
BELARUS

1523.5

1523.5-0000010 OM

OPERATOR'S MANUAL

2013

The operator's manual was composed by an engineer of the first Department of Constructive and Experimental Works (DCEW-1), A.V. Runov, with participation of key specialists of DCEW-1 of RUE "Minsk Tractor Works"

Publication responsible person – Y.M. Korotky, head of engineering office of design documentation of the DCEW-1.

Executive editor – A.G. Stasilevich, design manager of tractor production of PA "MTW".

Editor-in-chief – I.N. Uss, PA "MTW" chief designer.

Operator's manual contains brief description and specifications of tractors Belarus 1523.5 produced by Minsk Tractor Works. The main tractors operating rules are set forth, the information about their adjustments and maintenance is provided.

Operator's manual is meant for tractor study, operation rules and servicing of tractors "BELARUS-1523.5".

In view of P/A "MTW" policy directed to constant upgrading of produced goods, the construction of some units and parts of Belarus tractor may undergo changes which are not reflected in present edition. The detailed information may be obtained from "BELARUS" dealer.

CONTENTS

1 TRACTOR DESCRIPTION AND OPERATION	11
1.1 Tractor assignment.....	11
1.2 Technical specifications.....	12
1.3 Tractor composition.....	15
1.5 Noise level at the operator's working place of the tractor "BELARUS -1523.5»	18
1.6 Tractor and its component marking	18
2 CONTROLS AND INSTRUMENTS	20
2.1 Layout of controls and instruments of the tractor	20
2.2 Switches of the instrument board.....	21
2.3 Upper shield unit of button switches.....	24
2.4 Conditioner control	24
2.4.1 Conditioner control in the conditioning mode.....	24
2.4.2 Conditioner control in the heating mode.....	25
2.4.3 Cab ventilation	25
2.5 Cab heater and fan control.....	26
2.6 Instrument board.....	27
2.7 Pilot lamps unit.....	29
2.7.1 General information	29
2.7.2 Functioning algorithm of pilot lamp to indicate operation of heating plugs	30
2.8 Integrated indicator and integrated indicator control panel.....	31
2.8.1 General information	31
2.8.3 Pilot lamps of the integrated indicator.....	35
2.8.4 Description of testing the integrated indicator performance.....	36
2.8.5 The order of the integrated indicator programming	36
2.9.1 General information	39
2.9.2 Adjustment of brightness and sharpness of the information display.....	39
2.9.3 Call-up of changeable images and parameters on the screen of the information display	39
2.9.4 Engine control system panel	42
2.10 Steering.....	42
2.10.1 General information	42
2.10.2 Steering wheel adjustments	43
2.11 Parking brake control.....	43
2.12 Handle for fuel supply manual control.....	43
2.13 Tractor pedals	43
2.14 Switching of ranges and gears on GB 16x8.....	44
2.14.1 General information	44
2.14.2 Velocity diagram of tractor with GB 16x8.....	44
2.15 Control panel for rear axle DL, FDA and FPTO drives.....	45
2.15.1 General information	45
2.15.2 Front power take-off shaft control.....	46
2.15.3 FDA drive control	46
2.15.4 Rear axle differential lock control	47
2.15.5 Annunciation of oil emergency temperature in the hydraulic lift linkage	47
2.16 Rear PTO control.....	48
2.17 Control of rear lift linkage (RLL) with the hydraulic lift.....	50
2.17.1 General information on rules of RLL control.....	50
2.17.2 RLL control panel.....	50
2.17.3 Remote buttons of RLL control system	52
2.17.4 Troubleshooting of RLL electronic control system.....	53
2.17.5 Front lift linkage control	54

2.18 HLL pump control	54
2.19 HLL valve group section control (remote cylinders).....	55
2.20 Switching unit and electric cutout fuses	56
2.20.1 General information	56
2.20.2 Switching unit and fuses for electrical equipment.....	56
2.20.3 Fuses for electronic systems of DL, FDA, GB reduction unit, FPTO and RLL control	63
2.20.4 Fuses for engine electronic control system	64
2.21 Cab locks and handles	65
2.21.1 Cab door locks.....	65
2.21.2 Side window opening.....	65
2.21.3 Rear screen opening	66
2.21.4 Cab hatch opening.....	66
2.21.5 Cab emergency exits.....	66
2.22 Seat and its adjustments	67
2.22.1 General information	67
2.22.2 Adjustments of “BELARUS” seat.....	67
2.22.3 Adjustments of “Grammer” seat.....	68
2.23 Control of the transmission hydraulic system pump drive	69
2.24 Control of the pneumatic system compressor	69
2.25 Connector elements of the electrical equipment	70
2.25.1 Socket to connect coupled agricultural equipment.....	70
2.25.2 Connection of additional electrical equipment of coupled machines	70
2.26 Creeper control	71
2.26.1 Creeper control on tractors with GB16x8	71
2.26.2 Creeper control on tractors with GB 24x12.....	72
2.27 Gears and ranges shifting of GB 24x12.....	72
3 INTENDED USE OF TRACTOR	74
3.1 Safety measures while preparing tractor for operation.....	74
3.2 Tractor use.....	75
3.2.1 Boarding the tractor	75
3.2.2 Engine start and preparation for it	75
3.2.3 Start of tractor movement, GB shifting.....	77
3.2.4 Tractor stop	78
3.2.5 Engine stop	78
3.2.6 Leaving the tractor	79
3.2.7 PTO use.....	79
3.2.8 Selection of optimal inner pressure in tires depending on operational conditions and load on tractor axles.....	82
3.2.8.1 Selection of optimal inner pressure in tires depending on operational conditions and load on tractor axles.....	82
3.2.8.2 Tire inflation	83
3.2.9 Rear wheel track formation.....	84
3.2.10 Rear wheel twinning	85
3.2.11 Front wheel track formation	86
3.3 Safety measures while tractor operation	88
3.3.1 General safety measures while tractor operation	88
3.3.2 Fire safety measures	91
3.4 Tractor final assembly and run-in.....	92
3.4.1 Tractor final assembly	92
3.4.2 Technical maintenance before tractor run-in	92
3.4.3 Tractor run-in.....	92
3.4.4 Technical maintenance during tractor run-in	93

3.4.5 Technical maintenance after tractor run-in.....	93
3.5 Emergency actions	94
4 COUPLING OF IMPLEMENTS.....	95
4.1 General information.....	95
4.2 Types of implements coupled with tractor “BELARUS -1523.5»	96
4.3 Lift linkage.....	97
4.3.1 General information	97
4.3.2 Three-point rear lift linkage	97
4.3.3 RLL components adjustment rules	101
4.3.3.1 Buckles	101
4.3.3.2 Lifting rods.....	102
4.3.3.3 Upper link	103
4.3.3.4 The rules of RLL adjustment for tractor operation with implements of category 2 (LL-2).....	103
4.3.3.5 Mounting of implements to the tractor RLL.....	104
4.3.4 Three-point front lift linkage	105
4.3.5 The rules of agricultural implements coupling to FLL.....	107
4.3.6 The rules of shifting FLL from operating to transport position.....	108
4.4 Drawbar hitches	109
4.4.1 General information	109
4.4.2 Drawbar hitch DH-2V (short towing yoke).....	110
4.4.3 Drawbar hitch DH-3V (long towing yoke).....	111
4.4.4 Drawbar hitch DH-2R (“python”)	112
4.4.5 Drawbar hitch DH-1M-01 (draw bar).....	113
4.4.6 Drawbar hitch DH -1 (crossbeam).....	114
4.5 Usage patterns of tractor hydraulic system for drive of operating parts and other elements of hydraulically-powered coupled machines and implements	115
4.6 Front ballast weight	117
4.7 Trailer brake drive.....	118
4.7.1 General information	118
4.7.2 Integrated pneumatic drive of trailer brakes	118
4.7.3 Hydraulic drive of trailer brakes	119
4.8 Determination of PTO shaft and cardan shaft applicability.....	121
4.9 Peculiarities of PTO shaft and cardan shaft applicability	121
4.10 Ways of changing drawbar features and passing ability of the tractor	125
4.11 Features of tractor application in special conditions.....	126
4.11.1 Tractor operation in areas with rugged topography. Possibility of tractor application for haylage preparation	126
4.11.2 Application of substances for chemical treatment	126
4.11.3 Operation in a forest	126
4.12 Determination of total weight, loads on front and rear axles, tires holding capacity and the required minimum ballast	127
4.13 Possibility of front loader installation	129
4.13.1 General information	129
4.13.2 Safety measures while tractor “BELARUS-1523.5” operation with the loader installed	131
4.13.3 Information on the tractor mounting holes	133
5 MAINTENANCE	135
5.1 General instructions	135
5.2 Providing access to the components for maintenance services	137
5.3 Maintenance procedure	139
5.4 Scheduled maintenance service operations	142

5.4.1 Maintenance service on a shift basis (SBMS) in every 8 – 10 hours of operation or per shift	142
5.4.2 Maintenance service in every 125 hours of operation (MS-1)	148
5.4.3 Maintenance services in every 250 hours of operation (2MS-1), in every 500 hours of operation (MS-2), in every 1000 hours of operation (MS-3), in every 2000 hours of operation (special maintenance) and maintenance service that does not coincide with intervals of MS-1, 2MS-1, MS-2, MS-3 and special MS.....	157
5.4.3.1 General instructions.....	157
5.4.3.2 Operation 33. Check / adjustment of clearances in steering joints.....	157
5.4.3.3 Operation 34. Check / adjustment of wheel toe-in.....	158
5.4.3.4 Operation 44. Check / adjustment of service brake control	159
5.4.3.5 Operation 45. Check / adjustment of parking brake control.....	161
5.4.4 General maintenance services.....	162
5.4.4.1 General instructions.....	162
5.4.4.2 Operation 80. Adjustment of GB centrifuge valves	162
5.4.4.3 Operation 81. Maintenance of the engine air cleaner	163
5.5 Seasonal maintenance services	164
5.6 Safety measures while maintenance service and repair operations	165
5.6.1 General safety requirements	165
5.6.2 Safety precautions for exclusion of hazardous situations related to accumulator batteries and a fuel tank.....	165
5.6.3 Guidelines for safe use of leveling jacks and statement of proper places for their installation.....	166
5.7 Instruments, work tools and measuring devices while maintenance services and repair	168
5.8 Filling and lubrication of the tractor with fuel and lubrication materials.....	169
6. POSSIBLE FAILURES AND INSTRUCTIONS FOR THEIR TROUBLESHOOTING	174
6.1 Possible clutch failures and instructions for their troubleshooting	174
6.2 Possible failures in gearbox and instructions for their troubleshooting.....	177
6.3 Possible failures in the electronic control system for rear axle differential lock, front driving axle drive, front power take off shaft, GB reduction gear and instructions for their troubleshooting	178
6.4 Possible failures in rear axle and instructions for their troubleshooting.....	180
6.5 Possible failures in rear power take-off shaft and instructions for their troubleshooting	181
6.6 Possible failures in front power take-off shaft and instructions for their troubleshooting	182
6.7 Possible failures of brakes and instructions for their troubleshooting	183
6.8 Possible failures in the pneumatic system and instructions for their troubleshooting ..	185
6.9 Possible failures of the transmission hydraulic system and instructions for their troubleshooting	187
6.10 Possible failures of FDA and instructions for their troubleshooting.....	188
6.11 Possible failures of the hydrostatic steering control and instructions for their troubleshooting	190
6.12 Possible failures in the electronic control system of RLL and instructions for their troubleshooting	193
6.13 Possible failures of the hydraulic lift linkage and guidelines for troubleshooting	199
6.13.1 General information	199
6.13.2 Instructions for troubleshooting in HLL.....	199
6.14 Possible failures in the electrical equipment and instructions for their troubleshooting	202
6.15 Possible failures of air-conditioning and cab heating systems and instructions for troubleshooting	204

6.16 Possible engine failures and instructions on their troubleshooting	205
7. TRACTOR STORAGE	206
7.1 General instructions	206
7.2 Requirements for inter-shift storage of machines.....	206
7.3 Requirements for short-term tractors storage	206
7.4 Requirements for outdoors long-term storage	207
7.5 Preservation	208
7.6 Depreservation and represervation	208
7.7 Putting tractor into operation after long-term storage	208
7.8 Safety requirements for preservation	209
8. TRACTOR TOWING	209
Service bulletins	210

Introduction

The present manual is designed for studying the structure, operation rules and maintenance of tractors «BELARUS-1523.5».

Scrutinize this manual. It will help you to study the rules of correct operation and maintenance.

Failure to follow these instructions can lead to operator's injury or a tractor breakdown.

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

Due to constant tractor development, some changes which are not specified in the present manual can be introduced in the structure of certain units and parts.

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

Adopted abbreviations and conventional notations:

ADL – automatic differential lock;

AB – accumulator battery;

DL – differential lock;

RADL – rear axle differential lock;

PLU – pilot lamps unit;

FB – fuse block;

FC – fast coupling;

PTO – power takeoff shaft;

PRS – power reception shaft;

HSC – hydrostatic steering control;

HLL – hydraulic lift linkage;

HS – hydraulic system;

FFVS – frequency fuel volume sensor;

STM – shift-time maintenance;

RPTO – rear power take-off shaft;

SPTA – spare parts, tools and accessories;

RA – rear axle;

RLL – rear lift linkage;

II – integrated indicator;

GB – gearbox;

MI – multifunction indicator;

MTU – machine and tractor unit;

CC – coupling clutch;

LL – lift linkage;

CL – coolant;

IAC – inlet air cooler;

FDA – front driving axle;

FPTO – front power take-off shaft;

FLL – front lift linkage;

VC – voltage converter;

FDAD – front driving axle drive;

CM – control module;

IICP – integrated indicator control module;

HPH – high pressure hoses;

HP – heating plugs;

SM – seasonal maintenance;

MS – maintenance service;

MS1 – maintenance service No1;

MS2 – maintenance service No2;

MS3 – maintenance service No3;

DH – drawbar hitch;

ECS – electronic control system;

EECS – engine electronic control system;

EE – electrical equipment.

The manufacturer uses standard international symbols regarding application of instruments and control units.

Given below are the symbols with indication of their meanings.



see the manual;



control manipulations;



brake;



fast;



handbrake;



slowly;



audible beep;



forward;



alarm signaling;



reverse;



fuel;



accumulator charging;



coolant;



cab dome light;



heating plugs;



parking lights;



engine speed;



tractor turn indicator;



oil pressure in the engine;



tractor trailer turn indicator;



temperature of engine coolant;



upper beam;



low beam;



off / stop;



working lights;



on / start;



differential lock;



gradual adjustment;



PTO engaged;



front screen wiper;



front driving axle drive;



rear screen wiper and washer;



fan;



brake fluid level in main cylinder tanks;



air filter clogged;



oil pressure in HSC



engine start;



beacon



— road-train



oil pressure in gearbox



— external cylinder – retracting



braking of gearbox



— external cylinder – protracting



air pressure in pneumatic system



— external cylinder – floating



— swivel lever – up



engine stop



— swivel lever – down

1 TRACTOR DESCRIPTION AND OPERATION

1.1 Tractor assignment

Tractor “BELARUS-1523.5” is intended for performance of various general-purpose agricultural operations, primary cultivation and pre-sowing tillage, cereal and other crop sowing if coupled with wide-span and multi-purpose mounted, semi-mounted and trailed machines and implements, for forage conservation, grain crop harvesting as well as for loading-unloading and transportation work if combined with highly productive harvest complexes.

Tractor “BELARUS-1523.5” is a general-purpose wheeled tractor of traction class 3 with the wheel arrangement 4X4.

Physical configuration of tractor “BELARUS-1523.5” is shown in figure 1.1.1.

Physical configuration of tractor “BELARUS-1523.5” equipped with FPTO and FLL is shown in figure 1.1.2.

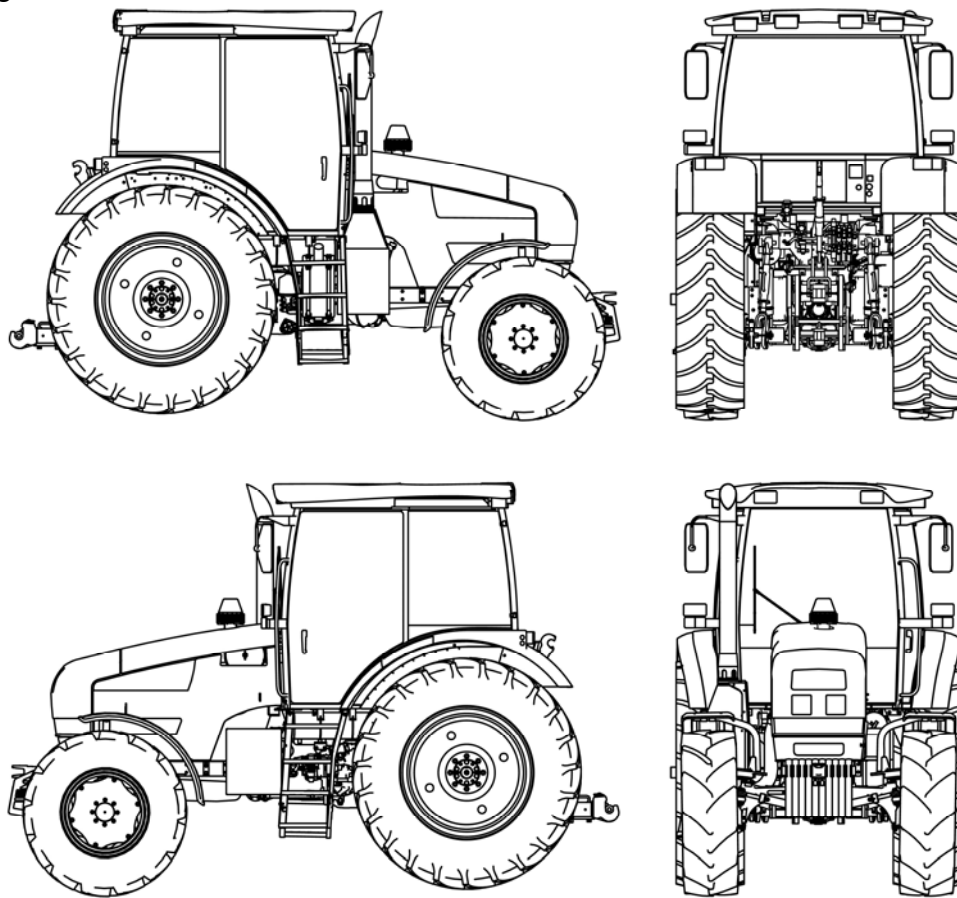


Figure 1 1.1 – Basic configuration of tractor “BELARUS -1523.5»

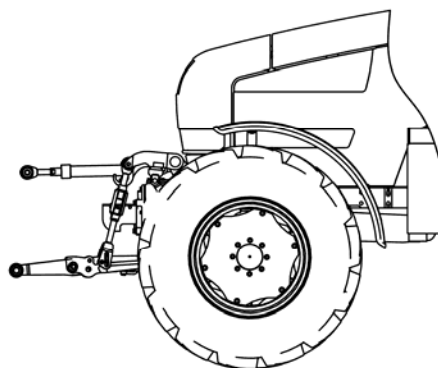


Figure 1.1.2 – Tractor “BELARUS -1523.5» equipped with FLL and FPTO (for the rest see figure 1.1.1)

1.2 Technical specifications

Main parameters and specifications of tractor BELARUS -1523.5» are given in table 1.1.

Table 1.1

Parameter (specification) designation	Parameter value for tractor "BELARUS -1523.5»
1 Traction class according to GOST 27021	3
2 Rated traction force, kN	30
3 Engine ¹⁾ a) model b) engine type ²⁾ c) number and arrangement of cylinders ²⁾ d) cylinder displacement, l ²⁾ e) engine power, kW: 1) rated ²⁾ 2) operating f) crankshaft rated speed, rpm ²⁾ g) specific fuel consumption at operating power, g/(kW·h) h) rated factor of torque backup, at least, % ²⁾ i) max torque, N·m ²⁾	D-260.1 S3B turbocharged with intercooling of inlet air six, in-line, vertical 7,120 116,1 112,4±2,0 2100 222±7 25 660±20
4 Number of gears: a) for forward travel b) for reverse travel	16 ³⁾ 8 ³⁾
5 Tractor travel speed (design) at crankshaft rated speed, km/h: a) for forward motion: 1) least 2) highest b) for backward motion: 1) least 2) highest	1,73 ³⁾ 32,38 2,72 ³⁾ 15,52
6 Tractor weight, kg: a) tare weight b) operating with ballast c) operating without ballast d) max operating e) ex-works ⁴⁾	5900±100 6400±100 5950±100 9000 6150±100
7 Distribution of operating weight on axles, kg: a) on front b) on rear	2600±40 ⁵⁾ (2100 ±40 ⁶⁾) 3800±60 ⁵⁾ (3860 ±60 ⁶⁾)

Table 1.1 continued

Parameter (specification) designation	Parameter value for tractor "BELARUS -1523.5»
8 Permissible load on axles, kN: a) on front b) on rear	40 60
9 Max weight of the trailer, kg a) without brakes b) with independent brake c) with overrunning brake d) equipped with a brake system (trailer brakes are interconnected with tractor brakes)	2800 4500 12000 25000
10 Road clearance, mm (on tires of basic configuration), mm, at least:	380
11 Track dimensions (on tires of basic con- figuration), mm: a) for front wheels b) for rear wheels	1535±20, 1635±20, 1700±20, 1800±20, 1850±20, 1950±20, 2020±20, 2120 ±20 from 1600 to 1916 and from 1946 to 2445
12 Least radius of turning circle (with brak- ing), m	5,5
13 Tractor base, mm	2760±30
14 Maximum fordable depth, m	0,85
15 Service life, years	12
16 Overall dimensions, mm: a) length with loads and rear lift linkage in transport position b) width along the ends of rear wheel semi- axles c) cab height	4710±50 2250±10 3000±50
17 Tires (basic configuration): a) front wheels b) rear wheels	420/70R24 520/70R38
18 Electrical equipment according to GOST 3940: a) rated supply voltage in on-board power system, V b) rated ignition voltage, V	12 24
19 Hydraulic system: a) pump displacement under crankshaft rated speed, l/min, at least b) safety valve operating pressure, MPa c) nominal volume factor, at least	53 20-2 0,7

Table 1.1 finished

Parameter (specification) designation	Parameter value for tractor «BELARUS -1523.5»
20 Operating equipment: a) rear power take-off shaft: b) front power take-off shaft: c) rear lift linkage: 1) load-lifting capacity of rear lift linkage on the suspension axle, kg, at least 2) rear lift linkage lifting time from lower- most to uppermost position with test load on the suspension axle, s, at least d) drawbar hitch:	In subsection 3.2.7 «PTO use» In subsection 3.2.7 «PTO use» 6500 5 In section 4 «Coupling of implements»
1) Engine parameters, not specified in table 1.1, shall comply with 260 S3B – 0000100 OM document. 2) For referential use. 3) Without a creeper. Installation of a creeper against order provides additional four speeds for forward travel and four speeds for the reverse. 4) To be specified depending on configuration. 5) With ballast mounted. 6) Without ballast.	

Note – In Table 1.1 the number of gears and tractor travel speed at engine shaft rated speed are specified for tractors «BELARUS-1523.5» with installed GB 16x8 (basic configuration). The number of gears and travel speed for tractors «BELARUS-1523.5» with installed GB 24x12 (custom design) are specified in subsection 2.27 «Gear and range shifting of GB 24x12».

1.3 Tractor composition

Tractor framework is semi-frame.

Undercarriage – front and rear wheels are driving, with pneumatic tires of low pressure. Front wheels are steering. Rear wheels can be twinned by means of a spacer.

The tractor is equipped with a 4-stroke piston six-cylinder inner combustion engine with in-line vertical arrangement of cylinders, with direct injection of diesel fuel and compression ignition, corresponding to environmental requirements of Stage 3B.

The system of engine lubrication is combined, some parts are lubricated under pressure, some – by spattering. The lubrication system consists of an oil sump, oil pump, liquid-oil heat exchanger, centrifugal oil filter and oil filter with paper filtering element.

The engine fuel supply system consists of the following parts:

- accumulator system of fuel supply Common RAIL, including a high-pressure fuel pump, injectors, a fuel accumulator under high pressure, sensors of the engine working environment condition (pressure and temperature of fuel and air), electromagnetic actuating mechanisms (fuel governor, electromagnetic injection valves), electronic unit of control and communication check circuits, low-pressure pipelines, high-pressure pipelines;
- fuel fine filters;
- fuel coarse filters.

The system of engine start-up is an electric starter. A means of start-up facilitation under low environmental temperatures are heating plugs.

The system of air delivery consists of a turbocharger, an air pipeline and a system of inlet air cooling.

The turbocharger is executed as follows: a radial centripetal turbine and a centrifugal single-stage compressor with a cantilever arrangement of wheels in relation to supports.

The system of air purification consists of a dry-type air cleaner with two paper filtering elements. Air ingress with an air-cleaner is performed through the monocyclone which provides preliminary inertial air cleaning at the expense of tangential inflow and centrifugal forces, arising at spiral air rotation in relation to the monocyclone housing axle discharging large-size dust particles.

The cooling system for inlet air is of a radiator type. The CAC radiator is intended for cooling the air, charged into the inlet collector.

The cooling system is closed-type with coolant compulsory circulation carried out by a centrifugal pump. The water pump is driven by a V-belt from the crankshaft pulley. Two thermostats TC-107 mounted at the delivery line are provided for acceleration of engine warming-up after start-up and for automatic control of a temperature mode at various loadings and ambient temperatures.

The system of selective catalytic reduction (SCR) is additionally installed in the exhaust system to provide a required chemical composition of exhaust gases under Tier-IIIB stage.

The coupling clutch is frictional, dry, two-disk, spring-loaded. The clutch pads are asbestos free. The coupling control drive is hydrostatic with a hydraulic booster.

The gearbox is 16x8, mechanical, step-by-step, with constant-mesh gears. Shifting of gears within the ranges is carried out by means of synchro-mesh units; switching between ranges is carried out by toothed clutches.

Against order it is possible to install GB 24x12.

Rear axle:

with the main drive – a pair of bevel pinions with circular teeth;

with the hub drive – a pair of cylindrical gears;

with final drives – of planetary type;

with a differential – with mechanical blocking, and electrohydraulic control.

Brakes: operating brakes are multi-disk, oil-lubricated, located on drive pinion shafts of hub drive; the parking brake is independent, manually controlled. It is possible to mount dry-friction brakes. The trailer brake control drive can be either double-line pneumatic, or hydraulic, interlocked with tractor operating brakes control. Against order it is possible not to install the trailer brake pneumatic drive on the tractor – tires are inflated through a valve of the pneumatic compressor.

The rear power take-off shaft is continuous, four-speed, with smooth start, having two modes – standard and economic. The direction of rotation is clockwise as viewed from the side of the shaft end extension butt end.

The first variant of supply:

The tractor is equipped with PTO 3 shaft end extension (20 splines) according to GOST 3480. PTO 1c shaft end extension (8 splines) according to GOST 3480 and PTO 2 shaft end extension (21 splines) according to GOST 3480 and ISO500 are included into tractor SPTA.

The second variant of supply:

The tractor is equipped with PTO 2 (21 splines) according to GOST 3480 and ISO500. PTO 1 (6 splines) according to ISO500 and PTO 3 shaft end extension (20 splines) according to ISO500 are included into tractor SPTA.

Front PTO (against order) is continuous, one-speed. PTO 2 shaft end extension (21 teeth) complies with GOST 3480. The direction of rotation is clockwise as viewed from the side of the shaft end extension butt end.

The transmission hydraulic system provides the following:

- switching of GB reduction unit passes, RPTO drive, FPTO drive, FDA drive, differential lock;
- filtration of transmission oil;
- pressure feed lubrication of gearbox bearings, RA planetary gear reducer, FDA bearings;
- operation of the clutch hydraulic booster.

The steering is hydrostatic. The feed pump is gear-type, the direction of rotation is left. The dosing pump is gerotor-type. The type of rotation mechanism is two hydraulic cylinders (L50x200) of bidirectional action and a steering linkage.

The front driving axle is portal-frame with dismountable tubes, with planetary-cylindrical final gears. The main drive is a pair of bevel gears with circular teeth. The differential is self-locked, with increased friction. The FDA is driven from the gearbox through the frictional hydraulically-operated clutch and the crankshaft. The FDA control is electro-hydraulic.

The hydraulic lift linkage is remote-cylinder, providing draft, position and combined adjustment of tillage depth of agricultural machinery, and suppression of vertical oscillation of agricultural implements in traveling position; with electrohydraulic system (HER) of rear lift linkage automatic control. The system has three pairs of independent outlets.

Free drain is available at the back for tractor operation with hydraulic units with constant delivery, for example, with hydraulic motors.

The rear lift linkage is a three-point linkage of category 3 under ISO 730 and a linkage 3 under GOST 10677. There are two cylinders L90x250.

Bushings are included into tractor SPTA to provide an opportunity for coupling of implements of category 2 according to ISO 730 and lift linkage 2 according to 10677 to RLL.

The front lift linkage (against order) is a three-point linkage of category 2 under ISO 730 and a linkage 2 according to GOST 10677. There are two cylinders L90x250.

Drawbar hitches of a lift type:

- short towing yoke DH 2V – for coupling with semi-trailers and semi-trailed implements;
- long towing yoke DH 3V – for coupling with trailers and trailed implements;
- pin DH-2R (“Python”) – for coupling with semi-trailers and semi-trailed machines (against order);
- towing bar DH-1M-01 –for coupling with semi-trailed and trailed agricultural machines (against order);
- cross member DH-1 – for coupling with trailed and semi-trailed machines (against order).

The cabin is a one-seated with a protective rigid framework, having thermal, noise and vibration insulation, equipped with a sprung seat adjustable for operator's height and weight, with rear-view mirrors, with a sun visor, with electrical wipers for front and rear screens, with front and rear screen washers, with a roof lamp and a place to install a radio set, with a system of heating and ventilation (against order – additional air-conditioning). Against order the tractor can be equipped with an additional seat. The cab doors have got locks, there are keys for the left door. The right door is for emergency exit. The cab complies with category 2 under EN 15695-1:2009.

The electrical equipment complies with GOST 3940. The rated power supply voltage for on-board network is 12V. The rated voltage for the start-up is 24V.

Instruments are a combination of devices; they are an integrated indicator; informational display; pilot lamps (glow lamps and light emitting diodes), located on the block of pilot lamps, on the control panel of the rear axle differential lock, PTO and FDA drive, on the engine control system board.

1.4 Vibration level at the operator's working place of the tractor “BELARUS -1523.5»

Vibration level at the operator's seat complies with the Council Directive 78/764/EEC. Values for vibration level are given in the EU type approval on each type of a seat.

1.5 Noise level at the operator's working place of the tractor “BELARUS -1523.5»

Noise level at the operator's workplace conforms to Directive 2009/76/EC, Appendix 2, and does not exceed the value 86 dB (A). External noise level conforms to Directive 2009/63/EC and does not exceed the value 89 dB (A).

1.6 Tractor and its component marking

A metal nameplate is fixed at the rear of the cab on the right side, as shown in figure 1.6.1. Additionally the tractor serial number is applied by means of percussion on the right side member and duplicated on the right plate of the front ballast weight.

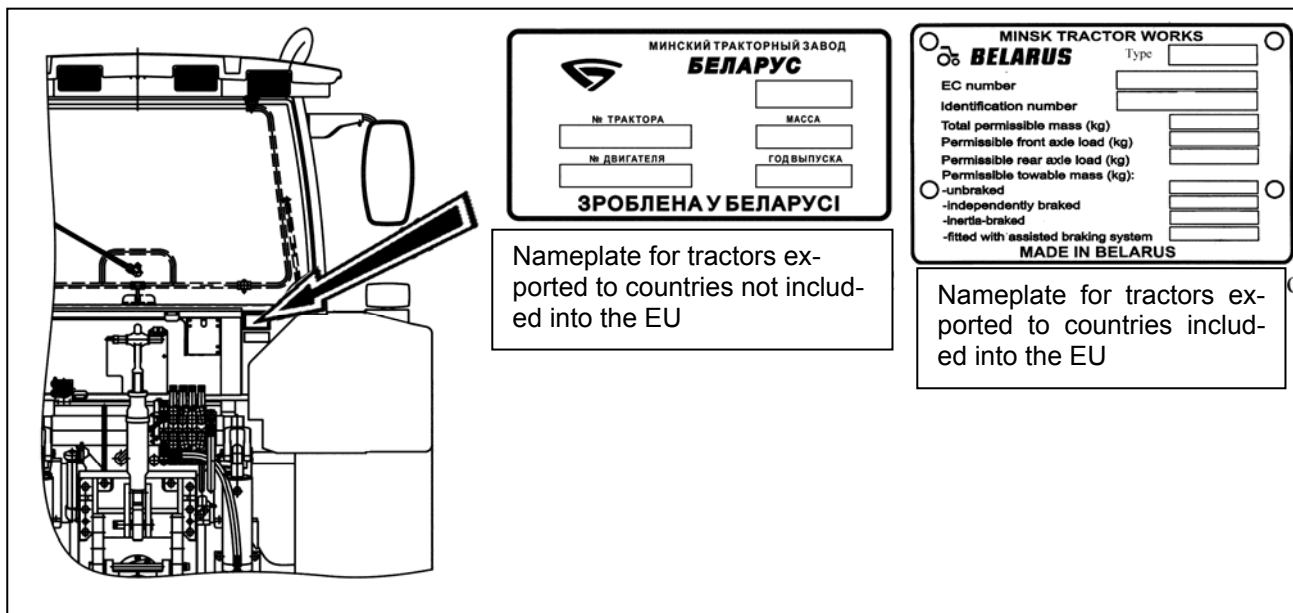
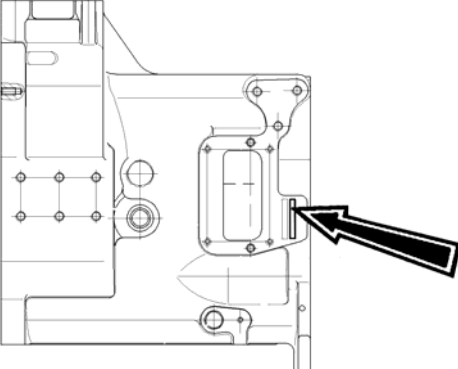
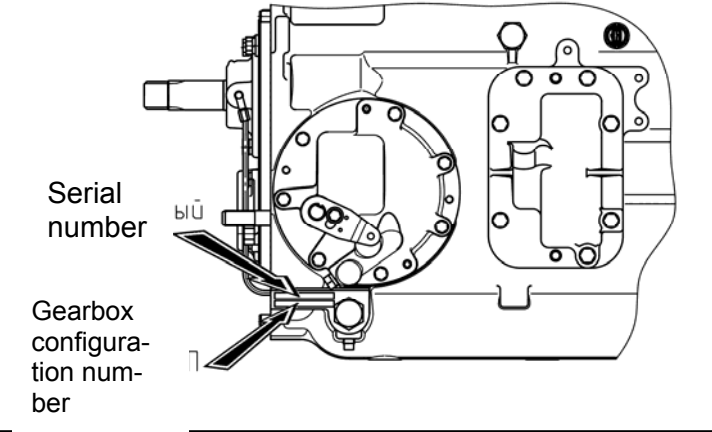
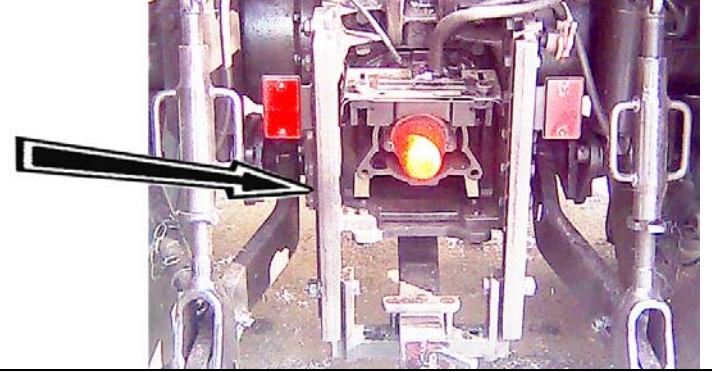
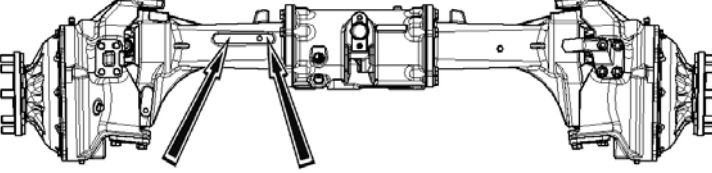
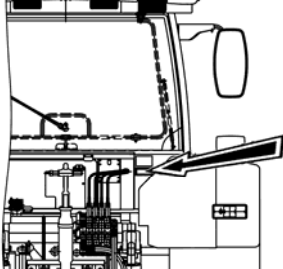


Figure 1.6.1 – The place of the tractor nameplate application

Engine number and numbers of its components are given in engine operation manual.

Numbers of tractor components are given in table 1.2

Table 1.2 – Numbers of tractor components

Number of clutch casing	
Number of gear box (to the left along the tractor movement)	
Transmission and rear axle serial number (at the rear wall of rear axle casing on the left side below)	
FDA number (on the tube of the bar in front)	
Cab serial number	 MINSK TRACTOR WORKS PROTECTIVE STRUCTURE MTZ 2522-6700010-01 FOR BELARUS TRACTOR TYPES: 1523/1523.3/1523.4/1222/1222.3/1222.4 SERIAL No. MADE IN BELARUS

2 CONTROLS AND INSTRUMENTS

2.1 Layout of controls and instruments of the tractor

Controls and instruments located in the tractor cab are shown in figure 2.1.1.

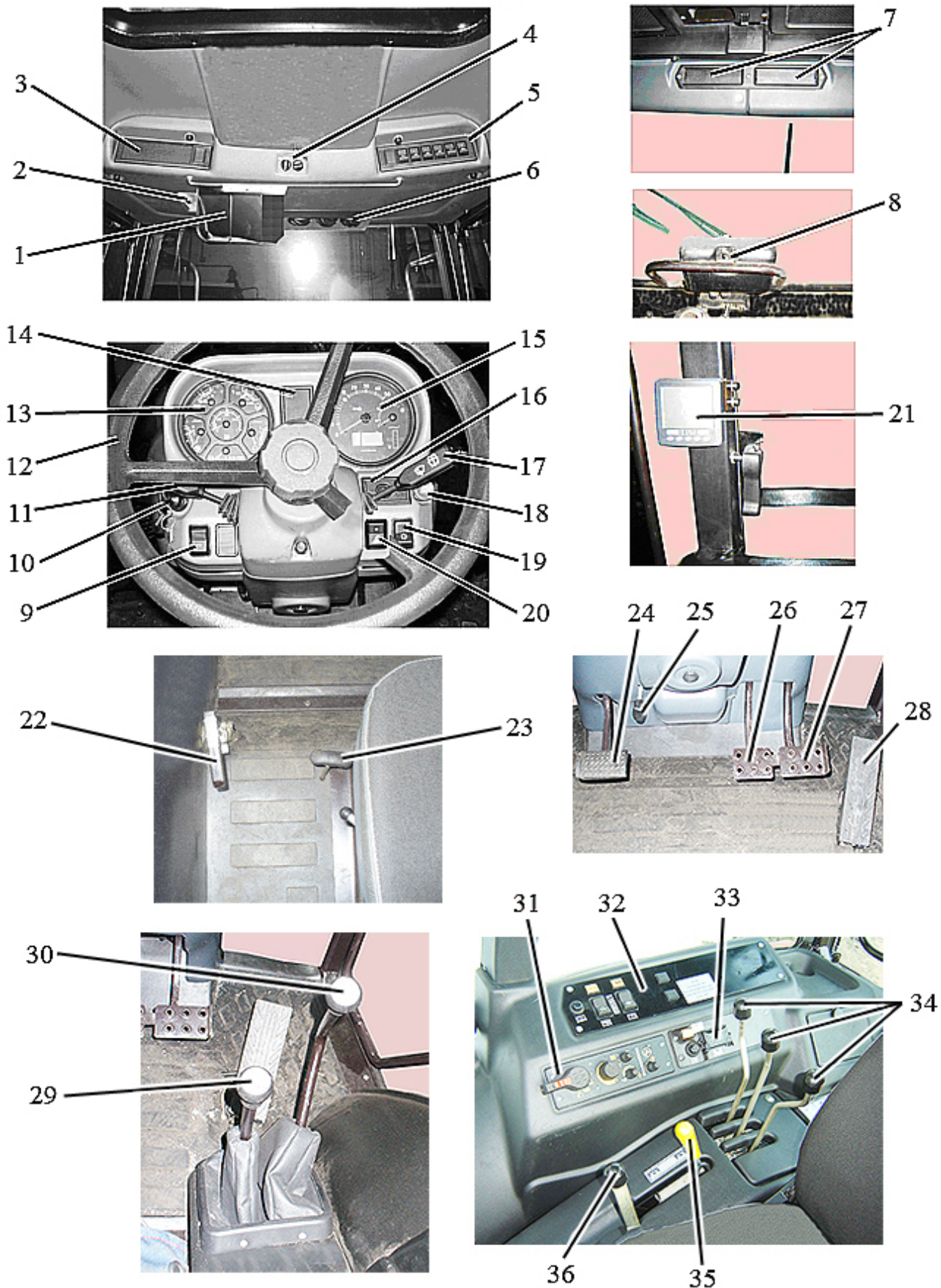


Figure 2.1.1 – Tractor controls and instruments

To the figure 2.1.1 – Layout of controls and instruments of the tractor:

1 – sun visor; 2 – dome light with a switch for cab lighting; 3 - place for radio receiver (car stereo) installation; 4 – air conditioner control panel; 5 – upper shield key switch block; 6 – deflectors; 7 – recirculation shutters; 8 – additional rear windscreen wiper switch; 9 – accumulator battery remote switch; 10 – starter and instruments switch; 11 – multifunctional under-wheel switch on the left; 12 – steering wheel; 13 – instrument board; 14 – pilot lamps unit; 15 – integrated indicator; 16 – integrated indicator control panel; 17 – multifunctional under-wheel switch on the right; 18 – emergency flashing switch; 19 – central light switch; 20 – switch of front working lights mounted on the front lights brackets; 21 – information display; 22 – parking brake control lever; 23 – rear PTO drive engaging handle; 24 – clutch control pedal; 25 –steering rake fixing handle; 26 – left brake control pedal; 27 – right brake control pedal; 28 – fuel supply control pedal; 29 – range shifting lever of gearbox; 30 – gear shifting lever of gearbox; 31 – RLL control panel; 32 – rear axle DL and FDA drive control panel; 33 – engine control board; 34 – hydrolinkage system distributor control handles; 35 – rear PTO control lever; 36 – fuel supply control lever.

Against order your tractor may be equipped with a fan heater instead of an air conditioner, gearbox 24x12 instead of gearbox 16x8. Against order your tractor may be equipped with a creeper, front power take-off shaft and front lift linkage.

2.2 Switches of the instrument board



1 – starter and instruments switch; 2 – multifunctional under-wheel switch on the left; 3 – multifunctional under-wheel switch on the right; 4 – emergency flashing switch; 5 – central light switch; 6 – switch of front working lights mounted on the front lights brackets; 7 – accumulator battery remote switch.

Figure 2.2.1 – Switches of the instrument board

The starter and instruments switch 4 (see fig. 2.2.1) has four positions:

- «0» – off;
- «I» – instruments, pilot lamps unit, heating plugs are on;
- «II» – starter is on (non-fixed position);
- «III» – radio set is on.

The layout of positions of the starter and instruments disconnect switch is given in figure 2.2.2 and on the informational plate of the switch.



Figure 2.2.2 – Layout of positions of the starter and instruments disconnect switch

ATTENTION: THE REPEATED STARTER ENGAGEMENT IS POSSIBLE ONLY AFTER RETURN OF THE KEY INTO THE POSITION “0” OF THE SWITCH. TO TURN THE STARTER AND INSTRUMENTS SWITCH INTO THE POSITION “III” IT IS NECESSARY TO PRESS IN THE KEY WHEN IN “0” POSITION AND TURN IT CONTRACLOCKWISE!

The multifunctional under-wheel switch 2 on the left (fig 2.2.1) provides activation of turn blinkers, switching between upper and lower beam of headlights, upper beam signalling (blinking), audible beep.

Turn blinkers are activated when shifting under-wheel switch 2 lever from the intermediate position forward (“a” – right turn) or backwards (“б” – left turn) according to figure 2.2.3. After tractor turning, the lever automatically returns to the initial position.

To switch on road headlights, set central light switch 5 (fig. 2.2.1) into the position “III” as it is shown below, and set the under-wheel switch lever into the intermediate position “B” – “lower beam” according to figure 2.2.3. For switching on “upper beam”, push the switch lever against the stop (position “r”). The positions of a lever “lower/upper beam” shall be fixed.

When pulling the lever against the stop (position “Д”, fig.2.2.3) from the position “lower beam”, non-fixed engagement of upper beam is carried out, upper beam blinking, irrespective of the central light switch position.

The audible beep is activated when pressing the lever in axial direction (the switch lever axle). The beep can be activated in any position of the switch lever.

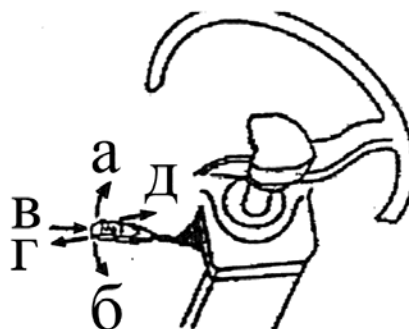


Figure 2.2.3 – The operation scheme of the multifunctional under-wheel switch on the left

Multifunctional under-wheel switch on the right 3 (figure 2.2.1) provides the engagement of two-speed windscreen wiper and washer.

The windscreen wiper is activated by moving under-wheel switch lever 3 (fig. 2.2.1) from "off" position ("0" position according to fig. 2.2.4) into "a" position (first speed) or "6" (second speed). All positions shall be fixed.

The windscreen washer is activated (in a non-fixed position) by moving the switch lever upward from any of three positions of the switch.

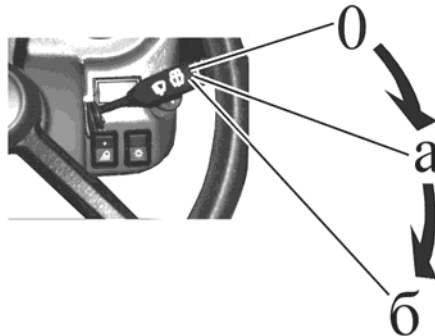


Figure 2.2.4 – The operation scheme of the multifunctional under-wheel switch on the right

Pressing emergency flashing button 4 (fig. 2.2.1) activates emergency flashing. A pilot lamp, built in the button, flashes simultaneously with emergency flashing lights. Repeated pressing button 4 deactivates emergency flashing.

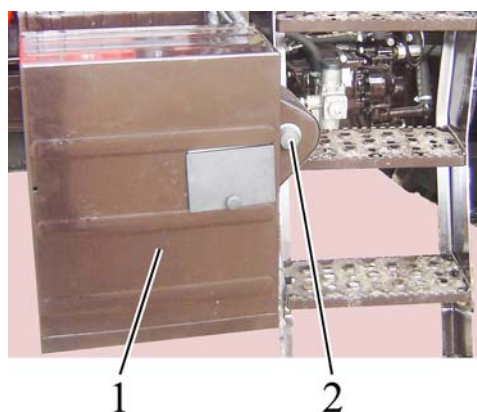
Central light switch 5 (fig.2.2.1) has three positions:

- position "I" – "off" (the upper part of the button is pressed as in fig 2.2.1);
- position "II" – "front and rear parking lights, license plate lights, lighting of instruments on the dashboard and also parking lights on a trailed machine are on" (intermediate position);
- position "III" – "all consumers of "II" position and road headlights are on" (lower part of the button is pressed against the stop as in fig. 2.2.1).

While pressing the button of front working lights switch 6 (fig. 2.2.1) two front working lights, located on front light brackets, are actuated together with a light indicator built in the button.

While pressing the button (non-fixed position) of the accumulator battery remote disconnect switch 7 (fig. 2.2.1) accumulator batteries are powered, the repeated pressing deactivates accumulator batteries.

It is possible to activate and deactivate the accumulator battery with the help of the accumulator battery manual switch, located in the area of the accumulator battery installation. To activate and deactivate the accumulator battery it is necessary to press the button of the accumulator battery manual switch 1 (fig. 2.2.5).



1 – accumulator battery box; 2 – AB manual disconnect switch.

Figure 2.2.5 – Installation of the accumulator battery manual disconnect switch

2.3 Upper shield unit of button switches

Pressing cut-out button 1 (fig 2.3.1) activates a flash beacon (if available).

Pressing cut-out button 2 activates two front working lights, mounted on the cab roof, and an indicating lamp built in the button.

Pressing cut-out button 3 activates two rear working lights (inner) and an indicating lamp built in the button.

Pressing cut-out button 4 activates two rear working lights (outer) and an indicating lamp built in the button.

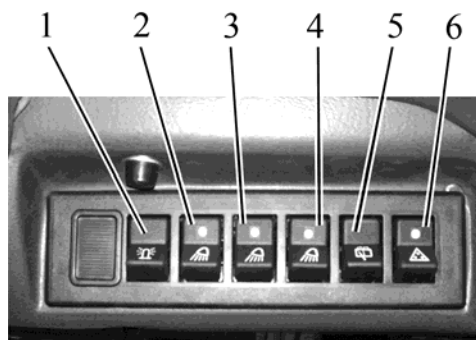
Pressing cut-out button 5 activates the rear screen wiper or the wiper and the washer of the rear screen simultaneously.

Cut-out button 5 has three positions:

- position "I" – "off";
- position "II" – "rear screen wiper is on" – fixed position;
- position "III" – "rear screen wiper and rear screen washer are on simultaneously" – non-fixed.

During tractor operation on forward motion, cut-out switch 8 (fig. 2.1.1) shall be in "on" position (i.e. in the upper position).

Pressing cut-out button 6 (fig. 2.3.1) activates "Road-train" signal lights and an indicating lamp built in the button (the "Road-train" lights are installed against order).



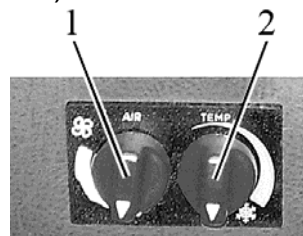
1 – flash beacon cut-out button; 2 – cut-out button of front working lights, mounted on the cab roof; 3 – cut-out button of rear inner working lights; 4 – cut-out button of rear outer working lights; 5 – cut-out button for rear screen wiper and washer; 6 – cut-out button of "Road-train" signal lights.

Figure 2.3.1 – Upper shield unit of button switches

2.4 Conditioner control

2.4.1 Conditioner control in the conditioning mode

Conditioner control unit 4 (figure 2.1.1) has switches 1 and 2 (figure 2.4.1).



- 1 – Switch for air flow adjustment;
- 2 – Conditioner cut-out switch and cooling capacity adjustment;

Figure 2.4.1 – Conditioner control unit

With the help of the switch 1 you can change air flow by changing fan speed. The switch 2 allows to change temperature of cold and dry air coming from deflectors 6 (fig. 2.1.1) in the conditioning mode.

ATTENTION: THE AIR CONDITIONER CAN BE SWITCHED ON AND CAN OPERATE ONLY WITH THE ENGINE ON!

To switch on the conditioner, it is required to do the following:

turn cut-out switch 2 (figure 2.4.1) clockwise to 180° until a blue scale begins;

then turn switch 1 to one of three marked positions (the fan rotor has three kinds of rotation speed). After 3-5 minutes adjust the required temperature in the cab by means of switch 2;

it is possible to adjust a mixture of outer air and recirculation air with recirculation shutters 7 (figure 2.1.1) if available;

To switch off the conditioner, it is required to turn both switches 1 and 2 (figure 2.4.1) contraclockwise into "0" position.

ATTENTION: MAKE SURE THE CONDITIONER IS SWITCHED OFF BEFORE STOPPING THE ENGINE!

ATTENTION: WHEN THE CONDITIONER OPERATES IN THE COOLING MODE MAKE SURE THAT THE HEATER CONTROL VALVE IS SHUT OFF IN ORDER TO PREVENT THE SYSTEMS OF HEATING AND COOLING FROM SIMULTANEOUS OPERATION!

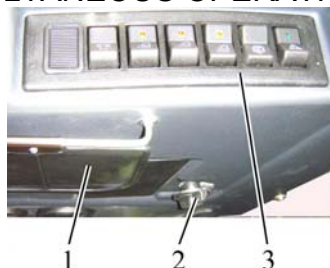
2.4.2 Conditioner control in the heating mode

ATTENTION: REFILLING OF THE ENGINE COOLING SYSTEM SHALL BE CARRIED OUT ONLY WITH LOW-FREEZING LIQUID SPECIFIED IN THE SUBSECTION "TRACTOR FILLING AND LUBRICATION WITH FUEL AND LUBRICATION MATERIALS"!

To set the conditioner into the heating mode, do the following:

- after refilling the cooling system with the cooling fluid, start the engine and let the engine run at medium idle without opening the heater control valve to reach 70-80°C of cooling system temperature;
- then open the heater control valve with handle 2 (figure 2.4.2), to do this turn handle 2 contraclockwise against the stop;
- increase engine speed and let it run for one-two minutes until the heater radiator is filled up with the fluid. Make sure the fluid circulates through the heater. The heater radiator must warm up. In this case the cooling fluid level in the cooling system radiator will decrease;
- refill the cooling fluid into the expansion tank until it is half full;
- to warm up the cab quickly, switch on the heater fan and open recirculation shutters.

ATTENTION: WHEN OPERATING IN THE HEATING MODE, SWITCH 2 (FIGURE 2.4.1) SHALL BE COMPLETELY OFF TO PREVENT THE COOLING SYSTEM AND THE HEATING SYSTEM FROM SIMULTANEOUS OPERATION!



1 – sun visor, 2 – handle of heater control valve; 3 – upper shield unit of button switches.

Figure 2.4.2 – Installation of heater control valve

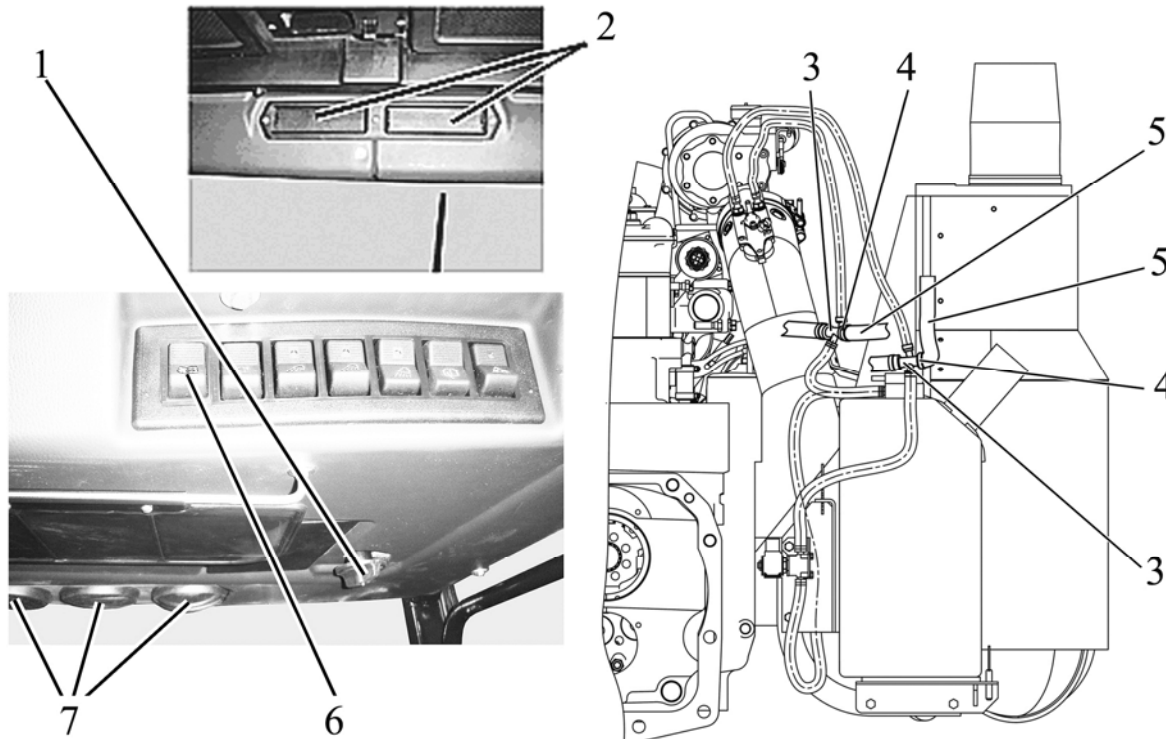
2.4.3 Cab ventilation

During the conditioner operation in the cooling and heating modes, cab ventilation is carried out at the same time. To make the conditioner operate only in the ventilation mode it is necessary to close the heater control valve, set switch 2 (figure 2.4.1.) in the position "0" and switch 1 in any of three marked positions.

2.5 Cab heater and fan control

Against order your tractor can be equipped with a cab heater and fan instead of an air conditioner.

Cab heater and fan controls are shown in Figure 2.5.1.



1 – heater valve handle; 2 – recirculating screen; 3 – T-piece; 4 – clamp; 5 – cab heater hose; 6 – cab fan switch; 7 – deflector.

Figure 2.5.1 – Cab heater and fan controls

Cab heater and fan can operate in two modes: heating and ventilation.

In order to actuate heater and fan in the heating mode, it is necessary to perform the following:

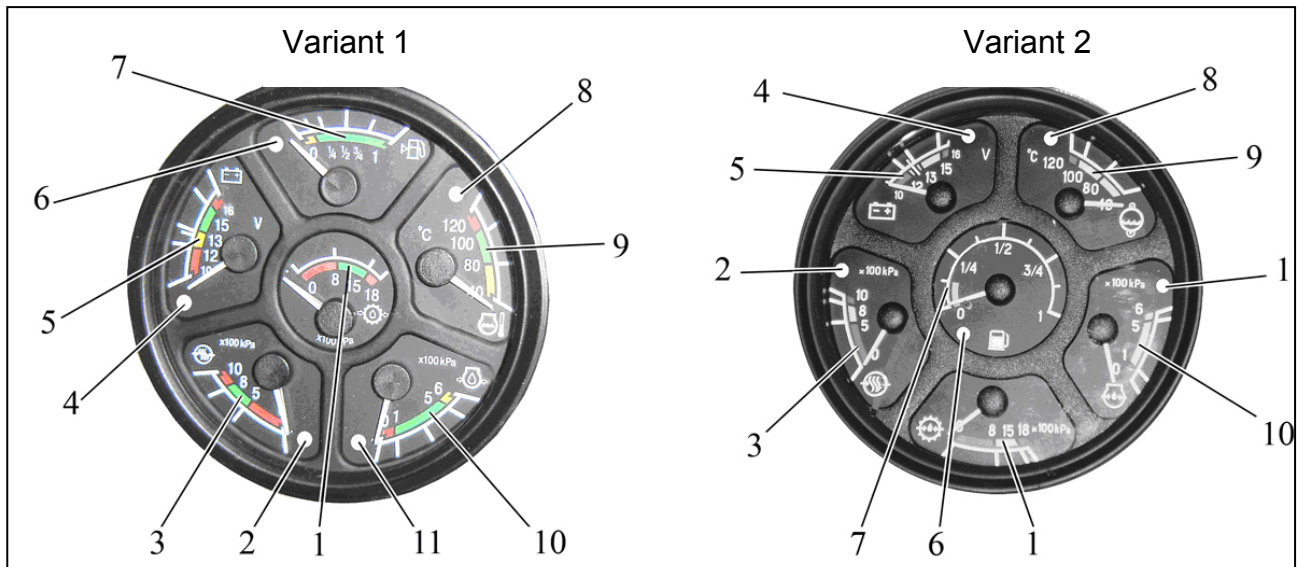
- after filling the cooling system start the engine and let it operate at medium rpm for warming-up coolant up to the temperature from + 50°C to 70°C, then open the heater valve. To do this, turn valve handle 1 (Fig. 2.5.1) counterclockwise against the stop. Increase engine rpm and in 1...2 minutes ensure that coolant circulates through the heating radiator. The heating radiator shall start warming-up. In this case the level of coolant in the engine cooling system shall come down;
- refill coolant in the expansion tank to the half of the expansion tank capacity;
- switch on the heater fan with the help of switch 6 and direct the air flow with the help of deflectors 7;
- the volume of air ventilated into the cab can be controlled by opening recirculating screens 2.

In order to drain coolant from the heating system, disconnect cab heater hoses 5 (situated on the right of tractor cab) from T-pieces 3 by turning off clamps 4, and drain coolant into a special reservoir. After draining coolant, blow off the system with compressed air. After blowing off, connect cab heater hoses 5 with T-pieces 3 and tighten clamps 4.

ATTENTION: WHEN THE CAB HEATER AND FAN ARE ON IN THE HEATING MODE, CAB VENTILATION IS CARRIED OUT AT THE SAME TIME. TO OPERATE THE CAB HEATER AND FAN IN VENTILATING MODE ONLY (DURING A WARM SEASON) THE HEATER'S VALVE SHALL BE CLOSED!

2.6 Instrument board

Instrument board 13 (figure 2.1.1) includes six gauges with five signal lamps as shown in figure 2.6.1.



1 – gauge to indicate oil pressure in the transmission system; 2 – signal lamp of emergency air pressure in the pneumatic system; 3 – gauge to indicate air pressure in the pneumatic system; 4 – pilot lamp of additional accumulator battery charge (not used); 5 – voltage gauge; 6 – signal lamp of reserve fuel volume in the tank; 7 – gauge to indicate fuel volume in the tank; 8 – signal lamp of emergency temperature of engine coolant; 9 – gauge to indicate temperature of engine coolant; 10 – gauge to indicate oil pressure in the engine lubrication system; 11 – signal lamp of emergency oil pressure in the engine lubrication system;

Figure 2.6.1 – Instrument dashboard

2.6.1 The gauge of oil pressure in the transmission hydraulic system 1 (figure 2.6.1) indicates oil pressure in the hydraulic system of friction clutches control in tractor transmission.

The scale of oil pressure gauge has three zones:

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

Normal operating oil pressure in the hydraulic system of the transmission is from 900 to 1100 kPa.

2.6.2 The scale of the gauge of oil pressure in the pneumatic system has three zones:

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

Signal lamp 2 (red color) is built in the gauge scale which lights up when the pressure in the pneumatic system drops below 500 kPa.

2.6.3 Voltage gauge 5 (figure 2.6.1) indicates accumulator batteries voltage with the engine stopped when the key of starter and instruments switch (figure 2.2.2) is set in position “I”. With the engine running the voltage gauge indicates voltage on generator terminals.

The states of the power supply system depending on the position of the gauge pointer on the scale are given in table 2.1.

Table 2.1 – The states of the power supply system

Zone on the voltage gauge scale 5 (figure 2.6.1), color	States of power supply system	
	with the engine running	with the engine stopped
13,0 – 15,0 V green	normal mode of charge	-
10,0 – 12,0 V red	the generator is out of order	accumulator battery discharged
12,0 – 13,0 V yellow	No AB charge (low charging voltage)	AB has a normal charge
15,0 – 16,0 V red	AB recharge	-
white line in the yellow zone	-	Rated AB electromotive force is 12,7 V

ATTENTION: IF THE VOLTAGE GAUGE INDICATES ABSENCE OF AB CHARGE, CHECK THE STATE AND TENSION OF THE GENERATOR DRIVE BELT!

2.6.4 The scale of the gauge indicating fuel volume in tank 7 has divisions “0-1/4-1/2-3/4-1”. Signal lamp 6 (orange color) is built in the gauge scale, which lights up when fuel volume in the tank drops below 1/8 of the total tank volume.

ATTENTION: DO NOT LET THE TANK BECOME EMPTY (THE GAUGE POINTER IS IN THE ZONE OF ORANGE COLOR)!

2.6.5 The gauge of engine coolant temperature 9 has three zones:

- operating – from 80 °C to 105 °C (green color);
- informational – from 40 °C to 80 °C (yellow color);
- emergency – from 105 °C to 120 °C (red color);

Emergency temperature lamp (red color) 8 is built in the scale, which operates in two modes:

- lights up and operates in a flashing mode with coolant values from 109 up to and including 112 °C.
- glows in a continuous mode with coolant temperature values from 113 °C and higher.

2.6.6 The oil pressure gauge in the engine lubricating system 10 has three zones:

- operating – from 100 to 500 kPa (green color);
- emergency (two) – 0 to 100 kPa and from 500 to 600 kPa (red color).

Signal lamp of emergency oil pressure drop 11 (red color) is built in the gauge scale, which lights up when the pressure drops below 100 kPa..

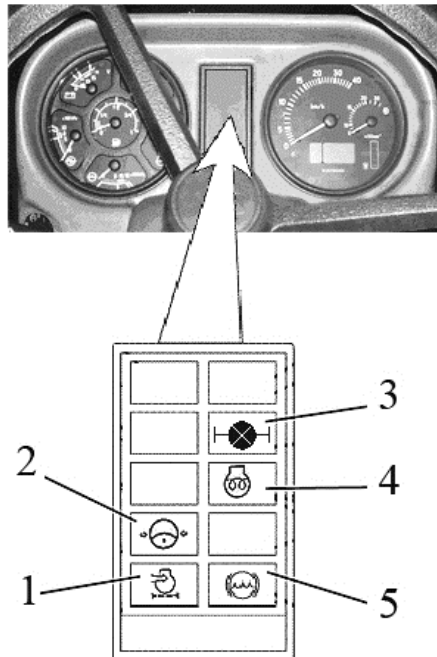
ATTENTION: WHEN THE COLD ENGINE IS STARTED THE PRESSURE CAN REACH 600 kPa!

ATTENTION: IF THE EMERGENCY PRESSURE LAMP IS ON WITH THE ENGINE RUNNING, STOP THE ENGINE IMMEDIATELY AND ELIMINATE THE FAILURE!

2.7 Pilot lamps unit

2.7.1 General information

Pilot lamps unit 14 (figure 2.1.1) includes five lamps. The allocation scheme is shown in figure 2.7.1.



1 – pilot lamp to indicate that the air cleaner filter is clogged to the max. (orange color); 2 – pilot lamp to indicate emergency oil pressure drop in the system of hydrostatic power steering (red color); 3 – pilot lamp to indicate rear axle differential lock (orange color); 4 – pilot lamp to indicate operation of heating plugs (orange color) 5 – pilot lamp to indicate emergency brake fluid level (orange color).

Figure 2.7.1 – Pilot lamps unit

The operating principle of the pilot lamps of PLU is the following:

- pilot lamp 1 to indicate that the air filter is clogged to the max. (figure 2.7.1) lights up when the max. permissible level of filter dirtiness is exceeded and the filter requires cleaning;
- pilot lamp 2 to indicate emergency oil pressure drop in the system of hydrostatic power steering lights up when the oil pressure in the system of hydrostatic power steering drops below 0,08 MPa (periodic lighting up of the lamp 2 with engine minimal speed is assumed – when revolutions are increased the lamp 2 will go out);
- pilot lamp 3 to indicate rear axle differential lock lights up when activating rear axle differential lock;
- pilot lamp 5 to indicate emergency brake fluid lights up when brake fluid level in the tanks of master brake cylinders is below the permissible level;
- pilot lamp of heating plugs 4 indicates heating plugs operation (functioning algorithm of the pilot lamp indicating heating plugs operation is provided in the manual below).

2.7.2 Functioning algorithm of pilot lamp to indicate operation of heating plugs

As a means of start facilitation, heating plugs (HP) are used in tractors "BELARUS – 1523.5" which are mounted in the cylinder unit head. For individual control of heating plug operation modes and indication of their operation, a heating plug control unit is used.

The heating plugs are not activated, if the engine temperature exceeds $+5^{\circ}\text{C}$. In this case heating plug pilot lamp 4 (figure 2.7.1) lights up for 2 sec. or does not light up at all.

If the engine temperature is below $+5^{\circ}\text{C}$, the heating plugs are activated automatically as the key of starter and instrument switch is turned from position "0" (off) into position "I" (Instruments on). In this case heating plug pilot lamp 4 lights up in the pilot lamp unit of the dashboard. The heating plug operation time depends on the engine temperature according to table 2.2. It is necessary to start the engine as lamp 4 goes out after the time specified in table 2.2. After the engine start-up, the heating plugs remain activated for some time, then they go out. The heating plug operation time after the engine start-up depends on the engine temperature at the moment of the heating plug activation. (see table 2.2).

The heating plug operation algorithm has the following emergency modes:

- as the key of starter and instrument switch is turned from position "0" (Off) into position "I" (Instruments on) the heating plug pilot lamp starts to flash continuously with 2 Hz frequency. This means that there is a failure in the heating plug operation – all heating plugs are closed-circuit or their connection is disturbed (disconnected from the heating plug control unit), the heating plug control unit is not powered or the power supply wire is damaged. In case of short circuit, the heating plug control unit cuts power supply (12V) to the heating plugs.

- after the engine start-up the heating plug pilot lamp 4 starts flashing for one minute with 3 sec. of cycle duration and 0,25 sec. of flash duration. The number of flashes can be different. The start-up procedure runs in an ordinary way. This means that one or more (but not all) heating plugs are faulty. The number of flashes within one cycle equals to the number of faulty heating plugs;

If the specified failure is not eliminated, it may be difficult to start the engine at low temperature.

- during the pre-start heating before the engine start-up, pilot lamp 4 flashes with 1 Hz frequency. This points at short-circuit of the heating plug temperature sensor, or breakage in the heating plug temperature sensor circuit, or sensor failure. The time of engine pre-start heating as well as plug heating after engine start-up is specified in table 2.2

TRACTOR OPERATION IS FORBIDDEN UNTIL FAILURES OF THE HEATING PLUG SYSTEM ARE DETECTED AND ELIMINATED. OTHERWISE IT MAY LEAD TO DISCHARGE OF ACCUMULATOR BATTERIES!

Table 2.2 – Heating plug operation time depending on engine temperature

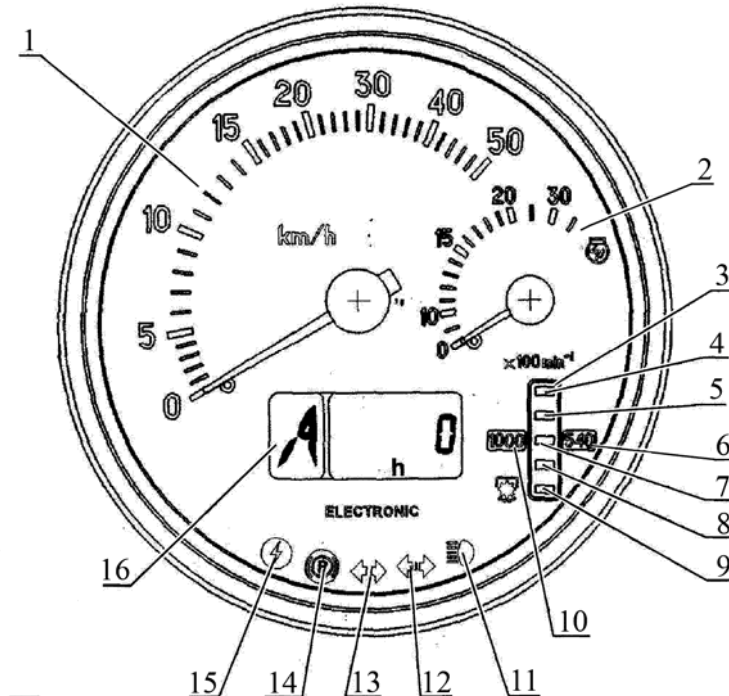
Engine temperature, $^{\circ}\text{C}$	Time of engine pre-start heating, sec., at least	Time of heating after engine start-up, sec., at least
-40	50	183
-20	33	183
0	20	74
+20	13	45
+40	9	33
+50	8,5	31
+60	0	0
sensor breakout	33	183

2.8 Integrated indicator and integrated indicator control panel

2.8.1 General information

Integrated indicator 15 (figure 2.1.1) (further in the text II) and integrated indicator control panel 16 (figure 2.1.1) (further in the text IICP) display information on operational parameters of systems and units of the tractor and provide operator with data on violation of operation or breakdown of any system.

II includes gauges and signal lamps according to figure 2.8.1:



1 – velocity gauge (needle indicator); 2 – engine speed gauge (needle indicator); 3 – RPTO speed gauge (light indicator); 4, 9 – segments of RPTO speed scale (yellow color); 5, 7, 8 – segments of RPTO speed scale (green color); 6 – annunciator of RPTO speed scale range «540 min⁻¹» (yellow color); 10 – annunciator of RPTO speed scale range «1000 min⁻¹» (yellow color); 11 – pilot lamp to indicate headlights upper beam switching (blue color); 12 – pilot lamp to indicate switching of trailer turn blinkers (green color); 13 – pilot lamp to indicate switching of tractor turn blinkers (green color); 14 – pilot lamp to indicate parking brake engagement (red color); 15 – pilot lamp to indicate increased voltage in on-board system (red color); 16 – pilot lamp to indicate low level of coolant (yellow color).

Figure 2.8.1 – Integrated indicator

Note – On tractors «BELARUS-1523.5» the pilot lamp to indicate low level of coolant 16 is not used.

While switching on the instrument scale lighting, i.e. while shifting the central dipswitch control into the position II “Instrument scale lighting, parking lights are on” and the position III “Consumers of the position II and front road headlights are on”, light intensity of multi-function display and PTO indicator segments is automatically reduced.

The integrated indicator control panel is shown in figure 2.8.2.

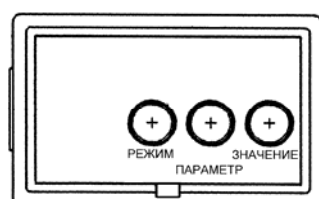


Figure 2.8.2 – Integrated indicator control panel

Control panel 16 (figure 2.1.1) allows to carry out manual programming of the indicator with buttons «Параметр» (“Parameter”) and «Значение» (“Value”) (see figure 2.8.2), and also to change the mode of showing data entered on the multifunction display with «Режим» (“Mode”) button. The “Режим” (“Mode”) button is also used to enter a non-fixed parameter value when programming the device.

The rules on IICP use in the mode of displaying operational parameters and failure messages on the multifunction display are given below in subsection 2.8.2 “Assignment and operation principle of II gauges”.

The rules on IICP use in the II programming mode are given below in subsection 2.8.5 “The order of Integrated Indicator programming”.

2.8.2 Assignment and operation principle of integrated indicator gauges

2.8.2.1 Velocity gauge 1 (figure 2.8.1) indicates tractor design speed on a needle indicator. Design speed exceeds the actual one as tractor skidding is not taken into account.

Velocity gauge 1 is actuated by signals coming from pulse sensors of rotation frequency of toothed gears of final drives of right and left rear wheels. The speed is indicated in accordance with the signal from the sensor installed on the final drive gear of the wheel rotating with a less speed.

In case one of the speed sensors is faulty, the integrated indicator shows speed readings in accordance with the signal coming from the correct sensor. Specific faults of circuits or speed sensors when the signals from them are missing are displayed in liquid crystal display as “0” digit, characterizing the fault location – to the right or to the left (see below).

2.8.2.2 Engine speed gauge 2 (figure 2.8.1) indicates rotation frequency of the engine crankshaft on a needle indicator.

Information on engine speed comes from the electronic control unit. The range of speed indications is from 0 to 3500 (rpm).

2.8.2.3 RPTO speed gauge 3 (figure 2.8.1) displays the RPTO speed on a light indicator. The rear PTO speed gauge is actuated by signals coming from a pulse speed sensor, installed above the toothed washer of the rear PTO reduction unit.

Upon engaging the rear PTO in the mode of “540 min⁻¹” the integrated indicator operates in the following way:

- the annunciator of “540 min⁻¹” of rear PTO speed scale range 6 lights up;
 - as the speed of the rear PTO shaft end extension reaches 320 min⁻¹, a lower segment of the rear PTO gauge 9 lights up in combination with the annunciator 6.
 - as the speed further increases, together with the annunciator 6 the rear PTO indicator segments light up successively from bottom upward in the following order: 8 – 7 – 5 – 4;
 - then in the process of the rear PTO operation, the rear PTO speed is displayed on indicator 3 in accordance with the upper lighting segment of the RPTO according to table 2.3.

When switching the mode “540 rpm economic” the operating order of the rear PTO speed indicator 6 is the same as for the mode “540 rpm” (an availability to switch on the economic mode of the RPTO operation is provided only on tractors with GB 24x12).

Upon engaging the rear PTO in the mode of “1000 rpm” the integrated indicator operates in the following way:

- the annunciator of “540 rpm” of rear PTO speed scale range 6 lights up (figure 2.8.1);
 - as the speed of the rear PTO shaft end extension reaches 320 rpm, a lower segment of the rear PTO gauge 9 lights up in combination with the annunciator 6.
 - as the speed further increases, together with annunciator 6 the rear PTO indicator segments light up successively from bottom upward in the following order: 8 – 7 – 5 – 4;

- as the speed of the RPTO shaft extension exceeds 750 rpm annunciator 6 as well as segments 9, 8, 7, 5, 4 go out. Then annunciator 10 and lower segment 9 light up;
- as the speed further increases, together with annunciator 10 the rear PTO indicator segments light up successively from bottom upward in the following order: 8 – 7 – 5 – 4;

- then in the process of the rear PTO operation the rear PTO speed is displayed on the indicator 3 in accordance with the upper lighting segment as per table 2.3.

When switching on the mode “1000 rpm economic”, the operating order of the rear PTO speed indicator 6 is the same as for the mode “1000 rpm” (an availability to switch on the economic mode of the RPTO operation is provided only on tractors with GB 24x12).

Note – A precise value for the RPTO speed can be checked on multifunction display 17 (table 2.8.1).

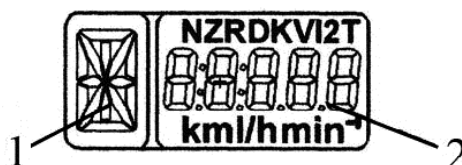
Table 2.3 – Correspondence of parameters of indicator 3 (figure 2.8.1) to the speed of the rear PTO shaft end extension

Active annunciator of ranges of the rear PTO speed scale		Upper (as per fig. 2.8.1) active segment of the rear PTO speed scale
Annunciator 6 (figure 2.8.1) “540 rpm” ¹⁾	Annunciator 10 (figure 2.7.1) “1000 rpm”	
650	1150	4
580	1050	5
500	950	7
420	850	8
320	750 ²⁾	9

¹⁾ the annunciator of the range of “540 rpm” of the rear PTO speed scale is actuated only if there is a signal from the sensor, and switches off when the annunciator of the range of “1000 rpm” of the rear PTO speed scale turns on or when the signal from the sensor is missing for more than 3 sec.

²⁾ speed value, whereby the annunciator of the range of “1000 rpm” of the rear PTO speed scale turns on.

2.8.2.4 Multifunction display 17 (figure 2.8.1) is a liquid-crystal display that shows information in two fields 1 and 2 at the same time (figure 2.8.3).



1 – digital symbol of the gear engaged; 2 – current numeric value of one of tractor system parameters.

Figure 2.8.3 – Information fields of the multifunctional display

1 – the digital symbol of the gear engaged (digits 0 to 6) is displayed only on tractors with the CECS. Due to absence of the CECS on “BELARUS-1523.5» tractors the number of the gear engaged is not displayed on the multifunction indicator. The information field displays letter “A”.

The following parameters are displayed in information field 2 (figure 2.8.3):

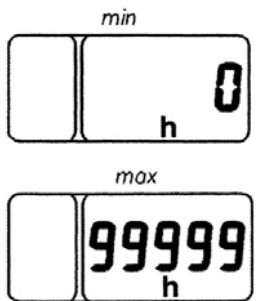
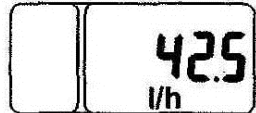
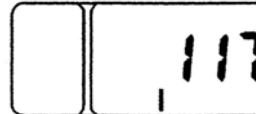
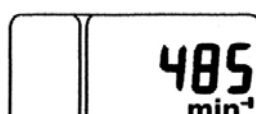
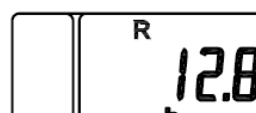
- total elapsed engine time;
- instant fuel flow;
- on-board voltage;
- remaining fuel volume;
- time of running with remaining fuel;

- rear PTO speed;
- engine operating time for the specified period;
- testing of speed sensors workability;
- testing of frequency fuel volume sensor (FFVS) workability;
- testing of CAN-bus workability and connection to the Integrated Indicator.

Switching between indication modes of “Total elapsed engine time“, “Instant fuel flow“, “Remaining fuel volume“, “Time of running with remaining fuel“, “On-board voltage“, “Rear PTO speed“, and switching between messages on faults is carried out with “Mode” button of the control panel (figure 2.8.2).

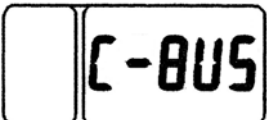
Samples of displaying operating parameters of the tractor on the multifunction display and their short description are given in table 2.4.

Table 2.4 – Samples of displaying operating parameters of the tractor on the multifunction display

Parameter	Sample of displaying parameter on the multifunction display	Parameter description
Total elapsed engine time, h		The counter accumulates information on the total elapsed engine time with uploading a message “engine speed” from the engine control unit and stores it when the power supply is off. The range of engine time indications is from 0 to 99999 hours.
Instant fuel flow, l/h		In this mode a current value of the instant fuel flow with a resolution of 0,1 l/h is displayed.
On-board voltage, V		In this mode a current value of on-board voltage with an accuracy of 0,1 V is displayed in a digital form.
Remaining fuel volume in the tank, l		In this mode current fuel volume remaining in the tank is displayed in liters. This mode is available only when the tractor is stopped (i.e. when there are no signals from the speed sensors).
Time of running on remaining fuel, h		In this mode assessed engine time, calculated for current values of the instant fuel flow and remaining fuel volume is displayed
Rear PTO speed, rpm		In this mode a precise speed of the rear PTO shaft end extension depending on the signal from the rear PTO speed sensor is displayed.
Engine operating time for the specified period		In this mode engine operating time for the specified period with an accuracy of 1/10 of an hour is displayed. If necessary, it is possible to zero the value of a meter by pressing the button “Mode” and holding it pressed for at least 2 sec.

Samples of displaying fault messages on the multifunctional display and a short description of the tractor fault displayed are given in table 2.5.

Table 2.5 – Samples of displaying messages on tractor faults on the multifunction display

Parameter tested	Sample of fault displaying on the Integrated Indicator	Fault description
Testing of speed sensors workability		In case there are no signals coming from the speed sensor for 10-12 sec. a message in the form of “0” digit is displayed on the multifunctional display characterizing the location of the faulty sensor (left or right) or breakage in the circuit of the given sensor. .
Testing of frequency fuel volume sensor (FFVS) workability		If there is no signal coming from the frequency fuel volume sensor for two sec. a message “FUEL” is displayed on the screen.
Testing of CAN-bus workability and connection to the Integrated Indicator		If there are no signals through CAN-bus of the integrated indicator a message “C-BUS” appears on the multifunction display.

If there are no signals from the engine control unit, missing the respective indication modes are switched off automatically and the message C-BUS appears in information field 2 of the multifunction display (figure 2.8.3).

Each of the above stated fault messages is displayed according to the priority on information field 2 of the multifunction display irrespective of the information currently displayed. With successive pushing the “Mode” button of the integrated indicator control module, the messages shall be listed in turn. After listing the last message and the repeated pressing “Mode” button, the multifunction display changes into displaying the cyclic mode of the operating parameters specified before.

The fault messages are displayed on the LCD-screen every time the device is actuated until the cause is eliminated.

When the integrated indicator is turned on, the multifunction display shows information in the indication mode chosen before the moment of turning off the integrated indicator.

2.8.3 Pilot lamps of the integrated indicator

The operating principle of pilot lamps on the integrated indicator is the following:

- pilot lamp to indicate switching on the road lights upper beam 11 (figure 2.8.1) lights up when switching on the upper beam;
- indicators of tractor turns and trailer turns 13 and 12 operate in the flashing mode when actuated with the under-wheel multifunction switch 2 (figure 2.2.1) or when emergency button 4 is turned on;
- pilot lamp to indicate the actuation of parking brake 14 (figure 2.8.1) operates in the flashing mode with 1 Hz frequency when the parking brake sensor goes off;
- pilot lamp to indicate increased on-board voltage 15 gets activated when the tractor on-board supply voltage goes up above 19V and goes out when the voltage falls below 17V;
- pilot lamp to indicate low level of coolant. It is not used on “BELARUS – 1523.5” tractors.

ATTENTION: WHEN THE TRACTOR ON-BOARD SUPPLY VOLTAGE GOES UP ABOVE 19V THE INTEGRATED INDICATOR FULLY GOES OUT AND RECOVERES WHEN THE ON-BOARD VOLTAGE FALLS BELOW 17V!

ATTENTION: PILOT SIGNALLING LAMPS ARE ACTIVATED AND DEACTIVATED SYNCHRONOUSLY WITH CHANGING THE STATE OF SYSTEM SENSORS!

2.8.4 Description of testing the integrated indicator performance

Each time the power supply is on, testing of needle pointers and scale elements of the rear PTO indicator is carried out in the integrated indicator. In this case the indicator needle pointers move away from zero marks for one sec. (or the pointers flutter for not more than one second on indicator zero marks) and also both annunciators of the rear PTO scale range 6 and 10 get actuated (figure 2.8.1) as well as all segments of the rear PTO scale.

2.8.5 The order of the integrated indicator programming

2.8.5.1 Integrated indicator control panel

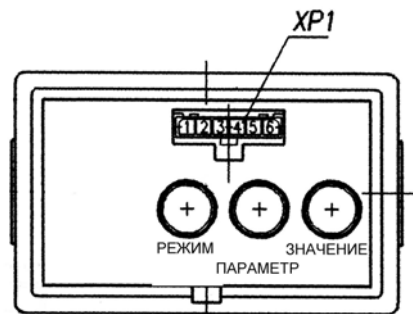


Figure 2.8.4 – Integrated indicator control panel

Control panel 16 (figure 2.1.1) makes it possible to perform manual programming of the integrated indicator with buttons «Параметр» (“Parameter”) and «Значение» (“Value”) (figure 2.8.4) and to change the mode of displaying the parameters on LCD.

A diagnostic connector XP1, located on the front surface of the control panel, makes it possible to perform automatic programming (reprogramming) of the integrated indicator (II) by means of a special device (if provided). In case such a device is not provided, the programming shall be performed by means of the above mentioned buttons. On “BELARUS-1523.5” tractors, the XP1 connector is not provided.

2.8.5.2 The algorithm of the integrated indicator programming

When choosing a fixed value of the parameter, the II programming is carried out in the following way:

- when the “Parameter” button is pressed for the first time (see figure 2.8.4), multi-function indicator 17 (figure 2.8.1) switches to the mode of viewing the programmed parameter and its numerical value. When the button is pressed repeatedly, the numerical value of the set programmed parameter is changed;
- when the “Value” button is pressed repeatedly, the numerical value of the set programmed parameter is changed;
- when neither the “Parameter” nor “Value” button is pressed for 7.0 seconds, the mode is exited automatically.

When exiting the mode, the last set parameter values chosen with the “Value” button are saved.

When choosing an unfixed parameter value of the integrated indicator programming, it is necessary to do the following:

- press the “Parameter” button (figure 2.8.4) to choose the parameter value to be set;

- press the "Mode" button twice, after which the low-order digit will start blinking on multifunction indicator 17 (figure 2.8.1);
- to change the blinking digit of the parameter, press the "Value" button (figure 2.8.4);
- to select the high-order digit, press the "Parameter" button;
- to exit the programming mode of an unfixed parameter value, press the "Mode" button twice;
- after exiting the specified mode (entering an unfixed parameter value), the digits of the set parameter value stop blinking.

The newly set value is put the last in the list of allowed values for programming.

When the "Mode" button is pressed once in the programming mode, entering of an arbitrary parameter value is not possible.

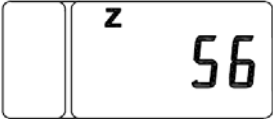
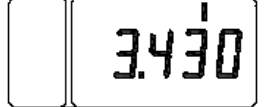
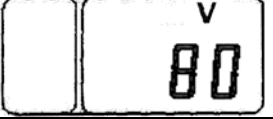
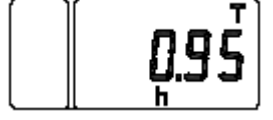
When none of the buttons "Mode", "Parameter" or "Value" is pressed for seven seconds in the mode of unfixed value input, the II automatically switches to the main multifunction indicator operation mode, and all set parameter values are saved.

It is allowed to enter one unfixed parameter value in the following ranges:

- for "Z" – from 23 to 69;
- for "I" – from 1,000 to 4,000;
- for "R" – from 400 to 1000;
- for "KV2" – from 0.346 to 0.600;
- for "ZV" – from 12 to 99;
- for "V" – from 0 to 1000.

The list of programmed parameter values for tractors "BELARUS-1523.5" (graphic examples of parameter presentations and their values on the multifunction indicator in the programming mode) is given in Table 2.6.

Table 2.6 – The list of programmed parameter values for tractors “BELARUS-1523.5”

	“Z” parameter Z is the number of teeth of final shaft gears of the driving wheels (right and left), over which the travel speed (rotation speed) sensors are installed. Note: 56 is the value of parameter “Z” for tractors “BELARUS-1523.5” with gearbox 16x8. 54 is the value of parameter “Z” for tractors “BELARUS-1523.5” with gearbox 24x12.
	“I” parameter I is the gear ratio multiplier of the wheel-hub drive
	“R” parameter R is the rear axle rolling radius, mm. When reprogramming, this parameter can be modified with a 5 mm step¹⁾.
	“KV2” parameter KV2 is the PTO gear ratio²⁾
	“ZV” parameter ZV is the number of teeth of the RPTO reduction unit toothed washer
	“V” parameter V is the fuel tank volume, l³⁾
	Also, when the “Parameter” button is pressed in the programming mode, the list of programmed parameters contains an independent “T” parameter of precise readout of the as-tronomic service hours of the engine. This parameter cannot be modified, it is the precise number (to 0,01 of hour) of engine service hours.
1) «830» – is the value for tires 520/70R38. When mounting another type of tires, it is required to set the parameter value “R” which corresponds to the rolling radius of the mounted tires. 2) On tractors “BELARUS-1523.5» readout of RPTO revolutions is carried out with the help of PTO speed sensor. Considering this, any value, except for number “000”, can be set in parameter “KV2”. 3) On tractors “BELARUS-1523.5» only the value of the side fuel tank volume (80 litres) shall be set, so the data about the operation time on the remaining fuel and etc. are formed without considering the fuel volume in the tank (the volume of the fuel tank under the cab is 130 litres).	

During operation, it is allowed to modify the parameter value 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 mounting surface.

IT IS FORBIDDEN TO MODIFY THE ENTERED VALUES OF ALL OTHER PARAMETERS (FACTORY DEFAULTS).

2.9 Information display and engine control system panel

2.9.1 General information

Information display 21 (figure 2.1.1) is designed to display engine actual parameters and indication of the engine electronic control system (EECS) faults.

When the key of starter and instrument switch is set into "I" position (figure 2.2.2) the supply voltage is delivered to the engine electronic control system. After the supply voltage is delivered, the EECS constantly performs self-testing. If there are no faults in the EECS operation, the information display functions in the operating mode – it displays actual parameters of engine operation.

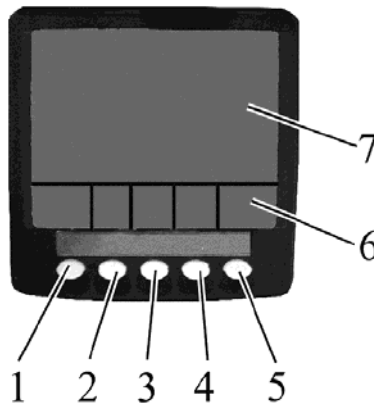
When the error is detected, the information display produces an acoustic signal and a brief description of the identified errors (the error code designation and its description) appears on the screen, also a fault testing annunciator lights up or flashes on engine control panel 33 (figure 2.1.1). The interpretation of error codes and the recommended actions to be taken to eliminate the identified faults are given in the engine operation book.

ATTENTION: IT IS REQUIRED TO ELIMINATE THE DETECTED ERRORS! TO ELIMATE THE ERRORS, CONTACT YOUR DEALER!

2.9.2 Adjustment of brightness and sharpness of the information display

To enter the mode of adjustment of screen brightness and sharpness 7 (figure 2.9.1) press button 5. Images of buttons are given in the screen lower part. Pressing button 1 decreases brightness, pressing button 2 increases brightness, pressing button 3 decreases sharpness, pressing button 4 increases sharpness, and pressing buttons 1,2,3,4 at the same time adjusts to an average value of sharpness and max. brightness. Repeated pressing button 5 exits the mode of brightness and sharpness adjustment.

2.9.3 Call-up of changeable images and parameters on the screen of the information display



1 – button to activate the main (three-segment) image and choose between displayed parameters; 2 – button to activate four-section image and choose between displayed parameters; 3 – button to activate graphic display and choose between displayed parameters; 4 – button to activate indication of error (fault) list and choose between displayed parameters; 5 – button to enter/exit the mode of adjustment of sharpness, brightness and configuration menu; 6 – changeable display of buttons functional purpose; 7 – screen.

Figure 2.9.1 – Information display

Monitor buttons 1, 2, 3, 4, 5 (figure 2.9.1) are of multifunctional purpose. When pressing any of buttons 2, 3, 4 during the monitor operation, an image of button panel 6 appears on the screen, the icons denoting the current functions of each button. Pressing button 1 on the monitor activates the main three-segment image on the screen. In this case an engine speed scale is displayed in the upper left corner and a scale of oil pressure in the engine

lubrication system is displayed in the upper right corner, cooling fluid temperature - in the lower right corner, current fuel flow per hour - in the lower left corner. When the three-segment imaging is indicated, the displayed parameters in the lower left corner are chosen with button 1. To exit the mode of choosing between the displayed parameters in the upper right corner it is required to press button 5 after activation of the button panel 6. After that the parameters are chosen between with buttons 1 and 2.

After calling up button panel 6, a four-segment imaging of parameters on screen 7 is activated with button 2. After the first pressing button 2, four parameters are displayed in the digital mode on the screen:

- in the upper left corner – engine speed;
- in the upper right corner – coolant temperature;
- in the lower left corner – on-board voltage;
- in the lower right corner – oil pressure in the lubrication system.

When pressing button 2 for the second and third time, four parameters are displayed on the screen in an analog form.

Using the mode of choosing between the displayed parameters, the customer can activate if necessary displaying of various engine parameters on the screen according to table 2.7. The mode of parameter choosing is activated after calling up the button panel with short-time pressing button 5. Successive pressing button 1 changes the parameters displayed in the upper left corner, pressing button 2 changes the parameters in the upper right corner, button 3 – in the lower left corner, button 4 – in the lower right corner. The parameter choosing mode is exited with short-time pressing button 5.

After calling up the button panel by pressing button 3, graphical displaying of parameters in the course of time is activated (functions as a parameter analogue recorder).

The required parameters are chosen with a successive pressing button 3 according to table 2.7.

A temporary net can be adjusted in a configuration menu from 2, 10 or 30 min. to 1, 2, 4 or 8 hours. To enter the configuration menu it is necessary to press button 5 and hold it pressed for more than 3 sec. Also it is possible to choose metric and British units of measurement in this menu, among available languages it is possible to choose English, Spanish, Swedish, French, German, Italian, Dutch, Portuguese and Russian.

ATTENTION: ONLY DEALERS ARE AUTHORIZED TO CHANGE SETTINGS OF THE CONFIGURATION MENU!

When errors (faults) are detected during the operation, the monitor produces a sound signal and a rhombic flashing window with an exclamation mark appears on the screen.

After calling up the button panel, a list of active errors (faults) is invoked with button 4. Moving over the list is carried out with buttons 1 and 2.

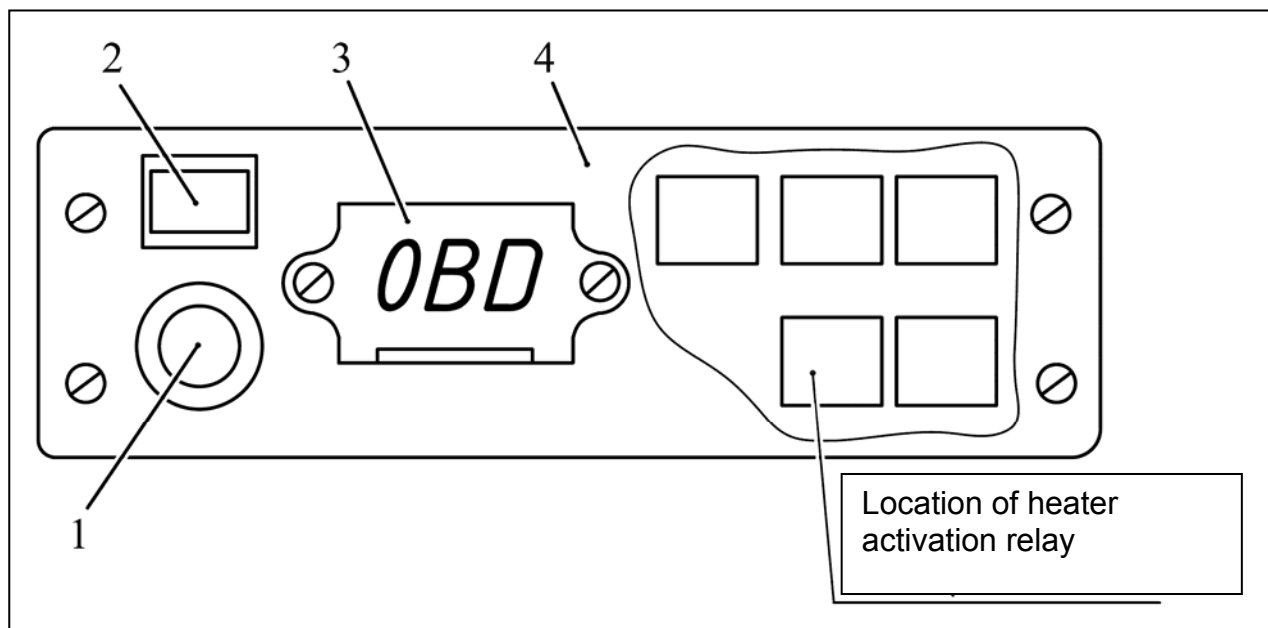
To exit displaying of the list of active errors, it is necessary to confirm the reception of all errors by pressing button 3. After the errors stop appearing on the display, they are automatically deleted from the list.

Table 2.7 – Lift of parameters of four-segment and graphic indication of engine operation

Parameters	Four-segment imaging	Graphic imaging	Symbol
Electric voltage directly on terminals of information monitor connection, V	✓	✓	
Voltage on the accumulator battery terminals, measured by the engine electronic control unit, V	✓	✓	
Fuel consumption, l/h	✓	✓	
Fuel delivery pressure, kPa	✓	✓	
Air pressure at the inlet pipe, kPa	✓	✓	
Engine oil pressure, kPa	✓	✓	
Barometer pressure, kPa	✓		
Engine oil temperature, °C	✓	✓	
Fuel temperature, °C	✓		
Temperature of coolant in the engine, °C	✓	✓	
Air temperature at the inlet pipe, °C	✓	✓	
Accelerator position, %	✓		
Use of turning torque, rpm	✓		
Engine torque, requested by the driver, %	✓		
Torque consumption, %	✓		
Engine speed, rpm	✓	✓	
AdBlue level in the tank, %	✓		
AdBlue temperature in the tank, %	✓		
AdBlue temperature in the tank, %	✓		

2.9.4 Engine control system panel

The engine control system panel is introduced in figure 2.9.2.



1 – button switch of testing activation, 2 – fault testing annunciator, 3 – testing jack, 4 – panel cover.

Figure 2.9.2 – Engine control system panel

The button switch of testing activation 1 (figure 2.9.2) is intended to call up active errors from the memory of the engine electronic control unit by means of light codes, displayed by fault testing annunciator 2. This way of testing is alternative in comparison with information display 21 (figure 2.1.1). Regarding reading and decoding light codes errors and the recommended actions on fault elimination, it is necessary to refer to the engine operation manual, attached to your tractor. The detected errors shall be eliminated. To eliminate the detected faults, please, contact your dealer.

Five heater activation relays are located under cover 4 on the left side, as it is shown in figure 2.9.2.

After turning the key of the starter and instrument switch from the position “Off” into the position “Instruments are on”, the system is powered. After powering the system, it carries out a self-check. If there are no errors in the system operation, fault testing annunciator 2 on the panel of engine control system shall turn on and go out, which shows the workability of annunciator 2 lamp and its correct connection to the tractor on-board system.

Special testing jack 3 is intended to connect system testing devices KTS of “BOSCH” company to carry out an extended service diagnostics of the engine in operation. The specified system testing devices are recommended for dealer centers.

2.10 Steering

2.10.1 General information

“BELARUS-1523.5” tractors are equipped with hydrostatic steering control (HSC). When the engine is stopped, the HSC feed pump, driven by the engine crankshaft, does not feed the hydraulic system of the HSC and it is automatically shifted to a manual mode, which requires greater effort on the steering wheel to turn the tractor.

2.10.2 Steering wheel adjustments

The steering wheel has the following adjustments:

- according to the horizon tilt angle;
- according to the height, along the steering shaft axis.

To change height positioning of the steering wheel, do the following:

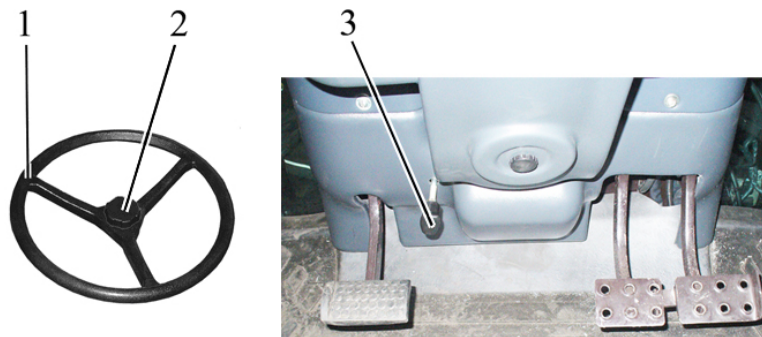
- unscrew chuck 2 (figure 2.10.1) by 3-5 revolutions;
- set wheel 1 to a position comfortable for work;
- screw in chuck 2 with max. possible force of hand fingers.

The range of the steering wheel height adjustment is 100 mm, stepless.

To change the steering column tilt angle, do the following:

- pull handle 3.
- tilt the steering column to reach the position comfortable for work and releasing handle 3, swing the steering column smoothly in longitudinal direction until fixed firmly.

The steering column can be tilted and fixed in four positions from 25° to 40° with 5° interval.



1 – steering wheel; 2 – chuck; 3 – handle to fix the tilt of the steering column.

Figure 2.10.1 – Steering wheel adjustment

ATTENTION: WHEN FIXING THE STEERING COLUMN IN THE EXTREME FRONT POSITION, SET THE GEAR SWITCH LEVERS OF GEARS AND RANGES INTO A NEUTRAL POSITION, START THE ENGINE AND WITH THE TRACTOR NOT MOVING MAKE SURE THE STEERING CONTROL OPERATES WELL!

2.11 Parking brake control

Upper position of the lever 22 (figure 2.1.1) – parking brake “On”;

Lower position of the lever 22 – parking brake “Off”.

2.12 Handle for fuel supply manual control

When moving handle 36 (figure 2.1.1) into the extreme front position, max. fuel supply is provided, when moving the handle into the extreme rear position – min. fuel supply is provided which corresponds to the minimum idle speed.

2.13 Tractor pedals

2.13.1 Pressing pedal 24 (figure 2.1.1) disengages the clutch.

2.13.2 Pressing pedal 26 (figure 2.1.1) brakes the rear left wheel.

2.13.3 Pressing pedal 27 (figure 2.1.1) brakes the rear right wheel. A joint plate of the brake pedals is intended for simultaneous braking with the right and left brakes.

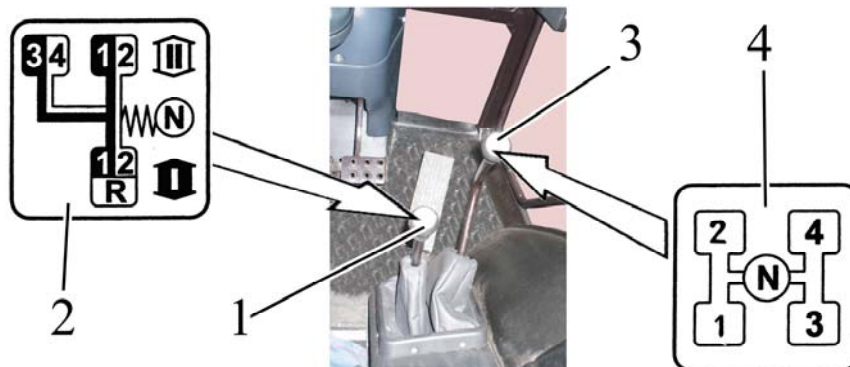
2.13.4 Pressing pedal 28 (figure 2.1.1) increases the engine speed.

2.14 Switching of ranges and gears on GB 16x8

2.14.1 General information

GB control is carried out with two levers: range shifting lever 1 (figure 2.14.1) and gear shifting lever 3.

The required range or gear shall be set according to switching schemes 2 and 4, as it is shown in figure 2.14.1.



1 – lever to switch ranges of gearbox; 2 – scheme of switching GB ranges; 3 – lever to switch gears of gearbox; 4 – scheme of switching GB gears.

Figure 2.14.1 – GB 16x8 control

2.14.2 Velocity diagram of tractor with GB 16x8

The table of “BELARUS-1523.5” tractor velocity diagram (figure 2.14.2) on tires of basic configuration is attached to the cab right window.

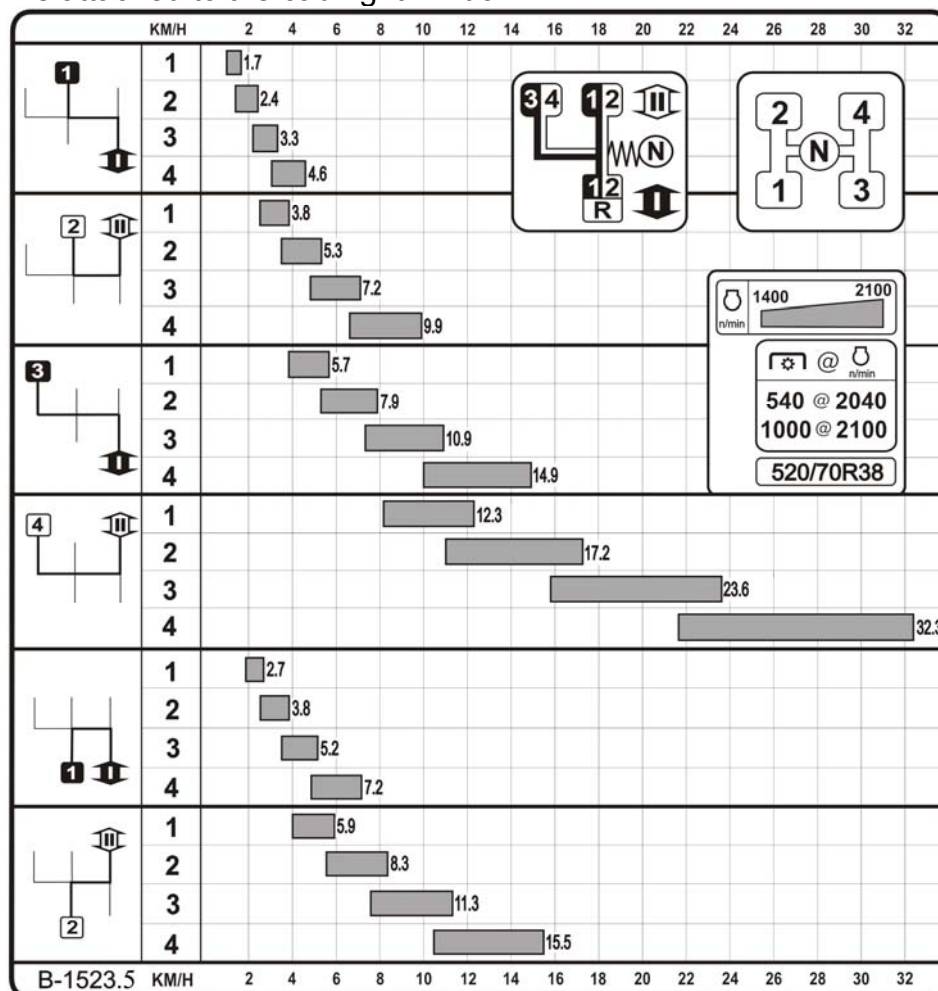
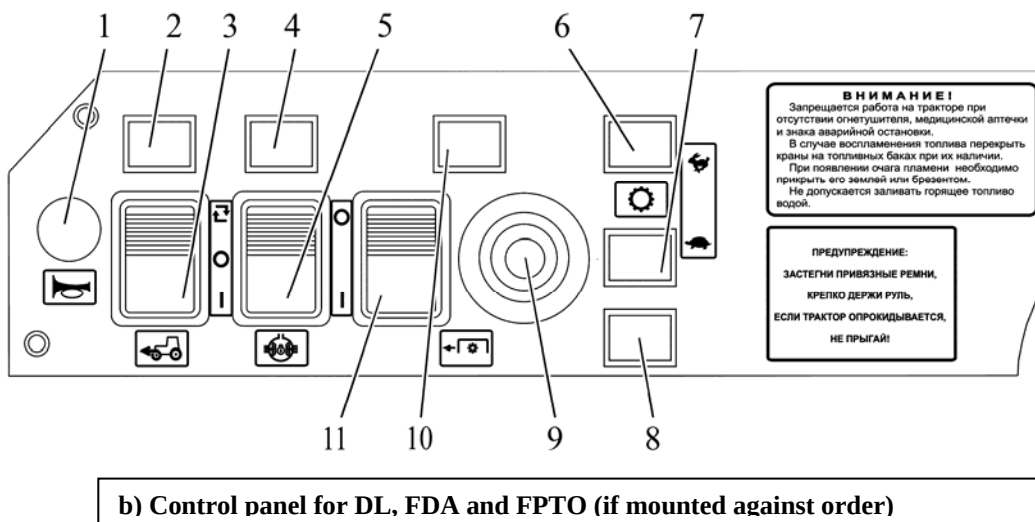
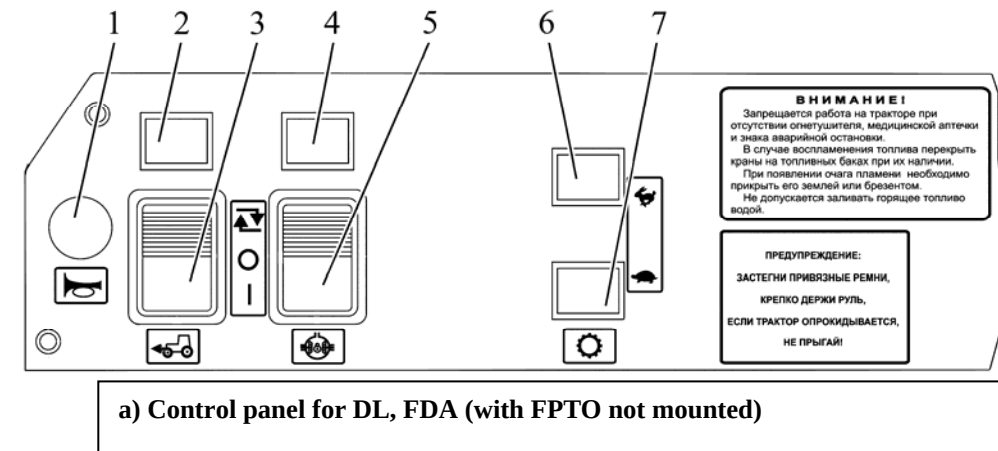


Figure 2.14.2 – Velocity diagram of tractor “BELARUS-1523.5” with GB 16x8

2.15 Control panel for rear axle DL, FDA and FPTO drives

2.15.1 General information

Elements of control panel of rear axle DL, FDA drive and front PTO (if it is mounted against order) are shown in figure 2.15.1.



1 – acoustic signal button; 2 – annunciator of FDA drive activation; 3 – switch of FDA drive control; 4 – annunciator of rear axle DL activation; 5 – switch of rear axle DL control; 6 – annunciator of activation of GB reduction unit higher pass; 7 – annunciator of activation of GB reduction unit lower pass; 8 – annunciator of oil emergency temperature in the HLL tank; 9 – button of FPTO activation; 10 – annunciator of FPTO activation; 11 – FPTO control switch.

Figure 2.15.1 – Control panel for rear axle DL, FDA and FPTO drives

Annunciators of activation of GB reduction unit higher and lower pass 6 and 7 (figure 2.15.1) are mounted only on tractors with GB 24x12. The operation order of annunciators of GB reduction unit pass activation is given in subsection 2.27 “Switching of GB 24x12 ranges and gears”.

On tractors with GB 16x8 with FPTO not mounted, element 6 is a blank cover, element 7 is an annunciator of oil emergency temperature in the HLL tank.

On tractors with GB 16x8 with FPTO mounted, elements 6 and 7 are blank covers, element 8 is an annunciator of oil emergency temperature in the HLL tank.

2.15.2 Front power take-off shaft control

FPTO, if mounted against order, is controlled with switch 11 (figure 2.15.1) and button 9. The indication of FPTO engagement is carried out by annunciator 10.

In the initial state the FPTO drive is disengaged by default, annunciator 10 is off.

To engage the FPTO after the engine start, it is required to set switch 11 into the position "On" and press button 9. After that annunciator 10 lights up indicating that the FPTO is engaged.

To disengage the FPTO, it is required to set switch 11 into the position "Off", in this case annunciator 10 goes out.

To engage the FPTO repeatedly, first it is required to set switch 11 into the position "On", then press button 9.

ATTENTION: AS THE ENGINE IS STOPPED, THE FRONT POWER TAKEOFF SHAFT IS AUTOMATICALLY OFF. TO ENGAGE THE FPTO AFTER THE ENGINE START, FOLLOW THE PROCEDURES ON THE FPTO ENGAGEMENT.

Note – Additional information on the FPTO operation rules is given in subsection 3.2.7 "PTO use".

2.15.3 FDA drive control

The FDA drive is controlled with switch 3 (figure 2.15.1). The indication of the FDA drive operation is performed by annunciator 2.

The switch 3 has three fixed positions:

"FDA off" – middle position;

"FDA automatic control" – upper position;

"FDA positive activation" – lower position.

The mode "FDA off" is used when moving on roads with hard surface when the traveling speed is above 13 km/h in order to avoid increased wear of front wheel tires.

In the position "FDA automatic control" the FDA drive is automatically engaged when the rear wheel skidding limit is exceeded. The FDA drive is disengaged automatically as the rear wheel skidding drops below the limit.

Annunciator 2 is on, when the FDA drive is engaged, and it goes out when the FDA drive is disengaged.

The mode "FDA automatic control" shall be used for performing various types of field work.

The mode "FDA automatic control" is disengaged by setting switch 3 into the position "FDA off". In this case annunciator 2 goes out.

If FDA positive activation is required irrespective of rear wheel skidding, set switch 3 into the position "FDA positive activation". In this case the FDA drive is permanently engaged and annunciator 2 is on. To disengage the positive activation mode, set switch 3 into the position "FDA off", and annunciator 2 goes out.

ATTENTION: ONLY POSITIVE ACTIVATION OF FDA SHALL BE USED WHEN OPERATING ON REVERSE!

ATTENTION: ONLY POSITIVE ACTIVATION OF FDA SHALL BE USED WHEN OPERATING THE TRACTOR UNDER BAD TIRE GRIPPING CONDITIONS WHILE REAR WHEELS SKIDDING, INCLUDING TRACTOR TURNING, TO ENSURE SMOOTH FDA ACTIVATION, FOR WHICH DO THE FOLLOWING:

- STOP THE TRACTOR DEPRESSING THE CLUTCH PEDAL;
- ENGAGE THE FDA IN THE MODE "FDA POSITIVE ACTIVATION";
- RELEASE THE CLUTCH PEDAL SMOOTHLY.

ATTENTION: AUTOMATIC ACTIVATION OF FDA DRIVE IRRESPECTIVE OF THE SET MODE (INCLUDING THE MODE "FDA OFF"), TAKES PLACE WHEN PRESSING THE INTERCONNECTED BRAKE PEDALS!

ATTENTION: WHEN OPERATING ON ROADS WITH HARD SURFACE, IT IS REQUIRED TO DISENGAGE THE FDA DRIVE IN ORDER TO PREVENT INCREASED WEAR OF FRONT WHEEL TIRES!

ATTENTION: VIOLATION OF RULES FOR USING FDA DRIVE OPERATION MODES MAY RESULT IN BREAKDOWN OF FDA PARTS AND OTHER PARTS OF TRANSMISSION!

TRACTOR OPERATION WITH FDA DRIVE ENGAGED WHEN THE TRAVELLING SPEED IS ABOVE 13 KM/H IS FORBIDDEN!

2.15.4 Rear axle differential lock control

The rear axle differential lock (DL) is controlled with switch 5 (figure 2.15.1). The indication of rear axle DL operation is performed by annunciator 4.

Switch 5 has three positions:

"DL off" - middle fixed;

"DL automatic control" – upper fixed;

"DL positive activation" – lower non-fixed.

To avoid increased wear of rear wheel tires and rear axle DL, use the mode "DL off" when moving on roads with hard surface with the travelling speed above 13 km/h.

The mode "DL automatic control" with guide wheel position corresponding to linear movement, engages the rear axle DL and annunciator 4 goes off.

The rear axle DL is disengaged automatically when the guide wheels turn to the angle above 13° or when any or both brake pedals are depressed. In this case annunciator 4 goes out.

The mode "DL automatic control" is disengaged by setting switch 5 into the position "DL off". Annunciator 4 goes out.

Use the mode "DL automatic control" when carrying out operations with significant relative skidding of rear wheels.

If rear axle DL short-time positive activation is required irrespective of front wheel turning angle, press switch 5 and hold it pressed in the position "DL positive activation". The rear axle DL remains engaged during the time of holding switch 5 pressed. Simultaneously annunciator 4 goes off. When switch 5 is released, the RADL returns to its initial (disengaged) state and annunciator 4 goes out.

TRACTOR OPERATION WITH RADL ENGAGED WHEN THE TRAVELLING SPEED IS ABOVE 13 KM/H IS FORBIDDEN!

TRACTOR OPERATION ON ROADS WITH HARD SURFACE WITH RADL CONSTANTLY ENGAGED IS FORBIDDEN!

2.15.5 Annunciation of oil emergency temperature in the hydraulic lift linkage

The annunciator of oil emergency temperature in the HLL lights up when oil temperature in the HLL tank exceeds the permissible limit.

The annunciator of oil emergency temperature in the HLL can be mounted in the following places:

- element 7 (figure 2.15.1) – on tractors with GB 16x8 with FPTO not mounted;
- element 8 – on tractors with GB 24x12 and with GB 16x8 with FPTO mounted.

2.16 Rear PTO control

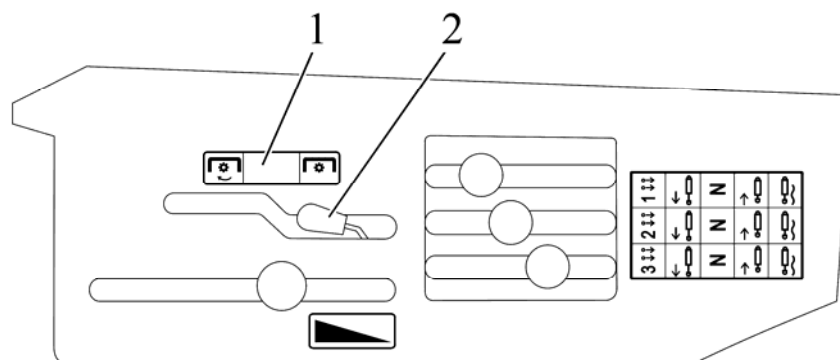
The handle to engage the rear PTO drive 23 (figure 2.1.1) has three positions:
 upper position – “PTO independent drive engaged”;
 middle position – “PTO drive off”;
 lower position – “PTO synchronous drive engaged”.

The rear PTO control lever has two positions:
 shifting lever 2 (figure 2.16.2) from the extreme rear position to the extreme front position engages the rear PTO;
 shifting the lever from the extreme front position to the extreme rear position disengages the rear PTO.

ATTENTION: ENGAGE THE RPTO SYNCHRONOUS DRIVE ONLY FROM THE NEUTRAL POSITION WHEN THE ENGINE IS ON, AT LOWEST GEARS OF GB FIRST AND SECOND RANGES WHEN THE TRACTOR IS MOVING. OTHERWISE, POWERTRAIN CAN BE DAMAGED! SWITCHING OF PTO SYNCHRONOUS DRIVE INTO THE NEUTRAL POSITION IS PERFORMED IN THE SAME WAY!

ATTENTION: ENGAGE THE PTO INDEPENDENT DRIVE FROM THE NEUTRAL POSITION ONLY WHEN THE ENGINE IS OFF! SWITCHING OF PTO INDEPENDENT DRIVE INTO THE NEUTRAL POSITION IS PERFORMED IN THE SAME WAY!

Note – The PTO control lever 2 in figure 2.16.2 is set into the position “PTO off”.



1 – instruction plate for rear PTO control; 2 – rear PTO control lever.

Figure 2.16.2 – Rear PTO control lever

Switching between the rear PTO speed of 540 and 1000 rpm is carried out exclusively by installing the corresponding PTO shaft end extensions, that have corresponding markings of “540” and “1000”. “BELARUS-1523.5” tractors do not have a special switch between the speeds of 540 and 1000 rpm of the rear PTO.

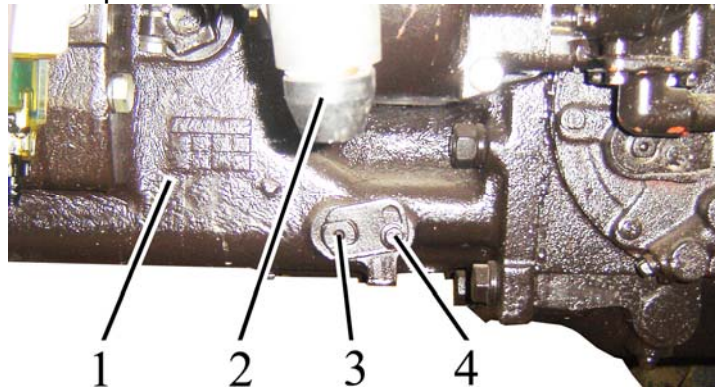
The rear PTO drive on tractors “BELARUS-1523.5” with GB 24x12 has two operation modes:

- standard – 540 and 1000 rpm;
- economic – 770 and 1460 rpm under engine rated speed.

Shaft 3 (figure 2.16.3) located on the left of the clutch coupling housing under the HLL pump, is designed for switching the modes of the RPTO drive.

Switching between the modes of the rear PTO (standard and economic) shall be carried out only when the engine is off or with the engine min. idle speed. To do this, it is required to loosen fixing bolt 4 (figure 2.16.3) and turn shaft 3 until engaged into the clutch, after

that tighten the fixing bolt. To engage the standard mode, it is necessary to turn shaft 3 contraclockwise against the stop; to engage the economic mode it is required to turn shaft 3 clockwise against the stop.



1 – clutch coupling housing; 2 – pressure control group of the pneumatic system; 3 – shaft; 4 – fixing bolt.

Figure 2.16.3 – Switching between the RPTO standard and economic modes on tractors “BELARUS-1523.5” with GB 24x12

Note – In figure 2.16.3 the position “PTO standard mode on” is set.

Note - The RPTO operation is controlled with the integrated indicator, as specified in subsection 2.8.2 – “Assignment and operation principle of the integrated indicator gauges”.

While tractor operation without using the RPTO, it is required to set the handle of the RPTO drive activation into the neutral position, and set the PTO control lever into the position “PTO off”. The RPTO guard hood shall be mounted.

Note – Additional information on the RPTO operation rules is given in subsection 3.2.7 “PTO use”.

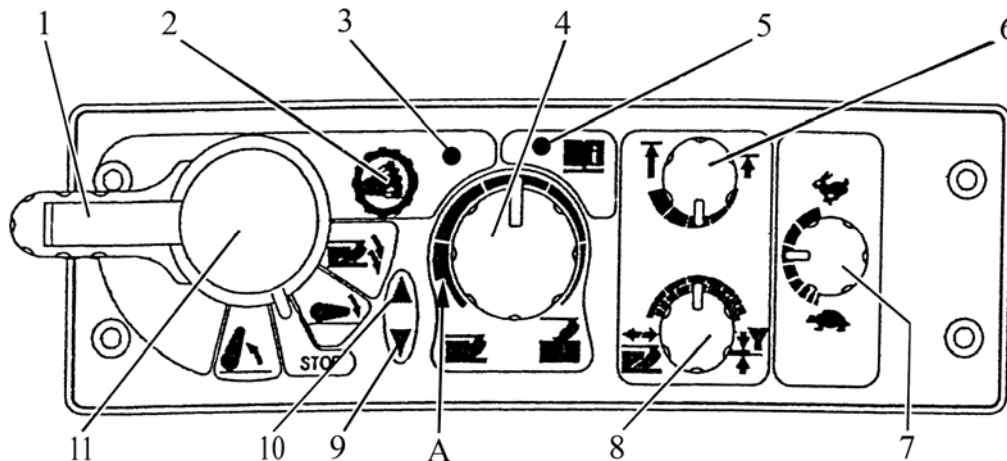
2.17 Control of rear lift linkage (RLL) with the hydraulic lift

2.17.1 General information on rules of RLL control

RLL is controlled with control panel (figure 2.17.1) and remote buttons 4 and 5 (figure 2.17.3). If there are any failures in the RLL electronic-hydraulic control system, a diagnostics annunciator 5 (figure 2.17.1) displays information on the failure and, if necessary, the operation of RLL control system is blocked.

2.17.2 RLL control panel

RLL control panel, located on a side console in tractor cab, is shown in figure 2.17.1.



1 – retainer of RLL control handle blocking; 2 – button of “dampening” mode activation; 3 – annunciator of “dampening” mode activation (orange color); 4 – handle to adjust depth of soil tillage; 5 – troubleshooting annunciator (red color); 6 – handle to adjust height limit of linkage uplifting; 7 – handle to adjust speed of lowering; 8 – handle to select control method; 9 – annunciator of linkage lowering (green color); 10 – annunciator of linkage uplifting (red color); 11 – handle of RLL control.

Figure 2.17.1 – RLL control panel

The order of RLL control is the following:

- set a method of control depending on type of operation with handle 8 (figure 2.17.1). Turning the handle clockwise against the stop is a position method of control; contraclockwise against the stop – draft control; in between – combined control; the combined control is preferential;
 - set the required admissible height of implement uplifting in transport condition with handle 6. Turning the handle clockwise against the stop corresponds to max. uplifting, contraclockwise against the stop – to min. uplifting;
 - set the tillage depth with handle 4. Turning the handle clockwise against the stop corresponds to min. depth, contraclockwise up to “A” position corresponds to max depth; turning the handle contraclockwise against the stop corresponds to floating position;
 - lower the linkage by moving handle 7 to a lower fixed position.
- Then, during the operation it is required to adjust an implement for optimal operation conditions:
- with handle 8 – combination of control methods;
 - with handle 4 – depth of soil tillage.
 - with handle 7 – speed of RLL lowering and uplifting. Turning of the handle clockwise against the stop corresponds to the max. speed of lowering (uplifting), turning the handle contraclockwise corresponds to min. speed lowering (uplifting).

Handle 11 has four positions:

- a) middle position – off;
- b) upper position – uplift;
- c) lower position – lowering (in operation – automatic control);
- d) moving the handle downward (nonfixed) from “B” position – implement penetration (in this case the automatic control is off).

During RLL lowering or penetration, annunciator 9 turns on and during uplifting – annunciator 5 turns on.

The system automatically limits frequency of correction under draft control to an average of 2 Hz. In case of intensive heating of oil in the hydraulic system, it is necessary to reduce frequency of correction by moving handle 8 towards the position method of control and handle 7 towards the “turtle”. In case of raising (“working out”) of the agricultural implement when moving over consolidated soil or ruts, deepen the implement by pressing handle 11 downwards. After releasing handle 11 it comes back to its fixed position of “lowering”. In this case the agricultural implement returns to the mode of the depth set before with handle 4. The implement is raised by moving handle 11 into upper position.

When height adjustment of RLL is carried out during operation, annunciators 10 or 9 turn on.

ATTENTION: IN ORDER TO AVOID HLL PUMP FAILURE, TRACTOR OPERATION IS FORBIDDEN IF ANNUNCIATOR 10 (FIGURE 2.17.1) DOES NOT GO OUT AFTER THE IMPLEMENT UPLIFTING!

ATTENTION: AT THE EMERGENCY STOP OF THE TRACTOR, IN ORDER TO AVOID FURTHER PENETRATION OF THE AGRICULTURAL IMPLEMENT, SHIFT CONTROL HANDLE 11 (FIGURE 2.17.1) INTO THE POSITION “OFF”. AFTER STARTING THE MOVEMENT, SHIFT THE HANDLE INTO THE POSITION “LOWERING” – THE IMPLEMENT WILL PENETRATE TO THE DEPTH SET BEFORE!

It is required to know the following operation peculiarities of RLL control system:

- after the engine start, diagnostics annunciator 5 lights up, indicating the control system workability and blocking;
- to unblock the system, set handle 11 into the operating position for one time (uplift or lowering). In this case diagnostics annunciator 5 goes out.
- after unblocking the system during the first activation, automatic speed limitation for RLL uplift and lowering is provided for safety reasons. Setting handle 11 into the position “Off” and then into the position “Uplift” or “Lowering” removes the speed limitation.

Beside the functions described above, the RLL electronic control system has a mode “dampening” – suppression of oscillations of the agricultural implement in a transport mode.

Turn on the “dampening” mode in the following order:

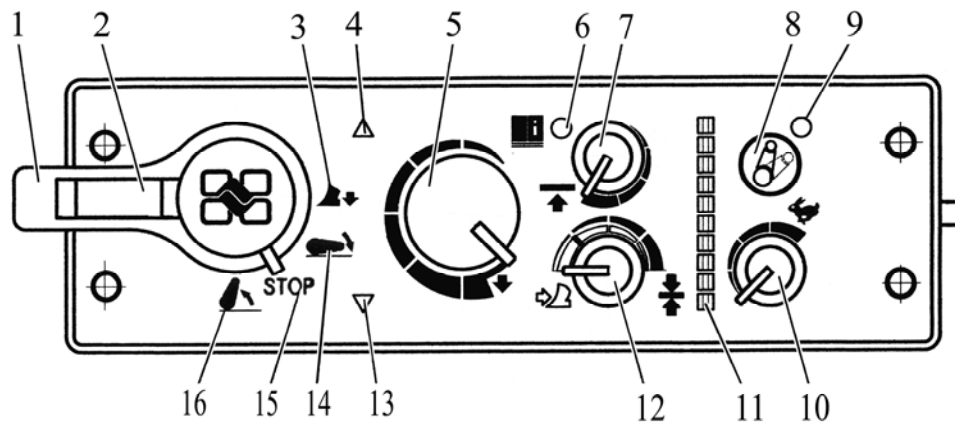
- set handle 11 into the “uplift” position – in this case RLL lifts to the extreme upper position and automatically gets deactivated;
 - press button “dampening” 2 – in this case RLL moves from the extreme upper position down by 3% of full RLL stroke and annunciator of “dampening” activation 3 turns on;
 - then to prevent accidental shifting of handle 11 during transportation, move blocking retainer 1 to the rotation axis of handle 11. In this case handle 11 gets mechanically blocked in the upper position (“uplift”).

To turn off the “dampening” mode, press button 2. The annunciator of “dampening” activation goes out, and RLL returns to the upper position. Move retainer 1 to its initial position.

ATTENTION: THE “DAMPENING” MODE IS ACTIVE ONLY WHEN HANDLE 11 IS IN THE “UPLIFT” POSITION!

ATTENTION: DURING FIELD WORK (TILLAGE, CULTIVATION, ETC.) THE “DAMPENING” MODE SHALL BE TURNED OFF!

Your tractor can be equipped with the RLL control panel ПУ-03 manufactured by “Izmeritel” plant and shown in figure 2.17.2.



1 – handle of lift linkage control (position 16 – uplift; position 15 – off; position 14 – lowering (in operation – automatic control); position 3 – mode of implement deepening in case it raises (non-fixed)); 2 –retainer to lock the lift linkage control handle; 4 – annunciator of linkage uplifting (red color); 5 – handle to adjust depth of soil tillage; 6 – troubleshooting annunciator (red color); 7 – handle to adjust height limit of linkage uplifting; 8 – “dampening” button; 9 – “dampening” annunciator (green color); 10 – handle to adjust speed of lowering; 11 – RLL position indicator (green color, upper scale point – RLL in max. raised position, lower scale point – RLL fully lowered); 12 – handle to select control method; 13 – annunciator of linkage lowering (green color).

Figure 2.17.2 – Rear lift linkage control panel ПУ-03

Note – RLL position indicator 11 (figure 2.17.2) is not used on “BELARUS-1523.5” tractors.

The rules on using the RLL control panel ПУ-03 manufactured by “Izmeritel” plant are similar to the rules on using the RLL control panel produced by “BOSCH” company, shown in figure 2.17.1.

2.17.3 Remote buttons of RLL control system

Remote buttons of RLL control are used as a rule for coupling agricultural implements and machines to the rear lift linkage.

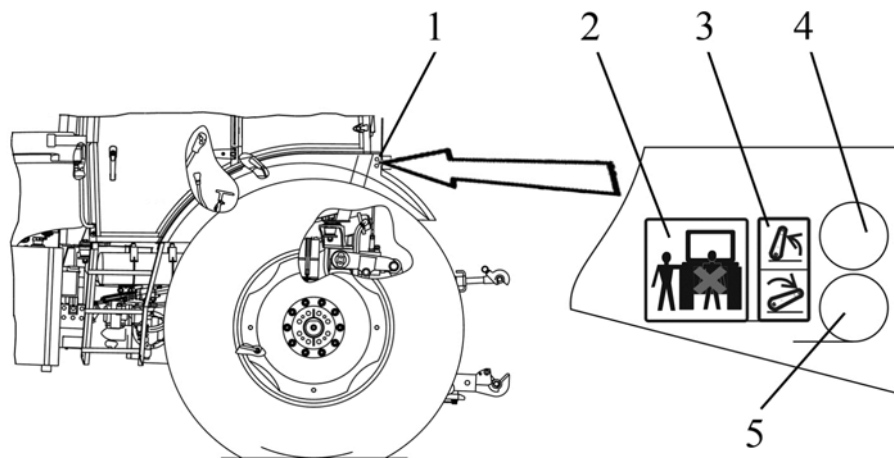
Uplift and lowering of the rear lift linkage with remote buttons on rear wheel fenders can be carried out at different control modes – handles 4, 6, 7, 8, 11 (figure 2.17.1) and similar handles of the RLL control console ПУ-03 can be left in any position, as the system of control from inside the cab is blocked in this case.

To lift the RLL, press any of buttons 4 (figure 2.17.3) and hold it pressed. To lower the RLL, press any of buttons 5 and hold it pressed.

For safety reasons control with remote buttons shall be performed with interruption of work. Pressing uplift button 4 (lowering button 5) and holding it pressed lifts up (lowers) the RLL for 5 sec., then it stops. For further uplifting (lowering) it is necessary to press the corresponding button once again and hold it pressed!

Then after attaching the implement, activation and operation with RLL shall be performed in accordance with subsection 2.17.2.

WARNING: WHEN USING REMOTE BUTTONS OF RLL CONTROL DO NOT STAND BETWEEN THE TRACTOR AND THE ATTACHED IMPLEMENT! TO PREVENT ACCIDENTS IT IS FORBIDDEN TO USE BUTTONS OF MECHANICAL SHIFTING OF ELECTRIC VALVES OF REGULATOR EHR23-LS!



1 – RLL remote control console; 2 – instruction plate on safety regulations; 3 – instruction plate on RLL control diagram; 4 – RLL uplift button; 5 – RLL lowering button.

Figure 2.17.3 – RLL controlled with remote buttons

2.17.4 Troubleshooting of RLL electronic control system

The electronic control system installed on your tractor has an option of self-testing and if any failures are detected, it provides the operator with code information by means of troubleshooting annunciator 5 (figure 2.17.1) on RLL control panel. After the engine start, as specified in subsection 2.17.2, annunciator 5 is constantly on, if no failures are detected in the RLL control system. Moving handle 11 up or down deactivates annunciator 5.

If any failures are detected in the system after the engine start, annunciator 5 begins to show code information of the failure. If necessary the system gets blocked.

The failure code is displayed as a two-digit number, where the first digit is equal to the number of flashings of annunciator 5 after the first long pause, and the second digit is equal to the number of flashings after the second long pause. For example, the operation algorithm of annunciator 5 is the following:

- engine start;
- continuous glowing;
- after unblocking the system, the annunciator goes out;
- three-time flashing of the annunciator;
- long pause (glow missing);
- six-time flashing of the annunciator;
- long pause (glow missing).

It means that the system has a failure with a code “36”. If several failures are detected at the same time, the system indicates failure codes one after another dividing them with a long pause.

All failures are divided by the system into three groups: complex, medium and light.

If complex failures are detected, the control is stopped and the system gets deactivated. The system is not controlled with the control panel or with the remote buttons.

The troubleshooting annunciator shows a failure code. After elimination of the failure and the engine start, the system recovers.

If medium failures are detected, the control is stopped and the system gets blocked. The system is controlled only with the remote buttons and is not controlled from the main console. The troubleshooting annunciator shows a failure code. After elimination of the failure and the engine start, the system recovers.

If light failures are detected, the troubleshooting annunciator shows a failure code, but the system remains controlled and is not blocked. In case of light failures, the RLL control system operates improperly – there is no correct soil sensing. After elimination of the failure, the troubleshooting annunciator goes out.

If the system detects a failure related to any group of complexity, the following actions shall be taken:

- read the code;
- stop the engine;
- contact your dealer and inform him of the read code in order to eliminate the problem;
- after your dealer eliminates the problem, start the engine and if there are no failures, get down to work.

If the RLL control panel ПУ-03 manufactured by “Izmeritel” plant is installed (troubleshooting annunciator 6 (figure 2.17.2), RLL control handle 1) troubleshooting of the RLL electronic control system is the same.

2.17.5 Front lift linkage control

The front lift linkage, installed against order, is controlled by handle 2 or 3 (figure 2.19.1) which in their turn control the second and the third sections of the hydraulic valve group, respectively.

Note – Connection of the FLL control to the first section of the hydraulic valve group having the fixed position “uplift” is not reasonable, as this section is intended to control the hydraulic units of coupled machines having a hydraulic drive with permanent oil circulation (hydraulic motor).

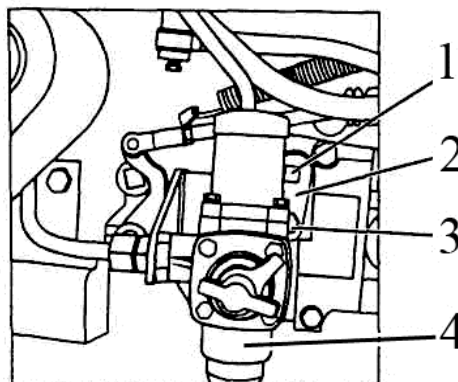
2.18 HLL pump control

The HLL pump is located on the coupling clutch body to the left.

The HLL pump switching shaft 1 (figure 2.18.1) has two positions:

- “shaft on” – the shaft is turned clockwise against the stop;
- “shaft off” – the shaft is turned contraclockwise against the stop.

Before turning shaft 1 to any of two positions, loosen bolt 3 by 1,5...2 revolutions and turn shaft 1 together with locking plate 2. Tighten bolt 3.



1 – shaft; 2 – locking plate; 3 – bolt; 4 – pressure adjustor in the pneumatic system.

Figure 2.18.1 – HLL pump control

Note – Figure 2.18.1 shows the position “HLL pump on”.

ATTENTION: THE PUMP SHALL BE TURNED ON AND OFF ONLY WITH THE MIN. IDLE SPEED OF THE ENGINE!

In case of failures in the HLL that lead to oil leakage out of the hydraulic lift linkage, the pump shall be turned off when moving the tractor to repair facilities.

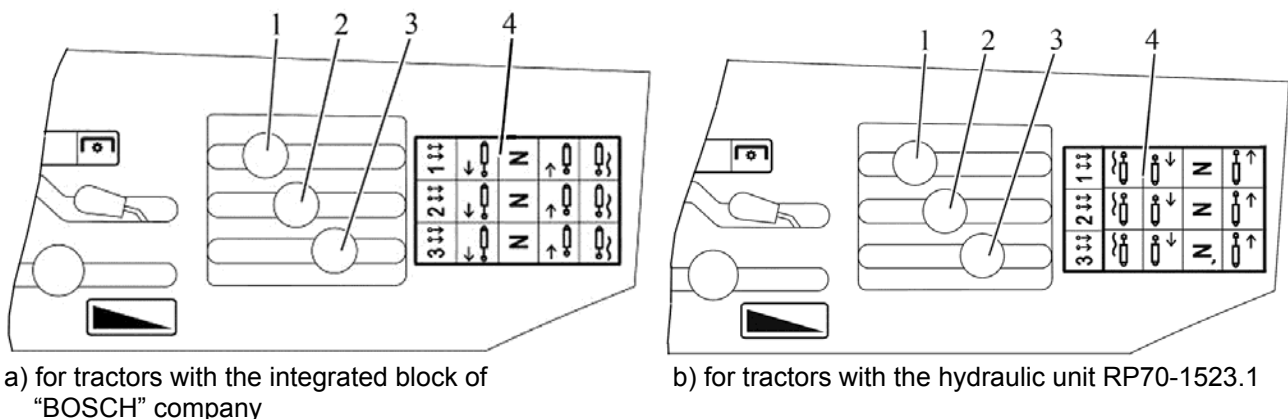
2.19 HLL valve group section control (remote cylinders)

The control handles are located on the right side console of the cab. The handles have the following positions: “neutral”, “lowering”, “floating” and “uplift”.

Handle 3 (figure 2.19.1) controls the left section of the valve group as viewed along tractor movement (left rear outlets of the hydraulic system). It can be fixed in positions “floating” and “neutral”. When set into positions “lowering” and “uplift”, the handle shall be held with a hand, when released the handle automatically returns to “neutral” position.

Handle 2 controls the middle section of the valve group (middle rear outlets of the hydraulic system). It can be fixed in positions “floating” and “neutral”. When set into positions “lowering” and “uplift”, the handle shall be held with a hand, when released the handle automatically returns to “neutral” position.

Handle 1 controls the right section of the valve group (right rear outlets of the hydraulic system). It can be fixed in positions “floating”, “neutral” and “uplift”. When set into position “lowering”, the handle shall be held with a hand, when released the handle automatically returns to “neutral” position. For the valve group of “BOSCH” company handle 1 automatically returns to “neutral” position from the “uplift” position when the automatic return pressure is reached (from 17,5 to 19,5 MPa). Your tractor can be equipped with a valve group of the hydraulic unit RP70-1523.1 where handle 1 does not have the mechanism of automatic return from the “uplift” position. In this case, after performing the uplift operation, handle 1 shall be returned to the “neutral” position manually.



1, 2, 3 – handles to control HLL valve group sections; 4 – instruction plate with the diagram of HLL valve group section control.

Figure 2.19.1 – HLL valve group section control

For tractors with the integrated block of “BOSCH” company:

- setting of valve spindles into the position “uplift” is performed by shifting the lever from the “neutral” position forward as viewed along tractor movement;
- setting of valve spindles into the positions “floating” and “lowering” is performed by shifting the lever from the “neutral” position backwards.

For tractors with the hydraulic unit RP70-1523.1:

- setting of valve spindles into the position “lowering” and “floating” is performed by shifting the lever from the “neutral” position forward as viewed along tractor movement;
- by shifting the lever from the “neutral” position backwards – valve spindles are set into the position “uplift”.

The instruction plate with the diagram of HLL valve group outlets connection to outer consumers is attached to the tractor valve group, as specified in figure 2.19.2. The valve group outlets are equipped with fast couplings with color protective covers.

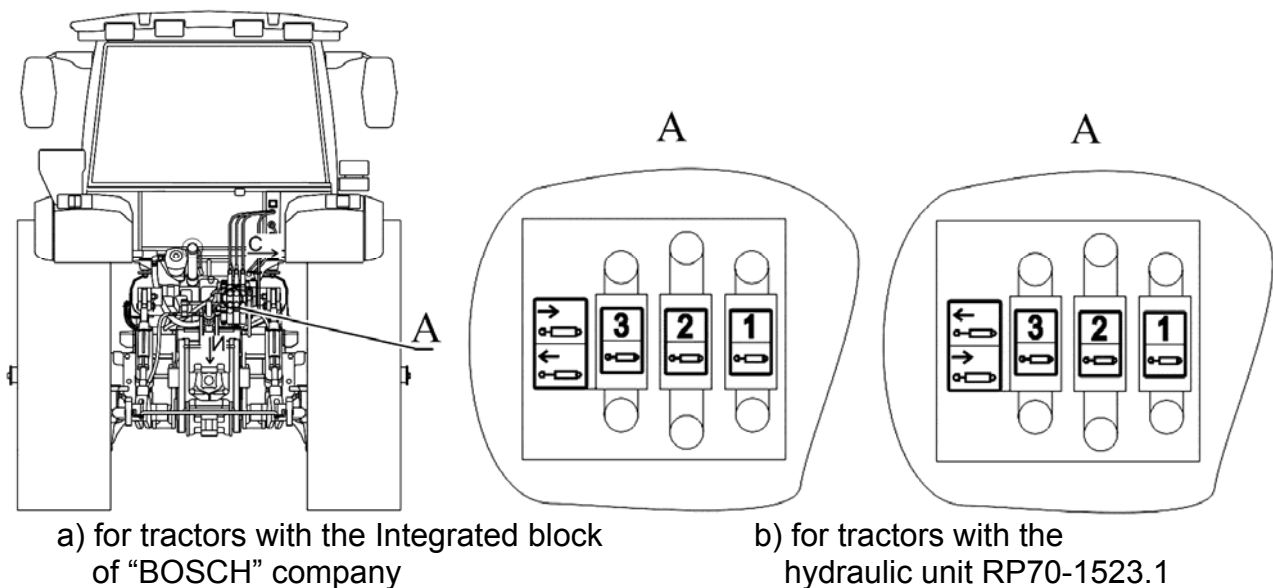


Figure 2.19.2 – Diagram of HLL valve group outlets connection to outer consumers
The outlet for the connection of the hydraulic motor drain pipe is shown in figure 2.19.3.

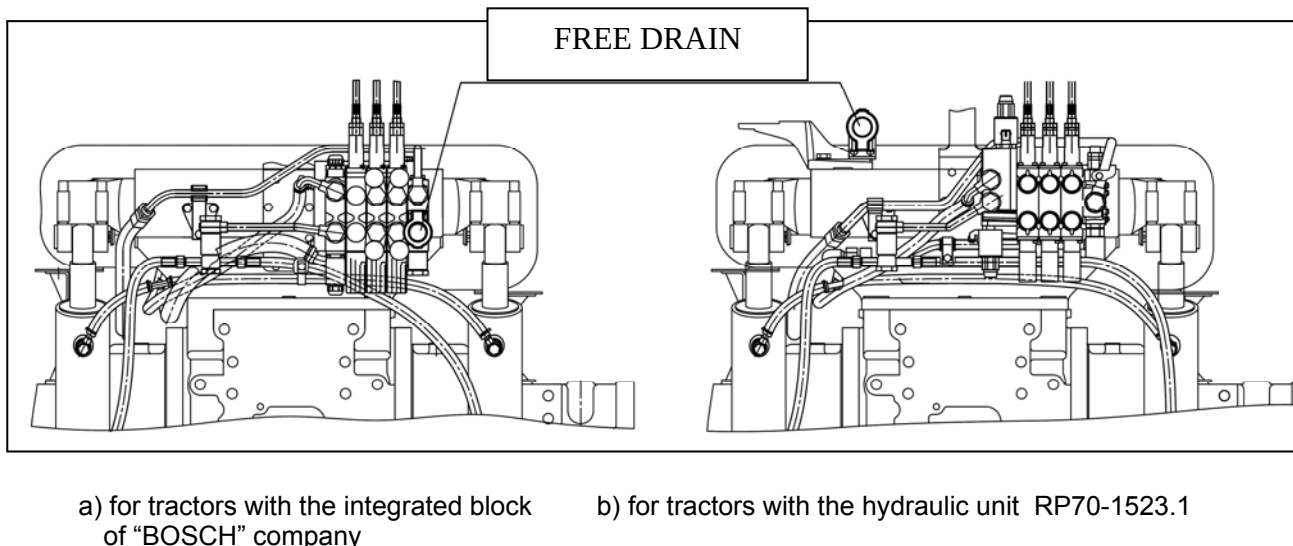


Figure 2.19.3 – Arrangement of free drain outlet

Note – Tractors with the hydraulic block RP70-1523.1 may not be equipped with free drain outlet.

2.20 Switching unit and electric cutout fuses

2.20.1 General information

Electric cutout fuses are intended for the protection of electrical lines against overloads and short circuit.

WARNING: TO AVOID BURNING OF TRACTOR WIRING, NEVER USE FUSES WITH CURRENT RATING HIGHER THAN THE RATINGS SPECIFIED IN THIS SECTION. IF A FUSE OFTEN BURNS OUT, FIND OUT THE CAUSE AND ELIMINATE THE FAILURE!

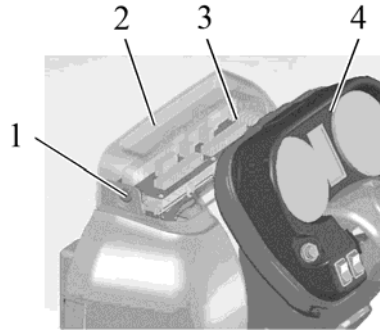
2.20.2 Switching unit and fuses for electrical equipment

Switching unit 3 (figure 2.20.1) is intended for current supply, its distribution among the consumers of tractor electrical equipment and for the protection of electrical lines against current overloads and short circuit.

Your tractor can be equipped with two types of switching units - BKA-7.3722 or BK-1 which are interchangeable.

The place of unit 3 mounting is the cab, on the metallic bar of plastic shell fixing, between instrument panel 4 and the windscreen.

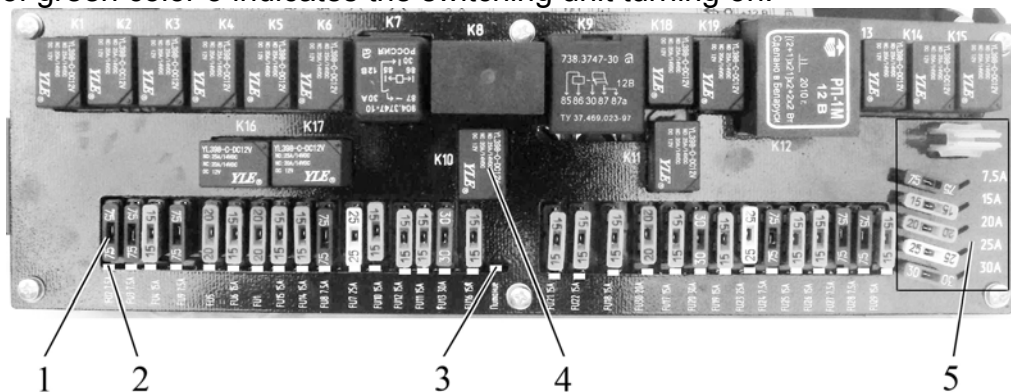
To get an access to the relay and the fuses of unit 3, it is required to unscrew two quick-detachable screws 1, then to remove plastic cap 2. The unit also has the protective plastic casing for the protection from dust.



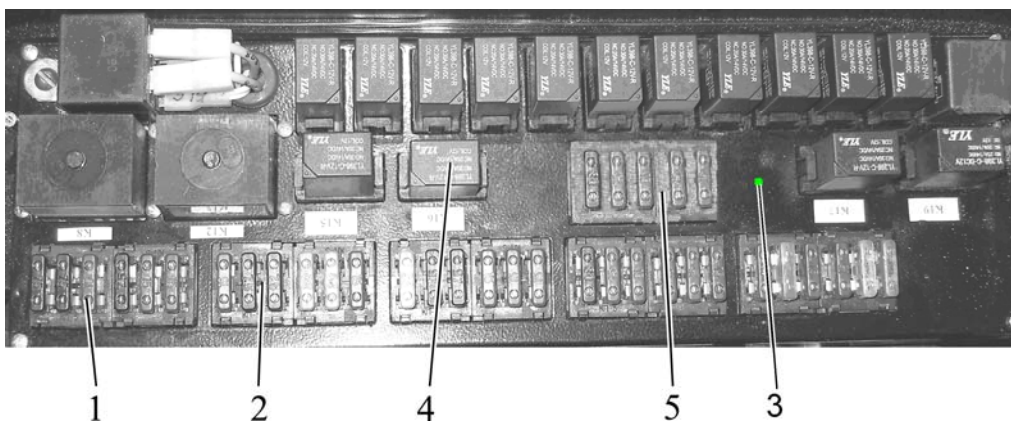
1 – screw; 2 – cap; 3 – switching unit; 4 – instrument panel.

Figure 2.20.1 – Switching unit mounting

The unit consists of thirty cutout fuses 1 (figure 2.20.2) (FU1-FU30) and eighteen electromagnetic relays 4 (K1-K7, K9-K19, relay K8 is not mounted), commutating current supply for consumers, a set of spare fuses 5. Signal led lamps of red color 2 located on the front board near each fuse are intended for indication of a corresponding fuse blow out. A signal led lamp of green color 3 indicates the switching unit turning on.



a) BKA-7.3722

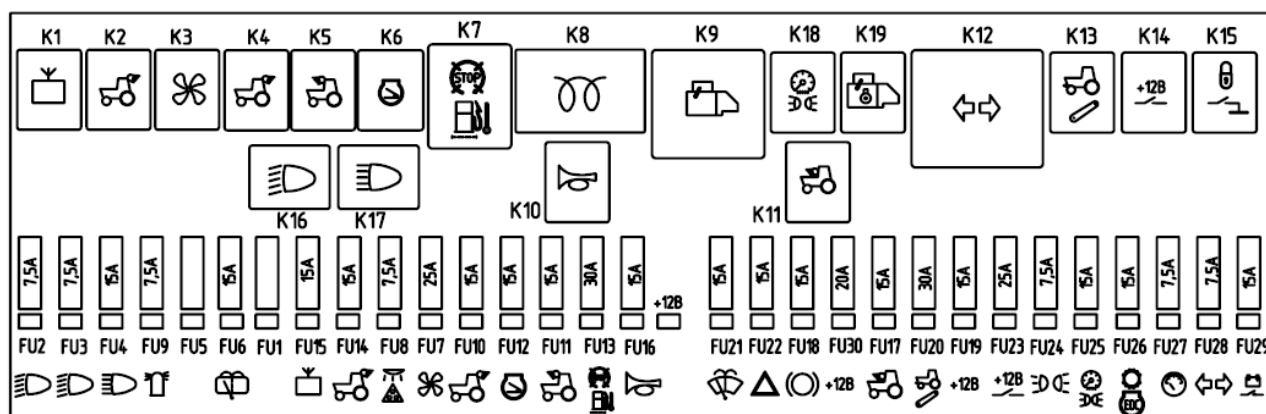


b) BK-1

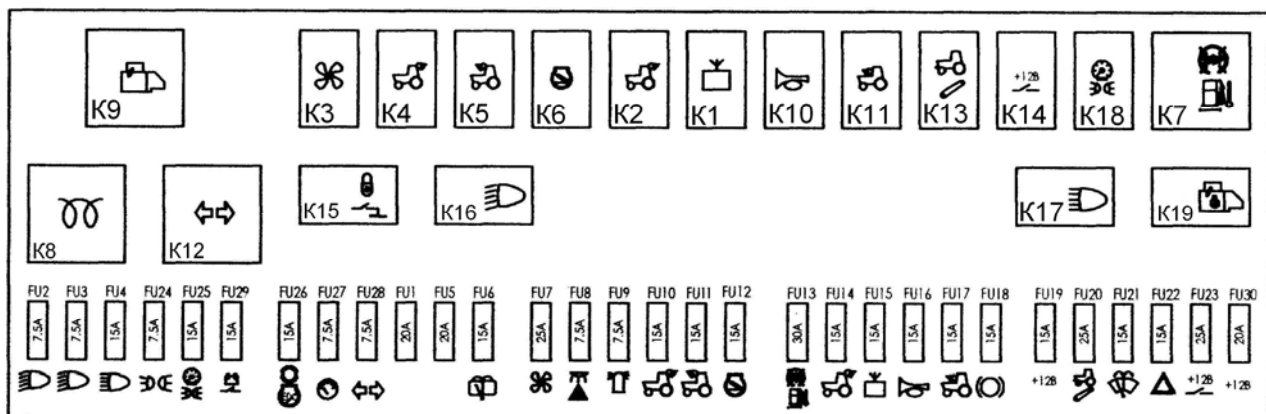
1 – cutout fuse; 2 – signal led lamp of red color; 3 – signal led lamp of green color; 4 – electromagnetic relay; 5 – set of spare fuses.

Figure 2.20.2 – Switching unit

Diagram of fuses and relay location in the switching unit is shown in figure 2.20.3.



a) Diagram of fuses and relay location in BKA-7.3722



b) Diagram of fuses and relay location in BK-1

Figure 2.20.3 – Diagram of fuses and relay location in the switching unit

Tables of fuses and relay assignment shown in figure 2.20.3 are stuck from inside to the upper plastic cap 2 (figure 2.20.1) from the windscreen side.

The information on fuses and relay assignment as well as fuse ratings is given in tables 2.8 and 2.9.

Table 2.8 – Assignment of switching unit fuses

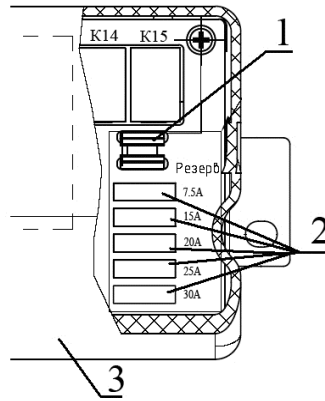
Fuse designation	Fuse assignment (protected electric circuit)	Fuse rating
FU1	Reserve	20A
FU2	Lower beam of right road headlight	7,5A
FU3	Lower beam of left road headlight	7,5A
FU4	Road headlights upper beam	15A
FU5	Reserve	20A
FU6	Rear screen washer and wiper	15A
FU7	Power supply to conditioner electric motor	25A
FU8	“Road-train” lights and cab light	7,5A
FU9	Signal beacon	7,5A
FU10	Rear working lights (a pair of outer lights)	15A
FU11	Front working lights (on the roof)	15A
FU12	Not used	15A

FU13	Fuel filter heater	30A
FU14	Rear working lights (a pair of inner lights)	15A
FU15	Radioset (stereo-recorder)	15A
FU16	Horn	15A
FU17	Front working lamps (on the handgrip)	15A
FU18	Braking lights	15A
FU19	Power supply of terminal No.8 on the socket for the trailed agricultural implement connection (portable lamp)	15A
FU20	Signal from the generator terminal "D" to the RLL control system	30A
FU21	Front screen washer and wiper	15A
FU22	Warning indication	15A
FU23	Power supply to consumers working when the starter and instrument switch is in the position "instruments on"	25A
FU24	Left parking lights	7,5A
FU25	Right parking lights and instruments illumination	15A
FU26	EECS, gearbox reduction unit control	15A
FU27	Test instruments, sensors of speed, PTO and fuel volume	7,5A
FU28	Annunciation of tractor and trailer turning	7,5A
FU29	Remote disconnect switch of accumulator battery	15A
FU30	Power supply of relay coil of instruments illumination and tractor parking lights engagement	20A

Table 2.9 – Relay assignment

Relay designation	Relay assignment
K1	Radioset (stereo-recorder)
K2	Rear working lights (a pair of inner lights)
K3	Conditioner
K4	Rear working lights (a pair of outer lights)
K5	Front working lights (on the roof)
K6	Not used
K7	Fuel filter heater
K8	Not used
K9	Starter
K10	Horn
K11	Front working lamps (on the handgrip)
K12	Tractor turning indication and emergency indication
K13	Signal from the generator terminal "D" to the RLL control system
K14	Power supply to consumers working when the starter and instrument switch is in the position "instruments on"
K15	Lock of AB remote disconnect switch
K16	Lower beam of road headlights
K17	Upper beam of road headlights
K18	Parking lights and instrument illumination
K19	Starter startup lock with gearbox range engaged

A set of spare fuses 5 (figure 2.20.2) installed on the front panel of the switching unit, includes spare fuses 2 (figure 2.20.4) with ratings 7,5A, 15A, 20A, 25A, 30A and for BKA-7.3722 - fuse removal tool 1. BK-1 is not completed with the fuse removal tool.



1 – fuse removal tool; 2 – spare fuses; 3 – switching unit.

Figure 2.20.4 – Set of spare fuses for the switching unit BKA-7.3722

Electrical connection of equipment harnesses to the switching unit is shown in figure 2.20.5.

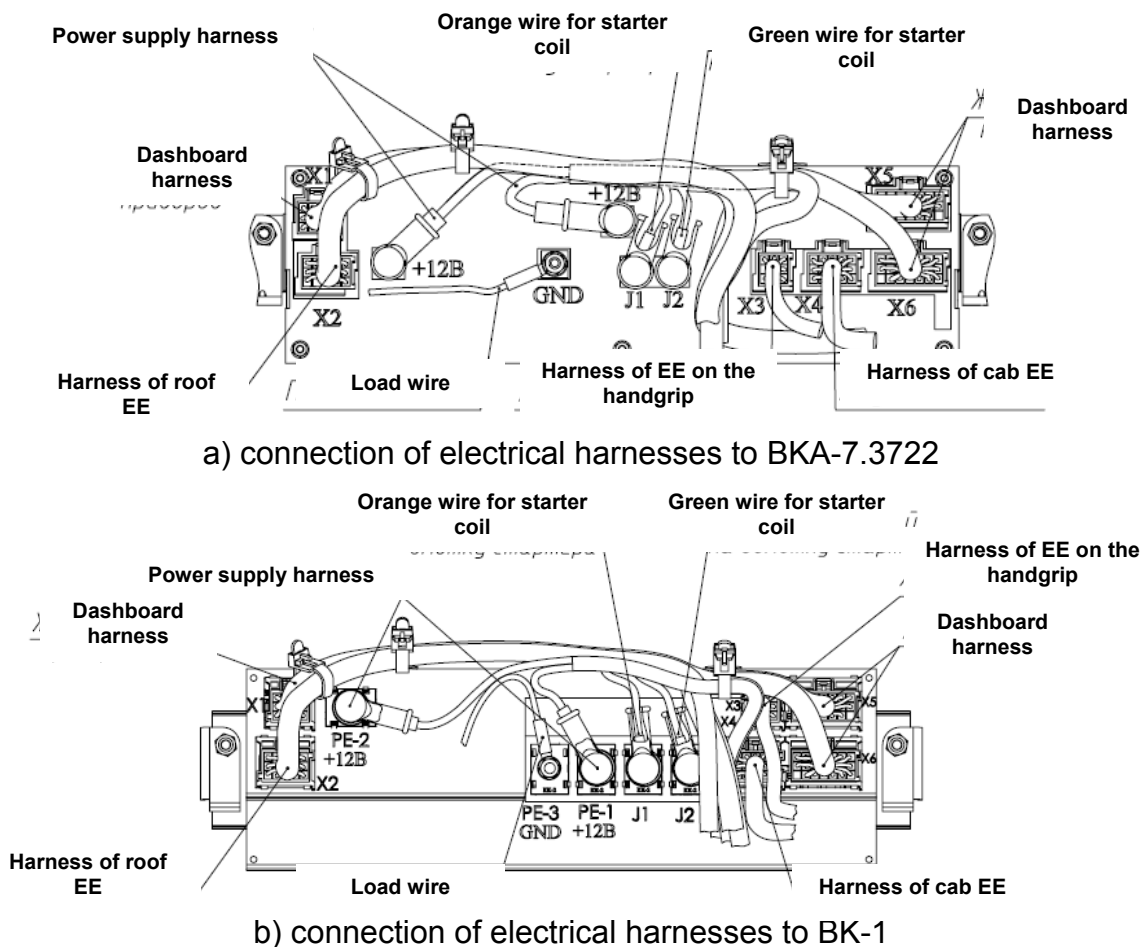
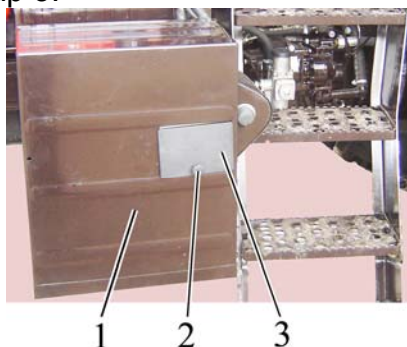


Figure 2.20.5 – Diagram of equipment harnesses connection to the switching unit

Apart from fuses located in the switching unit and shown in figure 2.20.3, electrical equipment fuses are also located in the accumulator box, in the engine area under the air purification filter and on the voltage converter 12/24W.

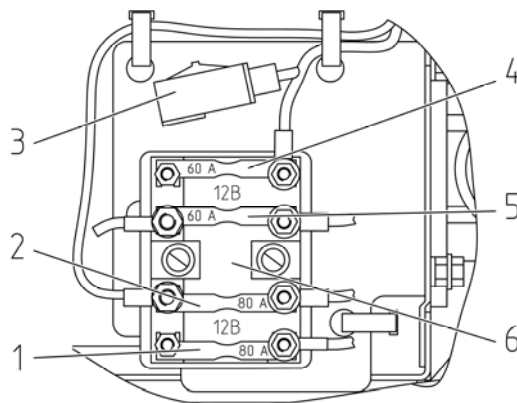
To get an access to the fuses located in accumulator box 1 (figure 2.20.6), it is required to turn off screw 2 and remove cap 3.



1 – accumulator box; 2 – screw; 3 – cap.

Figure 2.20.6 – Access to the fuses located in the accumulator box

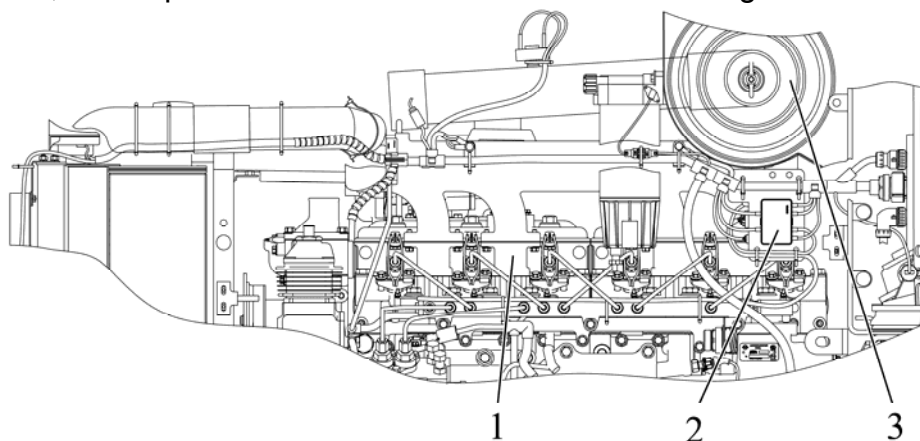
The fuses located in the accumulator box are shown in figure 2.20.7.



1 – power fuse of the instrument board before engine start and of the main accumulator battery charging circuit with rated value of 80 A; 2 – duplicate fuse; 3 – additional suspended power fuse of a radio recorder with rated value of 25A; 4 – power fuse of a radio recorder with rated value of 60A; 5 – EECS constant supply fuse (in any position of the accumulator battery switch) with rated value of 60A; 6 – fuse block.

Figure 2.20.7 – The fuses located in the accumulator box

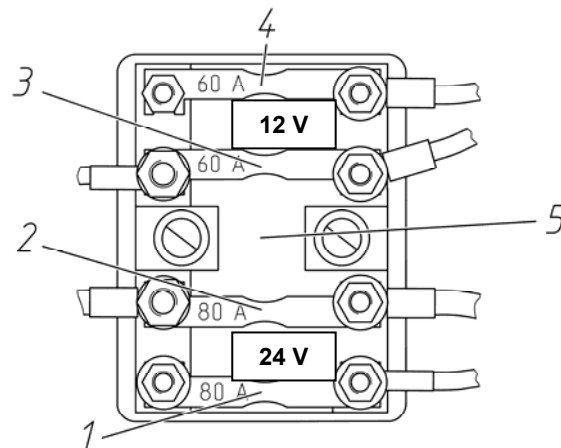
To get an access to the fuse block (figure 2.20.8) located in the engine area under the air purification filter, it is required to remove the left side of the casing.



1 – engine; 2 – fuse block; 3 – air purification filter.

Figure 2.20.8 – Arrangement of the fuse block in the engine area

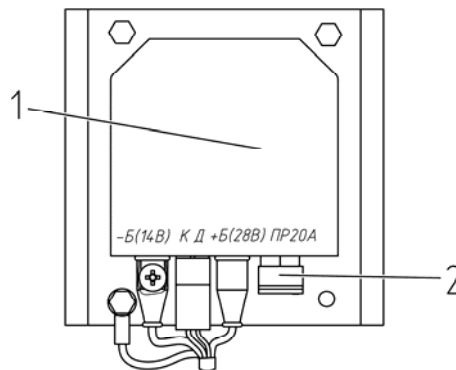
The fuses located in the engine area under the air purification filter are shown in figure 2.20.9.



1 – power fuse of the starter relay and the additional AB charging circuit with rated value of 80A; 2 – power fuse of heating plugs with rated value of 80A; 3 – power fuse of the switching unit and of voltage converter 12/24V with rated value of 60A; 4 – power fuse of the switching unit with rated value of 60A; 5 – fuse block.

Figure 2.20.9 – Fuses located in the engine area

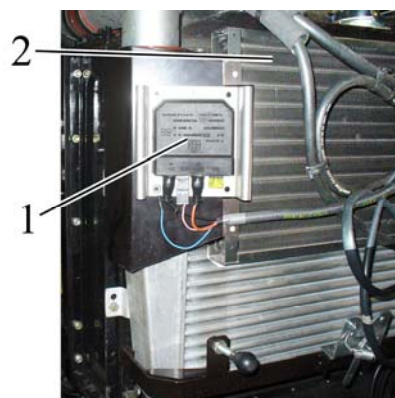
Fuse 2 (figure 2.20.10) of voltage converter 1 is built in the VC casing.



1 – voltage converter; 2 – voltage converter fuse with rated value of 20A.

Figure 2.20.10 – Installation of voltage converter fuse

Voltage converter 12/24W is installed before the radiator block on the right as viewed along tractor movement, as it is shown in figure 2.20.11.

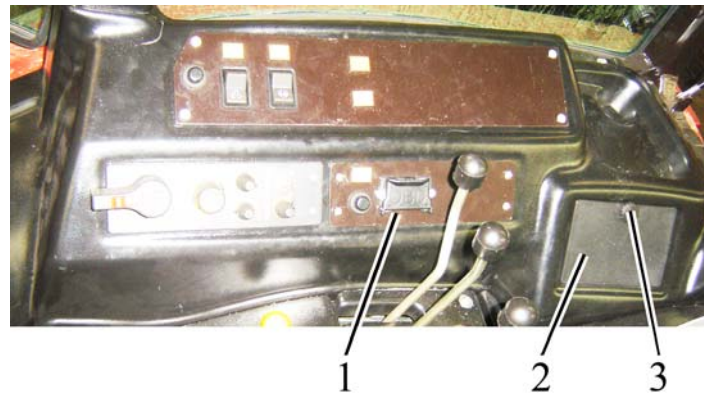


1 – voltage converter; 2 – air conditioner radiator.

Figure 2.20.11 – Installation of voltage converter

2.20.3 Fuses for electronic systems of DL, FDA, GB reduction unit, FPTO and RLL control

To access the cutout fuses of electronic control systems (ECS), turn off screw 3 (figure 2.20.12) on cap 2 of side console 1 and open the cap.



1 – side console; 2 – cap; 3 – screw.

Figure 2.20.12 – The location of fuses for ECS of DL, FDA, GB reduction unit, FPTO and RLL.

The fuses for ECS of DL, FDA, GB reduction unit, FPTO (if mounted) and RLL are shown in figure 2.20.13.

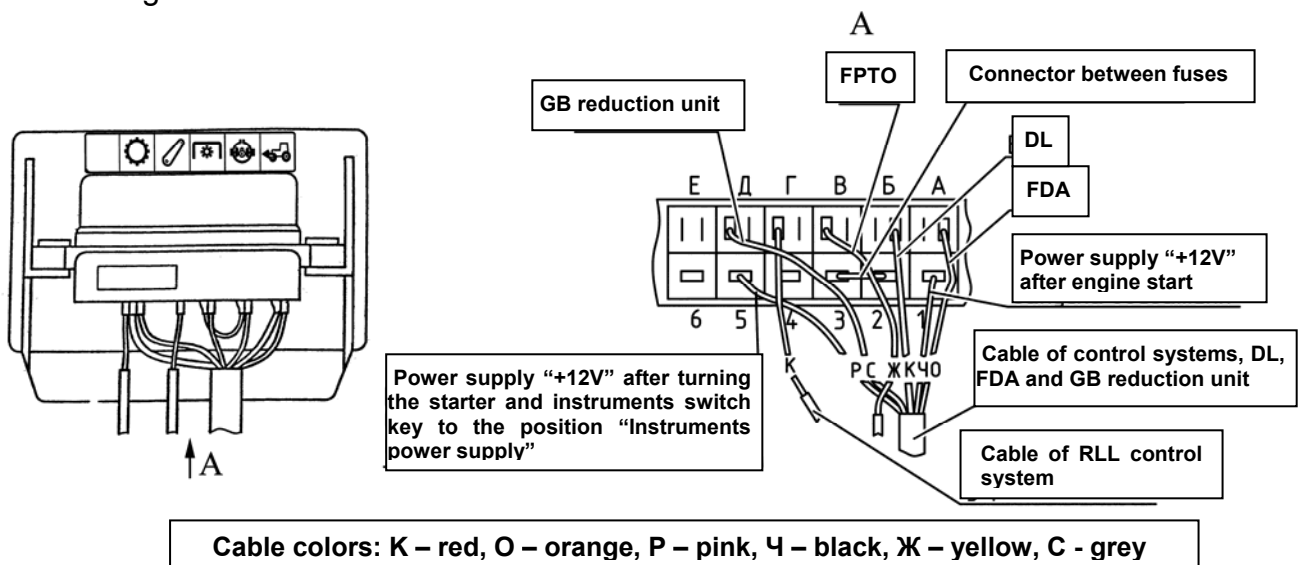


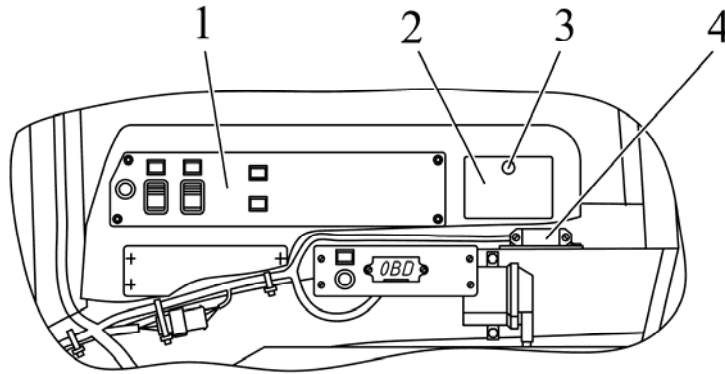
Figure 2.20.13 – Fuses for ECS of DL, FDA, GB reduction unit, FPTO and RLL
Five cutout fuses (figure 2.20.13) protect the following electric circuits from overcharge:

- 1 – FDA drive control (7,5 A);
- 2 – rear axle DL control (7,5 A);
- 3 – FPTO control, if mounted (7,5 A);
- 4 – RLL control (7,5 A);
- 5 – GB reduction unit control, if mounted (15 A);
- 6 – duplicate (7,5 A).

2.20.4 Fuses for engine electronic control system

The installation place of the fuse for the EECS constant supply (at any position of the AB switch) with rated value of 60A is shown in fig. 2.20.7.

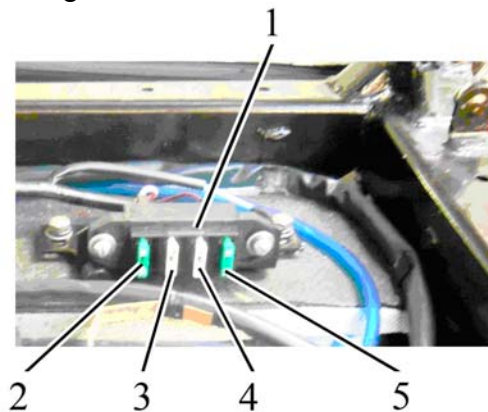
To get an access to the rest of the EECS cutout fuses, turn off screw 3 (figure 2.20.14) on cap 2 of side console 1 and open the cap. The EECS block fuse is fixed to the element of the cab housing.



1 – side console; 2 – cap; 3 – screw; 4 – EECS block fuse.

Figure 2.20.14 – The location of EECS fuses

The EECS fuses are shown in figure 2.20.15.



1 – block fuse; 2 – power fuse of the engine electronic control box; 3, 4 – duplicate fuse; 5 – power fuse of the reagent AdBlue hose pipe heaters (discharge, drain, intake) and of SCR system feeding module heater.

Figure 2.20.15 – EECS fuses

2.21 Cab locks and handles

2.21.1 Cab door locks

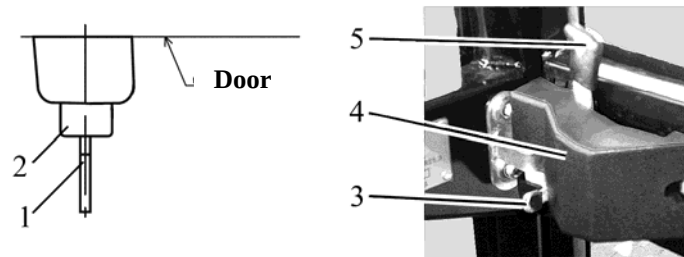
Left and right doors of tractor cab are secured with locks 4 (figure 2.21.1). Lever 5 serves to open the left and right cab doors from inside the cab. Moving lever 5 backwards unlocks the door. The locks of the right and left doors can be blocked from inside the cab. To block the lock from inside the cab, it is required to shift detent 3 into the extreme upper position. To unblock the lock, it is required to shift detent 3 into the extreme lower position, respectively.

With locks 4 unblocked, the left door opens from outside by pressing button 2 of the handle.

The lock of the cab left door can be opened and closed from outside. To close it from outside, do the following:

- insert key 1 into the hole of the cylinder mechanism, which is located in button 2;
- without pressing button 2, turn the key into the position "close".

To open the left door lock outside the cab, it is necessary to insert key 1 into the hole of the cylinder mechanism which is located in button 2 and without pressing button 2, turn the key into the position "open", then press button 2.



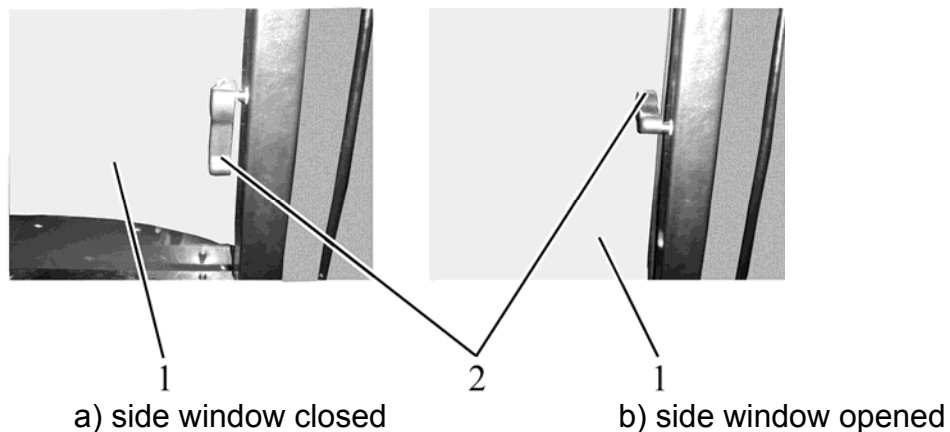
1 – key; 2 – button; 3 – detent; 4 – lock; 5 – lever.

Figure 2.21.1 – Cab door lock

2.21.2 Side window opening

To open right or left side window 1 (figure 2.21.2), turn handle 2 up and push it. Then fix the side window in an open position, for which turn handle 2 down.

To close side window 1, turn handle 2 up, then pull handle 2, then turn it down until the side window is fixed in a closed position.



1 – side window; 2 – handle.

Figure 2.21.2 – Side window opening

2.21.3 Rear screen opening

To open the rear screen, turn handle 1 (figure 2.21.3) to the left (as viewed along tractor movement) and holding handgrip 2, push rear screen 3 until the screen is fixed in the open position. To close the rear screen, pull handgrip 2 until screen 3 is fixed in a closed position.



1 – handle; 2 – handgrip; 3 – rear screen.

Figure 2.21.3 – Rear screen opening

2.21.4 Cab hatch opening

Installation of two hatch variants for roof upper part is possible on tractors “BELARUS-1523.5”:

- hatch with a detent;
- hatch with a handle.

To open the hatch with the detent, pull board 2 (figure 2.19.4) down, move the detent 3 forward as viewed along tractor movement, push board 2 up until hatch 1 is fixed in an open position.

To close hatch 1, pull board 2 down until the hatch is fixed in the closed position.

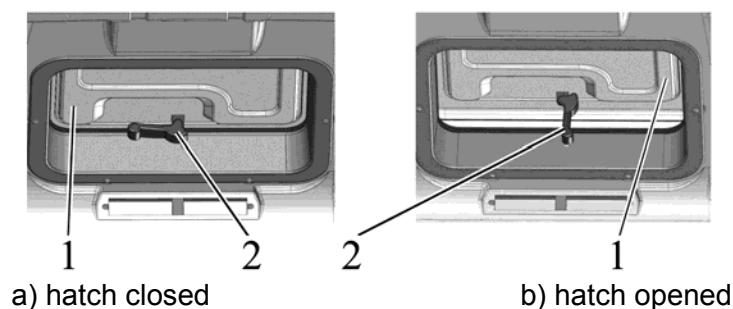


1 – hatch; 2 – board; 3 – detent.

Figure 2.19.4 – Opening of hatch with the detent

To open the hatch with the handle, move handle 2 (figure 2.19.5) down and push it up. Then fix hatch 1 in an open position, pressing handle 2 to the right as viewed along tractor movement.

To close the hatch, turn handle 2 to the position “not fixed”, pressing it to the left as viewed along tractor movement. Pull handle 2 down, and then turn it to the right as viewed along tractor movement until the hatch is fixed in a closed position.



1 – hatch; 2 – handle.

Figure 2.19.5 – Opening of hatch with the handle

2.21.5 Cab emergency exits

The cab has the following emergency exits:

- doors – left and right;
- rear window;
- side window – right and left.

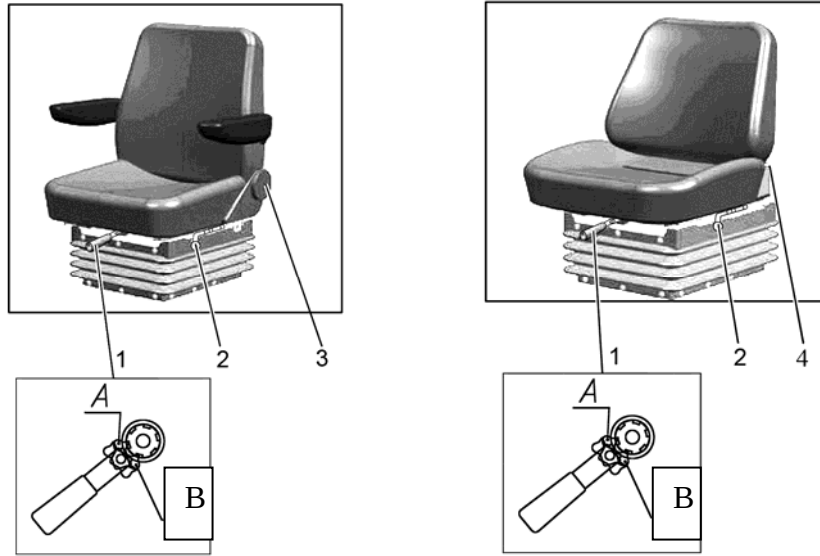
2.22 Seat and its adjustments

2.22.1 General information

The seat has a mechanical suspension, consisting of two spiral torsion springs and a gas charged shock absorber of bidirectional operation. A "scissors"-type guiding mechanism ensures strictly vertical movement of the seat. A dynamic seat stroke is 100 mm.

ATTENTION: BEFORE STARTING TO OPERATE THE TRACTOR, ADJUST THE SEAT TO REACH THE MOST COMFORTABLE POSITION. CARRY OUT ALL ADJUSTMENTS WHEN STAYING IN THE SEAT! THE SEAT IS CONSIDERED CORRECTLY ADJUSTED ACCORDING TO THE MASS IF IT MOVES HALF OF THE STROKE UNDER THE OPERATOR'S WEIGHT (THE SUSPENSION STROKE IS 100 MM)!

2.22.2 Adjustments of "BELARUS" seat.



a) Seat "BELARUS 80-6800010"

b) Seat "BELARUS 80B-6800000"

1 – handle for adjustment according to the weight; 2 – handle for longitudinal adjustment; 3 – hand wheel for backrest tilt adjustment; 4 – handle for backrest adjustment

The seat "BELARUS" has the following adjustments:

- adjustment according to the operator's weight. It is carried out by means of handle 1 (figure 2.22.1) within the range from 50 to 120 kg. To adjust the seat for a bigger weight it is required to shift the pawl of lever 1 into the position "A" and tighten the springs with a reciprocal movement. To adjust the seat for a smaller weight, it is required to shift the pawl into the position "B" and release the springs with a reciprocal movement.

- longitudinal adjustment. It is carried out by means of handle 2 within the range of ± 80 mm from the middle position. To move the seat forward-backwards, it is required to pull handle 2 up, move the seat and then release the handle. The seat will automatically get locked in a required position.

- adjustment of the backrest tilt angle:

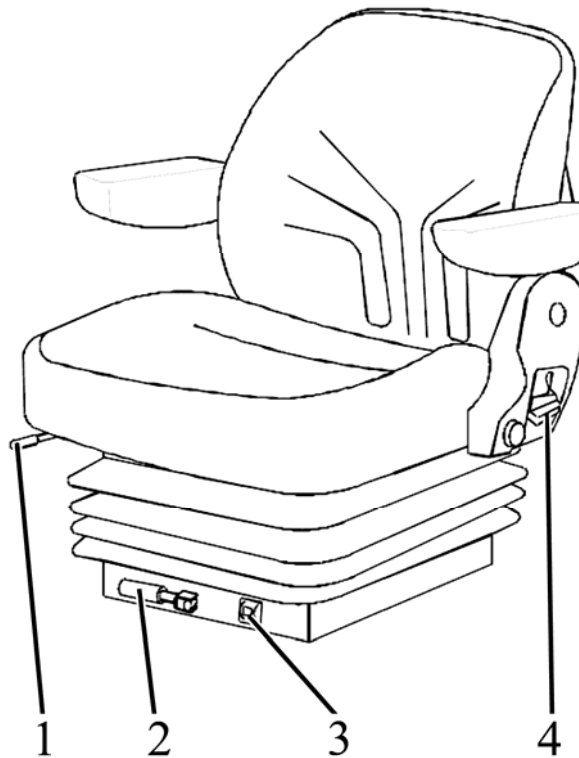
a) For the seat "BELARUS 80-6800010" the backrest tilt angle is adjusted by means of hand wheel 3 within the range from minus 15° to plus 20° . To increase the backrest tilt angle, it is necessary to turn the hand wheel clockwise, to decrease it – counterclockwise.

b) For the seat "BELARUS 80B-6800000" the backrest tilt angle is adjusted by means of handle 4 within the range from plus 5° to plus 25° . To change backrest tilt angle, it is required to pull handle 4 up against the stop, move the backrest to the necessary direction to achieve the required angle and then release the handle. The seat will get locked in a required position.

- height adjustment is carried out within the range of ± 30 mm from the middle position. The seat has three height positions: "lower", "middle" and "upper". To move the seat from the "lower" position to the "middle" position or from the "middle" position to the "upper" one, it is required to lift the seat smoothly till the arresting stop goes off (a specific click is heard). To move the seat from the "upper" position to the "lower" one, it is necessary to lift the seat against the stop with an abrupt movement and let it down. It is impossible to move the seat from the "middle" position to the "lower" one.

2.22.3 Adjustments of “Grammer” seat

Against order your tractor can be equipped with “Grammer” seat (figure 2.22.2).



1 – handle for longitudinal adjustment; 2 – handle for adjustment according to the weight;
3 – indicator of seat adjustment according to the weight; 4 – handle for backrest tilt adjustment.

Figure 2.22.2 – “Grammer” seat adjustments

The “Grammer” seat has the following adjustments:

adjustment according to the operator's weight. It is carried out by means of handle 2 (figure 2.22.2) within the range from 50 to 130 kg with weight indication in 10 kg. To adjust the seat for a bigger weight, it is required to turn the handle clockwise, to adjust the seat for a smaller weight – turn it contraclockwise.

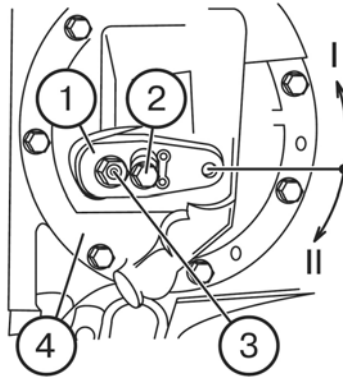
longitudinal adjustment. It is carried out by means of handle 1 within the range of ± 75 mm from the middle position. To move the seat forward-backwards, it is required to pull handle 2 up, move the seat and then release the handle. The seat will automatically get fixed in a required position.

adjustment of the backrest tilt angle. The backrest tilt angle is adjusted by means of lever 4 within the range from minus 10° to plus 35° . To change the backrest tilt angle, it is required to pull handle 4 up against the stop, move the backrest to the necessary direction to achieve the required angle and then release the lever. The seat will get locked in a required position.

- height adjustment. It is carried out within the range of ± 30 mm from the middle position. The seat has three height positions: “lower”, “middle” and “upper”. To move the seat from the “lower” position to the “middle” position or from the “middle” position to the “upper” one, it is required to lift the seat smoothly till the arresting stop goes off (a specific click is heard). To move the seat from the “upper” position into the “lower” one, it is necessary to lift the seat against the stop with an abrupt movement and let it down. It is impossible to move the seat from the “middle” position to the “lower” one.

2.23 Control of the transmission hydraulic system pump drive

The drive of the transmission hydraulic system pump is located on the left side of the gearbox body.



1 – lever; 2 – bolt; 3 – centre pin; 4 – gearbox pump drive assembly.

Figure 2.23.1 – Control of the transmission hydraulic system pump drive

Control lever 1 (figure 2.23.1) of the transmission hydraulic system pump drive can have two fixed positions:

position I – “Pump drive on” (normal operating position) – lever 1 is turned contraclockwise (when you look at the gearbox from the tractor left side) in relation to center pin 3 until the lower edge of the groove in lever 1 stops and fixed with bolt 2.

position II – “Pump drive off” (non-operating) position.

Shift lever 1 to the position II if it is required to mount and dismount the GB pump drive assembly 4, and then fix lever 1 in the position I again.

Note – Figure 2.23.1 shows the position “the transmission hydraulic system pump drive on”.

ATTENTION: TURN THE TRANSMISSION HYDRAULIC SYSTEM PUMP DRIVE ON AND OFF ONLY WITH THE ENGINE NOT RUNNING OR WITH MIN. IDLE SPEED OF THE ENGINE!

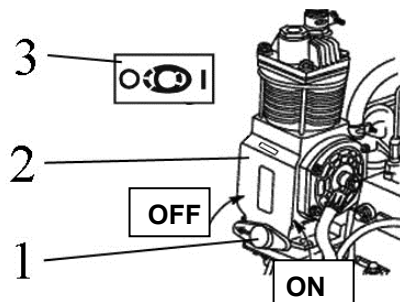
2.24 Control of the pneumatic system compressor

Handle for the pneumatic system compressor engagement 1 (figure 2.24.1) has two positions:

left (the arrow on the handle is directed forward as viewed along tractor movement) – “compressor off”,

right (the arrow on the handle is directed backward to tractor cab) – “compressor on”.

ATTENTION: TURN THE PNEUMATIC SYSTEM COMPRESSOR ON AND OFF ONLY WITH THE ENGINE NOT RUNNING OR WITH MIN. IDLE SPEED OF THE ENGINE!



1 – handle for the pneumatic system compressor engagement; 2 – pneumatic system compressor; 3 – diagram of the pneumatic system compressor control.

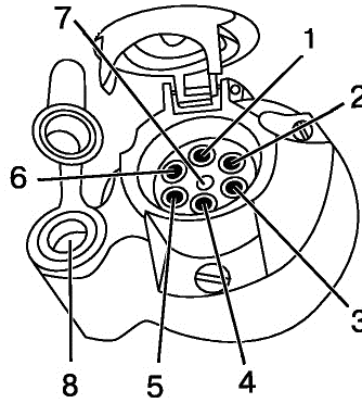
Figure 2.24.1 – Control of the pneumatic system compressor

Note – Figure 2.24.1 shows the position “pneumatic system compressor off”.

2.25 Connector elements of the electrical equipment

2.25.1 Socket to connect coupled agricultural equipment

A standard seven-pin socket with an additional receiver to connect a portable lamp (figure 2.25.1) is intended to connect current consumers of a trailer or a trailed agricultural implement. It is mounted on the rear cab support. A male plug of wire harness from a trailer or a coupled agricultural implement is connected to the socket.



1 – left turn indicator; 2 – horn; 3 – ground; 4 – right turn indicator; 5 – right clearance lamp; 6 – brake light; 7 – left clearance lamp; 8 – receiver to connect a portable lamp or other electrical elements with useful current up to 8A.

Figure 2.25.1 – Assignment of seven-pin socket terminals with an additional receiver to connect a portable lamp.

2.25.2 Connection of additional electrical equipment of coupled machines

To control the working process of coupled machines, it is possible to install control equipment (control consoles), which belongs to the coupled machine.

Coupled machines are equipped with various electrical and electronic units, the activity of which can influence the readings of tractor instruments. Thus, the used electrical instruments shall have a certificate of electromagnetic compatibility according to international requirements.

Connect electrical equipment of coupled machines to the following elements of tractor electrical equipment:

1. Seven-pin socket (type 12N, GOST 9200, figure 2.25.1) – permissible input current is not higher than 10A, the electrical circuit is protected by a fuse in tractor electrical equipment:

- “+” to terminal No.5 of the socket;
- “-” to terminal No.3 of the socket (it is possible to connect the coupled machine electrical consumer when the parking lights of this machine are on).

2. Two-pin socket (ISO 4165:2001), located on the body of the seven-pin socket (figure 2.25.1).

- (terminal No.8) – permissible input current is not higher than 12A, the electrical circuit is protected by a fuse in tractor electrical equipment;

3. Tractor generator.

- “+” to terminal “B+” of the generator
- “-” to the engine housing.

4. Electric socket and cigar lighter, mounted on the engine control panel.

ATTENTION: WHEN CONNECTING THE ELECTRICAL EQUIPMENT OF IMPLEMENTS COUPLED WITH THE TRACTOR, CONTACT YOUR DEALER AS WRONG CONNECTION OF ELECTRICAL EQUIPMENT OF IMPLEMENTS MAY RESULT IN BREAKAGE OF TRACTOR ELECTRICAL EQUIPMENT!

2.26 Creeper control

2.26.1 Creeper control on tractors with GB16x8

Against order your tractor can be equipped with a creeper.

The creeper is intended to be mounted on tractors, coupled with implements, requiring low speeds of travel.

The creeper additionally reduces tractor speed at the gears of the first range for forward and reverse travel by 4.5 times each.

If you need to use the gears of the first range for forward and reverse travel with their rated ratio, it is enough to turn off the creeper.

The creeper is controlled by a double-lever mechanism with links 1 and 2 (figure 2.26.1), brought into the cab to the left of the driver's seat.

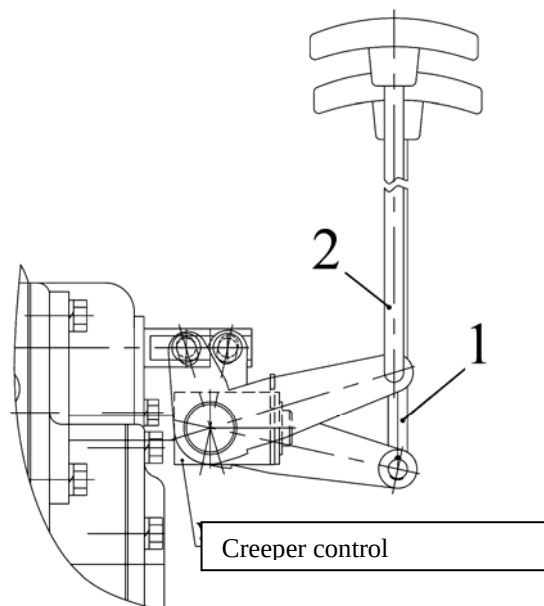
The creeper shall be operated in the following way:

to turn on the creeper, it is required to depress the clutch pedal and to shift down link 1 closest to the driver's seat, at the min. idle speed of the operating engine;

then, before starting the movement, engage the required gear with the gear levers and releasing the clutch pedal smoothly, shift up link 2 of the creeper farthest from the driver's seat;

to change the gear, depress the clutch pedal, engage the required gear with the gear levers and release the clutch pedal smoothly;

to turn off the creeper, force link 2 in, and pull link 1 out until pushers of both links get secured by the securing mechanism, located in the creeper body. The design of the securing mechanism excludes the possibility of simultaneous shifting of both links as well as their engagement one by one.



1, 2 – creeper control links.

Figure 2.26.1 – Creeper control elements

ATTENTION: IT IS TECHNICALLY POSSIBLE TO TURN ON THE CREEPER AT GEARS OF THE SECOND RANGE FOR FORWARD TRAVEL AND FOR REVERSE. HOWEVER, IN ORDER TO AVOID TRANSMISSION FAILURE AND OIL OVERHEATING IT IS FORBIDDEN TO OPERATE THE TRACTOR WITH THE CREEPER TURNED ON AT GEARS OF THE SECOND RANGE FOR FORWARD AND FOR REVERSE TRAVEL!

ATTENTION: TO OBTAIN ADDITIONAL INFORMATION ON PECULIARITIES OF OPERATION AND MAINTENANCE OF TRACTORS EQUIPPED WITH THE CREEPER, CONTACT YOUR DEALER!

2.26.2 Creeper control on tractors with GB 24x12

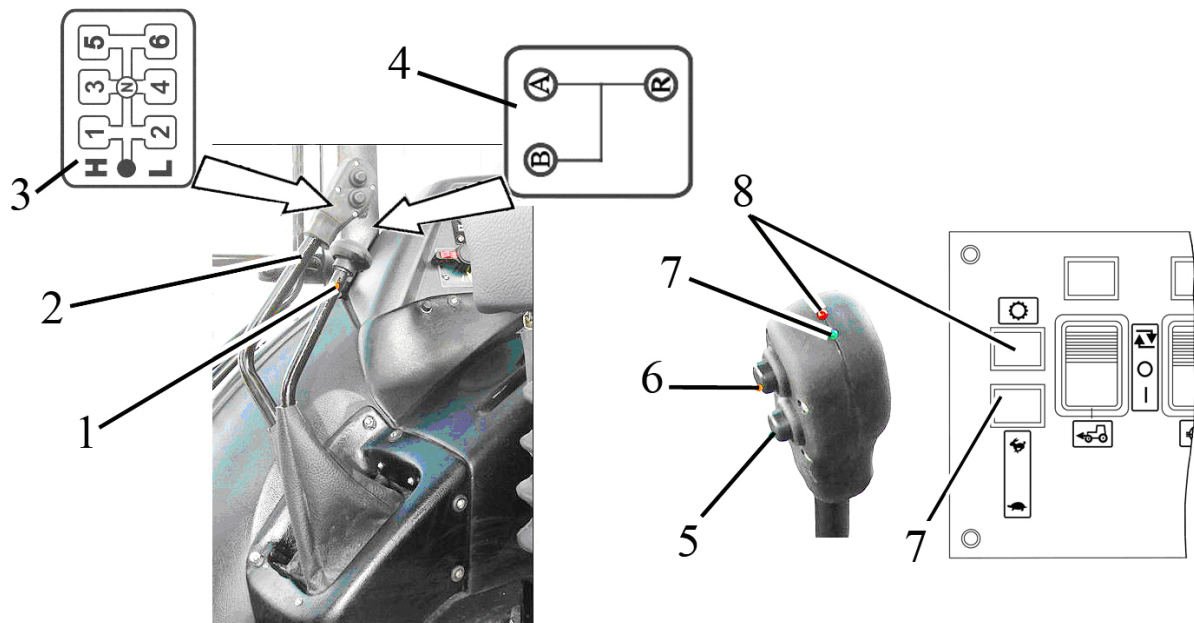
The rules for creeper control on tractors with GB 24x12 are identical to creeper control on tractors with GB 16x18.

With the help of a creeper, tractor speed is additionally reduced by 4,5 times at forward travel gears of range “A” when the reduction unit lowest “L” or highest “H” pass, i.e. “A_L” and “A_H”, is on, as well as at reverse travel gears of range “R” when the reduction unit lowest “L” or highest “H” pass, i.e. “R_L” and “R_H”, is on.

ATTENTION: IN ORDER TO AVOID TRANSMISSION FAILURE AND OIL OVERHEATING IT IS NOT RECOMMENDED TO USE A CREEPER WHEN GEARS 5 AND 6 OF RANGES “A_H” AND “R_H” ARE ON.

2.27 Gears and ranges shifting of GB 24x12

Against order your tractor can be equipped with gearbox 24x12 which provides twenty-four forward speeds and twelve reverse speeds.



1 – shifting lever of GB ranges; 2 – gear and pass shifting lever of GB reduction unit; 3 – diagram of GB reduction unit gear and pass shifting; 4 – diagram of GB range shifting; 5 – button of GB reduction unit lower pass (L) activation; 6 – button of GB reduction unit higher pass (H) activation; 7 – annunciator of GB reduction unit lower pass activation; 8 – annunciator of GB reduction unit higher pass activation.

Figure 2.27.1 – Gearbox 24x12 control

Setting the required gear is performed with gear and pass shifting lever of GB reduction unit 2 (figure 2.27.1) according to scheme 3.

Setting the required GB range is performed with shifting lever of GB ranges 1 according to scheme 4.

Pressing button 5 or 6 on the shifting lever handle of GB reduction unit gear and pass 2 switches on a lower or a higher pass of GB reduction unit correspondingly. Indication of the activated GB reduction unit pass is performed with annunciators 7 and 8 located on lever 2 handle and on RADL control board, with FDA drive and PTO. Activation annunciator of GB reduction unit lower pass on lever 2 handle is green; activation annunciator of GB reduction unit higher pass is red.

Activation of GB reduction unit pass “L” or “H” is only possible while setting gear and pass shifting lever of GB reduction unit 2 into the position “Neutral”.

The velocity diagram table of tractor “BELARUS-1523.5” on tires of basic configuration is attached to the cab right window and is shown in figure 2.27.2.

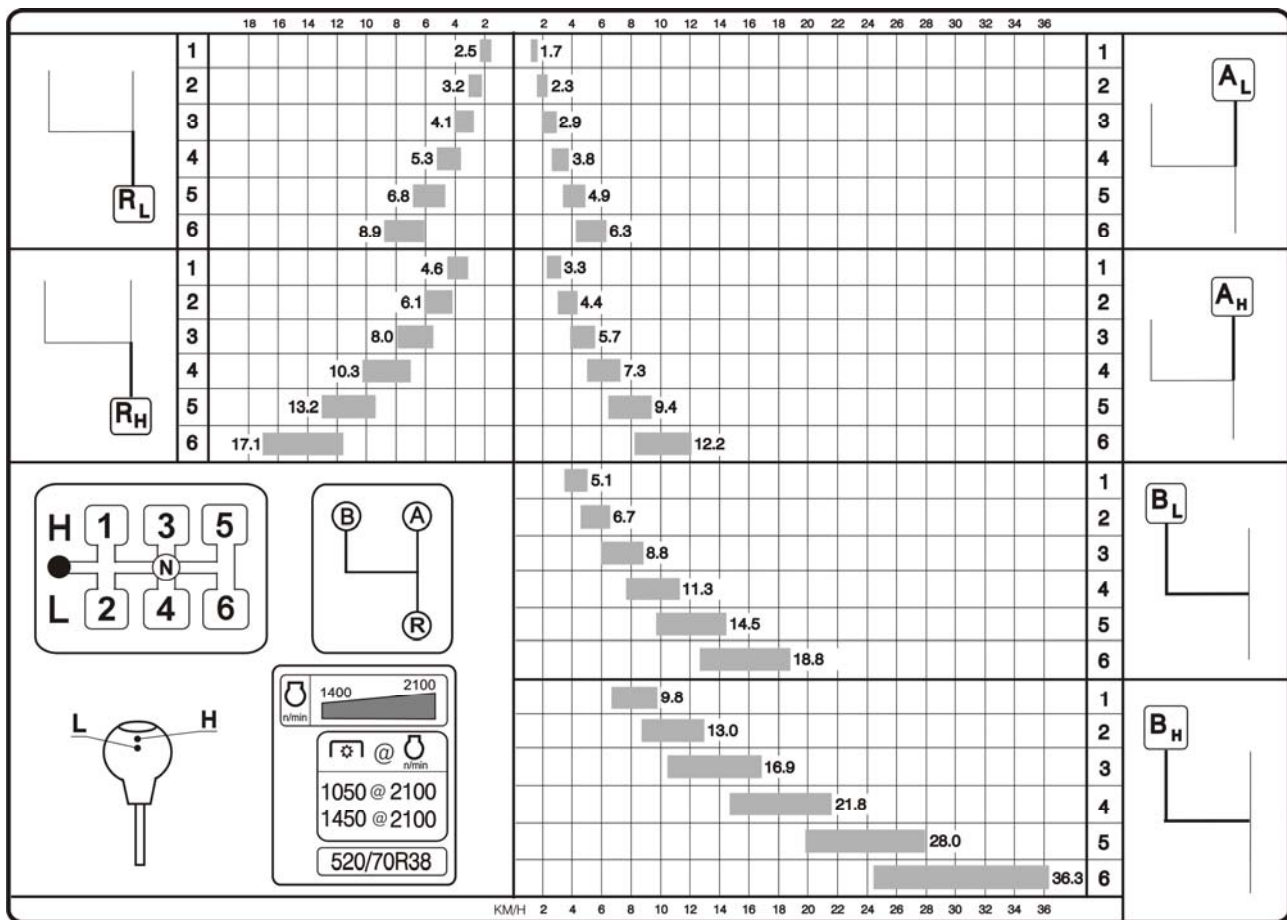


Figure 2.27.2 – The velocity diagram of tractor “BELARUS-1523.5” with GB 24x12.

3 INTENDED USE OF TRACTOR

3.1 Safety measures while preparing tractor for operation

Strict observance of safety requirements ensures safe operation of the tractor and improves its reliability and durability.

Only persons not younger than 17, having a driving license for tractors of drawbar category 3.0, being briefed on accident and fire prevention, may be admitted to operate the tractor.

Before operating the tractor, scrutinize the Operator's Manual and the Engine operation manual. Insufficient knowledge of tractor controls and servicing may lead to accidents.

When performing depreservation of the tractor and optional equipment, follow the fire prevention instructions and sanitary requirements when dealing with chemicals, rag wastes and oiled paper.

Before starting to operate the tractor, replace special nuts of rear wheel hubs (one at each hub), used for tractor fastening on the vehicle platform, with the nuts of basic hub configuration, attached in a set of spare parts, tools and accessories. Tighten the nuts with a torque of 300...350 Nm. Replace special nuts of front wheels (one at each wheel), used for tractor fastening on the vehicle platform, with the nuts of basic wheel configuration, attached in a set of spare parts, tools and accessories. Tighten the nuts with a torque of 200...250 Nm.

The tractor shall be run in, in accordance with the requirements under subsection 3.4 "Tractor final assembly and run-in".

The tractor shall be completely outfitted and in good working order.

DO NOT dismantle design-stipulated protective enclosures or safeguards from the tractor, as well as other parts and assembly units which affect its safe operation (protective guard of the fan, rear PTO enclosure, etc.)

The technical condition of the braking system, steering controls, lighting and indication devices and the drive system shall conform to safety requirements of relevant standards and the present Manual.

The trailed agricultural machines and harvest trailers shall be fitted with rigid coupling which excludes their swaying and colliding with the tractor during transportation.

The tractor controls shall be provided with reliable locking in their operating positions.

Keep all the warning plates of the tractor clean and readable. If damaged or lost, replace them with new ones.

Tractor operation without an accumulator battery in the electrical equipment system is not allowed.

The first aid kit shall be completed in accordance with the regulations, adopted on the territory of the state, where the tractor is used.

3.2 Tractor use

3.2.1 Boarding the tractor

The tractor is boarded through the cab left door. A foot step is provided for making tractor boarding more convenient.

3.2.2 Engine start and preparation for it

To start the engine of tractor "BELARUS-1523.5", do the following:

engage the tractor parking brake;

if required, fill in fuel and bleed the fuel delivery system to remove air from it;

set the handle for fuel feed control into the position that corresponds to the minimum fuel supply to the engine;

make sure that the electronic pedal of fuel feed control is in its initial position and it is not affected by physical influence. Do not press the fuel feed control pedal when starting the engine;

set the handle for rear PTO drive activation into the position "PTO drive off", and the handle for rear PTO control - into the position "off";

the handles of the hydraulic system valve group control shall be in "neutral" position, the handles for RLL control shall be in the middle position, the switches of the rear axle DL, FDA drive, FPTO (if mounted) shall be in "off" position;

set the levers shifting GB gears and ranges into a neutral position;

turn on the accumulator battery switch;

turn the key of the starter and instruments switch from "0" position into position "I";

By doing this:

1) On the integrated indicator both RPTO scale range annunciators and all RPTO scale segments turn on for not more than one second, and the needles of engine speed and rpm indicators deviate from their initial positions (or the needles "shake" on indicator zero marks for not more than one second) – it confirms LED annunciators and needle indicators workability.

2) The engine control system panel carries out self-check. If there are no errors in the system operation, the fault testing annunciator on the engine control system panel shall light up and go out - it confirms the annunciator lamp workability and its correct connection to the tractor on-board system. If any errors are detected, the testing annunciator provides a light code of the fault. The detected faults shall be eliminated before the engine start.

3) The information screen displays a company logo for several seconds – it confirms workability of the screen. Then in case there are no failures in the EECS operation, the information screen functions in the operating mode – it displays actually measured parameters of the engine. If failures are detected, the information screen produces an acoustic signal, and a brief description of the detected failures appears on the screen. The detected faults shall be eliminated before the engine start.

4) A pilot lamp of emergency oil pressure in HSC lights up on the pilot lamp unit. A signal lamp of oil emergency pressure in the engine lubrication system (and a buzzer sounds), a signal lamp of air emergency pressure in the pneumatic system (if it is below the accepted value), a signal lamp of fuel reserve capacity in the tank (when reserve volume of fuel remains in the tank) light up on the dashboard. A pilot signal annunciator of the engaged parking brake turn on in a flashing mode with 1 Hz frequency on the integrated indicator.

5) A pilot lamp that indicates heating plug operation lights up on the pilot lamp unit.

- after the heating plug pilot lamp goes out, start the engine, for which depress the clutch pedal and turn the key of starter and instruments switch from "I" position ("instruments on") into position "II" (engine start);

- hold the key of the starter switch turned until the engine is started, but not longer than 20 seconds; if the engine fails to start, carry out a repeated start-up not earlier than after one minute;

- after the engine is started, release the clutch pedal, check functioning of all signal lamps and gauge indications (coolant temperature, oil pressure in the engine, on-board circuit voltage, etc.). Let the engine run at low rpm until pressure stabilizes within gauge operation range. Actually measured parameters and operation states of tractor systems and units are displayed on the integrated indicator, on the dashboard, on the pilot lamp unit, on the control panel of the rear axle DL, of FDA drive, on the engine control system panel and on the information screen. The troubleshooting annunciator of RLL electronic control system lights up on RLL control panel - it indicates the workability and blocking of the RLL control system;

- in case the tractor is equipped with GB 24x12, after the engine start a LED lamp of green color lights up on the handle of GB reduction unit gear and pass shifting lever, and the annunciator of GB reduction unit lower pass activation lights up on the control panel of rear axle DL and FDA drive indicating the GB reduction unit lower pass activation;

- a pilot lamp indicating the charge of additional AB with the voltage of 24W shall go out after the engine start – it indicates that the additional AB with the voltage of 24W is being charged through the voltage converter. If the pilot lamp indicating the charge continues to glow after the engine start – it indicates that the additional AB is not being charged and it is required to eliminate the failure.

IT IS FORBIDDEN TO OPERATE THE TRACTOR IN CLOSED ROOMS WITHOUT REQUIRED VENTILATION (AIR EXCHANGE). EXHAUST GASES MAY LEAD TO A LETHAL OUTCOME!

IT IS FORBIDDEN TO RUN THE ENGINE WITH THE SYSTEMS OF COOLING AND ENGINE LUBRICATION UNFILLED!

ATTENTION: THE TRACTOR CAB IS EQUIPPED WITH A SINGLE-OCCUPANCY SEAT AND THE OPERATOR IS THE ONLY PERSON TO STAY IN!

ATTENTION: START THE ENGINE AND INSPECT GAUGES ONLY WHEN STAYING IN THE OPERATOR'S SEAT!

ATTENTION: REMEMBER THAT THE ENGINE START IS POSSIBLE ONLY WHEN THE RANGE SHIFTING LEVER IS SET INTO A NEUTRAL POSITION!

ATTENTION: WHILE STARTING THE ENGINE, THERE MUST BE NO PEOPLE UNDER, IN FRONT OF AND BEHIND THE TRACTOR, AS WELL AS BETWEEN THE TRACTOR AND AN IMPLEMENT COUPLED TO IT!

IT IS FORBIDDEN TO START THE ENGINE TAKING THE TRACTOR IN TOW, AS IT MAY RESULT IN ENGINE BREAKDOWN. START THE ENGINE ONLY WHEN YOU STAY IN THE OPERATOR'S SEAT!

3.2.3 Start of tractor movement, GB shifting

ATTENTION: YOUR TRACTOR IS EQUIPPED WITH TURBOCHARGED ENGINE. HIGH SPEED OF THE TURBOCHARGER REQUIRES GOOD LUBRICATION AT ENGINE START. AFTER THE ENGINE START, WARM UP THE ENGINE TO ACHIEVE STABLE RUNNING UNDER THE CRANKSHAFT SPEED OF 1000-1300 RPM (FOR 2-3 MIN), AND THEN LET IT RUN AT HIGHER RPM, GRADUALLY INCREASING THE SPEED UP TO 1600 RPM (NOT MORE) UNTIL THE COOLANT TEMPERATURE REACHES 40°C. TRACTOR OPERATION IS FORBIDDEN, IF THE ENGINE EMERGENCY OIL PRESSURE LAMP IS ON WITH THE ENGINE RUNNING, STOP THE ENGINE IMMEDIATELY!

Before starting the movement, define a necessary speed of tractor movement. The speed diagram of the tractor "BELARUS-1523.5" with tires of basic configuration is given in the instruction table attached to the cab right window and also in subsection 2.14.2. "Tractor velocity diagram". (for tractors equipped with GB 24x12 the tractor velocity diagram is shown in subsection 2.27)

To put the tractor in motion, do the following:

- reduce engine speed;
- depress the clutch pedal;
- set a required GB range using the range shifting lever according to the range shifting diagram;
- set a desired speed, for which move the speed and pass shifting lever from neutral ("N") into any of positions according to the speed shifting diagram;
- before setting the required gear on tractors equipped with GB 24x12, if necessary, press the GB reduction unit higher pass (H) activation button. In this case, a LED lamp of red color lights up on the handle of GB reduction unit gear and pass shifting lever, and the annunciator of GB reduction unit higher pass activation lights up on the control panel of rear axle DL and FDA drive indicating GB reduction unit higher pass activation;
- disengage the parking break, slowly release the clutch pedal, increasing fuel feed at the same time. The tractor will start moving.

IT IS FORBIDDEN TO START TRACTOR MOVEMENT WITH BIG TRACTION LOAD!

TRACTOR MOVEMENT WITH THE DOOR OPEN IS FORBIDDEN!

ATTENTION: SHIFT GB RANGES AND GEARS ONLY WITH THE TRACTOR STOPPED AND THE CLUTCH PEDAL FULLY DEPRESSED! PERFORMING TRANSPORT OPERATIONS IT IS ALLOWED TO SHIFT GEARS WITHIN A RANGE. SHIFTING SHALL BE CARRIED OUT AS THE TRACTOR COASTS WITH THE CLUTCH PEDAL FULLY DEPRESSED!

ATTENTION: REDUCTION UNIT PASS "L" OR "H" ACTIVATION IS ONLY POSSIBLE WITH THE TRACTOR STOPPED AND AFTER SETTING THE GEARSHIFTING LEVER IN THE NEUTRAL POSITION!

ATTENTION: DO NOT HOLD THE FOOT ON THE CLUTCH PEDAL DURING TRACTOR OPERATION AS IT CAN LEAD TO CLUTCH SLIPPING, ITS OVERHEATING AND FAILURE!

ATTENTION: IN ORDER TO ENGAGE THE GEAR, MOVE THE GEARSHIFTING LEVER SMOOTHLY, WITHOUT SHARP PUSHES, ACCORDING TO THE DIAGRAM, AND HOLD IT PRESSED UNTIL THE GEAR IS FULLY ENGAGED!

ATTENTION: WHEN STARTING TO MOVE, MAKE SURE THE PARKING BRAKE IS DISENGAGED!

ATTENTION: WITH THE DIFFERENTIAL LOCK ENGAGED, THE SPEED OF TRACTOR MOVEMENT SHALL NOT EXCEED 13 KM/H!

ATTENTION: OPERATING ON ROADS WITH HARD SURFACE, IT IS NECESSARY TO SWITCH OFF THE FDA DRIVE TO AVOID INCREASED WEAR OF FRONT WHEEL TIRES!

ATTENTION: IT IS ALLOWED TO USE THE ENGINE AT ITS FULL POWER ONLY AS THE COOLANT TEMPERATURE REACHES 70°C!

ATTENTION: TRACTOR OPERATION WITH EMPTY ADBLUE (UREA) TANK IS NOT ALLOWED! WHEN INFORMATION ABOUT THE CRITICAL LEVEL OF ADBLUE REAGENT (UREA) IN THE TANK APPEARS ON THE MONITOR, IT IS NECESSARY TO FILL THE TANK WITH ADBLUE AGENT.

3.2.4 Tractor stop

To stop the tractor, do the following:

- decrease engine speed;
- fully depress the clutch pedal;
- set the GB range and gear shifting lever into neutral position;
- release the clutch pedal;
- stop the tractor with service brakes;
- engage the parking brake.

ATTENTION: FOR TRACTOR EMERGENCY STOP, PRESS THE CLUTCH AND BREAK PEDALS TOGETHER SHARPLY!

3.2.5 Engine stop

ATTENTION: BEFORE STOPPING THE ENGINE, LOWER LIFT LINKAGES UNTIL THEY REACH THE GROUND, IF THEY ARE UPLIFTED; LET THE ENGINE RUN AT (1000±100) RPM FOR 3 TO 5 MINUTES. THIS ALLOWS TO REDUCE ENGINE COOLANT TEMPERATURE!

To stop the engine, do the following:

- set the rear PTO control lever into the position “off” and the handle for the rear PTO drive activation – into the position “PTO drive off” ;
- disengage the rear axle differential lock, the FDA drive, FPTO (if mounted);
- shift the control handles for the hydraulic lift linkage distribution valve group into neutral position;
- set the lift linkage control handle into the position “off”;
- turn off the conditioner or heater fan;
- turn the key of the starter and instruments switch from the position “I” into the position “0”;
- deactivate the accumulator battery when the engine is stopped for a long time.

ATTENTION: FOR ENGINE EMERGENCY STOP, TURN THE KEY OF THE STARTER AND INSTRUMENTS SWITCH FROM THE POSITION “I” INTO THE POSITION “0”!

3.2.6 Leaving the tractor

Leaving the tractor is carried out through the cab left door, except for emergency situations. The rules on leaving the tractor at emergency situations are given in clause 3.5.3 of subsection 3.5 “Emergency actions”.

Leaving the tractor, make sure that all actions, listed in subsection 3.2.5 “Engine stop” have been performed, lift linkages of the tractor and of coupled implements have been lowered.

3.2.7 PTO use

The rules on engagement and disengagement of rear power take off shaft are described in subsection 2.16 “Rear power takeoff control”.

The rear power take off shaft operation is controlled by means of the integrated indicator as described in subsection 2.8.2 “Assignment and operation principle of integrated indicator gauges”.

The rules of RPTO coupling with different types of agricultural machines and implements are described in section 4 “Coupling of implements”.

ATTENTION: TO EXCLUDE IMPACT LOAD, ENGAGE THE REAR PTO AT ENGINE SPEED CLOSE TO MINIMUM (BETWEEN 1000 AND 1100 RPM), THEN ENGINE SPEED SHALL BE INCREASED!

The rear PTO has 6 changeable shaft end extensions. One shaft end extension (of type 3, 20 splines, $\varnothing 45\text{mm}$, or of type 2, 21 splines, $\varnothing 35\text{mm}$) is mounted on the tractor, the others are attached to the spare parts, tools and accessories kit of the tractor against order.

ATTENTION: IT IS FORBIDDEN TO USE REAR PTO SHAFT END EXTENSIONS OF THE CORRESPONDING TYPES WHILE COUPLING OF “BELARUS-1523.5” TRACTORS WITH MACHINES WHICH REQUIRE POWER TRANSFER HIGHER THAN THAT SPECIFIED IN TABLE 3.1!

In their design and arrangement the front and rear PTO shaft end extensions (figure 3.2.1) of “BELARUS-1523.5” tractors conform to the regulations and standards applicable to PTO shafts of agricultural tractors.

Parameters of shaft end extensions and specifications of the rear PTO operation when the independent drive is on, are given in Table 3.1.

Specifications of the rear PTO operation when the synchronous drive is on, are given in table 3.2.

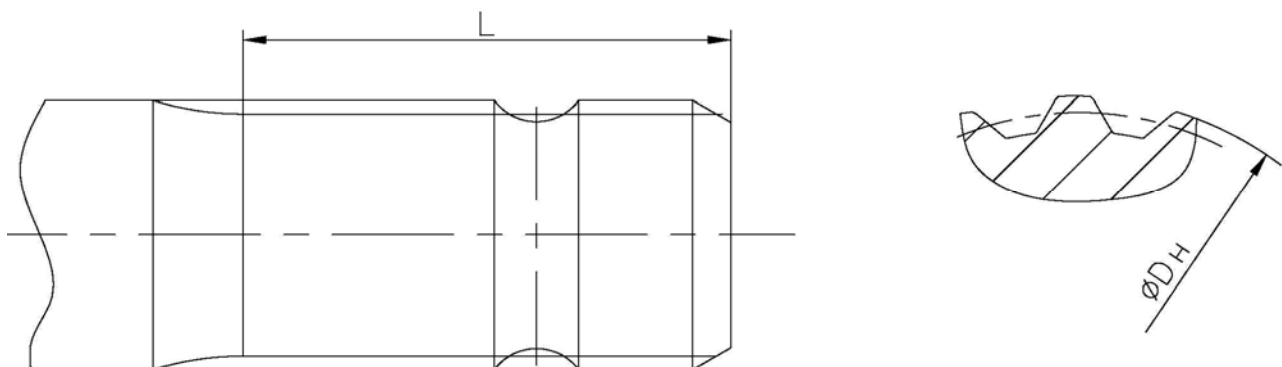


Figure 3.2.1– Power take off shaft end extension

Table 3.1 – Parameters of shaft end extensions and specifications of the rear PTO operation when the independent drive is on

Parameters of shaft end extensions and FPTO and RPTO drives	Type of PTO shaft end extension					
	Type1 ¹⁾	Type 1c	Type 2	Type 3	Type 2c ¹⁾	Type 2c1 ¹⁾
1 Spline length L, mm	76	78	64	89	78	76
2 Outer diameter DH, mm	35	38	35	45	38	35
3 Number of teeth, n	6	8	21	20	8	6
4 RPTO shaft end extension rotation speed (standard mode) when the independent drive is on, min ⁻¹	540 when the engine speed is 1924 (590) ²⁾	540 when the engine speed is 1924 (590) ²⁾	1000 when the engine speed is 1909 (1100) ²⁾	1000 when the engine speed is 1909 (1100) ²⁾	1000 when the engine speed is 1909 (1100) ²⁾	1000 when the engine speed is 1909 (1100) ²⁾
5 RPTO shaft end extension rotation speed (economy mode, only on tractors with GB 24x12) when the independent drive is on, min ⁻¹	540 when the engine speed is 1473 (770) ²⁾	540 when the engine speed is 1473 (770) ²⁾	1000 when the engine speed is 1462 (1437) ²⁾	1000 when the engine speed is 1462 (1437) ²⁾	1000 when the engine speed is 1462 (1437) ²⁾	1000 when the engine speed is 1462 (1437) ²⁾
6 Power transferred by RPTO shaft end extension, kW, not more	60	60	92	112	92	92
7 Direction of RPTO shaft end extension rotation (look at the butt end) when the independent drive is on	Clockwise					
¹⁾ Can be completed against order. ²⁾ PTO shaft end extension rotation speed when the engine crankshaft rated speed is 2100 rpm.						

Table 3.2 – Specifications of the rear PTO shaft end extension operation when the synchronous drive is on, with rear tires 520/70R38 (basic configuration), when the engine rated speed is 2100 min⁻¹.

Type of RPTO shaft end extension	PTO shaft end extension rotation speed on tractors «BELARUS-1523.5» with GB 16x8, min ⁻¹	PTO shaft end extension rotation speed on tractors «BELARUS - 1523.5» with GB 24x12, min ⁻¹
Type 1	3,82 rotation/meter of track	3,28 rotation/meter of track
Type 1c	3,82 rotation/meter of track	3,28 rotation/meter of track
Type 2	7,14 rotation/meter of track	6,12 rotation/meter of track
Type 3	7,14 rotation/meter of track	6,12 rotation/meter of track
Type 2c	7,14 rotation/meter of track	6,12 rotation/meter of track
Type 2c1	7,14 rotation/meter of track	6,12 rotation/meter of track

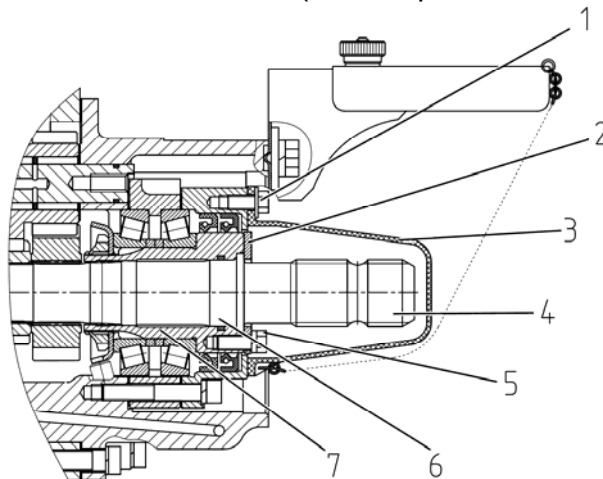
When operating with RPTO in a synchronous mode, it is necessary to take into account the following:

- PTO shaft end extension rotates only while tractor movement;
- operating tractor speed in structure of machine-tractor unit shall not exceed 8 km/h;
- the direction of rotation of PTO shaft end extension (if you look at the butt end of PTO shaft end extension) is different as the tractor moves forwards and backwards: at forward motion – it rotates clockwise, at backward motion – counterclockwise.

For operation with RPTO, remove protective cap 3 (figure 3.2.2) that covers shaft end extension 4, for which unscrew two fixing bolts 1. After finishing the operation with RPTO, it is required to mount the protective cap back to its place.

To change the shaft end extension, do the following:

- unscrew two bolts 1 and remove cap 3;
- unscrew four bolts 5 and remove retainer washer 2;
- extract shaft end extension 4 out of bushing opening 7;
- mount another shaft end extension into the spline opening, grease center pilot 6 with solid lubricant;
- mount retainer washer 2 and fix it with four bolts 5 (bolt torque 1 - from 40 to 50N·m);
- mount PTO cap 3 and fix it with two bolts 1 (bolt torque 1 – from 13 to 16N·m).



- 1– bolt; 2 – retainer washer; 3 – protective cap; 4 – changeable shaft end extension; 5 – bolt; 6 – center pilot; 7 – bushing.

Figure 3.2.2– Protective cap removal and change of RPTO shaft end extension

ATTENTION: THE WIDTH OF THE RPTO PROTECTIVE CAP OPENING IS LESS THAN 360MM. ACCORDINGLY, WHILE CONNECTING CARDAN SHAFT TO THE RPTO SHAFT END EXTENSION OF TYPE 3 (PTO 3) IT IS REQUIRED TO BE CAREFUL IN ORDER TO EXCLUDE HAND INJURIES! NO SPECIAL INSTRUMENTS AND TOOLS FOR CONNECTING CARDAN SHAFT TO THE SHAFT END EXTENSION OF TYPE 3 ARE REQUIRED!

The rules for FPTO activation and deactivation mounted against order, are given in subsection 2.15 “RADL, FDA and FPTO drives control panel”.

The rules for FPTO coupling with different types of agricultural machines and implements are given in section 4 “Coupling of implements”.

FPTO is completed with the shaft end extension of type 2. The direction of FPTO shaft end extension rotation (look at the butt end) is clockwise. For FPTO at 1845min^{-1} of the engine crankshaft, the rotation speed of FPTO shaft end extension is 1000min^{-1} (at the rated speed of the engine crankshaft, the rotation speed of FPTO shaft end extension is 1138min^{-1}). The power transferred by the FPTO shaft end extension is not more than 44 kW.

Coupling of machines, which require power transfer more than 44kW, with FPTO is not allowed!

For operating with front PTO, in case it is mounted, remove the protective cap by pressing it at the bottom and pulling it down. After finishing the operation with FPTO it is required to mount the protective cap back to its place, for which put the cap onto the shaft end extension and press it lengthway to secure the cap in the protector opening.

ATTENTION: WHILE RPTO AND FPTO OPERATING, IT IS REQUIRED TO FOLLOW ALL SAFETY MEASURES SPECIFIED IN THIS MANUAL!

3.2.8 Selection of optimal inner pressure in tires depending on operational conditions and load on tractor axles

3.2.8.1 Selection of optimal inner pressure in tires depending on operational conditions and load on tractor axles

Selection of optimal air pressure in tires of wheeled tractors and degree of its influence on gripping abilities depend on soil type and load, applied to tractor axles. Air pressure in tires influences the wheel point being in contact with soil, and affects its gripping abilities as well as tractor operational performance depending on soil conditions. Rates of loads on tires for selection of operation mode at various inner pressure and speed are set forth by a tire manufacturer and are provided in table 3.3.

Pressure value depends on travel speed and weight loads on tractor axles, created by weight of coupled implements with due account for tractor own weight and ballast weight and also operation conditions.

Inner pressure in tires for each specific case of tractor coupling with implements is different. That is why if tractor operational conditions are changed, it is required to check and if necessary, adjust pressure value in tires. Failure to comply with pressure rates decreases tire life significantly.

Tractor operation with tire pressure set below the required rate, results in the following wheel failures:

- tire turning on rims;
- wearing of tire bead against rim edge;
- cracks on tire sides appear;
- ply separation or rupture of a tire;
- tear-out of tire valve (for tubed tires);

Operation with tire pressure set higher than the norm, results in the following wheel failures:

- noticeable increased wear of tires;
- stretching of carcass layers and decrease of tire flexibility;
- increased skidding of wheels;
- increased sensitivity to impacts and cuts.

Operation overload including excess of max. load capacity (for given pressure and speed) of tires and tractor axles is a reason for failures and damages not only to the undercarriage (tire carcass rupture, etc.) but also to other units and parts of the tractor, which can lead to accidents and decrease of the tractor life span in general.

ATTENTION: ALWAYS SET TIRE PRESSURE WITH DUE ACCOUNT FOR LOAD AND SPEED EFFECTIVE FOR THE KIND OF OPERATION BEING CARRIED OUT!

It is possible to choose tire pressure correctly and identify if it is necessary to mount ballast weights, their mass and type only after defining load value on tractor axles.

The exact load value for a specific case of tractor use, which is applied to front and rear wheels of the tractor, can be defined only by practical weighing the tractor with the implement coupled.

The method of identifying load value on front and rear wheels of the tractor by weighing is given in section 4 "Coupling of implements".

To check tire pressure use pressure gage MD-124 GOST 9921-81 (it is possible to use other tire pressure control devices with the metrological characteristics identical to manometer MD-124).

Rates of admissible loads on single tires of tractors "BELARUS-1523.5" for selection of operation mode at various tire inner pressure and speed are given in table 3.3.

Table 3.3

Tire	Load index**	Speed symbol**	Speed, km/h	Loading of tire, m, kg, at inner pressure, kPa					
				80	100	120	140	160	200
420/70R24	130	A8	10	1875	2050	2230	2405	2585	2850 (at 190 kPa)
			20	1720	1845	2030	2210	2335	
			30	1500	1605	1765	1925	2035	
			40	1400	1500	1650	1800	1900	
18.4R38	146	A8	10*	3240	3555	3870	4185	4500	
			20	2655	2915	3170	3430	3690	
			30	2310	2535	2760	2985	3210	
			40	2160	2370	2580	2790	3000	
520/70R38	150	A8	10	2940	3350	3725	4080	4410	5025
			20	2770	3130	3480	3810	4120	
			30	2390	2725	3030	3315	3585	
			40		2545	2830	3100	3350	

* - inner pressure shall be increased by 25 %

** Load index and speed symbol (see on tire side).

Rates of loads are provided for tires with indicated load index and speed symbol.

Pressure shall be set in "cold" tires.

Performing operations which require large pulling force on the hook, set the pressure as for the speed of 30 km/h. When performing transport operations on roads with hard surface, increase pressure by 30 kPa.

Tractor operation with twinned tires is allowed only at the speed of 20 km/h.

Total loading capacity of twinned tires shall not exceed the loading capacity of a single tire by more than 1,7 times;

When twinning tires, make sure the pressure in outer tires is 1,2 – 1,25 times lower than the pressure in inner tires.

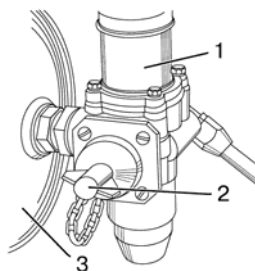
Rear wheel tires 18.4R38 is an alternative configuration.

3.2.8.2 Tire inflation

Inflate tires through an air bleed valve of pressure regulator 1 (figure 3.2.3), for which do the following:

- let the air out of balloon 3 of the pneumatic system through a condensate removing valve;
- unscrew winged nut 2 of the air bleed valve cap;
 - connect a pipe for tire inflation to the air bleed valve cap and to a tire valve;
- start the engine and inflate the tire to reach the required pressure, controlling it with a pressure gage МД-124 GOST 9921-81 (or with a pressure gage having identical metrological characteristics);
- disconnect the pipe from the tire valve and from the air bleed valve cap;
- screw the winged nut back on the air bleed valve cap.

ATTENTION: AS PRESSURE IN THE BALLON GOES UP TO 0.77 MPA, THE COMPRESSOR IS SWITCHED TO IDLE RUNNING BY THE PRESSURE REGULATOR AND TIRE INFLATION STOPS AUTOMATICALLY. FOR THIS REASON CHECK THE PRESSURE OVER THE INDICATOR ON THE DASHBOARD FROM TIME TO TIME AND, IF NECESSARY, REDUCE IT THROUGH THE CONDENSATE REMOVING VALVE!



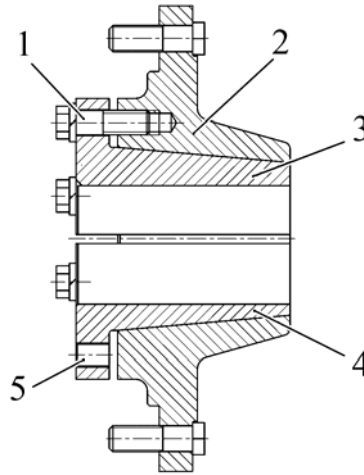
1 – pressure regulator; 2 – winged nut; 3 – balloon of the pneumatic system.

Figure 3.2.3 – Tire inflation

3.2.9 Rear wheel track formation

Tractor rear wheels are mounted on hub groups which consist of split conic bushings 3 and 4 (figure 3.2.4) and hub group housing 2.

The bushings are tightened into the hub group housing with six bolts 1 (M20) with a torque from 360 to 450 Nm, clenching the semiaxle.



1 – tie bolts; 2 – hub group housing; 3 – upper bushing; 4 – lower bushing; 5 – dismounting holes.

Figure 3.2.4 – Rear wheel hub group

The rear wheel track with the wheels of basic configuration 520/70R38 is changed by moving the hub and the wheel along the semiaxle and by replacing the wheels from one sideboard to the other one.

To change the rear wheel track, do the following:

- put the tractor on a flat ground, put the stops under the front and rear wheels, clean the semiaxles from dirt;
- jack up the corresponding semiaxle tube;
- turn off the wheel retaining nuts and remove the wheel;
- release two tie bolts 1 (figure 3.2.4) of bushings 3 and 4 (one at each bushing) for three complete turns. Screw out the rest of the tie bolts. Remove the blind plugs from the dismounting holes. Screw in the bolts which were screwed out from the bushings into the dismounting threaded holes;
- in case it is impossible to squeeze out the bushings with the help of tie bolts 1, fill kerosine or other penetrant into the split between the bushings and the hub group housing, wait for some time and then screw in the dismounting bolts, tapping on the hub group housing at the same time until the bushings are completely squeezed out;
- shift the hub group onto the required track (use table 3.4 to set track “K” (figure 3.2.5) by measuring dimension «L» from the semiaxle butt end to the bushing butt end);
- screw out the tie bolts from the dismounting holes and screw them into the bushings. Screw in the tie bolts with a torque from 360 to 450Nm in stages – until all the bolts are screwed in with the required torque;
- mount the wheel onto the hub group, tighten the wheel retaining nuts with a torque from 300 to 350Nm, set the blind plugs to their places;
- set the other wheel track in the same way;
- check and tighten the tie bolts and wheel retaining nuts after the first operation hour, after the first eight – ten operation hours and every succeeding 125 operation hours.

ATTENTION: AFTER BOLT TIGHTENING MAKE SURE THE BUTT ENDS OF UPPER AND LOWER BUSHINGS OVERHAND ONE IN RELATION TO THE OTHER FOR NOT MORE THAN 1...2 MM!

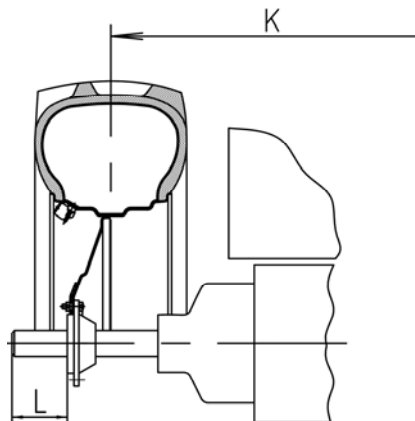


DIAGRAM 1

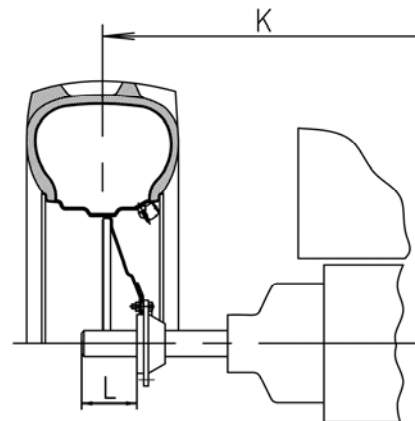


DIAGRAM 2

Figure 3.2.5 – Rear wheel track setting

Figure 3.4 – Rear wheel track setting

Tire size	standard	Diagram No. (figure 3.2.5)	Track dimension «K», mm	The setting size from the butt end of the bushing hub group to the semi-axle butt end «L», mm
520/70R38		1	1600...1916	160...0
		2	1946...2445	250...0

ATTENTION: WHEN SHIPPED FROM THE WORKS, REAR WHEELS ARE MOUNTED ONTO THE WHEEL TRACK ACCORDING TO DIAGRAM 1 (FIGURE 3.2.5)!

Note – To get information on the rules of rear wheel track setting on tires 18.4R38 (alternative configuration), address your dealer!

3.2.10 Rear wheel twinning

With an aim to improve gripping properties of the tractor when coupled with heavy agricultural implements on soil with low bearing capacity, rear wheel twinning with use of spacers is provided.

To get information on the rules of rear wheel twinning and operating restrictions for the tractors with rear wheels twinned, contact your dealer!

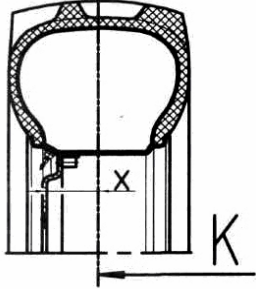
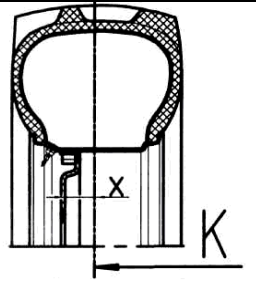
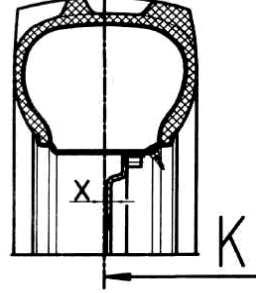
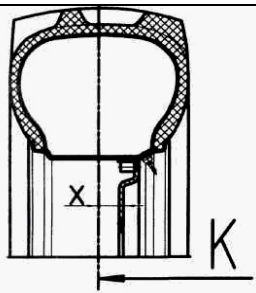
3.2.11 Front wheel track formation

The front wheel track is adjusted in stages by displacing the wheels from one sideboard to the other and by changing a position of the wheel disk in relation to the rim.

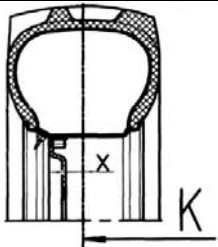
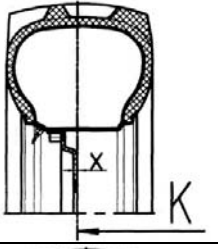
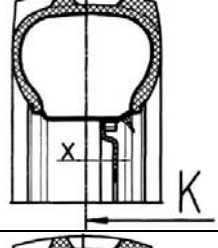
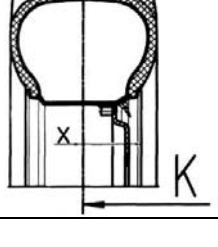
The front wheel track may have the following dimensions: 1535, 1635, 1700, 1800, 1850, 1950, 2020, 2120.

Diagrams of installation and track dimensions for tires 420/70R24 (basic configuration) are given in table 3.5.

Table 3.5 – Front wheel track adjustment

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

End of table 3.5

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

To set a required track, do the following:

- brake the tractor using the parking brake. Put stop members at the front and back of rear wheels;
 - jack up the tractor front part (or front wheels one by one), ensuring clearance between the wheels and the ground;
 - to obtain the track by displacing the wheel from one sideboard to the other one without changing disk position in relation to the rim, unscrew the retaining nuts of the wheel disk to the gear group flange, take the wheels off and change from one sideboard to the other one,
 - to obtain the track by changing disk position in relation to the rim with the wheels taken off the tractor, unscrew the retaining nuts of the wheel rim to the disk, and depending on the track required, set mutual arrangement of the rim and the disk as shown in the diagram in table 3.5.
- Mounting the wheels make sure the wheel rotation direction coincides with the direction of an arrow on tire side.

The tightening torque for the retaining nuts of disks to the gear group flanges shall make 200 to 250 Nm;

The tightening torque for the retaining nuts of disks to the rim brackets shall make 180 to 240 Nm.

ATTENTION: AFTER MOUNTING THE WHEELS, CHECK THE NUTS FOR TIGHTENING AFTER THE FIRST OPERATION HOUR, AFTER 10 OPERATION HOURS AND EVERY NEXT 125 HOURS OF OPERATION!

ATTENTION: AFTER CHANGING THE FRONT WHEEL TRACK, CARRY OUT CHECK AND ADJUSTMENT OF FRONT WHEEL TOE-IN. BEFORE CHECKING TOE-IN, CONTROL AND, IF NECESSARY, ADJUST THE GAPS IN STEERING JOINTS!

3.3 Safety measures while tractor operation

3.3.1 General safety measures while tractor operation

The cab complies with category 2 under EN 15695-1:2009. This category cab ensures protection against dust, but not against sprays and vapor – the tractor shall not be used under conditions, requiring protection against sprays and vapor.

Do not operate the tractor in a closed room without required ventilation. Exhaust gases may result in lethal outcome!

Tractor start-up and operation with the hood opened is not allowed.

It is forbidden to open the hood when the engine is running.

Do not start the engine when staying outside the operator's seat. Starting the engine and manipulating the controls, always stay inside the cab in the operator's seat.

Do not start the engine by way of towing.

Before starting the engine, engage the parking brake, the rear (front) PTO shall be disengaged, the GB range and gear shifting levers shall be in "Neutral" position.

During the tractor start no people are allowed to be under the tractor, in front of or behind it, as well as between the tractor and the coupled implement or trailer.

Before starting the movement, warn people around including people operating the coupled implements using the horn, make sure the parking brake is off and start moving slowly.

Use safety harnesses (supplied against order) during transport operations.

A passenger staying in the cab during tractor operation is strictly forbidden. (A passenger may stay in the cab only when an additional seat is installed and during transport operations only).

Do not leave the tractor on the move.

Performing transport operations observe traffic regulations, adopted in your country.

Transport operations may be carried out by operators having not less than two years of tractor operation experience and those who have passed exams on traffic regulations.

Drive the tractor on slippery roads with automatic DL engaged only at a speed of not higher than 10 km/h.

Using the tractor for transport operations, do the following:

- set a track (1635 ± 20) for front wheels and (1840 ± 20) for rear wheels, mm;

check the brakes workability, interlock brake pedals, check and if necessary adjust the brakes for the synchronism of operation;

check the parking brake workability;

check the condition of devices for light and sound annunciation, transport trailers shall have rigid hitches and shall be linked with a safety chain or a cable;

never move downhill with the gear disengaged. Move uphill and downhill at the same gear.

It is forbidden to operate with a trailer without independent brakes, if its weight exceeds a half of a total actual weight of the tractor. The faster you move and the more weight you tow, the bigger safety distance shall be.

It is forbidden to drive the tractor with twinned wheels on public roads!

People transportation inside trailers is forbidden.

Before starting the operation with a trailer, turn on the pneumatic compressor, check the condition of the trailer brake pneumatic drive and air pressure in the system. Remove the failures detected. Make sure to connect the trailer brake pneumatic drive. Carry out the connection of the trailer connecting head to the tractor connecting head with the parking brake engaged.

Do not work under raised agricultural implements. Do not leave implements uplifted when stopping for a long time.

Trailers attached to the tractor shall have a braking system, ensuring:

trailer brake during the movement;

brake engagement in case of trailer detachment from the tractor;

holding the trailer when staying on slopes;

prevention of trailer from pushing the tractor when the travel speed is changed abruptly.

The trailer shall be linked to the tractor by means of a safety chain.

It is required to check operation of the braking system of tractor-trailer train at a speed of 3 to 5 km/h.

The travel speed at access ways and at passways shall not exceed 10 km/h.

While loading (unloading) the trailer, engage the parking brake of the tractor.

While driving on public roads, turn on a flashing beacon, if mounted.

Do not stop the tractor on slopes. If there is a necessity to stop the tractor, engage the parking brake.

While working on the slopes, increase the tractor track to the max.

While working on the slopes with an angle of more than 20°, set the max. rear wheel track. Before leaving the cab, disengage the rear (front) PTO, stop the engine, engage the parking brake and remove the key from the starter switch.

If the engine or the steering is broken down, stop the tractor immediately. Remember that with the engine stopped, tractor operation requires greater force applied to the steering wheel.

In case of a failure, stop the tractor immediately and eliminate the failure.

Avoid leakage of electrolyte, coolant, fuel, oil and braking fluid.

Use summer and winter grades of fuel correctly. Fill in the fuel tank at the end of each day to decrease night condensation of moisture. Fill the tractor only with grades of oil and lubricants recommended by the manufacturer. It is strictly forbidden to use other lubricants.

It is forbidden to turn off the system of electrical equipment with the battery disconnect switch with the engine running.

Operate the tractor at night-time with lighting devices on and being in good working order.

If used improperly, your tractor can be dangerous for you and for other people. Avoid using equipment not intended for installation on the tractor.

Make sure any additional equipment or auxiliary units are mounted correctly and that they are intended to be used with your tractor.

To prevent the tractor from turning over, observe the following precaution measures when operating the tractor:

- choose safe speed, corresponding to road conditions, especially when moving cross-country, when crossing ditches, slopes and at sharp turns;
- turn round corners with a speed not higher than 5 km/h, on a slippery road – not higher than 3 km/h.
- move down the hill with first or second gear engaged.

Note – This list of precaution measures is not exhaustive. To avoid turning over, be always careful when operating the tractor.

It is forbidden to use the tractor at work where there is a possibility for the tractor to turn over.

Do not operate the tractor with gages out of order.

It is not allowed to inflate tires without pressure control.

While coupling the tractor with agricultural implements, additionally observe safety measures concerning the use of these implements.

Before coupling the tractor with agricultural implements, make sure the automatic grips of the lower and upper links of the RLL are clean and faultless. It is forbidden to operate with the automatic grips out of order, with their inner cavities stuffed with dirt and foreign particles.

If the tractor front part rises from the ground when heavy implements are hinged on the mechanism of the rear lift linkage, mount front ballast weights.

Do not work under raised agricultural implements. Do not leave implements uplifted when stopping for a long time.

Before lifting and lowering a hinged agricultural implement and also when turning the tractor, make sure there is no danger of catching somebody or stumbling on the hurdle.

The mounted and semi-mounted machine shall be lowered into its operating position and uplifted into the transport position only with a straight-line movement of the assembly unit.

To avoid breakdown of the tractor or the agricultural implement, drive and turn the tractor assembly with the agricultural implement uplifted only after you make sure the rear PTO is disengaged.

While linking and hinging the agricultural machines and implements on the tractor, the rear operator shall stay at a safety distance until the operation is fully stopped. The linkage (hinge) shall be started only after the tractor operator gives a command.

While linking the machine cardan shaft to the PTO, disengage the PTO, stop the tractor with the parking brake and stop the engine.

After disconnecting the machines driven by the PTO, remove the cardan drive and cover the PTO shaft end extension with the protective cap.

Cardan shafts, transferring torque from the tractor PTO to the implement working units, shall be safeguarded.

While operating with stationary machines, driven by the PTO, always engage the parking brake and lock rear wheels at the front and at the back. Make sure the machine is securely fixed.

Make sure the safeguards of the PTO shaft end extensions are mounted and, if the PTO is not used, put back the cap of the PTO shaft end extension.

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

To avoid breakdown of the tractor or the agricultural machine, turning the tractor assembly is possible only after the working units of the machine have been fully raised from the ground.

When tractor assemblies are operating in a column, they shall have an interval not less than 30 m between each other.

Depending on operation conditions, use natural ventilation of the cab or the unit of air cooling and heating.

During tractor operation, the operator shall use standard means of protection for hearing organs.

In case the tractor assembly is operated or is driven in an area of power transmission lines, a distance between the top of the tractor assembly and wires shall conform to table 3.5.

Table 3.5

Line voltage, kV, up to	11	20-25	110	154-220	330-500
Horizontal distance, m, at least	1,5	2	4	6	9
Vertical distance, m, at least	1	2	3	4	6

3.3.2 Fire safety measures

The tractor shall be equipped with fire fighting equipment, i.e. a shovel and a fire extinguisher. Operating the tractor without fire fighting equipment is forbidden.

Never fuel the tractor with the engine running.

Do not smoke when fueling the tractor.

Do not fuel the tank to the max. Leave some volume for fuel to expand.

Never add petrol or mixtures to engine fuel. This combination may create increased danger of inflammation or explosion.

Places for tractor parking, storing of fuel and lubricants shall have a plowed around band of not less than 3 m width and also be provided with fire extinguishing means.

The tractor must be filled with fuel and lubricants by a mechanic way and with the engine stopped. Use lighting at night time. It is not recommended to fill in tanks using buckets. While carrying out repair operations in field conditions with the use of electric/gas welding, clean the parts and assembly units from plant remains.

Prevent the manifold and muffler from getting dirty with fuel, thatch, etc.

Avoid thatch winding around rotating parts of the implements coupled with the tractor.

While washing parts and assembly units with kerosene or gasoline, take care to exclude a possibility of inflammation of flushing fluid vapor.

Do not operate the tractor in places subjected to fire risk with the hood and other protective units removed from heated parts of the engine.

Do not use open fire to warm up oil in the engine sump, to fill in fuel tanks, to burn out dirt in a radiator cell.

In case a fire bed occurs, cover it with sand, canvas cloth, sackcloth or other dense texture. Use a carbon-dioxide fire extinguisher. Do not pour water over burning fuel and oil.

Make sure there are no flammable materials near the exhaust manifold and the muffler when the engine is running.

While harvesting hay and thatch, operating at places with increased danger of fire, avoid amassment of inflammable materials on a muffler guard and on gas links.

Performing daily maintenance, make sure to do the following:

- check the condition of the wiring, wire bundles in the engine area, in the cab front area, and the condition of visible parts for signs of abrasion, melt or damage of outer insulation. In case of detecting the above mentioned faults, restore the damaged areas using insulation tape and eliminate the cause of insulation damage;
- check the hydraulic system elements. If there is steaming and leakage, it shall be eliminated by tightening of threaded connections. Faulty high-pressure hoses and pipes shall be replaced.

To avoid burning of tractor wiring, never use fuses with current rating higher than the rating specified in subsection 2.20 "Switching unit and electric cutout fuses".

It is forbidden to mount wire bridges and other current-conductive elements, manufactured using crude method instead of cutout fuses.

Turn off the power disconnect switch when finishing to operate the tractor.

3.4 Tractor final assembly and run-in

3.4.1 Tractor final assembly

"BELARUS-1523.5" tractors are supplied to a consumer ready assembled, final assembly is not required.

3.4.2 Technical maintenance before tractor run-in

Before placing a new tractor in operation, do the following:

- wash the tractor, remove preservative lubricant (if any on the tractor);
- inspect the tractor carefully, check it for completeness and availability of instruction manuals;
- remove accumulator batteries, set them into working condition and mount back;
- check outer threaded joints for tightness and tighten more, if necessary;
- check oil level in the engine oil sump, in the transmission, in FDA case tubes, in cases of FDA wheel gear groups, in HLL and HSC oil tanks, in FPTO reduction unit (if mounted) and if necessary, add oil according to section 5 "Maintenance";
- check brake fluid level in the main cylinder tanks of hydrostatic clutch drives and in the tanks of service brakes, if necessary add brake fluid according to section 5 "Maintenance";
- drain the available fuel from the fuel tank and fill the fuel tank with new settled fuel: in winter – winter grade, in summer – summer grade;
- fill the engine cooling system with coolant to the upper edge of the radiator filler neck, fill the expansion tank with coolant till it occupies half of the tank volume;
- check and if necessary, adjust the tire pressure to a desired value in accordance with subsection "Selection of optimal inner pressure in tires depending on operational conditions and load on tractor axles";
- make sure protective guard shields (for PTO shaft end extensions, etc.) are available;
- check engine, lighting and warning devices workability, brakes and steering control workability, and functioning of other systems and units of the tractor using standard control gages.

Before starting to run in, check tightness of retaining bolts of the hubs (the tightening torque shall make from 360 to 450 Nm), tightness of the retaining nuts of rear wheels to the hub (the tightening torque shall make from 300 to 350 Nm), the retaining nuts of front wheel disks to FDA gear group flanges (the tightening torque shall make from 200 to 250 Nm) and the retaining nuts of front wheel disks to rim brackets (the tightening torque shall make from 180 to 240 N·m).

3.4.3 Tractor run-in

ATTENTION: THE FIRST 30 HOURS OF TRACTOR OPERATION HAVE GREAT INFLUENCE ON OPERATIONAL PARAMETERS AND LIFE SPAN OF THE TRACTOR. YOUR TRACTOR WILL FUNCTION PROPERLY FOR A LONG TIME PROVIDING YOU CARRY OUT THE RUN-IN CORRECTLY AND PERFORM OPERATIONS ON TECHNICAL MAINTENANCE IN TERMS SPECIFIED IN SECTION 5 "MAINTENANCE"!

ATTENTION: IT IS OBLIGATORY THAT YOU CARRY OUT TRACTOR RUN-IN FOR 30 HOURS! LOAD THE TRACTOR UP TO 80 % OF ITS RATED POWER BEFORE THE FIRST TECHNICAL MAINTENANCE (TM-1) (125 HOURS)!

Start the engine. Let the engine run at idle speed for five minutes with gradual increase of the rotation speed up to 1600 rpm, then run in under load for 30 operation hours.

While carrying out a 30-hour run-in, follow the instructions below:

- constantly inspect gage indications, operation of lubrication system, cooling system and power supply system. Control levels of oil and fluids in refill capacities;
- check outer fastening links for tightness and tighten them regularly;
- do not overload the engine, avoid engine smoking and speed decrease. The features of overload are sharp decrease of speed, smoking and absence of engine reaction to in-

crease of fuel feed. Operation at high gear under load results in excessive wear of friction parts of the engine;

- tractor operation at lower gear under small load and with increased speed of the engine will result in fuel overconsumption. The correct selection of gear for each specific condition of operation ensures fuel economy and reduces engine wear;
- avoid prolonged engine operation without load in a mode of max. or min. speed of the engine;
- for correct break-in of the clutch friction parts during the run-in process, engage the clutch more often and more smoothly.

3.4.4 Technical maintenance during tractor run-in

After the first tractor operation hour check tightening of retaining nuts of rear wheels to the hub, retaining nuts of front wheels to FDA gear group flanges and retaining nuts of the front wheel disks to the rim brackets. Then inspect the wheel tightening every eight hours during the run-in.

During the run-in process regularly carry out operations on shift-time technical maintenance according to the instructions specified in section 5 "Maintenance" of this manual.

3.4.5 Technical maintenance after tractor run-in

After the tractor run-in, do the following:

- carry out shift-time maintenance operations;
- inspect and wash the tractor, clean the cab;
- listen to the operation of all tractor constituents;
- check tightening of retaining nuts of rear wheels to the hub, retaining nuts of front wheels to FDA gear group flanges and retaining nuts of the front wheel disks to the rim brackets;
- tighten two lock nuts M27x1,5 (with left and right thread) of the steering link tube with a torque of 100 to 140 N·m and two crown nuts M20x1,5 of the steering link ball pins. To tighten the crown nuts, remove the cotter pin first, tighten each crown nut with a torque of 100 to 140 N·m, then turn each crown nut until the nearest notch on the nut coincides with a hole in the ball pin and then fasten with a cotter pin.
- check and if necessary, tighten outer threaded links;
- drain condensate from the pneumatic system receivers;
- drain sediment from fuel tanks and from the fuel coarse and fine filters;
- check the state of accumulator batteries, clean terminal connections and ventilation holes;
- check brake fluid level in the main cylinder tanks of hydrostatic clutch drives and in the tanks of service brakes, if necessary add it;
- check and if required, adjust free movement of the clutch pedal, of the service and parking brakes control and the brake valve drive of pneumatic system;
- drain oil from the transmission. Then clean the rotor of the gearbox centrifugal oil filter and the gearbox net filter. Fill the transmission with new oil;
- check and if necessary, adjust drive belts tension;
- check and if necessary, tighten engine outer threaded connections and engine mounting;
- replace oil in the housings of wheel-hub drives and FDA housing;
- replace oil in the FPTO reduction unit housing, if mounted;
- replace oil in the engine crankcase;
- replace the engine oil filter;
- check and if required tighten the retaining bolts of cylinder heads;
- check and if required adjust clearance between the valves and rockers arms;
- replace oil in the housings of the wheel gear groups and in the FDA housing;
- check lubrication in all assembly units according to clause 3 of table 5.4. In the places where lubrication is required - lubricate or replace the lubricant;
- check and if necessary, restore hermiticity of the air cleaner and inlet line;

- control engine operation, steering, brakes, operation controls, lighting and warning systems.

3.5 Emergency actions

3.5.1 To stop the tractor immediately, sharply depress clutch and brake pedals together.

3.5.2 For emergency engine stop, turn the key of the starter and instrument switch from "I" position to "0" position according to the diagram provided in figure 2.2.2.

3.5.3. In case of an accident, stop the engine immediately, brake the tractor, deactivate accumulator batteries and leave the tractor cab through one of the emergency exits, opening the left or right cab door, depending on tractor position, or rear window, or one of side windows. To open side windows, it is required to turn the handle for opening the window to the working position (working position – the window is opened), then press the handle in the direction opposite to the tractor forward movement until the guide pin fully goes out, and open the window completely. If it is not possible to open the emergency exits, break the window of an emergency exit with a heavy subject at hand and leave the tractor cab.

Note – The location of emergency exits is given in subsection 2.21 "Cab locks and handles".

3.5.4 In case the engine crankshaft speeds up excessively, stop the engine and brake the tractor immediately.

3.5.5 In case a fire bed occurs, stop the engine, brake the tractor, turn off the accumulator battery switch. Cover the fire bed with sand, canvas cloth, sackcloth or other dense texture. Use a carbon-dioxide fire extinguisher. Do not pour water over burning fuel and oil.

4 COUPLING OF IMPLEMENTS

4.1 General information

In section 4 "Coupling of implements" necessary instructions and information on the peculiarities of tractor "BELARUS -1523.5" use are given.

The permissible field of tractor "BELARUS-1523.5" use includes places with unrestricted air exchange, sufficient flotation and overall passing ability.

Tractors "BELARUS-1523.5" are designed for performance of mechanized work in plant growing and fodder production.

Tractors "BELARUS-1523.5" are packaged with necessary work equipment for coupling of implements i.e. lift linkage and drawbar hitches, PTO, hydraulic outlets, pneumatic heads and electrical outlet receptacles. The tractor implements listed above allow coupling of various machines in structure of MTU (machine and tractor units or tractor-mounted units).

ATTENTION: TRACTORS "BELARUS-1523.5" ARE DESIGNED FOR COUPLING OF MOUNTED, SEMI-MOUNTED, SEMI-TRAILED AND TRAILED IMPLEMENTS IN STRUCTURE OF MTU, TECHNICAL CHARACTERISTICS OF WHICH RELATED TO THE ABILITY TO BE COUPLED, CORRESPOND TO TRACTOR SPECIFICATIONS! OTHER USE OF TRACTOR IS NOT ALLOWED!

Selection and buying of agricultural implements (fertilizer distributors, plows, motor cultivators, harrows, seeding machines, rotary tooling and other implements) for tractors "BELARUS-1523.5" is carried out by the customer individually according to their needs, and with consideration of the implement and tractor performance specifications, and also local conditions i.e. agrotechnical requirements, soil conditions, personal experience, guidelines of corresponding regional advisory centers and institutions of agricultural industry.

ATTENTION: INSTRUCTIONS AND INFORMATION ON SPECIFIC ASPECTS OF THE IMPLEMENTS USE WITH THE TRACTOR, INCLUDING GUIDELINES ON THE RECOMMENDED TRACTOR SPECIFICATIONS ARE PRESENTED IN OPERATIONAL DOCUMENTATION FOR IMPLEMENTS COUPLED!

Possibilities of agricultural tractors use in specific conditions are limited by the permissible range of rated force on hook and engine power, tractor maximum permissible load, road-hold of chassis, frictional sliding, operating driving speed, PTO value and operating weight of the implements coupled.

ATTENTION: WHILE OPERATING THE TRACTOR IN STRUCTURE OF MTU, IT IS REQUIRED TO STUDY CAREFULLY AND FOLLOW THE INSTRUCTIONS SPECIFIED IN THE OPERATIONAL DOCUMENTATION OF THE IMPLEMENTS COUPLED WITH THE TRACTOR! WORKERS WHO FAILED TO STUDY THE GIVEN DOCUMENTATION INCLUDING THE PROCEDURES ON SAFE MACHINE OPERATION AND WHO DO NOT HAVE THE GIVEN DOCUMENTS IN THE WORKING PLACE, ARE NOT ALLOWED TO OPERATE THE TRACTOR!

ATTENTION: WHEN COUPLING MOUNTED, SEMI-MOUNTED, SEMI-TRAILED AND TRAILED IMPLEMENTS WITH TRACTORS "BELARUS-1523.5", IT IS ALLOWED TO INSTALL IN THE CAB THE AUTOMATED SYSTEMS FOR OPERATIONAL PROCESS CONTROL, BEING THE PART OF THE MACHINE KIT, WITH THEIR CONNECTION TO THE TRACTOR ON-BOARD NETWORK, IF IT IS PROVIDED IN THE DOCUMENTS ON THE IMPLEMENTS USE.

Tractors "BELARUS-1523.5" belong to the category of motor vehicles covered by traffic regulations and other regulatory documents on road vehicles operation.

A tractor operator is personally responsible for observance of traffic regulations and safety requirements as well as safety measures and correct tractor “BELARUS-1523.5” use, specified in this operation manual.

Service staff qualification requirements for tractor “BELARUS-1523.5” operation:

- only qualified service staff trained for safety arrangement and precautions, having tractor driving license of due form and having admission to operate the specific tractor, is allowed;
- if a tractor owner (or any person responsible for tractor operation) does not operate the tractor himself, he shall make sure that before starting tractor operation all persons related to tractor operation have been duly trained for safety arrangement and precautions and for correct coupling of implements with the tractor, and have studied the operation manual for tractor use.

ATTENTION: OWNERS AND OFFICIALS OR OTHER PERSONS RESPONSIBLE FOR TRACTOR OPERATION AND MAINTENANCE MUST NOT ALLOW THE TRACTOR FOR ROAD TRAFFIC AND COUPLING WITH IMPLEMENTS, OR ADMIT OPERATORS FOR TRACTOR DRIVING WITH VIOLATION OF CURRENT TRAFFIC REGULATIONS AND THE GIVEN OPERATION MANUAL!

ATTENTION: BEFORE STARTING TRACTOR MOVEMENT IN STRUCTURE OF MTU, MAKE SURE THERE ARE NO PEOPLE NEARBY, INCLUDING THE AREA BETWEEN THE TRACTOR AND THE IMPLEMENTS OR TRAILERS (SEMI-TRAILERS) COUPLED!

4.2 Types of implements coupled with tractor “BELARUS -1523.5»

According to the type of coupling with tractors «BELARUS-1523.5» the implements are divided into the following types:

- mounted implement is fixed in three points to the LL upper and lower links. The tractor can carry the weight of an implement in full. The implement structural elements in transport position do not touch the ground. While changing the implement position from operating to transport, the point of the implement connection to the tractor is forcedly displaced up to the new point;
- semi-mounted implement is fixed in three points to the LL upper and lower links or only in two points to the LL upper and lower links. The tractor can carry the weight of an implement in transport position partly and mostly by its traveling wheels (usually one or two). While changing the implement position from operating to transport, the point of the implement connection to the tractor is forcedly displaced up to the new point. Two-point articulated linkage is carried out by connecting the implement suspension axis link pins to the LL lower links (upper link is not used). It is also possible to use a cross bar from the tractor or implement kit;
- semi-trailed implement is usually fixed in one point by means of a tractor drawbar ring to the DH. It is also possible to use a two-point connection with lift linkage (upper link is not used). The tractor can carry the weight of an implement in transport position partly and mostly by its traveling wheels (usually two). While changing the implement position from operating to transport, the point of the implement connection to the tractor remains unchanged. Semi-trailed implements include various vehicles for general and special purposes: general purpose semi-trailers, tank semi-trailers, dump trucks and special purpose semi-trailed vehicles for mechanization of technological process in agriculture;
- trailed implement is usually fixed in one point by means of a tractor drawbar ring to the DH. It is also possible to use a two-point connection with lift linkage (upper link is not used). The chassis can carry the weight of an implement in transport position in full, the tractor hitch mechanism (DH or LL) is loaded only with the weight of an implement con-

nector. While changing the implement position from operating to transport, the point of the implement connection to the tractor remains unchanged. Semi-trailed implements include various vehicles for general and special purposes: general purpose trailers and semi-trailers, tank semi-trailers, dump trucks, and special purpose semi-trailed vehicles for mechanization of technological process in agriculture.

4.3 Lift linkage

4.3.1 General information

While operating front or rear lift linkage with the remote control console (if available), the operator shall stay beyond the reach of the three-point lift linkage and also consider the sizes of the uplifted implement projecting parts.

ATTENTION: BEFORE LEAVING THE TRACTOR FOR ANY TIME PERIOD, IT IS REQUIRED TO LOWER THE IMPLEMENT TO THE GROUND!

ATTENTION: MAXIMUM LIFTING POWER OF LIFT LINKAGE AT THE SUSPENSION AXIS DETERMINES TECHNICAL OPERABILITY OF THIS LIFT LINKAGE, BUT NOT THE PERMISSIBLE WEIGHT OF THE IMPLEMENT COUPLED WITH IT. THE PERMISSIBLE WEIGHT OF THE IMPLEMENT DEPENDS ON THE CENTROID OVERHANGING LENGTH IN RELATION TO THE SUSPENSION AXIS, AND IT IS LIMITED BY PERMISSIBLE LOADS ON THE TRACTOR AND BY THE CONTROLLABILITY CRITERION!

4.3.2 Three-point rear lift linkage

Three-point rear lift linkage of "BELARUS-1523.5" tractor is made according to State Standard GOST 10677 and ISO 730. Basic parameters of RLL specified in table 4.1 and in figures 4.3.1, 4.3.2 are given with rear tires of standard configuration (520/70R38 both single and twinned) mounted on the tractor and with standard static radius, specified by the tire manufacturer.

Rear lift linkage consists of three links (upper and two lower links) coupled with the tractor with front ends by means of hinged joint, and with rear ends with free hinged joints for connection to the link pins of the implements coupled. RLL is designed for connection of rear position implements to the tractor, for link power transfer during operation and for adjustment of their position during operation or movement in transport position. RLL provides coupling of the following types of implements and machines:

- mounted implement fixed in three points (upper and lower links);
- semi-mounted (lower links);
- semi-mounted with a cross bar to the suspension axis of lower links.

ATTENTION: IT IS ALLOWED TO MOUNT A CROSS BAR OR TRAILING SUSPENSION AXIS BEING A PART OF THE IMPLEMENTS KIT TO THE RLL LOWER LINKS ENDS FOR COUPLING OF SEMI-MOUNTED, SEMI-TRAILED AND TRAILED IMPLEMENTS, FOR PERFORMANCE OF DIFFERENT WORK WITH THE TRAVEL SPEED NOT MORE THAN 15 KM/H!

RLL sizes and design of tractors "BELARUS-1523.5" make it possible to couple all implements having the corresponding dimensions of the coupling triangle connecting elements shown in RLL diagram.

Rear lift linkage diagram of type "LL-3" is shown in figure 4.3.1.

Rear lift linkage diagram of type "LL-2" is shown in figure 4.3.2.

RLL design provides the use of a control bar which by way of fixing lower links together at a specific size, ensures the required length of the suspension axis and makes their coupling with the machine easy. For the protection of coupled implements from swaying, length adjustable limit external rods are used.

To ensure the required position of the implement, the following RLL vertical and horizontal adjustments by means of upper link, lifting rods and buckles are provided:

1. Adjustment of the upper link length.

It is carried out in order to ensure equal soil penetration of operating parts (running depth levelling of operating parts located one after another in the direction of tractor movement). If the mounted plough frame is bent forward in the direction of tractor movement and the plough front body penetrates deeper than the rear, it is required to extend the upper link; and if the plough front body penetrates with less depth than the rear, the upper link shall be shortened.

2. Adjustment of left or right lifting rod length.

The adjustment is carried out in the following cases:

- to ensure the horizontal position of the implement;
- to ensure even depth of soil processing with the coupled machine operating parts across the lifting rod width.

3. Adjustment of both lifting rods length, upper link length for the implement transport position.

The adjustment is carried out in the following cases:

- to ensure the required road clearance;
- to ensure sufficient safe distance between the tractor elements and the implement, excluding contact of implement parts with the tractor (the clearance shall be at least 100 mm).

4. Adjustment of both buckles length.

The adjustment is carried out in the following cases:

- during transportation of the implement, buckles shall be blocked to limit the implement swaying to avoid tractor elements damage in case of an accident;
- during tractor operation with mounted, semi-mounted tilling machines, it is required to use the adjustment "buckle locked" or "buckle unlocked" according to the instructions on the coupled implement (machine) use, provided in the operator's manual.

IT IS FORBIDDEN TO DISPLACE THE LONGITUDINAL AXIS OF THE IMPLEMENT IN RELATION TO THE LONGITUDINAL AXIS OF THE TRACTOR BY MEANS OF BUCKLES ADJUSTMENT.

ATTENTION: THE LENGTH OF RLL LEFT LIFTING ROD MAKES UP 780 MM, WHICH SHALL NOT BE CHANGED WITHOUT PARTICULAR NEED. USUALLY THE RIGHT LIFTING ROD CAN BE ADJUSTED ALONG THE LENGTH. WHEN THE LIFTING ROD IS USED ON THE SUSPENSION AXIS AND WHEN THE REVERSIBLE PLOUGH IS USED, THE LENGTH OF LIFTING RODS SHALL BE THE SAME!

ATTENTION: NONCOMPLIANCE WITH THE REQUIREMENTS FOR BUCKLES AND LIFTING RODS ADJUSTMENT MAY RESULT IN BUCKLES OR SUPPORT BRACKETS ABRUPTION OR OTHER BREAKAGE!

ATTENTION: ESSENTIAL FEATURES AND ADJUSTMENT WAYS OF THE IMPLEMENT POSITION COUPLED WITH MOUNTED DEVICES ACCORDING TO THE PECULIARITIES OF TECHNOLOGICAL PROCESS EXECUTION AND AGROTECHNICAL REQUIREMENTS ARE SPECIFIED IN OPERATIONAL DOCUMENTATION OF SUCH IMPLEMENTS. IF THERE IS NO SUCH INFORMATION IN OPERATIONAL DOCUMENTATION, CONTACT THE MANUFACTURER OR SELLER OF THE IMPLEMENT FOR INFORMATION!

During operation with wide-cut implements in order to facilitate crossover contour following (seeding machines, cultivators and etc.) and reduce load on RLL, it is required to provide free movement in vertical plane of one lower link in relation to the other. To do this, adjust the lifting rods so that one lower link moves freely in vertical plane in relation to the other. Such adjustment is made by exchanging pins, mounted on the yoke as specified in section 4.3.3.2. "Lifting rods". RLL is controlled by RLL control panel located in the cabin and by remote buttons on rear wheels wings which ensure setting of RLL lower links at the required height. An operator chooses the way to adjust the RLL position in manual mode by turning the adjusting lever on the RLL control panel. Remote RLL control buttons allow the operator to maintain prompt control of RLL during coupling of assembly unit.

Electronic system for the rear lift linkage control provides the following performance capabilities for RLL:

- adjustment of lower links lifting and lowering speed;
- limiting of lower links rising height;
- choice of the required way of adjustment of lower links positions;
- adjustment of soil processing depth;
- possibility to work with implements with depth control of operating parts travel height (depth adjustment is carried out by the implement support wheel).

Note – The rules on RLL control are specified in subsection 2.17 "Lift linkage control".

RLL control system provides the following adjustment methods of mounted and semi-mounted implements and their operating parts:

1 For the implements and aggregated units having no support wheels:

- draft adjustment (depth adjustment is carried out according to link resistance of the implement);
- position adjustment (the implement is held in the predetermined position in relation to the tractor frame);
- mixed adjustment (draft and position adjustment in any correlation).

2 For the implements and aggregated units having support wheels:

- mixed adjustment (draft and position adjustment in any correlation).

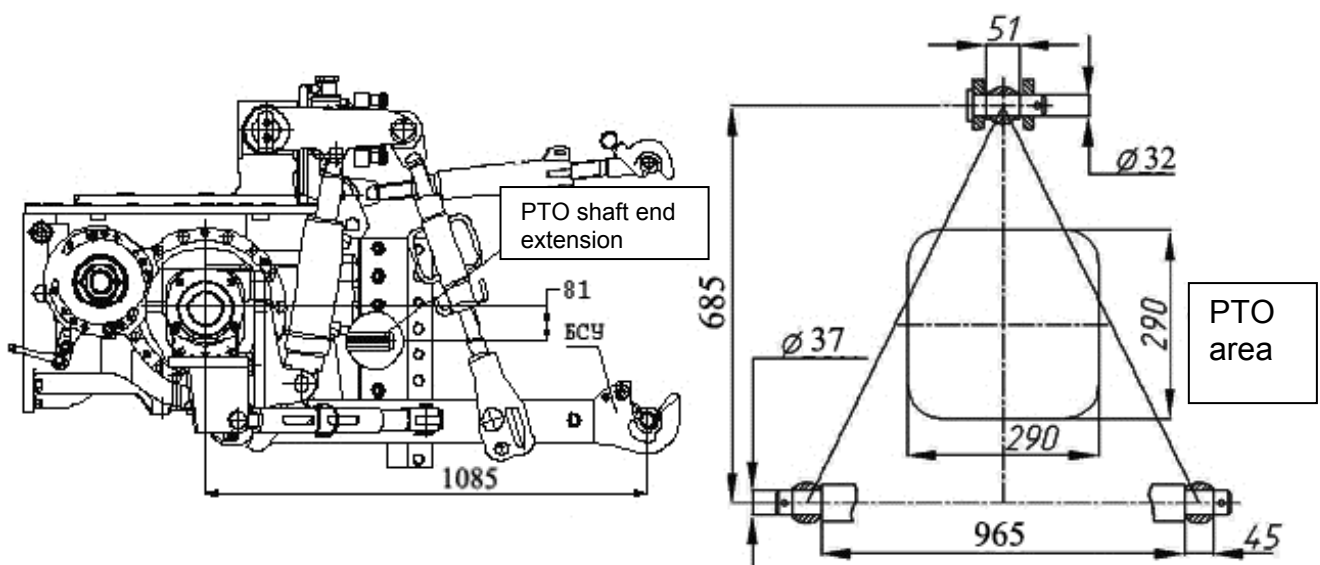


Figure 4.3.1 – Rear lift linkage diagram of "LL-3" type

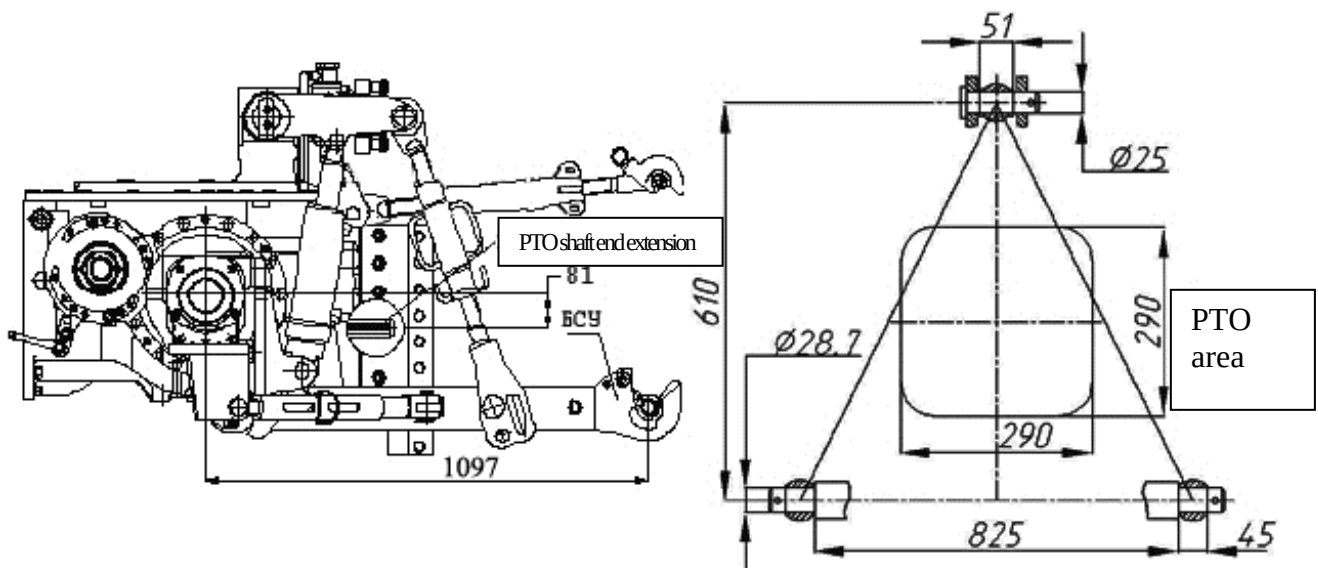


Figure 4.3.2 - Rear lift linkage diagram of "LL-2" type

Table 4.1 – Basic parameters and coupling dimensions of RLL

Standard size (configuration) of the device	LL-3 ²⁾ (figure 4.3.1)	LL-2 (figure 4.3.2)
1 Category (acc. to ISO 730-1)	Category 3	Category 2
2 Design features	It consists of three links (one upper and two lower), connected with the tractor with hinge joints, free ends of links with hinge joints are connected to the implement connecting elements while coupling	
3 Assignment	For connection (mounting) or coupling of mounted, semi-mounted implements	
4 Lower links	Solid with on-board control system and changeable hinge joints	
5 Lower links length, mm	1060	1060
6 Hinged joint width of the upper (lower) link, mm	51 (45)	51 (45)
7 Diameter of a rear-end hinged joint pin of the upper link, mm	32	25
8 Diameter of holes in rear hinge joints of lower links, mm	37	28,7
9 Distance between PTO shaft end extension butt end and suspension axis, mm	585	597
10 Column height ¹⁾ , mm	685	610
11 Length of the suspension axis along the shoulders ¹⁾ , mm	965	825
12 Lifting capacity of the device, kN ³⁾ :		
a) on the suspension axis;	65	65
b) at overhang of 610 mm from the suspension axis	45	45

¹⁾ Dimension refers to the implement coupled.

²⁾ The recommended type for basic use.

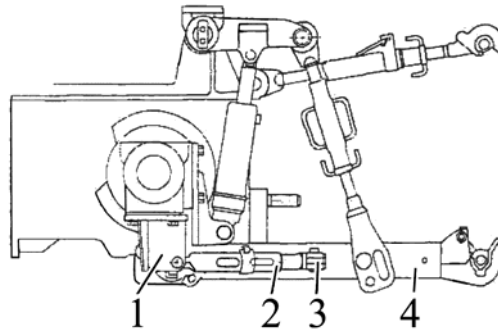
³⁾ It is not allowed to overload RLL higher than the tire load norm specified in table 3.1.

4.3.3 RLL components adjustment rules

4.3.3.1 Buckles

Buckles are used to limit side swaying of RLL lower links in transport and in operating position. Your tractor can be equipped with outer turnbuckles.

Buckles 2 (figure 4.3.3) are fixed with one end to eye lugs 3 of lower links 4. The other end of buckles with hinge joints is fixed into the brackets of buckles 1 with the help of pins. The brackets of buckles 1 are fixed on the lower part of RLL semi-axle tubes



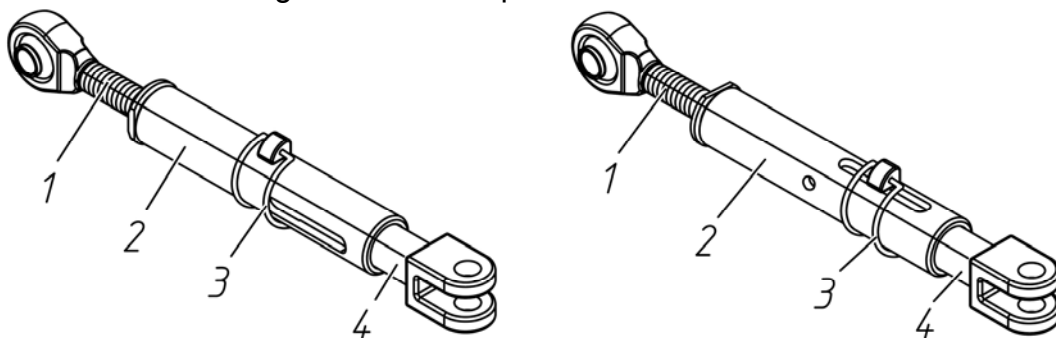
1 – buckle bracket; 2 – buckle; 3 – eye lug; 4 – lower link.

Figure 4.3.3 – Installing of buckles in RLL

The buckle consists of screw 1 (figure 4.3.4), guiding pin 2, slide piece 4 and linch pin 3.

Guiding pin 2 has a through groove on the side surface and a through hole in the surface perpendicular to it.

Slide piece 4 has two through holes in one plane.



a) buckle locked

b) buckle unlocked

1 – screw; 2 – guiding pin; 3 – linch pin; 4 – slide piece.

Figure 4.3.4 – Setting of buckles

While tractor operation buckles shall always be locked in one of the two positions:

buckle locked;

buckle unlocked.

Setting of buckles shall be carried out with the implement mounted on lower links rear ends and lowered onto the supporting surface.

Setting of “buckle locked” shall be carried out in the following order:

- match the hole for linch pin 3 in guiding pin 2 with the hole in slide piece 4;
- in case of mismatch, turn guiding pin 2 clockwise or counterclockwise until the holes match;
- insert linch pin 3 into the hole and fix it with the spring clip.

Setting of “buckle unlocked” shall be carried out in the following order:

- turn guiding pin 2 for $\approx 90^\circ$ and match the groove in guiding pin 2 with the hole in slide piece 4;
- while rotating guiding pin 2, place the hole in slide piece 4 on the groove center (adjust the right and left buckles);
- insert linch pin 3 into the hole and fix it with the clip.

ATTENTION: WHILE PERFORMING TRANSPORT WORK, IT IS REQUIRED TO USE THE SETTING "BUCKLE LOCKED"!

ATTENTION: WHILE TRACTOR OPERATION WITH THE MOUNTED IMPLEMENT OR MACHINE, IT IS REQUIRED TO USE THE SETTING "BUCKLE LOCKED" OR "BUCKLE UNLOCKED" ACCORDING TO THE INSTRUCTIONS OF THE OPERATOR'S MANUAL ON COUPLED IMPLEMENTS (MACHINES) OPERATION!

IT IS NOT ALLOWED TO USE BUCKLE WITHOUT FIXING THE SLIDE PIECE ON THE GUIDING PINS WITH A LINCH PIN!

4.3.3.2 Lifting rods

A lifting rod consists of a screw with hinge pivot 1 (figure 4.3.5), pipe 2, yoke 3, splint pin 4, pin 5, washer 6, counter nuts 7.

Adjustment of the lifting rod length is carried out in the following order:

- unscrew counter nut 7;
- while rotating pipe 2 clockwise or counterclockwise, change the lifting rod length;
- adjust the lifting rod length and locknut the screw connection with counter nut 7.

While setting pin 5 into the upper hole of yoke 3 as shown in figure 4.3.5, the lifting rod length shall be adjusted within 630 to 830mm.

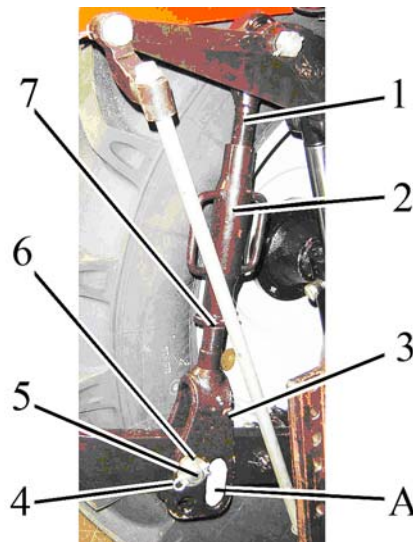
During shipment from the works, pins 5 are mounted into the upper holes of yokes 3, lifting rods are adjusted for the length of 780mm.

While setting pin 5 into the lower hole of yoke 3, the lifting rod length shall be adjusted within 700 to 900mm.

Setting of the lifting rod shall be carried out in the following way:

while tractor operation with mounted and semi-mounted implements and machines (except for wide-cut), RLL links shall not move freely in the lifting rod yokes. For this, pin 5 in the lifting rod shall be fixed into one of yoke 3 holes. Setting of pins 5 on the left and right lifting rod shall be equal;

while tractor operation with wide-cut mounted or semi-mounted implements, it is required to fix pins 5 in lifting rods into the grooves (cut slots) "A" of yokes 3 to provide vertical movement of lifting rods in relation to the lifting rod yoke. While setting pins 5 into the grooves "A" of yokes 3, the lifting rods length shall be adjusted within 700 to 900mm.



- 1 – screw with hinge pivot assembly; 2 – pipe; 3 – yoke; 4 – splint pin; 5 – pin; 6 – washer; 7 – counter nut.

Figure 4.3.5 – Lifting rod

While operating with implements, adjust the right lifting rod length according to the soil processing depth.

4.3.3.3 Upper link

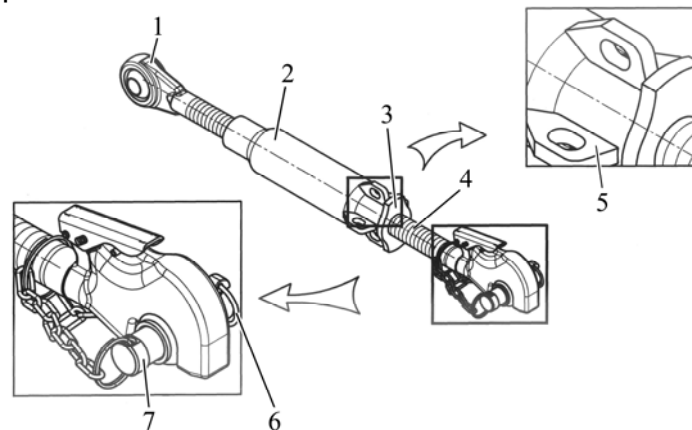
Upper link is shown in Figure 4.3.6.

The upper link length may be adjusted within 675 to 900mm.

Adjustment of the upper link length shall be made in the following order:

- unscrew counter nut 3 (figure 4.3.6);
- while rotating pipe 2 clockwise or counterclockwise with a crowbar catching ears 5, change the upper link length;
- after adjusting the link length, locknut the screw connection with counter nut 3.

Use pin 7 of rear hinge pivot to connect upper link to the implement; mount linch pin with ring 6 on it to fix the pin.



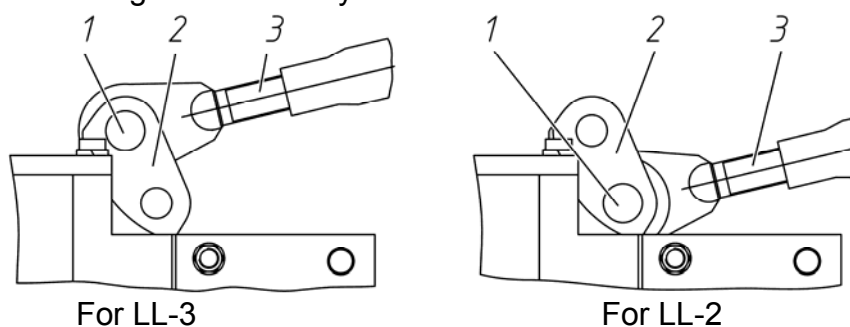
- 1 – front screw with hinge pivot assembly; 2 – pipe; 3 – counter nut; 4 – screw with a gripper (hinge joint); 5 – ear; 6 – linch pin; 7 – pin.

Figure 4.3.6 – Upper link

4.3.3.4 The rules of RLL adjustment for tractor operation with implements of category 2 (LL-2)

To provide implements of category 2 coupling to the tractor RLL, it is required to do RLL adjustment in the following way:

- if lower and upper links are completed with grippers, mount the corresponding hinge joints of category 2 (included into SPTA) into the grippers;
- if lower and upper links are completed with hinge joints, mount the corresponding reducing bushings (included into SPTA) into the hinge joints;
- set the distance between the hinge joints (the lower links grippers) according to the diagram in figure 4.3.2 by changing the buckle length. Changing the buckle length shall be carried out by rotating guiding pin 2 (figure 4.3.4);
- shift the front end of upper link 3 (figure 4.3.7) from the upper hole of bracket 2 to the lower hole;
- after the implement coupling to the lower links, couple the upper link to the implement, adjust the upper link length if necessary.



- 1 – pin; 2 – bracket; 3 – upper link front end

Figure 4.3.7 – Setting of the upper link front end for operation with implements and machines of different categories

4.3.3.5 Mounting of implements to the tractor RLL

While mounting of implements to the tractor, make sure that there are no people in the area of implement mounting. Using RLL controls put down lower links to the required position and connect lower links hinge joints to the implement, and then connect upper link hinge joint by means of a pin. Use the right lifting rod to adjust the implement position in transverse plane. To make adjustments in fore-and-aft plane for depth levelling of the implement front and rear operating parts, change the upper link length by turning the link pipe to the corresponding direction.

Final adjustment of the machine shall be made in the field.

Before starting operation, make sure that:

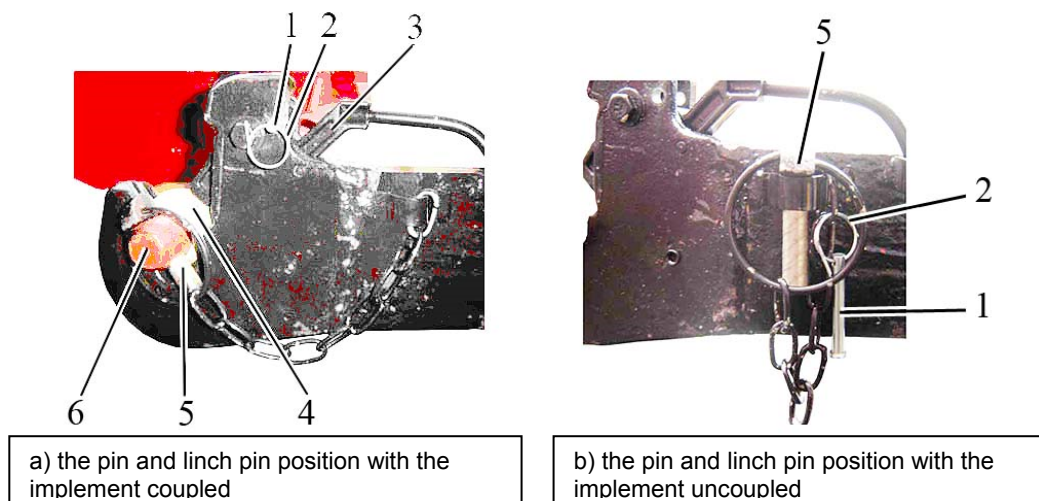
- tractor parts are not in dangerous closeness to implement elements;
- upper link does not touch the PTO guard with the implement in lowest position;
- cardan drive from PTO is not abnormally long, with bigger joint angles and there is no thrust force;
- PTO guard does not touch the machine cardan drive guard;
- lift the implement slowly and check availability of clearances between the tractor and the implement in upper position;
- check availability of the required side oscillation of lower links and adjust it by means of buckles, if necessary.

WARNING: SOME TYPES OF MOUNTED OR SEMI-MOUNTED IMPLEMENTS CAN TOUCH THE CAB AND DAMAGE IT. IT CAN RESULT IN DAMAGE OF THE CAB WINDOWS AND CAUSE INJURY TO THE OPERATOR. CHECK AVAILABILITY OF CLEARANCES (AT LEAST 100 MM) BETWEEN THE UPLIFTED IMPLEMENT AND THE OPERATOR'S CAB!

Mounting of machines (implements) to the tractor shall be carried out by means of automatic coupler CA-1, connected to the tractor lift linkage in three points (two rear hinge joints of lower links and a rear hinge joint of the upper link).

ATTENTION: AFTER COUPLING OF THE TRACTOR EQUIPPED WITH LINKS AND GRIPPERS MANUFACTURED BY MTW, WITH MOUNTED OR SEMI-MOUNTED IMPLEMENTS, IT IS REQUIRED TO LOCK THE RLL LOWER LINKS GRIPPERS BY MEANS OF PIN 1 (FIGURE 4.3.7a) WITH RING 2!

ATTENTION: WHILE DETACHING THE IMPLEMENT FROM THE TRACTOR, IT IS REQUIRED TO REMOVE FROM THE IMPLEMENT AXLE 6 (FIGURE 4.3.7a) LINCH PIN 5 WHICH FIXES HINGE JOINT 4 ON THE IMPLEMENT AXLE 6, ALSO REMOVE PIN 1 WITH RING 2 FROM THE GRIPPER, THEN UPLIFT THE HANDLE OF GRIPPER 3 AGAINST THE STOP. SET THE PIN AND THE LINCH PIN AS SHOWN IN VIEW b) OF FIGURE 4.3.7a!



1 – pin; 2 – ring; 3 – gripper handle ; 4 – hinge joint; 5 – linch pin; 6 – implement handle.

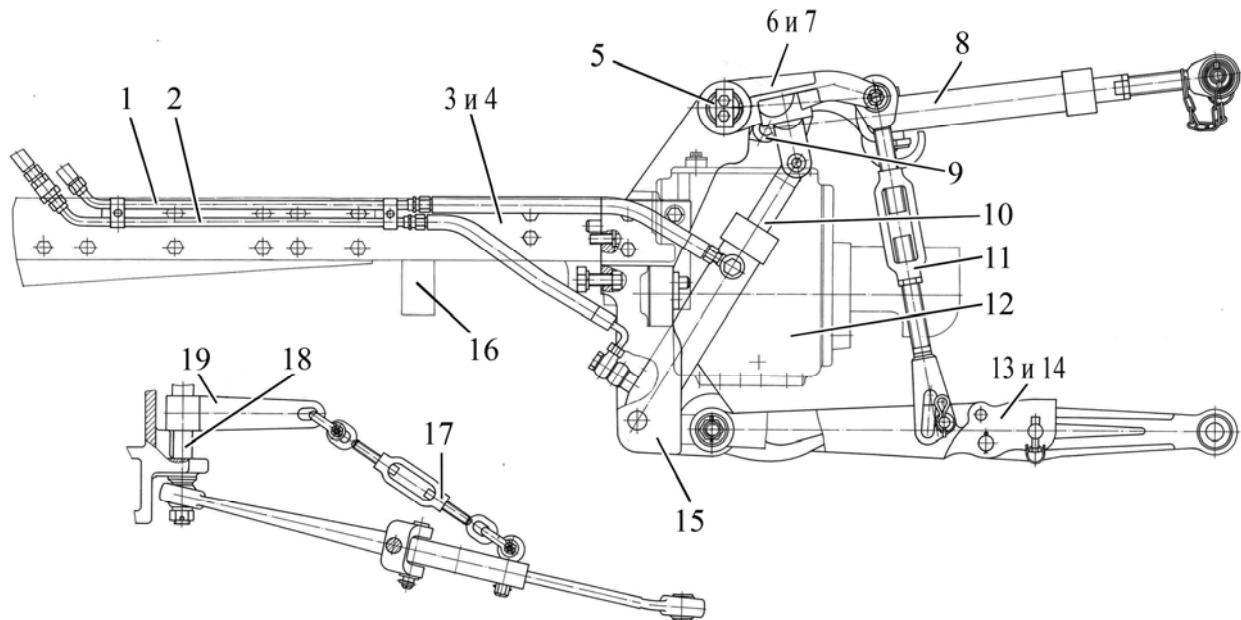
Figure 4.3.7a – Locking of the RLL lower links grippers

4.3.4 Three-point front lift linkage

Front lift linkage (FLL) is mounted on tractor "BELARUS-1523.5" against order.

Tractor with FLL is completed with front independent PTO 12, mounted on the front plane of bracket 15 (figure 4.3.8). FLL is mounted on the front plane of beam 16 and is fixed with two plates 3 and 4 to the beam side members and side surface. FLL hydraulic cylinders 10 are fed from side outlets located on the right as viewed along tractor movement through oil pipes 1 and 2 and high pressure hoses. Double-acting hydraulic cylinders are fixed to bracket 15 from one side, and from the other side they are connected with swivel levers 6 and 7 mounted on the splines of turning shaft 5 by means of rods. Swivel levers 6 and 7 are connected by means of lifting rods 11 with the FLL lower links 13 and 14 mounted on axle 18 which passes through bracket 15. Brackets 19 located on this axle as well are connected with lower links 13, 14 by means of buckles 17. The main purpose of buckles is to exclude swaying of the coupled implement.

Lever 9 is mounted on the turning shaft as well as swivel levers 6, 7. Upper link 8 is connected to lever 9. Lever 9 turns around together with levers 6, 7 which provides FLL specifications improvement while uplifting implements along the whole height of LL operation.



1, 2 – oil pipe; 3, 4 – plate; 5 – turning shaft; 6, 7 – swivel lever; 8 – upper link; 9 – lever; 10 – hydraulic cylinder; 11 – lifting rod; 12 – front power take-off; 13, 14 – lower link; 15 – bracket; 16 – beam; 17 – buckle; 18 – axle; 19 – bracket.

Figure 4.3.8 – FLL mounting

FLL is designed for tractor operation in structure of combined assemblies and is intended for tractor coupling with mounted implements of category 2 located at the tractor front.

FLL is intended for the following purposes:

forming of combined assemblies (at the front – cultivator, at the back – seeding machine, etc.);

forming of echelon linkage (front and side mowing machines, etc.);

transportation of separate machines from the structure of combined assemblies of rear location while long-distance moving.

With FLL mounted, front ballast weight mounting is not provided.

Tractor FLL is used with tillage machines only in pushing mode – FLL use with tillage machines on reverse is not provided.

IT IS FORBIDDEN TO OPERATE FLL WITH LOGGING BLADES AND FOR JACKING OF TRACTOR FRONT ELEMENT!

Front lift linkage is a three-point lift linkage of category 2 according to ISO 730 and LL-2 according to GOST 10677. The diagram of RLL of configuration LL-2 is shown in figure 4.3.9.

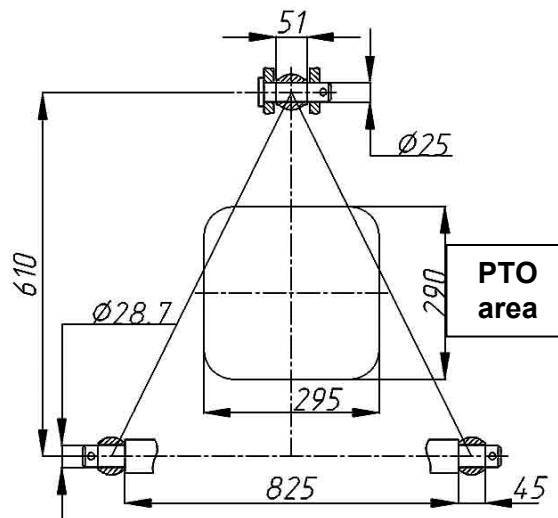


Figure 4.3.9 – Front lift linkage diagram

Table 4.2 – Basic parameters и coupling dimensions of FLL

Standard size (configuration) of the device	LL-2
1 Category	Category 2
2 Design features	The device consists of three links (one upper and two lower). Free ends of the links are pivotally joined with the implement connecting elements while coupling.
3 Assignment	For connection (mounting) and coupling of agricultural mounted and semi-mounted implements and quick-detachable mounted loads.
4 Lower links	Dismountable with hinge joints (without on-board control system)
5 Lower links length, mm	885
6 Free front hinge joints width for upper (lower) link, mm	51 (45)
7 Hinge pin diameter of the upper link, mm	25
8 Pivot pin bore diameter of lower links, mm	28,7
9 Distance between the PTO butt end and suspension axis, mm	576
10 Column height ¹⁾ , mm	610
11 Suspension axis length along the shoulders ¹⁾ , mm	825
12 Lifting power of the device, kN ²⁾ : a) on the suspension axis; b) at overhang of 610 mm from the suspension axis	25 20

¹⁾ The dimension refers to the coupled implement

²⁾ It is forbidden to overload FLL with loads exceeding the tire load norm specified in figure 3.3

4.3.5 The rules of agricultural implements coupling to FLL

Agricultural implements coupling to FLL is similar to RLL coupling. First it is necessary to place hinged joints of FLL lower links grippers on a lower axle of the agricultural machine (or on ears with pins), then couple the upper link to the implement.

For FLL lower links coupling to the lower axle of the agricultural implement, it is necessary to do the following:

unlock both lower links 3 and 5 (figure 4.3.11) for which it is necessary to unscrew the counter nut on turnbuckle 4 and turning the central element of the turnbuckle, provide free movement of the lower link (on the level of the connecting hinge joint) at least 40 mm to both sides;

slowly, at the speed of not more than 3 km/h, approach the agricultural implement uplifting the hinge joints of lower links 3, 5 to the same height as the lower axle of the implement;

stop when openings of FLL lower links hinge joints match with the implement lower axle. Place the hinge joints from both sides to the axle manually.

secure the hinge joints from side displacement putting locating fixtures into the openings on the coupled implement axle edge;

lock lower links 4 (rotate the central element of the turnbuckle, then screw the counter nut) to avoid the coupled implement swaying.

The procedure differs a little while FLL lower links coupling to agricultural implements that have no single lower axle, but have ears with pins for coupling.

For FLL lower links coupling to the implements ears, it is necessary to do the following:

it is necessary to set the dimension 870 mm between the hinge joints centers (unscrew turnbuckles counter nuts, set the dimension 870 mm by rotating the central elements of the turnbuckle, screw counter nuts) and uplift lower links between the ears of the coupled implement until the hinge joints openings match with the openings in ears;

pass the pin for each link through the openings in pairs (ear – hinge joint – ear);

secure the pins from displacement with locating fixtures.

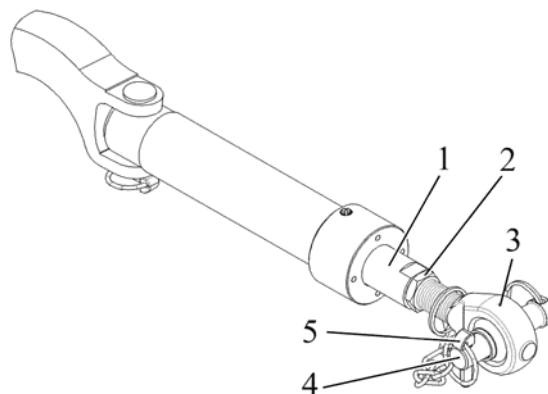
For FLL upper link coupling to the agricultural implement, it is necessary to do the following:

unscrew counter nut 2 (figure 4.3.10) which locks screw 3 turning of the upper link in slide piece 1. Take linch pin 5 out of pin 4. Take pin 4 out of the upper link hinge joint;

before coupling upper link to the implement with pin 4, turn off screw 3 out of linch pin 1 for the required value. Secure pin 4 setting linch pin 5;

final adjustment of the implement operating condition shall be done by turning the slide piece with the key to either side, screw 3 twists in (the link shortens) or twists off (the link lengthens) out of slide piece 1;

after adjusting, screw counter nut 2.



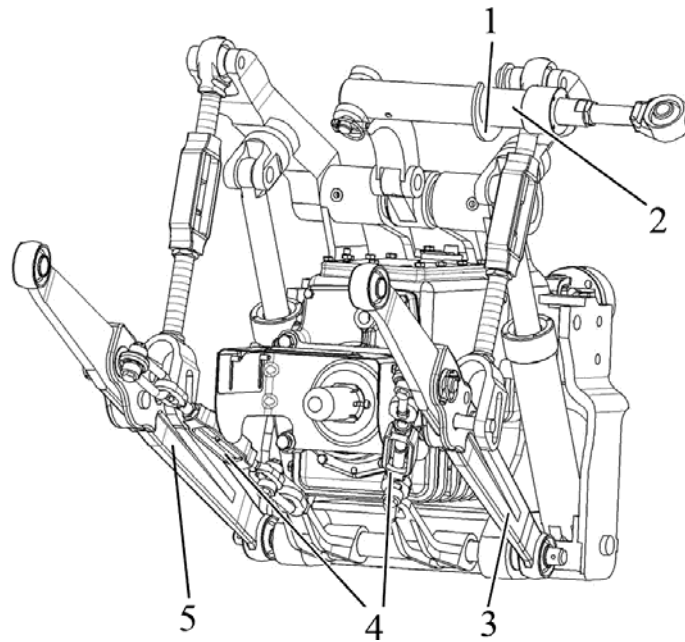
1 – slide piece; 2 – counter nut; 3 – screw; 4 – pin; 5 – linch pin.

Figure 4.3.10 – FLL upper link

4.3.6 The rules of shifting FLL from operating to transport position

FLL is shifted from the operating position to the transport position in the following order:

- dismount the upper link hinge joint from the implement;
- unscrew counter nuts on turnbuckles 4 (figure 4.3.11) of lower links 3, 5, loosen the turnbuckles, take the locating fixtures out of the implement axle, release connecting hinge joints of lower links;
- separate lower links – take FLL connecting hinge joints off the implement axle;
- uplift FLL and tighten the nuts on turnbuckles;
- turn upper link 2 to the side and put it on detent 1 fixed on the FLL lever pin.



1 – detent; 2 – upper link; 3, 5 – lower links; 4 – turnbuckles.
Figure.3.11 – FLL transport position

4.4 Drawbar hitches

4.4.1 General information

Drawbar hitch of "BELARUS-1523.5" can be completed with drawbar elements of type DH-2V (short towing yoke), DH-3V (long towing yoke), DH-2R ("python"), DH-1 (crossbeam) and DH-1M-01(draw bar), providing coupling and transportation of trailed and semi-trailed implements, connecting devices of which correspond to the following requirements:

- compatibility according to the coupling dimensions;
- implements are equipped with rigid drawbar hitch;
- draft poles are equipped with a device making the procedure of coupling/uncoupling with tractor drawbar hitch easy;
- drawbar hitches of semitrailers have an adjustable support.

Tractor "BELARUS - 1523.5" has a special-purpose rear mounting device of lift type in the form of vertical guiding plates with several openings, fixed to the rear joint face of the rear axle body. The device is designed for mounting drawbar hitches and provides height adjustment of DH-2V (short towing yoke), DH-2R ("python") and DH-3V (long towing yoke).

Installation variant diagram of DH-2V (short towing yoke) is shown in figure 4.4.1.

Installation variant diagram of DH-3V (long towing yoke) is shown in figure 4.4.2.

Installation variant diagram of DH-2R ("python") is shown in figure 4.4.3.

Installation diagram of DH-1M-01 (draw bar) is shown in figure 4.4.4.

Installation diagram of DH-1 (crossbeam) is shown in figure 4.4.5.

Basic parameters of drawbar hitches shown in tables 4.3, 4.4, 4.5, 4.6, 4.7 and in figures 4.4.1, 4.4.2, 4.4.3, 4.4.4, 4.4.5 are given with standard rear tires (520/70R38 –single and twinned) mounted on the tractor and with standard static radius, specified by the manufacturer.

4.4.2 Drawbar hitch DH-2V (short towing yoke)

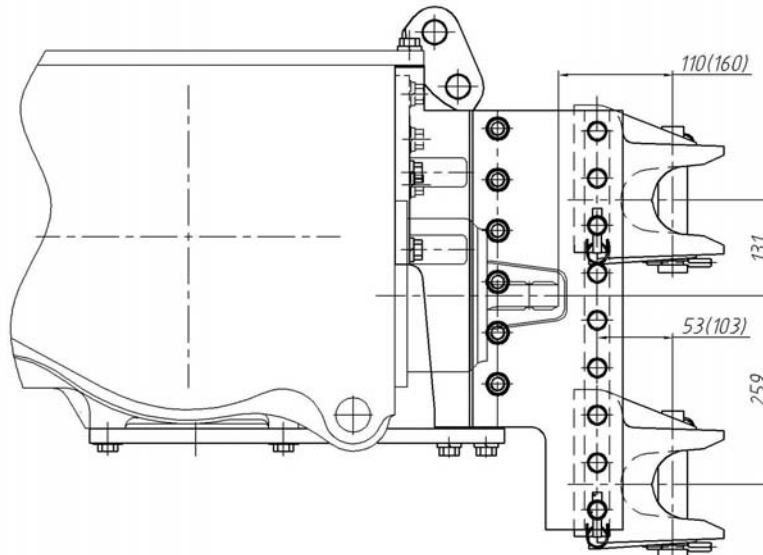


Figure 4.4.1 – Installation variant diagram of DH-2V (short towing yoke)

Table 4.3 – Basic parameters and coupling dimensions of DH-2V (short towing yoke)

Standard size (configuration) of the device		DH-2V (short towing yoke)	
1 Variant		Yoke acc. to ISO	Yoke acc. to GOST
2 Mounting location		Rear lifting device	
3 Design features		Non-rotational, height adjustable	
4 Assignment		For connection and coupling of trailed, semi-trailed implements with traveling wheels, including tractor semi-trailer type	
5 DH yoke dimensions, mm: a) connecting pin diameter b) yoke gap height c) yoke gap depth d) yoke position ¹ for the implements driven by rear PTO shaft e) distance between the PTO butt end and the connecting pin axis, mm		40	
		85	
		70	
		Extreme lower position	
		110	160
6 Trailing device for coupling to DH: a) type b) vertical load in hitch point, kN, not more than c) turning angle of the implement trailing device in horizontal plane, degrees, not less than d) protective device type e) connection point of the protective device on the tractor		Rigid, with tractor drawbar clevis 25 ±60 Safety chain (rope) ²⁾ Lifting device holes	
<			

ATTENTION: IT IS FORBIDDEN TO PUT DH-2V YOKE TO A POSITION WHERE ITS BODY OVERHANGS THE DH SUPPORTING BRACKET END (UP OR DOWN) FOR MORE THAN 15 MM!

4.4.3 Drawbar hitch DH-3V (long towing yoke)

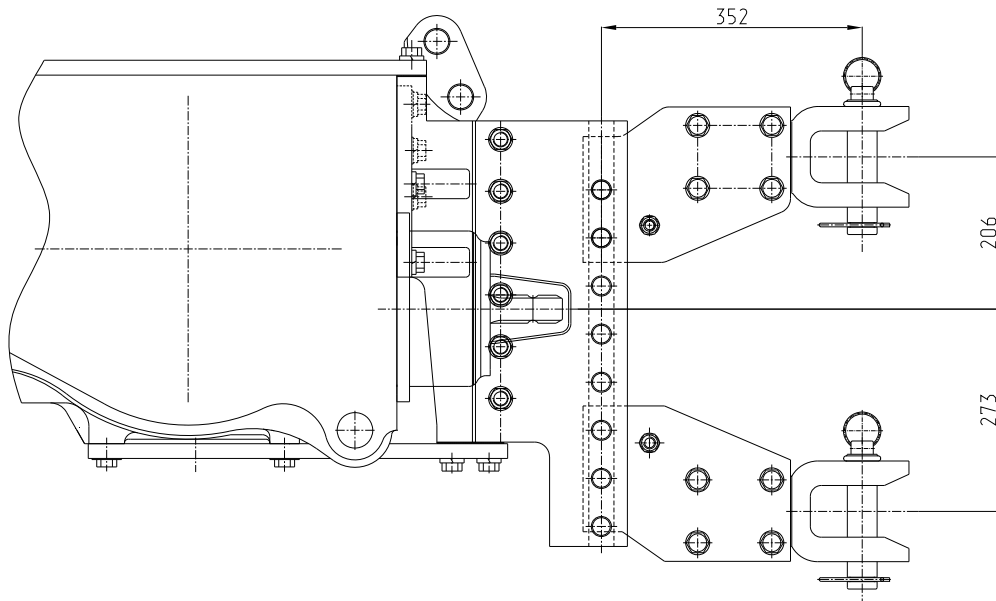


Figure 4.4.2 – Installation variant diagram of DH-3V (long towing yoke)

Table 4.4 – Basic parameters and coupling dimensions of DH-3V (long towing yoke)

Standard size (configuration)	DH -3V (long towing yoke)
1 Mounting location	Rear lifting device
2 Design features	Rotational, height adjustable
3 Assignment	For coupling of trailed implements, including tractor trailer type equipped with drawbar clevises
4 DH yoke dimensions, mm: a) connecting pin diameter b) yoke position ¹⁾ for the implements driven by rear PTO shaft c) distance between the PTO butt end and the connecting pin axis	40 Extreme lower position, as shown in figure 4.4.2 400
5 Trailing device for coupling to DH: a) type b) vertical load in hitch point, kN, not more than c) turning angle of the implement trailing device in horizontal plane, degrees, not less than d) protective device type e) connection point of the protective device on the tractor	Rigid, with tractor drawbar clevis 20 ±60 Safety chain (rope) ²⁾ Lifting device openings
¹⁾ Recommended. ²⁾ Implement accessories.	

ATTENTION: IT IS FORBIDDEN TO PUT DH-3V YOKE TO A POSITION WHERE ITS BODY OVERHANGS THE DH SUPPORTING BRACKET END (UP AND DOWN) FOR MORE THAN 15 MM!

4.4.4 Drawbar hitch DH-2R (“python”)

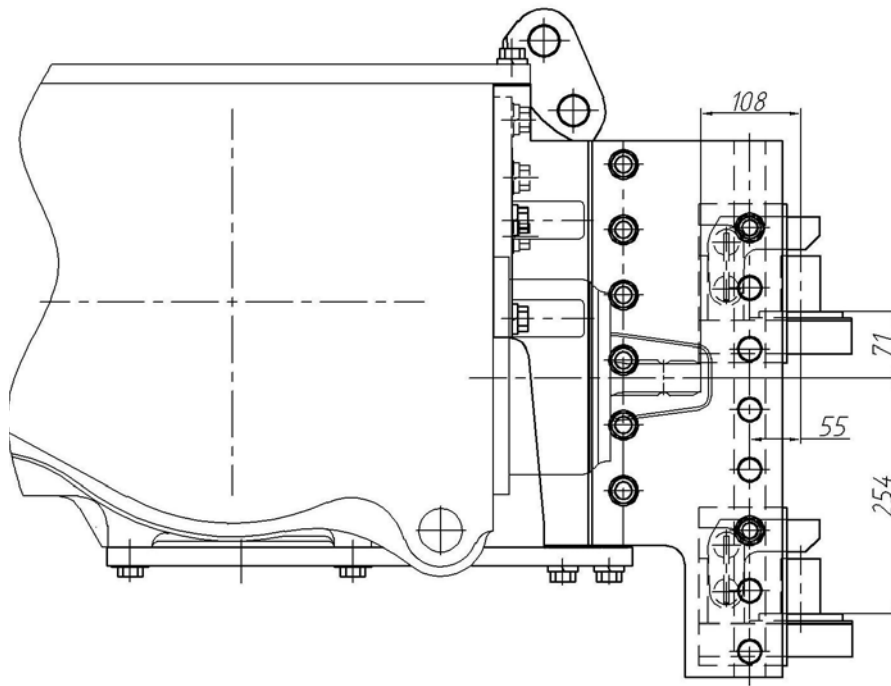


Figure 4.4.3 – Installation variant diagram of DH -2R (“python”)

Table 4.5 – Basic parameters and coupling dimensions of DH -2R (“python”)

Standard size (configuration)	DH -2R (python)
1 Mounting location	Rear lifting device
2 Design features	Cantilever fitted connection pin, vertically adjustable
3 Assignment	For coupling of semi-trailed implements and implements of tractors semi-trailers types having hitch clevises
4 Distance between the PTO butt end and the connecting pin axis, mm	108
5 Connecting pin diameter, mm	40
6 Vertical load on DH in hitch point, kN, not more than	25
7 Protective device type	Safety chain (rope) ¹⁾
8 Connection point of the protective device on the tractor	Lifting device openings
¹⁾ Implement accessory.	

ATTENTION: IT IS FORBIDDEN TO PUT THE DEVICE TO THE EXTREME LOWER POSITION, WHERE IT OVERHANGS THE DH SUPPORTING BRACKET END!

4.4.5 Drawbar hitch DH-1M-01 (draw bar)

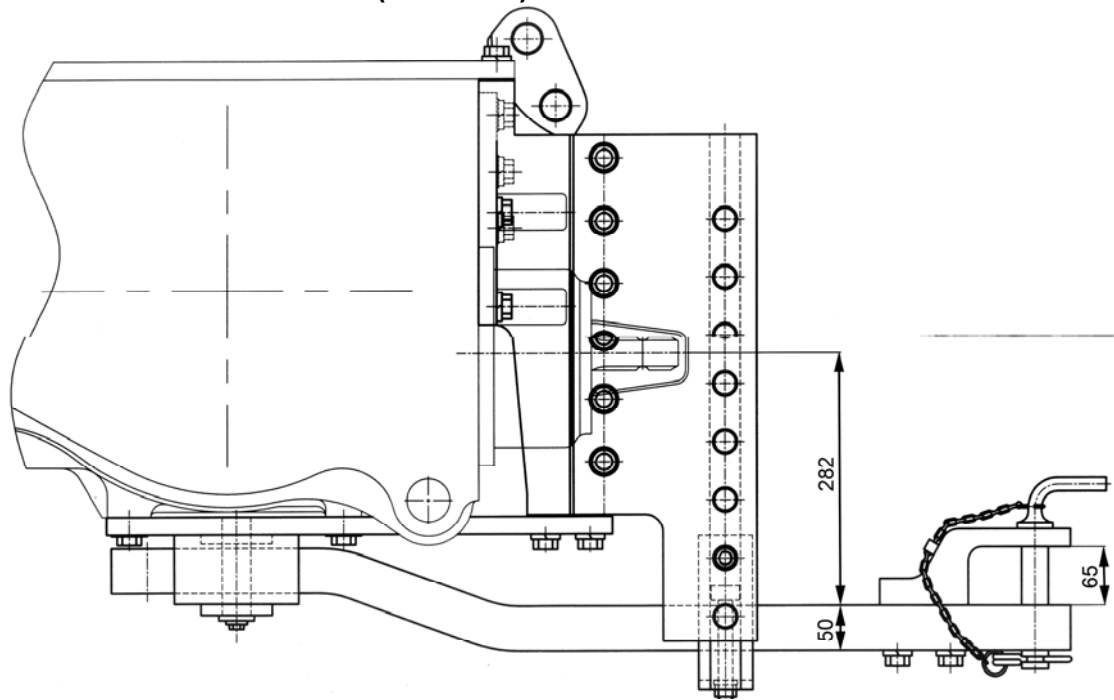


Figure 4.4.4 – Installation variant diagram of DH-1M-01 (draw bar)

Table 4.6 – Basic parameters and coupling dimensions of DH -1M-01(draw bar)

Standard size (configuration)	DH -1M-01 (draw bar)	
1 Variant	First position	Second position
2 Mounting location	At the bottom of the rear axis body and rear lifting device	
3 Assignment	For connection and coupling of trailed, semi-trailed implements with traveling wheels, excluding tractor trailers and semi-trailers	
4 Design features	Draw bar with possibility to change its horizontal position in relation to the RPTO butt end	
5 Distance between the PTO butt end and the connecting pin axis, mm	400	500
6 Vertical load on DH in hitch point, kN, not more than	15	12
7 Turning angle of the implement trailing device in horizontal plane, degrees, not less than	±60	
8 Connecting pin diameter, mm	30	
9 Protective device type	Safety chain (rope) ¹⁾	
10 Connection point of the protective device on the tractor	Lifting device openings	
¹⁾ Implement accessory.		

ATTENTION: MOUNTING OF COVER PLATE ON THE DRAW BAR BOTTOM (WITH OVERTURN) TO REDUCE HEIGHT OF YOKE POSITIONING IN RELATION TO THE SUPPORTING SURFACE IS NOT ALLOWED!

4.4.6 Drawbar hitch DH -1 (crossbeam)

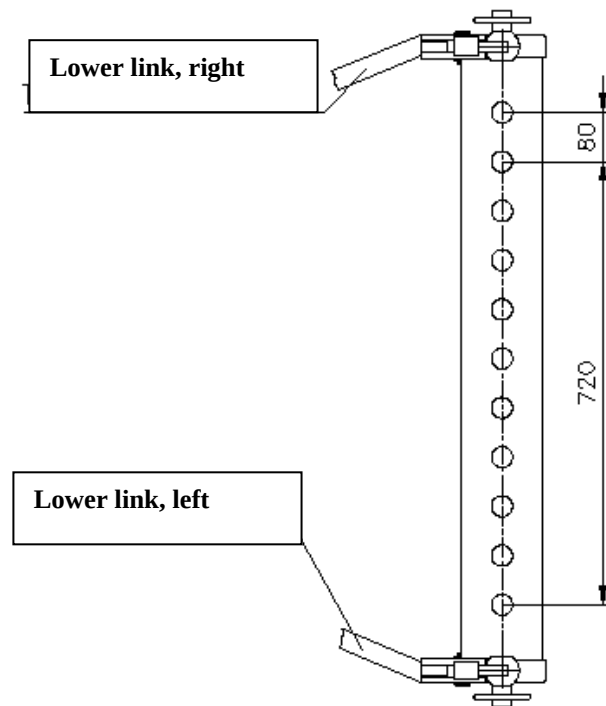


Figure 4.4.5 – Installation diagram of DH -1 (crossbeam)

Table 4.7 – Basic parameters and coupling dimensions of DH -1 (crossbeam)

Standard size (configuration)	DH -1 (crossbeam)
1 Mounting location	On the RLL suspension axis
2 Design features	Draw crossbeam on the RLL suspension axis
3 Assignment	For connection and coupling of trailed, semi-trailed and semimounted implements equipped with towing yokes
4 Distance between the PTO butt end and the connecting pin axis, mm	668
5 Diameter of crossbeam openings for the connecting pin, mm	32,5
6 Vertical load on DH in hitch point, kN, not more than	3,5
7 Protective device type	Safety chain (rope) ¹⁾
8 Connection point of the protective device on the tractor	Lifting device openings
¹⁾ Implement accessory.	

4.5 Usage patterns of tractor hydraulic system for drive of operating parts and other elements of hydraulically-powered coupled machines and implements

Hydraulic control system for implements mounted on tractors "BELARUS-1523.5" provides an opportunity for oil extraction for the coupled implements operation. The following variants of oil extraction are possible:

- oil extraction by unilateral and bidirectional hydraulic cylinders;
- replenishment of oil volume in the tank caused by filling of cylinder and the implement fittings shall be provided after testing the performance of the tractor hydraulic system with the implement;
- oil extraction for hydraulic motors drives, in this case the implement applicability shall be stipulated with the tractor plant-manufacturer.

While operating hydraulically-powered machines having hydraulic motors, the hydraulic motor drain pipe shall be connected to a special tractor outlet to ensure free oil drain into the tank past the distribution valve.

ATTENTION: FOR PROVIDING NECESSARY ROTATIONAL SPEED OF THE COUPLED IMPLEMENT HYDROMOTOR, CERTAIN OIL SUPPLY IS REQUIRED. HYDRAULIC FLUID SUPPLY ON THE TRACTOR "BELARUS-1523.5" DEPENDS ON THE ENGINE RPM, FOR THIS REASON THE IMPLEMENT HYDRAULIC DRIVE SHALL BE EQUIPPED WITH ITS OWN FLOW ADJUSTING VALVE!

In case of using tractor hydraulic system outputs for the coupled implement service, it is necessary to ensure the required volume of oil in the tank. Oil extraction by cylinders of the coupled implement shall not exceed 8 liters.

Excessive oil extraction during coupling causes load increase on the tractor hydraulic system. If using a hydraulic drive for a long time, it is necessary to check the temperature range in the hydraulic system.

Level check in the tractor hydraulic tank and its refilling shall be carried out with the operating cylinder retracted plungers on the coupled implement and on the tractor. It is forbidden to fill in the oil when the coupled implement plungers are put forward as it can result in the tank overflow and the hydraulic drive elements blowout because of the excessive oil displacement from cylinders at the subsequent lowering (uplift) of the operating parts.

The main characteristics of tractor "BELARUS-1523.5" HLL for drive of operating parts and other elements of coupled hydraulically-powered implements and machines are shown in table 4.8.

Table.4.8 – Tractor “BELARUS-1523.5” hydraulic drive specifications

Parameter designation	Parameter value (characteristic)	
1 Paired hydraulic outlets	Side	Rear
	-	Three pairs
2 Oil pipe of free drain into the tank	-	One item
3 Oil consumption through hydraulic outlets, l/min, not more than	up to 53 ¹⁾	
4 Nominal minimum diameter of the oil pipe-line, mm: - oil pressure pipeline - oil drain pipeline - free drain	16,0 25,0 18,0	
5 Hydraulic system rated operating pressure, MPa	16,0	
6 Operating pressure of the safety valve, MPa	20 ₋₂	
7 Permissible hydraulic liquid extraction from the tank, l, not more than	8,0	
8 Permissible hydrostatic power take-off (GSPTO) kW, not more than	15,0	
9 Coupling thread of fast-coupling joint sleeves, mm: - oil pressure pipeline and oil drain pipeline - free-drain oil pipeline	M20×1,5 M24×1,5	
¹⁾ At standard engine rpm		

ATTENTION: INSTALLATION OF ADDITIONAL ELEMENTS AND CHANGE OF HYDRAULIC LIFT LINKAGE PIPELINES ROUTE IS ALLOWED ONLY AFTER CONSULTATION WITH THE PLANT OR THE DEALER!

Note – The arrangement of the HLL hydraulic outlets and the diagram of their connection to the external consumers are given in section2 “Controls and instruments”.

4.6 Front ballast weight

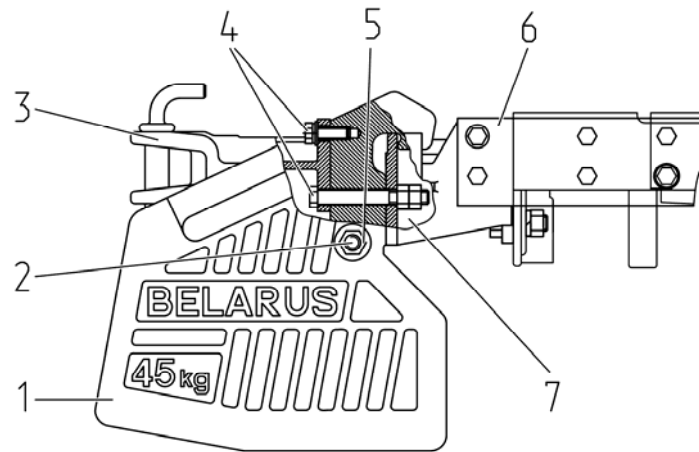
The front ballast weight is designed for preserving tractor normal controllability in the conditions of significant front axle unloading while operating with heavy mounted machines and implements mounted onto tractor RLL and DH.

For the front ballast weight mounting three variants are possible:

ballast with one row of additional weight of 450kg (10 pieces at 45kg each) is shown in figure 4.6.1, basic configuration;

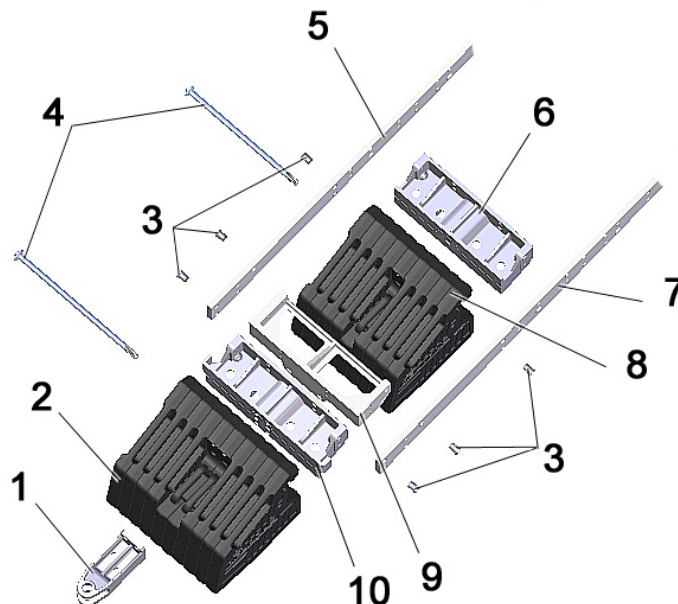
ballast with one row of additional weight of 360kg (8 pieces at 45kg each) is shown in figure 4.6.1, configuration against order;

ballast with two rows of additional weight total of 990 kg is shown in figure 4.6.2, configuration against order.



1 – additional weight; 2 – string; 3 – towing device; 4 – tension bolts of additional weight and a towing device; 5 – nut; 6 – plate; 7 – bracket.

Figure 4.6.1 – Ballast with one row of additional weight



1 – towing device; 2 – the first row of additional weight; 3 – bushing; 4 – string; 5 – right plate; 6 – bracket; 7 – left plate; 8 – the second row of additional weight; 9 – spacer; 10 – bracket.

Figure 4.6.2 – Ballast with two rows of additional weight

4.7 Trailer brake drive

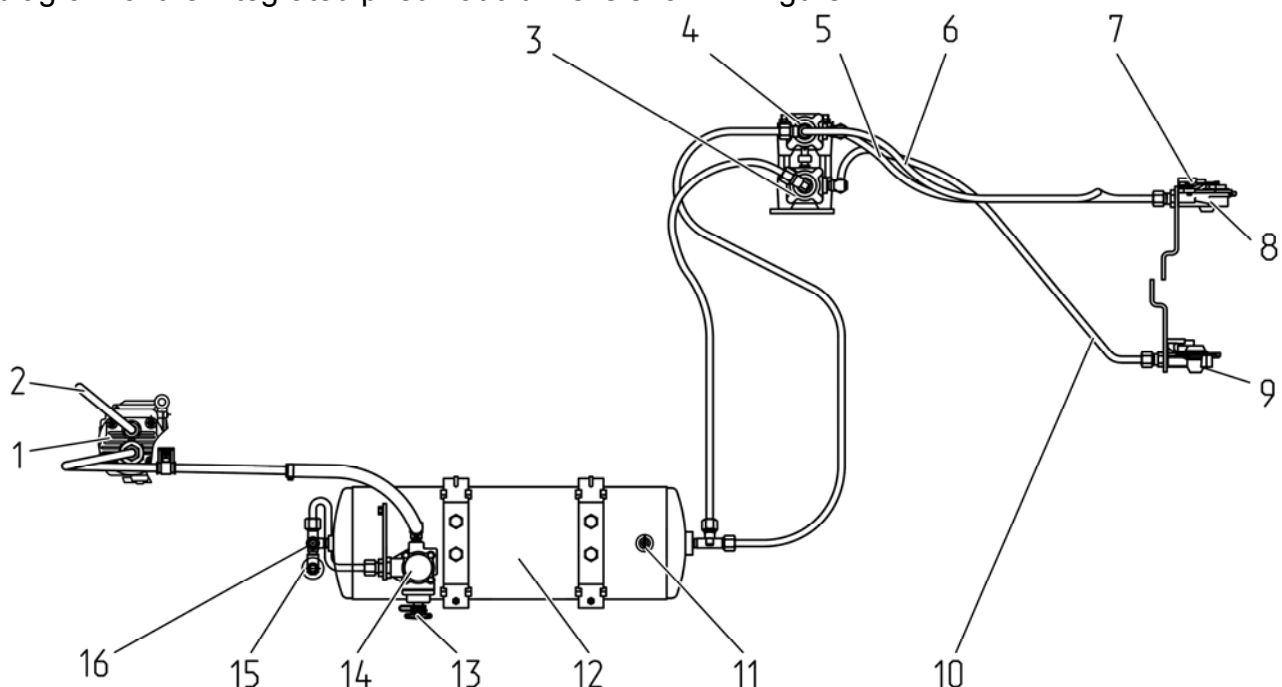
4.7.1 General information

Your tractor can be equipped with an integrated pneumatic drive for trailer brakes or a hydraulic drive for trailer brakes. General information on the integrated pneumatic drive for trailer brakes configuration is given in subsection 4.7.2. General information on the hydraulic drive for trailer brakes configuration is given in subsection 4.7.3.

ATTENTION: ALL ADJUSTMENT OPERATIONS OF THE BRAKING SYSTEM AND THE TRAILER BRAKES DRIVE AS WELL AS TROUBLESHOOTING SHALL BE CARRIED OUT WITH THE ENGINE STOPPED AND THE TRACTOR IN A HORIZONTAL POSITION, WHICH SHALL BE SECURED BY STOP BLOCKS PUT BEHIND THE WHEELS AND PREVENTING THE TRACTOR FROM SELF-MOVEMENT!

4.7.2 Integrated pneumatic drive of trailer brakes

The integrated pneumatic drive provides brake control of trailers and implements equipped with single-wire or double-wire brakes of the pneumatic drive as well as tire inflation. The diagram of the integrated pneumatic drive is shown in figure 4.7.1.



1 – compressor; 2 – line from the engine inlet manifold; 3 – brake valve (double-wire); 4 – brake valve (single-wire); 5 – connecting line; 6 – feed line; 7, 8, 9 – connecting heads; 10 – control line; 11 – condensate drain valve; 12 – tank; 13 – air bleed valve; 14 – pressure regulator; 15 – air pressure indicator; 16 – emergency air pressure sensor.

Figure 4.7.1 – Diagram of the integrated pneumatic drive of trailer brakes

While coupling of the trailer with single-wire pneumatic drive, the trailer head is attached to connecting head 8 (black color) and air flows to the trailer pneumatic drive. When pressing the brake pedal or engaging the parking brake, compressed air flows out of connecting line 5 through brake valve 4 into the atmosphere.

The air distributor comes into action on the trailer supplying compressed air from the trailer tanks into brake chambers and the trailer brakes. In case of emergency disconnection of the trailer, connecting heads are detached, air flows out of the trailer line into the atmosphere and the trailer brakes automatically.

Direct brake control is carried out due to pressure fall in the connecting line from 5 to 0 MPa while tractor braking. In this case, compressed air supply to the trailer pneumatic system stops.

Automatic brake control (automatic braking) is carried out in case of hitch breakage or trailer disconnection due to pressure fall in the trailer connecting line.

While coupling of the trailer with double-wire pneumatic drive, connecting heads of the trailer are attached to connecting heads 7 (with a red cap) and 9 (with a yellow cap), that is to feed line 6 and control line 10. In this case, compressed air constantly flows to the trailer through feed line 6. When pressing the brake pedal or engaging the parking brake, compressed air is supplied to the trailer through brake valve 3 and control line 10. The air distributor comes into action on the trailer supplying compressed air from the trailer tank into brake chambers and the trailer brakes.

Direct brake control is carried out due to pressure in the control line 10 set from 0,65 to 0,8 MPa while tractor braking. In this case, feed line 6 stays under pressure and compressed air supply to the pneumatic system is kept.

Automatic brake control (automatic braking) is carried out in case of hitch breakage or trailer disconnection due to pressure fall in the trailer feed line.

Connecting heads of valve type 7, 8, 9 are mounted at the end of connecting lines. The valves of connecting lines prevent compressed air from flowing out when using the drive without a trailer (for example, while tire inflation). While connecting the trailer brake lines with the tractor brake lines 5, 6, 10, the valves of connecting heads open providing the compressed air ingress from the tractor hydraulic drive to the trailer. In this case, it is required to connect the tractor and trailer pneumatic lines when there is no pressure in tank 12 of the tractor.

ATTENTION: BEFORE CONNECTING OR DISCONNECTING THE TRACTOR OR TRAILER PNEUMATIC LINES, ENGAGE THE PARKING BRAKE! CONNECTION OF TRACTOR AND TRAILER PNEUMATIC LINES SHALL BE CARRIED OUT WHEN THERE IS NO PRESSURE IN THE TRACTOR PNEUMATIC SYSTEM!

4.7.3 Hydraulic drive of trailer brakes

Tractors "BELARUS-1523.5" can be equipped with the hydraulic drive of trailer brakes against order.

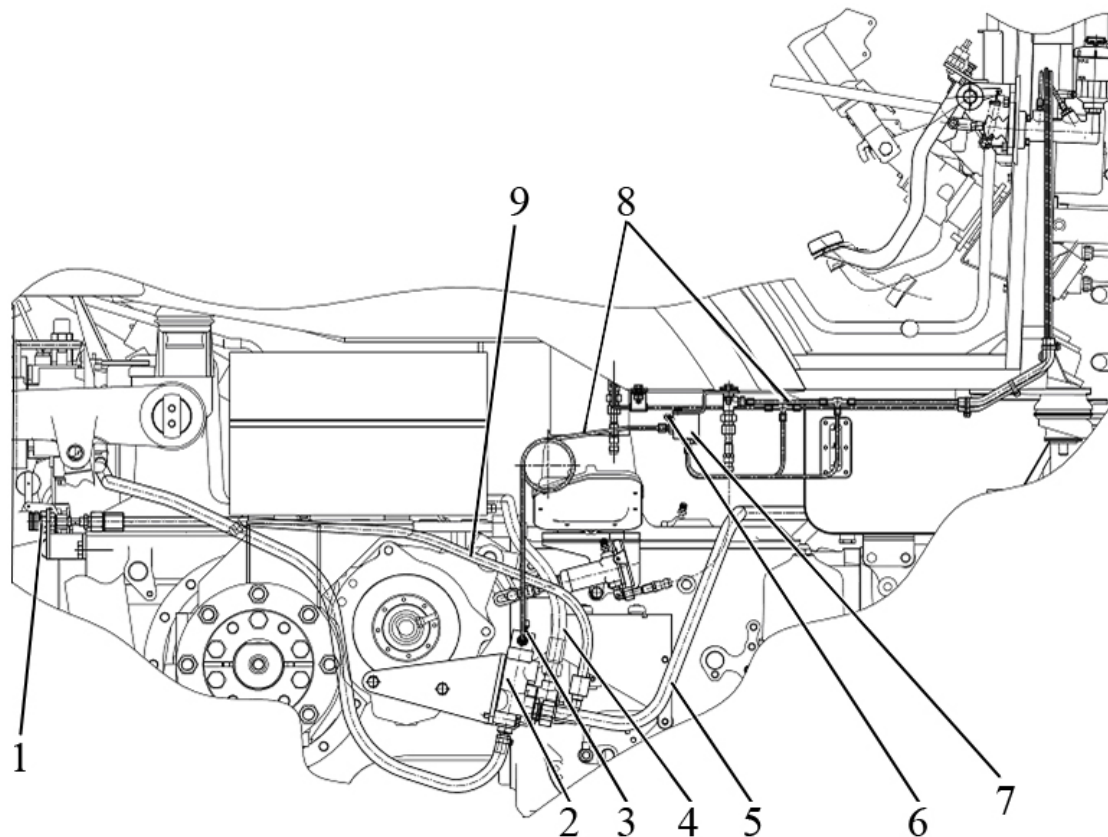
The hydraulic drive of trailer brakes is interlocked with tractor operating brakes control and provides actuation of wheel brakes of trailer or semi-trailer, equipped with the system of the hydraulic drive of trailer brakes. The hydraulic connecting line is fed from the HLL pump that provides pressure between 10 ... 15 MPa and is made as single-wire brake system. The connection of the hydraulic drive corresponds to the standard ISO/5676 of 1983.

The hydraulic drive of trailer brakes is subsequently fed from the pump of the tractor hydraulic lift linkage with the help of high-pressure hoses 4 and 5 (figure 4.7.2). As brake valve 2 comes into action, oil is supplied to the trailer (semi-trailer) brake system along line 9 through coupling 1. Brake valve 2 comes into action when brake liquid is supplied from the operating brakes control system to brake valve 2 along lines 8 to distribution valve 7. Brake liquid is supplied to brake valve 2 when both operating brake pedals are pressed at the same time. If only one brake pedal is pressed, distribution valve 7 does not come into action and accordingly, brake liquid is not supplied to brake valve 2.

Coupling 1 prevents oil outlet when the hydraulic drive is used without the trailer. When brake line of the trailer is connected with brake line of the tractor, the coupling provides oil inlet to the trailer

ATTENTION: TRACTOR EQUIPPED WITH THE HYDRAULIC DRIVE OF TRAILER BRAKES CAN NOT BE COUPLED WITH TRAILERS HAVING THE PNEUMATIC DRIVE OF THE BRAKES!

ATTENTION: CONNECT AND DISCONNECT THE BRAKE HYDRAULIC LINE OF THE TRACTOR AND TRAILER ONLY WHEN THE ENGINE IS STOPPED AND THE PARKING BRAKE IS ENGAGED!



1 – coupling; 2 – brake valve; 3, 6 – hole fitting for bleeding; 4 – oil feed line from the brake valve to the HLL distribution valve; 5 – oil feed line from the HLL pump to the brake valve; 7 – distribution valve; 8 – brake liquid feed line; 9 – oil feed line from the brake valve to the connecting coupling.

Figure 4.7.2 – Hydraulic drive of trailer brakes

ATTENTION: WHILE THE HYDROSTATIC CONTROL BLEEDING BY MEANS OF OPERATING BRAKES WHEN THE HYDRAULIC DRIVE OF TRAILER BRAKES IS MOUNTED, IT IS ADDITIONALLY REQUIRED TO LET OUT AIR FROM BRAKE VALVE 2 AND DISTRIBUTION VALVE 7 (FIGURE 4.7.2) THROUGH HOLE FITTING FOR BLEEDING 3 AND 6 RESPECTIVELY!

4.8 Determination of PTO shaft and cardan shaft applicability

To avoid failures of PTO shaft and PRS in implements with active operating parts (tilling rotary implements, combine harvester, mowers, cattle-feeders, pickup balers and etc.) mechanical safety clutches are used.

Functional assignment of the safety clutch is automated gear deactivation or limitation of the torque value transmitted from the PTO shaft to PRS under overloads caused by large starting moment, overload (locks) of the operating parts and loads fluctuations on the PRS drive.

ATTENTION: THE RESPONSE TIME OF THE COUPLED IMPLEMENT SAFETY CLUTCH SHALL EXCEED THE RATED OPERATING TORQUE ACTING FOR A LONG TIME IN THE IMPLEMENT DRIVE, BUT BE ALWAYS EQUAL TO OR LESS THAN THE MAXIMUM PERMISSIBLE PTO SHAFT TORQUE! IF THE RESPONSE TIME OF THE IMPLEMENT SAFETY CLUTCH EXCEEDS THE PERMISSIBLE PTO SHAFT TORQUE, SUCH IMPLEMENT MUST NOT BE COUPLED WITH THE TRACTOR.

Safety clutches are divided into cam clutches, frictional clutches, disk clutches, and they can be subdivided into two basic types – with destructible and indestructible operating elements. Clutches with a destructible element are used as unlikely overload control device.

ATTENTION: IT IS NOT RECOMMENDED TO USE CARDAN SHAFTS WITH SAFETY CLUTCHES WITH A DESTRUCTIBLE ELEMENT FOR IMPLEMENTS COUPLING WITH TRACTORS “BELARUS-1523.5”!

In some implements freewheeling clutches are used. Freewheeling clutches (sprag clutches) are automatically locked if the rotating direction is straight, and are unlocked if the rotating direction is opposite. Freewheeling clutches provide operation of the implements with the increased inertia moment of the implement rotating masses to prevent it from the drive failure during the PTO shaft deactivation.

There are also integrated safety clutches. An integrated safety clutch is a safety clutch which is structurally combined with a clutch of other type, for example with a free-wheeling clutch.

ATTENTION: MANUFACTURER OF THE IMPLEMENT WITH CARDAN DRIVE FROM THE TRACTOR PTO, SHALL INFORM YOU IN ADVANCE ABOUT THE NECESSITY OF SAFETY CLUTCH USE, CLUTCH DESIGN PECULIARITIES AND CONSEQUENCES OF THE IMPLEMENTS USE WITHOUT THE SAFETY CLUTCH!

While choosing (purchasing) and operating the cardan shaft, it is required to follow the instructions of the implement and cardan shaft manufacturer first of all. It is recommended to apply implements with active operating parts with the tractor, which have the length of the fully displaced cardan shaft between hinge joint centers not more than 1 m.

4.9 Peculiarities of PTO shaft and cardan shaft applicability

WARNING: BE CAREFUL WHEN PTO SHAFT IS ACTIVATED AND THE CARDAN SHAFT OF THE COUPLED IMPLEMENT IS ROTATING. IN CASE THERE ARE PEOPLE IN THE AREA OF PTO SHAFT OPERATION, THEY OR THEIR CLOTHES CAN BE CLAMPED BETWEEN THE IMPLEMENT ROTATING PARTS AND OTHER MOVING MACHINERY. THAT CAN RESULT IN PERMANENT INJURY INCLUDING FATAL OUT-COME! FOR THIS REASON BEFORE STARTING THE PTO SHAFT, MAKE SURE THERE ARE NO PEOPLE IN THE DANGEROUS AREA BETWEEN THE TRACTOR AND THE IMPLEMENT. ALL KINDS OF WORK CONNECTED WITH MAINTENANCE SERVICES (ADJUSTMENT, GREASING AND ETC.), MOUNTING AND DISMOUNTING OF THE CARDAN SHAFT SHALL BE CARRIED OUT WHEN THE TRACTOR PTO SHAFT AND ENGINE ARE OFF. BEFORE CARDAN SHAFT MOUNTING, STOP THE ENGINE, GET THE IGNITION KEY OUT OF THE STARTER AND INSTRUMENTS SWITCH, AND ENGAGE THE PARKING BRAKE!

ATTENTION: TRACTOR MANUFACTURER SHALL NOT BE RESPONSIBLE FOR THE COUPLED IMPLEMENTS CARDAN SHAFTS FAILURES. CARDAN SHAFTS SPECIFI-

CATIONS AND DESIGN ARE IN SPHERE OF RESPONSIBILITY OF THE IMPLEMENTS AND CARDAN SHAFT MANUFACTURERS!

ATTENTION: THE COUPLED IMPLEMENT CARDAN SHAFT SHALL PROVIDE RATED-LOAD TORQUE TRANSFER WHEN ROTATION FREQUENCY IS AT LEAST 540 RPM OR 1000 RPM, DEPENDING ON THE MODE SET!

ATTENTION: DO NOT USE CARDAN SHAFTS WITHOUT APPROPRIATE PROTECTIVE DEVICES AND IF THEY ARE SELF-MANUFACTURED OR DAMAGED!

ATTENTION: BE CAREFUL WHILE COUPLING OF THE IMPLEMENTS WITH THE CARDAN DRIVE - CARDAN SHAFT ANGLES ARE LIMITED BY THE TRACTOR STRUCTURAL ELEMENTS, FOR EXAMPLE BY THE LIFTING DEVICE GUIDING RODS OR TRACTOR WHEELS. DUE TO MUTUAL TOUCH-DOWN OF THE CARDAN SHAFT AND OTHER STRUCTURAL ELEMENTS, SOME BREAKAGE OF THE IMPLEMENT TRAILER CAN HAPPEN OR, FOR EXAMPLE TRACTOR TIRES OR CARDAN SHAFT DAMAGE!

ATTENTION: WHEN THE IMPLEMENT IS OPERATED WITH THE CARDAN DRIVE, THERE IS HAZARD OF PROCESS MATERIAL OR THE IMPLEMENT PARTS RELEASE. FOR THIS REASON IT IS NECESSARY TO OBSERVE SAFE DISTANCE!

ATTENTION: THE WIDTH OF THE RPTO PROTECTIVE DEVICE CLEARANCE MAKES UP LESS THAN 360MM. FOR THIS REASON, WHILE CONNECTING THE CARDAN SHAFT TO THE RPTO SHAFT END EXTENSION OF TYPE 3 (PTO 3), IT IS REQUIRED TO BE CAREFUL IN ORDER TO EXCLUDE ANY HAND INJURIES! NO SPECIAL INSTRUMENTS OR DEVICES FOR CONNECTING THE CARDAN SHAFT TO THE SHAFT END EXTENSION OF TYPE 3 ARE REQUIRED!

While the implement cardan shaft connection to the PTO shaft end extension, the following rules and requirements shall be observed:

1. Check the engaged PTO shaft speed mode for compliance according to the tractor PTO shaft end extension type and the implement PRS installed, check the engaged rear PTO drive (independent/synchronous) for compliance.
2. Before activation, detach the cardan shaft into two parts.
3. Visually Inspect the cardan shaft, PTO shaft and PRS for absence of mechanical damage and for completeness of the set. Clear the PTO shaft end extensions from dirt if needed, and lubricate them according to the lubrication chart given in the implement operation manual.
4. The part of cardan shaft which has the icon "Tractor" on it, shall be coupled to the PTO shaft end extension, and the second part – to the implement PRS accordingly. Remember to fasten the connecting splined bushings on the PTO and PRS shaft ends properly: a fastening method shall be specified by the cardan shaft manufacturer.
5. The implement cardan shaft end yokes from the side of PTO shaft and PRS shall be in the same plane as shown in figure 4.9.1.

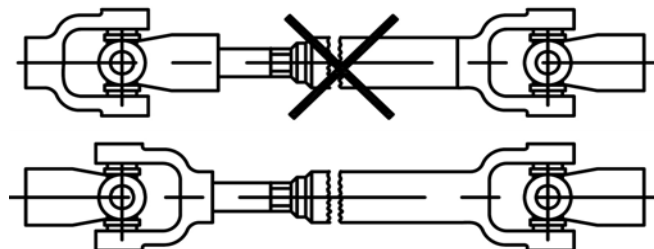


Figure 4.9.1 – Cardan shaft mounting diagram

6. Safety clutch as shown in figure 4.9.2 shall be installed only from the side of PRS of the coupled implement drive, another mounting method does not provide timely protection of

the tractor PTO from the excess of maximum permissible torque. After lengthy non-productive time, check technical condition of the implement safety clutch.

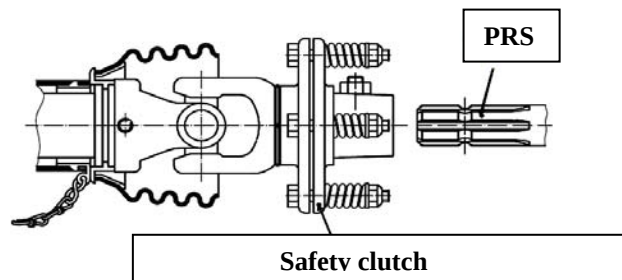


Figure 4.9.2 – Safety clutch mounting diagram

7. Mounting of the cardan shaft with a guard housing together with PTO shaft and PRS protective devices, with retaining chains both from the side of the PTO shaft and of the PRS, as shown in figure 4.9.3, provides cardan joint safety.

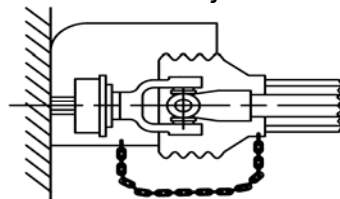


Figure 4.9.3 – Safety cardan shaft mounting diagram

8. When the cardan shaft is used for the first time, it is necessary to check the cardan shaft length, and to adjust it to the operating conditions with tractors "BELARUS-1523.5" if needed. For more detailed instructions on cardan shafts - see the technical documentation enclosed. Contact the cardan shaft manufacturer when needed.

9. The length of the cardan shaft maximally driven apart (which is permitted for operation) shall be of such type when one part of the cardan shaft enters the other for not less than $L_2=150$ mm. If the value is below $L_2=150$ mm (figure 4.9.4, view A) the cardan shaft shall not be operated. Sufficiency of overlapping L_2 can be checked by rotating or lifting the coupled implement.

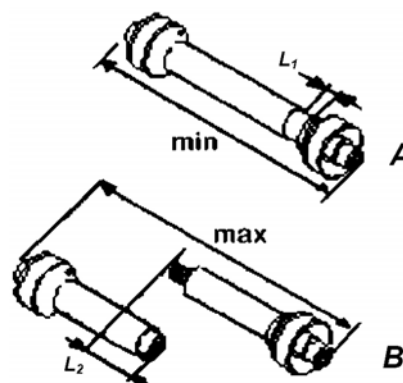


Figure 4.9.4 – Choice of the cardan shaft length

10. With the tractor and the coupled implement in a straight-line position, when the cardan shaft is pushed in fully, it is required to check if there is sufficient clearance L_1 (figure 4.9.4, view C) between the tube butt and the universal joint yoke butt. The minimum permissible clearance L_1 shall make at least 50 mm.

11. After cardan shaft coupling, bring all protective devices into a proper condition, including fixing of the guard shaft housing with the chains to prevent rotation, as shown in figure 4.9.3.

12. If necessary, limit the RLL height of the extreme upper position while the implement uplifting. It is required for the slope angle decrease, for exclusion of cardan shaft touching and damaging, and for providing safety clearance between the tractor and the implement.

13. Maximum permissible slope and turning angles (figure 4.9.5) of the cardan shaft hinge joints are shown in table 4.9.

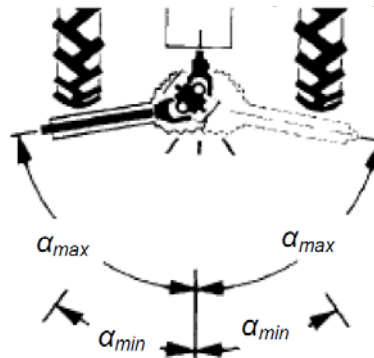


Figure 4.9.5 – Maximum permissible slope and turning angles of the cardan shaft hinge joints

Table 4.9

Tractor power take-off shaft position	Maximum permissible angle of slope (turning) $\alpha_{max}^{1)}$, In degrees	
	Cardan shaft hinge joints type	
	Universal	Equivalent angular rates
“On” position:		
- under load	20	25
- no-load ²⁾	50	50
“Off” position ³⁾	50	50

1) Other variants are possible (see the documentation of cardan shaft and implement manufacturers).

2) For short period, for the PTO shaft operating with no load.

3) For the implement transport position when the PTO shaft is off.

14. While operating with mounted and semi-mounted implements having cardan drive, it is required to block the lift linkage lower links.

15. After the cardan shaft dismounting, it is required to put guard hoods on the PTO shaft end extensions and PRS!

16. After the PTO shaft deactivation, consider the hazard of the implement cardan shaft and separate mechanisms coupled coasting. For this reason the dangerous area between the tractor and the implement can be entered only after the PTO shaft complete stop!

17. Check the operation of the implement with the cardan shaft mounted to the PTO shaft and PRS at the minimum and maximum rpm of the tractor engine shaft.

18. While tractor transportation with trailed, semi-trailed and semi-mounted implements for long distances, including from one field to another, it is recommended to disconnect the cardan shaft from the tractor and from the implement.

19. Maintenance, cleaning and repair services of the implement with the cardan drive coupled to the tractor shall be carried out only when the PTO shaft and the tractor engine are off.

The PTO shaft shall be disengaged in the following cases:

- after the tractor stop, only after the coupled implement fully completed its duty cycle;
- on turns, when the implement is lifted to the transport position;

- when moving up a steep slope.

Do not engage the PTO shaft in the following cases:

- when the tractor engine is off;
- the implement coupled to the tractor is in transport position;
- when the implement operating parts are sunken into the soil;
- if the implement operating parts are covered in process material or if the operating parts are clogged or wedged;
- if there is a considerable slope angle (refraction angle) in any plane of cardan shaft hinge joints.

While operating rotation tilling machines with active operating parts, it is additionally required to observe the following rules:

- not to engage the PTO shaft when the implement is grounded. The PTO shaft shall be engaged only when the ready to operate implement is lowered so that its operating parts do not touch the ground with the clearance not less than 35 mm;
- lowering of the implement with rotating operating parts shall be carried out smoothly when the tractor is moving forward;
- during operation prevent the tractor from moving in the direction not corresponding the implement working travel, when the operating parts are sunken into the soil with the PTO shaft engaged and disengaged;
- during operation on solid soils it is required to carry out processing of cross ranges for moving in enclosure, and then process the soil in the lengthwise direction;
- it is recommended to work at the minimum soil processing depth needed for the specific crop. It is necessary for load reduction on the tractor PTO shaft and for reduction of fuel consumption during tractor operation. It is particularly important to consider this fact during tractor operation with multiple-purpose tillage units.

4.10 Ways of changing drawbar features and passing ability of the tractor

There are the following ways of changing drawbar features of "BELARUS-1523.5" tractor:

- increase of tractor adhesion weight;
- increase of wheel tire-soil adhesion.

To increase the adhesion weight of the tractor, do the following:

- use quick-detachable hitch ballast weight;
- fill tires with water (solution);

To increase wheel tire-soil adhesion, do the following:

select optimal internal pressure in tires, depending on the operating conditions and load on tractor axles;

apply rear axle differential lock;

twin the wheels.

Note – Pneumatic pressure rate in the front and rear tires of the tractors "BELARUS - 1523.5" under actual load is shown in subsection "Selection of optimal internal pressure in tires depending on the operating conditions and load on tractor axles".

To obtain information on the rules of rear wheel twinning and filling of wheel tires with water (solution), as well as on operating limitations for tractors equipped with twinned wheels and tires with water (solution) - contact your dealer.

4.11 Features of tractor application in special conditions

4.11.1 Tractor operation in areas with rugged topography. Possibility of tractor application for haylage preparation

An operator working in the fields and roads with slopes shall be very careful.

Technical characteristics of the general-purpose implement coupled in the structure of MTU ensure its safe and proper operation on working fields with a slope not more than 9 degrees.

ATTENTION: TRACTORS "BELARUS-1523.5" ARE NOT INTENDED FOR OPERATION WITH GENERAL-PURPOSE IMPLEMENTS AT UPLAND TERRITORIES INCLUDING STEEP SLOPES. FOR THIS REASON TRACTORS ARE NOT COMPLETED WITH SPECIAL-PURPOSE DEVICES, FOR EXAMPLE UTMOST LURCH ANNUNCIATORS!

ATTENTION: APPLICATION OF TRACTORS "BELARUS-1523.5" FOR GRASS STACKING (SILAGE OR HAYLAGE) IN TRENCHES AND PITS IS NOT ALLOWED!

4.11.2 Application of substances for chemical treatment

Tractor cabin corresponds to category 2 under EN 15695-1:2009. The cabin of this category protects from dust, but not from aerosol and vapor ingress, for this reason the tractor shall not be used in conditions requiring protection from aerosol and vapor ingress.

The cabin is equipped with ventilation, heating and conditioning system according to GOST 12.2.120. In ventilation system there are four paper filters with operating specifications according to GOST ISO 14269-5. Cabin design ensures its hermiticity according to GOST ISO 14269.

ATTENTION: CABIN OF THE TRACTOR "BELARUS-1523.5" DOES NOT PROTECT FROM POSSIBLE DAMAGING EFFECT OF SUBSTANCES USED FOR CHEMICAL TREATMENT OF AGRICULTURAL PLANTS AND SOILS INCLUDING SPRAY TREATMENT. FOR THIS REASON WHEN OPERATING WITH CHEMICAL SUBSTANCES, THE OPERATOR SHALL WEAR INDIVIDUAL PROTECTIVE EQUIPMENT ACCORDING TO OPERATING CONDITIONS!

IT IS FORBIDDEN TO PUT SUBSTANCES USED FOR CHEMICAL TREATMENT OF AGRICULTURAL PLANTS AND SOILS IN THE CABIN.

IT IS FORBIDDEN TO ENTER THE TRACTOR CABIN WEARING CLOTHES OR SHOES CONTAMINATED WITH SUBSTANCES USED FOR CHEMICAL TREATMENT OF AGRICULTURAL PLANTS AND SOILS.

For safe and proper application of the specified substances, it is necessary to observe the instructions written on the labels and documents accompanying the substances.

It is required to use all individual protective equipment and special clothes (work clothes and covered footwear, etc), corresponding to the operating conditions and current safety requirements.

If a breathing mask inhaler is required by the instruction on the substance use for chemical treatment, it shall be used inside the tractor cabin.

4.11.3 Operation in a forest

IT IS FORBIDDEN TO USE TRACTOR "BELARUS-1523.5" FOR OPERATION IN A FOREST AS WELL AS FOR CLAMSHELL LOADER COUPLING, TRAILING EQUIPMENT, SPECIAL-PURPOSE FORESTRY MACHINERY DESIGNED FOR GATHERING, LOADING, AND TRANSPORTATION OF TREES, AND THEIR UNLOADING, SORTING AND WAREHOUSING!

ATTENTION: ACCORDING TO THE ASSIGNMENT OF THE TRACTOR "BELARUS- 1523.5", A SPECIAL PROTECTION DEVICE "OPS" FOR OPERATOR'S WORKING PLACE INCLUDING SPECIAL ATTACHING POINTS FOR IT ARE NOT PROVIDED IN ITS DESIGN. FOR THIS REASON THE TRACTOR SHALL NOT BE OPERATED IN THE CONDITIONS WHEN THERE IS A HAZARD OF TREES, BRANCHES, AND SINGLE PARTS OF THE COUPLED EQUIPMENT PENETRATION INTO THE OPERATOR'S CABIN!

4.12 Determination of total weight, loads on front and rear axles, tires holding capacity and the required minimum ballast

The amount of load on tractor axles in structure of MTU may be determined by direct weighting on truck scales of the corresponding carrying capacity.

Tractor weighting on scales gives an opportunity to consider accurately weight distribution of MTU masses along tractor axles of your configuration in different operating conditions: "main operation" and "transport". While determination of loads on tractor axles, it is required to consider the technological load weight, for example the weight of seeds, distributed by a seeder.

For determination of load on tractor front and rear axles by weighting on truck scales, it is necessary to place the tractor with the wheels of the measured axle on a weighting platform, and the wheels of the other axle shall be kept out of the weighting area on the same level with the platform.

The following formula is used for load determination:

$$T = m \cdot g, \text{ where}$$

T is load, N;

M is mass, kg;

g=9,8 is gravity acceleration, m/s²

Calculation of load on front tractor axle:

$$T_f = m_1 \cdot g, \text{ where}$$

T_f is load on front tractor axle, N;

m₁ is the amount of tractor operating weight with ballast (the unit installed), distributed on tractor front axle, kg;

g=9,8 is gravity acceleration, m/s².

Calculation of load on the rear tractor axle:

$$T_z = m_2 \cdot g, \text{ where}$$

T_z is load on the rear tractor axle, N;

m₂ is the amount of tractor operating weight with the unit installed (ballast), distributed on tractor rear axle, kg;

g=9,8 is gravity acceleration, m/s².

Calculation of load acting on one front or one rear tractor wheel for selection of pressure in tires:

a) during operation of tires on single wheels:

$$G_f = \frac{T_f}{2} ; G_z = \frac{T_z}{2}, \text{ where } G_f \text{ and } G_z \text{ are loads acting on one front or one rear}$$

tractor tire accordingly.

b) during operation of tires on twinned wheels

(considering the reduction of permissible load on a tire during operation of tires on twinned wheels):

$$1,7 G_{f \text{ twinned}} = G_f$$

$$1,7 G_{z \text{ twinned}} = G_z$$

$$G_{f \text{ twinned}} = \frac{G_f}{1,7}$$

$$G_{z \text{ twinned}} = \frac{G_z}{1,7}$$

where $G_{f \text{ cдв.}}$ and $G_{z \text{ cдв.}}$ are calculated loads for tire inflation pressure during operation on twinned wheels.

Further according to the calculated loads, it is necessary to determine tire pressure (according to subsection "Selection of tires internal pressure depending on operating conditions and load on tractor axles").

Calculation of tractor controllability criterion:

$$k_f = \frac{T_f}{M}, \quad \text{where}$$

T_f is load on tractor front axle, N;

k_f is tractor controllability criterion;

M is tractor operating weight (during calculation, ballast weights in the tractor operating weight M are not taken into account), kg.

ATTENTION: COUPLING OF IMPLEMENTS TO THE TRACTOR SHALL NOT RESULT IN EXCESS OF PERMISSIBLE AXLE LOADING AND LOADS ON THE TRACTOR TIRES!

ATTENTION: MINIMUM WEIGHT OF COUPLED IMPLEMENTS AND BALLAST WEIGHTS SHALL ALWAYS MAKE NOT LESS THAN VALUES AT WHICH LOAD ON THE FRONT TRACTOR WHEELS IN STRUCTURE OF MTU SHALL ALWAYS MAKE NOT LESS THAN 20% OF THE TRACTOR OPERATING WEIGHT, AND THE CONTROLLABILITY CRITERION SHALL MAKE NOT LESS THAN 0.2!

4.13 Possibility of front loader installation

4.13.1 General information

When choosing, buying and installing mounted front loaders (further in the text – loaders), it is necessary to pay attention to the conditions specified in the present tractor operation manual and in table 4.10.

Table 4.10 – The rules of tractor with loader use

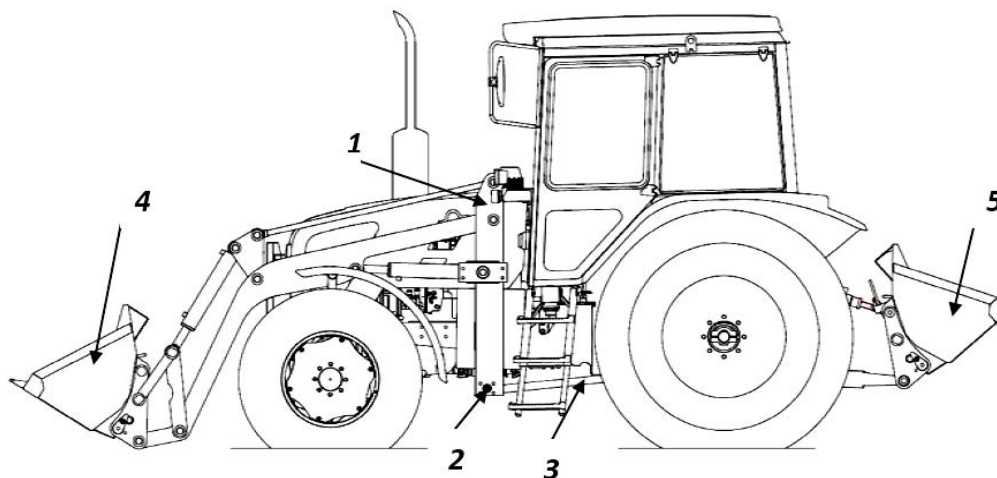
Name of indicator (characteristics)	Indicator (characteristics) value
Standard size of tractor "BELARUS-1523.5" wheel tires on which loader installation is possible	420/70R24 – front, 520/70R38 – rear (i. e. tires of basic configuration or imported tires of the same type)
Tire pressure in tractor wheels	Internal tire pressure of rear wheels shall be set as pressure for 30km/h speed
Tractor wheel track, m, not less : - for front wheels - for rear wheels	1800
	2150
Permissible load on tractor axle (considering tractor and loader weights), kN, not more than: - for front axle; - for rear axle	40,0
	60,0
Tractor weight with a loader installed, kg, not more than	9000
Push force in cutting mode, kN, not more than	27,0
Overloading protection when in cutting mode	Automated protection in loader design
Speed of tractor movement with a loader installed, km/h, not more than: - operation speed with load - operation speed without load - transport speed	
	6
	12
	20
Tractor ballasting with a loader installed (when necessary)	1. Ballast weight – on rear lift linkage. 2. Water solution in rear tires.
Places of loader fastening to the tractor: - loader mounting frame - loader push rods	Front beam, side members, clutch coupling case
	Semi-axle tubes, clutch coupling and rear axle cases
Shift-time control (testing parameters, in addition to STMS operations listed in the tractor and loader operation manuals)	1. Tightness of fasteners of loader mounting frame and tractor wheels 2. Tire pressure in tractor wheels
Connection of the loader hydraulic system	Tractor hydraulic outlets
Recommended pressure of safety valve adjustment (when self-supporting hydraulic distribution valve is available in the loader kit) of the loader hydraulic system, MPa, not more than	17,0

ATTENTION: FORK LOAD DEPENDS ON THE OVERHANG AND DESIGN OF THE LOADER OPERATING PARTS, AND SPECIFICATIONS OF THE LIFTED LOAD!

IT IS FORBIDDEN TO USE WITH A LOADER A TRACTOR WITHOUT A CAB OR A CANOPY TENT; WITHOUT NOT-WILLED MOVEMENT LIMITING SYSTEM (SEAT BELTS), AND ALSO IN CONFIGURATION WITH FRONT AND REAR TIRES OF MINOR CONFIGURATION.

For installation of the complete set of loading equipment openings on a front beam, side members and the tractor clutch coupling case are used. For the purpose of unloading a semi-frame and a tractor clutch coupling case, it is required to use adjustable bars or other constructive elements connected to rear semi-axes tubes of the rear axle which transfer a part of push force to the tractor rear axle. For rigidity maintenance it is desirable that the right and left parts of the loader mounting frame are rigidly connected with each other.

Loader installation scheme is shown in figure 4.15.1.



1 – loading equipment kit for the tractor; 2 – crossed linkage of loader frame; 3 – tapped rod; 4 – loader bucket; 5 – rear ballast weight.

Figure 4.13.1 – Loader installation scheme

To provide sufficient drawbar power generated by tractor rear wheels, it is necessary to create sufficient load on the rear axle which shall make not less than 60 % of tractor operational weight considering the installed loader weight.

The right proportion of loads on tractor axles can be achieved by rear axle ballasting with loads, solution filled in wheel tires, rear counterweight (hook-on bucket with ballast load) attached to rear lift linkage.

ATTENTION: IN THE LOADER OPERATION MANUAL DESIGNED FOR CONSUMERS, LOADER MOUNTING ORDER SHALL BE SPECIFIED WITH PICTURES INCLUDING INFORMATION ON SHIFTING AND DISMOUNTING OF TRACTOR ELEMENTS.

In the loader design, safety and locking devices (fast coupling clutches, slowing-down valves, overload limiters and others) shall be provided excluding conflicting motion of gears, overloads and breakages in operation when there is excess of permissible pressure values in the hydraulic system, rated load capacity or drawbar power.

In the mode of ground cutting, it is necessary to provide protection of tractor and loader chassis from overload. Loader operating part overturning (bucket and etc.) can happen due to actuation of a special valve integrated in the loader system.

In order to avoid breakages in loader design for the purpose of loader lowering speed limitation, the loader shall be equipped with slowing-down valves in the lifting cavity of loader hydraulic cylinders.

Loader design shall provide a possibility of fixing operating parts in transport position.

To exclude contact and/or tractor and loader damages, minimum distances between the tractor fixed elements and the loader coupled elements shall make not less than 0.1 m, and in case of moving members – not less than 0.15 m.

A loader shall have the label "Maximum speed limitation" and also necessary warning labels, for example "Fix". Limiting values of load-carrying capacity shall be specified on the fore of the loader operating equipment.

ATTENTION: INSTALLATION OF MOUNTED FRONT LOADERS OF VARIOUS MANUFACTURERS IS ALLOWED ON TRACTOR "BELARUS-1523.5" IF IT IS PROVIDED IN TECHNICAL DOCUMENTATION FOR THESE LOADERS!

ATTENTION: FRONT LOADERS WHICH ARE NOT DESIGNED FOR BEING USED TOGETHER WITH TRACTOR "BELARUS-1523.5" SHALL NOT BE INSTALLED ON THE TRACTOR!

Depending on the type of replaceable operating equipment installed, two modes of loader operation are possible – "Loader" and "Bulldozer".

ATTENTION: THE LOADER MANUFACTURER SHALL PROVIDE A CONSUMER WITH ALL KINDS OF NECESSARY TECHNICAL DOCUMENTATION INCLUDING CONFIRMATION OF POSSIBILITY OF LOADER COUPLING WITH TRACTOR "BELARUS-1523.5"!

4.13.2 Safety measures while tractor "BELARUS-1523.5" operation with the loader installed

While operation with the loader installed, it is necessary to check tightening of fasteners of the loader mounting frame and tractor wheels, and tire pressure on shift-time basis.

While operation with the loader installed, it is required to observe safety requirements listed in subsection 3.3 "Safety measures while tractor operation".

Additionally during loader operation it is forbidden to:

- uplift load with weights exceeding those specified in the loader OM;
- fill the loader bucket again, and to work on soft soils;
- place the bucket outside the slope crest when throwing off soil aslope (in order to avoid tractor slipping);
- transport load in the bucket with the maximum boom length;
- work with cracks on rims and with tires damaged up to the cord or perforation damage;
- leave the tractor when the load is lifted (for operator);
- make all types of turns and reverse movements when operating parts are sunk in the soil;
- operate when lights, signalling system, steering or brakes have failures;
- carry out operations at nighttime when electrical equipment is faulty and the working area does not have sufficient lighting;
- lift people with the loader;
- lift and move loads with the loader if there are people in the dangerous zone (the danger line near the loader moving members and operating parts is within 5 m, unless other exclusive requirements are specified in the works certificate or manufacturer's instruction);
- carry out tractor maintenance with the loader arm raised;
- make loading and unloading operations under electric power lines;
- carry the loader bucket over a car cabin.

ATTENTION: TO IMPROVE PITCH STABILITY AND REDUCE LOAD ON FRONT AXLE, THE TRACTOR COUPLED WITH THE LOADER CAN BE EQUIPPED WITH REAR MOUNTED BALLAST WEIGHTS!

LOADER OPERATION ON THE SLOPE WITH MORE THAN 8° IS FORBIDDEN!

Tractor service brake control pedals shall be always interlocked during loader operation. Avoid abrupt start, braking, sharp turns and long-term frictional slip of tires while tractor operation with the loader.

While tractor moving with the loader on public roads, it is required to observe traffic regulations.

Traveling speed of the tractor with loader must not exceed 25 km/h. Operation speed of the tractor with loader must not exceed 10 km/h.

Before starting the movement on public roads, it is required to raise the loader into transport position and fix it properly.

There is hazard of spontaneous lowering of the loader. That is why before leaving the cab, it is required to lower the loader in the extreme lower position and fix the hydraulic control mechanism levers of the loader properly.

It is required to carry out mounting and dismounting of the loader on a level ground with hard surface.

If the housing of the tractor with loader is under voltage, an operator shall lower the operating part in the extreme lower position, stop the engine, switch AB off and leave the cab urgently without touching the loader housing metal parts.

Before starting loading-unloading operations, an operator shall carry out preparatory inspection of the working place, and also study the rules and methods of operation depending on specific conditions.

It is forbidden to let other people drive the tractor with loader.

Before starting the movement or engaging reverse gear, it is necessary to set the signal and make sure there are no people in the area of loader operation.

It is required to be very careful while moving on the enterprise territory (the maximum speed shall be determined by the enterprise standards).

When driving the tractor with loader, it is required to watch over for upper obstacles (wires, pipelines, arches and etc.).

When filling the loader bucket, avoid striking against obstacles hidden under the load.

Intake of bulk materials shall be carried out by slow cutting in a stock pile and simultaneous turning of the loader bucket.

An operator is not allowed to start operation on load handling in the following cases:

- the load weight is unknown;
- poor light in the operation area, poor visibility of loads;
- the territory of the working area on which the loader operates, does not have proper solid and smooth surface (asphalt, concrete, paving blocks and etc.), or the territory is not cleaned from snow and ice, ice-covered ground is not sanded or covered with special agent in winter;
- slope of the working area, on which the loader is intended to operate, exceeds 8°.

Stop the loader operation in the following cases:

- tire puncture or insufficient tire pressure;
- detection of failure in steering, hydraulic and braking systems;
- availability of ambient noise and slap noises in the engine, chassis, loader operating parts.

4.13.3 Information on the tractor mounting holes

The present subsection contains the information on availability of the tractor mounting holes which can be used by manufacturers of front loaders for loader installation, and also by manufacturers of tractors for installation of various equipment. The mounting holes arrangement scheme for tractor "BELARUS-1523.5" is shown in figure 4.13.2. The parameters of mounting holes are listed in table 4.11.

Table 4.11 – Parameters of mounting holes of tractor "BELARUS -1523.5"

Designation	№ 1	№ 2	№ 3	№ 4	№ 5
Diameter	M16	M16	M16	M16	M16
Length	-	20	20	-	-
Designation	№ 6	№ 7	№ 8	№ 9	№ 10
Diameter	M16	M16	M16	M16	M16
Length	-	-	-	-	-
Designation	№ 11	№ 12	№ 13	№ 14	№ 15
Diameter	M16	M16	M16	M16	√18
Length	-	-	-	-	-
Designation	№ 16	№ 17	№ 18	№ 19	№ 20
Diameter	√18	√18	√18	√18	√18
Length	-	-	-	-	-
Designation	№ 21	№ 22	№ 23	№ 24	№ 25
Diameter	M16	M16	M16	M16	M16
Length	-	-	-	-	-
Designation	№ 26	№ 27	№ 28	№ 29	№ 30
Diameter	M16	M16	M16	M16	M16
Length	-	23	23	23	23
Designation	№ 31	№ 32	№ 33	№ 34	№ 35
Diameter	M16	M16	M16	M16	√20
Length	23	23	-	-	-
Designation	№ 36	№ 37	№ 38	№ 39	№ 40
Diameter	√20	√18	√18	M22	M22
Length	-	-	-	54	54
Designation	№ 41	№ 42	№ 43	№ 44	№ 45
Diameter	M22	M22	M10	M10	M10
Length	54	54	15	15	15
Designation	№ 46	№ 47	№ 48	№ 49	№ 50
Diameter	M10	M20	M20	M20	√20
Length	15	40	40	40	28
Designation	№ 51	№ 52	№ 53		
Diameter	√20	M20	M20		
Length	28	32	32		

NOTES:

Sizes in table 4.11 are given in mm.

Holes 1...30 are right and left.

Holes 1...29 (odd numbers) are upper row. for installation of pins.

Holes 2...30 (even numbers) are low row.

While installation of mounted elements, provide safety of bushings in holes 1, 6 and 14. It is not recommended to use holes with bushings for coupling.

In table 4.11 the symbol "-" means a through hole.

Holes 27, 28, 29, 30 on the right side of the tractor are used for installation of the tank and muffler brackets.

ATTENTION: IT IS NOT RECOMMENDED TO USE TRACTOR SIDE HOLES WITH BUSHINGS! THE MOUNTED LOADER ELEMENTS SHALL NOT CAUSE BUSHING DAMAGE!



5 MAINTENANCE

5.1 General instructions

Maintenance service (MS) is necessary for maintaining the tractor in operable state during operational processes. Failure to observe the specified intervals of MS and bad quality of MS may result in reduction of tractor life significantly, increase of failures, engine power loss and increase in expenses for tractor operation. An operator shall carry out daily inspection of the tractor, checking fasteners for tightening, fuel, liquid, and oil leakage, dirt and other deposits accumulation, which can cause operating troubles, ignition or accidents.

Notes about performance of maintenance services shall be made in the tractor service book.

Observe storage precautions and waste recovery rules. Never discharge used liquid to the ground. Use special tanks for safe storage of waste.

WARNING: WHILE CARRYING OUT MAINTENANCE AND REPAIR SERVICES, ALWAYS COMPLY WITH SAFETY PRECAUTIONS, LISTED IN SUBSECTION 5.6 “SAFETY PRECAUTIONS WHILE MAINTENANCE AND REPAIR SERVICES”!

ATTENTION: IF THERE ARE NO SPECIAL INSTRUCTIONS, BEFORE STARTING ANY MAINTENANCE OR ADJUSTMENT SERVICES, ETC., STOP THE ENGINE AND ENGAGE PARKING BRAKES. IN CASE SAFETY GUARDS AND COVERS ARE OFF, MAKE SURE THEY ARE MOUNTED BACK AFTER CONDUCTING MAINTENANCE SERVICES, BEFORE YOU START OPERATING THE TRACTOR!

In the process of conducting maintenance services of the hydraulic lift system, steering, and the transmission hydraulic system, it is strictly required to observe oil change and filter replacement intervals. It is not allowed to use oil for filling (refilling), not specified in the tractor operation manual.

Before refilling, replacing or cleaning filter cartridges, it is necessary to clean filler plugs, necks and caps, and adjoining surfaces from dirt and dust. While filter cartridge replacement, wash internal surfaces of filter housings and caps with the diesel fuel.

While tractor coupling with hydraulically-operated implements, it is necessary to clean clutches, couplings, adapting pipes and other connecting parts of the implement and the tractor thoroughly.

In case the hydraulic system is operated with hydraulically-operated implements filled with oil origin of which is unknown, the oil in the implement shall be replaced by the oil filled into the tractor hydraulic lift system.

Purity of oil in the hydraulic system ensures its fail-safe operation.

Types of scheduled maintenance service are shown in table 5.1.

Table 5.1 – Types of scheduled maintenance service

Types of maintenance service	Intervals, h
Maintenance service while operational run-in ¹⁾	MS before, during and after tractor run-in (after 30 hours of operation)
Shift-time (STMS)	8-10
First maintenance service (MS-1)	125
Additional maintenance service (2MS-1)	250
Second maintenance service (MS-2)	500
Third maintenance service (MS-3)	1000
Special maintenance service	2000
General maintenance service	As required
Seasonal maintenance service (MS-SS and MS-AW)	While transfer to autumn and winter operation (MS-AW) and spring and summer (MS-SS)
Maintenance service not corresponding to the set intervals with MS-1, 2MS-1, MS-2, MS-3 and special MS	–
Maintenance service in special operating conditions	During preparation of tractor operation in special conditions
Maintenance service during storage ²⁾	In case of long-term storage
¹⁾ Information on maintenance services carried out by the operator before, during and after tractor run-in is given in subsection 3.4 “Tractor final assembly and run-in”. ²⁾ Information on maintenance services carried out by the operator during long storage of the tractor is given in section 7 “Tractor storage” of this operation manual.	

Deviation of +10% for MS-1, 2MS-1 and MS -2 and +5% for MS -3 from the set intervals of MS are permitted (early or late MS) depending on the operating conditions for the chassis. In order to provide high-quality performance of maintenance service operations, it is required to use instruments, tools and measuring devices specified in subsection 6.7. “Instruments, tools and measuring devices while maintenance services and repair”.

5.2 Providing access to the components for maintenance services

Before starting maintenance service operations, it is required to remove both side pieces 8 and 16 (figure 5.2.1), open and fix tractor hood 6.

To get an access to the units located under mask 4, it is required to open, then fix the tractor mask with the hood being closed.

IT IS FORBIDDEN TO OPEN HOOD 6 AND MASK 4 AT THE SAME TIME!

The mask and the hood are pivotally joined on supports located on the front frame just behind the radiator of the engine refrigerator unit. The mask and the hood fastening design provides their quick opening which ensures an easy and quick access to the tractor separate units.

ATTENTION: BEFORE STARTING MAINTENANCE SERVICE OPERATIONS IN THE ZONE UNDER THE MASK AND THE HOOD, MAKE SURE THEY ARE SECURELY FIXED IN THE OPEN POSITION!

To remove left side piece 8, it is necessary to open two locks 7 on the left and remove side piece 8.

To remove right side piece 16, it is necessary to open two locks 7 on the right and remove side piece 16.

To open hood 6 and fix it in the open position, it is necessary to do the following:

- close mask 4, if it was in the open position;
- remove monocyclone 5;
- open lock 10 by pulling cable 11;
- take the edges of hood 6 (near the cab) and open it into the extreme upper position;
- fix hood 6 by means of link 12 in bracket 13.

To open mask 4 and fix it in the upper position, it is required to do the following:

- close hood 6, if it was in the open position;
- open lock 1 by pulling cable 9;
- take the lower edge of mask 4 and open it into the extreme upper position;
- fix mask 4 by means of link 3 in bracket 2.

To mount side pieces 8 and 16, it is required to do the following:

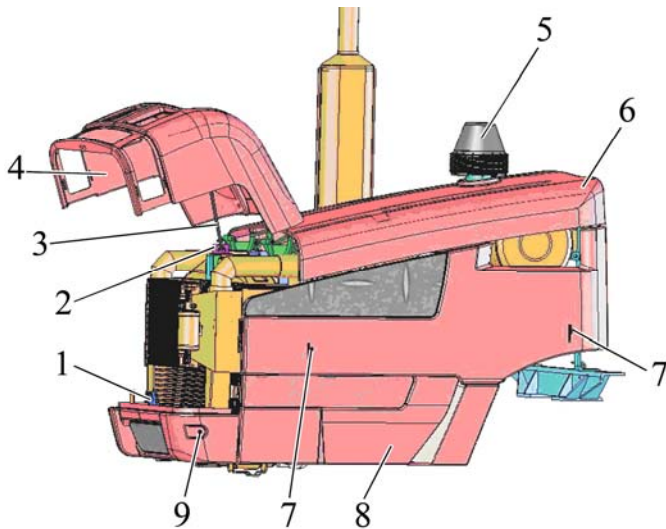
- set side piece detents 15 into the mounting seats of brackets 14;
- fix side pieces 8, 16 by means of locks 7.

To lower and close hood 6, it is required to do the following:

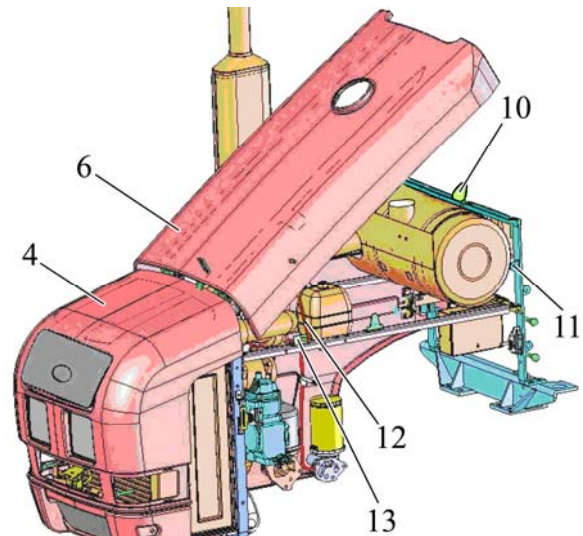
- uplift hood 6 a little to release link 12;
- fix link 12 in the chuck on the hood;
- lower hood 6 into the lower position until the specific click is heard (lock 10 functioning);
- set monocyclone 5.

To lower and close mask 4, it is required to do the following:

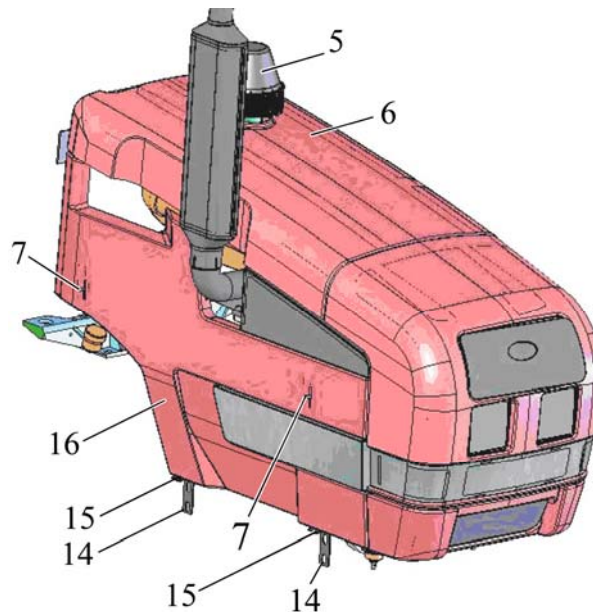
- uplift mask 4 a little to release link 3;
- fix link 3 in the chuck on the mask;
- lower mask 4 into the lower position until the specific click is heard (lock 1 functioning).



Mechanism of mask lockup in the open position



Mechanism of hood lockup in the open position



Mounting-dismounting of end trim side pieces

1 – lock; 2 – bracket; 3 – link; 4 – mask; 5 – monocyclone; 6 – hood; 7 – lock; 8 – left side bar; 9 – cable; 10 – lock; 11 – cable; 12 – link; 13 – bracket; 14 – bracket; 15 – detent; 16 – right side piece.

Figure 5.2.1 – Mechanism of hood and mask lockup in the open position, mounting-dismounting of end trim side pieces.

5.3 Maintenance procedure

Contents of scheduled servicing operations for tractors "BELARUS-1523.5" in the course of operation are listed in Table 5.2.

Table 5.2

Operation No	Operation description	Periodicity, h					
		8-10	125	250	500	1000	2000
1	Check oil level in the engine crankcase	X					
2	Check oil level in the transmission line	X					
3	Check oil level in the HLL tank	X					
4	Check oil level in HSC tank	X					
5	Check cooling liquid level in the engine cooling system	X					
6	Check brake fluid level in the tanks of hydraulic drive main cylinders of clutch and brake control	X					
7	Check tires state	X					
8 ¹⁾	Check air conditioner hose fixtures	X					
9	Check the hydraulic system elements	X					
10 ¹⁾	Check/clean air conditioner drainage pipes from condensate water	X					
11 ¹⁾	Check/clean air conditioner condenser	X					
12	Check/clean engine water radiator and engine CAC-radiator	X					
13 ²⁾	Check/clean gripper tools of RLL	X					
14	Check breaks functioning in running order, engine, steering, light/alarm devices operability	X					
15	Drain condensate water from the pneumatic system balloon	X					
16	Check the condition of wiring, wire bundles of the electric equipment in the engine compartment, in the cab front area, and the condition of visible parts of the wiring	X					
17	Drain condensate water from the radiator tanks of CAC	X winter	X summer				
18 ³⁾	Check threaded connection tightening of wheel fastening	X	X				
19	Wash the tractor and clean the cab interiors		X				
20	Check bolt tightening of CAC air-duct clamps		X				
21 ⁴⁾	Check pneumatic pressure in tires		X				
22	Drain sediment from the fuel tank		X				
23	Drain sediment from the coarse fuel filter		X				
24	Check belt tension in generator and water pump drive		X				
25	Clean filter cartridges of ventilation and air heating systems of the cab		X				
26	Lubricate pivot axis bearings of FDA		X				
27 ¹⁾	Check/adjust air conditioner compressor drive belt tension		X				
28	Check / adjust clutch control		X				
29 ⁵⁾	Carry out maintenance of AB			X			
30	Lubricate HSC hydraulic cylinders hinge joints			X			

Table 5.2 continued

Operation No	Operation description	Periodicity, h					
		8-10	125	250	500	1000	2000
31	Rinse the mesh filter of the transmission hydraulic system			X			
32	Check oil level in the main gear housing and in FDA wheel reduction unit			X			
33	Check/adjust clearances in the steering link hinge joints			X			
34	Check/adjust front wheels toe-in			X			
35	Lubricate the clutch release yoke bearing			X			
36	Clean the rotor of the GB centrifugal oil filter			X			
37	Change the engine oil filter			X			
38	Change oil in the engine crankcase			X			
39 ⁶⁾	Check oil level in the FPTO reduction unit			X			
40	Drain sediment from the from the fine fuel filter			X			
41	Clean the rotor of the engine centrifugal oil filter			X			
42	Provide maintenance for generator and starter			X			
43	Clean filter cartridge of air pressure regulating filter in the pneumatic system				X		
44	Adjust the service brake control				X		
45	Adjust the parking brake control				X		
46	Check/adjust brake valve actuators of the pneumatic system				X		
47	Check all joints of the air cleaner and inlet duct for hermiticity				X		
48 ⁶⁾	Clean and lubricate FPTO spline joints				X		
49	Check / adjust wheel-hub drive bearings of FDA				X		
50	Check / adjust bearings of pivot axis of FDA wheel-hub drives				X		
51	Check oil level in the housings of brakes operating in oil sump				X		
52	Check/adjust clearances between valves and rocking arms of the engine				X		
53	Lubricate the sleeves of RLL turning shaft				X		
54	Rinse the breathers of HLL and HSC oil tanks				X		
55	Carry out maintenance of the air cleaner				X		
56	Check hermiticity of the pneumatic system main pipes				X		
57 ⁷⁾	Change the HLL changeable filter cartridge				X	X	
58 ⁷⁾	Change the changeable filter cartridge of HSC tank				X	X	
59	Change oil in HLL tank					X	
60	Check oil in HSC tank					X	
61	Change oil in the transmission line					X	
62	Change oil in the main gear housing and in FDA wheel-hub drive housings					X	
63	Change oil in brake housings					X	

Table 5.2 finished

Operation No	Operation description	Periodicity, h					
		8-10	125	250	500	1000	2000
64 ⁶⁾	Change oil in the FPTO reduction unit					X	
65	Change brake liquid in the clutch control drive					X	
66	Change brake liquid in the brake control drive					X	
67 ⁶⁾	Lubricate the sleeves of FLL lever pin					X	
68	Change grease in steering joints and rinse the steering joints elements					X	
69	Check / adjust the pneumatic system pressure regulator					X	
70	Check / tighten tension bolts of cylinder heads					X	
71	change the main filter cartridge of the air cleaner					X	
72	Check / tighten tractor external threaded joints					X	
73	Rinse the engine cooling system and replace the cooling liquid in the engine cooling system						X
74	Rinse the engine breathers						X
75	Change filter cartridge of the cab ventilation and heating systems						X
76	Change filter cartridge of the fine fuel filter	Every 600 hours of operation or once a year					
77	Change filter cartridge of the coarse fuel filter	Every 600 hours of operation or once a year					
78 ¹⁾	Change the filter-drier of the air-conditioning system	Every 800 hours of operation or once a year					
79	Carry out complex maintenance service of system "COMMON RAIL"	Every 3000 hours of operation or once a year					
80	Adjust the valve adjusting operating pressure in the hydraulic system of transmission, located the gearbox centrifuge	Depending on oil pressure deviation in the transmission hydraulic system					
81	Carry out maintenance service of the engine air cleaner	Depending on dirtiness					

¹⁾ The operation is performed when the tractor is equipped with an air conditioner instead of a fan-heater.

²⁾ The operation is performed when the tractor RLL is equipped with lower links with gripper tools.

³⁾ The operation shall be carried out once during the first maintenance service on a shift basis (in every 8-10 hours of operation), carried out by the customer, and then every 125 hours of tractor operation.

⁴⁾ Control and if necessary, bringing tire internal pressure to the norm shall be carried out each time when one mode of the tractor operation is changed to another operation mode, and when the implements and tools coupled with the tractor are changed.

⁵⁾ AB check and maintenance shall be carried out once every 3 months and not less.

⁶⁾ The operation is performed when the tractor is equipped with FPTO and FLL against order.

⁷⁾ The first and second change shall be carried out in 500 hours of tractor operation. Then the change shall be carried out every 1000 hours of operation at the same time with oil change.

5.4 Scheduled maintenance service operations

5.4.1 Maintenance service on a shift basis (SBMS) in every 8 – 10 hours of operation or per shift

5.4.1.1 General instructions

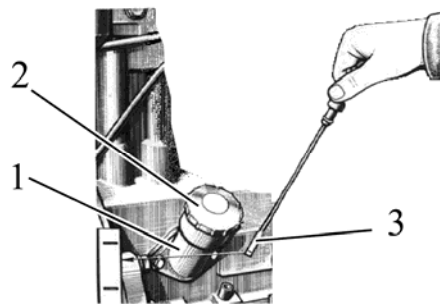
Every 8 – 10 hours of tractor operation or at the end of shift (depending on which comes first), do the following operations:

5.4.1.2 Operation 1. Check of oil level in the engine crankcase

Check oil level putting the tractor on a flat surface and not earlier than in 3-5 min after the engine is off, when the oil completely flows to the crankcase.

To check oil level in the engine crankcase, do the following:

- take dipstick 3 out (figure 5.4.1), wipe it clean and then put it back against the stop;
- take dipstick 3 out and define the oil level. The oil level shall stay between the upper and lower marks of the dipstick. If required, top up the oil through neck 1 after removing cap 2;
- put cap 2 back.



1 – oil filler neck; 2 – cap; 3 – dipstick.

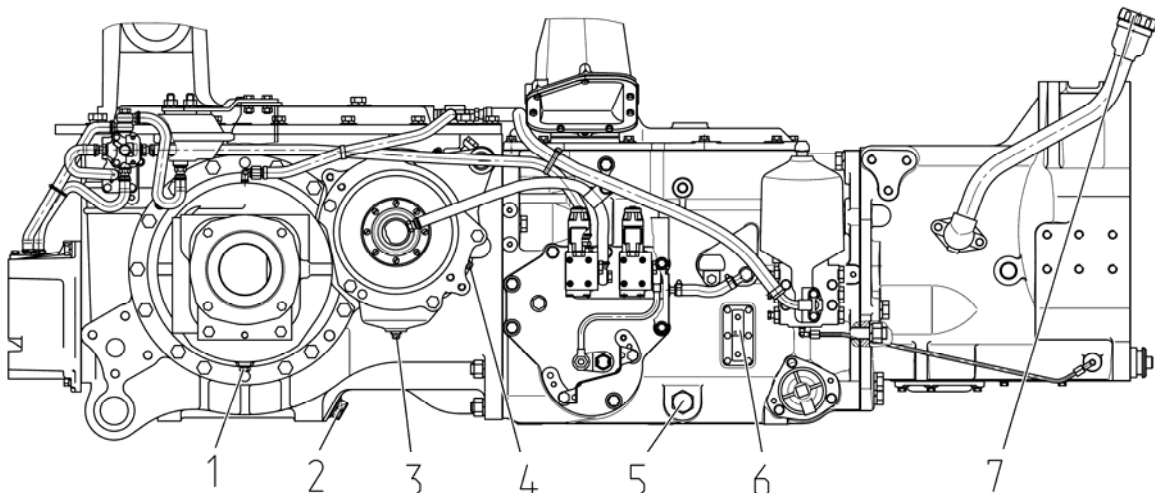
Figure 5.4.1 – Check of oil level in the engine crankcase

ATTENTION: DO NOT RUN THE ENGINE WITH THE OIL LEVEL BELOW THE LOWER MARK ON THE DIPSTICK!

ATTENTION: DO NOT TOP OIL ABOVE THE UPPER MARK OF THE DIPSTICK. THE OIL BURNS OUT CREATING WRONG IMPRESSION OF LARGE OIL CONSUMPTION!

5.4.1.3 Operation 2. Check of oil level in the transmission

Check oil level visually according to oil level indicator 6 (figure 5.4.2) located on the right side of the transmission housing. Oil level shall be up to the mark “П” $\pm$ 5 mm. If necessary, take off oil filler neck cap 7 and refill the oil up to the required mark “П” through the oil filler. Normal oil level shall be within $\pm$ 5 from the mark «П».



1, 2, 5 – transmission drain plugs; 3 – brake housing drain plug; 4 – brake check/fill plug; 6 – oil level indicator; 7 – oil filler neck cap of transmission.

Figure 5.4.2 – Check of oil level and oil replacement in the transmission and brake housings

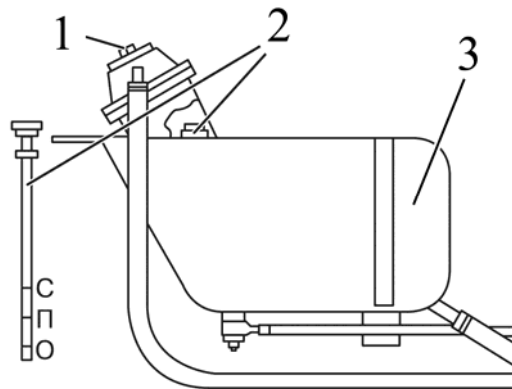
5.4.1.4 Operation 3. Check of oil level in the HLL tank

Before checking oil level, set the tractor on the flat horizontal ground. Lower RLL links to the extreme lower position. Stop the engine and engage the parking brakes.

HLL tank is located on the left side of the clutch coupling housing.

Check the oil level visually according to oil level indicator 2 (figure 5.4.3) on the tank. The level shall be between the marks “O” and “П” of the oil level indicator. If necessary, refill the oil up to the “П” mark through an oil filler hole, for which turn off plug 1.

While operating the tractor coupled with implements requiring higher oil consumption, fill the oil up to the mark “C” on the oil level indicator with the hydraulic cylinder retracted rods of the implement coupled with the tractor.



1 – oil filler hole plug; 2 – oil level indicator; 3 – HLL tank.

Figure 5.4.3 – Check of oil level in the HLL tank

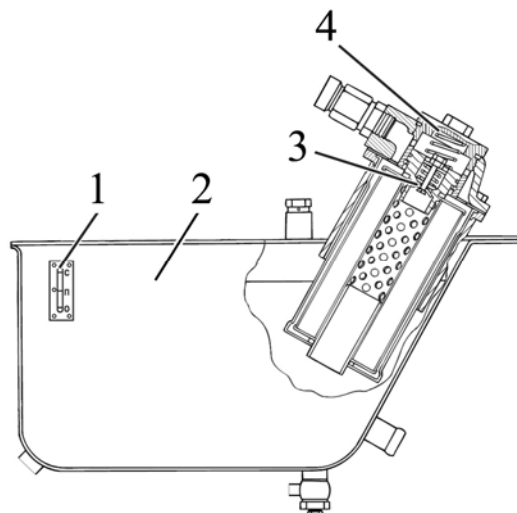
ATTENTION: OIL LEVEL CHECKING OPERATION IN THE HYDRAULIC LIFT LINKAGE TANK SHALL BE CARRIED OUT ONLY WITH THE RETRACTED RODS OF RLL HYDRAULIC CYLINDERS AS WELL AS OF THE IMPLEMENTS COUPLED WITH THE TRACTOR!

5.4.1.5 Operation 4. Check of oil level in the HSC tank

Before checking the oil level in the HSC tank (figure 5.4.4), it is required to set the tractor on flat horizontal ground. Stop the engine and engage the parking brakes.

The HSC oil tank is located on the right side of the clutch coupling housing.

Check the oil level visually according to oil level indicator 1 on HSC tank 2. The level shall be between the marks “C” and “П” of the oil level indicator. If necessary, refill oil up to the required level for which unscrew plug 4 together with valve 3 and refill oil up to the mark “C”.

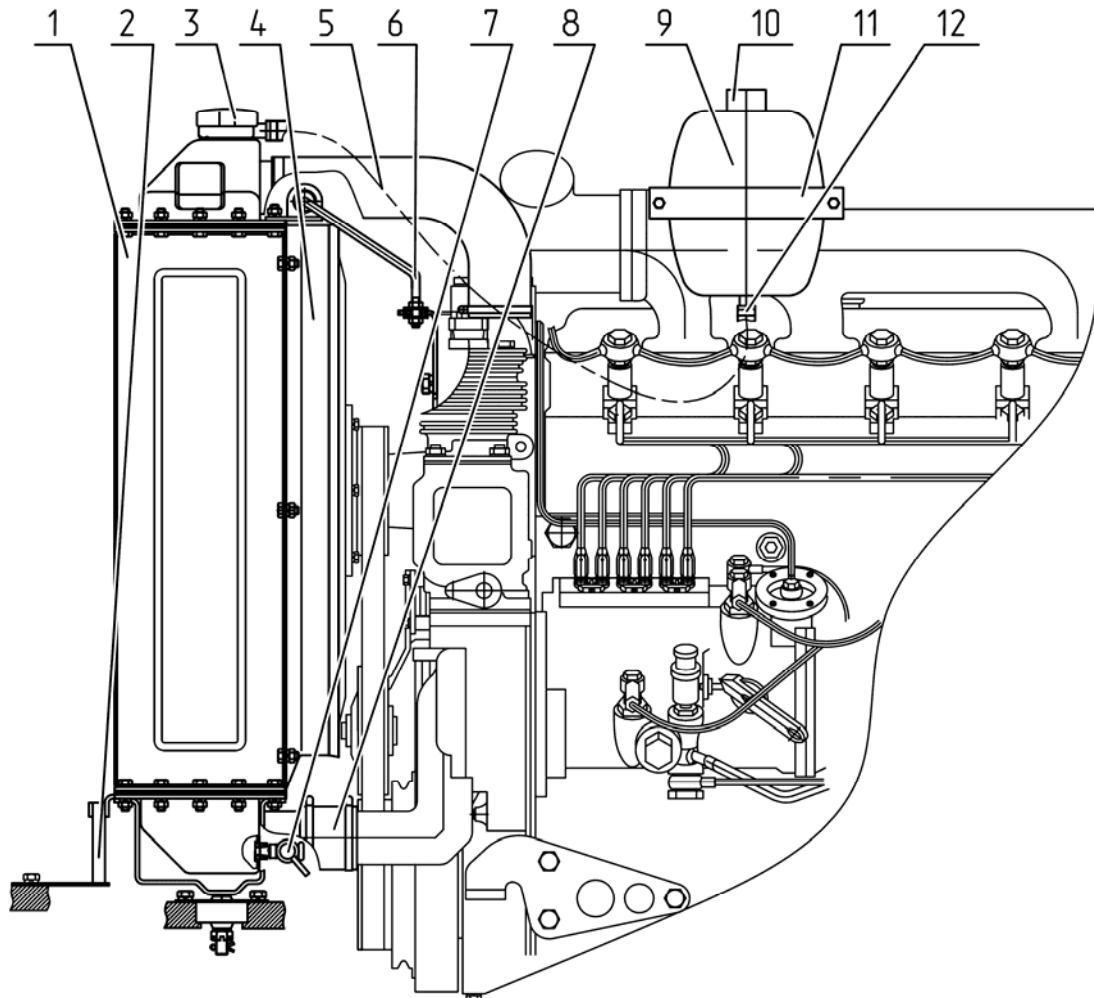


1 – oil level indicator; 2 – HSC tank; 3 – valve; 4 – plug.

Figure 5.4.4 – Check of oil level in HSC tank

5.4.1.6 Operation 5. Check of cooling liquid level in the engine cooling system

The cooling liquid level in the engine cooling system shall be controlled by fullness of expansion tank 9 (figure 5.4.5). The cooling liquid quantity in the expansion tank shall stay at the level of 20 to 30 mm from the expansion tank bottom to the upper edge of fixing clamp 11 of expansion tank 9. If the cooling liquid level is lower than 20 to 30 mm from the expansion tank bottom, add coolant to the expansion tank up to the upper edge of the expansion tank fixing clamp 11.



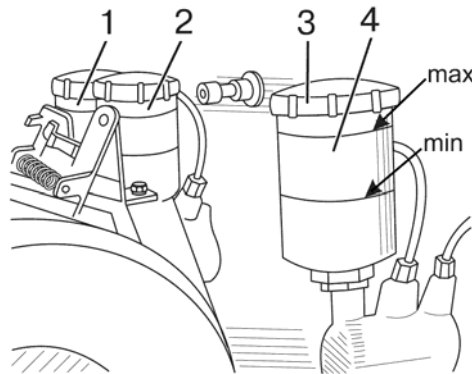
1 – water radiator; 2 – lower sealer; 3 – water radiator plug; 4 – fan casing; 5 – junction pipe from the water radiator to the engine; 6 – bracing; 7 – drain valve; 8 – junction pipe from the engine water pump to the water radiator; 9 – expansion tank; 10 – expansion tank plug; 11 – expansion tank fixing clamp; 12 – steam discharging and compensating pipe.

Figure 5.4.5 – Installation of the engine cooling system elements

WARNING: THE ENGINE COOLING SYSTEM WORKS UNDER PRESSURE WHICH IS MAINTAINED BY A VALVE LOCATED IN THE EXPANSION CHAMBER PLUG. IT IS DANGEROUS TO REMOVE THE PLUG WHEN THE ENGINE IS HOT. IF IT IS REQUIRED TO REMOVE THE WATER RADIATOR PLUG, LET THE ENGINE COOL DOWN FIRST, COVER THE PLUG WITH DENSE TEXTURE AND TURN IT SLOWLY TO REDUCE PRESSURE SMOOTHLY BEFORE REMOVING THE PLUG. AVOID BURNS BY HOT FLUID!

5.4.1.7 Operation 6. Check of hydraulic-brake fluid level in the tanks of main cylinders of hydraulic drive of clutch and brake control

Carry out visual inspection of fluid level in tank 4 (figure 5.4.6) of the main clutch coupling cylinder and tanks 1, 2 of the main brake cylinders. The level shall be between “min” and “max” marks, made on the tank housings. If necessary, add hydraulic-brake fluid up to the “max” mark, turning off tank caps 3.



1, 2 – main brake cylinder tank; 3 – tank cap; 4 – tank of the main cylinder clutch.

Figure 5.4.6 – Check of hydraulic-brake fluid level in the tanks of main cylinders of hydraulic drive of clutch and brake control

5.4.1.8 Operation 7. Check of tire state

Carry out visual inspection of tires outside appearance and conditions in order to detect faults or objects getting stuck in the tires (tacks, rocks and etc.). If necessary, clear the tires of foreign objects. In case the tires have defects going up to the tire fabric or cracks going through the whole tire thickness, dismount the tire and send it to the special repair workshop for retreading. If the tires have defects beyond repair, replace the tire. A defective tire shall be sent to recycling.

5.4.1.9 Operation 8. Check of air conditioner hose fixtures

Note – The operation shall be carried out while mounting of an air conditioner instead of a fan-heater on the tractor.

Carry out visual inspection of air conditioner hose fixtures. Air conditioner hoses shall be properly fixed with coupling clamps. The hoses shall not be in contact with moving parts of the tractor.

5.4.1.10 Operation 9. Check of the hydraulic system elements

Carry out inspection of the tractor hydraulic system elements. In case condensation and down-flows are detected, eliminate them by means of threaded joints tightening. Change failed hoses and high pressure hoses.

5.4.1.11 Operation 10. Check/cleaning of air conditioner drainage pipes from condensate water

Note – The operation shall be carried out while mounting of an air conditioner instead of a fan-heater on the tractor.

Light-blue drain pipes are placed to the right and to the left of the heating and cooling device under the ceiling panel. To avoid clogging, the drain pipes shall be checked and cleaned, if necessary. Cleanliness of a drain pipe is indicated by water dripping when the air conditioner operates in hot weather.

5.4.1.12 Operation 11. Check/cleaning of an air conditioner condenser

Note – The operation shall be carried out while mounting of an air conditioner instead of a fan-heater on the tractor.

Check cleanliness of the air conditioner condenser core. If it is clogged, it is necessary to clean the condenser with compressed air. Open the hood and direct the air flow perpendicular to the condenser plane from top downward. Jammed finning shall be straightened by means of a special comb or a plastic (wooden) plate. In case of severe condenser clogging, rinse it with hot water under pressure of not more than 0.2 MPa and blow it off by compressed air. Condenser cores shall be cleaned both from the hood mask side and from the engine fan side.

CORROSIVE DETERGENT COMPOSITIONS SHALL NOT BE USED!

5.4.1.13 Operation 12. Check/cleaning of the engine water radiator and the engine CAC-radiator

Check cleanliness of the hood mask, engine CAC-radiator core and engine water radiator. In case it is clogged, do the following actions:

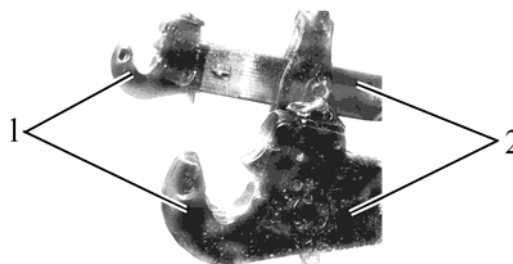
- carry out cleaning of the hood mask with compressed air at both sides;
- carry out CAC-radiator cleaning with compressed air. Direct the air flow perpendicular to the CAC-radiator plane from top downward. In case of severe CAC-radiator clogging, rinse it with hot water under pressure of not more than 0.2 MPa and blow it off by compressed air;
- carry out water radiator cleaning with compressed air. Direct the air flow perpendicular to the water radiator plane from top downward. In case of severe water radiator clogging, rinse it with hot water under pressure of not more than 0.2 MPa and blow it off by compressed air;
- radiator cores shall be cleaned both from the hood mask side and from the engine fan side.

ALKALINE SOLUTIONS AND CORROSIVE DETERGENT COMPOSITIONS SHALL NOT BE USED!

5.4.1.14 Operation 13. Check /rinse of RLL gripper tools

Note – The operation shall be carried out while mounting of lower links with gripper tools on the tractor RLL.

It is required to check the cavity where the hinge joint locking mechanism in gripper tools 1 (figure 5.4.7) of the RLL is located. In case of dirt accumulation, clean internal cavities in gripper tools and rinse them with water.



1 – gripper tool; 2 – link.

Figure 5.4.7 – RLL gripper tool

5.4.1.15 Operation 14. Check of brakes functioning on the move, the engine, steering, light/alarm devices operability. Check of electrical cables condition in the engine compartment

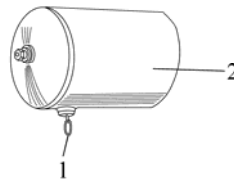
The following tractor operating parameters shall be ensured:

- the engine shall operate properly in all modes;
- controls, light warning and acoustic alarm devices shall operate properly;
- simultaneous engagement of the right and left service brakes.

In case the above mentioned conditions are not observed, make the required adjustments or repair of the corresponding tractor systems.

5.4.1.16 Operation 15. Drainage of condensate water from the pneumatic system balloons

To drain condensate from balloon 2 (figure 5.4.8) of the pneumatic system, pull ring 1 of the drain valve installed on balloon in the horizontal direction to any side, and hold it till the full drainage of condensate.



1 – ring; 2 – pneumatic system balloon.

Figure 5.4.8 – Drainage of condensate water from the pneumatic system balloon

5.4.1.17 Operation 16. Check of the condition of the wires and wire bundles of the electrical equipment in the engine compartment, in the cab front area, and the condition of visible parts of the wiring

Check the condition of the wiring, wire bundles in the engine compartment, in the cab front area, and the condition of visible parts for abrasion, melt or damage of outer insulation.

In case of detection of the above mentioned faults, do the following:

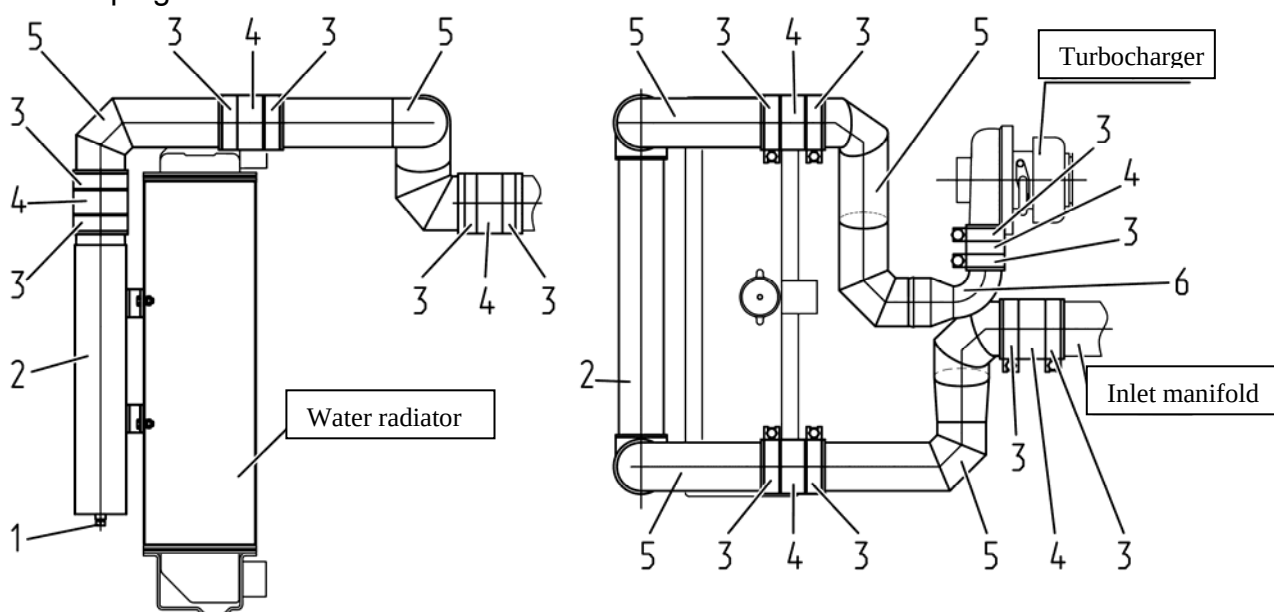
- restore the damaged areas using insulation tape;
- eliminate the cause of insulation damage;

5.4.1.18 Operation 17. Drainage of condensate water from the radiator tanks of diesel CAC

The operation shall be carried out in autumn and winter period every 8-10 hours of tractor operation or on a shift-time basis, and in spring and summer period – every 125 hours of tractor operation.

In order to drain condensate water from the radiator tank of diesel CAC, it is necessary to do the following actions:

- turn off two plugs 1 (figure 5.4.9) in the bottom of CAC radiator 2;
- let condensate drain;
- screw plugs 1.



1 – plug; 2 – charged air cooler (CAC) radiator; 3 – clamps; 4 – high-temperature silicone connecting pipes; 5 – air pipes; 6 – connecting pipes.

Figure 5.4.9 – Maintenance of engine CAC

5.4.2 Maintenance service in every 125 hours of operation (MS-1)

5.4.2.1 General instructions

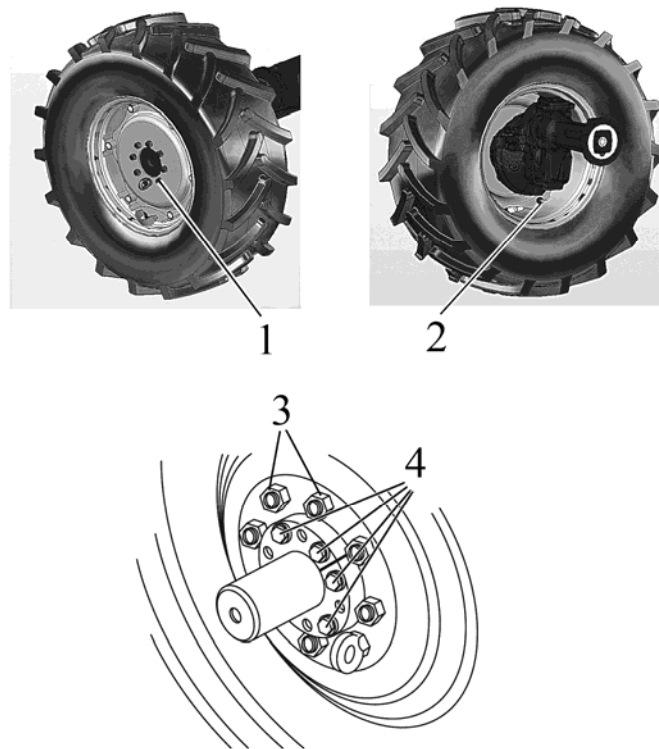
Perform previous operations, and the operations specified in the present subsection

5.4.2.2 Operation 18. Check of threaded joint tightening of wheel fixing

The operation on check of threaded joint tightening of wheel fixing shall be carried out once during the first MS on a shift basis (in 8-10 hours of operation) carried out by a customer and then every 125 hours of operation.

Check the tightening of wheel and hub bolt retaining nuts and if necessary, tighten them up:

- tightening torque for bolts 4 (figure 5.4.10) of rear wheel conic hubs shall be from 360 to 450 Nm;
- tightening torque of nuts 3 for rear wheels mounting on hubs shall be from 300 to 350 Nm;
- tightening torque of nuts 1 for front wheels mounting on reducing gear flanges of FDA shall be from 200 to 250 Nm;
- tightening torque of nuts 2 for front wheel disks mounting on rim brackets shall be from 180 to 240 Nm.



1 – nuts for front wheels mounting on reducing gear flanges of FDA; 2 – nuts for front wheel disks mounting on rim brackets; 3 – nuts for rear wheels mounting on hubs; 4 – bolt for fastening rear wheel taper hubs.

Figure 5.4.10 – Check of threaded joint tightening of wheel mounting

5.4.2.3 Operation 19. Washing of the tractor and cleaning of the cabin interiors

Wash the tractor and clean the cabin inside.

Before washing the tractor with water jet, stop the engine, put the battery disconnect switch in "OFF" position.

While tractor washing, it is necessary to take steps to protect electric and electronic components, plugs and sockets against entry of water jets. It is forbidden to direct water jet on-to electric and electronic work-pieces and cable connectors.

Maximum water temperature shall not exceed 50°C. It is forbidden to add corrosive agents (detergents) into water for washing.

After tractor washing, clean the electric and electronic work-pieces and cable connectors with compressed air.

5.4.2.4 Operation 20. Check of bolt tightening of CAC air duct clamps

Check and if necessary, tighten clamp bolts 3 (figure 5.4.9) of CAC air ducts. Bolt torque of worm type clamps shall be from 5 to 8 Nm, bolt torque of hinge type clamps – from 10 to 15 Nm.

ATTENTION: AFTER CHECK OF CLAMP BOLTS TIGHTENING TORQUE, IT IS REQUIRED TO CHECK HERMITICITY OF ALL JOINTS OF CAC DUCT. TO DO THIS, INSPECT THE JOINTS OF ALL AIR PIPELINES AND SILICONE CONNECTING PIPES OF THE CAC SYSTEM FOR DAMAGES AND LEAKAGES. IN CASE OF DETECTION ANY FAILURES AND DAMAGES, IT IS REQUIRED TO FIND OUT THE REASON FOR THEIR APPEARANCE AND TAKE MEASURES TO ELIMINATE THEM!

IT IS FORBIDDEN TO OPERATE THE TRACTOR WITH THE CAC SYSTEM FAULTY!

5.4.2.5 Operation 21. Check of pneumatic pressure in tires

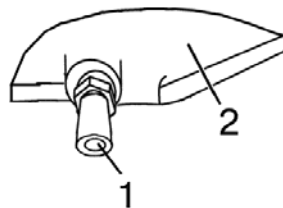
Value pressure in front and rear tires shall be chosen according to the load per single tire, driving speed and operations performed. If it is necessary, bring tire pressure to the required value according to subsection 3.2.8 "Selection of optimal internal pressure in tires, depending on operating conditions and load on tractor axles".

ATTENTION: CONTROL AND BRINGING TIRE INTERNAL PRESSURE TO THE NORMAL VALUE, WHEN NEEDED, SHALL BE CARRIED OUT EACH TIME THE TRACTOR CHANGES ONE OPERATION TO ANOTHER AND CHANGES IMPLEMENTS AND MACHINES COUPLED!

5.4.2.6 Operation 22. Drainage of sediment from the fuel tank

To drain sediment from the fuel tank, it is necessary to do the following:

- screw out tank adapter 1 with screw key S 17 (figure 5.4.11, tank adapter 1 is located at the bottom of fuel tank 2);
- drain sediment until clean fuel appears;
- after clean fuel without water and dirt appears, screw in tank adapter 1, holding metallic embedded part of fuel tank 2.



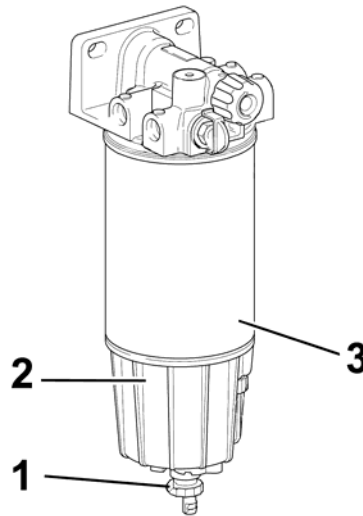
1 – adapter; 2 – fuel tank.

Figure 5.4.11 – Drainage of sediment from the fuel tank

5.4.2.7 Operation 23. Drainage of sediment from the coarse fuel filter

To drain sediment from the coarse fuel filter, it is necessary to do the following:

- open drain valve 1 (figure 5.4.12) of coarse fuel filter 3;
- drain sediment until clean fuel appears, collect the sediment into a special container;
- after appearing of clean fuel without water and dirt, close drain valve 1.



1 – drain valve; 2 – water-catching bowl; 3 – coarse fuel filter.
Figure 5.4.12 – Drainage of sediment from the coarse fuel filter

ATTENTION: IF DURING TRACTOR OPERATION THE MESSAGE ABOUT PRESENCE OF WATER IN THE COARSE FUEL FILTER APPEARED ON THE INFORMATIONAL DISPLAY, DRAIN SEDIMENT FROM THE COARSE FUEL FILTER NOT WAITING FOR THE DAY OF REGULAR MAINTENANCE!

5.4.2.8 Operation 24. Check of generator and water pump drive belt tension

Generator belt tension is considered normal if its deflection on the crankshaft pulley branch – the generator pulley is located within 13-18 mm when pressing it by force of 40 ± 2 N.

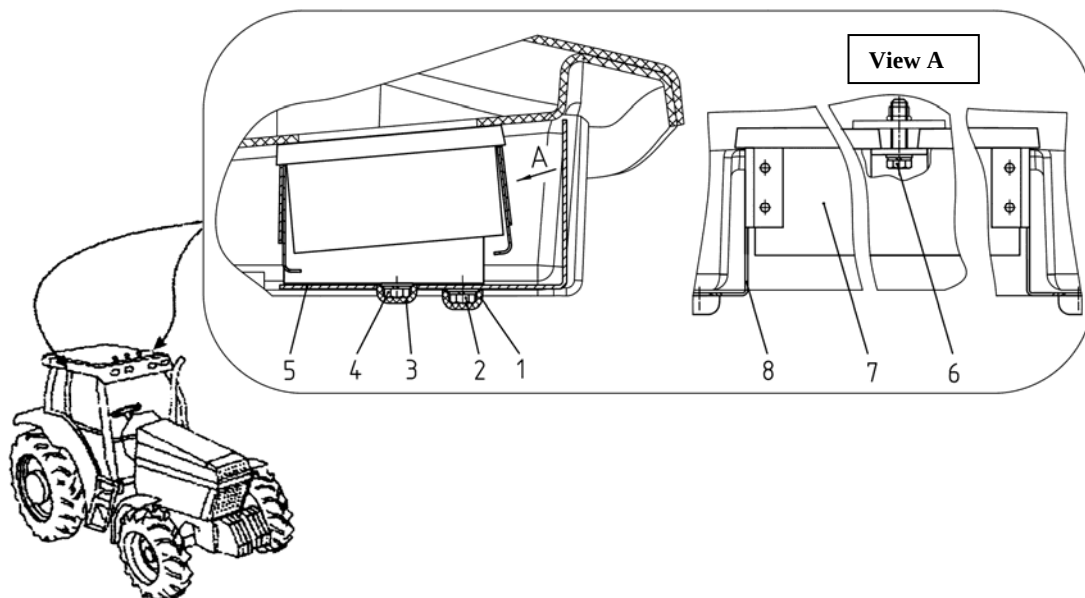
Release generator mounting for belt tension adjusting. Adjust belt tension by turning the generator housing. Tighten the tension bolt of the plank and the nuts of generator tension bolts. Belt deflection of the water pump drive shall be within 9-18 mm when pressing the branch water pump pulley – crankshaft pulley by force of $39,2 \pm 2,0$ N.

5.4.2.9 Operation 25. Cleaning of filter cartridges of the cab ventilation and air heating systems

The ventilation system filters are mounted at both sides of the tractor cab, as shown in figure 5.4.13. The filter consists of two filter cartridges. .

To clean the cab ventilation and heating systems filter, it is necessary to do the following:

- to get an access to the filter, put a support or a small ladder;
- remove two filter caps 1 (figure 5.4.13) from bolts 2 and two filter caps 3 from bolts 4 under the protrusive edge of the cab roof;
- remove protection net 5, for which unscrew two bolts 2;
- remove frame 8 with filter cartridges 7, for which unscrew two bolts 4 and one bolt 6;
- take filter cartridges 7 out of frame 8;
- clean the filter cartridge with compressed air under the pressure of not more than 0,1MPa. It is required to hold the pipe head at the distance not closer than 300mm from the filter cartridge in order not to damage it;
- mount filter cartridges 7 into frame 8, then mount frame 8 and protection net 5 onto the cab, put caps 1 and 3 on bolts 2 and 4 correspondingly;
- perform the above mentioned operations for the filter located at the other side of the tractor cab.



1, 3 – filter cap; 2, 4, 6 – bolt; 5 – protection net; 7 – filter cartridge; 8 – frame.

Figure 5.4.13 – Cleaning of the cab ventilation and air heating systems filter

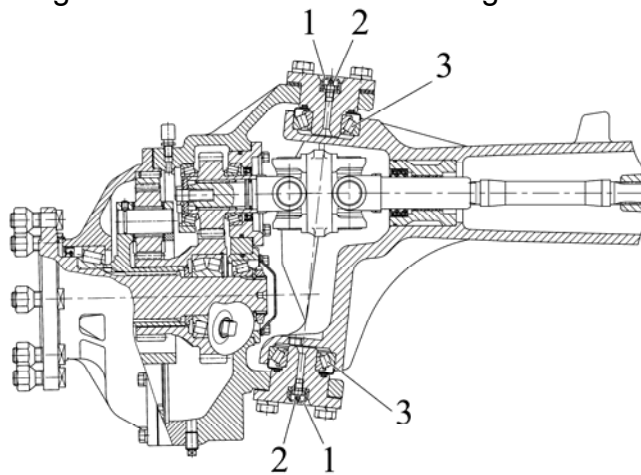
ATTENTION: DO NOT SWITCH ON THE FAN BEFORE CLEANING THE FILTERS AT HIGH HUMIDITY OF THE ENVIRONMENT, FOR EXAMPLE IN THE MORNING, AS IT IS DIFFICULT TO REMOVE DUST FROM A WET PAPER FILTER CARTRIDGE!

ATTENTION: DURING TRACTOR OPERATION IN HEAVY DUSTING CONDITIONS, CLEAN THE FILTER EVERY 8-10 HOURS OF OPERATION, I.E. ON A SHIFT BASIS!

5.4.2.10 Operation 26. Lubricating of pivot axis bearing of FDA

To lubricate pivot axis bearing 3 of FDA, do the following:

- remove caps 1 (figure 5.4.14) from four lubricating boxes 2 of bearings 3;
- clean lubricating boxes 2 from accumulated dirt and consolidated lubricant;
- squirt lubricating boxes 2 with lubricant making form four to six injections.



1 – cap, 2 – lubricating box; 3 – bearing

Figure 5.4.14 – Lubricating of pivot axis bearing of FDA

5.4.2.11 Operation 27. Check / adjustment of air conditioner compressor drive belt tension

Note – The operation shall be carried out while mounting of an air conditioner instead of a fan-heater on the tractor.

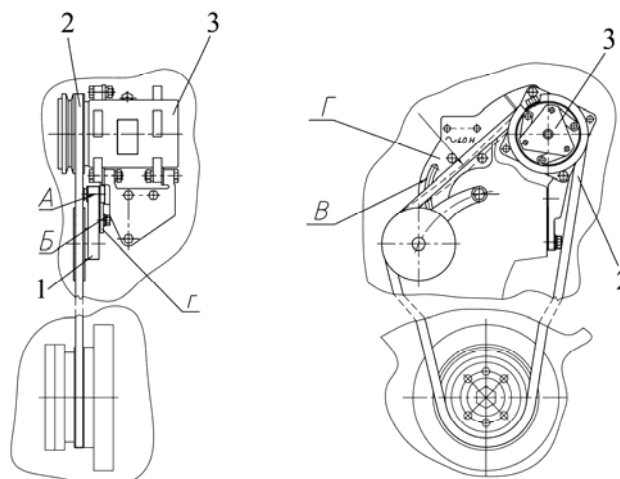
1. Check of air conditioner compressor drive belt tension:

Belt 2 tension (figure 5.4.15) is considered normal if deflection of its side “tension lever pulley – compressor pulley” measured in the middle is within 4 to 6 mm when pressing it by force of (39.2 ± 2.0) N.

In case this condition is not observed, it is necessary to adjust air conditioner compressor drive belt tension.

2. Adjustment of air conditioner compressor drive belt tension:

Adjustment of belt 2 tension (figure 5.4.15) of conditioner compressor 3 shall be carried out by turning tension lever 1 on rotational axis A and threaded joint chuck B in slot C of plate D. Belt deflection in response to force of (39.2 ± 2.0) N applied perpendicular to the center of belt side shall be within 4 to 6 mm.



1 – tension lever; 2 – belt; 3 – compressor.

Figure 5.4.15 – Adjustment of air conditioner compressor drive belt tension

5.4.2.12 Operation 28. Check / adjustment of clutch control

5.4.2.12.1 Check of clutch control

Check the condition of the expansion tank, main and operating cylinders, hydraulic booster and pipelines. Brake fluid or oil leakage is not allowed. Clean the control drive and the clutch control pedal from dirt and outside particles.

Check the clearance between the clutch coupling release bearing and release levers: when the engine is not running, the total pedal free travel 7 (figures 5.4.16 and 5.4.17) shall make size E that corresponds to lever 33 shifting at the radius of 105mm for size K. When pedal 7 is fully depressed, lever 33 shifting at the radius of 105mm shall make not less than size Л.

If necessary, adjust clutch control according to subsection 5.4.2.12.2 "Adjustment of clutch control" with the help of two people.

ATTENTION: ONLY DEALERS ARE ALLOWED TO ADJUST AND BLEED CLUTCH CONTROL!

5.4.2.12.2 Adjustment of clutch control

5.4.2.12.2.1 The rules for adjustment of clutch control

Adjustment of clutch control shall be performed in the following order:

1. Adjustment of clearing "B" (figures 5.4.16 and 5.4.17) between piston 10 and pusher 9 of main cylinder 11:

- set pedal 7 into size "Д" by means of bolt 3, tighten nut 4 with the torque from 10 to 16 Nm;
- by screwing and unscrewing yoke 5 try to shift pedal 7 from its initial position to the moment of touching pusher 9 into piston 10, measured on the center of pedal casing so that it makes size "Г";
- tighten up nut 8 with the torque from 30 to 50 Nm and splint pin 6.

2. Adjustment of clearing "И" (figures 5.4.16 and 5.4.17) between rod 24 of main cylinder 23 and pusher 25 of hydraulic booster 26:

- remove operating cylinder 23 from bracket 13 after taking out pin 15;
- set rod 24 in cylinder 23 into the extreme right position against the stop into cover 20;
- set cylinder 23 into pusher 25 of hydraulic booster 26 until their light contact and by screwing and unscrewing support 14 match the holes of the support and bracket 13, after which screw in support 14 for ½ revolutions, set pin 15;
- tighten up nut 19 with the torque from 18 to 30 Nm and splint pin 15.

3. Adjustment of clearing between the clutch coupling release bearing and release levers:

- disconnect link 28 (figures 5.4.16 and 5.4.17) from lever 33 after taking out pin 32;
- unlock yoke 31;
- turn lever 33 contraclockwise against the stop of the release bearing into release levers and rotating yoke 31 match the holes of the lever and yoke, after which screw it in for 5...5,5 revolutions and connect them with the lever by means of pin 32;
- tighten up nut 30 with the torque from 50 to 70 Nm without letting link 28 turn, splint pin 32.

4. Bleed the hydraulic system of clutch control according to clause 5.4.2.12.2.2 or 5.4.2.12.2.3 of the present operator manual.

5.4.2.12.2.2 Bleeding of the hydraulic system of clutch control with the main and operating cylinders manufactured by RUE "Gomel Works "Hydraulic drive"

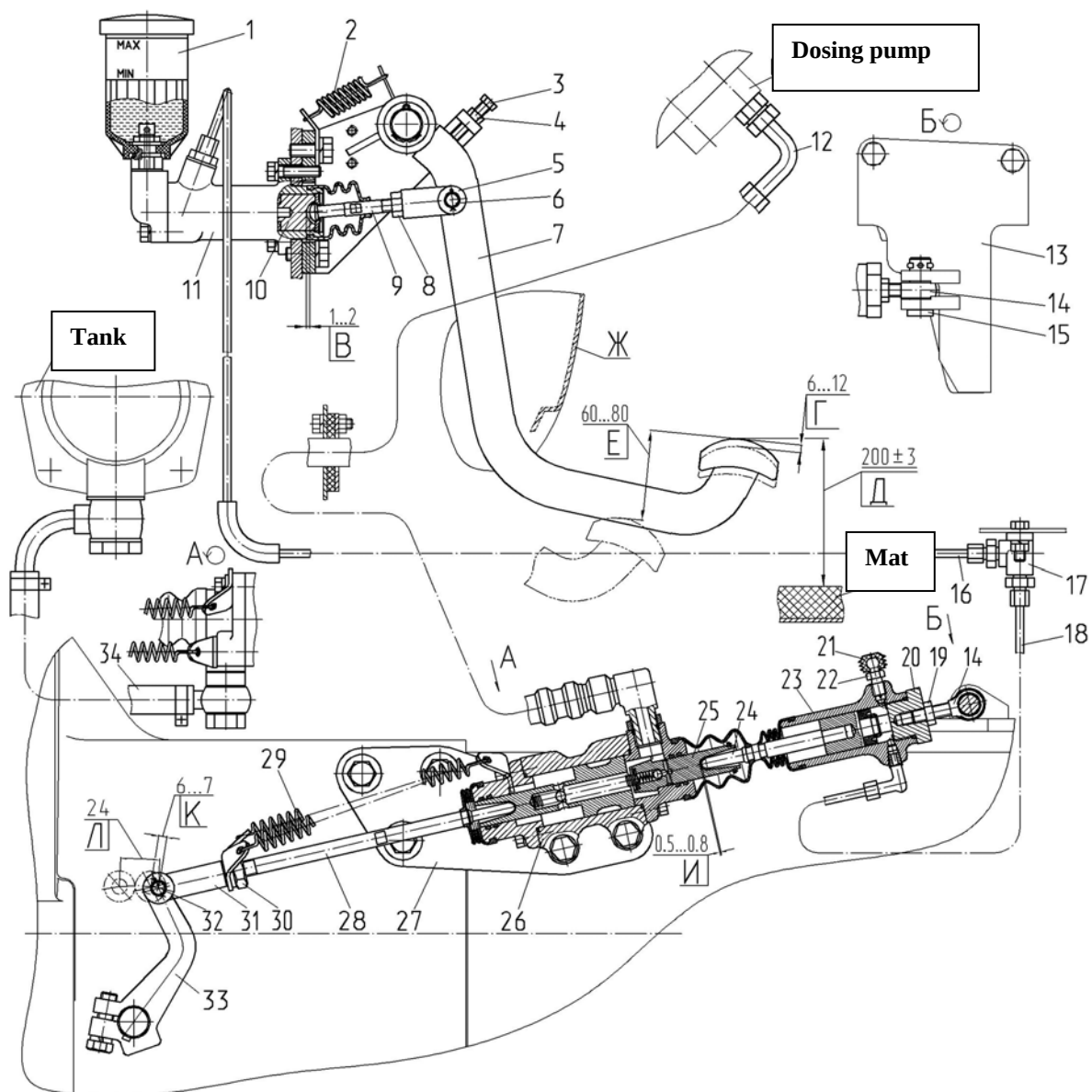
Before bleeding, fill tank 1 (figure 5.4.16) of main cylinder 11 with brake fluid.

Bleeding of the hydraulic system shall be performed in the following order:

fill tank 1 with brake fluid up to the mark "MAX";

- remove protection cap 21 from operating cylinder 23 and mount a rubber hose pipe onto the head of overflow valve 22, put the hose pipe into the container with brake fluid;
- depress the clutch pedal several times;
- holding the clutch pedal depressed, unscrew overflow valve 22 for $\frac{1}{4}$ of the revolution, draining brake fluid surplus with air bubbles into the container with brake fluid;
- screw in overflow valve 22 and release the clutch pedal;
- bleed the system until the drained brake fluid has no bubbles;
- remove the hose pipe and mount protection cap 21;
- check the brake fluid level in tank 1 and if necessary, refill it.

ATTENTION: WHILE BLEEDING THE HYDRAULIC SYSTEM OF CLUTCH CONTROL, IT IS REQUIRED TO MAINTAIN BRAKE FLUID LEVEL IN TANK 1 BETWEEN THE MARKS "MIN" AND "MAX"!



1 – tank; 2 – spring; 3 – bolt; 4, 8, 19, 30 – nut; 5, 31 – yoke; 6, 15, 32 – pin; 7 – pedal; 9, 25 – pusher; 10 – piston; 11 – main cylinder; 12 – oil pipe; 13, 27 – bracket; 14 – support; 16, 18 – pipeline; 17 – angle piece; 20 – cover; 21 – protection cap; 22 – overflow valve; 23 – operating cylinder; 24 – rod; 26 – hydraulic booster; 28 – link; 29 – pullback spring; 33 – lever; 34 – hose pipe.

Figure 5.4.16 – Diagram of the main and operating cylinder clutch control, manufactured by RUE “Gomel Works “Hydraulic drive”

5.4.2.12.2.3 Bleeding of the hydraulic system of clutch control with the main and operating cylinders manufactured by "FENOX"

Before bleeding, fill tank 1 (figure 5.4.17) of main cylinder 11 with brake fluid.

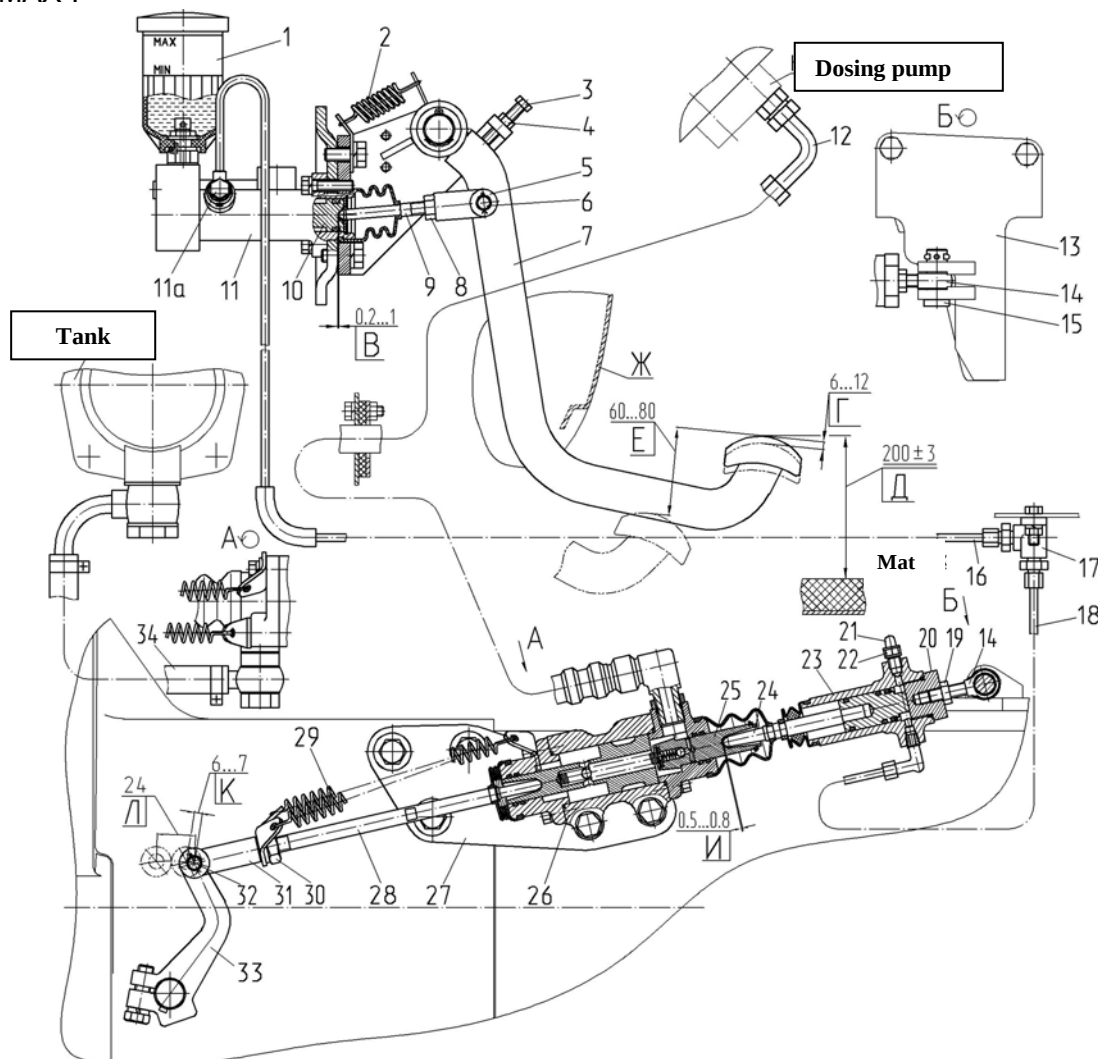
Bleeding of the hydraulic system:

disconnect pipeline 16 from main cylinder 11 by unscrewing bolt 11a;

fill tank 1 with brake fluid up to the mark "MAX";

- remove protection cap 21 from operating cylinder 23 and mount a rubber hose onto the head of overflow valve 22, put the hose pipe into the container with brake fluid;
- after 4min (or when brake fluid appears at the outlet of main cylinder 11), connect pipeline 16 to main cylinder 11 by screwing in bolt 11a;
- depress the clutch pedal several times;
- holding the clutch pedal depressed, unscrew overflow valve 22 for $\frac{1}{4}$ of the revolution, draining brake fluid surplus with air bubbles into the container with brake fluid;
- screw in overflow valve 22 and release the clutch pedal;
- bleed the system until the drained brake fluid has no bubbles;
- remove the hose pipe and mount protection cap 21;
- check the brake fluid level in tank 1 and if necessary, refill it.

ATTENTION: WHILE BLEEDING THE HYDRAULIC SYSTEM OF CLUTCH CONTROL, IT IS REQUIRED TO MAINTAIN BRAKE FLUID LEVEL IN TANK 1 BETWEEN THE MARKS "MIN" AND "MAX"!



1 – tank; 2 – spring; 3, 11a – bolt; 4, 8, 19, 30 – nut; 5, 31 – yoke; 6, 15, 32 – pin; 7 – pedal; 9, 25 – pusher; 10 – piston; 11 – main cylinder; 12 – oil pipe; 13, 27 – bracket; 14 – support; 16, 18 – pipeline; 17 – angle piece; 20 – cover; 21 – protection cap; 22 – overflow valve; 23 – operating cylinder; 24 – rod; 26 – hydraulic booster; 28 – link; 29 – pullback spring; 33 – lever; 34 – hose pipe.

Figure 5.4.17 – Diagram of the main and operating cylinder clutch control, manufactured by "FENOX"

5.4.2.12.2.4 Check of declutching cleanliness

After performing the above mentioned adjustments of clutch control, it is required to check declutching cleanliness, for which do the following:

- engage the parking brake;
- start the engine and set diesel rated speed (1400 ± 100) rpm;
- fully depress the clutch coupling pedal and not less than in 5sec engage GB ranges, the activation of which shall be “clear” – without unwanted sounds and rattle.

In case there are unwanted sounds or rattle, it is required to check and if necessary, make adjustments specified in subclause 5.4.2.12.2.1 again.

Pedal 7 (figures 5.4.16 and 5.4.17) shall not bear against panel Ж (figures 5.4.16 and 5.4.17).

After bleeding of the hydraulic system with the engine off, the total pedal 7 free travel shall make size E that corresponds to lever 33 shifting at the radius of 105mm for the size K. When pedal 7 is fully depressed, lever 33 shifting at the radius of 105mm shall be not less than size Л.

5.4.3 Maintenance services in every 250 hours of operation (2MS-1), in every 500 hours of operation (MS-2), in every 1000 hours of operation (MS-3), in every 2000 hours of operation (special maintenance) and maintenance service that does not coincide with intervals of MS-1, 2MS-1, MS-2, MS-3 and special MS

5.4.3.1 General instructions

ATTENTION: ONLY DEALERS ARE ALLOWED TO PERFORM OPERATIONS 2 MS-1, MS-2, MS-3 AND SPECIAL MAINTENANCE EXCEPT FOR THE OPERATIONS "CHECK / ADJUSTMENT OF FRONT WHEEL TOE-IN" AND "CHECK / ADJUSTMENT OF CLEARANCES IN STEERING JOINTS"!

The operations 2MS-1 shall be performed every 250 hours of tractor operation together with the operations of STM and TM-1.

The operations TM-2 shall be performed every 500 hours of tractor operation together with the operations of STM, TM-1 and 2TM-1.

The operations TM-3 shall be performed every 1000 hours of tractor operation together with the operations of STM, TM-1, 2TM-1 and TM-2.

The operations of special maintenance shall be performed every 2000 hours of tractor operation together with the operations of STM, TM-1, 2TM-1, TM-2 and TM-3.

5.4.3.2 Operation 33. Check / adjustment of clearances in steering joints

To check the backlash and clearances in steering joints 1 (figure 5.4.19) of steering link 4, it is necessary to turn the steering wheel to both sides when the engine is running. In case the steering wheel has the backlash of more than 25° as shown in figure 5.4.18, eliminate the steering joint clearance by performing the following actions:

- stop the engine;
- remove locking wire 3 (figure 5.4.19);
- screw threaded plug 2 to eliminate the steering joint clearance;
- lock plug 2 with wire 3.

If the steering joint clearance can not be eliminated by tightening threaded joints, take the hinge joint to pieces and replace the worn-out parts.

Besides, weak tightening of castle nuts of HSC hydraulic cylinders cone-shaped pins may be a reason for increased steering wheel clearance angle.

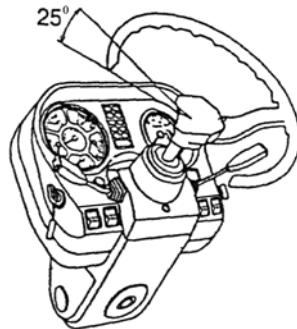
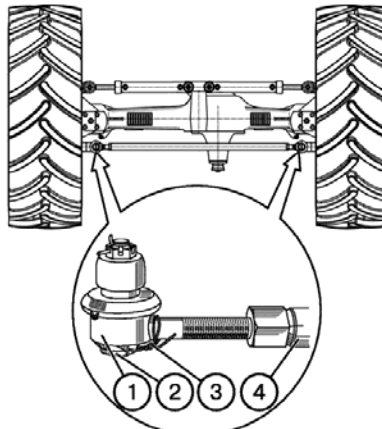


Figure 5.4.18 – Check of clearances in steering joints



1 – hinge joint; 2 – plug; 3 – locking wire; 4 – steering link.

Figure 5.4.19 – Maintenance of steering joints

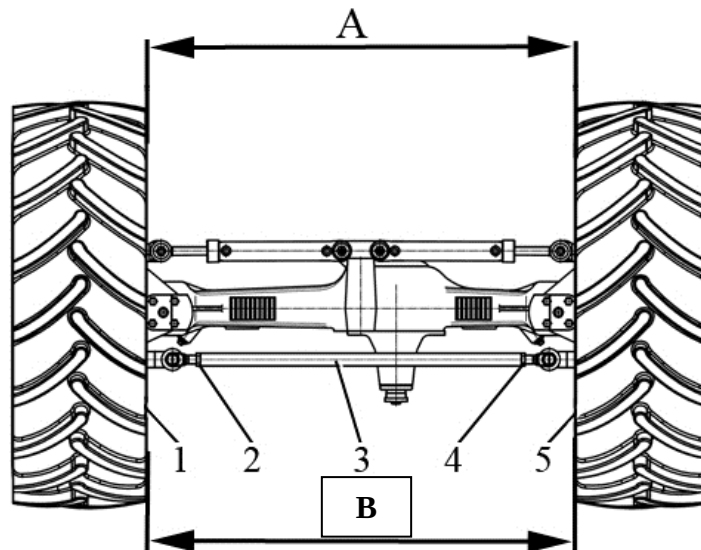
5.4.3.3 Operation 34. Check / adjustment of wheel toe-in

Adjustment of front wheel toe-in is carried out to prevent front tires from premature breakdown.

ATTENTION: CHECK AND ADJUSTMENT OF FRONT WHEEL TOE-IN SHALL BE CARRIED OUT EVERY 250 HOURS OF TRACTOR OPERATION, AND AFTER EACH TIME THE FRONT WHEEL TRACK WIDTH IS CHANGED. BEFORE CHECKING FRONT WHEEL TOE-IN, CHECK AND ADJUST IF NECESSARY, THE STEERING JOINT CLEARANCES!

To make necessary adjustments, do the following:

1. Make sure there are no clearance gaps in hinges of the steering mechanism, of the pivot supporting block bearings and wheels.
2. Set front wheels into straight position corresponding to the direct tractor movement for which drive the tractor on hard flat surface for not less than 3 meters and stop. Engage the parking brake to avoid tractor movement.
3. Measure distance "A" (figure 5.4.20) between rim edges of front wheels 1 and 5 (figure 5.4.20) at the height of front wheel centers, and make visible marks in the measured places.
4. Disengage the parking brake, drive the tractor forward so that front wheels turn by half revolution and measure distance "B" between wheel rim edges at the height of wheel centers at the back in the marked points.
5. If the value ("B"- "A") is within 0 to 8 mm that means the toe-in is correctly adjusted. If the value ("B"- "A") is lower 0 or more than 8 mm, do the following:
 - a) leaving the tractor position unchanged, unscrew lock nuts 2 and 4;
 - b) rotating steering link tube 3, try to get the value ("B"- "A") within 0 to 8 mm;
 - c) repeat the operations described in subclauses 4 and 5.
 - d) if the value ("B"- "A") is within the limits from 0 to 8 mm, tighten steering link lock nuts 2 and 4 with torque from 100 to 140 Nm, leaving the steering link length unchanged.

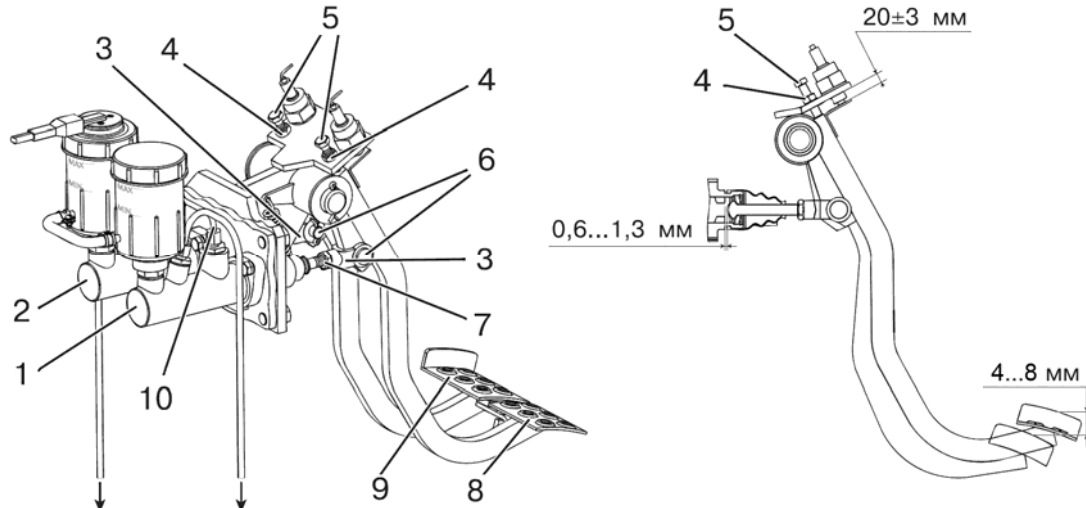


1, 5 – rim edge of front wheel; 2, 4 – locking nuts; 3 – adjustable tube.

Figure 5.4.20 – Diagram of front wheels toe-in adjustment

5.4.3.4 Operation 44. Check / adjustment of service brake control

ATTENTION: IT IS REQUIRED TO CHECK AND ADJUST THE BRAKE SYSTEM AS WELL AS ELIMINATE ANY FAILURES IN IT ONLY WITH THE ENGINE OFF AND THE TRACTOR BEING FIXED IN THE HORIZONTAL POSITION BY MEANS OF STOPS UNDER THE WHEELS WHICH EXCLUDE THE TRACTOR SPONTANEOUS MOVEMENT! ONLY DEALERS ARE ALLOWED TO MAKE ADJUSTMENTS OF THE BRAKE SYSTEM AND ELIMINATE ANY FAILURES!



1, 2 – main brake cylinder; 3 – yoke; 4 – nut; 5 – adjustable stop bolt; 6 – pin; 7 – counternut; 8, 9 – pedal; 10 – pipeline connecting two main brake cylinders.

Figure 5.4.21 – Adjustment of pedal free travel of service brake control

Adjustment of the tractor service brake control shall be performed in the following order:

1. Set cradles of pedals 8 and 9 (figure 5.4.21) in the same plane by means of adjustable stop bolts 5 by screwing them to the depth of (20 ± 3) mm. Lock nuts 4.

2. Check the pedals free travel. Free travel of pedals 8, 9 shall be within 4 to 8mm. If this condition is not observed, adjust the pedals free travel doing the following operations:

- unsplint and remove pins 6 and disconnect yokes 3 from pedals 8 and 9 cores;
- unscrew counternuts 7 for several resolutions, then by screwing or unscrewing yokes 3 shorten or lengthen the rods of main brake cylinders 1 and 2 to get the required pedal free movement;
- lock nuts 7, set pins 6 and splint them. Free travel of pedals within 4 to 8mm corresponds to the clearance between the pusher and the piston of each main brake cylinder from 0,6 to 1,3mm;
- the pedals shall not contact with the cab elements. The arrangement of pedal cradles along the height shall be adjusted by means of bolts 5 and the length of main brake cylinders rods if necessary, ensuring the pedal free travel from 4 to 8mm.

3. Check the length of operating brake cylinders 1 and 14 (figure 5.4.22). The operating cylinders length shall be (207 ± 2) mm while measuring from the cylinder fixing point to the pin axis which connects levers 5 and 9 with yokes 3 and 12 correspondingly, with the operating brake cylinder rod pushed inside into the extreme position, as shown in figure 5.4.22. In case this condition is not observed, set the length for operating brake cylinders 1 and 14 into the size (207 ± 2) mm.

Setting of length for operating brake cylinders shall be performed by means of yokes 3 and 12, bolts-links 6 and 10, doing the following operations:

unscrew counternuts 2 and 13 for several resolutions;

unsplint and remove pins 4 and 11 after disconnecting yokes 3 and 12 from levers 5 and 9 of the right and left operating cylinders correspondingly;

by screwing and unscrewing yokes 3 and 12 from the rods of operating brake cylinders 1 and 14, set the size (207 ± 2) mm;

lock counternuts 2 and 13, set and splint pins 4 and 11.

4. After making adjustments, fill the drive hydraulic system with brake fluid and bleed the hydraulic system in the following order:

fill tanks 17 and 18 of main brake cylinders 16 and 15 with brake fluid up to the mark "MAX" on the tanks. In the process of bleeding, observe the fluid level not letting its lowering below the mark "MIN";

interlock pedals 19 and 20 by means of plank 21;

clean overflow valves 7 and 8 from dirt and dust, remove caps from them, put a pipe on the overflow valve head of the left operating cylinder, and put its free end into the transparent container of at least 0,5l, half filled with brake fluid;

press the interlocked brake pedals from four to five times and holding them depressed, unscrew the left operating cylinder valve for $1/2 \dots 3/4$ revolutions and after the pedal full travel, when half of fluid with air disappears from the system, screw in the valve and release the brake pedals. Press them quickly, release slowly! Repeat this operation several times until the air totally disappears from the system. Take off the pipe from the valve and put on a protection cap.

bleed the right brake hydraulic drive in the same order;

refill fluid into both tanks (17 and 18) up to the mark "MAX" ((15 ± 5) mm from the tank upper butt end), take off pipes from the valves and put on protection caps.

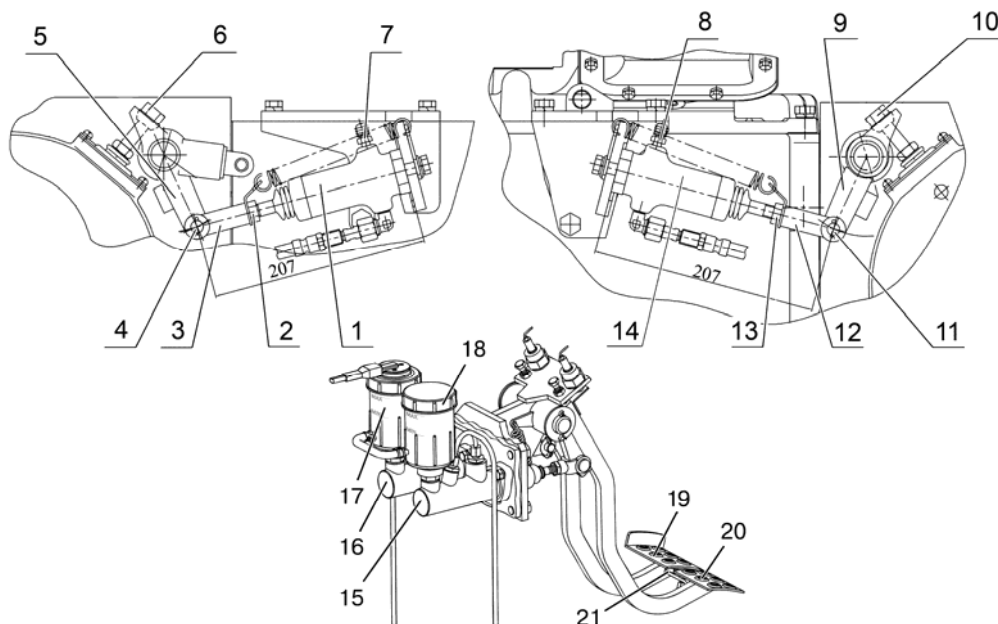
Check the value of the unlocked pedals full travel separately with the applied force (300 ± 30) N which shall be within 100 to 120mm. In case the value of the pedal full travel exceeds the specified limits, it is required to make adjustments doing the following operations:

unscrew conternuts of bolts-links 6 and 10 for several revolutions;

screw in and screw out adjusting bolts-links 6 and 10 of the right and left service brakes;

lock the bolts-links.

6. Check the efficiency of service brakes operability while tractor movement along dry road with hard surface with the clutch off. When depressing the interlocked brake pedals with the force applied from 590 to 600 N, the length of brake path shall not exceed 6,4m with the tractor travel speed of 20 km/h. Unevenness of tractor movement in the process of braking shall not exceed 0,5m. If necessary, adjust the synchronism of braking start by means of one of adjustable bolt-links 6 or 10.



1 – operating brake cylinder; 2 – conternut; 3 – yoke; 4 – pin; 5 – lever of the right service brake; 6 – adjustable bolt-link; 7 – overflow valve; 8 – overflow valve; 9 – lever of the left service brake; 10 – adjustable bolt-link; 11 – pin; 12 – yoke; 13 – conternut; 14 – operating brake cylinder; 15 – operating brake cylinder; 16 – main brake cylinder; 17 – tank; 18 – tank; 19 – pedal; 20 – pedal; 21 – locking plank.

Figure 5.4.22 – Installation of operating brake cylinder length and bleeding of service brakes control

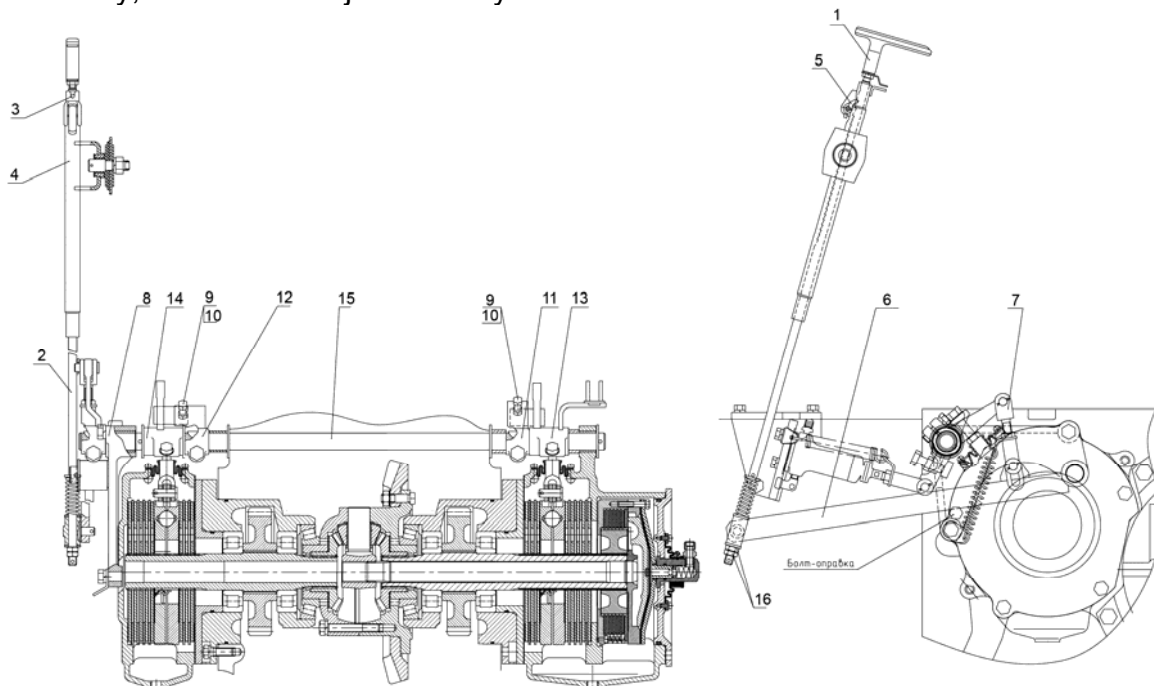
5.4.3.5 Operation 45. Check / adjustment of parking brake control

ATTENTION: CHECKS AND ADJUSTMENTS OF THE PARKING BRAKE AS WELL AS TROUBLESHOOTING IN IT SHALL BE PERFORMED WITH THE ENGINE OFF AND THE TRACTOR BEING FIXED IN HORIZONTAL POSITION WITH STOPS UNDER THE WHEELS WHICH EXCLUDE SPONTANEOUS TRACTOR MOVEMENT! ONLY DEALERS ARE ALLOWED TO PERFORM ADJUSTMENTS AS WELL AS TROUBLESHOOTING OF THE PARKING BRAKE!

Before making adjustments of the parking brake control, adjust service brakes first.

The parking brake control adjustment shall be performed in the following order:

- shift handle 1 (figure 5.4.23) with link 2 into the extreme lower (disengaged) position – detent pin 3 of link 2 shall be in the slot of bracket 4 and retainer 5 – on the first tooth of link 2;
- disconnect handle 2 from lever 6;
- disconnect link 7 from lever 6. Set the length of link 7 equal to (97 ± 1) mm. Connect lever 6 with link 7;
- screw in the bolt-former into the mounting hole in bracket 8 against the stop;
- unscrew conternuts 9 of bolts 10 of the right and left levers 11 and 12. Rotating bolt 10 of the right brake, choose the clearance between bolt 10 and the plate of lever 13. For the left brake set the clearance between bolt 10 and the plate of lever 14 equal to $(3,5 \pm 0,5)$ mm to compensate twisting of shaft 15 while the right brake tightening;
- lock bolts 10 of the left and right brakes by means of conternuts 9;
- connect link 2 with lever 6, screwing nuts 16 of link 2 until lever 6 starts to separate from the bolt-former and lock the nuts together;
- final check and adjustment of the manual mechanical control of the brake shall be carried out at the assembled tractor. The tractor shall be able to keep itself on the slope of not less than 18% while applying to the handle the force of not more than 400N.
- if necessary, correct the adjustment by means of bolts 10.



1 – handle; 2 – link; 3 – detent pin; 4 – bracket; 5 – retainer; 6 – lever; 7 – link; 8 – bracket; 9 – conternut; 10 – adjustable bolt; 11, 13 – right brake levers; 12, 14 – left brake levers; 15 – shaft; 16 – nuts.

Figure 5.4.23 – Adjustment of parking brake control

5.4.4 General maintenance services

5.4.4.1 General instructions

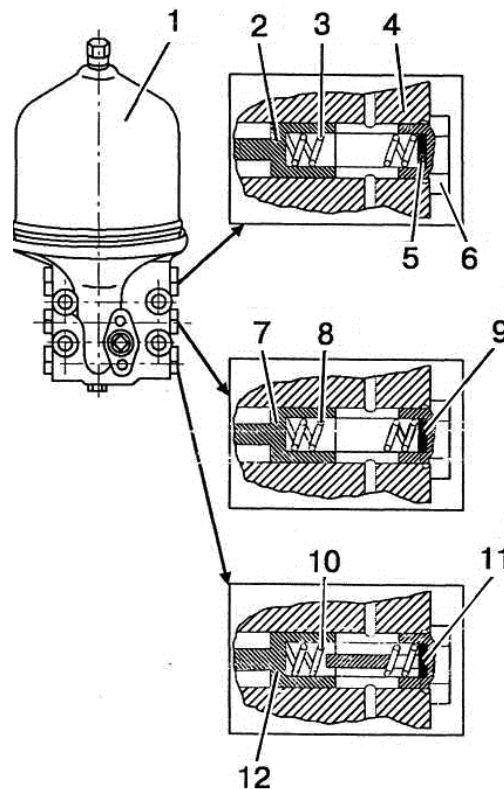
Carry out maintenance service operations listed in subsection 5.4.4 as may be necessary (i.e. according to corresponding pressure or dirtiness sensor indications).

5.4.4.2 Operation 80. Adjustment of GB centrifuge valves

Valve 2 for adjustment of working pressure in the transmission hydraulic system (figure 5.4.24) maintains oil pressure in the hydraulic system within 0.9 to 1.1 MPa. In case pressure in the hydraulic system transmission (acc/ to gauge 1 in figure 2.6.1) falls below the specified limit, adjust valve 2 (figure 5.4.24) by mounting auxiliary washers 5 between spring 3 and plug 6.

Valve 7 maintains oil pressure before the centrifuge rotor. It shall be from 0.77 to 0.83 MPa and can be adjusted by mounting washers 9. Lubrication valve 12 is adjusted for pressure from 0.2 to 0.25 MPa and maintains oil pressure in GB lubricating system. Valve adjustment can be performed by means of washers 11.

To increase pressure, it is required to increase the number of washers, to reduce pressure - decrease the number of washers.



1 – GB centrifuge; 2 – valve for adjustment of working pressure of transmission hydraulic system; 3 – spring; 4 – housing; 5 – washer; 6 – plug; 7 – rotor valve; 8 – spring; 9 – washer; 10 – spring; 11 – washer; 12 – lubrication valve.

Figure 5.4.24 – Adjustment of GB centrifuge valves

ATTENTION: IF PRESSURE FALLS TO 0.7 MPa, STOP THE TRACTOR AND ELIMINATE THE FAILURE IN THE TRANSMISSION HYDRAULIC SYSTEM!

ATTENTION: HYDRAULIC PRESSURE IN THE TRANSMISSION HYDRAULIC SYSTEM SHALL BE ADJUSTED ONLY BY WAY OF ADJUSTING VALVE 2 (FIGURE 5.4.24). ONLY DEALERS ARE ALLOWED TO ADJUST VALVES 7 AND 12 WHEN PERFORMING REPAIR WORK!

5.4.4.3 Operation 81. Maintenance of the engine air cleaner

Maintenance of the engine air cleaner with paper filter elements made from special high-porous cardboard shall be performed every 500 hours of diesel engine operation or if necessary, according to the data provided by the filter clogging indicator.

Maintenance of the engine air cleaner consists in blowing of the main filter element which keeps dust coming into the air cleaner. Control filter element dirtiness indicates the failure of the main filter element (paper shutter breach, bedplates unsticking). In that case it is required to blow off the control filter element and to replace the main one.

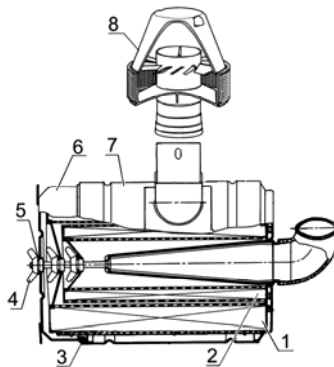
Maintenance of the air cleaner shall be performed in the following order:

take off monocyclone 8 (figure 5.4.25), clean the net, swirler and releasing slots of the monocyclone from dirt and dust;

take off sump 6;

take off main filter element 1. It is not recommended to take control filter element 2 out of the case.

Blow over the main filter element with compressed air firstly inside, then outside until the dust is totally removed. To avoid paper shutter breach, air pressure shall be not more than 0,3 MPa.



1 – main filter cartridge; 2 – control filter cartridge; 3 – gasket; 4 – winged nut; 5 – ring; 6 – sump; 7 – housing, 8 – monocyclone.

Figure 5.4.25 – Air cleaner

An air stream shall be directed at an angle to the surface of the filter element. While maintenance services it is necessary to protect the filter element from mechanical failures or greasing.

It is forbidden to blow over the filter element with releasing gases or wash it off in diesel fuel.

Clean the feed pipe, inner surfaces of the casing and the air cleaner sump from dust and dirt.

Before the air cleaner mounting, check the condition of sealing rings. While mounting, make sure that filter elements are fixed correctly in the casing and tighten securely the winged nut manually.

ATTENTION: AFTER THE AIR CLEANER MOUNTING, IT IS REQUIRED TO CHECK HERMITICITY OF ALL INLET LINE COUPLINGS!

To check hermiticity, use the device KI-4870 GOSNITI or its analog. In case you do not have such a device, check hermiticity of couplings visually. Damaged coupling elements shall be replaced.

TRACTOR OPERATION WITH UNTIGHT INLET LINE IS FORBIDDEN.

Decompression of air supply circuit into the turbo-compressor can influence the reliability of the data provided by the filter clogging indicator in a negative way, as a result of which a significant portion of unpurified air with heavy concentration of dust can enter the cylinders via a turbo-compressor. The dust ingress in the oil results in accelerated wear and tear of cylinder and piston unit of the engine.

5.5 Seasonal maintenance services

Carrying out seasonal maintenance service shall be combined with the performance of operations of regular maintenance services. The scope of work which shall be carried out during seasonal maintenance service is given in table 5.3.

Table 5.3 – Seasonal maintenance services

Scope of work	
When changing into autumn-winter period (with fixed daily average temperature $+5^{\circ}\text{C}$)	When changing into spring-summer period (with fixed daily average temperature above $+5^{\circ}\text{C}$)
Replace in accordance with table 5.4, summer oil grades by winter in transmission and brake housings	Replace in accordance with table 5.4, summer oil grades by winter in transmission and brake housings
Replace in accordance with table 5.4, summer oil grades by winter in the engine crankcase	Replace in accordance with table 5.4, summer oil grades by winter in the engine crankcase

5.6 Safety measures while maintenance service and repair operations

5.6.1 General safety requirements

While carrying out maintenance service and repair operations, it is necessary to provide safety measures observation according to GOST 12.2.019.

It is forbidden to dismount the hood side panels and/or open the tractor hood or the mask of the hood with the engine running.

Maintenance (repair) operations shall be carried out only if the engine is not running and PTO is disengaged. Hinged implements shall be in a lower position, the tractor shall be stopped with the parking brake.

Observe safety requirements while using lift-and-carry means of transport.

During inspection of units under control and adjustment, use the portable lamp with voltage of not more than 36V. The lamp shall be protected by wire guard.

Tools and accessories for MS shall be in a proper operating condition, correspond to their assignment and ensure safe operation.

In order to avoid injury and burns, be careful while draining (refilling) the coolant from the engine cooling system, hot oil from the engine, hydraulic systems of LL and HSC, transmission bodies, FDA and PTO reducing gears. Avoid contact with hot surfaces of the above mentioned units.

Mounting and dismounting of the engine shall be carried out by means of a rope, fastened to eye-bolts on the engine.

Do not make alterations in the tractor or its separate parts design without sanction of the manufacturing works. Otherwise the tractor after-sales service warranty is no longer valid.

5.6.2 Safety precautions for exclusion of hazardous situations related to accumulator batteries and a fuel tank

During maintenance of the accumulator battery, do the following:

- avoid skin contact with electrolyte;
- clean the batteries with wiping material moistened with aqua ammonia solution (ammonium hydroxide);
- while checking the electrolyte level, refill distilled water only;
- do not check the battery charge by means of the terminal short circuit;
- do not connect the accumulator battery with reversed polarity.

In order to avoid damaging of the electronic units of the electrical facilities and electrical control systems, observe the following safety precautions:

- do not disconnect AB outputs with the engine running. It will cause peak voltage in charging circuit and will result in inevitable failure of the diodes and transistors;
- do not disconnect electric wires when the engine is running and electric switches are on;
- do not cause short circuit by incorrect wire connection. Short circuit or incorrect polarity will result in failure of the diodes and transistors;
- do not connect the AB in the electrical facilities system until the outputs/inputs polarity and voltage are checked;
- do not check the electric current by spark test as it can result in immediate breakdown of transistors.

Repair operations connected with application of electric welding for the tractor shall be carried out while the AB switch is off.

To avoid ignition or explosion hazard, prevent the fuel tank, engine fuel system and accumulator batteries from being close to the open flame sources.

5.6.3 Guidelines for safe use of leveling jacks and statement of proper places for their installation

Use leveling jacks to lift tractor, and after lifting insert backing blocks and limit stops under the front axle beam, rear wheel semi-axes, or base components of the tractor frame.

Places for leveling jack installation on the tractor are marked by a sign shown in figure 5.6.1.



Figure 5.6.1 – Sign of a place for leveling jack installation

To lift tractor rear elements, set leveling jacks (or a single jack) under the rear semi-axle tube as illustrated in figure 5.6.2.

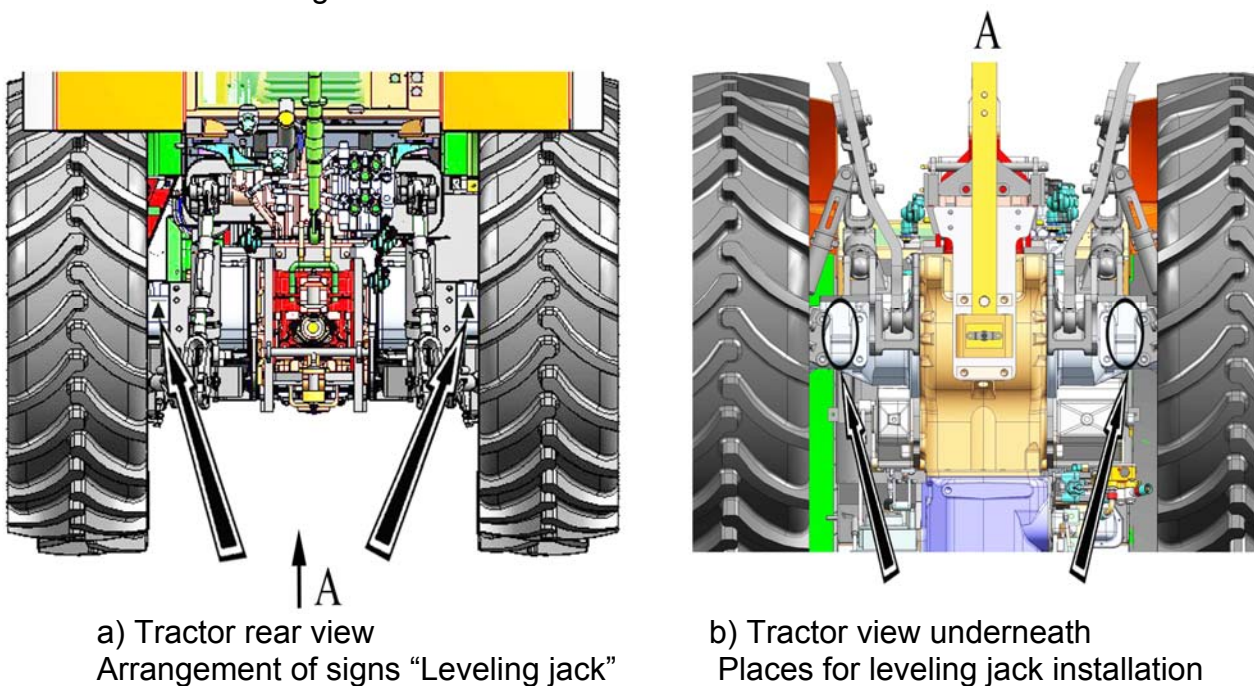


Figure 5.6.2 – Scheme of leveling jack installation for lifting tractor rear elements

To lift tractor front elements, set leveling jacks (or a single jack) under the front driving axle beam tube, as illustrated in figure 5.6.3.

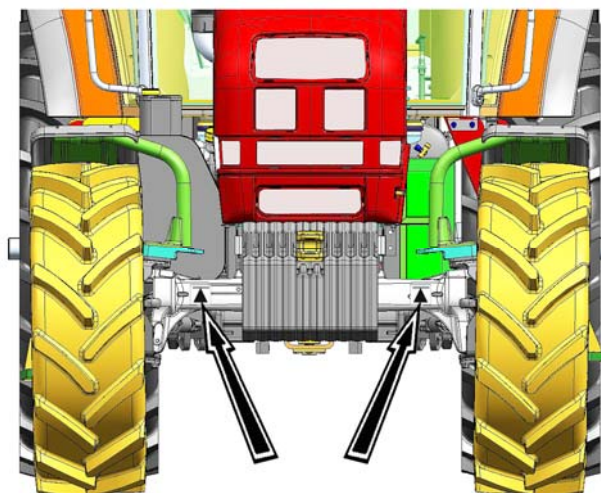


Figure 5.6.3 – Scheme of leveling jack installation for lifting tractor front elements

When using leveling jacks, observe the following safety requirements:

- while lifting tractor "BELARUS-1523.5", use properly operating leveling jacks with lifting capacity of at least 5 tons;
- before tractor jacking, stop the engine and engage the parking brake;
- while jacking tractor front elements, put cotteners under rear wheels;
- while jacking tractor rear elements, engage the gear and put cotteners under front wheels;
- do not put the jack on soft or slippery surface as it may cause the tractor falling off the jack. When needed, use steady and relatively large support;
- after lifting the tractor, put the limit stops under the front axle beam, rear wheel semi-axles, or tractor frame base components to exclude tractor falling or rolling movement.

IT IS FORBIDDEN TO START THE ENGINE WHEN THE TRACTOR IS JACKED.

ATTENTION: ONLY PERSONNEL PROPERLY INSTRUCTED ON LEVELING JACK SAFE USE AND METHODS OF LEVELING JACK SAFE OPERATION ARE ALLOWED TO OPERATE LEVELING JACK!

5.7 Instruments, work tools and measuring devices while maintenance services and repair

For maintenance services and repair, it is required to use the following instruments, work tools and measuring devices:

- areometer or density gage for measuring electrolyte density with lower-range value not more than 1,15 g/cm³, upper-range value – not less than 1,31 g/cm³, with measuring inaccuracy not more than 0,01 g/cm³;
- multimeter for control of electric chain and electrical equipment running order, with the opportunity of measuring: constant and alternating voltage – from 1 mV to 1000 V, direct and alternating current – from 20 mA to 20 A, resistance – from 20 Ohm to 20 megohm. Measuring inaccuracy of multimeter shall not exceed 30% of the controlled access;
- the device KI-4870 GOSNITI for checking inlet line hermiticity;
- hydraulic manometer with the opportunity of measuring oil pressure and hydraulic liquids with measurement range from 0 to 50 MPa with a flexible extension rod (tube) and lugs for coupling with threaded openings. Measuring inaccuracy of the hydraulic manometer shall not exceed 30% of the controlled access;
- a ruler GOST 7502-98 or tapeline GOST 427-75 for measuring engine cooling liquid level, belt tension, electrolyte level in combination with a glass tube with diameter from 4 to 10 mm, for adjusting tractor units and systems with measuring inaccuracy of not more than 30% of the controlled access;
- torque wrenches for tightening threaded couplings having measuring inaccuracy not more than 30% of the controlled access;
- manometer MD-124 GOST 9921-81 for tire inflation pressure control (other devices having metrological specifications similar to the manometer MD-124 for tire inflation pressure control may be used);
- manometer – 1,6 MPa-1 GOST 2405-80 for pneumatic system pressure control (other devices having metrological specifications similar to the manometer M-1,6MPa-1 for pneumatic system pressure control may be used);
- a trammel with a measurement range 150 mm and a division value not more than 0,1 mm according to GOST 166-89 for speed sensor adjustment and rear PTO speed sensor;
- control device 8538-7367-02 for checking and adjustment of conditioner compressor drive belt tension;
- dynamometer DPR-0,1 GOST 13837-79 for forcing control of FLL wheel reducer fist turn;
- dynamometer-endfloatmeter for measuring steering wheel angle gap;
- a rack-type tool for radiator ribs flattening;
- a set of screw keys GOST 2839-80 for operating with threaded couplings;
- a set of fitter and assembler screwdrivers GOST 17199-88 for operating with screwed threaded couplings;
- wheel blocks for prevention spontaneous tractor movement while maintenance services or repair;
- supporting blocks for machine uplift with lifting capacity not less than 10 tons;
- funnels for filling cooling liquid, oils and other tractor hydraulic liquids;
- tanks for discharge of waste oils and liquids with volume not less than that specified in column 8 of Table 5.4 “The list of tractor “BELARUS-1523.5” FLM (fuel and lubrication materials)”.

Instead of the specified instruments, work tools and measuring devices it is possible to use other instruments, work tools and measuring devices having similar metrological specifications.

5.8 Filling and lubrication of the tractor with fuel and lubrication materials

In Table 5.4 titles and trademarks of fuel and lubrication materials (FLM) used during the tractor operation and maintenance are listed, their quantity and change intervals are also specified.

Table 5.4 – List of the tractor “BELARUS - 1523.5” FLM

Item reference	Title of the assembly unit	Quantity of assembly units , pieces.	Name and designation of fuel and lubrication materials				Refill capacity (l)	Change interval (h)	Remarks
			Basic components	Backup components	Auxiliary components	Foreign-made			
1	2	3	4	5	6	7	8	9	10
1 Fuels									
1.1 1)	Fuel tank	2	At ambient temperature of 0°C and more				(210±2)	Filled in every shift	
			Diesel fuel STB1658-2006 with sulfur content not exceeding 50 mg/kg (0.005%) Grade B	Not available	Not available	Diesel fuel EN 590:2009 +A1:2010 with sulfur content not exceeding 50 mg/kg (0.005%)			
			At ambient temperature of minus 5°C and more						
			Diesel fuel STB 1658-2006 with sulfur content not exceeding 50 mg/kg (0.005%) Grade C	Not available	Not available	Diesel fuel EN 590:2009 + A1:2010 with sulfur content not exceeding 50 mg/kg (0.005%)			
			At ambient temperature of minus 20°C and more						
			Diesel fuel STB 1658-2006 with sulfur content not exceeding 50 mg/kg (0.005%) Grade F	Not available	Not available	Diesel fuel EN 590:2009 + A1:2010 with sulfur content not exceeding 50 mg/kg (0.005%)			
2 Oils									
.1	Engine oil crank-case ²⁾	1	In summer				(18±0,18)	250	
			Engine oils «G-Profi GT LA» SAE 10W-40 API CI-4, «Lukoil Avangard Professional LS» SAE 10W-40 API CI-4	Not available	Engine oils «Lukoil Avangard Extra» SAE 10W-40 API CH-4/CG-4/SJ	Engine oils «Shell Rimula R6 LM» SAE 10W-40, «Shell Rimula R4L» SAE 15W-40, «Castrol Enduron Low SAPS 10W-40», «Comma Ultra Diesel 10W-40», «Elf Performance Expert LSX 10W-40»			
			In winter						
			Engine oil «Lukoil Avangard Professional LS» SAE 5W-30 API CI-4	Not available	Engine oil «Lukoil Avangard Ultra» SAE 5W-40 API CI-4/SL	Engine oil «Shell Rimula R6 LME» SAE 5W-30			

Table 5.4 continued

1	2	3	4	5	6	7	8	9	10
2.2	High-pressure fuel pump of the engine	1	Engine oil is the same as filled in the engine crankcase				See engine operating manual		When new or repaired fuel pump of the company "Bosch", Germany or "Motorpal", Czech Republic is installed.
2.3	Transmission housing (clutch, GB and rear axle)	1	Engine oil M-10Г ₂ GOST 8581-78 (in summer) Engine oil M-8Г ₂ GOST 8581-78 (in winter)	Engine oil M-10B ₂ GOST 8581-78 (in summer) Engine oil M-10Г _{2к} (in summer) GOST 8581-78 Engine oil M-8Г _{2к} (in winter) GOST 8581-78	Engine oil is the same as filled in the engine crankcase	Engine oil SAE 15W-40 (in summer) SAE 5W-40 (in winter)	(43±0,4) Oil level shall be between marks «П» and «П»+7mm (55±0,4)	seasonal, but at least 1000	without a creeper with a creeper
2.4	Brake housing		Engine oil M-10Г ₂ GOST 8581-78 (summer) Engine oil M-8Г ₂ GOST 8581-78 (winter)	Engine oil M-10B ₂ GOST 8581-78 (летом) Engine oil M-10Г _{2к} (летом) GOST 8581-78 Engine oil M-8Г _{2к} (зимой) GOST 8581-78	Engine oil is the same as filled in the engine crankcase	Engine oil is the same as filled in the engine crankcase	(2,5±0,1) to the level of check plugs	seasonal, but at least 1000	
2.5	FDA body	1	Transmission oil TAn-15B GOST 23652-79	Transmission oil ТАД -17и, ТСп-15К GOST 23652-79 ТЭп-15М ТУ 38.401-58-305-2002	Not available	HESSOL BECHE M HYPOID SAE 80W-90 API GL5/GL4	(3,9±0,04)	1000	
2.6	Wheel-hub drive casing of FDA	2	Transmission oil TAn-15B GOST 23652-79	Transmission oil ТАД -17и, ТСп-15К GOST 23652-79, ТЭп-15М ТУ 38.401-58-305-2002	Not available	HESSOL BECHE M HYPOID SAE 80W-90 API GL5/GL4	(4,0±0,04)	1000	

Table 5.4 continued

1	2	3	4	5	6	7	8	9	10
2.7	Front PTO re-duction unit ³⁾	1	Transmission oil TAn-15B, TЭn-15 GOST 23652-79	Transmis- sion oil ТАД –17и, ТСn-15K GOST 23652-79, TЭn-15M TY 38.401-58- 305-2002	Engine oil M-10Г ₂ GOST 8581-78	HESSOL BECHE M HYPOID SAE 80W-90 API GL5/GL4	(4,3±0,2)	1000	
2.8	HSC tank with hy- draulic unit	1	All-weather oils: hydraulic BECHEM Staroil №32, №68 ADDINOL Hydraulikol HLP 32, HLP 68 THK Hydraulic HLP 32, HLP 68 HYDROL HLP 32, HLP 68 VITTOL HLP-32 LUKOIL Geiser 32CT, 68CT Gazpromneft Hydraulik HLP 32, HLP 68 ⁴⁾	Not avail- able	Not available	Not available	(30,0±0, 5)	1000	
2.9	HSC tank with hy- draulic unit	1	All-weather oils: hydraulic BECHEM Staroil №32, №68 ADDINOL Hydraulikol HLP 32, HLP 68 THK Hydraulic HLP 32, HLP 68 HYDROL HLP 32, HLP 68 VITTOL HLP-32 LUKOIL Geiser 32CT, 68CT Gazpromneft Hydraulik HLP 32, HLP 68 ⁴⁾	Not avail- able	Not available	Not available	(13,5±0, 35)	1000	

Table 5.4 continued

1	2	3	4	5	6	7	8	9	10
3 Greases and lubricants									
3.1	Hinge joint of the steering hydraulic cylinder	4	Grease Litol-24 GOST 21150-87	BECHEM LCP-GM	Not available	BECHE M LCP-GM	0,05 ±0.003	250	
3.2	Hinge joint of the steering link	2	Grease Litol-24 GOST 21150-87	BECHEM LCP-GM	Not available	BECHE M LCP-GM	0,02 ±0,001	1000	
3.3	RLL turning shaft bushing	2	Grease Litol-24 GOST 21150-87	BECHEM LCP-GM	Grease solid oil C GOST 4366-76 or solid oil Ж GOST 1033-79	BECHE M LCP-GM	0,02 ±0,001	500	
3.4	Clutch coupling shifter bearing	1	Grease Litol-24 GOST 21150-87	BECHEM LCP-GM	Grease solid oil C GOST 4366-76 or grease solid oil Ж GOST 1033-79	BECHE M LCP-GM	0,02 ±0,001	250	
3.5	FDA spider bearing of twinned hinge joint	2	Grease №158M TY 38.301-40-25-94	Grease AZMOL №158 TY Y 00152365. 118-2000	Not available		0,0112 ±0.001	One-time	Filled by the manufacturer, not refilled during operation
3.6	FDA drive cardan shaft spider bearing	1	Grease №158M TY 38.301-40-25-94	Grease AZMOL №158 TY Y 00152365. 118-2000	Not available		0,0056 ±0.001	One-time	Filled by the manufacturer of cardan shaft
3.7	FDA reduction gear pivot axle bearing	4	Grease Litol-24 GOST 21150-87	BECHEM LCP-GM	Grease solid oil C GOST 4366-76 or grease solid oil Ж GOST 1033-79	BECHE M LCP-GM	0,12 ±0.006	125	
3.8	FPTO cardan shaft splines ³⁾	1	Graphite grease GOST 3333-80	Not available	Not available	Not available	0,01 ±0,001	500	
3.9	FLL lever pin bushing ³⁾	2	Grease Litol-24 GOST 21150-87	BECHEM LCP-GM	Grease solid oil C GOST 4366-76 or grease solid oil Ж GOST 1033-79	BECHE M LCP-GM Mobil Grease MP ISO-L-XDCIB2	0,02 ±0,001	1000	

End of table 5.4

1	2	3	4	5	6	7	8	9	10
4 Special-purpose liquids									
4.1	Clutch hydraulic drive tank and cylinders	1	Brake fluid «ROSDOT» TY 2451-004-36732629-99	Not available	Not available	DOT3, DOT4 (Germany)	(0,4±0,1)	1000	
4.2	Brake hydraulic drive tank and cylinders	2	Brake fluid «ROSDOT» TY 2451-004-36732629-99	Not available	Not available	DOT3, DOT4 (Germany)	(0,8±0,1)	1000	
4.3	Engine cooling system (with radiator)	1	Cooling fluid «Tosol-A40MH» or «Tosol-A65MH» TY Republic of Belarus 500036524.104-2003 Manufactured by «Grodno-Azot» Ltd., Grodno city, Republic of Belarus	Low-freezing cooling fluid (antifreeze) «Tosol - TC FELIX-40 Standard» (up to minus 40°C), «Tosol - TC FELIX-65 Standard» (up to minus 65°C), TY 2422-006-36732629-99 Manufactured by LLC «Tosol-Sintez», Dzerzhinsk, Russian Federation	Cooling fluid OЖ-40 (up to minus 40°C), OЖ-65 (up to minus 65°C), GOST 28084-89	MIL-F-5559 (BS 150), (USA) FL-3 Sort S-735, (England)	(33,5±0,5)	Once in two years	
4.4	Tank for fluid of SCR-system	1	Agent AUS 32 for reduction of NOX emissions as per STB ISO 22241-1-2009	Not available	Not available	Not available	(20,0±1,0)	Shift-time filling	

1) According to Directive 2004/26/EC and Regulations of EEC of UN № 96 (02) (stage IIIA) it is allowed to use fuel with sulfur content up to 0.3 g/kg (0,03 %)

2) Use of motor oils depending on operation conditions:

a) summer (plus 5°C and higher) – SAE 30; SAE 10W-40 (30); SAE 15W-40 (30); SAE 20W-40 (30);

b) winter (minus 10°C and higher) – SAE 20; SAE 10W-40 (30);

c) winter (minus 20°C and higher) – SAE 10W-20 (30, 40); SAE 5W-30 (40);

d) winter (below minus 20°C) – SAE 5W-30 (40); SAE 0W-30 (40).

It is allowed to use other types of motor oil corresponding to classes E6, E9 under the classification of ACEA and to CI-4, CI-4+, CJ-4 under the classification of API, with viscosity conforming to the ambient temperature at the place of engine running.

3) When FLL and FPTO are mounted against order.

4) Hydraulic types of oil HLP 68, No 68 68CT are used in tractors shipped to Venezuela.

6. POSSIBLE FAILURES AND INSTRUCTIONS FOR THEIR TROUBLESHOOTING

6.1 Possible clutch failures and instructions for their troubleshooting

The list of possible failures of tractor "BELARUS-1523.5" and instructions for their troubleshooting are shown in table 6.1.

Table 6.1

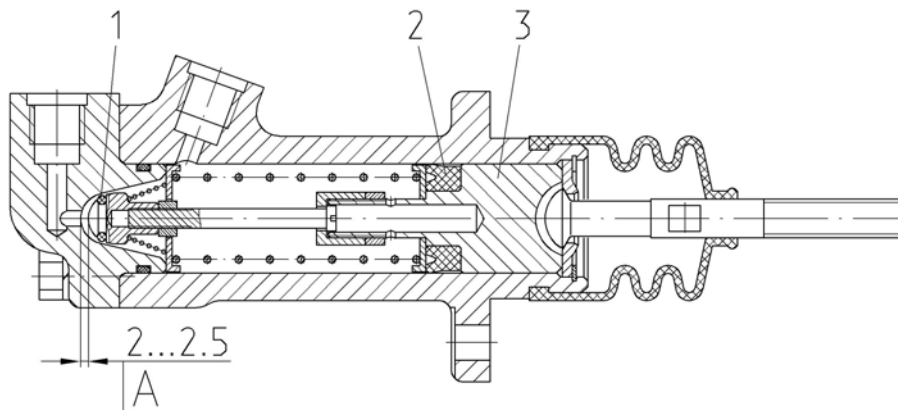
<i>Failure, external manifestation, cause</i>	<i>Troubleshooting</i>
Clutch coupling does not transmit full torque ("clutch skidding")	
There is no clearance between the clutch release bearing and release levers – "clutch is half disengaged" (insufficient clutch pedal free travel)	Adjust the clearance as specified in clause 5.4.2.12 "Operation 28. Check / adjustment of clutch control"
Partial engagement of clutch coupling (clutch lever 33 (figures 5.4.16 and 5.4.17) fails to return to its initial position) when the clutch pedal is released, due to failure in clutch operation control	Detect and eliminate the cause of failure, performing the operations indicated for troubleshooting "Clutch lever 33 (figure 5.4.16 and 5.4.17) fails to return to its initial position while releasing the clutch pedal"
Clutch driven disk facings are worn out	Change facings or driven disks assembled
Clutch driven disk facings are oiled-up due to ingress of oil into the dry section	Detect and eliminate the cause of oil ingress into the dry compartment
Poor compression spring force (spring shrinks due to continuous skidding and clutch overheating)	Change compression springs
Clutch coupling can not be fully disengaged ("clutch grabs and shudders")	
Clearance between the clutch release bearing and release lever is increased (increased clutch pedal free travel)	Adjust the clearance between the clutch release bearing and release lever according to clause 5.4.2.12 "Operation 28. Check / adjustment of clutch control"
Insufficient clutch lever 33 travel (figures 5.4.16 and 5.4.17) when the clutch pedal is fully depressed	Ensure the clutch lever full travel performing the operations specified for troubleshooting "Clutch lever 33 (figures 5.4.16 and 5.4.17) full travel is not provided"
Misalignment of release levers	Adjust the position of release levers
Excessive warping of driven disks	Replace driven disks
Blocking of driven disk hub on transmission shaft splines	Condition the surface of splines by grinding ensuring free movement of disks on the transmission shaft
Damaged transmission shaft support bearing in the flywheel	Replace the transmission shaft support bearing

Table 6.1 continued

<i>Failure, external manifestation, cause</i>	<i>Troubleshooting</i>
Clutch lever 33 (figures 5.4.16 and 5.4.17) fails to go back to its initial position when the clutch pedal is released	
There is no clearance between the main cylinder piston and piston follower	Adjust the clearance between main cylinder piston and piston follower according to clause 5.4.2.12 "Operation 28. Check / adjustment of clutch control"
There is no clearance between operating cylinder rod 23 (figure 5.4.16 and 5.4.16) and hydraulic booster push rod 26	Adjust the clearance according to clause 5.4.2.12 "Operation 28. Check / adjustment of clutch control"
Sticking of the main cylinder piston (fails to go back to its initial position) due to piston cup and O-ring expansion, resulting in closure of compensating port "A" (figure 6.1.1)	Use of incorrect hydraulic-brake fluid or ingress of mineral oil, petroleum, kerosene, diesel fuel into hydraulic-brake fluid. Rinse the hydraulic drive system with hydraulic-brake fluid. Replace damaged cups and O-ring in the main and operating cylinders. Replace hydraulic-brake fluid. Bleed the hydraulic system with hydraulic-brake fluid
Blocking of the main cylinder piston due to piston cup expansion	
Hydraulic cylinder piston strokes are carried out with difficulty	Replace the hydraulic push rod
Clogging of compensating port "A" (figure 6.1.1) in the main cylinder	Unclog the compensating port of main cylinder and bleed the hydraulic system of clutch control
Loss of pullback spring power 29 (figures 5.4.16 and 5.4.17)	Replace the pullback spring
Full clutch lever 34 stroke can not be achieved (figures 5.4.16 and 5.4.17) when the clutch pedal is depressed	
The clearance between the main cylinder piston and piston follower is not properly adjusted	Adjust the clearance according to clause 5.4.2.12 "Operation 28. Check / adjustment of clutch control"
The clearance between operating cylinder rod 23 (figures 5.4.16 and 5.4.17) and hydraulic booster 26 push rod is not properly adjusted	Adjust the clearance according to clause 5.4.2.12 "Operation 28. Check / adjustment of clutch control"
Air presence in the clutch control hydraulic system	Bleed the hydraulic system with hydraulic-brake fluid
Insufficient level of hydraulic-brake fluid in the hydraulic system reservoir	Fill hydraulic-brake fluid to the required level in the main cylinder reservoir. Bleed the clutch control hydraulic system
Leakage of work space of the main and operating cylinder due to damage, wear of cups or O-rings	Replace cups or O-rings in the main and operating cylinder in case they are worn out. Check if the cylinder bearing surface has sharpened edges, ridges, or pits. Bleed the clutch control hydraulic system

Table 6.1 finished

<i>Failure, external manifestation, cause</i>	<i>Troubleshooting</i>
Brake fluid leakage in joints and pipelines in the hydraulic drive system. Air inflow into the clutch control hydraulic system.	Tighten up joints, replace damaged parts. Bleed the clutch control hydraulic system
Clogging of opening in the tank fitting, causing depression in the main cylinder, as a result of which air leaks into the cylinder through sealings	Unclog the opening. Bleed the clutch control hydraulic system
Clogging of pipelines of the hydraulic drive system due to dent or blockage	Replace pipelines. Bleed the clutch control hydraulic system
Oil leakage through O-rings of the hydraulic booster	Replace O-rings in the hydraulic booster
No clutch pedal force	Air presence in the hydraulic system. Cups and an O-ring in the main and operating cylinder are worn out. Replace cups and O-rings in the main and operating cylinder. Check if cylinder bearing surface has sharpened edges, ridges, or pits. Bleed the clutch control hydraulic system



1 – O-ring, 2 – cup; 3 – piston; A – compensating port.

Figure 6.1.1 – Main cylinder

6.2 Possible failures in gearbox and instructions for their troubleshooting

The list of possible failures in gearbox and instructions for their troubleshooting are shown in Table 6.2.

Table 6.2

<i>Failure, external manifestation, cause</i>	<i>Troubleshooting</i>
Tractor fails to start in any gear, the transmission hydraulic system operates properly	
Wear of clutch shaft spline joint, primary shaft or a coupling bushing	Disconnect the tractor, disassemble the clutch case and gear-box casing, replace worn-out parts
A gear can not be engaged	
Wear of transmission yoke plate or clutch	Disconnect the tractor, dismount the gearbox and replace worn-out parts
Synchronizer damage	Disconnect the tractor, dismount the gearbox and replace worn-out parts
“L-H” pass of GB reduction unit can not be engaged on tractors with GB 24x12	
Sticking or failure of the hydraulic cylinder valve for control of switching of GB reduction unit pass	Rinse the valve spool. Replace the valve if necessary
The cylinder of GB reduction unit pass shifting is not adjusted	Adjust the cylinder of GB reduction unit pass shifting
Synchronizer for GB reduction unit shifting is damaged	Replace the synchronizer and worn-out parts
Increased noise	
Not enough oil in the transmission	Refill oil up to the required level mark
Wear or damage of bearings and other transmission components	Replace worn-out bearings and other damaged parts
The engine fails to start when the range shifting lever is set in neutral position or starts when a range is engaged	
Faulty switch for engine start-up lock with the range engaged	Replace the switch for engine start-up lock with the range engaged
The switch for engine start-up lock with the range engaged is not adjusted	Adjust the switch for engine start-up lock with the range engaged
A range can not be engaged or becomes self-disengaged	
Wear of transmission yoke plate or clutch	Disconnect the tractor, dismount the gearbox and replace worn-out parts
Noisy gear shifting	
Incomplete clutch coupling disengagement (clutch grabs and shudders)	Adjust clutch coupling according to subsection 6.1
Wear of synchronizer conic surfaces	Replace worn-out parts
Oil leakage in the dry compartment of the clutch coupling casing	
Oil leakage through connection: bowl — cover — case, or through connection: shifter bracket — clutch coupling case	Disconnect the tractor in order to detach the engine from clutch coupling case and stop leakage
Oil leakage through cups	Disconnect the tractor in order to detach from clutch coupling case and replace cups

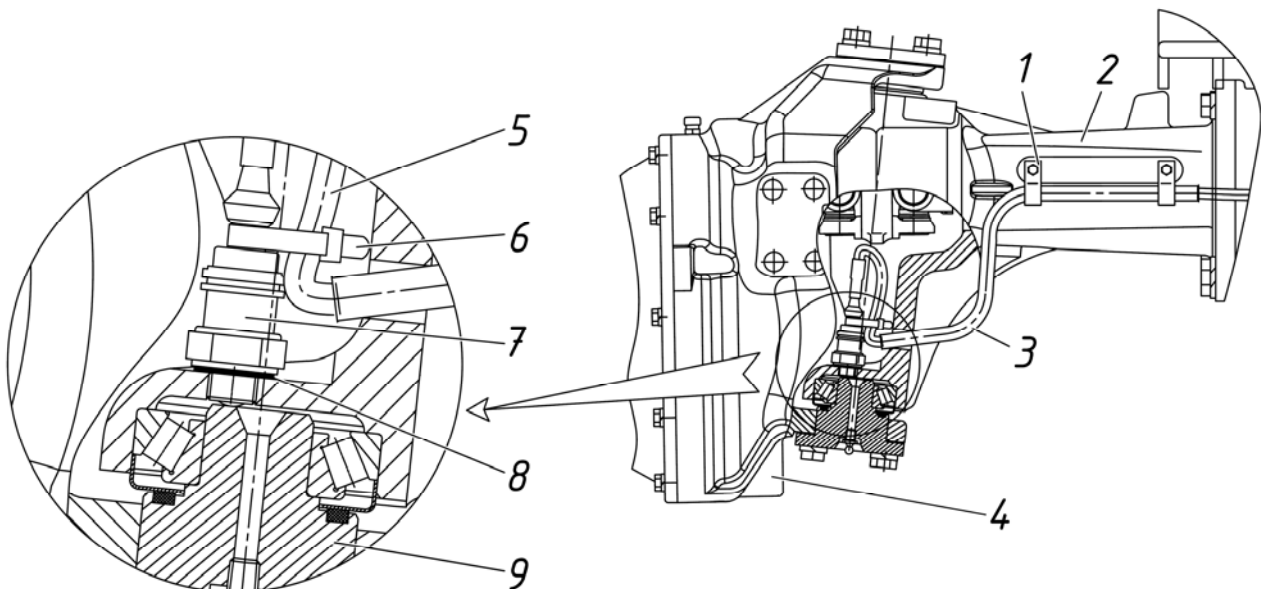
6.3 Possible failures in the electronic control system for rear axle differential lock, front driving axle drive, front power take off shaft, GB reduction gear and instructions for their troubleshooting

The list of possible failures in the electronic system for rear axle DL, FDA drive, FPTO (if mounted), GB reduction gear (if mounted) and instructions for their troubleshooting are shown in Table 6.3.

Table 6.3

<i>Failure, external manifestation, cause</i>	<i>Troubleshooting</i>
FDA drive or rear axle DL can not be engaged in the forced mode, or GB reduction unit can not be shifted to the higher pass, FPTO drive can not be engaged	
Power supply voltage is not transferred to the respective distribution valve solenoid	Check according to the electric circuit diagram if the power supply voltage is transferred to the respective distribution valve solenoid
Jamming of the respective distribution valve spool	Rinse the distribution valve
None of the drives (FDA, rear axle DL, FPTO) can be engaged and GB reduction unit can not be shifted to the high gear	
There is no pressure in the transmission hydraulic system	Eliminate the failure in the transmission hydraulic system
When the front PTO drive is engaged, indicating lamp lights up but the PTO shaft end extension fails to rotate	
Make sure that the cylinder pin is moving while engagement	If the cylinder rod is moving, FPTO shaft electric control is operating in a proper manner
Rear axle DL can not be engaged in an automated mode when guide wheels are in the forward motion position	
Electric circuit breakage to drive wheels rotation angle sensor	Check electric circuits according to the electric connections diagram
Drive wheels rotation angle sensor is not adjusted properly	Adjust the sensor – the operating clearance between the sensor butt end of drive wheels rotation angle sensor 7 (figure 6.3.1) and the overhang on center pin axis 9 butt end shall be adjusted by means of the required number of gaskets 8 so that while axis turning in relation to the middle position to both sides for the angle $(13 \pm 2)^\circ$, sensor 7 activates. The increased number of gaskets leads to the reduction of sensor operating angle, the decreased number of gaskets leads to the increase of sensor operating angle
While tractor slowing down (depressing both brake pedals simultaneously), FDA drive can not be engaged and rear axle DL can not be disengaged (depressing either of the brake pedals)	
Faulty one or both brake actuation sensors BK 12-21 (actuation of brake pedals)	Simulate sensor actuation one-by-one by means of contact closure in cable sockets to the sensors. Replace the faulty sensor
Cable of connection to sensors BK 12-21 is faulty	Check the cable for operability according to the electric circuit diagram
Faulty relay in FDA drive actuation circuit and rear axle DL deactivation circuit while slowing down	Replace the relay

FDA drive fails to operate in an automated mode	
Automatic activation sensor is not properly adjusted or out of order	Adjust the automatic activation sensor or replace it
On tractors with GB 24x12 after engine start, the lamp of the reduction unit lower pass actuation fails to light up, or after reduction unit switching to the higher pass, the lamp of the reduction unit higher pass actuation fails to light up	
Oil pressure in the control hydraulic system is less than 0,8 MPa	Check oil pressure value according to the oil pressure gauge in the transmission on the dashboard. Eliminate the failure in the transmission hydraulic system according to subsection 6.9 "Possible failures in the transmission hydraulic system and instructions for their troubleshooting"
Faulty oil pressure sensor of GB reduction unit higher or lower pass respectively, or the pilot lamp for GB reduction unit actuation has burnt out, or GB reduction unit led lamp has burnt out	Replace faulty parts (pressure sensor or pilot lamp or led lamp)
Circuit breakage from the sensor to the pilot lamp or circuit breakage from the sensor to the led lamp	According to the diagram, check the circuit "sensor-pilot lamp" or "sensor-led lamp" operability and eliminate the breakage in the faulty circuit
FDA drive is constantly engaged at any of three positions of the switch	
Jamming of the FDA drive distribution valve spool in the open position	Rinse FDA drive distribution valve



1 – clamp; 2 – front driving axle beam; 3 – pipe; 4 – left wheel-hub drive; 5 – cable; 6 – cup; 7 – drive wheels rotation angle sensor; 8 – adjustable gasket; 9 – center pin axis.

Figure 6.3.1 – Installation and adjustment of drive wheels rotation angle sensor

6.4 Possible failures in rear axle and instructions for their troubleshooting

The list of possible failures in rear axle and instructions for their troubleshooting are shown in table 6.4.

Table 6.4

<i>Failure, external manifestation, cause</i>	<i>Troubleshooting</i>
Increased noise of the main gear	
Improper adjustment of gear engagement of main gear according to tooth-contact and side clearance	- adjust gear engagement of main gear according to tooth-contact; - adjust side clearance in the engagement of main pair (0.25...0.55 mm).
Improper adjustment of conic bearings of the main gear	Adjust bearing preload
Not enough oil in transmission	Check oil level in the transmission casing and refill oil to the oil level mark if necessary
Gear teeth damage	Check the condition of the gear tooth ring. Chipping and damage are not allowed. Gears with damaged teeth shall be replaced in pairs
Differential lock fails to operate	
Friction facings of lockup clutch disks are worn-out	Replace the disks
Lockup clutch diaphragm is damaged	Replace the diaphragm
Low pressure of oil running to the actuating mechanism of lockup device	Check oil pressure running to DL clutch. It shall be within 0,9 to 1,0 MPa while oil viscosity shall be within 18 to 26 mm ² /s
Electrical hydraulic distribution valve for lockout control fails to operate	Check differential lock ECS operability, ease of spool movement, correct the trouble
There is no pressure in the hydraulic system	
Transmission hydraulic system pump drive is off	Start the transmission hydraulic system pump drive

6.5 Possible failures in rear power take-off shaft and instructions for their troubleshooting

The list of possible failures of rear power take-off shaft and instructions for their troubleshooting are shown in Table 6.5.

Table 6.5

<i>Failure, external manifestation, cause</i>	<i>Troubleshooting</i>
Rear PTO shaft end extension fails to rotate while activation	
PTO mode shifting handle is not engaged in the independent drive position	Check and shift the handle in upper position
Improper adjustment of valve control	Adjust valve control
There is no oil pressure at valve input or at valve output to PTO friction coupling	Check pressure at control valve input, in case there is no pressure correct the failure of the transmission hydraulic system. In case there is no pressure at valve output to PTO friction coupling - replace the control valve
Rear PTO shaft fails to transmit full torque ("skidding")	
Improper adjustment of valve control	Adjust valve control
Low oil pressure in the transmission hydraulic system	Adjust pressure reducing valve of the transmission hydraulic system or correct other failures in the transmission hydraulic system
Low oil pressure at valve output to PTO friction coupling due to excessive internal leakage	Check oil pressure running to PTO friction coupling, replace friction coupling O-rings, if necessary
Friction coupling operation failure due to piston deadlock or wear and tear of frictional disks	Rinse friction coupling components in pure diesel fuel, replace frictional disks, if necessary
While the PTO brake engagement, the shaft end extension goes on rotating	
There is no oil pressure at valve input or at the output to the PTO brake	Check pressure at control valve input, in case there is no pressure – eliminate the transmission hydraulic system failures. In case there is no pressure at valve output to the PTO brake - replace the control valve
Low oil pressure at the output to the PTO brake due to excessive internal leakage	Check oil pressure running to the PTO brake, replace brake piston O-rings, if necessary
Brake operation failure due to piston deadlock or wear and tear of frictional disks	Rinse brake components in pure diesel fuel, replace frictional disks, if necessary
Bent fracture of the PTO shaft end extension	
Heavy bending load on the shaft end extension from the coupled implement drive (out-of-limit angles of cardan shaft and etc.)	Eliminate breaks of coupling requirements. Correct failures in the machine, replace the PTO shaft end extension
Twisting of splines (teeth) of the PTO shaft end extension	
Impact load generated by coupled implement, that is transmitted to the PTO shaft end extension	Check availability and operability of safety elements of the coupled implement (torque-limiting clutch, shear bolt) and eliminate the failure, replace the PTO shaft end extension
Application of the PTO shaft end type having unsuitable horsepower capacity for the coupled implement drive	Install the PTO shaft end of corresponding horsepower capacity required by the implement drive (from the set supplied with SPTA)

6.6 Possible failures in front power take-off shaft and instructions for their troubleshooting

The list of possible failures of front power take-off shaft and instructions for their troubleshooting are shown in table 6.6.

Table 6.6

<i>Failure, external manifestations, cause</i>	<i>Troubleshooting</i>
Front PTO shaft can not be engaged and its end extension fails to rotate	
While the FPTO engagement, the indicating lamp does not light up, the unit does not operate or FPTO can be engaged only for a short period	Follow the instructions of subsection 6.3 "Possible failures in the electronic control system for rear axle differential lock, front driving axle drive, front power take off shaft control, GB reduction unit and instructions for their troubleshooting"
No pressure in the FPTO control channel	FPTO distribution valve spool jamming is possible. Check the distribution valve operability by pressing the spool pusher. Depending on the distribution valve configuration, it is required to press the pusher covered with a rubber cap on the solenoid kit or through the opening in the solenoid kit butt end. While pressing the spool pusher, the cylinder rod shall be shifted. If the distribution valve spool does not move - replace the distribution valve. If the distribution valve spool shifts and the cylinder rod remains fixed, check pressure in the tractor transmission hydraulic system. Operating pressure shall be within 0,9 to 1,0 MPa. In case the pressure is below the required value, eliminate the transmission hydraulic system failure as specified in subsection 6.9 "Possible failures of the transmission hydraulic system and instructions for their troubleshooting"
Front PTO fails to transmit the required power, the FPTO shaft end extension is rotating	
Operation at lower pressure in the transmission hydraulic system, skidding of FPTO band-brake	Operation with FPTO at lower pressure in the transmission hydraulic system is not allowed! Eliminate the transmission hydraulic system failure as specified in subsection 6.9 "Possible failures of transmission hydraulic system and instructions for their troubleshooting"
Control cylinder rod is moving but FPTO does not transmit full torque or while FPTO shaft disengagement the PTO shaft end extension goes on rotating. Cylinder rod overstroke	Adjust clearances in band-brake
FPTO does not transmit full torque or while FPTO shaft disengagement the PTO shaft end extension goes on rotating	
If the clearances in band-brakes are adjusted, it proves significant wear of band-brakes	Replace the PTO shaft bands
Noise in FPTO reduction unit	
Reduction gear parts breakdown	Dismount reduction unit from the tractor, replace bearings and worn-out parts causing failure

6.7 Possible failures of brakes and instructions for their troubleshooting

The list of possible brake failures and guidelines for troubleshooting are shown in table 6.7.

Table 6.7

<i>Failure, external manifestations, cause</i>	<i>Troubleshooting</i>
Inefficient braking	
Increased pedal free travel (increased clearance between the piston and the main cylinder piston follower)	Adjust pedal free travel
Presence of air in the hydraulic brake control system	Bleed the hydraulic system with brake fluid
Hydraulic brake fluid shortage in hydraulic brake control system tanks	Bring hydraulic brake fluid in the main cylinder reservoirs to the required level, then bleed the hydraulic system with brake fluid
Loss of hermiticity in operating spaces of main and operating cylinders due to damage, wear and tear of cups and O-rings	Replace the main and operating cylinder cups and O-rings in case they are worn out. Check if the cylinder bearing surface has sharpened edges, ridges, or pits. Bleed the hydraulic system with brake fluid
Hydraulic brake fluid leakage in junctions or pipelines in the hydraulic drive system. Air inflow into the hydraulic brake control system	Tighten up junctions, replace damaged parts, then bleed the hydraulic system with brake fluid
Clogging of the opening in main cylinder tank fitting, causing depression in main cylinder, as a result of which air leaks into the cylinder through sealings	Unclog the opening. Then bleed the hydraulic system with brake fluid
Clogging of pipelines of the hydraulic drive system due to dent or clogging	Replace pipelines. Then bleed the hydraulic system with brake fluid
Insufficient brake pedal travel or the pedal strikes against the cab wall	Adjust the clearance between the piston and the main cylinder piston follower
Increased brake pedal operating stroke which can not be adjusted – wear of brake disks	Disassemble the brakes, replace worn-out disks. Adjust the clearance in the friction couple and the brake pedal operating stroke
Frictional brake disks are worn-out	Replace frictional disks

Table 6.7 continued

<i>Failure, external manifestation, cause</i>	<i>Troubleshooting</i>
Sticking of brakes	
There is no pedal free travel (no clearance between the piston and the main cylinder piston follower).	Adjust pedal free travel
Sticking of main brake cylinder pistons (fail to go back in their initial position) due to piston cup and O-ring expansion, resulting in closure of compensating openings because of using incorrect hydraulic brake fluid or because of ingress of mineral oil, petroleum, kerosene, diesel fuel into the hydraulic brake system	Rinse the hydraulic drive system with hydraulic brake fluid. Replace damaged cups and O-rings in the main and operating cylinders. Replace hydraulic brake fluid. Then bleed the hydraulic system with brake fluid
Sticking of operating brake cylinder pistons due to piston cups expansion	Rinse carefully the hydraulic drive system with hydraulic brake fluid. Replace damaged cups and O-ring in operating cylinders. Replace hydraulic brake fluid. Then bleed the hydraulic system with brake fluid
Clogging of compensating opening in the main cylinder	Unclog the compensating port of the main cylinder and bleed the hydraulic system with brake fluid
Weakening or breakage of pressure discs pullback springs	Replace pullback springs of pressure discs
Presence of wear and tear signs on working surfaces of pressure discs	Clean working surfaces of pressure discs
Presence of wear and tear signs on dimple surfaces of pressure discs	Replace pressure discs
Oil shortage in the brake casing	Refill oil to the brake casing
Uneven braking of left and right wheels	
Faulty adjustment of service brakes	Make adjustments
Malfunctioning of leveling valves of main brake cylinders	Disconnect the tube connecting two main brake cylinders, turn back fittings and dismount leveling valves. Replace worn-out parts. Then bleed the hydraulic system with brake fluid
Clogging or crumpling of brake control pipelines in one of the circuits or pipelines of main brake cylinders leveling valves	Clean or replace pipelines. Bleed the hydraulic system with brake fluid
Frictional brake discs wear and tear	Replace frictional discs
Inefficiency of parking brake operability	
Improper adjustment of the parking brake	Adjust the parking brake

6.8 Possible failures in the pneumatic system and instructions for their troubleshooting

The list of possible failures in the pneumatic system and instructions for their troubleshooting are shown in Table 6.8.

Table 6.8

<i>Failure, external manifestation, cause</i>	<i>Troubleshooting</i>
Slow increase of pressure in the balloon	
Air leakage from the pneumatic system for the following reasons: - undertightened or damaged pipe-line nuts, fitting nuts, and coupling clamps - damaged rubber sealing of the coupling head - the coupling head O-ring nut torque is loose - dirt ingress under the coupling head valve - contact of the dust cover with the coupling head valve plug - faulty adjustment of brake valve drive - improper operation of pressure regulator - filter for pressure regulator is clogged - faulty pneumatic compressor	Detect leakages and eliminate them by tightening junctions or replacing damaged parts Replace the damaged sealing Screw up the nut Clean Eliminate Adjust the brake valve drive Dismount pressure regulator from the tractor and send it to a repair workshop Rinse the pressure regulator Contact your dealer
Rapid decrease of pressure in the balloon when the engine is stopped	
Air leakage through coupling members of the pneumatic system	Stop the leakage
Rapid decrease of pressure in the balloon when break pedal is depressed	
Faulty break valve	Replace the break valve
Increased oil slobbering into the pneumatic system by the pneumatic compressor	
Faulty pneumatic compressor	Contact your dealer
Insufficient air pressure in the balloon	
Faulty location of the pressure regulator adjusting cap	Adjust the pressure regulator
Faulty pneumatic compressor	Contact your dealer

End of Table 6.8

<i>Failure, external manifestation, cause</i>	<i>Troubleshooting</i>
Pressure regulator engages compressor for idle stroke when pressure is below 0.77...0.80 MPa, and for operating stroke when pressure is below 0.65 MPa or over 0.70 MPa	
Dirt accumulation in cavities and channels of pressure regulator	Rinse and clean the pressure regulator
Faulty location of the pressure regulator adjusting cap	Adjust the pressure regulator
Damaged rubber parts of pressure regulator, spring shrinkage	Replace damaged parts or send them to a repair workshop
Tilting, deadlock of spool of the pressure regulator adjusting part	Provide freedom of the spool movement, lubricate it or send the pressure regulator to a repair workshop
Pressure regulator gets actuated frequently (engages the pneumatic compressor) without air bleeding from the receiver tank	
Air leakage from the pneumatic system or pressure regulator, failure of the back-pressure regulator	Detect the reason and stop air leakages
Pressure regulator operates in the mode of pressure-relief valve	
Pressure regulator adjusting cap is turned for a big value	Adjust the pressure regulator
Pressure regulator dummy piston jamming	Disassemble the pressure regulator and eliminate jamming
Clogged outlet ports in the pressure regulator adjusting cap	Unclog outlet openings
There is no air feeding in the connecting hose through air bleeding valve of pressure regulator	
Insufficient sinking of air bleeding valve rod in the pressure regulator	Screw the nut of the connecting hose on the outlet and tighten it
Pressure regulator changes the pneumatic compressor for idle stroke	Decrease pressure in the receiver tank to the value below 0.65 MPa
Ineffective operation of trailer brake	
Brake valve drive got out of adjustment	Adjust the brake valve drive
Brake valve failure	Replace the brake valve
Failure in the trailer brake system	Eliminate the failure in the trailer brake system
Trailer brakes are slowly released	
Brake valve drive got out of adjustment	Adjust the brake valve drive
Brake valve failure	Replace the brake valve
Failure in the trailer brake system	Eliminate the failure in the trailer brake system

ATTENTION: WHILE TROUBLESHOOTING IN THE PNEUMATIC SYSTEM, ALL SELF-MAINTAINED OPERATIONS RELATED TO PRESSURE REGULATOR ADJUSTMENT AND REPAIR, ARE ALLOWED AFTER THE TRACTOR GUARANTEE PERIOD TERMINATION. OTHERWISE THE PRESSURE REGULATOR SHALL BE WITHDRAWN FROM AFTER-SALES SERVICE. TO REPAIR OR ADJUST YOUR PRESSURE REGULATOR (INCLUDING MS3) DURING TRACTOR GUARANTEE PERIOD CONTACT YOUR DEALER!

6.9 Possible failures of the transmission hydraulic system and instructions for their troubleshooting

The list of possible failures in the transmission hydraulic system and instructions for their troubleshooting are shown in Table 6.9.

Table 6.9

<i>Failure, external manifestation, cause</i>	<i>Troubleshooting</i>
Low oil pressure in the transmission hydraulic system	
Insufficient oil level in the transmission	Check oil level in the transmission as indicated in section 5 "Maintenance service". Refill oil up to the required level, if necessary.
Clogging of the distributor-filter overflow valve	Rinse the distributor-filter overflow valve
Clogging of the full-flow mesh filter	Rinse the full-flow mesh filter
Clogging of the distributor-filter	Remove the cap and rinse the distributor-filter
Oil leakage through the pressure-relief valve on the pump drive	Replace the pressure-relief valve
Shrinkage of the distributor-filter overflow valve spring	Adjust pressure by means of adjusting washers. If it is not possible - replace the spring
No oil pressure in the transmission hydraulic system	
Breakdown of the gear wheel pump in the transmission hydraulic system	Replace the gear wheel pump in the transmission hydraulic system
Transmission hydraulic system pump drive is off	Engage the transmission hydraulic system pump drive
Damaged parts of the transmission hydraulic system pump drive	Replace damaged parts of the transmission hydraulic system pump drive
High oil pressure in the transmission hydraulic system	
Filled oil does not correspond to the season (ambient temperature)	Fill in corresponding seasonal oil
Deadlock of the distributor-filter overflow valve	Rinse the distributor-filter overflow valve
Increased noise	
Insufficient oil level in transmission	Check oil level in the transmission as indicated in section 5 "Maintenance service". Refill oil up to the required level, if necessary.
Wear or breakage of bearings of other transmission components	Replace bearings

6.10 Possible failures of FDA and instructions for their troubleshooting

The list of possible failures of front driving axle and instructions for their troubleshooting are shown in Table 6.10.

Table 6.10

<i>Failure, external manifestation, cause</i>	<i>Troubleshooting</i>
Increased wear and delaminating of front tires	
Faulty toe-in of front wheels	Adjust toe-in of front wheels as indicated in section 5 "Maintenance service".
Noncompliance of pressure in tires to the recommended standards	Adjust pressure in tires as indicated in subsection 3.2.8 "Selection of optimal inflation pressure in tires depending on operating conditions and tractor axle load"
Front axle is constantly forcedly engaged	Do not use the mode "FDA on" all the time. If FDA is constantly engaged for the reason of FDA control failure, eliminate it
Drive clutch fails to transmit torque	
No pressure in the clutch booster	Disassemble the distribution valve, rinse the case and spool
Failure of system electrics	Detect and eliminate the failure in ECS of FDA
Insufficient value of torque transferred	
Low pressure in the transmission hydraulic system	Adjust pressure in the transmission hydraulic system to the value from 0.9 to 1.0 MPa
Increased leakage in drive control hydraulic system: - wear of piston and drum O-rings;	Replace O-rings
- wear of mating surfaces sleeve – drum hub, drum – piston;	Replace worn-out parts
- wear of disk packs	Replace worn-out parts
Drive fails to operate in automated mode	
Disconnect switch of FDA drive automatic engagement sensor got out of adjustment	Adjust the disconnect switch of FDA drive automatic engagement sensor
Increased noise generated by main gear	
Increased clearance in the driving gear bearing of reduction unit	Check and adjust gear bearings, if necessary
Side clearance in the main pair of central reduction unit got out of adjustment	Adjust the side clearance in the main pair of central reduction unit

End of Table 6.10

<i>Failure, external manifestations, cause</i>	<i>Troubleshooting</i>
Oil leakage through the wheel-hub drive	
Increased oil level in the wheel-hub drive	Set the required oil level in the wheel-hub drive
Oil leakage through the main gear flange cup	
Worn-out or damaged flange sealing of driving gear of the main gear	Replace the sealing
Oil leakage through the drive gear cup of the wheel-hub drive	
Increased clearance in the gear bearings	Check and adjust
Wear or damage of the cup	Replace the cup
Noise while wheel maximum rotation angle	
Improper wheel rotation limit angle	Check and adjust the FDA reduction unit rotation angle
Hammering in pivot while moving	
Pivot bearing got out of adjustment	Check and adjust
Hammering in FDA while abrupt wheel turning	
Clearances in the steering link pins and in rotation hydraulic cylinders	Check and adjust

ATTENTION: AFTER ANY DISMOUNTING OF STEERING LINK AND ITS SUBSEQUENT INSTALLATION, AFTER MAKING ALL NECESSARY ADJUSTMENTS, TIGHTEN TWO CASTLE NUTS M20X1.5 OF BALL PINS WITH TORQUE FROM 100 TO 140 N·M, AND FASTEN THEM BY COTTER (WHILE MATCHING THE NUT SLOT AND THE OPENING OF BALL PIN, THE NUT TURNING OFF IS NOT ALLOWED) AND TWO LOCKING NUTS M27X1.5 (WITH THE LEFT AND RIGHT-HAND THREAD) OF STEERING LINK PIPE WITH TORQUE OF 100 TO 140 N·M!

6.11 Possible failures of the hydrostatic steering control and instructions for their troubleshooting

The list of possible failures of the hydrostatic power steering and instructions for their troubleshooting are shown in Table 6.11.

Table 6.11

<i>Failure, external manifestation, cause</i>	<i>Troubleshooting</i>
Great effort at the steering wheel	
No pressure or insufficient pressure in the steering control hydraulic system (it shall be from 14.0 to 14.5 MPa (steering wheel is turned up to the stop)) due to the following reasons: - HSC was not bled - faulty adjustment of dosing pump pressure relief valve (low pressure) - faulty feed pump (the pump fails to increase pressure because of low efficiency factor)	Bleed the HSC hydraulic system by turning the steering wheel moving guide wheels from left-most to the right-most position (stop-to-stop position) for 2-3 times Contact the dealer. Adjust the pressure relief valve for the required pressure ¹⁾ . The operation shall be performed only by maintenance department Contact the dealer for feed pump replacement or repair
Hard abrasion or blocking up in steering column mechanical components	Stop abrasion in the steering column, for which do the following: - loosen upper nut; - lubricate friction surfaces of plastic bushings; - eliminate contact of universal-joint yoke with steering column bracket walls
Increased torque of FDA reduction unit turn	Make repair of FDA
Steering wheel is rotating without driven wheels turning	
There is no oil in the tank	Fill the tank with oil to the required level and bleed air from the hydraulic system of HSC
Improper adjustment of dosing pump valves. Adjusting pressure of the pressure-relief valve exceeds the pressure of anti-shock valves	Contact the dealer. Adjust the pressure-relief valve and anti-shock valves to the required pressure. The operation shall be performed only by maintenance department ¹⁾
Worn-out sealings of the hydraulic cylinder piston	Repair or replace the hydraulic cylinder
Steering is too slow and too hard while quick turning of steering wheel	
Faulty feed pump (the pump fails to increase pressure because of low efficiency factor)	Contact the dealer for feed pump replacement or repair.
Improper adjustment of dosing pump pressure-relief valve (set to low pressure or stuck in the open position due to dirt accumulation)	Contact the dealer. Adjust the pressure relief valve for the required pressure. The operation shall be performed only by maintenance department. ¹⁾

Table 6.11 continued

<i>Failure, external manifestation, cause</i>	<i>Troubleshooting</i>
Steering wheel fails to return to neutral position	
Hard abrasion or blocking up in steering column mechanical components	Stop abrasion in the steering column, for which perform the following: - loosen upper nut; - lubricate friction surfaces of plastic bushings; - eliminate contact of universal-joint yoke with steering column bracket walls
Steering wheel goes on rotating after turning	
Gripping of sleeve with the spool (possible due to dirt accumulation)	Contact the dealer. Rinse of dosing-pump components is required. Assembly and check of operability shall be performed only by maintenance department in accordance with manufacturer's instruction ¹⁾
Spool recentering springs of dosing pump have lost spring power or broken	Contact the dealer. Replacement of springs, assembly and check of operability shall be performed only by maintenance department in accordance with manufacturer's instruction ¹⁾
Permanent adjustment of steering wheel is required (steering wheel fails to follow the selected direction)	
Spool recentering springs of dosing pump have lost spring power or broken	Contact the dealer. Replacement of springs, assembly and check of operability shall be performed only by maintenance department in accordance with manufacturer's instruction ¹⁾
One of anti-shock valves setting springs is broken or gerotor pair is worn-out	Contact the dealer. Replacement of faulty components assembly and check of operability should be performed only by maintenance department in accordance with manufacturer's instruction ¹⁾
Worn-out sealings of the hydraulic cylinder piston	Replace faulty cylinder components
Increased clearance in the steering wheel	
Conic-shaped pins of HSC hydraulic cylinders are not tightened	Tighten pin nuts as
There is clearance in steering link joints	Eliminate the clearance in steering joints, as indicated in section 5 "Maintenance service"
Worn-out steering column end extension splines	Replace the lower universal-joint yoke
Worn-out steering column cardan shaft	Replace cardan shaft
Spool recentering springs of dosing pump have lost spring power or broken	Contact the dealer. Replacement of springs, assembly and check of operability shall be performed only by maintenance department in accordance with manufacturer's instruction ¹⁾

Table 6.11 finished

<i>Failure, external manifestation, cause</i>	<i>Troubleshooting</i>
Wobbling of driven wheels when moving	
Conic-shaped pins of HSC hydraulic cylinders are not tightened	Tighten pin nuts
There is clearance in steering joints	Eliminate the clearance in steering joints, as indicated in section 5 "Maintenance service"
Worn-out mechanical joints or bearings	Replace worn-out components
Air presence in the HSC hydraulic system	Bleed air from the HSC hydraulic system by turning the steering wheel moving guide wheels from the left-most to the right-most position (stop-to-stop position) for 2-3 times
Break of dosing pump air tightness throughout spool end extension, socket casing - gerotor pair – cover	
Wear of spool sealing	Contact the dealer. Replacement of faulty sealing, assembly and check of operability shall be performed only by maintenance department in accordance with manufacturer's instruction ¹⁾
Loose dosing-pump cover bolt	Tighten the bolts with torque of 30 to 35 N·m
Damaged sealing gaskets under the dosing pump cover bolt heads	Replace the gaskets
Different minimum minimal radius of tractor turning to the left and to the right	
Faulty toe-in of front wheels	Adjust toe-in of front wheels as specified in section 5 "Maintenance service"
Partial steering angle of driven wheels	
Insufficient pressure in the HSC hydraulic system due to the following reasons: - faulty adjustment of dosing pump pressure relief valve (low pressure) - faulty feed pump (the pump fails to increase pressure because of low efficiency factor)	Contact the dealer. Adjust the pressure relief valve for the required pressure ¹⁾ . The operation shall be performed only by maintenance department. Contact the dealer.
Increased FDA reduction unit steering torque	Make repair of FDA
Breakdown of feed pump	
High pressure in the HSC hydraulic system due to the following reasons: - Incorrect high-pressure hose connection - locking of the back-pressure valve or dosing pump pressure relief valve (possible due to dirt accumulation)	Contact the dealer. Rinse of dosing-pump components is required. Assembly and check of operability shall be performed only by maintenance department in accordance with manufacturer's instruction ¹⁾
¹⁾ Considering extreme complexity and responsibility of the dosing pump from the point of view of steering system safety, its assembly and disassembly shall be carried out only by servicing personnel of manufacturing company (or other authorized maintenance department), properly trained, studying dosing pump design and service and dosing pump assembly-disassembly manuals, and provided they have all required service tools, accessories and special hydraulic stand, ensuring adjustment and check of dosing pump parameters and operability after the repairs have been made. Otherwise, a person performing the dosing pump assembly and disassembly, replacement of parts and components or adjustment of valves, as well as a tractor owner, bears full responsibility for dosing pump non-operability.	

6.12 Possible failures in the electronic control system of RLL and instructions for their troubleshooting

Cables and control system of RLL connecting diagrams are shown in figures 6.12.1, 6.12.2. The rules of failure diagnostics of the RLL ECS are specified in clause "Troubleshooting of RLL electronic control system" of subsection 2.17 "Lift linkage controls". Possible RLL electronic control system error codes and instructions for their troubleshooting are shown in table 6.12.

ATTENTION: DISCONNECTION OF THE ELECTRIC SOCKETS OF THE REAR LIFT LINKAGE ELECTRONIC CONTROL SYSTEM SHALL BE CARRIED OUT WHEN THE ENGINE IS NOT RUNNING ONLY!

ATTENTION: ALTERATIONS OF THE SPECIFIED VOLTAGE VALUES SHALL BE DONE WITH THE ENGINE RUNNING, WITH DUE ATTENTION TO THE SAFETY MEASURES IF OPERATING WITH ELECTRIC UNITS ON LOAD!

ATTENTION: TERMINALS IN THE CABLE SOCKETS ARE NUMBERED ON THE SOCKETS SHELLS!

ATTENTION: REPAIR OPERATIONS OF THE REAR LIFT LINKAGE AND FRONT LIFT LINKAGE ELECTRONIC CONTROL SYSTEM SHALL BE CARRIED OUT ONLY BY DEALERS. OTHERWISE THE WARRANTY FOR THE REAR LIFT LINKAGE AND FRONT LIFT LINKAGE CONTROL SYSTEM BECOMES INVALID!

Table 6.12

<i>Error code</i>	<i>Description, possible problem</i>	<i>Failure inspection method</i>
Complex failures		
11	Failure in the electromagnetic lift valve control circuit. Break in the solenoid coil or in solenoid control cable	Disconnect the cable from the solenoid and test the solenoid with a testing apparatus to detect a break. Solenoid resistance shall not exceed 2...4 Ohm. In case the solenoid failure is not detected check the solenoid control cable for mechanical damage, and check the wire with the testing apparatus to detect if there is a break between the solenoid socket terminal and the terminal 2 of 25-pole socket of the electronic unit (Figures 6.12.1, 6.12.2)
12	Failure in the electromagnetic lowering valve control circuit. Break in the solenoid coil or in solenoid control cable	Disconnect the cable from the solenoid and test the solenoid with a testing apparatus to detect a break. Solenoid resistance shall not exceed 2...4 Ohm. In case the solenoid failure is not detected check the solenoid control cable for mechanical damage, and check the wire with the testing apparatus to detect if there is a break between the solenoid socket terminal and the terminal 14 of 25-pole socket of the electronic unit (Figures 6.12.1, 6.12.2)
13	Failure in the electromagnetic lowering valve or lift valve control circuit. Short circuit in one of the solenoids or short circuit of the solenoids control wires in the cable	Disconnect the cable from the solenoid and test the solenoid with a testing apparatus to detect a short circuit. Solenoid resistance shall not exceed 2...4 Ohm. Or measure the solenoid useful current applying the current of 6 V. The current shall not exceed 3.2A. Disconnect the socket from the electronic unit, check the terminals 2 and 14 for a short circuit (the solenoids shall be disconnected during this procedure) (Figures 6.12.1, 6.12.2)
14	Failure in remote control buttons for lift 4 (Figure 2.17.3). Short circuit of wires or sticking of a remote control buttons for lift	Check the remote control buttons cables for mechanical damage by lift of RLL. Disable each button for lift one-by-one until the failure is gone. Stop the engine when you disable the buttons. If the failure is still not eliminated, disconnect the socket from the electronic unit and ring out the terminals 10 and 12 for a short circuit by testing apparatus (Figures 6.12.1, 6.12.2)
15	Failure in remote control buttons for lowering 5 (Figure 2.17.3). Short circuit of wires or sticking of a remote control buttons for lowering	Check the remote control buttons cables for mechanical damage by lift of RLL. Disable each button for lift one-by-one until the failure is gone. Stop the engine when you disable the buttons. If the failure is still not eliminated, disconnect the socket from the electronic unit and ring out the terminals 20 and 12 for a short circuit by testing apparatus (Figures 6.12.1, 6.12.2)

Continuation of Table 6.12

Error code	Description, possible problem	Failure inspection method
16	Failure in electronic unit. Stabilized power supply voltage, powering the control panel is lower than the required level. Short circuit may occur in the force and position sensors sockets of RLL caused by water entering the sockets	Disconnect the main control panel from the common cable. Measure stabilized power supply voltage of the terminals 6 (minus) and 4 (plus) of the control panel socket, which shall make 9.5 - 10 V (with the engine running). If the supply voltage is low or in absence of it, check the reliability of electronic unit socket connection. Disconnect the force sensor and the position sensor of RLL one-by one (Figure 6.12.2)
Moderate failures		
22	Failure of the position sensor. Breakage of the sensor wire, the sensor was not connected or adjusted	1. Faulty adjustment of the position sensor. Disconnect the cable socket from the sensor. Unscrew the sensor. Lift the LL in an uppermost position by remote buttons or button "lift" on the solenoid (bottom solenoid). Screw the sensor in by hand as far as it may go and unscrew by 2 turns. Connect the cable socket to the sensor. Lower and lift in an uppermost position the LL by means of the control panel. Lift indicator shall be out. If the indicator is still flashing, make the position sensor further by 1/6 of a turn. Check the system operation again. If it is necessary (lift indicator is not out in an uppermost position), make the position sensor a little bit further and try to check again. If the adjustment was made in a proper manner, LL shall be lowered and lifted by means of the control panel to the extreme positions. The lift indicator shall be out in an uppermost position 2. Failure of the position sensor. 2.1 To check the operability of "BOSCH" position sensor, dismount it from the tractor. According to the electric circuit diagram of the RLL control system (figure 6.12.2, the position sensor connection), it is required to supply voltage of 10V (in case the power supply unit is not available, voltage of 12V can be supplied from the accumulator battery for a short moment) to: output 1 "load" (minus) and to output 3 "+" (plus) and pressing the sensor migrating rod by a finger, measure the voltage at the sensor output by the testing apparatus: between output 2 – "signal" and output 1 – "minus". While the full sensor rod (core) shifting, the voltage at the sensor output shall be measured within the limits from 0.2 to 0.75 of the value of voltage supplied to the sensor. If the specified parameters are broken, it is required to mount a new sensor on the tractor and adjust it properly. Numbers of sensor outputs are indicated on the cable socket connector which is attached to the position sensor. 2.2 It is impossible to check the ДП-01 sensor manufactured by the works "Izmeritel", operability by means of dismounting it from the tractor. If carrying out adjustments failed to eliminate the ДП-01 sensor failure, it is required to mount a new ДП-01 sensor on the tractor and adjust it properly. 3. Failure (breakage) of the cable in sensor circuit. Check the cable according to the diagram (figure 6.12.2)

End of Table 6.12

Error code	Description, possible problem	Failure inspection method
23	Failure of the control panel. Potentiometer of the depth control lever is damaged	Check the reliability of the control panel sockets and electronic unit connection, and check the cable for mechanical damage. Check the voltage output according to the electrical connections diagram (Figure 6.12.2)
24	Failure of the control panel. The RLL uppermost end position lever is damaged	Check the reliability of the control panel sockets and electronic unit connection, and check the cable for mechanical damage. Check the voltage output according to the electrical connections diagram (Figure 6.12.2)
28	Failure of the control panel. The RLL operation lever 11 (Figure 2.17.1) is damaged	Check the reliability of the control panel sockets and electronic unit connection, and check the cable for mechanical damage. Check the voltage output according to the electrical connections diagram (Figure 6.12.2)
31	Failure of the right force sensor. Cable breaking or the sensor short circuit	To check if it is failure of the sensor or the cable (in circuit to the sensor), disconnect the sockets from the cable to the sensors (left and right) and interchange their positions (the socket from the left sensor to the right sensor channel and the socket from the right sensor to the left sensor channel). If after that the error code has changed (31 was replaced by 32 or 32 was replaced by 31), that means that the sensor is out of order, if the error code is still the same, that means that the cable is out of order
32	Failure of the left force sensor. Cable breaking or the sensor short circuit	
Light failures		
34	Failure of the control panel. Potentiometer of the RLL speed control lever is damaged	Check the reliability of the control panel sockets and electronic unit connection, and check the cable for mechanical damage. Check the voltage output according to the electrical connections diagram (Figure 6.12.2)
36	Failure of the control panel. Potentiometer of tilling modes combination lever: force mode – point-to-point operation mode	Check the reliability of the control panel sockets and electronic unit connection, and check the cable for mechanical damage. Check the voltage output according to the electrical connections diagram (Figure 6.12.2)
Code is not displayed	Spontaneous lift of RLL after the engine start	“Lift” forward/reverse spool was blocked in the open position. Disconnect the cable sockets from the “Lifting” and “Lowering” solenoids. If the failure is still displayed, eliminate the failure in the RLL hydraulic system.

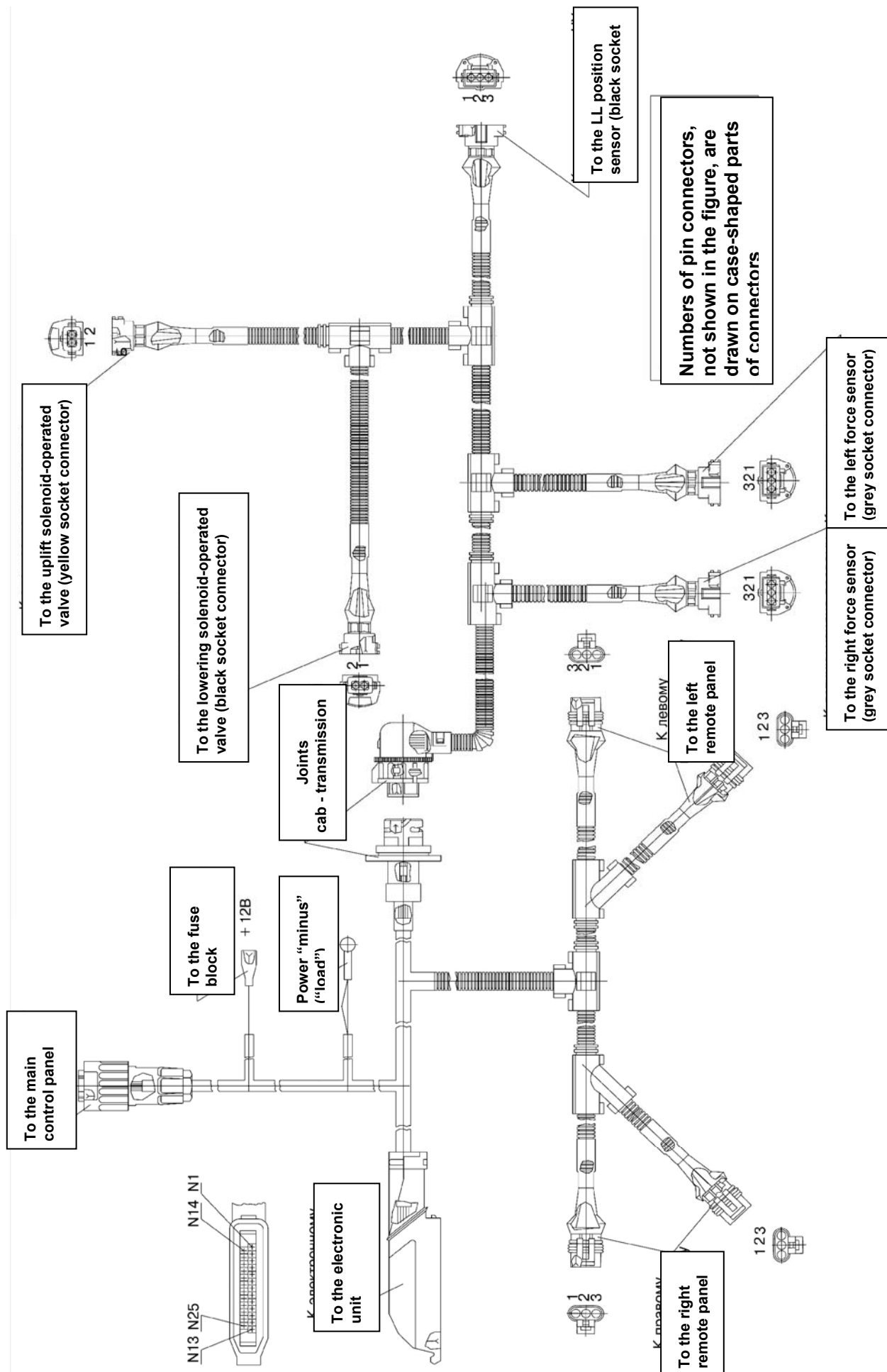


Figure 6.12.1 – RLL electronic control system cables



6.13 Possible failures of the hydraulic lift linkage and guidelines for troubleshooting

6.13.1 General information

IT IS FORBIDDEN TO DISASSEMBLE THE SECTION OF THE DISTRIBUTION VALVE AND THE INTEGRAL UNIT DURING PERIOD OF WARRANTY. OTHERWISE THE WARRANTY FOR DISTRIBUTION VALVE SECTION AND THE INTEGRAL UNIT BECOMES INVALID!

ATTENTION: REPAIRMENT OF EHS DISTRIBUTION VALVE AND EHS DISTRIBUTION VALVE SECTIONS ELECTRONIC CONTROL SYSTEM SHALL BE CARRIED OUT ONLY BY DEALERS. OTHERWISE THE WARRANTY FOR DISTRIBUTION VALVE SECTION AND THE INTEGRAL UNIT BECOMES INVALID!

IT IS FORBIDDEN TO ROTATE THE SPOOL ABOUT ITS AXES. SUCH ROTATION CAN RESULT IN BREAKDOWN OF THE HYDRAULIC COMPONENTS IN THE DISTRIBUTION VALVE SECTION!

6.13.2 Instructions for troubleshooting in HLL

Possible failures in HLL and guidelines for troubleshooting are shown in Table 6.13.

Table 6.13

<i>Failure, external manifestation, cause</i>	<i>Troubleshooting</i>
LL hydraulic-system pressure loss (RLL can not be lifted, pressure loss or no pressure of pressure at external outputs), overheating and/or foaming of hydraulic oil takes place	
Loss of pump efficiency	Replace the pump
Air inflow in the hydraulic system	Check and tighten the suction line clamps if necessary. If the failure can not be eliminated, replace the oil suction line Check integrity and replace if necessary suction line hose pipe. Check and replace if necessary O-ring under foot pipe
Water in HLL tank (oil became red-white)	Change oil
Lighting up of the lift indicator located in the RLL control panel after the lifting is completed means that the RLL position sensor is not adjusted	Perform the RLL position sensor adjustment according to the table 6.12 (code 22)
One or more distribution valve control levers are not in neutral position. Levers don't go back to neutral position after they were taken off from fixed operating position	Adjust lever hub on axis, ensuring their free movement
Low oil level in HLL tank	Refill oil up to the required level

Continuation of Table 6.13

<i>Failure, external manifestation, cause</i>	<i>Troubleshooting</i>
Overheating of HLL oil in course of tractor operation with an implement with hydraulic oil motor coupled	
Wrong choice of hydraulic motor for the implement. Hydraulic motor oil consumption should be by 10...15% below pump output flow at engine operating speed	Adjust engine rpm or change hydraulic motor or install hydraulic fluid cooler on hydraulic motor drain
Implement delivery pipe or drain pipe have restricted flow passages	Replace pipes by the recommended ones according to subsection 4.5 "Features of tractor hydraulic system use for actuation of mover working attachments and other components of coupled hydraulically operated implements and units" of this operation manual
Hydraulic motor of the implement lost efficiency coefficient	Replace worn-out hydraulic motor
Oil drain from hydraulic motor through active section of distribution valve	Ensure oil drain from hydraulic motor through tractor spare drain
HLL pressure loss (RLL can not be lifted, pressure loss or no pressure of pressure at external outputs), hydraulic system overheating does not occur	
Locking of differential pressure control valve (overload relief valve) in access cap of integrated unit)	Perform the following actions: - rinse the valve - check pressure at any external output, which should be 20.0-2.5 MPa - valve rinsing should be carried out at the dealers center by specially trained personnel
Spontaneous lowering of RLL (lowering without a command received from the instrument panel or remote control buttons)	
Deadlock of the lowering valve of a regulatory section EHR -23LS (if integrated unit BOSCH is installed)	Failure can be eliminated only by a dealer in a service centre in the following manner: - dismount the electro hydraulic section (EHR), by unscrewing the nuts of the stud-bolts of the integral unit. During dismounting procedure pay attention to integrity of the O-rings and the shuttle valve (OR VALVE), both in the regulatory section and in the distribution valve neighboring section; - disassemble the lowering valve EHR-23LS and rinse its components; - put the electro hydraulic section (EHR) back in its place
Deadlock of the lowering valve of a regulatory section (if hydraulic unit RP70-1523.1 is installed)	To eliminate failure contact your dealer

End of Table 6.13

<i>Failure, external manifestation, cause</i>	<i>Troubleshooting</i>
Spontaneous lifting of RLL (lifting without a command received from the instrument panel or remote control buttons)	
Deadlock of the lift spool of a regulatory section EHR-23LS (if integrated unit BOSCH is installed))	Elimination of failure should be carried out directly in tractor, without the need of integrated unit disassembly, for which perform the following: - thread out four screws fastening lower solenoid 13 (Figure 7.13.1) then withdraw the solenoid ; - withdraw the lift spool 14 and the spring 15, rinse the mentioned components and the bore in the section housing; - assemble the lift valve in reverse sequence
Deadlock of the lift spool of a regulatory section (if hydraulic unit RP70-1523.1 is installed)	To eliminate failure contact your dealer
Failure diagnostics signaling device located on the RLL control panel reports numerical error codes	
Damage in electrical wiring, solenoids, corrosion of terminals, sensors failure (force or position) of RLL ECS.	Eliminate the failure according to the subsection 6.12 "Possible failures in the electronic control system of RLL, and guidelines for troubleshooting"

6.14 Possible failures in the electrical equipment and instructions for their troubleshooting

6.14.1 General information

Tractor "BELARUS-1523.5" electrical equipment includes electrical elements (switches, relays, electrical engines, tools and instruments, lamps, headlights, fuses, relay interrupters, sensors, etc.) as well as wires and electrical connections which serve for coupling the element with power supply and the body weight.

Before starting operation on troubleshooting of any of electrical circuits, it is required to study carefully the electrical diagram to familiarize yourself with the functional specifications of this device. Search for a failure can be limited by gradual detection and exclusion of properly functioning elements of the same loop. In case several electrical elements fail to operate properly at the same time, the most probable reason for a failure can be burning-out of the corresponding fuse or the absence of "load" (different electrical elements in many cases can lock at one fuse or at the same terminal of the "load").

Electrical equipment failures can be explained by simple reasons like terminals corrosion, faulty fuses, burning of the insert or a switching relay defect. Check visually the condition of all fuses, wires and electrical connections of the circuit before starting the specific check of the elements failures.

In case of using test instruments for detecting a failure, plan carefully in accordance with the applied electrical diagram the succession of the instrument connection to the circuit to detect the failure most effectively. The main test instruments include a tester (multimeter) of electrical circuits, a voltmeter (a 12volt-pilot lamp can be applied with a set of connection cables), an indicator of the circuit segment conductivity (a tester) which includes a lamp, electrical power supply and a set of connection cables.

Electrical circuit troubleshooting can not be regarded as a complicated task if taking into consideration the fact that current is supplied to all electrical elements (lamp, electrical engine, etc.) from AB by wires through switches, relays, fuses, inserts, and then goes back to AB through tractor "weight". Any problems related to the electrical equipment failure can be caused only by electrical current supply termination from AB or by electrical current return to AB.

Note – The information provided in subsection 6.14 "Possible failures in the electrical equipment and instructions for their troubleshooting" shall be used for eliminating ECS failures of rear axle differential lock, front driving axle drive, front power take-off and partially for eliminating failures in the engine electronic control system.

6.14.2 Check of voltage supply

Check of voltage supply shall be carried out in case of circuit malfunctioning. Connect one of the tester wires either to the negative battery terminal or to the tractor safe "weight". The other tester wire shall be connected to the terminal of the circuit electrical connection, preferably the one located nearer to the AB or the fuse. If the pilot lamp on the tester lights up, there is voltage on this circuit segment which proves circuit operability between this terminal and AB. Acting analogically, inspect the rest part of the circuit. Detecting absence of voltage supply indicates the failure between this circuit point and the last of the checked before (where voltage supply was detected). In most case, the reason for malfunctioning is weakening of electrical connections and contact quality break. Remember that voltage to some of the on-board electrical equipment circuits can be supplied only in the positions of starter and instruments switch "I" (instruments on) or "II" (starter on (unfixed position)).

6.14.3 Search for short circuit

One of the short circuit search methods is removal of the fuse and engagement of the lamp-tester or a voltmeter instead of it. There shall be no voltage in the circuit. Shake the wire looking at the lamp-tester. If the lamp starts blinking, there is short ground failure in this cable, possibly caused by rubbing of wire isolation. A similar check can be carried out for each of the circuit elements including the switch of this circuit.

6.14.3 Check of availability of the electrical element "load"

This check is carried out with the purpose of determining the availability of electrical element safe "load". Disengage AB with the "load" switch and connect one of the wires of the continuity test lamp equipped with the self-contained power supply to the safe "load". The other lamp wire shall be connected to the cable or terminal which is being checked. If the lamp lights up, grounding is normal (and vice versa). If the minus supply circuit of the high-current consumer is under checking, it is required to use the continuity test lamp with the power not less than 21V because with the bad contact of the "load", the consumer fails to operate and the lamp with small power will light up.

6.14.4 Check of electrical circuit breakage

This check is carried out with the purpose of determining electrical circuit breakages. After disconnection of circuit power supply, check it by means of a continuity test lamp equipped with a self-contained battery. Connect the continuity test lamp wires to both sides of the circuit (or to the high-power end (+) and to the reliable tractor "load"), if the control lamp lights up it means the circuit has no breakage. The lamp failure to switch on indicates that the circuit has conductivity fault.

The switch operability can be checked in a similar way by connecting the continuity test lamp to its terminals. While shifting the switch into the position "On", the control lamp shall light up. In this case if the switch commutating supply for a high-current consumer is under check, it is also required to use the continuity test lamp with the power not less than 21 kW. The reason is that with the bad contact in the switch, a high-current consumer fails to operate and the lamp with small power will light up.

6.14.5 Breakage localization

While carrying out diagnostics of the circuit segment suspected of breakage, it is difficult to detect circuit breakage visually as inspection of terminals for presence of corrosion or their defects in contact quality can be difficult due to access limitation to them (as a rule terminals are covered with the connection housing). Abrupt shaking of the connection housing on the sensor or of the bundled cable leads to conductivity recovery in many cases. Remember this when trying to localize the reason for failure of the circuit suspected of breakage. Occasionally arising failures can be caused by terminals oxidation or defects in contact quality.

6.15 Possible failures of air-conditioning and cab heating systems and instructions for troubleshooting

List of possible failures of air-conditioning and cab heating systems and guidelines for troubleshooting are shown in Tables 6.15a and 6.15b.

Table 6.15a – Possible failures of air-conditioning and cab heating systems and guidelines for troubleshooting

<i>Failure, external manifestations, cause</i>	<i>Troubleshooting</i>
Warm air is not supplied into the cab	
Coolant is not circulated through heating unit: - turn over heater control valve - heater fan is out of order	Open the heater control valve Correct the fan failure, check electric circuit of fan engagement according to the electrics diagram
Warm air of high humidity is supplied into the cab	
Leakage of coolant in heating radiator	Leakage of coolant in heating radiator
Leakage of coolant in heating system connection	Leakage of coolant in heating system connection

WARNING: DURING TRACTOR DISCONNECTION, CLOSED-CIRCUIT AIR CONDITIONING SYSTEM MAY BE DETACHED BY MEANS OF SEPARATION OF A QUICK DISCONNECT COUPLER. DISCONNECTION SHALL BE PERFORMED BY UNSCREWING CAP NUT "B" (FIGURE 6.15.1) (WITH HEXAGON SCREW KEY SIZE 30MM) FROM VALVE "A" (WITH HEXAGON SCREW KEY SIZE 29 MM)! WHILE CONNECTING THE DUCT, IT IS NECESSARY TO PUT SILICONE SEALANT ON THE THREAD. AFTER THREE OR FIVE DISCONNECTIONS A LEAKAGE CAN OCCUR IN THE JUNCTION POINT – IN THIS CASE IT SHALL BE REPLACED!

WARNING: WHILE DISCONNECTION AND CONNECTION OF DUCTS, WEAR PROTECTIVE GLOVES AND GLASSES!

WARNING: ANY OPERATIONS RELATED TO DISCONNECTION OF AIR CONDITIONING SYSTEM COMPONENTS SHALL BE CARRIED OUT ONLY BY TRAINED PERSONNEL WITH USE OF SPECIAL EQUIPMENT FOR AIR CONDITIONING SYSTEM MAINTENANCE. HIGH PRESSURE IS MAINTAINED EVEN IN THE SHUT SYSTEM!

WARNING: COOLING AGENT R134A IS NON TOXIC, NON COMBUSTIBLE, NOT FORMING EXPLOSIVE MIXTURES. COOLING AGENT BOILING TEMPERATURE UNDER NORMAL CONDITIONS IS MINUS 27°C. IN CASE OF SKIN CONTACT WITH LIQUID COOLING AGENT, IT FLASHES AND CAN CAUSE OVERCOOLING OF SKIN AREAS!

WARNING: ONLY SPECIALLY TRAINED PERSONNEL IS ALLOWED TO PERFORM REPAIR AND MAINTENANCE SERVICES OF SYSTEM COMPONENTS!

Table 6.15b – Possible failures of air-conditioning (mounted against order) and instructions for their troubleshooting

<i>Failure, external manifestations, cause</i>	<i>Troubleshooting</i>
Compressor electromagnetic coupling will not respond (no metallic click while turning temperature regulator)	
Electric equipment failure	By means of a tester or a multimeter, check operability of pressure sensor unit, sensor unit outputs (red and pink wires) shall be "rung out" among themselves. Check up operability of electric circuit connections from compressor coupling to air conditioner control console according to the electrical equipment diagram
Coolant leakage took place	Detect the leak path. Only specially trained personnel is allowed to detect the leak path, replace hoses and air conditioner components using special equipment (after-sales service and repair shall be carried out by CJSC "Belvneshinvest", Minsk, tel./fax 8-017-262-40-75, 8-029-662-97-69, 8-029-628-67-98)
Non-operable conditioner fan electric motor	
Electric equipment failure	Check up operability of the corresponding fuse element located in the switching unit. Replace if it is faulty. If the safety lock is properly operating, check by means of indicating lamp power supply on the electric motor of air conditioner fan when the switch is on and "ground" is available in electric motor. If electric circuits are properly operating, but there is lack of power supply, replace the switch.
When air conditioner operated in cooling mode warm air is supplied into cab	
Valve PO-11 seal element breakage	Replace valve PO-11
Coolant leakage from cab ventilation compartment	
Disruption of heating unit tubes (heating unit "defrosting" due to incomplete drain during cool weather period operation)	Replace the conditioner climatic unit

6.16 Possible engine failures and instructions on their troubleshooting

The list of possible failures of engine D-260.1 S3B and instructions on their troubleshooting are specified in the engine operation manual 260 S3B-0000100 OM.

7. TRACTOR STORAGE

7.1 General instructions

ATTENTION: THE PRESENT SECTION CONTAINS STORAGE REGULATIONS FOR TRACTOR "BELARUS-1523.5" CHASSIS SYSTEMS AND UNITS. ENGINE STORAGE, PRESERVATION, REPRESENTATION, DEPRESERVATION REGULATIONS ARE SPECIFIED IN THE ENGINE OPERATION MANUAL!

The tractors shall be stored in the indoor area or under a shed.

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

Put the tractors in the inter-shift storage, if their operation is interrupted for up to 10 days, short-term storage if duration of idle interval is from 10 days to 2 months, and long-term storage if interruption of use lasts for over 2 months. Start preparation for short-term storage after finishing work, and for long-term storage – not later than ten days after finishing work.

7.2 Requirements for inter-shift storage of machines

The tractor may be stored on storage yards and inter-shift storage grounds or directly on work execution sites. All openings through which atmospheric precipitation can get inside tractor cavities shall be tightly covered. Accumulator batteries shall be switched off.

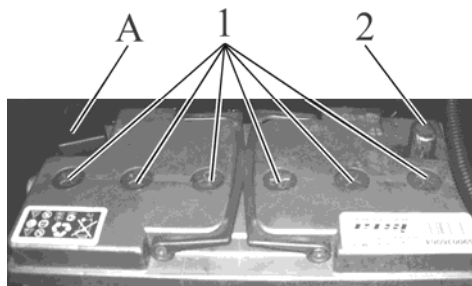
7.3 Requirements for short-term tractors storage

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

Disconnect accumulator batteries. Carry out regular maintenance of accumulator batteries.

To carry out AB maintenance, perform the following actions:

- open tractor hood;
- remove the accumulator box housing, for which unscrew two bolts fixing the accumulator box;
 - clean the battery from dirt and dust;
 - check the state of terminals 2 (figure 7.3.1) of output pin connectors, placed under the protecting cover "A" (figure 7.3.1) and ventilating openings in plugs 1. When necessary, grease the terminals with technical petroleum jelly and clean ventilating openings;
 - unscrew plugs 1 of the accumulator batteries filler openings and check:
 1. electrolyte level – if necessary, refill distilled water in order to increase electrolyte level by 10...15 mm above the protective grid or up to the level of mark on the battery case;
 2. degree of battery discharge by electrolyte density - if necessary, recharge the batteries. The degree of battery discharge shall not be lower than 50% in summer and 25% in winter.



1 – terminal of output pin connector; 2 – filler plug.

Figure 7.3.1 – Maintenance of accumulator batteries

If the tractor is stored at low temperatures or over one month, accumulator batteries shall be dismantled and sent to a warehouse.

7.4 Requirements for outdoors long-term storage

Before putting a tractor in the storage, check its technical condition. Carry out basic maintenance services.

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

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

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

Painting shall be carried out according to GOST 6572-91.

With long-term outdoor storage, electrical equipment, components made of rubber, polymer and textile materials (hydraulic circuit hoses, etc) shall be dismounted, prepared for storage and sent to a warehouse. Fastening parts of the tractor dismounted components shall be mounted back in their places. Electrical equipment (headlights, generator, starter, accumulator batteries) shall be cleaned, blown off with compressed air, terminals shall be coated with protective grease.

When preparing a tractor for long-term storage, it is required to carry out internal and outside preservation procedures for the engine according to the engine operation manual. Lubricate all tractor units according to clause 3 of table 5.4 of the present operation manual. Drain oil and fill fresh oil with the required amount of additives up to the control level to the transmission and brake bodies, FDA reducing gears, HLL and HSC (FPTO if installed) oil tank. Run the tractor for 10-15 minutes. Put accumulator batteries in long-term storage after conducting control-training cycle in accordance with GOST 9590-76. Projecting joints, threaded connections of lift linkage mechanism, steering geometry, splined surfaces of PTO shaft end extension and of cardan shafts, and projecting parts of cylinder rods and shock absorbers, front and rear track adjusting mechanism shall be preserved. Cover carefully the fuel tank filling neck, diesel breather openings, transmission, hydraulic systems, the engine exhaust pipe and the inlet air purifier pipe, relative openings after starter removal, and other cavities, through which atmospheric precipitation may get inside inner cavities of tractor assembly units with caps, polyethylene film sacks or other special accessories. Set shift levers and pedals to a position excluding spontaneous engagement of tractor units and implements.

Only unloaded pneumatic tires are allowed for outdoor storage on tractors, resting on supports. Tire surface shall be covered with protective agent. Tire pressure shall be decreased to 70% of the standard. It is required to clean exterior surfaces of the hydraulic system flexible hoses off mud and oil. Hoses may be kept on the tractor. In this case they are coated with protective substance or wrapped with insulating material (wax paper, polyethylene film, etc).

Cabin hoods and doors shall be closed.

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

Tractor technological maintenance when removing from storage includes taking off supporting blocks, cleaning and if required depreservation of tractor, its components, removal of packoff, reinstallation of dismounted components, tools, check of operation and adjustments of tractor and its components.

7.5 Preservation

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

Engine, its systems and fuel tank preservation instructions are listed in the engine operation manual.

It is required to clean tractor surfaces subject to preservation from mechanical staining, degrease it and dry up. It is required to cover unpainted inside and outside galvanized surfaces, specific assemblies of tractor and cabin with corrosion-proof oil RUST BAN 397, SUMIDERA 397.

Preservation of units (radiator and fuel tank filler, breathers, cylinder rods) shall be carried out by polyethylene film.

The applied materials provide tractor protection and its assemblies for the period of storage and transportation within one year.

Outside tractor and its assemblies preservation shall be made by lubrication of surfaces with a brush or sputtering by means of a paint sprayer. Inside tractor preservation is carried out by filling cavities with preservation mixture and subsequent engine operation.

During tractor inter-shift, short-term and long-term storage, the enterprise operating the tractor shall be responsible for compliance with preservation methods and storage conditions specified in GOST 7751-85. Inside tractor surface preservation shall be carried out with preservation grease KC-Y according to TU RB 600125053.019-2004. When a tractor is stored outside, specific surfaces shall be preserved with grease "BELA-COR" of type "A" according to TU RB 600125053-020-2004. Upon agreement with Minsk Tractor Works other preservation greases can be used.

7.6 Depreservation and represervation

Depreservation method is chosen depending on preservation materials used. Surfaces under preservation shall be wiped with cleaning cloth soaked with low-viscous oils, solvents, or washed away with washing water-soluble detergents. Sealed assemblies shall be cleaned from insulation materials (film, paper). Inside surfaces under preservation do not need depreservation.

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

7.7 Putting tractor into operation after long-term storage

Perform depreservation of an engine according to the engine operation manual.

Remove grease from external surfaces under preservation. Dismount protective covers, plugs, special accessories and mount the parts which were removed earlier back in their places. Before mounting the parts, clean them off grease and dust. Drain sediment out of all containers, fill them with operation fluids and if necessary, top up to control level.

Lubricate all tractor mechanisms according to clause 3 of table 5.4 of the present operation manual. Carry out scheduled maintenance. Run tractor for 15-20 minutes. Correct detected faults if necessary.

7.8 Safety requirements for preservation

The preservation procedure includes surface preparation, coating with preservation materials, paper marking and cutting, packing and shall be carried out only by persons of the age, subjected to medical examination, properly instructed on labor and fire safety, and receiving primary instructions on the working place. Preservation premises and sections shall be separated from other production premises and equipped with plenum-exhaust ventilation. Materials used for preservation are combustible substances with flash temperature from 170 to 270°C, and shall comply with state standards, technical specifications and have quality certificate.

The supplied conservation materials shall bear labels with material description. Perform preservation operations in special clothes and footwear and use individual protection means. When performing preservation operations, observe personal hygiene rules, dry clean special clothes in time, do not wash them in emulsions, solvents, kerosine. By the degree of impact on human health, preservation materials are classified as of moderate hazard, so use recommended individual protection means while handling materials.

With prolonged exposure to skin of preservation oils, greases and liquids, skin may be injured. White spirit vapors in small concentrations act as a weak drug, large concentration may result in poisoning. Anticorrosion paper contains corrosion inhibitors causing irritation and inflammation of skin, mucous of nose and eyes. Before starting work, it is required to put on cotton overalls, robe or an apron, prepare individual protection means depending on work conditions and toxicity of substances used. Grease hands with protection paste (cream) and put on cotton and rubber gloves. Before starting work, safe conditions of which are not known, demand for safety instructions training.

8. TRACTOR TOWING

Tractor towing is allowed at a speed of not more than 10 km/h for a distance of 5 km. Before starting tractor towing, do the following:

- set the GB range and gear shifting levers to a "Neutral" position;
- set the handle for RPTO switching from independent to synchronous drive to a "Neutral" position.

In order to connect a towing rope on tractors with FLL (additional configuration), there is a towing shackle located on the FLL bracket!

In case the tractor is towed without FLL (basic configuration), the towing rope shall be fastened to the towing shackle located on the spacer plate with weights.

THE TOWING SHACKLE SHALL NOT BE USED TO LIFT THE TRACTOR!

ATTENTION: DURING TRACTOR TOWING, IT IS REQUIRED TO OBSERVE TRAFFIC REGULATIONS!

Service bulletins