BELARUS
1021 / 1021.3

1021 – 0000010 OM

OPERATING MANUAL

Minsk Tractor Works 2010

Due to continual improvement of manufactured articles, design of some assembly units and parts can be amended without being included in this publication.

Some technical data and figures given in this manual, can differ from those actually installed on your tractor. Overall dimensions and values of mass are approximate (for reference purpose only). You can obtain more detailed information from your dealer of trade mark BELARUS.

CONTENT

INTRODUCTION

This manual is intended for familiarization with the design, operating and maintenance rules of BELARUS 1021/1021.3 tractors.

Carefully read this Manual. This will help you know good operating and maintenance practices.

Failure to fulfill this instruction may result in operator's injuries or tractor malfunction.

This tractor may be operated, serviced or repaired only by personnel acquainted with all its features and safety requirements to prevent accidents.

Due to constant improvement of the tractor, its separate assemblies and parts can have modifications not reflected in this operating manual.

Any arbitrary modifications made by the user to the design of separate assemblies shall release the manufacturer from any liability for consequent operator's injuries or tractor failures.

BELARUS-1021/1021.3 tractors are designed for various agricultural works with mounted, semi-mounted, and trailer-type farm machinery and implements attached, cargo handling, transportation works, driving stationary agricultural machinery, and are delivered to consumers in the Republic of Belarus and abroad.

Main features of BELARUS — 1021/1021.3 tractors:

- synchronized gearbox (7/2) and synchronized multiplier (speed increaser), allowing to obtain 14 forward gears and 4 reverse gears. On demand, a speed reducer or a hydraulic speed reducer can be installed expanding the scope of use of the tractor.

- improved stiffness and strength of the force loop of the new front driving axle achieved through use of solid-cast tubes and planetary parallel-shaft wheel reducers.

- the rear axle with planetary final drives with improved stiffness and strength of axles, tubes and housing. A planetary final drive significantly increasing the lifetime of the rear axle.

- electro-hydraulic control of the rear power take-off shaft and rear axle differential lock.

- a remote-cylinder hydraulic linkage with a hydraulic lift ensuring possibility of power, position and combined control of implement position.

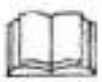
- a safe and comfortable cab conforming to the requirements of EU and OECD regulations equipped with an upgraded instrument panel with alarms, an improved heating and ventilation system.

- a new modern tractor facing providing better visibility of equipment mounted in the front of the tractor.

Abbreviations and designations

SB — storage battery;
DL — differential lock;
PFE — paper filter element;
UDC — upper dead center;
PTO — power take-off shaft;
PTI — power take-in shaft.
HLL — hydraulic lift linkage;
HSU — hydrostatic steering unit;
HCG — hydraulic speed reducer
STM — shift-time maintenance;
SPA — spare parts, tools and accessories;
RA — rear axle;
RHL — rear hitch linkage;
ID – integrated display;
MFE - master filter element of the diesel engine air cleaner;
GB — gearbox;
MD – multifunction display;
MTU — machine-tractor unit;
C — clutch;
MCG — mechanical speed reducer;
CL – coolant liquid;
SP – spark plugs;
M — maintenance;
TC — towing coupler,
FDA — front driving axle;
PC – integrated display programming console;
OM — operating manual.
SPH – start preheater;
SRU –speed reducer;

Manufacturerusesstandardinternationalsymbolsdesignatinguse ofinstrumentsand controls.

 — see manual

 — brake

 — hand brake

 — horn

 — emergency stop signaling

 — fuel

 — coolant

 — start preheater

 — diesel engine speed

 — diesel engine oil pressure

 – diesel engine coolant temperature

 — off/stop

 — on/start

 — continuous adjustment (by moving)

 — lever down

 — lever up

 — remote power cylinder — retraction

 — remote power cylinder — extension

 — control manipulations

 — fast

 — slow

 — forward

 — reverse

 — storage battery charging

 — interior lamp

 — clearance lights

 — tractor turn signal

 — tractor trailer turn signal

 — upper beam

 — lower beam

 – working headlights

 — differential lock

 — power take-off shaft

 — front driving axle drive

 — fan;

 — windshield washer

 — remote power cylinder — equilibrium

 — GB oil pressure

 — pneumatic system air pressure

 — air filter clogging

 — engine stop

 — windshield wiper

 — rear window wiper

 — HSU oil pressure

 — coolant level in main cylinder tanks

1. SAFETY PRECAUTIONS

1.1 General instructions

1.1.1 Strict observance of safety precautions and strict compliance with tractor operation and maintenance rules ensure its fully safe operation.

1.1.2 Carefully read the opeator's instruction before you operate the tractor. Insufficient knowledge on tractor control and operation may result in accidents.

1.1.3 Only specially trained and skilled operators are allowed to operate the tractor.

1.1.4 If the tractor is equipped with a safety belt, use it when working. If the tractor has no safety belts, contact your dealer.

1.1.5 Do not take a passenger into the cab if no extra seat and handrail is installed. There is no other safe place for a passenger in the cab!

1.1.6 Keep clean all warning plates. If the plates are damaged or lost, replace them with new ones.

1.1.7 Before starting the work, carefully inspect the tractor, trailed machine, implement and hitch. Get started only when you make sure they are in good condition. Trailed agricultural machines and transport trailers must have rigid hitches excluding their swinging and hitting the tractor during transportation.

1.2Safety precautions for tractor operation

1.2.1 Before starting the engine, engage the park brake and:

- with single lever control — shift the gear-change and range-change lever to the position of the I-st or II-nd range;
- with two-lever control — shift the range-change lever to the position of the I-st or II-nd range and shift the gear-change lever to the Neutral position;

1.2.2 Before you begin the movement, horn to warn other people being around and working on trailed machines.

1.2.3 Do not abandon the tractor during movement.

1.2.4 Before leaving the cab, turn off the PTO, stop the diesel engine, engage the parking brake and remove the starter and instrument key.

1.2.5 Do not work on the tractor indoors if adequate ventilation is not available, as exhaust gases can cause death.

1.2.6 To avoid damage to power gear of the PTO drive, do not use the synchronous drive at speeds above 8 km/h.

1.2.7 If the engine or the steering fail during work, immediately, stop the tractor. Remember that when the engine is stopped, you need a much greater force on the steering wheel to control the tractor.

1.2.8 Do not work under lifted implements. For long stops, do not leave a mounted implement in the raised position.

1.2.2.9 If the front of the tractor takes off the grond when hinging heavy machines or equipment on the hinging mechanism, install the front counterweights.

1.2.10 When working with a front loader, fill the rear tires with a liquid ballast.

1.2.11 Before raising or lowering a mounted implement, as well as before turning the tractor, make sure that there is no danger to hurt anyone or get caught on an obstacle.

1.2.12 The driveshaft transmitting rotation from the tractor PTO to tools of the unit must be enclosed.

1.2.13 Verify that any additional equipment or auxiliary devices are properly installed and are intended for use with your tractor. Remember that your tractor, if improperly used, can be dangerous both for you and for outsiders. Do not use equipment that is not intended for installation on the tractor.

1.2.14 In order to avoid a tipover, be careful when driving the tractor. Choose a safe speed appropriate to the road conditions, especially when driving on a rough terrain, driving over ditches, slopes and making sharp turns.

1.2.15 When working on slopes, increase the tractor wheel track to the maximum.

1.2.16 Do not make sharp turns at a full load and a high speed.

1.2.17 To avoid damages of parts of the rear hitch linkage, do not turn the unit when the implement is in the soil.

1.2.18 When using the tractor for transport works:

- set the tractor front track to 1530 ± 20 mm and the rear track to 1800 ± 20 mm.
- interlock the brake pedals, check and adjust as necessary the brakes for simultaneous action;
- check the parking brake operation.
- check condition of light and sound alarms;
- transport trailers must have rigid hitches and, in addition, be connected by a safety chain or sling;
- never drive downhill with the transmission off (coasting). Drive using the same gear both downhill and uphill;
- do not work with a trailer without brakes, if its weight exceeds half the service weight of the tractor operating without ballast weights. The faster you drive and the greater is the towed weight, the greater must be the safety distance;
- turn off the FDA in order to avoid excessive wear of the drive parts and tires;
- do not use the rear axle DL at speeds exceeding 10 km/h and when turning;
- do not tow trailers and semitrailers with no safety chains;
- do not leave the tractor on slopes. If necessary, engage the first gear and tighten the parking brake;
- do not operate the tractor with a weakened fastening of the TC and RHL, as this can result in a traffic accident.

1.2.19 When working with equipment driven from the PTO, stop the engine and make sure that the PTO shaft completely stops before getting out of the cab and disconnecting the equipment.

1.2.20 Do not wear loose clothing when working with the PTO or near rotating equipment.

1.2.21 When working with stationary machines driven from the PTO, always engage the parking brake and block the rear wheels from front and rear. Make sure the machine is securely fixed.

1.2.22 Do not leave the tractor with a mounted implement in the transportation position for a long time with the engine running. To avoid overheating of the hydraulic system, lower the implement or stop the engine before leaving the tractor.

1.2.23 Make sure that the PTO end enclosure is installed, and when the PTO is not used, install the PTO end cap to place.

1.2.24 Do not clean, adjust or service PTO-driven equipment when the engine is running.

1.2.25 Do not remove the hood side panels and (or) raise the hood of the tractor when the engine is running.

1.2.25 The cab has the following emergency exits — the left and right doors, the rear window, the roof. In case of an accident, immediately brake the tractor, kill the engine, disconnect the batteries and leave the cab through any of the emergency exits, opening, depending on the position of the tractor, the left door of the cab, or the right door of the cab, or the rear window, or the roof. To open the roof need, press the lever of the roof latch to bring the roof to its highest position (the roof fully open). If opening the emergency exits is impossible, break the glass of the required emergency exit with any heavy object available and leave the cab.

1.3 Safety precautions for maintenance

1.3.1 Never refuel the tractor when the engine is running.

1.3.2 Do not smoke when refuelling the tractor.

1.3.3 Do not fill the fuel tanks full. Leave a space for fuel expansion.

1.3.4 Never add gasoline or blends to diesel fuel. Such combinations may result in higher hazard of fire or explosion.

1.3.5 Correctly use summer and winter grades of fuel. Fill the fuel tank at the end of each day to reduce condensation at night.

1.3.6 Perform all operations related to cleaning of the diesel engine and tractor, preparation to work, maintenance, etc. when the engine is stopped and the tractor is braked.

1.3.7 The cooling system operates under pressure which is maintained by a valve installed in the filler cap. It is dangerous to remove the cover on a hot engine! To avoid burns of face and hands, open the radiator cap on a hot engine cautiously, first put a dense cloth on the cap, wear protective gloves.

1.3.8 To avoid burns, exercise caution when discharging coolant or hot water from the cooling system, hot oil from the engine from the hydraulic system and transmission.

1.3.9 Exercise caution when servicing batteries as the electrolyte in case of skin contact causes burns.

1.3.10 To avoid hazard of explosion, keep open flames away from the fuel system of the engine and the batteries.

1.3.11 Maintain the tractor and its equipment, especially brakes and steering, in operable condition to ensure your safety and the safety of the people being nearby.

1.3.12 Do not change or modify the design of the tractor or its parts without a prior approval by your dealer and the manufacturer.

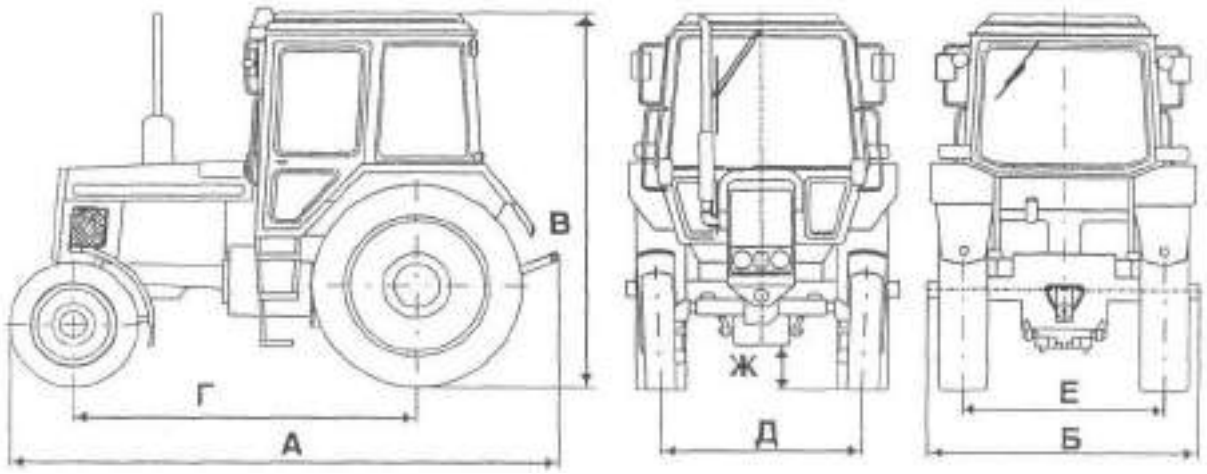
1.3.13 Refill the tractor only with oils and lubricants recommended by the manufacturer. Use of other lubricants is strictly forbidden!

1.3.14 To avoid damage to semiconductor devices and resistors, observe the following precautions:

- do not disconnect the battery terminals with the engine running. This will result in a peak voltage in the electrical circuit and in an inevitable damage to the products containing semiconductor devices and incandescent lamps.
- do not disconnect electrical wires before the engine is stopped and all electrical switches are off.
- avoid a short circuit due to incorrect connection of wires. Short circuit or wrong polarity will cause damage to the diodes and transistors.
- do not connect the battery to the electrical system until the polarity of the terminals and voltage are verified.
- do not check presence of electric current “by spark” as it will result in an immediate breakdown of transistors.

2. TECHNICAL DATA

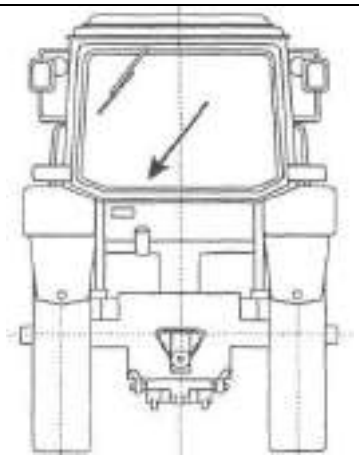
2.1 Weight and dimensions

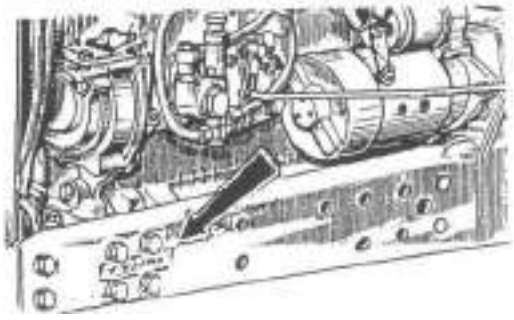
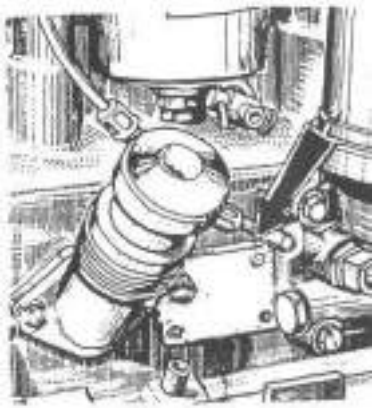
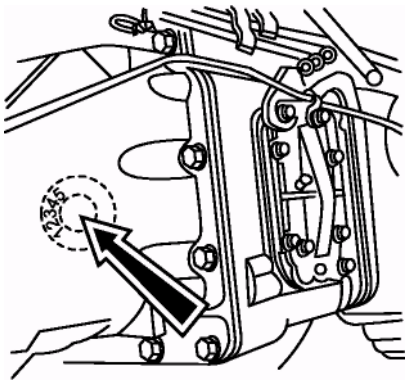
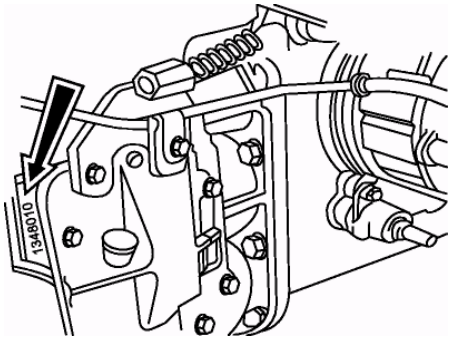


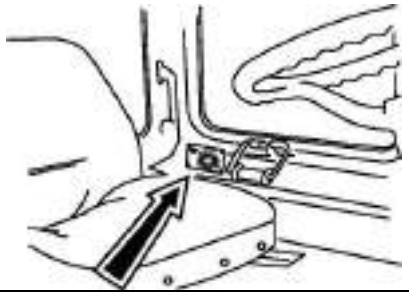
Name		BELARUS 1021	BELARUS 1021.3
А	Length with linkage in transportation position, mm	4,105±50	4,525 ± 50
Б	Width by ends of rear wheel half-axles, mm	2,250 ± 20	2,250 ± 20
В	Height by cab, mm	2,840 ± 20	2,840 ± 20
Г	Base, mm	2,445 ± 20	2,445 ± 20
Д	Front track, mm	See 5.1 Setting front wheel track	See 5.1 Setting front wheel track
Е	Rear track, mm	1,600 — 2,400	1,600 — 2,400
Ж	Road clearance, mm	450	450
	Service weight, kg	4,635 ±100	4,675 ±100

2.2 Tractor part numbers

The tractor nameplate with the serial numbers of the tractor and the diesel engine mounted on the left niche of the cab.



The serial number of tractoris duplicated at the right plate of the side member	
The serial number of the engine is duplicated on the nameplate attached to the cylinder block on the left.  An example of thenameplate for the BELARUS 1021 tractor	
The engine turbo charger number	
The clutch number (on the clutch housing on the left)	
The gearbox number (on the GB housing on the left)	

The transmission number	
Front driving axle number	
Cab serial number	

2.3. General information on design of BELARUS-1021/1021.3 tractors

Diesel engine parameters

Diesel engine model	D-245 (D-245S on request)	D-245S2
Manufacturer	MMW (MinskMotorWorks)	MMW (MinskMotorWorks)
Type	4- stroke	4- stroke
Cylinder number and arrangement	4, in-line, vertical	4, in-line, vertical
Mixing method	direct fuel injection	direct fuel injection
Compression ratio (designed)	15.1 (16)	17
Diameter ofcylinder,mm	110	110
Piston stroke,mm	125	125
Displacement volume, l	4.75	4.75
Firing order	1 - 3 - 4 - 2	1 - 3 - 4 - 2
Air supply	turbocharged	turbocharged
Cooling system	liquid	liquid
Rated speed, rpm	2,200	2,200
Maximum idle speed, max., rpm	2,380	2,420
Minimum stable idle speed, max., rpm	700 (600±50)	800±50
Rated power, kW (HP)	77 (79)	81
Maximum torque, Nm (kg-force•m)	384 (392)	440
Rated advance angle of fuel injection to UDC, deg.	(20 ± 1)° – for D-245 (for D-245S with PP4M10P1f-3480 fuel pump – (13 ± 1)°) (for D-245S with 4UTNI-T-1111007-610 fuel pump – (15 ± 1)°) (for D-245S with 773.1111005-01 fuel pump – (12 ± 1)°)	With fuel pump PP4M10Pli-3705 – (3.5 ± 0.5)°) With fuel pump 773.1111005-01T – (3.5 ± 0.5)°)

Lubrication system of D-245 / D-245S / D-245S2 diesel engines

Type: combined with liquid-oil heat exchanger.
Oil cleaning: full flow oil filter with non-separable filter element.
Minimum oil pressure: at minimum idle speed 0.08 MPa min.
Oil pressure at rated speed: 0.25 — 0.35 MPa.
Maximum pressure on cold engine: up to 0.6 MPa.

Fuel supply system of D-245 / D-245S / D-245S2 diesel engines

Fuel pump: four-cylinder, in-line with booster pump.
Governor: mechanical full-range with pneumatic fuel supply corrector.
Turbocharger: inward radial turbine on one shaft with centrifugal compressor.
Fuel filters: coarse filter and fine filter (paper filtering element).
Fuel tank capacity: options of 135 l and 140 l.
Air cleaner: combined type, with dry centrifugal and dry two-stage air cleaning by paper filter elements.

Start system of D-245 / D-245S diesel engines

Electric starter, 24 V (12 V – on request)
Starting aid: start preheater at air intake manifold;

Start system of D-245S2 diesel engine

Electric starter, 24 V
Starting aid: spark plugs.

Cooling system of D-245 / D-245S / D-245S2 diesel engines

Type: liquid, closed with forced circulation of coolant. Temperature is controled by thermostat.
Normal operating temperature from 85°C to 95°C.

CAC(on BELARUS-1021.3 tractors)

Radiator type, installed before water radiator. Intended for cooling of air charged into the intake manifold of the engine.

Steering

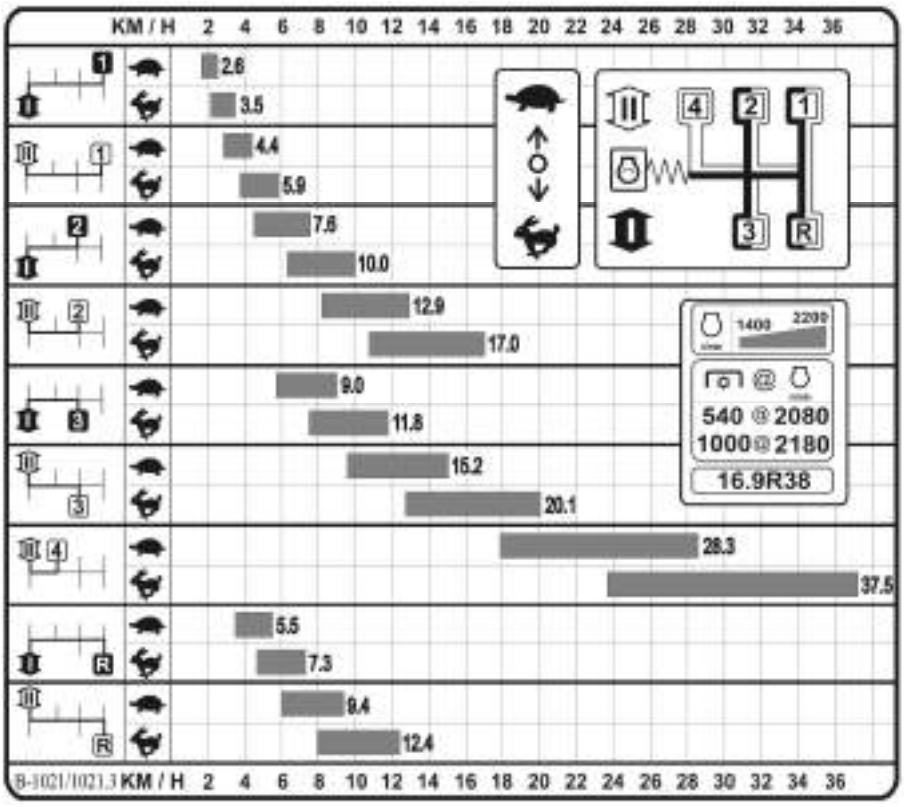
Type: hydrostatic with one hydraulic cylinder in steering linkage.
Safety valve setting pressure — 14 MPa
Non-slam valve setting pressure — 20 MPa
Supply pump capacity: 32 l/min.
Hydraulic cylinder: bidirectional, cylinder diameter — 63 mm, piston stroke — 200 mm.
Range of steering wheel adjustment:
- tilt — from 25° to 40° with fixation at each 5°;
- height — within 100 mm. Steering wheel free play — 25°.

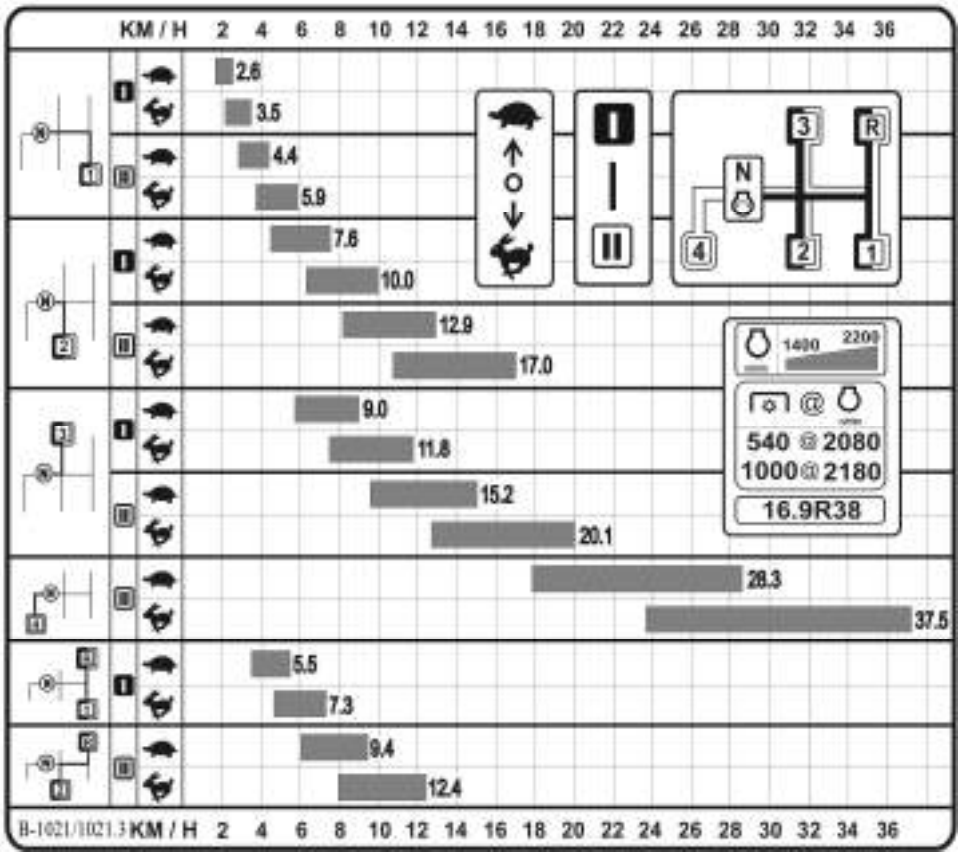
Clutch

Type: friction, single-disk dry spring-loaded.
Diameter ofdisk — 340 mm.

Gearbox

Type: mechanical, synchronized, with multiplier (accelerator) at input.
Gears: 14 forward, 4 reverse
The figures below present charts of tractor speeds on standard tires with single-lever and two-lever GB control respectively.





Speed reducer

Note: on request. Purchased separately from the tractor with an order for a GB for installation of a speed reducer.

Type: mechanical MHU-05 or hydromechanical GHU-05 (provides stepless speed control ranging from 0 to 4.0 km/h)

Design travel speeds of BELARUS-1021/1021.3 tractors in km/h at engine nominal speed of 2,200 rpm on 16.9R38 tires (standard) with and without speed reducer

Travel	GB gear number	GB range number	Stage of multiplier(accelerator)	Tractor travel speed V, km/h				
				Without SRU	With SRU			
					I-stSRU range		II-ndSRU range	
					First SRU gear	Second SRU gear	First SRU gear	Second SRU gear
forward	1	I	Overdrive	3.45	0.80	2.39	3.35	9.95
			Direct	2.60	0.61	1.81	2.53	7.52
	2		Overdrive	9.99				
			Direct	7.55				
	3		Overdrive	11.83				
			Direct	8.94				
	1	II	Overdrive	5.87	1.37	4.07	5.70	16.94
			Direct	4.44	1.04	3.07	4.31	12.81
	2		Overdrive	17.00				
			Direct	12.86				
	3		Overdrive	20.13				
			Direct	15.23				
	4		Overdrive	37.45				
			Direct	28.32				
reverse	1R	I	Overdrive	7.26	1.69	5.03	7.05	20.94
			Direct	5.49	1.28	3.80	5.33	15.84
	2R	II	Overdrive	12.36	2.88	8.56	12.01	35.66 [1)]
			Direct	9.35	2.18	6.47	9.08	26.97 [1)]

[1)] Do not engage!

Rear axle

Main drive: pair of bevel pinions with circular-arc tooth.

Hub drives: pair of cylindrical pinions.

Final drive: planetary.

Differential lock: friction-type clutch with electrohydraulic control and possibility of forced lock.

Brakes

Service: on rear wheels: three-disk, dry, with mechanical servo actuator. Diameter of disks: 204 mm (or 8-disk working in oil bath (on request)).

Parking: on rear wheels via a differential on hub and final drives. Disk, dry, with mechanical manual actuator. Diameter of disks: 180 mm (or 4-disk working in oil bath (on request)).

Pneumatic system

Compressor: single-cylinder, air-cooled

Trailer brake control drive: pneumatic, single-wire, interconnected with the tractor brakes (on request — pneumatic two-wire)

Front driving axle

Type: portal.
Main drive: bevel pinions with circular-arc tooth.
Type of differential: self-locking, high friction.
Final drives: two-stage with cylindrical and planetary stages;
FDA drive: from a transfer case by two driveshafts with an intermediate bearing;
FDA control: mechanical by a lever under operator's right hand. Has 3 operating modes:

- FDA off;
- FDA on/off automatically;
- FDA on forced

Power takeoff shaft (PTO) drive

Type: independent two-speed and synchronous.
Drive: mechanical, planetary reducer with control belt brakes.
Control: electrohydraulic, with a combination of switches on the right control panel.
PTO end speed at independent drive:

- I — 540 rpm at 2,040 rpm of diesel engine;
- I — 1,100 rpm at 2,160 rpm of diesel engine;

Synchronous drive:

- 4.17 revolutions per meter of travel with 16.9R38 tires installed.
- 4.33 revolutions per meter of travel with 18.4R34 F11 tires installed.
- 4.45 revolutions per meter of travel with 11.2R42 tires installed.

PTO change end:

- for 540 rpm — 8 slots according to GOST 3480 or 6 slots according to ISO 500
- for 1,000 rpm — 21 slots according to GOST 3480 and ISO 500

Direction of rotation: clockwise when viewed from the shaft end.

Hydraulic lift linkage (HLL)

Type: remote-cylinder type, with open center.
Maximum pressure in the hydraulic system: from 18.5…20 MPa
Distributor: section type, 3-valve with a spring-loaded neutral, with a fixed floating position, forced lowering and lifting. Low force on the levers when controlling the distributor provides precise movement of an implement. Oil flow and speed of the rod in the cylinder are linear and proportional to the movement of the operator's hand.
Hydraulic system outputs: left and right side, rear; free discharge.
The system provides the following hitch control modes: height, power, position, mixed (power + position control).
Hydraulic lift: a device equipped with a regulator distributor and two plunger cylinders.

Rear hitch linkage (RHL):

Type: four-bar linkage of category 2
Lifting capacity at a distance of 610 mm from the suspension axle 27.5 kN (2,750 kgf) min at a pressure of 16.7 MPa.

Towing coupler

Lift type TSU-3-V; a fork with a possibility of vertical travel in steps of 65 mm; a crossbar at the ends of the lower rods and a draw bar

Distance from ground to horizontal axis of towing yoke on standard tires — (400 ± 10) mm
Opening — (70.0 ± 2.5) mm

Electric equipment

Electrical system voltage: 12 V

Supply system:

- two batteries, 12 V each, capacity of 88 A•h or 90 A•h.
- alternator, rated voltage 14 V, power 1.15 kW.

Illumination and light signaling system:

- upper and lower beam headlights
- front and rear operating headlights;
- frontandrearlights;
- illumination of the instrument panel, the number plate
- emergency stop signaling;
- road train sign lights (on request).

Other equipment:

- windshield and rear window wipers;
- windshield washer;
- cab lamp

Instrumentation

- instrument cluster;
- electrictachometer/speedometer;
- indicator lamp blocks.

Connectionforelectricity consumers: multipincombinedsocket.

Cab

The cab is unified, protective, ensuring safety, microclimate, noise and vibration protection. The cab is equipped with front windscreen and rear visor vipers and a windscreen washer, a cab heater, a sprung seat adjustable to operator's height and weight. On customer's demand, additional front headlights on the brackets of front lights can be installed.

Wheels

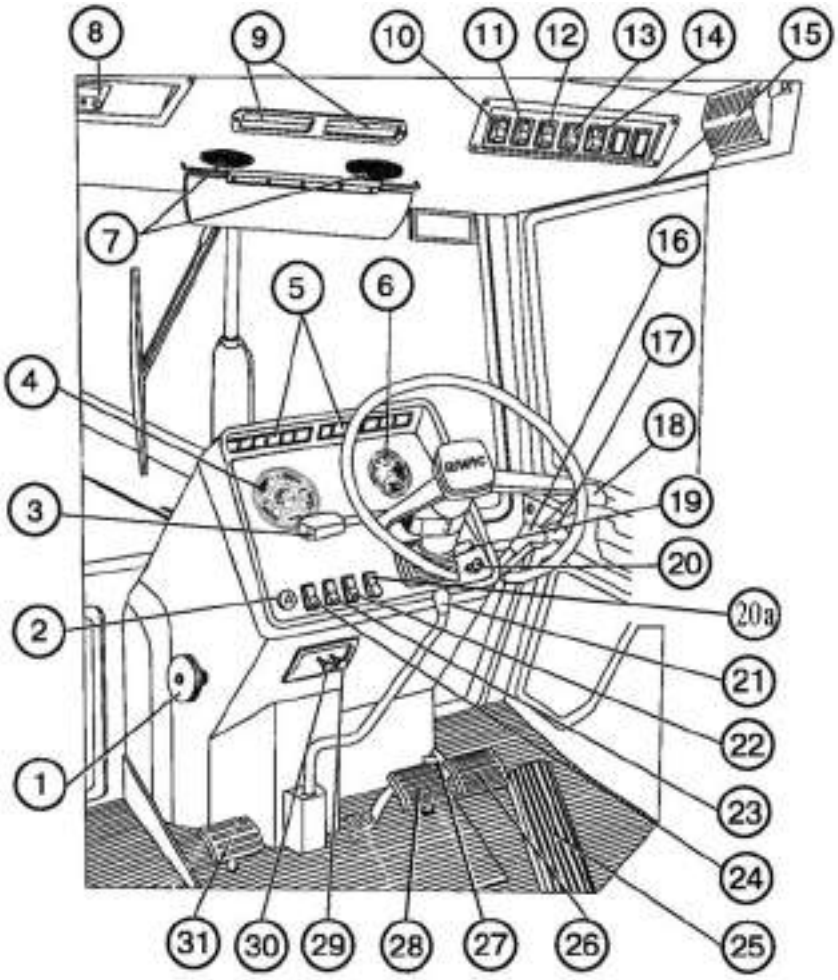
Front wheel tires: 360/70R24 (standard).

Rear wheel tires: 16.9R38(standard).

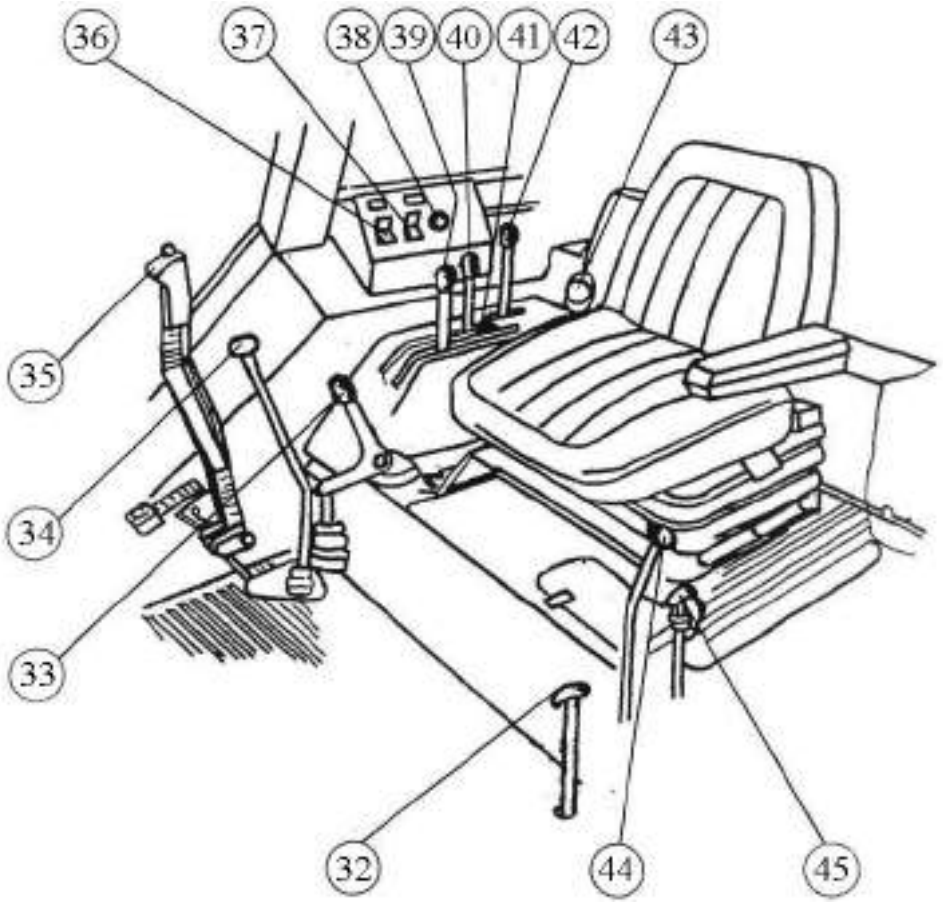
3. CONTROLS AND INSTRUMENTS

3.1. General

Attention! Before starting to work on the tractor, learn the purpose of controls, instruments and their functions.

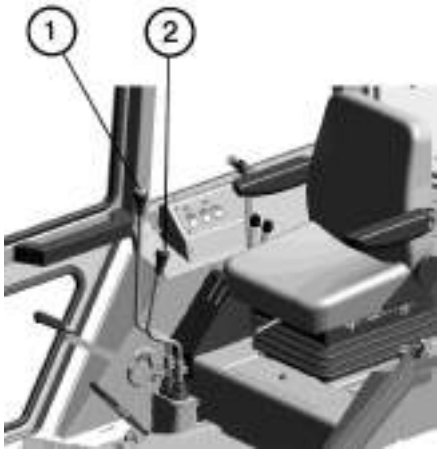


1. Cooling system radiator shutter control (only in Belarus-1021);
2. Emergency stop signaling switch;
3. Multifunction understeering switch, (horn, turn indicators, upper/lower beam);
4. Instrument cluster;
5. Pilot lamp units;
6. Electric tachometer/speedometer or integrated display;
7. Air distributors;
8. Place for radio;
9. Recirculating shutters.
10. Windshield wiper switch;
11. Cab heater and fan switch.
12. Rear operating headlight switch.
13. Front operating headlight switch.
14. Roadtrain sign lamp switch (if roadtrain sign lamps are installed);
15. Cab lamp with switch.
16. Hydraulic system side outlet control.
17. Hydraulic system right side outlet control.
18. Hydraulic system left side outlet control.
19. Tachometer/speedometer control panel;
20. Starter and instrument switch;
20a. SB remote disconnect key (only on BELARUS-1021.3);
21. Multiplier (accelerator) control;
22. SPH switch (only on BELARUS-1021, if SPH installed).
23. Windscreen washer switch.
24. Central light switch
25. Fuel control pedal.
26. Right service brake pedal.
27. Brake pedal connection plate;
28. Left service brake pedal.
29. Steering column tilt control.
30. Engine stop cable lever (red);
31. Clutch pedal.



32. PTO shifter lever (independent/synchronous);
33. FDA shifter lever for single-lever GB control (with two-lever GB control, the FDA shifter lever is on the top of GB control cover);
34. Range and speed shifter lever (with single-lever control);
35. Parking brake lever;
36. Rear axle differential lock switch;
37. PTO switch;
38. PTO button;
39. Hydraulic lift draft control lever;
40. Hydraulic lift position control lever;
41. Position control adjustable stop;
42. Fuel control lever;
43. Ground disconnect switch (only on BELARUS-1021);
44. Speed reducer gear shifter (if installed);
45. Speed reducer range shift rod (if installed).

With two-lever GB control, ranges and gears are shifted by individual levers (1) and (2), as shown in figure below.



1 — gear shifter lever, 2 — range shifter lever.

3.2 Instruments, switches and pilot lamp units

Starter and instrument switch

The starter and instrument switch (1) has four positions:

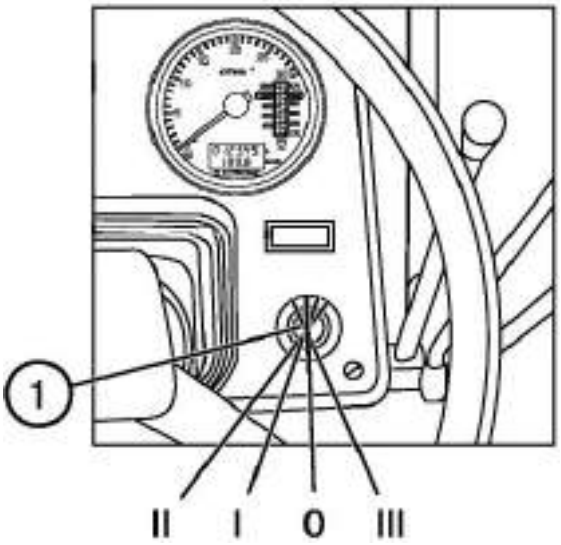
"0" – OFF;

"I" – instruments, pilot lamp units ON (for 1025.3 — spark plugs ON).

"II" – starter ON (unfixed position);

"III" – radio ON (key turned counterclockwise).

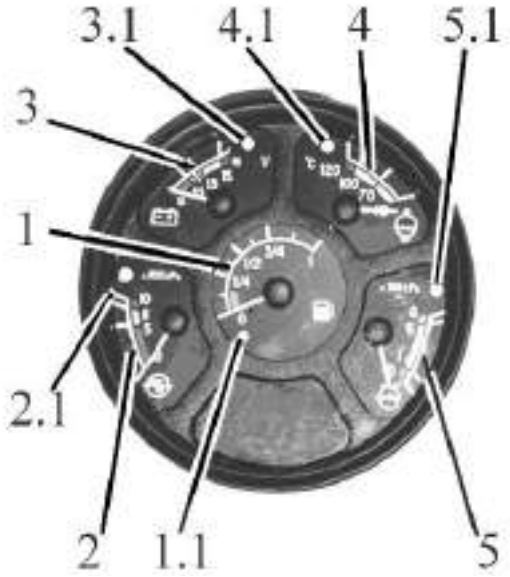
Note — The radio operates only in the positions "I" and "III" of the starter and instrument switch.



Instrument cluster

The instrument cluster (option 1 and option 2) includes five indicators with five pilot lights.

Option 1



Option 2

1 – fuel tank level indicator;
1.1 – fuel reserve level alarm lamp;
2 – pneumatic system air pressure indicator;
2.1 – low-pressure alarm lamp of pneumatic system;
3 – voltage indicator;
3.1 – additional battery charging pilot lamp;
4 – diesel engine coolant temperature indicator;
4.1 – diesel engine coolant high temperature alarm lamp;
5 — diesel engine lubrication system oil pressure indicator;
5.1 — engine lubrication system emergency oil pressure alarm lamp;

Instrument cluster

The fuel tank level indicator scale (1) has the divisions of 0–1/4–1/2–3/4–1. The indicator scale has a built-in alarm lamp (1.1) (orange) that goes on when the fuel level in the tank drops to 1/8 of the total tank volume.

ATTENTION: DO NOT CONSUME FUEL TO THE 'DRY TANK' CONDITION (WHEN THE INDICATOR POINTER IS IN THE ORANGE ZONE).

The pneumatic system air pressure indicator scale (2) has three zones:

- operating — 500 to 800 kPa (green);
- non-operating (two) — 0 to 500 kPa and 800 to 1000 kPa (red).

The indicator scale has a built-in alarm lamp (2.1) (red) that goes on when the pneumatic system pressure drops below 500 kPa.

The voltage indicator (3) shows voltage of the batteries with the engine off, when the starter and instrument switch key is in the 'I' position. With the engine on, the voltage indicator shows voltage at the generator terminals. The voltage indicator scale has a built-in red alarm lamp (3.1). Used only for a 24V start system. Shows the charging process of a second 24V battery – detects operability of the voltage changer.

Feed system condition

Zone at voltage indicator scale 3, color	Feed system condition	
	when engine is running	when engine is off
13.0 – 15.0 V Green	normal charging mode	—
10.0 – 12.0 V red	generator not operating	battery discharged
12.0 – 13.0 V Yellow	no SB charging (low charging voltage)	SB has normal charging
15.0 – 16.0 V Red	SB recharged	—
white hairline in yellow zone	—	rated generated voltage battery – 12.7 V

Attention: if the voltage indicator indicates no charging of the SB, check condition and tension of the generator driving belt.

The engine coolant temperature indicator scale (4) has three zones:

- operating — 70 to 100°C (green);
- informative — 40 to 70°C (yellow)
- non-operating — 100 to 120°C (red).

The indicator scale has a built-in alarm lamp (4.1) (red) that goes on when the coolant temperature is 105°C or higher.

The engine oil pressure indicator scale 5 has three zones:

- operating — 100 to 500 kPa (green);
- non-operating (two) — 0 to 100 kPa and 500 to 600 kPa (red).

The indicator scale has a built-in alarm lamp of emergency oil pressure drop 5.1 (red) that goes on when the pressure drops below 100 kPa.

Note–A cold engine can produce a pressure of up to 600 kPa when started.

Attention:if the emergency pressure alarm lamp glows with the engine running, immediately stop the engine and correct the fault.

Electric tachometer/speedometer

Tachometer/speedometer operates as follows:

When the tractor is stopped, after switching the starter and instrument switch to the position 'I', the display (9) shows engine service hours (h).

After start, the diesel pointer indicator (10) moves along the circular scale (4) to indicate the engine crankshaft speed. At the same time, the display (8) shows the PTO speed (rpm) on the scale (6) for the PTO I and on the scale (7) for the PTO II. An electrical signal of the rotation speed goes from the phase winding of the alternator.

When the tractor is moving, the display (9) indicates the design travel speed of the tractor (km/h), and the service hour indication disappears. Speed is indicated by the signal from the transducer installed on the final drive gear of the wheel rotating with the lowest speed. The design speed exceeds the actual speedas skidding of the tractor is not considered.

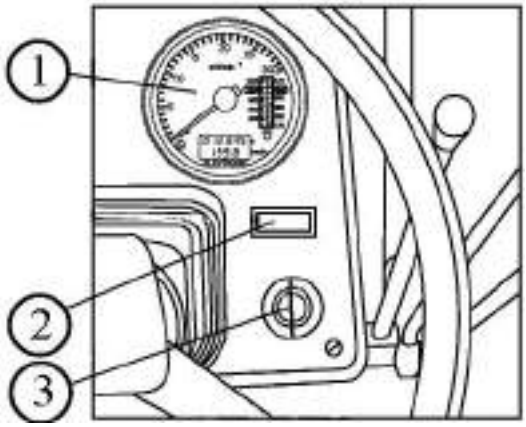
If, while the tractor is moving, the indicator (9) shows the numbers "02…07" instead of the speed read-out, and after 12 seconds the figure "0" on the right side — there is no signal from the right speed sensor. Correct the fault If, while the tractor is moving, the indicator (9) shows the numbers "02…07" instead of the speed read-out, and after 12 seconds the figure "0" on the left side — there is no signal from the left speed sensor. Correct the fault The digital display has no speed readout at that. To restore the speed readout, correct the above faults.

The electrical system high voltage alarm (5) of the tractor goes on when the electrical system supply voltage is 18 to 19 V in and goes off when the supply voltage drops below 16 V. When the alarm is on, the tachometer/speedometer does not operate.

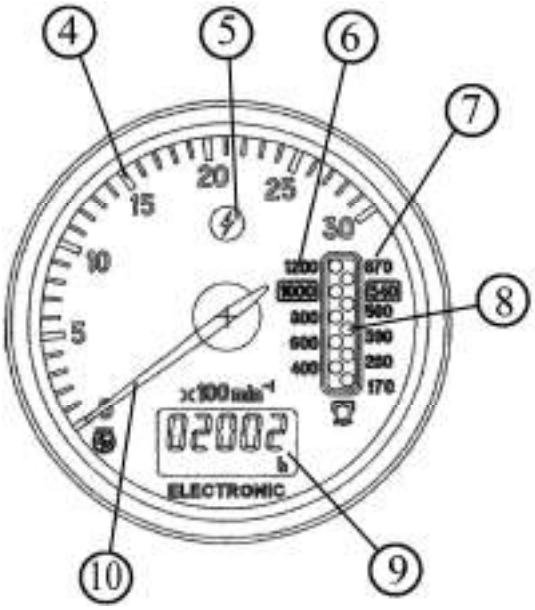
When the electrical system exceeds 18 V, the illuminating lamps of the TX may fail, if they were on! In this case, replace the illuminating lamps of the TX!

Attention! The manufacturer programmed the tachometer/speedometer exactly for your tractor model. Reprogramming is required only when changing the tire type. Do not reprogram the tachometer/speedometer unless necessary.

For the procedure of tachometer/speedometer programming and rules of use of the panel (2), see Adjustments.



1. Electric tachometer/speedometer
2. Tachometer/speedometer programming panel;
3. Starter and instrument switch;



4. Engine crankshaft speed scale, rpm;
5. Electric system high voltage signal (red);
6. PTO speed scale - II — 1,000 rpm;
7. PTO speed scale - I — 540 rpm;
8. PTO speed indication display (LED);
9. Engine service hours and tractor travel speed indication display (LCD);
10. Engine crankshaft speed pointer indicator.

Integrated display KD 8083

The indicator operates as follows:

When the power is on, the indicator switches to the main mode of operation. When no signal arrive from the speed sensors, the digital indicator (4) shows the readout of the engine service hour counter, and the LED goes on located next to the “h” symbol.

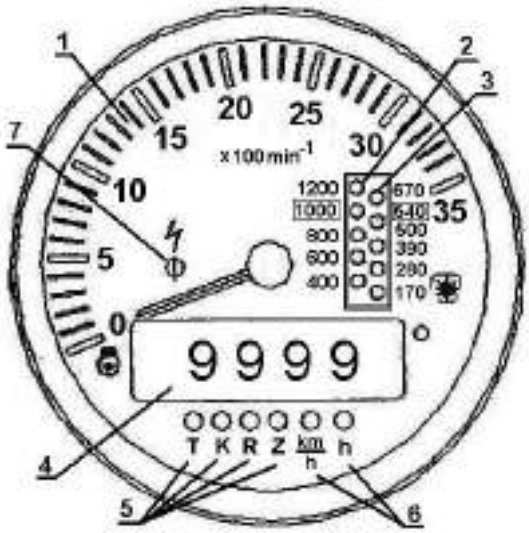
When the tractor is moving, pulses from the speed sensors arriving to the input of the pulse indicator results in switching to the speed indication mode. At that, the digital indicator shows the changed design travel speed, and the LED goes on located next to the “km/h” symbol.

When no signal arrives from the right wheel speed sensor for more than 12 seconds after start of movement, the right side of the digital display shows the symbol “□” indicating that the connection and operability of the right wheel speed sensor needs to be checked. When no signal arrives from the left wheel speed sensor for more than 12 seconds after start of movement, the right side of the digital display shows the symbol “□” indicating that the connection and operability of the left wheel speed sensor needs to be checked. The digital display has no speed readout at that. To restore the speed readout, correct the above faults.

The tractor electric system high voltage alarm goes on when the voltage exceeds 18.5 V. At that, the indicator KD 8083 goes off, as the protection operates. When the voltage drops to 16.5 V, the display returns to the operation status, and the high voltage alarm goes off.

Attention! The manufacturer has programmed the KD 8083 integrated display exactly for your tractor model. Reprogramming is required only when changing the tire type. Do not reprogram the KD 8083 integrated display unless necessary.

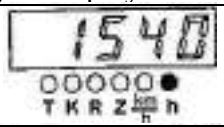
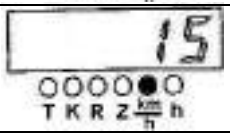
For the procedure of KD 8083 integrated display programming, see Adjustments.



1 Engine speed indicator (pointer indicator);
2 PTO speed indicator in 1,000 rpm mode (light indicator);
3 PTO speed indicator in 540 rpm mode (light indicator);
4. Digital five-digit display;
5 LEDs illuminated in the programming mode of “K”, “R”, “Z” coefficients, and the LED “T” illuminated in the mode of indication of precise total service hours of the engine (opposite to the respective LED).
6 LEDs illuminated in the mode of indication of speed “km/h” and total service hours of the engine “h” (opposite to the respective LED).
7 Electric system high voltage signal (red);

Integrated display KD 8083

Examples of information display by the digital display in the operating mode

	Total service hours of the engine, hrs
	Design travel speed, km/h

Emergency stop signaling switch

When the key (1) is pressed, the emergency stop signaling is switched on. The pilot lamp built into the key blinks simultaneously to the blinking signaling light. When the key (1) is pressed again, the emergency signaling is switched off.

Central light switch

The key (2)hasthreepositions:

I. OFF;
II. Illumination of the instrument panel, the clearance lights, the number plate light ON
III. Illumination of the instrument panel, the clearance lights, the number plate light, the headlights ON

Windscreen washer switch

When they key (3) is pressed (unfixed position), the windscreen washer is turned on.

Start preheater switch

(only on BELARUS-1021, if SPH installed).

Used for engine start at low temperatures

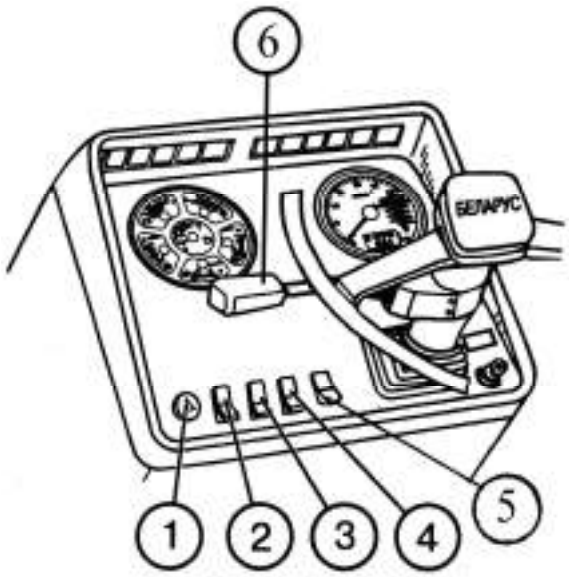
After switching the starter switch to “I”, press the key (4) to turn on the start preheater spiral.

On the pilot lamp unit, the start aid pilot lamp will glow continuously. After it starts blinking, start the engine. After the engine starts, release the key (4) and the starter and instrument switch key.

Remote ground switch key

(Only on BELARUS-1021.3)

When they key (5) is pressed (unfixed position), the SB ground switch is actuated remotely. When pressed again, it’s off. On the BELARUS-1021 tractors, this place is plugged, the SB ground is switched on and off by pressing the button (43) (see Figure on page 23).



Understeering multifunction switch

The understeering multifunction switch (6) ensures turning on of turn indicators, switching headlight beams (lower-upper), signaling with the upper beam, horning:

- by turning the lever (6) of the understeering switch away or to the operator, the right or left turn indicator is turned on respectively. After the tractor makes a turn, the lever returns automatically to its initial position.
- the horn is switched on, when the lever is pressed in the axial direction. The signal can be switched on in any position of the switch lever (6).
- with the headlights on (the key 2 in the position “III”) and switching the lever (6) down, the upper beam is on, and switching the lever up the lower beam is on.
- when the lever (6) is shifted from the headlights on position up to the stop, the upper beam is switched on briefly (non-fixed position). When the lever is released, it automatically returns to the lower beam position.

Windshield wiper switch

When they key (1) is pressed, the windscreen wiper is turned on.

The switch has three positions:

- OFF;
- low wiping speed ON;
- high wiping speed ON.

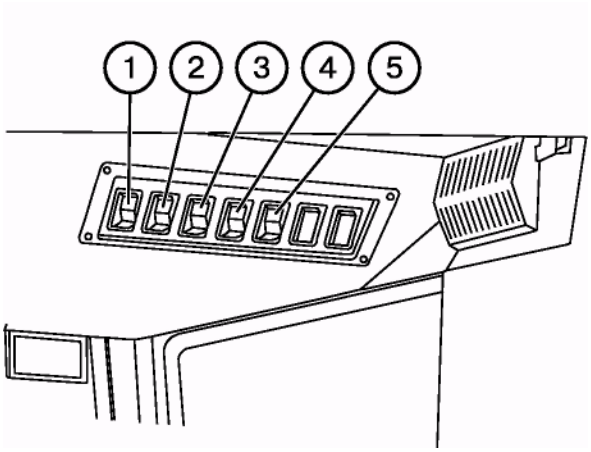
Note: In the off position, the wiper brush will automatically return to its original position

Cab heater and fan switch

When they key (2) is pressed, the cab air ventilation is on.

The switch has three positions:

- OFF;
- low air delivery mode ON;
- high air delivery mode ON;



Rear operating headlight switch

When the key (3) is pressed, the rear operating headlights and the light indicator built into the key are switched on.

Front operating headlight switch

When the key (4) is pressed, the front operating headlights and the light indicator built into the key are switched on.

Roadtrain sign lamp switch

When the key (5) is pressed, three orange lamps installed on the front of the cab roof and the light indicator build into the key are switched on.

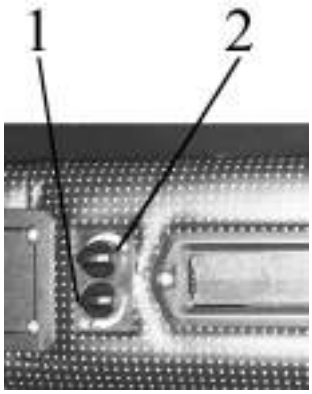
Air conditioner control

(installed on BELARUS-1021.3 on request instead of fan heater)

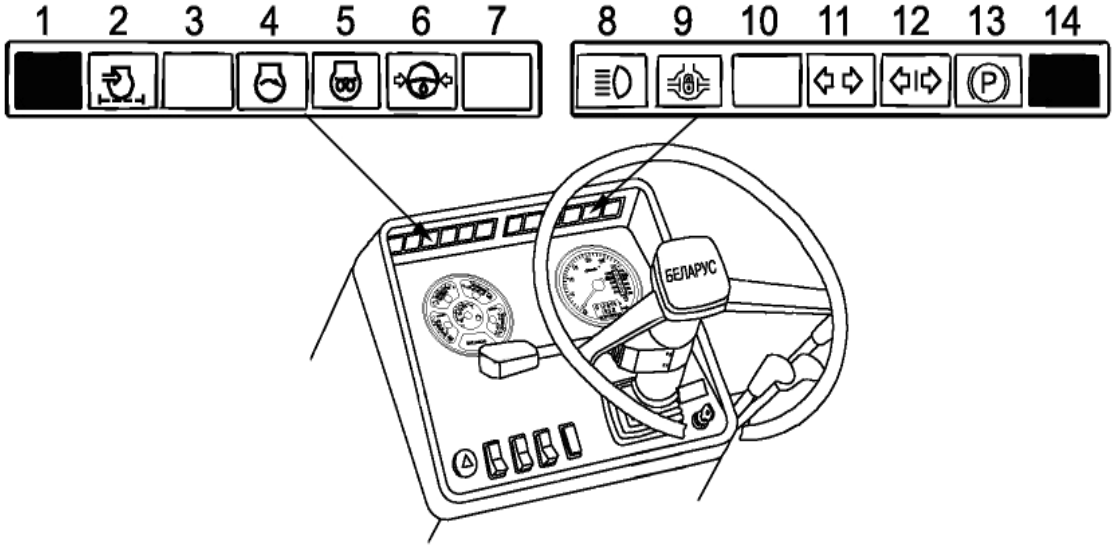
The climate system control panel has the switches (1) and (2).

(1)–air flow switch;

(2)–air conditioner switch and refrigerating capacity control;



Pilot lamp units



1, 14. Buttons to check operation of the pilot lamp unit. When the buttons are pressed, all lights must go on.

2. Air filter blockage indicating lamp (orange). The lamp is on when the maximum allowable level of filter blockage is exceeded, and it needs cleaning. When the air filter blockage indicating lamp is on, service the engine air cleaner (see operation 21 in 8.4 Scheduled maintenance operations).

3.Reserve.

4. Diesel engine start indicator lamp. Not used at BELARUS-1021/1021.3 tractors.

5. The engine start aid indicator lamp (orange) is intended to indicate readiness of the engine for start.

For BELARUS-1021 tractors — a SPH indicator;

For BELARUS-1021.3 tractors — a spark plug indicator.

For details, see Operating instruction.

6. HSU emergency oil pressure indicator lamp (red). The lamp goes on when the HSU hydraulic system oil pressure drops below 0.08 MPa.

7. Reserve.

8. Headlight upper beam indicator lamp (blue); The lamp goes on when the headlight upper beam is switched on.

9. Rear axle differential lock indicator (green). Not used at BELARUS-1021/1021.3 tractors.

10. Reserve.

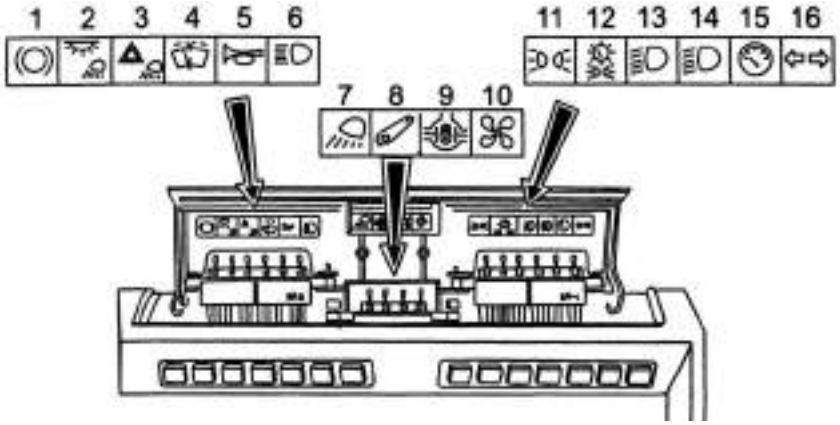
11. Tractor turn indicator pilot lamp (green).

12. Tractor trailer turn indicator pilot lamp (green).

13. Park brake pilot lamp (red). The park brake pilot lamp blinks at the frequency of 1 Hz when the park brake is engaged.

3.3 Fuses

The instrument panel has three fuse boxes mounted. To have access to the fuses, unscrew the screw and open the instrument panel cover.

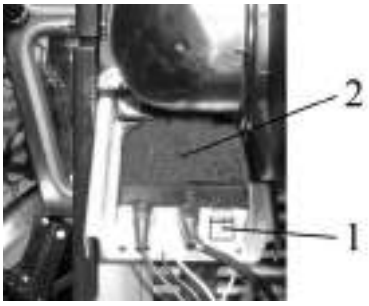


Sixteen fuses (see Figure above) protect the following tractor electrical circuits against overloads:

1 — Braking signal (15 A);
2 — Cab lamp, roadtrain rear operating headlights (15 A);
3 — emergency stop signaling (15 A);
4 — Windshield and rear window wipers and window washer (25 A);
5 — Horn (15 A);
6 — Headlight upper beam (25 A);
7 — Front operating headlights (25 A);
8 — Heater fan, rear PTO control system and turning on the rear axle differential lock (25 A);
9 — Power supply to consumers working with the starter and instrument switch in the “instruments ON” position (25 A);
10 — Air conditioner control (for BELARUS-1025.3 tractors if an air conditioner is installed on request instead of the heater) (25 A);
11 — Left clearance lamps (7.5 A);
12 — Right clearance lamps and instrument panel illumination (15 A);
13 — Right headlight lower beam (7.5 A);
14 — Left headlight lower beam (7.5 A);
15 — Instruments and speed sensors power supply (7.5 A);
16 — Turn indicators relay switch (for tractors BELARUS-1025.3 — also power supply of the SP unit and the SP relay switch winding) (15 A).

A battery voltage charge circuit fuse with 60 A rating is located on a bracket mounted on the body of the HLL oil tank

The fuse (1) (see Figure below) with 20 A rating for charging of an extra battery, which is only used to start the engine 24 V, is integrated into the body of the voltage changer (2).

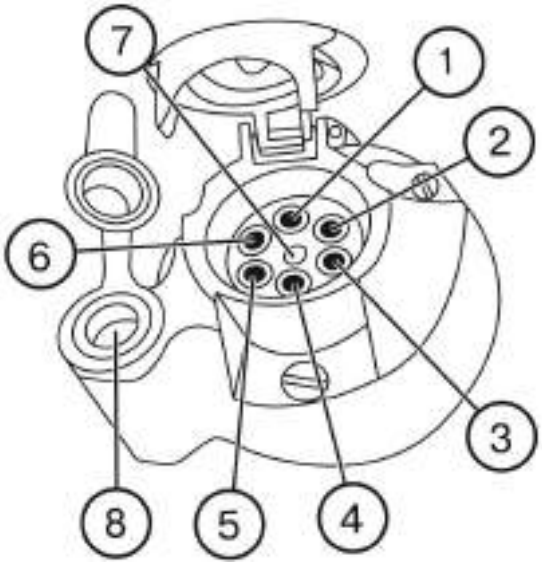


1 — fuse, 2 — voltage changer.

Warning!To avoid burnout of the tractor wiring, never use fuses of a higher current rating that indicated above. If the fuse blows frequently, find the cause and fix the problem.

3.4 Electric equipment connecting devices

To connect current consumers of a transport machine or trailed agricultural implements, a standard seven-pin socket is used. Mounted on the rear cab support. To the socket, the plug of the wire harness of the linked machines is connected.

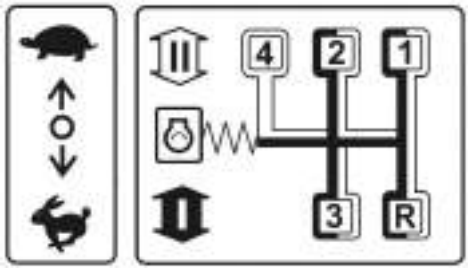


Socket terminal labeling:
1. Lever turn indicator;
2. Horn;
3. Ground
4. Right turn indicator;
5. Right clearance lamp;
6. Stop signal;
7. Left clearance lamp;
8. Connecting a portable lamp and other consumers with a current load up to 8 A.

3.5 Gearbox control

With single lever control, the gears are shifted by the lever (1) in accordance with the shifting pattern. Before engaging a gear, use the lever (1) to select the desired range.

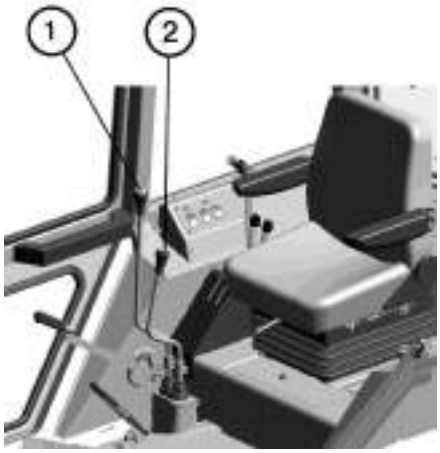
Important! Ranges and gears are engaged by the single lever (1), first the range is selected (I-st or II-nd), then the lever is shifted to the "N" position and the desired gear is selected.



Important! The 4th gear can only be engaged when the II-nd range is selected.

The multiplier lever (2) must be in the ON position: forward — slow gear (L) or backward — overdrive gear (H).

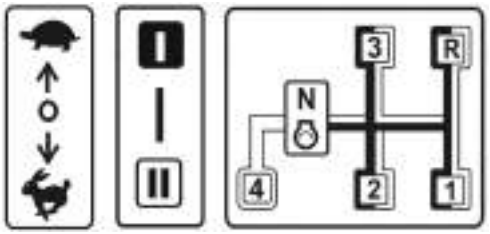
Note: The multiplier (accelerator) lever is fixed in its extreme positions. The multiplier lever can be shifted to its neutral position to facilitate start of the engine during cold season.



Your tractor can be equipped with two-lever GB control

Ranges and gears are shifted by individual levers (1) and (2), as shown on the charts on the left-side figure.

First use the lever (2) to engage a range (I-st or II-nd), then use the lever (1) to engage the required gear.



Important! With two-lever GB control, the 4th gear can only be engaged when the II-nd range is selected.

Important! The 4th gear can only be engaged when the II-nd range is selected.

3.6 Speed reducer control (if installed)

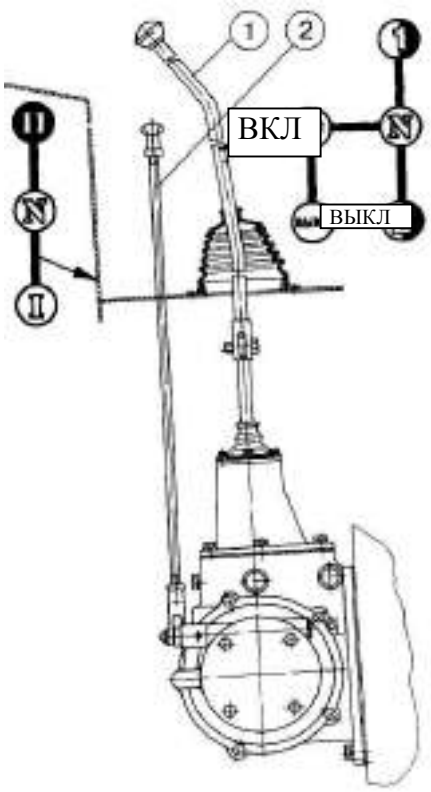
The speed reducer gear lever (1) has five positions (see see the chart on Figure at the right side):

- OFF — off;
- ON — on;
- N — neutral;
- 1 — 1st gear of speed reducer;
- 2 — 2nd gear of speed reducer;

The speed reducer range shift rod (2) has three positions:

- I — firstrange — underdrive gears (lower position);
- II — secondrange — elevated gears (upper position);

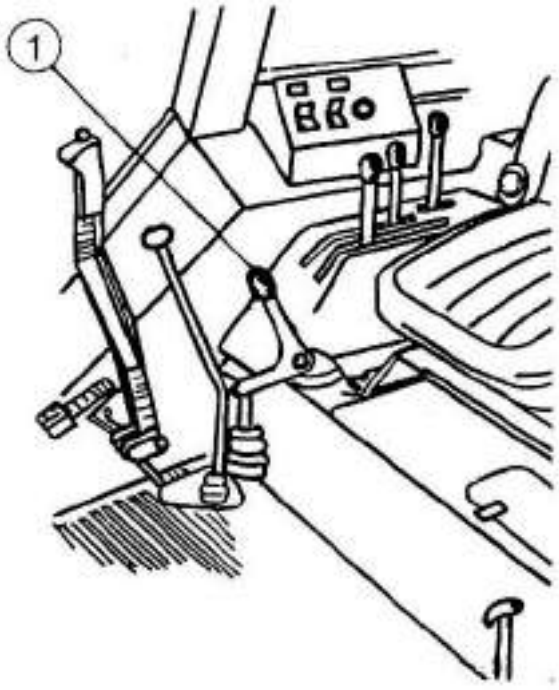
N — Neutral (middle position).



3.7Front driving axle control

The control lever (1) has three fixed positions:

- FDA off — full forward position. Use on the vehicle, when driving on hard-surface roads in order to avoid increased wear of tires;
- FDA on/off automatically — middle position. In this mode, the FDA is automatically engaged and disengaged with a freewheeling clutch, depending on rear wheel slipping. Use when performing various field works.
- FDA on forced — rearmost position. Use this mode only in cases of permanent rear-wheel slip and when driving in reverse, when you want to turn on the FDA.



3.8Rear axle DL and rear PTO control system

Rear PTO control

The rear PTO is engaged by the key switch (4) and the button switch (5) located on the panel above the right control panel. The switch (4) has two fixed positions:

PTO on — when the lower part of the switch key is pressed;

PTO off — when the upper part of the key is pressed;

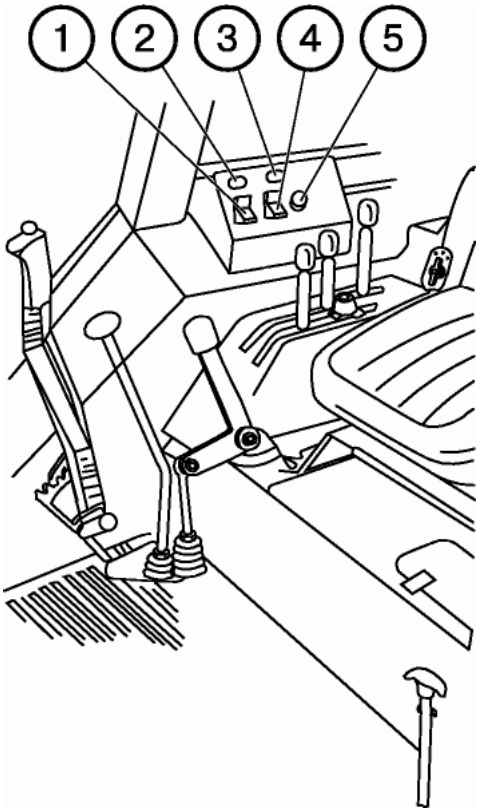
Toturn on thePTO:

- Press thelowerpart of thekey;
- Brieflypressthe buttonswitch(5). The pilot lamp (3) goes on, and the PTO end starts rotating.

To turn off the PTO, press the upper part of the key. The pilot lamp (3) goes off, and the PTO end stops.

Attention: After stopping the engine, the PTO is turned off automatically.

Attention! Turn on the PTO only when the engine is running.



Rear axle differential lock (DL) control

The DL is controlled by the key (1) having three positions:

- DL ON — middle fixed position. Used for transportation works on hard-surface roads.

DL ON automatically — when the upper part of the key (1) is pressed; Fixed position Used when performing operations with significant rear-wheel slip. In automatic mode, the rear wheels are blocked during rectilinear motion, but when the wheel guides are turned to an angle exceeding 13° in any direction, become unblocked.

- forced DL ON — when the lower part of the key is pressed. Non-fixed position Used for short-term lock of the rear wheels when overcoming obstacles. When the key lower part is released, it returns to its middle position. When the DL is engaged, the pilot lamp (2) goes on that goes off when the DL is unlocked in the automatic mode and when the key (1) is set to its middle position.

ATTENTION! Engage the differential lock in high slippage conditions during field and transport works.

IMPORTANT! Disengage the DL when the tractor speed exceeds 15 km/h. Otherwise, this will reduce the power gear service life and impede tractor control. Use positive locking only for a short time to overcome road obstacles.

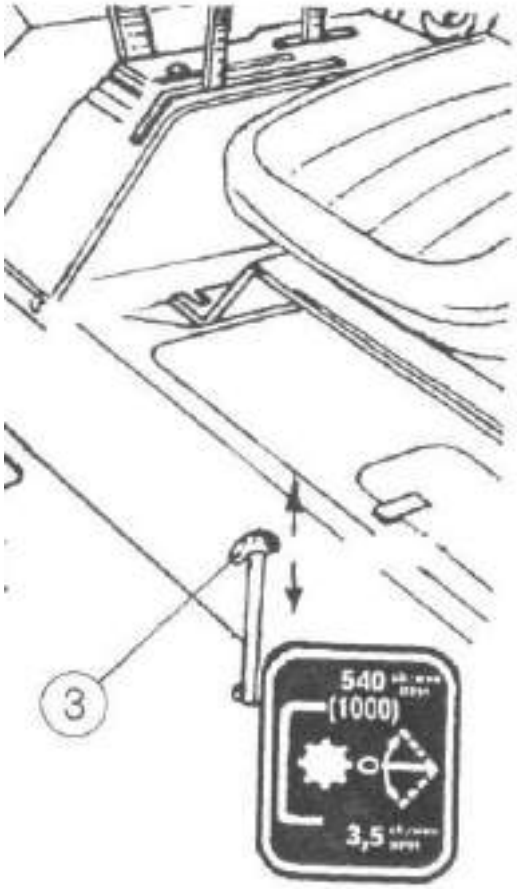
Note — The electric circuit diagram of rear axle DL and FDA control connections is presented in Appendix A of this Manual.

3.9 PTO drive shifters

The PTO independent and synchronous drive shifter

The shifter (3) has three positions:

- PTO independent drive ON — uppermost position;
- PTO synchronous drive OFF — lowermost position;
- Neutral — middle position.



Important!To avoid damage to power gear of the PTO drive:

- do not use the synchronous drive at speeds above 8 km/h.
- when the PTO is not used, the shifter lever (3) must be in the middle position.

Turn on the required PTO drive as follows:

a) independent drive:

- start the engine and set the minimum steady speed;
- move the lever (3) to the uppermost position.

b) synchronous drive:

- start the engine and set the minimum steady speed;
- press the clutch pedal and engage the 1st gear.
- slowly releasing the clutch, simultaneously move the lever (3) to the lowermost position.

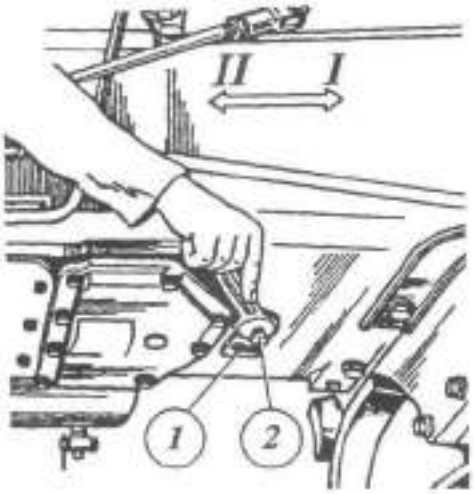
2-speed independent PTO drive shifter

The PTO independent drive drag-bar (1) has two positions:

I — 540 rpm — rightmost position;

II — 1,000 rpm — leftmost position;

To set the desired PTO speed loosen the bolt (2), turn the drag-bar (1) and tighten the bolt (2).



3.10 Control of rear hookup hydraulic pump and distributor (remote power cylinders)

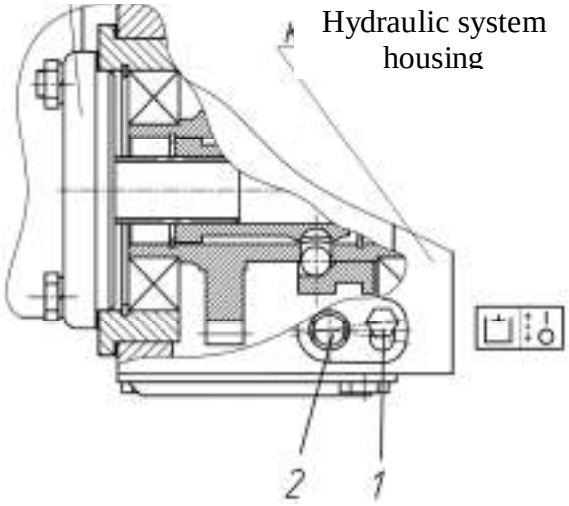
Rear hitch linkage hydraulic system pump control

To turn on the pump, unscrew the bolt (1) by 1…1.5 turns and turn the shaft (2) using a wrench counterclockwise until it stops, then tighten the bolt 1.

Attention!Turn on the pump only at the engine minimum idle speed!

Turn off the pump for cold start of the engine or when performing maintenance operations!

HLL pump



1 — bolt, 2 — shaft

HLL pump control

Note — the figure shows the HLL pump OFF position.

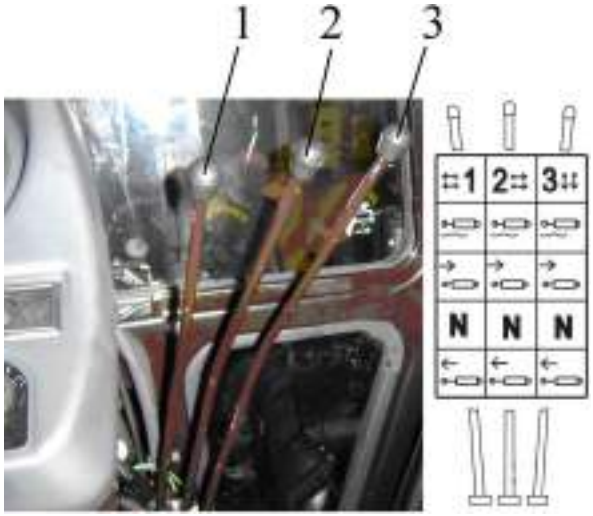
HLL distributor control (remote power cylinders)

Each of the three levers controls the remote power cylinders and has four positions:

- Neutral — lower middle position (fixed).
- Lifting — lower non-fixed position. In the lifting position, hold the lever by hand, when released, the lever automatically returns to the Neutral position;
- Forced lowering — upper middle non-fixed position between the Floating and Neutral positions. In the forced lowering position, hold the lever by hand, when released, the lever automatically returns to the Neutral position;
- Floating — upper fixed position.

The hydraulic system lever control chart is shown in Figure on the right, as well as on the nameplate in the cab chassis on the front glass behind the levers of the distributor.

The chart of location and connection of hydraulic system outputs to external customers is shown in 6.7.6 Intended use of remote power cylinder control hydraulic system of this manual.



1. Hydraulic system left side output control lever;
2. Hydraulic system right side output control lever;
3. Hydraulic system left rear output control lever;

HLL distributor control

3.11 Control of HLL with hydraulic lift

HLL is controlled by two handles (1) and (2) located in the cab on the right control panel.

The draft control handle (1) is located first to the operator's seat and has the following positions:

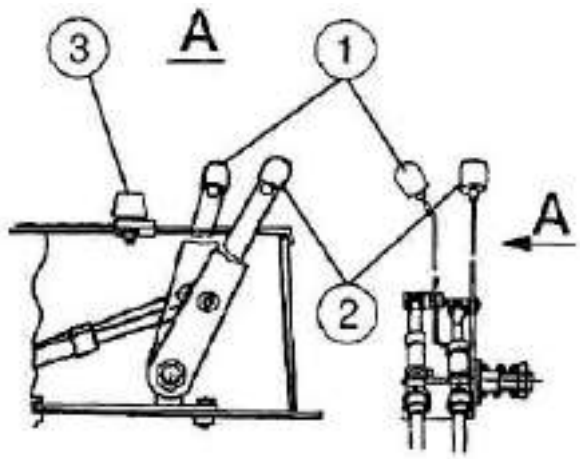
- Foremost — maximum tiling depth ("10");
- Rearmost — minimum tiling depth ("0");

The range of the handle positions is marked with numbers from 0 to 10.

The position control handle (2) has the following positions:

- Rearmost ("0") — RHL transportation position
- Foremost ("10") — minimum height of the implement above the ground.

Maximum implement lifting height by the handle (2) is limited by the adjustable stop (3).



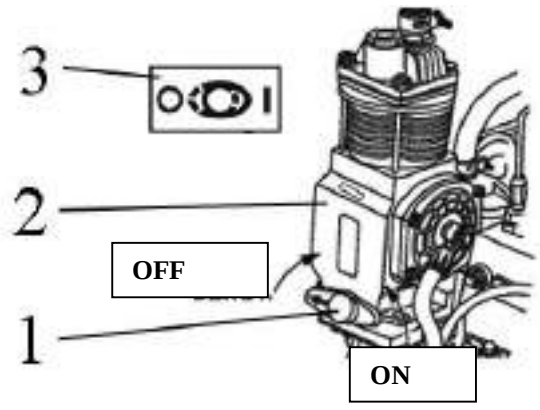
Important: Mixed control is carried out by limiting the depth of implement penetration by the handle (2) when working in the draft control mode.

3.12 Turning on compressor drive

The pneumatic system compressor handle (1) (see Figure at the right) has two positions:

- left (arrow on the handle facing forward along the course of the tractor) — compressor off;
- right (arrow on the handle facing backward) — compressor on;

Attention: turn on the compressor only when the engine is off!



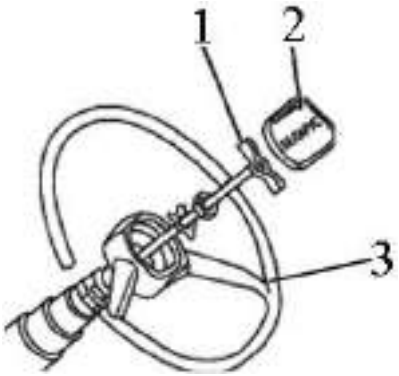
1 — pneumatic system compressor handle;
2 — pneumatic system compressor;
3 — pneumatic system compressor control chart.

Pneumatic system compressor control

3.13 Changing steering wheel position

To change the two-arm steering wheel height position, proceed as follows:

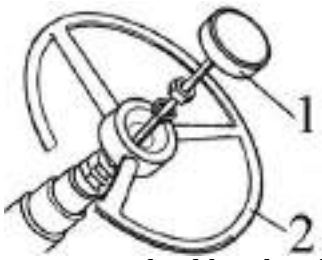
- remove the cover (2);
- unscrew the clamp (1) by 3...5 turns;
- move the steering wheel (3) to the desired position;
- tighten the clamp (1) by hand and put the cover (2) to place.
- the adjustment range of the steering wheel height is 100 mm.



Two-arm steering wheel height adjustment

To change the three-arm steering wheel height position, proceed as follows:

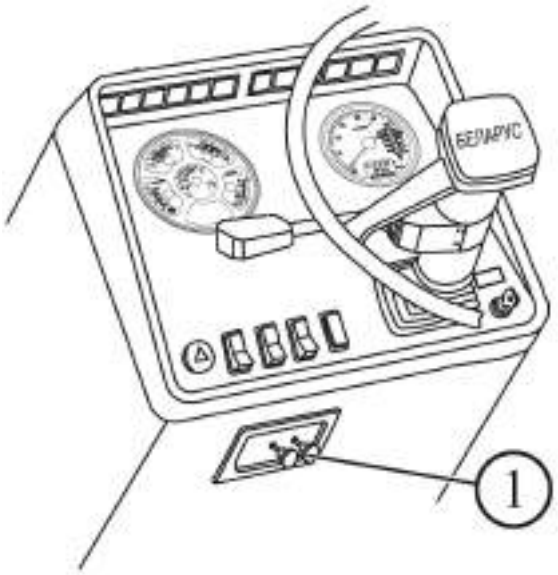
– unscrew the clamp (1) by 3...5 turns;
– move the steering wheel (2) to the desired position;
– tighten the clamp (1) by hand.
– the adjustment range of the steering wheel height is 100 mm.



Three-arm steering wheel height adjustment

The steering column can be tilted and fixed in four positions from 25° to 40° with a 5° step. To tilt the steering column, pull the lever (1), tilt the steering column to a convenient working position, and releasing the lever (1), gently sway the steering column in the longitudinal direction until it fixes securely.

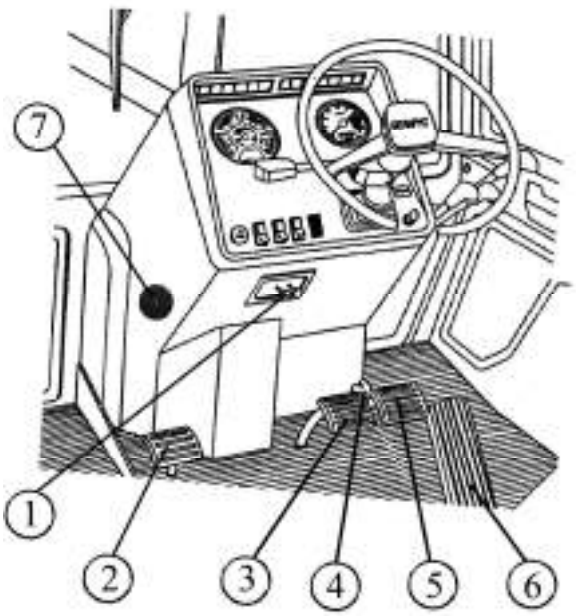
With the steering column fixed in its full forward position, shift the gearshift lever (34) (Figure on page 23) to the Neutral position, then shift it to the leftmost position and, holding it in this position up to the full start of the engine, start the engine. Then, with the tractor standing still, make sure the steering operates normally.



3.14 Tractor pedals, engine stop lever, engine cooling system shutter control

Engine stop lever

Pulling the red handle (1) cuts off fuel supply to the engine cylinders, and the engine stops. When the handle (1) is released, action of the spring returns it to its original position.



Clutch pedal

When the pedal (2) is pressed, the clutch is disengaged.

Left brake pedal

When the pedal (3) is pressed, the left rear wheel is braked.

Right brake pedal

When the pedal (5) is pressed, the right rear wheel is braked, simultaneously when the pedal (5) is pressed, the brake valve of the trailer brake pneumatic drive operates.

Note — if the parking brake control lever (linkage) is located under operator's left arm, the trailer pneumatic drive brake valve operates when the left brake pedal (3) is pressed.

The brake pedal connection plate (4) is designed for simultaneous action of the right and left brakes.

Fuel control pedal

When the pedal (6) is pressed, the engine speed increases.

Engine cooling system shutter control

(Installed only on BELARUS-1021 tractors)

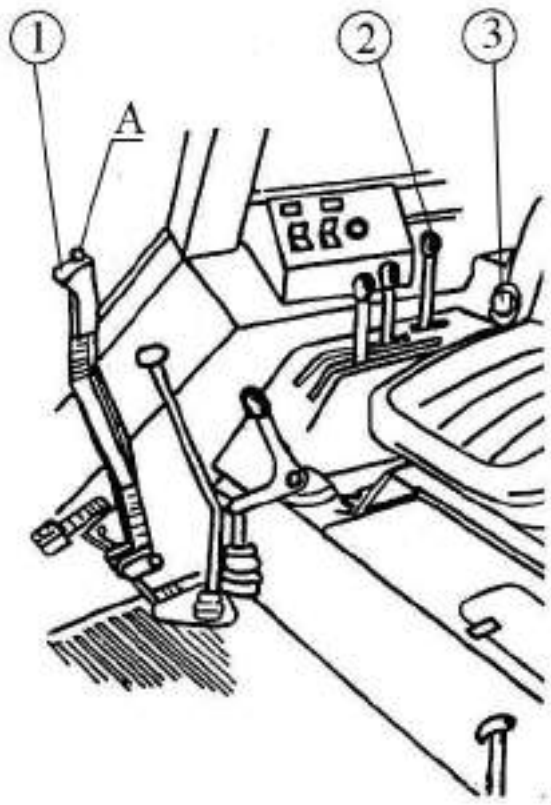
When starting and warming up a cold engine, the shutter is raised by rotating the knob (7) clockwise. To decrease the coolant temperature, the shutter is lowered by pressing on the knob along its axis.

3.15 Ground switch, fuel supply control lever, parking brake control.

Ground switch

(Installed only on BELARUS-1021 tractors)

When the button (3) is pressed, the battery is ON. When pressed again, the battery is OFF.



Fuel control lever

When the lever (2) is moved forward along the course of the tractor, fuel supply increases, when the lever (2) is moved back, the fuel supply is reduced. The full forward position — maximum fuel supply, the rearmost position of the lever (2) — minimum fuel supply corresponding to the minimum idle speed.

Parking brake control lever (option with the location under operator's right hand).

The uppermost position of the lever (1) — the parking brake engaged;

The lowermost position of the lever — the parking brake disengaged;

To disengage the parking brake, press the A button on the control lever and push the lever down until it stops.

Figure on the left shows the parking brake control lever (1) in the Engaged position.

Parking brake control linkage (option with the location under operator's left hand).

Parking brake engaged — uppermost position of the linkage (4).

Parking brake disengaged — lowermost position of the linkage (4).

Figure on the left shows the parking brake control linkage (4) in the Disengaged position.

3.16 Cab heater control

When turning on the heater, proceed as follows:

1. After refilling the engine cooling system, start the engine and let it work at medium speed to have water warmed up to plus 50 to 60°C, after that open the heater valve by turning the valve knob (1) counterclockwise up to stop. If the heater valve is installed outside the cab, turn the handle (1a). Then increase the engine speed and after 1...2 minutes check the coolant circulating through the heater heat exchanger opening the drain cock plug (5) at the right side of the cab. The heat exchanger must start warming up. The coolant level in the heat exchanger of the engine cooling system will drop at that.

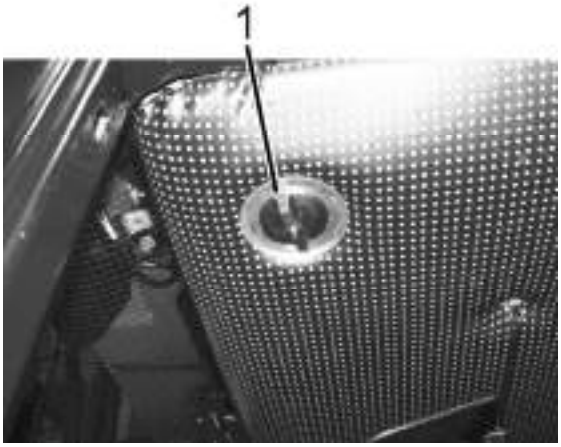
2. Add coolant to the engine cooling system heat exchanger to the required level (50 to 60 below the filler neck upper edge);

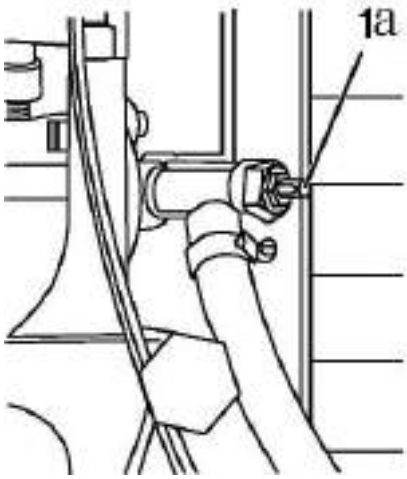
3. Switch on the heater fan with the switch (3) and direct the air flow with the air distributors (4).

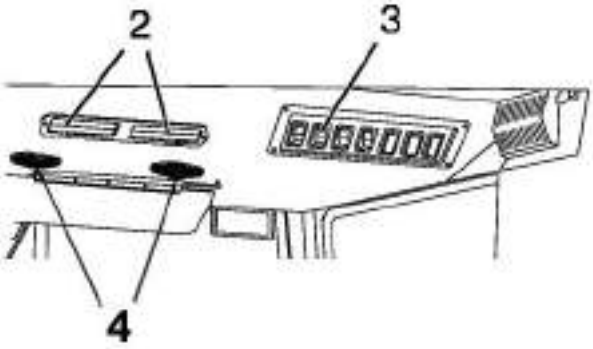
4. By opening the recirculation shutters (2), the amount of fresh air entering the cabin can be controlled.

5. To discharge the coolant from the engine heating system, the drain plugs (5) are provided from the cab left and right sides. After draining the coolant, purge the system with compressed air, first closing the valve on the cylinder block and unscrewing the plug (5). After purging, tighten the plugs.

Attention:for the system operation in the ventilation mode during the warm season, the heater valve must be closed.





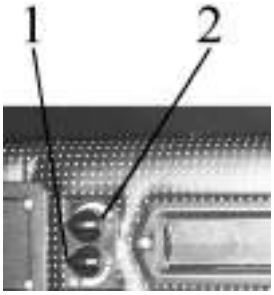


3.17 Cab air conditioning and heating system control

The cab air conditioning and heating system can be installed instead of the heater fan on BELARUS-1021.3 tractors on request.

Climate system control in air conditioning mode

The climate system control panel is in the center of the upper panel of the cab. The control panel has the switches (1) and (2).



\With the switch (1), you can adjust air flow by changing fan speed. With the switch 2, you can change temperature of cold and dry air going out of the deflectors in the air conditioning mode.

Attention:the 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) 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 to 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 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 recirculating 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 in the rear part of the engine and disconnect the heater hoses before the entry to the cab posts.

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.

3.18 Seat and its adjustments

BELARUS-1021/1021.3 tractors can be equipped with the seats Belarus 80-6800010 or 80V-6800000. On request, your tractor can be equipped with a Grammer MSG85/721 seat.

Attention! Before starting work on the tractor, adjust the seat to your convenience. Make all adjustments, when being in the seat. The seat is properly adjusted by weight, if the operator's weight makes it go down by half a travel (the suspension travel 100 mm).

Seat Belarus 80-6800010 / 80V-6800000

The 80-6800010 seat differs from the 80V-6800000 seat by the seating position and an option of furnishing the 80-6800010 seat with armrests and a safety belt.

The seat has the following adjustments:

- by drivers's weight from 50 to 120 kg. Performed by the knob (1). To adjust the seat to a larger weight, shift the knob latch (1) to the position "A" and by reciprocating linear motion tighten the springs. To adjust the seat to a smaller weight, shift the knob latch to the position "B" and by reciprocating linear motion release the springs.

- seat back tilt adjustment from minus 15° to 20° (for 80-6800000 seat). Performed by the knob (3). To increase the seat back tilt, turn the knob clockwise, to decrease, turn it counter-clockwise.

- seat back tilt adjustment from 5° to 25° (for 80V-6800000 seat). Performed by the lever (3). Lift the lever up until it stops, tilt the back and release the lever. The back locks into the required position.

- longitudinal seat adjustment within ± 80 mm from its middle position. Performed by the knob (2). To move the seat back and forth, pull the handle up, move the seat and then release the handle. The seat automatically locks into the required position.

- height adjustment (from 0 to 60 mm). The seat has three positions by height — lower, middle and upper. To transfer the seat from the lower position to the middle one or from the middle to the upper one, smoothly lift the seat until the ratchet mechanism actuates (a distinct click will be heard). To transfer the seat from the upper position to the lower, sharply lift the seat up to stop and release it down.

Attention!You can't transfer the seat from the middle of the lower position.

Seat Belarus 80-6800010

Seat Belarus 80V-6800010

Seat Grammer MSG85/721
(installed on request)

The seat Grammer MSG85/721 has the following adjustments:

- by operators's weight from 50 to 130 kg with weight indication each 10 kg. Performed by the knob (2). To adjust the seat to a larger weight, turn the knob clockwise, to adjust to a lower weight, turn it counter-clockwise.

- seat back tilt adjustment from minus 10° to 35°. Performed by the lever (3). Lift the lever up until it stops, tilt the back and release the lever. The back locks into the required position.

- longitudinal seat adjustment within ± 75 mm from its middle position. Performed by the knob (1). To move the seat back and forth, pull the handle up, move the seat and then release the handle. The seat automatically locks into the required position.

- height adjustment (from 0 to 60 mm). The seat has three positions by height — lower, middle and upper. To transfer the seat from the lower position to the middle one or from the middle to the upper one, smoothly lift the seat until the ratchet mechanism actuates (a distinct click will be heard). To transfer the seat from the upper position to the lower, sharply lift the seat up to stop and release it down.

Attention!You can't transfer the seat from the middle of the lower position.

4. OPERATING INSTRUCTION

4.1 Preparation of tractor to work

4.4.2 Running-in preparation of new tractor

Attention: The first 30 service hours of the tractor have a great impact on its performance and service life, especially its diesel engine.

Your new tractor will work reliably and for a long time subject to proper preparation of the tractor to running-in, correct running-in and performing necessary service operations listed in this section.

Before running-in of the tractor, perform the following operations:

1. Clean the tractor of dust and dirt, remove the preservation grease (if it is on the tractor).
2. Check oil level and add as necessary:
- to diesel engine crankcase;
- hydraulic linkage system HSU tank (for BELARUS-1021 — a common HSU and HLL tank);
- transmission (housings of wet brakes, if installed);
- FDA final drive housing, FDA wheel reduction gear housings, intermediate support.
3. Lubricate:
- clutch release bearing;
- gear brace pinions;
- HSU cylinder joints;
4. Check the storage battery and, if necessary, clean its terminals of oxides and grease them with technical petrolatum, clean the vents, check the degree of discharge.
5. Check and, as necessary, adjust:
- fan drive belt tension;
- air conditioner compressor belt drive tension (if installed);
- tractor control mechanisms;
- air pressure of tires;
- toe-in.
6. Check and tighten up as necessary external threaded connections.
7. Fill coolant into the cooling unit radiator.
8. Listen to the engine operation and check the readings of instruments for compliance with the established standards.

4.1.2 Running-in of tractor

When performing a 30-hour running-in, follow these instructions:

1. Constantly watch the readings of the instruments, operation of the lubrication, cooling and feed systems. Monitor the oil and liquid levels in the refilling tanks.
2. Check tightness and tighten up the external fasteners.
3. Do not overload the engine, do not allow fuming and speed falling. The signs of overloading are a sharp drop in the engine speed, fuming and engine’s failure to react to increased fuel supply. Working on a high gear under load results in excessive wear of the engine friction parts.
4. Working on the tractor on a too low gear with a small load at a high engine speed will result in excessive fuel consumption. Correct choice of the gear for each particular operating condition ensures saving of fuel and reduces wear of the diesel engine.
5. Avoid long operation without a load at the maximum or minimum engine speed.
6. Avoid long operation at a constant engine speed.
7. To ensure proper alignment of friction parts of the clutch during the running-in, engage the clutch more frequently and smoothly.
8. Regularly perform shift-time maintenance operations in accordance with the instructions set forth in the section 5 MAINTENANCE of this Manual.

4.1.3 Tractor maintenance after running-in

After finishing the running-in (after 30 service hours of the tractor), perform the following operations:

1. Inspect and wash the tractor;
2. Start the engine and listen to operation of tractor constituent parts.
3. Check the oil level and, as necessary, add to the hydraulic linkage system and HSU tanks (for BELARUS-1021 — a common HSU and HLL tank);
4. Check the degree of clogging of the engine water heat exchanger. If necessary, clean it.
5. Check the level and, as necessary, add coolant to the engine water heat exchanger.
6. Pour off sediment from the coarse and fine fuel filters and condensate from the pneumatic system cylinder;
7. Change oil:
- in diesel engine crankcase;
- transmission;
- in the FDA final drive housing: FDA wheel reduction gear housings, intermediate support;
8. Change the oil filter of the diesel engine;
9. Check and tighten up as necessary the bolts fastening the cylinder head. Check clearances between the engine valves and rockers;
10. Check and, if necessary, restore tightness of all connections of the air cleaner and the engine air inlet.
11. Check and tighten up as necessary threaded connections fastening the wheels.
13. Check and, as necessary, adjust:
- fan drive belt tension;
- air conditioner compressor belt drive tension (if installed);
- clutch pedal free travel;
- service brake pedal control;
- parking-reserve brake control;
- pneumatic drive brake valve actuator;
- tightness of pneumatic line.
14. Check and, as necessary, tighten most critical external threaded connections of the tractor.
15. Check the storage batteries and, as necessary, perform maintenance of the SB.
16. Check operability of the engine, the lighting and alarm systems, the windshield wiper.

4.2 Preparation to start and engine start

4.2.1 General instructions

Do not work on the tractor indoors if adequate ventilation (air exchange) is not available. exhaust gases can cause death!

Do notrun the engine when the cooling and lubricating systems of the engine not refilled!

Do notoperate the tractor, if with the diesel engine running the emergency oil pressure pilot lamp in the engine is on. Immediately stop the engine!

Attention:the tractor cab is equipped with a bucket seat, and only the operator must be in it!

Attention: start the engine and control the instruments only when seated in the operator's seat!

Attention: Remember that the engine can only be started when the gear shifter is in its neutral position!

Attention: start the diesel engine when towed only in the case of an extreme emergency in order to avoid intensive wear of the diesel engine parts!

Attention: Your tractor has a turbo-charged diesel engine. A high turbocharger speed requires a reliable lubrication when the engine is started. After the engine start for the first moment or after long-time storage, let the engine run for 2...3 minutes at the idle speed before loading it.

4.2.2 Preparation to start and engine start at normal conditions (+4°C and above)

To start the tractor engine, perform the following operations:

1. Engage the tractor parking brake, shifting the lever (linkage) to the uppermost position.

2. Check oil level in the engine crankcase and coolant level in the radiator;

3. Pump through the fuel supply system to remove air from it.

4. Shift the PTO independent and synchronous drive shifter to the neutral position.

5. Set the fuel control lever to its middle position.

6. Perform the following operations:

- with single lever control, pressing the clutch pedal, shift the gear-change and range-change lever to the position of the I-st or II-nd range, release the clutch pedal;

- with two-lever control, pressing the clutch pedal, shift the range-change lever to the position of the I-st or II-nd range and shift the gear-change lever to the Neutral position, release the clutch.

7. Switch on the disconnect switch.

8. Turn the starter and instrument key to the position**"I"**("Instruments ON", a fixed position). At that, in the pilot lamp unit the HSU emergency oil pressure lamp goes on, and the park brake pilot lamp goes on flashing at the frequency of 1 Hz. In the instrument cluster, the engine emergency oil pressure goes on (buzzer heard), as well as the emergency air pressure lamp (if it is below the allowable), the second storage battery pilot lamp, the fuel reserve pilot lamp (if the fuel in the tanks is at the reserve level).

9. Press the clutch pedal.

10. Turn the starter and instrument key from the position**"I"**to the position**"II"**(engine start). Note: on BELARUS-1021.1 tractors turn the starter and instrument key from the position**"I"**to the position**"II"**for at least three seconds. In such a case, the spark plugs are not switched on, and the spark plug pilot lamp does not go on.

11. Keep the key until the engine starts, but no more than 15 s. If the engine does not start, make a new try to start no sooner than in 30...40 s. If after three attempts the diesel does not start, find the fault and correct it.

12. After starting the engine, release theclutch pedal, check operation of all pilot lamps and instrument readings (coolant temperature, engine oil pressure, storage battery charge, etc). After the engine emergency oil pressure lamp goes off, the buzzer switches off. Let the engine run at 1,000 rpm until the pressure stabilizes in the working range.

13. In the instrument cluster, the second SB charge lamp must go off after the engine start, which indicates that the second battery is charged by 24V via the voltage converter. If the charge pilot lamp does not go off after the engine start continues, this means that the second battery is not charging, it is necessary to correct the fault in the charging chain of the second SB.

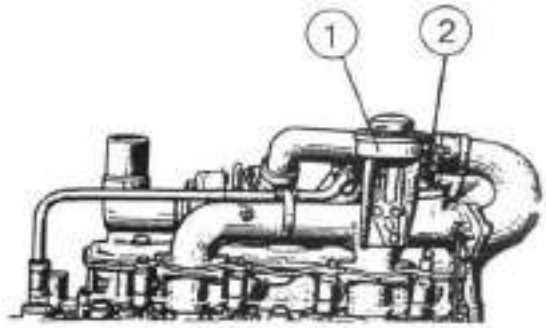
4.2.3 Engine start aid for low temperatures (+4°C and below)

Start preheater

Start preheater is installed on BELARUS-1021 tractors.

Warning: Never use ether starting aids if a start preheater is installed. Use of ether may result in an explosion in the intake manifold and to serious traumas or injuries to the operator. When installing ether starting aids, disconnect and isolate the start preheater wires located at the engine intake manifold.

The start preheater is efficient in the range of ambient temperatures from +4°C to minus 20°C. It consists of the tank (1) with diesel fuel and the heating element (2) consisting of a spark plug, a solenoid-operated valve and a nozzle.



When the SPH is switched on, the glowing plug ignites the fuel in the intake manifold and heats up the intake air going to the cylinders.

Spark plugs

On BELARUS-1021.3 tractor, spark plugs installed in the cylinder head are used as a starting aid. For SP control, a spark plug control unit and a spark plug switch are introduced to the electric circuit. The operator selects the operating mode of the spark plug unit according to the engine or environment temperatures.

The following operating and diagnostic modes of the spark plugs are possible:

1. Starting the engine without switching on the spark plugs (this mode is described in 4.2.2 above).

2. Starting the engine with switching on the spark plugs (this mode is described in 4.2.4 below).

3. Emergency modes.

The emergency modes are tracked by the spark plug unit, information is presented by periodic, with various frequency, flashing of the SP pilot lamp. The spark plug unit diagnoses the following emergency modes:

- if the spark plugs do not go off after completion of the full cycle of work as specified in 4.2.4 (possible sticking of the relay switch contacts or a mechanical failure), the pilot lamp goes on flashing with the frequency of 2 Hz until the terminal voltage is removed;

- if during operation of the spark plugs in the mode of starting the engine with the spark plugs on, the voltage is not supplied to the SPs, the pilot lamp goes on flashing with the frequency of one flash per 3 seconds;

- when the supply voltage of the spark plug unit exceeds 16V, the electronic module is switched off.

4.2.4 Preparation to start and engine start at low temperatures (+4°C and below)

BELARUS-1021 with a start preheater

To start the engine of the BELARUS-1021 tractor at low temperatures, perform the following operations:

1. Engage the tractor parking brake, shifting the lever (linkage) to the uppermost position.
2. Fill the start preheater tank with diesel fuel or kerosene.
3. Turn off the hydraulic system oil pump drive to reduce resistance to crankshaft cranking.
4. Lift (close) the water heat exchanger shutter for rapid heating of the diesel.
5. Check oil level in the engine crankcase and coolant level in the radiator;
6. Pump through the fuel supply system to remove air from it.
7. Shift the PTO independent and synchronous drive shifter to the neutral position.
8. Set the fuel control lever to its middle position.
9. Perform the following operations:
- with single lever control, pressing the clutch pedal, shift the gear-change and range-change lever to the position of the I-st or II-nd range, release the clutch pedal;
- with two-lever control, pressing the clutch pedal, shift the range-change lever to the position of the I-st or II-nd range and shift the gear-change lever to the Neutral position, release the clutch;
10. Switch on the disconnect switch.
11. Turn the starter and instrument key to the position **"I"** ("Instruments ON", a fixed position). At that, in the pilot lamp unit the HSU emergency oil pressure lamp goes on, and the park brake pilot lamp goes on flashing at the frequency of 1 Hz. In the instrument cluster, the engine emergency oil pressure goes on (buzzer heard), as well as the emergency air pressure lamp (if it is below the allowable), the second storage battery pilot lamp, the fuel reserve pilot lamp (if the fuel in the tanks is at the reserve level).
12. Press the SPH switch key. At that in the pilot lamp unit, the SPH pilot lamp goes on indicating that the SPH spiral switches on and warms up. As soon as the SPH pilot lamp starts flashing, the engine is ready for start (the spiral is hot to heat up the intake air going to the engine cylinders).
13. Press the clutch pedal.
14. Turn the starter and instrument key from the position **"I"** to the position **"II"** (engine start) and hold it in this position up to start but no more than 15 s. At that, keep the SPH switch key pressed. If the engine does not start, make a new try to start no sooner than in 30...40 s. If after three attempts the diesel does not start, find the fault and correct it.
15. After starting the engine, release the clutch pedal, release the SPH switch key, check operation of all pilot lamps and instrument readings (coolant temperature, engine oil pressure, storage battery charge, etc). After the engine emergency oil pressure lamp goes off, the buzzer switches off. Let the engine run at 1,000 rpm until the pressure stabilizes in the working range.
16. Adjust the position the water heat exchanger shutter to maintain normal temperature condition.
17. In the instrument cluster, the second SB charge lamp must go off after the engine start, which indicates that the second battery is charged by 24V via the voltage converter. If the charge pilot lamp does not go off after the engine start continues, this means that the second battery is not charging, it is necessary to correct the fault in the charging chain of the second SB.

BELARUS-1021.3 with spark plugs

To start the engine of the BELARUS-1021.3 tractor at low temperatures, perform the following operations:

1. Engage the tractor parking brake, shifting the lever (linkage) to the uppermost position.

2. Turn off the hydraulic system oil pump drive to reduce resistance to crankshaft cranking.

3. Check oil level in the engine crankcase and coolant level in the radiator;

4. Pump through the fuel supply system to remove air from it.

5. Shift the PTO independent and synchronous drive shifter to the neutral position.

6. Set the fuel control lever to its middle position.

7. Perform the following operations:

- with single lever control, pressing the clutch pedal, shift the gear-change and range-change lever to the position of the I-st or II-nd range, release the clutch pedal;

- with two-lever control, pressing the clutch pedal, shift the range-change lever to the position of the I-st or II-nd range and shift the gear-change lever to the Neutral position, release the clutch;

8. Switch on the disconnect switch.

9. Turn the starter and instrument key to the position**"I"**("Instruments ON", a fixed position). At that, in the pilot lamp unit the HSU emergency oil pressure lamp goes on, and the park brake pilot lamp goes on flashing at the frequency of 1 Hz. In the instrument cluster, the engine emergency oil pressure goes on (buzzer heard), as well as the emergency air pressure lamp (if it is below the allowable), the second storage battery pilot lamp, the fuel reserve pilot lamp (if the fuel in the tanks is at the reserve level).

10. Switch on the spark plugs.To do that, after switching the starter and instrument switch to the position "I", wait until the spark plugs are switched on (approximately after two seconds after the key is switched to the position "I".

At that:

- on the pilot lamp unit, the spark plug pilot lamp goes on and glows continuously, which indicates that the spark plugs are on.

- when the SP pilot lamp switches from continuous glowing to flashing at the frequency of 1 Hz, start the engine by pressing the clutch pedal and turning the starter and instrument key from the position**"I"**(instruments on) to**"II"**(engine start).

- when there is no attempt to start the engine when the SP lamp is flashing at 1 Hz, the spark plugs and the SP pilot lamp go off.

Note — In emergency modes, when there are failures in the spak plug system, the SP pilot lamp instead of using the algorithm described above starts operating as follows:

a) flashing mode at the frequency of 2 Hz;

b) flashing mode at the frequency of one flash per three seconds.

For a detailed description of emergency modesof operation see 4.2.3 of this manual.

11. Hold the starter and instrument key in the position "II" up to start but no more than 15 s. If the engine does not start, make a new try to start no sooner than in 30...40 s. If after three attempts the diesel does not start, find the fault and correct it.

Note — after the engine starts, the SP pilot lamp goes off, but the spark plugs continue operating for three more minutes, and then switch off;

15. After starting the engine, release the clutch pedal, check operation of all pilot lamps and instrument readings (coolant temperature, engine oil pressure, storage battery charge, etc). After the engine emergency oil pressure lamp goes off, the buzzer switches off. Let the engine run at 1,000 rpm until the pressure stabilizes in the working range.

17. In the instrument cluster, the second SB charge lamp must go off after the engine start, which indicates that the second battery is charged by 24V via the voltage converter. If the charge pilot lamp does not go off after the engine start continues, this means that the second battery is not charging, it is necessary to correct the fault in the charging chain of the second SB.

4.3 Setting out tractor. Shifting GB

Before starting travel, determine the required speed of the tractor. A tractor speed chart for standard tires is presented on the instruction plate on the cap right window.

To start movement, proceed as follows:

- fully press the clutch pedal.
- with single-lever control, to engage a range, shift the range and gear shifter from its neutral to the leftmost position, overcoming the resistance of the return spring, and then by shifting the lever (1) longitudinally, engage the required range I or II. After engaging a range, shift the lever longitudinally back to the center, after that the spring will automatically return it to its neutral position (with two-lever control, the desired range is set by a separate lever according to the pattern of range switching);
- select the desired gear by shifting the lever (1) from its neutral position transversely and longitudinally according to the chart.

To engage the 1st gear and reverse, shift the lever (1) to the right, overcoming the lock force. If a gear does not engage immediately, gently release and press the clutch pedal, then engage the desired gear;

To engage the synchronized gears 2, 3, 4 and the multiplier, smoothly, without sharp jerks, move the gear shifter according to the chart and hold it in the pressed position until the gear fully engages.

- set the required multiplier gear. To switch from the higher gear of the multiplier to the lower one, push the multiplier shifter lever (2) forward according to the multiplier shift chart. To switch from the lower gear to the higher one, pull it back.
- disengage the parking brake, smoothly release the clutch pedal simultaneously increasing diesel fuel supply, and the tractor starts moving.

Shifting the GB with single-lever control and a multiplier (accelerator);

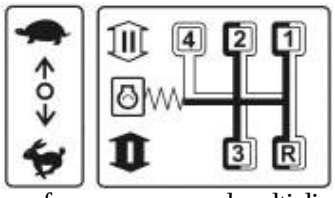


Chart of shifting of ranges, gears and multiplier gears of GB with single-lever control

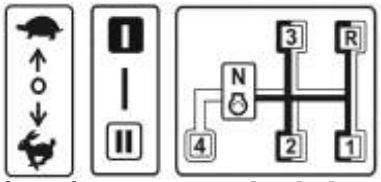


Chart of shifting of ranges, gears and multiplier gears of GB with two-lever control

ATTENTION:

1. Shift gears and GB ranges only when the tractor is stopped and the clutch is disengaged!

2. The GB range reducer has no fixed neutral position of the drive pinion of the reducer Ist gear, thus, in the range reducer either the Ist or the IInd reducer gear must be always engaged!

3. The 4th gear can only be engaged when the IInd range is selected!

4. Do not use the R reverse gear in the traction mode!

5. The multiplier has no fixed neutral position, thus, in the multiplier either the higher or the lower gear must be always engaged! The multiplier lever can be shifted to its neutral (non-fixed) position only to facilitate start of the engine during cold season!

6. Shift the multiplier gears at any GB gear and only when the tractor is stopped and the clutch is disengaged!

7. While working on the tractor, do not keep your foot on the clutch pedal. This will avoid slipping of the clutch, which results in its overheating or premature failure.

4.4 Stopping tractor

To stop the tractor, proceed as follows:
- reduce the engine crankshaft speed;
- press the clutch pedal.
- shift the gearbox shifter lever to the neutral position;
- release the clutch pedal.
- stop the tractor using the service brake;
- engage the parking brake.

Attention: To stop the tractor in an emergency situation, simultaneously press the clutch andinterlocked brake pedals.

4.5 Diesel engine stop

Attention! Before stopping the engine, lower the implement to the ground, let the engine work at 1,000 rpm for one to two minutes. This will reduce the engine and turbocharger temperature and avoid turbocharger operation by inertia without adequate lubrication.

To stop the diesel engine, proceed as follows:

— engage the PTO and shift the PTO independent and synchronous drive shifter to the neutral position.

— shift all levers of the hydraulic linkage system distributor to the neutral position;

— lower the implement to the ground;

— set the fuel control lever to the position of minimum fuel supply;

— pull the engine stop cable handle;

— switch off the disconnect switch.

4.6 Steering

Attention! BELARUS-1021/1021.3 tractor have a with hydrostatic steering unit. If the diesel engine is stopped, the oil pump driven from the diesel engine crankshaft does not power the hydraulic steering system, and it automatically switches to the manual mode, which requires a greater force on the steering wheel to turn the tractor.

4.7 Power takeoff shaft (PTO)

Attention: At a speed of the shaft end of 540 rpm, power take-off through the PTO shaft must not exceed 60 kW. To avoid shock loads, engage the PTO at an engine speed close to minimum about (900 rpm), then increase the diesel engine speed!

There are two shaft ends with 6 and 8 straight-sided splines and a shaft end with 21 involute splines.

When working with an 8 or 6 spline end, set the PTO drive to 540 rpm. When working with a 21 spline end, set the PTO drive to 1,000 rpm.

To work with the PTO, remove the cap (3) (see Fig. below), to do that, compress the cap at its base and pull it down and on. After working with the PTO, make sure to install the cap to place, to do that, put the cap onto the end and press on it longitudinally to secure the cap in the enclosure hole (2).

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

Replacing PTO end

To replace the end, proceed as follows:

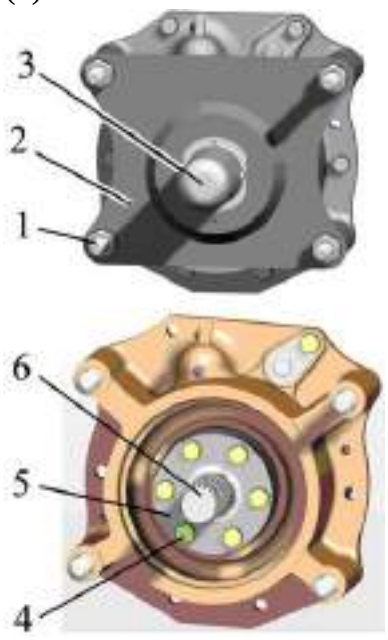
— remove the cap (3), unscrew the nuts (1) and remove the enclosure (2);

— unscrew the bolts (4) and remove the plate (5);

— remove the end (6);

— install the other shaft in the splined hole, greasing the center pilot,

— install the plate (5), tighten up the bolts (4), install the enclosure (2) and secure it with the nuts (1).



4.8 Operation of tractor equipped with speed reducer

If your tractor is equipped with a speed reducer or hydraulic speed reducer, follow the instructions below.

Before you start driving:

1. Set the engine minimum idle speed.
2. Shift the gearbox shifter lever (3) to the neutral position;
3. Set the speed reducer controls as follows:

— the speed reducer gear shifter (1) to "ON";

— the range rod (2) to the speed reducer position "N" (neutral).

To set out the tractor.

1. Press the clutch pedal.
2. Shift the speed reducer gear shifter from "ON" to the neutral position;
3. Set the required speed reducer gear in accordance with the chart in the speed reducer operating manual.
4. Set the required speed reducer gear range in accordance with the chart in the speed reducer operating manual.
5. Engage the GB first gear in the GB I-st or II-nd range;
6. Slowly release the clutch pedal. If necessary, increase fuel supply.
7. Adjust the tractor speed by changing the fuel supply.

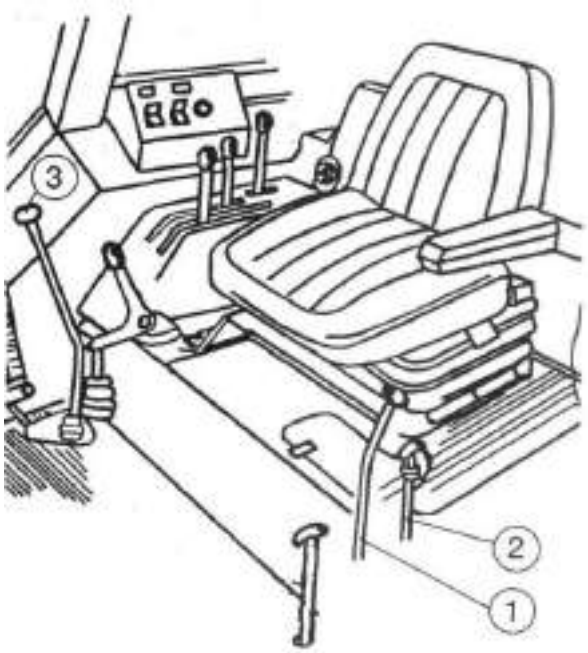
Switching speed reducer gears

1. Set the engine minimum idle speed.
2. Press the clutch pedal.
3. Wait for 5...10 s and shift the GB shifter lever to the neutral position.
4. Set the required speed reducer gear in accordance with the chart in the speed reducer operating manual.
5. Set the required speed reducer gear range in accordance with the chart in the speed reducer operating manual.
6. Engage the first GB gear.
7. Slowly release the clutch pedal.
8. Adjust the travel speed by the foot or hand fuel supply control.

Stopping tractor

1. Set the engine minimum idle speed.
2. Press the clutch pedal.
3. Wait for 5...10 s and shift the gearbox shifter lever to the neutral position;
4. Stop the tractor using the service brake.
5. Engage the parking brake.
6. Shift the speed reducer gear shifter, the speed reducer range rod to the neutral position;

Note — If your tractor is equipped with a speed reducer or hydraulic speed reducer, the tractor is supplied with a MCG (HCG) operating manual.



4.9 Hydraulic linkage system

General information

The hydraulic linkage system is equipped with a hydraulic lift and provides operation of the rear hitch linkage in the following modes:

- rising the hitch and its lowering by gravity;
- position control (automatically holding the hitch in a set position relative to the tractor);
- draft control (tiling depth control depending on soil resistance);
- mixed control (tiling depth control by soil resistance soil with limiting the maximum depth by 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 implements on even fields. Use of the position control on fields with uneven surfaces is limited because of unavoidable vertical displacements of the implement while driving the tractor on field unevennesses.

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.

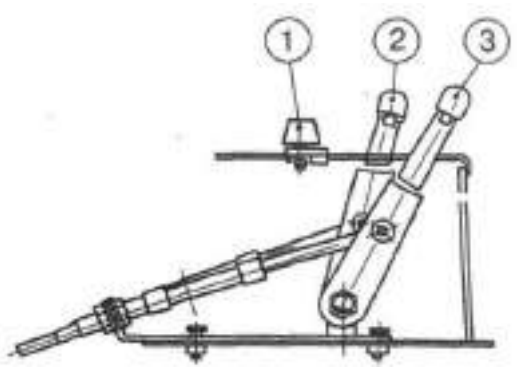
Mixed control.

If, due to uneven density of the soil draft control does not let reach a constant tillage depth, increase in depth over a set value should be limited with position control.

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 “0” on the control panel corresponds to the RHL transport position, and the number “10” to the minimum implement height above the ground. If you need to limit the maximum lifting height (for example, because of possibility of rear PTO parts failure), use the handle (3) to set the maximum lifting height and move the adjustable stop (1) to it.

Draft control

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

1. Shift the draft control handle (2) to its leftmost position along the course of the tractor (figure “10” on the panel).
2. Using the position control handle (3), link the instrument to the RHL.
3. Upon entry into the furrow, shift the lever (3) to its forward position and use the handle (2) to adjust the desired tillage depth.
4. When exiting and subsequently entering the furrow (while plowing), use only the positional control lever (3), do not shift the draft control handle (2).
5. 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.

Mixed control

The degree of mixing signals from two sensors (draft and position) is determined by the handles (2) and (3).

5. ADJUSTMENTS

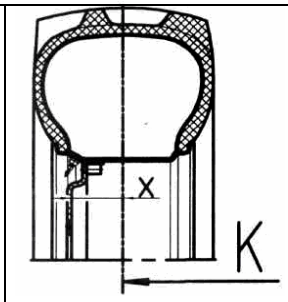
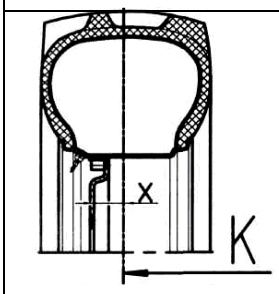
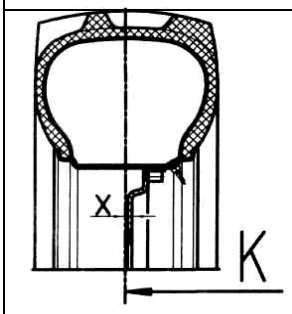
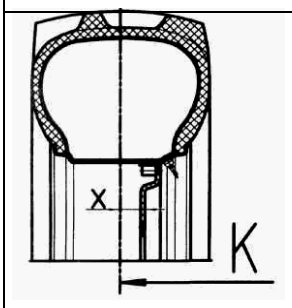
5.1 Setting front wheel track

Changing the front wheel track is made in steps, both by swapping the wheels from side to side, and due by changing the position of the wheel disk relative to the rim.

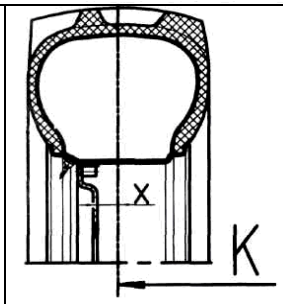
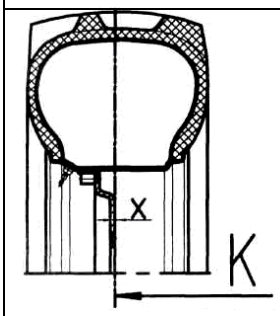
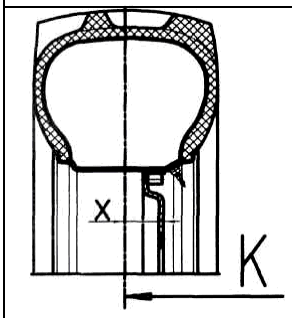
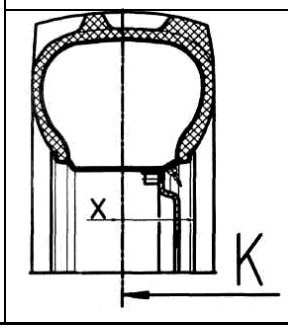
The front wheel track can have the following values in mm.: 1,415, 1,515, 1,585, 1,685, 1,735, 1,835, 1,900, 2,000 (for the short beam), and 1,535, 1,635, 1,705, 1,805, 1,855, 1,955, 2,020, 2,120 (for the long beam).

Table below presents patterns of installation and track sizes for tires 360/70R24 (standard).

Table — Changing front wheel track

Variants of disk and rim installation		Disk offset X, mm	Tractor rack K, mm (360/70R24 tire)		Method of installation
			Short beam	Long beam	
Standard installation of the disk with swapping the rim		+ 140	1,415	1,535	Main position. The disc mated with its inner surface to the reducer flange and is situated on the outer side of the wheel support.
		+ 90	1,515	1,635	**As delivered from the factory.** The rim is transposed relative to the disk. The support is mated with the disk with its inner surface.
		−18	1,735	1,855	The rim is rotated by 180 degrees. The disk is mated with the inner surface of the support.
		−68	1,835	1,955	The rim is rotated by 180 degrees. The disk is mated with the outer surface of the support.

Table, continued

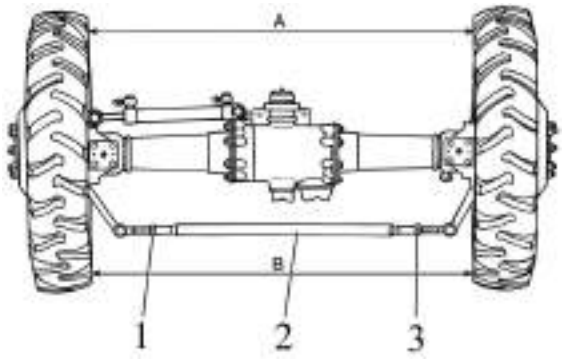
Variants of disk and rim installation		Disk offset X, mm	Tractor rack K, mm (360/70R24 tire)		Method of installation
			Short beam	Long beam	
Swapping the disk and the rim		+ 56	1,585	1,705	The disk is mated with the outer surface of the support.
		+ 6	1,685	1,805	The disk is mated with the inner surface of the support.
		−102	1,900	2,020	The rim is rotated by 180 degrees. The disk is mated with the inner surface of the support.
		−152	2,000	2.120	The rim is rotated by 180 degrees. The disk is mated with the outer surface of the support.

To adjust the track, perform the following operations:

- brake the tractor using the parking brake. Put stops before and after the rear wheels;
- jack up the front of the tractor (or the front wheels in turn), providing a clearance between the wheels and the ground;
- remove the front wheels;
- unscrew the nuts fastening the wheel disk to the reducer flange (to obtain a track by turning the wheel from side to side);
- unscrew the nuts fastening the wheel rim to the disk;
- depending on the desired track, set the corresponding relative position of the rim and disk as shown on the chart in the table above. At that, make sure that the direction of rotation of the wheels coincide with the direction of the arrow on the tire sidewall.
- when swapping the wheels, tighten the nuts fastening the disks to the flanges to a torque of 200 to 250 N•m, the nuts fastening the disks to the rim carriers to a torque of 180 to 240 N•m

5.2 Checking and adjusting toe-in

Attention — 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.



1, 3 — nut, 2 — steering rod adjusting tube.

Checking and adjusting toe-in

To check and, if necessary, adjust the toe-in of the BELARUS -1021/1021.3 tractors, proceed as follows:

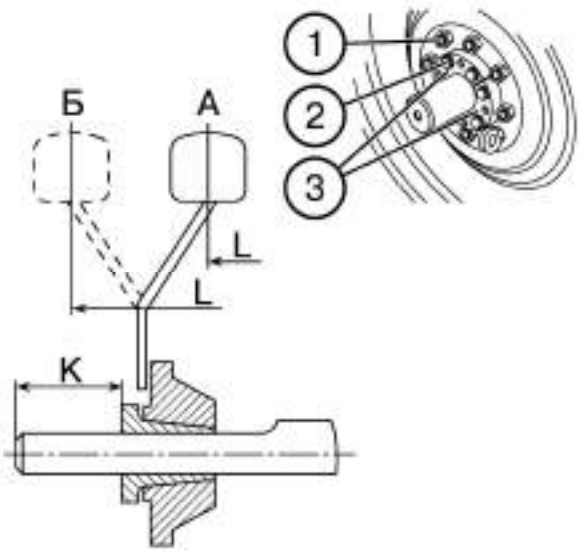
- set the required tire pressure in accordance with the instructions in Table Standards of loads on tires to choose mode at various internal pressures in 6.10 of **6 UNITIZING**;
- on a flat site, drive the tractor forward at least 3 meters and stop. Engage the parking brake.
- measure the distance B 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 in the measurement of the size B. The toe-in is correct if the dimension A is 0 to 8 mm less than the dimension B. If the toe-in does not meet these values, procede as follows:

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

5.3 Setting rear wheel track

To set the rear wheel track, proceed as follows:

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.



1 — nut, 2 — tie bolt; 3 — liner.

Patter of setting rear wheel track

Table — Setting rear wheel track for tires 16.9R38

Track L, mm		
Distance K, mm	Wheel installation pattern	
(for tires 16.9R38)	A	B
133	1,650	—
58	1,800	—
222	—	2,000
147	—	2,150

Table — Setting rear wheel track for tires 11.2R42

Track L, mm		
Distance K, mm	Wheel installation pattern	
(for tires 11.2R42)	A	B
245	1,420	—
205	1,500	—
155	1,600	—
55	1,800	—
5	1,900	—
245	—	1,950
220	—	2,000
170	—	2,100

5.4 Setting track for paired rear wheels

Information on setting the track when pairing the rear wheels is given in 6.5.3 Pairing rear wheels of this Manual.

5.5 PTO adjustments

5.5.1 Checking wear of PTO brake band linings

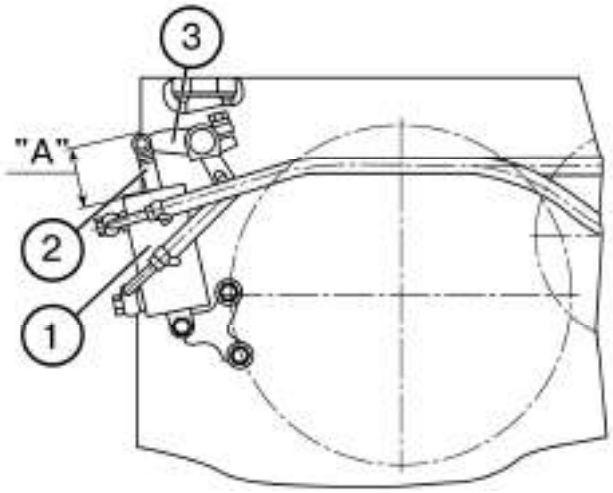
The external sign indicating the degree of wear of PTO brake belt linings and the need for adjustment operations is the size A (Fig. 5.5.1) between the upper point of the rod head (2) and the cylinder cover (1).

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 1 MPa min.

On an adjusted PTO, the size A must be:

- 66 ± 3 mm (PTO ON);
- 46 ± 3 mm (PTO OFF).

If the size A > 80 mm (PTO ON) and A < 32 mm (PTO OFF), as well as if the PTO slips, adjust the band brake clearance.



1 — cylinder, 2 — rod, 3 — lever.

Fig. 5.5.1 — Checking wear of PTO brake band linings

5.5.2 Adjusting clearance in PTO belt brakes

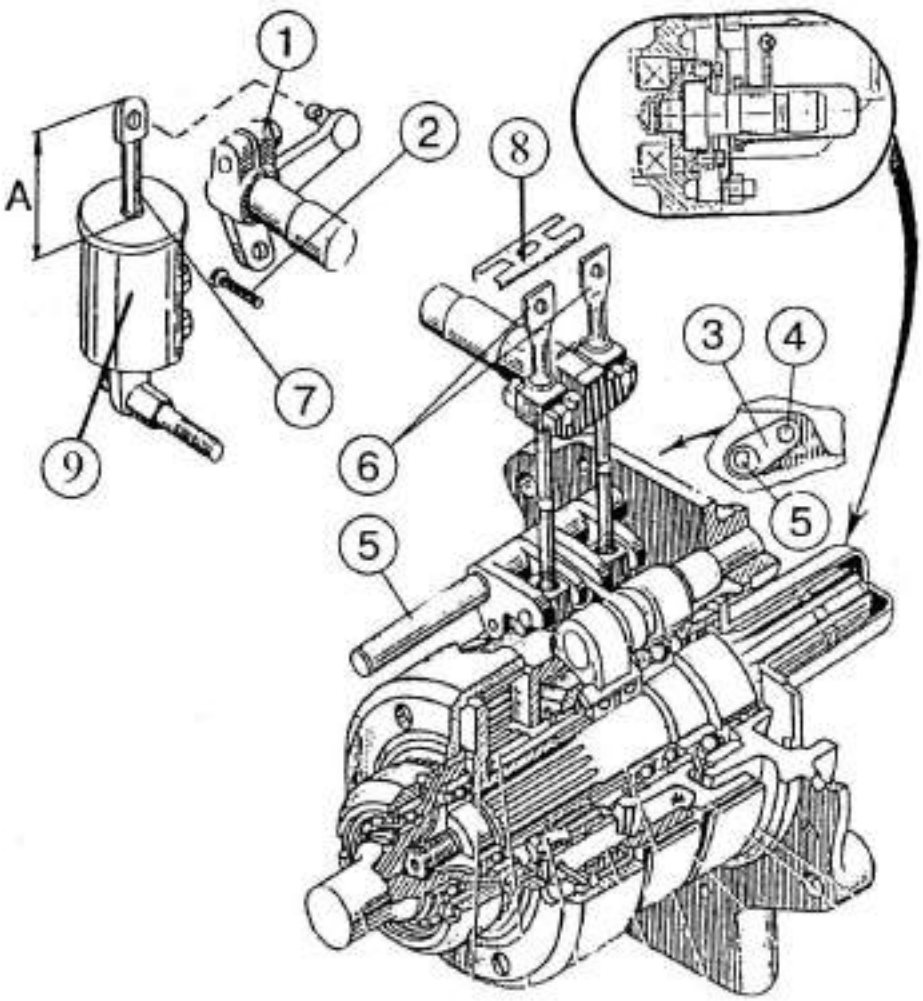
Attention: Adjust the PTO belt brake clearance only in a special workshop.

Adjust the clearance in the PTO belt brakes as follows:

- shift the lever (1) (Fig. 5.5.2) 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. 5.5.1) 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;



1 — lever; 2 — auxiliary bolt; 3 — locking plate; 4 — bolt, 5 — eccentric axle; 6 — adjustment bolts; 7 — rod; 8 — locking plate; 9 — cylinder.

Fig. 5.5.2 — PTO adjustments

5.5.3 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) (Figure 5.5.2) 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, proceed as follows:

- remove the locking plate (3) (Fig. 5.5.2);
- unscrew the bolts (6) by 5…7 turns;
- turn the eccentric shaft (5) of the external adjustment mechanism by 180 ° (at that, the eccentric axle flat will be vertical on the left side);
- install to place the locking plate (3) and secure it with the bolt (4).
- readjust the belt brake clearances as described in 5.5.2 Adjusting clearance in PTO belt brakes of this Manual.
- if the problem persists,replace the PTO belts

5.6 FDA adjustments

5.6.1 Checking and adjusting preload in drive pinion tapered bearings of main drive. Checking and adjusting preload in differential tapered bearings

5.6.1.1 Checking and adjusting preload in drive pinion tapered bearings of main drive

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 5.6.1) of the required thickness.

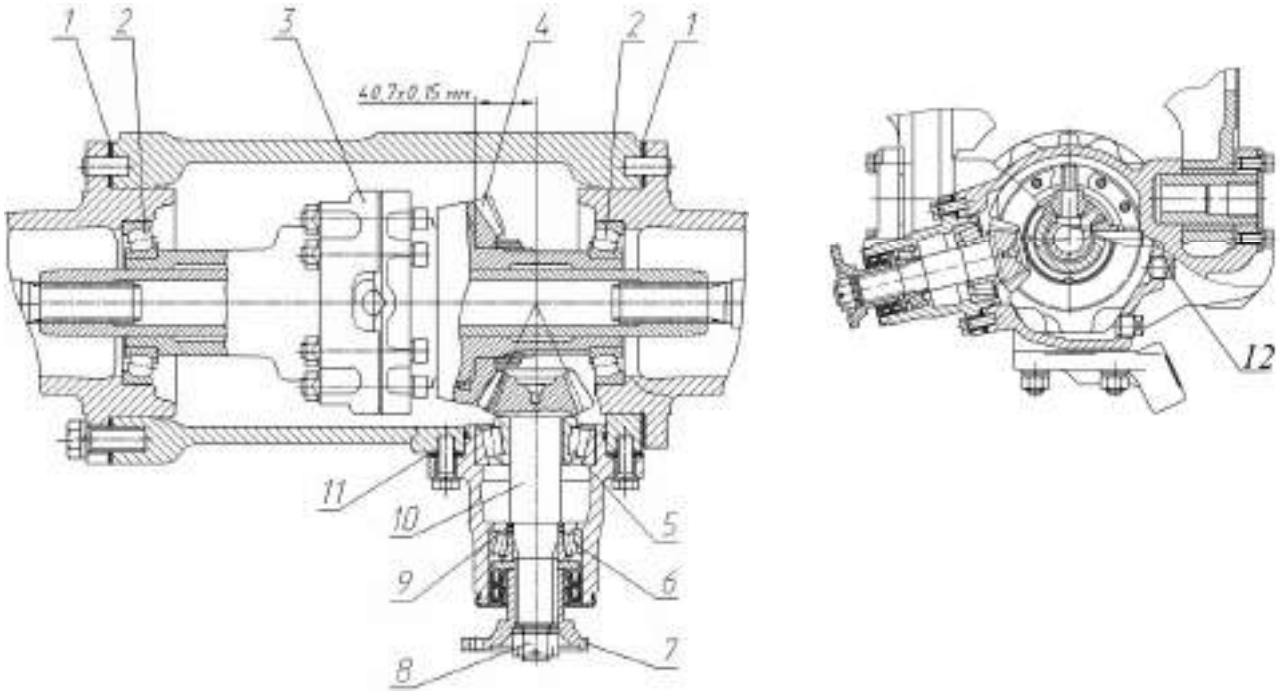
When adjusting:

- tighten up the bearings (5) and (6) wiht the nut (8) (Fig. 5.6.1) to a torque of 120 to 150 N•m When tightening up, rotate the pinion holding by the flange (7) of the driving pinion (10) 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 — driving pinion flange; 8 - nut; 9 — adjusting washers, 10 — driving pinion; 12 — filler cap.

Fig. 5.6.1 — FDA adjustments

5.6.1.2 Checking and adjusting preload in differential tapered bearings

The differential bearing preload must not exceed 0.10 mm. Adjust by installing the respective number of split adjusting shi\ms (1) (Figure 5.6.1) between the flanges of the housing and the sleeves. The diametrically placed shims must have the same thickness. When tightening the bearings with the bolts of the FDA housing, rotate the differential housing so that the bearing rollers get to their correctposition in the bearing races.

In an adjusted unit, the differential must rotate without jamming.

If the bearings are adjusted correctly, the torque of the differential must be from 0.6 to 6.0 N•m, which corresponds to a force from 8.5 to 85 N at the large tooth end of the driven pinion (4);

Adjust as follows:

- install a set of shims (1) under the flange of the left sleeve to provide the dimension of 40.7 ± 0.15 mm from the drive pinion axle to the mounting surface of the driven pinion;

- by selecting the shims (1) under the flange of the right sleeve, set the desired preload.

5.6.2. Checking and adjusting side clearance in main set

Adjust the side clearance in the mesh with the differential bearings are 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 at the radius of holes in the flange (7) of the driving pinion (10).

Adjust using the shims (11) (Figure 5.6.10, 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 (12) (Figure 5.6.1) in the FDA housing. The drive pinion must have no axial play.

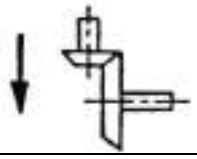
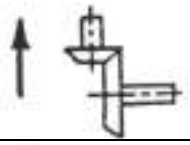
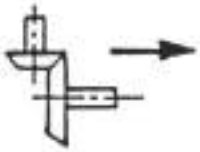
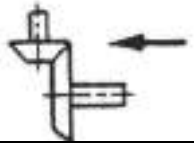
Worn pinions are replaced only in pairs. Do not replace only one pinion, since pinions are produced by the manufacturer in pairs

5.6.3 Mesh (contact pattern)

Adjust using the shims (11) (Figure 5.6.1) 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.	

5.6.4 Checking and adjusting axial preload in pivot tapered bearings

Prior to adjusting the axial preload in the pivot tapered bearings (7) (Figure 5.6.2), 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 (5) fastening the upper pivot axle;
- using the extracting bolts, lift the upper axle (4) (Figure 5.6.2) 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) (Figure 5.6.2) 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) (Figure 5.6.2) 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.

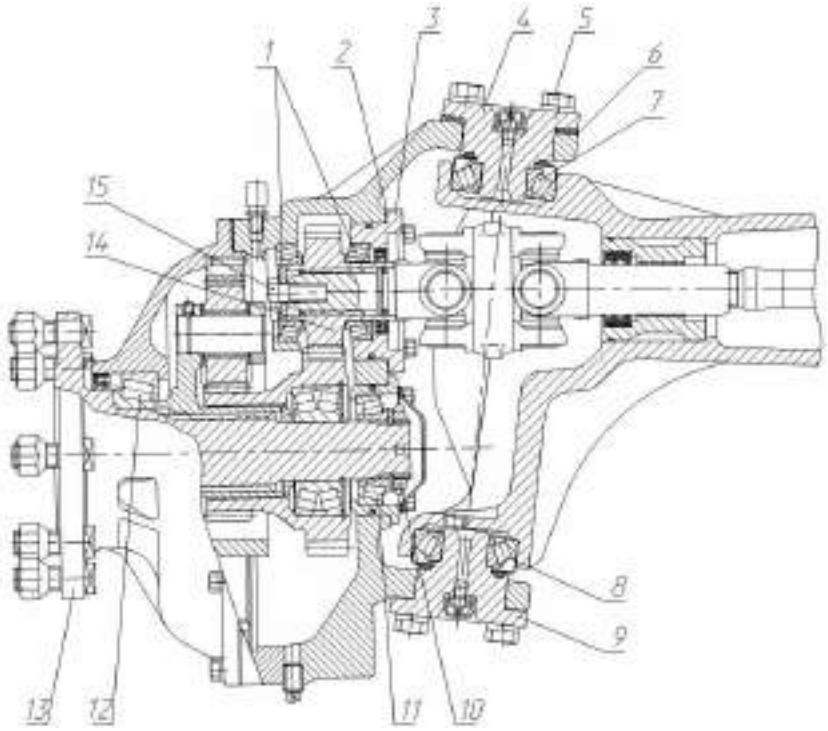
5.6.5 Checking and adjusting axial play in drive pinion tapered bearings of wheel reducer

Check and adjust axial play in the drive pinion tapered bearings (14) (Figure 5.6.2) of the gear set as follows:

Use an indicator to check the axial play in the tapered bearings (1) (Figure 5.6.2) 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) (Figure 5.6.2).
- using the extracting bolts, move away the barrel (3) and removing the adjusting shims (2) (Figure 5.6.2) 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. 5.6.2 — FDA adjustments made during maintenance

5.6.6 Checking axial play and adjusting wheel flange tapered bearings

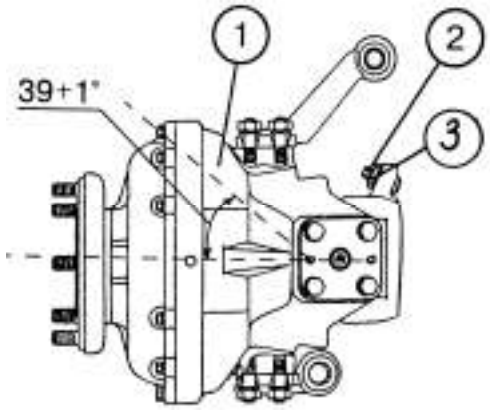
Use an indicator to check the axial play in the tapered bearings (11), (12) (Figure 5.6.2) measuring the displacement of the flange (13).

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) (Figure 5.6.2);
- 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.

5.6.7. Adjusting FDA reducer turn angle

The maximum rotation angle of the reducer housing (1) (Figure 5.6.3) 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.

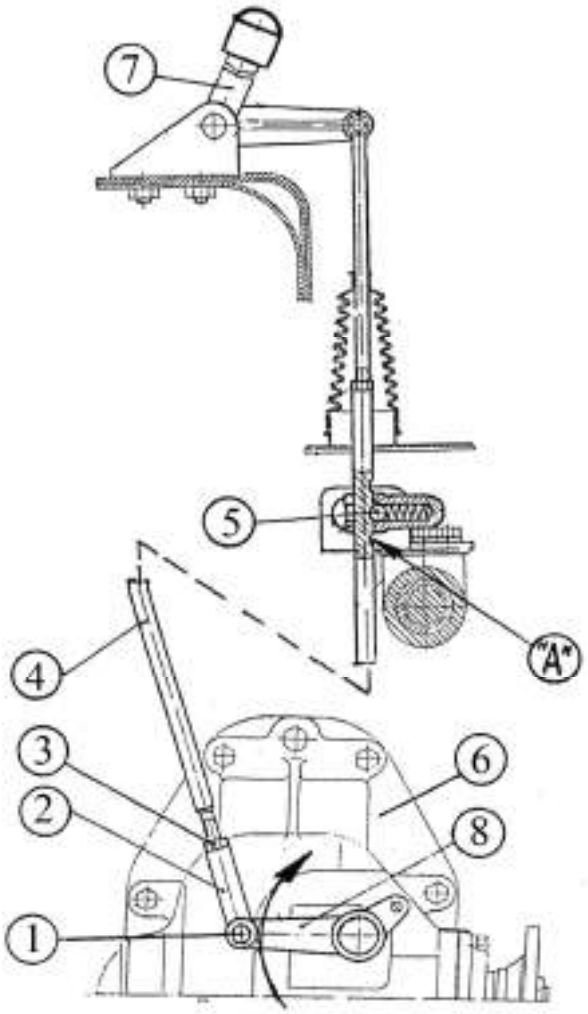
Fig. 5.6.3 – Adjusting FDA reducer turn angle

5.6.8. Adjusting control linkage of FDA drive transfer case

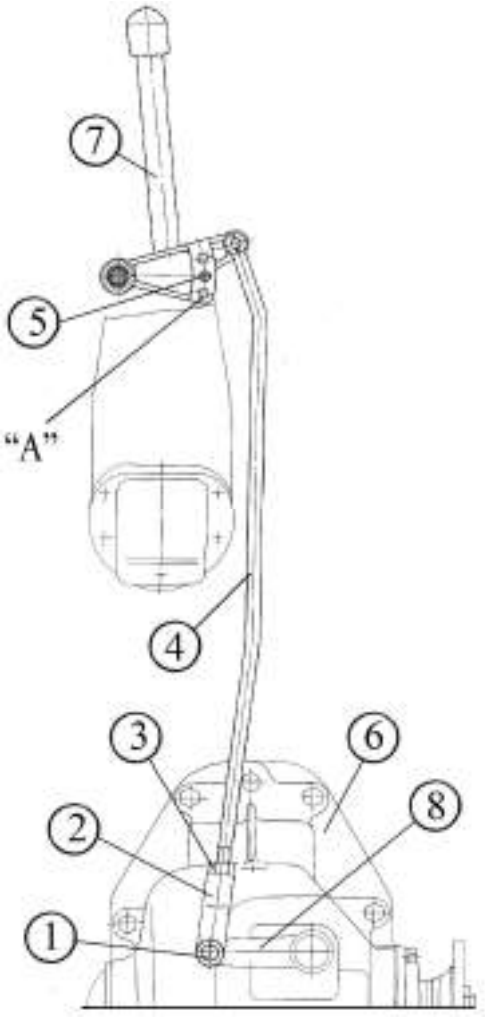
To adjust the linkage, proceed as follows:

- shift the lever (7) (Figure 5.6.4) to the position of FDA on forced (the upper fixed position, the retainer ball (5) in the bottom hole A of the rod (4)).
- unscrew the locknut (3) by 2 ... 3 turns, remove the cotter pin and remove the finger (1).
- turn the lever (8) clockwise up to full engagement of the transfer case (6), i.e. the tooth-type coupling is engaged with the outer and inner freewheeling clutch holders.
- turning the fork (2), adjust the length of the rod (4) so that the finger freely enter into the holes of the fork and the lever (8) turned clockwise until it stops.
- tighten up the locknut, install the finger and cotter it.

Pattern of adjustment of FDA drive transfer case control linkage in case of single-lever GB control



Pattern of adjustment of FDA drive transfer case control linkage in case of two-lever GB control



1 — finger; 2 — fork; 3 — nut; 4 — linkage; 5 — retainer ball; 6 - transfer case; 7 — lever; 8 — lever.

Fig. 5.6.4 – Adjusting control linkage of FDA drive transfer case

5.7 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 5.7.1) and the upper edge of the grooves in the arms (6 and 7). The clearance must be 1 to 2 mm;

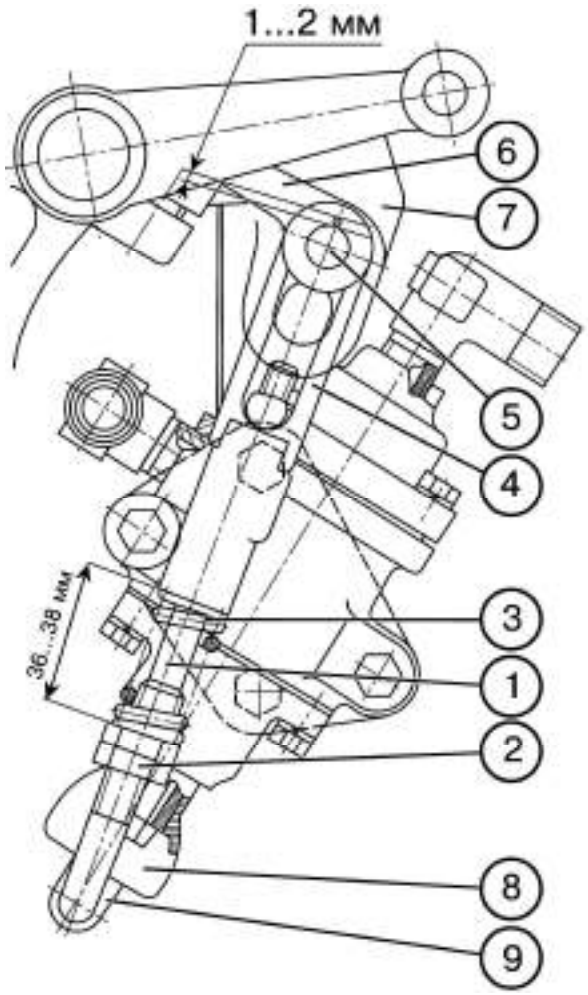
If there is no clearance, remove the cotter pin and remove the finger (5) and adjust the length of the arm by turning the end (4).

- 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. 5.7.1 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 5.7.1) 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.

5.8 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.

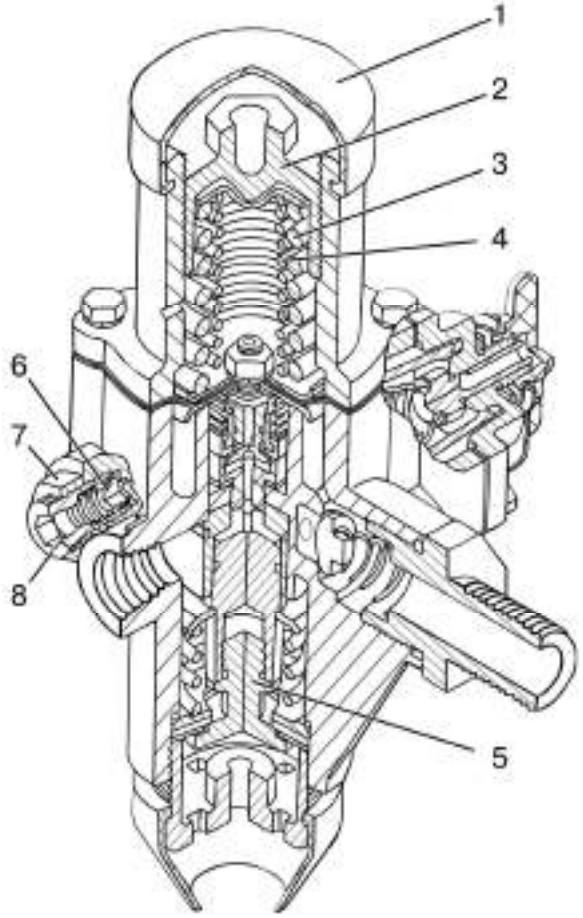
Check and adjust the pneumatic system pressure regulator after completion of adjustment of the service brake control, the parking-reserve brake control and the brake valve.

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

5.9 Clutch adjustments

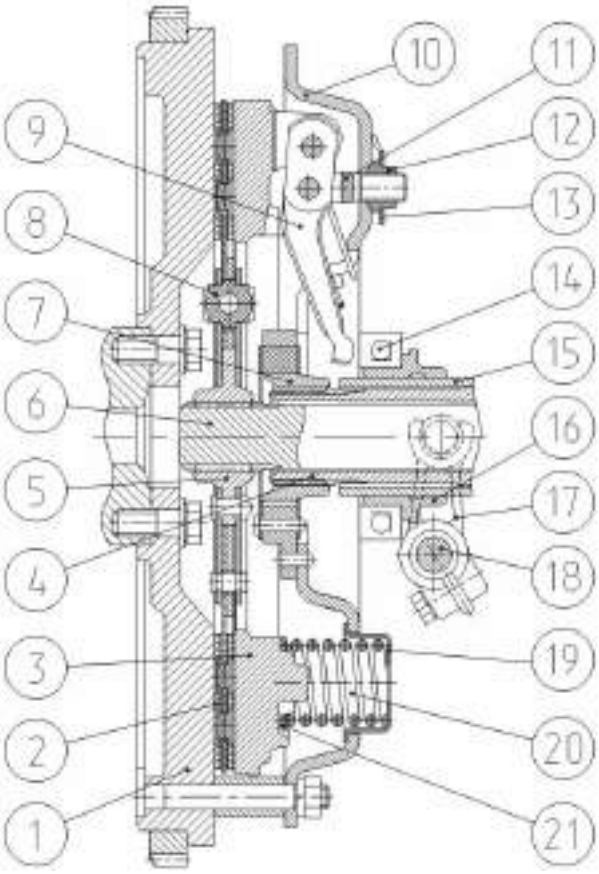
5.9.1. General information

On the engine flywheel (1) (Figure 5.9.1), a dry single-disk spring-loaded clutch is installed. The driving part of the clutch is the flywheel (1) and the pressure plate (3). The driven part of the clutch includes the driven plate (2) with the torsional vibration damper (8) mounted on the force shaft (6). The required force of pressing the friction surfaces of the drive and driven parts is provided by nine springs (20).

Between the floating bushing (7) linked with the PTO drive shaft (4) and the backing plate (10), elastic elements are installed.

The clutch is engaged and disengaged by the shifter (16) with the release bearing (14) moving on the bracket (15). The shifter fork (17) with the roller (18) are connected through the rod with the clutch pedal.

The release bearing (14) is lubricated through the grease cup screwed into the shifter journal.



1 — flywheel; 2 — driven plate; 3 — pressure plate; 4 — PTO drive shaft; 5 — hub; 6 — force shaft; 7 — floating bushing; 8 — torsional vibration damper; 9 — release lever; 10 — backing plate; 11 — fork; 12 — nut, 13 — locking plate; 14 — bearing, 15 — shifter bracket; 16 — shifter; 17 — disengaging fork; 18 — control roller; 19 — barrel; 20 — pressure spring; 21 — insulating washer.

Fig. 5.9.1 — Clutch

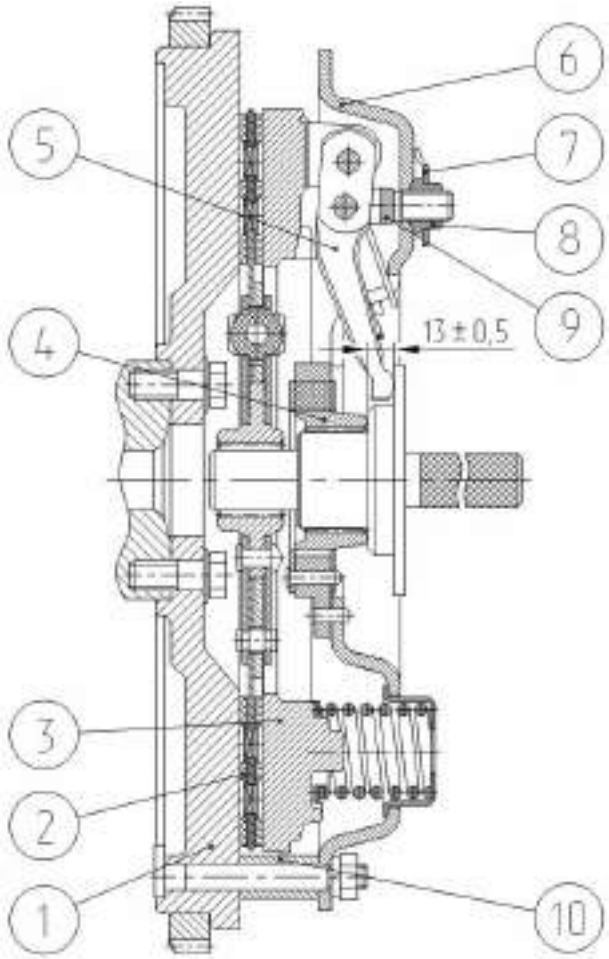
5.9.2 Mounting, removing and adjusting clutch release levers

Procedure of removing the clutch from the engine:

1. Install the three auxiliary bolts (M12×40) screwing them into the pressure plate (3) (Figure 5.9.2) through the auxiliary holes of the backing plate (6).
2. Unscrew the nuts fastening the backing plate to the flywheel and remove the clutch plate assembly (the backing (6) and the pressing (3).
3. Remove the driven plate (2).

Procedure of installing the clutch to the engine:

1. Install the driven plate (2) (Figure 5.9.2) with the long hub end to the flywheel (1).
2. Install the clutch plate assembly (the backing (6) and the pressing (3)) onto the flywheel fingers with hubs (10), fasten with the nuts (to a torque from 70 to 90 N·m).
3. Install the auxiliary snap (Figure 5.9.3) and unscrew the auxiliary bolts.
4. Adjust the position of the release levers (5).



1 — flywheel; 2 — driven plate; 3 — pressure plate; 4 — hub; 5 — release lever; 6 backing plate; 7 — locking plates; 8 — adjusting nuts; 9 — fork; 10 — hub.

Fig. 5.9.2 — Mounting, removing and adjusting clutch release levers

Adjusting release lever position

1. Screwing in or out the adjustment nuts (8) (Figure 5.9.2), adjust the position of the release levers to the size of 13 ± 0.5 from the support faces of the levers to the hub end (4). The difference in the sizes for separate levers must not exceed 0.3 mm.
2. After adjustment of the levers, install the locking plates (7) and secure them with bolts.
3. Remove the auxiliary snap.

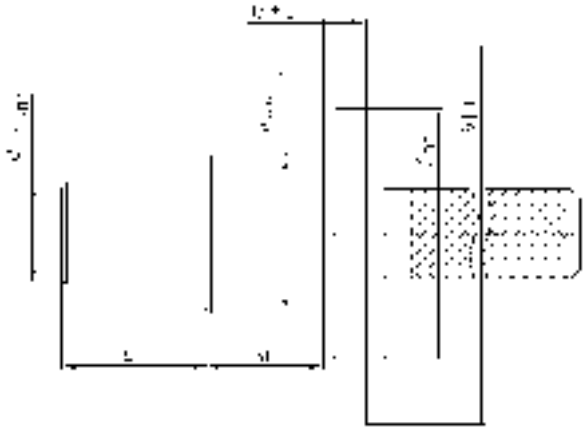
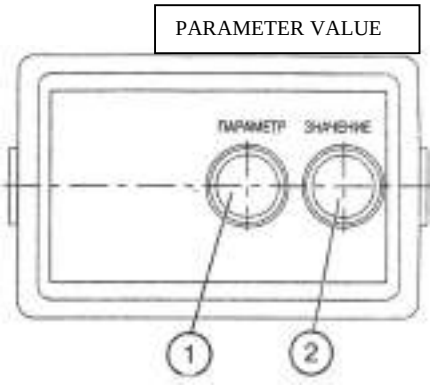


Fig. 5.9.3 — Auxiliary snap

5.10 Tachometer/speedometer programming

5.10.1 Tachometer/speedometer control panel

The control panel is installed on the instrument panel and is intended for programming of the tachometer/speedometer (integrated display) for a particular model (modification) of the BELARUS tractor.



1 — Button to switch the tachometer/speedometer to the programming mode and select programming parameters on the tachometer/speedometer display (integrated display);

2 — Button to select values for the encoded parameter shown on the tachometer/speedometer display (integrated display).

Fig. 5.10.1 — Control panel

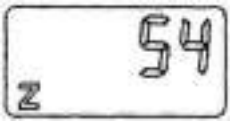
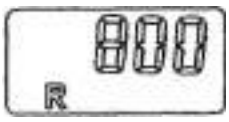
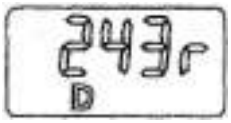
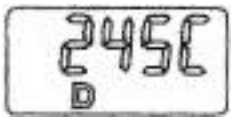
5.10.2 Procedure of programming electric tachometer/speedometer AR70.3813

Indicator programming procedure:

- remove the control panel cover;
- press the button 1 (Figure 5.10.1) of the panel, this will switch the tachometer/speedometer display to the mode of tractor unit parameter readout;
- repeatedly pressing the panel button 1 cycles through the programmed parameters “Z”, “R”, “D”, “T” and then again “Z”;
- to enter the required value for the selected parameter, press the panel button 2 (Figure 5.10.1), this will cyclically change the fixed values of the parameters “Z”, “D”. For the parameter “R”, the value is changed from 400 to 950 in 5 mm increments;
- using the panel button 2, select the required value of the selected parameter;
- pressing the panel button 1 again will switch to the next parameter.
- the programming mode is exited automatically if the buttons 1 or 2 are not pressed for 7.0 s. At that, the new programmed parameter values are fixed and will be used by the tachometer/speedometer to display information.

Table below lists programmable parameter values of the tachometer/speedometer AR70.3813 for BELARUS-1021/1021.3 tractors.

List of programmable ratios of the tachometer/speedometer AR70.3813 for BELARUS-1021/1021.3 tractors.

Parameter value	Parameter
	"Z" parameter Number of pinion teeth in the point of speed sensor installation (parameter to display the tractor speed)
	"R" parameter R is the rear axle rolling radius, mm. When reprogramming, this parameter can be modified with a 5 mm step. **Note** — 800 is the value for tires 16.9R38. If 11.2R42 tires are installed, set the value to 750. If other tire types are installed, set the "R" value corresponding to the rolling radius of the installed tires.
 or 	"D" parameter Engine type — this parameter takes into account the gear ratio of the alternator drive from the crankshaft, the gear ratio of the PTO shaft end (parameter to display the engine and PTO speeds). **Note** for BELARUS-1021/1021.3 tractors, the PTO sensor is not installed, the signal for indicating the PTO and engine speeds is the signal from the alternator phase winding.
	"T" parameter Precise astronomical service hours This parameter is displayed in the programming mode and cannot be modified. The parameter provides a precise value (up to 1/10 hour) of the engine service hours.

During operation, it is allowed to modify the failure of the parameter of 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.

Do not modify the entered values of all other parameters (factory defaults).

5.10.3 Procedure of programming integrated display KD8083

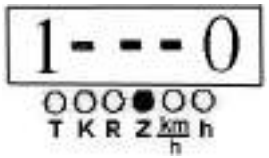
Procedure of programming integrated display KD8083

- remove the control panel cover;
- press the panel button (1) (Figure 5.10.1) and hold for at least two seconds;
- the five-digit display will show the mode of precise total service hours of the engine. At that, the LED goes on located next to the “T” symbol.
- repeatedly pressing the panel button (1) cycles through the programmed parameters “T”, “K1”, “K2”, “K3”, “K4”, “R”, “Z1”, “Z2” and then again “T”;
- to enter the required value of the selected parameter, press the panel button (2) (Figure 5.10.1), at that the lower order digit (the first from right) of the selected display parameter will start flashing at 3 Hz;
- using the panel button (2), set the required value of the lower order digit of the selected parameter;
- briefly press the panel button (1), at that the second digit from right of the digital display will start flashing;
- using the panel button (2), set the required value of the second digit from right of the adjusted parameter;
- briefly press the panel button (1), at that the third digit from right of the digital display will start flashing;
- using the panel button (2), set the required value of the third digit from right of the adjusted parameter;
- fix the entered setting of the parameter by pressing the panel button (1);
- pressing the panel button (1) again will switch to the next parameter;
- to exit the programming mode, switch to the mode of precise total service hours of the engine, then press the panel button (2) and hold it at least two seconds. At that, the five-digit display will show “8.8.8.8.8” for one to four seconds, and all LEDs of the PTO dials must go on. This indicates that the new programmed parameters are fixed and will be used by the display to show information.

Attention: if you exit the programming mode in a manner different from the above, the newly entered parameters will not be saved.

Table below lists programmable ratios of the display KD8083 for BELARUS-1021/1021.3 tractors.

List of programmable ratios of the display KD8083 for BELARUS-1021/1021.3 tractors.

Parameter value	Parameter
	"T" parameter In the programming mode, when the button 1 is pressed for the first time and held for more than two seconds, the digital display indicates the value of precise total service hours of the engine. This parameter cannot be modified, it is the precise number (to 1/100 of hour) of engine service hours.
	"K1" parameter Gear ratio of wheel reduction gear. (parameter for tractor speed indication)
	"K2" parameter Gear ratio of alternator drive. (parameter for engine speed indication)
	"K3" parameter Gear ratio of PTO drive (540) (parameter for PTO speed indication in 540 rpm mode)
	"K4" parameter Gear ratio of PTO drive (1,000) (parameter for PTO speed indication in 1,000 rpm mode)
	"R" parameter R is the rear axle rolling radius, mm. When reprogramming, this parameter can be modified with a 5 mm step. **Note** — 800 is the value for tires 16.9R38. If 11.2R42 tires are installed, set the value to 750. If other tire types are installed, set the "R" value corresponding to the rolling radius of the installed tires.
	"Z1" parameter Number of pinion teeth in the point of speed sensor installation (parameter for tractor speed indication)
	"Z2" parameter Number of pinion teeth in the point of PTO speed sensor installation **Note** for BELARUS-1021/1021.3 tractors, the "Z2" parameter value is set to "0" as the PTO speed sensor is not installed (the signal for indicating the PTO speed is the signal from the alternator phase winding).

During operation, it is allowed to modify the failure of the parameter of 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.

Do not modify the entered values of all other parameters (factory defaults).

5.10.4 Installing and adjusting speed sensors

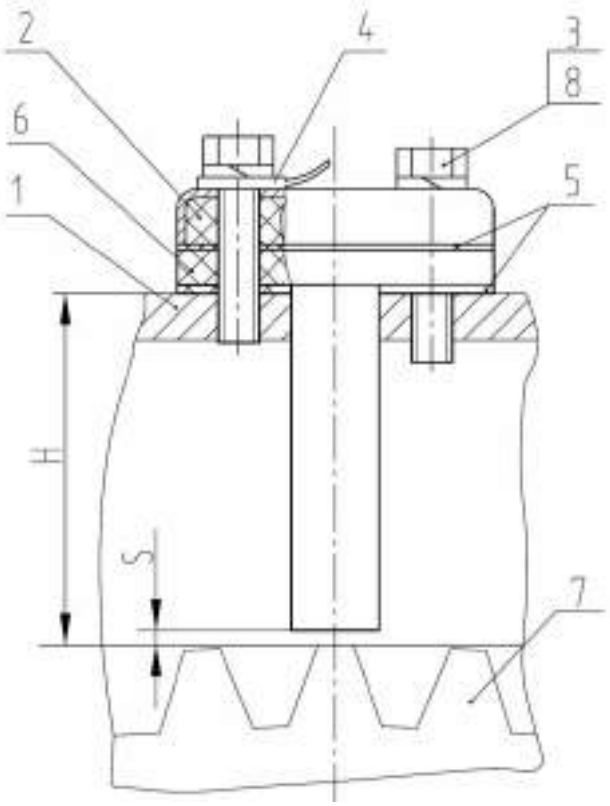
The speed sensors (2) (Figure 5.10.2) are fastened by the bolts (3) to the rear axle housing cover (1) in the area of the left and right side pinions (7) of the final drives.

When installing speed sensors, adjust the clearance S between the sensor end and the projection of the side pinion tooth using the spacers (5) and (6) as follows:

- set the pinion (7) with its tooth against the installation hole for the sensor (2)
- measure the size H on the surface of the cover (1) to the addendum of the tooth;
- select and install the required number of spacers to set the clearance S corresponding to the measured value of H (see table below);
- put the ground wire (4) under any of the bolts (3).
- secure the bolts (3) with a sealant and tighten up.

Adjusting speed sensors

H, mm	Qty. of shims (5)	S, mm
56.5—56.9	7	2.5—2.9
57.0—57.8	6	2.0—2.8
57.9—58.7	5	1.9—2.7



1 — rear axle cover; 2 — speed sensor; 3 — bolt M8×30; 4 — ground wire; 5 — adjusting shim (1 mm), 6 — adjusting shim (6 mm); 7 — side pinion; 8 — spring washer M8.

Fig. 5.10.2 — Installing speed sensors:

6. UNITIZING

This section provides information on the specifics of unitizing BELARUS-1021/1021.3 tractors, including recommendations on selection of vehicles, conditions of safe use of the tractor and determination of handling criteria, rules of proper kitting-up of machine-tractor units (hereinafter — MTU or tractor-based unit), as well as some other necessary information to evaluate possibility of joint operation of the tractor with machines.

Recommendations on unitizing of specific agricultural tools varying by their range and specifications, including descriptions of their design, information on adjustments, procedure of kitting-up of tractor-based units and technology of works are in the operating documentation that comes with them.

6.1 Intended use of tractor

Purpose, method and conditions of use of the tractor:

A universal wheeled tractor of agricultural purpose, providing possibility of operation of mounted, semi-mounted, semi-trailed and trailed machines of various purposes as a power unit by means of standardized working equipment.

BELARUS tractors enable unitizing of machines with technical specifications aligned with the tractor specifications:

- by mounting dimensions;
- by allowable loads;
- by possibility to provide travel with the required service speed;
- by power take-off value;
- by compliance of the tractor's tractive force and drought resistances of unitized machines.

Operating equipment of the tractor for unitizing

BELARUS tractors are equipped with the following working equipment for unitizing — HL, TC, PTO, hydraulic outputs, air gage head and electric socket.

Availability and sizes of working equipment for unitizing of machines is set forth by the manufacturer of the tractor depending on the model and configuration of the tractor.

Attention!

The manufacturer of the tractor is not responsible for failures and breakdowns of the tractor, accidents and injuries that occur during its operation in the following cases:

due to actions of unqualified personnel;

- due to failure to fulfill, inaccurate (or incomplete) fulfillment of recommendations in the operating documentation, traffic rules, requirements of regulatory documents on labor safety;

- due to improper selection, improper use and unitizing of machines with the tractor;

- with power take-off and draught resistance exceeding admissible values for the tractor;

- with a noticeable long-term slips and overloads of the tractor wheels;

- exceeding allowable vertical loads on the tires, axles, TC and HL;

- failure to observe recommendations on selection of tire pressures and travel speeds.

Guidelines on operation:

Operation of the tractor, as well as the safety requirements for its intended use, must be performed in full conformity with the operating manual of the tractor, regulations on labor safety and traffic rules. The manufacturer guarantees a possibility of reliable and safe operation of the tractor only if the consumer observes rules and conditions of operation, maintenance, transportation and storage as set forth by this Manual, as well as preservation of the seals. Subject to observance of any guidelines given by the manufacturer of the tractor, including observance of movement speed limits, the tractor can be used for non-agricultural works by unitizing machines in an MTU as a power unit with standard working equipment for unitizing.

The possibilities of using the tractor in specific conditions with unitized machines are determined by the acceptable range of rated tractive forces on the hook and the engine power; are limited by the maximum loads on the tractor, tractive and coupling properties of the running gear and allowable slippage, the working travel speed, the allowable power take-off and weight of the unitized machines.

Qualification of service personnel:

To work on the tractor, drive and unitize it, persons (hereinafter — tractor drivers, operators) are allowed who have had special training and instruction on labor safety, have documents as per the model prescribed by the law granting the right to drive the tractor and are allowed to work on a particular tractor.

Owners, as well as officials and other persons responsible for the technical condition and operation of the tractor, are prohibited to let the tractor participate in road traffic and be unitized with machines, are prohibited to allow tractor drivers drive the tractor in violation of the applicable traffic rules and this Manual for the tractor. The owner (or person responsible for operation of the tractor) of the tractor must learn this Manual for the tractor and observe all safety requirements and operating rules contained herein.

If the owner (or person responsible for operation of the tractor) of the tractor does not operate directly, then he must make sure that before starting to work, all persons involved into operation of the tractor have been briefed on safety and correct unitizing of the tractor with the machines, as well as learned of the tractor manual.

The tractor driver operating the tractor is personally responsible for observing traffic rules and safety rules, as well as security precautions and correct use of the tractor in accordance with the tractor manual. Before working, the tractor driver must read also the technical documentation on operation of the unitized machine which will be operated with the tractor.

6.2 Types and classification of machine-tractor units on the basis of BELARUS-1021/1021.3 tractors

6.2.1 Agricultural units operating on the basis of BELARUS-1021/1021.3 tractors are classified as per the following operational characteristics:

By the process performed — plowing, sowing, planting, tilling and sowing, harvesting, and other.

By the manner of performing the work:

- mobile, performing the work in motion;
- stationary-mobile, performing the work when standing still and in motion;
- stationary, performing the work in stationary conditions when the tractor is not moving.

By machine implement drive — towed, towed and driven, driven. In the towed tractor-based units, the entire operating power is realized by towing with the TC or HL. The operating power of the towed and driven MTU is realized simultaneously by towing through the tractor towing coupler and simultaneously mechanical and/or hydraulic power takeoff through the PTO shaft and available hydraulic outputs of the tractor. The driven MTUs operate in stationary conditions (the tractor not moving) by mechanical and/or hydraulic power takeoff through the PTO shaft and free hydraulic outputs of the tractor. A particular example of a towed unit is a transport MTU.

By the number of machines in the MTU — single- and multiple-machine. A machine that performs several working operations, use of the process modules of which as of separate technical tools is not provided, is deemed one machine.

By position of the implements relative to the longitudinal plane of the tractor — symmetrical and asymmetrical.

By position relative to the rear wheels and the longitudinal plane of the tractor — rear, left-side and right-side (in the inter-base space between front and rear wheels), front and mixed.

By the number of process operations performed:

- uniform tractor-based units performing one process operation;
- hybrid or integrated performing with multiple machines simultaneously two or more process operations;
- combined performing by one machine several process operations;
- universal equipped with replaceable implements capable of performing various operations at different times.

6.2.2 By the manner of unitizing with the tractor, agricultural machines are divided into the following types:

MOUNTED — *fixed at three points to the joints of the HL upper and lower rods.* The machine weight of in the transport position is fully borne by the tractor. Components of the machine in the transport position have no contact with the supporting surface. When transferring the machine from working to transport position, the point of junction of the machine with the tractor is moved forcedly to a new height.

SEMI-MOUNTED — *is fixed at three points to the joints of the HL upper and lower rods or only two points to the joints of the HL lower rods.* The machine weight in the transport position is partially borne by the tractor and mostly by own road wheels (usually one or two). When transferring the machine from working to transport position, the point of junction of the machine with the tractor is moved forcedly to a new height. The two-point joint coupling is done by attaching the connecting fingers of the suspension axle of the machine with the joints of the HL lower rods (the upper rod is not used). The option of using a cross-beam supplied with the tractor or the machine is possible.

SEMI-TRAILED — *usually attached at one point through a drag ring to the TC.* The option of a two-point joint connection with the HL is possible (without using the upper rod). The machine weight in the transport position is partially borne by the tractor and mostly by own road wheels (usually two or more). When transferring the machine from working to transport position, the point of junction of the machine with the tractor does not change its position. To semi-trailed machines, also various general-purpose and special transportation tools belong such as: general-purpose semi-trailers, tank semi-trailers, dump semi-trailers and semi-trailed special vehicles for mechanization of processes in agriculture. A particular example of semi-trailed machines are technical tools unitized with used of saddle-type coupling devices.

TRAILED — *usually attached at one point through a drag ring to the TC.* The option of a two-point joint connection with the HL is possible (without using the upper rod). The machine weight in the transport position is fully borne by its own running gear, the coupler of the tractor (TC or HL) bears only the weight of the machine coupling device. When transferring the machine from working to transport position, the point of junction of the machine with the tractor does not change its position. To trailed machines, also various general-purpose and special transportation tools belong such as: general-purpose trailers, tank trailers, dump trailers and trailed special vehicles for mechanization of processes in agriculture. When unitizing mounted, trailed, semi-mounted and semi-mounted machines, it is allowed to fasten their individual elements (SAK panels, markers, limit rods, fasteners, brackets, etc.) subject to observing all guidelines in the operating manual.

ASSEMBLED — *secured by fastening assembly units (usually a strapping framework) from the machine kit to the mounting holes of the tractor.* As connecting elements, the HL rod joints may serve fixed in their highest position against spontaneously going down; at that the desired position of the machine relative to the bearing surface can be achieved by lengthening the braces or installing special braces from the machine kit. The weight of the assembled technical means is fully borne by the tractor. The equipment of this type includes mounted front loaders and grab loaders. It is allowable to use without a special permit the semi-frame holes and the rear axle barrels to fasten auxiliary elements (strainers, brackets, markers, hitches) being parts of the agricultural machinery unitized with the help of three-point hitches and towing couplers of the tractor.

Attention!

1. Unitizing assembled vehicles (loaders, bulldozers and other similar tools) is not an intended use of the BELARUS-1021/1021.3 tractors.

2. A permit to joint operation of the BELARUS-1021/1021.3 tractors with mounted, trailed, semi-mounted and semi-trailed machines, which is performed in full compliance with this tractor manual and does not exceed the permissible scope of its intended use, is not required. At the same time, RUE MTW is not responsible for failures, breakdowns and other problems in the operation of the tractor resulting from the incorrect choice and/or inappropriate use of machines with the tractor. Agreeing of unitizing of mounted, trailed, semi-mounted and semi-mounted agricultural machines is the recommended procedure.

6.3 Recommendations on selection of agricultural machines for unitizing

Selection and purchase of agricultural machinery to the tractor is performed by the consumer independently, according to his needs, taking into account the specifications of the machine and the tractor, as well as local conditions (requirements of agricultural technologies, soil conditions, personal experience, recommendations of relevant regional advisory centers and organizations for agricultural production). Bear in mind that agricultural machines of the same purpose but from different manufacturers may differ on specifics of their unitizing, have various specifications and adjustment.

The operational documentation of machines usually considers in detail the proper intended use of the machines, including recommendations on selection and safe unitizing of the tractor. In any case, the manufacturer (seller) of the machine must on request provide information on basic specifications of the tractor which must ensure possibilities for unitizing of the machine.

Making a tractor-based unit means determining the number and specifications of the machines to attach to your tractor, the hitch to use, if required, any additional operating equipment to use, adjustments and setups to perform, the gear to work at. But for this you must buy a machine first. The procedure for making tractor-based units, features of operation are contained in the operation manuals of the tools to unitize. In all cases check compatibility by connecting elements, load-bearing capacity of hitches and tires, permissible loads on the TC and the tractor axles.

The BELARUS tractor can be unitized with machines with the resistance of implements of 18.0 kN max.

The coverage of the unit and the tilling depth depend mainly on the specific soil resistance, which determine the range of operating speeds subject to agricultural requirements. The heavier is the soil, the higher is the resistance. Changing the speed by 1 km/h changes the specific resistance by up to 1 to 6%.

Attention!

Make sure to obtain from the manufacturer (seller) of the machine the required volume of information on specifications of the tractor which will ensure possibilities for operating the machine. If such information is not provided, we recommend you not to operate (buy) such a machine to avoid possibly larger problems during its operation which may result in damages to the tractor.

Initial data for the selection of machines to unitize with tractors:

- type and characteristics of the processed soil or crops;
- dimensions and relief of the fields;
- agrotechnical requirements to the work performed (working speed agrotechnical clearance, track, tire width, direction of working path, operating weight, method of unitizing, vertical load on the connecting device);
- draught resistance and energy consumption of the working machines, tractive characteristics and power of the tractor.

When selecting machines, pay particular attention to variable characteristics of the operating conditions of agricultural machines in the field. For example, a tractor of the drawbar class 1,4 normally must work with a three-bottom plow with the coverage width of 1.5 m, and on light soils, on non-slope field areas, provides work of a four-bottom plow with the coverage width of 1,6 m

When composing a machine-tractor unit, it is extremely important to select the gear to operate the tractor. Of course, it is advantageous to work at a high speed and with a greater coverage and tilling depth of the working tools of the unitized machines. Unfortunately, it is impossible to simultaneously increase the unit speed, its coverage and depth. The greater is the speed, the lesser is the draught of the tractor, therefore it is necessary to reduce the coverage and tilling depth, and vice versa. It should also be remembered that the speed and depth of processing are often limited by the agrotechnical requirements.

6.4 Determining and evaluating possibilities of unitizing BELARUS-1021/1021.3 tractors with agricultural machines

Determining and evaluating possibilities of unitizing BELARUS-1021/1021.3 tractors with agricultural machines is made in several stages:

First stage — Preparation and collection of baseline data

1. Study the tractor operating manual. Determine the basic characteristics of the tractor: drawbar class, rated tractive force, engine power, allowable power of mechanical and hydraulic takeoff, mounting dimensions/type (TC or HL; PTO shaft ends, hydraulic outputs, electric socket, pneumatic head), relative position of the PTO shaft end to the centerline of the HL suspension axle or the TC connecting finger; kitting-up, range of speeds and tracks, availability of required working equipment and maximum allowable tractor weight, permissible axle and wheel tire loads, full weight of towed trailer.

2. Study the machine operating manual. Determine the basic technical characteristics of the machine: draught resistance, power of mechanical (PTI), electrical and hydraulic takeoff, mounting dimensions/type (pole or arm eyes; connecting triangle; PTI shaft ends, hydraulic outputs, electric plug, pneumatic head), relative position of the PTI shaft end to the center of the connecting triangle suspension axle or the pole/arm eye, possibility to change the supplied PTI shaft end type and direction of PTI shaft end rotation, range of operating speeds, full operating weight with process load, availability of brakes, availability of a driveshaft (type, length, availability and type of protective coupling). Consult when necessary the seller (manufacturer) of the machine. Request, if necessary, missing data on the machine.

Second stage — Checking assemblability

Evaluate constructive linkage of the connected elements of the tractor (towing couplers, mounted three-point devices; hydraulic, electric connections; pneumatic head; PTO shaft ends) with the corresponding elements of the machine including correspondence of the wheel track and size and the process requirements of the work performed, location of the PTO, PTRI and driveshaft of the machine shaft, as well as possibility of installing a system of automated control of process performance and installing a control panel in the cab from the machine package.

Check availability of necessary equipment for unitizing in the tractor package: required TC type, pneumatic head, electric socket, required PTO shaft end type, wheel tires of correct size for pairing, front or rear HL, reverse control post, spacers for wheel pairing, availability of hitch hoses, availability of quick-release cutoff clutches. Purchase missing equipment for the tractor separately. After checking availability and additional installation of the necessary working equipment on the tractor, kit up and prepare the MTU in view of the recommendations of the operational documentation for unitized tools.

When purchasing new vehicles to the tractor, always specify in the order the necessary configuration with relevant working equipment ensuring possibility of unitizing with the BELARUS-1021/1021.3 tractor.

For machines driven by the rear PTO shaft, order a driveshaft of the required length and type, with the corresponding joint dimensions. Machines driven from a PTO can technically be equipped with a reduction gear ensuring driveshaft rotation both clockwise and counterclockwise. Therefore, when purchasing a machine, instruct the representative of the company to kit up the machine with a reduction gear driven through a driveshaft with the direction of PTI rotation counterclockwise when viewing the driveshaft fork end from the side of the machine drive.

Third stage — Checking correspondence of vertical load on connecting device of tractor.

1. For mounted and semi-mounted machines.

Checking correspondence of the load-bearing capacity of the three-point hitch linkage of the tractor to the load generated by the attached machine. Make sure that the hitch linkage can raise/lower the attached machine taking into account the process material weight.

2. For semi-trailed and trailed machines (with the hitch point height unchanged during work and transportation).

For machines unitized with a TC, the vertical load on the connecting device of the machine must not exceed the allowable values for the TC.

Fourth stage — Checking static vertical loads on the tractor axles, including the criterion of controllability, need for additional ballasting.

Determine by calculation or empirically the total weight of the tractor with the machine, the load on the axles and the maximum permissible load on the tires, the weight of the needed ballast and process load. The weight of the tractor in the MTA borne by the tractor axles must not exceed the allowable values. In any case, the load on the front and rear axles must not exceed the total tire capacity respectively the sum of capacities of the rear or front wheels.

Fifth stage — Checking capability of moving the tractor unitized with the machine, including checking turn angles and maximum lift heights of the HL up to stop of the machine elements against the tractor elements, sufficient length and areas of free space of the driveshaft at turns and when transferring the machine to the transport position.

Sixth stage — Assessment of correspondence of power capabilities of the tractor and the requirements of the machine (draught resistance, power consumption, including through the PTO).

It is possible to asses by calculation when the source data are available or on the basis of a test report.

Seventh stage — Checking the possibility of work performance by the machine unitized with the tractor.

1. Perform trial unitizing to perform process operations in accordance with the purpose of the machine and in strict compliance with safety requirements.

2. Check fitting of the tractor into spaces between rows of the cultivated crops, determining:

- correspondence of the track and tire section width;
- agrotechnical clearance;
- protective zones on the tires.

Eighth stage — Checking the total cross-country ability, the static stability on slopes, the effectiveness of the brakes under local conditions:

1. Tractor’s capability to overcome ups and downs with the machine with the process material;

2. Capability to move along a slope.

Estimate the clearance and controllability of the tractor in the unit. The tractor front wheels during motion must not break away from the road surface. On the tractor front axle in any case of its use, at least 20% of the load (the criterion of controllability $Ku \geq 0,2$) of its own operating weight must fall.

Ninth stage — Holding control shifts to determine performance indicators:

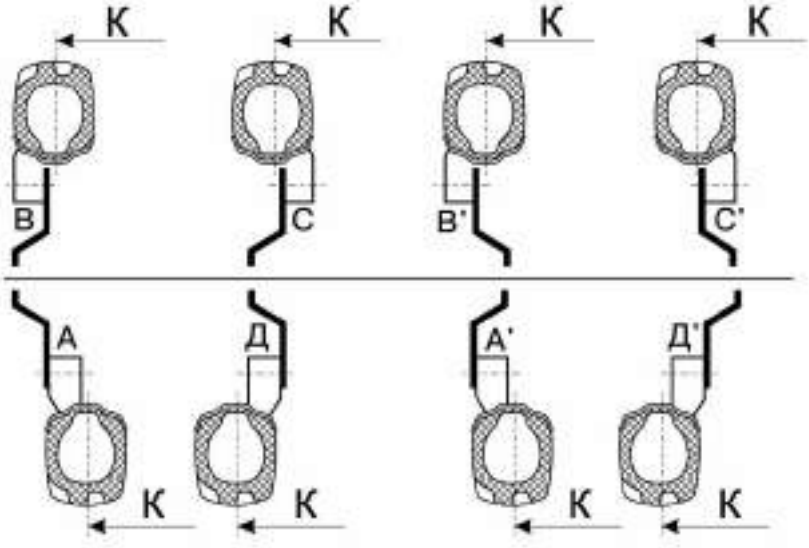
- time of labor input to make a MTU;
- average operating speed;
- performance per 1 hour of main (shift, operating time);
- volume of work performed for the monitoring time;
- fuel consumption per hour (specific).

6.5 Adjusting wheel track

6.5.1 Adjusting 360/70R24 front wheel track

Changing the front wheel track is made in steps, both by swapping the wheels from side to side, and due by changing the position of the wheel disk relative to the rim. Table below lists track values for the front wheels.

Table below and Fig. 6.5.1 show track sizes and installation patterns for 360/70R24 tires.



A, B, C, D — standard installation of the disk with permutation of the rim;
A', B', C', D' — permutation of the disk and the rim;
The wheel position in the positions C' and D' should only be used in exceptional cases.

Fig. 6.5.1 – Patters of setting track for 360/70R24 tires

Track options for short-beam axle

Position of wheels	Track K, mm
A	1,415
C	1,515 [1)]
C	1,735
E	1,835
A’	1,585
B’	1,685
C’	1,900
D’	2,000

[1)]as shipped ex-works

Track options for long-beam axle

Position of wheels	Track K, mm
A	1,535
C	1,635 [1)]
C	1,855
E	1,955
A’	1,705
B’	1,805
C’	2,020
D’	2.120

[1)]as shipped ex-works

6.5.2 Adjusting rear wheel track

The rear track is adjusted steplessly by moving the hubs along the semi-axles. Table below lists the values of the adjustment range of the rear wheel track

Tire size	Position of wheel	Wheel track K, mm	Mounting dimension [1] of hub H to semi-axle end, mm
18.4R34 F11	A C	1,480 … 1,900 1,950 … 2,440	215…5 245…0
16.9R38	A C	1,450 … 1,900 1,950 … 2,440	230…5 245…0

[1] — Changing the track by n corresponds to changing the hub position by n/2 from each side.

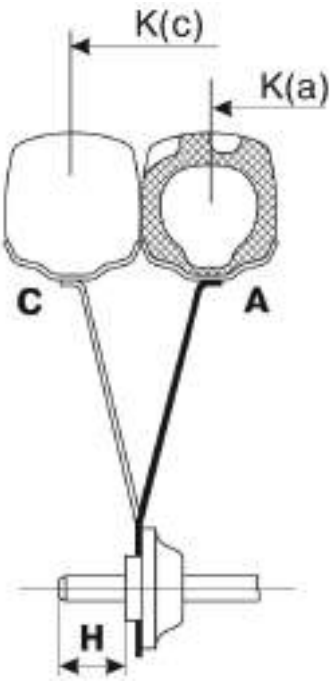


Fig. 6.5.2—Adjusting rear wheel track

6.5.3 Pairing rear wheels by installing two hubs on each semi-axle

In order to reduce specific pressure on soil and to ensure cross-road ability when working on soils with low bearing capacity, wheel pairing is used. Pairing is performed by installing two hubs on each semi-axle.

Tire size in package	Wheel track K_1, K_2, mm	Mounting dimension of hubs H_1, H_2, mm	Note
18.4R34 F11+18.4R34 G11	K_1 = 1,480 K_2 = 2,440	H_1 = 215 H_2 = 0	Paired hubs
16.9R38 + 16.9R38	K_1 = 1,450 K_2 = 2,430	H_1 =230 H_2 = 0	Paired hubs

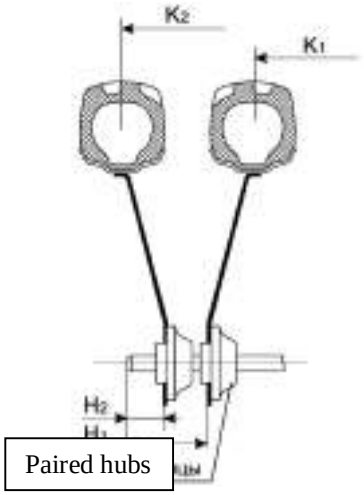


Fig. 6.5.3 Pairing rear wheels by installing two hubs on each semi-axle

На рисунке:
Сдвоенные ступицы

6.5.4 Pairing rear wheels using spacer

The spacer 1221-3109030 is designed for pairing of the rear wheels of standard and optional package (tires 16.9R38, 18.4R34 mod. F-11) for continuous tillage instead of paired hubs.

The spacer 1522-3109060 is designed for pairing of the rear wheels of standard package (tires 16.9R38) for continuous tillage instead of paired hubs.

The spacer 1522-3109060-02 is designed for pairing of the rear wheels of optional package (tires 11.2R42) only for 450 mm row spacing.

The spacer 1221-3109030 is designed for pairing of the rear wheels for 450 mm row spacing (tires 11.2R42) and for continuous tillage (tires 11.2R42 and 360/70R24).

Pairing of the rear wheels for 450 and 700 mm row spacing on optional tires 11.2R42 is performed using a spacer 1522 - 3109060-01. Fig. 6.5.4. shows the pattern of pairing rear tires with a spacer 1522-3109060-01, and parameters of obtained rear track.

K1, K2, mm — rear track;
H, mm — distance from the semi-axle end to the liner end;
M, mm — width between rows.

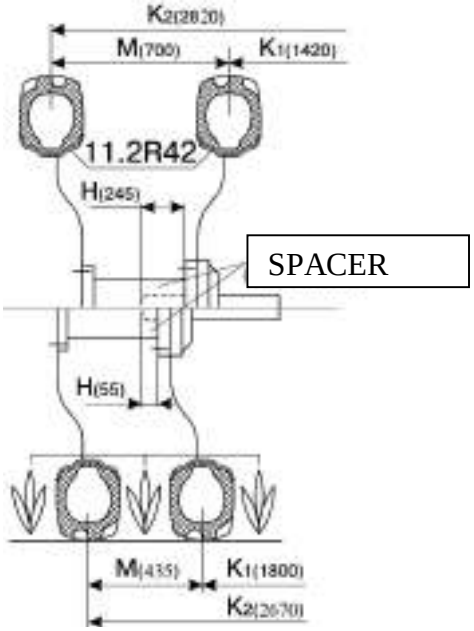


Fig. 6.5.4 — Pairing rear wheels on tires 11.2R42 using spacer

6.5.5 Tire specifications

Table below lists specifications of tires used on BELARUS - 1021/1021.3 tractors.

Tire size	Tire section width, mm	Rolling radius, mm	Package
360/70R24	360	540	Standard
16.9R38	429	800	
11.2R24	284	518	Optional
18.4R34 F11	467	770	
11.2R42	284	749	

6.5.6 Protective zones for tractor wheels for processing of tilled crops

Table below lists dimensions of protective zones for tractor wheels for processing of tilled crops

Main crops	Protective zone size, mm
Beet	80
Maize	120
Potatoes in ridges	200
Cotton	200

6.6 Tires

6.6.1 General information and recommendations on use of tires

Selection of optimal tire pressure for wheeled tractors and the extent of its influence on the traction characteristics depend on the soil type and the load borne by the tractor axles. The tire pressure affects the bearing contact area of the tractor wheel and, depending on soil conditions, affects its haul-and-draw qualities. The recommended tire pressures subject to the loads applied are listed in Table Standards of loads on tires to choose mode at various internal pressures in 6.10 Determining weight of tractor, machine and ballast, loads on TC and HL, tires and axles of tractor, criteria of controllability. Procedure of filling tires with liquid and discharging liquid from tires of this manual.

Every shift:

- before and after the work, inspect the appearance and condition of tires and wheels: reliability of wheel fastening, damages, presence of items stuck in the tires (nails, stones, etc.), assessment of tire wear and the like.
- monitor and set the internal pressure in cold tires.
- As necessary: inflate the tires, clear the tires from foreign objects and tighten up wheel fasteners.

Changes in the tire pressure affect the performance and productivity of the tractor in work.

The pressure depends on the speed and weight loads on the tractor axles created by the weight of the unitized machines considering own operating weight of the tractor and ballast, as well as working conditions.

The internal tire pressure is different for each particular case of tractor unitizing. Therefore, when the conditions of use of the tractor are changed, check and if necessary adjust the tire pressure. Failure to comply with the standard pressures significantly reduces the tire life.

Operating with overloads consisting in exceeding the maximum tire capacity (for a given pressure and speed) and the tractor axles is the cause of failures and damages not only to the running gear (breakages of carcasses of tires, etc.), but also to other units and parts of the tractor, may also result in accidents and reduced the tractor life in general. The standard allowable loads on the tires of BELARUS-1021/1021.3 tractors and the respective internal pressures depending on the travel speed are set forth by the tire manufacturer and are given in subsections. Therefore, always set the tire pressure subject to the prevailing loads and speeds.

To select the correct tire pressure and to establish the need for ballasting, as well as the weight and type of ballast is possible only after determining the loads on the tractor axles.

To check the tire pressure, use operable devices with a scale step of 0.1 kPa max. This will ensure reliability of measurements. It is recommended that deviations of the pressure exceed by ± 0,015 MPa max. of the recommended standard value as per the pressure gauge readout.

Attention!

The exact load in case of a particular use of the tractor borne by the front or rear wheels of the tractor can be determined only by actual weighing of the tractor with the unitized machine.

The load on a particular wheel is determined by dividing by two the load borne by respectively the front or the rear axle of the tractor. Then based on the obtained load and travel speed, the necessary pressure for the tire is selected from the table.

Operating the tractor with a set tire pressure below the standard results in the following failures of the wheels:

- tire rotation on the rims;

tire bead rubbing against the rim flange;

- cracks on the tire sidewalls;
- delamination or fracture of the tire carcass;
- broken out tire valve.

Operating with a set tire pressure above the standard results in the following failures of the wheels:

- noticeable increase in tire wear;
- extension of carcass layers and decrease in tire elasticity;

increased wheel slip.

Attention!

1. Use of tire pressures above 0.16 MPa or below 0.09 MPa should be avoided. When the tire pressure is 0.08 MPa or less (increased risk of the internal pressure dropping below the permissible value because of possible air leaks), ensure constant monitoring of the pressure.

2. The table data on loads for 10 km/h are applied only in circumstances requiring low tractive forces: when unitizing with sowing and harvesting machines. To work with a high torque (plowing, etc.), use the recommendations for 30 km/h.

3. Do not use paired tires to increase the load-bearing and tractive forces: they serve to reduce pressure when working in the field.

4. Use tire sizes not listed in the manual only after approval by the manufacturer.

5. Do not use the tractor with noticeable long slips and overloading of the wheels: with heavy machines (the weight of which exceeds the allowable values for the tractor) or tillage machines the resistance of which in particular soil conditions is too large for the tractor.

6. Never exceed tire pressures as recommended by the manufacturer. Tires can explode with lethal consequences for the people.

7. Do not weld the disk or perform other repairs of an inflated tire.

8. To unmount and repair the tires, contact a repair shop with trained staff.

During use of tires, observe the following rules:

1. Maintain the prescribed standard internal pressures in the tires in accordance with the recommendations of the manual.

2. Monitor the tire pressure in cold condition, using a tire pressure gage that should be periodically checked for accuracy of readings at stations or points of maintenance of any motor vehicles.

3. During the work, if necessary, never check tire pressure and never inflate tires immediately after stopping the tractor: make a break of at least 15 minutes.

4. Do not operate the tractor with the internal tire pressure that does not conform to the standard for the particular case of its use.

5. To maximize the tractive force in particular operating conditions when tilling and to minimize soil compaction, observe the permissible axle load.

6. When selecting and purchasing new tires, consider the recommendations of this manual. Incorrect installation and removal of tires causes damages to the structural elements of the tire. Install and remove tires only using special equipment. On one axle, install tires of the same size, model and design. Periodically interchanging the wheels prevents their uneven wear. Do not install wheels with varying degrees of wear on the same axle. Using old tubes for new tires is not recommended.

7. When installing paired wheels on the same axle, ensure internal pressure in accordance with the recommendations.

8. When setting the track, make sure to provide equal distances of the opposite wheels relative to the centerline of the tractor. When installing the wheels, observe the correct direction of tire rotation and sufficient distance between the wheel and the other structural elements of the tractor (eg. cabin).

9. Protect tires from contact with fuels, oils and other petroleum products.

10. Avoid sharp set-offs, sharp braking and sharp turns, long slipping of wheels when the tractor gets stuck.

11. Do not operate the tractor and avoid long stops on damaged or flat tires.

12. If the tire pressure constantly drops, find the cause and correct it.

13. Check the pressure in tires filled with solution when the valve is in its topmost position.

Notes.

1. Changing the rated tire load depending on the speed is applied in the cases when the tire is not subjected to long operation at high torques.

2. During the field work and other conditions of continuous operation at high torques, use the values corresponding to the speed of 30 km/h (see table below).

6.6.2 Allowed combinations of front and rear tires

Attention! On tractors with FDA, use a correct combination of front and rear tires. Using correct combinations of front and rear tires provides maximum performance of the tractor, increases the tire life and reduces wear of the power gear components. Combining new and worn tires or tires of different diameters or different rolling radius can result in violation of the requirements for kinematic mismatch and, as a result, excessive wear of tires and breakdowns of FDA parts. Table below lists allowed combinations of front and rear tires.

Allowed combinations of front and rear tires

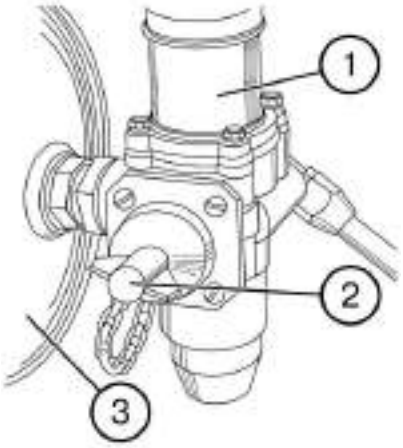
Rear tires	Front Tires	
	360/70R24	11.2R24
16.9R38	+	—
18.4R34 F11	+	—
11.2R42	—	+

6.6.3 Inflating tires

Inflate the tires through the air bleed valve of the pressure regulator (1) (Figure 6.6.1), proceeding as follows:

- bleed air from the pneumatic system cylinder (3) through the condensate drain valve;
- unscrew the finger nut or the cap (2) of the air bleed valve connector;
- connect the hose to inflate the tires to the air bleed connector and to the tire valve;
- turn on the compressor and inflate the tire to the desired pressure, controlling it with a tire pressure gauge;
- disconnect the hose from the tire valve and the air bleed valve connector;
- turn off the compressor and screw the finger nut onto the air bleed valve connector.

Attention! When the pressure in the cylinder increases to 0.77 MPa, the compressor automatically is switched by the pressure regulator to idling, and tire inflation automatically stops. Therefore, periodically check pressure by the indicator on the instrument panel and, as necessary, decrease it through the condensate drain valve.



1 — pressure regulator; 2 — finger nut or cap; 3 — pneumatic system cylinder.

Fig. 6.6.3 — Inflating tires

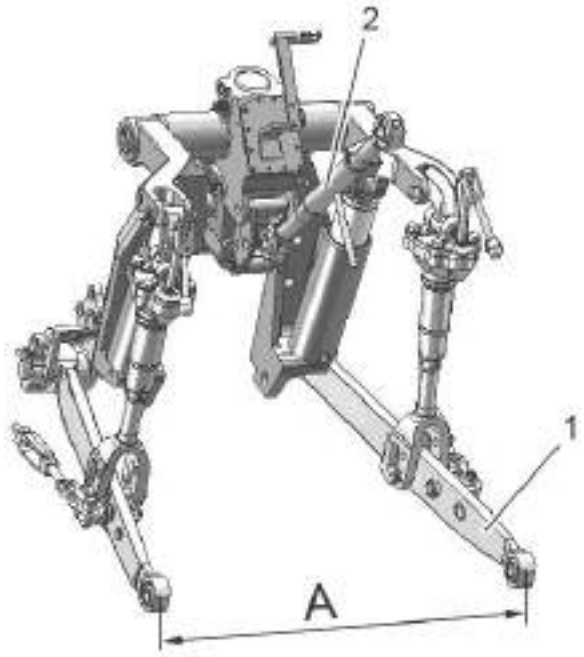
6.7 Rear hitch linkage

6.7.1 General information about RHL design

The three-point hitch linkage of 2nd category is designed to attach to the tractor mounted and semi-mounted agricultural machines and implements using the following connection elements:

- length of the suspension axle A (conditional distance between the joints of the lower rods) is 870 mm;
- diameter of the holes of the rear joints of the lower rods is 28.7 mm;
- diameter of the upper rod finger is 22 or 25 mm.

The tractor is fitted with solid lower rods (1) (Figure 6.7.1) with the length of 885 mm and the upper rod (2) with joints of 2nd category.



1 – lower rod; 2 – upper rod.

Fig. 6.7.1 — Rear hitch linkage

6.7.2 Upper rod and braces

The length of the upper rod (2) (Figure 6.7.2) is adjusted in the range from 500 to 740 mm with the knob (3).

In the RHL, one gear (adjustable) brace, the right one, and one screw brace is installed. The length of the gear brace can be changed within 580 to 665 mm by rotating the knob (1).

When shipped from the factory, the length of both braces is set to the default value of 640 mm.

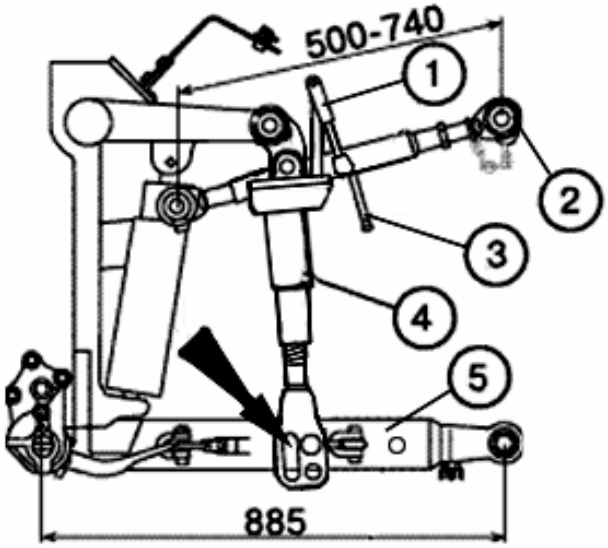
To accelerate changing the brace lengths, their fork has two holes for installation of a finger (center-to-center spacing between holes is 60 mm).

Attention! Adjust the machine position only with the right (gear) brace. If necessary, using a wrench you can change the length of the screw brace.

Note — At your request, the tractor can be fitted with two gear or two screw braces.

To copy the relief of the tilled part of the field when working with wide-coverage machines and to avoid damages to the braces, connect the braces (4)with the lower rods (5) through the grooves (indicated by arrows). At that, the grooves in the brace fork must be behind the hole along the course of the tractor to avoid damages to the brace.

To increase the load-bearing capacity of the RHL, the brace forks and the bracing eye can be shifted by one hole back along the course of the tractor. At that, increase the length of the brace by adding an extra shackle on each side.



1 — gear brace knob; 2 — upper rod; 3 — upper rod knob; 4 — brace; 5 — lower rod.

Fig. 6.7.2 — Upper rod and braces

6.7.3 External strainers

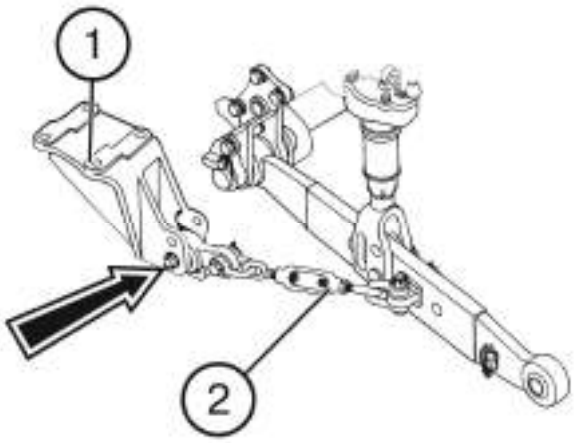
6.7.3.1 Partial lock

Ensure horizontal travel of the implement in the working position by connecting braces to the lower holes of the brackets (1) (Figure 6.7.3) and adjusting the length using the braces (2) to let the implement swing to each side by 125 mm min. or in accordance with the operating instructions for the implement.

When working with plows, adjust the length of the right brace to the tilling depth.

Attention: Make sure to keep the size of implement swinging of 125 mm min. to avoid breakages of the braces with lifting the implement in the transport position.

When setting the implement to the transport position, tighten the strainers (2). The implement can swing by 20 mm max. in both directions.

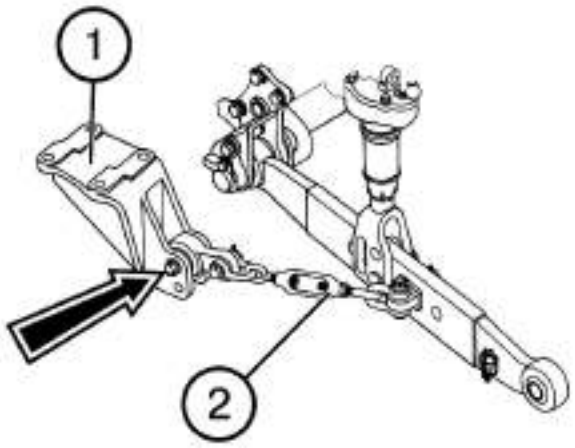


1 — bracket 2 — brace

Fig. 6.7.3 — Partial lock

6.7.3.2 Full lock

To fully lock the implement in the working position, connect the strainers (2) (Figure 6.7.4) to the upper hole in the bracket (1) and minimize their length providing implement swinging by 20 mm max. in both directions.



1 — bracket 2 — brace

Fig. 6.7.4 – Full lock

6.7.4 Hinging implements on tractor

Most agricultural implements can be hitched to the tractor proceeding as follows:

1. Put the hight to the lower position. Align the axles of the lower rod joints (1) (Figure 6.7.5) and of the implement fingers and attach the implement to the lower rods. Cotter the fingers. Stop the engine.

2. Extend or shorten the upper rod (2) and attach it using the rear joint finger to the implement. Fasten the finger using a cotter pin with a ring.

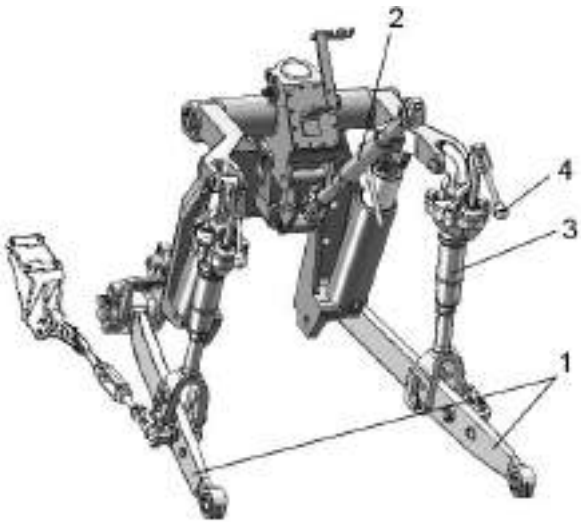
3. If necessary, adjust the upper rod to the original or desired length.

4. If necessary, adjust the implement transverse tilt with the right brace (3). To increase the brace length, turn the knob (4) clockwise and vice versa.

5. Attach the necessary extended equipment.

6. Before starting the work, check that:

- tractor parts are not in dangerous proximity to the implement elements;
- the upper rod does not touch the PTO enclosure at the lowest position of the implement;
- the universal-joint drive from the PTO is not too long, with large angles of joints, and there is no thrust forces;
- the PTO enclosure does not touch the machine driveshaft enclosure;
- slowly raise the implement and check for gaps between the tractor and the implement in the raised position;
- check for the required lateral swing of the lower rods and, if necessary, adjust them with the braces.



1 — lower rod; 2 — upper rod; 3 — right brace; 4 — right brace knob.

Fig. 6.7.4 — Hinging implements on tractor

Attention: When hitching mounted or semi-mounted equipment on the tractor or coupling the tractor with trailed equipment through the coupler, make sure that there is a sufficient gap between the implement and the tractor!

Caution: Some mounted or semi-mounted implements may touch the cab and damage it. This can result in damages to the cab windows and injuries to the operator. Check for an adequate gab (100 mm min.) between the implement raised to its upper position and the tractor cab!

6.7.5 Intended use of rear hitch linkage

The 1021/1021.3 tractors are equipped with a rear hitch linkage HL-2. Figure 6.7.6 shows the chart of unitizing for HL-2.

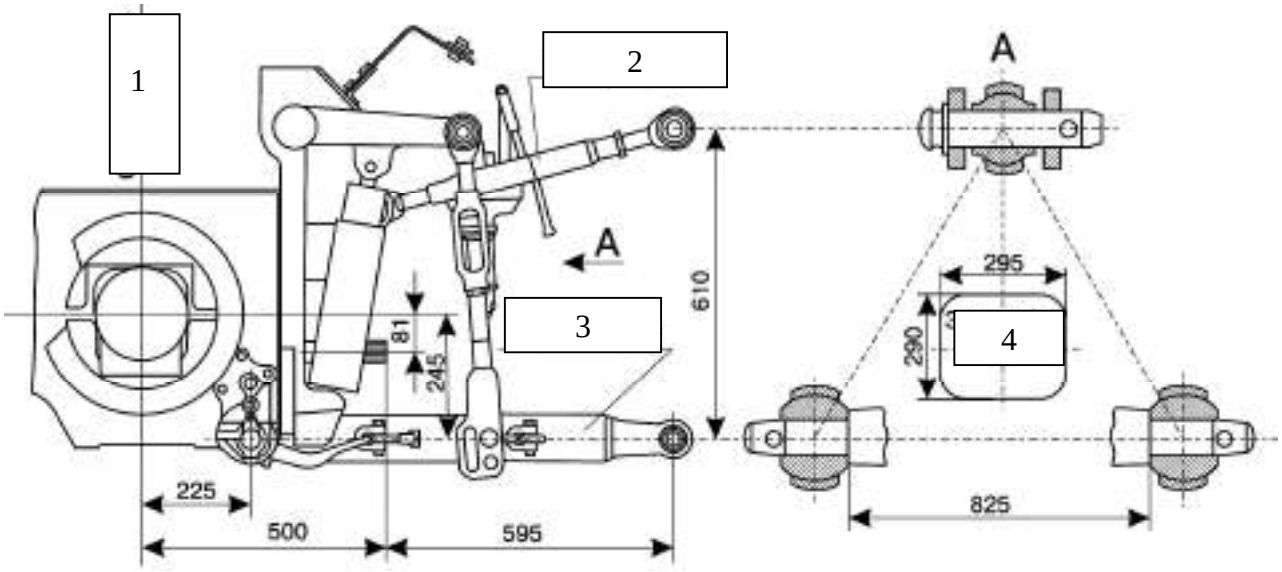


Fig. 6.7.6 — Chart of three-point rear hitch linkage of 2nd category (HL-2).

1 - Front wheel axle
2 - Upper rod
3 - Lower rod
4 - PTO area

Parameters and dimensions of connecting elements of the RHL for unitizing with machines of IInd category

Parameter	
Lower links	solid
Length of lower rods: solid, mm	885
Width of rod joints: upper, mm lower, mm	 51 38 or 45 [1)]
Rated diameter of connecting elements: upper rod finger, mm lower rods joints, mm	 22 or 25 [1)] 8
Distance from PTO end to hook axis, mm	595
Load-carrying capacity on hook axis, kN extended to 610 mm, kN	 43 8

[1)] – on request

The rear hitch linkage of HL-2 type is made in accordance with GOST 10677 (corresponds to Cat. 2 as per ISO 730/1).

The hitch linkage, as mentioned above, consists of three rods (upper and two lower) connected by joints with the front ends to the tractor and the rear end with free joints to connect with connecting fingers of the unitized machines. It is designed for connection to the tractor of machines in the rear position, transmit tractive force during work and adjust their position during operation or movement in the transport position.

The hitch linkage provides unitizing of the following types of machines and tools:

- mounted with three-point hitch (upper and lower rods);
- semi-mounted (lower rods);
- semi-trailed with a crossbeam on the suspension axle (lower rods) as described in 6.8.3 TC-1 (crossbeam) of this manual.

To prevent swinging of the attached machines, the restrictive external strainers with adjustable length serve (see below).

To ensure the required position of the machine, the following adjustments of the rear HL in the vertical and horizontal planes with the upper rod, braces and strainers are provided:

Changing upper rod length.

Made to ensure the same depth (equalizing the depth of travel of the working tools arranged one after another along the tractor course); if the frame of a mounted plow is tilted forward along the tractor course and the front bottom plows deeper than the rear, lengthen the upper rod and shorten it if the front bottom plows with a lesser depth than the rear.

Changing brace length.

Made to bring the machine to the horizontal plane in order to ensure a uniform tillage depth by the working tools of the mounted machine by coverage;

Attention: Changing the length of the left (screw) brace of the HL of 640 mm (standard tires) is not recommended. The length is adjusted usually for the right (gear) brace. When using a cross-beam on the suspension axle and working with reversible plows, the brace lengths must be the same.

Adjusting brace.

During work, the braces are usually connected to the lower rods through the holes in the brace forks. When working with wide-coverage machines in order to improve relief copying (cultivators, planters, etc.) and reduce loads on the HL, it is necessary to ensure free travel in the vertical plane of one lower rod relative to the other. To do that, adjust the braces to obtain free travel in the vertical plane of one lower rod relative to the other. Such adjustment is provided by connecting the braces through grooves.

The HL is controlled by moving the respective hydraulic lift control levers from the cab, which ensures setting the lower rods of the rear HL to the required height position.

Changing length of both braces, upper rod for transport position of machine.

Done to ensure:

- road clearance of 300 mm min.;
- sufficiently safe distance between the elements of the tractor and the machine excluding machine elements touching the tractor (clearance of 100 mm min.).

Note — Rules of adjustment of the upper rod and braces are in 6.7.2 Upper rod and braces of this manual.

Changing length of both strainers.

When transporting the machine (in the HL highest position), the strainers must be as possible shortened within the available adjustment range to limit rocking of the machine during movement in order to avoid damages to the components of the tractor or possible accidents.

When working with mounted and semi-mounted tillage machines with passive working tools for continuous processing (share and chisel plows, hoeing plows, deep tillers and other machines), it is necessary to ensure free movement in the horizontal plane (rocking) of the lower rods 125 mm in each direction from the longitudinal plane of the tractor by unblocking the strainers; restriction of coverage with the strainers is not allowed.

- when working with agricultural machines (except for plows, deep tillers and other similar machines for continuous tillage with passive working tools), ensure full blocking by limiting the swing of the lower rods in the horizontal plane to 20 mm max.

Note — Rules of changing lengths of the external strainers are in 6.7.3 External strainers of this manual.

Attentions: Failure to observe the recommendations for adjustment of the strainers and braces can result in break-off of the strainers, support brackets or other failures!

Attention: The necessary characteristics and method of adjustment of machines unitized through hitch linkages in accordance with the peculiarities of performing the process and agrotechnical requirements are specified in the operational documentation for those machines. If such data are not available, make sure to get the necessary information from the manufacturer or seller of the machine!

The universal hydraulic system for control and adjustment of mounted implements of the tractor additionally provides for the rear HL the following features:

- correction of speed of raising and lowering the lower rods;
- limiting the lift height of the lower rods;
- choosing the desired method of adjustment of the lower rod position;
- correction of the tillage depth;
- ability to work with machines with depth control of the travel height of the working tools (depth is adjusted by the machine supporting wheel).

6.7.6 Intended use of remote power cylinder control hydraulic system

The hydraulic system for mounted implement control allows additional takeoff of oil for operation of the unitized machines.

The tractor has free hydraulic outputs to serve the unitized tools through attached high-pressure hoses.

Oil flow through the outputs is 45 ... 55 l / min (depending on the technical condition of the hydraulic pump). Oil takeoff by the hydraulic cylinders of the unitized machines must not exceed 16 liters. Check the level in the hydraulic tank with the working cylinder rods retracted.

To avoid losses of oil during unitizing with technical tools or unforeseen disconnection, the stop and cutoff devices are provided supplied in the tractor SPTA (on request). Hydrostatic power takeoff through one of the outputs is possible to drive auxiliary hydraulic motors. To avoid overheating of the hydraulic system, the operating pressure must not exceed 11 MPa, which corresponds to the power of 11 kW max. To discharge the oil from the hydraulic motor circumventing the distributor, a separate line is provided.

The tractor is equipped with valves, fittings and accessories with a conventional flow cross-section of Du = 12 mm and the connecting thread M20×1.5. If it is necessary to connect to different valves, fittings and accessories of the unitized machines, make the required adapters with the conventional flow cross-section of Du = 12 mm min.

Attention: Oil in the working cylinders of the unitized machine must be clean and consistent with the grade used on the tractor. Failure to observe these requirements may result in failure of the tractor hydraulic units!

Attention: Do not modify the structural elements of the tractor hydraulic system except for modifications allowed in this operating manual without manufacturer's approval!

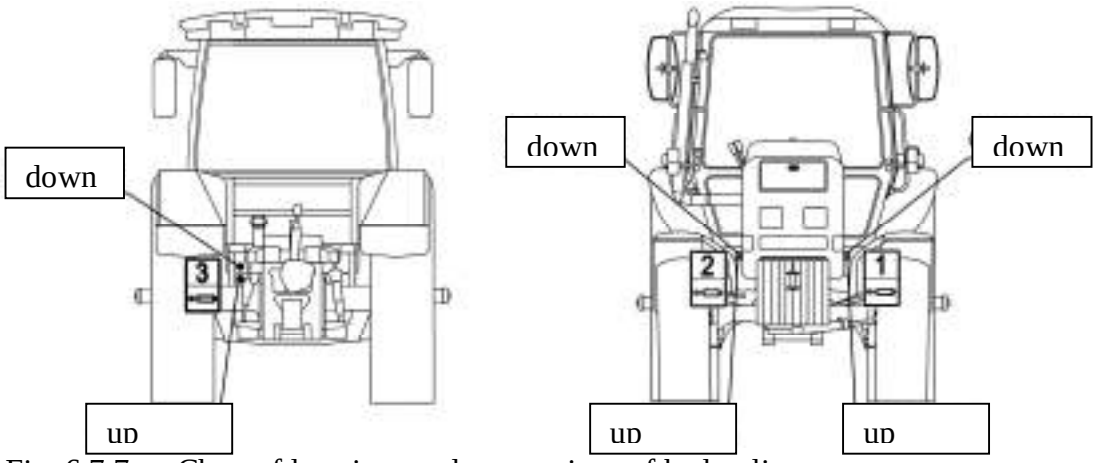


Fig. 6.7.7 — Chart of locations and connections of hydraulic system outputs to external customers (when distributor RP70-1221 installed)

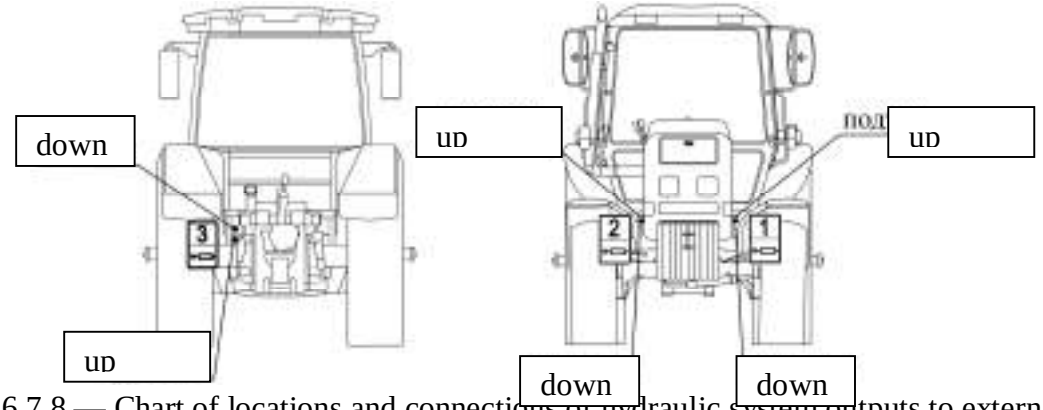


Fig. 6.7.8 — Chart of locations and connections of hydraulic system outputs to external customers (when distributor RS213Mita installed)

подъем up
опускание down

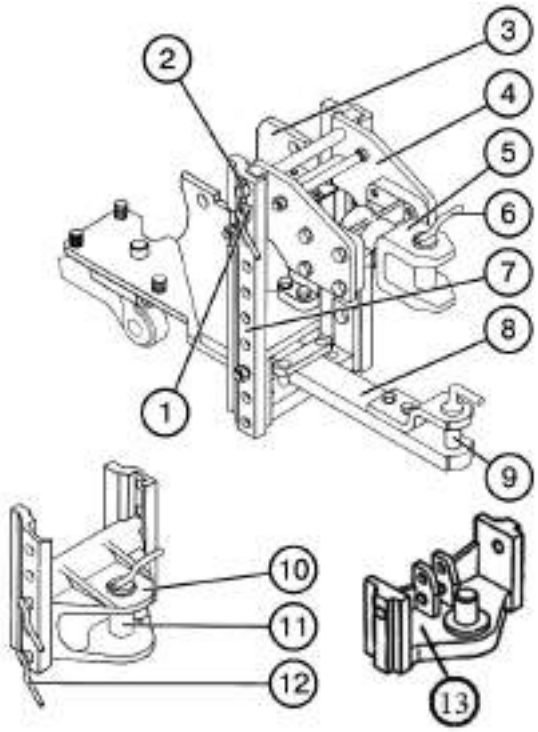
6.8 Universal towing coupler

6.8.1 General information about TC design

The towing device for work with two-axle trailers consists of the towing yoke (5) (Fig. 6.8.1) with the pivot (6). The yoke body is connected to the plates (4) that enter the groove in the side guides (3, 7) and are fixed with two fingers (12). The fingers are fixed with the cotter (2) and locked with the ring (1). Position of the towing yoke together with the body can be changed in height by its permutation in the holes in the side guides (3, 7).

The towing yoke (10) with the pivot (11) is designed to work with semi-trailers. For those purposes, the drawbar pin “python” (13) can also be used.

The draw bar (8) with the pivot (9) is designed for connection of trailed and semi-trailed agricultural machines to the tractor.

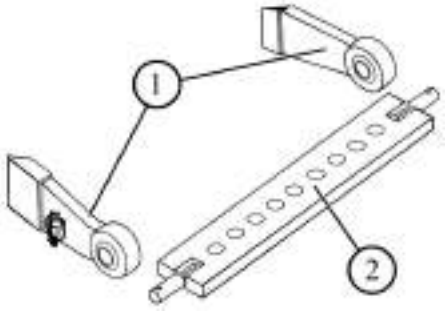


1 — ring; 2 — cotter; 3 — side guide; 4 — plate; 5 — towing yoke; 6 — pivot; 7 — side guide; 8 — draw bar; 9 — pivot; 10 — towing yoke; 11 — pivot; 12 — finger; 13 — drawbar pin.

Fig. 6.8.1 — Towing coupler

The single cross-beam (2) (Figure 6.8.2) conforms to international standards and is designed for connection of trailed and semi-mounted machines to the tractor.

Mounted on the RHL suspension axle (rear joints of the lower rods (1)) and is connected to machines that have a yoke instead of an eye and improves MTU maneuverability.



1 — lower rod; 2 — single crossbeam.

Fig. 6.8.2 – Single crossbeam

6.8.2 Intended use of towing couplers

The BELARUS-1021/1021.3 tractor can be equipped with towing couplers of various types that ensure unitizing with trailed and semi-trailed machines, connecting devices of which meeting the following requirements:

- compatibility by connection dimensions and height of the hitch relative to the supporting surface;
- machines have rigid hitches
- trailer towbars are equipped with a device that facilitates coupling and uncoupling with the tractor TC;
- vertical load on the TC does not exceed the allowable values as specified by the tractor manufacturer.

The BELARUS-1021/1021.3 tractor has a rear lift device in the form of vertical guide plates. The device is designed for fastening TC-2V and TC-3V. The lift device allows changing the position of the connecting link of the TC by height and facilitates removal.

TC-1 (cross-beam on the suspension axle of HL-2) is designed for unitizing with semi-mounted and semi-trailed machines only to perform a process at a speed of less than 15 km/h. The cross-beam has a number of holes for joining. A normally unitized machine is attached through the middle hole of the cross-beam. If there is a need to alight the tractor track with the unitized machine (mainly, harvesting one) with low draught resistance, asymmetric connection is allowed. The cross-beam is purchased on customer's request

Given that the TC-2V, TC-3V and TC-1M-01 take a fixed position by height, the connecting devices of semi-trailed machines must be equipped with an adjustable support that ensures adjusting the position of the towing ring of the machine by height.

6.8.3 TC-1 (crossbeam)

Used for work with the following machines:

- semi-mounted (drill machines, potato planters, potato harvesters, vegetable harvesters, etc.);
- semi-trailed (mowers, balers, top-gathering machines, etc.);
- equipped with a towing yoke on the towbar.

Figure 6.8.3 shows the chart of unitizing for TC-1.

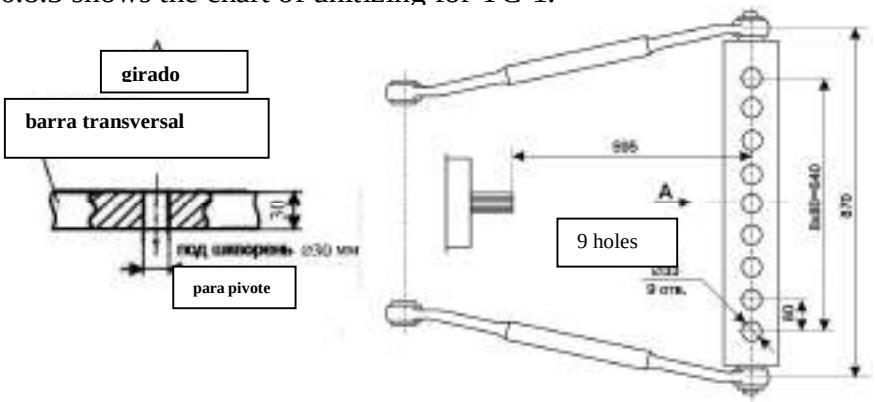


Fig. 6.8.3 – Chart of unitizing for TC-1

Parameters and dimensions of connecting elements of TC-1

TC-1 (with a pad under the ring or without)	cross-beam on the suspension axle of the hitch in the package of TC-2
Distance from the PTO end to axis of joining pin, mm	595
Diameter of connecting finger mm	30
Vertical load on TC, kN	6.5
Angle of machine turn relative to tractor, deg	± 60

6.8.4 TC-2V (fork)

Used for work with the following machines:
- semi-trailed (semi-trailers, fertilizing machines, etc.);
- trailed (disk harrows, tillage machines, hoeing plows, hitch of harrows, cultivators, seeders, etc.).

Figure 6.8.4 shows the chart of unitizing for TC-2V.

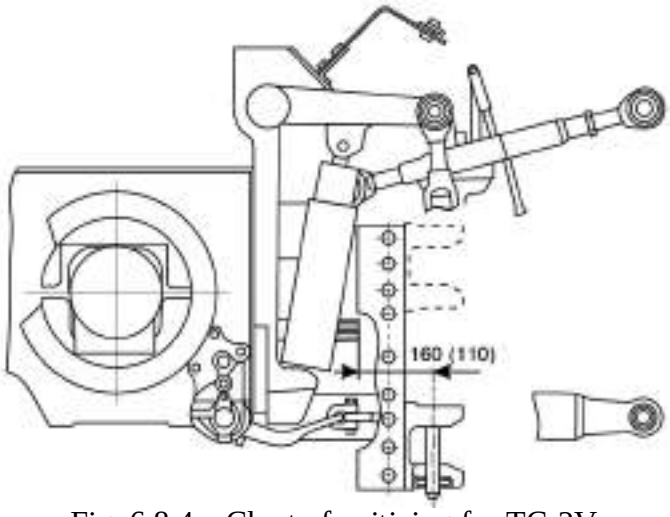


Fig. 6.8.4 – Chart of unitizing for TC-2V

Parameters and dimensions of connecting elements of TC-2V

Coupling device	Yoke with the possibility of vertical travel
Distance from yoke or hook sphere to support surface, mm	493…898 (to axis of opening) in steps
Position of fork for machines driven by PTO	lowermost or uppermost
Distance from the PTO end to axis of joining pin, mm	160 or 110
Diameter of connecting finger mm	40
Vertical load on TC, kN	20
Angle of machine turn relative to tractor, deg	± 65

6.8.5 TC-3V (fork)

Used for work with the following machines:
- trailed (two-axle truck-type trailers, etc.);
- semi-trailed (same as with TC-1).

Figure 6.8.5 shows the chart of unitizing for TC-3V.

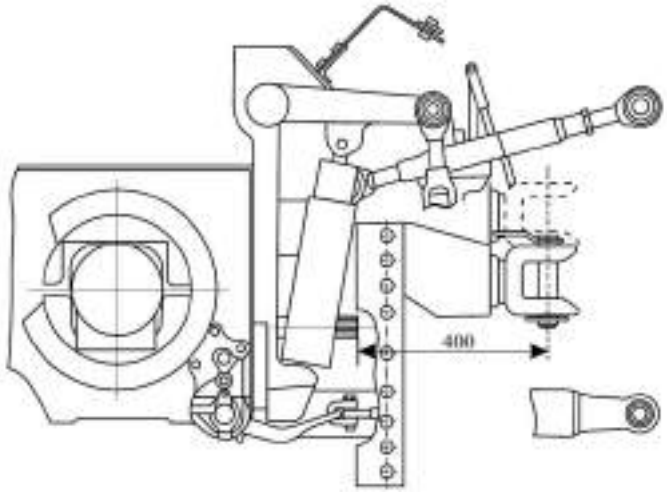


Fig. 6.8.5 – Chart of unitizing for TC-3V

Parameters and dimensions of connecting elements of TC-3V

Coupling device	Rotating yoke with the possibility of vertical travel
Distance from yoke to support surface, mm	435 … 905 or 589 … 1059 (with towing yoke turn) in steps
Position of fork for machines driven by PTO	lowermost or uppermost, including with towing yoke turn
Diameter of connecting finger mm	30
Distance from the PTO end to axis of joining pin, mm	400 [1)]
Vertical load on TC, kN	12
Angle of machine turn relative to tractor, deg	± 55 (trailers) ± 85 (agricultural machines)

[1)] — For BELARUS-1021/1021.3 tractors produced from III quarter 2010, the distance from PTO end to axis of joining pin is 390 mm

6.8.6 TC-1M-01 (draw bar)

Used for work with the following machines:
- semi-trailed (same as with TC-2V and TC-3V).
- trailed (same as with TC-2V and TC-3V).

Figure 6.8.6 shows the chart of unitizing for TC-1M-01.

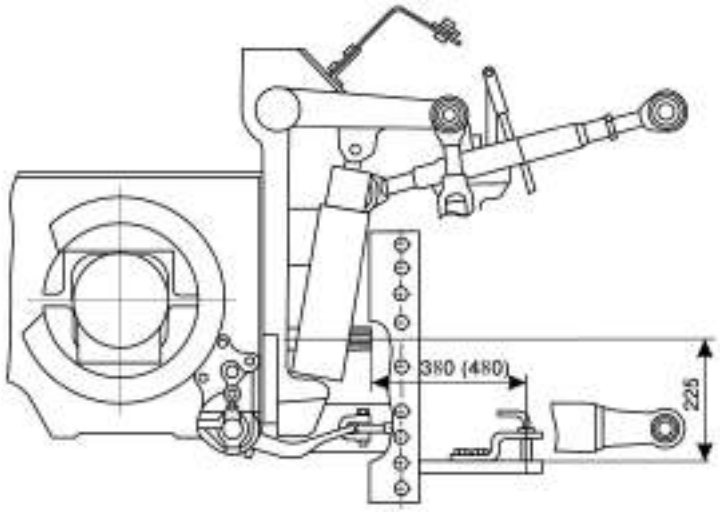


Fig. 6.8.6 – Chart of unitizing for TC-1M-01

Parameters and dimensions of connecting elements of TC-1M-01

Coupling device	Yoke with the possibility of changing position relative to the PTO shaft end
Distance from towbar upper surface to support surface, mm For tires 16.9R38 For tires 11.2R42	 437 382
Distance from the PTO end to axis of joining pin, mm	390 or 490
Diameter of connecting finger mm	30
Vertical load on TC, kN	12
Angle of machine turn relative to tractor, deg	± 85

6.9 PTO and drive of machines

With proper arrangement of PTIs of the unitized machines relative to the tractor PTO, standard driveshafts can be installed.

The PTO provides synchronous drive to machines (active semi-trailers, planters, etc.), at that any shaft end type can be used. The maximum movement speed must not exceed 8 km/h.

When using the rear PTO at 540 rpm, install a safety coupling from the PTI side, which limits power takeoff in excess of allowable values (60 kW max.). The safety coupling can be installed also to protect the drive from overloads.

The PTO shaft end is not designed to transfer radial forces that exceed the load from the driveshaft weight.

One rear PTO speed is changed to another by replacing one shaft end with another.

Tables below list characteristics of tractor PTO shaft ends.

Attention!

1. For protection of the PTO drive, it is advisable to install a safety coupling on the machine.

2. To avoid overloading of the PTO drive when unitizing with inertial machines (forage harvesters and others), a driveshaft should be used with an overrunning or combined clutch on the PTI side.

3. Power taken off from the PTO shaft end of BELARUS-1021/1021.3 tractors must not exceed the operating power of BELARUS -1021/1021.3 tractors.

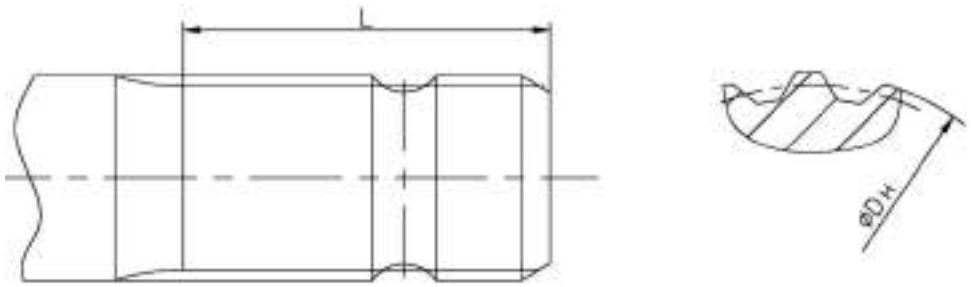


Fig. 6.9.1 – PTO shaft end parameters

Characteristic of PTO drive

Parameters	Designation (see Fig. 6.9.1)	**PTO1**	**PTO1S**	**PTO2**
Spline length, mm	**L**	76	78	72
Outer diameter, mm	**Do**	35	38	35
Number of splines, pcs.	**n**	6	8	21

PTO modes

PTO	Shaft end type	Speed, rpm		Transmission capacity, kW
		PTO	of engine	
Rear independent	PTO 1S PTO 1 PTO 2	540 540 1,000	2,040 2,040 2,160	60 max. 60 max. For 1021 — 74 max., for 1021.3 — 75 max.
Rear synchronous	PTO 1S PTO 1 PTO 2	See Power takeoff shaft (PTO) drive on p. 20 of this manual		60 max.

To transfer torque from the tractor PTO to the agricultural machine PTI with a rated speed of 540 rpm or 1,000 rpm, telescopic driveshafts with a protective enclosure are used.

The driveshaft is supplied in the machine package. Driveshafts are manufactured in compliance with the requirements of the standard and design documentation of the manufacturer. Table below lists main types of driveshafts.

Driveshaft types

Driveshaft type designation	Name of driveshaft design type
10	Telescopic, with universal cardan joints with protective enclosure.
20	Telescopic, with universal cardan joint and constant-velocity universal joint with protective enclosure.
30	Telescopic with two constant-velocity universal joints with protective enclosure.
40	Telescopic, with safety coupling [1)], constant-velocity universal joints with protective enclosure.
50	Telescopic, with safety coupling[1)], with universal cardan joint and constant-velocity universal joint with protective enclosure.

[1)] Type of coupling is determined by machine operation conditions.

The used PTO shaft type is determined depending on the method of connection, torque and operating conditions of the machine in accordance with Table Use of driveshafts (see below).

The main initial parameter for PTO choice is the maximum allowable torque that can be determined from the chart presented onFig. 6.9.2.

For machines unitized with use of HL-2, the driveshaft is determined by the distance (the shaft fully moved) in the horizontal position of the HL lower rods. The driveshaft is extended when the machine is lifted, thus, check for overlap of telescopic elements in the upper position. The joint tilt angle from the PTO side is greater than from the PTI (see Table Use of driveshafts).

For mounted machines and machines, for which $L_1 = L_2$ (see Table Use of driveshafts) and the PTI shaft end is provided, a driveshaft with universal cardan joints is normally used.

For unitized machines that do not provide equal distances from the hitch point to the tractor PTO and the machine PTI (with the difference of the distances exceeding 10 mm). The driveshaft length is determined when the machine turns to the maximum angle relative to the tractor. When the equation$L_1 = L_2$ is not observed, unevenness of rotation increases sharply, which results in overloads of the entire drive. The driveshaft length is not almost changed when the machine turns relative to the tractor. The unevenness of drive shaft rotation, which appears during driving, is compensated by installing a constant-velocity joint ((see Table Use of driveshafts").

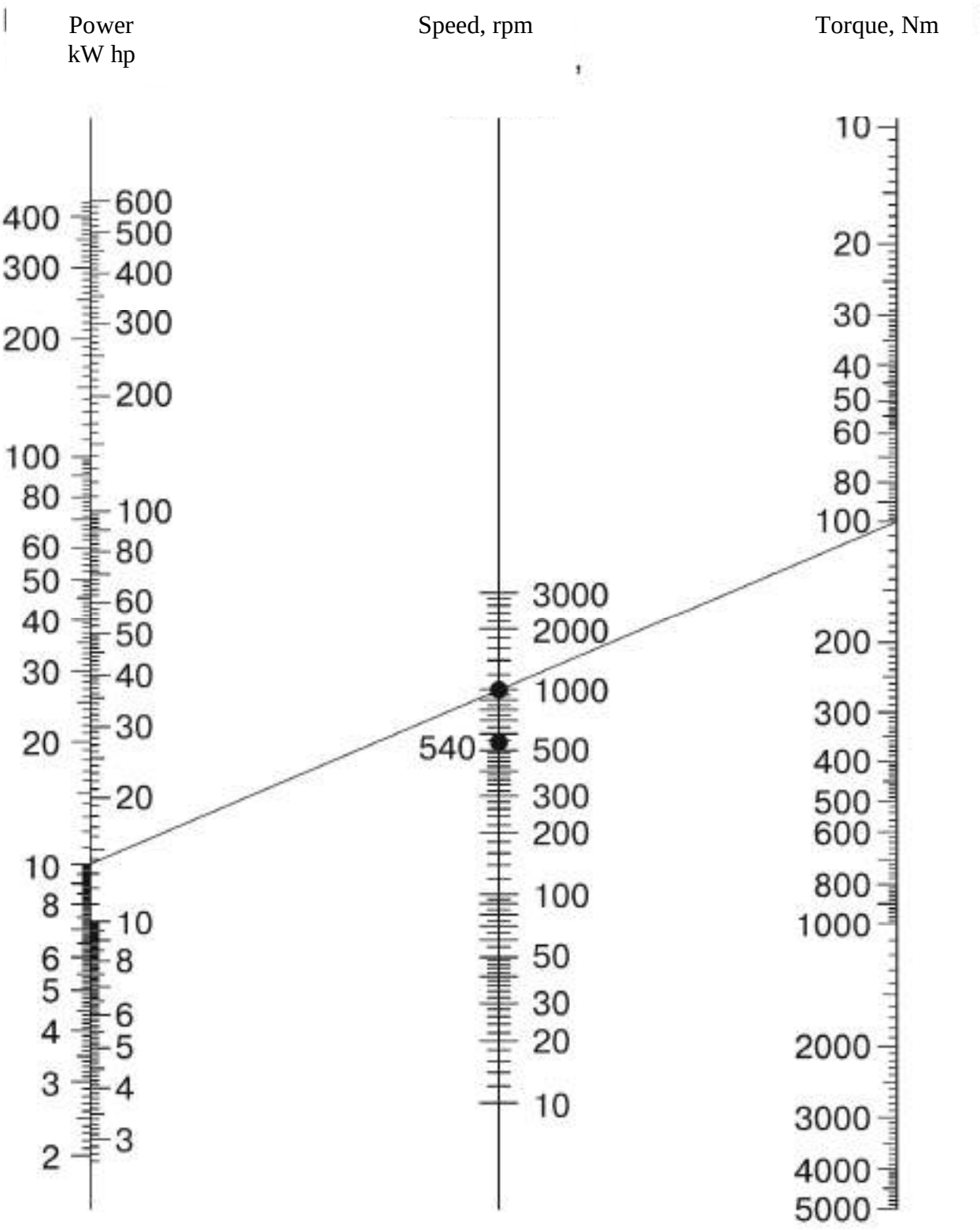
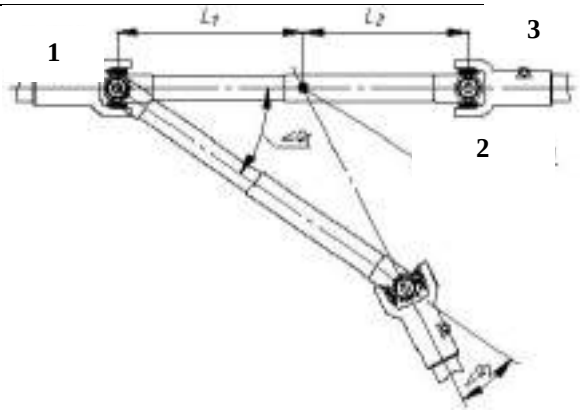
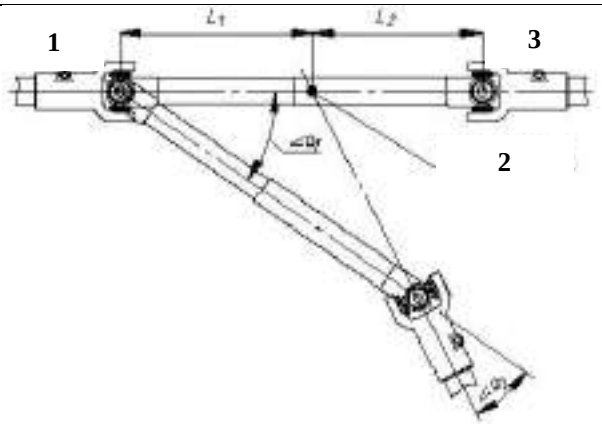
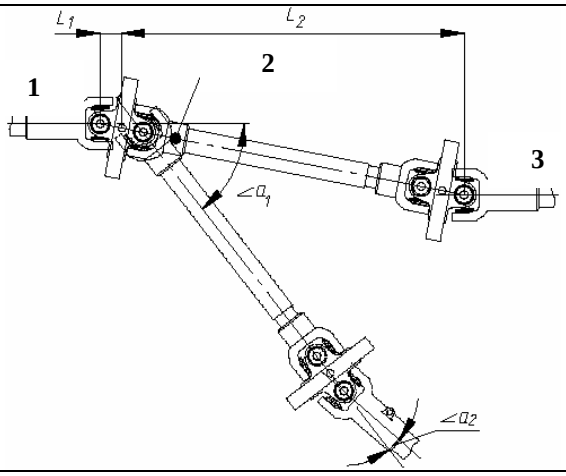


Fig. 6.9.2 — Determining maximum allowable torque

Use of driveshafts depending on the method of unitizing

Driveshaft of machine				Type of tractor device for unitizing
Driveshaft type designation	Figure	Location of hitch relative to PTO and PTI	Joint tilt angles	
10 or 40		–	$\angle a_1$ $\angle a_2$	HL-2
		$L_1 = L_2$	$\angle a_1$ $\angle a_2$	TC-1M-01
20 or 50		$L_1 < L_2$	$\angle a_1 > \angle a_2$ at $\angle a_2 > \pm 5^o$	TC-1M-01
		$L_1 < L_2$	$\angle a_1 > \angle a_2$ at $\angle a_2 = 0^o$	TC-2V
30		$L_1 < L_2$	$\angle a_1 > \angle a_2$ at $\angle a_2 > 5^o$	TC-2V

1 - PTO
2 - Hitch point
3 - PTI

In order to avoid breakdowns of the tractor PTO, manufacturers of agricultural machinery with active working tools (rotary tillers, forage harvesters, mowers, fodder distributors, balers, etc.) must use mechanical clutches in their designs.

Attention: The manufacturer of the machine must warn you beforehand of the need to use a clutch and consequences of using the driveshaft without a clutch!

The clutch is designed for automatic cutoff or restriction of the transmitted torque in case of overloads caused by high starting torques, overloads (locks) of working tools and pulsating loads on the PTI drive. Use of driveshafts without clutches complicates the machine operation, and in some circumstances results in emergency situations and tractor overloads.

Selecting the type and design of the clutch is determined by the conditions of operation and the characteristic of the torque transmitted by the driveshaft of the machine.

The design of mechanical drive of agricultural machines uses safety, overrunning and combined types of clutches.

Overrunning or freewheeling clutches are design options of safety clutches. They protect against overloads caused by increased moment of inertia of rotating masses of the working tools of machines such as balers.

A combined clutch is a safety clutch combined by design with a clutch of another kind such as a freewheeling clutch.

Clutches are subdivided into two basic types — with breakable (shearing clutches) and unbreakable working element, such as jaw or, friction-type disk clutches.

Attention: Moment of actuation of a cardan drive clutch of the machine depending on its characteristics (type and accuracy of actuation) must be greater than the rated working torque that acts for a long time in the machine, but always less than the maximum allowable torque on the tractor PTO.

A safety clutch is installed on the side of the power take-in shaft of the unitized machine drive —other installation does not provide timely protection of the tractor PTO from exceeding the maximum allowable torque and respective failures. A clutch with purely freewheeling functions is usually set closer to the working tools of the machine.

Attention: After a long downtime, check the technical condition of the clutch! Mount or unmount the driveshaft only with the tractor PTO off, thus before connecting or disconnecting the driveshaft, turn off the PTO, kill the engine, remove the starter and instrument switch key!

When connecting the machine driveshaft to the PTO shaft end, proceed asfollows:

- visually inspect the driveshaft, the power take-off shaft and the power take-in shaft for mechanical damages and completeness;
- check that the engaged speed mode match the type of installed shaft ends of the tractor PTO and the machine PTI;
- the driveshaft end forks must be securely fixed in the PTO and the PTI;
- make sure that the internal forks of the intermediate (telescoping) shaft joints lay with the ears in the same plane, as the failure to observe this requirement will cause overloads of the gimbal drive and PTO;
- after installing the gimbal drive make sure that there is no thrust of the telescopic joint elements of the gimbal drive and there is a sufficient overlap of the telescopic part (110 mm min.), as a greater overlap may result in disconnection of transmission;
- lock the lower rods to avoid cross-movements with the mounted or semi-mounted machines connected;
- if necessary, limit the lifting height to the transport position of hinged and semi-mounted machines to avoid possible contact and damage to the gimbal drive and provide a gap between the tractor and the machine.

Control lifting or turning the unitized machine with the driveshaft connected to avoid damaging or thrusting of the driveshaft to the tractor elements. Ensure a safe distance between the driveshaft and the tractor towing coupler TC-1 (cross-beam on the lower rod ends of the hitch linkage) 70 mm min.

Turn off the PTO:

- after stopping the tractor, only after the unitized machine completes its operating cycle;
- when lifting the machine to the transport position (for semi-mounted and mounted machines);
- when making sharp turns (for semi-mounted, semi-trailed and trailed machines).

Do not turn on the PTO:

- when the engine tractor is off;
- when the machine is lowered to the ground;
- when the working tools are buried in the ground;
- if the working tool of the machine are carrying process material or are clogged or jammed;
- if there is an angle of tilt (refraction) of the machine driveshaft in any plane.

Attention!

The manufacturer of the tractor is not responsible and disclaims any warranty for the tractor PTO and the elements of its drive in the following cases:

-driveshaft from the machine package is damaged.

-type of the said driveshaft does not meet the conditions of unitizing.

- the driveshaft coupling is missing (or damaged, or maladjusted).

-the clutch actuation torque exceeds the permissible torque of the PTO shaft end.

-the PTO shaft end type chosen for the machine drive does not meet the conditions of unitizing (for each PTO shaft end the maximum allowable power is specified) of the tractor.

No later than every 10 hours inspect the driveshaft state: reliability of fastening of the end yokes and of the protective enclosure.

Periodically lubricate bearings, telescopic parts of the drive shaft during operation. Lubrication intervals must be as follows:

- bearings with periodic lubricated of protective enclosure — each shift;
- bearings with periodic lubrication of joints and telescopic parts of the driveshaft in a temperate climate — each 70 service hours, in a tropical climate — each 16 service hours.

On machines running PTO tractor PTO shaft safety guard must be secured from rotation by a chain! from rotation, the guards (enclosures) of the driveshaft with protective devices from the tractor side and the machine side must ensure overlapping by 50 mm min.

Turn on the shaft with a driveshaft connected to it smoothly, gradually increasing its speed up to the rated. Up to the start of working process, ensure the rated speed of working tools.

Warnings:

-when working with the PTO, make sure no person is in the area of PTO and driveshaft rotation!

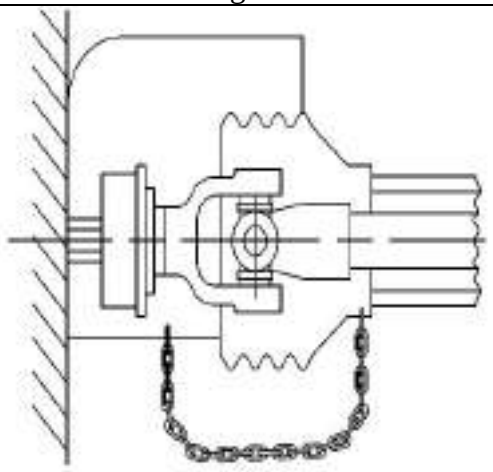
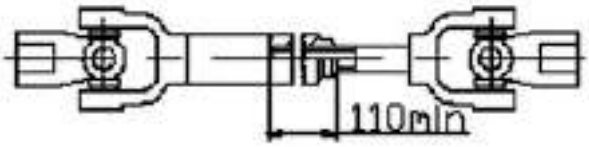
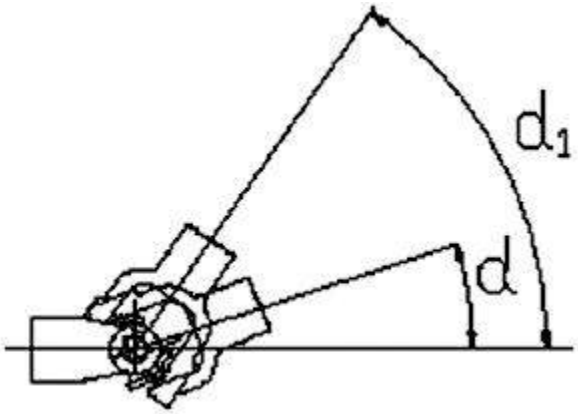
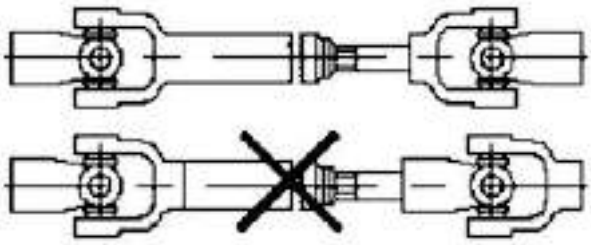
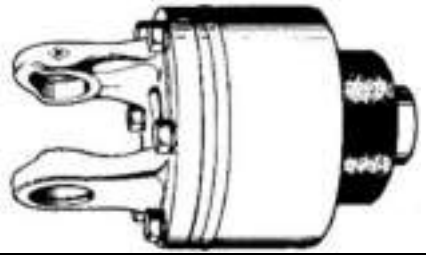
-always turn the PTO when driving up a steep slope and in cases where its operation is not necessary!

-after turning off the PTO, a danger remains for some time because of the inertial mass of rotating parts of the machine. During this time do not approach the MTU! Execution of works is permitted only after a full stop! Make sure to kill the engine and take out the key from the starter and instrument switch!

-clean, lubricate or adjust a unit driven from the PTO or driveshaft only provided that the PTO and the engine are off, and the starter and instrument switch key is removed!

- secure disconnected driveshaft on an appropriate bracket! After removing the driveshaft, install a safety guard on the PTO shaft end.

When installing a driveshaft on the MTU, observe the requirements listed in the table below.

<table>
<tr><th>Requirement</th><th>Figure</th></tr>
<tr><td>Installing a driveshaft with a safety guard and a PTO visor and a restraining chain ensure safety of the joint</td><td>  </td></tr>
<tr><td>Overlapping of the driveshaft telescopic elements must be 110 mm min. to avoid disconnecting and jamming of the connection.</td><td> 
</td></tr>
<tr><td>
table
<table>
<tr><td>Power take-off shaft</td><td colspan="2">Maximum permissible angle of rotation (tils) of machine driveshaft [1], deg.</td></tr>
<tr><td></td><td colspan="2">type of joints</td></tr>
<tr><td></td><td>Universal</td><td>Constant-velocity</td></tr>
<tr><td>In work</td><td>22 [1]</td><td>25 [1]</td></tr>
<tr><td>On process crossings and turns</td><td>55 [2]</td><td>50 [2]</td></tr>
</table>
[1]Permissible operating angle for rated torque transfer.
[2] With PTO off or working without load.
</td><td> 
</td></tr>
<tr><td>The end yokes of the machine driveshaft must be in the same plane</td><td>  </td></tr>
<tr><td>Safety, overrunning and other mechanical clutches protect the tractor and the machine from damages, breakdowns and overloads. A clutch is designed for a certain torque of operation which is usually indicated on its housing.</td><td>  </td></tr>
</table>

6.10Determining weight of tractor, machine and ballast, loads on TC and HL, tires and axles of tractor, criteria of controllability. Procedure of filling tires with liquid and discharging liquid from tires

The tractor and its structural elements, including tires, are designed for reliable operation in a certain range of vertical loads and speeds as set forth in this operating manual for the tractor. In case of non-observance of the recommendations on load and speed modes of the tractor and tires, the manufacturer does not guarantee its trouble-free operation and warns against such operation. Each pneumatic tire is designed to work in a certain range of vertical loads. The width of this range is determined by the size and the design of the tires.

Standard loads on tires for selection of operating mode at various internal pressures

Tire	Load index	Speed symbol	Speed, 20 km/h	Tire load, kg, at internal pressure, kPa								
				60	80	100	120	140	160	180	200	210
11.2R24	114	A8	10 20 30 40	875 815 710 665	1,035 965 840 785	1,180 1100 960 895	1,315 1,220 1,065 995	1,435 1,340 1,170 1,090	1,555 1,450 1,265 1,180	1,770		
360/70R24	122	A8	10 20 30 40	1,365 1,230 1,070 1,000	1,500 1,340 1,165 1,090	1,635 1,450 1,265 1,180	1,775 1,580 1,375 1,285	1,910 1,720 1,500 1400	2,045 1,845 1,605 1,500	2250 (190 kPa)		
18.4R34 F 11	144	A8	10 20 30 40	 2250 1,955 1,830	2,745 2,480 2,160 2,020	3030 2,730 2,375 2,220	3,330 2,960 1,575 2,410	3,615 3,210 2,790 2,610	3,915 3,440 2,995 2,800	4,200		
16.9R38	141	A8	10 20 30 40	 1,595 1,390 1,300	2,275 2,090 1,815 1,700	2,550 2,360 2,050 1,920	2,880 2,630 2,285 2,140	3,210 2,895 2,515 2,355	3,530 3,165 2,755 2,575			
9.5-42	116	A6	10 20 30		 850 710	990 970 810	1,130 1,090 910	1,270 1,180 990	1,385 1,275 1,065	1,490 1,370 1,145	1,600 1460 1,220	1,650 1,500 1250
11.2R42	126	A6	10 20 30		 1,070 895	1250 1,220 1,020	1,425 1,365 1,140	1,595 1,485 1,240	1,735 1,600 1,335	1,860 1,715 1,435	2,005 1,830 1,525	2,160 2,040 1,700 (240 kPa)

Attention:

1. Set pressure in “cold” tires.
2. When performing works requiring higher tractive forces on the hook, set the pressure as for the speed of 30 km/h. For transport operations on the hard-surface roads, increase the pressure by 30 kPa.
3. When pairing wheels, their total load-carrying capacity must not exceed the load-carrying capacity of a single tire more than 1.7 times.
4. When using paired tires, the pressure in the outer one must be 1.20 to 1.25 times lower than in the inner one.

The most reliable and accurate way to determine weights and loads is weighing on the scales for motor vehicles.

Attention!

The load on the HL, TC, axles, tires and frame of the tractor from the weight of the unitized machines must not exceed the maximum allowable valuesas specified in this operating manual for the tractor. At that, the load on the front axle of the tractor in all cases of use must always be at least 20% of tractor own operating weight without the counterweights and water solution in the tires.

Practical determination of the tractor and machine weight, vertical loads on the tractor axles is usually performed on any scale appropriate for this purpose of corresponding load-bearing capacity, which are designed for heavy vehicles. By weighting on the scales, the real load also on the coupling devices of trailed, semi-trailed and semi-mounted machines can be determined.

The value of vertical loads on the coupling devices of trailed, semi-trailed and semi-mounted machines can be determined with a special load gage.

Important: To determine on the scales the load on a particular axle of the tractor in the MTU, put the wheels with the wheels of the measured axle on the scale platform and with the wheels of the other axle out of weighing area at the same level with the platform. We recommend measuring the load on a single axle of the tractor with a rear-mounted machine and (or) mounted counterweights proceeding as follows:

- weigh the front axle (with a lowered RHL);
- weigh the rear axle (with a raised RHL);

Specifications of 1021/1021.3 tractor with trailers and semi-trailers

Parameter name	Parameter value
1. Drawbar category as per GOST 27021	1.4
2. Rated tractive force, kN	14.0
3. Operating maximum allowable weight of the tractor when driving on public roads at speeds of 30 km/h max., kg	8,000
4. Maximum permissible load, kN:	
a) on the front driving axle:	38.0
c) on the rear axle	60.0
5. Operating maximum weight[1)] of tractor trailers and semi-trailers, max., kg:	
a) on categorized public roads[2)]	10,000.0
b) on unsurfaced roads[2)]	8,000.0
c) without brakes	Not more than 50% of the standard operating weight of tractor without ballast counterweights
6. Minimum permissible criterion of tractor controllability K_u	0.2

[1)] Also applies to special semi-trailed and trailed machines on the basis of tractor trailers and semitrailers (for example, trailed machines for fertilizing).

[2)] With the service brake system.

Notes.

1. The load on the front or rear axle must not exceed the total capacity of single tires respectively of the rear or front wheels.

2. When pairing wheels, their total load-carrying capacity must not exceed the load-carrying capacity of a single tire more than 1.7 times.

3. When setting the wheel track of more than 1,800 mm, reduce the load on the axles by about 5% for every 100 mm of increase in the track.

Divide the obtained actual load on the weighed axle of the tractor by two to obtain the load on an individual wheel. Then, depending on the resulting load and speed at which the tractor in the MTU will operate when performing agricultural operations, determine using Table Standard loads on tires for selection of operating mode at various internal pressures above the pressure to set in the wheel tire for the given axle. The left and right tire pressures must be the same.

The load on the coupling device of the machine can be determined in two ways:

1. On scales:

The machine is put on the scales so that only the coupling device of the machine is on the scales with the towing ring (for trailed, semi-trailed machines) or the suspension axle (for semi-mounted machines) rest on the platform through a support with the weight of less than 50 kg and height of 300 ... 500 mm, and the rest (main) part of the machine is outside of the weighing area. Determining the load on the coupling device of the machine on floor scales is only possible when its length is sufficient to install the machine outside the weighing area.

2. With a pressure gage.

The load on the coupling device of the machine can be determined by his hanging on an overhead-track hoist with a load gage.

Soil compaction is largely dependent on the number of passes by the tractor with mounted machines. Therefore it is expedientto reduce the number of passes combining operations with the help of combined units.

Pairing the wheels can significantly reduce the specific pressure on the soiland maintain soil structure, especially of wet fields. Pairing the wheels on dense soils can improve traction qualities of the power unit, especially when combined with proper ballasting or loading of the tractor.

One common method of unitizing block is mounting with the rear hitch. At that, the need arises to ensure longitudinal stability of the MTU without compromising the controllability of the tractor.

The controllability criterion K_u is determined by:

$$K_u=(m_f \cdot g) / M_t \cdot g \geq 0,2,$$

where g = 9.8 m/s, m_f is the operating weight of the tractor in the MTU borne by the front axle of the tractor, kg; M is the standard operating weight of the tractor (without the machine), kg.

The required criterion of controllability is achieved by installing front ballast weights and when not sufficient by filling water (solution) in the front tires.

Filling water (solution) in the tires is made to increase the adhesion weight (increase tractive force of the tractor).

Attention: in this case, the tire load at a given internal pressure must be reduced by the weight of the water filled in!

Under the conditions of satisfactory and sufficient grip of the wheels with the ground, filling a fluid to the tires is not recommended due to overloading of the transmission.

Attention: Additionally loading the wheel by filling water (solution) in the tubes of the tractor is used only in case of insufficient grip of the wheels with the ground under adverse conditions (sand, waterlogged soils, etc.). Tires filled with liquid impair smooth travel of the tractor at speeds exceeding 20 km/h, and at running over an obstruction on such tires may break the carcass!

Attention: It is strictly forbidden to fill the tires with water (solution) over 75% of their volume, because an excessive volume of fluid can result in destruction of tires (casings or tubes)!

Using water (solution) in the front and especially in the rear tires significantly increases the rigidity of the tires, the depth of trace and soil compaction. If water (solution) must be used, we recommend filling all tires to the same level not exceeding 40%.

Attention: Apply filling tires with (water) solution by over 40% only as a last resort!

Volume of water (solution) filled in tire.

Tire	Amount of water, l (when filled at 75%)	Amount of water, l (when filled at 40%)
11.2R24	80	42
360/70R24	119	60
18.4R34 F-11	374	199
16.9R38	356	189
11.2R42	135	72

During the cold season, when the temperatures drop below + 5ºC, in order to prevent the danger of water freezing, add CaCI to the water, g in amount of:

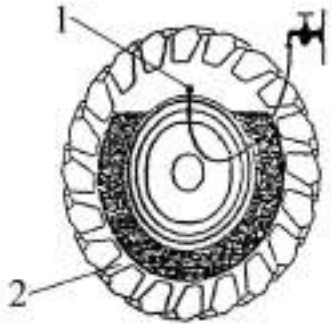
Ambient temperature	Amount of calcium chloride,g/l of water
up to −15°C	200.0
up to −25°C	300.0
up to −35°C	435.0

Caution: When making a solution of liquid ballast, always add calcium chloride in water and stir the solution until calcium chloride is completely dissolved! Never add water to the calcium chloride! When preparing the solution wear protective goggles! In the case of eye contact with the solution, immediately rinse them with clean cold water for five minutes! As soon as possible, seek medical help!

Procedure for filling tires with water or aqueous solution

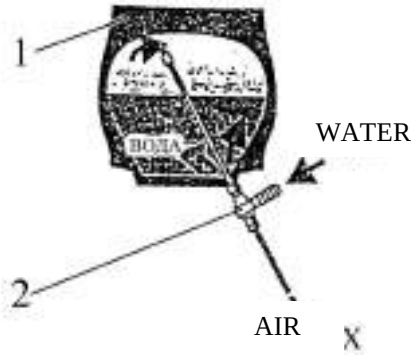
Fill fluid proceeding as follows:

1. Jack up the tractor;
2. Turn the wheel (2) (Fig. 6.10.1) with its valve (1)up;
3. Screw out the inner valve and insert a combined air/water valve in its place (2) (Fig. 6.10.2) through which water (solution) is filled in and air is evacuated from the tire simultaneously;
4. Fill in water (solution);
5. When filling is completed, remove the combined valve and screw in the inner valve, to bring the pressure up to the rated operating pressure of the tire.



1 – valve; 2 – wheel.

Fig. 6.10.1 — Wheel position when filling in liquid



1 – tire; 2 – combined air/water valve.

Fig. 6.10.2 — Pattern of filling tires with fluid

Procedure of partial discharge of water or aqueous solution from wheel tires

For partial removal of the liquid, proceed as follows:

1. Release the wheel with liquid from the load: jack up the wheel so that it breaks off the ground.
2. Install the wheel so that the valve is in the down position.
3. Unscrew the inner valve and drain water or non-freezing liquid to the level of the valve lower position.

Procedure of full discharge of water or aqueous solution from wheel tires

To fully remove the fluid, remove the wheel from the tractor and unmount it proceeding as follows:

1. Bleed the air from the tube and discharge the liquid.
2. Move the both beads of the tires from the rim seat to its recess on the side opposite to the location of the valve.
3. Insert two tire irons between the tire bead and the rim from side of the valve at a distance of about 100 mm on both sides of it.
4. Pull through the rim edge first the part of the bead at the valve, and then the entire bead.
5. Remove from the vale from the hole in the rim taking care not to damage the tube and not to tear off the valve from it.
6. Remove the tube from the casing.
7. Discharge the water from the tube squeezing it with hands.
8. Then mount the tire on the wheel rim observing the rules of assembly and necessary safety precautions.
9. Remove from the cap from the valve and inflate the tire with air to the normal pressure in accordance with the recommendations.
10. Put the cap on the valve and fasten the wheel on the tractor.

Attention: With tubes filled with water (solution), check tire pressure only with the valve in its top position, as otherwise the water entering a tire pressure gage can damage it.

6.11 Working with plows

Tillage with plows (plowing) is the main method of tillage used for cultivation of most crops. Plowing is the most energy-intensive type of work.

The plow type, coverage (number of bottoms) depends on the soil, its mechanical composition, contamination with stones, plowing depth.

Tentatively, on light and medium soils one plow bottom requires up to 14 ... 25 kW of power at a coverage of 0.35 m and plowing depth of 0.22 m. The average coverage can be determined:

$$B_{ï} = \frac{0,88Ð_{í}}{àr_{ï}}$$

where $B_{ï}$ is the plow coverage, m;

$r_{ï}$ - specific draught resistance of the plow (for light soils $r_{ï}$ <30êÍ /ì ^{2}; for medium $r_{ï}$ =30...50êÍ /ì ^{2}, for heavy soils $r_{ï}$ =50...85êÍ /ì ^{2}; for very heavy soils $r_{ï}$ >85êÍ /ì ^{2}), kN/m^2 ;

$Ð_{í}$ - allowable rated tractive force : for 1021/1021.3tractors — 18.0 kN max.;

- a depth of travel (processing) of working tools, m

For unitizing of BELARUS-1021/1021.3 tractors, plows with a coverage of 1,4 m max. are normally used.

As a rule, BELARUS-1021/1021.3 tractors in plowing units are used as per the “tractor wheels in the furrow” pattern. To obtain smooth plowing, reversible (double) or turning plows are used providing one-side soil overturning.

In spite of the variety of plow designs, there are general principles and procedures to prepare them for work with the tractor:

The plow model is selected in accordance with the realized range of nominal tractive forces taking into account the soil types, depths of processing, and the housings are selected in line with the agrotechnical requirements.

The plows are prepared to ensure fulfillment of the requirements to technical condition of working tools, auxiliary devices.

Prepare the unit so, first adjusting the mechanisms of the tractor HL for the given working conditions and preliminary setting the given depth of plowing. It is recommended to check plows and other tillage machines on a specially equipped test area with a hard surface and made markup corresponding to correct placement of the working tools. In the field condition, check can be confined to checking with a twine or a long straight rail. If the plow shares are at different heights and the plow bottoms are in different planes, the plow will go unstable, the draught resistance and fuel consumption will increase.

6.12 Choosing movement speed

When choosing a tractor speed in the MTU, the operator must consider the requirements for speed limits set forth by current traffic rules, as well as traffic density, visibility of the road, features and condition of the tractor and unitized tools, as well as the cargo transported, road and weather conditions. In this case, the unitized machine usually bears a sign of speed limit.

During tractor operation in an machine-tractor unit,two speed mode are used, the working and the auxiliary ones.

1. Choosing speedsfor the working mode.

The working speed of the tractor with a unitized machine is selected based on the guidance from the machine manufacturers listed in the operating manuals for the machine, agrotechnical requirements, as well as taking into account working conditions and technical specifications of the tractor.

The working speed of the tractors during operation in field conditions is limited primarily by the quality of the work performed. Besides, for traction machines it is limited by tractive characteristics of the tractor, and for tractive powered units by the permissible capacity of the PTO and hydraulic take-off, through put of the working tools.

It is recommended to choose the working speed so that it exceeds the minimum permissible and is less than the maximum permissible. And, if possible, operation is performed at engine speeds slightly higher (by 1 ... 2%) than the rated.

2. Choosing speeds for the auxiliary mode

This mode is characterized by speeds of the tractor movement with a unitized machine on the near transport (idling, on process turns and crossings) with the operating tools off. The speed mode of tractor movement with a machine on the near transport is limited mainly by security requirements. Due to a relatively short duration of turn, a need to observe the guidance on limiting the transport speed when moving from one field to another, the corresponding speed of the tractor at idle is often close to the working one.

3. Maneuvering with operating speeds of unitizing

The need for maneuvering with the speeds at unitizing with agricultural machines results from the fact that during the work even on the same field the working conditions change and so do the loads of the tractor. Maneuvering with speeds of the tractor should be done in the range of permissible movement speeds of the MTU as per agrotechnical requirements.

At a significant and relatively long-term increase in the resistance of the machine (when the rotation decreases by more than 200 rpm), shift to a lower gear, otherwisean overload of the tractor will occur and the engine will overheat. This is characterized by a decrease in the engine crankshaft speed and high smoking. In this case, it is very likely that the engine will stop.

At short-term changes of machine resistance (on a route of less than100 m) maneuvering with speeds is not feasible.

Efficiency of shifting the GB gears of the tractor during its work can be assessed by the time for the passage of the tractor in the same direction on two adjacent gears. If at a higher gear time the time for a run is less than at a lower gear, switching from the lowest gear is not feasible.

If due to agrotechnical conditions the process parameters of the machine or the speed cannot be changed and the tractor is working with underload, you can try to save fuel by increasing the movement speed by switching the highest possible gear and reducing the engine speed through reducing the fuel supply.

Table below lists recommended travel speeds of BELARUS-1021/1021.3 tractors in MTUs with different types of machines.

Choosing speed mode

Work performed	Movement speed, km/h, max.
1. Transportation of tractor trailers and semitrailers [1)]	
a) On public roads	25
b) On uncategorized roads	15
2. Delivery of agricultural machines to place of work[2)]	
a) TC-1M-01; TC-2V; TC-3V	25
b) TC-1 (crossbeam)	15
c) with rear HL-2	20
3. Tractor with pairedwheels (via spacers or hubs)	15
4. Driving on slopes and making sharp turns	10

[1)] Also applies to special semi-trailed and trailed machines such as tractor trailers and semitrailers (for example, trailed machines for fertilizing).

[2)] Including process passovers from a field to a field.

6.13 Safety precautions when using tractor in MTU

To ensure trouble-free operation of the tractor and unitized machines, as well as to avoid accidents and emergencies, read this operating manual and the operating manual of the machine unitized with your tractor.

Attention: the operating documentation (applies to both the tractor and the unitized machine) must be always kept in the cab so that it can be used in the event of any issues during work. If the instruction manual for the machine or the tractor is lost, immediately acquire a new one.

This section contains guidance and information on safety precautions to be strictly observed when unitizing your tractor with various machines, which, often without realizing it, are not observed during daily use of the tractor and machines.

6.13.1 Security requirements for driving tractor in MTU on public roads and during transport operations

6.13.1.1 Machines such as tractor trailers or semitrailers must be equipped with service and parking brakes and safety chains (slings). Load carrying capacity of vehicles (trailers, semitrailers, fertilizing and spraying machines) depends on the terrain, slope and road conditions. Given the allowable longitudinal slope of 12 deg., the total weight of a semi-trailer (trailer) with brakes is 9,000 kg max., on a relatively flat area (with a slope of less than 4%) with dry hard surface — 10,000 kg max..

6.13.1.2 The tractor wheel track must correspond to the work conditions, technical characteristics of the tractor and ensure safe use of the tractor in machine and tractor units. When driving the tractor on slopes and making sharp turns, increase the tractor wheel track to ensure sustainability.

6.13.1.3 The service brake drive is of a single-wire design and is actuated from the driver’s seat. The parking brake drive must be located on the machine.

6.13.1.4 Unitizing of general-purpose vehicles (trailers and semi-trailers) must be made via the TC-2V or TC-3V. Coupling with TC-1M-01 and TC-1 is strictly forbidden due to safety reasons.

6.13.1.5 On machines such as trailers or semitrailers, an MTU maximum speed limit sign must be attached on the rear left part. Points for attachment of safety chains (slings) on the tractor are the 24 mm holes in both cheeks of the lift device (fastenings are included into the unitized tool).

6.13.1.6 Unitizing the tractor in a road train (tractor + semitrailer + trailer) is permitted only on dry roads with hard surface with slopes of 4% max. The MTU dimensions when driving on public roads must not exceed: width — 2.6 m, height — 3.2 m. In case of deviations from the above standard values, approval by state authorities responsible for traffic safety is required.

6.13.1.7 When performed transport works on hard-surface roads, increase the tire pressure to the maximum allowed by the manufacturer.

6.13.1.8 To connect the signal equipment of unitized tools, the tractor is provided with a socket for power supply of the unitized machine.

6.13.1.9 Observe the traffic rules.

6.13.1.10 Check the condition of the equipment of the machines for transportation (illumination kit, warning and protective devices). Install this equipment on the machines.

6.13.1.11 When driving on public roads, observe the following requirements:
- drive only with the flashing beacon on;
- do not use the working headlights, because this leads to dazzling of other road users;
- driving the tractor in a unit with agricultural machines with filled tanks (process material such as fertilizers, seeds, etc.) on public roads is prohibited.

6.13.2 Safety precautions for intended use of tractor and machines in MTU

6.13.2.1 Use the tractor and machines, separately and as MTU parts, only in accordance with their intended purposes as specified in the operation documentation for the tractor and the unitized machine in the conditions and modes as set forth by the manufacturer. Use of technical tools, including the tractor, for any other purposes is deemed to be improper use. The manufacturer is not liable for damages resulting from such a use of the unit. In this case, the responsibility falls on the user. The concept of intended use also includes compliance with the operating, maintenance and service conditions as prescribed by the manufacturer. Use of the tractor and machines, their maintenance and service must be performed by the personnel qualified for this.

6.13.2.2 Observe the relevant regulations on accident prevention: common safety rules, health recommendations for labor safety, traffic rules.

6.13.2.3 Unauthorized changes in the unit design releases the manufacturer from liability for any damage resulting from it. This is equally applicable to those cases where defective units were disassembled or repaired improperly; using incomplete tractors or cars, or in a package different from the specifications, as well as in case of replacement of factory original parts and assemblies with other special or non-original not specified by the manufacturer, and when seals are broken.

6.13.2.4 It is forbidden to unitize tolls with the tractor if the results of weighing, calculations, and ballasting yield vertical statics load on the axles, tires, TC and HL of the tractor exceeding the allowable values and ones specified in the tractor manual.

6.13.2.5 In order to ensure handling, stability and stable towing and braking qualities, especially on fields sites with slopes and soft soils, we recommend to ensure a load the front driving wheels of the tractor in the MTU of 25 ... 40% of the standard operating weight of the tractor.

6.13.2.6 Before starting to work, always inspect the tractor in the MTU on traffic and operation safety.

6.13.2.7 Observe all generally accepted regulations for safety and accident prevention specified in instructions on labor protection.

6.13.2.8 The plates on the unitized machines contain important warnings and instructions for safe operation.

6.13.2.9 Before starting to work, familiarize yourself with the design of the mounted machine, controls and functions performed.

6.13.2.10 Garment of the people working on the tractor must be tight fitting. Wearing loose clothing is not allowed.

6.13.2.11 To avoid fire, keep clean the tractor and machines.

6.13.2.12 Before starting the tractor and beginning its operation, make sure that no one is near the tractor and the machine.

6.13.2.13 Attach machines to the tractor strictly according to this operating manual and operating instructions.

6.13.2.14 Take special care when attaching machines to the tractor and when disconnecting them. When attaching or disconnecting tools, make sure that the supporting devices used are in the correct position. Assess stability.

6.13.2.15 Install ballast weights and counterweights only in designated fastening points in accordance with the recommendations.

6.13.2.16 Observe the permissible vertical static loads on the axles, tires, the total operating weight and vehicle dimensions.

6.13.2.17 The disconnecting slings for the quick-release joint should hang freely and must not spontaneously open in the lower position.

6.13.2.18 While driving, do not leave the tractor cab.

6.13.2.19 The machines attached to the tractor, as well as ballast weights affect the transport characteristics, handling and braking ability. Keep this in mind when driving and braking of the tractor, especially in an MTU. Keep the distance. Consider the possibility of skidding, departure and inertial mass of the unitized machines when cornering.

6.13.2.20 Drive the tractor with machines only under the condition that all the protective devices of the tractor and machines are installed and set to the respective working position.

6.13.2.21 Being in the working area of machines is strictly forbidden! Do not be in the zone of turnover and turning of the machines, working tools and their other elements.

6.13.2.22 The hydraulically folding frame of the machines must be operated only in the absence of people in the area of rotation or lifting.

6.13.2.23 The remotely actuated elements of the machines (for example, using hydraulics) can cause injuries (sqeezing and cuts). When moving the unit at a high speed, the driven working tools are dangerous because of the possibility of their extension under the action of the inertial mass. Wait until full stop of the working tools.

6.13.2.24 Before leaving the tractor cab, bring down all the machine elements to the ground, turn off the engine, remove the starter and instrument switch key.

6.13.2.25 It is strictly forbidden to be in an area between the tractor and the machine, if the vehicle is not fixed from spontaneous rolling with the parking brake and/or a brake shoe and the engine is not off.

6.13.2.26 The folding frame and the loader bucket in transport position must be fixed.

6.13.2.27 Before starting transportation on public roads, turn inward and fix the swinging lever of additional equipment of the machines such as packing wheel. Also fix the markers in the transport position.

6.13.2.28 Use the charging platform of the unitized machine only for filling seeds and fertilizers. It is strictly prohibited to be on the platform during the MTU operation.

6.13.2.29 When driving the MTU on the slopes and making sharp turns, when necessary, increase the track to improve stability.

6.13.2.30 During work, do not turn the tractor with the working tools of the unit deepened into the soil. Make a turn fully all the working tools of the unit get fully out of the soil.

6.13.3 Safety requirements for unitizing tractor with mounted and semi-mounted machines

6.13.3.1 Before starting to unitize machines with the three-point hitch linkage, and before disconnecting the machines from the three-point hitch linkage, set the controls of the device to a position precluding spontaneous lifting or lowering of the unit.

6.13.3.2 When connecting the machine to the three-point hitch linkage joints, ensure compliance of the dimensions of the respective connecting elements (category or type: tractor+unit).

6.13.3.3 Do not stay in the area of the three-point hitch linkage because of hazard of serious injuries squeezing and cuts. When remotely controlling during hitching of the machine to the three-point hitch linkage, staying in the area between the tractor and the unit is also prohibited.

6.13.3.4 Ensure reliable lateral fixation of the lower rods of the three-point hitch linkage of the tractor using strainers if the unit is in the transport position. When driving on public roads with a machine in the transport position with the unit raised, lock the three-point hitch linkage in the upper position to avoid spontaneous lowering of the unit and provide a sufficient clearance between the machine elements and the road (300 mm min.).

6.13.4 Safety requirements for unitizing tractor with trailed and semi-trailed machines

6.13.4.1 Take measures to avoid spontaneous movement of machines that have running wheels.

6.13.4.2 When attaching a trailed or semi-trailed machine to the tractor, ensure compliance with the respective dimensions of connecting elements of the tractor and machine.

6.13.4.3 Observe the maximum permissible vertical static load on the towing couplers of the tractor.

6.13.4.4 When using a single-point hitch of agricultural machines by a towing ring (towbar or stun pole), ensure the required mobility at the point of connection and avoid a possibility of jamming.

6.13.4.5 A single-point hitch (towbar or stun pole) of the machine must have a support and a safety connecting chain or sling.

6.13.4.6 The connecting devices of trailed and semi-trailed machines must be rigid, not allowing to run against the tractor.

6.13.5 Safety requirements for unitizing tractor with machines driven from PTO

6.13.5.1 Use only driveshafts recommended by the manufacturer of the machine. Monitor the condition of the driveshaft.

6.13.5.2 The driveshaft must have a protective enclosure. The driveshaft enclosure must be fixed by a chain to prevent rotation.

6.13.5.3 Before connecting or disconnecting the driveshaft, turn off the PTO, kill the engine, remove the starter and instrument switch key.

6.13.5.4 Always check the correctness and security of driveshaft installation.

6.13.5.5 When turning on the PTO, make sure that the selected speed of the PTO tractor is consistent with the allowable rotation speed for the unit.

6.13.5.6 When using a ground-speed PTO, make sure that the PTO speed depends on the travel speed, and when driving in revers, the rotation direction is reversed.

6.13.5.7 Before turning on the PTO, make sure no one stays in the danger area of the unit.

6.13.5.8 Never turn on the PTO when the engine is off.

6.13.5.9 When working with the PTO, make sure no person stays in the area of PTO and driveshaft rotation!

6.13.5.10 Always turn off the PTO when driving up a steep slope and in cases where its operation is not necessary.

6.13.5.11 After turning off the PTO, a danger remains for some time because of the inertial mass of rotating parts of the machine. During this time do not approach the attached machine! Execution of works is permitted only after a full stop. Make sure to kill the engine and take out the key from the starter and instrument switch.

6.13.5.12 Clean, lubricate or adjust a unit driven from the PTO or driveshaft only provided that the PTO and the engine are off, and the starter and instrument switch key is removed.

6.13.5.13 Secure a disconnected driveshaft on an appropriate bracket.

6.13.5.14 After removing the driveshaft, install a safety guard on the PTO shaft end.

6.13.5.15 Visually inspect the driveshaft, the power take-off shaft and the power take-in shaft. Immediately correct any faults if found.

6.13.6 Safety requirements for unitizing tractor with machines operating under pressure

6.13.6.1 Always consider a high pressure in the hydraulic and pneumatic systems of the tractor and unitized machines.

6.13.6.2 Before connecting hydraulic hoses to the hydraulic system of the tractor, make sure there is no pressure in the hydraulic systems of the tractor and unit.

6.13.6.3 When connecting hydraulic hoses of the machine to the tractor hydraulic system, make sure that there is no pressure in the system, observe proper connections of the tractor hydraulic system with the unit hydraulic system in accordance with the labeling of hoses and the connection diagram. The layouts and connection charts of hydraulic system outputs are presented in this tractor operating manual and the machine operating manuals. Erroneous connection of an inverse function (e.g., lifting or lowering) may cause an accident.

6.13.6.4 Regularly check the condition of hydraulic hoses. If any damages found, immediate replace them. The new hoses intended for replacement must fully meet the requirements of the manufacturer.

6.13.6.5 When finding a point of leak, in order to avoid injuries use respective auxiliary mean. Hydraulic oil flowing out under a high pressure can penetrate the skin, causing severe injuries. In case of an injury seek immediate medical help.

6.13.6.6 All works with hydraulic and pneumatic connections of the hydraulic accumulators and receivers of the machines must be performed with pressure relieved.

6.13.6.7 Incorrect installation and operation of the hydraulic accumulators in violation of occupational safety requirements and operational documentation can cause severe accidents.

6.13.7 Safety requirements for maintenance and repair of machine-tractor units

6.13.7.1 Perform repair, maintenance, cleaning, as well as troubleshooting always provided that the hydraulic system, actuators and engine are off, the key removed from the starter and instrument switch.

6.13.7.2 Regularly check tightness of bolts and nuts. If necessary, tighten them up. Pay attention to fixing elements of the tractor carcass, wheels, connecting devices, including towing and hitch three-point devices.

6.13.7.3 Do not perform welding, soldering or mechanical works on the hydraulic accumulators.

6.13.7.4 When performing maintenance on a lifted machine, ensure a stable position of the machine using appropriate support elements.

6.13.7.5 When replacing the working tools with sharp cutting edges of the machines, always use appropriate tools and protective gloves.

6.13.7.6 Before starting maintenance or repair of electrical equipment, make sure to disconnect all electrical appliances and devices.

6.13.7.7 When using electric welding on the tractor and the machine, switch off the ground switch, disconnect the cable and harnesses from the batteries and alternator.

6.13.7.8 Spare parts of the tractor and machines must fully meet the specifications of the manufacturer. For your safety, use genuine parts.

7. TROUBLESHOOTING

7.1 Troubleshooting of diesel engine and its systems

Trouble, its manifestation	Remedy
1. The engine does not start	
Air in the fuel system	Pump through the system using a hand-priming pump. Eliminate air leak in the fuel system
Faulty fuel pump	Remove the fuel pump from the engine and send off for repair.
Fuel filters clogged	Rinse the coarse fuel filter and replace the fine fuel filter
The engine is not warm enough	At low temperatures, warm up the diesel using available starting aids.
2. The engine does not develop its capacity	
The fuel pump control lever does not reach all the way	Adjust the control linkages of the fuel pump
Clogged filter element of the fine fuel filter	Replace the filter element of the fine fuel filter
Faulty injectors	Identify the faulty injectors, rinse, and adjust
Incorrect setting of the advance angle of fuel injection	Set the recommended advance angle of fuel injection
Faulty fuel pump	Remove the fuel pump from the engine and send off for repair.
Boost pressure dropped	Remove the turbo charger from the engine and send off for repair.
Broken tightness of the engine charge air cooler (in BELARUS-1021.3)	Determine the cause of leak and correct it
3. Engine fumes on all modes of operation	
3.1 Black smoke from the exhaust pipe:	
Clogged engine air cleaner	Perform maintenance of the air cleaner
Injector nozzle needle hangs	Identify the faulty injector, rinse or replace the nozzle, adjust the injector
Faulty fuel pump	Remove the fuel pump from the engine and send off for repair.
3.2 White smoke from the exhaust pipe:	
Engine works with overcooling	Warm up the engine, during work, maintain the coolant temperature within 70 to 95°C
Water in fuel	Change fuel
No clearance between the valves and the rockers.	Adjust the clearances between the valves and the rockers.
No clearance between the valves and the rockers.	Adjust the clearances between the valves and the rockers.
Incorrect setting of the advance angle of fuel injection	Set the recommended advance angle of fuel injection

Trouble, its manifestation	Remedy
3.3 Blue smoke from the exhaust pipe:	
Oil in the combustion chamber as a result of wear of piston rings, pistons, sleeves	Replace worn piston rings, pistons, sleeves
Excessive oil in the diesel engine crankcase	Pour off excess oil, setting the level on the top mark of the oil gage stick
4. Engine overheats	
Insufficient amount of coolant in the cooling system	Add coolant to the heat exchanger to the normal level
Heat exchanger contaminated from outside	Clean the heat exchanger
Thermostat valve does not open fully	Replace the thermostat
Insufficient tension of the fan belt	Tighten the belt
Oil on the fan belt and pulleys	Remove the drive belt, remove traces of oil from the surface of the belt and pulleys
5. Oil pressure in the hot engine lower than allowable	
Faulty pressure sensor or indicator	Replace the pressure sensor or indicator, if necessary, after checking the oil pressure with a control tool set
Broken tightness of oil line connections	Find the location of leakage and restore it
Faulty oil pump	Find the fault and correct it
Oil level in the diesel engine crankcase lower than allowable	Add oil to the top mark of the oil gage stick
Jammed safety valve in the oil filter housing	Rinse the valve and bushing, adjust the pressure in the lubrication system
Wear limit in the joints of the crankshaft journal — bearing bushings (rod bearings)	Correct the fault
6. Engine overspeeding	
Immediately stop the engine by shutting off fuel or air delivery. Remove the fuel pump from the engine and send it to a specialized repair shop to determine the cause and fix the problem	
7. Engine suddenly stops	
No fuel delivery	Check fuel in the fuel tank, condition of fuel lines, filters and priming pump.
8. Turbocharger Turbocharger rotor does not rotate (no characteristic high-pitched sound)	
Presence of foreign objects preventing rotor rotation;	Remove the inlet and outlet pipes, remove foreign objects.
Rotor jammed in the bearing	Replace the turbocharger.
Increased release of oil from the compressor or turbine, broken tightness of oil seals of the turbocharger	Remove the turbo charger from the engine and send off for repair

Trouble, its manifestation	Remedy
9 Starter	
9.1 When the starter is turned on, the engine crankshaft does not rotate or rotates very slowly	
Weak tightening of the battery terminals or oxidized wire terminals.	Clean the terminals and tighten up the terminals.
Battery discharge lower than the allowable threshold.	Recharge or replace the battery.
Poor contact of the brushes with the commutator. Wear of the brushes exceeds the allowable.	Remove the starter from the engine, clean the commutator, remove hanging of the brushes or replace them if they are worn out.
In the starter relay, burned surfaces of the contact bolts and the contact plate, getting in contact when activated.	Clean the starter relay contacts or install the contact screws into the nests on the cover, turning around the axis by 180°, and install the contact plate set upside down.
Faulty starter drive.	Replace the starter drive.
Engine start lock device operated or its switch faulty	Shift the gear shifter to its neutral position. If after this no start occurs, check operability of the start lock switch and its electrical circuits.
Engine not prepared for start at temperature below 5°C.	Prepare the engine to start at low temperatures.
9.2 After engine start, the starter remains on:	
Contact plate welded to the contact bolts of the starter switch.	Clean the starter relay contacts or install the contact screws into the nests on the cover, turning around the axis by 180°, and install the contact plate set upside down.
9.3 Starter armature rotates at high speed without cranking engine crankshaft	
Broken teeth of the flywheel rim.	Replace the flywheel rim.
Faulty starter drive.	Replace the starter drive.
9.4 Starter switch operates with erratically (turns on starter and immediately turns off)	
Broken hold-in winding of the switch.	Replace the starting relay
Storage battery discharged	Recharge or replace the battery.
9.5 Drive pinion systematically does not engage with flywheel rim during normal operation of switch	
Butt wear of form-relieved part of flywheel rim.	Relieve the rim teeth or replace the flywheel rim.
Jamming drive pinion on the rotor shaft due to the lack or poor lubrication.	Clean the drive and the shaft of the old grease; apply grease CIATIM-201/203/221.
Butt wear of form-relieved part of drive gear rim.	Relieve the teeth or replace the drive.

10 Alternator	
10.1 Voltmeter shows no charging after starting engine and then during entire work	
The plus terminal broken or short-circuited to the alternator housing;	Disconnect the rectifier, solder and insulate the point of failure. Isolate the damaged insulation point
Broken circuit of the excitation coil	Disassemble the alternator, solder and insulate the damaged point, if impossible to correct this fault, replace the excitation coil
Short-circuit of one of the stator phases to the alternator housing	Replace the stator
Short-circuit of the power rectifier terminals, or breakdown in forward and reverse diodes	Replace the rectifier unit
Faulty voltage regulator	Replace the voltage regulator
10.2 Alternator does not develop its full capacity	
Broken wires leading to the regulator	Solder and insulate the point of failure
Broken one of the stator phases	Replace the stator
Turn-to-turn short circuit of the stator winding	Replace the stator
Turn-to-turn short circuit of the excitation coil winding	Replace the excitation coil
Faulty one of the power rectifier diodes	Replace the rectifier unit
10.3 Systematic overcharge of storage battery	
Faulty voltage regulator	Replace the voltage regulator
Short-circuit to the housing of terminal “SH” of the voltage regulator	Isolate the damaged insulation point
10.4 Noise in alternator	
Drive belt slip or excessive tension	Adjust the drive belt tension
Excessive wear of bearings	Replace the bearings
11 Start preheater (only on BELARUS-1021)	
Solenoid valve of the engine start preheater does not operate	
No contact in the circuit of the SPH solenoid coil.	Check integrity of the electrical control circuits of the SPH, tighten the contact of wire fastening to the EPT.

7.2 Troubleshooting of clutch

Trouble, its manifestation	Remedy
1. Clutch does not transmit a full torque (“skids”)	
No clearance between the release bearing and the release levers — the clutch is “half-disengaged” (lack of clutch pedal free travel).	Adjust the clutch pedal free travel as described in 8 Maintenance of this Manual.
Unfinished clutch engaged (the clutch lever does not return to its original position) when releasing the clutch pedal because of the disruption of clutch control.	Adjust the clutch pedal free travel as described in 8 Maintenance of this Manual.
Worn lining clutch disk facings.	Replace the facings or drive plate assemblies.
Oil contamination of clutch driven plates because of oil ingress into the dry chamber.	Find and correct the cause of oil ingress into the dry chamber.
Insufficient force of the pressure springs (springs shrinkage during long slippage and overheating of the clutch).	Replace the pressure springs.
2. The clutch is not completely disengaged (“leads”)	
Increased clearance between the release bearing and the release levers (too long clutch pedal free travel).	Adjust the clutch pedal free travel as described in 8 Maintenance of this Manual.
The release levers are not evenly adjacent to the release bearing.	Adjust the position of the release levers.
Increased warp of the driven plates.	Check the butt beat of the driven plate facings relative to the outer diameter of the hub splines — it must be 0.8 mm max. at a radius of 165 mm. If straightening is not possible, replace the plates.
Jamming of the driven plate hub on the transmission shaft splines.	Clean the splines ensuring free movement of the plates on the transmission shaft.
Destroyed bearing of the transmission shaft journal in the flywheel.	Replace the bearing.
3. Oil in the dry chamber of the clutch	
Worn sealing cup of the crankshaft	Replace the cup
Embossed cover of the driven shaft bearing of the PTO drive during coupling of the tractor after repair	Install a new cover or straighten the old one
Worn sealing cup of the release yoke bracket	Replace the cup

7.3 Troubleshooting of rear axle

Trouble, its manifestation	Remedy
High noise in the final bevel gear and pinion	
Maladjusted mesh of the final drive pinion and the differential bearings.	Adjust the mesh and clearance in the bearings.
Rear axle differential lock does not operate	
Oil on lock clutch plates (only for tractors equipped with dry brakes).	Eliminate leakage of oil, rinse the plates.
Worn friction linings of the lock clutch plates.	Replace the plate assemblies.
Damaged lock clutch diaphragm.	Replace the diaphragm.
Low oil pressure supplied to the lock actuator.	Check the pressure supplied to the DL clutch. It must be 0.9 to 1 MPa
Differential lock hydraulic distributor does not operate.	Check the fuses, switches and other elements of the DL circuit, correct the problem. If the electrical circuit and its elements are operable, unmount the DL hydraulic distributor and send it for repair.

7.4 Troubleshooting of rear PTO

Trouble, its manifestation	Remedy
Rear PTO does not transmit a full torque or keeps on rotating when turned off	
Maladjustment of control due to significant wear of the friction linings of brake bands or due to other reasons.	Adjust the PTO control mechanism as indicated in 5.5 PTO adjustments.
Faulty hydraulic control system.	Contact a qualified technician.

7.5 Troubleshooting of brake system

Trouble, its manifestation	Remedy
1. Inefficient braking	
Increased travel of pedals.	Adjust the service brake pedal free travel as specified in 8 Maintenance of this Manual.
Worn out friction brake disks.	Replace friction disks.
2. Service brakes are not disengaged	
Incomplete return of the pedals to the original position after braking due to weakening or breakdown of the pedal return springs.	Replace the return springs of the service brake pedals.
3. One of the service brakes is not disengaged	
Weak or broken return springs of the pressure plates.	Replace the return springs of the pressure plates.
No lubricant in the pressure plate holes (only for tractors equipped with dry brakes).	Lubricate the pressure plate holes with Lithol-24 grease as per GOST 21150-87 or a similar
Signs of wear and corrosion on the working surfaces of the pressure plates.	Clean the working surfaces of the pressure plates.
Signs of wear and corrosion on the hole surfaces (only for tractors equipped with dry brakes).	Polish and then lubricate the holes.
No (insufficient) oil in the brake housing	Fill the brake housing with oil (or add it) as specified in 8 Maintenance of this Manual.
4. Uneven braking of the right and left wheels	
Maladjustment of the service brakes.	Adjust the service brakes as specified in 8 Maintenance of this Manual.
Worn frictional brake disks of one of the brakes.	Replace friction disks.
Inefficient parking brake	
Maladjustment of the parking brake.	Adjust the parking brake as specified in 8 Maintenance of this Manual.
Worn out friction brake disks of the parking brake.	Replace the friction disks of the parking brake

ATTENTION: Often the tractor brakes fail due to use of trailed and semi-trailed machines with no brakes interlocked with the tractor brakes. Do not use trailed and semi-trailed machines with no brakes interlocked with the tractor brakes if their weight exceeds half the weight of the tractor.

7.6 Troubleshooting of pneumatic system

Trouble, its manifestation	Remedy
1. Insufficient air pressure in the cylinder, the pressure increases slowly and drops rapidly when the engine is stopped	
Air leakage from the pneumatic system due to the following reasons:	
- weakly tightened nuts of the piping, valves, tension bands;	Eliminate leaks by tightening the connections.
- damaged seal ring of the coupling head;	Replace the damaged seal ring.
- weakened tightening of the coupling head connecting piece;	Tighten up the connecting piece.
- dirty valve of the coupling head;	Clean the valve.
- dust cover contact with the valve of the coupling head;	Eliminate the contact.
- weakened fastening of the pressure regulator covers, leakage of its seals;	Tighten up the bolts fastening the covers, eliminate leakage in the seals.
- clogged filter of the pressure regulator.	Rinse the air filter and blow it with compressed air.
Faulty air compressor.	Unmount the air compressor and send it in for repair.
2. Air pressure in the cylinder drops quickly when pressing the brake pedal	
Faulty brake valve	Replace the brake valve
3. Increased release of oil to the pneumatic system	
Faulty air compressor	Unmount the air compressor and send it in for repair.
4. Insufficient pressure in the receiver	
Air leakage from the pneumatic system.	Eliminate air leaks as described above.
Disturbed position of the adjusting cap of the pressure regulator.	Adjust the pressure regulator as specified in 5.8 Checking and adjusting pneumatic system pressure regulator of this Manual.
Faulty air compressor	Unmount the air compressor and send it in for repair.
5. Pressure regulator switches the compressor to idle at a pressure of less than 0.77 ... 0.80 MPa, and to a stroke less than 0.65 MPa or more than 0.70 MPa	
Dirt in cavities and channels of the pressure regulator.	Wash and clean the pressure regulator.
Disturbed position of the adjusting cap of the pressure regulator.	Adjust the pressure regulator as specified in 5.8 Checking and adjusting pneumatic system pressure regulator of this Manual.
Damaged rubber components of the pressure regulator, shrinkage of springs.	Replace the damaged parts or send the pressure regulator for repair.
Skewed, hanging spool of the regulating part of the pressure regulator.	Ensure mobility of the spool, lubricate it or send the pressure regulator for repair.

Trouble, its manifestation	Remedy
6. Pressure regulator operates in the safety valve mode	
The adjusting cap of the pressure regulator is screwed in too much.	Adjust the pressure regulator.
Jammed dummy piston of the pressure regulator.	Disassemble the pressure regulator and eliminate the jamming.
Clogged vents in the cap of the pressure regulator.	Clean the vents.
7. No air flow into the hose for tire inflation through the air bleed valve	
Insufficiently recessed air bleed valve stem in the pressure regulator.	Fully screw the hose nut onto the connecting piece.
The pressure regulator switched the compressor to idle.	Reduce the cylinder pressure to below 0.65 MPa
8. Trailer brakes operate inefficiently	
Maladjusted brake valve actuator.	Adjust the brake valve actuator as specified in 5.7 Checking and adjusting brake valve of pneumatic system of this Manual.
Maladjusted brake valve.	Replace the brake valve.
Faulty brake system of the trailer.	Correct the fault.
9. Trailer brakes release slowly	
Maladjusted brake valve actuator.	Adjust the brake valve actuator as specified in 5.7 Checking and adjusting brake valve of pneumatic system of this Manual.

Attention: When troubleshooting the pneumatic system, adjust or repair the pressure regulator on your own only after the warranty period for your tractor has expired. Otherwise, the warranty for the pressure regulator will be void. To repair and adjust the pressure regulator during the guarantee period of the tractor, contact your local dealer!

7.7 Troubleshooting of steering

Trouble, its manifestation	Remedy
1. Too much effort on the steering wheel.	
No or insufficient oil pressure in the steering hydraulic system (oil pressure in the steering hydraulic system must be 14 to 16 MPa) because of:	
- insufficient oil level in the tank;	Fill the tank with oil to the required level and pump through the hydraulic system;
- metering pump safety valve hangs open or is set to low pressure;	Flush the safety valve and adjust to a pressure of 14 to 15.5 MPa;
- faulty feed pump or a pump with the right rotation installed;	Repair or replace the pump;
Too high friction or slight jamming in the mechanical parts of the steering column.	Eliminate friction in the steering column proceeding as follows: - weaken the upper nut; - lubricate the friction surfaces of the plastic bushings; - eliminate contact of the universal-joint yokes with the walls of the steering column bracket.
Too high steering torque of FDA reducers.	Repair the FDA.
2. The steering wheel rotates continuously without turning the steerable wheels.	
Insufficient oil level in the tank.	Fill the tank with oil to the required level and pump through the HSU hydraulic system;
Safety valve set higher than the no-slam valves.	Adjust setting of the safety valves and no-slam valves.
Metering pump incorrectly assembled after disassembling (not installed universal joint, back-pressure valve ball, etc.)	Assemble strictly observing manufacturer's instructions.
Worn out gerotor set of the metering pump.	Replace the gerotor set
Worn out seals of the hydraulic cylinder piston	Repair or replace the cylinder.
3. When turing the steering wheel, the steerable wheels turn to the opposite direction.	
High pressure hoses are incorrectly connected to the steering hydraulic cylinder or the metering pump.	Swap the high-pressure hoses.
4. Steering is too slow and heavy at rapid rotation of the steering wheel.	
Faulty feed pump.	Repair or replace the pump.
Low-performance feed pump installed.	Install the feed pump of the size specified in the operating manual.
The metering pump safety valve is set to low pressure or hangs open due to dirt.	Flush the safety valve and adjust to a pressure of 14 to 15.5 MPa.

Trouble, its manifestation	Remedy
5. Steering wheel does not return to neutral, the metering pump tends to rotate spontaneously.	
Too high friction or slight jamming in the mechanical parts of the steering column.	Eliminate friction in the steering column proceeding as follows: - weaken the upper nut; - lubricate the friction surfaces of the plastic bushings; - eliminate contact of the universal-joint yokes with the walls of the steering column bracket.
Spline drive of the steering column and the metering pump are installed not coaxially (due to thrust of the driveshaft).	Release the driveshaft by trimming the end of the upper universal-joint yoke or reducing the height of the lower rubber bushing to get a gap between the end of the upper universal-joint yoke and the sleeve.
Too little or no end clearance between the spline drive of the steering column and the metering pump spool.	Shorten the spline drive if the drive end protrudes above the mating face of the steering column bracket more than by 7.1 mm, or install additional washers not thicker than 1.5 mm between the metering pump and the bracket.
6. Spontaneous rotation of metering pump (steering wheel continues to rotate after making a turn).	
The sleeve grips the spool, possibly due to dirt.	Rinse the metering pump parts and assemble observing manufacturer's instructions.
Spool return springs lost elasticity and broken.	Replace the springs.
7. Constant adjustment of the steering wheel required (the wheel does not hold the road)	
Spool return springs lost elasticity or broken.	Replace the springs.
Broken non-slam valve spring.	Replace the spring and adjust the pressure of no-slam valves.
Worn out gerotor set.	Replace the gerotor set.
Worn out cylinder piston seals.	Replace defective parts of the cylinder.
8. Speed of sliding of the steering wheel is more than three rpm (applying a force of 100 ± 5 N to the wheel)	
High leaks through the gerotor set.	Replace the gerotor set.
9. Strong jolts on the steering wheel in both directions	
Incorrectly installed universal joint in the metering pump.	Assemble the metering pump observing manufacturer's instructions.
10. Increased steering wheel play.	
Not tightened tapered fingers of the cylinder or steering rods.	Tighten the nuts of the fingers to a torque of 180 to 200 N•m, cotter them.
Worn out splines of the steering column shank.	Replace the bottom universal-joint yoke.
Worn out steering column universal joint.	Replace the universal joint.
Spool return springs lost elasticity or broken.	Replace the springs.

Trouble, its manifestation	Remedy
11. Oscillations of steerable wheels (shimmy) when driving.	
Too high play in the joint pins of the steering rods and hydraulic cylinder	Tighten up the nuts of the fingers and steering rod joints.
Worn out mechanical joints or bearings.	Replace the worn out parts.
Air in hydraulic system.	Bleed air from the hydraulic system.
12. Oil leaks on the spool shank of the metering pump, cover or housing of the gerotor set.	
Worn out spool seal.	Replace the spool seal using a special device.
Loosened bolts of the metering unit cover.	Tighten up the bolts to a torque of 30 to 35 N • m
Damaged sealing gaskets under the bolt of the metering unit cover.	Replace the gaskets.
13. Unequal minimum turning radius of the tractor to the left and right.	
Toe-in not adjusted.	Adjust the toe-in as specified in 5.2 Checking and adjusting toe-in of this Manual.
14. Incomplete turn angle of steerable wheels.	
Insufficient pressure in the steering hydraulic system: - safety valve set to low pressure; - faulty feed pump.	 Set the valve to a pressure of 14 to 15.5 MPa; Repair or replace the feed pump.
Too high steering torque of FDA reducers.	Repair the FDA.
15. Destruction of feed pump.	
High pressure in the steering hydraulic system: - incorrect connection of high pressure hoses; - jammed metering pump safety valve	 - connect strictly observing respective documents on repair and operation. - flush and adjust the safety valve to a pressure of 14 to 15.5 MPa;

Attention: Considering high complexity and responsibility of the metering pump in terms of safety of the steering, it can be repaired, disassembled and reassembled only by an expert of manufacturer's service center (or other authorized service center) who was trained adequately, is well acquainted with the design of the metering pump and documentation for maintenance and disassembly-assembly of the metering pump, as well subject to availability of all necessary special equipment, tools and a special hydraulic stand providing setting and checking parameters and operation of the metering pump after any repair performed. Otherwise, the full responsibility for the non-functional metering pump falls on the person who disassembled and reassembled the metering pump, replaced parts or adjusted valves, as well as on the owner of the tractor!

7.8 Front driving axle

Trouble, its manifestation	Remedy
1. The front axle does not engage automatically in case of rear-wheel slip activated when driving the tractor forward	
Worn out parts of the freewheeling clutch of the transfer case.	Replace the freewheeling clutch.
Wedge grooves of the outer race of the freewheeling clutch contaminated with oil oxidation products and part wear.	Remove the clutch and rinse the clutch parts.
Deformed springs of the roller pressure mechanism.	Replace the springs.
Overload clutch in the intermediate support does not transmit the required torque.	Adjust the clutch to transfer a torque of 50 ... 70 kgf•m (500 ... 700 N•m) tightening the flange nuts from the transfer case side.
Worn out driving and driven overload clutch disks.	Replace the disks.
Disc springs lost elasticity or broken.	Replace the springs.
The control linkage of the transfer case has an increased length.	Adjust the linkage length as described in Adjustments.
2. Rapid wear and lamination of front wheel tires	
Tire pressures in front and rear wheels do not match the recommended values.	To prevent malfunctions, maintain air pressure in the front and rear tires as per the recommended values.
Maladjusted toe-in.	Adjust the toe-in as specified in 5.2 Checking and adjusting toe-in of this Manual.
FDA is always engaged due to failure or jamming in the transfer box control.	Perform the following operations: - check operation of positive engagement of the FDA, fix any fault; - adjust the transfer box control gear.
3. High noise and heat in the area of final drive	
Play in the pinion bearings of the final drive.	Adjust preload in bearings of the driving pinion of the final drive as described in 5.6 FDA adjustments of this Manual.
Incorrect mesh of the pinions of the final drive.	Check and, if necessary, adjust mesh by the contact pattern as described in 5.6 FDA adjustments of this Manual.

Trouble, its manifestation	Remedy
4. Noise at maximum turn angle of wheels	
Incorrect FDA operation mode. FDA operates in positive engagement mode.	Check the FDA drive engagement mode and set the switch to OFF or Automatic
Incorrect limit wheel turn angle of steerable wheels.	Check and adjust the FDA reducer turn angle as described in 5.6 FDA adjustments of this Manual.
5. Knocking in pivot during motion	
Maladjusted pivot bearings	Check and adjust axial preload in pivot bearings as described in 5.6 FDA adjustments of this Manual.
6. Knocking in FDA at a sharp turn of wheels	
Plays in pins of the steering rods and turn cylinders.	Check and adjust.
7. Lubricant leak through the flange cup of the final drive driving pinion	
Worn or damaged flange cup.	Replace the worn out parts.
8. Lubricant leak through the yoke cup of the double universal joint	
Worn or damaged cup	Replace the cup
9. Lubricant leak through the cup of the wheel reducer driving pinion	
Increased play in the pinion bearings.	Check and adjust axial play in driving pinion bearings as described in 5.6 FDA adjustments of this Manual.
Worn or damaged cup.	Replace the cup.
10. Lubricant leak through the wheel flange cup	
Axial play in the bearings of the flange.	Adjust wheel flange bearings as described in 5.6 FDA adjustments of this Manual.
Worn or damaged cup.	Replace the cup.
11. Lubricant leak through wheel reducer breathers	
High oil level.	Check and set the correct level.

7.9 Troubleshooting of hydraulic linkage system

Trouble, its manifestation	Remedy
1. Hitch without a load does not rise, when any of the control levers of the extension cylinder distributor is set to the position of lifting or lowering, the characteristic sound emitted by the pump under load is not heard	
Contamination of the safety valve of the tractor distributor.	Disassemble and rinse the safety valve. Adjust the pressure maintained by the safety valve.
2. Hitch without a load does not rise, when any of the control levers of the extension cylinder distributor is set to the position of lifting or lowering, the characteristic sound emitted by the pump under load is heard After stopping the position engine, shifting the lever to the forward position, then to the rear position and starting the engine, the hitch rises (the power lever must be in the forward position).	
Clogged jet hole in the relief valve.	Unmount the regulator distributor from the tractor, take out the bypass valve, rinse the valve, clean the jet hole of the valve.
3. Hitch without a load does not rise, when any of the control levers of the extension cylinder distributor is set to the position of lifting or lowering, the characteristic sound emitted by the pump under load is heard After stopping the engine, shifting the position lever to the forward position, then to the rear position and starting the engine, the hitch does not rise (the power lever must be in the forward position).	
Foreign particles under the edges of the spool.	Remove the cover from the regulator distributor, set the positional lever in to the forward position. The spool retaining ring must rest against the housing of the regulator distributor. Shift the position lever to the rear position. The spool must travel up by at least 7 mm. In case of shorter travel, unmount the regulator distributor, remove the foreign particles stuck between the edges of the spool and the housing.
4. Hitch with a load does not rise or rises slowly	
Fault manifests itself as the oil in the hydraulic system warms up — faulty pump.	Check the pump performance. If coefficient of performance of the pump is less than 0.7 — replace the pump.
Fault appears at any oil temperature — clogged relief valve.	Unmount the regulator distributor, take out the bypass valve, rinse it and the housing in diesel fuel.
5. Hitch with a load rises slowly, after stopping the engine spontaneously lowers noticeable to the eye, frequent position correction, possible “freeze” of the pressure.	
Destroyed rubber seals of the regulator distributor.	Unmount the regulator distributor, replace rubber seals with new ones.

Trouble, its manifestation	Remedy
6. Pump does not unload on the whole travel of the hitch with a load at position control when the hitch gets to the given position	
If at minor shifts of the positional lever in the direction of lowering the pump momentarily unloads, when stopping the engine tightness is normal — jammed or leaking accelerator valve.	Unmount the regulator distributor, take out, disassemble and rinse the bypass valve. If necessary, calk the valve ball to its seat.
If when shifting the position lever to the direction of lowering, the pump does not unload, when stopping the engine tightness is normal — Leak in the pressure setting valve.	Unscrew the conical cap on the upper surface of the regulator, take out the spring, calk the valve ball to its seat, install the parts to place.
7. Hitch with a load lowers spontaneously by a small amount after the hitch gets to the position set by the position lever (drawdown of the hitch)	
Leak of no-drawdown valve	Unmount the regulator distributor, unscrew the cap of the regulator distributor, take out the spring, calk the valve ball to its seat, install the parts to place.
8. Position of the position lever at 0 and 10 does not correspond to the transport and the lowermost position of the hitch	
Maladjusted position cable in the drive.	By turning the nuts fastening the position cable sheath to the bracket on the panel or to the bracket on the hydraulic lift, obtain alignment of the relevant positions of the lever and the hitch.
9. Hitch without a load does not rise or rises with jerks, when turning on the distributor pump “squeals”	
Insufficient oil volume in the hydraulic system.	Make sure there is oil in the oil tank, if necessary, add.
10. Spontaneous travel of the power or position lever on the panel	
Weakened tightening of friction washers on the bracket in the panel.	Using the nut on the bracket axle, adjust the spring pressure to eliminate the fault.

7.10 Troubleshooting of air conditioner unit

Trouble, its manifestation	Remedy
1. The electromagnetic coupling of the compressor does not operate (when turning the temperature regulator, no distinctive metallic click is heard)	
1. Electric equipment failure	With a tester or multimeter, check operation of the pressure sensor unit, the sensor unit terminals (the red and pink wires) must create a continuous circuit. If no result, check operation of the electric circuit connections from the compressor coupling to the air conditioner control panel.
2. Refrigerating fluid leak occurred	Find the refrigerating fluid leak spot. Detection of leaks, replacement of hoses and components is performed by trained personnel with use of special equipment (warranty service and repair is performed by Belvneshinvest CJSC, Minsk, tel./fax ++375-17-262-40-75, ++375-29-662-97-69, +375-29-628-67-98)
2. Air conditioner fan engine does not operate	
Electric equipment failure	Check condition of the respective fuse (25A, see the electric circuit diagram, Appendix B) on the fuse block F4 located on the instrument panel. Replace if faulty. With a test lamp, check availability of power at the air conditioner engine (see the electric circuit diagram, Appendix B) with the switch ON and the engine “ground” available. If the electric circuits are in good condition, but there is no power at the engine, replace the switch.
3. When the air conditioner is in the cooling mode, warm air is supplied to the cab	
Sealing of the valve PO-11 (or VS11) damaged.	Replace the valve PO-11 (or VS11)
4. Leak of refrigerating fluid from cab ventilation box	
Broken pipes of the heater (damage from frost due to incomplete discharge when working with water during cold season).	Replace the climate unit of the conditioner.

Note – Air conditioner is installed on BELARUS-1021.3 tractors on request. The basic configuration of BELARUS-1021/1021.3 includes a heater fan. Possible troubles and remedies for the heater fan are listed below.

7.11 Troubleshooting of fan heater

Trouble, its manifestation	Remedy
1. Warm air is not supplied to the cab	
No water circulation through the heating unit for the following reasons: – heater valve closed; - at low temperatures, icing-up in the heater hoses.	 Open the heater valve; Crush ice, run hot water through the pipes.
Heater fan does not operate.	Check: - heater motor condition; - integrity of control circuits of the heater fan.
2. Warm air of high humidity is supplied to the cab	
Water leak in the heater heat exchanger.	Eliminate the leak or replace the heat exchanger.
Water leak in the heater system connections.	Tighten the tension bands.

7.12 Troubleshooting of electric part of rear axle DL and PTO control system

Trouble, its manifestation	Remedy
1. FDA does not operate in positive engagement mode, PTO drive does not engage	
No voltage supply to the appropriate solenoid of the electrohydraulic distributor.	Check: - feed voltage supply to the solenoid according to the electric circuit diagram (Appendix A); - serviceability of the winding of the respective solenoid (the winding resistance must be 4 to 7 Ohms).
No oil pressure at the distributor output.	Check pressure at the distributor output. Correct the failure in the hydraulic system.
2. Rear axle DL does not engaged in the automatic mode when the wheel guides are in the “straight” position	
The wheel guide turn sensor (VK 12-51 switch) did not operate, which is on the FDA left side.	Check serviceability of the electric circuit to the sensor per the diagram (Appendix A). If the circuit is serviceable, check operation of the sensor: - when the wheel guides are in the “straight” position, the sensor contacts must be closed; - when the wheel guides turn to an angle exceeding (13 ± 2)°, the sensor contacts must open. - if necessary, adjust operation of the sensor using adjusting shims 50-1702048.
3. When the DL or PTO control switch is switched to OFF, the respective distributor does not disengage (the channel remains open)	
The distributor spool hangs in the OFF position.	Disassemble and rinse the hydraulic distributor in diesel fuel.

8. MAINTENANCE

8.1 Guidelines for maintenance

Maintenance (M) is necessary to maintain the tractor in operable condition during operation. Failure to comply with the established intervals and low maintenance quality greatly reduce the service life of the tractor, lead to an increase in the number of failures, fall in the engine power and increase in the costs of tractor operation. The operator must daily check the tractor, avoiding weakening of fasteners, fuel, fluid and oil leaks, accumulation of dirt and other deposits that can cause malfunctions, fire or accidents.

All maintenance works must be reflected by marks in the tractor service book.

Observe rules of waste storage and disposal. Never pour off waste fluids to the ground. Use special containers to safely store waste.

Warning: when performing maintenance works, always follow safety precautions listed in 1.3 Safety precautions for maintenance of this Manual.

Attention: Unless there are special instructions, before performing any maintenance, adjustments etc., kill the engine and engage the parking brake. If any guards or enclosures were removed, make sure to install them to place after maintenance and before starting work on the tractor!

When performing maintenance of hydraulic systems of the hitch linkage, steering and the hydraulic system of the tractor transmission, strictly observe intervals of oil and filter change. For filling (adding), never use oils not listed in the instructions in the tractor operating manual.

Before refilling and filter element change, clean filler caps, necks, filter covers and the adjacent surfaces from dirt and dust. When replacing filter elements, rinse the inside surfaces of the filter housings and covers with diesel fuel.

When unitizing the tractor with hydraulic actuated agricultural machines, thoroughly clean couplings, pipes, adapters and other connecting elements of agricultural machines and the tractor from dirt.

When operating the hydraulic linkage system with hydraulically actuated agricultural machines filled with an oil of unknown origin, change the oil in the agricultural machine with the oil filled in the tractor hydraulic linkage system.

Purity of the hydraulic system oil is a guarantee of its trouble free operation.

Kinds and intervals of maintenance are specified in Table 8.1.

Table 8.1 — Scheduled maintenance kinds

Kind of maintenance	Interval, hours
Maintenance during running-in 1)	Before running in the tractor, maintenance during running-in and after running-in (after 30 service hours).
Shift-time (STM)	8—10
First maintenance (M-1)	125
Second maintenance (M-2)	500
Third maintenance (M-3)	1,000
Special maintenance	2,000
General maintenance	As necessary
Seasonal maintenance (M-SS and M-FW)	At start of fall-winter (M-FW) or spring-summer (M-SS) operation periods
Maintenance not coinciding with the periods of M-1 M-2, M-3, and special maintenance	—
Maintenance in special conditions of use	When preparing tractor to work in special conditions
Maintenance during storage 2)	At long-term storage

1) Information about maintenance operations performed by the operator before running in the tractor, during running-in and after running-in is presented in 4.1 Preparation of tractor to work of this Manual.

2) Information about maintenance operations performed by the operator during long-time storage of the tractor is presented in 9 Storage of tractor of this Manual.

Depending on the operating conditions of the chassis, a deviation from the prescribed maintenance intervals (earlier or later) is allowed for M-1 and M-2 by plus 10%, and for M-3 by 5%.

8.2 Ensuring access to tractor parts for maintenance

8.2.1 Ensuring access to parts during maintenance of BELARUS-1021 tractors

Before any maintenance work, lift, then lock the hood (1) (Fig. 8.2.1) hinged on the tractor front. To do it, proceed as follows:

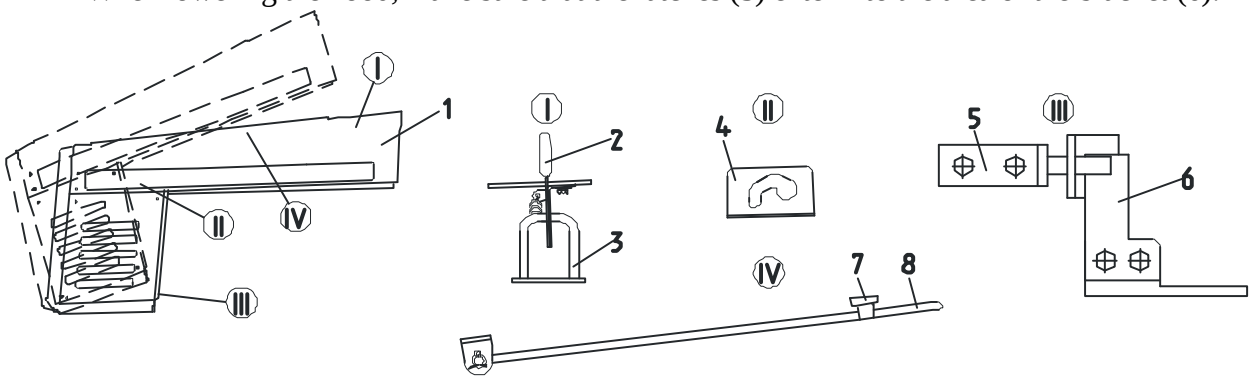
- push the lock lever (2) to release the lock from the bracket (3);
- raise the hood (1) and release the rod (8) from the clamp (7);
- raise the hood (1) to its highest position and lock the rod (8) in the bracket (4).

Attention: before you start maintenance works in the area under the hood, make sure it is securely locked raised!

To lower the hood (1), proceed as follows:

- release the rod (8) from the cam slot of the bracket (4);
- lock the rod (8) in the clamp (7) and lower the hood (1) to the low position;
- press down on the back of the hood (1) until it clicks.

When lowering the hood, make sure that the latches (5) enter into the area of the bracket (6).



1 — hood; 2 — lock; 3 — bracket; 4 — bracket; 5 — latch; 6 — bracket; 7 — clamp; 8 — rod.

Fig. 8.2.1 — Diagram of mechanism of raising, locking, and lowering metal hood

8.2.2 Ensuring access to parts during maintenance of BELARUS-1021.3 tractors

Before you carry out any maintenance work, remove both sides, open, then lock the facing hood. To have access to the units under the facing mask, open and the lock the tractor facing mask with the hood closed.

To remove the sides, raise and lock the hood, proceed as follows:
- open the four locks (7) (Fig. 8.2.2);
- remove the sides (4) and (5);
- open the lock (1), pulling the cable lever (9);
- raise the hood (3) and lock it open using the rod (6) in the bracket (12);
- make sure that the hood (3) is securely locked in the raised position.

To provide access to units and parts located under the facing mask, proceed as follows:
- close the hood (3);
- pull the lock (8) to the left;
- open the mask (2);
- lock it open using the rod (11) in the bracket (10);
- make sure that the mask (2) is securely locked in the raised position.

Do not open the mask and hood at the same time.

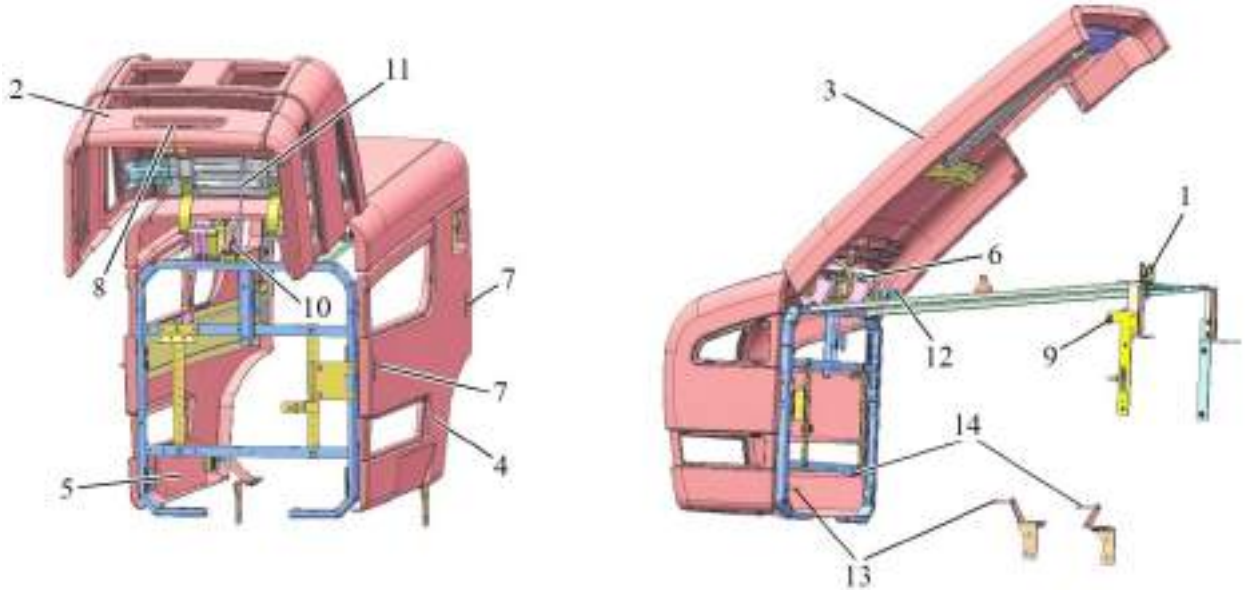


Fig. 8.2.2 — Diagram of mechanism of raising, locking, and lowering hood of BELARUS-1021.3 tractor

To install the sides (4) and (5) (Fig. 8.2.2), proceed as follows:
- install the sides (4) and (5) on the brackets (13) and (14), respectively;
- fasten the sides (4) and (5) with the locks (7);

To lower and close the hood (3), proceed as follows:
- slightly raise the hood (3) to release the rod (6);
- fasten the rod (6) in the clamp on the hood;
- lower the hood (3) to its low position until a distinctive click is heard (the lock (1) engages);

To lower and close the mask (2), proceed as follows:
- slightly raise the mask (2) to release the rod (11) from the bracket (10);
- fasten the rod (11) in the clamp on the mask;
- lower the mask (2) to the low position until a distinctive click is heard (the lock (8) engages);

8.3 Maintenance procedure

Table 8.2 lists intervals and content of scheduled maintenance of BELARUS-1021/1021.3 tractors during operation.

Table 8.2

Pos. #	Operation name	Interval, hours					
		8—10	125	250	500	1,000	2,000
1	Check oil level in the engine crankcase.	×					
2	Check coolant level in engine heat exchanger	×					
3	Check oil level in hydraulic linkage system tank	×					
4	Check oil level in HSU tank	×					
5	Remove condensate from pneumatic drive cylinder	×					
6	Check degree of clogging of engine water heat exchanger and CAC heat exchanger (for 1021.3)	×					
7	Check fastenings of air conditioner hoses [1)]	×					
8	Check/clean air conditioner condenser [1)]	×					
9	Check/clean conditioner drain pipes of condensate [1)]	×					
10	Check operation of the brakes on the move, operability of the engine, the steering, the illumination and signaling devices	×					
11	Check and wash RHL grapples[2)]	×					
12	Remove condensate from the tanks of the heat exchanger of the engine charge air cooler [3)]	× winter	× summer				
13	Check tightening of wheel threaded connections[4)]	×	×				
14	Wash the tractor		×				
15	Pour off sediment from the coarse fuel filter and the fuel tanks.		×				
16	Clean filter of cab air conditioning and heating system		×				
17	Check the oil level in the intermediate support of the FDA universal-joint drive		×				
18	Lubricate bearings of the pivot axles of the FDA wheel reducers		×				
19	Check condition/tension of the fan belt of the engine cooling system		×				
20	Check tightening of the clamp bolts fastening the CAC air ducts [3)]		×				
21	Check/service engine air cleaner		×				
22	Check air pressure in the tires [5)]		×				
23	Check / adjust tension of the air conditioner compressor drive belt [1)]		×				

Table 8.2, continued

Pos. #	Operation name	Interval, hours					
		8—10	125	250	500	1,000	2,000
24	Pour off sediment from the fine fuel filter.			×			
25	Service the storage battery [6)]			×			
26	Service the alternator			×			
27	Lubricate the clutch release bearing			×			
8	Lubricate the HSU cylinder joints			×			
29	Check/adjust the clutch pedal free travel			×			
30	Change the engine oil			×			
31	Change the oil filter of the engine			×			
32	Check/adjust plays in the steering rod joints			×			
33	Check/adjust toe-in			×			
34	Check/tighten TC bolting connections			×			
35	Check the transmission oil level				×		
36	Check oil level in wet brake housings [7)]				×		
37	Check oil levels in the housings of the wheel reducer and FDA final drive				×		
38	Check/adjust clearances between the valves and the rockers of the engine				×		
39	Check/adjust axial preload in pivot tapered bearings				×		
40	Adjust service brake pedal control				×		
41	Adjust parking-reserve brake control				×		
42	Clean the filter element of the air pressure regulator filter in the pneumatic system				×		
43	Check tightness of the pneumatic lines				×		
44	Check/adjust pneumatic drive brake valve actuator;				×		
45	Replace the filter element in the hydraulic linkage system tank [8)]				×	×	
46	Replace the filter element in the HSU tank [8)]				×	×	
47	Replace air conditioner filter drain [1)]	After each 800 service hours					

Table 8.2, continued

Pos. #	Operation name	Interval, hours					
		8—10	125	250	500	1,000	2,000
48	Change lubricant in steering rod joints					×	
49	Wash the coarse fuel filter					×	
50	Replace the filter element of the fine fuel filter					×	
51	Check/tighten the bolts fastening the cylinder heads					×	
52	Change oil in the transmission					×	
53	Change oil in the wet brake housings [7)]					×	
54	Change oil in the FDA housings and the intermediate support					×	
55	Change oil in the HSU tank					×	
56	Change oil in hydraulic linkage system tank					×	
57	Check/adjust the pneumatic system pressure regulator					×	
58	Lubricate the gear brace mechanism of the RHL					×	
59	Check/tighten external threaded connections of the tractor					×	
60	Check the injectors for injection start pressure and fuel dispersion quality						×
61	Check/adjust the fuel pump on a test bench.						×
62	Check/adjust the setting advance angle of fuel injection on the engine.						×
63	Flush the engine cooling system						×
64	Adjust the engine lubrication system oil pressure	As necessary					

[1)] For BELARUS 1021.3, when an air conditioner installed on request instead of the fan-heater.
[2)] When the RHL is equipped with lower rods with Walterscheid grapples.
[3)] For BELARUS-1021.3.
[4)] The operation is performed once with the first STM (after 8 to 10 service hours) performed by the consumer and then after every 125 service hours of the tractor.
[5)] Monitor and, if necessary, bring the tractor wheel air pressure to the normal every time when shifting the tractor from one work to another and changing the machines and tools unitized with it.
[6)] Frequency of check and maintenance of the battery — at least once in 3 months.
[7)] When brakes working in oil bath (wet brakes) are installed on request.
[8)] Fist change after 500 service hours of the tractor. Further on, change every 1,000 service hours as well as during seasonal maintenance

8.4 Scheduled maintenance operations

8.4.1 Shift-time maintenance (STM) after each 8-10 service hours or daily

Operation 1. Check oil level in engine crankcase

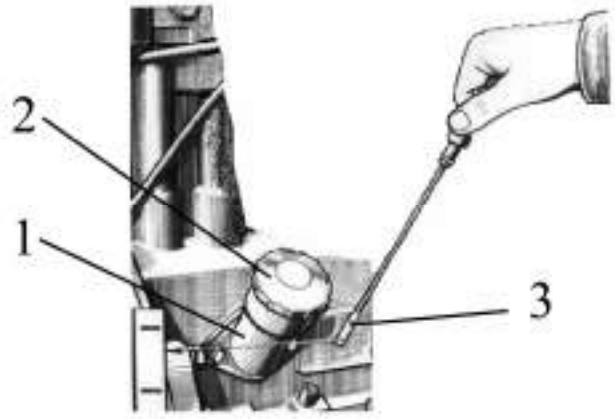
Check the oil level installing the tractor on a flat surface and not less than 3-5 minutes after killing the engine when the oil completely drains into the crankcase:

To check the oil level in the engine crankcase, proceed as follows:

- take out the oil level gage (3) (Fig. 8.4.1), wipe it clean and reinsert it into place until it stops;

- take out the oil level gage (3) and determine the oil level. It must be between the lower and upper marks of the oil gage. If necessary, add oil to the desired level through the neck (1), removing the cap (2).

- install the cap (2) to place.



1 — oil filler neck; 2 — cap; 3 — oil level gage.

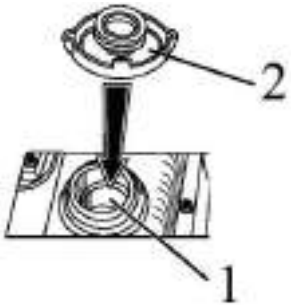
Fig. 8.4.1 — Check oil level in engine crankcase

Attention: do not let the engine run when the oil level is below the lower mark of the oil gage!

Attention: do not add oil above the upper mark of the oil gage. excess oil will burn out, creating a false impression of high oil consumption!

Operation 2. Check coolant level in engine heat exchanger

Remove the heat exchanger cap (2) (Fig. 8.4.2) and check the coolant level that must be up to the upper end of the filler neck (1). Do not let the level drop lower than 40 mm from the upper end of the filler neck. If necessary, add coolant to the required level.



1 — upper end of heat exchanger filler neck; 2 — heat exchanger cap

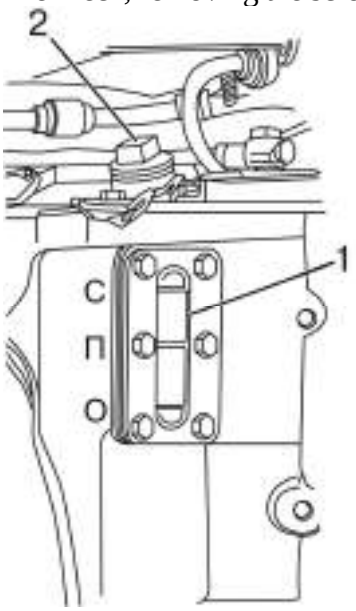
Fig. 8.4.2 — Check oil level in engine crankcase

Warning: the engine cooling system operates under pressure which is maintained by a valve installed 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 turn slowly to gradually reduce the pressure before complete removal of the cap. beware of burns from hot liquid!

Operation 3. Check oil level in hydraulic linkage system tank

Before checking the oil level, install the tractor on a flat horizontal surface. Kill the engine and brake the tractor using the parking brake.

Check the oil level in the hydraulic linkage system tank using the oil gage glass (1) (Fig. 8.4.3) on the left side of the tractor. The level must be between the marks "0" and "P" ± 5 mm, and for machines that require high oil consumption, at the level of the mark "C". As necessary, add oil to the level of the mark "P" through the oil filler neck, removing the screw cap (2).



1 — oil gage glass; 2 — oil filler cap.

Fig. 8.4.3 — Check oil level in hydraulic linkage system tank

Attention: check the oil level in the hydraulic linkage system tank only with the retracted cylinder rods of the RHL and the machines unitized with the tractor!

Operation 4. Check oil level in HSU tank

Before checking the oil level, install the tractor on a flat horizontal surface. The engine must be killed.

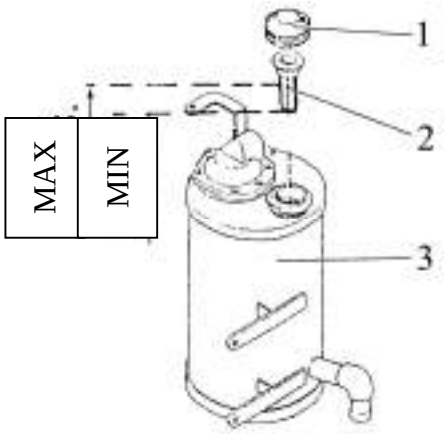
Checking oil level in HSU tank on BELARUS-1021 tractors

Check oil level in HSU oil tank (3), proceeding as follows:

Unscrew the filler cap (1);

Take out the strainer (2) from the filler neck;

Check the oil level on the strainer, which must be between the filter bottom (lower limit) and the middle of the filter (upper limit). If necessary, add oil to the middle of the filter.



1 — cap; 2 — strainer; 3 — HSU tank.

Fig. 8.4.4a — Check oil level in HSU tank

Check oil level in HSU tank on BELARUS-1021.3 tractors

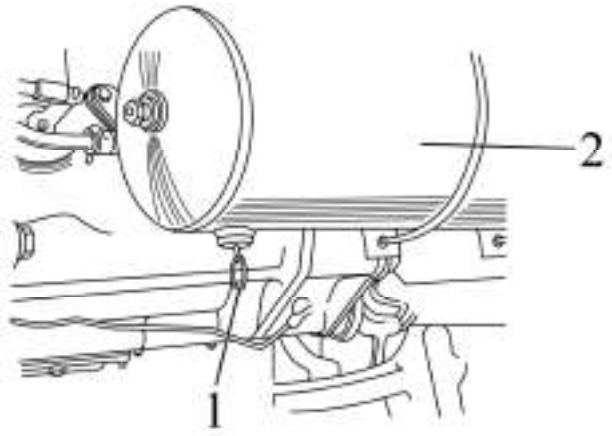
Check oil level in HSU oil tank using the oil gage stick (1) (Fig. 8.4.4b). The oil level must be between the lower and upper marks of the oil gage stick. If necessary, remove the oil filler cap (2) and add oil to the upper mark on the oil gage stick.

1 — oil gage stick; 2 — oil filler cap.

Fig. 8.4.4b — Checking oil level in HSU tank

Operation 5. Remove condensate from pneumatic drive cylinder

To drain condensate from the pneumatic drive cylinder (2) (Fig. 8.4.5), pull the ring (1) of the discharge valve in the horizontal direction to any side and hold it until condensate completely drains. The cylinder must contain compressed air.



1 – ring; 2 – pneumatic drive cylinder.

Fig. 8.4.5 – Remove condensate from pneumatic drive cylinder

Operation 6. Check degree of clogging of engine water heat exchanger and CAC heat exchanger.

Check cleanliness of the hood mask grill and the cores of the engine heat exchanger and the CAC heat exchanger (for 1021.3). If they are clogged, clean them with a soft brush and blow with compressed air.

In case of severe clogging, rinse with hot water under pressure and blow with compressed air, or clean the cores using a Kärcher washing unit. At that, clean the heat exchanger cores both from the hood mask side, and from the engine fan side.

Attention: The heat exchanger cores are fragile, therefore do not subject them to a strong pressure of water, air or to mechanical action. Do not use alkaline solutions and aggressive detergents!

Operation 7. Checking fastening of air conditioner hoses

Note — The operation is performed for BELARUS-1021.3 tractors, when an air conditioner installed on request instead of the fan-heater.

The conditioner hoses must be securely fastened with tension bands. Do not allow contact of the hoses with tractor's moving parts.

Operation 8. Check / clean air conditioner condenser

Note — The operation is performed for BELARUS-1021.3 tractors, when an air conditioner installed on request instead of the fan-heater.

Check cleanliness of the air conditioner core. If it is clogged, clean the air conditioner with compressed air. Direct air flow with the hood open perpendicularly to the condenser plane top-down. Straighten folded finning with a special comb or plastic (wooden) plate. In case of severe clogging of the condenser, rinse it with hot water under pressure of 0.15 to 0.2 MPa max and blow with compressed air.

Operation 9. Check / clean air conditioner drain pipes of condensate

Note — The operation is performed for BELARUS-1021.3 tractors, when an air conditioner installed on request instead of the fan-heater.

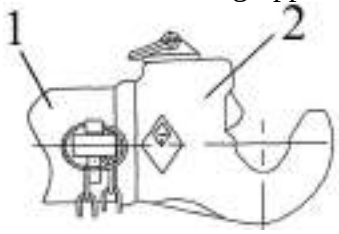
Blue drain pipes are to the right and left of the heat exchanger pipe under the ceiling panel. Check and, as necessary in order not to allow plugging, clean the drain pipes. A sign of a clean drain pipe is water dripping when the conditioner is working during hot weather.

Operation 10. Check operation of the brakes on the move, operability of the engine, the steering, the illumination and signaling devices

The engine must run steadily in all modes.
The controls, sound and light alarms must be operable.
Simultaneous engagement of the right and left service brake must be ensured.

Operation 11. Check / wash RHL grapples

When the RHL is equipped with lower rods with Walterscheid grapples, check cleanliness of the cavity where the mechanism for locking the joints in the grapples (2) (Fig. 8.4.6.) of the RHL is located. If dirty, clean the inner cavities in the grapples and wash them with water.



1 — lower rod; 2 — grapple.

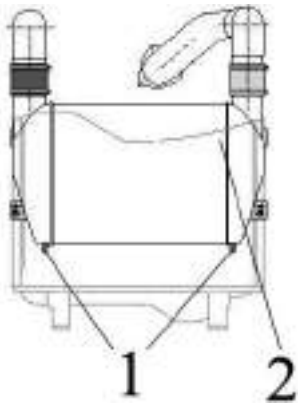
Fig. 8.4.6 – RHL grapple

Operation 12. Remove condensate from the tanks of the heat exchanger of the engine charge air cooler

Note — The operation is performed on BELARUS 1021.3 tractors every 8-10 service hours or every shift during fall and winter, and every 125 service hours during spring and summer.

To remove condensate from the tanks of the engine CAC heat exchanger, proceed as follows:

- unscrew two plugs (1) (Figure 8.4.7) in the lower part of the charged air cooler (2);
- let condensate drain;
- screw the plugs (1).



1 – plug; 2 – charge air cooler.

Fig. 8.4.7 – Remove condensate from the tanks of the engine CAC heat exchanger

8.4.2 Maintenance after each 125 service hours

Perform the above operations plus the following:

Operation 13. Check tightening of wheel threaded connections

Note — The operation is performed once with the first STM (after 8 to 10 service hours) performed by the consumer and then after every 125 service hours of the tractor.

Check tightening of the nuts fastening the wheels and the hub bolts, and, if necessary, tighten:

- the tightening torque of the rear wheel hub bolts must be 360 to 450 N•m.
- the tightening torque of nuts fastening the rear wheel disks to the hub must be 300 to 350 N•m.
- the tightening torque of nuts fastening the front wheel disks to the FDA reducer flanges must be 200 to 250 N•m.
- the tightening torque of nuts fastening the front wheel disks to the rim carriers must be 180 to 240 N•m.

1 — nut fastening front wheel disks to FDA reducer flanges;
2 — nut fastening front wheel disks to rim carriers;
3 — nuts fastening rear wheels to hubs;
4 — bolts fastening rear wheel hubs.

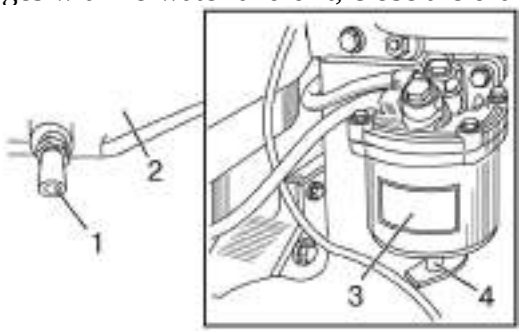
Fig. 8.4.8 – Check tightening of wheel threaded connections

Operation 14. Wash the tractor

Operation 15. Pour off sediment from fuel tanks and coarse fuel filter

To pour off sediment, proceed as follows:

- open the drain plug (1) (Fig. 8.4.9) of the fuel tank (2) and the drain plug (4) of the coarse fuel filter (3);
- pour off the sediment until clean fuel emerges, drain sediment to a special container and properly dispose of;
- after clean fuel emerges with no water and dirt, close the drain plugs (1) and (4).



1 — fuel tank drain plug; 2 — fuel tank; 3 — coarse fuel filter; 4 — fuel coarse filter drain plug;

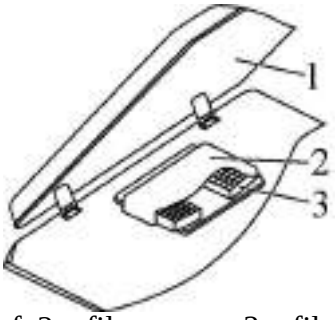
Fig. 8.4.9 – Pour off sediment from fuel tank and coarse fuel filter

Operation 16. Clean filters of cab air conditioning and heating system

To clean the filter of the cab air conditioning and heating system, proceed as follows:
- lift the cab roof (1) (Fig. 8.4.10).
- unscrew the two mounting bolts and remove the filter cover (2) together with two filter elements (3).
- gently shake the elements to remove loose dust particles from the filter, be careful not to damage the filter.
- clean the filters using compressed air under a pressure of 0.2 MPa max. Hold the hose nozzle no closer than 300 mm from the filter in order not to damage the paper filter element. Direct air flow through the filter in the direction opposite to normal air flow as shown by arrows on the filter.
- assemble the filter in reverse order, close the cab roof.

Attention: in wet conditions, such as in early morning hours, before serving the filter do not operate the fan, as trapped moisture particles in the filter are difficult to remove!

Attention: when operating the tractor in conditions of high dust, clean the filter more frequently!

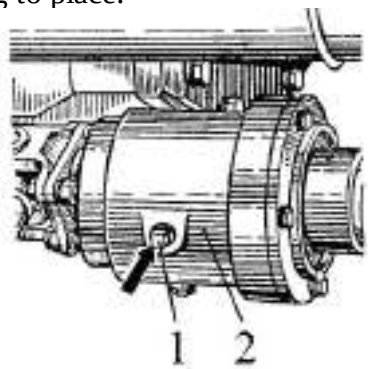


1 – cab roof; 2 – filter cover; 3 – filter element.

Fig. 8.4.10 – Clean filters of cab air conditioning and heating system

Operation 17. Check oil level in intermediate support of FDA universal-joint drive

To check the oil level in the intermediate support (2) (Fig. 8.4.11), proceed as follows:
- install the tractor on an even place;
- unscrew the check-filler plug (1) of the intermediate support (2);
- check that the oil level coincide with the bottom edge of the check-filler hole.
- if necessary, add oil to the intermediate support (2);
- install the check-filler plug to place.



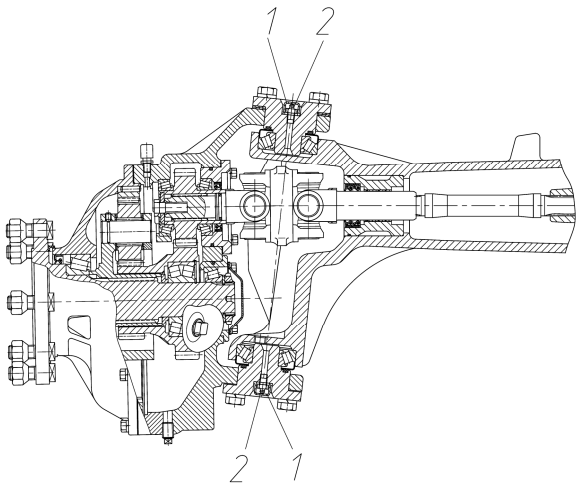
1 — check-filler cap; 2 — intermediate support of FDA universal-joint drive.

Fig. 8.4.11 — Check oil level in intermediate support of FDA universal-joint drive

Operation 18. Lubricate bearings of pivot axles of FDA parallel-shaft wheel reducers

Lubricate the oilers of the upper and lower pivot axles of the wheel reducers proceeding as follows:

- unscrew the four protective caps (1) (Fig. 8.4.12);
- using a gun, inject lubricant, as specified in Table 8.4, to the oilers (2) of the upper and lower pivot axles of the parallel-shaft wheel reducers (four lubrication pointa), making four to six injections;
- install the protective caps (1) to place.



1 – cap, 2 – oiler.

Fig. 8.4.12 — Lubricate bearings of pivot axles of FDA wheel reducers

Operation 19. Check condition and tension of engine cooling system fan belt

Check the belt for traces of wear or damage. If necessary, replace it.

To check the alternator fan belt tension, apply a force of about 40 N to the middle point of its crankshaft pulley to alternator pulley generator branch as shown in Fig. 8.4.13. The deflection must be 12 to 17 mm. If necessary, adjust the belt tension. To adjust the belt tension, loosen the alternator fastening. By turning the alternator housing, adjust the belt tension. Tighten up the strip fastening bolt and the nuts of the alternator fastening bolts.

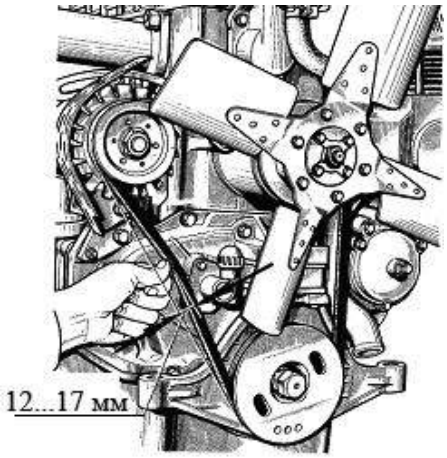


Fig. 8.4.13 — Check tension of engine cooling system fan belt

Operation 20. Check tightening of bolts fastening the CAC air ducts

Note — The operation is performed on BELARUS-1021.3 tractors.

Check and tighten up as necessary the bolts fastening the CAC air ducts. The tightening torque of the CAC air duct clamps must be 8 to 10 N•m.

Operation 21. Check and maintenance of engine air cleaner

Check/service engine air cleaner of BELARUS-1021 tractors

Check condition of the paper filter elements (PFEs) for dirt, paper break and correct installation of the PFE.

To check the basic filter element (BFE), proceed as follows:

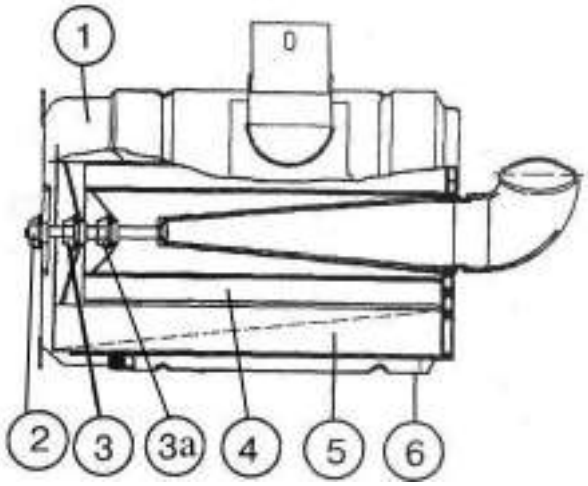
- unscrew the nut (2) (Fig. 8.4.14) and remove the tray (1);
- unscrew the nut (3) and remove the BFE (5);
- check if there dirt in the master filter element (4) without removing it from the housing (6).

Dirt in the master filter element indicates a failed BFE (break of the paper shutter, loose bond of the bottom). In such a case, rinse the MFE and replace the BFE. Before cleaning the MFE, take it out from the housing, unscrewing the nut (3a).

To clean the PFE, blow it with compressed air to remove dust from the surface. The air pressure must be 0.2 to 0.3 MPa max. Direct the air flow at an acute angle to the PFE surface, and adjust the air pressure at the surface by varying the distance between the hose and the element. After each service work on the PFE or when installing new PFEs, check their condition visually, when any mechanical damage, cracking in corrugated paper, loose bonds of the bottoms are found, replace the PFEs. During maintenance work, protect the filter element from mechanical damages and contamination with oil.

Before installing a PFE, clean the surface of the housing (6) and the tray (1) of dust and dirt, doing this, make sure that dust does not get into the clean air line.

When installing a PFE, tighten the nuts (2), (3) and (3a) to a torque of 10 to 12 N•m.



1 – tray; 2, 3, 3a – nut; 4 – control filter element; 5 – basic filter element; 6 – housing.

Fig. 8.4.14 — Check engine air cleaner of BELARUS-1021 tractors

Attention: untimely maintenance of air cleaner worsens air cleaning and leads to dust in the engine, which causes increased wear of the cylinder-piston group and engine failure!

Attention: after assembling the air cleaner, check tightness of all intake connections (connecting pipes must not be broken or cracked, clamps must be securely tightened). If the check reveals any faults or damages, find out their reason and take measures to eliminate them!

Attention: in case of operation in high dust, perform the maintenance operation of check/maintenance of engine air cleaner every 20 service hours of the tractor.

Check/service engine air cleaner of BELARUS-1021.3 tractors

Check condition of the paper filter elements (PFE) for paper break and correct installation of the PFE. To check the basic filter element (BFE), proceed as follows:

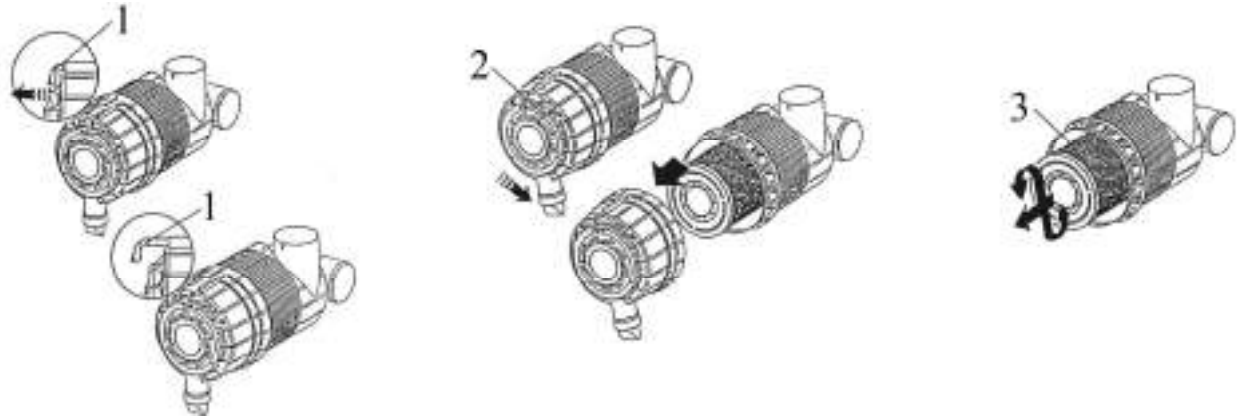
- open the tractor hood to get access to the air cleaner;
- pull the yellow latch (1) (Figure 8.4.15), turn the cover (2) counterclockwise by 12.5° and remove it;
- remove the basic filter element (3);
- check if there dirt in the master filter element (MFE) without removing it from its housing.
- blow the filter element with compressed air first from inside, then from outside to completely remove dust. To avoid a break of the paper blind, air pressure must not exceed 0.2 to 0.3 MPa. Direct the air jet at an angle to the filter element surface. During maintenance work, protect the filter element from mechanical damages and contamination with oil.

Attention: do not blow the BFE with exhaust gases or rinse in diesel fuel.

Attention: removing the MFE from its housing is not recommended. Dirt in the MFE indicates a failed BFE (break of the paper shutter, loose bond of the bottom). In such a case, rinse the MFE and replace the BFE.

Clean the supply pipe, the inner surfaces of the casing and the cover of the air cleaner of dust and dirt.

- check condition of the sealing rings;
- assemble the air cleaner in the reverse order;
- make sure that the BFE is correctly installed and close the latches (1);
- set the hood mask to its original position.



1 — latch; 2 — cover; 3 — basic filter element.

Fig. 8.4.15 — Check engine air cleaner of BELARUS-1021.3 tractors

Attention: untimely maintenance of air cleaner worsens air cleaning and leads to dust in the engine, which causes increased wear of the cylinder-piston group and engine failure!

Attention: after assembling the air cleaner, check tightness of all intake connections (connecting pipes must not be broken or cracked, clamps must be securely tightened). If the check reveals any faults or damages, find out their reason and take measures to eliminate them!

Attention: in case of operation in high dust, perform the maintenance operation of check/maintenance of engine air cleaner every 20 service hours of the tractor!

Operation 22. Check tire pressure

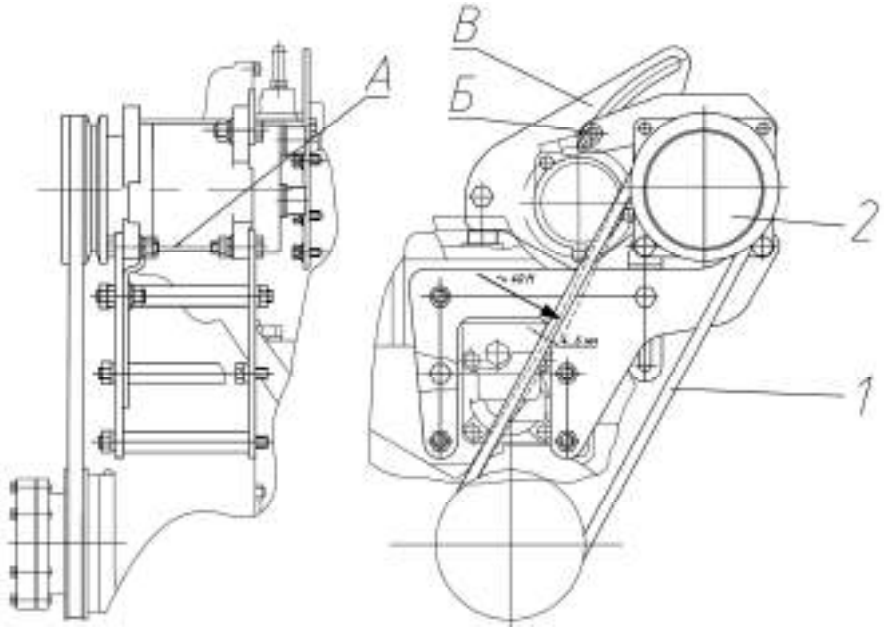
Check tire thread condition and air pressure. If necessary, bring the pressure to the required in accordance with the load as specified in Table Standardsof loads on tires to choose the operation mode at various internal pressures in 6.10 of 6 UNITIZING;

Operation 23. Check / adjust tension of air conditioner compressor drive belt.

Note — The operation is performed for BELARUS-1021.3 tractors, when an air conditioner installed on request instead of the fan-heater.

Check tension of the air conditioner compressor drive belt:

tension of the belt (1) (Fig. 8.4.16) of the air conditioner drive 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.



1 — air conditioner compressor drive belt; 2 — air conditioner compressor.

Fig. 8.4.16 – 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) (Figure 8.4.16) 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.

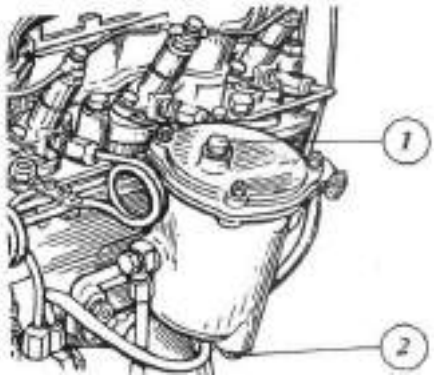
8.4.3 Maintenance after each 250 service hours

Perform the above operations plus the following:

Operation 24. Pour off sediment from fine fuel filter of engine

Pour off sediment from fine fuel filter on BELARUS-1021 tractors with D-245 engine.

- unscrew by 1...2 turns the air bleed plug (1) (Fig. 8.4.17).
- unscrew the plug (2) located in the lower part of the filter and pour off sediment until clean fuel shows up;
- tighten the plugs (1) and (2).

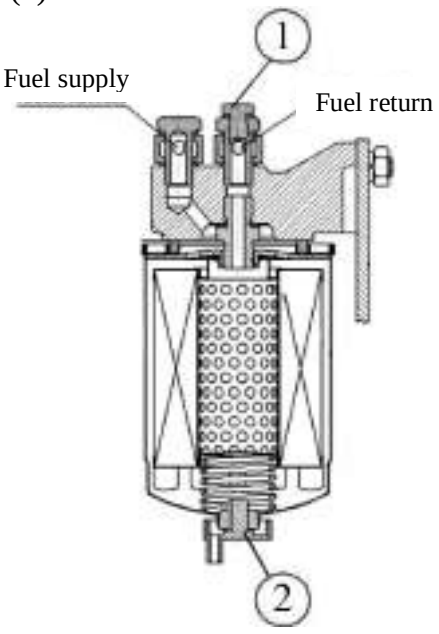


1 — air-bleed plug; 2 — sediment discharge plug.

Fig. 8.4.17 – Pour off sediment from fine fuel filter of D-245 engine

Pour off sediment from fine fuel filter on BELARUS-1021 tractors with D-245S engine and BELARUS-1021.3 with D-245S2 engine.

- unscrew by 1...2 turns the air bleed plug (1) (Fig. 8.4.18).
- unscrew the plug (2) located in the lower part of the filter and pour off sediment until clean fuel shows up;
- tighten the plugs (1) and (2).



1 — air-bleed plug; 2 — sediment discharge plug.

Fig. 8.4.18 – Pour off sediment from fine fuel filter of D-245 S/D-245S2 engine

Operation 25. Maintenance of storage batteries

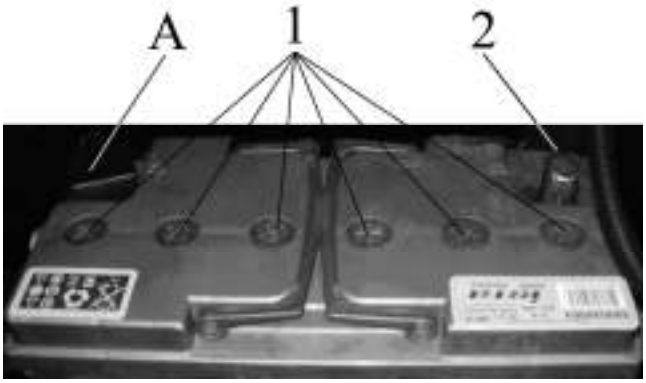
Note — Perform the operation every 250 service hours of the tractor, but at least every three months.

To service the storage batteries, proceed as follows:

- clean the batteries of dust and dirt;
- check the condition of the terminals (2) (Fig. 4.8.19) of the output pins which are under the protective covers A (Fig. 8.4.19) and the vent holes in the plugs (1). If necessary, lubricate the terminals with petrolatum and clean the ventilation holes;
- unscrew the filler plugs (1) in the storage batteries and check:

1. Electrolyte level — if necessary, add distilled water so that the electrolyte level be above the grill by 10 ... 15 mm or be at the level of the mark on the battery body.

2. Battery discharge by electrolyte density — if necessary, recharge the batteries. The lowest allowable battery discharge is 50% in summer and 25% in winter.

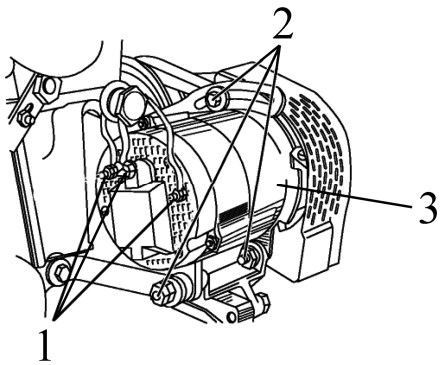


1 — output pin terminal; 2 — filler plug.

Fig. 8.4.19 – Maintenance of storage batteries

Operation 26. Service alternator

Clean the alternator (3) (Fig. 8.4.20) of dust and dirt. Check and tighten up as necessary the bolts fastening the alternator (2). Check the condition and the tightening torque of the three terminal connections (1) of the alternator.



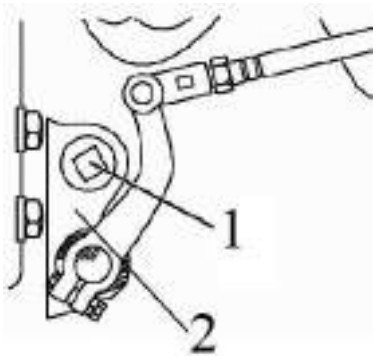
1 — terminal connections; 2 — bolts fastening alternator; 3 — alternator.

Fig. 8.4.20 — Service alternator

Operation 27. Lubricate clutch release bearing

To lubricate the clutch release bearing, proceed as follows:

- unscrew the plug (1) (Fig. 8.4.21) on the left side of the clutch housing (2);
- insert the tip of the lever-plunger injector into the opening;
- through the oiler screwed into the release yoke housing for lubrication of the release bearing, make four to six injections of the lubricant specified in Table 8.4.



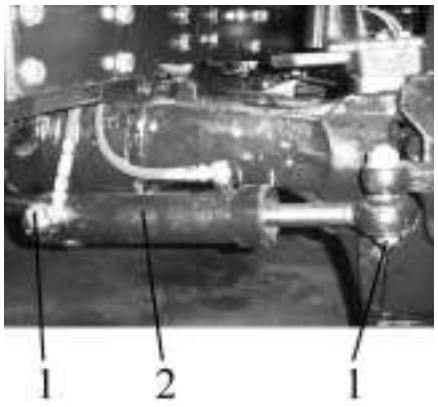
1 — plug; 2 — clutch housing.

Fig. 8.4.21 — Lubricate clutch release bearing

Attention: do not inject excessive lubricant, as excessive lubricant will accumulate inside the clutch housing and can get to the friction surfaces of the driven plate linings!

Operation 28. Lubricate HSU cylinder joints

Use a gun to inject a lubricant specified in Table 8.4 to the HSU cylinder joints 2 (Fig. 8.4.22) through the oilers 1.



1 – oiler; 2 – HSU cylinder.

Fig. 8.4.22 – Lubricate HSU cylinder joints

Operation 29. Check/adjust clutch pedal free travel

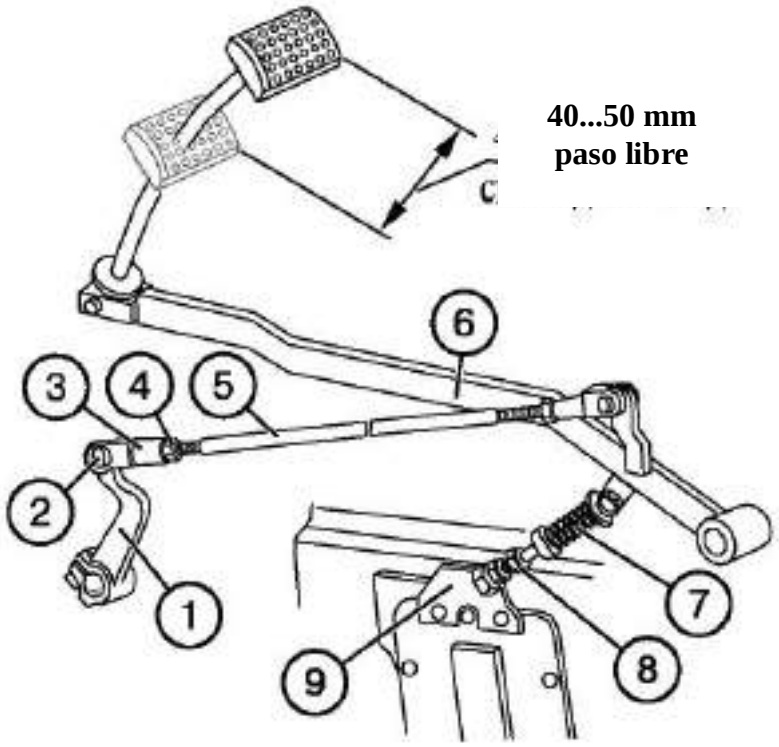
Attention: too large pedal free travel will not completely disengage the clutch and make it difficult to switch gears. lack of free travel of the pedal will make the clutch slip, cause rapid wear of friction linings and overheating of clutch parts!

The clutch pedal free travel as measured with the engine off must be 40 to 50 mm. If the value is too high or too low, adjust the clutch pedal free travel.

To adjust the clutch pedal free travel, proceed as follows:

- remove the cotter pin and remove the finger (2) (Fig. 8.4.23) disconnecting the rod (5) from the lever (1).
- loosen the locknut (4).
- unscrew the bolt (8) so that the pedal rod (6) move upwards up to stop against the cab floor.
- turn the lever (1) counterclockwise until it stops, that is, when the release bearing touches the clutch release levers.
- unscrewing the fork (3), align the holes in the plug and the lever (1), and then screw the fork into the rod (5) by 5 ... 5.5 turns (i.e., shorten the rod). Connect the fork (3) with the lever (1) using the finger (2).
- assemble the leverage of the clutch pedal in reverse order.

Make sure that the clutch pedal securely returns up to stop against the floor at the area of pedal free travel. Otherwise, adjust the servo spring force (7) with the bolt (8) or change the position of the bracket (9) by turning it relative to the fastening bolt axis.



1 — lever; 2 — pin; 3 — fork; 4 — locknut; 5 — rod; 6 — pedal rod; 7 — servo spring; 8 — bolt; 9 — bracket.

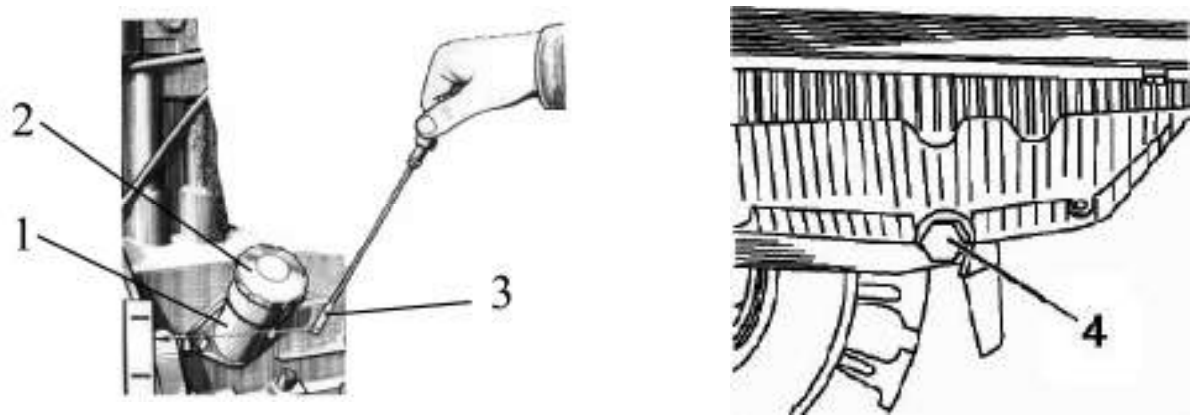
Fig. 8.4.23 — Check/adjust clutch pedal free travel

Operation 30. Change engine oil

Before changing oil, warm up the engine to the normal operating temperature (70°C min.), install the tractor on an even surface, kill the engine and brake tractor with the parking brake.

To change oil in the engine crankcase, proceed as follows:

- remove the cover (2) (Fig. 8.4.24) of the oil filler neck (1) and unscrew the drain plug (4);
- drain the oil into a container for storing waste oils;
- reinstall the drain plug (4) and through the oil filler neck (1) fill fresh clean motor oil (winter grade according to Table 8.4 during winter and summer grade during summer) up to the upper mark on the oil gage stick (3);
- install the filler neck cover (2) to place;
- start the engine and let it run for one to two minutes;
- in ten minutes after stopping the engine, check the oil level using the oil gage stick (3);
- if necessary, add oil to the engine crankcase.



1 — oil filler neck; 2 — cover; 3 — oil level gage; 4 — drain plug.

Fig. 8.4.24 – Change engine oil

Caution: Be careful to avoid contact with hot oil!

Operation 31. Replace engine oil filter

Replace the filter element according to Fig. 8.4.25 simultaneously with changing oil in the engine crankcase in the following order:

- screw out the filter FM 009-1012005 from the connecting piece using a special wrench or other means available;
- screw a new filter FM 009-1012005 on the connecting piece.

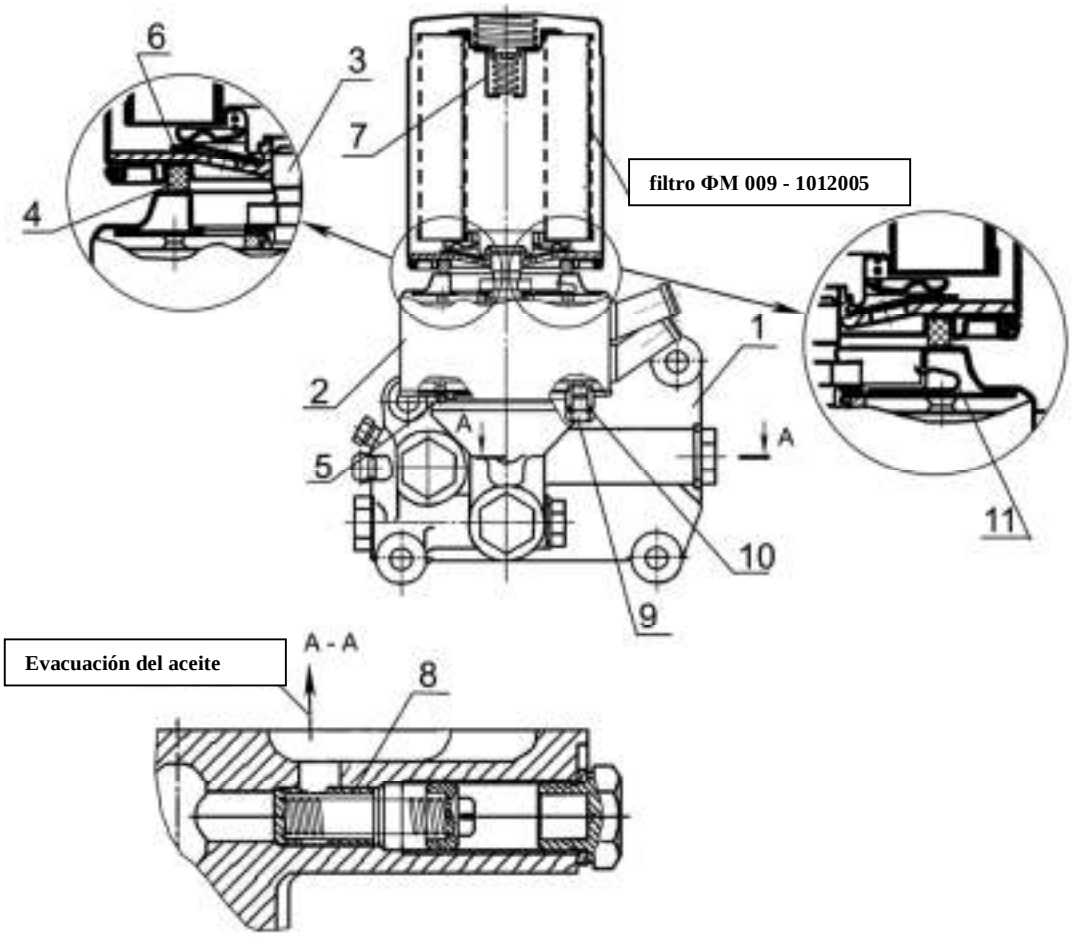
*When installing the filter on the casing, lubricate the gasket 3 with motor oil.

After the shim touches the support surface of the filter housing 1, screw the filter by additional 3/4 turn. Install the filter on the casing only by force of the hands.

Further on, to order oil filters FM 009-1012005 use the contact address: Avtoagregat OJSC, 2a Industrialnaya St., Livny 303858, Orel region, Russia.

Instead of filters FM 009-1012005, you can install sealed filter cartridges such asAS Lelko H149 (France),Purolator L37198 (Italy) and from other vendors, which have an anti-drain valve and a bypass valve with main dimensions as follows:

- diameter — 95 ... 105 mm;
- height — 140 ... 160 mm;
- thread —."-16UNF.



1 — filter housing; 2 - liquid-oil heat exchanger (LOHE); 3 — connecting piece; 4 — filter gasket; 5 — LOHE gasket; 6 — anti-drain valve; 7 — bypass valve; 8 — safety valve; 9 — coolant drain plug; 10 — seal ring; 11 — LOHE safety valve.

Fig. 8.4.25 – Oil filter with LOHE

Operation 32. Check/adjust plays in steering rod joints

To check free travels and plays in the joints (1) (Fig. 8.4.27) of the steering rod (4), turn the steering wheel in both directions with the engine running. If the angular play of the steering wheel exceeds 25°, as shown in Fig. 8.4.26, eliminate plays in the steering rod joints, proceeding as follows:

- remove the lock wire (3) (Fig. 8.4.27);
- screw the screw plug (2) to eliminate the clearance in the joint connection;
- lock the plug (2) with the wire (3).

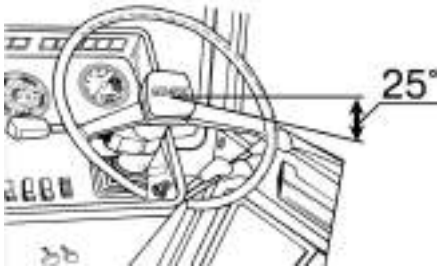
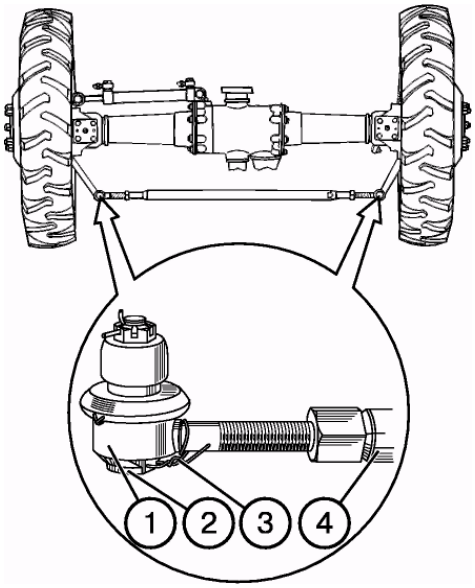


Fig. 8.4.26 – Check steering wheel play



1 — joint; 2 — plug; 3 — lock wire; 4 — steering rod.

Fig. 8.4.27 — Check/adjust plays in steering rod joints

Attention: If tightening the threaded plugs does not eliminate the play in the joints, disassemble the joint and replace worn out parts!

Operation 33. Checking and adjusting toe-in

Check and, as necessary, adjust the toe-in as specified in 5.2 Checking and adjusting toe-in of this Manual.

Operation 34. Check/tighten threaded connections of TC and hydraulic lift

Check and, if necessary, tighten six nuts M20 fastening the TC and the hydraulic lift to the rear axle housing (tightening torque of 180 to 224 N•m), four nuts M20 fastening the hydraulic lift to the rear axle housing (tightening torque of 180 to 224 N•m), four bolts M16 (200 to 250 N•m) fastening the TC side elements to the TC plate and four bolts M22 (265 to 335 N•m) fastening the TC to the bottom of the rear axle.

8.4.4 Maintenance after each 500 service hours

Perform the above operations plus the following:

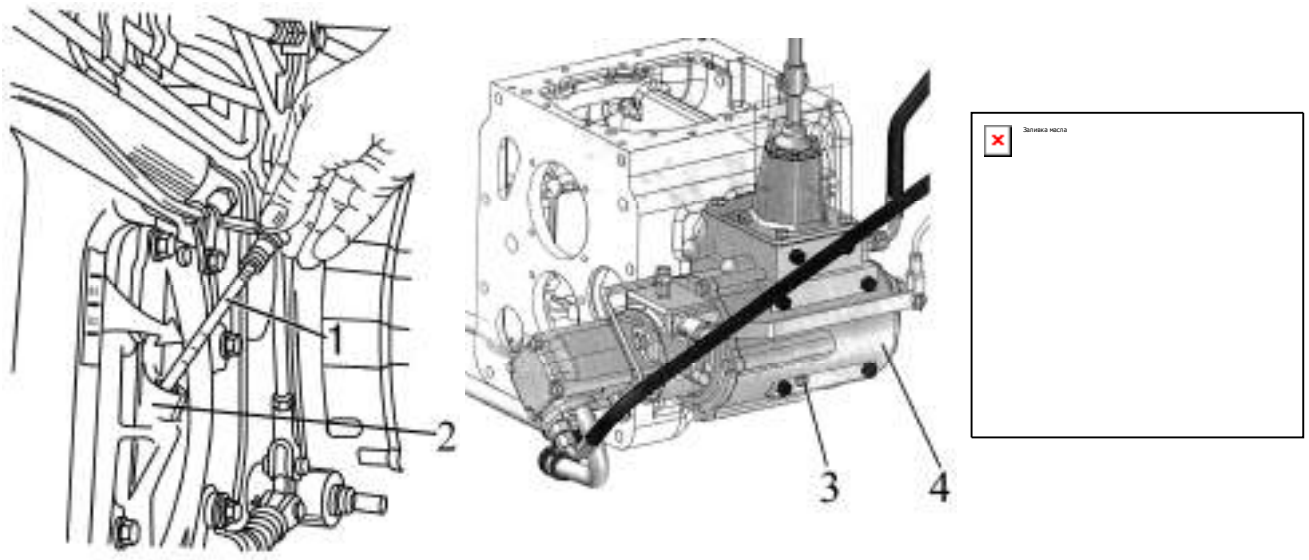
Operation 35. Check oil level in transmission

To check the oil level in the transmission of BELARUS-1021/1021.3 tractors without a speed reducer, proceed as follows:

- install the tractor on an even place;
- remove the oil gage stick (1) (Fig. 8.4.29) located on the left side of the gearbox and determine the oil level;
- normal operating oil level must be between the upper and middle marks of the oil gage stick;
- if necessary, remove the cap (5) on the top cover of the gearbox and add oil to the required level (for access to the oil filler cap (5), unscrew five bolts and remove the floor cover under feet);
- install the oil gage stick (1), and the cap (5), and the floor cover to place.

To check the oil level in the transmission of BELARUS-1021/1021.3 tractors with a speed reducer (hydraulic speed reducer), proceed as follows:

- install the tractor on an even place;
- unscrew the control plug 3 (Fig. 8.4.29) located on the speed reducer(hydraulic speed reducer) housing from the left side of the gearbox;
- check that the oil level coincide with the bottom edge of the check plug hole (4).
- if necessary, remove the filler cap (5) on the top cover of the gearbox and add oil to the required level (for access to the oil filler cap (5), unscrew five bolts and remove the floor cover under feet);
- install the plugs (3) and (5), and the floor cover to place.



1 — oil gage stick; 2 — gearbox housing; 3 — check plug of speed reducer (hydraulic speed reducer); 4 — speed reducer (hydraulic speed reducer) housing; 5 — filler cap; 6 — gearbox top cover.

Fig. 8.4.29 – Check oil level in transmission

Operation 36. Check the oil level in the wet brake housings

Note — The operation is performed on BELARUS-1021/1021.3 tractors equipped with the brakes working in oil bath (wet brakes) installed on request.

To check the oil level in the wet brakes housing, proceed as follows:
- install the tractor on an even surface;
- unscrew the check-filler plugs (1) (Fig. 8.4.30) in the right and left brake housings;
- the oil level in the brake housings must up to the hole edges of the check-filler plugs (1) on the front walls of the housings;
- if necessary, add oil through the holes of the check-filler plugs (1);
- screw the check-filler plugs (1).

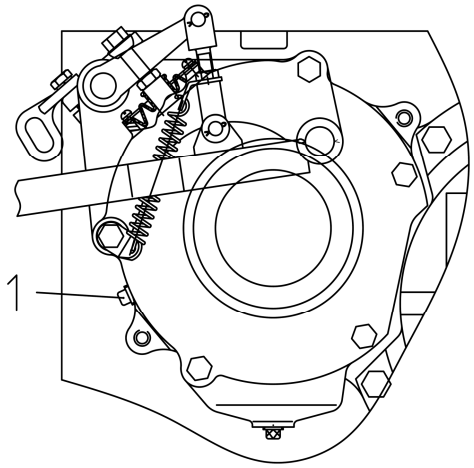


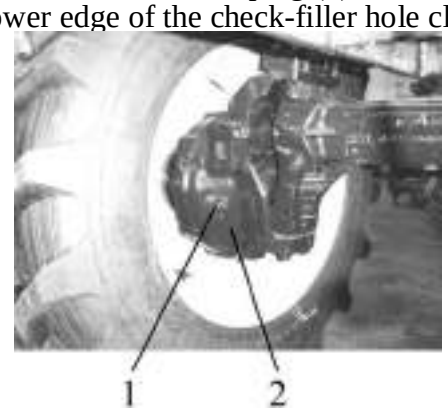
Fig. 8.4.30 – Check the oil level in the wet brake housings

Attention: The oil grade added to the brake housings must be the same as the oil grade used in the transmission!

Attention: it is forbidden to operate brakes without oil or with insufficient oil level!

Operation 37. Check oil levels in housings of wheel reducers and FDA final drive

Check the oil level in left and right wheel reducer housings, proceeding as follows:
- install the tractor on an even horizontal place;
- unscrew the check-filler plug (1) (Fig. 8.4.31) in the wheel reducer housing (2);
- the oil level must reach the threaded hole in the plug (1);
- if necessary, add oil to the lower edge of the check-filler hole closed by the plug (1);



1 – check-filler plug, 2 – wheel reducer housing.

Fig. 8.4.31 – Check oil levels in housings of wheel reducers and FDA final drive

- install the check-filler plug (1) in place;

Check the oil level in the FDA central gear, proceeding as follows:
- unscrew the check-filler plug (1) (Fig. 8.4.32) in one of the axle beam tubes;
- the oil level must reach the threaded hole in the plug (1);
- if necessary, add oil to the lower edge of the check-filler hole closed by the plug (1);
- install the check-filler plug (1) in place;

1 – FDA housing check-filler plug.

Fig. 8.4.32 – Check oil level in FDA central gear

Operation 38. Check/adjust clearances between valves and engine rockers

Note — Check the clearances between the valves and rockers and, as necessary, adjust every 500 service hours, as well as after removing the cylinder head, tightening the bolts fastening the cylinder head, and when valve hammering appears.

The clearances between the rocker striker and the valve stem end when checking on a cold diesel engine (water and oil temperature not exceeding 60°C) must be:

1) inlet valves— $0{,}25^{+0{,}05}_{-0{,}10}$ mm;

2) exhaust valves— $0{,}45^{+0{,}05}_{-0{,}10}$ mm.

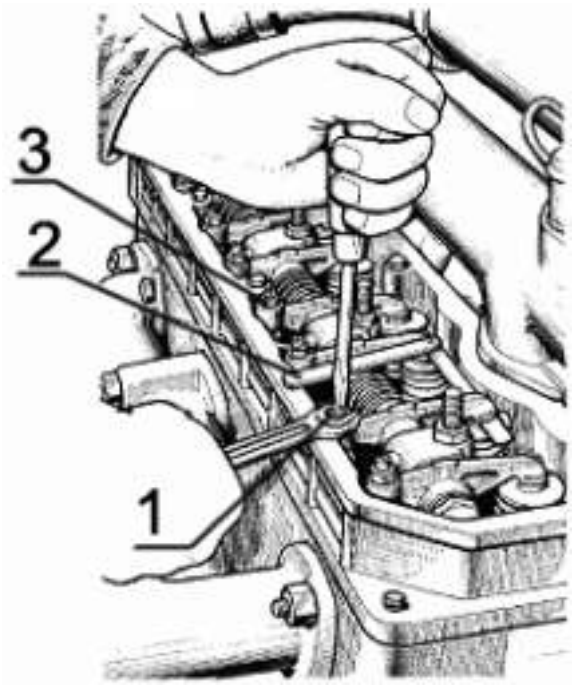
When adjusting the clearance between the valve stem and the rocker striker on a cold diesel engine, set:

1) inlet valves $0{,}25_{-0{,}05}$ — mm;

2) exhaust valves— $0{,}45_{-0{,}05}$ mm.

Adjust as follows:
- remove the cap of the cylinder head cover and check fastening of the rocker shaft support;
- crank the crankshaft until the valves overlap in the first cylinder (inlet valve of the first cylinder starts opening, and the exhaust valve ends closing), and adjust the clearances in the fourth, sixth, seventh and eighth valves (counting from the fan), then turn the crankshaft by one revolution causing an overlap in the fourth cylinder, and adjust the clearances in the first, second, third and fifth valves.

To adjust the clearance, release the locknut 2 of the screw on the rocker of the adjusted valve as per Fig. 8.4.33, and, screwing in or unscrewing the screw, set the required clearance by the dipstick between the rocker striker and the valve stem end. After adjusting the clearance, tighten up the locknut. After completion of valve clearance adjustment, put to place the cap of the cylinder head cover.



1 — adjusting screw; 2 — dipstick; 3 — locknut.

Fig. 8.4.33 – Adjust valve clearance.

Operation 39. Check and adjust axial preload in pivot tapered bearings

Check and, if necessary, adjust the axial preload in pivot tapered bearings, as described in 5.6.4 Checking and adjusting axial preload in pivot tapered bearings

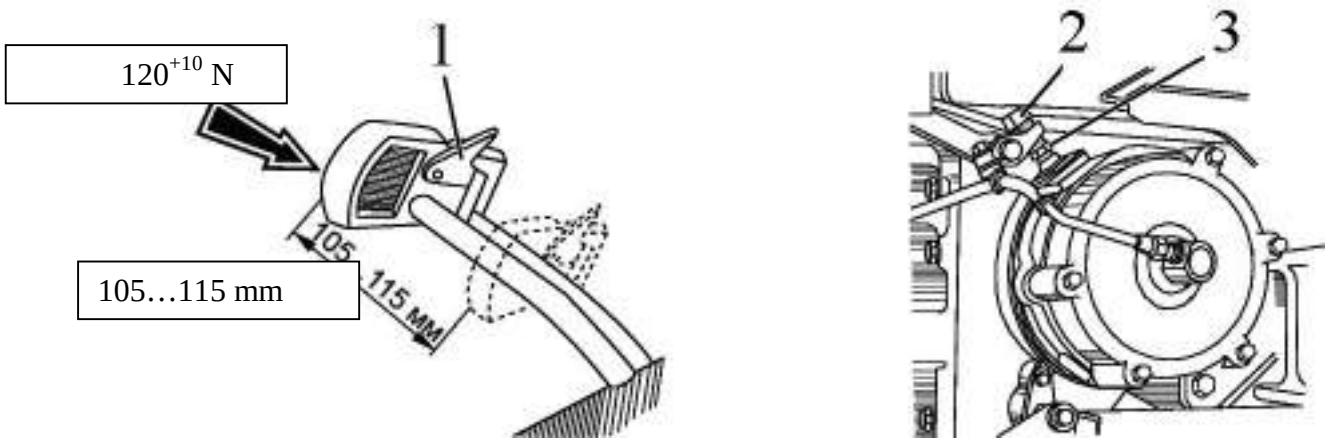
Operation 40. Adjust service brake control

Attention — For BELARUS-1021/1021.3 tractors equipped with optional multi-disk brakes working in oil bath (wet brakes), the operation of adjusting the service brake control is identical to the steps below for BELARUS-1021/1021.3 tractors with dry friction brakes.

Before adjusting the service brake control, install the tractor on an even horizontal surface. The engine must be killed. Put brake shoes in front and behind the wheels precluding spontaneous motion of the tractor.

Adjust the service brake control as follows:

- unscrew the locknuts (3) (Fig. 8.4.34) of the adjusting bolts (2);
- screw the bolts (2) into the adjusting forks or unscrew them to provide the right pedal full travel of 105 to 115 mm under a force of 120 to 130 N and the stopping distance of 6.0 meters max. at a speed of 20 km/hours and under a force of 600 N max. on the pedals interlocked with the plate (1), as well as unsimultaneous start of wheel braking by no more than one meter (by tire footprint). The left brake pedal travel must by 5-20 mm less than of the right brake pedal for simultaneous action of the brakes in the interlocked position. Reduction in the brake pedal travel by more than the indicated values is not allowable because it leads to premature wear of the linings and overheating of the brakes;
- tighten up the locknuts (3).



1 — connection plate; 2 — adjusting bolt; 3 — locknut.

Fig. 8.4.34 – Adjust service brake control

Attention: lubricant in a dry friction brake causes oiling of the disks, reduction in friction between their working surfaces — brakes "do not hold". In this case, disassemble the brake, eliminate oil leakage, and rinse oily disks with gasoline and let them dry for 5 to 8 minutes. After assembly, adjust the brake control as indicated above.

Operation 41. Adjust parking-reserve brake control

Attention — For BELARUS-1021/1021.3 tractors equipped with optional multi-disk brakes working in oil bath (wet brakes), the operation of adjusting the parking-reserve brake control is identical to the steps below for BELARUS-1021/1021.3 tractors with dry friction brakes.

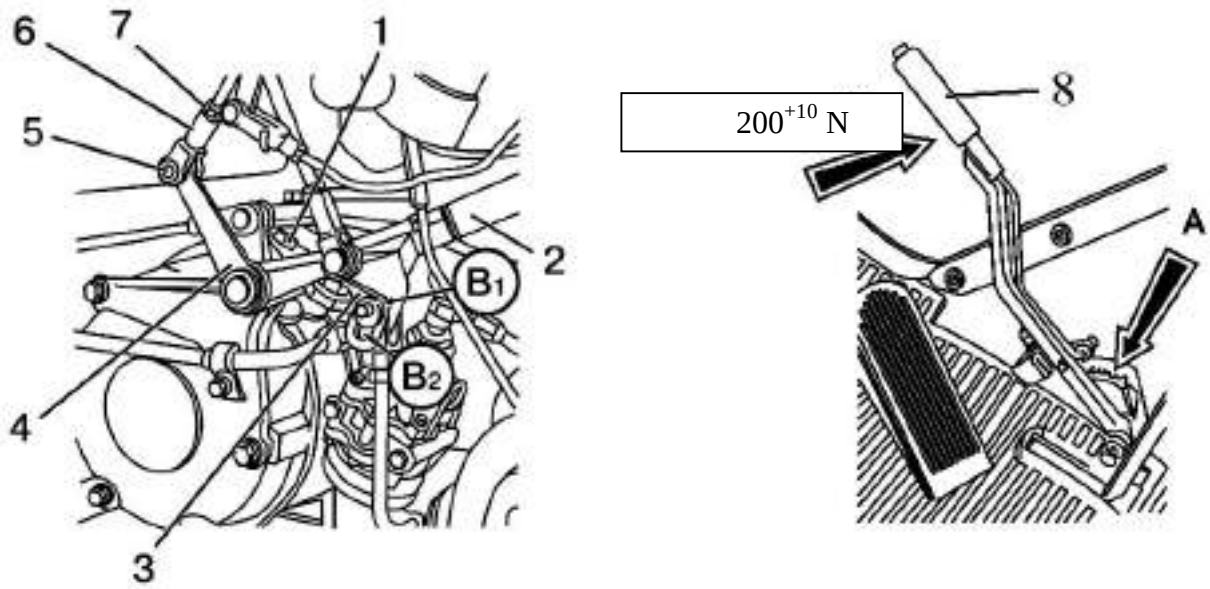
Adjust the parking-reserve brake control after adjusting the service brake control.

Before adjusting the parking-reserve brake control, install the tractor on an even horizontal surface. The engine must be killed. Put brake shoes in front and behind the wheels precluding spontaneous motion of the tractor.

Adjust the parking-reserve brake control (option with a lever located under operator's right hand) as follows:

- shift the parking brake lever (8) (Fig. 8.4.35) in the forward position (push);
- loosen the adjusting screw locknut (1) and the locknut (7) and take out the pin (5);
- turn the lever (4) and align the top edge of the groove B_2on the lever (3) with the upper edge of the groove B_1on the lever (2) of the right brake pedal, and then, rotating the fork (6), align the holes in the lever (4) and the fork (6) and insert the pin (5);
- loosen or tighten the bolt (1) so that when pulling the control lever with a force of 200^{+10} N, the latch holds in the hollows of the third or fourth tooth of the sector A. After adjustment, tighten the loosened locknuts.

Perform final check and adjustment of the parking brake on an assembled tractor. The tractor must be held on a slope of 18% min. with a force applied to the parking brake lever (8) not exceeding 400 N. If necessary, re-adjust using the adjusting bolt (1).



1 — adjusting bolt; 2 — right brake pedal lever; 3,4 — lever; 5 — pin; 6 — fork; 7 — locknut; 8 — parking brake control lever.

Fig. 8.4.35 – Adjust parking-reserve brake control (with lever)

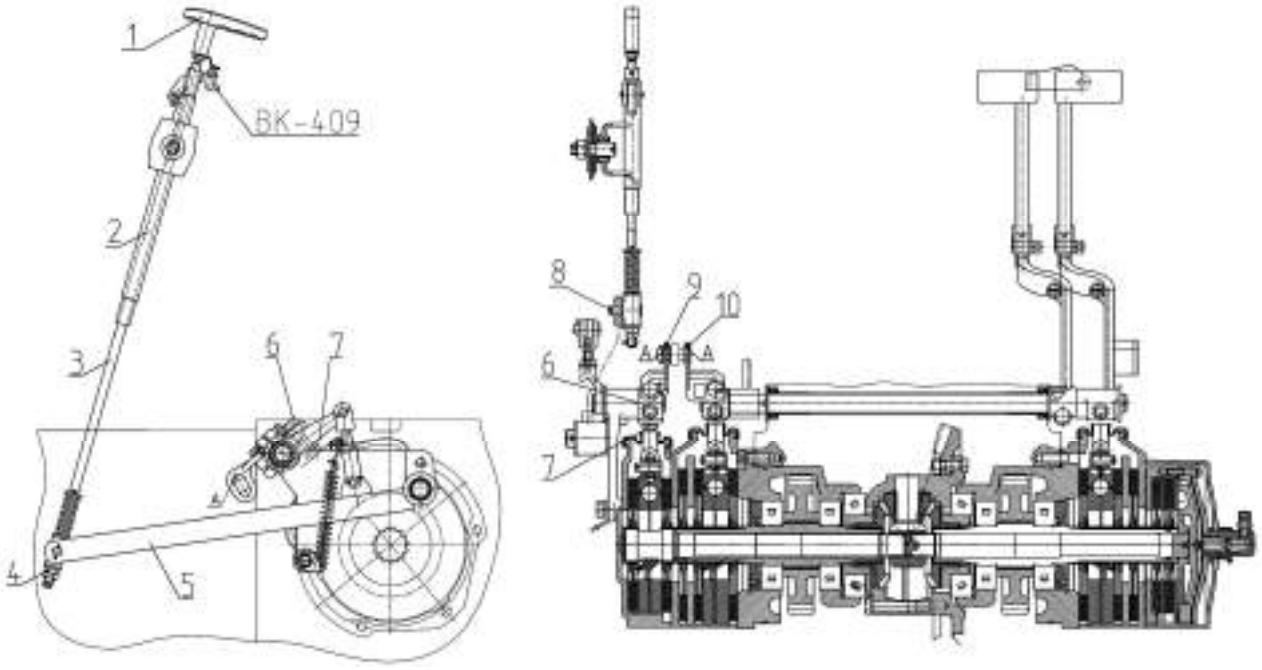
Adjust the parking-reserve brake control (option with a rod located under operator's left hand) as follows:

Link the rod (3) (Fig. 8.4.36) of the extension mechanism (2) with the lever (5) and cotter it with the pin (8); rotating the nuts (4) ensure alignment of the upper edges A of the arm holes (9) and (10), then lock the nuts (4).

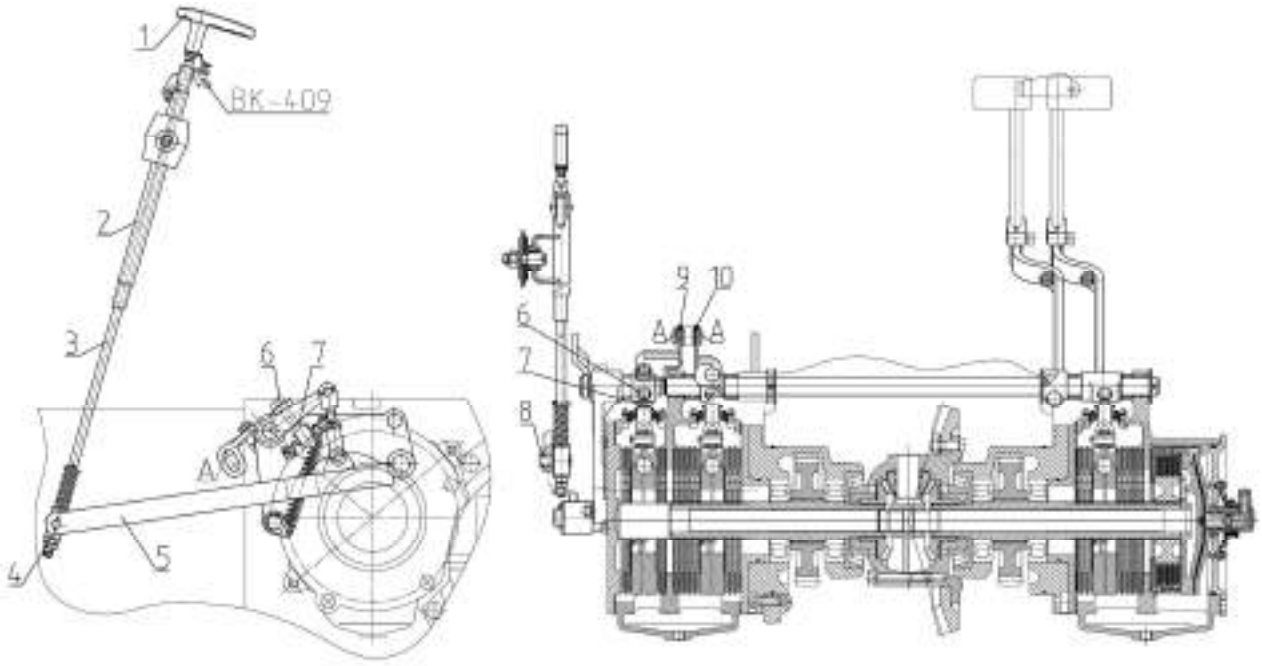
Adjust the travel of the lever (1) with the screw (6) so that under an effort (300 ± 10) N on the lever (1) its travel be 110 to 120 mm, then tighten up the nut (7).

Set the switch VK-409 so that shifting the lever (1) of the extension mechanism (2) to its lowest position ensure opening of the electrical circuit of the parking brake lamp, and shifting it to the first tooth of the rod close of the circuit.

Perform final adjustment of the parking brake on an assembled tractor. The tractor must be held on a slope (18±3)%. If necessary, re-adjust using the bolt (6).



For BELARUS-1021/1021.3 tractors with dry friction brakes



For BELARUS-1021/1021.3 tractors equipped with the optional multi-disk brakes working in oil bath (wet brakes)

1 — extension mechanism lever; 2 — extension mechanism; 3 — exhaust mechanism rod; 4 — nut; 5 — lever; 6 — adjusting bolt; 7 — nut; 8 — cotter pin; 9 — lever; 10 — lever.

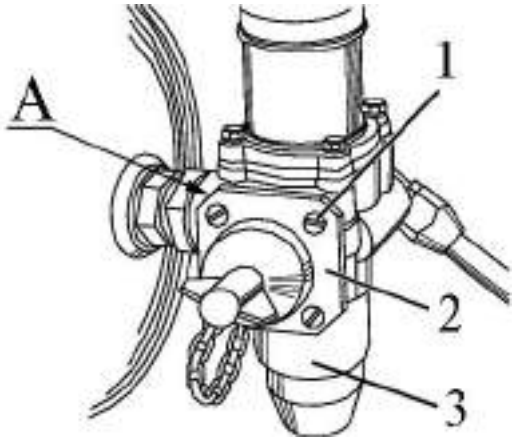
Fig. 8.4.36 – Adjust parking-reserve brake control (with rod)

Operation 42. Clean filter element of air pressure regulator filter in pneumatic system

Note — The operation is performed only on BELARUS 1021/1021.3 tractors with an air pressure regulator 80-3512010. The label tag with the regulator number is located on the area A of the regulator housing.

To clean the filter element of the air pressure regulator filter in the pneumatic system, proceed as follows:

- unscrew the bolts (1) (Fig. 8.4.37) and remove the cover (2);
- remove the filter element, rinse it in detergent solution and blow with compressed air;
- install the filter element, and then the cover to place.



1 — bolt; 2 — cover; 3 — pneumatic system air pressure regulator.

Fig. 8.4.37 – Clean filter element of air pressure regulator filter

Operation 43. Check tightness of pneumatic lines.

To check tightness of the pneumatic lines, proceed as follows:

- bring the pneumatic system pressure to 0.6 to0.65MPa (per the air pressure indicator on the instrument panel) and kill the engine;
- for a single-cable pneumatic drive, connect a pressure gage with a scale of 1 MPa min. to the coupling head with a black cover, for a two-cable pneumatic drive — to the coupling head with a red cover;
- check by the pressure gage that the pressure drops in 30 minutes by 0.2 MPa max. Otherwise, locate the air leakage and correct the flaw.

Operation 44. Check/adjust brake valve drive of pneumatic system

Check and, if necessary, adjust the pneumatic system brake valve actuator as specified in 5.7 Checking and adjusting brake valve actuator of pneumatic system of this Manual.

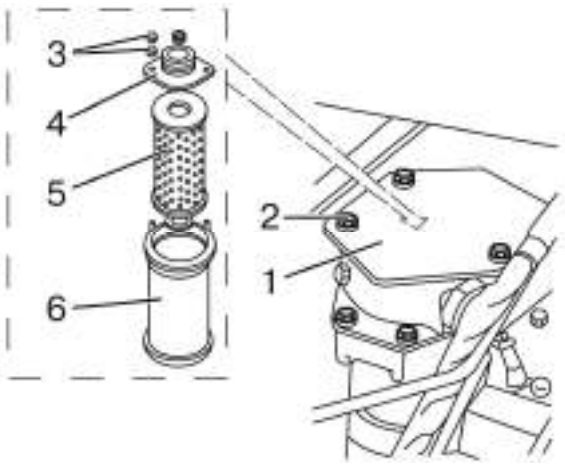
Operation 45. Replace filter element in hydraulic linkage system tank

Note — The fist change of filter element is performed after 500 service hours of the tractor. Further on, change the filter element every 1,000 service hours.

To replace the filter element in the hydraulic linkage system tank, proceed as follows:

- remove the bolts (2) (Fig. 8.4.38), the cover (1) and take out the filter element assembly using the limiter (4);
- remove the nuts (3), the limiter (4), and the filter element (5);
- rinse the housing 6 in detergent solution;
- install a new filter element and assemble the filter proceeding in reverse order;
- install the filter assembly into the hydraulic system tank, close it with the cover (1) and fasten with the bolts (2).

If necessary, remove the oil filler plug and add oil to the required mark (P or S) by the oil gage glass.



1 — cover; 2 — bolt; 3 — nut; 4 — limiter; 5 — filter element; 6 — housing.

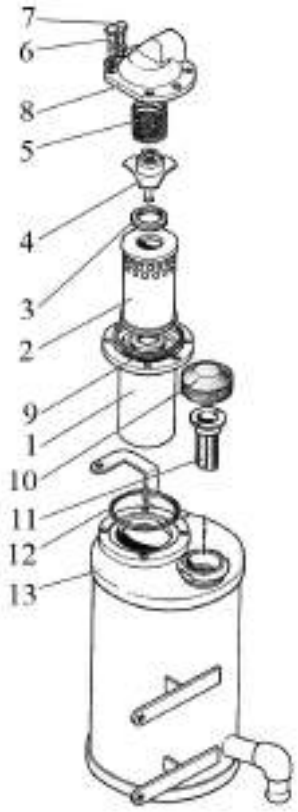
Fig. 8.4.38 – Replace filter element in hydraulic linkage system tank

Operation 46. Replace filter element in HSU tank

Note — The fist change of filter element is performed after 500 service hours of the tractor. Further on, change the filter element every 1,000 service hours.

To replace the filter element in the HSU tank of BELARUS-1021 tractors, proceed as follows:

- unscrew the four bolts (6) (M6×25) and remove the filter assembly;
- unscrew the two bolts (7) (M6×16) and disconnect the cover (8) (Fig. 8.4.39) of the filter from the barrel (1);
- remove the spring (5), the safety valve assembly (4), the seals, the filter element (2), the barrel (1);
- rinse the barrel (1) in detergent;
- install a new filter element (2) and assemble the filter proceeding in the order reverse to assembly;
- install the filter assembly into the HSU tank (13), ensure correct installation of the seals (3), (9), (12);
- tighten up the bolts (6, 7);
- if necessary, remove the oil filler cap (10) and add oil to the required level between the marks on the strainer (11).



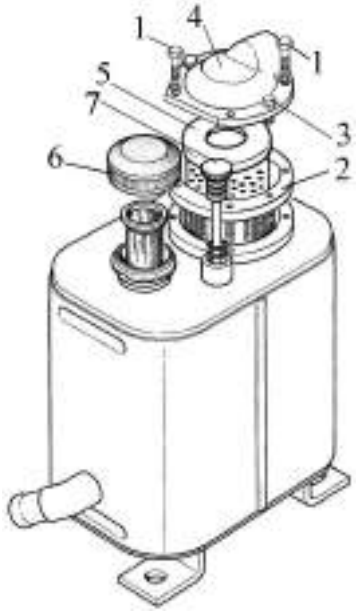
1 — barrel; 2 — filter element; 3, 9, 12 — seal; 4 — safety valve assembly; 5 — spring; 6 — bolt M6×25; 7 — bolt M6×16; 8 — filter cover; 10 — oil filler cap; 11 — strainer; 13 — HSU tank.

Fig. 8.4.39 – Replace filter element in HSU tank of BELARUS-1021 tractors

To replace the filter element in the HSU tank of BELARUS-1021.3 tractors, proceed as follows:

- unscrew the four bolts (1) (M6×25) and remove the filter assembly (2) (Fig. 8.4.40);
- on the filter (2) unscrew the two bolts (3) (M6×16), remove the cover (4), take out the filter element (5);
- install a new filter element (5);
- assemble the filter (2) and install it on the tank in reverse order;

If necessary, remove the oil filler cap (6) and add oil to the upper mark on the oil gage stick (7).



1 — bolt; 2 — filter assembly; 3 — bolt; 4 — filter cover; 5 — filter element; 6 — oil filler cap; 7 — oil gage stick.

Fig. 8.4.40 – Replace filter element in HSU tank of BELARUS-1021.3 tractors

Operation 47. Replace air conditioner filter drain

Notes.

1. The operation is performed for BELARUS-1021.3 tractors, when an air conditioner installed on request instead of the fan-heater.

2. Note — Perform the operation every 800 service hours of the tractor, but at least every year.

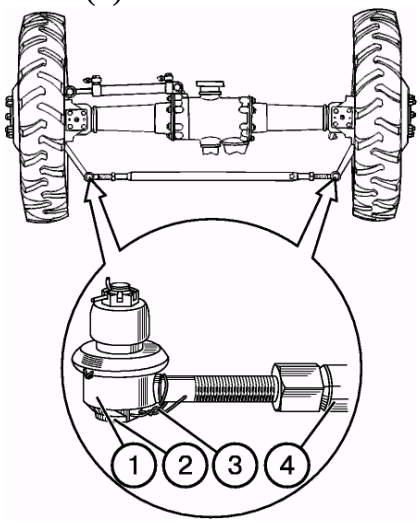
Attention: for replacement of filter drain, contact a special service station. replace only using special equipment!

8.4.5 Maintenance after each 1,000 service hours

Perform the above operations plus the following:

Operation 48. Change lubricant in steering rod joints

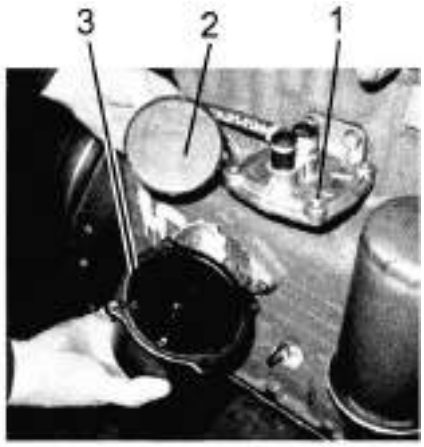
To change lubricant in steering rod joints, proceed as follows:
- remove the lock wire (3) (Fig. 8.4.41);
- unscrew the threaded plug (2);
- remove grease from the joints (1);
- fill in the joints with new grease as specified in Table 8.4;
- screw the screw plug (2) to eliminate the clearance in the joint connection;
- lock the plug (2) with the wire (3).



1 — joint; 2 — plug; 3 — lock wire; 4 — steering rod.
Fig. 8.4.41 – Change lubricant in steering rod joints

Operation 49. Wash the coarse fuel filter

Rinse the fuel coarse filter proceeding as follows:
- shut off the fuel tank valve;
- unscrew the nuts of the sleeve fastening bolts;
- remove the barrel (3) (Fig. 8.4.42);
- unscrew the deflector with mesh (2) with a wrench;
- remove the scatterer;
- wash the deflector with mesh, the scatterer and the filter barrel in diesel fuel and install them to place.
- after assembling the filter, replace the fuel fine filter, fill the system with fuel and bleed air from the fuel supply system, as described below.

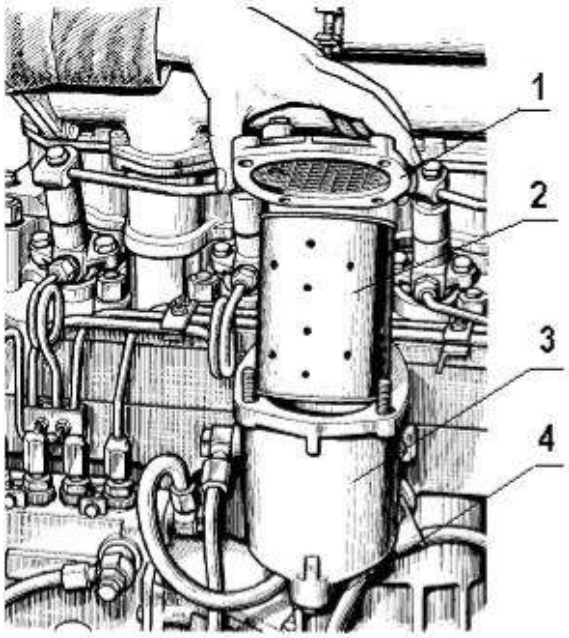


1 — filter housing; 2 — scatterer with mesh; 3 — barrel
Fig. 8.4.42 – Wash the coarse fuel filter

Operation 50. Replace fine fuel filter

On BELARUS-1021 tractors with a D-245 diesel engine, replace the filter element of the fuel fine filter, proceeding as follows:

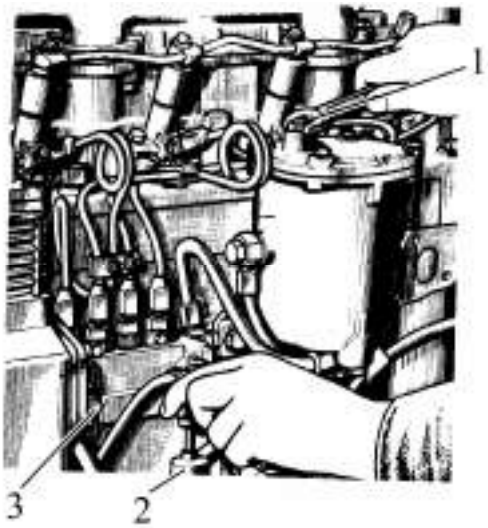
- drain fuel from the filter by unscrewing the cap (4) (Fig. 8.4.43) at the bottom of the housing;
- avoid fuel spillage, drain fuel to a special container;
- unscrew the nuts fastening the cover (1) and remove the cover;
- take the filter element (2) out of the housing (3);
- rinse the inside of the filter housing;
- assemble the filter with a new filter element;
- fill the filter housing with fuel;
- install the cover (1) and the fastening nuts;
- bleed air from the fuel supply system.



1 — filter cover; 2 — filter element; 3 — filter housing; 4 — cap.

Fig. 8.4.43 — Replace filter element of fine fuel filter

To bleed air, unscrew the plug (3) (Fig. 8.4.44) on the fuel pump housing (the location of the air-bleed plug on fuel pumps of different types varies) and by 1-2 turns the connecting pipe (1) on the fuel fine filter. Flush the system with the priming pump (2), closing consequently the plug (3) on the fuel pump housing when fuel emerges, and then the connecting pipe (1) on the fine fuel filter.

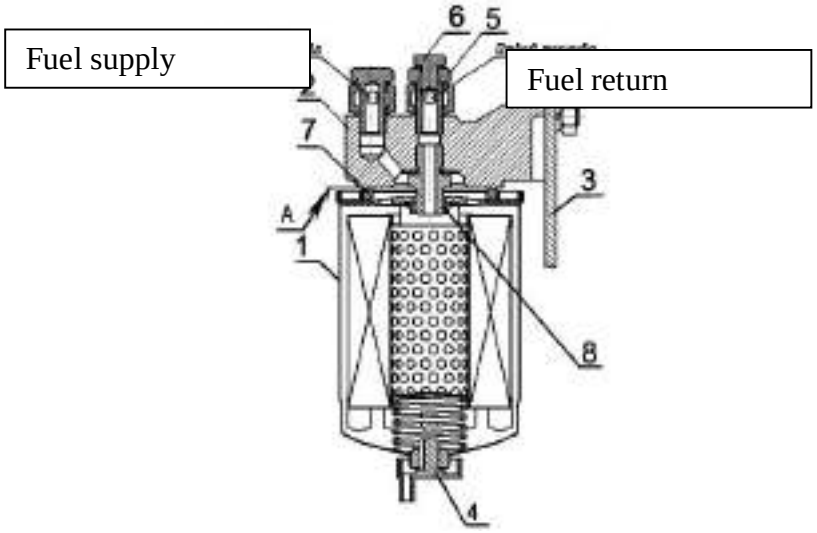


1 — connecting pipe; 2 — priming pump; 3 — piug.

Fig. 8.4.44 — Bleed air from fuel supply system of D-245 diesel engine.

On BELARUS-1021 tractors with a D-245S diesel engine and BELARUS-1021.3 with a D-245S2 diesel engine, replace the filter element of the fuel fine filter, proceeding as follows:

- drain fuel from the filter by unscrewing the cap (4) (Fig. 8.4.45) at the bottom of the housing;
- avoid fuel spillage, drain fuel to a special container;
- unscrew the filter (1) from the connecting pipe (8) in the housing (2) and install a new filter instead of it supplied assembled with the gasket (7), which should be pre-lubricated with engine oil
- after the gasket (7) touches the seat A on the housing (2), screw the filter by additional 3/4 turn. In this case, screw the filter only by force of the hands;
- fill the system with fuel;
- bleed air from the fuel supply system;



1 — filter FT020-1117010; 2 — housing; 3 — bracket; 4 — plug (to drain sediment); 5 — outlet connecting pipe; 6 — plug (to bleed air); 7 — gasket; 8 — connecting pipe.

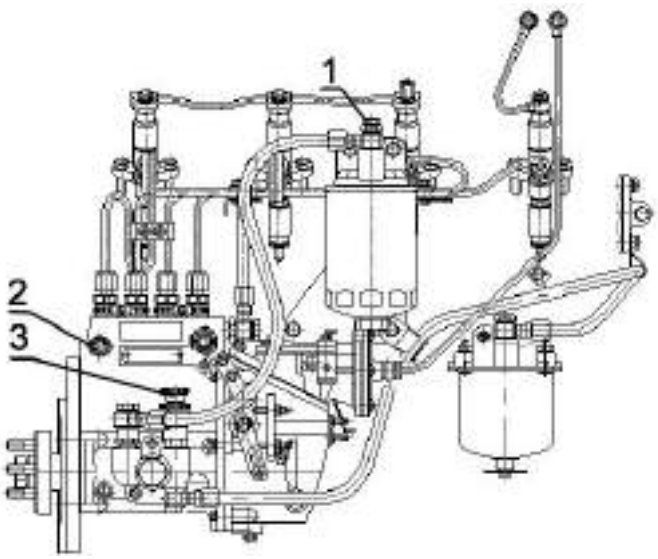
Figure 8.4.45 — Replace fine fuel filter

Instead of a filter FT020-1117010, other sealed fuel filters can be installed with basic specifications and dimensions such as follows:

- screening efficiency 90% min.;
- relative capacity at pressure difference of 0.01 MPa 150 l/h min.;
- diameter — 95 to 105 mm;
- height — 140 to 160 mm;
- connecting thread — M16×1.5;
- outer diameter of sealing gasket — 70 to 75 mm.

To bleed air from the fuel supply system, proceed as follows:

- unscrew the cap (1) (Fig. 8.4.46) located on the bolts fastening the outlet connecting pipe by 2…3 turns;
- flush the system with the priming pump (3), screwing in the plug (3) when fuel emerges without air bubbles;
- unscrew the plug (2) on the fuel pump housing (the location of the air-bleed plug on fuel pumps of different types varies);
- flush the system with the priming pump, screwing in the plug (2) until fuel emerges without air bubbles;



1 — plug (to bleed air); 2 — plug; 3 — priming pump;

Fig. 8.4.46 — Bleed air from fuel supply system of D-245S and D-245S2 diesel engines.

Operation 51. Check tightening of bolts fastening cylinder head

Check tightening of the bolts fastening the cylinder heads on a warmed-up engine in the following order:

- remove the cap and the cylinder head cover;
- remove the rocker shaft with the rockers and the supports;
- using a torque spanner, check tightening of all bolts fastening the cylinder head in the order shown in Fig. 8.4.47, and, if necessary, tighten up the bolts;
- the tightening torque of the cylinder head bolts must be (240±10) N•m.
- after check of tightening of the bolts fastening the cylinder heads, put the rocker shaft to place and adjust the clearance between the rockers and the valves as specified in Operation 38 Check/adjust clearances between valves and engine rockers of this Manual.
- install the cap and the cylinder head cover to place;

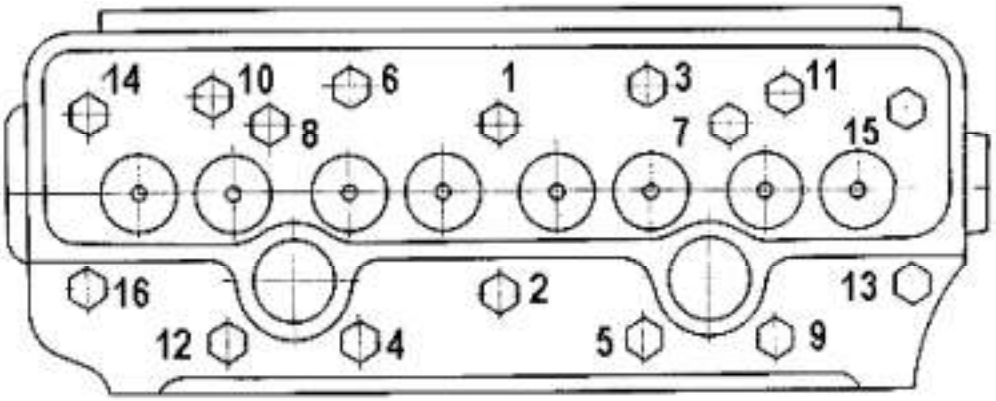


Fig. 8.4.47 – Order of tightening of bolts fastening cylinder head

Operation 52. Change transmission oil

Before changing oil, warm up the transmission to its normal operating temperature by driving the tractor.

To change oil in the transmission, proceed as follows:

- install the tractor on an even horizontal surface. The engine must be killed. Engage the parking brake and put brake shoes in front and behind the wheels precluding spontaneous motion of the tractor.

- unscrew the drain plug (1) (Fig. 8.4.48) from the rear axle housing and the drain plug (2) from the gearbox housing, drain oil into a special container for waste oil, if the tractor is equipped with a speed reducer (hydraulic speed reducer), also unscrew the check plug (3);

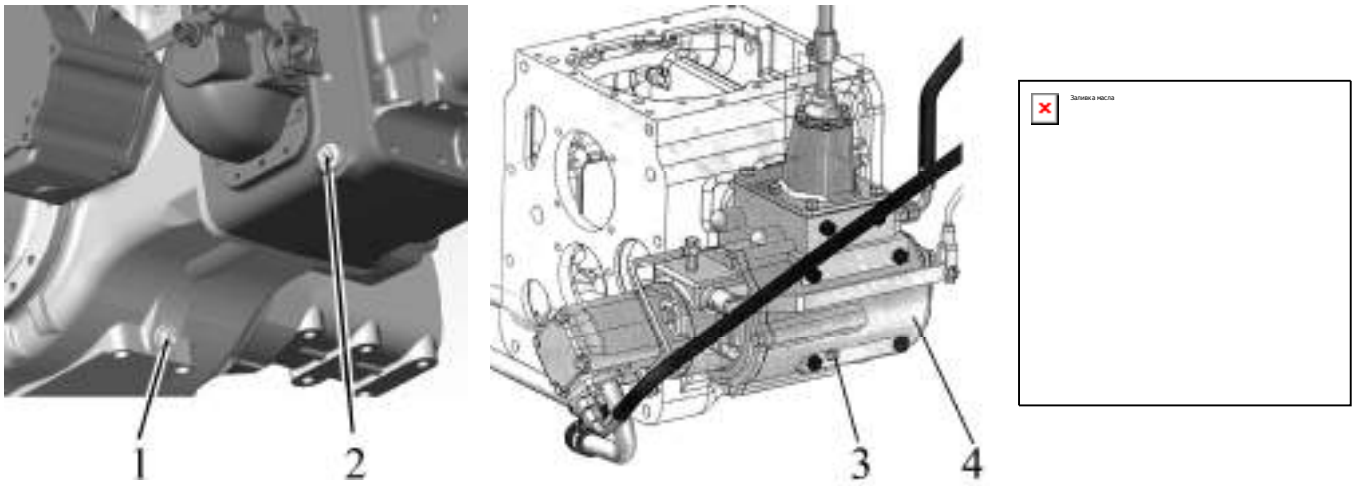
- install the drain plugs (1) and (2) in place;

- unscrew the oil filler cap (5) on the top cover of the gearbox and fill in fresh oil to the transmission (for access to the oil filler cap (5), unscrew five bolts and remove the floor cover under feet);

1. On tractors without a speed reducer (hydraulic speed reducer), the normal operating level of transmission oil must be between the upper and middle marks on the oil gage stick, as shown in Operation 35 Check oil level in transmission of this Manual.

2. On tractors equipped with a speed reducer (hydraulic speed reducer), the normal oil level in the transmission must coincide with the bottom edge of the check plug hole (3).

- put the check plug (3) and the oil filler cap (5) and the floor cover to place.



1 — rear axle drain plug; 2 — gearbox housing drain plug; 3 — speed reducer (hydraulic speed reducer) check plug; 4 — speed reducer (hydraulic speed reducer) housing; 5 — filler cap; 6 — gearbox upper cover.

Fig. 8.4.48 – Change transmission oil

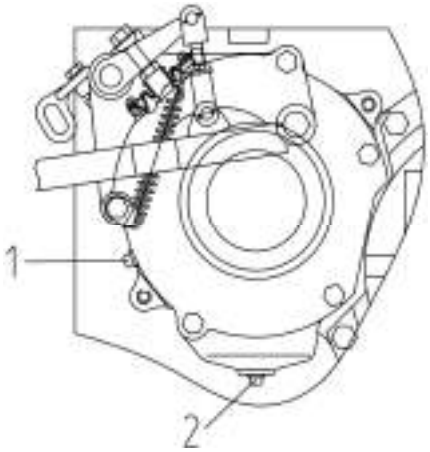
Caution: Be careful to avoid contact with hot oil!

Operation 53. Change oil in wet brake housings

Note — The operation is performed on BELARUS-1021/1021.3 tractors equipped with the brakes working in oil bath (wet brakes) installed on request.

To drain the oil from the wet brake housings, perform the following:

- install the tractor on an even surface;
- unscrew the check-filler plugs (1) (Fig. 8.4.49) in the right and left brake housings;
- unscrew the drain plugs (2) in the right and left brake housings and drain oil into a container for waste oil;
- screw the drain plugs (2);
- through the holes in the check-filler plugs (1), fill oil to the both brake housings to the hole edges of the check-filler plugs (1) on the front walls of the housings;
- screw the check-filler plugs (1).



1 — check-filler plug, 2 — drain plug

Fig. 8.4.49 – Change oil in wet brake housings

Attention: perform the operation of oil change in the brake housings simultaneously with oil change in the transmission. The oil grade used for the brakes is the sames as the oil grade used for the transmission!

Caution: Be careful to avoid contact with hot oil!

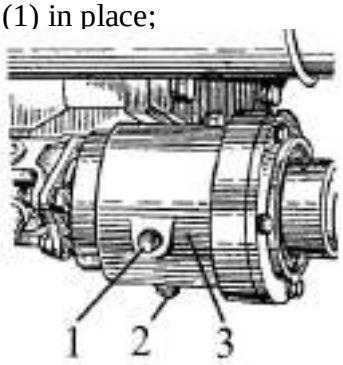
Operation 54. Change oil in FDA and intermediate support housings

Before changing oil, warm up the oils in the FDA housings and the intermediate support to the operating temperature by driving the tractor.

Then install the tractor on an even horizontal surface. The engine must be killed. Engage the parking brake and put brake shoes in front and behind the rear wheels precluding spontaneous motion.

To change oil in the intermediate support housing, proceed as follows:

- unscrew the check-filler plug (1) (Fig. 8.4.50) and the drain plug (2) from the intermediate support housing, drain oil into a special container for waste oil;
- put the drain plug (2) to place and fill fresh oil through the check-filler hole to the intermediate support housing to the level of the lower edge of the check-filler plug hole (1);
- install the check-filler plug (1) in place;

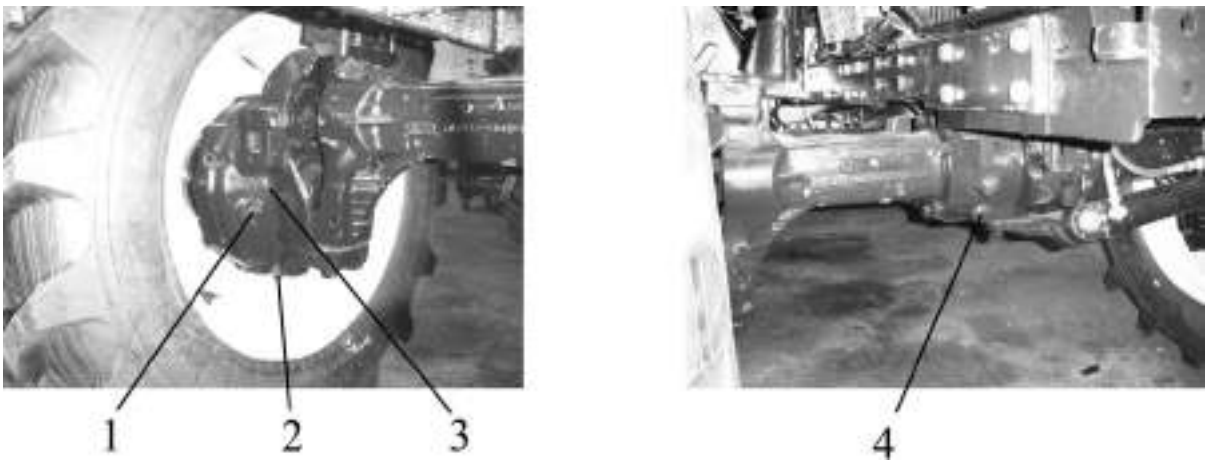


1 — check-filler plug, 2 — drain plug; 3 — intermediate support housing;

Fig. 8.4.50 – Change oil in intermediate support housing

To change oil in the FDA housings, proceed as follows:

- unscrew the check-filler plugs of both wheel reducers (1) (Fig. 8.4.51), the check-filler plugs (1) in the right and left arms of the axle tube (Fig. 8.4.32), as well as the drain plugs of both wheel reducers (2) (Fig. 8.4.51) and the drain plug of the final drive (4) (Fig. 8.4.51), and drain oil into a special container for waste oil;
- install the drain plugs (2) and (4) in place;
- fill the wheel reducer housings with fresh oil to the lower edges of the check-filler holes;
- fill oil to the final drive housing through the check-filler hole in one of the tubes of the axle beam, fill in the hole until the oil in the other tube reaches the bottom edge of the check-filler hole;
- install the check-filler plugs of the wheel reducer and final drive housings.



1 – check-filler plug of wheel reducer; 2 – drain plug of wheel reducer; 3 —wheel reducer housing; 4 — central gear drain plug.

Fig. 8.4.51 – Change oil in FDA housings

Caution: Be careful to avoid contact with hot oil!

Operation 55. Change oil in HSU tank

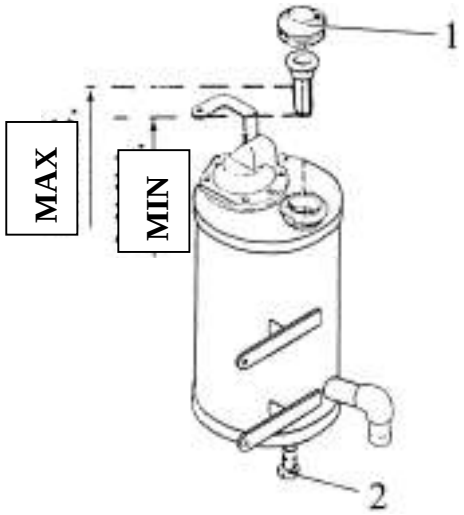
Before changing oil, in order to warm up the HSU oil, turn the steering wheel to the extreme position with the engine running and keep it in that position for five to ten minutes.

Then install the tractor on an even horizontal surface. The engine must be killed. Engage the parking brake and put brake shoes in front and behind the rear wheels precluding spontaneous motion.

Caution: Be careful to avoid contact with hot oil!

Changing oil level in HSU tank on BELARUS-1021 tractors

- remove the oil filler cap (1) (Fig. 8.4.52) and the drain plug (2);
- drain oil from the tank to a container for waste oil;
- install the drain plug (2) to place and fill in fresh oil;
- the oil level must be between the strainer bottom (lower limit) and the middle of the strainer (upper limit).



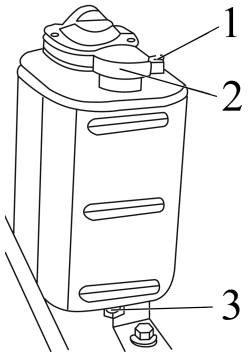
1 — oil filler cap; 2 — drain plug.

Fig. 8.4.52 – Change oil level in HSU tank on BELARUS-1021 tractor

Changing oil level in HSU tank on BELARUS-1021.3 tractors

To replace the filter element in the HSU tank of BELARUS-1021.3 tractors, proceed as follows:

- remove the oil filler cap (2) (Fig. 8.4.53) and the drain plug (3);
- drain oil from the tank to a container for waste oil;
- install the drain plug (3) to place and fill in fresh oil;
- the oil level must be to the upper mark of the oil gage stick (1);



1 — oil gage stick; 2 — oil filler cap; 3 — drain plug.

Fig. 8.4.53 – Change oil level in HSU tank on BELARUS-1021.3 tractor

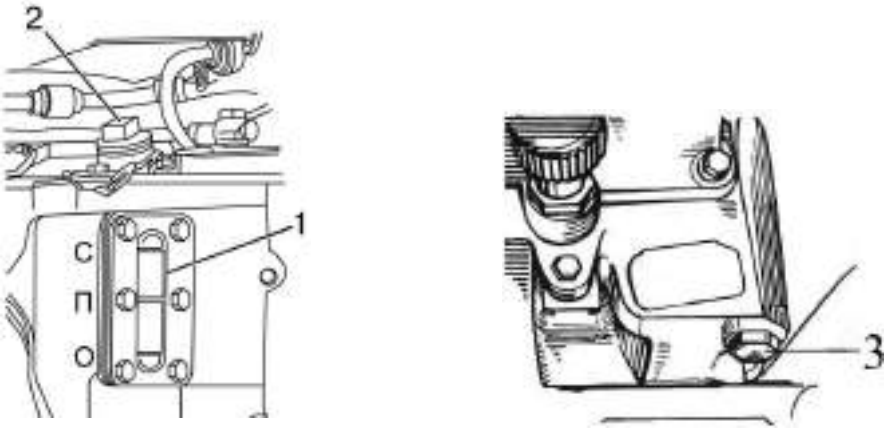
Operation 56. Change oil in hydraulic linkage system tank

Before changing oil, warm up oil in the hydraulic linkage system to a normal operating temperature by starting the engine, shifting any of the hydraulic output control levers to the lift position and holding the lever in this position until the hydraulic system warms up.

To replace oil in the hydraulic linkage system, proceed as follows:

- install the tractor on an even surface, shift down the rear hitch rods to the lowest position, brake the tractor using the parking brakes. The engine must be killed.
- unscrew the check-filler plug (2) (Fig. 8.4.54) and the drain plug (3) from the oil tank drain oil into a special container for waste oil;

- install the drain plug (3) to place and fill the system with fresh oil to the required mark P by the oil gage glass (1). When using machines requiringhigh oil take-off, fill oil to a level corresponding to the upper mark S.
- install the oil filler cap (2) to place.



1 — oil gage glass; 2 — oil filler cap; 3 — drain plug.

Fig. 8.4.54 – Change oil in HL and HSU hydraulic system

Attention: change oil in the HL and HSU system only with the retracted cylinder rods of the RHL and the machines unitized with the tractor!

Caution: Be careful to avoid contact with hot oil!

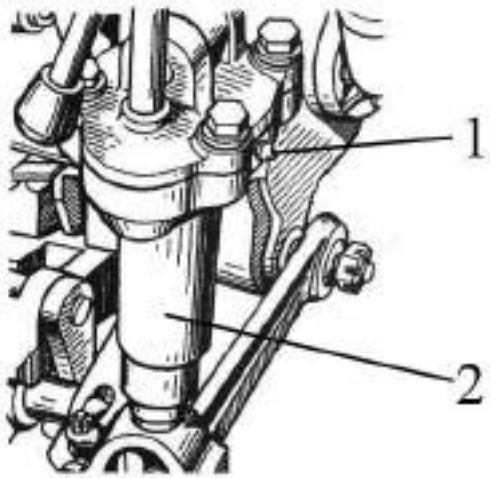
Operation 57. Check/adjust pneumatic system pressure regulator

Note — The operation is performed only on BELARUS 1021/1021.3 tractors with an air pressure regulator 80-3512010. The label tag with the regulator number is located on the area A of the regulator housing.

Check and, if necessary, adjust the pneumatic system pressure regulator as specified in 5.8 Checking and adjusting pneumatic system pressure regulator of this Manual.

Operation 58. Lubricate gear brace mechanism of RHL

Using a gun, inject lubricant, as specified in Table 8.4, to the brace mechanism (one lubrication point per each gear brace), making four to six injections through the oiler (1) (Fig. 8.4.55) in the upper part of the brace (2).



1 — oiler; 2 — gear brace.

Fig. 8.4.55 – Lubricate gear brace mechanism of RHL

Operation 59. Check/tighten external threaded connections of the tractor

Check and, as necessary, tighten most critical external threaded connections of the tractor as follows.

1 — front bar — semi-frame girders;
2 — semi-frame girders — clutch housing;
3 — engine — clutch housing;
4 — clutch housing — gearbox housing;
5 — gearbox housing — rear axle housing;
6 — rear axle housing — semi-axle tubes;
7 — rear axle housing — upper cover (two rear bolts M20).
8 — RHL rear rod brackets — rear axle housing;
9 — front and rear cab supports;
10 — FDA housing — tubes;
11 — tubes — wheel reducers;
12 — universal-joint drive intermediate support housing — clutch housing;
13 — steering cylinder pins;
14 — fixtures of air conditioner compressor to engine (on 1021.3 with air conditioner).

1. Check and, if necessary, tighten twelve bolts M16 (six bolts on each side) fastening the girders to the front bar to a torque 160 to 180 N•m;

2. Check and, if necessary, tighten nine bolts M16 fastening the girders to the clutch housing to a torque 160 to 200 N•m;

3. Check and, if necessary, tighten two bolts M12 fastening the engine to the clutch housing to a torque 70 to 80 N•m;

4. Check and, if necessary, tighten ten bolts M16 on the joint of the gearbox housing and the clutch housing to a torque 160 to 200 N•m;

5. Check and, if necessary, tighten nine bolts M16 (seven bolts on the joint contour and two bolts under the transfer case) on the joint of the gearbox housing and the rear axle housing to a torque 200 to 250 N•m;

Note — For access to the heads of two bolts M16 under the transfer case, unmount the transfer case.

6. Check and, if necessary, tighten nine bolts M16 on each joint of the rear axle housing and the semi-axle tube to a torque 160 to 200 N•m;

Note — For access to the bolt heads, unmount the tractor rear wheels.

7. Check and, if necessary, tighten two rear bolts M20 fastening the cover to the rear axle housing to a torque 315 to 400 N•m;

8. Check and, if necessary, tighten eight bolts M16 (four bolts on each side) fastening the HL rear rod brackets to the rear axle housing to a torque 250 to 300 N•m;

9. Check and, as necessary, tighten most fixtures of the cab support brackets (front and rear) to the tractor chassis. Tightening torque of four bolts M16 — 200 to 220 N•m.Tightening torque of four nuts M18 — 110 to 160 N•m.

Visually check if the cotter pin reliably locks the castle nut M16 fastening the lower vibration absorber of the cab (four points).

10. Check and, if necessary, tighten fourteen bolts M16 (seven bolts on each side) fastening the FDA housing to the tubes to a torque 180 to 200 N•m;

11. Check and, if necessary, tighten sixteen bolts M16 (eight bolts on each side) fastening the FDA wheel reducers to the tubes to a torque 180 to 200 N•m;

12. Check and, if necessary, tighten three bolts M16 fastening the universal-joint drive intermediate support housing to the clutch housing to a torque 100 to 120 N•m;

13. Check and, if necessary, tighten the nuts of the taper joint of the steering cylinder pins, proceeding as follows:

- remove cotter pins from the castle nuts;
- check and tighten as necessary to a torque 180 to 200 N•m two castle nuts M27 of the steering cylinder.
- then tighten the nut to align the nearest groove on the nut with a hole in the pin and cotter;

14. Check and, if necessary, tighten five bolts M8 fastening the air conditioner compressor and the adjusting brackets, as well as four nuts M8 of the pins fastening the air conditioner compressor brackets to the engine to a torque 40 to 50 N•m.

8.4.6 Maintenance after each 2,000 service hours

Perform the above operations plus the following:

Operation 60. Check injectors for injection start pressure and fuel dispersion quality

The injector is considered to be operable if it disperses fuel into mist from all five nozzle holes, without separately ejected drops, continuous jets and condensations. Injection start and end must be clear, no drops on the injector nozzle are allowed.

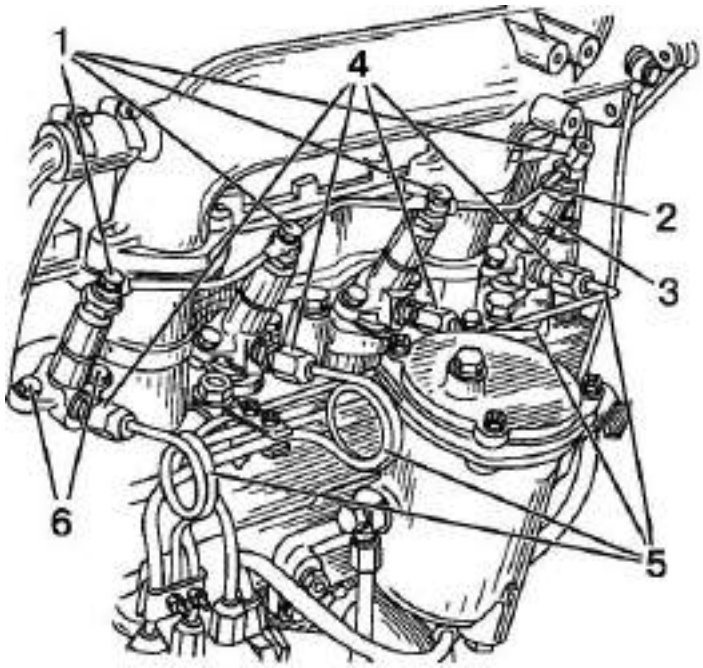
Attention: check and, if necessary, adjustment and cleaning of nozzles must be performed only at a test bench in a special dealer workshop!

Remove the injectors from the engine, proceeding as follows::

- before disconnecting or loosening any part of the fuel system, fully clean an adjacent work surface;
- unscrew the nuts (4) (Fig. 8.4.56) and disconnect the high-pressure fuel lines (5) from the injectors (3) and the fuel pump;
- unscrew the four bolts (1) of the drain line and remove the return pipe (2). Reject sealing copper washers (two washers on each banjo bolt);
- unscrew the bolts (6) fastening the and remove the injectors (3);
- send the injectors to service at a dealer's shop;
- install checked, cleaned and adjusted injectors by following the above steps in the reverse order.
- bleed air from the system as indicated in Operation 50 Replace fine fuel filter of this Manual.

Attention: every time you install injectors, use new copper washers!

Note — It is convenient to have a spare set of tested and adjusted injectors for quick installation on the engine.



1 — bolt; 2 — drain fuel line; 3 — injector; 4 — nut; 5 — high-pressure fuel line; 6 — injector fastening bolt.

Fig. 8.4.56 – Remove injectors from engine

Operation 61. Check and adjust fuel pump on test bench

Remove the fuel pump from the engine to send it to a special shop.

Attention: the fuel pump is adjusted by a dealer at a specialized workshop using special equipment!

Attention: the fuel pump must be removed from and installed on the engine only by a qualified technician!

Operation 62. Check and adjust setting advance angle of fuel injection on engine

Attention: In case of difficult engine start, smoky exhaust, and during replacement or installation of the fuel pump after checking on the bench after 2,000 service hours or an engine repair, always check and, as necessary, adjust the setting advance angle of fuel injection on the engine!

The method of checking and adjusting the setting advance angle of fuel injection on the engine depends on the make of the fuel pump installed on the diesel engine of your tractor. The fuel pump designation is on the nameplate located on the fuel pump housing.

Check and, if necessary, adjust the setting advance angle of fuel injection with fuel pumps 772, 773 (YAZDA OJSC), proceeding as follows:

- set the piston of the first cylinder to the compression stroke at 40-50°to UDC;
- set the regulator control lever to the position corresponding to the maximum fuel supply;
- disconnect the high-pressure pipe from the union of the first section of the pump and instead of it connect a check device being a high-pressure pipe segment 100 to 120 mm long with a packing nut on one end and the second end bent aside by 150 to 170°C as per Fig. 8.4.57;
- fill the fuel pump with fuel, bleed air from the low-pressure system and create a positive pressure using the priming pump until a continuous jet of fuel emerges from the tube of the check device;
- slowly rotating the engine crankshaft clockwise and maintaining a positive pressure in the pump head (using the priming pump), watch the fuel flowing out of the check device. When the fuel ceases to flow (dropping is allowed of up to 1 drop per 10 seconds), quit rotating the crankshaft;
- unscrew, in accordance with Fig. 8.4.58, the latch from the threaded hole of the back plate and insert it upside down into the same hole up to stop against the flywheel, at that the latch must align with the hole in the flywheel (this means that the piston of the first cylinder is set to the position corresponding to the setting advance angle of fuel injection specified in Table Diesel engine parameters on page 16 of this Manual).

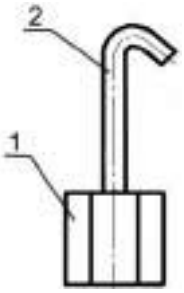
If the latch does not align with the hole in the flywheel, make an adjustment, proceeding as follows:

- remove the hatch cover as per Fig. 8.4.59;
- align the latch with the flywheel hole rotating the crankshaft to one direction or the other;
- release by 1...1.5 turns the nuts fastening the fuel pump drive pinions;
- using a wrench, turn the fuel pump shaft by the nut counterclockwise until the pins stop against the groove edged of the fuel pump drive pinion;

- create a positive pressure in the fuel pump head until a continuous jet of fuel emerges from the tube of the check device;
- rotating the pump shaft clockwise and maintaining a positive pressure, watch the fuel flowing out of the check device.
- at the moment when the fuel ceases to flow out, quit rotating the shaft and lock it, tightening up the nuts fastening the drive half-coupling to the drive pinion.

Re-check the moment of fuel supply start.

Disconnect the check device and install the high-pressure pipe and the hatch cover to place. Screw the latch into the back plate hole.



1 — packing nut; 2 — high-pressure pipe

Fig. 8.4.57 — Design of check device

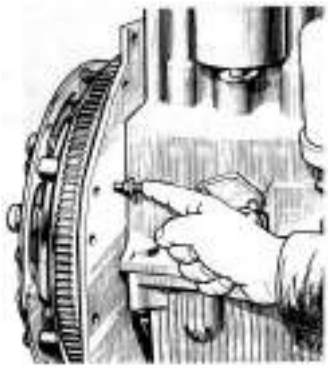
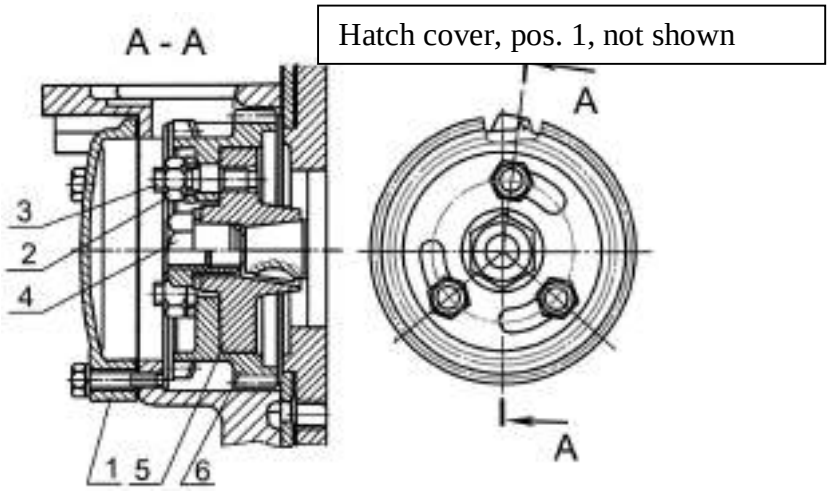


Fig. 8.4.58 — Install latch in back plate and flywheel hole.



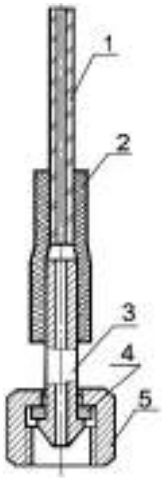
1 — hatch cover; 2 — nut; 3 — pin; 4 — special nut; 5 — drive half-coupling; 6 — fuel pump drive pinion.

Fig. 8.4.59 — Fuel pump drive

Крышка люка, поз. 1, не показана Hatch cover, pos. 1, not shown

Check and, if necessary, adjust the setting advance angle of fuel injection with fuel pumps 4UTNI, 4UTNI-T (NZTA OJSC, Russia), PP4M10P1f, PP4M10U1f (Motorpal A.S., Czech Republic, RAAZ OJSC, Russia), proceeding as follows:

- set the regulator control lever to the position corresponding to the maximum fuel supply;
- disconnect the high-pressure pipe from the union of the first section of the pump and instead of it connect an ignition tester (a coupling nut with a short pipe, to which with a rubber pipe a glass pipe of the inner diameter of 1...2 mm is connected, Fig. 8.4.60);
- rotate the engine crankshaft with a wrench clockwise until fuel without air bubbles shows out of the ignition tester glass pipe;
- remove part of the fuel from the glass pipe by shaking it;
- rotate the crankshaft in the opposite direction (counterclockwise) by 30-40°;
- slowly rotating the engine crankshaft clockwise, watch the fuel level in the pipe, at the moment of fuel rise start stop rotating the crankshaft;
- unscrew, in accordance with Fig. 8.4.58, the latch from the threaded hole of the back plate and insert it upside down into the same hole up to stop against the flywheel, at that the latch must align with the hole in the flywheel (this means that the piston of the first cylinder is set to the position corresponding to the setting advance angle of fuel injection specified in Table Diesel engine parameters on page 16 of this Manual);



1 — glass pipe; 2 — rubber adapter pipe; 3 − high-pressure pipe segment; 4 — washer; 5 — nut.

Fig. 8.4.60 – Ignition tester

If the latch does not align with the hole in the flywheel, make an adjustment, proceeding as follows:

- remove the hatch cover;
- align the latch with the flywheel hole rotating the crankshaft to one direction or the other;
- release by 1...1.5 turns the nuts fastening the fuel pump drive pinions;
- remove part of the fuel from the ignition tester glass pipe, if there is any;
- using a wrench, turn the fuel pump shaft by the special nut to one and the other direction within the grooves located on the end face of the fuel pump drive pinion until the ignition tester pipe fills up with fuel;
- install the fuel pump shaft to the extreme (counterclockwise) position within the grooves;
- remove part of the fuel from the glass pipe;
- slowly rotate the fuel pump shaft clockwise to the moment of start of fuel rise in the glass pipe;
- at the moment of start of fuel rise in the glass pipe, stop turning the shaft and tighten up the nuts fastening the pinion to the fuel pipe flange;
- re-check the moment of fuel supply start;
- disconnect the ignition tester and install the high-pressure pipe and the hatch cover to place;
- screw the latch into the back plate hole.

Operation 63. Flush engine cooling system and change coolant

To flush the engine cooling system, proceed as follows:

- drain the coolant from the engine cooling system
- pour two liters of kerosene into the heat exchanger and fill the system with the prepared solution (a solution to flush the engine cooling system — 50 to 60 g of soda ash per liter of water);
- start the engine and let it run for 8 to 10 hours, then drain the solution;
- fill the cooling system with pure water, start the engine and warm up it to the normal operating temperature (70°C min.), then drain the water from the system;
- fill the cooling system with fresh coolant.

To drain the coolant from the engine cooling system, unscrew two drain plugs located on the lower heat exchanger tank and the cylinder block on the right.

The coolant is filled in the engine cooling system through the filler neck of the heat exchanger.

8.4.7 General maintenance

General maintenance is performed as necessary.

Operation 64. Adjust engine lubrication system oil pressure

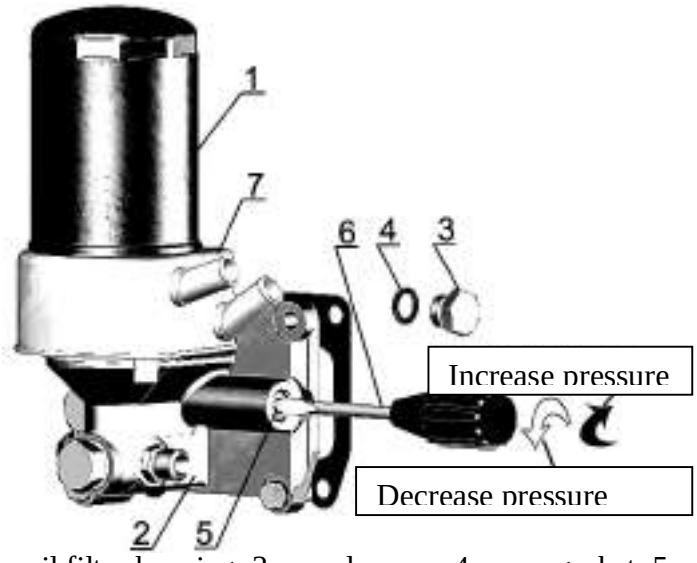
- always watch the oil pressure on the pressure indicator located on the instrument panel (when running a diesel engine with a rated speed and a coolant temperature 85 to 95°C, the oil pressure must be 0.25 to 0.35 MPa, and on a cold engine a pressure up to 0.6 MPa is allowable);

If the lubrication system is operable (connections of oil lines are tight, the safety valve in the oil filter is serviceable, etc.), but at the engine rated speed and the at normal operating temperature of the coolant the oil pressure either is permanently above 0, 0.35 MPa, or is permanently below 0.25 MPa, adjust the oil pressure in the engine lubrication system.

Adjust engine lubrication system oil pressure, proceeding as follows:

- unscrew the cap (3) (Fig. 8.4.61), remove the gasket (4);
- in the housing channel of the oil filter (2), using the screwdriver (6), turn the adjusting plug (5) by one turn in the direction of increasing or decreasing the pressure (depending on the actual pressure);
- install the gasket (4) to place and screw the cap (3);
- if necessary, repeat the above adjustment steps.

It is forbidden to make adjustments when the engine is running.



1 — oil filter; 2 — oil filter housing; 3 — valve cap; 4 − cap gasket; 5 — adjusting plug; 6 — screwdriver; 7 — fluid-oil heat exchanger.

Fig. 8.4.61 – Adjust engine lubrication system oil pressure

8.5 Seasonal maintenance

Combine seasonal maintenance with scheduled maintenance. Table 8.3 lists content of works to be performed during seasonal maintenance.

Table 8.3

Contents works	
In transition to fall-winter period (when the steady daily average temperature is below +5°C)	In transition to spring-summer period (when the steady daily average temperature is above +5°C)
Replace summer-grade oils with winter-grade oils as per Table 8.4: - in engine crankcase; - in HSU tank [1)]; - in HLL tank [1)].	Replace winter-grade oils with summer-grade oils as per Table 8.4: - in engine crankcase; - in HSU tank [1)]; - in HLL tank [1)].
[1)] When using all-season oil grades, change oil in the tanks of HSU and HLL systems only during M-3 (every 1,000 service hours of the tractor).	

8.6 Maintenance of tractor in special conditions of use

When operating the tractor in the special conditions (at low temperatures in a desert, on sandy and marshy soils, rocky ground), the adopted frequency and volume of maintenance is maintained.

In addition, the following works are performed additionally or more frequently.

8.4.9.1 When operating a tractor in a desert, on sandy soils, at high temperatures and in dusty air, refuel the diesel engine with oil and fuel applying a close method. After every three shifts, change oil in the air cleaner tray.

When performing M-1, in addition to the operations listed in Table 8.2, do the following:

- check engine oil — no mechanical impurities in oil are allowed. If necessary, make a replacement;
- Check the central pipe of the air cleaner — the pipe must be clean. Flush and service the air cleaner every 20 service hours of tractor;
- flush the water heat exchanger core with a water jet or blow with air. The heat exchanger must be clean, its surface must not have any trace of oil. When performing M-2, rinse the fuel tank cap.

8.4.9.2. When operating the tractor at low temperatures, preheat the engine before start to 20-30°C. At the end of a shift, refill the tanks with fuel (at minus 30°C, fill in arctic-grade fuel) and drain condensate from the receiver. Fill the cooling system with antifreeze.

8.4.9.3. When operating the tractor on rocky soils, as well as in high mountains, every shift visually inspect the running gear and other parts of the tractor for damage, as well as the fastening of the engine crankcase plugs, rear and front axles, the fastening of the drive wheels. Check tightness of the heat exchanger cap of the engine cooling system.

Besides, when operating in high mountains, in order to avoid troubles in the engine operation, adjust the fuel pump to reduce its performance in the following ranges:

- at altitudes of 1,500 to 2,000 m above the sea level, decrease the performance by 10%;
- at altitudes of 2,000 to 2,500 m above the sea level, decrease the performance by 15%;
- at altitudes of 2,500 to 3,000 m above the sea level, decrease the performance by 20%;

Operating at altitudes above 3,000 m is not recommended.

8.7 Refilling and lubrication of tractor with fuels and lubricants

Table 8.4 lists names and grades of lubricants and fuels used for operation and maintenance of the tractor with their volumes and change intervals.

Table 8.4

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 when changing (adding), kg (dm³)	Change interval of fuel/lubricant, service	Note
			Main	Backup	Reserve	Foreign			
1	2	3	4	5	6	7	8	9	10
1 fuels									
1.1	Fuel tank[1)]	1	At ambient temperature of 0°C and above				(140 ± 1)	Refillin every shift	1021/1021.3
			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.			
1.2	Start preheater tank	1	Same diesel fuel as in fuel tank				(0.25 ± 0.01)		1021 with SPH

Table 8.4, continued

1	2	3	4	5	6	7	8	9	10
2 Oils									
2.1	Diesel engine oil crankcase [2)]	1	Summer				(12.0±0.12)	250	1021/1021.3
			Motor oil Lukoil-Avangard SAE 15W-40	Motor oils M-10DM, M-10G_{2K} GOST 8581-78	None	Castrol Turbomax 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 engine crankcase				(0.25±0.01)	—	When installing new or repaired pump Motorpal PP4M10P1f
2.3	Transmission housing (C, GB and RA)	1	Transmission oil TAp-15V GOST 23652-79	Transmission oil TAD-17i,TSp-15K, TSp-10 GOST 23652-79, TE_P-15M TU 38.401-58-305-2002	Motor oil M-10G_2 GOST 8581-78	HESSOL BECHEM HYPOID SAE 80W-90 API GL5; GL4	(40±0.4)	1,000	1021/1021.3 (without speed reducer)
							(50±0.4)		1021/1021.3 (with speed reducer)
2.4	Brake housing (wet brakes)	2	Transmission oil TAp-15V GOST 23652-79	Transmission oil TAD-17i, TSp-15K GOST 23652-79, TE_P-15M TU 38.401-58-305-2002	Motor oil M-10G_2 GOST 8581-78	HESSOL BECHEM HYPOID SAE 80W-90 API GL5; GL4	(2.5±0.1) up to check plugs	1,000	1021/1021.3 (with wet brakes)

Table 8.4, continued

1	2	3	4	5	6	7	8	9	10
2.5	FDA housing (portal, planetary parallel-shaft with short beam)	1	Transmission oil TAp-15V GOST 23652-79	Transmission oil TAD-17i, TSp-15K GOST 23652-79, TE_P-15M TU 38.401-58-305-2002	None	HESSOL BECHEM HYPOID SAE 80W-90 API GL5; GL4	(3.7±0.04)	1,000	1021/1021.3 (with short-beam FDA)
2.6	FDA wheel reducer housing (portal, parallel-shaft)	2	Transmission oil TAp-15V GOST 23652-79	Transmission oil TAD-17i, TSp-15K GOST 23652-79, TE_P-15M TU 38.401-58-305-2002	None	HESSOL BECHEM HYPOID SAE 80W-90 API GL5; GL4	(4.0±0.04)	1,000	1021/1021.3
2.7	FDA housing (portal, parallel-shaft with long beam)	1	Transmission oil TAp-15V GOST 23652-79	Transmission oil TAD-17i, TSp-15K GOST 23652-79, TE_P-15M TU 38.401-58-305-2002	None	HESSOL BECHEM HYPOID SAE 80W-90 API GL5; GL4	(3.9±0.04)	1,000	1021/1021.3 (with long-beam FDA)
2.8	FDA intermediate support housing	1	Transmission oil TAp-15V GOST 23652-79	Transmission oil TAD-17i, TSp-15K GOST 23652-79, TE_P-15M TU 38.401-58-305-2002	None	HESSOL BECHEM HYPOID SAE 80W-90 API GL5; GL4	(0.15±0.002)	1,000	1021/1021.3
2.9	HSU tank with hydraulic units and	1	All-season: Hydraulic oil BECHEM Staroil # 32 ADDINOL Hydraulikol HLP 32 TNK Hydraulic HLP 32 HYDROL HLP 32	Industrial oil IGP-18 TU 38.10 1413-97 (winter) MGE-46V TU 38.001347-2000 (summer)	None	None	(28.5±0.5)	1,000, or seasonal, depending on used oil	1021/1021.3
2.10	HSU tank with hydraulic units	1	All-season: Hydraulic oil BECHEM Staroil # 32 ADDINOL Hydraulikol HLP 32 TNK Hydraulic HLP 32 HYDROL HLP 32	Industrial oil IGP-18 TU 38.10 1413-97 (winter) MGE-46V TU 38.001347-2000 (summer)	None	None	(7.5±0.35) (9.0±0.35)	1,000, or seasonal, depending on used oil	1021.3 1021

Table 8.4, continued

1	2	3	4	5	6	7	8	9	10
3 Greases									
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	1021/1021.3
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	1,000	1021/1021.3
3.4	Steering cylinder joint	2	Lubricant Litol-24 GOST 21150-87	BECHEM LCP-GM	None	BECHEM LCP-GM	0.05±0.003	250	1021/1021.3
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	1,000	1021/1021.3
3.6	Rear hitch linkage brace 3)	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	1,000	1021/1021.3
3.7	FDA driveshaft cross bearings	2	Lubricant # 158M TU 38.301-40-25-94	AZMOL # 158 grease TU U 00152365.118-2000	None	None	0.0112±0.0001	Once	Applied by manufacturer, not to refill during operation
3.8	FDA double-joint cross bearings	2	Lubricant # 158M TU 38.301-40-25-94	AZMOL # 158 grease TU U 00152365.118-2000	None	None	0.0112±0.0001	Once	Applied by manufacturer, not to refill during operation

End of Table 8.4

4 Special fluids									
1	2	3	4	5	6	7	8	9	10
4.1	Engine cooling system (with heat exchanger)	1	Cold-proof coolant Tosol Dzerzhinsky TC-40 (to minus 40°C) Tosol Dzerzhinsky TC-65 (to minus 65°C) 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)	(21.5± 0.2) (22.5±0.2)	once every 2 years	1021 1021.3

[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 for adjustable brace.

9. STORAGE OF TRACTOR

9.1 General instructions

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 protective 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.

9.2 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.

9.3 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.

9.4 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.

9.5 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.

9.6 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.

9.7 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 BELA-KOR, Grade A as per TU RB 600125053-020-2004.

9.8 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.

9.9 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 personal 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.

10. TRANSPORTING AND TOWING OF TRACTOR

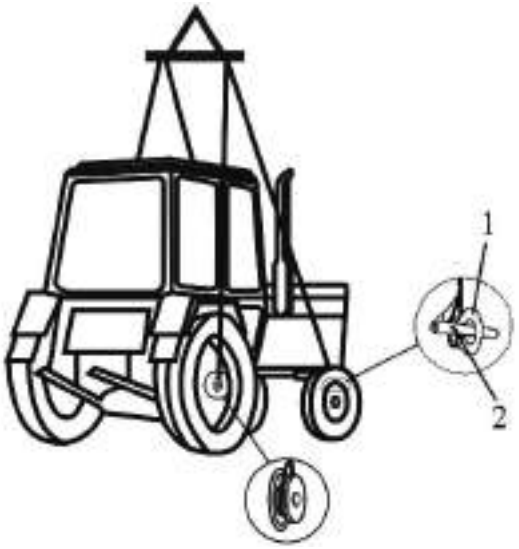
The tractors are transported by railroad, in trucks and trailers, as well as by towing and by driving them.

When transporting the tractors, do:

- shift the range shifter lever of the GB to the position of Ist range engaged;
- engage the parking-reserve brake;
- fasten the tractor to the platform using a wire of 3 to 5 mm diameter, chains, bracings.

When loading and unloading the tractors, use hoisting devices with the lifting capacity of 10 t min.

Fasten the slings by the front axle beam or the ring nut (1) and by the rear wheel semi-axles, as shown on the figure at the right. When fastening the slings by the ring-nut (1), lead the load-grappling device to the ring-nut body and it secure with the stop (2) through the eye of the ring-nut.



1 — ring-nut; 2 — stop.

Roping chart of tractor.

Towing the tractor with inoperative HSU pump is allowed at 10 km/h max. to 5 km max. When towing the tractor, do:

1. Shift the PTO independent and synchronous drive shifter to the neutral position;
2. With single lever control — shift the gear-change and range-change GB lever to the neutral position;

With two-lever control — shift the gear-change GB lever to the neutral position;

To attach a towing rope, an eye is provided fastened to the front ballast weights and the load bracket.

When towing the tractor, strictly observe the traffic rules.

Attention: when the tractor is lifted by the ring-nuts, it can travel up to 1.5 m forward or backward.

Do not use the towing shackle to lift the tractor!

Do not tow the tractor with the front wheels lifted!

11 DISPOSING OF TRACTOR

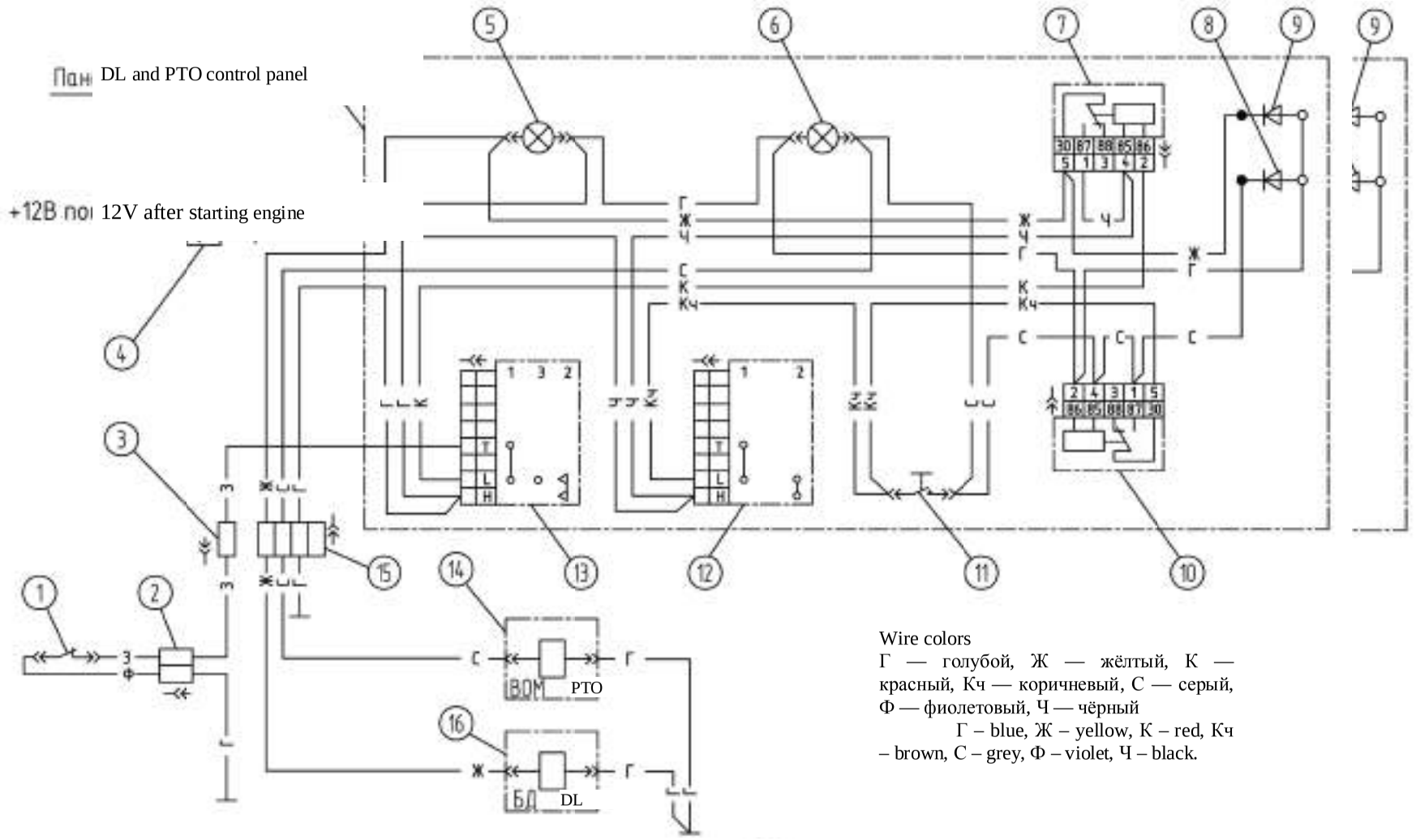
When disposing of the tractor after its service (operation) life, do the following:

- drain and send for recycling according to the established procedure oil from the engine lubrication system, HSU tank with hydraulic units, HLL tank with hydraulic units, transmission, wet brake housings (if installed), FDA main drive, FDA intermediate support housing, FDA final drive reducer housings.
- drain the coolant from the cooling system, heating system and cab air cooling system and put it to storage containers;
- pour off sediment from the coarse and fine fuel filters and the fuel tanks;
- drain the diesel fuel from the fuel tank and put it to storage containers;
- drain the electrolyte from the battery of the tractor, put it to storage containers and send it for recycling according to the established procedure;
- perform a full disassembly of the tractor and sort out parts made from non-metals, steel, cast iron, aluminum, non-ferrous and precious metals, and send them for recycling according to the established procedure;
- 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.

Attention — 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

APPENDIX A (informative)

Electric circuit diagram of rear axle DL and PTO of BELARUS – 1021/1021.3 tractors



1 — front wheel turn sensor±13°; 2, 3, 4, 15. — carrier socket; 5. — DL engagement pilot lamp; 6. — PTO engagement pilot lamp; 7. − DL relay switch; 8, 9 — diodes; 10 — PTO relay switch; 11 — PTO switch; 12 — on/off two-position PTO control switch; 13 — three-position DL control switch; 14 — PTO hydraulic distributor solenoid; 16 — DL hydraulic distributor solenoid.

APPENDIX B (informative)

Electric circuit diagram of BELARUS–1021/1021.3

Table B.1 lists items of the electric circuit diagram of BELARUS-1021/1021.3 tractors presented on Figure B.1.

Table B.1

Designation	Name	Qty.	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	
BP1	Engine oil pressure sensor	1	
BP2	Air pressure sensor	1	
BV1,BV2	Speed sensor	2	
E1,E2	Road headlight	2	
E3,E4,E5,E6,E8,E9	Working headlight	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,EL16,EL25	Lamp AKG12-55-1	7	Supplied with E3...E6,HL8
EL4…EL6,EL9,EL10,EL20,EL21	Lamp A12-5	7	Supplied with HL1...HL5,E10
EL11,EL14,EL17,EL19,EL22,EL24	Lamp A12-21-3	7	Supplied with HL4,HL5,E7,HL6,HL7
EL18,EL23	Lamp A12-10	2	Supplied with HL6,HL7

Table B.1, continued

Designation	Name	Qty.	
F1…F4	Fuse blocks	4	
FU1	Fuse	1	
FU2,FU3	Fuse link 25 A	2	
G1	Alternator 14V,1150 W	1	
GB1,GB2	Storage battery 12V, 88 Ah.	2	
HA1	Horn	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	Normally open relay switch 30A	7	
K4	Normally closed relay switch 20A	1	
K7	Starter relay switch	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 windshield wiper	1	
M3	Starter 24V, 4 kW	1	For 24V start system
	Starter 12V, up to 3kW	1	For 12V start system (Tier-0, Tier-1)
	Starter 12V, 2.7 kW	1	For 12V start system (Tier-2)
M4	Electric washer	1	
M5	Windshield wiper	1	
M7	Fan electric motor (120 W)	1	
P2	Instrument cluster KP-5	1	
P3	Tachometer/speedometer	1	
QS1	Remote battery switch 24V	1	
QS2	Remote battery switch 12V	1	
QS3	Manual battery switch 12V	1	
QS4	Manual battery switch 24V	1	

End of Table A.1

Designation	Name	Qty.	Note
R1	Fan motor ballast resistor	1	
SA1	Roadtrain sign lamp switch	1	
SA2,SA3,SA11	Headlight switch	3	
SA4	Fan switch	1	
SA5	Windshield wiper switch	1	
SA6	Starter switch with start lock	1	
SA7	Combined switch	1	
SAB	Ground switch	1	
SA9	Windshield washer switch	1	
SAW	Light switch	1	
SA12	Start lock switch	1	
SA13	Flashing beacon switch	1	
SAW	Start pre-heater switch	1	
SB1	Emergency stop signaling 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	
	Cylindrical 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	Two-pin backplane	2	
XT3.1,XT3.2	Three-pin backplane	2	
WA1	Antenna	1	

Basic option

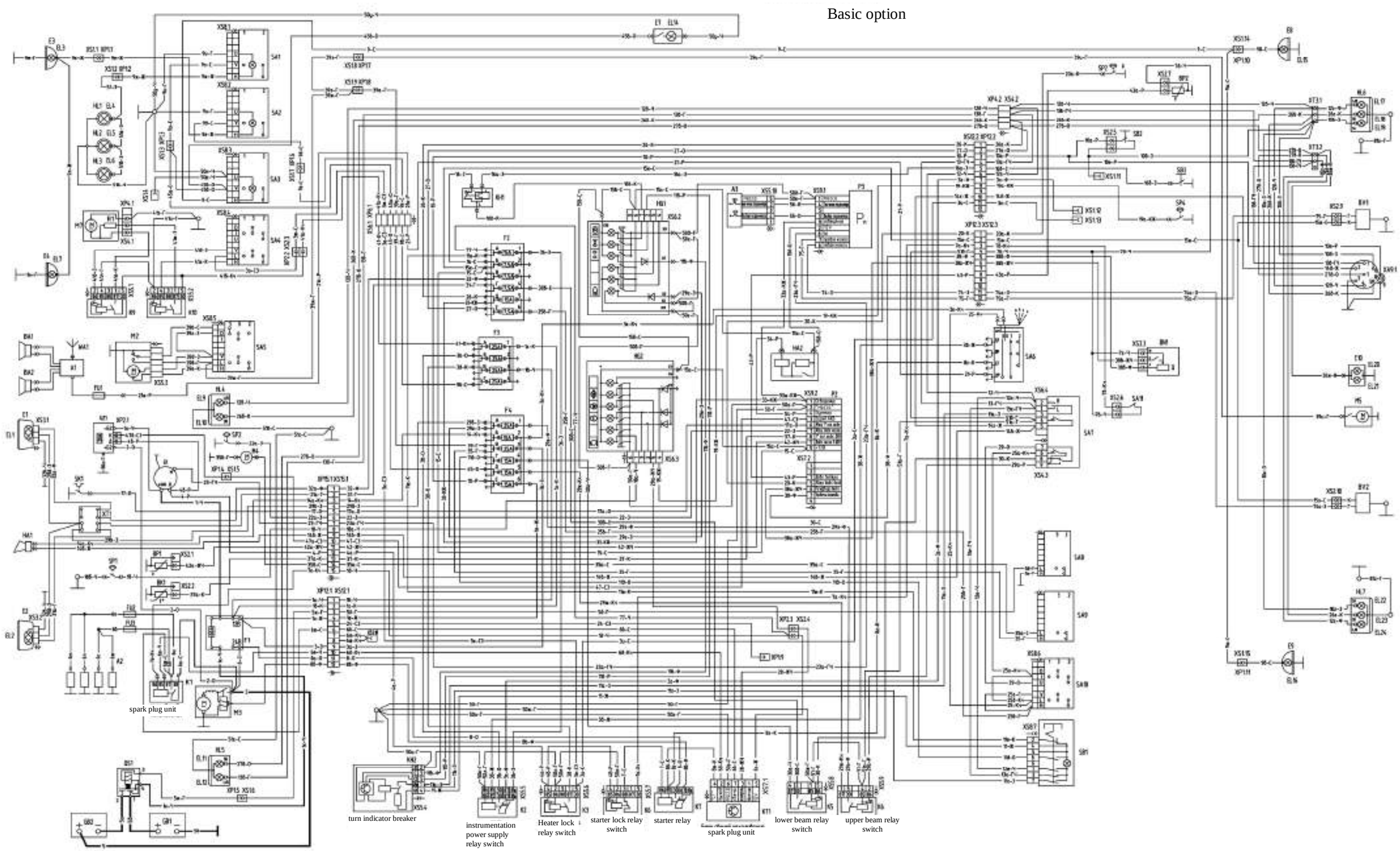


Figure B1, Sheet 1 — Electric circuit diagram of BELARUS-1021/1021.3 tractors

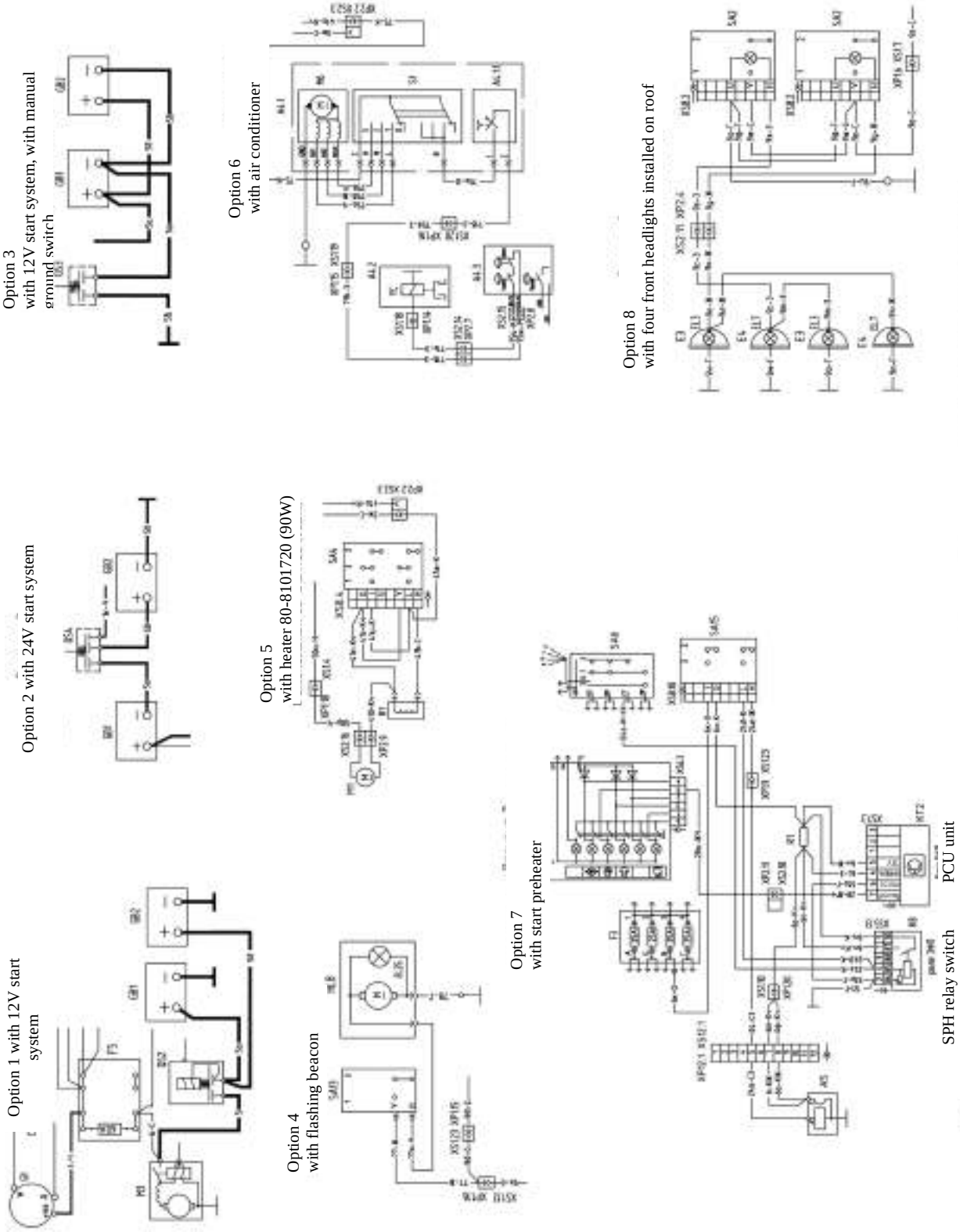


Figure B1, Sheet 2 — Electric circuit diagram of BELARUS-1021/1021.3 tractors