid breakage of pins (5) of the angle braces.

If the tractor is equipped with the EHR, the position sensor shall be set in the following order: Screw in the sensor (12) with applying the hand torque until full taking up of its travel (up to the stop) and then screw it out by 0.5...1.0 revolutions and stop by means of a locknut (with applying the hand torque too).

To adjust the control mechanism, proceed as follows:

1. Lift the lift levers to the maximum possible height, which can be determined by the position sensor and position handle of the distributor, adjust the length of the lifting bars by means of the screws (3), turn in the screws (3) into the shackles (4) until the heads of the screws rest against the surfaces of the shackles 6 and stop them with locknuts. When it will be done, the grips (7) shall pass under the hook axle 8 without striking against it.
2. Set the pawl E of the handle (10) onto the bracket (11).
3. Ensure the clearance «Д» between the grips (7) and the hook axle (8) when lowering and lifting the same by adjusting the length of the rod (9).
4. Lift the levers to the top position and move the handle (10) down. When it will be done, the grips (7) shall be positioned under the hook axle.
5. Make sure that the grips ensure the locking of the hook in the working position when lowering the levers.

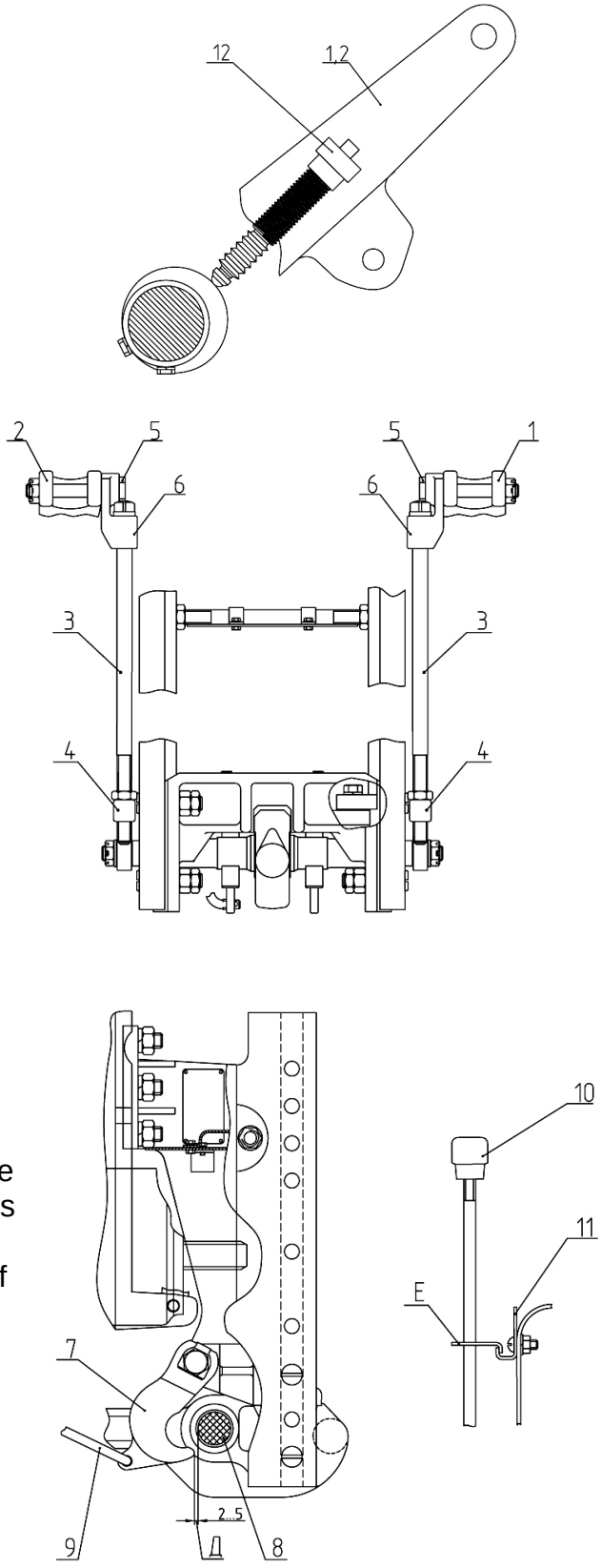

Fig. E-39

Hydrostatic steering control

The hydrostatic steering control (HSC) is intended for controlling the turning of the steerable wheels and reducing the force to be applied to the steering wheel for turning the tractor. The steering wheel and the steerable wheels are connected hydraulic by oil pipelines and high-pressure hoses which connect the dosing pump mounted in the tractor's cabin on the steering column and differential hydraulic cylinder which is installed in the steering linkage of the front driving axle. The hydraulic circuit of HSC of the tractors MTZ-1220.1/1220.3 is given on Fig. Д-40.

During turning of the steering wheel the dosing pump (2) (Fig. Д-40) gives the steering hydraulic cylinder (1) the oil volume which is proportional to the turning value of the steering wheel. When the steering wheel is not rotated the dosing pump locks in the oil volume in the hydraulic cylinder. It achieves stability of the direction of movement of the chassis through road or soil variations. At the normal working conditions when the feed pump (3) ensures necessary flow and oil pressure, maximal force on the steering does not exceed 30 N.

If oil flow from the dosing pump is too small or is out (for example, in case of failures of the diesel engine, dosing pump or break of the oil supply pipeline), the dosing pump works as a handl pump in the steering control system. The steering wheel force which is applied by the operator for wheels turning at the hand control is very much increasing, sometimes till 600 N.

When the diesel engine is running oil from the feed pump (3) (Fig. Д-40) (the steering wheel does not rotate) comes to the dosing pump (2) and is delivered to the oil tank (5) through the filter (4) in the oil tank. As you rotate the steering wheel, the spool of the dosing pump (the spool is connected to the steering wheel) displaces, ensuring oil supply into one of the cavities of the hydraulic cylinder of the turn 1 in the volume that corresponds to the turning angle of steering wheel.

When the diesel engine is not running and you rotate the steering wheel left or right the dosing pump is acting as a pump, supplying oil into the corresponding cavity of the hydraulic cylinder of the turn und ensuring the turning of the directive wheels.

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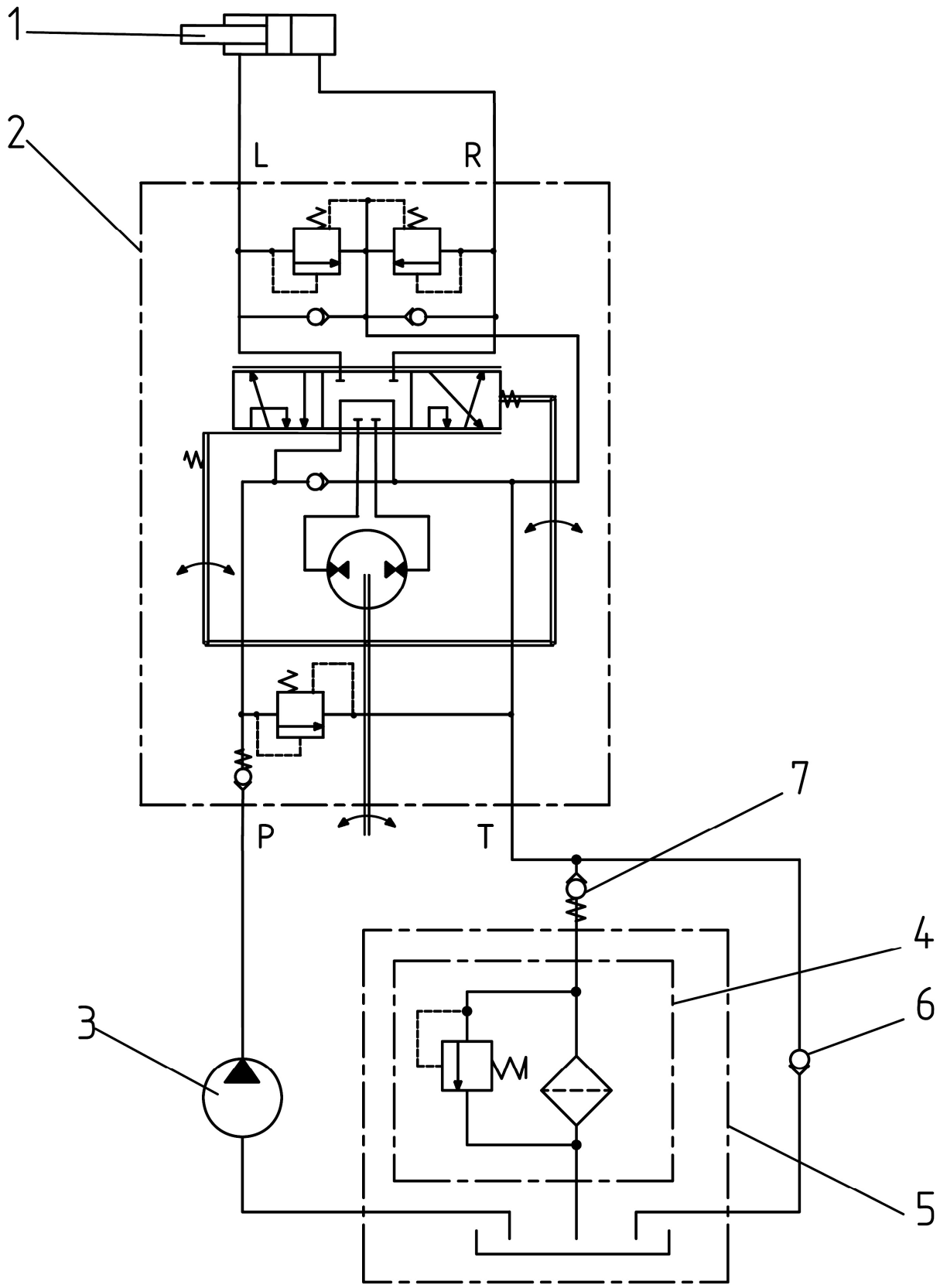

Figure D-40 Hydraulic circuit HSC

1 – hydraulic cylinder, 2 – dosing pump, 3 – gear-type feed pump HSC, 4 - filter, 5 – oil tank 6 – return valve, 7 - valve

Designation: L – left turn; R –right turn; P – pressure line; T – delivery to the oil tank

Measuring Pump

The measuring pump (Fig. E-41) consists of a pumping unit (I), distributor (II), a non-return valve (9), two anti-shock valves (7), safety valve (6) and two anti-vacuum valves (8).

The safety valve (6) limits maximum pressure in the oil discharge duct to within 14…15 MPa (140…150 kgf/cm^2).

The anti-shock valves (7) limit pressure in the cylinder ducts in case of impact loads. Pressure setting for the anti-shock valves is within 20…21 MPa (200…210 kgf/cm^2).

The anti-vacuum valves (8) make it possible to ensure supply of the required amount of working fluid to the hydraulic cylinder in an emergency and on operation of the anti-shock valves

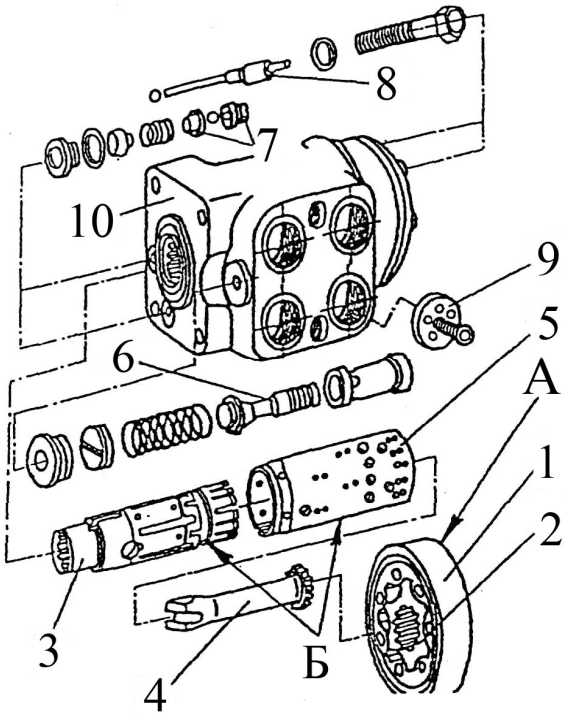

Fig. D-41. Measuring pump (exploded view):

1 – stator; 2 – rotor; 3 – slide valve; 4 – driven shaft; 5 – sleeve; 6 – safety valve; 7 – anti-shock valve (2 off); 8 – anti-vacuum valve (2 off); 9 – non-return valve; 10 – casing; I – pumping unit; II – distributor

2.10.3 Steering hydraulic cylinder

The steering hydraulic cylinder consists of body (3) (figure Д-42), a rod (4), a piston (1), a front cover (6) and a cap nut (8). The piston is fixed on the rod with a nut (15), which is locked by punching of the land in rod slots. In eyes of the body and the rods, spherical bearings (7), that have channels in the inner race for lubrication of friction surfaces through the oiler in the pin, are installed. In the cover (6) a collar (9) (wiper seal), rod guides (13), that exclude friction of the rod and the cover, and rod packings (10) are installed. An integrated seal (14), that excludes friction of the piston and cylinder liner, is mounted on the piston.

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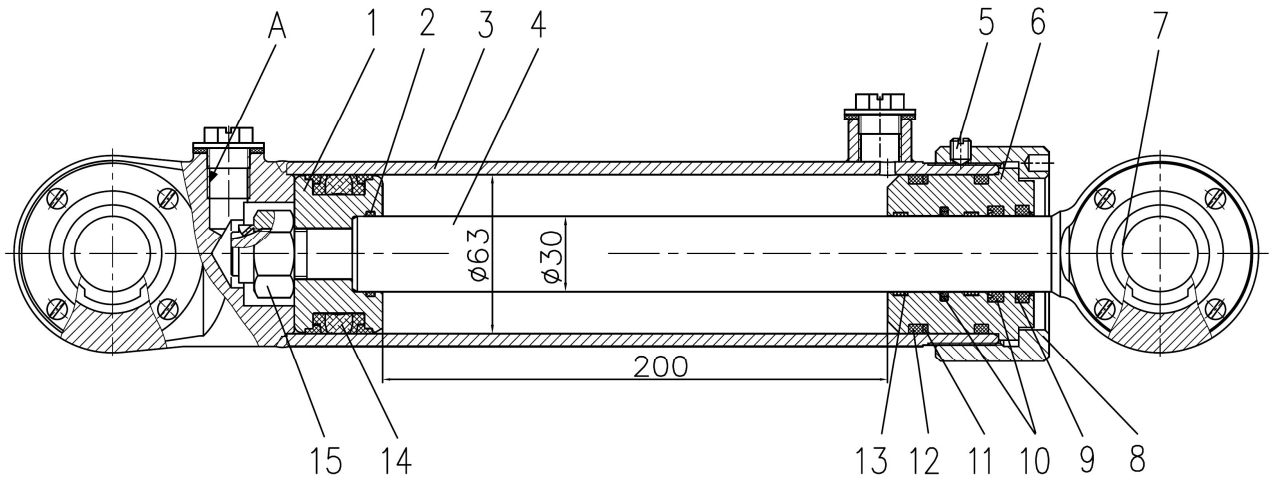

1 - piston; 2, 12 – O-ring; 3 - body; 4 - rod; 5 – lock screw; 6 – front cover; 7 - spherical bearing; 8 – cap nut; 9 – rod collar; 10 – rod seal; 11 – protective ring, 13 – rod guide, 14 – piston seal; 15 – piston nut

Fig. D-42. Steering hydraulic cylinder

Recommendations for operation of HSC

When assembling HSC the following operations are to be done:

- install properly the oil pipelines and hoses in accordance with the hydraulic diagram of HSC, given on figure 2.10.1;

- protect the connecting holes of the dosing pump, hydraulic cylinder, oil pipelines and high-pressure hoses against penetration of dirt;

- prior to starting the engine, check the tightening of all the connections of the HSC hydraulic system, bleed air from the hydraulic system. To do this, proceed as follows:

1. Raise the controlled axle of the tractor (for example, with adjustable jack). When the controlled wheels are unloaded, the steering control is acting under minimal pressure and air is removed from oil faster. The unload can also be done by disconnection of the steering hydraulic cylinder from the controlled wheels.

2. Fill the oil tank to the upper limit as seen on the level indicator.

3. Start the engine. Turn the steering wheel in both directions 3-4 times at the idling rotational speed of the engine without reaching the extreme positions of turning of the steerable wheels. Add oil to the tank to the required level.

4. Turn the wheels from one stop to another 2-3 times. Hold the steering wheel at the extreme positions for 4...5 seconds.

5. If necessary, eliminate the oil leaks and add oil to the top level of the tank.

6. Drive the figure of eight to check the operation of the steering control.

Section E. **TRACTOR PREPARING FOR OPERATION**

GENERAL REQUIREMENTS

When putting a new tractor into operation proceed as follows:

- clean the tractor;
- take the protective poly-chlorine vinyl covers off;
- attentively inspect the tractor, check its completeness, remove storage batteries, bring them into operation and replace into the same position;
- install the drain cocks of the radiator and diesel cylinders' block which are enclosed to the tractor and kept in a separate packing box;
- check tightening of the carving joints and, if needed, tighten;
- unpack the muffler laid in a tractor's cabin and install it on an exhaust manifold so that an exit cut of the pipe is turned forward the tractor movement. Then install a tension band at a distance of 8…12 mm from the muffler socket flank. Clamp nuts are to be tightened with torque of 44…56 N·m;
- check oil level in the diesel engine crankcase, transmission, front driving axle housing and final drive reducers, in the oil tanks of hydraulic system and hydrostatic steering system, and if necessary, add more;
- empty the fuel out of the fuel tanks and fill them with settled fresh fuel: in winter – with winter fuel, in summer – with summer one.
- fill the diesel cooling system with coolant fluid up to the level of upper flank of the filler neck;
- check and if necessary, adjust tension of the generator belt;
- lubricate tractor's mechanisms and components in accordance with the recommendations of the present Operators manual;
- check and, if necessary, adjust the tires to the normal inflation.

ATTENTION! Before operating a tractor, make sure that all the guards (guards of rear PTO shank, etc.) are in place.

PREPARING FOR STARTING AND STARTING THE DIESEL ENGINE

Normal temperature starting (+4°C and above)

IMPORTANT! Start the diesel engine and perform the devices control only when sitting in an operator's seat.

IMPORTANT! Never start the diesel engine with an empty cooling system!

- Apply a parking brake of a tractor;
- Open a fuel tank cock;
- Fill a fuel supply system with fuel and bleed it for air removal;
- Put fuel supply control levers in mid-position, and PTO control lever - in "Off" position;
- Put the transmission gearshift levers in neutral position;
- Switch "Storage battery" button on;
- Turn the key-start switch to the position "I" (fixed). At the same time an oil pressure warning light will illuminate in the block of the warning lights indicating emergency oil pressure in the hydrostatic steering system, and a warning light indicating oil pressure in the diesel engine (a buzzer sounds) as well as air pressure indicator (if it is less than acceptable), voltage indicator and fuel-level indicator (if the fuel tank

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is filled with fuel up to a reserve level) will light up in the dashboard;

On the control lamps block the control lamp of parking brake engagement works in flashing mode with frequency 1 Hz.

- Turn the key-start switch to the position «II» («Start»).

  Before turning the key-start switch to the position «II», hold it in the position «I» for less than 2 seconds.
- Before starting the diesel engine, hold the key-start switch for less than 15 seconds. If the diesel engine fails to start, wait for 30…40 seconds before starting a new attempt. If the diesel engine fails to start after 3 attempts, find the defect and rectify it.
- When the diesel engine starts, check all indicator lights and data of the dashboard (coolant fluid temperature, oil pressure in the diesel engine and gear box, storage batteries charge, etc.). Idle the diesel engine at 1000 rpm until the pressure stabilizes in the operating range.

• The pilot lamp of second AB charge should go out after diesel engine start. It points out that charging of the second AB with 24-V-frequency through the voltage transducer is going on. If the pilot lamp of charging stays on after the engine is started, this means, that the additional battery is not being charged, this failure is to be eliminated.

IMPORTANT! Your tractor is equipped with turbocharged diesel engine. To provide lubrication of turbocharger's bearings, idle the diesel engine for 2...3 minutes before loading it down.

Cold temperature starting (+4°C and below).

IMPORTANT! To avoid damage of the drive train, do not push or tow the tractor to start the diesel engine.

The same as preparing for starting and starting the diesel engines of the tractores MTZ-1220.1 at the air temperature +4°C and more, only for better diesel start one shall switch on the glow plugs. Turn the key of the starter and instrument switch from "I" position to "0" position and wait until glow plug control lamp switches on.

Further:

• wait for the end of continuous flashing of the control lamp (fixed time interval for heating of glow plugs);

• when the lamp is in blink mode with the frequency 1 Hz, start the diesel engine (the beginning of the discrete lamp mode indicates the heating of glow plugs, fixed time interval);

• when the diesel engine starts, the control lamp goes out, but the glow-plugs remain switched for 3 minutes with the motor running.

• if no start within this period (discrete lamp mode), the plugs and the control lamp go out;

• in the emergency mode the glow plug control lamp is operating as follows:

- if the glow plugs do not go out after the full working cycle (sticking of relay contacts and mechanical failure are possible), the control lamp switches on in the blink mode with the frequency 2 Hz.

- if the voltage is not delivered to the glow plugs, the control lamp starts flashing, one switching on in 3 s ;

In these cases the failure is to be found and eliminated.

To start the diesel engine at ambient temperatures of - 20° C and below it is necessary to use special circulation heater of the coolant fluid in combination with the means of diesel engine start heating.

NOTE: Circulation heater of the coolant fluid should be used only for cooling system filled with antifreeze.

Use oil of winter types*) in the crank case, transmission, hydraulic system and hydrostatic steering system during stabilized cold ambient temperatures in accordance with recommendations of the given Operators manual.

Keep the batteries fully charged.

Use pure winter diesel fuel without water adding. To avoid defects, empty fuel gravity filter and fuel tanks from sediment every day.

IMPORTANT! Fill the tanks at the end of each operating day to prevent condensation in the fuel tank.

Breakaway and tractor moving

NOTE: Refer to the travel speed chart in section «B» of this manual for desired speed range selection (p. B6).

1. Tractors with 16F+8R gear box

To drive a tractor, please, do as follows:

- Reduce diesel engine speed.
- Depress the clutch pedal.
- Select a desired gear range of the gear box:
  - Move the lever (1) to an extreme right-hand (spring-loaded) position and pull it to yourself or push the lever away to select a desired range: I (low) or II (high) ones accordingly;
  - Return the lever to neutral position («N») and then turn the lever to the left to select a desired gear range in accordance with shift pattern I.
- Select a desired speed with the lever (2) as per shift pattern II.
- Turn off a parking brake, release a clutch pedal smoothly and simultaneously speed up the diesel engine – a tractor starts moving.

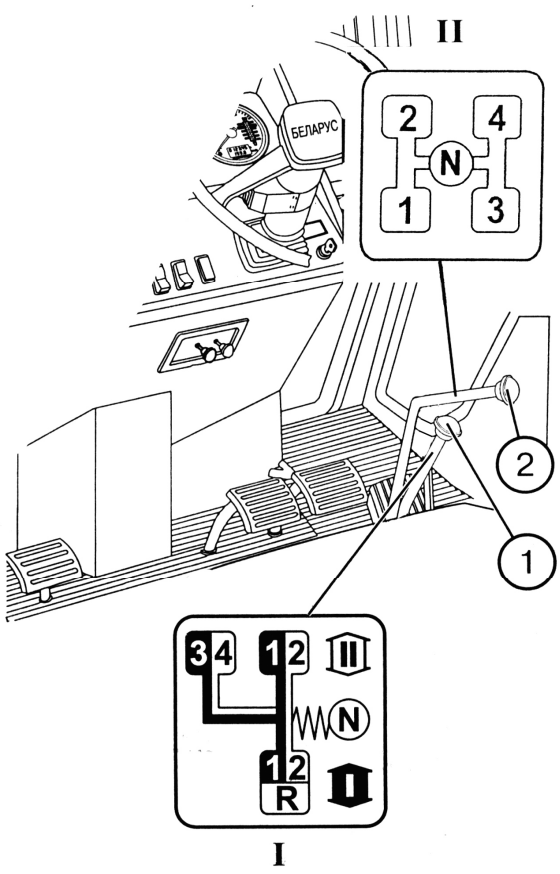
WARNING! Always depress a clutch pedal before selecting a required gear range or gear in the gear box.

IMPORTANT!

Shift gear ranges (by gear clutch) only when a tractor is stopped**.**

To shift a gear smoothly without sharp pushes, displace the gear shift lever (2) in accordance with pattern II (see the figure above) and hold it in a pressed position till the gear is fully shifted.

While operating a tractor, do not keep your foot on a clutch pedal. It will result in clutch slipping, its overheating and breaking.



Do not start driving a tractor with heavy traction loading (for example, a plough buried in soil). After shifting a gear, turn the parking brake off and engage the clutch smoothly. After a tractor starts moving, increase fuel feeding smoothly.

2. Tractors with c 24F+12R gear box (optional)

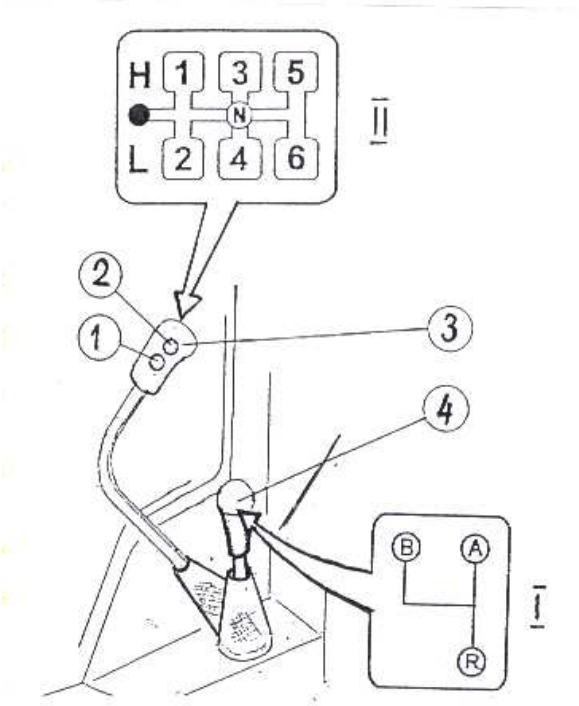
To drive a tractor, please, do as follows:

- Reduce diesel engine speed.
- Fully depress the clutch pedal.
- Select a required gear range of the gear box, doing the following:
  - Move the lever (4) to any of the positions “A”, “B” or “R” in accordance with gear range shift pattern «I».
  - Push the button (1) to switch the lowest range of the gear box reducer (L) or button (2) to engage the highest range of the reducer (H).
  - Select a desired gear by shifting a lever (3) from neutral position «N» to one of the positions 1, 2, 3, 4, 5, 6 in accordance with gear shift pattern “II”.
  - Turn off the parking brake, release a clutch pedal smoothly and simultaneously speed up the diesel engine. A tractor starts moving.

IMPORTANT! Engaging «L» and «H» ranges of the reducer is possible only if the gear shift lever (3) is set to a neutral position.

IMPORTANT! To avoid noisy shifting, shift a range gear (4) only when a tractor is stopped.

While operating a tractor, do not keep your foot on a clutch pedal. It will result in clutch slipping, its overheating and breaking.



IMPORTANT! To shift a gear smoothly without sharp pushes, displace the lever (3) according to gear shift pattern II and hold it in a pressed position till the gear is fully shifted.

WARNING! Always depress a clutch pedal before selecting a required gear range or gear in the gear box.

Working brakes

When driving on the road at transport speed, both brakes pedals must be locked together with a latch.

Steering control

Important! "MTZ" tractor is equipped with hydrostatic steering system. If the diesel engine is stopped, an oil pump, which is put in action by the diesel engine crankshaft, no longer feeds the hydrostatic steering system. As a result it automatically proceeds to a manual mode which requires more effort to steer the tractor while turning.

Stopping the tractor

To stop the tractor:

- reduce diesel engine crankshaft rpm;
- depress the clutch pedal;
- set the gear shift levers to a neutral position;
- apply working brakes to stop the tractor;
- apply the parking brake.

INPORTANT! To stop the tractor in an emergency situation, simultaneously press the clutch pedal and both interlocked brake pedals as quickly as possible.

Stopping the diesel engine

IMPORTANT! Before stopping the diesel engine, put an implement down to the ground, and let the diesel engine run at 1000 rpm for about 3...5 minutes. It will allow decreasing the temperature of the coolant fluid of the diesel engine.

To stop the diesel engine, proceed as follows:

- switch PTO off;
- put all distributor handles to a neutral position;
- set the fuel feeding control lever to a position that corresponds to the minimum fuel position;
- pull diesel engine stop lever;
- turn a ground switch off (to avoid storage batteries discharging).

Power take-off shaft

IMPORTANT! To avoid shock loads on the PTO, reduce diesel engine speed to approximately 900 rpm when engaging the PTO, then increase diesel engine speed. Similarly, to reduce overstressing the tractor PTO braking bands, reduce PTO rpm at first by diesel engine speed slowing down before disengaging the PTO. It is particularly important for implements having a high moment of inertia. These implements should always be fitted with a free-running coupling.

There are two interchangeable PTO shaft tails. When operating with a 6-splined shaft tail, run the diesel engine at 2037 rpm to obtain standard PTO speed of 540 rpm.

When a 6-splined shaft tail is replaced with a 21-splined one, switch PTO drive to 1000 rpm and run the diesel engine at 2156 rpm to obtain standard PTO speed of 1000 rpm

Warning! To avoid unexpected movement of the implement, disengage the PTO after each use.

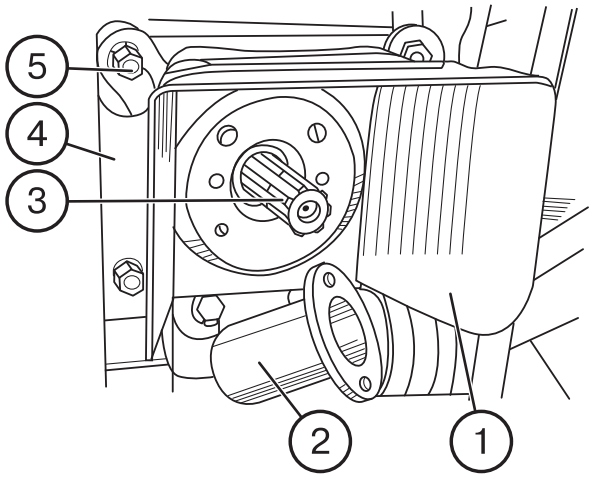
The PTO-driven equipment not requiring high power take-off, must have 6-splined coupling to run at 540 rpm. In this case it is necessary to set 2037 rpm of the diesel engine.

The PTO-driven equipment which requires high power take-off operates at 1000 rpm of PTO shaft tail and is provided with 21-splined coupling to be attached to PTO shaft tail.

Two-speed PTO switch position	Diesel engine speed (rpm)	PTO speed (rpm)
Power mode (6-splined, speed I, 82 h.p.)	2037 2100	540 556
High power mode (21-splined, speed II,123 h.p.)	2156 2100	1000 974

Changing PTO shaft tail

- Remove two bolts and tail cap (2).
- Unscrew four nuts (5), remove a housing (1) and a plate (4).
- Remove six bolts, the plate and take out the PTO tail (3).
- Install the other PTO shaft tail into a spline hole, mount the plate and all other removed parts in a reverse order.



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Running-in

IMPORTANT! The first 30 hours of tractor operation influences greatly tractor performance and operation life, especially its diesel engine.

Your new tractor will provide an effective and long operation in case of proper running-in procedure and other necessary services carried out at recommended intervals.

During the 30-hours running-in period, observe the following precautions:

1. Constantly check the devices' data, watch upon the lubrication, cooling and feeding systems' operation. Control the levels of oil and liquid in filling tanks.
2. Check the tightness and tighten the external fixing joints.
3. Do not overload the diesel engine and avoid its smudging and speed drop. Overloading has place if the diesel engine speed drops quickly, it is smudging and the diesel engine does not respond to fuel feed increase. Operating at a high gear under load leads to an excessive wear of rubbing diesel engine parts.
4. Operating a tractor at a too low gear, with light loading and at a high diesel engine speed leads to fuel waste. You will save fuel consumption and minimize diesel engine wear by selecting the correct gear range for each particular operation.

Carry out a tractor's running-in while doing light work (sowing, cultivating, moving, transporting). Load the diesel engine by not more than 50% from its rated power.

6. Avoid continuous tractor operation without loading at maximum or minimum diesel engine speeds modes.
7. Avoid continuous tractor operation at constant diesel engine speeds mode.
8. To ensure proper operation of rubbing parts of the clutch coupling, engage the clutch coupling more often and more smoothly during running-in period.
9. Carry out daily maintenance in accordance with the recommendations prescribed in the present Manual.

After completing of 30-hours running-in, carry out technical service operations as prescribed in section K "Routine maintenance", page K 2.

Warning: To prevent injury, be sure that all tractor safety guards are in their places before starting the diesel engine.

Section G. **OPERATING INSTRUCTION**

Hydraulic lift linkage

Hydraulic system of rear thee-point hitch control is equipped with distributor-regulator build in monoblock (HLL with hydraulic lift) that provide system operation in the following modes:

- draft control;
- position control;
- mixed control.

Effective use of this mode depends on implements coupled and on agricultural conditions.

Position control

The position provides accurate and sensitive control of the attached implement position above the ground, such as spraying machine, land leveler, etc. The position control can be used with tillage machines. Semi-mounted ploughs with remote cylinders etc.

But it is not recommended to use this type of control on on fields with uneven surfaces. Position control on the field with uneven surface can lead to constant impacts that arise due to quickly vertical displacement of implement mounted.

Draft control

Draft control is the most appropriate mode for use with mounted or semi-mounted implements, the working bodies of which are buried in the soil. The system is sensitive to changes in tractive force (due to changes in the soil resistance or the tillage depth) through the central rod of the linkage mechanism. The hydraulic system responds to such changes by raising or lowering the implement to support the given tractive force at a constant level. The system reacts to the force of compression and extension in the central rod, thus being a dual action system.

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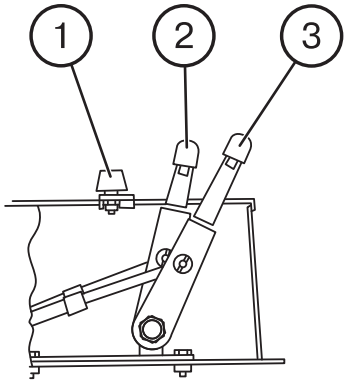
Operation of a tractor equipped with a HLL with a hydraulic lift

A HLL with a hydraulic lift is controlled by two handles located in the cab on the right control panel:

- the draft control handle (2);
- the position control handle (3).



Position control

1. Shift the draft control handle (2) to its full forward position along the course of the tractor.

2. With the postural control handle (3), set the required implement height above the ground.

The figure “1” on the control panel corresponds to the RHL transport position, and the number “9” to the minimum implement height above the ground.

If it is necessary to limit maximal lift hight (for example due to possible breackage of rear PTO parts), set maximum lift height with handle (3) and place to it adjustable stop (1).

Draft control

Use this control method when working with mounted implements (plows, cultivators).

Shift the draft control handle (2) to its leftmost position along the course of the tractor (figure “9” on the panel).

Using the position control handle (3) and (4), link the instrument to the RLL.

Upon entry into the furrow, shift the lever (3) to its forward position and use the handle (2) to adjust the desired tillage depth.

When exiting and subsequently entering the furrow (while plowing), use only the positional control lever (3), do not shift the draft control handle (2).

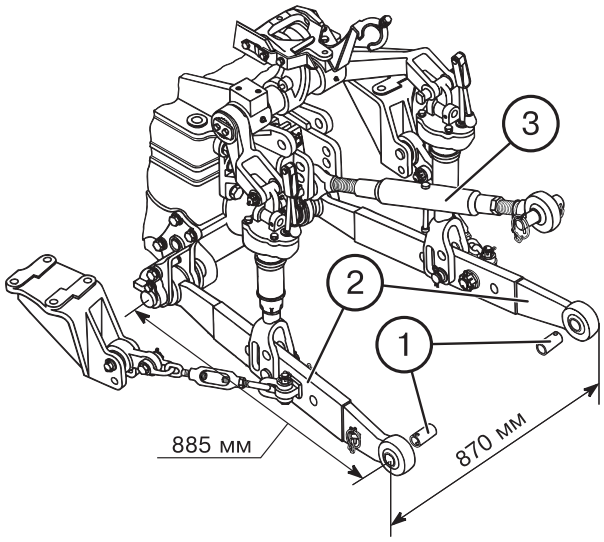
If, due to uneven density of the soil a constant tillage depth cannot be achieved, limit the maximum depth with the draft control handle (3) (mixed control mode), memorizing the respective figure on the control panel.

Rear hitch (RH)

The 2nd and 3rd category three-point hitch serves for coupling of mounted and semi-mounted agricultural machines and implements with the following coupling members:

- the length of the suspension axle (conventional distance between the joints of the lower rods) is 870 mm;
- the diameter of the pins for connection to the lower links (2) is equal to 28.7 mm.
- the diameter of the pin for connection to the upper link (3) is 25 mm.

ATTANTION! Before machine coupling read carefully this section.



The tractor is equipped with the one-piece lower links with joints of 3rd category (with corresponding crossbeams). For operation with the second-category machines, the SPTA kit of the tractor contains the adaptor bushings (1). The rear hitch can be equipped with one-piece and or telescopic lower links. The standard length of one-piece lower links is 885 mm.

The construction of telescopic links that consist of front part and rear ends with pivot balls allows to change length between 805 …965 mm with space of 80 mm.

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Upper link and crossbeam

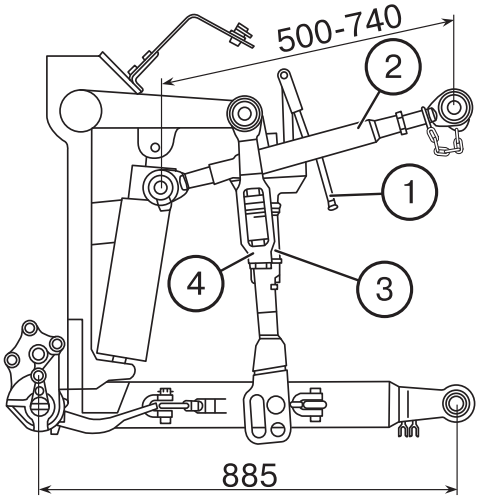
The length of the upper link (4) is adjustable within 500...740 mm.

The length of right adjustable crossbeam (3) can be changed within:

- 580...665 mm for RLL with hydraulic lift.

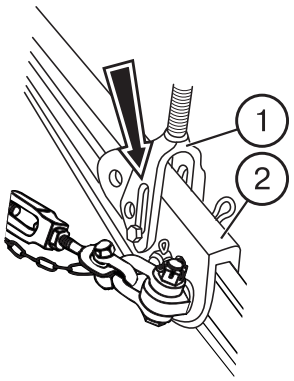
The adjustment of the arm length is carried out through the turning of the handle (2). When delivering to the customer the length of the right arm is adjusted at the standard value 640 mm (RLL with hydraulic lift).

The length arm (1) (non-adjustable) is also adjusted at the standard value 640 mm (b), when delivering to the customer.



IMPORTANT! Adjust the position of the machine by means of the right crossbeam (3).

To follow the relief of the field area to be treated when working with wide-cut machines and to avoid damage of the crossbeams, connect crossbeams (1) with lower links (2) through the slots (indicated by an arrow).



IMPORTANT! The slots of the crossbeam fork shall be behind the hole to avoid the damage of the crossbeam.

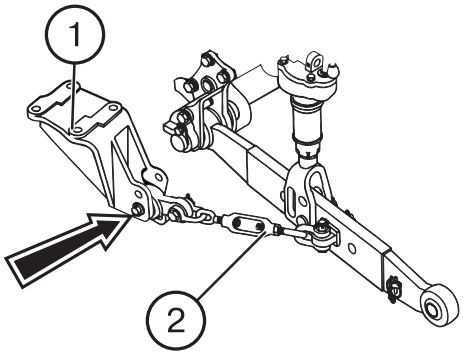
Depending on tilling depth and nature of soil bring the upper link (4) in one of two positions:

- I — light soils and small tilling depth in the mode of draft control;
- II — heavy soils and big tilling depth in the mode of draft control

During the hauling operations bring the link (4) in position III.

External tie-links

Partial locking

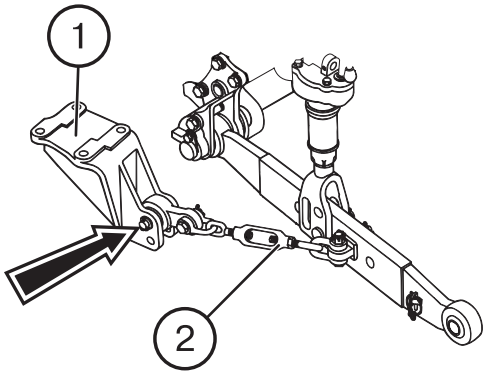


The horizontal movement of the implement in the working position shall be provided by connecting the tie-links to the lower holes of the brackets (1) and adjusting the length by means of the tie-links (2) to ensure the implement swinging to each side by at least 125 mm or in accordance with the operating manual for the implement.

When working with ploughs, adjust the length of the right-hand tie-link to the treatment depth.

ATTENTION! The implement swinging amplitude shall be obligatorily ensured to be at least 125 mm to avoid breakage of the tie-links when lifting the implement to the transportation position.

When transferring the implement to the transportation position, tension the tie-links (2). The swinging of the implement within 20 mm to both sides is allowed.



Full locking

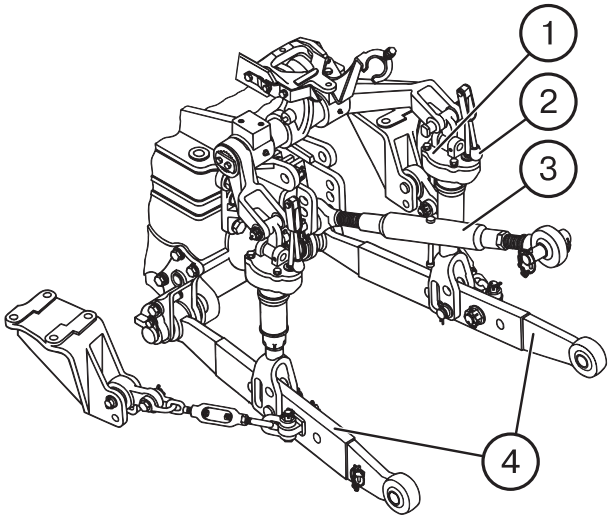
To provide the full locking of the implement in the working position, connect the tie-links (2) to the upper hole of the bracket (1) and reduce their length as much as possible having ensured the implement swinging within 20 mm to both sides.

G6

Mounting the agricultural implements onto the tractor

The most kinds of equipment can be mounted on the tractor by performing the following operations:

1. Bring the lift linkage (HLL without hydraulic lift) to the low position, drive the tractor back and connect the implement to the lower links (4). Lock the pins with cotter pins. Stop the engine.



Note: For HLL with hydraulic lift the lift linkage is bringed to the lower position with the handle of position control, by doing so the handle of draft control is to be in the extreme front position. Combine hinge pins of lower links with implement pins and connect the implement to the lower links.

2. Удлините или укоротите верхнюю тягу (3) и соедините шаровой шарнир тяги с орудием. Зашплинтуйте палец.

. Lengthen or shorten the upper link (3) and connect the same to the implement by means of the rear joint. Lock the pin with a linchpin with a ring.

3. If necessary, adjust the upper link to the required length.
4. If necessary, adjust the sideways tilt of the implement by means of the right-hand crossbeam (1). To increase the crossbeam length, turn the lever (2) clockwise and vice versa.
5. Attach the necessary remote mount equipment.
6. Prior to beginning the work, check to make sure that:
   - the parts of the tractor is not in dangerous vicinity of those of the implement;
   - the upper link is not in contact with the PTO enclosure when the implement is in the bottom position;
   - the cardan drive from the PTO is not too long with large joint angles and there are no thrust forces;
   - the PTO is not in contact with the cardan drive of the machine;
   - lift slowly the implement and check the presence of the clearances between the tractor and the implement in the lifted position;
   - check the presence of the required side swinging of the lower rods and adjust it be means of the tie-links, if necessary.

IMPORTANT! When mounting the mounted or semi-mounted equipment on the tractor or when hitching the trailed equipment to the tractor by means of the draft hitch, make sure that there is a sufficient clearance between the implement and the tractor.

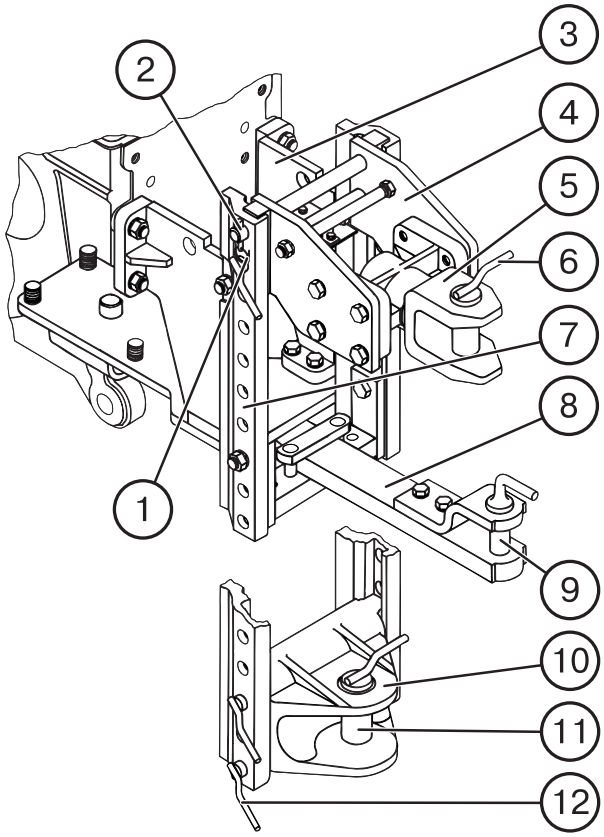
CAUTION! Some mounted or semi-mounted equipment can touch the cab and damage the same. It could cause the breakage of the cab glasses and injure of the operator. Check the presence of a sufficient clearance (at least 100 mm) between the implement lifted to the top position and the tractor cab.

G8

Universal drawbar hitch mechanism

The towing device for work with two-axle trailer consists of the towing jaw (5) with the pivot (6). The jaw body is connected with the plates (4) which enter the slot of the guiding side pieces (3, 7) and fixed by means of four pins (12). The pins are locked by means of a linchpin (2) and stopped by the ring (1). The height of the towing jaw with the body can be varied by repositioning the same on the holes in the side pieces (3, 7).

The towing jaw (10) with the pivot (11) is intended for work with semi-trailers. The drawbar (8) with the pivot (9) is intended for hitching the semi-trailed and trailed agricultural machines to the tractor.



Crossbar (double)

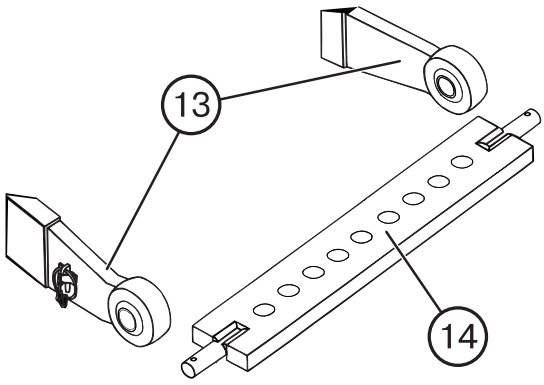
When the tractor is equipped with telescopic lower links, it is possible to mount the crossbar to the rear link ends for connecting to the tractor the trailed and semi-mounted agricultural machines without towing yoke. The crossbar is mounted to the front ends of the lower links when the rear ends are removed.

ATTENTION! Before mounting the double crossbar, remove the link (8) and fork (5) and (10).

Crossbar (single) (14)

The crossbar complies with international standards and is intended for coupling the trailed and semi-mounted machines to the tractor.

It is mounted onto the RLL suspension axle (rear joints of the lower links (13)) and connected with the machines having a fork instead of loop and makes it possible to improve the manoeuvrability of machine-tractor aggregate.



Section H. **ADJUSTMENTS**

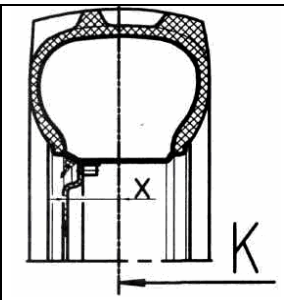
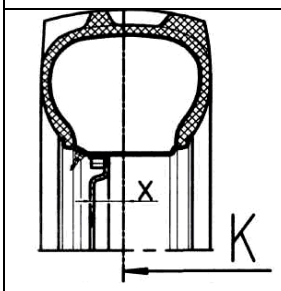
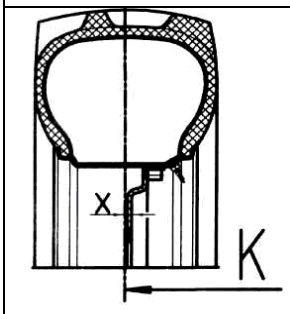
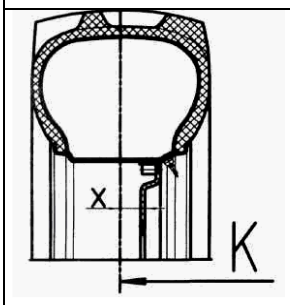
Front wheel track adjustment

The front wheel track is adjusted stepwise both by displacing the wheels from one sideboard to the other, and by changing a position of the wheel disk relative to the rim.

The front wheel track may have the following dimensions: 1620, 1725, 1790, 1890, 1940, 2040, 2105, 2205.

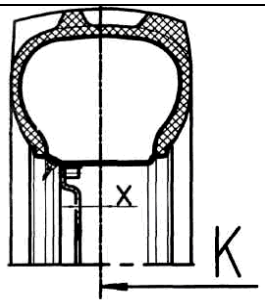
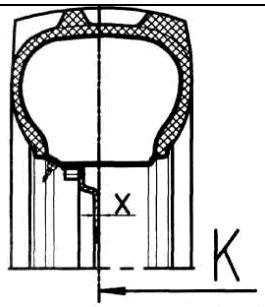
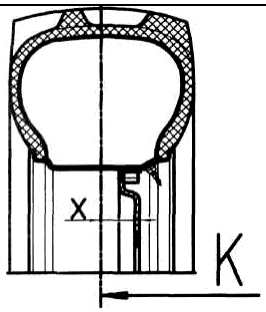
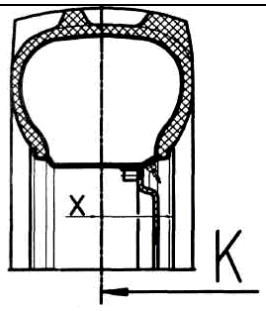
Installation diagrams and track dimensions for tires 420/70R24 (basic configuration) are given in table H-1.

Table H-1 – Front wheel track adjustment

Variants of mounting the disk and the rim		Disk offset X, mm	Tractor track K, mm (tire 420/70R24)	Description of mounting method
Standard disk mounting with rim displacement		+140	1535	Main position. The inner surface of the disk mates with the gear group flange, and the disk is located from the outer side of the wheel support
		+90	1635	***Ex-works condition.*** The rim is displaced relating to the disk. The inner surface of the support mates with the disk.
		-18	1850	The rim is turned by 180°. The disk mates with the support inner surface.
		-68	1950	The rim is turned by 180°. The disk mates with the support outer surface.

H2

Table H-1 continued

Variants of mounting the disk and the rim		Disk offset X, mm	Tractor track K, mm (tire 420/70R24)	Description of mounting method
Displacement of the disk and the rim		+56	1700	The disk mates with the support outer surface.
		+6	1800	The disk mates with the support inner surface.
		-102	2020	The rim is turned by 180°. The disk mates with the support inner surface.
		-152	2120	The rim is turned by 180°. The disk mates with the support outer surface.

Toe-in checking and adjusment

Check and adjust toe-in every 250 service hours of the tractor and after each change of the front wheel track. Before checking the toe-in, always check and, if necessary, adjust the play in the steering rod joints, as specified in section “Scheduled maintenance” of the present manual.

To check and, if necessary, adjust the front wheels toe-in of the MTZ - 1220.1/1220.3 tractors (fig. H-1), proceed as follows:

- установите требуемое давление в шинах в соответствии с указаниями настоящего руководства;
- set the required tire pressure in accordance with the instructions of the present manual;
- on a flat site, drive the tractor forward at least 3 meters and stop. Engage the parking brake.
- measure the distance B (fig. H-1) between two opposite points on the rim flange behind the front axle at the height of the wheel axle.
- move the tractor forward so that the front wheels turn by about 180°, then measure the distance A in front of the front axle between the same points as at the measurement of the size B. The toe-in is correct if the dimension A is 0 … 8 mm less than the dimension B. If the toe-in does not meet these values, procede as follows:

1. Loosen the nuts 1 and 3 of the steering rod adjusting tube 2.
2. Rotating the tube, set the desired toe-in;
3. Tighten the nuts 1 and 3.

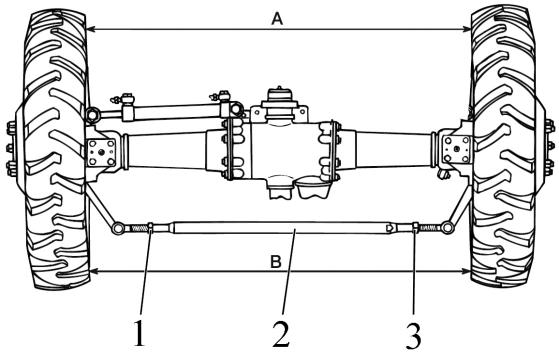


Fig. H-1Front wheels toe-in checking and adjusting of tractors MTZ- 1220.1/1220.3

1, 3 - nut, 2 – steering rod adjusting tube.

H4

Rear wheel track formation

1. Jack up the rear part of the tractor so that the wheels leave the ground.

2. Unscrew the nuts (1) and remove the wheels.

3. Loosen by 2…3 turns the tie bolts (2) of the upper and lower wheel hub liners (3).

4. With the four extracting bolts screwed into the upper and lower liners (two bolts on each liner), pull the liners (3) from the wheel hub to release the cone clamp and wheel hub to let the hub move.

5. Move the hub along the semi-axle to obtain the required track L (use the tables at the right side to determine the track by measuring the size K from the semi-axle end to the liner end).

6. Remove the extracting bolts and tighten up the bolts fastening the hub.

7. Install the wheel and repeat the operation for the opposite rear wheel.

Wheel truck formation when doubling the rear wheels

To install the hubs (basic and additional ones) of the external and internal wheels relative to the semi-axis of the rear axle and wheels disks, follow figure H-2.

Rear wheels toe-in is adjusted steplessly.

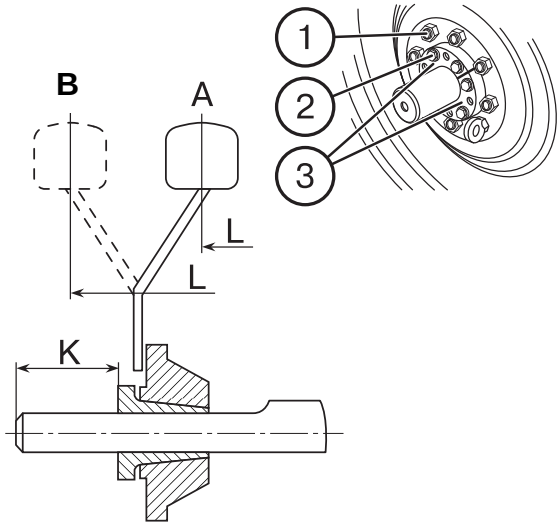


Fig. H-2.

Table H-2

Track L, mm		
Distance K, mm	Wheel installation pattern	
(for tyres 11,2R42)	A	B
245	1420	—
205	1500	—
155	1600	—
55	1800	—
5	1900	—
245	—	1950
220	—	2000
170	—	2100

Track L, mm		
Distance K, mm	Wheel installation pattern	
(for tyres 18,4R38)	A	B
1650	133	-
1800	58	-
200	-	222
2150	-	147

Doubled rear wheels track sizes

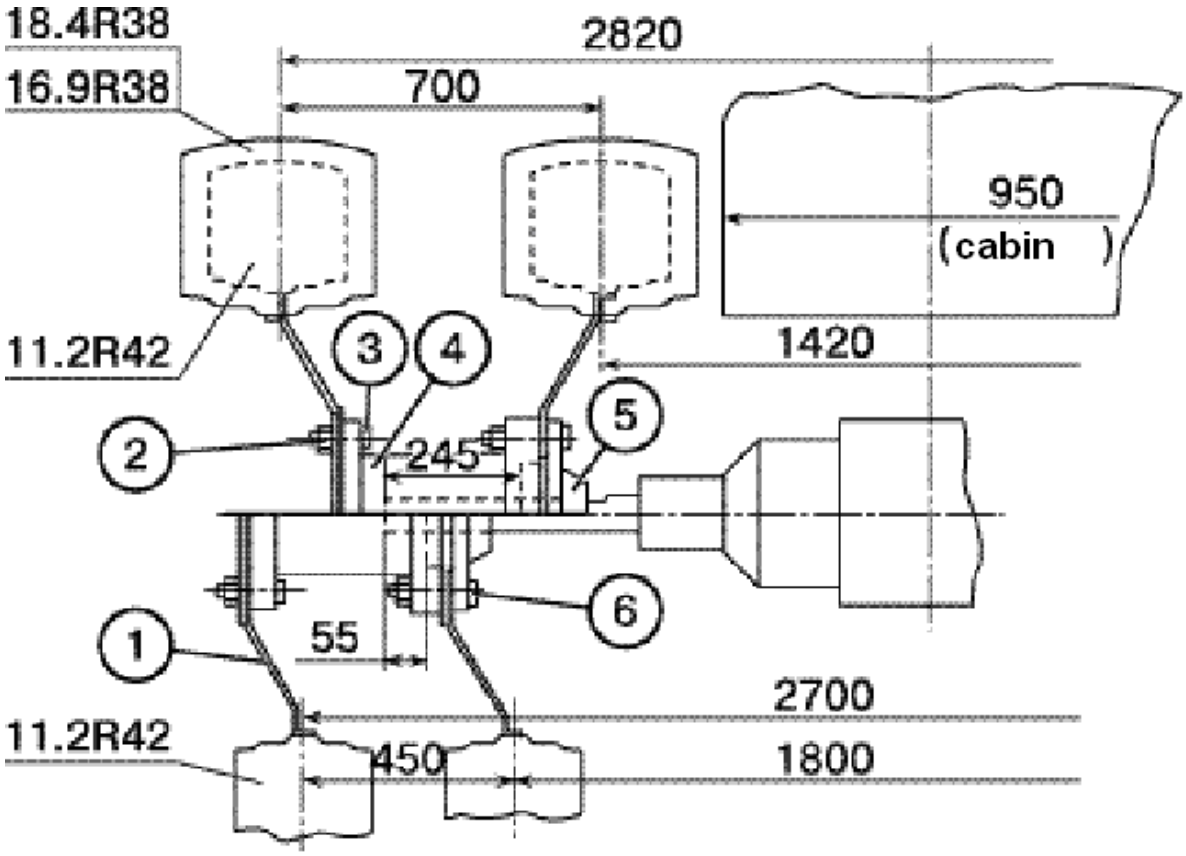


Fig. H-3. Installation scheme of doubled rear wheels with spacer for rows of 450 mm or 700 mm:

1 — wheel; 2 — nut; 3 — bolt; 4 — spacer; 5 — hub; 6 — elongated bolt.

H6

FDA adjustments

Checking and adjusting preload in drive pinion tapered bearings

The bearings must be adjusted so that the preload in the driving pinion bearings be from 0,01 to 0,04 mm. Adjust the preload by installing two washers (9) (Figure H-4) of the required thickness.

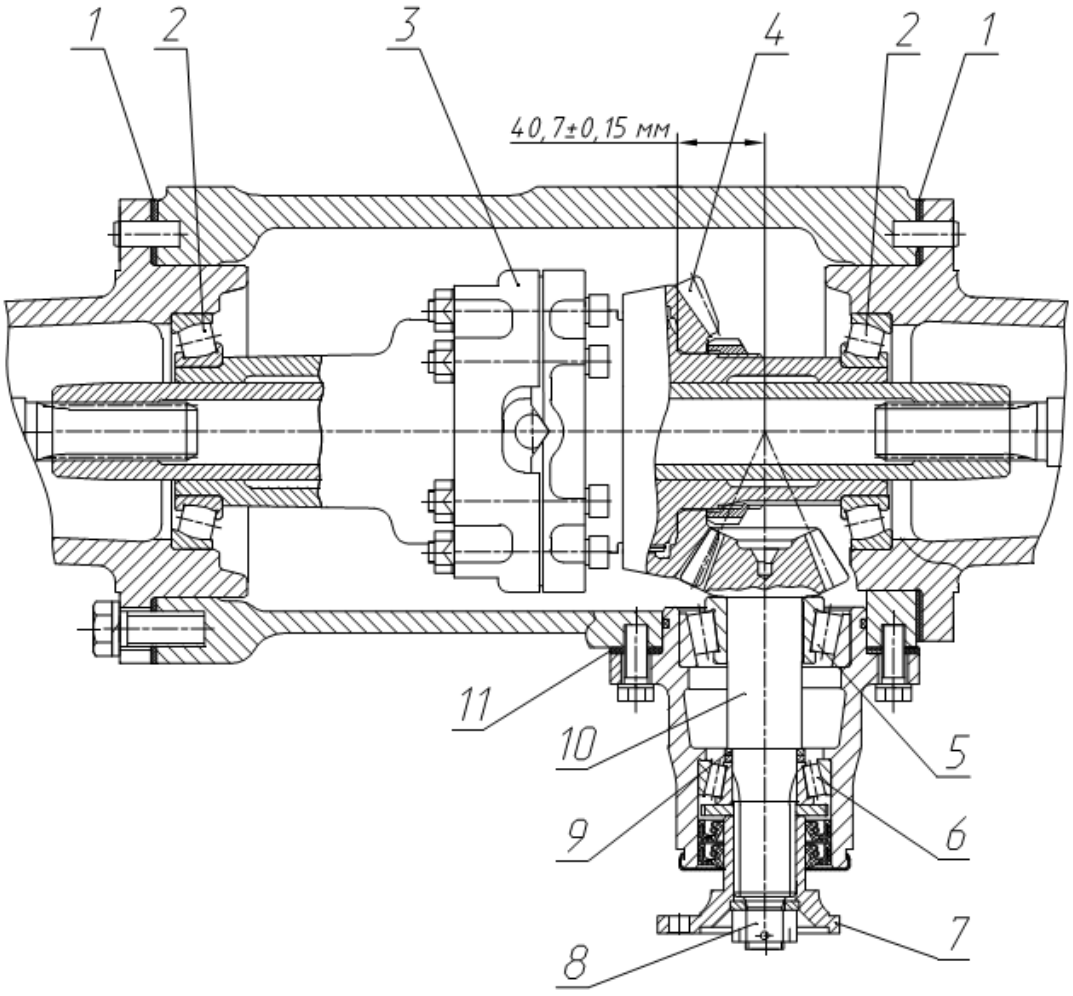
When adjusting:

- tighten up the bearings with the nut (8) (Fig. H-4) to a torque of 120 to 150 N•m When tightening up, rotate the pinion holding by the flange of the driving pinion to let the bearing rollers get into the correct position;

- measure the axial play in the bearings of the pinion. When there is a play, ensure the desired bearing preload using the adjusting washers (9) of lesser thickness. The tightening torque must be in the range from 0.20 to 1.60 N•m, which corresponds to a force from 5 to 40 N at the radius of drill holes of the flange (7) of the driving pinion (10);

- after adjusting, lock the nut (8) with a cotter pin.

At that, to align the nut slots with the holes for the cotter pin, it is allowed to increase the tightening torque of the nut.



1, 11 — shims; 2, 5, 6 — tapered roller bearing; 3 — differential; 4 — driven pinion; 7 — flange; 8 - nut; 9 — adjusting washers, 10 — driving pinion;.

Fig. H-4. FDA adjustments

Checking and adjusting side clearance in main set

Adjust the side clearance in the mesh with the differential bearings adjusted. The side clearance between the final drive teeth must be from 0.18 to 0.46 mm, which corresponds to an angular play in the range from 0.30 to 0.65 mm when measured on the radius of flange screws of cardan shaft.

Adjust using the shims (11) (Fig. H-4), at that the driven pinion must be set to a dimension of 40.7 ± 0.15 mm from the drive pinion axle to the mounting surface of the pinion (4).

When measuring the side clearance, lock the driven pinion from rotating with a crowbar or another tool, using the threaded hole for the filler cap 25 (Figure E-24) in the FDA housing. The drive pinion must have no axial play.

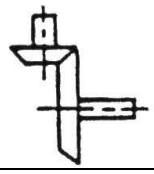
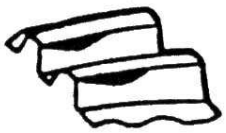
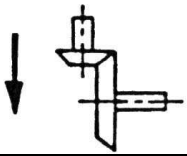
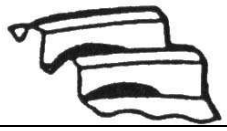
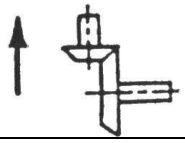
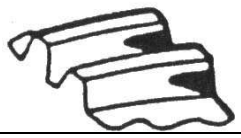
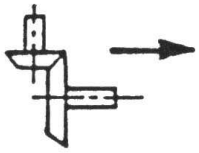
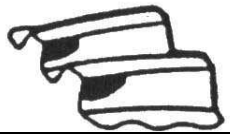
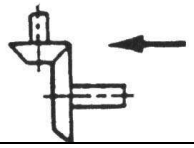
Worn pinions are replaced only in pairs. Do not replace only one pinion, since pinions are produced by the manufacturer in pairs

Mesh (contact pattern)

Adjust using the shims (11) (Fig. H-4) to move the driving pinion (10) or the shims (1) to move the driven pinion (4) in accordance with the table below.

The engagement of the teeth (contact pattern) must be by the length not less than 50% of the tooth length, and by the width — not less than 50% of the contact depth of the tooth. Displacement of the contact pattern is allowed only to the top of the drive pinion of the pitch cone.

Adjusting pinion mesh

Contact pattern at driven pinion	How to adjust pinion mesh	Adjustment scheme
	Proper pinion mesh at low load	
	Move the drive pinion to the driven one	
	Move the drive pinion aside from the driven one.	
	Move the driven pinion (differential) aside from the drive one.	
	Move the driven pinion (differential) to the drive pinion.	

H8

Checking and adjusting axial preload in pivot tapered bearings

Prior to adjusting the axial preload in the pivot tapered bearings (7) (Fig. H-5a), peform the following preparatory work:

- clean the PTO of dirt

- install the tractor on an even surface, brake it and exclude possible movement;

- jack up the front of the tractor installing supports under the FDA in the points of jacking;

- unscrew the nuts fastening the wheels and remove the wheels, observing safety precautions;

- disconnect the steering rod from the left and right wheel reduction gears and remove it from the FDA;

- disconnect the finger fastening the hydraulic cylinder from the mounting bracket fixed to the wheel reduction gear;

- using a dynamometer, determine the force of rotation of each wheel reduction gear, first in one and then in the other direction. Apply force to the wheel bolts nearest to the horizontal reduction gear axis.

The axial preload in the bearings must correspond to the force of rotation of the reduction gear from 60 to 80 N applied to the wheel bolts. Repeat the force check three times in each direction to determine the average value.

With a turn force of 30 to 50 N, adjust preload in the pivot bearings proceeding as follows:

- check the tightening force of the lower axle bolts (180 to 200 N•m);

- unscrew the four bolts M16 fastening the upper pivot axle;

- using the extracting bolts, lift the upper axle (4) (Fig. H-5a) and removing the adjusting shims (2) of the same thickness from both sides of the axle flange, achieve the required preload in the bearings;

- tighten up the bolts (5) (Fig. H-5a) fastening the axles to a torque of 180 to 200 N•m, make the tightening crosswise with mandatory cranking of the wheel reduction gear;

- re-check the preload in the pivot bearings by checking the force of turning the reducer in both directions;

- do the same for the second wheel reducer.

At a turn force of less than 30 N, before adjusting the preload in the bearings, unmount the bottom axle (9) (Fig. H-5a) and check the condition of the lower bearing.

After adjusting, lubricate the wheel reducer bearings. Inject the lubricant through the lubricator in the axles (4), (9).

After adjustment and lubrication of the pivot connection bearings, install the parts removed from the FDA in the reverse order. Tighten the nuts fastening the steering cylinder to a torque of 180 to 200 N•m and the nuts fastening the steering rod to a torque of 110 to 130 N•m.

Make subsequent adjustments of the pivot bearings every 500 hours.

Checking and adjusting axial play in drive pinion tapered bearings of wheel reducer

Check and adjust axial play in the drive pinion tapered bearings (14) (Fig. H-5a)of the gear set as follows:

Use an indicator to check the axial play in the tapered bearings (1) (Fig. H-5a) measuring the displacement of the double joint fork.

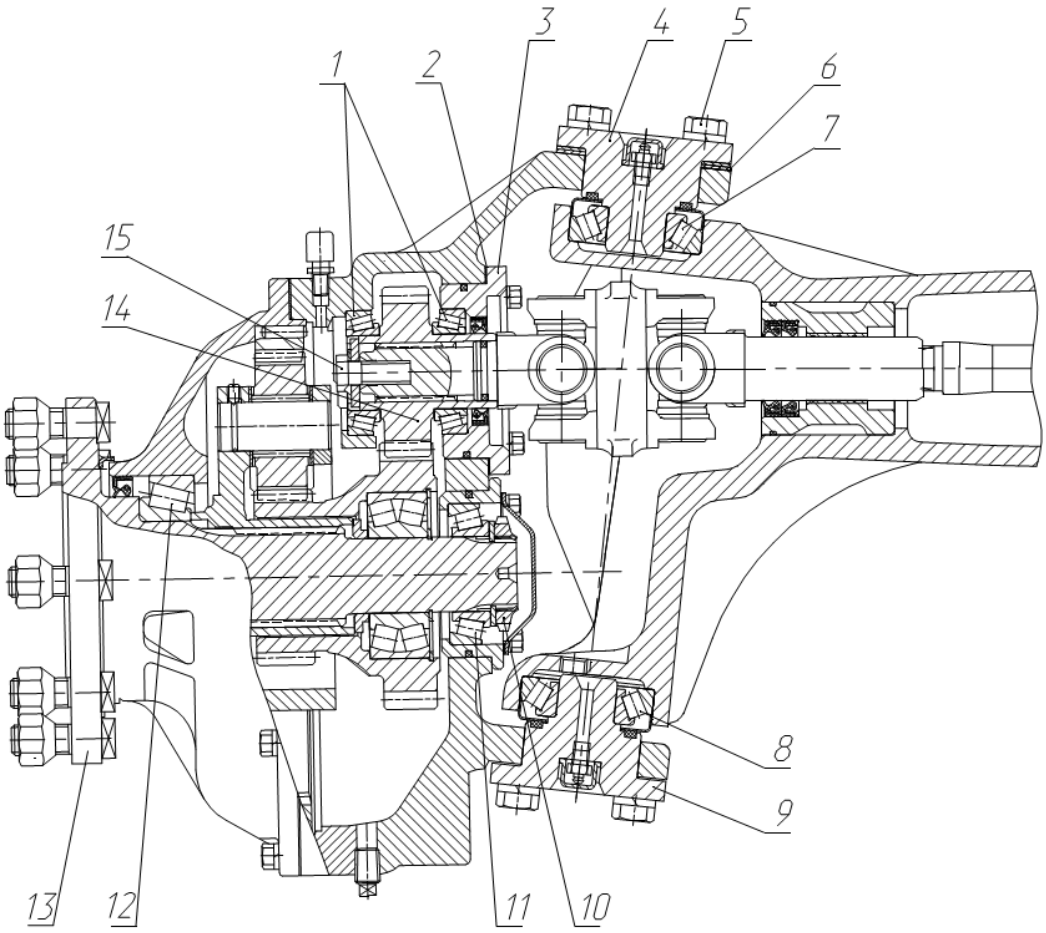
The axial play in the tapered bearings must not exceed 0,05 mm. If necessary, adjust as follows.

- loosen the fastening of the barrel (3) (Fig. H-5a).

- using the extracting bolts, move away the barrel (3) and removing the adjusting shims 4 (Fig. H-5a) of the same thickness from both sides of the barrel flange, achieve the required clearance of 0.05 mm max.

- tighten up the bolts fastening the barrel to a torque of 20 to 25 N•m, make the tightening crosswise with mandatory cranking of the double joint; To ensure

cranking of the joint, the FDA must hang so that the front wheels be able to rotate.



1, 7, 8, 11, 12 — tapered roller bearing; 2 — adjusting shims; 3 — barrel, 4, 9 — swivel pivot axle; 5 — bolt; 6 — adjusting shims; 10 — nut; 13 — wheel flange; 14 — driving pinion; 15 — central bolt.

Fig. H-5a. FDA adjustments made during maintenance

Checking axial play and adjusting wheel flange tapered bearings

Use an indicator to check the axial play in the tapered bearings (11), (12) (Fig. H-5a) measuring the displacement of the flange (13).

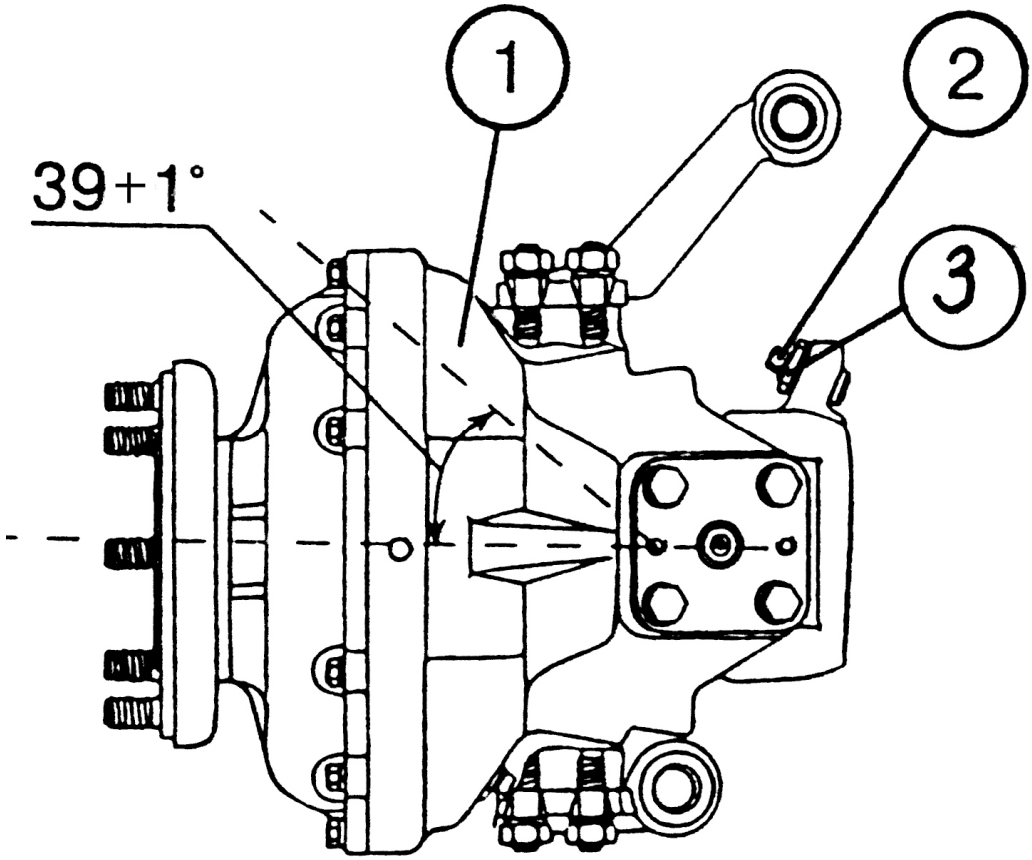
The tapered bearings must have no axial play. If any play is found, adjust the bearings as follows:

- unscrewing the bolts, remove the cover of the nut (10) (Fig. H-5a);
- tighten the nut to a torque of 180 to 200 N•m, then unscrew to an angle of 15 ... 200. When tightening the nut, turn the flange (13) so that the bearing rollers take correct positions in the races;
- after adjustment, unstake the nut pilot in two slots of the flange. Angular displacement of the nut is not permissible.

H10

Adjusting FDA reducer turn angle

The maximum rotation angle of the reducer housing (1) (Fig. H- 5b) from the position of direct motion is 40°. Adjust using the screw (2). Lock the screw with the locknut 3.



1- FDA final drive reduction gear; 2- adjusting screw; 3- locknut

Fig. H-5b. Adjusting FDA reducer turn angle

Adjusting FDA drive switch

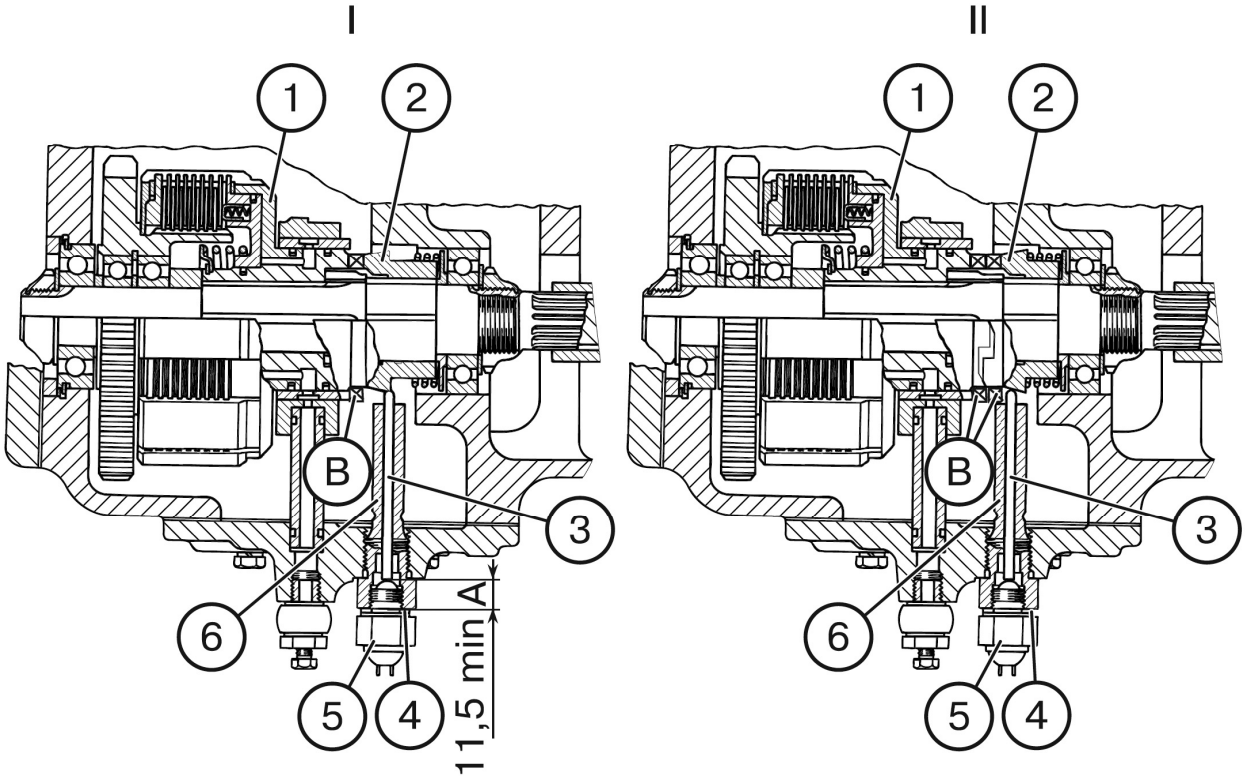


Fig. H-6. **Adjusting FDA drive switch**

If FDA doesn't switch on in the automatic mode, or if it's necessary to replace the switch of automatic FDA drive engagement sensor, perform the following adjusting operations:

1. Engage cams (B) of half-clutch (2)with drum cams (1), so that pusher (3) was extended from guide (6) to maximum (see Fig. H-6 (**I**)).
2. Put initial stack of adjusting spacers (4) (5…6 pieces) under switch end face (5).
3. Removing spacers one by one, provide closing of switch contacts (5).

4..Disengage cams (B) of half-coupling (2) from drum clams (1). In this case pusher (3) should be sunk to maximum, and switch contacts open (see fig. H-6 (II). Switch (5) is adjusted correctly if in position (I) its contacts are closed, and in position (II) are open. To make checking use control lamp, or an alarm on the control panel, having pressed upper key section if FDA control.

Important! In position (I) (Fig. H-6), dimension"A" from pusher end face (3) to switch end face (5) should be at least 11.5 mm. Failure to observe this requirement may result in switch damage.

Checking and adjusting brake valve of pneumatic system

Check and, if necessary, adjust the pneumatic system brake valve drive after completion of adjustment of the service brake control and adjustment of the parking-reserve brake control.

ATTENTION: adjust the brake valve drive when the service brake pedals are not pressed and the park emergency brake is completely disengaged!

Before checking and adjusting the pneumatic system brake valve drive, put the tractor on a flat horizontal surface. The engine must be killed. Put brake shoes in front and behind the wheels precluding spontaneous motion of the tractor.

Check and, if necessary, adjust the pneumatic system brake valve single-cable drive as follows.

1. Connect a pressure gage with a scale of 1 MPa min. to the coupling head of the tractor pneumatic drive.

2. Turn on the compressor, start the engine and fill the cylinder with air to a pressure of 0.77 to 0.8 MPa as per the air pressure gage located on the instrument panel of the tractor. Air pressure as per the pressure gage connected to the coupling head must be 0.77 MPa or higher. If it is lower than specified, proceed as follows:

- check availability of the clearance A between the finger (5) (Figure H-7) and the upper edge of the grooves in the arms (6 and 7). The clearance must be 1 to 2 mm;

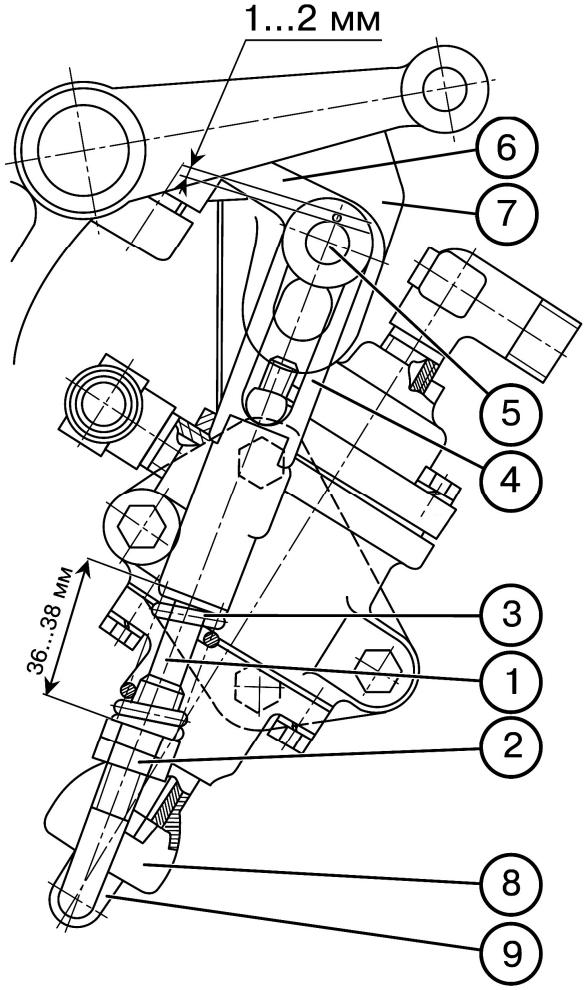
If there is no clearance, remove the cotter pin and remove the finger (5) and adjust the length of the arm by turning the end (4).

- check and adjust as necessary precompression of the spring (3) to a size of 36…38 mm by rotating the nuts (2), then lock the nuts. Adjust the spring precompression so that when you press the service brake pedal or engage the parking brake, first the brake valve rod moves until it stops, and then the spring compresses;

- if the brake valve drive is properly adjusted and the brake valve is in good condition, then when the blocked brake pedals move to a full travel or the parking brake is engaged up to its lock on the second-fourth tooth, the pressure as per the pressure gage connected to the coupling head must drop to zero;

- disconnect the gage from the coupling head.

If the mentioned adjustments do not provide the above pressure parameters, then unmount the brake valve and send it for repair.



1 — linkage; 2 — nut; 3 — spring; 4 — end; 5 — finger; 6, 7 - lever, 8 — casing; 9 — eye.

Fig. H-7 Checking and adjusting brake valve drive of pneumatic drive

Check and, if necessary, adjust the pneumatic system brake valve two-cable drive as follows.

1. Connect a pressure gage with a scale of 1 MPa min. to the coupling head with a yellow cap of the control manifold.

2. Turn on the compressor, start the engine and fill the cylinder with air to a pressure of 0.77 to 0.8 MPa as per the air pressure gage located on the instrument panel of the tractor. Air pressure as per the pressure gage connected to the coupling head must be 0 MPa. If it is higher than specified, proceed as follows:

- check availability of the clearance A between the finger (5) (Figure H-7) and the upper edge of the grooves in the arms (6 and 7). The clearance must be 1 to 2 mm;

If there is no clearance, remove the cotter pin and remove the finger (5) and adjust the length of the arm by turning the end (4).

- check and adjust as necessary precompression of the spring (3) to a size of 36…38 mm by rotating the nuts (2), then lock the nuts. Adjust the spring precompression so that when you press the service brake pedal or engage the parking brake, first the brake valve rod moves until it stops, and then the spring compresses.

- if the brake valve drive is properly adjusted and the brake valve is in good condition, then when the blocked brake pedals move to a full travel or the parking brake is engaged up to its lock on the second-fourth tooth, the pressure as per the pressure gage connected to the coupling head must increase to 0.65 to 0.8 MPa;

- disconnect the gage from the coupling head.

If the mentioned adjustments do not provide the above pressure parameters, then unmount the brake valve and send it for repair.

H14

Checking and adjusting pneumatic system pressure regulator

Checking and adjusting is performed only on tractors equipped with an air pressure regulator 80-3512010. The label tag with the regulator number is located on the regulator housing.

Adjustment of the pneumatic system pressure regulator must be performed during MS-3, as well as case of a pressure regulator failure and after it is disassembled for rinsing or replacement of worn parts.

Check and adjust the pneumatic system pressure regulator after completion of adjustment of the service brake control, the parking-reserve brake control and the brake valve.

ATTENTION: Make adjustment of brake valve drives with the service brake pedals not pressed and the parking brake completely turned off!

Before checking and adjusting of brake valve drive of pneumatic system bring the tractor on the horizontal ground. The diesel engine is to be turned off. Lock the wheels against movement fore and aft by anti-recoil limit stops, excluding tractor self-movement.

Check the pneumatic system pressure regulator as follows:

- for a single-cable pneumatic drive, connect a pressure gage (with a scale interval of 0.10 to 0.02 MPa and a scale of 1.6 MPa min.) to the coupling head with a black cover, for a two-cable pneumatic drive — to the coupling head with a red cover;

- remove the cap (1) (Figure 5.8.1);

- using a wrench, screw in the cover (2) into the body up to stop;

- turn on the compressor;

- start the engine and fill the cylinder with compressed until the safety valve (6) operates at a pressure of 0.85 to 1 MPa. If the valve operates at a pressure of less than 0.85 MPa or more than 1 MPa, adjust it using the screw (8), first loosening and then tightening up the nut (7).

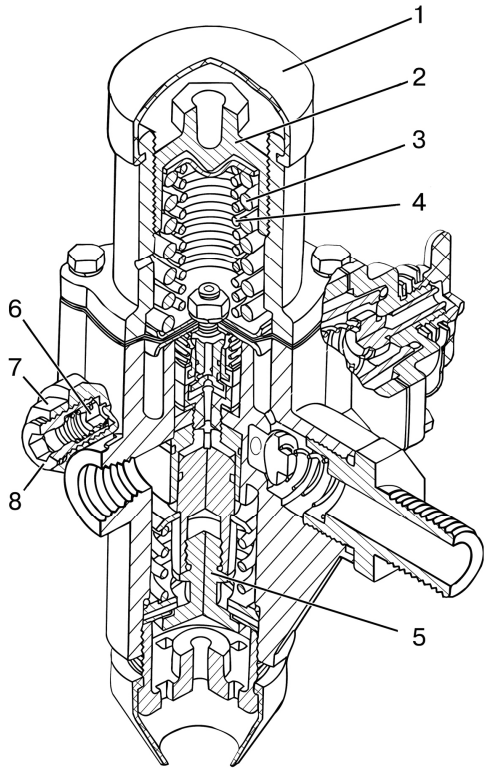
Adjust the pneumatic system pressure regulator as follows:

- gradually unscrewing the cover (2) (Figure 5.8.1), adjust the force of the springs (3, 4) so that the air pressure in the cylinder, which makes the discharge valve (5) open, be 0.77 to 0.8 MPa

- mark this provision of the cover (2) applying paint to the threaded part of the housing and put on the cap (1);

- in the cylinder, crack open the condensate drain valve and decrease the air pressure to 0.65 to 0.7 MPa. At these values, the pressure valve (5) must close and switch the compressor to filling the cylinder with compressed air;

- disconnect the test pressure gage from the coupling head.



1 — cap; 2 — cover; 3, 4 - spring; 5 — pressure relief valve; 6 — safety valve; 7 — locknut; 8 — screw

Fig. 5.8.1 — Checking and adjusting pneumatic system pressure regulator

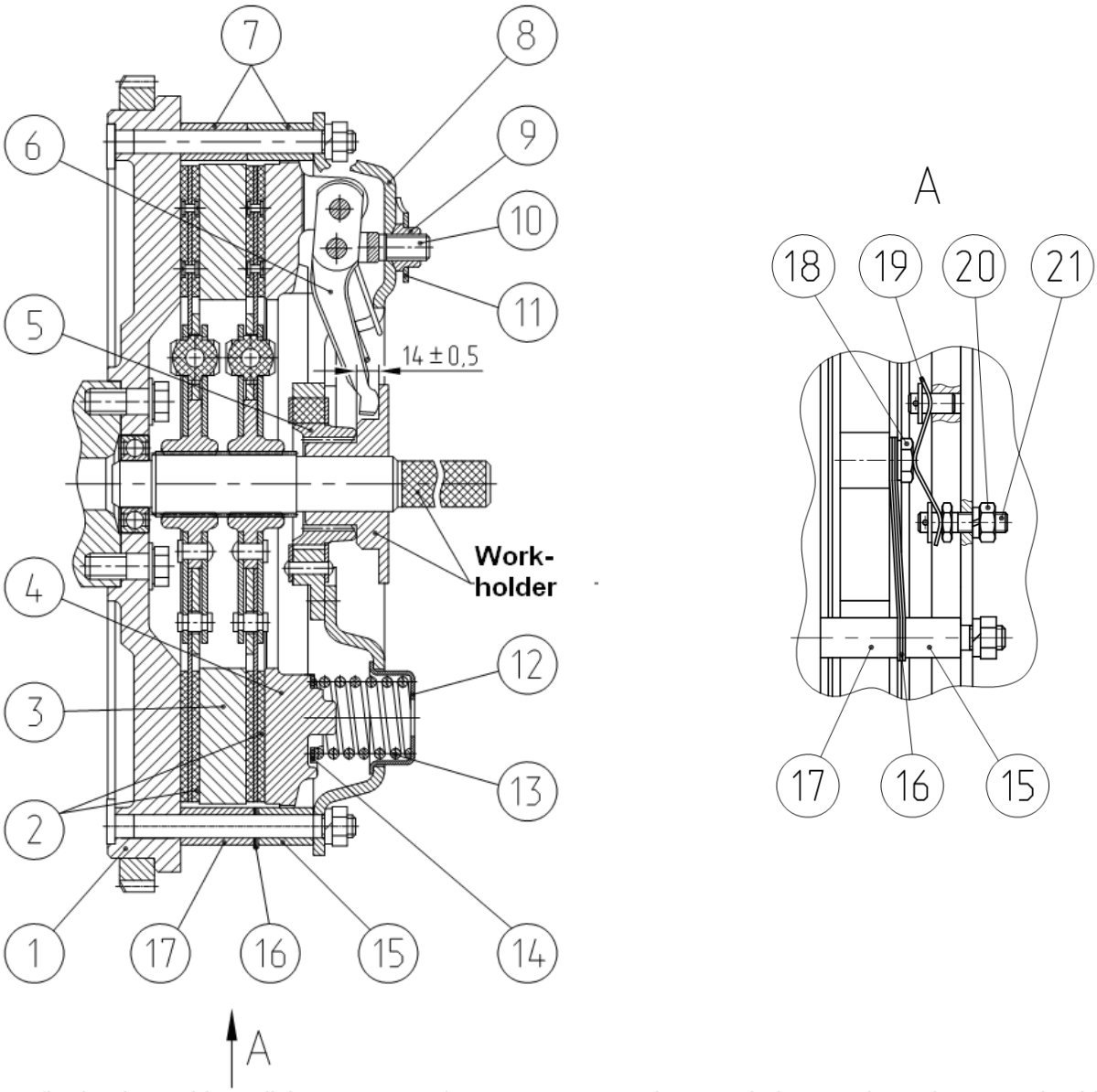
Installation, dismantling and adjustment of coupling clutch

1. Dismantling the coupling clutch from the engine.

Attention: Before starting to dismantle the clutch coupling it is recommended that you make marks, identifying mutual arrangement of the flywheel 1 (fig. K-9), the center plate 3, the pressure plate 4 and back plate 8. Assemble the clutch in accordance with the marks.

The clutch coupling is dismantled from the engine as follows:

- mount three manufacturing bolts (M12x40), having screwed them into the pressure disk 4 (figure K-9) through the manufacturing orifices of the back plate 7
- unscrew the nuts attaching the back plate to the flywheel and remove the clutch plate assembly (the back plate 7 together with the pressure plate 4)
- remove the first driven disk 2.
- remove from the flywheel pins three short bushings 15 and the center plate 3.
- remove the second driven disk 2.



1 – flywheel, 2 – driven disk, 3 – center plate, 4 – pressure plate, 5 – hub, 6 – release lever, 7 – bushing, 8 – back plate, 9 – adjusting nut, 10 – fork, 11 – lock plate, 12 – cage, 13 – pressure spring, 14 – insulating washer, 15 – bushing, 16 –tangential plates, 17 – bushing, 18 – bolt, 19 – back plate, 20 – nut, 21 – adjusting bolt.

Fig. K-9. Clutch coupling

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2. Installation of the clutch coupling on the flywheel

The clutch coupling is installed on the flywheel as follows:

- mount a splined workholder (fig. K-10) in the bearing of the flywheel.
- mount the first driven disk 2 (fig. K-9) on the workholder with the hub short end facing the flywheel 1.
- mount center plate 3 so that the tangential plates are fitted over the flywheel pins with the installed long bushings 17, then mount short bushings 15 on the flywheel pins with tangential plates.
- mount two bushings 7 of middle length on the other three flywheel pins.
- mount the second driven disk 2 on the workholder with the hub short end facing the flywheel.
- mount assembled clutch disks (back plate 8 with pressure plate 4) on the flywheel pins with the bushings, fix with the nuts (the torque of the nuts 70 to 90 Nm) and unscrew the manufacturing bolts.
- adjust the position of the release levers.

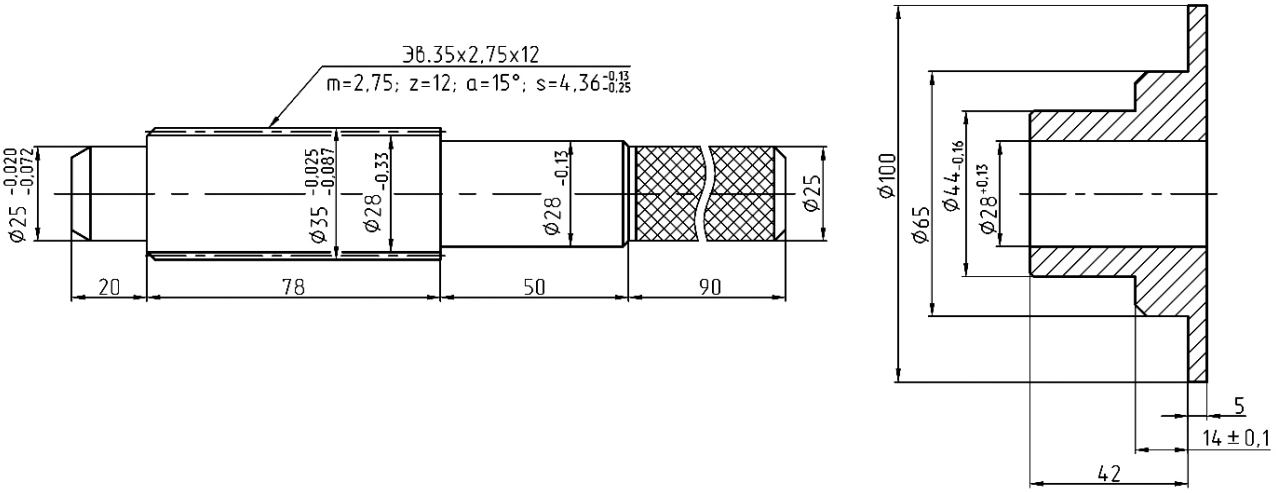


Fig. K-10. Workholder

3. Adjustment of the position of the release levers

Make adjustment of the position of the release levers as follows:

- screwing the adjusting nuts 9 (fig. K-9) in or out, adjust the position of the release levers for the dimension of 14±0,5 mm from the lever mounting surfaces to the face of the back plate hub. The dimensional difference for some levers shall not exceed 0,3 mm.
- after adjustment mount the lock plates 11.
- remove the workholder.

4. Adjustment of the position of the back plates

Make adjustment of the position of the back plates as follows:

- screwing/unscrewing the adjusting bolt 21 (fig. K-9) ensure such adherence of thrust plates 19 to the bolt 18 that a probe 0.1 mm would pass between faceplates of thrust plates 19 and end surface of the bolt 18 with light effort
- after adjustment of the position of the back plates fix lock nuts 20.

PTO adjustments

Checking wear of PTO brake band linings

The external sign indicating the degree of wear of PTO brake belt linings and the need for adjustment operations is the size A (Fig. H-11) between the upper point of the rod head (2) and the cylinder cover (1).

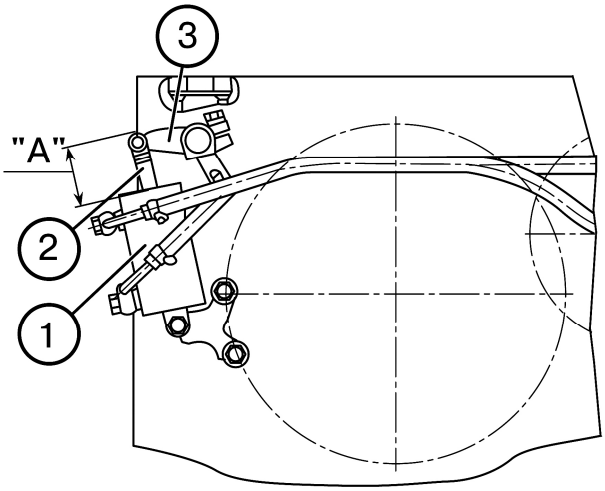
Check the sizes when the diesel engine is running and the synchronous — neutral — independent shifter is in its neutral position. To do this, run the diesel engine, first engaging the parking brake and blocking the rear wheel with wedges in front and behind. Check the oil pressure in the PTO control system. It must be min.

1 MPa (10 kgs/cm2).

On an adjusted PTO, the size A must be:

- 66 ± 3 mm (PTO engaged);
- 46 ± 3 mm (PTO disengaged).

If the size A > 80 mm (PTO engaged) and A < 32 mm (PTO disengaged), as well as if the PTO slips, adjust the band brake clearance.



1 — cylinder, 2 — rod, 3 — lever.

Fig. H-12 — Checking wear of PTO brake band linings

Adjusting clearance in PTO belt brakes

Attention: Adjust the PTO belt brake clearance only in a special workshop.

Adjust the clearance in the PTO belt brakes as follows:

- shift the lever (1) (Fig. H-12) to its neutral position, aligning the holes in the lever and the rear axle housing with an 8 mm rod or a M10×60 bolt (2);

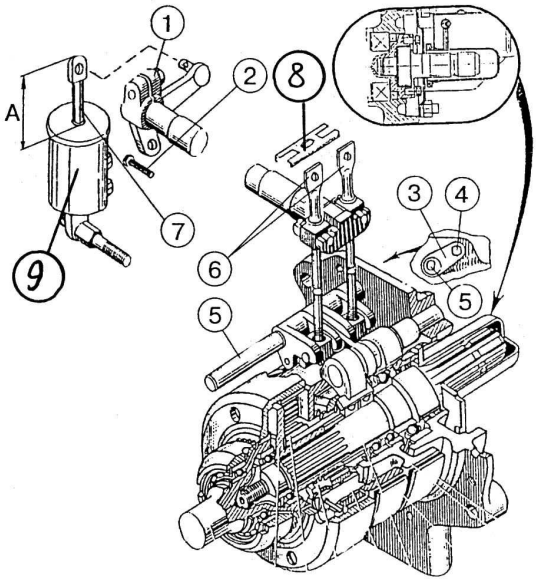
- remove the cotter pin and remove the locking plate (8); - screw the adjusting bolts (6) to a torque of 8 to 10 N·m and then then unscrew by two turns (access the bolts through a hatch in the rear axle cover), after that screw the bolts to the nearest side so that the bolt heads were parallel to the longitudinal axis of the tractor;

- with a properly adjusted PTO, the extension of the rod (7) relative to the cylinder body cover (the size A, Fig. H-12) with a running diesel engine must be:

a) in the position “PTO off” (stock retracted) — from 43 to 49 mm;

b) in the position “PTO on” (stock extended) — from 63 to 69 mm;

H18



1 — lever; 2 — auxiliary bolt; 3 — locking plate; 4 — bolt, 5 — eccentric axle; 6 — adjustment bolts; 7 — rod; 8 — locking plate; 9 — cylinder.

Fig. H-12 — PTO adjustments

External readjustment of brake bands

During operation, adjust the PTO brake bands in the cases when:

- PTO slips;

- the above adjustment of the clearance in the PTO belt brakes does not help.

During the assembly by the manufacturer or repairs, the eccentric axle (5) (Fig. H-12) is installed with its flat up on the right and locked with the locking plate (3) and the bolt (4);

The procedure of readjustment is as follows:

If the clearances in the belt brakes are adjusted, but the PTO does not transfer the full torque, then there is no margin for adjustment (significant wear of belts brake linings).

In this case unscrew the bolts (6) by 5…7 turns; turn the eccentric shaft (5) of the external adjustment mechanism by 180° and secure it with the locking plate (3) the bolt (4).

- readjust the belt brake clearances band brakes.

- if the problem persists,replace the PTO bands.

Section I. **COUPLING OF IMPLEMENTS**

General information provided in this Section will help to use efficiently tractor with a great variety of agricultural machines and implements.

As regards the method of coupling with tractors, the machines are classified as follows:

- **The tractor-mounted** ones are to be attached to the tractor's three-point hitch linkage. The machine weight in the transport position is fully transferred to the tractor.

- **The semi-mounted** ones are to be attached to the three-point hitch linkage run on supporting wheels. The machine weight in the transport position is partly transferred onto the tractor and partly is supported by the wheels of its own. When rearranging the machine from the working position to the transportation one, the point of attachment to the tractor is forcedly shifted to a new position as to height.

- **The semi-trailed** ones are to be attached in the same way as the semi-mounted are, but when rearranging the machine from the working position to the transportation one, the point of attachment to the tractor does not change its position as to height.

- **The trailed** ones are to be attached to the haul-and-draw coupling arrangement of the tractor. The machine weight is carried by its own running gear. When rearranging the machine from the working position to the transportation one, the point of attachment to the tractor does not change its position as to height.

- **The fitted** ones are to be attached to the tractor by means of additional assembly units using the mounting holes available on the tractor. The machine weight is fully taken by the tractor.

The MTZ tractors are equipped with standard lift linkages and drawbar hitches and also with mounted holes and provide all types of coupling. In addition, the provision of a power take-off shaft (PTO) and free outlets of the hydraulic system make it possible to drive tools of the attached machines/technical facilities by either mechanical or hydrostatic method.

Below there is information about the tractor working equipment possibilities; the methodology of choosing the machines for coupling with tractor, also are given admissible loads of the tractor when combined in a machine-tractor aggregate.

Lift linkages and drawbar hitches

Rear lift linkage LL-2 (3)

Implements: mounted ones (ploughs, cultivators, seeders, milling cutters, etc.), semi-mounted ones (ploughs, soil-cultivating machines, seeders, potato harvesters, etc.).

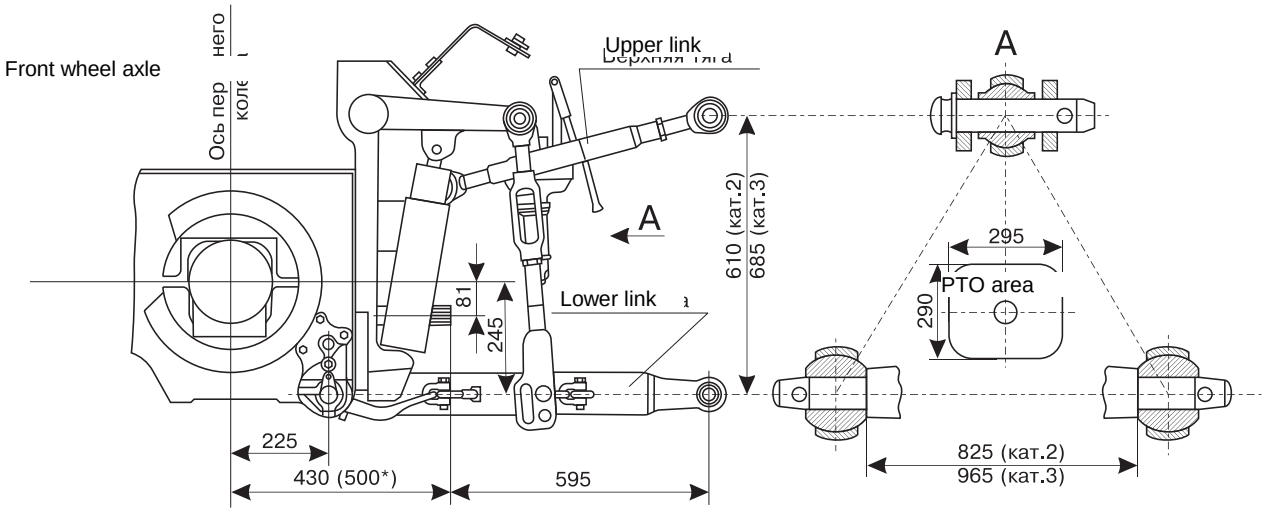


Fig. I-5.

Front lift linkage LL-2 (if installed)

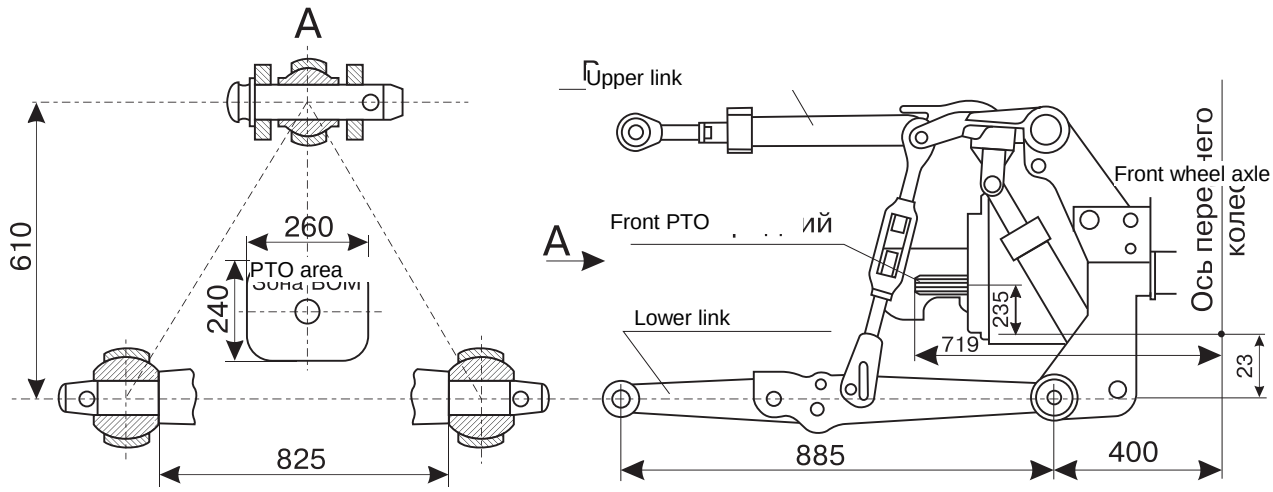


Fig. I-6.

Characteristics	Rear LL-2 (3)		Front LL-2
	cat. 2	cat. 3	
Lower links	solid or telescopic		composite
Lower links length: solid, mm	885		885
Links hinges width: upper, mm	51		51
lower, mm	38 or 45		38 or 45
Connecting elements rated diameter:			
upper links pin, mm	22*	32	22 or 25
lower links hinges, mm	28*	37	28
Distance between the PTO end and a suspension axle, mm	595		544
Loading capacity:			
on a suspension axle, kN	43		20
at 610 mm offset, kN	28		18

* PTO shaft end is drawn nearer to suspension axis by 70 mm starting from II quarter of the year 1999.
** Pin and transitional bushings in a tractor set of tools and accessories.

Drawbar hitch DH-1 (crossbeam)

Implements: semi-mounted ones (seeders, potato planters, potato harvesters, vegetables harvesters, etc.), semi-trailers (mowing machines, press-pickups, haulm pickers, etc.), equipment with a trailing clevis on the tow bar.

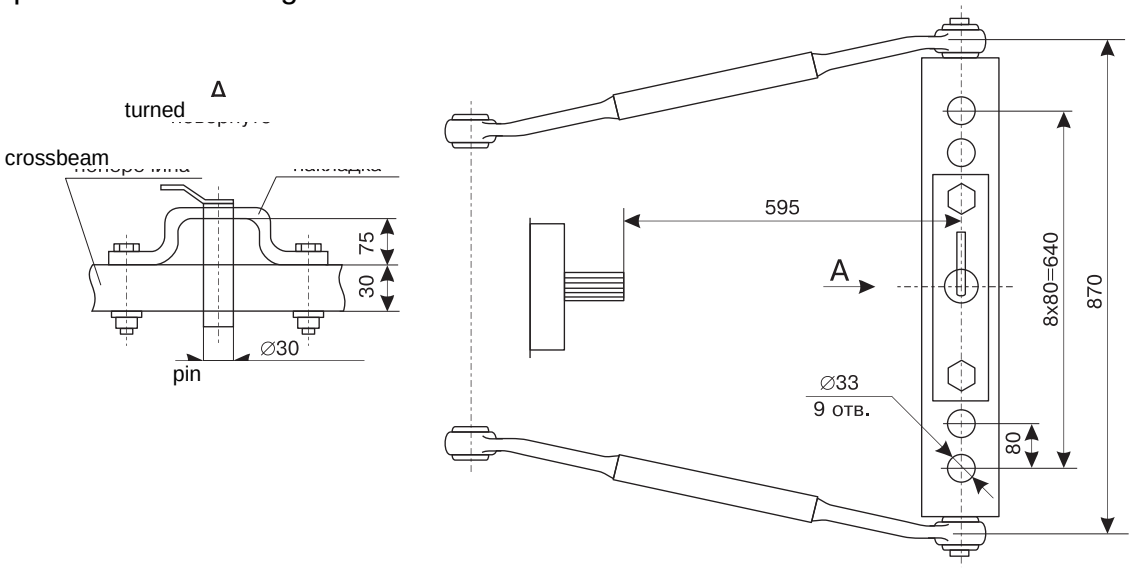


Fig. I-7.

DH-1 (with a lining for a hinge or without it)	A cross-bar on a suspension axle of a hitch linkage in a configuration LL-2
Distance between the PTO end and a connecting pin axis, mm	595
Connecting pin diameter, mm	30
Vertical load on a TD, kN	6,5
Implement turning angle with reference to a tractor, degrees	± 80

I 4

Drawbar hitch DH-2 (yoke)

Implements: semi-trailers (semi-trailers, fertilizer machines, etc.), trailers (disk harrows, soil-cultivators, hulling machines, coupling of harrows, cultivators, seeders, etc.).

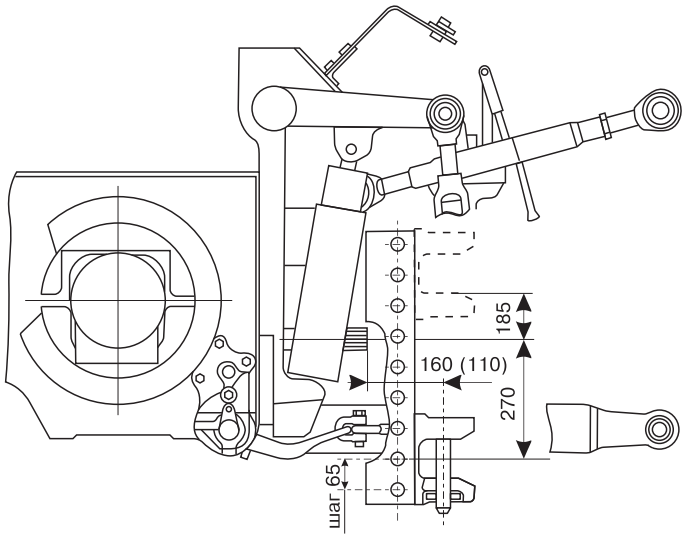


Fig. I-8.

Towing drawbar	Yoke with a possibility of vertical movement
Distance between the clevis or a hook sphere and a supporting surface, mm	458…913 stepwise in 65 mm
Clevis position for the implements with PTO drive	Extreme lower or extreme upper
Distance between the PTO end and connecting pin axis, mm	160 or 110
Connecting pin diameter, mm	30
Vertical load on a DH, kN	25
Implement turning angle with reference to a tractor, degrees	± 65

Drawbar hitch DH-3V (yoke)

Implements: trailers (motor-type double-axle trailers, etc.), semi-trailers (the same as for a DH-1).

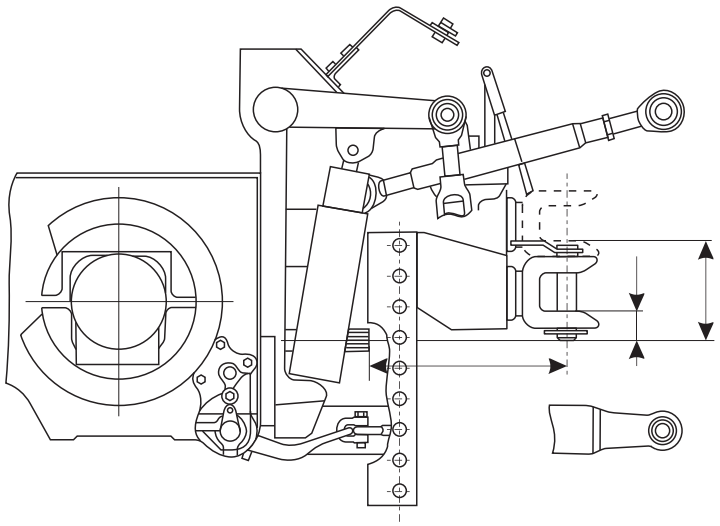


Fig. I-9.

Towing drawbar	Yoke rotatable with a possibility of vertical movement
Distance between the clevis and a supporting surface, mm	354…874 или 508…1028 (with yoke turn) stepwise in 65 mm
Clevis position for the implements with PTO drive	крайнее нижнее или крайнее верхнее, в т.ч. с переворотом вилки
Connecting pin diameter, mm	40
Distance between the PTO end and connecting pin axis, mm	400
Vertical load on a DH, kN	12
Implement turning angle with reference to a tractor, degrees	± 55 (trailers) ± 85 (agricultural machines)

I 6

Drawbar hitch DH-1M-01 (draw bar)

Implements: semi-trailers (the same as for a DH-2B and a DH-3V), trailers (the same as for a DH-2V and a DH-3V).

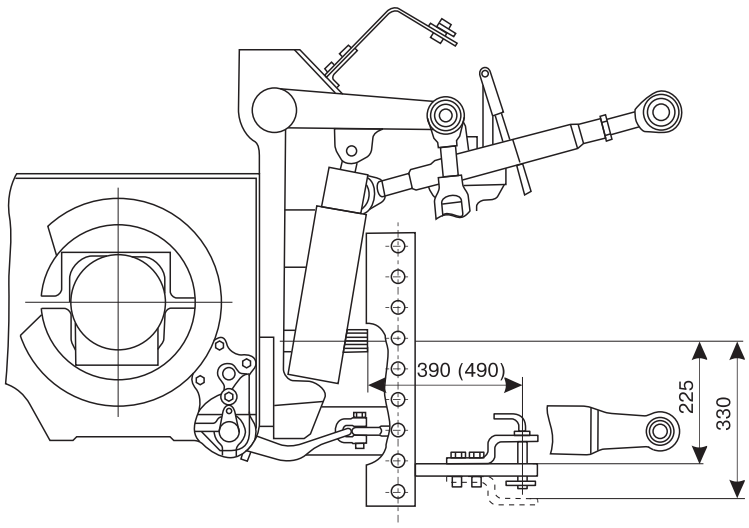


Fig. I-10.

Towing drawbar	A yoke with a possibility of a position change with reference to the PTO end
Distance between the clevis and a supporting surface, mm	500 or 395
Distance between the PTO end and connecting pin axis, mm	390 or 490
Connecting pin diameter, mm	30
Vertical load on a TD, kN	12
Implement turning angle with reference to a tractor, degrees	± 85

The rear hitch linkage НУ-2(3) is made to Cat. 2, with a potential of being readjusted to Cat. 3. With this purpose the tractors are packaged with solid lower links with coupled components of Cat. 3.

SPTA of tractors of Class1.4 or 2 comprise adapter sleeves for lower links and upper link pin for coupling of implements.

Lower links are blocked in cross direction with external tension rods.

The drop links are provided in addition to the main hole for coupling to the lower links with a slot to join up the wide-span machines and to follow the field relief more closely (cultivators, planters, and others).

For fast coupling is provided automatic hitch coupler CA-1 for the rear and front lift linkages.

The crossbeam DH-1 can be installed on suspension axis of lift linkages. When the PTO shaft is to be used, a cardan shaft with the nominal length of 1000 mm may be recommended. In this case the mounting point of the machine should be located at the middle of the cardan shaft; otherwise the PTO will be overload.

The tractor is equipped with three pairs of free hydraulic system outlets intended for connection to attached technical facilities with a help of applied high-pressure horses.

The oil consumption through the outlets is 45…55 l/min. (depending on the technical condition of the hydraulic pump). The oil intake by the hydraulic cylinders should not exceed 16 l. The oil level in the hydraulic tank shall be carried out with the service cylinders rods fully drawn-in.

To avoid the oil losses when aggregating the technical means or in case of unexpected disconnection, the quick-hitch mechanisms, cut-off and break-off fittings are provided.

The hydrostatic power takeoff is possible through one of the outlets for driving the auxiliary hydraulic motors. To avoid overheating of the hydraulic system, the operating pressure shall not exceed 11 MPa that corresponds to the power of not more than 10 kW. To drain oil from the hydraulic motor bypassing the distributor, a separate pipeline is fitted.

The tractor incorporates the hydraulic valves and accessories with nominal cross-section Ду = 12 mm and coupling thread M20x1.5. If necessary, the suitable adaptors with nominal cross-section of at least Ду = 12 mm should be made by the user for connecting the machines with other fittings than those specified above.

Lifting device has connecting yokes corresponding to DH-2V и DH-3V according to the purpose. Yoke of DH-2B is located at 160 mm or 110 mm from PTO shaft end and allows carrying significant vertical load with sufficient longitudinal stability of the aggregate. Yoke of DH-3B is located at 400 mm from PTO shaft end and allows coupling of semitrailed and trailed with active drive ensuring increased angle between the tractor and the device at turn of the aggregate. To achieve the required controllability criterion, vertical load on the yoke DH-3V is decreased as compared to DH-2V.

Lifting device of the guide rods are designed according to the requirements of the International Standards, therefore it is possible to install connecting segment of different design (a hook instead of a yoke and etc.).

DH-1M-01 (draw bar) is designed for coupling of the implements with active drive of working attachments. At that drive of Cat 2 and 3 is ensured (connecting segment is located at 400 mm or 500 mm from PTO shaft end).

Taking into account that DH-2V, DH-3V and DH-1M-01 have specific fixed position according to the hight, draft pole of semitrailed implements shall be equipped by adjustable support under the current Standard.

In case there is no adjustable supports in the implements in operation, such supports may be ordered in PA “Bobruiskagromash” and installed in household.

The front lift linkage of LL-2 type is similar to that of the rear one as to its design. It is mounted in place of the front counterweights and serves for making up the combined aggregates (a cultivator in front, seed planter in the rear, etc.), for mounting the echeloning implements (forward and side-mounted mowers, and others) as well as for transporting the certain machines from amongst rear-mounted combined aggregates in case of long trips.

PTO and drive of the machines

In case of correct location of aggregated machines power intake shaft (PIS) relatively to the tractor PTO, the cardan shafts of the standard design can be installed.

The rear PTO shaft provides a synchronous machines drive (active semitrailers, planting machines etc.), alongside of it the use of the shank type is not important.

The motion speed should not exceed 10 km/h.

To avoid the overloads of the PTO drive when aggregating with the inertial machines (pickup balers, fodder harvesters, etc.), it is necessary to use the cardan shaft with the overrunning clutch on the PIS side.

When using the rear PTO shaft at 540 rpm and front PTO shaft at 1000 rpm it is necessary to install a protective coupling from the PIS side, which limits the power take-off over the allowable values (not over 50-60 kW, respectively). It is possible to install the protective coupling also to protect the drive from overloading.

Tractor: PTO shaft end **Machine: PIS bushing**

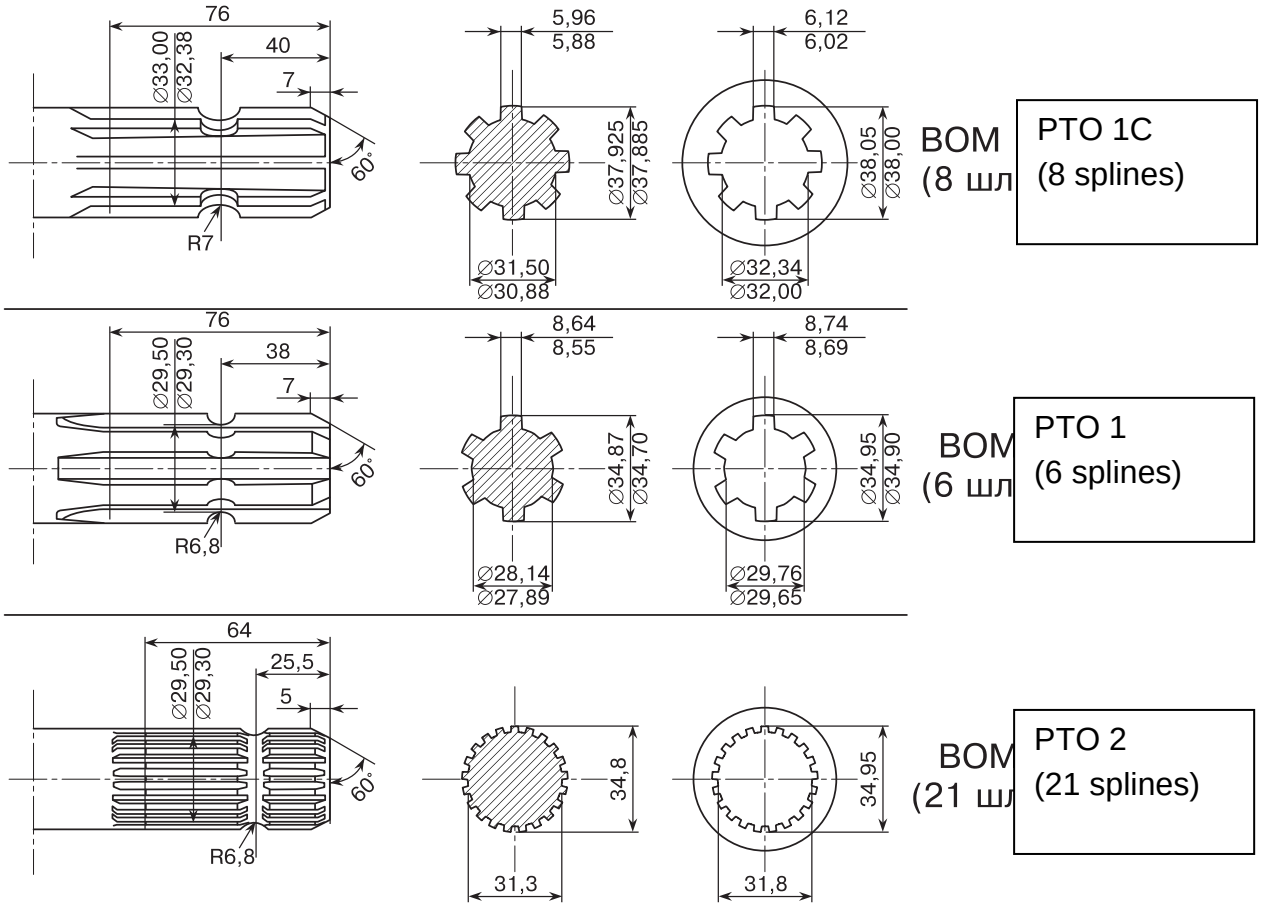


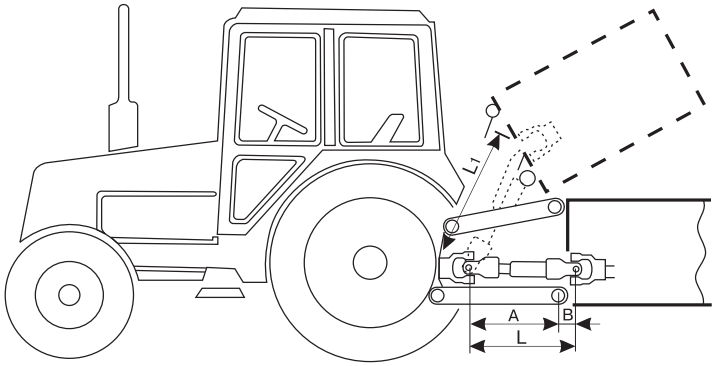
Fig. I-11.

PTO	Shank type	Rotational speed, rpm		Transmitted power, kW (h.p.)
		PTO	diesel engine	
Rear independent	PTO 1c	540	2037	60 (80)
	PTO 1	540	2037	60 (80)
	PTO 2	1000	2100	80 (120)
Front independent	PTO 2	1000	1845	50 (68)
Rear synchronous	PTO 1c	4,18 rev/1 meter of travel		60 (80)
	PTO 1			
	PTO 2			

I 10

Schemes of attachment

A cardan shaft length is determined by distance L (the shaft is entirely moved) at horizontal position of the lower rods. A shaft lengthening is effected when lifting the implement, so it is necessary to check telescopic elements overlap in an upper position. A hinge inclination is more from a PTO side than from a power intake shaft side.



L1 > L; A > B

Fig. I-12.

Cardan shaft length L is determined at the implement turning by a maximum angle with reference to a tractor. If equality A=B is not observed, a rotation irregularity is suddenly increases, resulting in the shaft overloading.

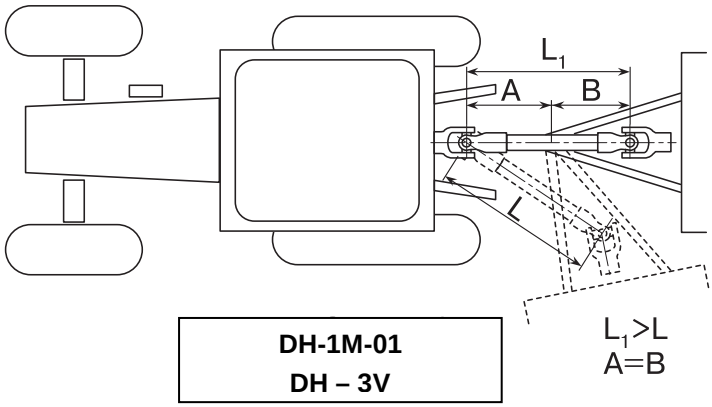


Fig. I-13.

A cardan shaft length remains unchanged at the implement turning with reference to a tractor. A rotation irregularity of the cardan shaft appeared on the way is compensated by an angular velocity hinge installation.

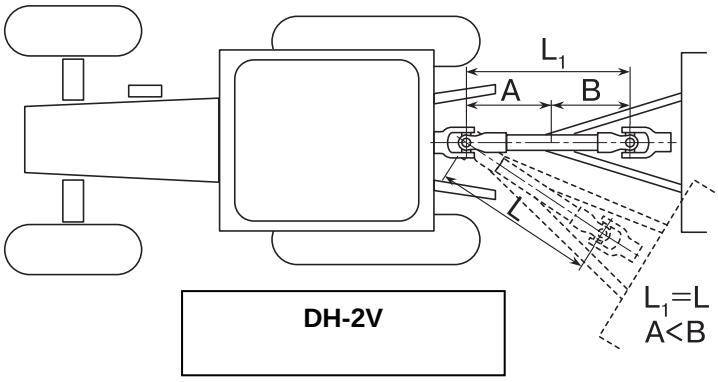


Fig. I-14.

Cardan shaft installation

Installation of a cardan shaft with a protective casing in combination with a PTO protective cover ensures safety of the connection (Fig. I-15a).

End clevises should be in the same plane (Fig. I-15b).

PTO	Cardan hinges inclination angle (max. degrees)	
	Universal	Equal angular velocities
Engaged	22	25 (50 short-run)
Disengaged	55	55

Cardan shaft telescopic elements overlapping should not be less than 110 mm to avoid disconnecting and jamming of the connection (Fig. I-15d).

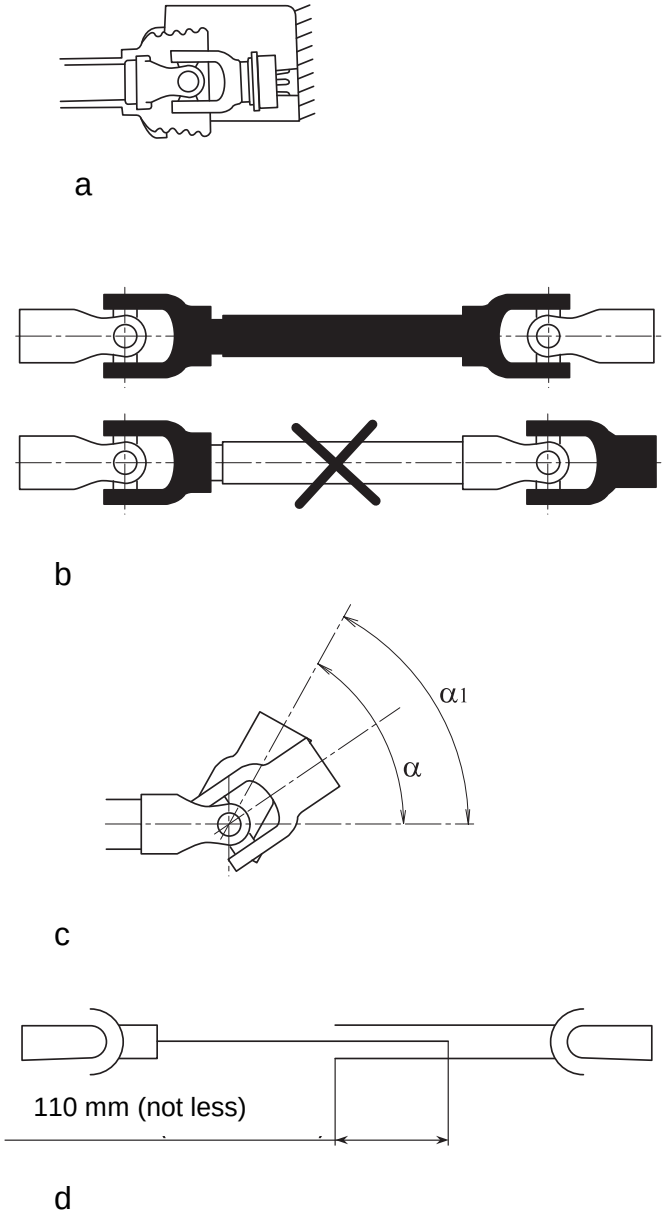
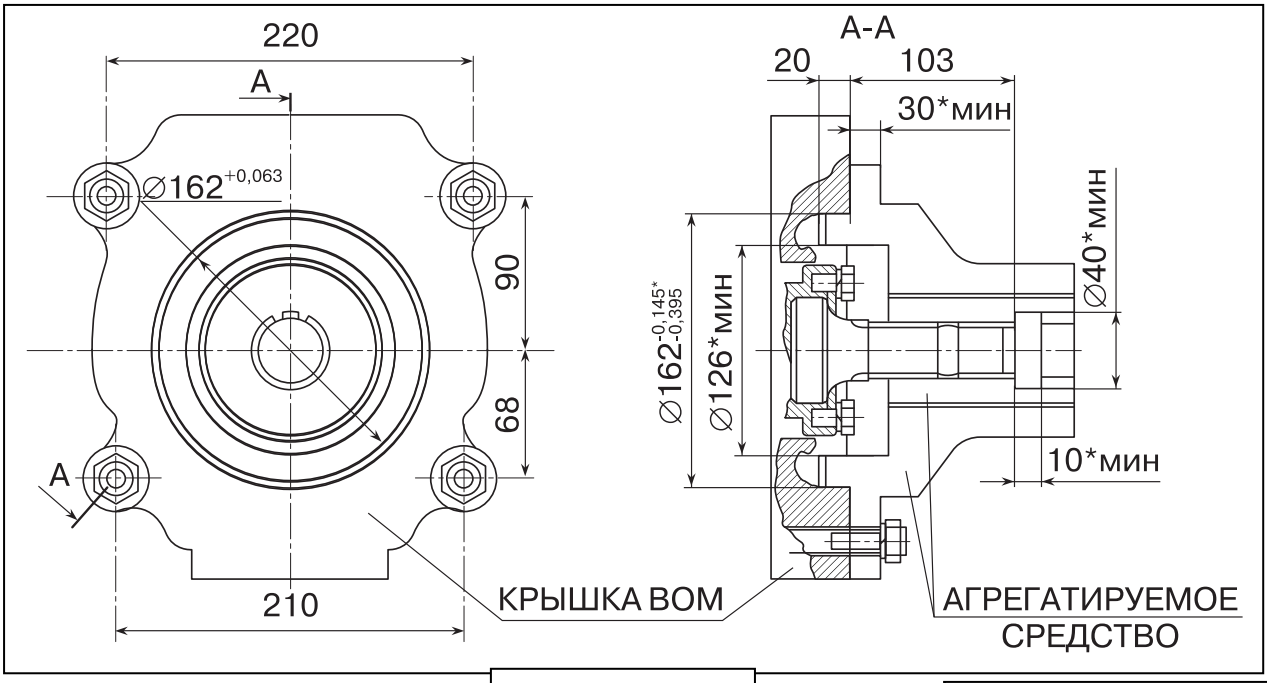


Fig. I-15.

I 12

PTO Drive without Cardan Shaft



* The dimensions attributed to the attached machines.

Fig. I-16.

A number of units can be installed on the PTO directly, without a cardan shaft (reduction gear boxes. hydraulic pumps and others). In this case, it is necessary to provide alignment of housings to 162-mm diameter in the PTO cover. To avoid abutment against the tractor, furrows should be made on the side of the end-face and at the outlet of the PTO spline outlet. If required, the PTO cover fastening studs can be replaced with longer ones of the same thread diameter. Also, the lift hitch can be dismantled.

Tractor loading

One of the wide spread means of coupling is a mounted one through a rear lift linkage. Here there is a necessity to provide the MTA with stiffness without worsening of tractor steerability.

Longitudinal stability is indicated by controllability criterion which is equal to ratio between load to steerable axle and bridge to tractor operating weight:

$$Ky = \frac{10^2 \cdot T_n}{m} \geq 0{,}2$$

The required controllability criterion is achieved by means of front ballast weights installation. If that is not enough – water (solution) is poured in the tires of front wheels.

To fill the tires up with water (solution), do the following:

- release the wheels from loading;
- turn a wheel getting a nipple up;
- unscrew the nipple and set a combined valve (“air-water”) in through which water filling up and air discharge are effected.

The tire is to be filled up as per standards (to 75% of its volume). Water (solution) leakage through a combined valve outlet is an indicator that the tire is filled up. As soon as the tire is filled up, screw the nipple back and pressure the tire up to its operative standards.

It is required to add $CaCl_2$ in water on the basis of 300 g/l of water (a freezing-point is 25°C) in cold seasons.

IMPORTANT! When preparing a solution, do not pour water in $CaCl_2$ to avoid formation of hardly dissoluble clots of calcium chloride.

If a tractor is equipped with a front hitch linkage, a longitudinal stability of the agricultural aggregated unit can be provided with combined machines of front and rear location.

Longitudinal stability can be approximately assessed with help of diagram (see fig. G-18 on page G 16).

The diagram allows to determine the following parameters during tractor loading through rear lift linkage:

- tractor configuration (without ballast, ballast, water) according to the set weight and center of mass overhang of the implement coupled;
- permitted weight of the implement coupled according to the set center of mass overhang and vice versa at *Ky* = 0.2 (curves A, B, C);
- permitted weight of the implement coupled according to the set center of mass overhang and vice versa on the basis of maximum carrying capacity of rear lift linkage (curve D). Contingency situation.

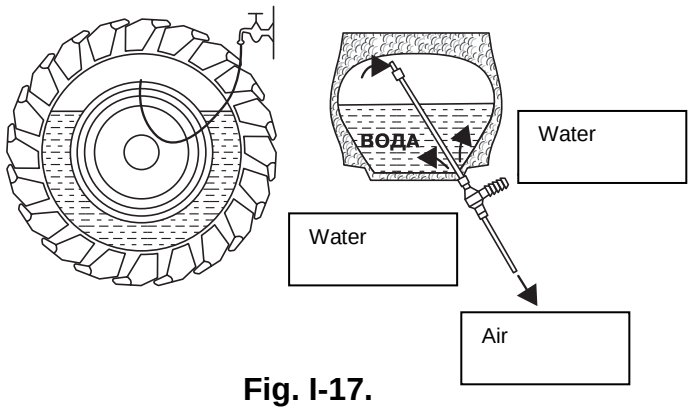
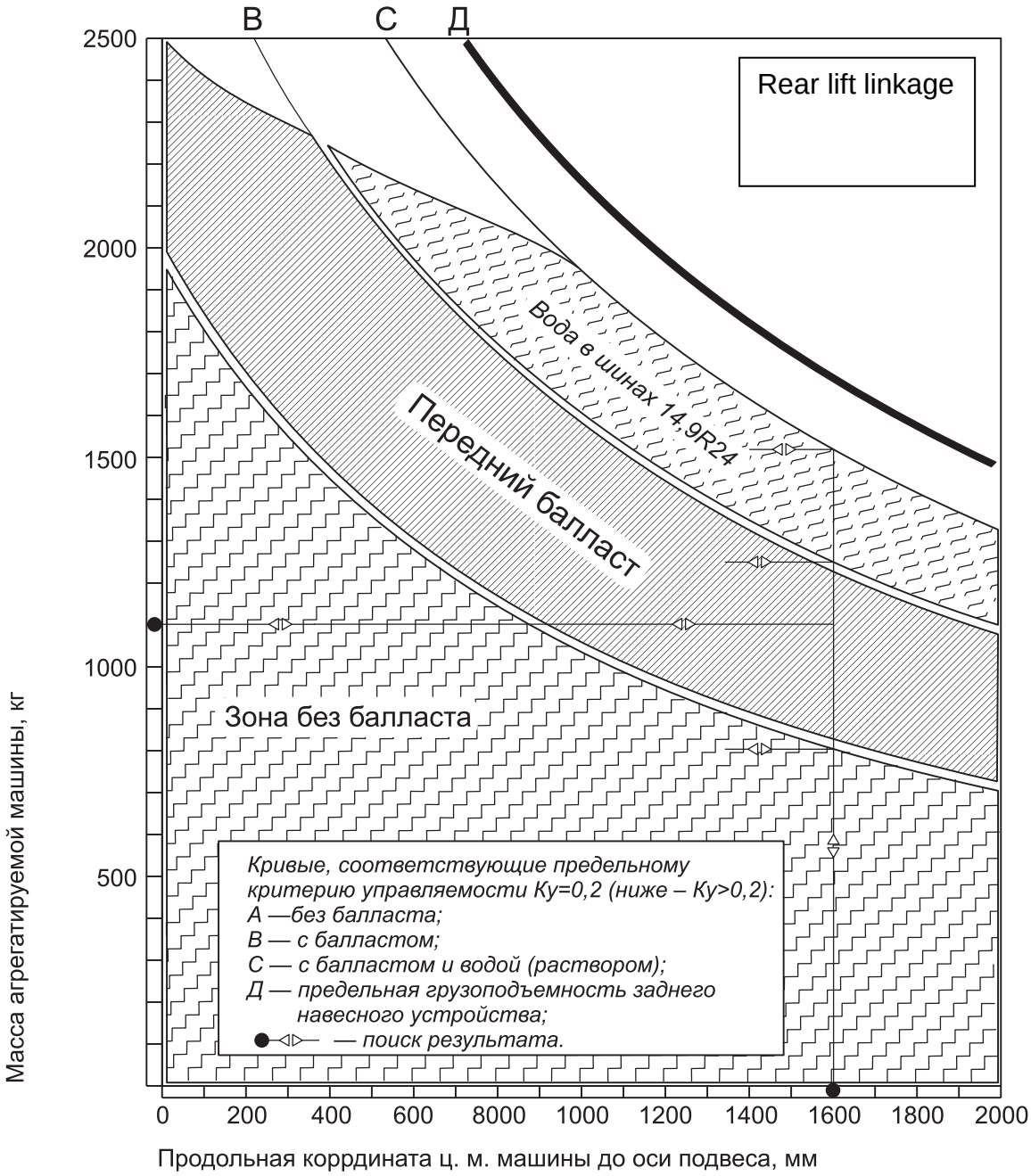


Fig. I-17.

I 14



Вода в шинах - Water in tires
Передний балласт - Front ballast
Зона без балласта - Zone w/o ballast
Кривые, соответствующие предельному критерию управляемости - Curves corresponding to a limit controllability criterion Ky=0.2 (below Ky>0.2);
A – w/o ballast
B – with ballast
C – with ballast and water (solution)
D – maximum carrying capacity of rear lift linkage
поиск результата - search of result
Продольная устойчивость ц.м. машины до оси подвеса – Longitudinal stability of central mass of the implement to the suspension axis.
Масса агрегатируемой машины - Weight of the implement coupled

Fig. I-18. Longitudinal stability of MTU based on tractor MTZ 1220.1/1220.3

I 16

Controllability criterion at implement coupling through DH is achieved without front ballast. The ballast can be used for improvement of haulage-adhesion features of a tractor.

Allowable loads on the axles:

Tractor axle	$T_{min}...T_{max}$, kN
Front	Tf = 10...40
Rear	Tr = 20...65

but not exceeding accumulated loading capacity of single tires of rear and front wheels.

In case of twinning the wheels with the tyres of the same or different standard sizes, their total load-carrying capacity should be reduced by 20%.

In case of setting the wheel track exceeding 1800 mm, the loads on the axles shall be reduced by 5% per each 100 mm of the track increase.

In all cases general load on tractor wheels shall not exceed

$$Tп + Tз \leq 80 \text{ kN}.$$

Received loads on tractor and implements` driving machines, used in the fields, grasslands and cattle-runs shall be checked for consistency with standard values of maximum floor pressure and soil standard mechanical stress. According to the State Standard (GOST) there is a complicated system for determining of the marked values. Pressure on the soil is approximately higher than tire pressure by 0.02 MPa (max/ value shall be chosen).

The soil compaction depends considerably on the number of passages of the tractor with the aggregated machines. Therefore, it becomes expedient to reduce the number of passages at the cost of combining the operations by means of combined aggregates.

Twinning the wheels makes it possible to reduce considerably the specific pressure on the soil and preserve the soil structure, especially, moistened fields. Twinning the wheels on dense soils makes it possible to improve the tractive and hitching capabilities of the power source, especially in combination with correct ballasting or loading of the tractor.

Depending on the loads on tractor axles, created by the devices couples, it is necessary to set the required pressure in tires (see. Table of tires carrying capacity at different speeds of tractor run).

Tires standard size	Speed, km/h	Load per one tire, kN and corresponding pressure, MPa						Water quantity (solution) per one tire, l
		0,10	0,12	0,14	0,16	0,18	0,20	
14,9R24	30 10	13,8 17,0	15,3 18,9	16,8 20,7	18,2 22,4			172
18,4R38	30 10	24,4 30,0	27,2 33,4	29,7 36,6	32,1 39,5		 45,0	412
16,9R38	30 8	18,3	20,3	22,3 27,0	24,3 29,8	 31,2	 34,0	356
11,2R28	20 10	9,8 11,9	10,9 13,4	11,9 14,6	12,8 15,6	13,8 16,8		90
11,2R42	20 10	12,7 15,5	13,5 16,5	14,8 18,0	15,8 19,4			120

Tires inflation

Inflate the tires using an air bleed valve of a pressure regulator (1) in the following order:

- bleed air from a balloon (3) of the pneumatic system through a valve of condensate ejection valve;
- unscrew a butterfly-nut (2) of an air bleed valve connecting pipe;
- connect a tire inflation hose to the air bleed connecting pipe and a tire's valve;
- switch a compressor on and inflate a tire up to a required pressure level, controlling it by a tire manometer;

IMPORTANT! If pressure in a balloon exceeds 7,7 kgf/cm^2, the compressor is switched over to idling by a pressure regulator and tires inflation stops automatically. Thus, control a pressure level by an indicator on the dashboard and decrease pressure through a condensate ejection valve if necessary.

- disconnect the pump from the tire's valve and the air bleed valve connecting pipe;
- switch a compressor off and screw a butterfly-nut on the air bleed valve connecting pipe;

Selection of implements

Tractor can be coupled with implements in drawbar Cat. 2 and with implements from the set for wheeled tractors of Cat. 3. Besides in adverse conditions on heavy textured soils use of implements from the set to tractors of Cat. 1.4 is permitted. Correspondence of DH, PTO shafts, hydraulic outputs design to the International Standards requirements allows coupling with imported implements.

Procedure for MTU composition and operating features are set forth on operation manuals to the implements coupled. In all cases it is necessary to check for compliance with requirements to connecting components, lift linkages and tires carrying capacity, permitted load on DH and tractor axles, controllability criterion.

The working width and operating depth of an implement/machine depend basically on the specific resistance of soils which defines the operating speed range with due account of the agricultural requirements. The heavier is the soil, the higher is the unit resistance. Based on the average traction effort of 18...27 kN developed by a Class 2 tractor on a stubble field, a rough estimate of the working width for the main power-consuming agricultural machine coupled to a tractor has been made.

The results shown make it possible to choose agricultural machines/implements by their working widths including echelon arrangement obtained by means of coupling devices (harrows, cultivators, seeding machines, etc.).

Specific resistance is shown at processing speed of 5 km/h. Change of speed by 1 km/h changes specific resistance up to 1%.

Interspace cultivation of cultivated crops is ensured on narrow-width tires (optional configuration) in the interspaces from 450 to 900 mm.

However interspace cultivation of corn, cotton and similar crops is possible on tires of standard configurations.

According to the drawbar characteristics tractor can be coupled with 4-6-rows group of implements for cultivation of potatoes in rest-balk, 12- rows group of implements for cultivation of sugar beet, 8-12- rows group of implements for cultivation of corn, sunflower, soya bean and other similar crops.

Technical means	Unit resistance, kN	Возможная ширина захвата, м

I 18

Ploughs		
Heavy-textured soil	18...25	aprox. 1.0
Medium-textured soil	12...14	1.4...1.7
Light-textured soil	6...8	up to 2.5
Disk harrows	1,6...2,1	up to 10.0
Share scuffler	6.0...10.0	2.0...3.0
Cultivators	1.6...3.0	up to 7.0
Sowing machines	1.2...1.8	up to 10.0
Reaping machines	1.2...1.5	up to 12
Combine harvesters		
Silage harvesters	2.6...3.3	up to 2.0
beet combine	6...12	1.7...3.0
potato harvester	10...12	1.7...2.0

For control console or control over operating procedure console mounting (seeders, combine harvesters and etc.) drilling of two holes for self-tapping screws is permitted on a side wall inside a cab

Tillage

Tillage is one of the most power-consumptive type of field operations.

The tractor is traditional used as part of an aggregated tillage combination in line with a “tractor-furrow” pattern. It requires appropriate wheel arrangement when running with common, swivel and turnabout ploughs.

It is possible to couple mounted ploughs of Cat. 3 tractors running outside the furrow with MTZ 1220.1/1220.3. With that corresponding adaptation of plough mounting mechanism is required. Plough PLN-5-35 adaptation is carried out by Government Enterprise “Minsk Gear Works”.

Tractor can be operated according to the scheme “tractor wheeld - outside the furrow”. At that requirements to the wheel arrangement become simplified. Doubling of rear wheels becomes reasonable as it allows to improve traction and connecting features of the tractor especially when wheels are filled with water (solution).

In this case operation with ploughs of tracked tractors is possible provided they were properly adapted, and with trailed ploughs also.

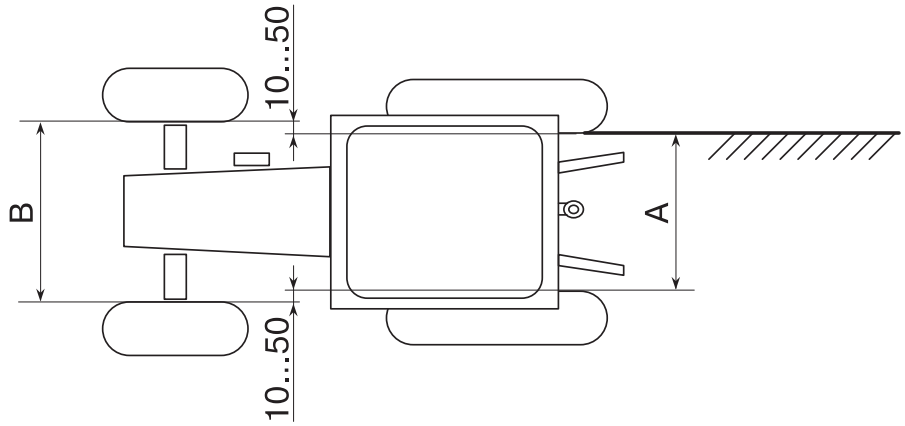
To achieve flatbreaking reversible (doubled) or turning ploughs are used that ensure one-way soil overturning применяют.

Comparatively flat field can be achieved during ploughing with ordinary ploughs, provided that ploughing was started and finished according to the given schemes.

The type of the plough, the grip width (number of plough-bodies) depends on the soil, its mechanical makeup, debris infestation, tillage depth. One body of a plough requires approximately 15...20 kW

Diagram of Wheel Arrangement for Aggregating the Tractor with 5...7-Furrow Ploughs

The tractor wheels are in the furrow



A = 1300...1600 мм
B = A+20...100 мм

Fig. I-19.

To obtain the wheel track figure, it is necessary to add the cross section of a respective tyre to the dimensions A and B.

The tractor wheels are out of the furrow.

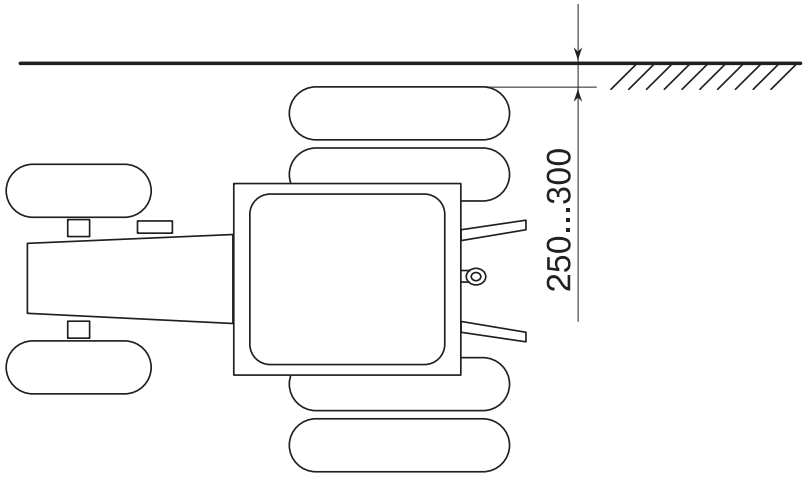


Fig. I-20.

The rear wheel track is in accordance with the twinning pattern.

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I 20

Field flatting during operation with ordinary ploughs

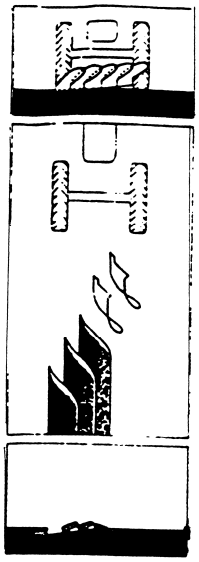


Fig. I-21.

First pass.

Only three plough shares are engaged. The last share cultivates approximately in half of standard plowing depth.

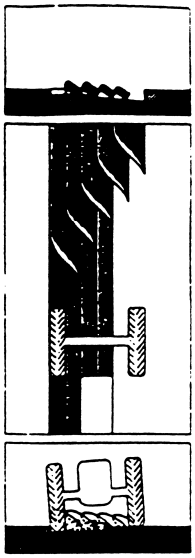


Fig I-22.

Second pass.

Right tractor wheel is in a furrow. The first plough share cultivates in half of standard plowing depth and the last share cultivates in full depth.

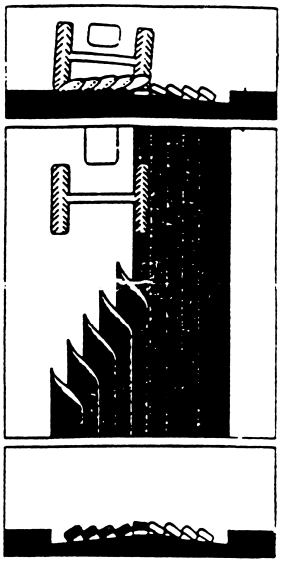


Fig I-23.

Third pass.

Right tractor wheel is in the first furrow after the second pass. Plough is set in half of the first share's depth allowing flat surface. The last share cultivates in full depth.

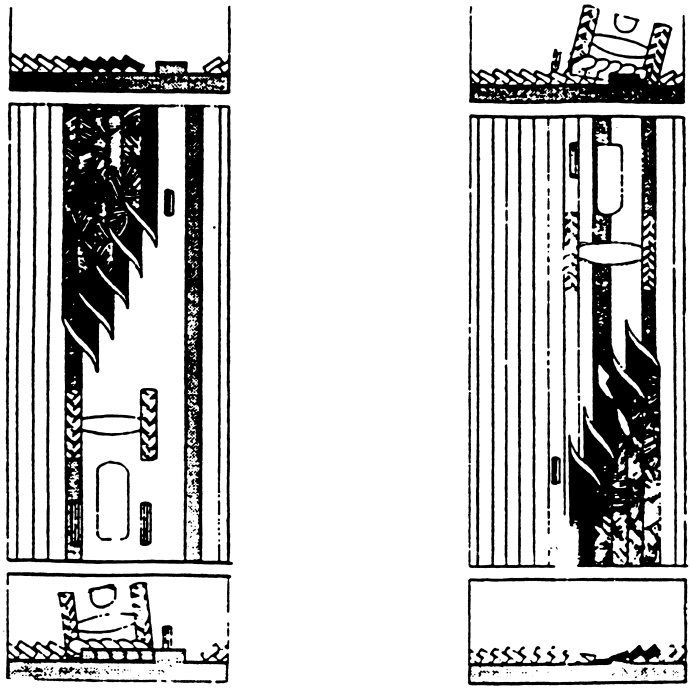


Fig. I-24.

End of ploughing.

During the last pass, ploughing in full depth is performed, leaving the field unploughed for 1-2 furrows. During the last pass the first two shares cultivate the two remaining furrows, and rear plough share cultivates for ½ the ground that has already been broken.

Hauling operations

Actually for the half of the time of its operation, the tractor is used on transport communication driving on public roads. Therefore, the transport MTAs are subject to exclusive safety standards.

According to the State Standard implements like trailers or semitrailers must be equipped with service and parking brakes and with safety chain (ropes). Service break drive is performed as per one-line scheme and is controlled from operator's working place. Parking brake drive shall be located on the implement.

The vehicles shall be coupled through the drawbar hitch DH-2V or DH-3V (lift device). For the safety reasons, the coupling with the drawbar hitch DH-1 (crossbar) is strictly forbidden.

On rear left part of the machines such as trailers or semitrailers there shall be a sign of limitation of the maximum speed of the MTA.

The hole with the diameter of 24 mm in the both cheeks of the lifting device serve as a place of attaching the safety chains (ropes) on the tractor (the fasteners are included in the standard equipment of the technical mean to be coupled).

The tractor aggregation with the train (tractor + semi-trailer + trailer) is only allowed on dry roads with hard pavement and slopes not exceeding 4%.

When driving to the public roads, the overall dimensions of the MTA shall not exceed: width – 2.5 m and height – 3.8 m.

In case of deviations from the provided norms, the consultation with the state authorities responsible for the traffic safety is required.

Before transportation of mounted implements it is necessary to install upper link to the lower hole in a bracket of rear LL-2 and fix it with retention mechanism against self-lowering.

Selection of driving speed

The speed of motion of the tractors on public roads can be limited by the technical possibilities of the tractor and aggregated machine in accordance with the sign provided on the technical mean

Carryng capacity of vehicles depends on terrain relief, slope and road condition. Taking into account longitudinal slope of 12 degrees, total semitrailer weight (trailer) shall not exceed 10000...12000 kg, on comparatively flat site — 12000...14000 kg.

Before transportation of mounted implements it is necessary to install upper link to the lower hole in a bracket of rear LL-2 (3).

For connection of signalling device of the implements coupled on the tractor there is 7-pin socket with a socket for power supply to the devices of the implement coupled according to local and foreign standards.

Traveling along the public roads can only be performed on the direct route. Reverse movement is forbidden because signaling and lighting equipment is designed only for forward movement.

I 22

Installation of mounted equipment

For coupling of mounted equipment (spraying machine reservoirs, loaders, haystackers and etc.) there is a number of mounting holes on a tractor allowing installation of frames (semi-frames) and other components. Holes are located on longerones, clutch coupling housing and rear-axle tubes (at the bottom). The frame shall cover longerones with plates, clutch coupling housing and rear-axle tubes to avoid case-shaped part connections disruption. Frame holes shall have elliptic shape to compensate tolerance linear dimension tolerance.

The plates are designed for reinforcement of semi-frame and are an integral part of a tractor. The plates may be dismounted in case of a frame of an implement coupled installation.

Taking into account the fact that longerones are fixed to a beam from two sides in two places with bolts via fitter bushings, it is forbidden to disrupt the given connections during installation of mounted components. In this case a hole of not less than 30 mm diameter shall be made in cross frame in places for installation of fitter bushings.

M1

Section J. **POSSIBLE FAILURES AND GUIDELINES FOR TROUBLESHOOTING**

Defect, external manifestation	Way of elimination
DIESEL ENGINE	
Diesel engine doesn't start	
Air in fuel system.	Pump over system by means of pump of manual fuel pumping. Remove air inflow in fuel system.
Oil pump is out of order.	Take off fuel pump from the diesel engine and hand over to workshop for repair.
Fuel filters are littered.	Wash out the coarse fuel filter and replace filtering elements of fine fuel filter.
The diesel engine is not enough warmed up.	Warm up diesel engine in cold weather by means of available means of start simplification.
The diesel engine does not develop full power	
Lever of fuel pump control does not reach against arrester.	Adjust the rods of fuel pump control.
Filtering element of fine fuel filter is clogged.	Replace filtering element.
Faulty injectors.	Find the faulty injectors, wash and adjust them.
Wrong fuel injection advance angle.	Set the recommended injection advance angle.
Pressure of boost has decreased.	Remove turbocharger from diesel engine and send it to workshop for repair.
Air gets in fuel system.	Pump over fuel system by means of pump of manual pumping.
Diesel engine fumes in all operating modes. **A. Black fume is emitted from the exhaust pipe**	
Diesel engine air cleaner is clogged.	Carry out technical maintenance of air cleaner.
Injector atomizer needle hovers.	Find defective atomizer, wash out and replace injector, adjust atomizer.
Defective fuel pump.	Remove the fuel pump from the diesel engine and send it for repair.
Diesel engine overload.	Reduce diesel loading engaging low gear.
Wrong fuel injection advance angle.	Set the fuel injection advance angle

Defect, external manifestation	Way of elimination
B. White fume is emitted from the exhaust pipe	
Diesel engine is not heated.	Warm up the diesel engine; maintain the cooling liquid temperature within 75 - 95°C during operation.
Hit of water in fuel.	Replace fuel.
Clearances between the valves and the rockers are not adjusted.	Adjust the clearances between the valves and the rockers
Fuel injection advance angle setting is disturbed.	Set the recommended fuel injection advance angle.
C. Blue fume is emitted from the exhaust pipe	
Ingress of oil into the combustion chamber as a result of wear of cup-piston group components	Replace the worn-out parts of the cup-piston group.
Excess of oil in the diesel engine crankcase.	Drain the excessive oil, having set the level against the upper mark of oil-measuring rod.
The diesel engine suddenly stops	
The fuel is not delivered.	Check up fuel in fuel tank, regularity of fluepipes, filters and pumping pump.
The diesel engine overheats	
There is not enough cooling fluid in the diesel engine.	Add cooling liquid up to normal level.
Radiator is polluted outside.	Clear radiator.
Presence of dirt and scum in cooling system.	Clean and wash out cooling system from dirt and scum.
Valve of thermostat does not open completely.	Replace thermostat.
Insufficient tension of belt of fan:	
• Break of spring of tension device.	Replace spring. At impossibility to replace spring it is supposed to block clutch of fan having clamped bolt with nut placket of generator and lever of idler.
• Jamming of idler on axle.	Disassemble tension device and remove defect.
Oiling of fan driving belt and pulleys.	Remove driving belt and remove oil tracks from belt surface and pulleys.
Oil pressure on warmed up diesel engine below admissible	
Pressure index is defective.	Replace pressure index after check of oil pressure by control manometer.
Tightness of connections of oil pipelines is broken.	Reveal place of seal failure and restore it.

M3

Defect, external manifestation	Way of elimination
Oil pump is defective.	Reveal defects and eliminate.
Oil level in diesel engine case is below admissible.	Add oil up to top label of oil meter core.
Jamming of safety valve in diesel engine case of oil filter.	Wash out valve and adjust pressure in system of greasing.
Limiting wear of interfaces of neck of diesel engine case — bearings.	Remove defect.
Turbocompressor	
Rotor of turbocompressor does not rotate (there is no specific sound of high tone)	
Presence of extraneous subjects interfering rotation of rotor.	Remove glow tube and outlet pipe, remove extraneous subjects.
Jamming of rotor in bearing.	Replace turbocompressor.
Increased emission of oil from the side of compressor or turbine, infringement of tightness of oil compaction of turbocompressor.	Remove turbocompressor from diesel engine and send to workshop for repair.
Units of system of automatic control of clutch of fan	
At temperature of water at output from diesel engine above 97° C fan of cooling system does not switch off, or at temperature of water below 70° C fan of cooling system does not switch off.	
Defect in thermo power gauge or fan clutch.	Remove clutch of fan. Press rod into water pump against arrester and measure its overhang. Start diesel engine and warm up it to temperature of water 80-85° C on output; stop diesel engine and measure overhang of rod from water pump: 1. If over hang of rod has not increased in comparison with initial, replace thermo power gauge; 2. If overhang of rod increased for 6-8 mm, replace fan clutch; defective fan clutch send to workshop for repair. At impossibility of replacement of fan clutch it is supposed to block it according to above-mentioned method.

Defect, external manifestation	Way of elimination
Coupling	
Coupling slips	
There is no pedal free travel.	Adjust pedal free travel.
Linings of driven disks are worn-out.	Replace linings or assembled driven disks.
The clutch is not disengaged fully	
Increased pedal free travel.	Adjust pedal free travel
Gear box, back axle	
Complicated switch in of gears	
“Drive” coupling.	Adjust.
Low pressure in hydraulic system of transmission	
Insufficient quantity of oil amount in case of transmission.	Add oil in case up to a label “П” ±5 mm on glass of oil-gauge glass.
Bedding of relief valve.	Wash out valve and adjust it in case of necessity.
Pollution of screen filter of hydrosystem of gear box.	Wash out filter.
High pressure in hydraulic system of transmission	
Bedding of relief valve.	Wash out valve.
There is no pressure in hydraulic system of transmission when the engine is running and tractor doesn’t move	
Drive of pump is carried out from moving system.	Switch pump to drive of diesel engine.
Increased noise in main conical pair	
Adjustment of interlock of pinions of main gear and bearings of differential is disrupted.	Adjust interlock and backlash in bearings.
Brakes	
Unsatisfactory work of brakes (brakes do not hold)	
Adjustment of brakes operation is disturbed.	Adjust brakes control
Oiled and worn lining of brake disc.	Wash out overlays. If necessary replace discs.
Seal failure of working cavities of main and working cylinders because of damage of collars.	Replace collars. Pump over system.
Non-disinhibition of brakes	
There is no free course of pedals.	Adjust
Jamming of cuffs of main and working cylinders because of:	
• Pollution and corrosion of working surfaces.	Replace protective covers. Clear cylinders, wash out, remove corrosion.
• Swelling of cuffs owing to mineral oil hit.	Wash out system. Replace cuffs.
Incomplete return of pedals to a starting position after braking	
• Jamming of profile flutes in press disks:	Replace press discs.

M5

Defect, external manifestation	Way of elimination
• Relief or failure of squeezing springs of pedals, working cylinders, pressing discs.	Replace springs.
Differential block does not work	
Clutch discs are greasy.	Eliminate oil running, wash out the disks.
Worn frictional overlays of lockup clutch disks	Replace assembled disks.
Diaphragm of clutch block is damaged.	Replace diaphragm.
Low pressure of oil, being brought to operative mechanism of block.	Check pressure, being brought to clutch of differential block. It should be 9…10 kilogram-force/sm^2.
Electro hydraulic valve of differential block control does not work.	Check serviceability of safety devices, relay and other elements of line, eliminate defect.
Rear power take off does not transfer full torque or continues to rotate when disengaged	
Because of significant deterioration of frictional overlays of brake tapes or due to another reason adjustment of operation is disturbed.	Adjust mechanism of Power Take Off control
Defect of control hydraulic system.	Contact a qualified specialist.
Front driving axle	
Insufficient draft of front driving axle	
Clutch of driving does not transfer torque:	
There is no oil pressure in clutch booster.	Disassemble and wash out details of distributor.
• Slipping of drive clutch	Check and regulate pressure in hydro system of transmission (9...10 kilogram force/sm^2). Replace worn out disks.
• Defects in electric line of front driving axle control.	Determine and eliminate defects.
Insufficient size of torque being transferred by clutch because of oil leakage in hydro system:	
• Deterioration of rubber sealing rings.	Replace rings.
• Deterioration of piston rings and clutch drum;	Replace rings.
• Deterioration of interfaced surfaces “holder – nave of drum”, “drum – piston”	Replace worn out details.
Drive of front driving axle does not work in automatic mode	
Deterioration of adjustment or refuse from switch of automatic switch-on gauge.	Adjust position of switch or replace it.
High noise and heating in zone of main gear	
Gap in gears bearings of main gear.	Adjust bearings of gears.
Wrong gears engagement of the main gear.	Check and if it is necessary adjust interlock on spot of contact.

Defect, external manifestation	Way of elimination
Noise at maximum angle of wheels rotation	
Wrong operation mode of front driving axle. Front driving axle works in compulsory mode.	Check mode of inclusion of FDA drive and install switch in position “switched off” or “automatic”.
Wrong limiting angle of wheels turn.	Check and adjust.
Bang in pivot at movement	
Adjustment of pivots bearings is disturbed.	Check and adjust.
Bang in front driving axle at sharp turn of wheels	
Gaps in pins of steering draft and hydro cylinders of turn.	Check and adjust.
Dribbling of greasing through cuff of main gear flange	
Deterioration and damage of flange cuff.	Replace worn out parts.
Dribbling of greasing through breathers of wheel reduction gears	
Increased level of oil.	Check and adjust correct level.
Dribbling of greasing through cuff of main gear of wheel reduction gear.	
Increased backlash in gears bearings.	Check and adjust.
Deterioration and damage of cuff.	Replace cuff.
Angular frictions of wheels	
Axial backlash in bearings of wheel reducer pivots.	Check and adjust.
Increased backlash in bearings of front wheels.	Check and adjust backlash in flange bearings.
Backlash in bearings of hydro cylinders of hydrostatic steering.	Replace worn out details.
Increased deterioration and ply separation of front wheels tires	
Adjustment of wheels convergence is disrupted.	Adjust convergence as it is shown in section “Adjustments”.
Inadequacy of air pressure in tires to recommended norms.	Maintain pressure in tires in accordance to recommendations (see section “Aggregation”).
Front drive is constantly positively engaged.	Check switch-on – switch-off of front driving axle. When the disorder is found – eliminate it.
Steering	
Increased effort on steering wheel	
Lack or insufficient pressure in hydraulic system of steering because of:	**(Pressure in hydrosystem of steering should be 140...155 kilogram-force/sm^2 (in arrester))**
• Insufficient oil level in tank; feeding pump does not develop necessary pressure.	Fill in tank with oil up to necessary level and pump up hydrosystem for air removal
• Safety valve of pump-dosator hovered in open position or it is adjusted to a low pressure.	Wash out safety valve and adjust pressure for 140...155 kilogram-force/sm^2 at diesel-engine work at nominal turns.
• Significant friction or shimming in mechanical elements of steering column.	Check and eliminate reasons preventing steering column from fluent motion in mechanical elements.
• Air leak into absorbent main line of system.	Check absorbing main line, eliminate leakage. Pump up system for air remove.

M7

Defect, external manifestation	Way of elimination
Steering wheel rotates without turn of steerable wheels	
Insufficient level of oil in oil tank.	Fill a tank up to demanded level and pump over hydrosystem for air removal.
Sealings of piston of hydrocylinder are worn out.	Replace sealings or hydrocylinder.
Steering wheel does not rotate to "neutral" position, "motoring" of pump-meter	
Increased friction or shimming in mechanical elements of steering column.	Eliminate reasons of friction and shimming.
Spline shank of steering column and pump-meter are installed out of axis alignment (end thrust of cardan shaft) or with insufficient backlash.	Release cardan. For increase of backlash install additional washers with thickness no more than 1,5 mm between pump-motor and bracket of steering column.
Increased gap of steering wheel	
Conical pins of hydrocylinders or steering drawbar are not tightened.	Tighten nuts of pins by moment 12...14 kilogram-force m and splint.
Increased backlash of spline connection «cardan of steering shaft — pump-meter».	Replace cardan bottom plug.
Unequal minimum radiuses of turn of tractor to the right-to the left	
Toe-in is not adjusted.	Adjust toe-in as it is specified in section "Adjustments".
Incomplete corner of turn of directive wheels	
Insufficient pressure in hydrosystem of steering control.	Adjust pressure within limits 140...155 kilogram-force/sm^2.
Feeding pump has a defect.	Repair or replace pump.
Hydraulic lift linkage With hydraulic lift	
The unloaded mounted attachment is not lifted; when setting any handles of the distributor to the "lifting" or "lowering" position, no specific sound emitted by the pump under load	
Clogging of the safety valve of the tractor distributor.	Disassemble and wash the safety valve. Adjust the pressure maintained by the safety valve.
The unloaded mounted attachment is not lifted; when setting any handles of the distributor to the "lifting" or "lowering" position, a specific sound emitted by the pump under load is heard. After stopping the diesel engine and moving the position handle to the foremost position and then to the rear position and starting the diesel engine, the mounted attachment is lifted (the power handle shall be in the foremost position).	
Clogging the orifice in the overload valve.	Remove the regulator-distributor from the tractor, remove a bypass valve from it, wash the valve and clean off the valve orifice.
The unloaded mounted attachment is not lifted; when setting any handles of the distributor to the "lifting" or "lowering" position, a specific sound emitted by the pump under load is heard. After stopping the diesel engine and moving the position handle to the foremost position and then to the rear position and starting the diesel engine, the mounted attachment is not lifted (the power handle shall be in the foremost position).	

Defect, external manifestation	Way of elimination
Ingress of foreign particles under the spool edge.	Remove the cover from the regulator-distributor, set the position handle to the foremost position. The spool valve lock ring shall rest against the body of the regulator-distributor. Move the position handle to the rear position. The spool valve shall move upwards to the distance of at least 7 mm. If not so, remove the regulator-distributor, clean it from foreign particles jammed between the edges of the spool valve and body.
The loaded mounted attachment is not lifted or is lifted too slowly	
The fault becomes apparent as oil in the hydraulic system is warmed up – the pump is faulty.	Check the capacity of the pump. If the pump efficiency is below 0.7, replace the pump.
The fault becomes apparent at any oil temperature – clogging of the overload valve.	Remove the regulator-distributor, take the bypass valve away and wash it and the casing in diesel fuel.
The loaded mounted attachment is lifted slowly; after stopping the diesel engine, the spontaneous mounted attachment lowering is noticeable by eye, the position corrections are frequent, the pressure "hanging-up" is possible	
Destruction of the rubber seals of the regulator-distributor.	Remove the regulator-distributor and replace rubber seals by new ones.
The pump is not unloaded over the whole range of travel of the mounted attachment with load when employing the position method of adjustment on reaching the specified position by the mounted attachment	
In case of minor displacements of the position handle towards the lowering position, the pump is shortly unloaded, on stopping the diesel engine the leak-proofness is normal	
Jamming or loss of sealing of the valve-accelerator.	Remove the regulator-distributor; take away the bypass valve, disassemble and wash it. If necessary, hammer the valve ball to its seat.
At move of position handle to side of lowering pump does not unload, by diesel engine stop, tightness is normal	
Decapsulation of valve of pressure adjustment.	Turn out conical plug on upper surface of regulator, remove spring, hammer ball of valve to its seat, install parts back on their places.
The loaded mounted attachment independently falls to a small size after mounted implement achieves specified position of position handle («subsidence» of mounted implement)	
Decapsulation of antishrinking valve.	Remove regulator-distributor, turn out plug of antishrinking valve, remove spring, hammer ball to its seat, install parts back on their places.

M9

Defect, external manifestation	Way of elimination
Position of position handle on digits “1” and “9” does not correspond to transport and extremely low position of mounted implement	
Adjustment of positional cable in drive is disturbed.	By rotation of nuts, fixing frame of positional cable to arm in board or to arm on hydrolift, work out coincidence of corresponding positions of handles and mounted implement.
There is no lift of unloaded mounted implement or it occurs with pushes, at engaging of distributor pump «squeals»	
Insufficient quantity of oil in hydrosystem.	Make sure that there is oil in oil tank, add in case of necessity.
Spontaneous move of power and position handles on board	
Fastener of frictional washers on arm in board is weakened.	Adjust a fastener of spring by nut on arm axle till defect eliminates..
Electrical equipment	
Storage battery has low degree of charge	
Transitive resistance between plugs of storage battery and tips of wires due to relief and degradation is increased.	Smooth out plugs of connections, tighten and grease contact parts with technical vaseline. Tighten fastening of switch of “mass” and balks of “mass.
Generator is faulty (there is no pressure on clips “+” and “Д”).	Remove generator and send it to workshop for repair.
Storage battery is faulty.	Replace.
Slipping of driving belt.	Adjust tension of belt of generator drive (see section “Maintenance”).
Storage battery «boils» and it requires frequent add of water	
Storage battery is faulty.	Replace.
At engaging of starter crankshaft of diesel engine does not turn or turns very slowly	
Weak fastening of storage battery terminals or oxidation of wires tips.	Smooth out tips and tighten clips.
Storage battery has been discharged below admissible limit.	Charge or replace storage battery.
Collector and brushes are contaminated.	Clean collector and brushes.
Poor contact of brushes with collector.	Remove starter from diesel engine and smooth out collector, remove hang-up of brushes and replace them in case they are worn out.
Starter relay contact are burned	Face up starter relay contact
Adjustment of solenoid starter switch is disturbed.	Adjust relay.
Blocker of diesel engine start has actuated or its switch is faulty.	Install levels of gear box in neutral position, check running order of switch. In case of necessary, adjust position of switch with help of adjusting washers.
Diesel engine is not ready to start at temperature below + 5°C.	Prepare diesel engine for start at low temperatures.

Defect, external manifestation	Way of elimination
After starting diesel engine starter remains in engaged position	
Power disk has sticked to contact bolts of starter relay.	Stop diesel engine, switch off battery by switch of "mass" and smooth out contacts of solenoid starter switch.
Drive gear does not jump out of mesh with crown of fly-wheel due to defect in spring of wishbone lever.	Replace return spring of wishbone lever.
Noise of generator	
Slipping or extreme tension of generator belt.	Remove generator and send it to workshop for repair. Adjust tension of generator drive belt.
Block of heating and cooling of air in cabin	
Warm air does not move to cabin	
There is no circulation of water through block of heating	
• Cock on head on cylinders block s closed	Open cock.
• Ice plugs in hoses of heater	Split ice, leak through hoses hot water.
• Fan of heater does not work.	Remove fan defect, check fan regularity, and check fan turn-on circuit.
Warm air of high humidity enters cabin	
Outflow of water in heater radiator.	Remove outflow of water or replace radiator.
Water leakage in connections of heating system.	Tighten coupling collars.
Pneumatic system	
Pressure in receiver increases slowly	
Outflow of air from pneumatic system	
• Nuts of pipelines, armature, coupling collars are poorly tightened or damaged	Reveal places of outflow and eliminate them by tightening of connections or by replacement of damaged parts.
• Rubber sealing of connecting head is damaged	Replace damaged sealing.
• Tie of nut connecting head sealing ring is weakened	Tighten.
• Dirt hits under valve of connecting head	Clean.
• Contact of dustproof cover with rod of connecting head valve	Remove.
• Parts of valve are deformed: diaphragm is torn, fastening of cover in brake valve is weakened	Check conditions of valve parts, in case of necessity change them, tighten bolts of fastening.
• Adjustment of valve drive is disturbed.	Adjust (see section "Adjustments").
• Work of pressure regulator is disturbed	Remove and send to workshop for repair. In your tractor is equipped with regulator 80-3512010, adjust it according to the Section "Adjustments"

M11

Defect, external manifestation	Way of elimination
• Filter is clogged	Wash out filter.
Pressure in receiver rise slowly	
Air outflow through compressor valves.	Remove head of compressor, clean valves and seats from coke formation. Replace damaged parts.
Hang-up and deterioration of compressor piston rings.	Remove head and compressor cylinder, clean rings from coke formation. In case of necessity replace them.
Pressure in receiver quickly falls down by the diesel engine stop	
Air outflow in connecting elements of pneumatic system.	Remove leakages.
Pressure in receiver goes down rapidly at pressing of brakes pedals	
Перекошен, засорен или поврежден впускной клапан тормозного крана. Inlet valve group of brake valve is cobbled, contaminated or damaged.	Remove cobble, clean valve or replace it.
Diaphragm of brake valve is disturbed.	Replace diaphragm.
Insufficient pressure in receiver	
Air outflow.	Remove air outflows.
Work of pressure regulator is disturbed.	Adjust pressure regulator.
Absorbing and pressure valves of compressor are out of order.	Clean valves from coke formation, in case of high wear replace them.
High wear of piston rings, hang-up of compressor rings.	Clean piston rings from coke formation or replace piston rings.
Increased emission of oil by compressor to pneumatic system.	
Hang-up or deterioration of piston compressors.	Clean piston rings from coke formation or replace piston rings.
Regulator of pressure switches compressor on idle at pressure not less than 77...0,80 МПа (7,7...8,0 кгс/см^2), on travel — not less than 0,65 MP(6,5 kilogram-force/sm^2), or more than 0,70 MP (7,0 kilogram-force /sm^2)	
Contamination of cavities and channels of pressure regulator.	Wash out and clean.
Unlocking of regulator cover.	Adjust pressure of switching in and switching off of compressor.
Loss of elasticity, damage or wrecking of rubber parts, shrink of springs.	Replace damaged parts.
Cobble, hang-up of adjustable part of regulator.	Check mobility of valves, grease in case of necessity.
Regulator of pressure often works (it switches on compressor) without air takeoff from receiver	
Air outflow from pneumatic system or regulator of pressure, damage of return valve of regulator.	Reveal and remove air outflow.
Regulator works in mode of safety valve	
Adjusting cover is wrapped on bigger size.	Adjust regulator.
Jamming of unloading piston of diaphragm	Disassemble regulator of pressure and eliminate jamming.
There is no gap between unloading valve	Turn off cover, clean outlet holes and check

Defect, external manifestation	Way of elimination
and bottom cover, outlet holes in cover are littered.	gap availability.
There is no air supply in connecting hose through air takeoff valve	
Rod of air takeoff valve in regulator of pressure is insufficiently sunk.	Screw a nut on the union of connecting pipe.
Regulator of pressure switched compressor to idle.	Reduce pressure in balloon below 0,65 MP (6,5 kilogram-force /sm^2).
Displacement of rubber ring on air takeoff valve.	Turn off cover, check position and condition of rubber ring.
Brakes of trailer are released slowly	
Adjustment of brake valve and its drive is disturbed.	Adjust. (see section “Adjustments”).
Work of trailer brake system is disturbed.	Adjust.
Brakes of trailer operate inefficiently	
Brake valve does not provide pressure 0,77…0,80 MP (7,7…8,0 kilogram-force /sm^2) in main pipe.	Adjust brake valve and its drive (see section “Adjustments”).
Brake valve does not provide pressure drop to zero in connecting pipe.	Adjust brake valve and its drive (see section “Adjustments”).
Pressure in connecting pipe slowly drops to zero.	Check condition of connecting pipe, atmospheric valve hole, brake pedal stroke.
Work of trailer brake system of is disturbed.	Adjust.

K1

Section K. SCHEDULED MAINTENANCE

Maintenance service (MS) is necessary to keep the tractor in good condition during operation.

Failure to maintain the prescribed frequency and low quality of MS results in a greatly reduced life of the tractor, in an increase in the number of failures, a fall in the engine power and higher costs of operating the tractor. The operator must daily check the tractor, preventing loosening of the fasteners, leaks of fuel, fluids and oil, accumulation of dirt and other deposits, which can cause a fault, fire or accidents.

Caution! If no special instructions are available, stop the engine and engage the parking brake before any MS works, adjustments, etc. If guards and casings were removed, make sure that they are installed to their respective places before you start working on the tractor.

IMPORTANT! Observe the rules of storage and disposal of waste. Never pour liquids to the soil. Use special containers for safe storage of waste.

Refill capacities, l

Engine crankcase / lubrication system	12±0,12
Engine cooling system	22,5±0,2
Transmission housing (CC, GB and RA)	43±0,4
FDA wheel reduction gear (each)	2,0±0,1
FDA final drive	3,9±0,04
Hydraulic system oil tank	25,5±0,2
HSU oil tank	7,5±0,35
Fuel tanks	Two tanks-270 (When one fuel tank is installed as an option – 140
Left wet brake and DL clutch housing, (when installed as an option)	1,5±0,1
Right wet brake and parking brake housing (when installed as an option)	1,0±0,1

Maintenance after running-in (30 service hours)

1. Inspect and wash the tractor.
2. Listen how all components of the tractor operate.
3. Check tightening of the cylinder head fastening bolts (Operation 35).
4. Check clearance between valves and rockers (Operation 22).
5. Clean the impellers of the engine centrifuge of gear box (Operation 13). Clean the GB strainer (Operation 15).
6. Check the generator belt tension (Operation 8).
7. Discharge sediment from fuel tanks, coarse and fine filters of the engine (Operations 7, 18).
8. Check and, if necessary, adjust the clutch, brake pedal free travel and the air system (Operations 24, 26).
9. Check condition of the batteries, clean the terminal connections and vent holes (Operation 27).
10. Change the oil in:
    - diesel engine crankcase (Operation 16),
    - power train housings (Operation 41),
    - wheel reduction gears and FDA final drive (Operation 41).
11. Replace the paper filter elements of the engine and hydraulic system filters (Operations 17, 30).
12. Lubricate the clutch release yoke bearing (Operation 19).
13. Discharge condensate from pneumatic system receivers (Operation 5).
14. Check and as necessary tighten the external threaded connections (Operation 39).
15. Check operation of the engine, steering, brakes, controls, illumination and signaling systems (Operation 6).
16. Lubricate the bearings of swivel pin of FDA wheel reduction gear (Operation 10).
17. Check toe-in of front wheels (Operation 33).
18. Lubricate the pivots of the steering cylinders (Operation 9).

K3
Maintenance table

Nos. of operations	Contents of works	Interval, every hrs						
		10	125	250	500	1000	2000	total
1	Oil level in diesel engine	X						
2	Coolant level in diesel engine	X						
2a	Air-conditioner maintenance *	X						
3	Oil level in hydraulic system tank	X						
3a	Oil level in HSU tank	X						
4	Transmission oil level	X						
5	Remove condensate from cylinder of pneumatic system	X						
5a	Remove condensate from the charge air cooler (CAC) tank of the engine	X winter	X sum-mer					
6	Check operation of the engine, HSU, brakes and instruments	X						
7	Discharge sediment from the coarse fuel filter and fuel tanks		X					
8	Check generator belt tension		X					
9	Lubricate steering cylinder pivots		X					
10	Lubricate bearings of FDA reducer king-pin axles		X					
11	Air pressure in tires		X					
11a	Check of bolts torquing of air duct clamps of CAC		X					
12	Check the engine air cleaner		X					
12a	Check/adjust tension of drive belt of air conditioner compressor		X					
13	Clean the GB centrifuge			X				
14	Oil level in the hub casings and FDA main gear			X				
15	Rinse the GB oil strainer			X				
16	Change diesel engine oil			X				
17	Replace the diesel engine oil filter			X				
18	Discharge sediment from the fuel fine filter of the engine			X				
19	Lubricate the clutch release yoke bearing			X				
20	Turbocharger (tightening fasteners)			X				
21	Check and tighten fasteners of wheel hubs and nuts			X				
22	Check and adjust valve clearances in the engine				X			
23	Check oil level in the wet brake housings				X			
24	Free travel of the clutch pedal				X			
25	Steering wheel play				X			
26	Brake pedal and parking brake lever tra-vel				X			

K4

Table, continued

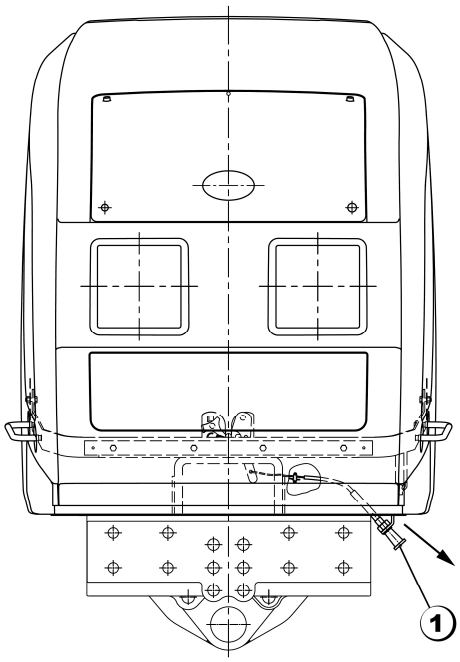
Nos. of operations	Contents of works	Interval, every hrs						
		10	125	250	500	1000	2000	total
27	Batteries				X			
28	Filter of the air pressure regulator in the pneumatic system				X			
29	tightness of pneumatic system lines				X			
30	Replace the oil filter of the hydraulic system **				X			
30a	Replace the HSU oil filter **				X			
31	Clean the cab heating and ventilation system filter				X			
32	Clean generator				X			
33	Front wheel toe-in				X			
34	Check bearings of FDA reducer kingpin axles				X			
34a	Replace filter drain *	Each 800 service hours or once a year						
35	Tighten engine cylinder head fastening bolts					X		
36	Clean diesel engine fuel coarse filter					X		
37	Replace the engine fuel fine filter PFE				X			
38	Play in HSU rod joint					X		
39	Check and tighten the outer bolted connections					X		
40	Change oil in the transmission and the hydraulic system and HSU oil tanks					X		
41	Change oil in the FDA final drive and wheel reduction gears					X		
42	Lubricate the RHL right brace					X		
44	Check disel engine injectors					X		
45	Generator					X		
46	Bearings of the FDA reducer flange (check, adjust)					X		
47	Diesel engine starter						X	
48	Engine fuel pump						X	
49	Generator (seasonal adjustment)							X
50	Flush the engine cooling system						X	
51	Flush the engine air breathers						X	
52	Adjusting the diesel engine centrifuge							X
53	Adjust oil pressure in the gearbox							X

* If an air-conditioner is installed as an option instead of heater

** Subsequent changes after 1,000s service hour

K5

Providing access to components for maintenance



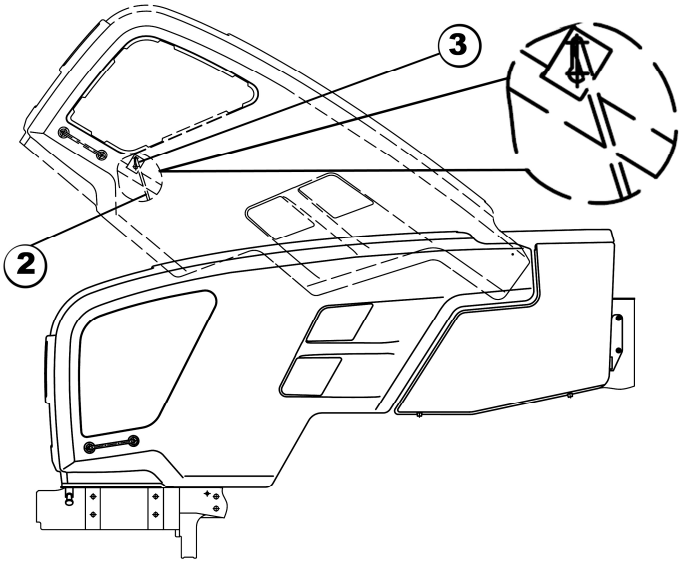
Before starting maintenance work open tractor hood by:

- Shifting handle 1 towards an arrow, open a hood and set a link 2 into a bracket 3 slot.

ATTENTION! Make sure that the hood is securely fixed in the raised position

To lower the hood:

- Press and lead the link 2 out of bracket 3 slot and close the hood until it strikes the lock;
- Lock the hood with fling.



Scheduled maintenance operations

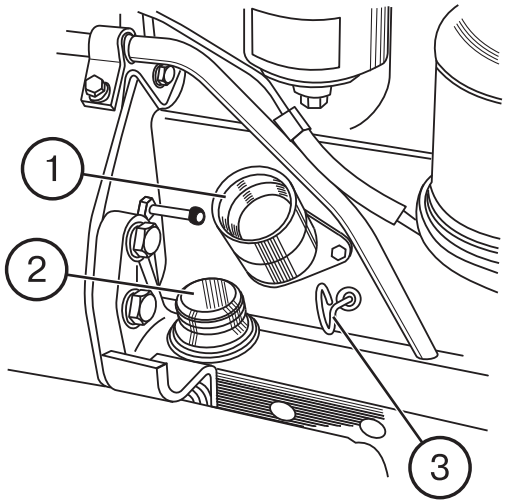
After every service 10 hours or daily (whichever is earlier)

Operation 1. Oil level in diesel engine

Check the oil level, installing the tractor on an even surface and not earlier than 3-5 minutes after stopping the engine when the oil fully flows down to the crankcase:

Remove the oil level gauge (3) from the right side of the engine, wipe it clean and reinsert it into place until it stops;

Remove the oil level gauge and determine the oil level. It must be between the top and bottom oil level gauge marks. As necessary, add oil through the filler neck (1), removing the cap (2).



IMPORTANT! Do not operate the engine with the oil level below the bottom oil level gauge mark.

IMPORTANT! Do not add oil to a level above the top oil level gauge mark. Excessive oil will burn up, creating a false impression of high oil consumption for fumes.

K7

Operation 2. Coolant level in engine

Caution! The engine cooling system operates under pressure which is maintained by a valve in the heat exchanger cap. It is dangerous to remove the cap on a hot engine. Let the engine cool down, put a thick cloth on the cap and, slowly opening the cap, remove the pressure from the system before you completely remove the cap. Avoid exposure of open parts of the body to hot coolant.

To get access to radiator plug (2), it is necessary to open hood as described at page H5. Remove the cap, taking the above precautions, and check the coolant level that must be up to the upper end of the filler neck (1).

IMPORTANT! Do not let the level drop lower than 40 mm from the upper end of the filler neck.

Operation 2a. Air-conditioner maintenance
(when installed as an option instead of fan heater)

During shift-time maintenance of air conditioner it is necessary to perform the following operations:

Check air conditioner hose fixtures

Air conditioner hoses shall be properly fixed with coupling bands. The hoses shall not be in contact with moving parts of the.

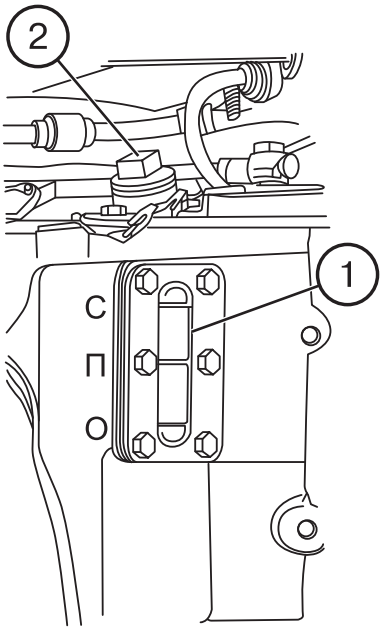
Inspect/clean air conditioner condenser

Check cleanness air conditioner condenser. If it is clogged, it is necessary to clean the condenser with a compressed air. Open the hood and direct an air flow perpendicular to the condenser plane from top downward. Jammed finning must be planished by means of special comb or plastic (wooden) plate. In case of severe condenser clogging rinse it with hot water under pressure not more than 0,15-0.2 MPa and blow it off by a compressed air.

Inspect/clean air conditioner drainage pipes from the condensate water

Light-blue drain pipes are placed to the right and to the left of the heating and cooling device under the under ceiling panel. To avoid clogging the drain pipes shall be checked and cleared when necessary. Cleanness of a drain pipe is indicated by water dripping when the work air conditioner is used in hot weather.

Operation 3. Oil level in hydraulic system tank

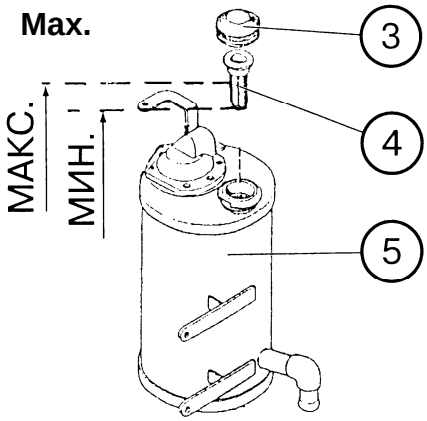


Before you check the oil level, install the tractor on a flat, horizontal surface. Stop the engine and brake the tractor with the parking brake.

Check the oil level in the hydraulic system tank by the oil gauge glass (1) on the left side of the tractor. The level should be between the marks “0” and “П”, and for machines that require high intake of oil, at the level of mark “С”. As necessary, add oil to the level of the mark “П”, removing the threaded cap (2).

ATTENTION! If you want to refill a hydraulic system unitized with machines having single-acting cylinders, the cylinders of the machines and the hitched device must have their rods pulled in.

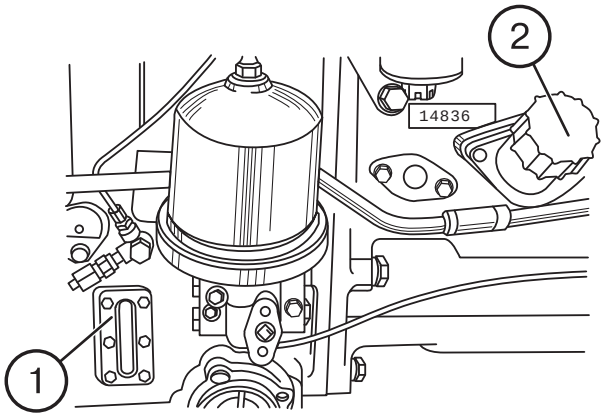
Operation 3a. Oil level in HSU tank



Check the oil level in the HSU tank (5) by performing the following operations:

- Remove the filler neck cap (3);
- Remove the strainer (4) from the filler neck;
- Check the oil level by the strainer, which must be between the filter bottom (the lower limit) and the middle of the strainer (the upper limit). As necessary, add oil until the middle of the strainer.

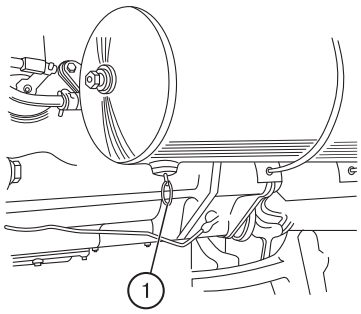
Operation 4. Transmission oil level



Check the oil level by the oil-gauge glass (1) on the right side of the GB, following the requirements set forth in the Operation 3. The oil level must be between the marks “0” and “П”. As necessary, add oil, removing the oil filler neck cap (2).

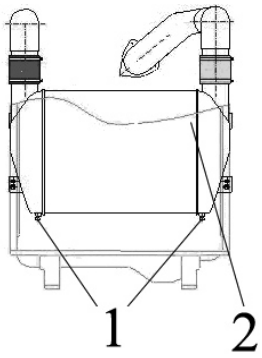
K9

Operation 5. Discharge condensate from cylinders of the pneumatic system



Pull the ring (1) towards and up, open the valve and hold it open until the complete condensate and dirt are fully discharged. Discharge condensate from the two cylinders on the left and right sides of the tractor.

Operation 5a. Drainage of the condensate water from the radiator tanks of CAC



In order to drainage the condensate water from the radiator tank of the engine CAC it is necessary to perform the following actions:

- turn off two plugs (1) in the bottom of the (2);
- let the condensate drain away;
- screw the plug (1).

Operation 6. Check operation of the engine, steering, brakes and lighting and signaling devices

The diesel engine must work steadily in all modes.

The controls, brakes, light and sound signaling devices must be in good condition.

After every 125 service hours

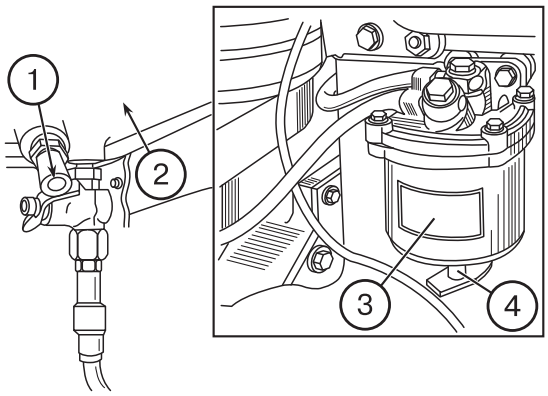
Perform the operations of the previous MS and the following ones:

Operation 7. Discharge sludge from the coarse fuel filter and from the fuel tanks.

Open the drain plugs (1) of the fuel tanks (2) and the drain plug (4) of the filter casing (3).

Drain sediment and water until pure fuel emerges from the plugs. Discharge sediment to a special container and properly dispose of it.

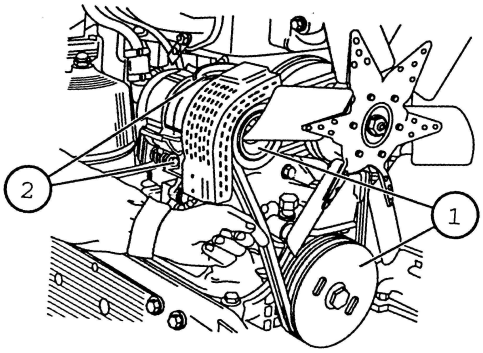
Close the drain plugs of the fuel tanks and filter.



Operation 8. Check generator drive belt tension

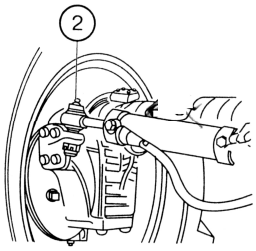
The generator belt tension is deemed normal if the deflection of its branch between the pulleys of the crankshaft and the generator is 30 to 33 mm when it is pushed with a force of 40 N.

To adjust the belt tension, loosen the generator fastening and turn the generator housing to provide the required tension. Tighten the strip fastening bolt and the nuts of the generator fastening bolts.



Operation 9. Lubricate the steering cylinder joints

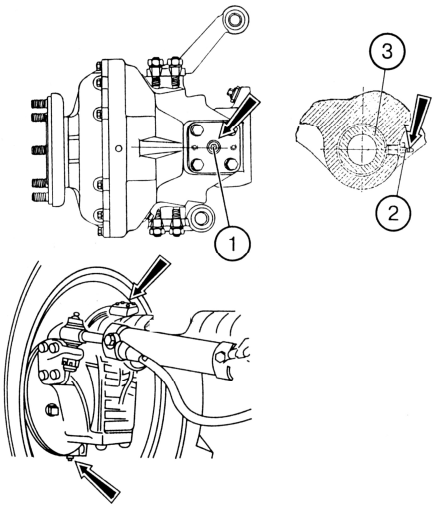
Using a gun, lubricate the joints through the lubricators (2) (4 lubrication points) with Litol-24 grease or its analogs (Bechem LCP-GM).



Operation 10. Lubricate bearings of the FDA reduction gear kingpin axles and the pivot axis hubs

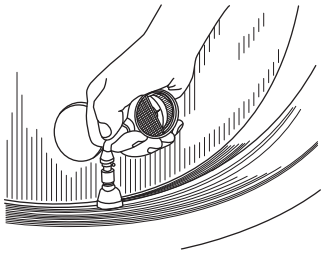
- Splint the lubricators (1) with Litol-24 or Bechem LCP-GM grease making 4 to 6 injections (4 lubrication points).
- Grease the lubricator (2) with the lubricant specified above until the lubricant emerges from the gaps between the FDA housing and the front bar.

3 — pivot axis hub.



Operation 11. Tires

Check condition of the tread and air pressure in the tires. If necessary, bring the pressure to the rated in accordance with the load as specified in the section “Technical data”



Operation 11a. Check of bolts torquing of air duct clamps of CAC

Check and, if necessary, tighten the clamp bolts 4 of CAC air ducts. The torque of air duckts of CAC shall be from 8 to 10 N·m .

K11

Operation 12. Servicing air purifier «Donaldson»

Use clogging indicator to control clogging of filtering elements of the air purifier. With excessive clogging an alarm lamp on instrument panel lights.

Make service of the air purifier in the following order:

• Remove the right-side grid from the front section and lining to get access to the air purifier;

• Pull latch (1) (yellow color), turn cover (2) anti clockwise by 12.5° and take it off;

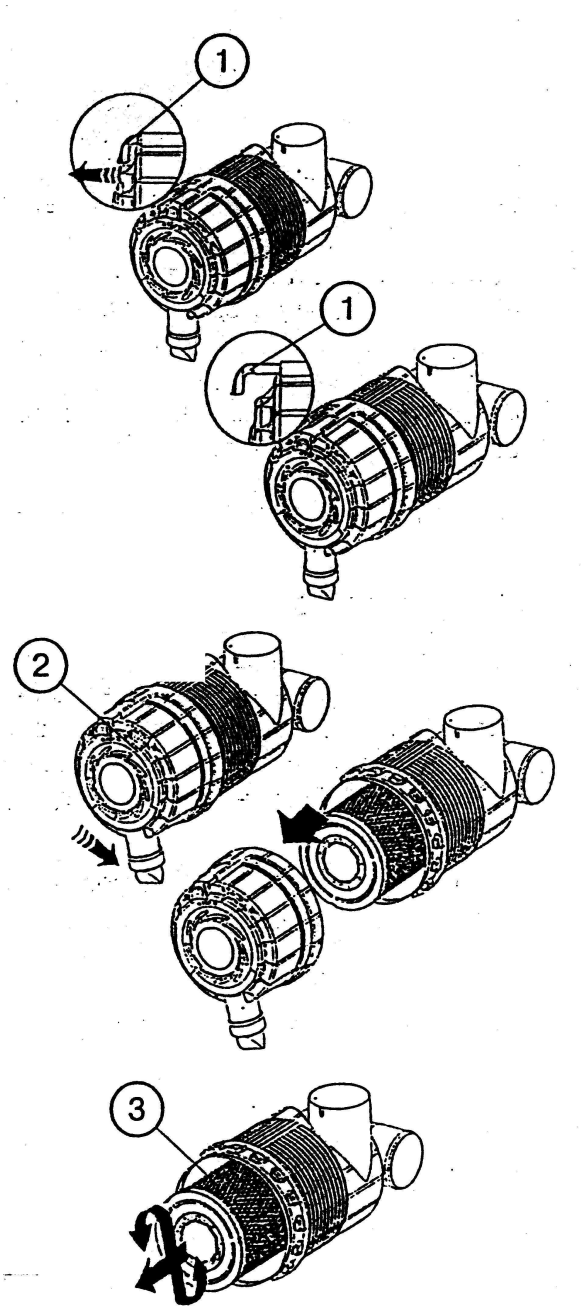
• Take off main filtering element (MFE) (3);

• Check if control filtering element (CFE) is stained, without pulling it out of casing;

ATTENTION! Removing the monitor filter element from the casing is not recommended.

Contamination of the monitor filter element indicates that the BFE is damaged (the paper shutter broken, the bottoms unstuck). In such a case, rinse the MFE and replace the BFE.

• blow off main filtering element with compressed air, first from inside, then from outside until dust is fully removed. To avoid breakage of paper shutter air pressure should not exceed 0.2-0.3 MPa (2-3 kgf/cm^2).



Direct air flow at an angle to the surface of a filtering element. During servicing protect filtering element from mechanical damage and oiling.

When filtering element is stained or oiled, and blowing off with air is not efficient, it should be washed in solution of soap paste OP-7 or OP-10 and water heated to temperature of 40-50°C.

Solution is prepared at proportion 20 grams of paste per one liter of water. If paste is not available, one may use solution of household detergent with the same concentration.

To wash the element, put it in washing solution for thirty minutes, then thoroughly rinse it for 15 minutes in the same solution and them in pure water heated to 35...45°C, and dry up for 24 hours. Do not use open flame and air with temperature above +70°C for drying.

ATTENTION: do not blow off MFE with exhaust gases and do not rinse it in diesel fuel.

- make assembly of the air purifier in the reverse order;

Note: Under dusty conditions check state of MFE after each 20 hours of tractor operation**.**

- put right-side lining grid in place.

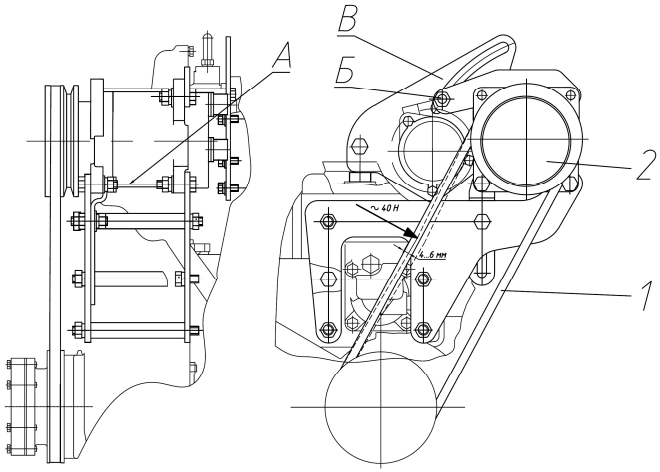
Attention! After assembling the air purifier check air tightness of all inlet duct connections. To this end start the diesel and at medium crankshaft rotation speed shut air purifier pipe. Diesel should quickly stop functioning. Otherwise, find out and correct leakage.

Operation 12a. Check/adjust tension of the air conditioner compressor drive belt.

(If installed as an option instead of fan heater)

Check tension of the air conditioner compressor drive belt:

Tension of the air conditioner compressor drive belt (1) (see figure below) is deemed normal if deflection of its branch from the engine crankshaft pulley to the compressor pulley as measured in the middle point is 4 to 6 mm when a force of (39 ± 2.0) N is applied perpendicularly to the middle part of the branch.



Check/adjust tension of the air conditioner compressor drive belt

Adjust tension of the air conditioner compressor drive belt:

Adjust tension of the belt (1) (see figures 3.4) by turning the compressor (2) around the rotation axis A and tightening the threaded coupling (B) in the groove of the sector (C). After adjustment, the belt deflection under a force of (39±2.0) N, applied perpendicularly to the middle part of the branch, must be 4 to 6 mm.

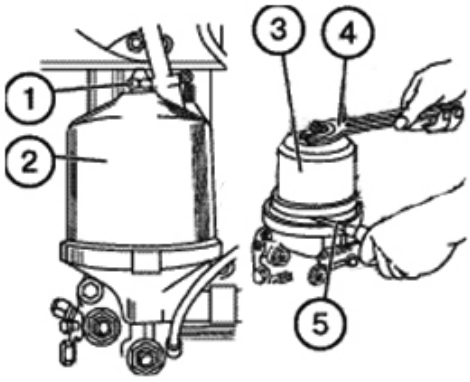
K13

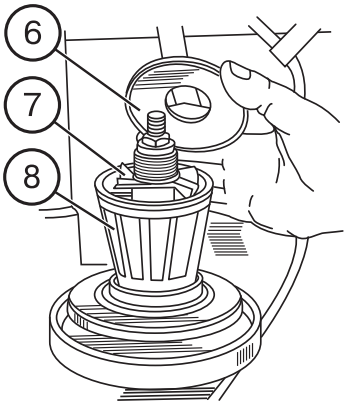
After every 250 service hours

Perform the previous MS and the following operations:

Operations 13. Centrifugal oil filters of GB.

- Remove the nut (1) and cap (2).
- Insert the screwdriver (5) or a rod between the filter casing and the rotor bottom to prevent rotation of the rotor (3), and turning the rotor nut with the key (4) remove the carrier of the rotor (3).
- Remove the cover (6), the impeller (7) and filter mesh (5) of the rotor. As necessary, clean and rinse the mesh.
- Using a non-metallic scraper, remove deposits from the inner walls of the rotor carrier.
- Clean all parts, rinse them in diesel fuel and blow with compressed air.
- Assemble the filter, performing the disassembling operations in the reverse order. Before assembling the carrier with the rotor housing, lubricate the O-ring with motor oil.
- Align the balance marks on the carrier and the rotor housing. Screw the carrier fastening nut with a small force until the carrier fully lands on the rotor.





- The rotor must rotate freely without jamming.
- Install the cap (2) and tighten the nut (1) to a torque of 35 to 50 N•m.

Note: After the engine stops, a noise of rotating rotor must be heard for 30 to 60 seconds. This indicates that the filter is working properly.

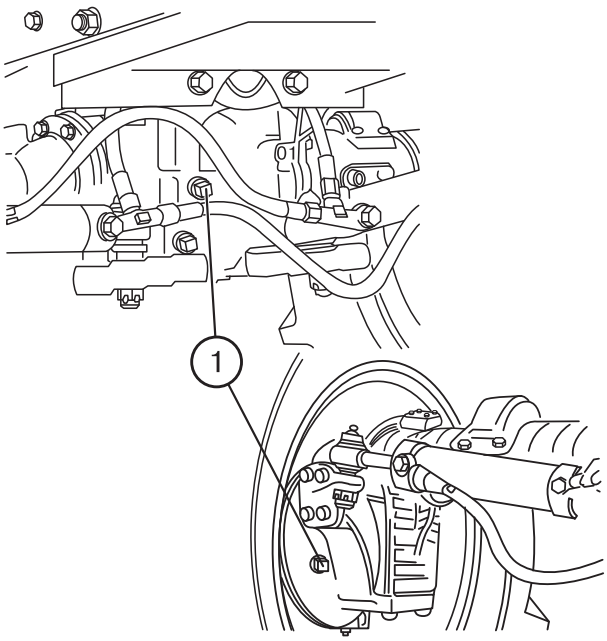
Operation 14 Check the oil level in the hub casings and FDA final drive

Check the oil level:

- In the hub casings (left and right). As necessary, add oil to the level of the check-filler hole plugged with the plug (1).
- In the FDA final drive. As necessary, add oil to the level of the check-filler hole plugged with the plug (1).

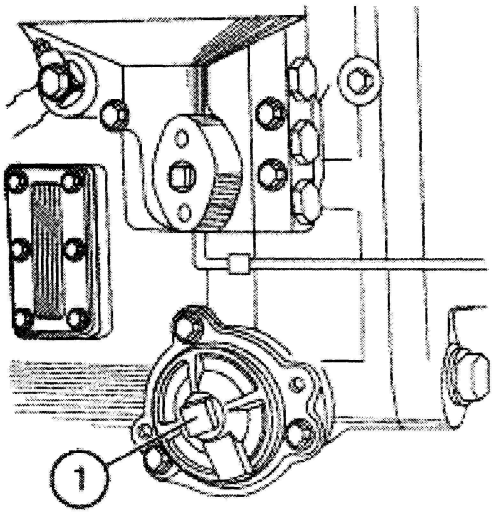
Grades of oils to fill:

Transmission oils: Tap-15V, TAD-17i, TSp-15K, or their equivalents.

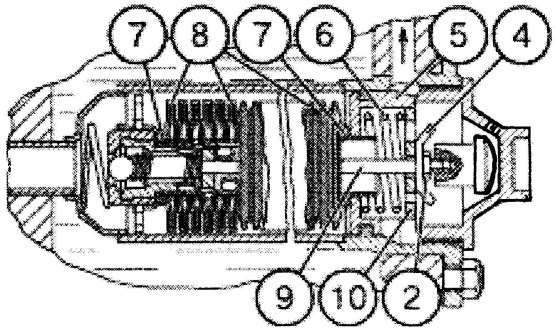


Operation 15. Rinse the GB oil strainer

- Unscrew and remove the strainer cover (1). Take the strainer assembly out from the GB housing.
- Unscrew the locknut (2) and the butterfly nut (4) from the rod (9).
- Remove the washer (10), spring (6), piston (5), O-ring (7) and the mesh elements (8).
- Rinse the mesh elements in pure diesel fuel.
- Assemble the strainer in the reverse order.



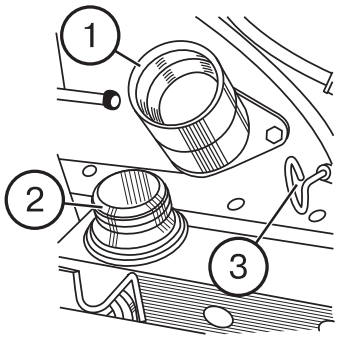
Note: Make sure that the sealing rings (7) are installed on the both sides of the package of mesh elements.

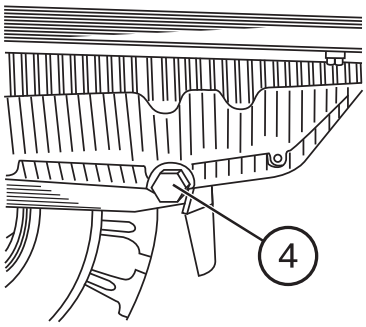


Note: Screw the butterfly nut (4) to get the washers (10) flush with the end face of the piston.

K15

Operation 16. Change engine oil





- Warm up the engine to its normal operating temperature (70°C min.).
- Install the tractor on an even surface, stop the engine and brake the tractor with the brake.
- Remove the cover (2) of the oil filler neck and unscrew the drain plug (4). Discharge oil into a suitable container for storage of waste oils.
- Install the drain plug (4) to place and fill in fresh clean motor oil through the oil filler neck (1).
- Install the cover (2) of the oil filler neck to place.
- Start the engine and let it operate for 1-2 minutes.
- Check the oil level with the probe (3) as described in the Operation 1.
- If necessary, add oil to the level.

Operation 17. Replace the engine oil filter (performed simultaneously oil change)

Instead of centrifugal oil filter, diesels D-245S2 are provided with filter 245-101701 0-B (with disassembled filter 245-1017030 with replaceable paper filtering element 245-1017060) on the housing of stand-alone, small-size liquid-oil heat-exchanger 245-1017005.

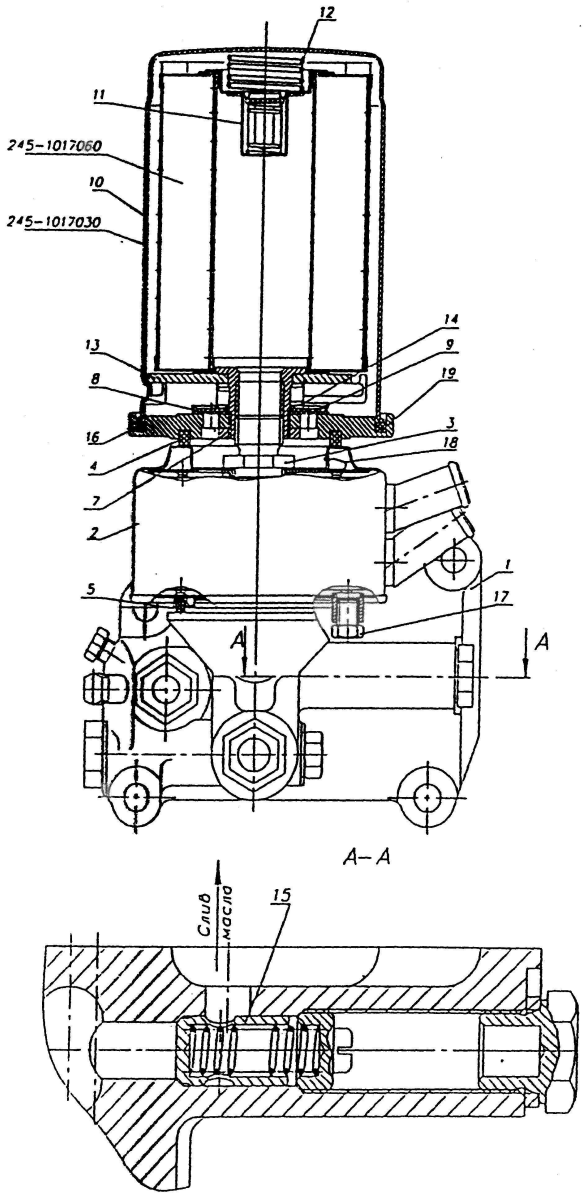
Change replaceable filtering element 245-1017060 at the same time with changing oil in diesel, having performed the following operations:

- unscrew disassembled filter 245-1017030 from connection (3), using special key or other makeshift means;
- Unscrew nut (7);
- Remove bottom (16) with spacers (4) and (19);
- Remove anti-drainage valve (8), washer (9) and spring (14);
- Press clamping (13), having moved it inside cup (10) by 3...4 mm and turn it in a way that clamping teeth were opposite outlet cup grooves;
- Pull clamping (13), filtering element, by-pass valve (11), spring (12) out of cup (10);
- Wash inside cup cavity and filter parts with diesel fuel;
- replace filtering element, spacers (4) (260-1017036) and (19) (160-4-4-1б), anti-drainage valve (8) (2105-1012009-MMZ) and assembly filter 245-1017030 in the reverse order.

Torque of nut (3) is 30...40 Nm (3...4 kgf.m). When installing filter on the connection, grease rubber spacer (4) with motor oil and screw filter in.

After spacer touches support surface of liquid-oil heat-exchanger, screw filter up by ¾ turns. Install filter only by hand effort.

For the first-time change, use filtering element 245-1017060, spacers 260-1017036,100-4-4-1b, and anti-drainage valve 2101-1012009-MMZ, enclosed in diesel spare parts and accessories kit.



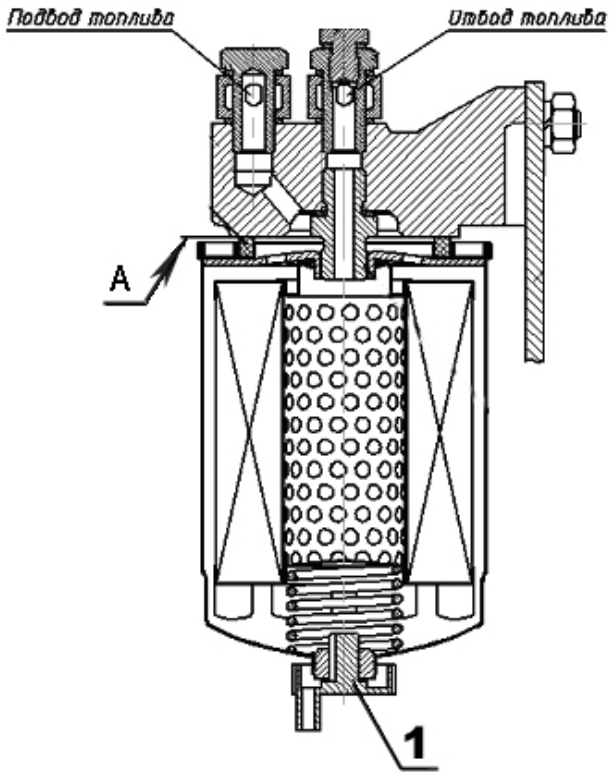
1 – filter casing; 2 - LOH; 3 - connection; 4 - spacer; 5 - spacer; 6 - spacer; 7 - nut; 8 –anti-drainage valve; 9 - washer; 10 - cup;11- by-pass valve; 12 - spring; 13 - clamping; 14-spring;15 – safety valve;16 - bottom; 17 -plug; 18 – LOH safety valve; 19 - spacer.

K17

Instead of built-up filter 245-1017030 with replaceable paper filtering element, one may install permanently sealed filter-cartridges, including anti-drainage and by-pass valves with dimensions in diameter - 95…105 mm; height -140...160 mm; mating thread -3/4-16 UNF.

Operation 18. Discharge sediment from the fuel fine filter of the engine

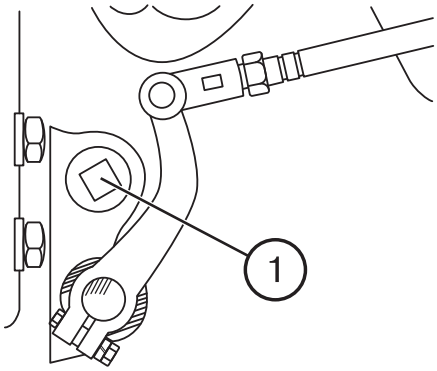
Sediment drain shall be carried out in every 250 hours of diesel engine operation.
Unscrew the plug (1) by 2…3 turns 1 in the lower part of a fuel fine filter according to figure below and discharge sediment from the filter housing until clean fuel emerges. Screw the plug.



Operation 19. Lubricating bearing of clutch shifter

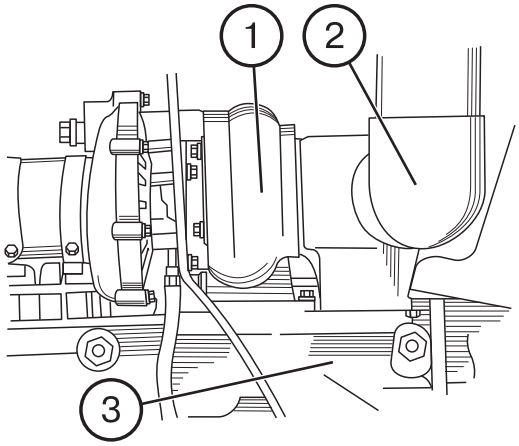
- Take off plug (1) on the left side of clutch casing.
- Using syringe make 4…6 injections of grease LITOL-24 via grease cup screwed in shifter casing for lubrication of squeeze bearing.

Note: Do not inject too much grease, as excessive grease will accumulate inside clutch casing and can get on friction surface of dry friction.



Operation 20. Turbo supercharger

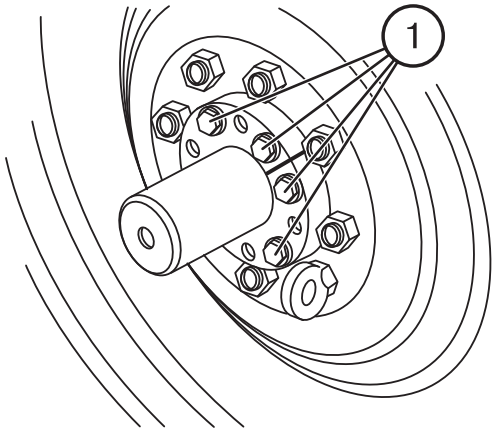
Check tightness of turbo supercharger attach hardware (1), exhaust manifold (3) and exhaust tube arm (2). If necessary, attach hardware with torque of 35...40 N•m.



Operation 21. Rear wheels' hubs, rear and front wheels fastening nuts

Check the tightening torques and, as necessary, tighten:

- bolts (1) of the rear wheel hubs to a torque of 360 to 450 N•m;
- nuts fastening the rear wheels to the hubs — 300 to 350 N•m;
- nuts fastening the front wheels to the flanges — 200 to 250 N•m;
- nuts fastening the front wheel disks to the rim brackets — 180 to 240 N•m.



K19

After every 500 service hours

Perform the operations of the previous MS and the following ones:

Operation 22. Checking clearance between valves and rockers

Note: Check clearances on cold diesel, having in advance checked tightness of cylinders' head bolts (Operation 37).

- Remove caps of cylinders' head covers.
- Check tightening of the bolts and nuts fastening the rockers arm shaft brackets (60 to 90 N•m).
- Turn the crankshaft until the valves overlap in the first cylinder (the inlet valve starts opening, and the exhaust valve ends closing).
- Adjust the clearances in the 3, 5, 7, 10, 11 and 12 valves (counting from the fan).

ATTENTION: Clearance between rocker pin and end face of valve rod while check with cold diesel engine (water and oil temperature shall not exceed 60 ºC), should be

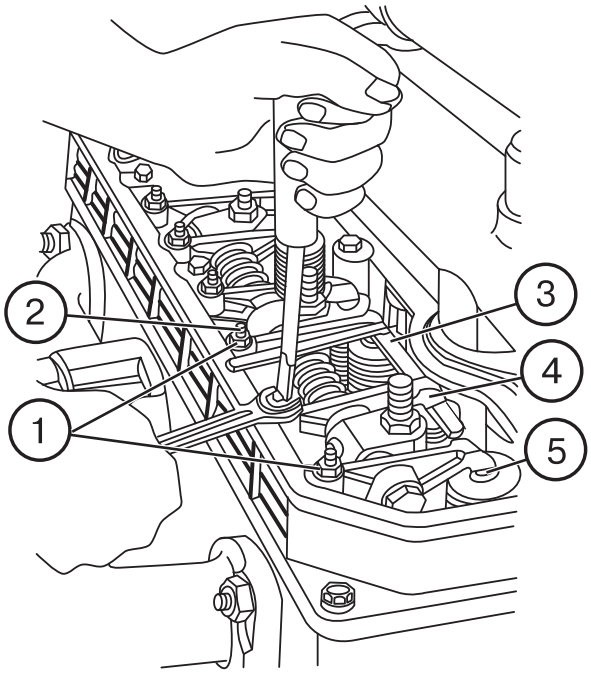
1) 0.25 $^{+0,05}_{-0,10}$ for inlet valves, and

2) $0{,}45^{+0,05}_{-0,10}$ mm for outlet valves

During adjustment of clearance between valve-stem end and rocker arm striker install on warmed-up diesel engine:

1) intake valve - $0{,}25_{-0,05}$ mm;
2) exhaust valve – $0{,}45_{-0,05}$ mm;

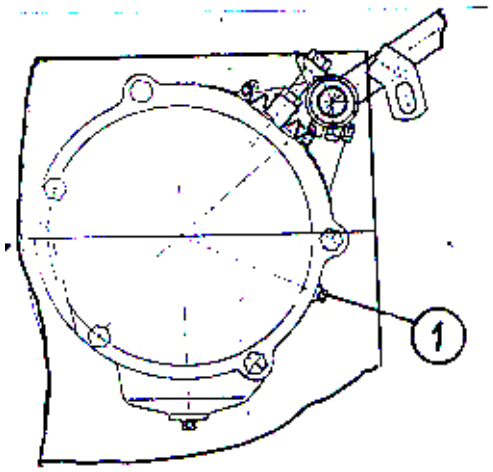
- Crank the crankshaft to 360°, making an overlap in the sixth cylinder, and adjust clearances in the 1, 2, 4, 6, 8 and 9 valves.



- To adjust the clearance, release the locknut (1) of the adjustment screw (2) and using a key and screwdriver set the necessary clearance by the probe (3). After setting the clearance, tighten the locknut (1) and re-check the clearance with the probe.
- After adjusting, install the removed parts to their places.

Operation 23. Check oil level in the wet brake housings

• Check oil level in the left and right housings. The oil level must be up to the lower edge of the check-fill hole plugged with the plug (1).



K21

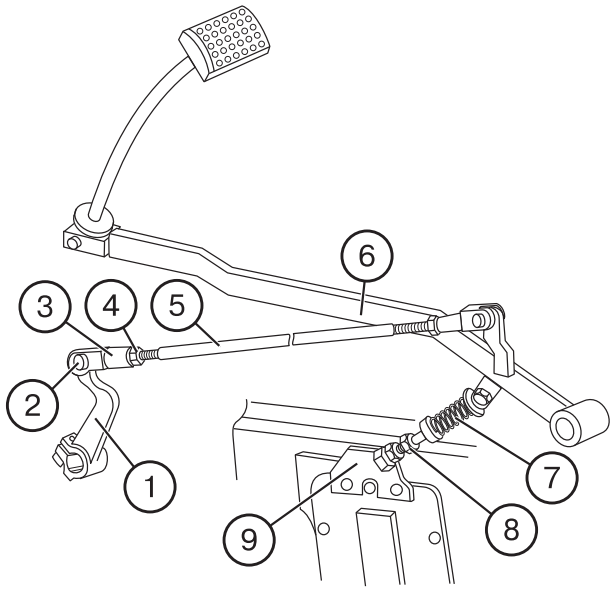
Operation 24. Adjust free travel of the clutch pedal

Free travel of the clutch pedal must be 30 to 40 mm.

IMPORTANT! A too long pedal travel will not let the clutch to be fully disengaged and will make the gear switching difficult. A too short pedal travel will result in slip of the clutch plates, rapid wear of the plates and overheating of clutch parts.

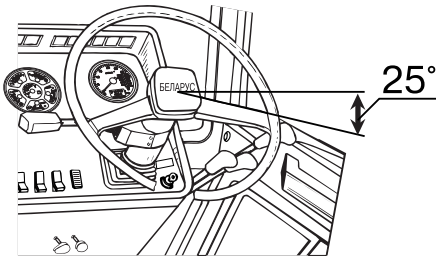
- To adjust the clutch pedal free travel:
- Unsplint and remove the pin (2), having disconnected the rod (5) from the lever (1).
- Loosen the locknut (4).
- Unscrew the screw (8) so that the pedal shaft (6) moves up to stop against the cabin floor.
- Turn the lever (1) counterclockwise until it stops, that is, when the release bearing touches the clutch toggle levers.
- Unscrewing the fork (3), align the holes in the fork and the lever (1) and then screw in the fork into the rod (5) by 5 to 5.5 turns (that is, shorten the rod).
- Assemble the clutch pedal leverage in the reverse order.

IMPORTANT! Make sure that the clutch pedal always safely returns up to stop against the floor in the area of pedal free movement. Otherwise, adjust the servo-unit spring force (7) using the bolt (8) or change the position of the bracket (9) turning it around the axis of the fastening bolt.



Operation 25. Steering wheel play

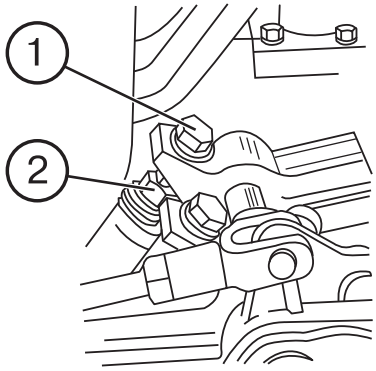
With the engine running, the steering angular play must not exceed 25°. Otherwise, check and eliminate plays in the joints of cylinders, steering link and steering column.



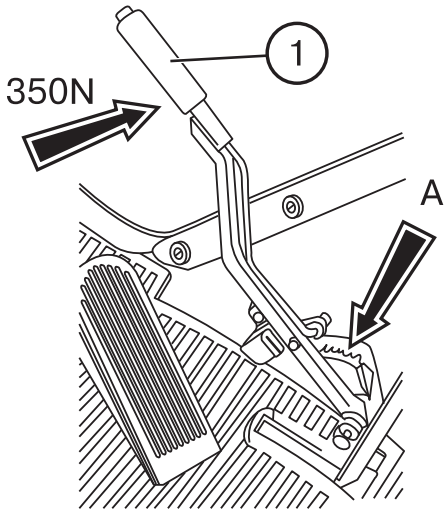
Operation 26. Brake pedal and parking brake lever travel

The full travel of the right service brake pedal under a force of 120 N on the pedals must be 115 to 125 mm. Otherwise, adjust the brakes as follows:

- Loosen the locknut (2) of the adjustment bolt (1) of the right service brake.
- Screwing in or out the bolt, adjust the travel of the right service brake pedal.
- Repeat the same for the left service brake pedal.

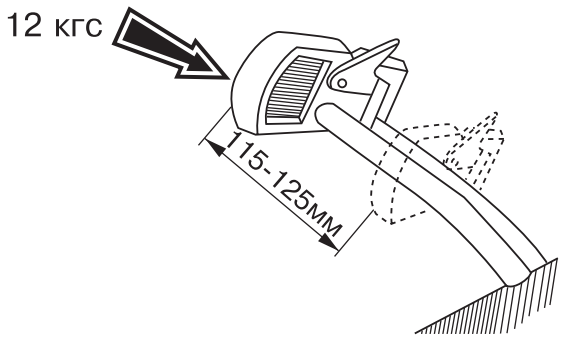


Note: The left service brake pedal travel must be by 5 to 20 mm less for simultaneous actuation of the brakes when braking with interlocked pedals.



The parking brake must be fully engaged when the lever (1) is locked on the third or fourth tooth of the sector (A) under a force on the handle of 400 N.

IMPORTANT! The minimum travel of the interlocked service brake pedals under a force of 250 N must not be less than 105 mm.



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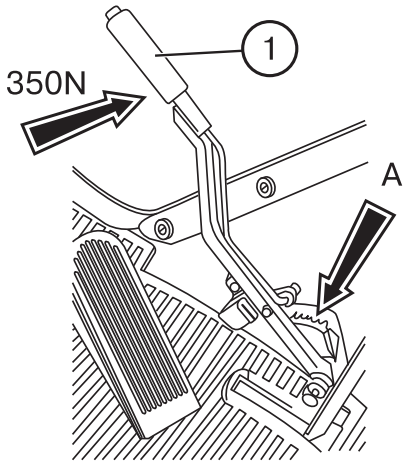
Before adjusting the parking brake, install the tractor on an even surface, stop the engine and lock the rear wheels from front and rear:

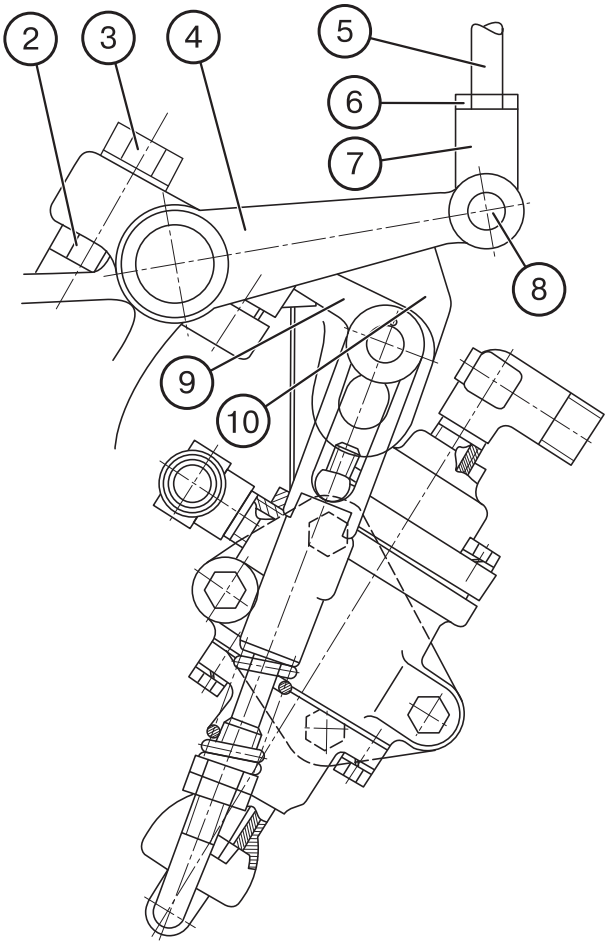
- Shift the lever (1) to the extreme front (off) position.
- Loosen the locknut (2) of the adjustment bolt (3) of the parking brake (on the right side of the tractor).
- Screwing in or out the bolt (3), obtain a complete disengagement of the parking brake at the fourth tooth of the sector (A) under a force on the lever (1) of 350 N.
- Lock the bolt (3) with the nut (2).

If the tractor is equipped with a pneumatic system and works with trailers equipped with pneumatic brakes, adjust the parking brake as follows:

- Shift the lever (1) to the extreme front (off) position.
- Loosen the locknuts (2) and (6) and remove the pin (8).
- Turn the lever (4) so that the upper edge of the groove in the lever (9) aligns with the upper edge of the groove in the lever (10).
- If necessary, adjust the length of the rod (5) with the fork (7), setting the pin (6) and splint it.
- Turning the adjusting screw (3), adjust the lever (1) so that the parking brake be fully engaged on the 3rd or 4th tooth of the sector A under a force on the lever of 350 N.
- Tighten the locknuts (2) and (6).

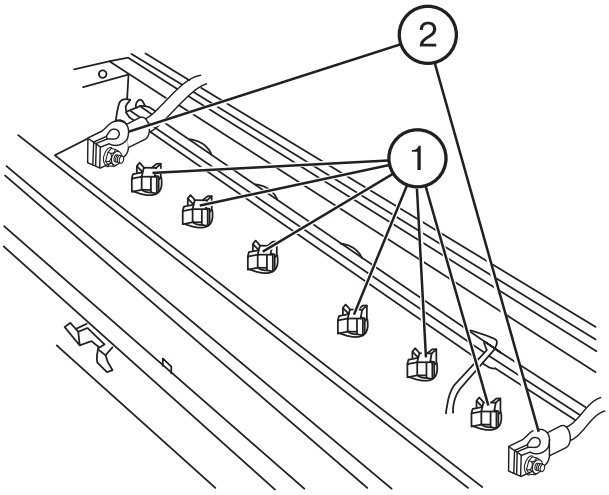
IMPORTANT! With the brake pedals interlocked, unsimultaneity of wheel braking must not exceed 1 m as measured by the wheel footprints





Operation 27 Batteries

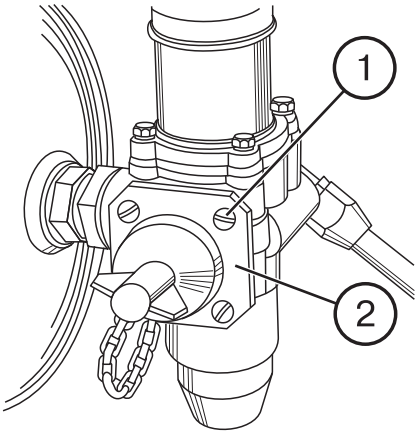
CAUTION! The batteries contain sulfuric acid that causes severe burns in case of skin exposure. Avoid exposure of hand skin, eyes and clothing to the acid. When the acid gets onto external body parts, rinse them with a strong jet of pure water. In case of ingestion, drink plenty of water or milk. In case of contact with the mucous membrane of an eye, rinse it with plenty of water for 15 minutes and then call for medical assistance. Keep sparks or flames away from the area of electrolyte, as this can cause an explosion. Charge the batteries in a ventilated room. When servicing batteries wear protective goggles and gloves.



- 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).
- Before adding distilled water check electrolyte density in each cell jar of the battery. If necessary, additionally distilled water.
- Check terminals (2) and plugs (1) for cleanness. If necessary, grease terminals with technical cup grease and clean ventilation holes in the plugs (1).

K25

Operation 28. Filter of the air pressure regulator in the pneumatic system



To clean the filter element:

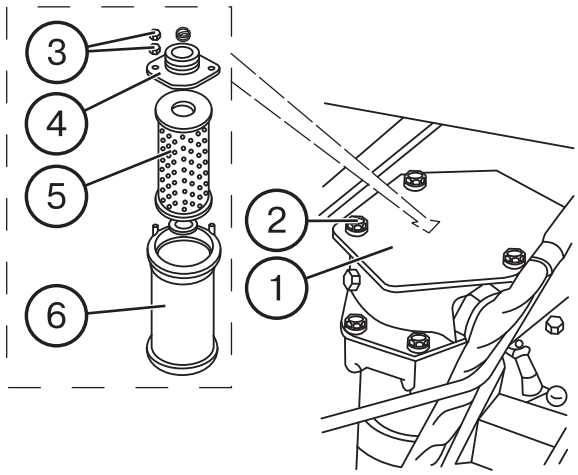
- Remove the bolts (1) and cover (2).
- Take out the filter element, wash it in detergent solution and blow with compressed air.
- Assemble the strainer in the reverse order.

Operation 29. Check tightness of pneumatic system lines

- Bring the air pressure in the pneumatic system to 6.0 to 6.5 kgf/cm² (by readings of the air pressure indicator on the dashboard) and stop the engine.
- Check by the pointer that the pressure drop for 30 minutes did not exceed 2 kgf/cm². Otherwise, find the location of air leak and fix the fault.

Operation 30. Replace the oil filter of the hydraulic system

Note: Perform subsequent replacements of the oil filter in the hydraulic system every 1,000 service hours.

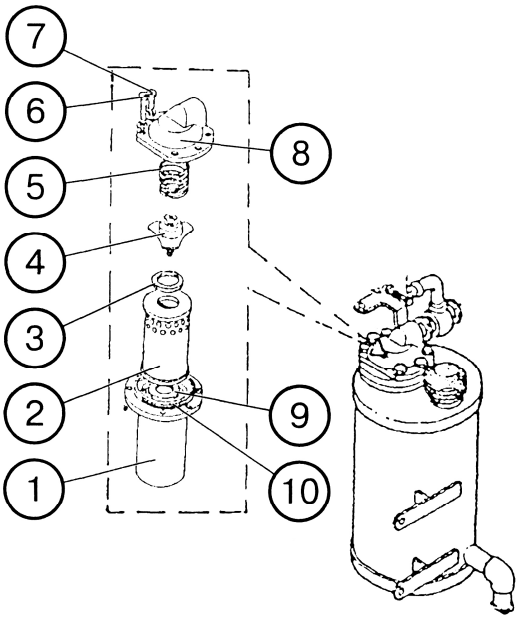


- Remove the screws (2), cover (1) and take out the filter element assembly using the stop (4).
- Remove the nuts (3), stop (4) and filter element (5).
- Wash the casing (6) in detergent solution.
- Install a new filter element and reassemble the filter performing the operations in the reverse order.
- Install the filter assembly to the tank of the hydraulic system, close with the cover (1) and fasten with the bolts (2).

Operation 30a. Replace the HSU tank oil filter

Replace the HSU oil filter proceeding as follows:

NOTE: Perform subsequent replacements of the oil filter in the HSU and hydraulic system every 1,000 service hours.



- Unscrew the four bolts (7) (M6×16) and remove the filter assembly;
- Unscrew the two bolts (6) (M6×25) and disconnect the filter cover (8) from the carrier (1);
- Remove the filter element (2), spring (5), pressure relief valve assembly (4) and O-rings (3), (9);
- Rinse the carrier (1) in a washing liquid;
- Install a new filter element and reassemble the filter performing the operations in the reverse order as compared to disassembling.
- Install the filter assembly into the HSU tank making sure that the seals (10) and the seals between the carrier and the tank are installed correctly. Tighten the bolts (6, 7);

K27

Operation 31. Clean the cab heating and ventilation system filter

Note: In wet conditions, such as in the early morning hours before servicing the filter do not switch on the fan, because any water particles trapped in the filter are difficult to remove.

- Raise the cab roof (1).
- Remove the two mounting bolts and filter cover (2) together with the two filtering elements (3).

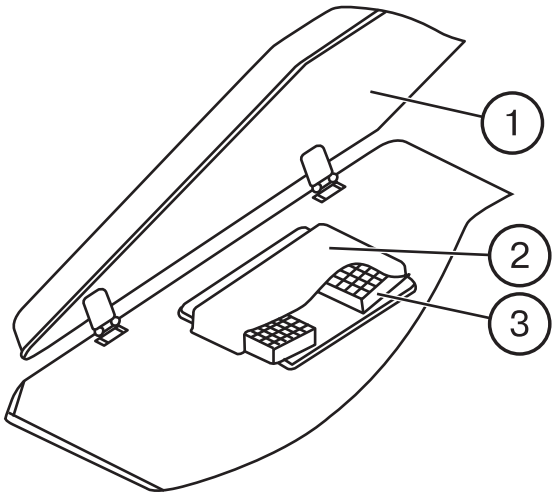
Lightly shake the elements to remove free dust particles from the filter.

ATTENTION! Be careful not to damage the filter!

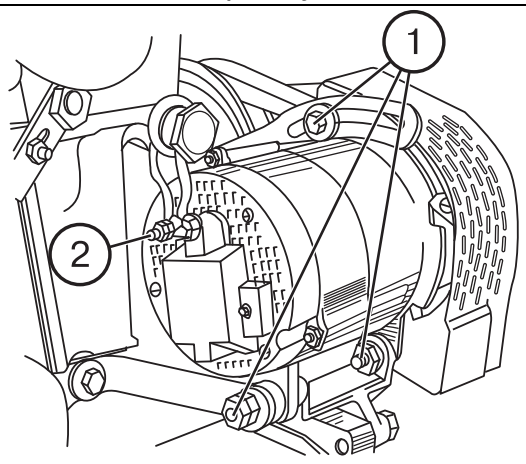
- Clean the filters with compressed air under a pressure not exceeding 2 bar. Hold the hose nozzle not closer than 300 mm from the filter in order not to damage the PFE.

Direct the air jet through the filter in the direction opposite to the normal flow as indicated by the arrows marked on the filter housing.

- Install the filter performing the operations in the reverse order.



Note: When operating the tractor in conditions of high dust exposure, clean the filter more frequently.



Operation 32. Clean generator

Clean the generator from dust and dirt.

Check and, if necessary, tighten the bolts fastening the generator.

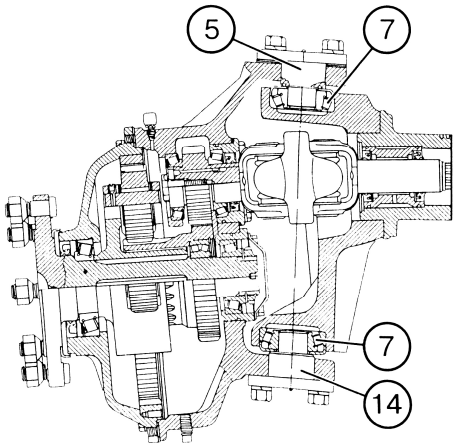
Check the tightening torque of the terminal connections (2).

Operation 33. Front wheel toe-in

The front wheel toe-in must be within 0 to 8 mm. If necessary, perform adjustment operations in accordance with the recommendations in the section “Adjustments”.

Operation 34. Check bearings of FDA reducer kingpin axles

Check and if necessary adjust the bearings (7) of the axles (5, 14) as described in the section “Adjustments”



Operation 34a. Replace filter drain.
(if installed as an options instead of fan heater)

Replacement shall be carried out once per year after 800 hours of operation.

ATTENTION: for replacement of the filter drain, contact a special service station. Replace only using special equipment.

After every 1,000 service hours

Perform the operations of the previous MS and the following ones:

Operation 35. Tighten engine cylinder head fastening bolts

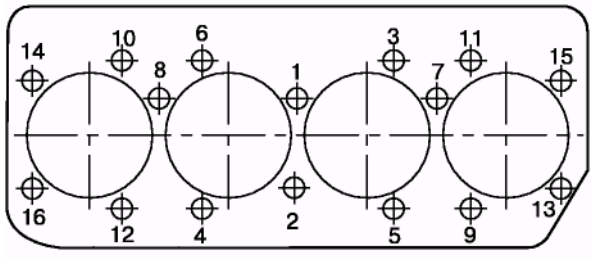
Check tightening of the fastening bolts of the cylinder heads on a hot engine proceeding as follows:

- Remove the caps and covers of the cylinder heads.
- Remove the rocker shafts with the rockers and poles.
- Using a torque spanner, tighten all the bolts fastening the heads to a torque of (210+/-10) N•m in the sequence shown in the figure on the right (in succession the figure shows).

Note: Before tightening the bolts, loosen them by 1/6 turn.

- Install the rocker shafts to places and adjust the clearances between the rockers and the valves (See Operation 21 of this Manual).
- Install the covers and caps of the cylinder heads to place.

ATTENTION! Perform the first check of bolt torque of the cylinder heads after running in the tractor.

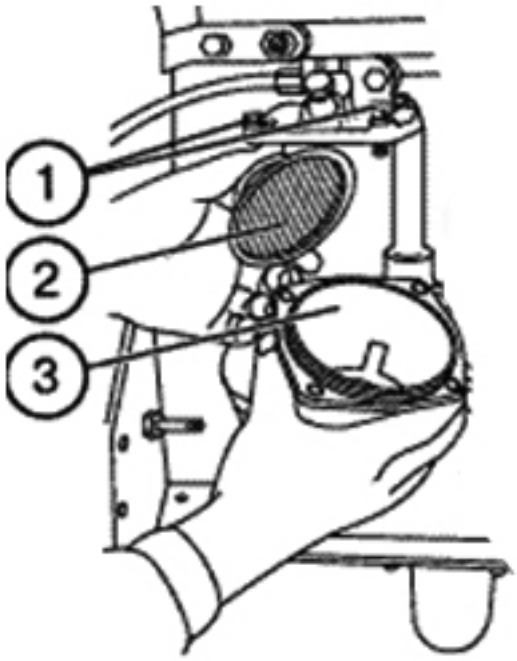


K29

Operation 36. Clean engine fuel coarse filter

Rinse the engine fuel coarse filter, performing the following operations:

- Shut off the fuel tank valve.
- Unscrew the screws (1) fastening the carrier (3) and remove the bowl.
- Unscrew the reflector with mesh (2) and remove the diffuser.
- Wash in diesel fuel the reflector with mesh, diffuser and filter bowl.
- Assemble the filter parts in the reverse order.
- Fill the system with fuel. Purge the system and bleed air from the fuel system as specified in the Operation 38.



Operation 37. Change filter elements of fine fuel filter

Fine fuel filter service life depends on purity of fuel used.

Filter shall be replaced according to the figure. To replace the filter perform the following:

- drain fuel from the filter by unscrewing the plug 4 at the bottom of the housing;

Do not allow fuel spillage, fuel shall be drained only in a reservoir.

- unscrew the filter 1 from union 8 in housing 2 and install a new filter supplied assembled with gasket 7, which shall be lubricated with engine oil before installation;

- after the gasket 7 touches mounting surface A on housing 2 make the filter further by ¾ turn. Making the filter further shall be carried out only with manual effort;

- open fuel tank valve and fill system with fuel.

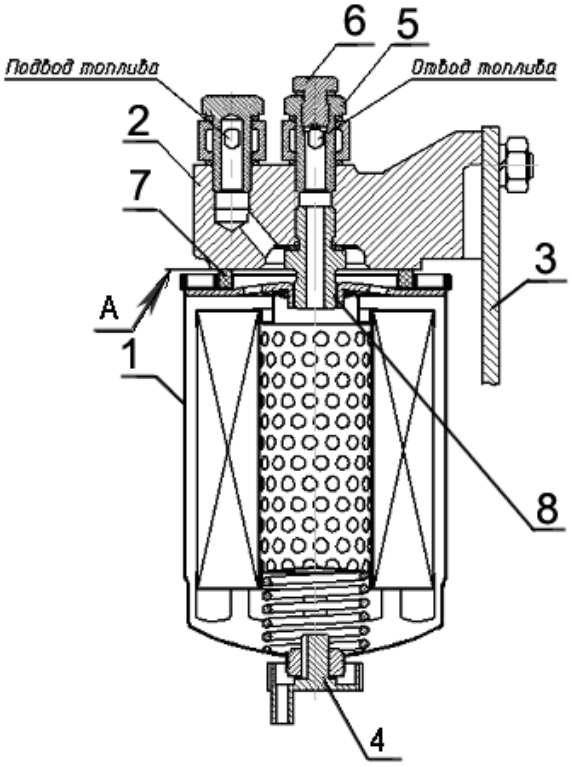
1 – filter ФТ020-1117010; 2 –housing; 3 – bracket; 4 - plug (for sediment drain); 5- outlet union; 6 – plug (for air discharge); 7 – gasket; 8 – union .

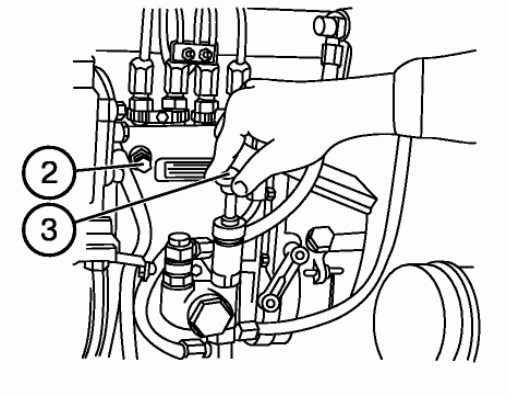
To bleed air from the system:

To bleed air from the system unscrew the plug 6, located on tension bolt of outlet union by 2..3 turns. Bleed the system with the manually-operated purge pump until clean fuel without air bubbles emerges from the plug, tighten up the plug 2.

It is permitted that instead of filter ФТ020-1117010 other indecomposable fuel filters were installed with general technical characteristics and dimensions for:

fullness of residue, not less than 90%;
conditional output at pressure differential 0.01 MPa not less than 150 l/hour;
diameter - 95…105 mm;
height – 140…160 mm;
conjoint thread - M16x1,5;
external diameter of sealing gasket - 70…75 mm.





K31

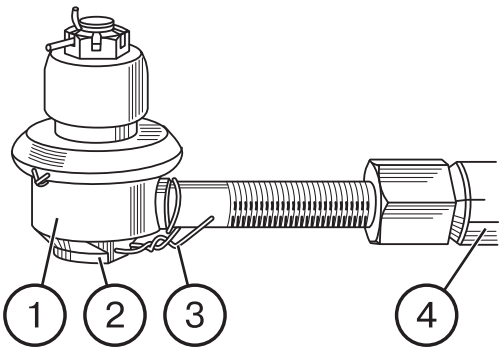
Operation 38. Check play in the steering link joints

When the engine is running, turn the steering wheel in both directions to check the free travel and play in the joints (1) of the steering link (4).

If there is play in the joints, proceed as follows:

- Remove the locking wire (3).
- Screw in the threaded plug (2) so as to eliminate the gap in the joint.
- Lock the plug with wire (3).

Note: If tightening of threaded plugs does not eliminate a gap in the joints, disassemble the joint and replace worn parts.



Operation 39. Check and tighten external fasteners

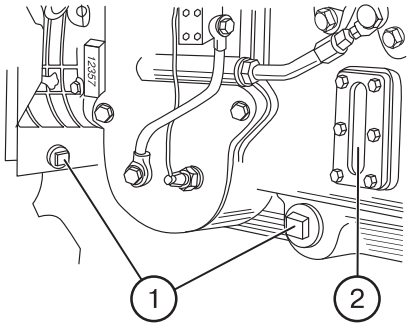
Check and, if necessary, tighten, the following bolted connections:

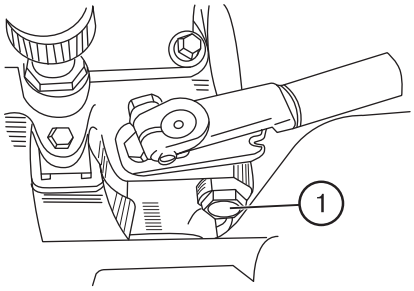
- Nuts of front and rear wheel hugs and bolts of rear hubs.
- Front beam — half-frame — side plates — front hitch linkage and PTO (if installed).
- Engine — clutch housing.
- Clutch housing — GB housing.
- GB housing — rear axle housing
- Rear axle housing — rear hitch linkage bracket.
- Rear axle housing — universal hitch.
- Front and rear cab supports.
- Nuts of FDA driveline flanges.
- Front fender brackets — FDA wheel reduction gears.
- Rear axle housing — top cover (two rear bolts M20).
- Bracket and fingers of the steering hydraulic cylinder.
- FDA-housing – sleeves –reduction gear wheels
- Hydraulic hoist fasteners (if installed)

Operation 40. Change oil in the transmission housings, hydraulic system oil tanks, HSU and wet brake housings

Before changing oil, operate the tractor to warm up the transmission and hydraulic system oil.

- Install the tractor on an even surface, lower the rear hitch linkage rods to the lowest position, stop the engine and brake the tractor with the parking brake.
- Lock the rear wheels with wedges on both sides.
- Remove the cover (1) of the oil filler neck of the transmission, the plug (3) of the hydraulic system oil tank and the plug (5) of the HSU oil tank.
- Remove the drain plugs (2, 4, 6) from housings of the gearbox, rear axle, hydraulic system oil tanks and HSU respectively and discharge oil into a container for collection of waste oil. Properly dispose of waste oil.





Caution! Be careful to avoid contact with hot oil.

- Install the drain plugs (1, 3, 4) to place and fill the transmission housing (Operation 4), the hydraulic system and HSU oil tanks (Operations 3 and 3.1) with fresh oil to the required level .

Oils shall be engine oil $М10Г_2$ or $М8Г_2$ — for transmission housing.

Engine oils $М8Г_2$; $М10Г_2$; $М8Г_{2К}$; $М10Г_{2К}$ — hydraulic system fuel oil tank.

Industrial oil BECHEM STAROIL №32 (TU RB 14733172.003-99) – HSC oil tank.

- Change oil in a multi-disk brake housings operating in oil bath, proceeding as follows:

• unscrew the check-fill plugs (1) of the left and right housings;

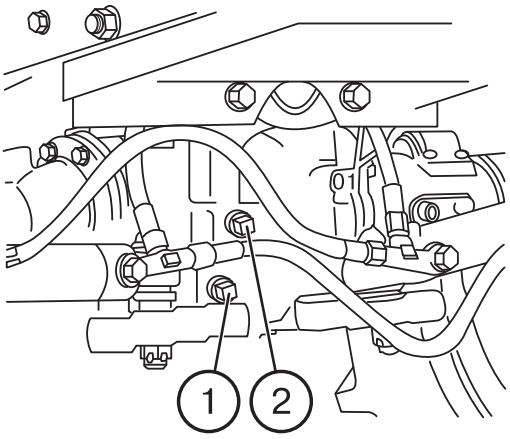
• unscrew the drain plugs (2) and discharge oil as described above;

• screw the drain plugs (2);

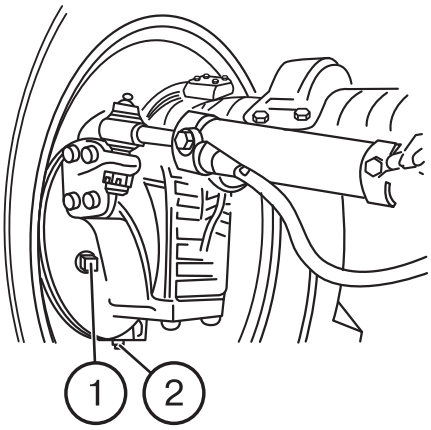
• fill the housings with fresh motor oil according to table П1 of section П “Annex” (left housing – 1.5 l, right – 1.0 l).

K33

Operation 41. Change oil in the FDA final drive and wheel reduction gears

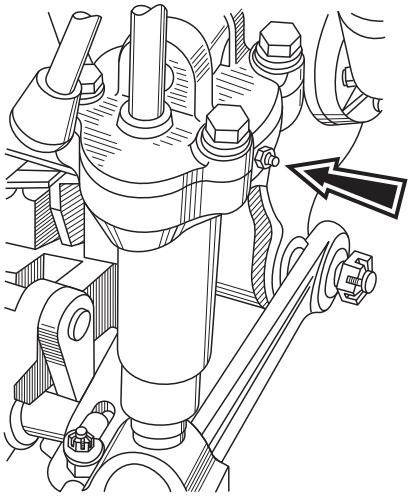


- Operate the tractor and warm up the oil in the FDA housings.
- Install the tractor on an even, horizontal surface. Stop the engine. Engage the parking brake and lock the wheel with wedges on both sides.
- Remove the check-fill plugs (2) and the drain plugs (1). Discharge oil into a special container to collect waste oils. Properly dispose of oil.
- Install the drain plugs to place and tighten them.
- Fill the housings with fresh transmission oil to the lower edge of the check-fill holes.
- Install to place and tighten the plugs (2).



Operation 45. Lubricate the RHL right adjustable brace

Using a gun, lubricate the adjustment mechanism of the right brace (one lubrication point). Make 4 to 6 injections through the lubricator in the upper part of the brace. Mark of the greasing is shown in Table П1 of Section П of “Annex”



Operation 44. Check injectors

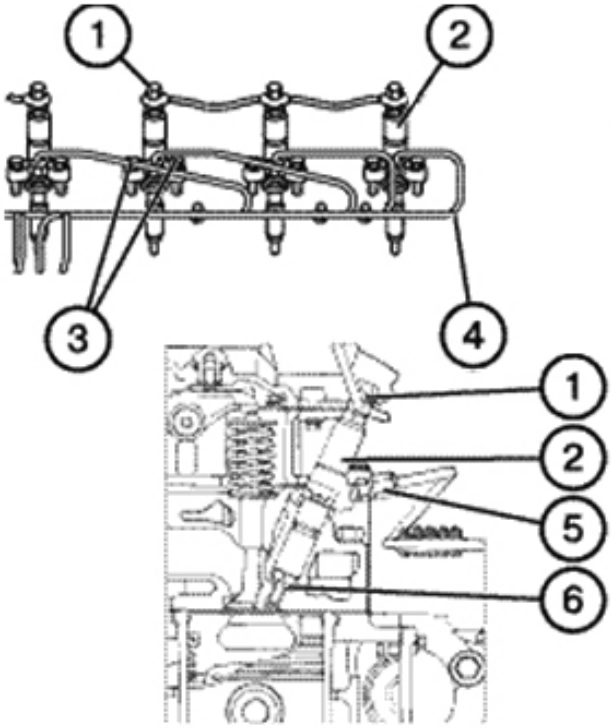
IMPORTANT! The injectors must be cleaned and adjusted by a qualified expert in shop.

Caution! Diesel fuel going out from the injector under a high pressure can penetrate deeply into the skin tissue of the hand resulting in serious injuries. Never use your hand to check injector leaks. Use paper or cardboard. Wear goggles. Before disconnecting the fuel lines, stop the engine to remove the pressure. Before you start the engine, firmly tighten connections of the fuel lines. In case of skin contact with a fuel jet, immediate seek medical help to avoid blood poisoning.

Note: It is convenient to have spare injectors ready for use.

To replace the injectors, proceed as follows:

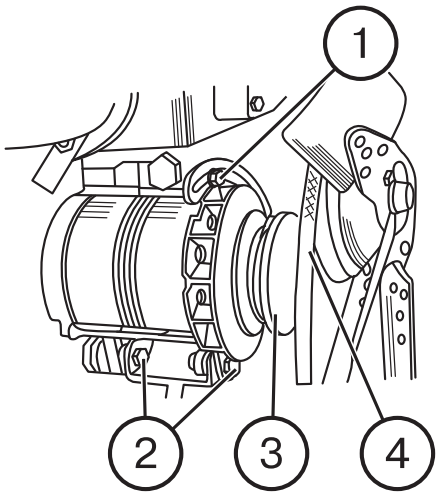
- Completely clean the surfaces adjacent to the removed parts.
- Unscrew the captive nuts (5) and disconnect the fuel injection pipes (4) from the injectors (2) and the fuel pump (not shown).
- Remove the fuel injection pipes (4).



- Remove the bolts (1) and the drain pipe. Sort out copper washers (two washers on each banjo bolt).
- Remove the bolts (3) fastening the injectors and remove the injectors (2).
- Send the injectors to a shop for maintenance.
- Install new injectors and removed parts in the reverse order. Tighten the bolts (3) fastening the injectors evenly in 2-3 steps. Final tightening torque is 20 to 25 N•m
- Purge the fuel system as specified in the Operation 37.

K35

Operation 45. Generator



- Loosen the bolts (1) and (2), turn the generator in the direction of the engine unit and remove the generator drive belts (4) from the pulley (3).
- Check free rotation of the rotor and wear of the bearings.

If necessary, remove the generator and send it to a shop for repair.

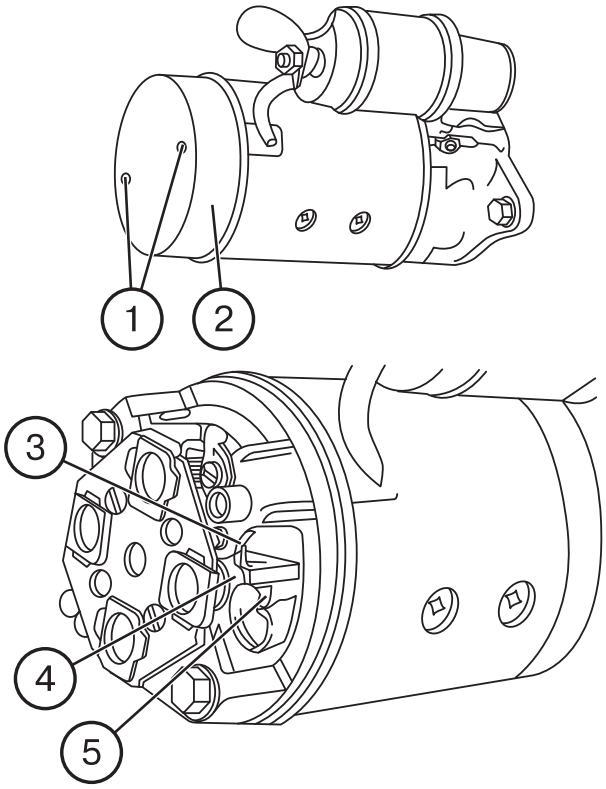
Operation 46. Flange bearings of the FDA planetary/parallel-shaft reduction gear

Check and, as necessary, adjust the tapered roller bearings (3, 5) without play, performing operations, as shown in Subsection “Adjustment of FDA” of section K “Adjustments”.

After every 2,000 service hours

Perform the operations of the previous MS and the following ones:

Operation 47. Diesel engine starter



- Clear starter from dirt and dust.
- Remove screws (1) and cap (2).
- Check collecting channel (3), brushes (5) and springs (4).
- Make sure that brushes (5) move easily. Replace the brushes when their height is 10 mm.
- Spring force (4) shall be 0.75...1.00 kg.
- If collecting channel surface is worn too much or burned, send starter to jobbing plant for repair.
- Check electromagnetic relay contacts condition. In case there is burning face up bolts with fine grain abrasive paper.

Operation 48. Engine fuel pump

The delivery commencement angle of the fuel pump must be within the limits specified the table on the right. Only a qualified technician should check and adjust the delivery commencement angle.

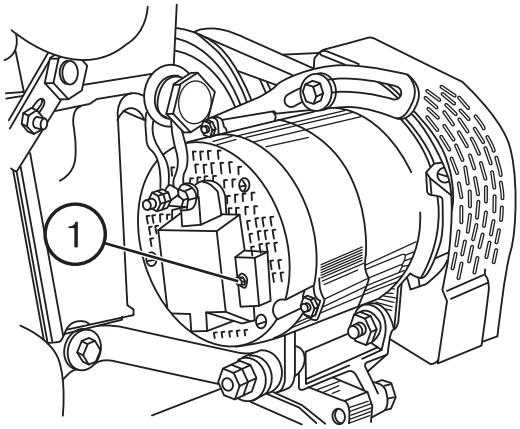
IMPORTANT! Adjustment of fuel equipment by tractor operator (ower) is a reason for termination of manufacturers warranty liability.

Adjustment of timing angle, deg. to UDC
Д-245.2S2
3,5±0,5

Remove the pump and send it to shop for bench check of conformity to the adjustment parameters (speed mode, rated delivery per stroke, delivery per stroke, etc.).

K37

Operation 49. Generator



Seasonally determined adjustment of generator voltage*) shall be carried out by screw (1), located on back cover of generator (“З-Л”).

*) If it is provided by generator design.

Operation 50. Flush the cooling system

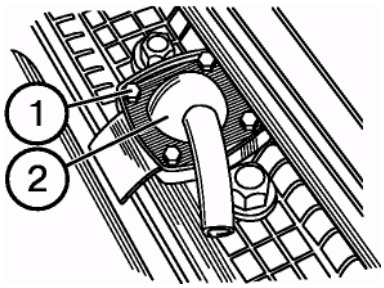
To flush, use a solution of 50-60 g of sodium carbonate and 1 liter of water.

Proceed as follows:

- Pour 2 liters of kerosene into the water heat exchanger and fill the system with the prepared solution.
- Start the engine and work for 8 to 10 hours, then discharge the solution into a special container and flush the cooling system with pure water.

Operation 51. Flush the engine air breathers

- Remove the air breather housing (2) unscrew breather housing (1).
- Remove the air breathers from the housing, rinse them in diesel fuel and blow with compressed air. Fill a union filter with small quantity of engine oil and install it in its place after bleeding it down.



Overall maintenance

Operation 52. Adjust oil pressure in the engine lubricating system

If the oil pressure in the lubrication system of a warmed-up engine at a rated crankshaft speed is below 0.28 MPa (2.8 kgf/cm²), stop the engine and correct the fault. Check tightness of the oil lines and serviceability of the relief valve in the oil filter. One way to increase the pressure is adjustment of the relief valve, paper oil filter in a special shop.

Operation 53. Adjust the relief valve of the gearbox centrifuge

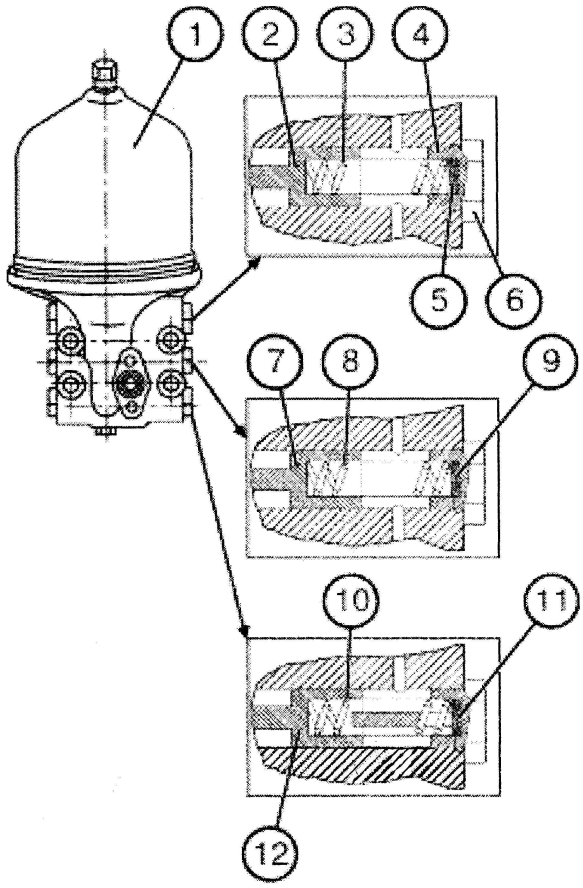
The valve (2) maintains an oil pressure in the system of 0.9 to 1.0 MPa (9 to 10 kgf/cm²).

If the pressure drops below the specified limit, adjust the valve (2) by installing additional washers (5) between the spring (3) and the plug (6).

IMPORTANT! If the pressure drops below 0.7 MPa (7.0 kgf/cm²), stop the tractor and contact a technician.

The valve (7) maintains an oil pressure before the rotor of the centrifuge. It must be 0.75 MPa (7.5 kgf/cm²).

The lubrication valve (12) is set for a pressure of 0.2 ± 0.05 MPa (2.0 ± 0.5 kgf/cm²) and maintains the oil pressure in the GB lubricating system. Adjust the valves with the washers (9) and (11).



K39

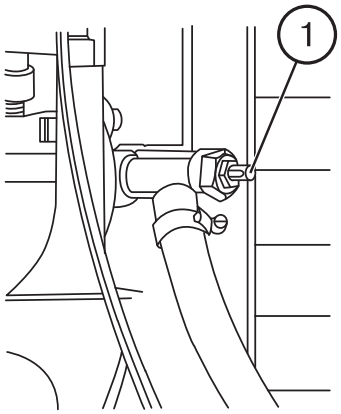
Operation 54. Maintenance of the cab ventilation and heating system

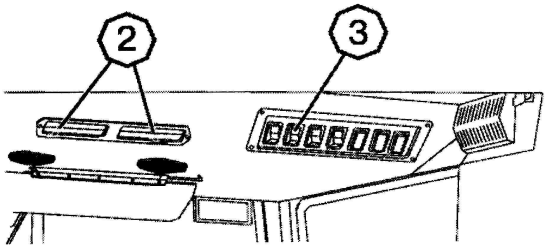
For efficient operation of the ventilation and heating system, perform the following operations:

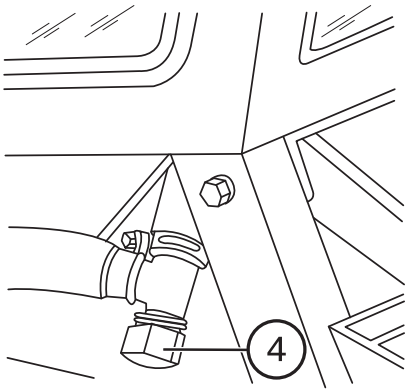
1. After pouring a cooling fluid (water) into the cooling system, start the engine and without opening the valve (1) on the left side of the engine let the engine operate at medium speed to warm up the coolant in the system to 50 to 60°C, and then open the valve (1) to fill the heat exchanger with the fluid.
2. Make sure that the fluid is circulating through the heater, slightly opening the drain plug (4) on the right side of the cab. The heat exchanger must start warming up, at that the coolant level in the water heat exchanger of the engine must drop.
3. Add the coolant to the heat exchanger to the upper edge of the filler neck (Operation 2, p. N7).
4. For a quick warm-up of the cab, switch on the heater fan switch (3) and open the recirculation valves (2).

5. To discharge the coolant from the heater and the engine cooling system, install the tractor on an even surface, open the heater valve (1), remove the cap of the engine water radiator, remove the left and right drain plugs (4) and open the drain valves of the water radiator and the cylinder block of the engine.

6. During the warm season, the valve (1) must be closed for operation of the system in the ventilation mode.







ATTENTION! During the cold season, to avoid ice plugs, if the cooling system is filled up with water, blow the heating system with compressed air, first closing the valves for draining water from the water radiator and the cylinder block of the engine and install the water radiator cap to place.

Seasonal maintenance

Combine seasonal maintenance with regular maintenance operations. Maintenance operations necessary during seasonal maintenance are listed Table below.

Seasonal maintenance

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: - In diesel casing; - In the transmission case (CC, GB, RA) - in a tank of HSC system [1]; - in HLL system [1]	Change winter oil grades for summer grades: - In diesel casing; - In the transmission case (CC, GB, RA) - in a tank of HSC system [1]; - in HLL system [1]
1) If all-season oil is used oil replacement in tanks of HSC and HLL systems shall be performed only at MS-3 (after every 1,000 service hours).	

Tractor maintenance under specific operation conditions

When operating the tractor under specific 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.

1. When operating the tractor in desert, on sandy soils, at high temperatures and dust, use enclosed method of filling diesel with oil and fuel. Change oil in the air purifier sink after each three shifts.

During MS-1 perform the following operations additionally to those listed in maintenance services operations table:

- check diesel oil, no mechanical impurities are allowed in oil. Replace the oil if necessary;

- service the air purifier after each 20 hours of tractor operation;

- 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.

2. When running the tractor under low temperatures, make pre-start diesel heating to up to 20-30 °C. At the end of the shift fill tanks with fuel (at below 30°C use arctic fuel), and drain condensate from cylinder. Fill the cooling system with antifreeze fuel.

3. When running the tractor on rocky soils and in highlands examine each shift visually driving gear and other tractor components for possible damages, as well as tightness of diesel casing plugs, rear axle and FDA, fastening of driving wheels. Check air tightness of the radiator plug of the diesel cooling system.

In addition, in highlands operation conditions to avoid disturbance of diesel 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 elevation of 2000 to 2500 m above see level reduce capacity by;

- at elevation of 2500 to 3000 m above see level reduce capacity by 20%; Operation at elevation over 3000 m is not recommended.

L1

Section L. **TRACTOR TRANSPORTATION AND ITS TOWING**

Tractors are transported by railway, auto transport, on trailers, by towing and under own power.

In case of tractor transportation:

- Put gearshift and range selector levers to the first position;
- Engage the parking brake;
- Fasten tractor to the platform with wires 3…5 mm in diameter, with chains and bracing wires.

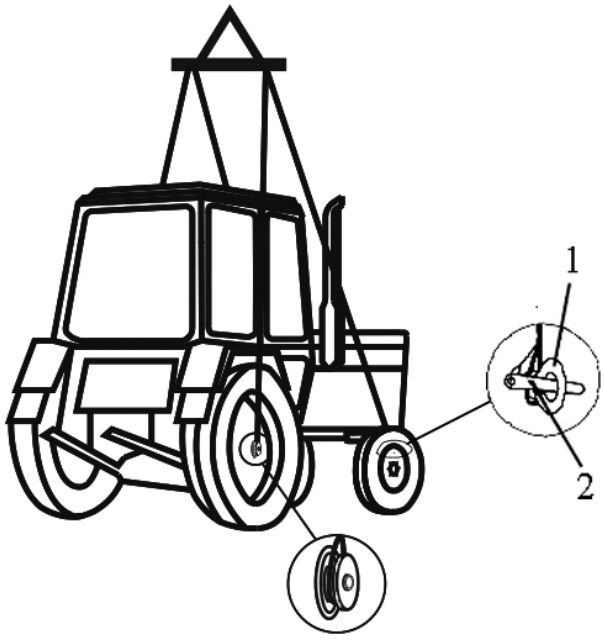
For loading/unloading tractors use lifting machines with carrying capacity not less than 10 ton-force.

Fasten ropes to the FDA beam or eyebolt (1) (Fig. L-1) and rear wheels half-axles as shown on figure L-1. If you fasten ropes to the eyebolt (1), run load-handling device under eyebolt shank and lock in with stopper (2) through eyebolt.

When hydrostatic steering unit pump is disengaged, it is allowed to tow tractor not faster than 10 km/h on distance up to 5 km. Before starting tractor towing set the range selector lever of GB to a “Neutral” position;

To connect towing rope use eye ring, fastened to the front balance weights and weights bracket.

When towing tractor strictly follow road laws.



1 – eyebolt; 2 –stopper.

Fig. L-1. Tractor roping diagram

ATTENTION! When lifting the tractor using its eye-bolts it may move forward or backward up to 1,5m!

IT IS FORBIDDEN to use towing shackle to lift a tractor**!**

IT FORBIDDEN to tow a tractor with front wheels uplifted!

M1

Section M. **TRACTOR STORAGE**

Tractors must be stored according to the recommendations of GOST 7751-85 indoors or under shed.

If no closed premise is available, it is allowable to store the tractor on open equipped yards with mandatory execution of works for preservation, sealing and removal of parts that require warehousing.

Put the tractor to storage as follows: inter-shift — for a break in tractor operation for up to 10 days, short-time — from 10 days to two months, and long-term — if a break in operation is over two months. Prepare the tractor to short-term storage immediately after completion of works, to long-time storage — no later than in 10 days after completion of works. Before putting to storage, carry out checks of the condition of the tractor. The tractor must undergo the next scheduled maintenance.

Maintenance of the tractor during preparation to long-time storage includes:

- cleaning and washing;
- removing from the tractor and preparing to storage of parts that must be stored in specially designed warehouses;
- sealing holes, cavities from moisture, dust;
- preservation of the tractor, its parts;
- installing tractors on supports (pads).

After operation, clean the tractor of dust, dirt, oil leaks, plant and other remains. Protect parts that must not be subject to contact with water (alternators, relay switches, etc.) with protective covers. After cleaning and washing, blow the tractors with compressed air to remove moisture. Restore damaged paint by applying paint or varnish, or a protective grease.

Paint as per GOST 6572-91.

For long-time storage of the tractors on open yards, remove, prepare for storage and send to warehouse electrical equipment, parts from rubber, plastics, textile (hydraulic hoses, etc.), tools. Install the fasteners of the removable parts of the tractor to their respective places. Clean and blow round with compressed air the electric equipment (headlights, alternator, starter, storage batteries), cover the terminals with protective lubricant.

When preparing the tractor to long-term storage, clean of scum and flush the engine cooling system, lubricate all tractor units according to the lubrication table. Drain oil and refill with fresh oil adding an additive to the desired oil volume up to the control level in the engine crankcase, air cleaner tray, gearbox, and front and rear axle housings, wheel reducer, intermediate support, hydraulic system oil tank. Run in the tractor for 10-15 minutes. Drain the coolant from the cooling system, heating system and cab air cooling system. Drain the fuel from the fuel system, rinse the inner surfaces of tanks with inhibitor lubricant and tightly close the filler neck. Preserve the fuel system and engine cylinders with a preservation mixture. Put the storage batteries place after a checking and conditioning cycle in accordance with GOST 9590-76. Preserve open joints, screw and threaded connections of the hitch mechanism, steering linkage, splined surfaces of PTO shaft end driveshafts, projecting parts of cylinder rods and shock absorbers, mechanisms for adjustment of front and rear track. Tightly close the fuel tank filler neck, holes of engine breathers, transmissions, hydraulic systems, engine exhaust pipe and air cleaner inlet pipe, respective holes after removing starter, and other cavities through which precipitation may fall in the internal cavities of units and subunits of the tractor, with covers, bags made of polyethylene film or other special devices. Put the control levers and pedals to position excluding spontaneous engagement of tractor units and assemblies.

It is permitted to store pneumatic tires in unloaded state on tractors installed on supports. Apply a protective composition to the tires. Lower the tire pressure to 70% of normal for indoors or open-yard storage. Clean outer surfaces of the hydraulic system flexible hoses of dirt and oil. It is allowable to store hoses on the machine. At that, cover them with protec-

tive composition or wrap around with insulating material (such as waxed paper, polyethylene film, etc.).

To ensure free exit of water and condensate from the cooling system, leave the drain devices open. Close the hoods and the cab doors.

When performing maintenance of the machines during storage, check correct installation of the machines on supports or pads (no warps), completeness, tire pressure, reliable sealing, condition of corrosion-resistant coatings (availability of protective grease, integrity of paint, no corrosion), condition of protective devices (integrity and strength of safety enclosures, covers). Eliminate all found faults.

Maintenance of the tractor when removing it from storage involves taking the tractor off the supports, cleaning, and if necessary depreservation of the tractor, components, removal of sealing devices, installation of removed parts, tools to the tractor, checking operation and adjusting the tractor and its parts.

Requirements to inter-shift storage of machines

The tractor can be stored on yards and places of inter-shift storage or directly on the place of works. Tightly close with cover all holes, through which precipitation can ingress internal cavities of the tractor. The storage batteries must be disconnected..

Requirements to short-time storage of machines

Install the tractor for storage complete without removing tractor units and assemblies.

Disconnect the storage battery. The electrolyte level and density must conform to the recommendations for maintenance and servicing of storage batteries. When storing tractors at low temperatures, or during more than one month, remove the batteries and sent to warehouse.

Requirements to long-time storage of machines on open yards

Preparing the engine for long-time storage includes preservation of the surfaces of parts located inside the engine (internal preservation) and flushing the cooling system, sealing the inner surfaces, preservation of exterior unpainted surfaces of the engine (exterior preservation), packing the engine into an enclosure polymer film when no hood is available. When there is no fuel in the fuel tanks, preservation must be done with use of volatile inhibitors. Clean and rinse the air cleaner, fill operating preservation oil to the tray.

Clean and lubricate threaded connections of the hitch mechanism, hydraulic systems, steering linkages, etc.

Preservation

Temporary corrosion protection of tractor units and systems from environmental impact during transportation and storage of the tractor is provided by preservation.

Clean all tractor surfaces to preserve of mechanical impurities, degrease and dry. Preservation is made to unpainted interior and exterior surfaces with galvanized coating, viewed units of the tractor and in the cab by applying rust-preventive oil RUST BAN 397. SUMIDERA 397. Material consumption is 0.02 to 0.03 kg per tractor.

Preservation of inner surfaces of the engine is carried out after running in the tractor by filling rust-preventive additive PFINDER AR 241. CORTEK VCI 329 through the coarse filter to fill cavities with preservation composition. Material consumption is 0.05 kg per tractor.

Preservation of the fuel tank internal surfaces is carried out by spraying after their manufacture prior to painting rust-preventive oil RUST BAN 335. ML -5888, instrument panel — after assembling — by spraying to the inner surfaces of the panel of rust-protective oil RUST BAN 397, SUMIDERA 397. The PTO shaft ends are preserved by lubricating with rust-protective oil RUST BAN 335, ML -

5888. Material consumption is 0.1 kg per tractor.

Units (such as heat exchanger and fuel tank necks, breathers, cylinder rods) are sealed using covers of polyethylene film. Material consumption is 0.66 kg per tractor.

The applied materials protect the tractor and its units for the period of storage and transportation for one year.

Before operating the tractor, remove the polyethylene covers, remove the preservation material from the outer surfaces of the tractor by rubbing with cleaning cloth dampened with solvent in accordance with GOST 3134-78.

Exterior preservation of the tractor and its components is made by lubricating the surfaces using a brush and by spraying the surfaces with a spray gun. Internal preservation of the tractor is made by filling the cavities with preservation composition, followed by running the engine.

Depreservation

The depreservation method is selected depending on the applied conservation materials. Rub the preserved surfaces with cleaning cloth dampened in low-viscosity oils, solvents or wash them with water-soluble detergent solutions. Remove insulating materials (film, paper) from the preserved units. The preserved inner surfaces require no depreservation.

Re-preservation

Re-preserve the tractor in case when any faults in preservation are found during storage or after the period of protection expires.

During the operation of the tractor, at inter-shift, short-term and long-term storage, preservation tools and methods, storage conditions are ensured by the enterprise operating the tractor in accordance with GOST 7751-85. Preservation of inner surfaces also is made by applying the universal preservation grease KS-U as per TU RB 600125053.019-2004. When storing on open yards, viewed surfaces are preserved with grease BELAKOR, Grade A as per TU RB 600125053-020-2004.

Preparation of tractor for operation after long-time storage

Remove the grease from exterior preserved surfaces. Remove installed protective covers, plugs, special devices and put the previously removed parts to place. Before installing, clean the parts of grease and dust. Pour off sediment from all tanks, fill with working fluids and, if necessary, add to the control level.

Lubricate all tractor mechanisms in accordance with the lubrication table. Fill the fuel tanks with fuel. Depreservation of the fuel system and engine cylinders is made by running the engine. Fill the system with coolant. Perform scheduled maintenance operations. Crank the crankshaft without fuel supply by several turns, and, after making sure that the crankshaft rotates normally, run the engine for 5-10 minutes, gradually increasing the crankshaft speed from the minimum to the rated. Run in the tractor for 15-20 minutes. Correct found faults.

Safety requirements for preservation

To perform the process of preservation consisting of surface preparation, application of preservation means, marking and cutting paper, packaging, only the persons are allowed that are 18 years old, have had a medical examination, introductory training on labor safety and fire safety, primary instruction at the workplace. Premises and areas of preservation must be separated from other production facilities and equipped with forced ventilation. Applied preservative materials are flammable substances with flash points between 170 and 270°C, must meet government standards, specifications and have a certificate of quality.

The preservation materials supplied must bear the name of the material. Perform preservation works in protective garment and footwear, always use personal protective equipment. When carrying out preservation works, observe per-

sonal hygiene rules, timely deliver protective garment to cleaning, do not wash it in emulsion, solvents, and kerosene. Preservation materials are moderately hazardous to human health, thus, use the recommended personal protective equipment when working with the materials.

Prolonged exposure of hand skin to preservation oils, greases and fluids can result in its lesions. White spirit vapors in low concentrations act as a weak narcotic substance, high concentrations may result in intoxication. Rust-preventive paper contains rust inhibitors that cause irritation and inflammation of skin and mucous coatings of the nose and eyes. Before you start working, put on a cotton gown or dress, an apron and prepare personal protective equipment, depending on the working conditions and toxicity of used substances. Apply protective paste (cream) to hands or wear cotton and rubber gloves. Before starting to perform works with unknown safety rules, require safety training.

Section N. **TRACTOR DISPOSAL**

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

•Drain and in the established order send for reprocessing oils from diesel engine lubrication system, rear axle housing, reduction gears and wheel hub drives, from gear box, FDA, final drives reduction gears of front wheels, oil tanks of hydraulic system ;

• Drain cooling fluid from diesel engine cooling system, cabin heating system and put it to storage containers;

• drain the diesel fuel from the fuel tank and put it to storage containers;

•Drain sediment from fuel coarse and fine filters;

• Drain electrolyte from tractor AB, put it special storage reservoir and send for reprocessing in a prescribed manner;

•Disassemble the tractor into parts, having sorted them out into non-metal, steel, cast iron, non-ferrous and precious metals, and send them for reprocessing in a prescribed manner;

• dismantling of parts and assembly units, air-conditioning system (if installed) must be performed only by trained personnel using equipment to service CFC refrigerating units.

•When performing maintenance and routine repairs, send changed fuels and lubricants for recycling, send replaced parts and assembly units for recycling, first disassembling assembly units to parts by sorting them by materials

Section An. **ANNEXES**

Advisable fuels, oils, lubricants and special fluids for tractors MTZ -1220.1/1220.3

Table An1

Position number	Name of assembly unit	Numbers of refilling (lubrication) points	Name and grade of fuel/lubricant				Weight (volume) of fuel/lubricant filled in tractor	Change interval of fuel/lubricant, service hours	Note
			Main	Backup	Reserve	Foreign			
1	2	3	4	5	6	7	8	9	10
1	1 Fuels								
1.1	Fuel tank[1)]	2	At ambient temperature of 0°C and above				(260±1,5)	Refilling every shift	1220.1/1220.3 With two fuel tanks
			Diesel fuel, STB 1658-2006 with sulfur content of 350 ppm (0.035%) max. Grade B	None	Biodiesel fuel BDL-B-10, BDL-B-50 TU BY 500036524. 121-2008	Diesel fuel, EN 590:2004 with sulfur content of 350 ppm (0.035%) max.			
			At ambient temperature of −5°C and above						
			Diesel fuel, STB 1658-2006 with sulfur content of 350 ppm (0.035%) max. Grade C	None	Biodiesel fuel BDL-F-10, BDL-F-50 TU BY 500036524. 121-2008	Diesel fuel, EN 590:2004 with sulfur content of 350 ppm (0.035%) max.			
			At ambient temperature of −20°C and above						
			Diesel fuel, STB 1658-2006 with sulfur content of 350 ppm (0.035%) max. Grade F	None	Biodiesel fuel BDL-F-10, BDL-F-50 TU BY 500036524. 121-2008	Diesel fuel, EN 590:2004 with sulfur content of 350 ppm (0.035%) max.	(140±1)		1220.1/1220.3 With one fuel tank

Table An1, continued

1	2	3	4	5	6	7	8	9	10
2	Oils								
2.1	Diesel engine oil crank-case D-245.2S2 [2)]	1	Summer				(12,0 ±0,1 2)	250	
			Motor oil Lukoil-Avangard SAE 15W-40	Motor oils M-10DM, M-10G_{2K} GOST 8581-78	None	Castrol Turbo-max SAE 15W-40, Hessol Turbo Diesel SAE 15W-40, Essolube XD-3 +Multigrate, Shell Rimula TX, Shell Rimula Plus, Teboil Super NPD (power), Royal Triton QLT (U 76), Neste Turbo LE, Mobil Delvac 1400 Super, Ursa Super TD (Texaco).			
			Winter						
			Motor oil Lukoil-Super SAE 5W-40	Motor oils M-8DM, M-8G_{2K} GOST 8581-78	None	Shell Helix Diesel Ultra SAE 5W-40, Hessol Turbo Diesel SAE 5W-40 API CF-4			
2.2	High-pressure fuel pump of diesel engine	1	Same motor oil as in diesel engine crankcase				(0,25 ±0,01)	One-time	When installing new or repaired pump
2.3	Trans-mission housing (clutch, GB and RA)	1	Engine oil М-10$Г_2$ GOST 8581-78 (summer) Engine oil М-8$Г_2$ GOST 8581-78 (winter)	Engine oil М-10$В_2$ GOST 8581-78 Engine oil М-10$Г_{2к}$ (summer) GOST 8581-78 Engine oil М-8$Г_{2к}$ (winter) GOST8581-78	En-gine oil is the same as filled in the engine crankcase	Engine oil SAE 15W-40 (summer) SAE 5W-40	(43± 0,4) Oil level shouls d be be-tween marks «П» and «П+7»	sea-sonal	

Table An1, continued

1	2	3	4	5	6	7	8	9	10
2.4	Brake housing	2	Engine oil M-10Г$_2$ GOST 8581-78 (summer) Engine oil M-8Г$_2$ GOST 8581-78 (winter)	Engine oil M-10В$_2$ GOST 8581-78 Engine oil M-10Г$_{2к}$ (summer) GOST 8581-78 Engine oil M-8Г$_{2к}$ (winter) GOST8581-78	Engine oil is the same as filled in the transmission housing	Engine oil is the same as filled in the transmission housing	(2,5±0,1) up to the level of control plugs	sea-sonal	1220.1/1220.3 With wet brakes (optional)
2.5	FDA body (portal, planetary-cylindrical, with long beam)	1	Transmission oil TAp-15V GOST 23652-79	Transmission oil TAD-17i, TSp-15K GOST 23652-79, ТЕ$_Р$-15М TU 38.401-58-305-2002	None	HESSOL BECHEM HYPOID SAE 80W-90 API GL5; GL4	(3,9±0,04)	1000	
2.6	FDA wheel hub drive housing (FDA, portal, planetary-cylindrical)	2	Transmission oil TAp-15V GOST 23652-79	Transmission oil TAD-17i, TSp-15K GOST 23652-79, ТЕ$_Р$-15М TU 38.401-58-305-2002	None	HESSOL BECHEM HYPOID SAE 80W-90 API GL5; GL4	(4,0±0,04)	1000	
2.7	Hydraulic lift linkage tank with hydraulic unit [3)3)]	1	All-seasonal Hydraulic oil BECHEM Staroil # 32 ADDINOL Hydraulikol HLP 32 TNK Hydraulic HLP 32 HYDROL HLP 32	Seasonal Industrial oil IGP-18 TU 38.10 1413-97 (winter) MGE-46V TU 38.001347-2000 (summer)	None	None	(25,5±0,2)	1000 or sea-sonal	
2.8	HSU tank with hydraulic units	1	All-seasonal Hydraulic oil BECHEM Staroil # 32 ADDINOL Hydraulikol HLP 32 TNK Hydraulic HLP 32 HYDROL HLP 32	Seasonal Industrial oil IGP-18 TU 38.10 1413-97 (winter) MGE-46V TU 38.001347-2000 (summer)	None	None	(7,5±0,35)	1000 or sea-sonal	

Table An1, continued

3	Greases								
1	2	3	4	5	6	7	8	9	10
3.1	Cooling system pump (bearing cavity)	1	Lubricant Litol-24-MLi 4.12-Z GOST 21150-87	None	None	Shell Alvania, Shell Tivela	0,05 ±0,003	Once	Applied by manufacturer, not to refill during operation
3.2	Clutch release bearing	1	Lubricant Litol-24 GOST 21150-87	BECHEM LCP-GM	Solid oil S grease GOST 4366-76 or Solid oil ZH grease GOST 1033-79	BECHEM LCP-GM	0,02 ±0,001	250	
3.3	FDA reducer pivot bearing	4	Lubricant Litol-24 GOST 21150-87	BECHEM LCP-GM	Solid oil S grease GOST 4366-76 or Solid oil ZH grease GOST 1033-79	BECHEM LCP-GM	0,12 ±0.006	125	
3.4	Steering cylinder joint	2	Lubricant Litol-24 GOST 21150-87	BECHEM LCP-GM	None	BECHEM LCP-GM	0,05 ±0.003	250	
3.5	Steering rod joint	2	Lubricant Litol-24 GOST 21150-87	BECHEM LCP-GM	Solid oil S grease GOST 4366-76 or Solid oil ZH grease GOST 1033-79	BECHEM LCP-GM	0,05 ±0.003	1000	
3.6	Gear cross-beam of rear lift linkage	1 или 2	Lubricant Litol-24 GOST 21150-87	BECHEM LCP-GM	Solid oil S grease GOST 4366-76 or Solid oil ZH grease GOST 1033-79	BECHEM LCP-GM	0,01 ±0,001	1000	

End of table An 1

4	Special fluids								
1	2	3	4	5	6	7	8	9	10
4.1	Engine cooling system	1	Cold-proof coolant Tosol Dzerzhinsky TC-40 (to minus 40°C) Tosol Dzerzhinsky TC-65 (to minus 65°C) TU 2422-050-36732629-2003 Cold-proof coolant OZH-40 (to minus 40 °C) GOST 28084-89. Cold-proof coolant Sibur-Premium OZH-40 (to minus 40°C) OZH-65 (to minus 65°C) TU 2422-054-52470175-2006	Coolant OZH-40 (to minus 40°C) OZH-65 (to minus 65°C) GOST 28084-89	None	MIL-F-5559 (BS 150), (USA) FL-3 Sort S-735, (UK)	(22,5±0,2)	Once every two years	

[1] Fuels with sulfur content not exceeding the maximum allowable value set forth for Tier 2 diesel engines can be used (Directive 97/68/EC (Stage II) and UN EEC Rules # 96 (01)) – up to 2 g/kg (0.2 %).

[2] Use motor oils depending on operation conditions:

a) summer (5°C and above) — SAE 30; SAE 10W-40 (30); SAE 15W-40 (30); SAE 20W-40 (30);

b) winter (minus 10°C and above) SAE 20; SAE 10W-40 (30); SAE 15W-40 (30);

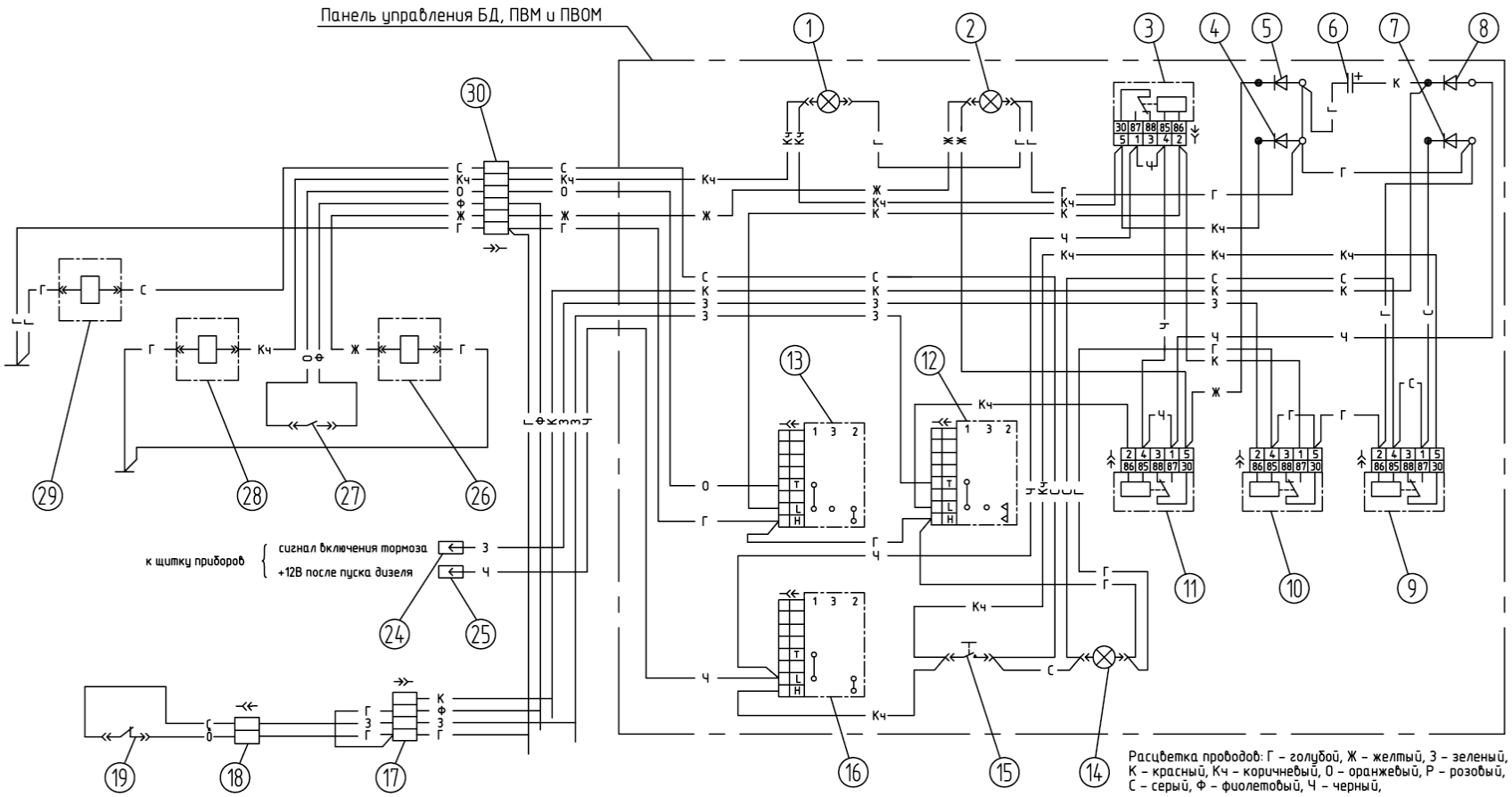
c) winter (minus 20°C and above) SAE 10W-20 (30, 40); SAE 5W-0 (40);

d) winter (below minus 20°C) SAE 5W-30 (40); SAE 0W-30 (40).

Use of motor oils from other manufacturers is allowed, which meet Classes CF-4, CG-4, CH-4, CI-4 as per API classification and ES-96, 4-99, 5-02 as per SAE classification in accordance with the ambient temperatures on the tractor operation place.

[3] Only hydraulic lift linkage, steering system with separate tank.

Схема электрическая системы управления БД, ПВМ и ВОМ тракторов Беларус–1220.1/1220.3 (с КП 16х8)



1. Лампа сигнализатора включения привода ПВМ
2. Лампа сигнализатора включения БД
3. Реле включения привода ПВМ
4, 5, 7, 8. Диод
6. Конденсатор
9. Реле включения ПВОМ
10. Реле торможения
11. Реле включения БД
12. Переключатель трехпозиционный управления БД
13. Переключатель трехпозиционный управления приводом ПВМ
14. Лампа сигнализатора включения ПВОМ
15. Выключатель ПВОМ
16. Переключатель двухпозиционный ПВОМ
17, 18, 24, 25, 26, 30. Колодка соединительная
19. Контактный датчик угла поворота передних колес ±13° (для БД)
26. Электромагнит гидрораспределителя БД
27. Датчик автоматического управления приводом ПВМ (буксования)
28. Электромагнит гидрораспределителя привода ПВМ
29. Электромагнит гидрораспределителя ПВОМ

Схема электрическая системы управления БД, ПВМ и ВОМ тракторов Беларус	Electric circuit diagram of control of DL, FDA, PTO shaft and reducing gear of tractors MTZ
с КП	with gearbox
Панель управления БД, ПВМ и ПВОМ	Control panel of DL, FDA, PTO front shaft
К щитку приборов	For instrument board
Сигнал включения тормоза	Brake engagement signal
После пуска дизеля	After switching of diesel engine
Расцветка проводов	Cable colours
Г-голубой	blue
Ж-желтый	yellow
З-зеленый	green
К-красный	red
Кч-коричневый	brown
О-оранжевый	orange
Р-розовый	pink
С-серый	grey
Ф-фиолетовый	purple
Ч-черный	black
Лампа сигнализатора включения привода ПВМ	Signal lamp of FDA drive engagement
Лампа сигнализатора включения БД	Signal lamp of DL engagement
Реле включения привода ПВМ	Relay of engagement of FDA drive
диод	diode
Конденсатор	condenser
Реле включения ПВОМ	Relay of engagement of PTO front shaft
Реле торможения	Braking relay
Реле включения БД	Relay of DL engagement
Переключатель трехпозиционный управления БД	Tripple-position switch of DL control
Переключатель трехпозиционный управления приводом ПВМ	Tripple-position switch of FDA drive control
Лампа сигнализатора включения ПВОМ	Signal lamp of PTO front shaft engagement
Выключатель ПВОМ	Switch of PTO front shaft
Переключатель двухпозиционный ПВОМ	Double-position switch of PTO front shaft
Колодка соединительная	Carrier socket
Контактный датчик угла поворота передних колес	Contact sensor of front wheels rotation angle
Для БД	For DL
Электромагнит гидрораспределителя БД	Electromagnet of DL hydraulic distributor valve
Датчик автоматического управления приводом ПВМ (буксования)	Sensor of FDA drive automatic control (slipping)
Электромагнит гидрораспределителя привода ПВМ	Electromagnet of FDA drive hydraulic distributor valve
Электромагнит гидрораспределителя ПВОМ	Electromagnet of PTO front shaft hydraulic distributor valve

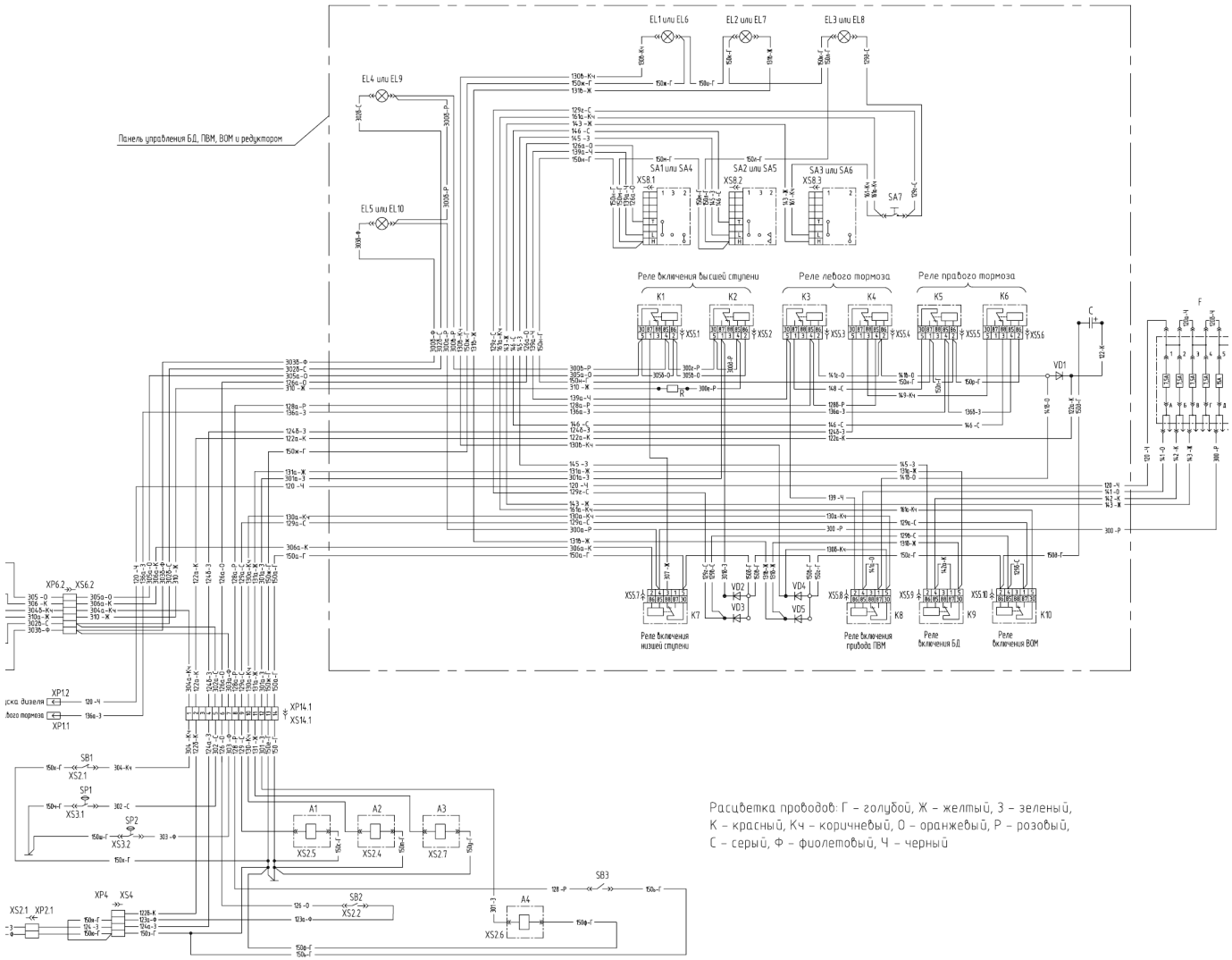
Electric circuit diagram of control of DL, FDA, PTO shaft and reducing gear of tractors MTZ-1220.1/1220.3 (with gearbox 24x12)
Lists items of the electric circuit diagram

Table P2

Designation	Name	Q-ty	Note
A1…A4	Electromagnet of discrete hydraulic distribution valve	4	A1-PTO shaft, A2-FDA, A3-DL, A4-reducing gear
C	Condenser NA-25B-4700мкФ	1	
EL1…EL5	Control lamp 12.3803-31 ТУ РБ 300228919.037-2002	5	EL1-FDA, EL2-DL, EL3-PTO shaft, EL4-high gear, EL5-low gear
EL6…El0	Control lamp 2202.3803-034 ТУ 37.003.1109-82	1	EL6-FDA, EL7-DL, EL8-PTO shaft, EL9-high gear, EL10-low gear
F	Fuse block БП-1 ТУ РБ 03428193.095-97	1	
K1…K10	Relay 90.3747 ТУ 37.003.1418-94	10	
SA1	Switch П147М-06.49 TU РБ 14795799.001-97	1	SA1-FDA
SA2	Switch П150М-06.14 TU РБ 14795799.001-97	1	SA2-DL
SA3	Switch П147М-01.17 TU РБ 14795799.001-97	1	SA3-PTO shaft
SA4	Switch П147-06.17 TU 37.003.701-75	1	SA4-FDA
SA5	Switch П150-06.17 TU 37.003.701-75	1	SA5-DL
SA6	Switch П147-01.17 TU 37.003.701-75	1	SA6-PTO shaft
SA7…SA9	Switch off 12-1 ЦИКС 642241.001 TU	3	SA7-PTO shaft, SA8- high gear, SA9- low gear
SB1	Switch off ВК12-41 TU РБ 3734210.004-97	1	Gearbox neutral conductor
SB3	Switch off ВК12-2 TU РБ 3734210.004-97	1	Left brake sensor
SB2, SB4	Switch off ВК12-51 TU РБ 3734210.004-97	2	SB2-automatic switching-on FDA SB4-DL (±13º)
SP1, SP2	Pressure sensor ДСДМ-М TU РБ 07513211.004-94	2	SP1-high gear, SP2-low gear
VD1…VD5	Diode КД206А ТТ3.362.141TU	5	
VD6	LED АЛ307КМ aAO.336.076 TU	1	High (red)
VD7	LED АЛ307НМ aAO.336.076 TU	1	Low (yellow)
XP1.1, XP1.2	Male socket 502601 OST 37.003.032-88	2	
XP2.1	Male socket 502602 OST 37.003.032-88	1	
XP4	Male socket 502604 OST 37.003.032-88	1	
XP6.1	Male socket 502606 OST 37.003.032-88	1	
XS2.1	Female socket 602602 OST 37.003.032-88	1	
XS4	Female socket 602604 OST 37.003.032-88	1	
XS5.1...XS5.10	Female socket 607605 OST 37.003.032-88	10	
XS6.1	Female socket 602606 OST 37.003.032-88	1	
XS8.1…XS8.3	Female socket 605608 OST 37.003.032-88	3	

	Connectors of AMP company		
XS2.1…XS2.3	Female socket 0-0282189-1	3	double-contact black socket
XS2.4	Female socket 0-0282189-2	1	double-contact grey socket
XP2.5, XS2.6	Female socket 0-0282189-4	2	double-contact green socket
XS2.7	Female socket 0-0282189-7	1	double-contact yellow socket
XP3.1, XS3.2	Female socket 0-0282191-1	2	tripple-contact black socket
XP14.1	Cable plug 0-0182649-1	1	
XS14.1	Set socket 0-0182641-1	1	

Схема электрическая системы управления БД, ПВМ, ВОМ и редуктором тракторов Беларус–1220.1/1220.3 (с КП 24х12)



Расцветка проводов: Г – голубой, Ж – желтый, З – зеленый, К – красный, Кч – коричневый, О – оранжевый, Р – розовый, С – серый, Ф – фиолетовый, Ч – черный

Схема электрическая системы управления БД, ПВМ и ВОМ тракторов Беларус	Electric circuit diagram of control of DL, FDA, PTO shaft and reducing gear of tractors MTZ
Панель управления БД, ПВМ, ПВОМ и редуктором	Control panel of DL, FDA, PTO front shaft and reducing gear
Реле включения высшей ступени	Relay of high gear engagement
Реле левого тормоза	Left brake relay
Реле правого тормоза	Right brake relay
Реле включения низшей ступени	Relay of low gear engagement
Реле включения привода ПВМ	Relay of engagement of FDA drive
Реле включения БД	Relay of DL engagement
Реле включения ВОМ	Relay of PTO shaft engagement
В щиток приборов	For instrument board
После пуска дизеля	After diesel engine starting
К выключателю правого тормоза	For right brake switch
Расцветка проводов	Cable colours
Г-голубой	blue
Ж-желтый	yellow
З-зеленый	green
К-красный	red
Кч-коричневый	brown
О-оранжевый	orange
Р-розовый	pink
С-серый	grey
Ф-фиолетовый	purple
Ч-черный	black

Electric circuit of connections “MTZ 626/826/926/1220.1/1220.3”
Lists items of the electric circuit diagram

Table P2

Designation	Name	Q-ty	Note
A1	Cassette radio recorder	1	
A2	Spark plugs	4	
A3	Control panel	1	
A4	Air conditioner	1	
A4.1	Air processing unit	1	Air conditioner kit
A4.1.1	Output air temperature regulator	1	
A4.2	Compressor-condenser unit	1	Air conditioner kit
A4.3	Pressure sensor unit	1	
M6	Fan electric motor	1	
S1	Fan mode selector	1	
YC	Compressor electromagnetic clutch	1	
A5	Start preheater	1	Engine kit
BA1,BA2	Loud speaker	2	Cassette radio recorder kit
BK1	Temperature indicator sensor	1	
BN1	Fuel level indicator sensor	1	For B-626/826/926
BN2, BN3	Fuel volume sensor	2	For B-1220.1/1220.3
BP1	Engine oil pressure sensor	1	
BP2	Air pressure sensor	1	
BV1,BV2	Speed sensor	2	
E1,E2	Road light	2	
E3,E4,E5,E6, E8,E9	Working light	6	
E7	Interior lamp	1	
E10	Number plate light	1	
EL1,EL2	Lamp AKP2-60+55-1	2	Supplied with E1,E2
EL3,EL7,EL8, EL13,EL15,E L16,EL25	Lamp AKG12-55-1	7	Supplied with E3...E6,HL8
EL4…EL6,EL 9,EL10,EL20, EL21	Lamp A12-5	7	Supplied with HL1...HL5,E10
EL11,EL14,E L17,EL19,EL 22,EL24	Lamp A12-21-3	7	Supplied with HL4,HL5,E7,HL6,HL7
EL18,EL23	Lamp A12-10	2	Supplied with HL6,HL7

Table P2 continued

Designation	Name	Q-ty	Note
F1…F4	Fuse blocks	4	
FU1	Fuse	1	Cassette recorder set
FU2,FU3	Fuse link 25 A	2	
G1	Generator 14V,1150 W	1	
GB1,GB2	Storage battery 12V, 88 Ah.	2	
HA1	Beep	1	
HA2	Signal relay switch	1	
HG1,HG2	Pilot lamp unit	2	
HL1...HL3	Roadtrain sign lamp switch	3	
HL4,HL5	Front lamp	2	
HL6,HL7	Rear lamp	2	
HL8	Signal beacon	1	
K1	Spark plug relay switch	1	
K2	Instrumentation power supply relay switch	1	
K3...K6,K8... K10	Cut-in relay 30A	7	
K4	Cut-out relay 20A	1	
K7	Starter relay	1	
KH1	Interrupter of park brake light	1	
KH2	Turn indicator breaker	1	
KT1	Spark plug unit	1	
KT2	Pre-heater control unit	1	
M1	Fan electric motor (90W)	1	
M2	Parallel-motion windscreen wiper	1	
M3	Starter 24V, 4 kW	1	For 24V start system
	Starter 12V, up to 3kW	1	For 12V start system (EURO-1)
	Starter 12V, 2.7 kW	1	For 12V start system (EURO-2)
M4	Electric washer	1	
M5	Windscreen wiper	1	
M7	Fan electric motor (120 W)	1	
P1	Integrated indicator		
P2	Instrument cluster KP-5	1	
QS1	Remote battery switch 24V	1	
QS2	Remote battery switch 12V	1	
QS3	Manual battery switch 12V	1	

Table P2 continued

Designation	Name	Q-ty	Note
QS4	Manual battery switch 24V	1	
R1	Fan motor ballast resistor	1	
SA1	Roadtrain sign lamp switch	1	
SA2,SA3,SA11	Headlight switch	3	
SA4	Fan switch	1	
SA5	Windscreen wiper switch	1	
SA6	Starter switch with start lock	1	
SA7	Combined switch	1	
SA8	Ground switch	1	
SA9	Windscreen washer switch	1	
SA10	Light switch	1	
SA12	Start lock switch	1	
SA13	Flashing beacon switch	1	
SA14	Start pre-heater switch	1	
SB1	Emergency stop signal switch	1	
SB2	Stop signal switch	1	
SB3	Park brake light switch	1	
SK1	Emergency temperature sensor	1	
SP1	Air cleaner clogging sensor	1	
SP2	Emergency air pressure sensor	1	
SP3	Emergency oil pressure sensor	1	
UZ1	Voltage converter	1	
	Connectors		
XS12.1,XS12.2	Socket ShS32P12G-M-7	2	
XS12.3	Socket ShS32PK12G-MT-7	1	
XS15.1	Socket ShS36U15G-M-6	1	
XP12.1,XP12.2	Plug ShS32PK12Sh-MT-7	2	
XP123	Plug ShS32P12Sh-M-7	1	
XP15.1	Plug ShS36PK15Sh-MT-6	1	
XA9.1	Socket for agricultural machines	1	
XT1	Splitting unit	1	
XT2.1,XT2.2	Connecting double-contact panel	2	
XT3.1,XT3.2	Connecting three-contact panel	2	
WA1	Antenna	1	

Схема электрическая соединений «БЕЛАРУС 626/826/926/1220.1/1220.3»

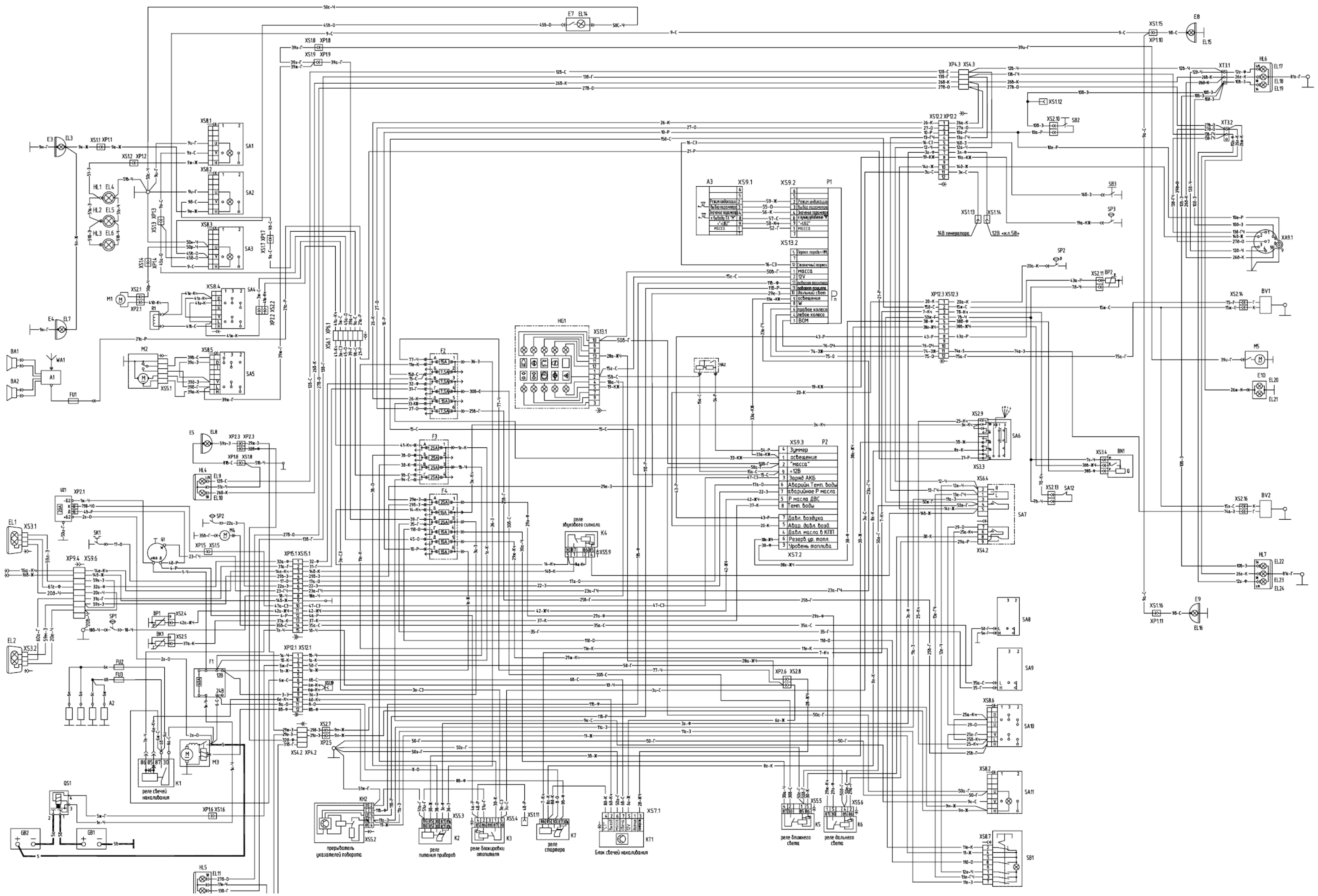
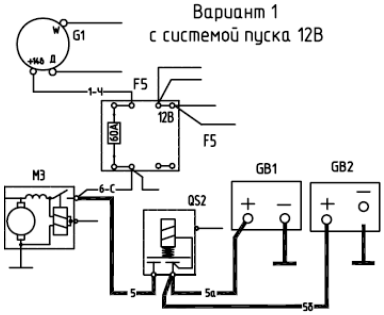


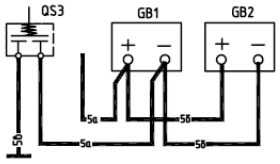
Схема электрическая соединений	Electric circuit of connectors
Реле свечей накаливания	Glow plug relay
Прерыватель указателей поворота	turn indicator flasher
Реле питания приборов	instrument power relay
Реле блокировки питания	Interlocking relay
Реле стартера	Starter relay
Блок свечей накаливания	Glow plug block
Реле ближнего света	Low beam relay
Реле дальнего света	High beam relay
Режим индикации	Display mode
Выбор параметра	Parameter selection
Значение параметра	Parameter value
К выводу	For output
масса	ground
К пульту управления	For control panel
Перекл. передач	Gear shifting
Стояночный тормоз	Parking brake
Поворот трактора	Tractor turning
Поворот прицепа	Trailer turning
Дальний свет	High beam
освещение	lighting
Правое колесо	Right wheel
Левое колесо	Left wheel
ВОМ	PTO shaft
зуммер	buzzer
Заряд АКБ	Battery charge
Аварийн. темп. воды	Emergency water temperature
Аварийное Р масла	Emergency oil pressure
Давл. воздуха	Air pressure
Авар. давл. возд.	Emergency air pressure
Давл. масла в КПП	Oil pressure in gearbox
Резерв ур. топл.	Fuel level reserve
Уровень топлива	Fuel level
Реле звукового сигнала	Beep relay
генератор	alternator

Варианты исполнений

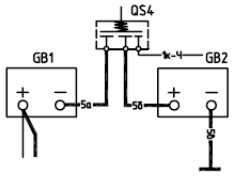
Вариант 1
с системой пуска 12В



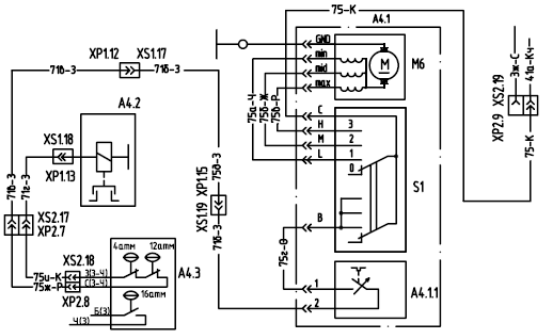
Вариант 2
с системой пуска 12В,
с ручным выключателем массы



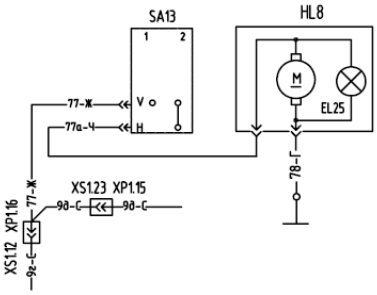
Вариант 3
с системой пуска 24В,
с ручным выключателем массы



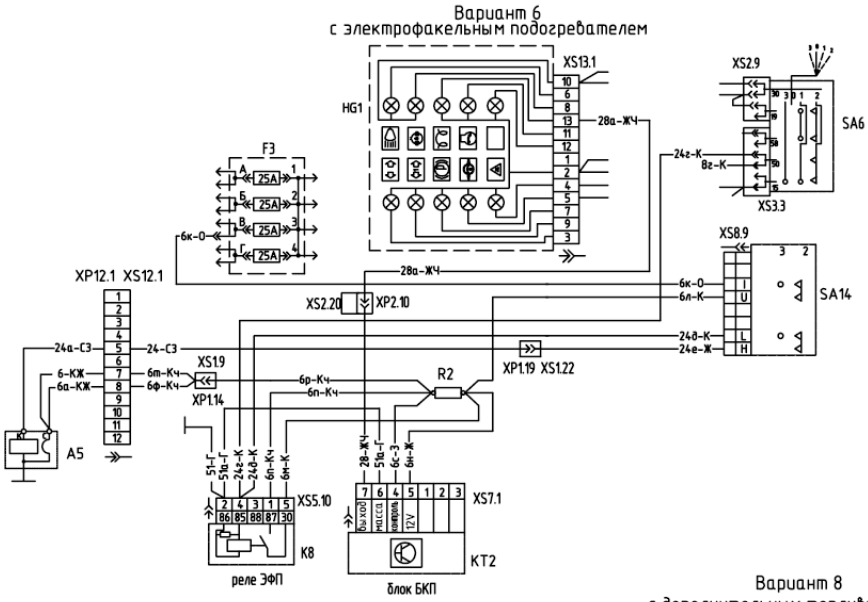
Вариант 4
с кондиционером



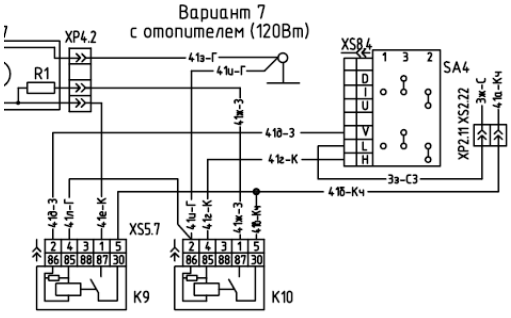
Вариант 5
с маяком сигнальным



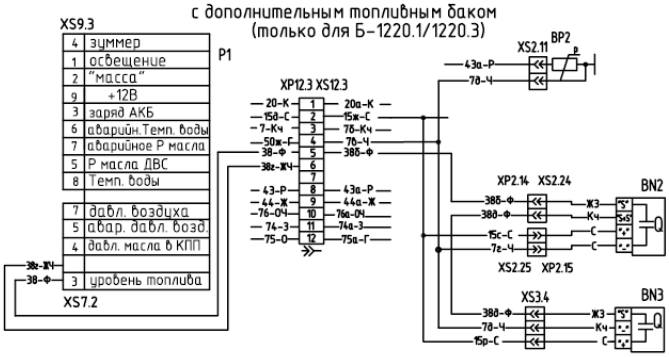
Вариант 6
с электрофакельным подогревателем



Вариант 7
с отопителем (120Вт)



Вариант 8
с дополнительным топливным баком
(только для Б-1220.1/1220.3)



Варианты исполнений	versions
вариант	variant
С системой пуска 12 В	With starting system 12 V
С ручным выключателем массы	With manual battery disconnect switch
С кондиционером	With conditioner
С маяком сигнальным	With signal beacon
С электрофакельным подогревателем	With glow plug
С отопителем	With heater
С дополнительным топливным баком	With additional fuel tank
Только для	Only for
зуммер	buzzer
освещение	lighting
масса	ground
Заряд АКБ	Battery charge
Аварийн. темп. воды	Emergency water temperature
Аварийное Р масла	Emergency oil pressure
Давл. воздуха	Air pressure
Авар. давл. возд.	Emergency air pressure
Давл. масла в КПП	Oil pressure in gearbox
Резерв ур. топл.	Fuel level reserve
Уровень топлива	Fuel level