BELARUS
3522.5

3522.5-0000010 OM

OPERATOR'S MANUAL

2011

CONTENT

Introduction

The present manual is designed for studying the structure, operation rules and maintenance of tractors "Belarus-3522.5".

Scrutinize this manual and operation manual of the engine TCD 7,8 L06, attached to your tractor. It will help you to study the rules of correct operation and maintenance.

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

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

In connection with constant development of a tractor some changes, which are not depicted 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 tractor breakdown.

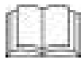
Adopted abbreviations and conventional notations:

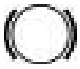
ADL – automatic differential lock;
AB – accumulator battery
DL – differential lock
RADL – rear axle differential lock;
PLU – pilot lamps unit;
SU – switching unit;
PASU – protection and switching unit;
FC – fast coupling;
ECU – engine control unit;
EJU – electronic joystick unit;
TDC – top dead center;
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 takeoff shaft;
SPTA – spare parts, tools and accessories;
RA – rear axle;
RLL – rear lift linkage;
IVA – integral voltage adjuster;
II – integrated indicator;
GB – gearbox;
CECS – complex electronic control system;
MTU – machine and tractor unit;
CC – coupling clutch;
LL – lift linkage;
CAC – charged air cooler;
IAH – inlet air heater;
FDA – front driving axle;
FPTO – front power takeoff;
VC – voltage converter;

FLL – front lift linkage;
SPIA – starting preheater of inlet air;
FDAD – front driving axle drive;
CM – control module;
IICP – integrated indicator control module;
IEP – integrated electronic panel;
HPH – high pressure hoses;
ATS – automatic test system;
SM – seasonal maintenance;
MS – maintenance;
MS1 – maintenance service No1;
MS2 – maintenance service No2;
MS3 – maintenance service No3;
DH –drawbar hitch;
GPCS – general-purpose system to control agricultural machines operation;
FE – filtering elements;
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.

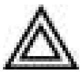
Given below are the symbols with indication of their meanings.

 — see the manual ;

 — brake;

 — manual brake;

 — audible beep;

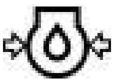
 — alarm signaling;

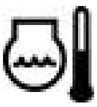
 — fuel;

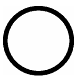
 — coolant;

 — electric starting preheater;

— engine speed;

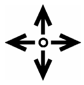
 — oil pressure in the engine;

 — temperature of engine coolant;

 — off / stop;

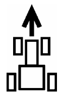
 — on / start;

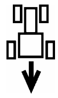
 — gradual adjustment;

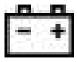
 — control manipulations;

 — fast;

 — slowly;

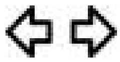
 — forward;

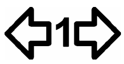
 — reverse;

 — accumulator charging;

 — cab roof light;

 — parking lights;

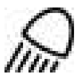
 — tractor turn indicator;

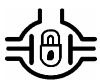


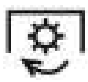
— trailer turn indicator;

 — upper beam;

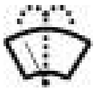
 — low beam;

 — working lights;

 — differential lock;

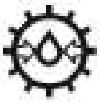
 — PTO engaged;

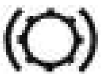
 — front screen wiper;

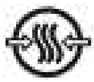
 — rear screen wiper and washer;

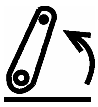
 — brake fluid level in main cylinder tanks;

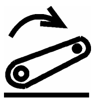
 — oil pressure in HSC

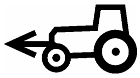
 — oil pressure in gearbox

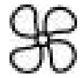
 — braking of gearbox

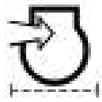
 — air pressure in pneumatic system

 — swivel lever – up

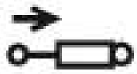
 — swivel lever – down

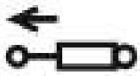
 — front driving axle drive;

 — fan;

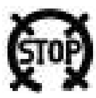
 — air filter clogged;

 — engine start;

 — external cylinder – retracting

 — external cylinder – protracting

 — external cylinder – floating



— engine stop

FOR OPERATOR'S ATTENTION!

Before going down to work on the tractor scrutinize the present Manual and Engine operation manual. Strictly observe all instructions on operation and maintenance.

IT IS FORBIDDEN TO OPERATE THE TRACTOR WITHOUT FIRE-EXTINGUISHING AIDS. THE TRACTOR SHALL BE EQUIPPED WITH A FIRE FIGHTING TOOL – A FIRE-EXTINGUISHER!

IT IS FORBIDDEN TO START THE ENGINE WITH THE COOLING SYSTEM UNFILLED!

IT IS FORBIDDEN TO START THE ENGINE “UNDER TOW” AS IT CAN RESULT IN ENGINE BREAKDOWN. START THE ENGINE ONLY FROM OPERATOR'S WORKPLACE!

IT IS FORBIDDEN TO OPERATE THE TRACTOR IF THE LAMP OF EMERGENCY OIL PRESSURE IN THE ENGINE IS ON WITH THE ENGINE RUNNING! IMMEDIATELY STOP THE ENGINE!

IT IS FORBIDDEN TO OPERATE THE TRACTOR WITH TRANSMISSION FILTERS CLOGGED (INDICATOR LAMPS ARE ON) AND WHEN THE OIL PRESSURE IN THE TRANSMISSION IS BELOW 1,3 MPA WITH ENGINE SPEED NOT LESS THAN 1400 REV/MIN!

IT IS FORBIDDEN TO OPERATE THE TRACTOR WITHOUT ACCUMULATOR BATTERIES IN THE SYSTEM OF ELECTRICAL EQUIPMENT, AND ALSO TO DEACTIVATE THE BATTERY DISCONNECT SWITCH WITH THE ENGINE RUNNING!

IT IS FORBIDDEN TO OPERATE THE TRACTOR WHEN THE SENSOR OF NEUTRAL OF RANGE REDUCTION UNIT WITH THE RANGES ENGAGED GOES OFF (ENGINE START LOCK IS MISSING) AND WHEN THE SENSOR OF DISENGAGED COUPLING STATE IS INCORRECTLY ADJUSTED!

IT IS FORBIDDEN TO SWITCH THE REVERSING GEAR VALVE WITH THE ENGINE RUNNING!

IT IS FORBIDDEN TO OPERATE THE TRACTOR ON ROADS WITH HARD SURFACE WITH THE DIFFRENTIAL LOCK PERMANENTLY ENGAGED!

IT IS FORBIDDEN TO OPERATE THE TRACTOR IF THE SIGNALLING INDICATOR OF LIFT LINKAGE UPLIFT DOES NOT GO OFF AFTER THE IMPLEMENT HAS BEEN RAISED.

IT IS FORBIDDEN TO OPERATE THE TRACTOR WHEN THE AUTOMATIC GRIPS ARE OUT OF ORDER, INNER CAVITIES OF THE GRIPS ARE CLOGGED WITH DIRT AND OTHER PARTICLES! BEFORE HINGING AGRICULTURAL IMPLEMENTS ON THE TRACTOR MAKE SURE THAT THE AUTOMATIC GRIPS OF LOWER AND UPPER LINKS OF RLL ARE CLEAN AND IN GOOD WORKING ORDER!

WHEN OPERATING WITH TRAILERS AND SEMI-TRAILERS OF ANY PURPOSE IT IS FORBIDDEN TO USE THE TRACTOR COMPLETED WITH TWIN WHEELS, WITH TYRES FILLED WITH WATER SOLUTION AND ALSO WITH MOUNTED BALLAST WEIGHTS!

IT IS FORBIDDEN TO OPERATE WITH THE FRONT TWIN WHEELS WHEN THE SPEED EXCEEDS 10 KM/H!

IT IS FORBIDDEN TO OPERATE WITH THE REAR TWIN WHEELS WHEN THE SPEED EXCEEDS 20 KM/H!

IT IS FORBIDDEN TO USE SEPARATE BRAKES WHEN OPERATING WITH REAR TWIN WHEELS!

IT IS FORBIDDEN TO MOVE ON REVERSE ON ROADS FOR PUBLIC USE AND AT WORKS, NOT RELATED TO AGRICULTURAL PRODUCTION!

IT IS FORBIDDEN TO DRIVE THE TRACTOR WITH TWIN WHEELS ON ROADS FOR PUBLIC USE!

ATTENTION: IT IS OBLIGATORY TO RUN-IN THE TRACTOR FOR 30 HOURS! BEFORE FIRST MAINTENACE (SM-1) (125 HOURS) THE LOAD ON TRACTOR SHALL BE 80% OF RATED POWER!

ATTENTION: ENGAGE AND CHANGE RANGES AND REDUCTION GEAR ONLY WITH THE TRACTOR FULLY STOPPED AND THE COUPLING CLUTCH PRESSED! WHEN ENGAGING THE REDUCTION RANGE ENGAGE ALSO THE MODE OF GEARBOX BRAKING!

ATTENTION: DURING TRAVEL CHANGE GEARS WITHOUT DEPRESSING COUPLING CLUTCH!

ATTENTION: KEEP THE FOOT OFF THE CLUTCH PEDAL DURING OPERATING THE TRACTOR AS IT WILL LEAD TO SKIDDING OF THE CLUTCH, ITS OVERHEATING AND BREAKDOWN!

ATTENTION: WITH THE DIFFERENTIAL LOCK ACTUATED THE TRACTOR TRAVEL SPEED SHALL NOT EXCEED 13 KM/H! WHEN CARRYING OUT WORKS WITH RELATIVE SKIDDING OF REAR WHEELS (TILLAGE AND OTHER OPARATIONS) IT IS NECESSARY TO SET THE DL CONTROL SWITCH INTO POSITION “AUTOMATIC LOCK”!

ATTENTION: WHEN WORKING ON ROADS WITH HARD SURFACE IT IS REQUIRED TO DEACTUATE THE FDA DRIVE TO PREVENT INCREASED WEAR OF FRONT TYRES!

ATTENTION: WHEN WORKING WITH THE PLOUGH ATTACHED IT IS REQUIRED TO USE THE SET-UP “COUPLER UNLOCKED”! AT TRANSPORTATION WORKS THE SET-UP “COUPLER LOCKED” SHALL BE USED! USING THE COUPLER WITHOUT FIXATION WITH THE GUIDE BLOCK PIN IN THE GUIDE ARMS IS FORBIDDEN!

ATTENTION: MAKE SURE ANY ADDITIONAL EQUIPMENT OR AUXILIARY DEVICES ARE MOUNTED CORRECTLY AND THAT THEY ARE INTENDED FOR USE WITH YOUR TRACTOR! DO NOT USE THE EQUIPMENT WHICH HAS BEEN NOT INTENDED FOR INSTALLATION ON THE TRACTOR!

ATTENTION: THE ENGINE STOP AND THE ENGINE EMERGENCY STOP ARE CARRIED OUT BY TURNING THE SWITCH OF THE STARTER AND DEVICES IN POSITION "OFF"!

ATTENTION: TURN OFF THE BATTERY DISCONNECT SWITCH WHEN FINISHING TO OPERATE THE TRACTOR!

ATTENTION: OPERATION OF THE TRACTOR WITH THE EMPTY TANK FOR THE AGENT AdBlue (UREA) IS NOT PERMITTED! IN CASE THERE IS DATA ON THE INFORMATION MONITOR OF A CRITICAL LEVEL OF THE AGENT AdBlue (UREA) IN THE TANK IT IS NECESSARY TO REFILL THE AGENT AdBlue IN THE TANK!

1 Tractor description and operation

1.1 Tractor assignment

The tractor “BELARUS-3522.5” is intended for performance of power-intensive agricultural works in traction and traction-drive modes in a structure with wide-span and combined units, including the articulated hitch; for basic and preseeding treatment of soil, planting of crops and other cultures, forage conservation, harvesting root crops, grain and industrial crops; for transport, stationary works, works in building and industry.

The tractor “BELARUS-3522.5” is a general-purpose wheeled tractor with the wheel formula 4К4.

Appearance of the tractor “BELARUS-3522.5” is presented in figures 1.1.1 and 1.1.2.

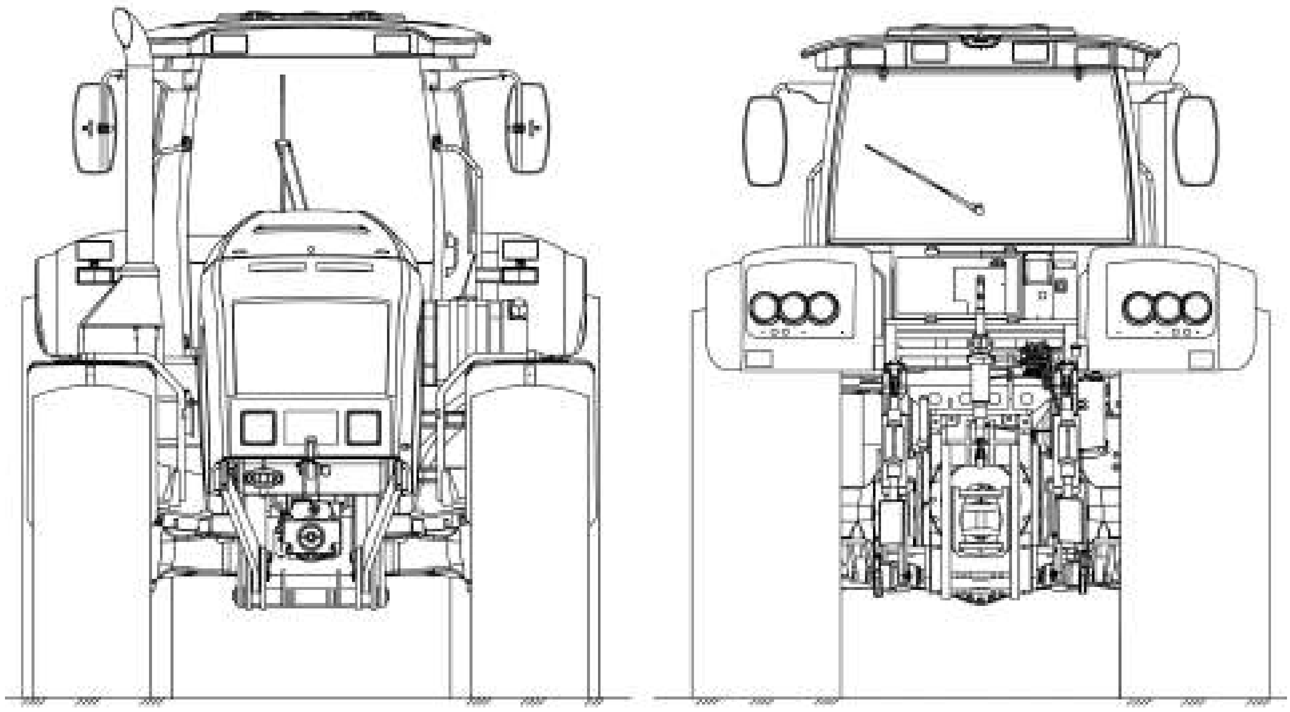


Figure 1.1.1 – Tractor “BELARUS-3522.5” (front and rear views)

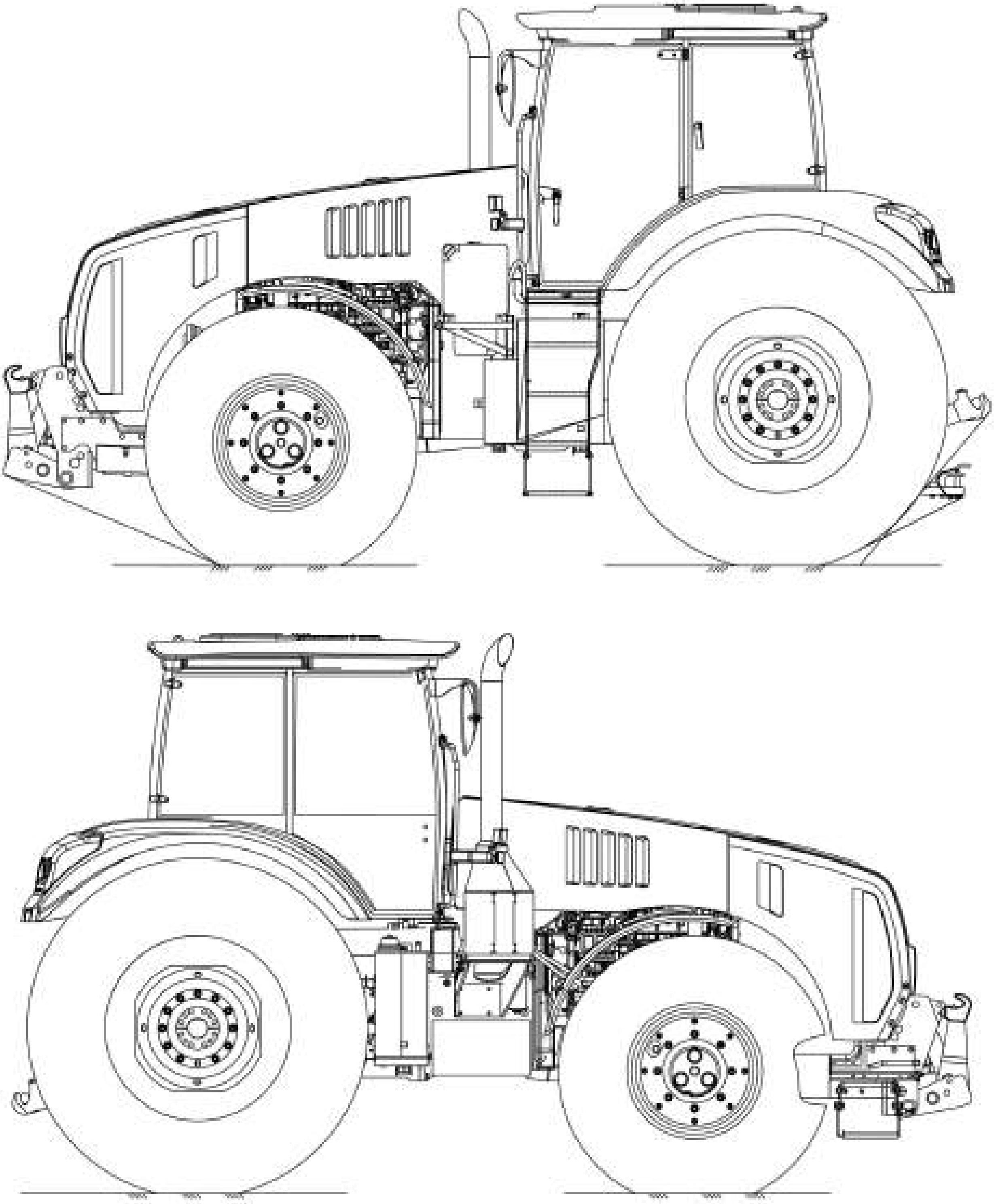


Figure 1.1.2 – Tractor “BELARUS-3522.5” (left and right views)

1.2 Technical specifications

Main parameters and technical specifications of the tractor are given in table 1.1.

Table 1.1

Parameter title (characteristics)	Parameter value for the tractor “BELARUS-3522.5”
1 Rated traction force, kN	50 (60 [1)])
2 Engine [2)]	
a) model	TCD 7,8 L06
b) engine type [3)]	diesel, turbocharged with intercooling of the charged air
c) number and position of cylinders [3)]	six, in-line, vertical
d) displacement, l [3)]	7,8
e) engine power, kW:	
1) rated [3)]	261,6
2) normal	235±3
f) crankshaft rated speed, min^{-1} [3)]	2200
g) specific fuel consumption at normal power, g/(kW·h) [3)]	240±5
h) turning torque rated factor, % [3)]	40
i) max turning torque, N·m [3)]	1449
3 Power on PTO in PTO mode “1000 min^{-1}”, kW, not less than:	
a) rear	216
b) front	58
4 Specific fuel consumption at power on PTO in PTO mode “1000 min^{-1}”, g/(kW·h), not more than	255
5 Number of gears:	
a) for forward travel	36
b) for backward travel	24
6 Tractor travel speed (design) with tyres 650/75R42 at crankshaft rated speed, km/h:	
a) for forward motion:	
1) least creep	0, 4 (0,34 [4)])
2) highest traveling	39,4 (40,00 [4)])
b) for backward motion:	
1) least	0,4 (0,43 [4)])
2) highest	20,50 (20,80 [4)])
7 Tractor weight, kg:	
a) operating	11900±100
b) maximum operating at highest traveling speed	16800

Table 1.1 continued

Parameter title (characteristics)	Parameter value for the tractor "BELARUS-3522.5"
8 Distribution of operating weight on axles, kg: a) on front b) on rear	 4750±50 7100±110
9 Permitted load on axles, kN: a) on front b) on rear	 80 112
10 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)	 5800 5800 25000 40000
11 Clearance, mm, not less than: a) road under drawbar hitch b) agrotechnical under rear wheel assemblies	 355 550
12 Track dimensions, mm: a) for front wheels b) for rear wheels	 2000±20, 2150±20 from 2020±20 to 2140±20 and from 2316±20 to 2576±20
13 Least radius of turning circle, m	6,5
14 Tractor base, mm	3000±20
15 Crossed hindrances: a) angle of climb without trailer, not less than b) angle of climb without trailer, not less than c) max fordable depth, m	 20º 12º 0,8
16 Overall dimensions, mm: a) length with front and rear lift linkages in transport position b) width on rear wheel tyres - on tyres 650/75R42 c) height to the top of cab	 6250±50 2550±20 3350±50
17 Tyres: a) front wheels b) rear wheels	 600/65R34 [5)] 710/70R42 [6)]
18 Electrical equipment under GOST 3940: a) rated supply voltage in on-board power system, V b) rated ignition voltage, V	 12 12

Table 1.1 finished

Parameter title (characteristics)	Parameter value for the tractor "BELARUS-3522.5"
19 Hydraulic system:	
a) pump displacement at crankshaft rated speed, l/min	от 0 до 120
b) safety valve operation pressure, MPa	20,5±0,5
c) conventional volume factor, not less than	0,75
20 Working equipment:	
a) rear power take-off shaft:	
rated speed of PTO shaft end extension in the following modes, min^{-1}:	
- stage I – main mode at 2000 min^{-1} of engine crankshaft speed	1000 (1100) [9)]
- stage II – economy mode: at 1440 min^{-1} of engine crankshaft speed	1000 (1530) [9)]
- stage III – additional mode: at 1500 min^{-1} of engine crankshaft speed	540 (790) [7)]
b) front power takeoff shaft:	
rated speed of PTO shaft end extension (at 2160 min^{-1} of engine crankshaft), min^{-1}	1000 (1017) [9)]
c) rear lift linkage:	
1) loading capacity of rear lift linkage on suspension axis, kg, not less than	10000
2) time for raising rear lift linkage from lowermost position into uppermost position with test load on suspension axis, sec., not more than	6,5
d) front lift linkage:	
1) loading capacity of front lift linkage on suspension axis, kg, not less than	5000
2) ballast weight, mounted on FLL, kg	1320
e) drawbar hitch:	In unit 5 "Implement coupling"

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[1)] When the tractor is completed with front supplementary wheels with twinning mechanism, rear supplementary wheels with spacers and front ballast weights with the mass of 1320 kg.

[2)] Engine parameters, not specified within these specifications, shall meet "DEUTZ" documents.

[3)] For referential use.

[4)] On tyres 710/70R42.

[5)] It is assumed to use front tyres 600/65R34.

[6)] It is assumed to use rear tyres 710/70R42.

[7)] At 2200 min^{-1} of engine crankshaft speed.

1.3 Tractor composition

Tractor framework – frame-type.

Undercarriage: front and rear driving wheels, with pneumatic tyres. Steering wheels are front wheels. The wheels are twinned by means of spacers. Rear wheels are twinned by means of spacers. Front wheels are twinned by means of clampbands.

Engine – TCD 7,8 L06.

System of engine lubrication is combined, with the liquid-oil heat exchanger. Oil cleaning is carried out by a full-stream oil filter. The minimum oil pressure at the minimum idle rotation frequency is not less than 0,08 MPa.

Engine feed system is a Deutz Common Rail fuel system with a two-section pump of high pressure. There are two fuel filters – coarse filter and fine filter (with dual indecomposable filtering element). The turbocharger is a centripetal radial turbine on one shaft with a centrifugal compressor.

Air purifier is combined. It consists of a precleaner with a built-in block "Multi-cyclone", a basic filtering element with interlocked filtering channels and a linear direction of a stream, and an additional secondary filtering element with radial sealing.

System of engine start-up is electric starter. A means of start-up facilitation is an electric air heater in an inlet collector.

System of engine cooling is liquid, closed with liquid compulsory circulation. For acceleration of engine warming up after start-up and for automatic control of a temperature mode at various loadings and ambient temperature there is a thermostat.

Cooling system for charged air is of a radiator type. The CAC radiator, intended for cooling the air, charged into an inlet collector, is mounted in front of a water radiator.

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

The coupling clutch is frictional, dry, two-disk, spring-loaded. The CC overlays are ceramic-metal. The coupling control drive is hydrostatic with hydraulic booster.

The transmission is mechanical, fixed-ratio, with constant-mesh gears. Gear shifting within ranges is electrohydraulic by means of frictional hydraulically operated clutches. Switching of ranges is cable-operated by means of tooth clutches.

The rear axle:
- with the main drive as a pair of bevel gears with circular teeth;
- with a differential with a frictional lock clutch;
- with the final drive of a planetary type.

Brakes:

Working brakes are multidisk, oil-lubricated, located on main sun gears of the final drive. Working brakes control is interlocked with a pneumatic drive of trailer brakes. The working brakes control drive is hydrostatic.

The parking brake is brought into coincidence with the working brakes, it has an independent manual mechanical control. The control is interlocked with the pneumatic drive of trailer brakes.

The trailer brakes control drive is pneumatic, combined, interlocked with tractor brakes control.

The rear power takeoff shaft is continuous dual-speed, with the soft start-up, it has two modes: basic and economy. The direction of rotation is clockwise when viewed from the shaft end face.

The tractor is equipped with the PTO shaft end extension 3 (20 splines).

The tractor set of spare parts, tools and accessories is completed with:

- o PTO shaft end extension 1 (6 splines) under ISO 500
- o PTO shaft end extension 2 (21 splines) under ISO 500

The front PTO is continuous, single-speed with a PTO shaft end extension of type 2 (21 teeth). The direction of rotation is clockwise when viewed from the shaft end face.

The transmission hydraulic system provides for the following:

- o engagement of gearbox friction clutches, PTO and FDA drives, differential lock;
- o filtration of transmission oil;
- o pressure feed lubrication of gearbox bearings, pump drives for HLL and transmission HS, PTO and RA.

Steering is hydrostatic. The feed pump is gear-type, the direction of rotation is left. The dosing pump of forward motion is gerotor-type, two-box. The dosing pump of the reverse motion is gerotor-type, one-box. The type of the rotation mechanism: two hydraulic cylinders of bidirectional operation and a steering linkage.

The forward driving axle is a coaxial type, with planetary final gears. The main drive is a pair of bevel gears with circular tooth. The differential is self-locked, with increased friction. The FDA drive is a reduction unit, built in the rear axle, with a multidisk, frictional hydraulically-operated clutch and the crankshaft. The FDA control is electro-hydraulic.

The hydraulic lift linkage is universal, with joystick control, based on axial-plunger adjustable pump of «Bosch-Rexroth» company, providing for the draft, position and combined adjustment of tillage depth, having a four-section distributor with electrohydraulic control and a possibility of programming the hydraulic system functions (EHS), electrohydraulic adjustor to control front and rear lift linkages. The hydraulic system has four pairs of independent outlets with one pair leading to the front lift linkage with a possibility to adjust the working liquid feed at each outlet.

The pump of the hydraulic system has a variable productivity, driven from the engine through a gear of PTO continuous drive.

Free drain is available in front of the tractor as well as behind it.

The rear lift linkage is a four-bar linkage of category 3 under ISO 730. There are two cylinders Ts110x250.

The front lift linkage is a three-point linkage of category 2 under ISO. There are two cylinders Ts90x250

Drawbar hitches of a lift type:

- towing yoke for coupling with semi-trailers and semi-trailed implements.
- towing bar for coupling with towed implements.

The cabin is a one-seated with a protective rigid framework, having thermal, noise and vibration insulation, with a system of heating, air-conditioning and ventilation, 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. 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 rated power supply voltage for on-board network is 12V and the rated voltage for the start-up is 12V.

Instruments are a combination of devices; these are an integrated indicator; pilot lamps (glow lamps and light emitting diodes), located on the block of pilot lamps, on the control panel of electronic block of complex electronic control system and on the combined electronic panel.

1.4 Vibration level at the operator's working place of the tractor “BELARUS-3522.5”

The vibration level at the operator's seat complies with the Council Directive 78/764/EEC. Values for the 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-3522.5”

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 marking

Metal nameplate is fixed at the rear of the cab on the right side, as shown in fig. 1.6.1.

Additionally the tractor serial number is applied by means of percussion on the right lateral surface of the beam.

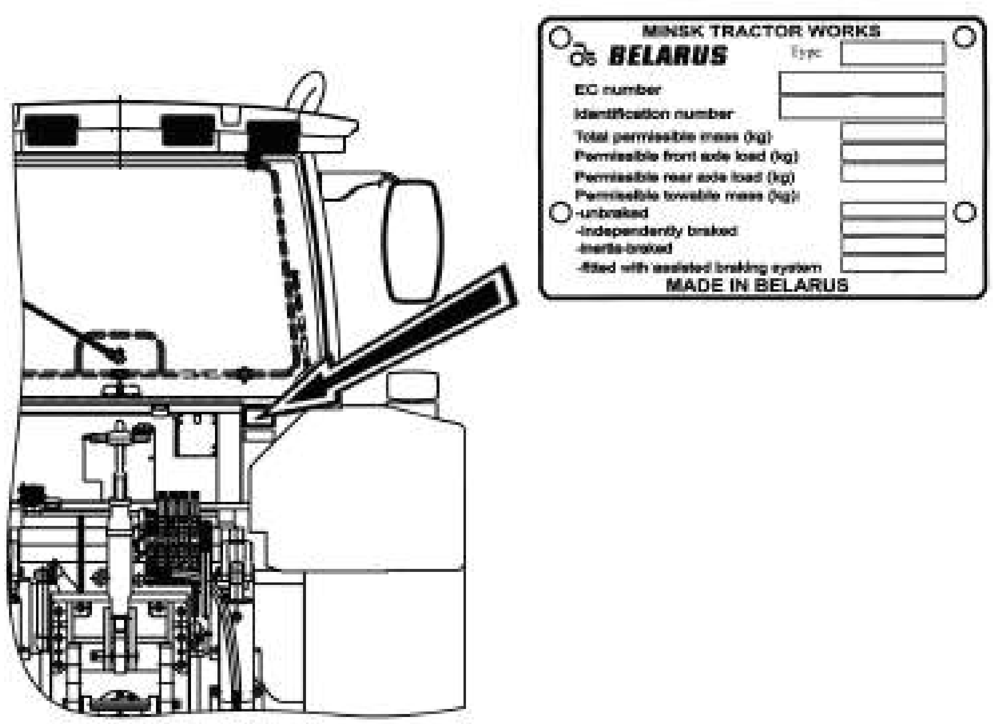


Figure 1.6.1 – Place of application the tractor nameplate

1.7 Packing

The tractor is dispatched to a consumer without packing.

2 Controls and instruments

2.1 Layout of controls and instruments of the tractor

Controls and instruments, located in the tractor cab, are presented in fig. 2.1.1.

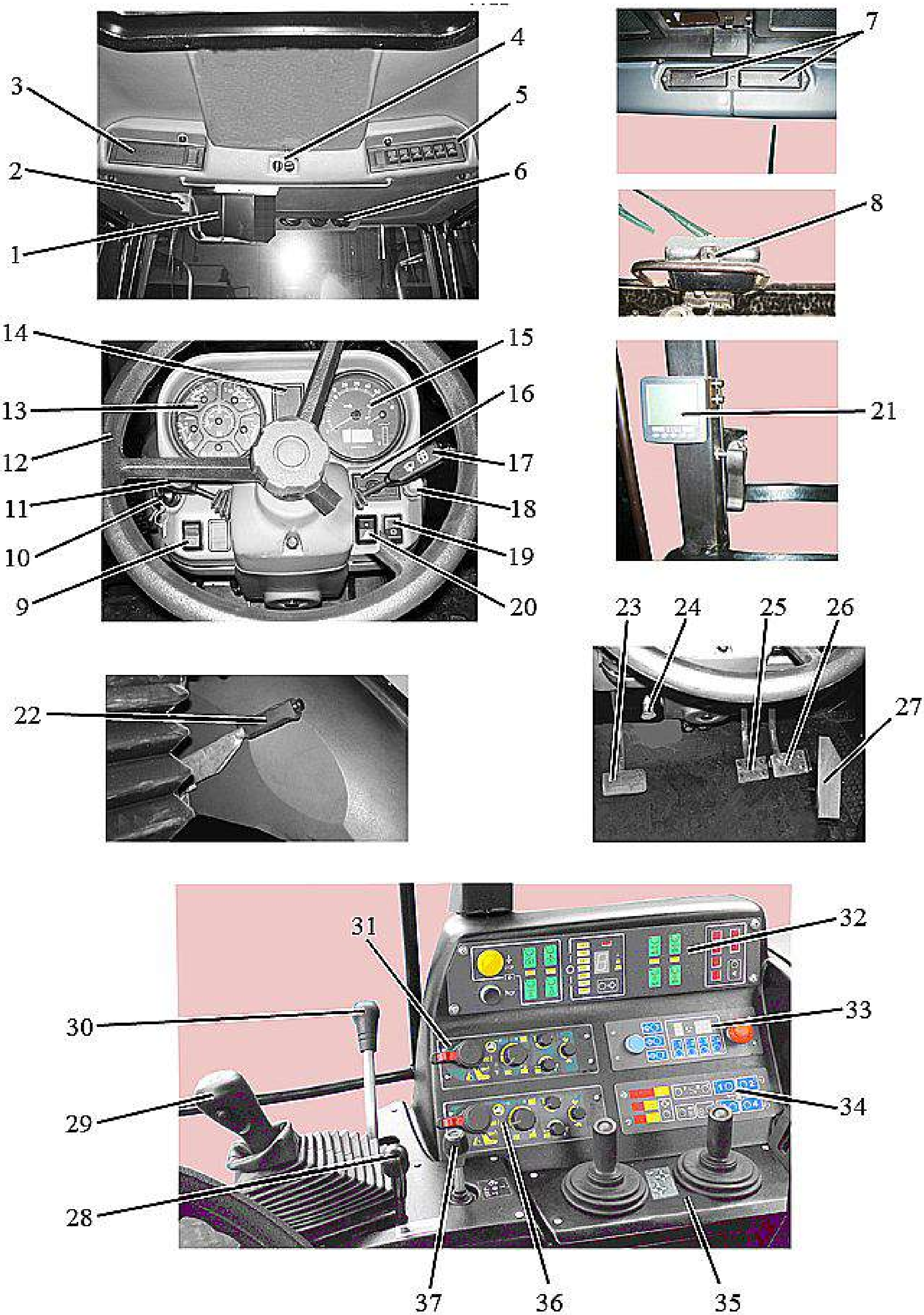


Figure 2.1.1 – Layout of controls and instruments of the tractor

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

1 – sun visor; 2 – cab light with switch; 3 – place for radio receiver (car stereo) installation; 4 – conditioner control panel; 5 – upper shield unit of button switches; 6 – deflectors; 7 – recirculation shutters; 8 – supplementary switch of rear screen wiper; 9 – accumulator battery remote disconnect switch; 10 – starter and instruments switch; 11 – left multifunctional underwheel switch; 12 – steering wheel; 13 – instrument board; 14 – pilot lamps unit; 15 – integrated indicator; 16 – integrated indicator control panel; 17 – right multifunctional underwheel switch; 18 – emergency flashing switch; 19 – central light switch; 20 – switch of front working lights mounted on front lights brackets; 21 – information display; 22 – parking brake control lever; 23 – clutch control pedal; 24 – handle for steering rake fixation; 25 – left brake control pedal; 26 – right brake control pedal; 27 – accelerator pedal; 28 – handle for fuel supply control; 29 – range shifting lever; 30 – reduction gear control unit; 31 – rear lift linkage control console; 32 – integrated electronic control system; 33 – module for programming rear lift linkage operations; 34 – combined electronic panel; 35 – electronic joystick unit; 36 – console of front lift linkage control; 37 – gear shifting joystick;

2.2 Switches of instrument board

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

Figure 2.2.1 – Switches of instrument board

The starter and instruments disconnect switch 1 (see fig. 2.2.1) has four positions:
- «0» – off;
- «I» – instruments; pilot lamps unit, inlet air preheater are on;
- «II» – starter is on (non-fixed position);
- «III» – radio set is on.

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

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

ATTENTION: IF WITH THE ENGINE WORKING THE KEY OF THE STARTER AND INSTRUMENTS SWITCH IS TURNED INTO POSITION “0” – THE ENGINE WILL BE STOPPED!

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

The left multifunctional underwheel switch 2 (fig 2.2.1) provides for activation of turn blinkers, switching between upper and lower beam of headlights, upper beam blinking, audible beep.

Turn blinkers are activated by moving a lever of the underwheel switch 2 from the middle position forward (“a” is a right turn) or backward (“б” is a left turn) as in fig. 2.2.3. As the tractor has made a turn the lever automatically returns to the initial position.

To switch on the road headlights set a central light switch 5 (fig. 2.2.1) into “III” position, as indicated below, and the lever of the underwheel switch into the middle position "в" – "lower beam" according to fig 2.2.3. "Upper beam" is switched on by pushing the switch lever against the stop (“г” position). The lever positions "lower beam" / "upper beam" are fixed.

When pulling the lever against the stop (“д” position, fig 2.2.3) from the position of the "lower beam" the lever is set into a non-fixed position activating the “upper beam”, called “upper beam blinking”, irrespective of the position of the central light switch.

The audible beep is activated by pressing the lever in axial direction (axis of the switching lever). The beep can be activated in any position of the switching lever.

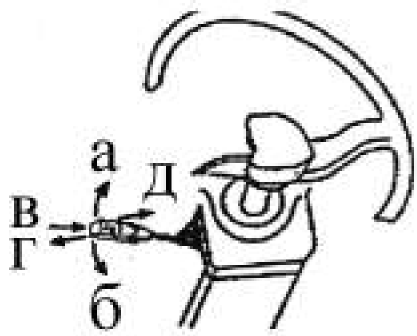


Fig 2.2.3 – Operational scheme of the left multifunctional underwheel switch

The right multifunctional underwheel switch 3 (fig.2.2.1) provides for activation of a dual-speed wiper and a washer of the windscreen.

The windscreen wiper is activated by means of moving the underwheel switch lever 3 (fig. 2.2.1) from "off" position (“0” position according to fig. 2.2.4) into “a” position (low speed) or (high speed). All positions are 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.

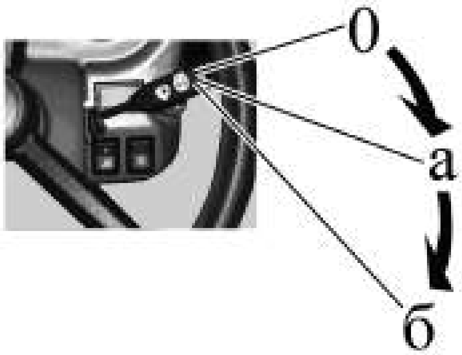


Figure 2.2.4 – Operational scheme of the right multifunctional underwheel switch

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

The 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 implement are on” (middle 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)

When pressing the button of front working lights 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.

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

It is possible to activate and deactivate the accumulator battery by means of manual accumulator battery switch. To activate and deactivate the accumulator battery it is necessary to press the manual AB cut-out button (non-fixed position).

2.3 Upper shield unit of button switches

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

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

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

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

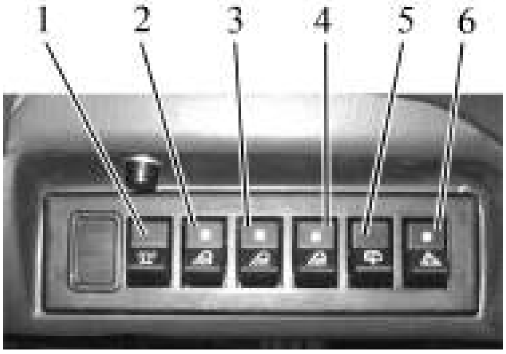
Pressing the cut-out button 5 activates the rear screen wiper or the wiper and the washer of the rear screen simultaneously.

The 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 wiper are on simultaneously – non-fixed.

During tractor operation on forward motion the cut-out switch 8 (fig. 2.1.1) shall be in “on” position (i.e. in upper position). Rules for rear screen wiper control when working on a reverse motion are given in subsection 2.23 “Reverse post controls” of this manual.

Pressing the 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).



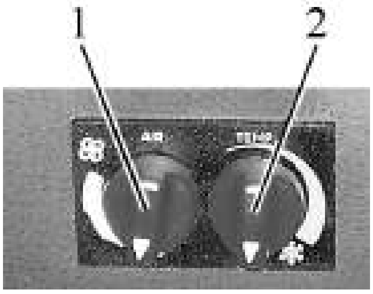
1 – flash beacon cut-out button; 2 – cut-out button of front working lights, mounted on the cab roof; 3 – cut-out button of rear inner working lights; 4 – cut-out button of rear outer working lights; 5 – cut-out button for rear screen wiper and washer; 6 – cut-out button of “Road-train” signal lights.

Figure 2.3.1 – Upper shield unit of button switches

2.4 Conditioner control

2.4.1 Conditioner control in conditioning mode

The 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 out from deflectors 6 (fig. 2.1.1) in the conditioning mode.

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

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

- o turn the cut-out switch 2 (figure 2.4.1) clockwise to 180° until a blue scale begins;
- o then turn the switch 1 to one of three marked positions (the fan rotor has three kinds of rotation speed). After 3-5 minutes adjust a required temperature in the cab with the switch 2;
- o it is possible to adjust a mixture of outer air and recirculation air with recirculation shutters 7 (figure 2.1.1) located on the upper panel;

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!

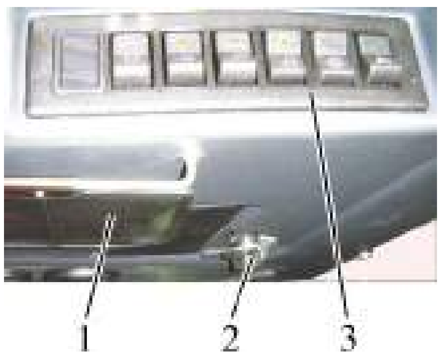
2.4.2 Conditioner control in a heating mode

ATTENTION: REFILLING THE ENGINE COOLING SYSTEM SHALL BE CARRIED OUT ONLY WITH LOW-FREEZING LIQUID SPECIFIED IN SUBSECTION 6.6 "REFILLING AND LUBRICATION OF A TRACTOR WITH LUBRICANTS”!

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 control valve with a handle 2 (figure 2.4.2), to do this turn the 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. Herewith the cooling fluid level in the cooling system radiator will decrease;
- refill the cooling fluid in the cooling system radiator through the filler of the expansion tank. Refill till the cooling fluid level in the expansion tank reaches 50…60 mm below the upper edge of the filler;
- to warm up the cab quickly switch on the heater fan and open recirculation shutters;

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



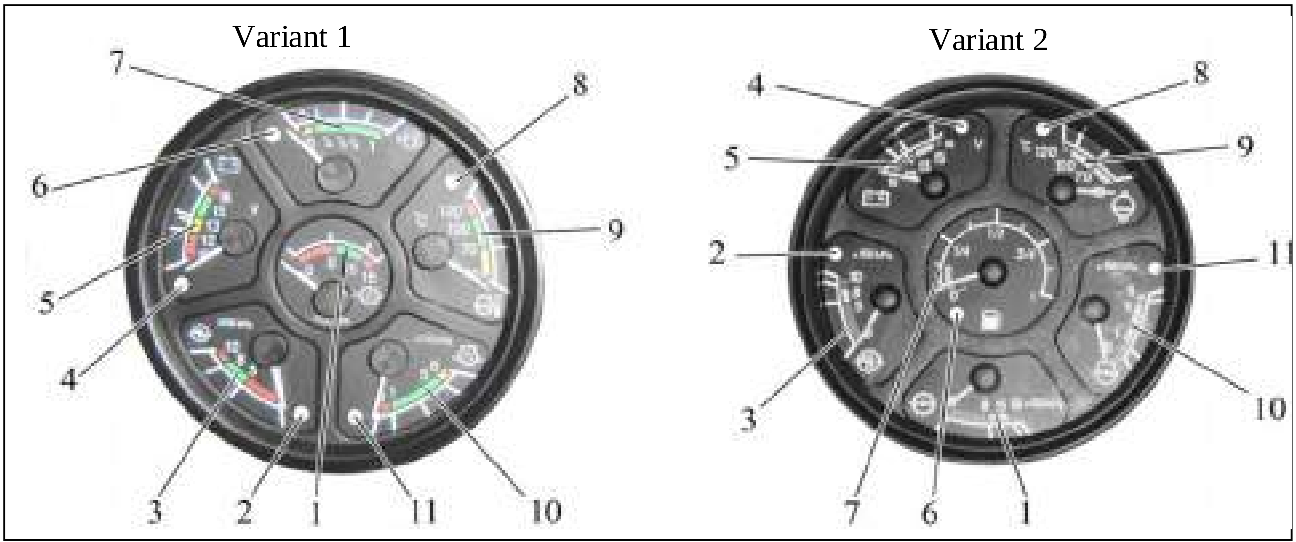
1 – sun visor, 2 – handle of heater control valve; 3 – upper shield unit of button switches.

Figure 2.4.2 – Installation of heater control valve

2.4.3 Cab ventilation

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

2.5 Instrument board



The instrument board 13 (figure 2.1.1) includes six gauges with five signal lamps as shown in figure 2.5.1.

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 voltage gauge; 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 2.5.1 – Instrument dashboard

2.5.1 The gauge of oil pressure in the transmission hydraulic system 1 (figure 2.5.1) indicates oil pressure in the hydraulic system of friction clutches control in tractor transmission.

The scale of oil pressure gauge has three zones:

- working — from 800 to 1500 kPa (green color);

ATTENTION: FOR TRACTOR “BELARUS-3522.5” THE WORKING ZONE IS CONSIDERED A SCALE SECTION FROM 1300 TO 1500 kPa. WITH MINIMUM STABLE ENGINE SPEED OIL PRESSURE IN THE TRANSMISSION HYDRAULIC SYSTEM SHALL BE NOT LESS THAN 1000 kPa!

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

ATTENTION: OPERATING TRACTOR WITH OIL PRESSURE IN THE TRANSMISSION BELOW 1300 KPA AT ENGINE SPEED NOT LESS THAN 1400 RPM IS FORBIDDEN!

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

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

A 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.

2.5.3 The voltage gauge 5 (figure 2.5.1) 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. A pilot lamp 4 is built in the scale of voltage gauge – on tractors "BELARUS-3522.5" it is not used.

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 – State of the power supply system

Zone on the voltage gauge scale 5 (figure 2.5.1), color	State 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 ABSENSE OF AB CHARGE, CHECK THE STATE AND TENSION OF THE GENERATOR DRIVE BELT!

2.5.4 The scale of the gauge indicating fuel volume in the tank 7 has three divisions "0-1/4-1/2-3/4-1". A 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)!

2.5.5 The gauge of engine coolant temperature 9 reads data from the engine control unit (ECU). The gauge scale has three zones:

- working – from 70 to 105 °C (green color);
- informational – from 40 to 70 °C (yellow color);
- emergency – from 105 to 120 °C (red color);

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

а) gets actuated and operates in a flashing mode with coolant values from 109 up to and including 112 °C.

б) glows in a continuous mode with coolant temperature values from 113 °C and higher.

2.5.6 The oil pressure gauge in the engine lubricating system 10 reads data from the engine control unit (ECU). The gauge scale has three zones:

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

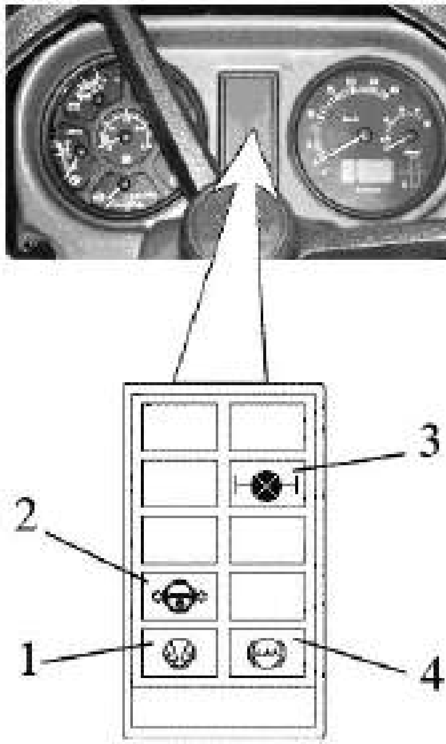
A signal lamp of emergency oil pressure drop 11 (red color) is built in the gauge scale, which lights up when the pressure drops below 100 kPa.

ATTENTION: WHEN THE COLD ENGINE IS STARTED THE PRESSURE CAN BE 600 kPa and HIGHER!

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

2.6 Pilot lamps unit

The pilot lamps unit 14 (figure 2.1.1) includes five lamps. The allocation scheme is presented in figure 2.6.1.



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; 4 – pilot lamp to indicate emergency brake fluid level (orange level).

Figure 2.6.1 – Pilot lamps unit

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

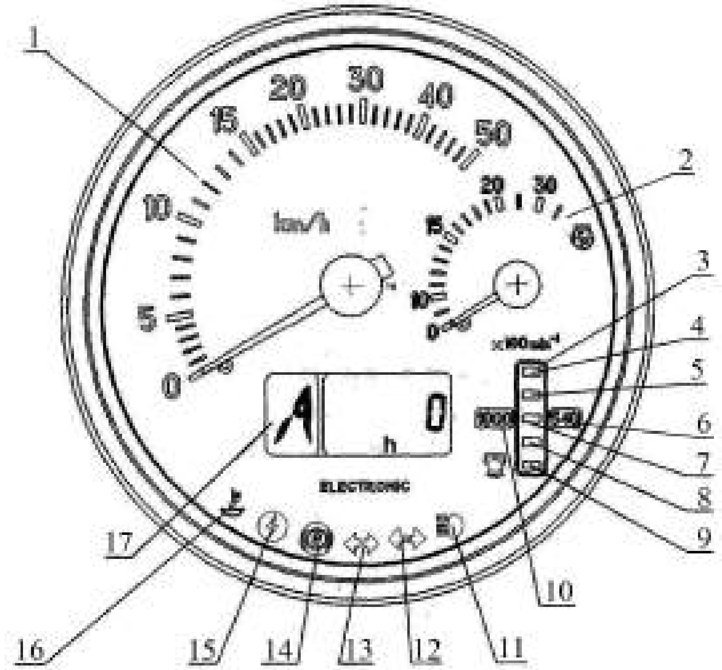
- pilot lamp to indicate that the air filter is clogged to the max. 1 (figure 2.6.1) lights up when the max. permissible level of filter dirtiness is exceeded and the filter requires cleaning;
- pilot lamp 2 to indicate emergency oil pressure drop in the system of hydrostatic power steering lights up 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 will go out);
- pilot lamp to indicate rear axle differential lock 3 lights up when activating rear axle differential lock;
- pilot lamp to indicate emergency brake fluid 4 lights up when brake fluid level in the tanks of master brake cylinders is below the permissible level.

2.7 Integrated indicator and integrated indicator control panel

2.7.1 General information

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

The II includes gauges and signal lamps as per figure 2.7.1.



1 – velocity gauge (needle indicator); 2 – engine speed gauge (needle indicator); 3 – rear PTO speed gauge (light indicator); 4, 9 – segments of rear PTO speed scale (yellow color); 5, 7, 8 – segments of rear PTO speed scale (green color); 6 – annunciator of “540 min^{-1}” of rear PTO speed scale range (yellow color); 10 – annunciator of “1000 min^{-1}” of rear PTO speed scale range (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 enhanced voltage in on-board system (red color); 16 – pilot lamp to indicate low level of coolant (yellow color); 17 – multifunction display.

Figure 2.7.1 – Integrated indicator

The II control panel is presented in figure 2.7.2.

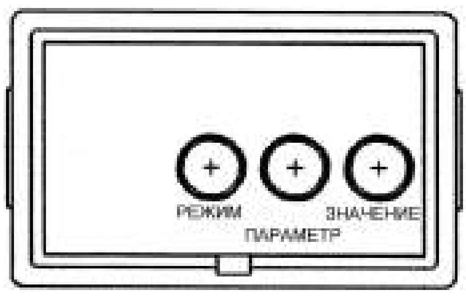


Figure 2.7.2 – The integrated indicator control panel

The control panel 16 (figure 2.1.1) allows to carry out manual programming with buttons «Параметр» (“Parameter”) and «Значение» (“Value”) (see figure 2.7.2), and also to change the mode of showing data entered on the multifunctional display with «Режим» (“Mode”) button.

Rules on use of the IICP in the mode of displaying operational parameters and failure messages on the multifunctional display are given below in subsection 2.7.2 “Assignment and operation principle of II indicators”.

Rules on use of IICP in the II programming mode are given in subsection 3.23.3 “Integrated Indicator programming order”.

2.7.2 Assignment and operation principle of Integrated Indicator pointers

2.7.2.1 Velocity gauge 1 (figure 2.7.1) indicates a design speed of the tractor on a needle indicator. The design speed exceeds the actual one, as tractor skidding is not taken into account.

The 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, turning 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 and speed sensors when the signals from them are missing are displayed in the multifunctional indicator as “0” digit, characterizing the fault location – to the right or to the left (see below).

2.7.2.2 The engine speed gauge 2 (figure 2.7.1) 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 readings are from 0 to 3500 (rpm).

2.7.2.3 Rear PTO speed gauge 3 (figure 2.7.1) displays the rear PTO speed on a light indicator.

The rear PTO speed gauge is actuated by signals coming from a pulse speed sensor, installed above the driven gear of the rear PTO reduction unit.

Upon engaging the rear PTO in the mode of “1000 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 (figure 2.7.1);
- 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 speed segments light up successively from bottom upward in the following order: 8 – 7 – 5 – 4;
- as the speed of the rear PTO shaft end extension goes up above 750 min^{-1} the annunciator 6 and segments 9,8,7,5,4 go out. Then the annunciator 10 and a lower segment 9 light up.
- as the speed further increases, together with the annunciator 10 the rear PTO speed 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 2.2.

Table 2.2 – Correspondence of parameters of the indicator 3 (figure 2.7.1) to the speed of the rear PTO end extension

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

[1] the annunciator of the range of “540 min^{-1}” 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 min^{-1}” 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 min^{-1}”of the rear PTO speed scale turns on.

The working order of the rear PTO speed indicator 6 when switching on a mode “1000min^{-1} economy» is the same as for the mode of “1000 min^{-1}”.

Note – A precise value of the rear PTO speed can be seen on the multifunctional display 17 (figure 2.7.1).

2.7.2.4 The multifunctional display 17 (figure 2.7.1) is a liquid-crystal display that shows information in two fields 1 and 2 simultaneously (figure 2.7.3).

1 – digital symbol of the gear engaged (digits from 0 to 6); 2 – current numeric value of one of tractor system parameters.

Figure 2.7.3 – Information fields of the multifunctional display

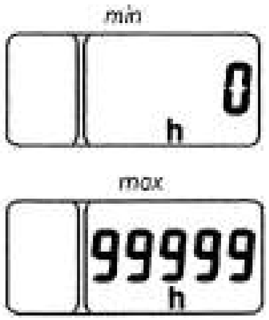
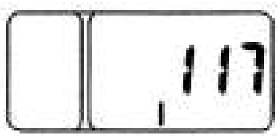
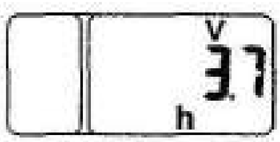
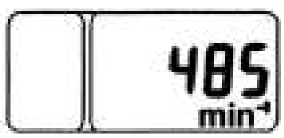
The multifunctional display receives information on the gear engaged from the transmission control unit in the complex electronic control system CECS. This parameter is displayed in the information field 1. In case the signal from CECS is missing (CECS fault, wire breakage, loss of electrical contact, etc.), letter “A” is displayed in the information field 1.

The following parameters are displayed in the information field 1 (figure 2.7.3):
- total elapsed engine time;
- instant fuel flow;
- on-board voltage;
- remaining fuel volume;
- time of running with remaining fuel;
- rear PTO speed;
- testing workability of speed sensors;
- testing workability of frequency fuel volume sensor (FFVS);
- testing workability and connection of CAN-bus 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 are effected with “Mode” button of the control panel (figure 2.7.2).

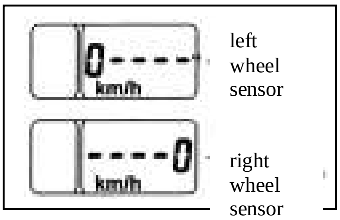
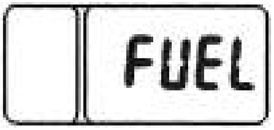
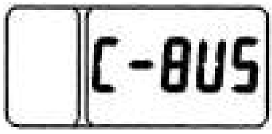
Samples of displaying operating parameters of the tractor on the multifunctional display and their short description are given in table 2.3.

Table 2.3 – Samples of displaying operating parameters of the tractor on the multifunctional display

Parameter	Sample of displaying parameter on the multi-functional 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.
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 a 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, min^{-1}		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.

Samples of displaying fault messages on the multifunctional display and a short description of the tractor fault displayed are given in table 2.4.

Table 2.4 – Samples of displaying messages on tractor faults on the multifunctional display

Parameter tested	Sample of fault displaying on the Integrated Indicator	Fault description
Testing workability and connection of speed sensors		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 speed sensor (left or right) or breakage in the circuit of the given sensor.
Testing workability of the frequency fuel volume sensor		If there is no signal coming from the frequency fuel volume sensor for two sec. a message “FUEL” is displayed on the screen
Testing workability and connection of CAN-bus to the Integrated Indicator with CAN-interface		If there are no signals through CAN-bus of the integrated indicator a message “C-BUS” appears on the multi-functional display.

If the signal coming from the engine control unit is missing the respective indication modes are switched off automatically and the message C-BUS appears in the information field 2 of the multifunction display (figure 2.7.3).

Each of the abovestated fault messages is displayed in priority on the information field 2 of the multifunctional display irrespective of the information currently displayed. With sequential pushing the “Mode” button of the integrated indicator control module the messages shall be listed in turn. After the last message has been viewed and the “Mode” button has been repeatedly pressed the multifunctional 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 powered-on the multifunctional display shows information in the indication mode which has been chosen before the moment of powering the integrated indicator.

2.7.3 Pilot lamps of the integrated indicator

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

- pilot lamp to indicate switching on the road lights upper beam 11 (figure 2.7.1) lights up when switching on the upper beam;
- indicators of tractor turns and trailer turns 13 and 12 operate in a flashing mode when actuated with the underwheel multifunctional switch 2 (figure 2.2.1) or when the emergency button 4 is pushed in;
- pilot lamp to indicate the parking brake is enabled 14 (figure 2.7.1) operates in a 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 16 get activated when the coolant level falls below the allowable threshold.

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 LAMS ARE ACTIVATED AND DEACTIVATED SYNCHRONOUSLY WITH CHANGING THE STATE OF SYSTEM SENSORS!

2.7.4 Description of testing performance of the integrated indicator

Each time the power supply is on, performance testing of needle pointers and scale elements of the rear PTO indicator is carried out in the integrated indicator. Herewith the indicator needle pointers move away from zero marks for one second (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 2.7.1) as well as all segments of the rear PTO scale.

2.8 Information display

2.8.1 General information

The information display 21 (figure 2.1.1) is designed to display engine actual parameters and indication of the engine electronic control system (EECS) faults, including the system of selective catalytic reduction.

When the key of starter and instrument switch is set into “I” position (the instruments are on) (figure 2.2.2) 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 errors in the EECS operation, the information display functions in a working mode – it displays actual parameters of engine and SCR operation.

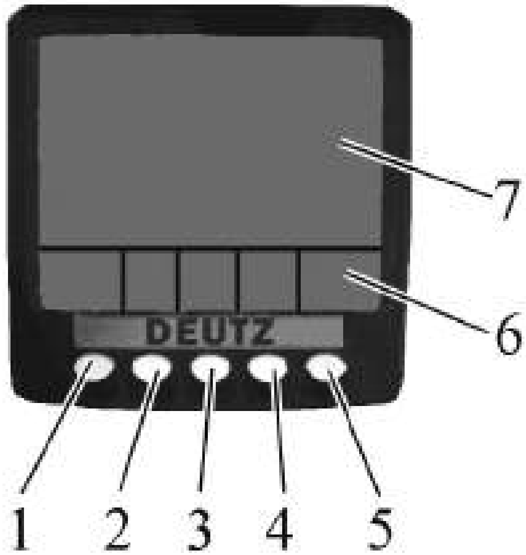
When the error is defined, the information display produces an acoustic signal and a rhombic flashing window with an exclamation marks appears on the screen, also a fault testing annunciator lights up or flashes on the engine control panel 34 (figure 2.1.1). After pushing any of five buttons of the information display a brief description of identified errors appears on the screen (error code identification and its description). Interpretation of error codes as well as recommended actions to be taken to eliminate the identified faults are given in the engine operation book attached to your tractor.

ATTENTION: THE ERRORS IDENTIFIED ARE TO BE ELIMINATED! TO ELIMATE THE ERRORS CONTACT YOUR DEALER!

2.8.2 Adjustment of brightness and sharpness of the information display

To enter the mode of adjustment of screen brightness and sharpness 7 (figure 2.8.2) press button 5. In the screen lower part images of buttons are given. 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 simultaneously adjusts to an average value of sharpness and max. brightness. Repeated pressing button 5 exits the mode of brightness and sharpness adjustment.

2.8.3 Activation of changeable images and parameters on the screen of the information display



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

Figure 2.8.1 – Information display

The monitor buttons 1, 2, 3, 4, 5 (figure 2.8.1) are of multifunctional purpose. When pushing any of the buttons 2, 3, 4 during the monitor operation, an image of the button panel 6 appears on the screen, the icons denoting the current functions of each button.

After the button panel 6 has been activated, pressing the button 1 on the monitor activates the main three-segment image on the screen. Hereby an engine speed scale is displayed in the upper left corner, and a scale of oil pressure in the engine lubrication system 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 displayed the inducible parameters are chosen between with the button 1. To exit the mode of choosing between the inducible parameters in the upper right corner it is required to press button 5 after activation the button panel 6. After that the parameters are chosen between with the buttons 1 and 2.

After the button panel 6 has been activated a four-segment imaging of parameters on the screen 7 is activated with the button 2. After the first pressing the button 2 four parameters are displayed in a 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 the button 2 for the second and the third time, four parameters are displayed on the screen in an analog from.

Using the mode of choosing between inducible parameters the customer can activate, if necessary, displaying of various engine parameters on the screen as per table 2.5. The mode of parameter choosing is activated after activation of the button panel with short-time pressing the button 5. Sequential pressing the button 1 changes the parameters displayed in the upper left corner, pressing the 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 the button 5.

As the button panel has been activated pressing the button 3 activates graphical displaying of parameters in the course of time (functions as parameter analogue recorder).

The required parameters are chosen with a sequential pressing the button 3 as per table 2.5.

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 the button 5 for more than 3 sec., after that enter PIN-code. After the PIN-code has been entered 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 AUTHORISED TO ENTER PIN-CODE AND CHANGE SETTINGS OF CONFIGURATION MENU!

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

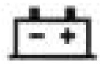
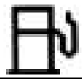
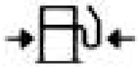
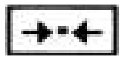
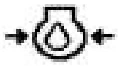
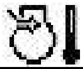
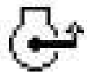
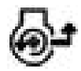
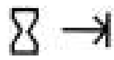
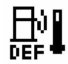
After the button panel has been activated a list of active errors (faults) is invoked with the button 4. Moving over the list is carried out with the button 1 and 2. The errors, the reception of which has not yet been confirmed, are printed in grey buttons on a black background.

To exit displaying of the lift of active errors it is necessary to confirm reception of all errors by pressing the button 3. After that confirmation errors are printed in black buttons on a grey background.

After the fault has been eliminated active errors pass automatically to the lift of inactive errors.

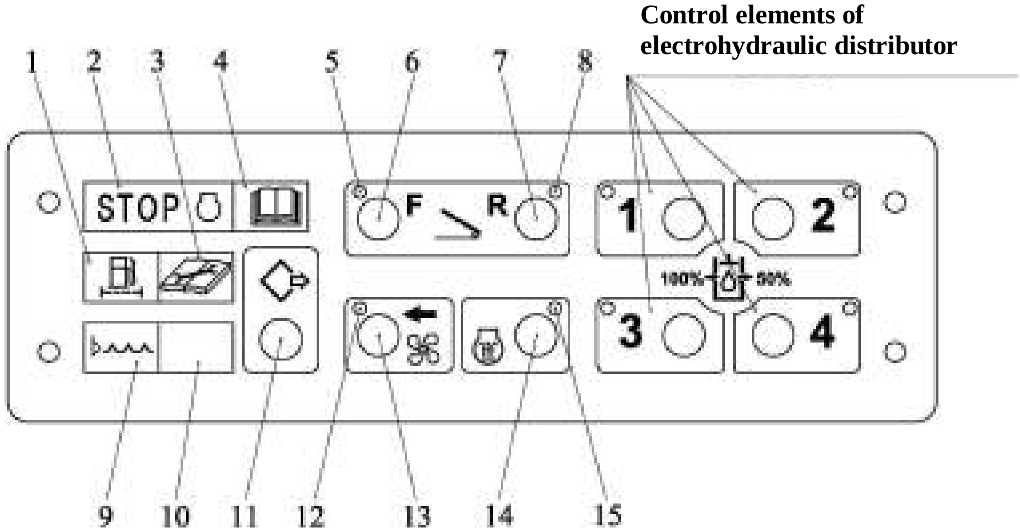
The list of inactive errors is activated with pressing and holding the button 4. The engine electronic control unit provides a possibility to delete the information on stored errors, it is possible to erase them when they are on the screen, to do this it is required to press and hold the button 3.

Table 2.5 – 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 terminals of the accumulator battery, measured by the engine electronic control unit, V	✓	✓	
Fuel flow	✓	✓	
Oil supply pressure	✓	✓	
Barometric pressure	✓		
Charging pressure	✓	✓	
Oil pressure in the engine	✓	✓	
Temperature of coolant in the engine	✓	✓	
Inlet air temperature	✓	✓	
Accelerator position, %	✓		
Level of coolant in the engine, %	✓		
Engine turning torque, input by the operator, %	✓		
Actual turning torque, %	✓		
Using of turning torque according to turning speed, %	✓		
Engine shaft turning speed, min^{-1}	✓	✓	
Engine total operation time, hours	✓		
Level of AdBlue agent in the tank, %	✓		
Temperature of AdBlue agent in the tank	✓		
Temperature of exhaust gases before SCR	✓		

2.9 Integrated electronic panel

2.9.1 Assignment of IEP



1 – annunciator of water presence in the fuel filter; 2 – annunciator of emergency oil pressure in the engine; 3 – maintenance annunciator; 4 – annunciator of fault testing; 5 – annunciator of activation an electronic foot fuel-feed pedal on forward motion; 6 – button to activate the electronic foot fuel-feed pedal on forward motion; 7 – button to activate an electronic foot fuel-feed pedal on reverse motion; 8 – annunciator of activation an electronic foot fuel-feed pedal on reverse motion; 9 – annunciator of emergency temperature and level of coolant; 10 – indicator of inlet air heating; 11 – button to activate testing; 12 – annunciator of activation of fan reverse rotation; 13 – button to activate fan reverse rotation; 14 – button to activate coolant warmer; 15 – annunciator of coolant warmer activation.

Figure 2.9.1 – Integrated electronic panel

Annunciator of water presence in the fuel filter 1 (figure 2.9.1) lights up when concentration of water in coarse fuel filter exceeds the allowable threshold. In case the annunciator 1 goes off it is required to drain sediment from the coarse filter.

Annunciator of emergency oil pressure in the engine 2 lights up when oil pressure in the engine drops below the allowable threshold.

If the annunciator 2 is on with the engine running, immediately stop the engine and eliminate the fault!

With buttons 6 and 7 foot fuel-feed pedal either on forward or on reverse motion is chosen. The pedal chosen is remembered and upon the next power supply switch the latest state will be chosen. Information on the pedal chosen is displayed on the annunciators 5 and 8.

Annunciator of emergency temperature or level of coolant 9 (figure 2.9.1) lights up when the coolant temperature goes up above the allowable threshold or the coolant level drops below the allowable threshold.

Indicator of inlet air heating indicates performance of inlet air heater (algorithm of functioning of the inlet air heater indicator 10 is given in subsection 3.23.2 “Operation principle of inlet air heater”).

Button to activate testing 11 is designed to invoke active errors from the memory of the engine electronic control unit by means of light codes, displayed by the annunciator of fault testing 4. This testing method is alternative to the information monitor 21 (figure 2.1.1). Refer to the engine operation manual, attached to the tractor, concerning read-out and decoding of error light codes and concerning recommended actions to be taken to eliminate faults. The identified faults are to be eliminated. To have the faults eliminated contact your dealer.

Buttons and annunciators 3, 12, 13, 14, 15 (figure 2.9.1) relating to warning of time for maintenance, control of fan reverse rotation and control of coolant heater do not currently function on IEP and stay reserve.

With short pressing any button sound annunciator goes off.

Note – Rules on using control elements of electrohydraulic distributor EHS are given in subsection 2.16.4 “Flow restriction”.

2.9.2 Description of IEP performance check

With each power-up the IEP carries out check of annunciators performance. Herewith all LED-annunciators and indicators are on for about two seconds and the acoustic signal goes off. Then the LED-annunciators and the acoustic signal turn into the operation mode – only the annunciator 5 or 8 (depending on the selected fuel delivery pedal) is on, the acoustic signal goes out.

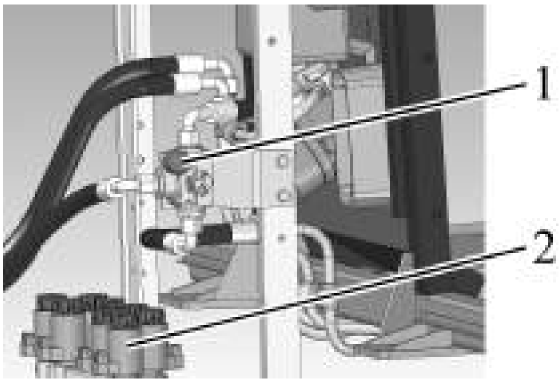
Note: The IEP without check of functioning of LED-annunciators 5, 8, 12, 15 as well annunciators indicating flow restriction of the electohydraulic distributor EHS can be installed in “BELARUS-3522.5” tractors.

2.10 Steering

2.10.1 General information

“BELARUS-3522.5” 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 application of great effort on the steering wheel in order to turn the tractor.

2.10.2 Reverse valve switch



1 – handle to control the reverse valve; 2 – electrohydraulic distributor of transmission hydraulic system.

Figure 2.10.1 – reverse valve switch

In HSC hydraulic system of “BELARUS-3522.5” tractors a reverse valve is installed which switches delivery of operating fluid from the feed pump to the dosing pump of forward motion or to the dosing pump of reverse motion.

The reverse valve is mounted to the left under the hood at driver's cab on the left post of hood fixation bracket.

The reverse valve is controlled by shifting the handle 1 (figure 2.10.1) into one of two positions until it gets fixed in one of them:

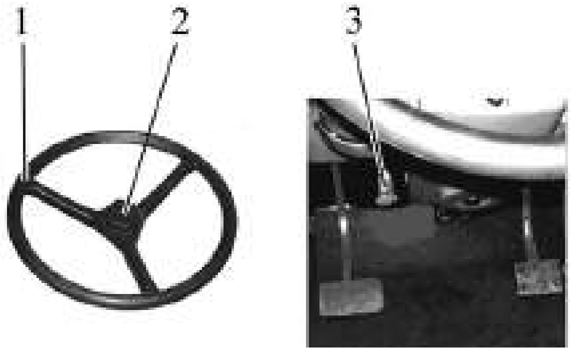
- to control the tractor during movement in the “forward motion” mode the valve control handle 1 shall be moved up until fixed;
- to control the tractor during movement in the “reverse motion” mode the valve control handle 1 shall be moved down until fixed.

Note – Figure 2.10.1 indicates the position of the handle to control the reverse valve in the mode of “reverse motion”.

ATTENTION: BEFORE STARTING THE ENGINE IT IS NECESSARY TO MAKE SURE THAT THE HANDLE CONTROLLING THE REVERSE VALVE IS SET INTO POSITION REQUIRED FOR THE DESIRED MODE OF TRACTOR MOVEMENT!

ATTENTION: TO PROVIDE FOR OPERATION OF STEERING CONTROL IN A DESIRED DIRECTION OF TRACTOR MOVEMENT THE REVERSE VALVE SHALL BE SWITCHED ONLY WITH THE ENGINE STOPPED IN ORDER TO PREVENT DAMAGE TO HSC FEED PUMP OR RUPTURE OF HIGH PRESSURE HOSES AND OIL PIPELINES!

2.10.3 Steering wheel adjustments



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

Figure 2.10.2 – Steering wheel adjustment

The steering wheel has the following adjustments:

- horizon tilt angle adjustment;
- height adjustment, along steering shaft axis.

To change height positioning of the steering wheel proceed as follows:

- unscrew the chuck 2 (figure 2.10.2) by 3-5 revolutions;
- set the wheel 1 to a position comfortable for work;
- screw in the chuck 2 with max. possible force of hand fingers.

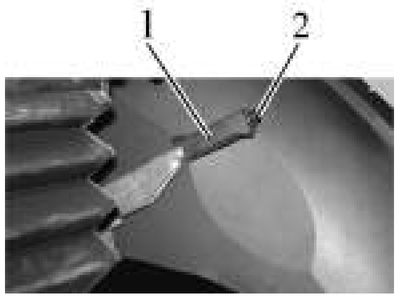
The range of the steering wheel height adjustment is 100 mm, stepless.

To change the steering column tilt angle do the following:
- pull the handle 3.
- tilt the steering column to reach the position comfortable for work and releasing the 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.

ATTENTION: HAVING FIXED THE STEERING COLUMN IN THE EXTREME FRONT POSITION SET THE GEAR SWITCH LEVER OF THE GEARBOX TO A NEUTRAL POSITION, DISENGAGE GEARS OF THE GEARBOX (SET "0" GEAR), START THE ENGINE AND WITH THE TRACTOR NOT MOVING MAKE SURE THE STEERING CONTROL OPERATES WELL!

2.11 Parking brake control



1 – parking brake control lever; 2 – button.

Figure 2.11.1 – Parking brake control

Upper position of the lever 1 (figure 2.11.1) – parking brake "On";
Lower position of the lever 1 – "Off".
To disengage the parking brake push the button 2 on the lever 1 and move the lever down against the stop.

2.12 Pedals and handle for fuel feed manual control

2.12.1 Pressing the pedal 23 (figure 2.1.1) disengages the clutch.

2.12.2 Pressing the pedal 25 (figure 2.1.1) brakes the rear left wheel.

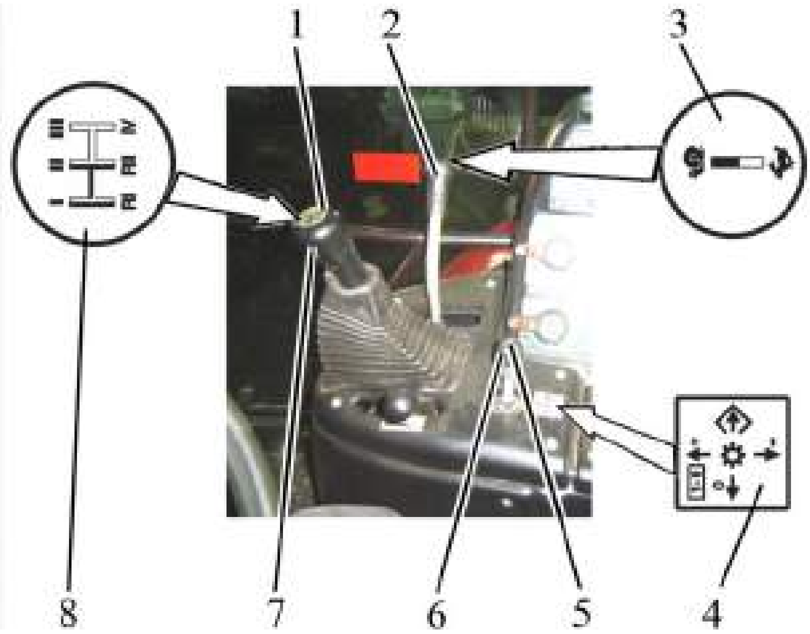
2.12.3 Pressing the pedal 26 (figure 2.1.1) brakes the rear right wheel. A joint plate of the brake pedals is intended for simultaneous braking with the right and left brakes.

2.12.4 Pressing the pedal 27 (figure 2.1.1) increases the engine speed.

2.12.5 When the handle 28 is moved to the extreme front position, fuel is fed to the max, when the handle is moved to the extreme rear position – fuel is fed in accordance with minimum idle speed.

2.13 Switching of ranges and gears of gearbox, creeper control, CECS

2.13.1 Switching of gearbox ranges



1 – lever to switch gearbox ranges; 2 – lever to control the creeper; 3 – diagram of the creeper control; 4 – diagram of gear switching; 5 – button of gear switching joystick; 6 – gear switching joystick; 7 – button to activate “Braking” mode; 8 – diagram to switch between gearbox ranges.

Figure 2.13.1 – Gearbox control

Note – button of gear shifting joystick 5 (figure 2.13.1) is not used on tractors “BELARUS-3522.5”.

Before starting movement first it is necessary to engage a desired gearbox range using the lever to switch gearbox ranges 1 (figure 2.13.1), having preliminary engaged the “Braking” mode of the gearbox (GB). The “Braking” mode is activated under the following conditions:

- the operator presses the button 7 on the handle to switch between gearbox ranges and keeps it pressed;
- the lever to switch gearbox ranges 1 is in neutral position (CECS receives signals from the neutral sensor of the range reduction unit and from the sensor of the transport (IV) range);
- the clutch is disengaged (CECS receives signal from the sensor of disengaged clutch).

The “braking” mode of the gearbox is engaged only when a symbol “P” (“Braking” is on) is displayed on the 7 (figure 2.13.4) located on CECS and corresponding segments of the first and sixth gear engagement of the annunciator 6 are on in a continuous mode. Each lighted segment of the symbol ”P” means fulfillment of any of conditions for activation of “GB braking” mode, specified above. If one of the segments of the symbol “P” does not light, then it means that there is no signal from one of the sensors as per diagram, given in fig. 2.13.2. In case faults in electrical circuit of the first and sixth gears are detected the corresponding segments of the annunciator 6 display a respective code (see clause 2.13.5.8).

Faults detected during engagement of the “Braking” mode shall be eliminated.

ATTENTION: ENGAGE RANGES ONLY AFTER THE “BRAKING” MODE HAS BEEN ACTIVATED! THE RANGES ARE SWITCHED THROUGH NEUTRAL POSITION WITH ACTIVATION OF THE “BRAKING” MODE OF THE GEARBOX!

ATTENTION: ENGAGE RANGES ONLY WITH THE TRACTOR STOPPED AND THE CLUTCH PEDAL FULLY DEPESSED!

IT IS FORBIDDEN TO SWITCH BETWEEN RANGES AS THE TRACTOR MOVES!

ATTENTION: RANGES OF THE REDUCTION UNIT ARE SWITCHED TO NEUTRAL POSITION AFTER THE GEARBOX HAS BEEN SET TO “0” GEAR!

Note – Places of location of the sensor of the range reduction unit neutral position, of the sensor of transport range (IV) and of the sensor of disengaged clutch (at forward travel and reverse) are provided in subsection 3.5 “Electrical part of gearbox control”.

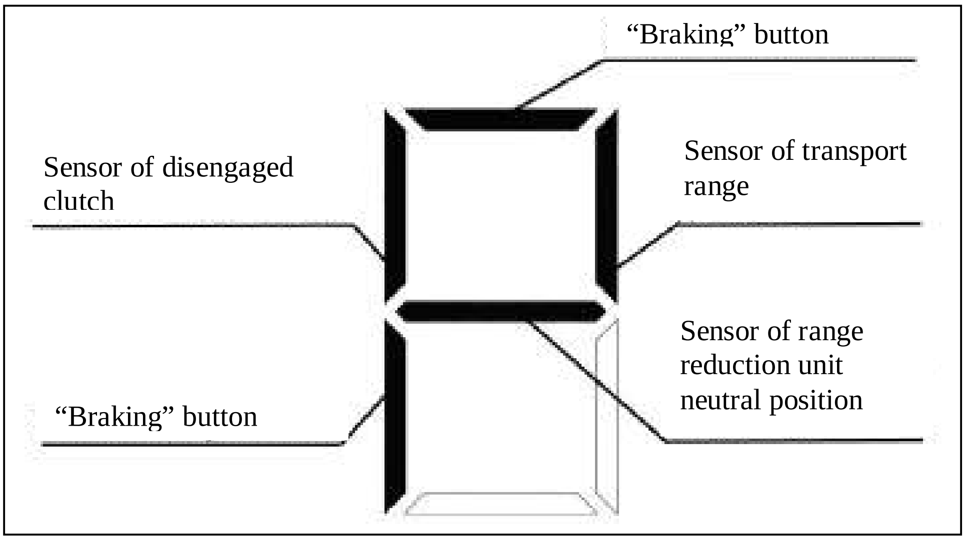


Figure 2.13.2 – Diagram of indication of sensors and button operation when the “Braking” mode is activated on a digital indicator.

2.13.2 Shifting of gears inside gearbox

Gears are shifted by means of a joystick 6 (figure 2.13.1). The engaged gear is indicated by “0” gear annunciator 28 (figure 2.13.4) and respective segments of the annunciator 6 and also by a digital indicator 7, all of them are installed in CECS.

In initial position when the operator sets the starter and instruments switch into position “”I” - the instruments are on”; all gears are disengaged. On CECS front panel “0” gear annunciator 28 is lighted, also “0” digit is displayed on the digital indicator 7. This testifies that supply voltage comes into the system of gear switching and the system does not output a pilot signal to any of electromagnets of gearshift electrohydraulic valves. After the engine has been started transmission hydraulic system pump is activated. “0” gear indication remains.

To start movement, before choosing a required gear, it is necessary to engage the selected range of the gearbox by means of the range shifting lever 1 (figure 2.13.1), having preliminary activated the “braking” mode, as specified in subsection 2.13.1 “Switching of gearbox ranges”.

After the desired range has been engaged, gears are shifted without power flow interruption by means of the joystick 6, except when exiting the condition “Gears are disengaged”. On forward travel exiting the condition “Gears are disengaged” (“0” gear) is allowed only with the clutch pedal depressed against the stop (the sensor of disengaged clutch on forward travel goes off), and on reverse travel – with the reverse post clutch pedal depressed against the stop (the sensor of disengaged clutch on reverse travel goes off). Sequential pressing the joystick handle against the stop forward ensures sequential gear shifting in direction of increasing (each pressing forward against the stop – plus one gear). Sequential pressing the joystick handle against the stop backward ensures sequential gear shifting in direction of decreasing (each pressing backward against the stop – minus one gear). Quick shifting from any gear to the position “Gears are disengaged” (“0” gear) is carried out by moving the joystick 6 to the left against the stop. Moving the handle of the joystick 6 to the right against the stop and holding it in this position for more than two seconds ensures “remembering” of the gear selected. Repeated pushing the handle of the joystick 6 to the right against the stop with the clutch fully depressed calls-up the “remembered” gear (for example, this allows to engage the remembered gear directly from the condition of “0” gear). Operation principle of indication of the selected gear is given in subsection 2.13.4 “CECS”.

ATTENTION: GEAR SHIFTING WITHIN ONE RANGE IS ALLOWED ON MOVING TRACTOR WITHOUT DEPRESSING THE CLUTCH PEDAL!

2.13.3 Creeper control

To switch on the creeper do the following:

a) depress the clutch pedal;

b) stop the tractor;

c) set the gearbox to “0” gear;

d) set the range switching lever 1 (figure 2.13.1) to neutral position;

e) holding the button of the “Braking” mode activation depressed, set the creeper control lever 2 into position “Snail” (forward along tractor movement);

f) engage a desired gearbox range, and then a desired gear, as specified in subsections 2.13.1 “Shifting of gearbox ranges” and 2.13.2 “Shifting of gears inside gearbox”.

To switch off the creeper do the abovestated operations a), b), c), d). Then holding the button of the gearbox “Braking” mode depressed set the creeper control lever 2 into position “Hare” (backward along tractor movement), after that engage a desired gearbox range and a desired gear.

Ranges and gears within the gearbox are shifted with the creeper switched on in accordance with instructions of the subsections 2.13.1 and 2.13.2!

ATTENTION: SWITCH ON THE CREEPER ONLY WITH THE TRACTOR STOPPED AND THE CLUTCH PEDAL FULLY DEPRESSED! IT IS FORBIDDEN TO ACTIVATE THE CREEPER AS THE TRACTOR MOVES!

ATTENTION! WHEN THE CREEPER IS ACTIVATED, GEARBOX RANGES “III” AND “IV” ARE LOCKED, THUS OPERATION WITH THE CREEPER ON IS POSSIBLE ONLY AT “I” AND “II” RANGES OF FORWARD AND REVERSE MOTION!

2.13.4 Tractor velocity diagram

Velocity diagram for “BELARUS-3522.5” tractor with tyres 650/75R42 is presented in figure 2.13.3.

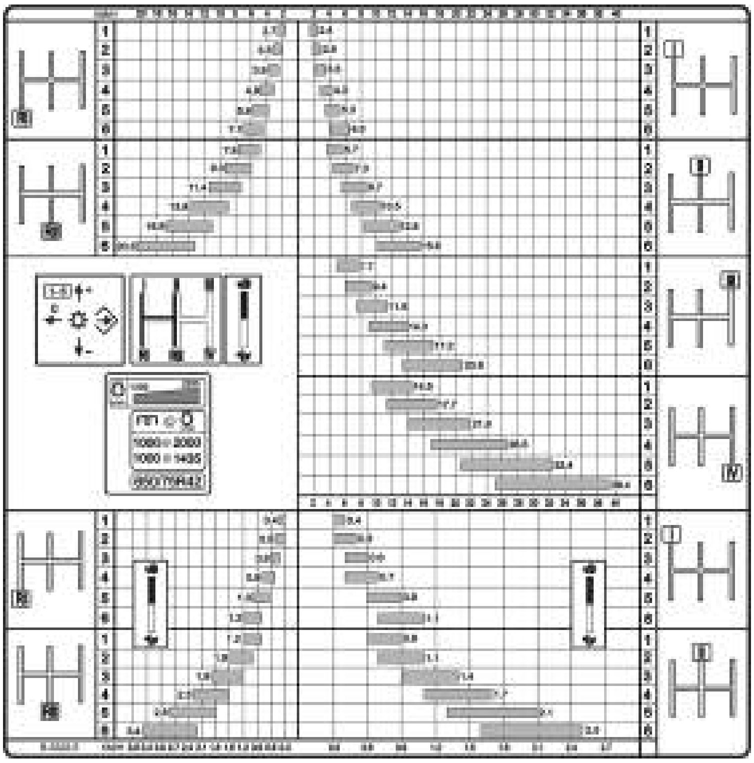


Figure 2.13.3 – Velocity diagram for “BELARUS-3522.5” tractor with tyres 650/75R42

Velocity diagram for “BELARUS-3522.5” tractor with tyres 710/70R42 is presented in figure 2.13.3a.

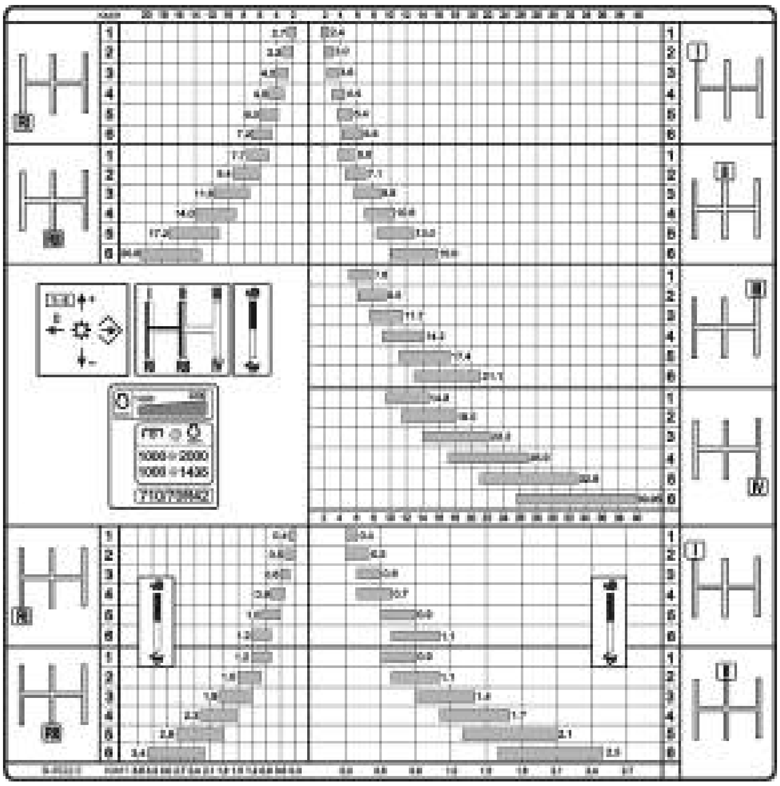


Figure 2.13.3a – Velocity diagram for “BELARUS-3522.5” tractor with tyres 710/70R42

2.13.5 Complex electronic control system

2.13.5.1 General information on assignment of complex electronic control system

The complex electronic control system (CECS) on "BELARUS-3522.5" tractors is intended to perform the following functions:

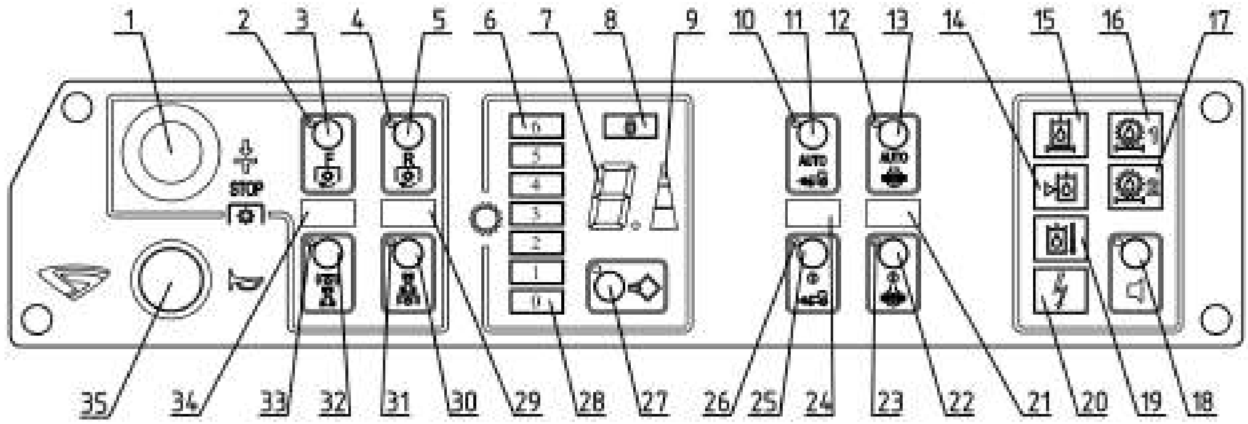
- indication of the gear engaged;
- control of gearshifting mode;
- rear PTO control;
- front PTO control;
- FDA drive control;
- rear axle differential lock control;
- warning indication of fault condition of transmission hydraulic system and HLL, testing emergency voltage in on-board system;
- failure testing of electronic systems controlling RPTO, FPTO, FDAD, rear axle DL, gearshifting;

Allocation of control elements, indicators and CECS annunciators is given in figure 2.13.4.

Confirmation of sending request for drive operation modes by buttons is accompanied by a short acoustic signal.

Switching on parking lights decreases lighting brightness of CECS indicators and annunciators.

ATTENTION: PILOT ANNUNCIATING LAMPS ARE ON AND OFF SYNCHRONOUSLY WITH CHANGES IN STATE OF SYSTEM SENSORS!



1 – FPTO and RPTO emergency-stop button; 2 – FPTO engagement annunciator; 3 – FPTO engagement button; 4 – RPTO engagement annunciator; 5 – RPTO engagement button; 6 – annunciators of gear engagement (first to sixth); 7 – digital indicator; 8 – annunciator of gearbox emergency operation state; 9 – indicator of gear shifting mode; 10 – annunciator of engagement of front driving axle drive (FDAD) automatic mode; 11 – button of engagement of front driving axle drive (FDAD) automatic mode; 12 – annunciator of engagement of rear axle differential lock (RADL) automatic mode; 13 – button of engagement of RADL automatic mode; 14 – annunciator of emergency oil level in hydraulic lift linkage (HLL); 15 – annunciator of HLL pump filter impurity and emergency temperature of oil in HLL pump; 16 – annunciator of impurity of duplex filter in transmission hydraulic system; 17 – backup annunciator; 18 – button to switch off the acoustic annunciator (buzzer); 19 – annunciator of oil emergency temperature in HLL tank; 20 – annunciator of CECS emergency feed voltage; 21 – annunciator of RADL engaged condition; 22 – button to engage RADL positive mode; 23 – annunciator of RADL positive mode engagement; 24 – annunciator of FDAD engaged condition; 25 – button to engage FDAD positive mode; 26 – annunciator of FDAD positive mode engagement; 27 – button to select mode of gearshifting; 28 – annunciator of zero gear ("0" gear); 29 – annunciator of RPTO engaged condition; 30 – button to disengage RPTO; 31 – annunciator of RPTO disengagement; 32 – button of FPTO disengagement; 33 – annunciator of FPTO disengagement; 34 – annunciator of FPTO engaged condition; 35 – button to activate acoustic signal.

Figure 2.13.4 – Complex electronic control system

2.13.5.2 Indication of the engaged gear and gear switching mode control

In initial condition, when the operator shifts the starter and instrument switch into position ""I – instruments are on", a middle mode of gear shifting is set by default – two upper segments light up on the indicator 9 (figure 2.13.4).

Pressing the button of gear shifting mode selection 27, it is possible to set easy, heavy or to come back to a middle mode of a gear shifting, depending on kinds of works carried out, with a method of circular search. The easy mode can be used when the tractor operates with minimum load, for example, on transport when moving with empty trailer, and the heavy mode – during implementation of power-intensive works with maximum load. If one top (smaller) segment burns on the indicator 9 – "easy" mode is set, if two top segments burn – "average" mode is set, if all three segments burn– "heavy" mode of a gear shifting is set.

Also when the operator shifts the starter and instruments switch into position ""I" – instruments are on"; all gears are disengaged. "0" gear annunciator 28 burns on CECS front panel (figure 2.13.4), and "0" figure burns on the digital indicator 7.

Then, when gears are shifted in the course of work, the digital indicator 7 displays the number of the gear, set up by means of the joystick, and the annunciator 6 displays the gear at which the tractor is currently moving.

Thus, if during tractor movement at first gear, the sixth gear is sequentially set up with the joystick, then the digital indicator 7 will display the number "6" at once, and the annunciators of the engaged gear 6 will light up in a successive order (first lower, then the rest, the last – the top one), in accordance with actuation of respective pressure sensors.

At normal operation mode the indicator 7 displays the number of the selected gear, and the respective annunciator 6 burns continuously, confirming actuation by pressure.

The digital indicator 7 also displays activation of the gearbox "braking" mode, as specified in subsection 2.13.1 "Switching of gearbox ranges".

2.13.5.3 Rear PTO control

Rear PTO is controlled with buttons 5 and 30 (figure 2.13.4). Indication of RPTO operation is performed by annunciators 4, 29, 31 and integrated indicator 15 (figure 2.1.1).

Note – Function of the integrated indicator in the mode of RPTO speed indication is presented in subsection 2.7.2 "Assignment and operation principle of Integrated Indicator pointers".

In initial condition, when the operator shifts the starter and instrument switch into position ""I – instruments are on", RPTO disengaged condition is set by default – the indicator 31 (figure 2.13.4) burns, confirming the RPTO disengaged state.

To engage the RPTO it is necessary to press the button 5 (figure 2.13.4). Right after pressing the button 5 the annunciator 4 will go off informing of the RPTO speeding up. Then, after a while, when the RPTO reaches a normal operation mode, the annunciator of the RPTO engaged condition 29 will light up.

To disengage the RPTO it is necessary to push button 30. Herewith the annunciators 4 and 29 will go out, and the annunciator of the RPTO disengagement 31 will light up, confirming the RPTO is in disengaged condition.

ATTENTION: RPTO REPEATED ENGAGEMENT IS POSSIBLE ONLY UPON EXPIRY OF 30 SEC. AFTER ITS DISENGAGEMENT!

ATTENTION: FOR EMERGENCY DISENGAGEMENT OF THE REAR POWER TAKE-OFF SHAFT PUSH BUTTON 1 (FIGURE 2.13.4)!

ATTENTION: RPTO CAN BE ENGAGED ONLY WHEN THE BUTTON 1 (FIGURE 2.13.4) IS IN PULLED POSITION!

Note – Additional information on the FPTO operation rules is given in subsection 4.2.7 "PTO use".

2.13.5.4 Front power take-off shaft control

Front PTO control is similar to RPTO control.

The FPTO is controlled with buttons 3 and 32 (figure 2.13.4). Indication of RPTO operation is performed by annunciators 2, 33, 34.

In initial condition, when the operator shifts the starter and instrument switch into position ""I – instruments are on", FPTO disengaged condition is set by default – the indicator 33 burns, confirming the FPTO disengaged state.

To engage the FPTO it is necessary to press button 3. Right after pressing the button 3 the annunciator 2 will go off informing of the FPTO speeding up. Then, after a while, when the RPTO reaches a normal operation mode, the annunciator of the FPTO engaged condition 34 will light up.

To disengage the FPTO it is necessary to push button 32. Herewith the annunciators 2 and 34 will go out, and the annunciator of the FPTO disengagement 33 will light up, confirming the FPTO is in disengaged condition.

ATTENTION: FOR EMERGENCY DISENGAGEMENT OF THE FRONT POWER TAKE-OFF SHAFT PUSH BUTTON 1 (FIGURE 2.13.4)!

ATTENTION: FPTO CAN BE ENGAGED ONLY WHEN THE BUTTON 1 (FIGURE 2.13.4) IS IN PULLED POSITION!

Note – Additional information on the FPTO operation rules is given in subsection 4.2.7 "PTO use".

2.13.5.5 FDA drive control

Front driving axle drive is controlled with buttons 11 and 25 (figure 2.13.4). Indication of FDAD operation is performed by annunciators 10, 24, 26.

In initial condition, when the operator shifts the starter and instrument switch into position ""I – instruments are on", FDAD disengaged condition is set by default.

Use the mode "FDAD disengaged" on transport when moving on roads with hard surface with speed above 13 km/h in order to prevent increased wear of front wheels.

Pressing button 11 "AUTO" with guide wheels position corresponding to linear movement, engages the FDAD in automatic mode. Simultaneously annunciators 10 and 24 go off.

The FDAD is disengaged automatically when the guide wheels turn to the angle above 25° or when travel speed is above 16 km/h. As the travel speed goes below 13 km/h the FDAD shall automatically engage. The annunciator of FDAD automatic mode engagement 10 will burn continuously, until this mode is disengaged, and the annunciator of the FDAD engaged state 24 will burn only during FDAD operation.

The mode of "FDAD automatic control" shall be used at various field works, including when driving in reverse.

ATTENTION: IN THE MODE OF "FDAD AUTOMATIC CONTROL" WITH REAR WHEELS SKIDDING PREVENT FRONT WHEELS FROM TURNING AT ANGLES CLOSE TO 25°, AS IN THIS CONDITION A CONSTANT ANTOMATIC ENGAGEMENT AND DISENGAGEMENT OF FDAD WILL TAKE PLACE, AND THIS CAN CREATE ABRUPT DYNAMIC LOADS IN TRANSMISSION AND FDAD!

The mode of "FDAD automatic control" is disengaged by repeated pressing the button 11 "AUTO" or by pressing and releasing the button of FDAD positive engagement 25. Herewith the annunciators 10 and 24 will go out.

If there is a necessity of FDAD positive engagement for short time, irrespective of tractor speed and front wheels turning angle, it is required to push button 25 and hold it pressed. FDAD remains engaged during holding the button 25 pressed. Simultaneously the annunciators 10 and 26 go off. On releasing the button 25 the FDAD returns to its initial (disengaged) state and the annunciators 10, 26 go out.

To transfer from the automatic mode of FDAD engagement to the positive mode it is necessary to press the button 25 at once and hold it pressed.

ATTENTION: USE ONLY POSITIVE ENGAGEMENT OF FDA WHEN OPERATING THE TRACTOR UNDER BAD TYRE GRIPPING CONDITONS WHEN REAR WHEELS SKID INCLUDING TRACTOR TURNING, TO INSURE SMOOTH ENGAGEMENT OF FDA, FOR THIS DO THE FOLLOWING:

- STOP THE TRACTOR, HAVING DEPRESSED THE CLUTCH PEDAL;
- ENGAGE THE FDA IN THE MODE “FDA DRIVE ENGAGED POSITIVELY”, HOLDING THE BUTTON 25 IN DEPRESSED CONDITION;
- SMOOTHLY RELEASE THE CLUTCH PEDAL.

ATTENTION: AUTOMATIC ENGAGEMENT OF FDA DRIVE, IRRESPECTIVE OF THE SET MODE (INCLUDING THE MODE “FDAD DISENGAGED”), TAKES PLACE WHEN PRESSING THE INTERCONNECTED BRAKE PEDALS!

ATTENTION: WHEN OPERATING ON ROADS WITH HARD SURFACE IT IS NECESSARY TO DISENGAGE THE FDA DRIVE IN ORDER TO PREVENET INCREASED WEAR OF FRONT WHEEL TYRES!

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

IT IS FORBIDDEN TO OPERATE THE TRACTOR WITH FDA DRIVE ENGAGED WHEN THE SPEED OF MOVEMENT IS ABOVE 13 KM/H!

ATTENTION: IN CASE WIRES IN CIRCUIT OF FDA DRIVE ELECTROMAGNET CONTROL ARE BROKEN, IRRESPECTIVE OF THE SET MODE (INCLUDING THE MODE “FDAD DISENGAGED”), AUTOMATIC ENGAGEMENT OF THE FRONT DRIVING AXLE TAKES PLACE!

2.13.5.6 Rear axle differential lock control

Rear axle differential lock (DL) is controlled with the buttons 13 and 22. (figure 2.13.4). Indication of rear axle DL operation is performed by annunciators 12, 21, 23.

In initial condition, when the operator shifts the starter and instrument switch into position ““I – instruments are on”, rear axle DL disengaged condition is set by default.

Use the mode “Rear axle DL disengaged” on transport when moving on roads with hard surface with speed above 13 km/h in order to prevent increased wear of rear wheel tyres and rear axle differential.

Pressing button 13 “AUTO” with guide wheels position corresponding to linear movement, engages the rear axle DL in automatic mode. Simultaneously annunciators 12 and 21 go off.

The real axle DL is disengaged automatically when the guide wheels turn to the angle above 13° or when travel speed is above 16 km/h, and also when pressing any or both brake pedals. As the travel speed goes below 13 km/h the rear axle DL shall automatically engage. The annunciator of rear axle DL automatic mode engagement 12 will burn continuously, until this mode is disengaged, and the annunciator of the rear axle DL engaged state 21 will burn only during RADL operation.

The mode of “RADL automatic control” is disengaged by repeated pressing the button 13 “AUTO” or by pressing and releasing the button of RADL positive engagement 22. Herewith the annunciators 12 and 21 will go out.

If there is a necessity of RADL positive engagement for short time, irrespective of tractor speed and front wheels turning angle, it is required to push button 22 and hold it pressed. RADL remains engaged during holding the button 22 pressed. Simultaneously the annunciators 21 and 23 go off. On releasing the button 22 the RADL returns to its initial (disengaged) state and the annunciators 21, 23 go out.

To transfer from the automatic mode of RADL engagement to the positive mode it is necessary to press the button 22 at once and hold it pressed.

IT IS FORBIDDEN TO OPERATE THE TRACTOR WITH RADL ENGAGED WHEN THE SPEED OF MOVEMENT IS ABOVE 13 KM/H!

IT IS FORBIDDEN TO OPERATE THE TRACTOR ON TRANSPORT ON ROADS WITH HARD SURFACE WITH RADL CONSTANTLY ENGAGED!

2.13.5.7 Annunciation of emergency states of transmission and HLL hydraulic systems, diagnostics of emergency voltage in on-board power system

Annunciator of impurity of a twinned filter of transmission hydraulic system 16 (figure 2.13.4) lights up when the twinned filter is clogged to a large extent. It is required to replace the filtering element of the twinned filter of the transmission hydraulic system.

Annunciator of HLL pump filter impurity 15 lights up (and operates in the mode of continuous glowing) when the HLL pump filter is clogged to a large extent. It is required to replace the HLL pump filter.

ATTENTION: IT IS POSSIBLE THAT THE ANNUNCIATORS MAY GET ACTUATED FOR SHORT TIME WHEN OIL IN TRANSMISSION AND HLL HYDRAULIC SYSTEMS IS COLD, THIS IS NOT A FAILURE!

Annunciator of emergency oil level in HLL 14 lights up when oil level in the HLL tank drops below the permitted value.

Annunciator of emergency oil temperature in HLL 19 lights up when oil temperature in HLL tank increases above the permitted value. Besides, when oil temperature in HLL pump increases above the permitted value, the annunciator 15 gets actuated and operates in a flashing mode.

In case the emergency annunciators of hydraulic systems 14 and 19 go off it is required to stop work, find out and eliminate causes for the emergency condition in order to prevent breakdown and failures of hydraulic system units.

ATTENTION: IF THE SUPPLY VOLTAGE GOES UP ABOVE 18V THE ANNUNCIATOR OF EMERGENCY SUPPLY VOLTAGE LIGHTS UP, THE CECS GETS FULLY DEACTIVATED (CONTROL OF ALL WIRES AND GEARBOX IS STOPPED) AND RECOVERS THE WORKABILITY WHEN THE VOLTAGE DROPS BELOW 17V!

IF THE SUPPLY VOLTAGE DROPS BELOW 9V THE CECS GETS FULLY DEACTIVATED (CONTROL OF ALL WIRES AND GEARBOX IS STOPPED) AND RECOVERS THE WORKABILITY WHEN THE VOLTAGE GOES UP ABOVE 9V!

When any of the annunciators 14, 15, 16, 19 or 20 gets activated an acoustic signal (buzzer) goes off. It is possible to deactivate the acoustic signal temporary, for this press the button 18 shortly, hereby the annunciator of buzzer activation, which is located to the left of the button 18, turns on and off. It shall be taken into account that in future when the CECS is activated and the emergency sensors go off, the acoustic annunciator will stay on until the corresponding fault is eliminated and the filtering element is replaced.

2.13.5.8 Diagnostics of electronic systems of RPTO, FPTO, FDAD, RADL control, gear shifting control for failures.

In CECS the annunciators 6, 21, 24, 29, 34 (figure 2.13.4), except for indication of engaged state of a respective drive or a gear, perform diagnostics of the following failures of the electronic system of the drive or gear control:

- short circuit in electromagnetic line of the distributor is indicated by a single flashing of a corresponding annunciator of drive or gear engaged condition;
- breaking of circuit to the distributor electromagnet is indicated by a two-time flashing of a corresponding annunciator of drive or gear engaged condition;
- malfunction of the pressure sensor is indicated by a three-time flashing of a corresponding annunciator of drive or gear engaged condition;
- sticking of the distributor valve is indicated by a four-time flashing of a corresponding annunciator of drive or gear engaged condition;

Besides in case of sticking of the gearbox distributor valve, an annunciator of gearbox emergency operation mode 8 is additionally activated.

Note – The annunciator of gearbox emergency operation mode 8 is also activated with actuation of the switch “Failure” 3 (figure 4.5.1).

Annunciation of failures in drives operation and in gear shifting operation is followed by a continuous signal of the acoustic annunciator. It is possible to switch off the acoustic annunciator temporary, for this it is necessary to press the button 18 shortly (figure 2.13.4), herewith the annunciator of buzzer deactivation, located to the left of the button 18 turns on and off. It shall be taken into account that in future when the CECS is activated and the respective pressure sensors go off, the acoustic annunciator will stay on until the corresponding fault is eliminated.

When several failures are detected simultaneously the corresponding annunciators indicate failure codes in the following order:

a) short circuit to electromagnet of proportional valve;
b) breaking of circuit to electromagnet of proportional valve;
c) malfunction of pressure sensors;
d) sticking of electrohydraulic valve.

Temporary pause between failure codes is three times more than the pause between flashings of the annunciator within the code.

Detected failures shall be eliminated in accordance with instructions of the subsection 7.1 “Possible failures of the electronic system for gearbox control, RADL control, FDAD control, FPTO and RPTO control and instructions on their elimination”.

2.13.5.9 Description of CECS performance testing

In CECS testing of indicator and annunciator performance is carried out by each power connection. Herewith, all LED- annunciators and indicators turn on for two seconds, the digital indicator 7 (figure 2.13.4) displays figure “8”; the acoustic annunciator goes off. Then the LED-indicators and annunciators, the digital indicator and the acoustic signal switch to the operating mode – the annunciators 28, 31, 33 remain on, the indicator of gear shifting mode displays a middle mode of operation, and the digital indicator displays “0” figure, the other LED-annunciators and the acoustic annunciator go out.

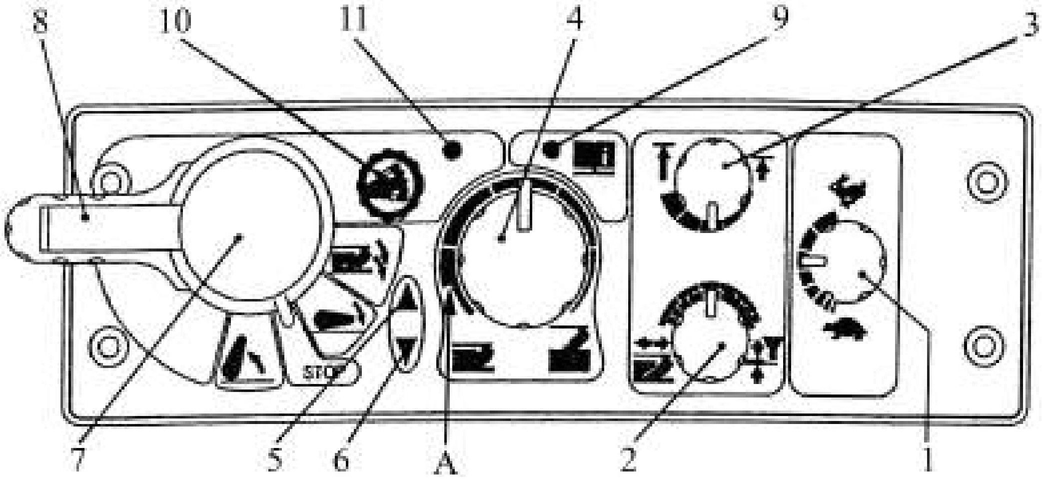
2.14 Rear lift linkage control

2.14.1 General information

RLL control is controlled with the control panel 31 (figure 2.1.1) and remote buttons 3 and 4 (figure 2.14.2). If there are failures in RLL electronic-hydraulic control system a diagnostics annunciator 9 (figure 2.14.1) displays information on the failure and, if necessary, operation of RLL control system is blocked.

2.14.2 RLL control panel

RLL control panel, located on a side console in tractor cab, is presented in figure 2.14.1.



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

Figure 2.14.1 – RLL control panel

Order of RLL control is the following:

- (figure 2.14.1) set a method of control depending on operation character using the handle 2. Turning of handle clockwise against the stop – position method of control; contraclockwise against the stop – draft control, in between – combined control, the combined control is preferential;

- set a required height of implement uplifting in transport condition with the handle 3. Turning the handle clockwise against the stop corresponds to max. uplifting, contraclockwise against the stop - to min. uplifting;

- set tillage depth with the handle 4. Turning the handle clockwise against the stop corresponds to min. depth, contraclockwise up to “A” position corresponds to max depth; turning of the handle contraclockwise against the stop corresponds to floating position;

- move the linkage using the handle 7 to a lower fixed position.

Then during operation it is required to adjust a mounted (semi-mounted) implement for optimal operation conditions:

- with the handle 2 – combination of control;

- with the handle 4 – depth of soil tillage.

- with the handle 1 – 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).

The handle 7 has four positions:

a) middle position – disengaged;

b) upper position – uplift;

c) lower position – lowering (in operation – automatic control);

d) moving the handle downward (nonfixed) from “в” position – implement penetration (herewith the automatic control is off);

During RLL lowering or penetration the annunciator 6 turns on, and during uplifting – the annunciator 5 turns on.

The system automatically limits a frequency of correction under draft control to an average of 2 Hz. In case of intensive heating of oil in hydraulic system it is necessary to reduce frequency of correction by moving the handle 2 towards the position method of control and the handle 1 towards “turtle”. In a case of raising (“working out”) of the agricultural implement when moving over consolidated soil or ruts, deepen the implement by pressing the handle 7 downwards. After releasing the handle 7 will come back to its fixed position of "lowering". Thus the agricultural implement returns to the mode of the depth, set up before by the handle 4. The implement is raised by moving the handle 7 into the upper position.

When height adjustment of RLL is carried out during operation, the unnunciators 5 and 6 turn on.

ATTENTION: IN ORDER TO AVOID HLL PUMP FAILURE, IT IS FORBIDDEN TO OPERATE THE TRACTOR IF ANNUNCIATOR 5 DOES NOT GO OUT AFTER THE IMPLEMENT WAS UPLIFTED.

ATTENTION: AT THE EMERGENCY STOP OF THE TRACTOR, IN ORDER TO AVOID FURTHER PENETRATION OF THE AGRICULTURAL IMPLEMENT, SHIFT THE HANDLE 7 INTO POSITION ”DISENGAGED”. AFTER STARTING TO MOVE SHIFT THE HANDLE INTO POSITION “LOWERING” – THE IMPLEMENT WILL PENETRATE TO DEPTH, SET UP BEFORE!

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

- after the engine was started the diagnostics annunciator 9 lights up, indicating workability and blocking of the control system;

- to unblock the system it is necessary to set the handle 7 into operating condition for one time (uplift or lowering) and return to the position “disengaged”. Hereby the diagnostics annunciator 9 goes out.

- after the system is unblocked during first engagement automatic speed limitation for the RLL uplift and lowering is provided for safety's sake. Moving the handle 7 into position “Disengaged” and then into position “Uplift” or “Lowering” removes the speed limitation.

Besides 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 the handle 7 into “uplift” position рукоятку 7 – herewith the RLL lifts up to the top extreme position and gets automatically deactivated;

- push the button “dampening” 10 – hereby the RLL moves form the top extreme position down by 3% of the full RLL stroke and the annunciator of “dampening” activation 11 turns on;

- then to prevent accidental shifting of the handle 7 during transportation move the blocking retainer 8 to the rotation axis of the handle 7. Hereby the handle 7 will be mechanically blocked in the upper position (“uplift”).

To turn off the “dampening” mode press the button 10. The annunciator of “dampening” deactivation will go out, and the RLL will return to its top position. Move the retainer 8 to its initial position.

ATTENTION: THE “DAMPENING” MODE IS ACTIVE ONLY THE HANDLE 7 IS IN THE “UPLIFT” POSITION!

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

2.14.3 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.

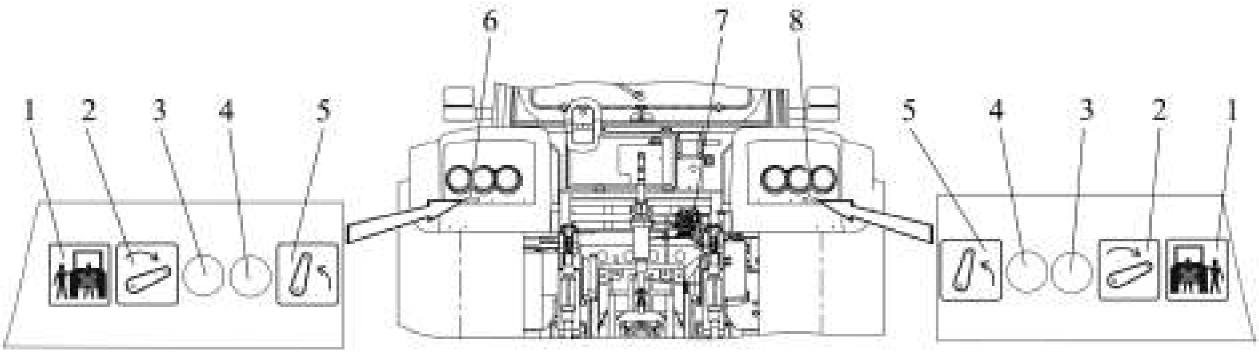
Uplift and lowering of the rear lift linkage with the remote buttons on rear wheel fenders can be carried out at different control modes – the handles 1, 2, 3, 4, 7 (figure 2.14.1) can be left in any position, as the system of control from inside the cab is hereby blocked.

To lift the RLL up, press any of the buttons 4 (figure 2.14.2) and hold it depressed. To lower the RLL, press any of the buttons 3 and hold it depressed.

For safety's sake the control with the remote buttons is performed under interruption of work. Pressing the uplift button 4 (lowering button 3) and holding it depressed lifts up (lowers) the RLL during 5 sec., then it stops. For further uplifting (lowering) it is necessary to press the corresponding button and hold it depressed once again!

Then after the implement has been detached, activation and work on HLL is performed in accordance with clause 2.14.2.

WARNING: WHEN USING THE REMOTE BUTTONS OF RLL CONTROL DO NOT STAND BETWEEN THE TRACTROR AND ATTACHED IMPLEMENT! TO PREVENT ACCIDENTS IT IS FORBIDDEN TO USE BUTTONS OF MECHANICAL SHIFTING OF ELECTRIC VALVES OF REGULATOR EHR23-LS 7 (FIGURE 2.14.2)!



1 – instruction shield on safety rules; 2, 5 – instruction shield of RLL control diagram; 3 – RLL lowering button; 4 – RLL uplift button; 6 – left remote RLL control panel; 7 – regulator EHR23-LS; 8– right remote RLL control panel.

Figure 2.14.2 – RLL control with remote buttons

2.14.4 Failure diagnostics of RLL electronic control system

The electronic control system BOSCH, installed on your tractor, has an option of self-testing and whenever failures are detected it provides the operator with code information by means of failure diagnostics annunciators 9 (figure 2.14.1) on RLL control panel. After engine start, as specified in clause 2.14.2, the annunciator 9 is burning continuously if no failures are detected in RLL control system. Moving the handle 7 up or down deactivates the annunciator 9.

In case failures are detected in the system after the engine start the annunciator 9 begins to show code information a 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 the annunciator 9 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 the annunciator 9 is the following:

- engine start;
- continuous glowing;
- after the system is unblocked 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 simultaneously 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 either with the control panel or with the remote buttons.

The diagnostics annunciator shows a failure code. After the failure has been eliminated and the engine started the system recovers.

With medium failures 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 panel. The diagnostics annunciator shows a failure code. After the failure has been eliminated and the engine started the system recovers.

With light faults the diagnostics annunciator shows a fault code, but the system remains controlled and is not blocked. In case of light faults the RLL control system operates improperly – there is no correct soil sensing. After the fault has been eliminated the diagnostics annunciator turns off.

In case the system detects a failure relating to any group of complexity the following actions shall be taken:

- read the code;
- stop the engine;
- eliminate the failure in accordance with instructions of subsection 7.2 “Possible failures in electronic control systems of RLL and FLL,guidelines for troubleshooting”;
- start the engine and if there are no faults get down to work.

2.15 Front lift linkage control

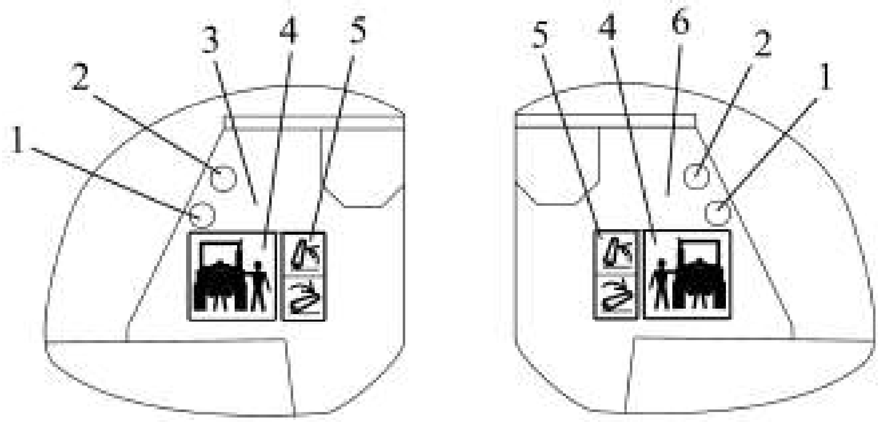
The front lift linkage is controlled by the control panel 36 (figure 2.15.1) and remote buttons 1 and 2 (figure 2.15.1). If there are failures in electronic-hydraulic system of FLL control, the diagnostics annunciator 9 (figure 2.14.1) displays information on the failure and if necessary the FLL control system gets blocked.

The FLL control panel is controlled by analogy with the RLL control panel except for the following differences – in FLL control system there are no force sensors, as a result, three are no draft and combined means of control, also the “dampening” mode is missing.

Basing on the abovesaid, a position control is installed in the FLL control system irrespective of the position of the handle 2 (figure 2.14.1).

Pressing the “dampening” button 10 lowers the FLL from the extreme top position down by 3% of the full stroke, the annunciator of “dampening” mode 11 will turn on, but oscillations of the implement will not be damped in transport mode.

The electronic system of FLL control is tested for failures by analogy with failure testing of the electronic system of RLL control, described in clause 2.14.4 of the this manual.



1 – button to lower the FLL; 2 – button to lift the FLL up; 3 – right remote FLL control panel; 4 – instruction shield on safety rules; 5 – instruction shield of FLL control diagram; 6 – left remote FLL control panel.

Figure 2.15.1 – FLL control with remote buttons

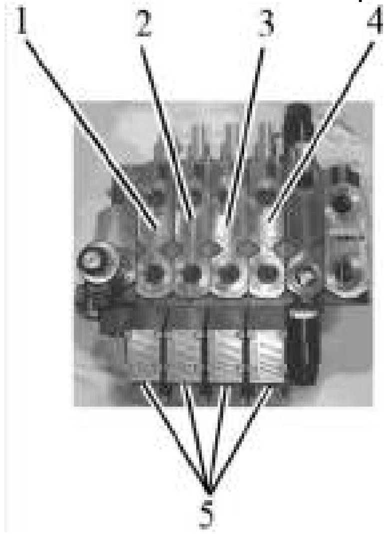
WARNING: WHEN USING THE REMOTE BUTTONS OF FLL CONTROL SYSTEM DO NOT STAND BETWEEN THE TRACTROR AND ATTACHED IMPLEMENT!

2.16 Electronic system of hydraulic distributor EHS sections control.

2.16.1 General information on electronic system of hydraulic distributor EHS sections control

Hydraulic distributor EHS sections control includes the following elements:
- unit of electronic joysticks 35 (figure 2.2.1);
- unit for programming operations of the hydraulic lift linkage 33;
- buttons to activate functions of “flow restriction”, located at the right part of the electronic combined panel 34.

Allocation of the hydraulic distributor EHS sections is presented in figure 2.16.1.



1 – hydraulic distributor EHS section No 4; 2 – hydraulic distributor EHS section No 3; 3 – hydraulic distributor EHS section No 2; 4 – hydraulic distributor EHS section No 1; 5 – annunciators of operation failures of the corresponding sections of the hydraulic distributor EHS.

Figure 2.16.1 – Allocation of the hydraulic distributor EHS sections

Instruction shield with a diagram of connection of hydraulic outlets of the hydraulic distributor EHS to external consumers is mounted on the tractor hydraulic distributor as shown in figure 2.16.2. The hydraulic outlets of the distributor are equipped with fast couplings with color protective covers: red – uplift; green – lowering.

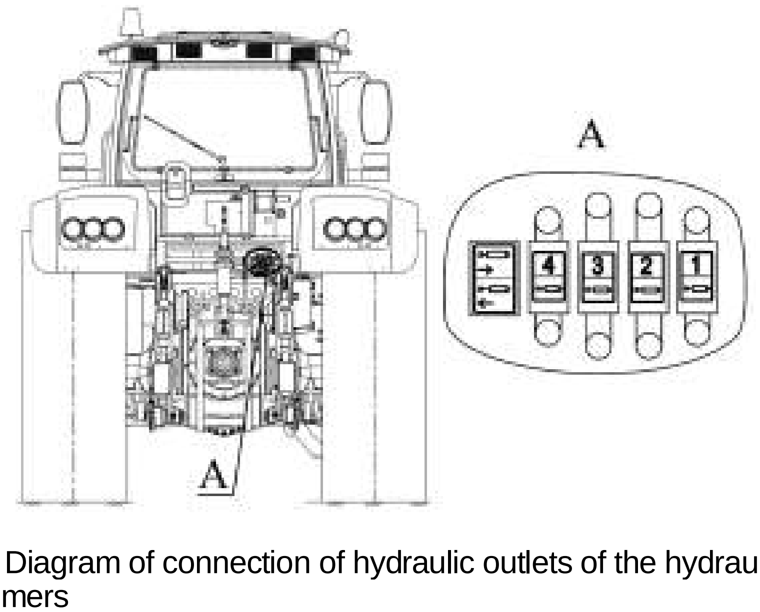


Figure 2.16.2 – Diagram of connection of hydraulic outlets of the hydraulic distributor EHS to external consumers

The electronic system operates in the following way. After the engine is started the supply voltage is delivered to the operation programming unit of the hydraulic lift linkage (OPU of HLL) 33 (figure 2.2.1). OPU of HLL checks the control system elements for function and informs of the system state after the check is completed. The system is controlled by means of joysticks 35 (figure 2.2.1) or by the operation programming unit OPU of the HLL. OPU of the HLL performs programming of order of sections operation or exercise of algorithms programmed before and kept in the memory of the operation programming unit of the HLL. It is possible to control the hydraulic distributor EHS sections only with joysticks, with OPU of the HLL turned off.

2.16.2 Unit of electronic joysticks

2.16.2.1 General information

Two types of units of electronic joysticks can be installed on your tractor – EJU-01 or “BOCORO” which are interchangeable, but have some differences in control of sections of the hydraulic distributor EHS.

If there are some failures in the hydraulic distributor sections, a failure code is displayed by a corresponding annunciator 5 (figure 2.16.1).

The failures detected shall be eliminated in accordance with the instructions of subsection 7.1.3 “Failures of the hydraulic distributor EHS. Failure indication, causes and ways of elimination”.

2.16.2.2 Unit of electronic joysticks EJU-01

Unit of electronic joysticks EJU-01 is presented in figure 2.16.3.

1, 5 – button to turn on fixed flow; 2 – joystick to control sections No 1 and No 2 of the hydraulic distributor EHS; 3 – board announcing EJU operation modes; 4 – joystick to control sections No 3 and No 4 of the hydraulic distributor EHS.

Figure 2.16.3 – Unit of electronic joysticks EJU-01

The joystick 2 (figure 2.16.3) controls sections No 1 and No 2, and the joystick 4 controls sections No 3 and No 4. Moving the handle of the joystick 2 forward means “lowering” over section No 1. Moving the handle of the joystick 2 backward means “uplift” over section No 1. Moving the handle of the joystick 2 to the right means “lowering” over section No 2. Moving the handle of the joystick 2 to the left means “uplift” over section No 2. Moving the handle of the joystick 4 forward means “lowering” over section No 3. Moving the handle of the joystick 4 backward means “uplift” over section No 3. Moving the handle of the joystick 4 to the right means “lowering” over section No 4. Moving the handle of the joystick 4 to the left means “uplift” over section No 4. As the abovestated actions are carried out a corresponding annunciator lights up on board 3 and the corresponding annunciators and indicators light up on OPU of HLL if turned on. Oil flow value is proportional to the value of the joystick handle deviation from the neutral position.

The “floating” mode over section No 1 is activated by moving the handle of the joystick 1 forward against the stop and holding it in this position for more than two sec. The “floating” mode over section No 2 is activated by moving the handle of the joystick 1 to the right against the stop and holding it in this position for more than two sec. The “floating” mode over section No 3 is activated by moving the handle of the joystick 2 forward against the stop and holding it in this position for more than two sec. The “floating” mode over section No 4 is activated by moving the handle of the joystick 2 to the right against the stop and holding it in this position for more than two sec. The “floating” mode activation is announced by a three-time flashing of annunciators on the board 3 along the axis of the corresponding section. This pair of annunciators will stay on until the “floating” mode of the hydraulic distributor section is exited.

The set-up “floating” mode is remembered by the joystick and remains on after moving the joystick handle to neutral position. To exit the “floating” mode it is required to move the corresponding joystick handle from the neutral position along the control axis of the hydraulic distributor section.

To set fixed flow over a section of the hydraulic distributor it is required to shift the handle of the corresponding joystick into the position of the flow required and holding it in this position press the button 1 (or 5) on the joystick handle. The fixed flow activation is announced by a three-time flashing of the corresponding annunciator in the direction of the flow set-up. This annunciator will stay on until the fixed flow mode for the hydraulic distributor section is exited.

After the button has been released and the joystick handle has been shifted into the neutral position the joystick remembers the set-up flow. To exit this mode it is necessary to move the joystick handle to the side of the set-up control of the corresponding hydraulic distributor section with the fixed flow and press the button 1 (or 5). To set new fixed flow return the joystick handle to the neutral position and then set the flow value as described above.

2.16.2.3 Unit of electronic joysticks “BOCORO”

The unit of electronic joysticks “BOCORO” is presented in figure 2.16.4.

1, 2 – button the turn on the “floating” mode; 3 – joystick to control sections No 3 and No 4 of the hydraulic distributor EHS; 4 – joystick to control sections No 1 and No 2 of the hydraulic distributor EHS; 5 – instruction shield of diagram of the hydraulic distributor EHS section control.

Figure 2.16.4 – Unit of electronic joystick “BOCORO”

The joystick 4 (figure 2.16.4) controls sections No 1 and No 2, the joystick 3 controls sections No 3 and No 4. Joysticks 4, 3 to set the corresponding sections of the hydraulic distributor to positions “neutral”, “uplift” and “lowering” are controlled by analogy with joysticks EJU-01 as described in clause 2.16.2.2.

The “floating” mode over section No 1 is turned on by moving the joystick 4 forward against the stop with the next pushing button 1, located on the handle of the joystick 4. The floating mode over section No 2 is activated by moving the handle of the joystick 4 to the right against the stop with the following pushing button 1. The set-up “floating” mode is remembered by the joystick and remains after the joystick handle is moved into neutral position. To exit the “floating” after the joystick handle was moved into neutral position mode it is necessary to make any manipulation with this joystick handle over this section. The sections No 3 and No 4 of the hydraulic distributor are set into the “floating” mode and exited it with the joystick 3 and the button 2 by analogy with the abovestated. Setting the sections No 3 and No 4 of the hydraulic distributor into the “floating” mode and exiting the “floating” mode is performed with the joystick 3 and the button 2 by analogy with the abovestated.

If “BOCORO” joysticks are available on “BELARUS – 3522.5” tractor it is possible to set the mode of fixed flow over a section of the hydraulic distributor only by means of programming OPU of HLL.

Because there is no a board announcing EJU operation modes on the unit of electronic joysticks “BOCORO”, it is possible to control operation of the hydraulic distributor EHS sections by means of HLL operation programming mode. Hereby the OPU of the HLL shall be on.

Diagram of the hydraulic distributor section control with the joysticks “BOCORO” is shown in the instruction board 5 and presented in figure 2.16.5.

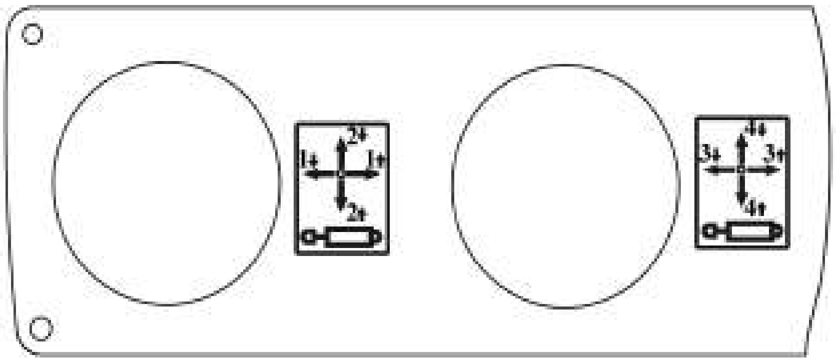


Figure 2.16.5 – Diagram of the hydraulic distributor section control with the joysticks

2.16.3 Operation programming unit (OPU) of the hydraulic lift linkage

2.16.3.1 General information

The OPU of the HLL displays operation of the hydraulic distributor EHS and controls sections of the hydraulic distributor EHS according to set-up operation modes and control algorithms.

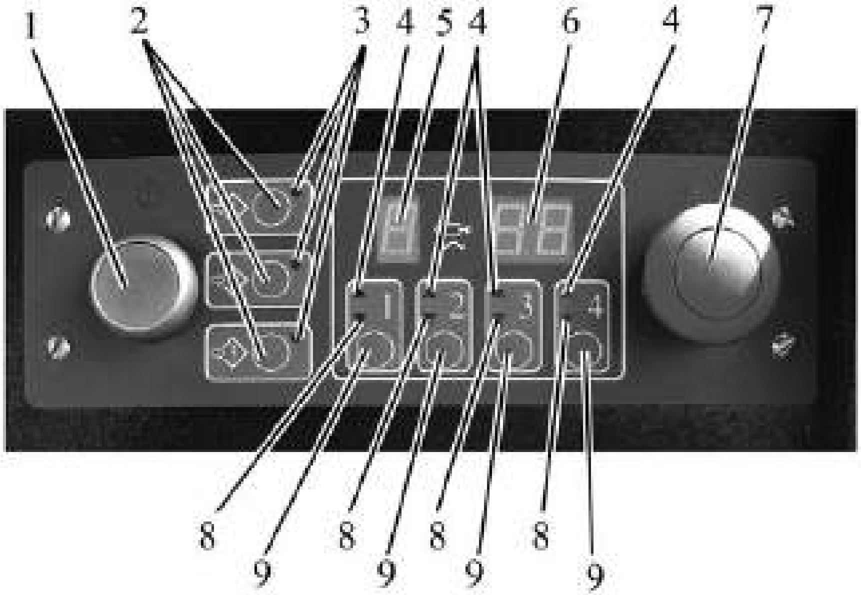
ATTENTION: IT IS POSSIBLE TO ACTIVATE THE OPU OF THE HLL ONLY WITH THE ENGINE RUNNING!

The OPU of the HLL has two operation modes:

- indication of operation of the hydraulic distributor EHS sections when the hydraulic distributor is controlled directly by two joysticks (manual mode);
- control of hydraulic distributor EHS sections when the hydraulic distributor operates according to the specified algorithm (automatic mode).

Board of operation programming unit of the hydraulic lift linkage is presented in figure 2.16.6.

If the electric signals coming from the joysticks to the activated OPU of the HLL are missing over any of channels, the annunciators “uplift” 4 (figure 2.16.6) and “lowering” 8 of the corresponding hydraulic distributor EHS section flash one by one. In this case before setting tractor into operation contact your dealer to eliminate the fault – it is required to eliminate breakage in the electric circuit or replace the joystick.



1 – power disconnect switch of OPU of HLL; 2 – buttons to servo the set-up programms P1, P2, P3; 3 – annunciators of programs P1, P2, P3; 4 – annunciators of uplift of the corresponding hydraulic distributor EHS sections; 5 – annunciator of number of the active hydraulic distributor EHS section; 6 – indicator of oil flow value of the active hydraulic distributor EHS section; 7 – “STOP” switch of hydraulic distributor EHS emergency operation; 8 – annunciators of lowering of the corresponding hydraulic distributor EHS sections; 9 – buttons to select the hydraulic distributor EHS section.

Figure 2.16.6 – Board of the operation programming unit of the hydraulic lift linkage

2.16.3.2 Indication of operation of the hydraulic distributor EHS sections when the hydraulic distributor is controlled directly by two joysticks (manual mode)

To work with OPU of the HLL it is necessary to push the power disconnect button 1 (figure 2.16.6). With each power connection function check of all light annunciators and indicators is carried out in OPU of the HLL. After switch-on all annunciators and indicators on the unit board shall turn on and off in one-two seconds as well as the acoustic signal. After this the OPU of the HLL starts to display a current joystick state.

Indication the hydraulic distributor EHS sections when controlled by the joysticks is the following:

- when the section is set by the joystick into position “uplift” – an uplift annunciator 4 of the corresponding hydraulic distributor EHS section lights up (figure 2.16.6);
- when the section is set by the joystick into position “lowering” – a lowering annunciator 8 of the corresponding hydraulic distributor EHS section lights up;
- when the section is set by the joystick into position “floating” –the annunciators 4 and 8 of the corresponding hydraulic distributor EHS sections lights up;
- the annunciator 5 displays the number of the hydraulic distributor EHS section, which is controlled with the joystick;
- the indicator 6 displays a value of oil flow within the section which is being controlled. Measuring units for oil flow value are l/min. In the “floating” mode the indicator 6 displays symbols “FL”.

2.16.3.3 Order of the hydraulic distributor EHS sections control according to the specified algorithm (automatic mode).

2.16.3.3.1 Automatic mode of the hydraulic distributor EHS sections control precludes multiple repetition of the same manual operations by the operator.

Performing operations on control of implements connected to the hydraulic distributor EHS sections, the OPU of the HLL allows to remember and reproduce operations, carried out before. The OPU of the HLL has a possibility to remember three different joystick manipulations.

To control the hydraulic distributor EHS sections in the automatic mode it is required to turn on the OPU of the HLL by pushing the button 1 (figure 2.16.6). After check of elements of the OPU of the HLL for performance it is possible to get down to work.

To record the sequence of operations performed it is required to press a button of the program selected for programming 2 on the board of OPU of the HLL and hold it depressed. After two seconds the OPU of the HLL produces a short acoustic signal, turns on the annunciator 3 of the corresponding program in the mode of quick flashes and goes into the programming mode – remembering of manipulations performed by the joystick. Herewith a program, recorded to this button before, is erased.

On entering the programming mode it is required to select the hydraulic distributor EHS sections to be controlled, by means of pressing the corresponding button switches 9, after this the OPU of the HHL produces an acoustic signal and turns on the annunciators “uplift” and “lowering” 4 and 8 of the hydraulic distributor EHS selected sections in the mode of slow flashes.

Then with joystick manipulations in accordance with clauses 2.16.2.2 and 2.16.2.3 the annunciators “uplift” 4 and “lowering” 8 display performance of the corresponding operations without flashes, the annunciator 5 displays a number the hydraulic distributor EHS section to be controlled, the indicator 6 displays oil flow value within the section to be controlled. In the “floating” mode the indicator 6 displays symbols “FL”.

The OPU of the HLL remembers all joystick manipulations. Repeated pressing the corresponding button switch 9 of the selected section results in finish of storing joystick manipulations for this section. After this the OPU of the HLL produces a short signal and annunciators, displaying state of the hydraulic distributor EHS sections, light up on the board.

To stop recording the selected program, first it is required to press buttons 9 of the sections which are in the mode of program recording. Then it is necessary to push the button 2 of the program recorded for short time. After this the OPU of the HLL produces a short acoustic signal and the corresponding annunciator 3 of the recorded program lights up on the board. With repeated short-time pressing the button 2 of the recorded program a short acoustic signal is produced, the corresponding annunciator 3 goes out, the OPU of the HLL deactivates the program recording mode and goes into the mode of joystick control (manual mode).

ATTENTION: MAX. POSSIBLE DURATION OF EACH PROGRAM RECORD IS NOT ABOVE 200 SECONDS!

ATTENTION: PROGRAM SHALL BE RECORDED AND REPRODUCED WITH THE SAME ENGINE SPEED!

With the beginning of the other program recording the annunciator of the previously activated program goes out. Recording other programs is carried out by analogy.

After the program is recorded it is possible to start its automatic implementation.

2.16.3.3.2 Automatic control of the hydraulic distributor EHS sections under the previously recorded programs is carried out with the OPU of the HLL activated. The OPU of the HLL performs commands according to one of the three algorithms programmed by the operator. Implementation the program recorded is started with pressing a corresponding button 2. Hereby the annunciator 3 of the selected program turns on in the mode of slow flashes on the board. If before the other program was active, then it gets deactivated. After implementation of the active part of the program the annunciator burns continuously, the annunciators 4, 5, 6, 8 of the hydraulic distributor EHS sections display their state.

If during the program implementation you turn the power disconnect switch 1 (figure 2.16.6) of the OPU of the HLL into the disengaged position, the program implementation will be stopped and further control is possible only with joysticks. After the OPU power switch-on and repeated pressing of the button 2 the selected program will be started from the beginning.

When during implementation of the program on the hydraulic distributor EHS section control, the hydraulic distributor EHS section is simultaneously controlled with the joystick, then the program implementation will be stopped and the hydraulic distributor EHS section will be controlled by the joystick. Hereby the annunciators 4, 8 of the hydraulic distributor section and the annunciators of the active program 3 will operate in a flashing mode. To continue the program implementation it is needed to press the button switch 2 of this program.

During the program implementation the hydraulic distributor EHS sections that are not enabled in this program can be controlled with the joysticks manually. Joystick control per unprogrammed sections of the hydraulic distributor EHS does not stop the program implementation.

2.16.3.3.3 Examples of programming operations on the hydraulic distributor EHS section control

Examples of programming operations on reversible plough and seeder control by means of the OPU of the HLL are given in subsection 4.2.6 “Examples of programming operations on the hydraulic distributor EHS section control”.

2.16.3.4 Adjustment of the fixed flow, programmed with the OPU of the HLL

After the program implementation and if there is a necessity to adjust a fixed flow value for one of the sections of the hydraulic distributor in this program it is needed to do the following:

- choose a required section of the hydraulic distributor EHS with the button switch 9 (figure 2.16.6). On the OPU board the annunciator 5 will display the number of the selected section of the hydraulic distributor, and the indicator of the hydraulic distributor flow value 6 will display the oil flow;
- change the flow value with the joystick – if the flow value, set up with the joystick, coincides with the recorded value, the OPU of the HLL produces a short acoustic signal and further the flow is changed synchronously with the joystick;
- set required flow with the joystick and press the button switch 9 of the selected section of the hydraulic distributor, after this the changes in the program will take place.

2.16.3.5 Hydraulic distributor EHS emergency shut-down

ATTENTION: FOR EMERGENCY SHUTTING-DOWN OF ALL SECTIONS OF THE HYDRAULIC DISTRIBUTOR EHS IT IS REQUIRED TO PRESS THE EMERGENCY “STOP” SWITCH 7 (FIGURE 2.16.6) ON THE OPU BOARD. HEREBY THE POWER SUPPLY TO THE HYDRAULIC DUSTRIBUTOR IS CUT OFF, CENTRAL VALVES OF ALL SECTIONS ARE SET INTO NEUTRAL POSITION, OIL SUPPLY TO DRIVES OF AGRICULTURAL IMPLEMENTS IS STOPPED (THE FLOW REGULATION VALVE SHUTS DOWN)!

REPEATED PRESSING THE EMERGENCY “STOP” SWITCH ACTIVATES POWER SUPPLY TO THE HYDRAULIC DISTRIBUTOR EHS AND RESUMES POWER SUPPLY TO ALL DRIVES OF AGRICULTURAL IMPLEMENTS!

ATTENTION: WHEN OPERATING THE TRACTOR WITHOUT NEED OF USING THE HYDRAULIC DISTRIBUTOR EHS IT MUST BE TURNED OFF BY MEANS OF PRESSING THE EMERGENCY “STOP” BUTTON!

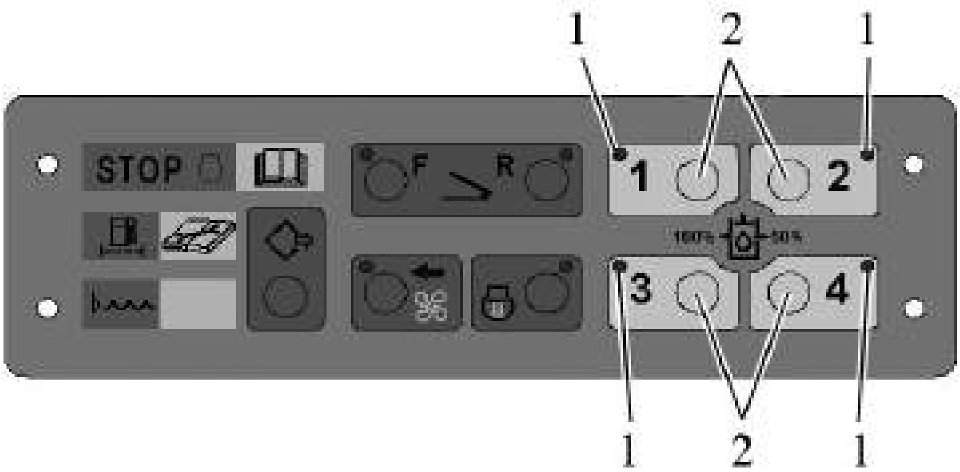
2.16.4 Flow restriction

The electronic system controlling the hydraulic distributor EHS sections performs a function of “flow restriction” to drive coupled agricultural implements operating with less oil flow. The set-up function of “flow restriction” provides for more precise and smooth control at the given rates. At the standard mode oil flow value can be changed from 0 to 80 l/min per each section, with the function of “flow restriction” turned on the oil flow value can changed from 0 to 60 l/min.

To activate this function the IEP 34 (figure 2.2.1) has got four buttons 2 (figure 2.16.7), turning on “flow restriction” for each hydraulic distributor section.

Working order with the function of “flow restriction” is the following:

- pressing buttons 2, turning on “flow restriction”, select required sections of the hydraulic distributor EHS, for which it is needed to restrict the flow. After the buttons 2 have been pressed, the annunciators 1 of the corresponding sections of the hydraulic distributor EHS light up;
- control the selected sections by means of the joysticks taking into account the current “flow restriction”;
- the function of “flow restriction” is turned off by repeated pressing the button 2 of the corresponding sections, after that all annunciators 1 go out.



1 – annunciators of “flow restriction” activation for the hydraulic distributor section; 2 – buttons to activate “flow restriction” for the hydraulic distributor section.

Figure 2.16.7 – IEP elements for activation and indication of “flow restriction” over the hydraulic distributor EHS sections.

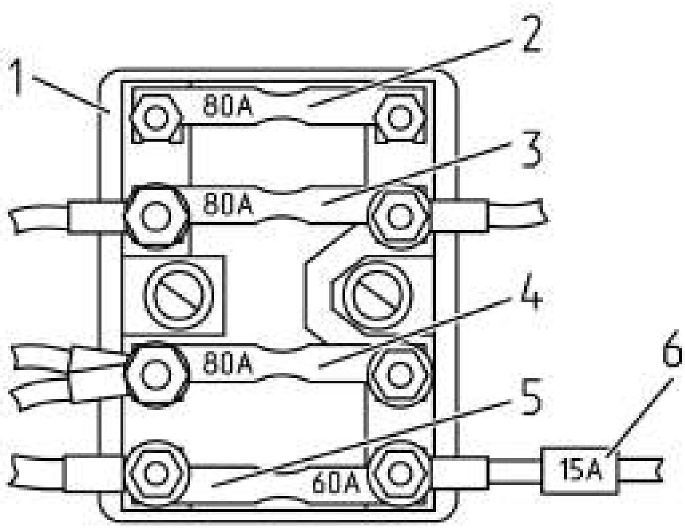
2.17 Cutout fuses

Cutout fuses are intended for protection of electrical lines against overloads and short circuit.

In the electrical line from the manual disconnect switch of the accumulator battery to the button switching the AB off there is a pendant 15 A fuse. In case this fuse is out of order it is possible to turn the AB on/off only with the manual switch.

In the electrical line from the accumulator battery to the engine control systems (EDC and SCR) two pendant 30A fuses are located (positioned in parallel).

Installation of fuses, located in the engine compartment, is presented in figure 2.17.1.



1 – fuse block; 2, 3 – 80 A fuse of inlet air heater (IAH) powering and accumulator battery charging circuit; 4 – 80 A fuse of the switching unit powering; 5 – 60 A fuse of the protection and switching unit (PASU) powering; 6 – 15 A fuse of front socket.

Figure 2.17.1 – Installation of fuses, located in the engine compartment

Besides, a supplementary 150 A fuse of inlet air heater powering is installed in the electrical line from the alternator to IAH.

Assignment, places of location and ratings of fuses, included into the switching unit, are given in subsection 2.18 “Switching unit”.

Assignment, places of location and ratings of fuses, included into the protection and switching unit, are given in subsection 2.19 “Protection and switching unit”.

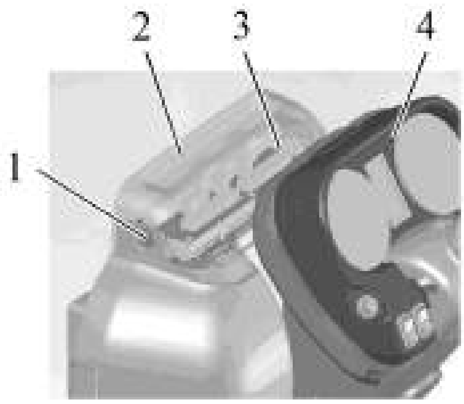
2.18 Switching unit

The switching unit 3 (figure 2.18.1) is intended for current supply, its distribution between tractor power consumers and for protection of electrical lines against short-circuit and current load excess, it is a central distributing unit, to which wiring harnesses of different systems of tractor electrical equipment are connected by means of straps. Using of the switching unit ensures convenience of diagnostics and repair of tractor electrical equipment during its operation.

Your tractor may be equipped with two types of switching units – БКА-7.3722 or БК-1, which are interchangeable.

Place of the switching unit installation is in the cab, on a metal beam of plastic shell fixation, between the dashboard 4 and a windscreen.

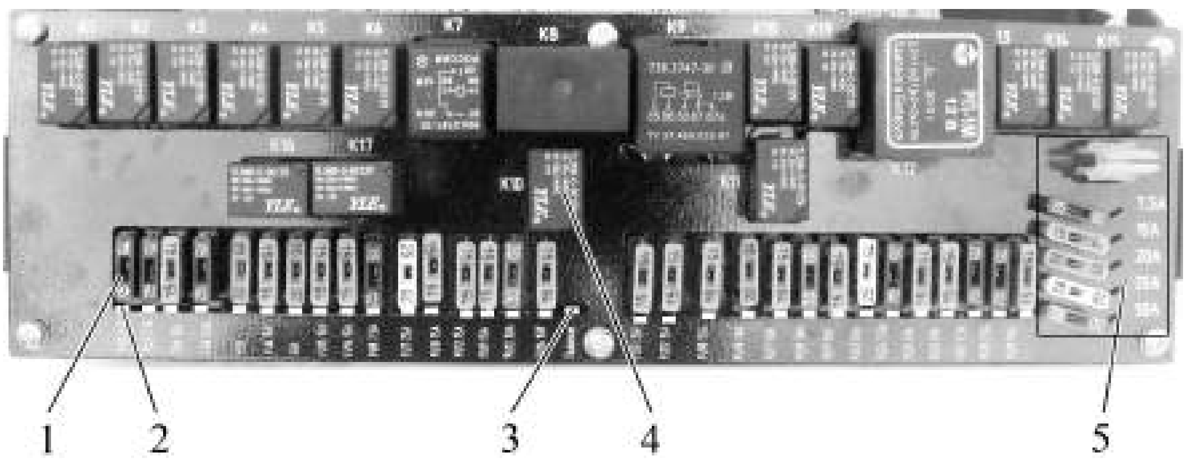
To access relay and fuses of the unit 3 it is needed to unscrew two quick detachable screws 1, then remove a plastic cover 2. The unit also has a plastic cover, intended for dust protection.



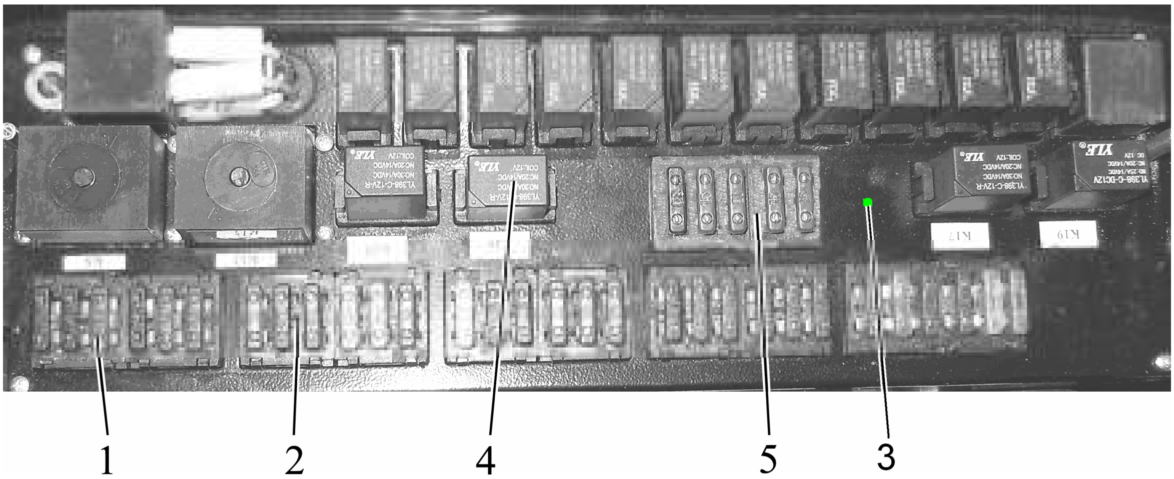
1 – screw; 2 – cover; 3 – switching unit; 4 – dashboard.

Figure 2.18.1 – Switching unit installation

The unit consists of thirty cutout fuses 1 (figure 2.18.2) (FU1-FU30) and nineteen electromagnetic relays 4 (K1-K19), 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 turning on of the switching unit.



a) БКА-7.3722

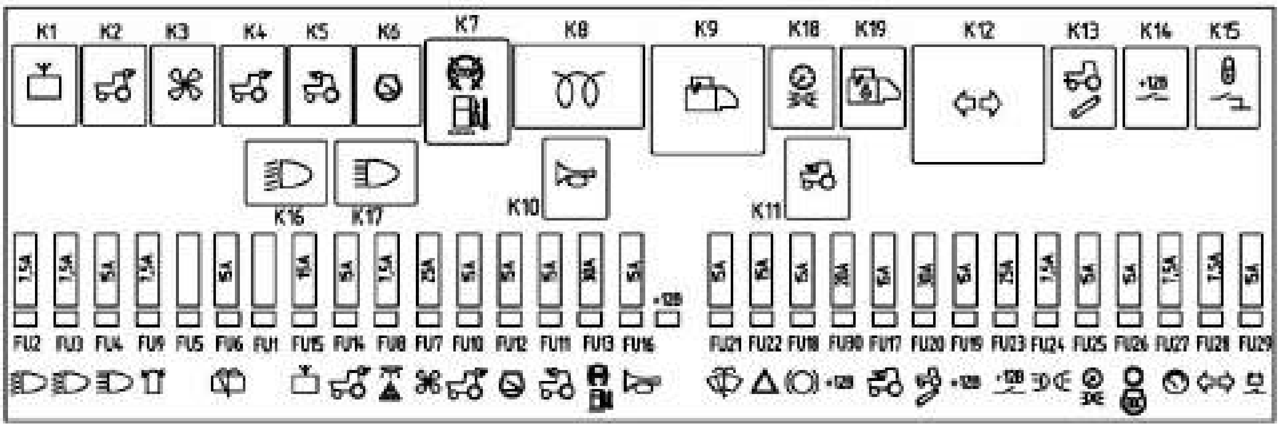


b) БК-1

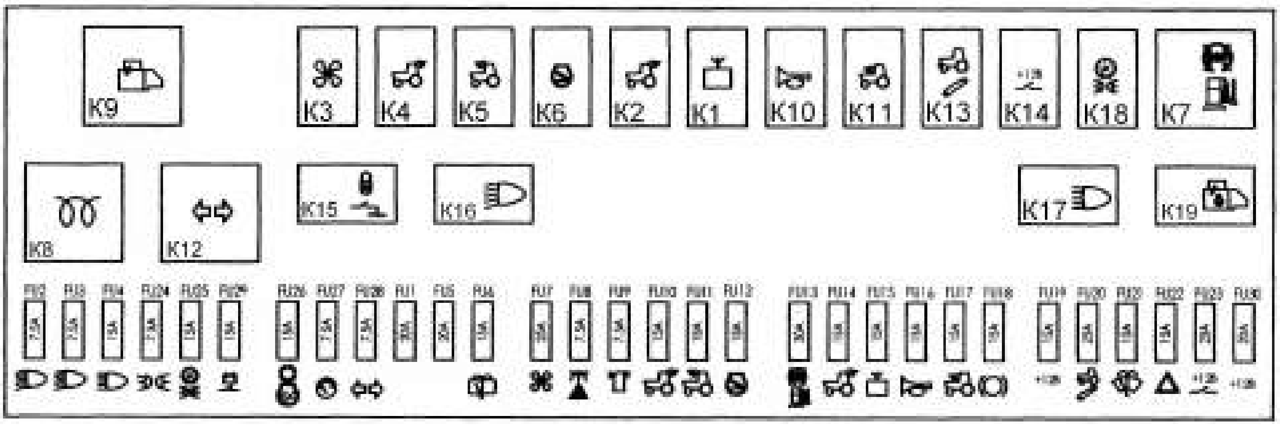
1 – cutout fuse; 2 – signal led lamp of red color; 3 – signal led lamp of green color; 4 – electromagnetic relay; 5 – set of spare fuses.

Figure 2.18.2 – Switching unit

Diagram of fuses and relay location in the switching unit is presented in figure 2.18.3.



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



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

Figure 2.18.3 – Diagram of fuses and relay location in the switching unit

Tables of fuses and relay assignment, presented in figure 2.18.3, are stuck from outside to the upper plastic cover 2 (figure 2.18.1) from the windscreen side.

Information on fuses and relay assignment as well as fuse ratings are given in tables 2.6 and 2.7.

Table 2.6 – Assignment of switching unit fuses

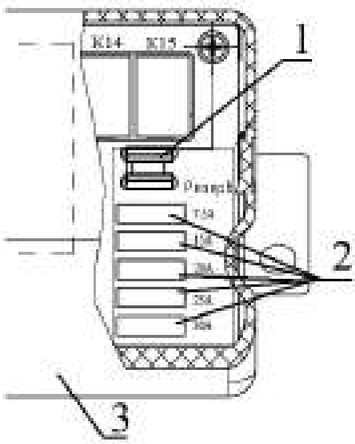
Fuse designation	Fuse assignment (protected electric circuit)	Fuse rating
FU1	Reserve	20A
FU2	Lower beam of right road headlight	7,5A
FU3	Lower beam of left road headlight	7,5A
FU4	Road headlights upper beam	15A
FU5	Reserve	20A
FU6	Rear screen washer and wiper	15A
FU7	Power supply to conditioner electric 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	Not used	30A
FU14	Rear working lights (a pair of inner lights)	15A
FU15	Radioset (stereo-recorder)	15A
FU16	Horn	15A
FU17	Front working lamps (on handgrip)	15A
FU18	Braking lights	15A
FU19	Socket to connect trailed agricultural equipment and a portable lamp.	15A
FU20	Signal from terminal “D” of the alternator to systems of FLL, RLL and OPU of the HLL control and to electic socket 6 (figure 2.22.2)	30A
FU21	Front screen washer and wiper	15A
FU22	Warning indication	15A
FU23	Power supply to consumers, staying on when the starter and instrument switch is in position “instruments are on”	25A
FU24	Left parking lights	7,5A
FU25	Right parking lights and instruments illumination	15A
FU26	CECS, IEP and EECS	15A
FU27	Test instruments, sensors of speed, RPTO and fuel volume	7,5A
FU28	Annunciation of tractor and trailer turning	7,5A
FU29	Remote cutout of accumulator battery	15A
FU30	Power supply to coil of instrument illumination and parking lights relay	20A

Table 2.7 – Relay assignment

Relay designation	Relay assignament
К1	Radioset (stereo-recorder)
К2	Rear working lights (a pair of inner lights)
К3	Conditioner
К4	Rear working lights (a pair of outer lights)
К5	Front working lights (on the roof)
К6	Not used
К7	Not used
К8	Not used
К9	Not used
К10	Horn
К11	Front working lamps (on handgrip)
К12	Tractor turning indication and emergency indication
К13	Signal from terminal “D” of the alternator to systems of FLL, RLL and OPU of the HLL control and to electic socket 6 (figure 2.22.2)
К14	Power supply to consumers, staying on when the starter and instrument switch is in position “instruments are on”
К15	Lock of AB remote cutout
К16	Road headlights lower beam
К17	Road headlights upper beam
К18	Parking lights and instrument illumination
К19	Not used

Note – Fuse and relay designation on the switching unit corresponds to fuse and relay designation on tractor electrical diagram in annex D.

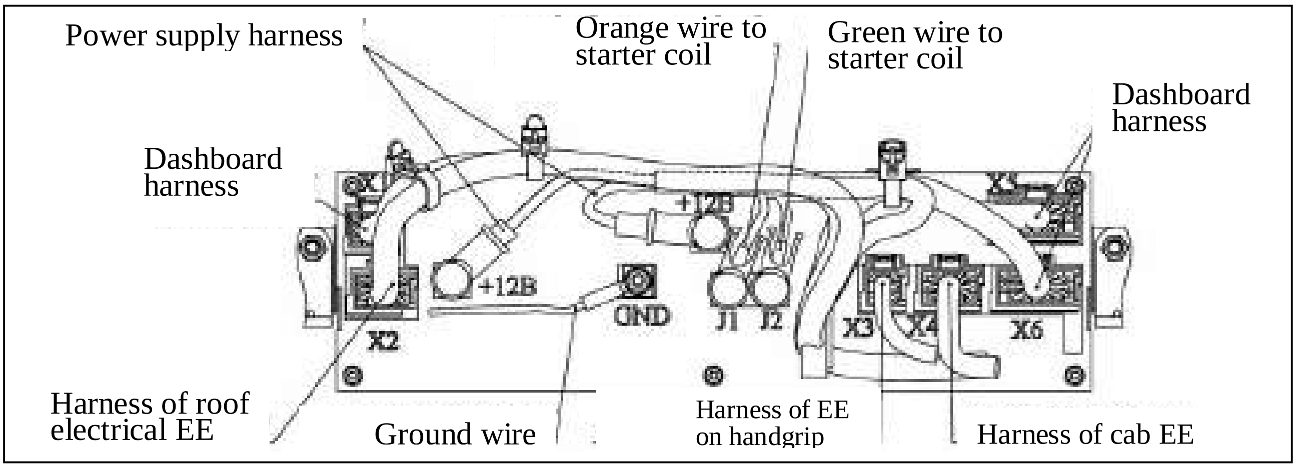
A set of spare fuses 5 (figure 2.18.2), installed on the front panel of the switching unit, includes spare fuses 2 (figure 2.18.4) with 7,5A, 15A, 20A, 25A, 30A ratings and, for БКА-7.3722, a fuse removal tool 1. БК-1 is not completed with the fuse removal tool.



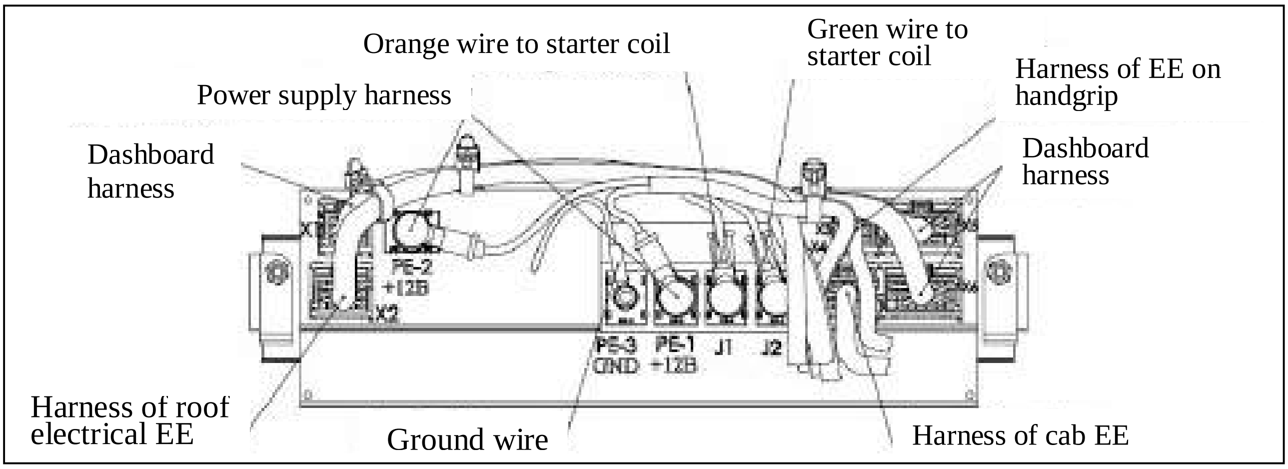
1 – fuse removal tool; 2 – spare fuses; 3 – switching unit.

Figure 2.18.4 – Set of spare fuses for the switching unit БКА-7.3722

Electrical connection of equipment harnesses to the swithing unit is presented in figure 2.18.5.



a) connection of electrical harnesses to БКА-7.3722



b) connection of electrical harnesses to БК-1

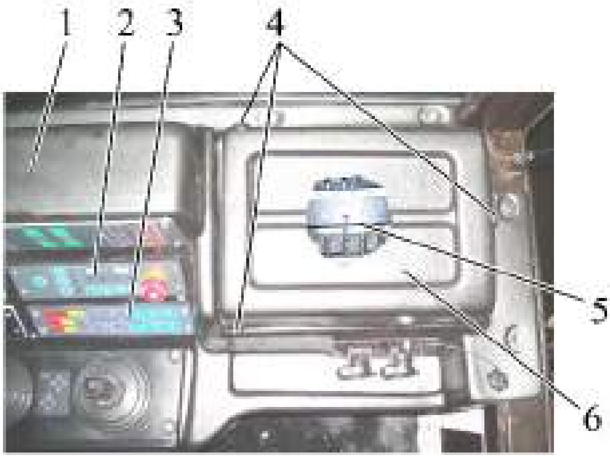
Figure 2.18.5 – Diagram of equipment harnesses connection to the switching unit

2.19 Protection and switching unit

The protection and switching unit (PASU) is intended to distribute power supply between tractor electronic control systems and to protect electrical lines from short circuit and current load excess. The tractor "BELARUS-3522.5" is equipped with a PASU of configuration БКЗ-3522.5.

Place of installation is a cab rear part, to the right behind the side consol.

To access the relay and fuses of the PASU 5 (figure 2.19.10) it is required to unfasten three screws 4 and remove a plastic cover 6. Then it is needed to unfasten four screws on the PASU and lift an iron cover up.

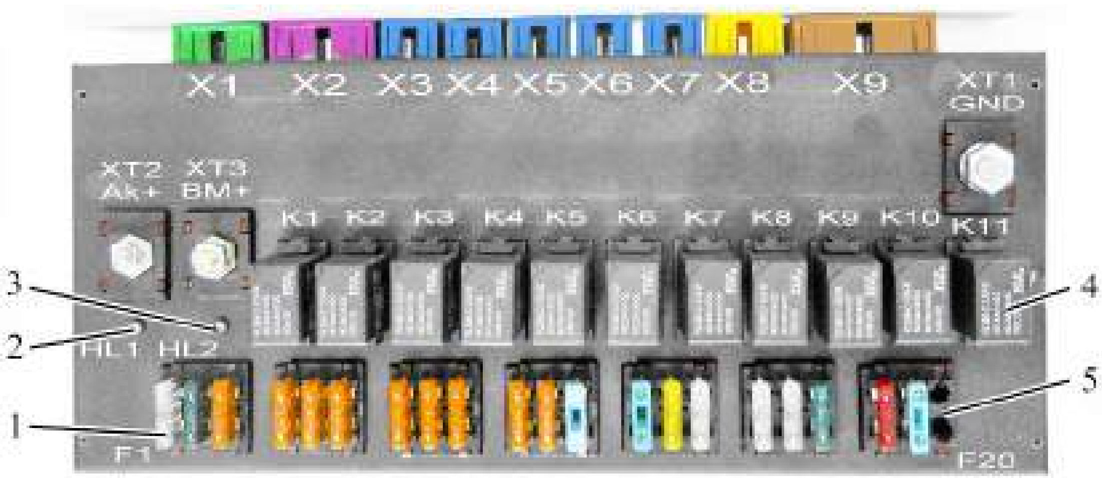


1 – side console; 2 – OPU of the HLL; 3 – IEP; 4 – screw; 5 – PASU; 6 – cover.

Figure 2.19.1 – Installation of the protection and switching unit

The unit consists of twelve electric fuses 1 (figure 2.19.2) (F1 ÷ F20), eleven electromagnetic relays 4 (K1 ÷ K11) commutating power supply to elements of tractor electronic control systems. Signal led lamps of red color 5, located on the front panel beside each fuse, are intended to indicate blow-out of a corresponding cutout fuse. Besides, there are signal led lamps of yellow color 2 and 3. The led lamp 2 indicates availability of constant current supply of PASU, irrespective of the AB disconnect switch position. The led lamp 3 indicates availability of current supply to the PASU only with the AB disconnect switch turned on.

Allocation diagram of fuses, relays and other elements in the PASU is presented in figure 2.19.2.



1 – cutout fuse; 2, 3 – signal led lamp of yellow color; 4 – electromagnetic relay; 5 – signal led lamp of red color.

Figure 2.19.2 – Protection and switching unit

Information on assignment and ratings of fuses and on relay assignment is given in tables 2.8 and 2.9, respectively.

Electrical connection of harnesses of electronic control systems to slots X1 ÷ X6, X8, X9 (figure 2.19.2) and to outputs XT1 ÷ XT3 of the PASU is presented in table 2.10.

Table 2.8 – Assignment of PASU fuses

Fuse designation	Fuse assignement (protected electrical circuit)	Fuse rating
F1	CECS	25A
F2	Power supply to engine control electronic system	30A
F3	Actuation of electronic unit of engine control	5A
F4	Power supply to IEP	5A
F5	Power supply to diagnostics equipment	5A
F6	Reserve	5A
F7	Power supply to information display	5A
F8	Reserve	5A
F9	Reserve	5A
F10	Power supply to FLL control system	5A
F11	Power supply to RLL control system	5A
F12	Power supply to OPU of the HLL	15A
F13	Reserve	15A
F14	Electric cigar lighter	20A
F15	Electric socket after engine start 6 (figure 2.22.2)	25A
F16	Electric socket after AB actuation (figure 2.22.2)	25A
F17	Reserve	25A
F18	Power supply to heaters of SCR system	30A
F19	Power supply to NOx sensors of SCR system	10A
F20	Power supply to turbocharger drive	15A

Table 2.9 – Assignment of relays in PASU

Relay designation	Relay assignement
K1	Neutral of range reduction unit
K2	Power supply to CECS
K3	Power supply to IEP, information display, diagnostics equipment
K4	Power supply to NOx sensors of SCR system, turbocharger drive
K5	Power supply to systems of FLL, RLL and OPU of the HLL control
K6	Electrical socket after engine start 6 (figure 2.22.2)
K7	Power supply to heaters of SCR system
K8	Actuation of charging hose heater of SCR system
K9	Actuation of drain hose heater of SCR system
K10	Actuation of intake hose heater of SCR system
K11	Actuation of delivery module heater of SCR system

Note – Designations of relays and fuses in PASU correspond to designations of relays and fuses in diagram of PASU electrical connections in annex A.

Table 2.10 – Harness connection to PASU

Slot (output)	Element connected
X1	CECS harness
X2	Harness of engine electronic control system
X3	Harness of engine electronic control system
X4	Harness of FLL electronic control system
X5	Harness of RLL electronic control system
X6	Harness of OPU of the HLL
X8	Harness of electrical sockets 5 and 6 (figure 2.22.2) and electric cigar lighter
X9	Harness of SCR system
XT1	Wire of black color or marked "Ч", with a lug M8 – PASU ground
XT2	Wire of green color or marked "З", with a lug M5 – PASU constant power supply (+12V), irrespective of the AB disconnect switch position
XT3	Wire of red color or marked "К", with a lug M6 – PASU powering (+12V), supplied to PASU only with the AB disconnect switch turned on irrespective of the AB disconnect switch position

2.20 Cab locks and handles

2.20.1 Cab door locks

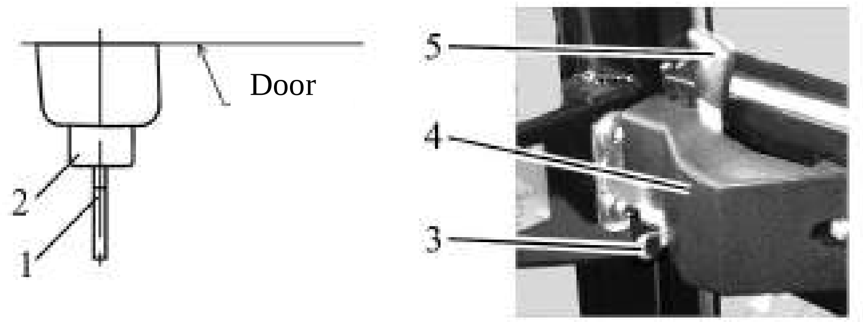
Left and right doors of tractor cab are secured with locks 4 (figure 2.20.1). The lever 5 serves to open the left and right cab doors from inside the cab. Moving the lever 5 backward unlocks the door. The locks of the right and left doors can be blocked from inside the cab. To block the lock from inside the cab it is needed to shift the detent 3 into the lower extreme position.

With the lock 4 unblocked the left door is opened from outside by pushing the 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 a key 1 into the hole of the cylinder mechanism, which is located in the button 2;
- without pushing the button 2 turn the key into position "closed".

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



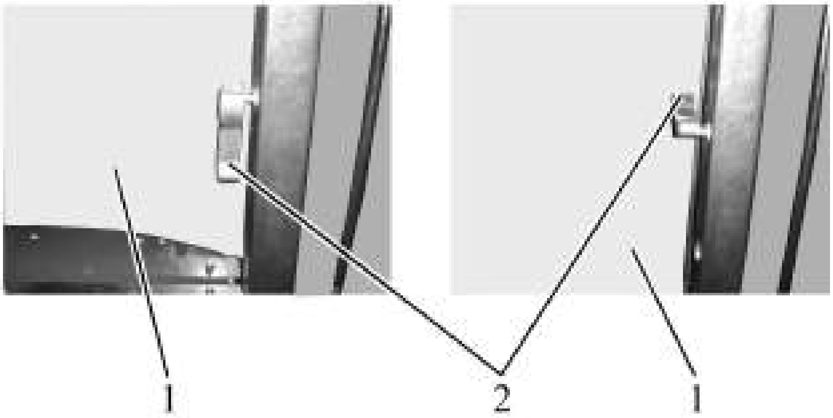
1 – key; 2 – button; 3 – detent, 4 – lock; 5 – lever.

Figure 2.20.1 – Cab door lock

2.20.2 Side glass opening

To open the side glass 1 (figure 2.20.2), right and left, rotate the handle 2 up and push it. Then fix the glass in opened condition, for this it is necessary to push the handle 2 down.

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



a) side glass closed b) side glass opened

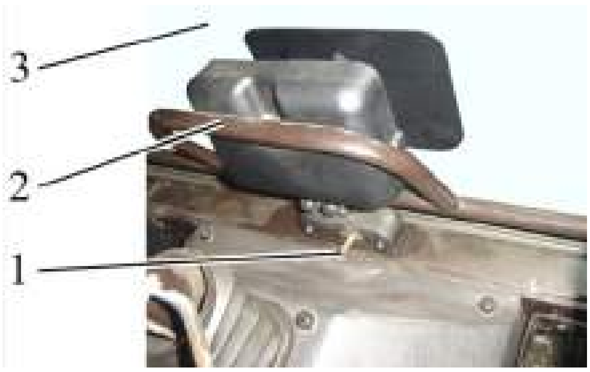
1 – side glass; 2 – handle.

Figure 2.20.2 – Side glass opening

2.20.3 Rear screen opening

To open the rear screen rotate a handle 1 (figure 2.20.3) to the right (along tractor movement) and holding a handgrip 2 push the rear screen 3 until the screen is fixed in an opened position.

To close the rear screen pull the handgrip 2 until the screen 3 is fixed in a closed position.



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

Figure 2.20.3 – Rear screen opening

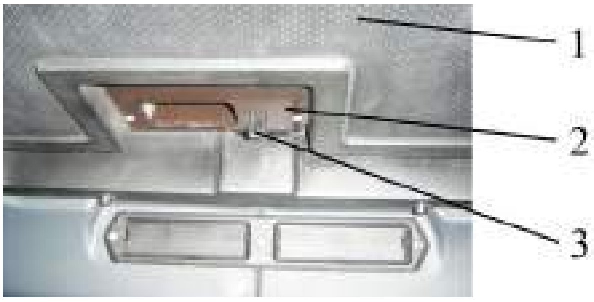
2.20.4 Cab hatch opening

Installation of two hatch variants for roof upper part is possible on tractors “BELA-RUS-3522.5”:

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

To open the hatch with the detent, pull the board 2 (figure 2.20.4) down, move the detent 3 forward along tractor movement, push the board 2 up until the hatch 1 is fixed in an opened position.

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

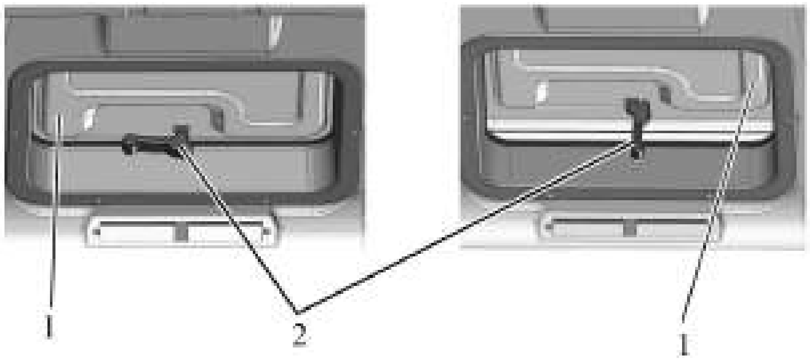


1 – hatch; 2 – board; 3 – detent.

Figure 2.20.4 – Opening of hatch with detent

To open the hatch with the handle move the handle 2 (figure 2.20.5) down and push it up. Then fix the hatch 1 in an opened position, pressing the handle 2 to the right along tractor movement.

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



a) hatch closed b) hatch opened

1 – hatch; 2 – handle.

Figure 2.20.5 – Opening of hatch with handle

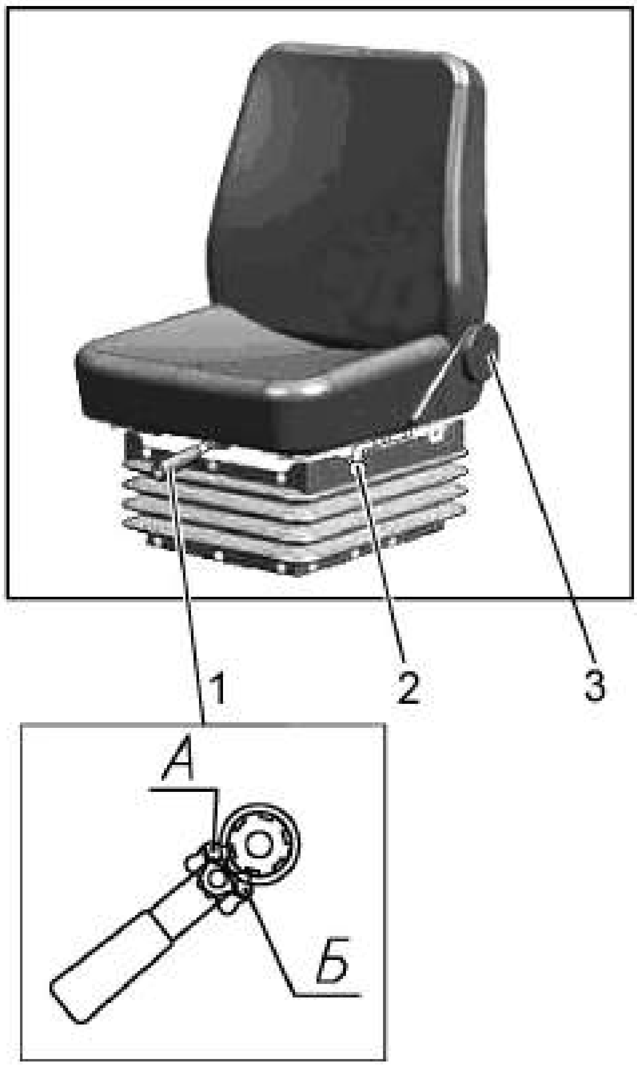
2.21 Seat and its adjustments

2.21.1 General information

The seat has a mechanical suspension, consisting of two spiral torsion springs and a gas charged shock absorber of two-directional operation. A “scissors”-type guiding mechanism ensures a 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)!

2.21.2 “BELARUS” seat adjustments



1 – handle to adjust according to the weight; 2 – handle for longitudinal adjustment; 3 – handwheel to adjust the backrest tilt.

Figure 2.21.1 – “BELARUS” seat adjustments

The “BELARUS” seat has the following adjustments:

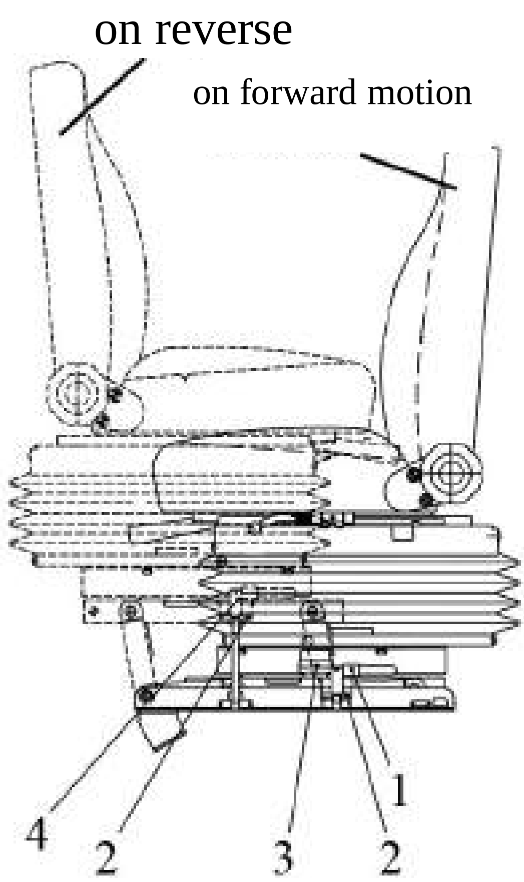
- adjustment according to the operator's weight. It is carried out by means of a handle 1 (figure 2.21.1) within the range from 50 to 120 kg. To adjust the seat for a bigger weight it is required to shift the pawl of the lever 1 into position “A” and tighten the springs with a reciprocal movement. To adjust the seat for a smaller weight it is required to shift the pawl into position “Б” and release the springs with a reciprocal movement.

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

- the backrest tilt angle is adjusted by means of a handwheel 3 within the range from minus 30° to plus 30°. To increase the backrest tilt angle it is necessary to turn the handwheel clockwise, to decrease it – contraclockwise.

- 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 up smoothly till the arresting stop goes off (a specific click is heard). To move the seat from the “upper” position into the “lower” one it is necessary to lift the seat up against the stop with an abrupt movement and let it down. It is impossible to move the seat from the “middle” position to the “lower” one.

2.21.3 Seat installation for operation on reverse



1 – clamp; 2 – jaw; 3 – handle; 4 – clamp.

Figure 2.21.2 – Seat installation for operation on reverse

Seat installation for operation on reverse is carried out in the following order:

- release clamps 1 (figure 2.21.2) and take them aside, exempting jaws 2 of the upper base of the uplift mechanism;
- pulling a handle 3 up, unlatch the rotation mechanism and rotate the seat by 180°;
- applying force up and forward, move the seat to the extreme position against the stop;
- carry clamps 4 into the jaws 2 and screw them in against the stop;

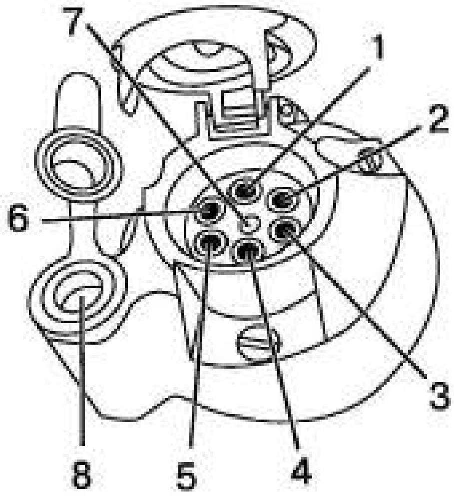
The seat installation for operation on forward motion is carried out in a reverse order.

Seat adjustments on reverse are carried out in the same way as on forward motion.

2.22 Connector elements of the electrical equipment

2.22.1 Socket to connect coupled agricultural equipment

A standard seven-pin socket with an additional receiver to connect a portable lamp (figure 2.22.1) is intended to connect current consumers of a trailer or trailed agricultural implement. It is mounted on the RLL bracket. A male plug of wire harness from a trailer or coupled agricultural implements 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 8 A.

Figure 1 – Assignment of socket terminals to connect trailed agricultural implement

2.22.2 Installation of electrical sockets

Apart from the socket to connect a trailed agricultural equipment “BELARUS-3522.5” tractors are equipped with additional electrical sockets. These sockets installation as well as cigar lighter installation is presented in figure 2.22.2.

Power to the front socket 2 (figure 2.22.2), to the rear socket 5 and to the cigar lighter 4 is supplied after the accumulator battery is switched on. Power to the rear socket 6 is supplied after the engine is started.

Max. current loads on the sockets and the cigar lighter are as follows:

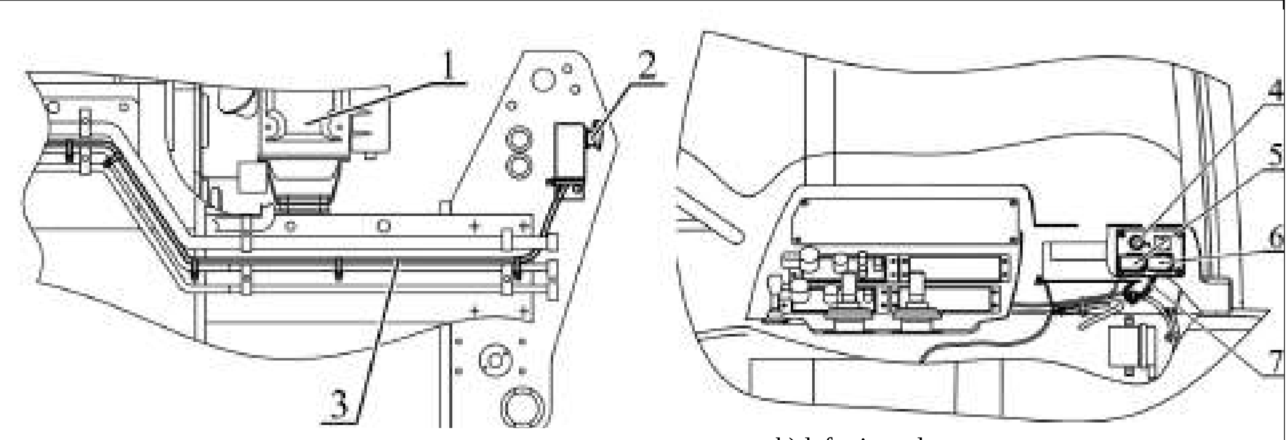
- front socket – 25 A;
- rear sockets – 25 A;
- cigar lighter – 10 A.

It is allowed to use the cigar lighter socket as a receiver to connect electrical consumers with current load not exceeding 10 A.

The fuse for the front socket 2 is located on the fuse block, which is mounted in the engine compartment (see subsection 2.17 “Cutout fuses”), the fuses for the rear sockets 5, 6 and for the cigar lighter are located in the protection and switching unit PASU (see subsection 2.19 “Protection and switching unit”).

Socket mating jacks (electrical plugs) are enclosed to tractor spare parts, tools and accessories.

ATTENTION: CONNECTING CONSUMERS, STRICLY OBSERVE THE POLARITY, SPECIFIED ON ELECTRICAL PLUGS!



a) right view along tractor movement b) left view along tractor movement

1 – radiator of engine cooling system; 2 – front socket (located on FLL); 3 – connecting harness of front socket; 4 – cigar lighter; 5, 6 – rear sockets (located in tractor cab); 7 – connecting harness of rear sockets and of cigar lighter.

Figure 2.22.2 – Installation of electrical sockets and of cigar lighter

2.23 Reverse post controls

"BELARUS – 3522.5" is equipped with a reverse control post with the aim to increase opportunities of coupling with front-mounted agricultural machines.

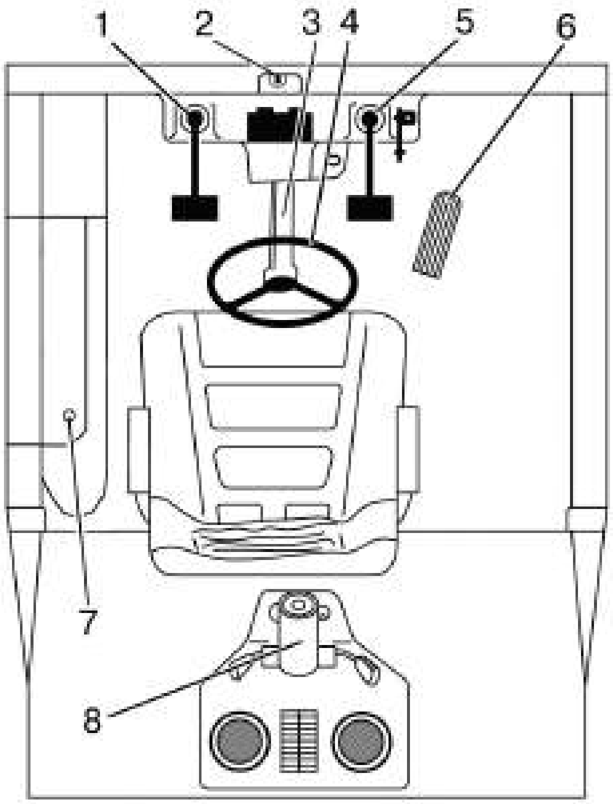
Elements of the reverse control are as follows:

- reverse motion steering column with a dosing pump;
- duplicated pedal drives to control the coupling clutch, brakes and fuel feed;
- seat reversing mechanism;
- button to actuate electronic foot pedal of engine control on reverse with an annunciator;
- additional disconnect switch of rear screen wiper, horn button and annunciator of emergency modes of engine operation (buzzer).

ATTENTION: TRACTOR REVERSE CONTROL POST IS INTENDED ONLY FOR AGRICULTURAL OPERATIONS WHEN MOVING BACKWARDS!

IT IS FORBIDDEN TO MOVE ON REVERSE ON PUBLIC ROADS, AND ALSO AT WORKS, NOT RELATED TO AGRICULTURAL PRODUCTION!

Supplementary controls of the reverse post are mounted at the rear of the cab, their location is shown in figure 2.23.1.



1 – duplicated clutch pedal; 2 – additional disconnect switch of the rear screen wiper; 3 – reverse steering column; 4 – steering wheel; 5 – duplicated brake pedal; 6 – duplicated fuel feed pedal; 7 – horn button; 8 – steering column of forward motion.

Figure 2.23.1 – Location diagram of reverse post supplementary controls

Pressing the pedal 1 (figure 2.23.1) engages the clutch. Removing the foot from the pedal disengages the clutch.

The disconnect switch 2 is designed to turn the rear screen wiper on / off.

The steering wheel 4 for tractor turning is displaced from the steering column of forward motion 8 to the steering column of reverse motion 3.

Pressing the pedal 5 engages two tractor brakes and a pneumatic drive of trailer brakes.

Pressing the pedal 6 increases fuel feed.

Pressing the button 7, located on CECS, activates the horn.

To operate the tractor on reverse, perform the following operations:

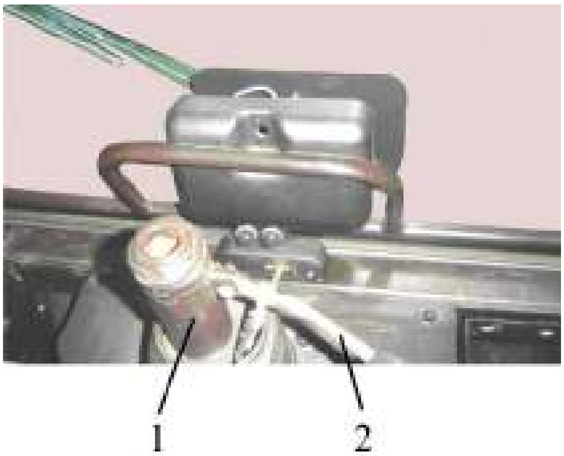
- displace the steering wheel to the steering column of the reverse motion. To do this unscrew the steering wheel fixing clamp, displace the steering wheel and fix it at a required height;
- mount the reverse seat to operate on reverse;
- set a handle of the reverse valve control in HSC system into the extreme lower position;
- push the button 7 (figure 2.9.1) to actuate the electronic foot pedal of engine control mode on reverse;
- set the disconnect switch of the rear screen wiper and washer, located on the upper shield unit of button switches, into position “Rear screen wiper on”. If necessary turn the rear screen wiper on/off with a supplementary rear screen disconnect switch.

To change a tilt angle of the reverse motion steering column 3 (figure 2.23.1) located on reverse post do the following:

- pull the handle 2 up (figure 2.23.2);
- tilt the reverse motion steering column 1 to a position comfortable for operation, and releasing the handle 2, swing the steering column smoothly in a longitudinal direction to reach a secure fixation.

The steering column can be tilted and fixed in five positions. Herein:

- o in four positions from 25° to 40° with a 5° period to operate on reverse;
- o in a 10° position to operate the tractor on forward motion.



1 – steering column for reverse motion; 2 – handle.

Figure 2.23.2 – Changing tilt angle of the steering column for reverse motion

ATTENTION: WITH THE STEERING COLUMN FIXED IN THE EXREME FRONT WORKING CONDITION SET THE RANGE SHIFTING LEVER INTO A NEUTRAL POSITION, DISENGAGE GB GEARS (SET “0” GEAR), START THE ENGINE AND WITH THE TRACTOR NOT RUNNING MAKE SURE THE STEERING CONTROL OPERATES WELL!

3 Description and operation of tractor constituents

3.1 Engine and its systems

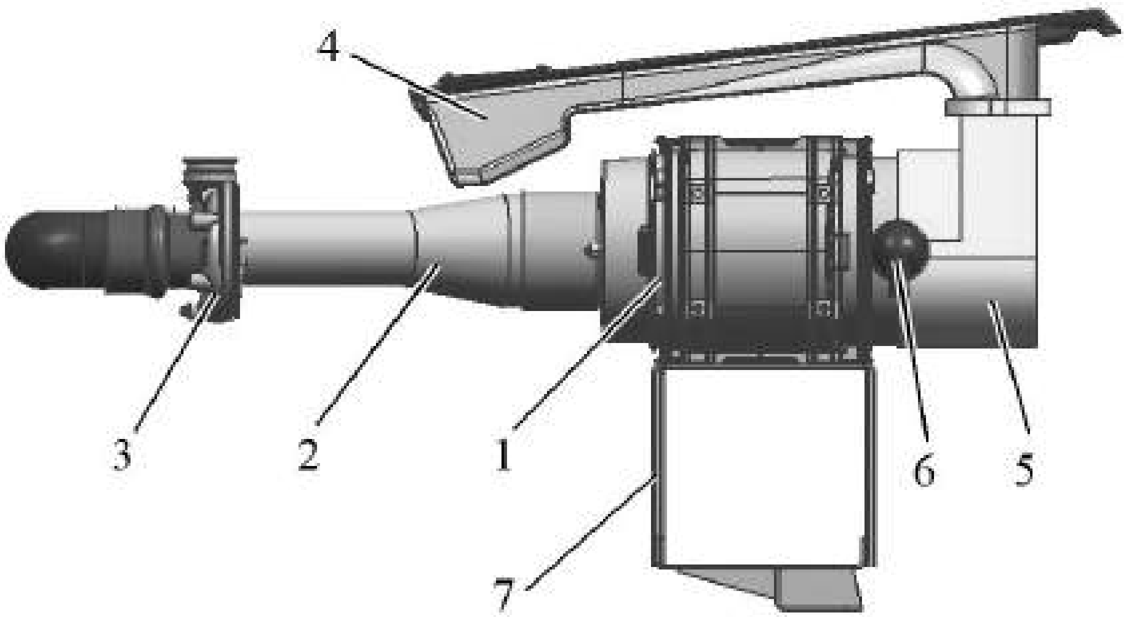
3.1.2 Engine

The “BELARUS-3522.5” tractor is equipped with a diesel engine TCD 7,8 L06 manufactured by "DEUTZ" company.

Data on operation procedures, maintenance, arrangement and elimination of TCD 7,8 L06 engine failures is provided in “TCD 7,8 L06 engine operation manual” attached to your tractor.

3.1.3 System of engine air cleaning

Arrangement of elements of the engine air cleaning system for “BELARUS-3522.5” tractors is presented in figure 3.1.1.



1 – air cleaner; 2 – air line; 3 – turbocharger; 4 – upper hood cover; 5 – air intake; 6 – backflow valve; 7 – bracket to mount the air cleaner.

Figure 3.1.1 – Engine air cleaning system

On “BELARUS-3522.5” tractors the system of cleaning the air, delivered to the engine turbocharger, includes:

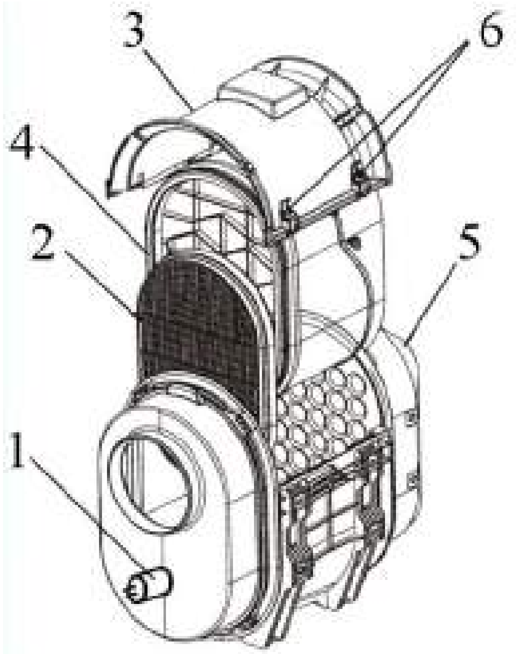
- air cleaner 1 (figure 3.1.1) with a built-in unit “multicyclone” of PSD (Donaldson) series;
- air line 2, connecting the air cleaner 1 with the turbocharger 3;
- impurity sensor, designed to indicate a rate of the air cleaner impurity. The electric sensor of the air cleaner filter impurity (see figure 3.1.2) is mounted on the air cleaner body and is actuated by discharging of not less than 7 kPa. Hereby a pilot lamp of air cleaner filter impurity, which is located on dashboard in pilot lamp unit, lights up.
- backflow valve 6 (figure 3.1.1) of the induction system, required to exclude a potential possibility of changing direction of air flow in the induction system – it is mounted on a dust-extract pipe of the “multicyclone” unit.

To reduce noise level in the cab, the air cleaner 1 is located in the underhood compartment in the middle part of the engine assembly, just behind the turbocharger 3, with the outlet of the air intake 5 in underhood compartment. The air intake 5 is brought into coincidence with the upper hood cover 4.

The air cleaner with the built-in unit “multicyclone” of PSD (Donaldson) series, presented in figure 3.1.2, has a number of advantages:

- small dimensions thanks to a compact design;
- long life span thanks to a high-performance pre-cleaner – “multicyclone” unit;
- enhanced operational reliability thanks to a filtering element with interclosed filtering channels and a linear flow direction and with an additional secondary filtering element with radial sealing.

Also to ensure secure and perfect functioning of the air cleaner in-built unit “multicyclone” of PSD (Donaldson) series, an induction system is provided, which guarantees constant removal of dust from the pre-cleaner by means of suction, thus allowing to avoid dust deposits, resulting in significant reduction of performance factor as well as life span of the air cleaner.



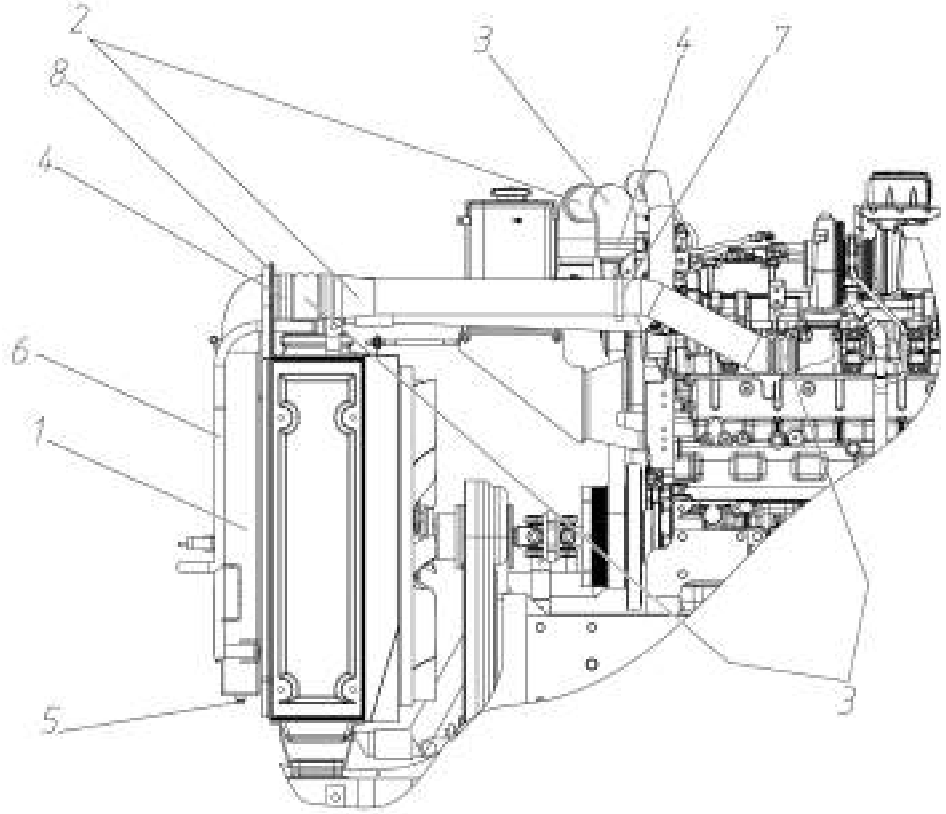
1 – sensor of air cleaner filter impurity; 2 – pilot filtering; 3 – cover for air cleaner maintenance; 4 – main filtering element; 5 – monocyclone inbuilt unit; 6 – latches of cover for air cleaner maintenance (4 pcs).

Figure 3.1.2 – Air cleaner with in-built unit “multicyclone”

3.1.2 System of charged air cooling

Intermediate cooling of charged air is a means, increasing density of air charge, coming to engine cylinders, thus enabling more effective burning of fuel in the cylinders and as a result ensuring increase of power with decrease of specific fuel consumption. An air-cooled cooling system is used in engine, with a plate-fin air cooler (radiator) 1 (figure 3.1.3), mounted in front of the water radiator on the CAC lifting mechanism 6. The CAC lifting mechanism is designed to simplify the procedure of cleaning the CAC radiator 1 and the water radiator from dirtiness.

The air charged by the turbocharger via the air line 2, the elements of which are connected by the silicone pipes 3, is delivered to the CAC radiator 1, where it is cooled by the airflow, created by the fan. The cooled air comes to the engine intake manifold via the air pipeline 9.



1 – air cooler (radiator); 2, 9 – air pipeline; 3 – silicone pipes; 4 – clamps; 5 – plug; 6 – CAC lifting mechanism; 7 – supporting bracket; 8 – sealing; 10 – winged nut.

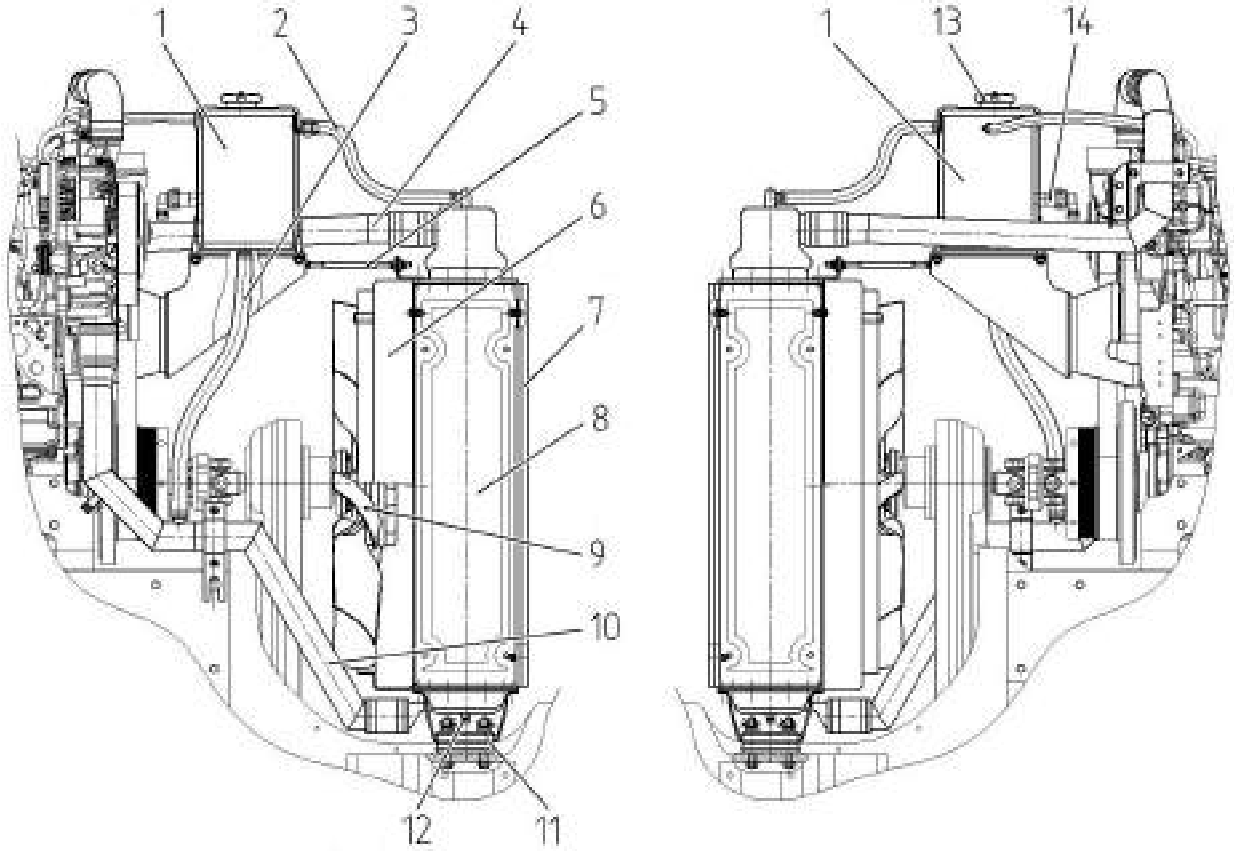
Figure 3.1.3 – Charged air cooling system

3.1.4 Cooling system

The system of engine cooling is a liquid closed-type, with forced coolant circulation and a deaerating-compensation circuit. It includes a cooling jacket, a water pump, a radiator with in-built deaeration system, a fan with an automatically controlled viscous clutch, an expansion tank, connection hoses, clamps, drain plugs, a plug of the expansion tank with a steam and air valves. The engine thermal mode is controlled by a thermostat and the viscous clutch of the fan 9. The cooling system radiator is a ribbed tube type.

Coolant temperature is controlled on the coolant temperature indicator and a pilot lamp of the engine coolant emergency temperature on dashboard. A normal temperature mode of the engine corresponds to the coolant temperature from 85 to 99° C. The pilot lamp of the engine coolant emergency temperature goes off when the temperature is 109°C and higher. Information on the parameters mentioned is transmitted to master instruments via CAN cable from the electronic unit of engine control, that handles signals from sensors.

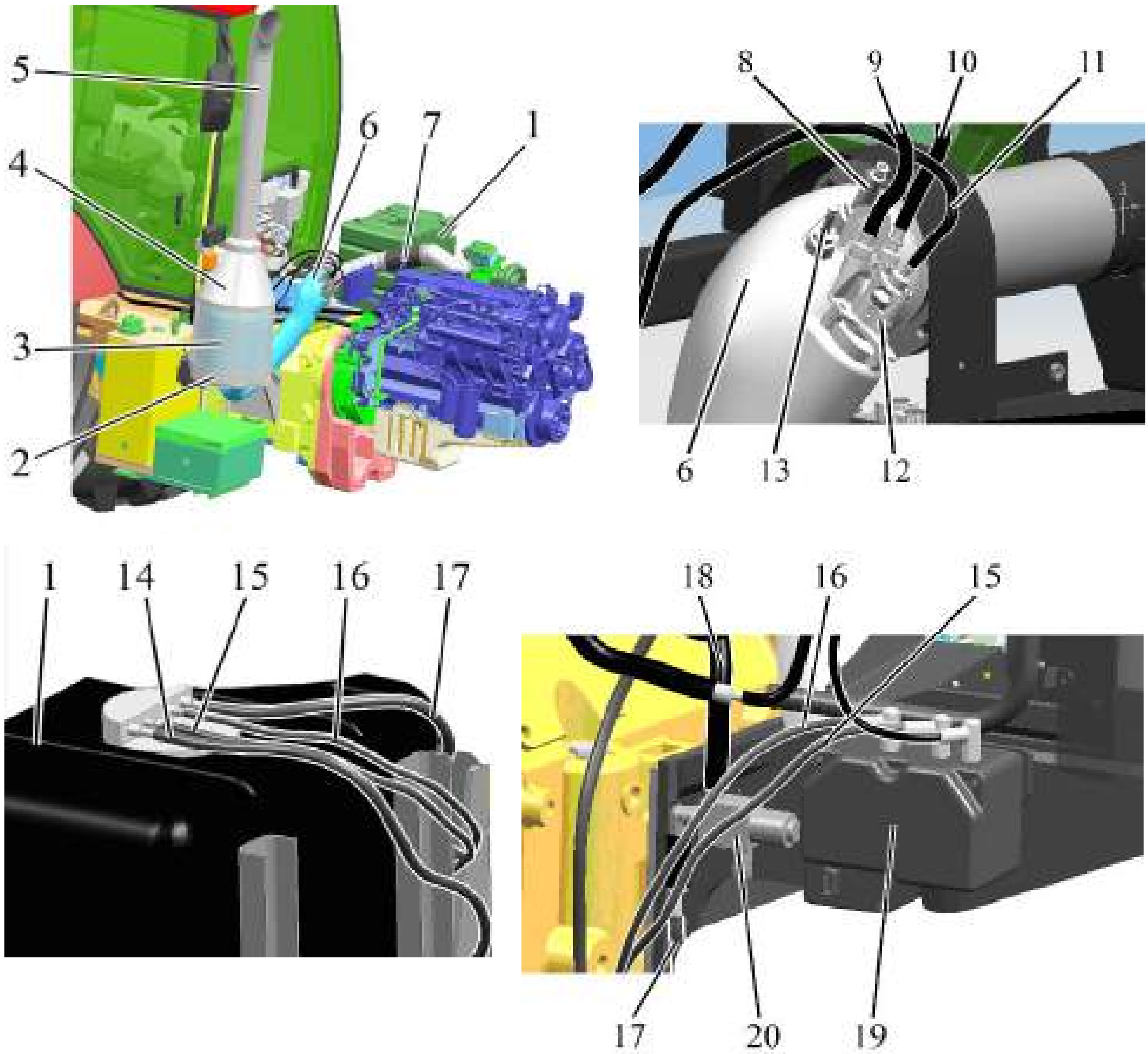
Elements of the engine cooling system are presented in figure 3.1.4.



1 – expansion tank; 2 – deaeration hoses; 3 – feeding hose; 4 – pipe from water pump to water radiator; 5 – tension elements; 6 – water radiator housing; 7 – seals; 8 – water radiator; 9 – fan with viscous clutch; 10 – pipe from water radiator to engine; 11 – rubber shock absorber; 12 – drain plug; 13 – plug of extension tank; 14 – coolant level sensor.

Figure 3.1.4 – Engine cooling system

3.1.5 Exhaust system



1 – tank with AdBlue agent (urea); 2 – bracket to fix a catalyst; 3 – catalyst; 4 – catalyst guard; 5 – exhaust pipe; 6 – mixing pipe; 7 – inlet pipe; 8 – NOx sensor (onitrogen oxides); 9, 10 – cooling pipelines of dosing module; 11 – pipeline of urea delivery from feeding module to dosing module; 12 – dosing module (urea injector); 13 – sensor of exhaust gas temperature before catalyst; 14, 17 – pipelines for warming up urea in the tank; 15 – pipeline to take urea away from the feeding module to the tank; 16 – pipeline to deliver urea from the tank to the feeding module; 18 – pipeline to deliver coolant from the engine cooling system to SCR system; 19 – feeding module (pump); 20 – urea warming up valve.

Figure 3.1.5 – Exhaust system

"BELARUS-3522.5" exhaust system consists of an inlet pipe 7 (figure 3.1.5), a system of selective catalytic reduction and an exhaust pipe 5.

The system of selective catalytic reduction (SCR) is intended to ensure a required chemical composition of exhaust gas under Stage Tier-IIIB in the exhaust system.

The SCR consists of a catalyst 3, a mixing pipe 6, a dosing module (injector) 12, a feeding module (pump) 19, a tank for AdBlue agent 1, a bracket to fix the catalyst 2, cooling pipelines of dosing module 9 and 10, pipelines for warming up urea in the tank 14 and 17 (14 – a pipeline to take coolant away to the engine cooling system; 17 – pipeline to deliver coolant from cab heating system); AdBlue intake pipelines 16, pipelines to deliver AdBlue agent 11, AdBlue takeaway pipelines 15, valves to control warming up of AdBlue tank 20, guards 4 of a catalyst 3.

The SCR operation principle is based on reduction of nitrogen oxide (NOx) level in exhaust gases to reach a required level. For this reason AdBlue agent is injected in the mixing pipe 6 in front of the SCR catalyst 3 by means of the dosing module 12. The location of the dosing module, dimensions and form of the mixing pipe ensure max. even distribution of AdBlue agent at the entrance to SCR catalyst. In SCR catalyst in presence of the inbuilt catalyst a chemical reaction of NOx reduction to nitrogen (N_2) and water vapour (H_2O), that are safe for the environment, occurs. To maintain optimal temperature mode on the mixing pipe surface, heat insulation of the mixing pipe is provided. To control temperature of exhaust gases a temperature sensor 13 is mounted on the mixing pipe. AdBlue agent is supplied by the feeding module 19. A required quantity of the injected AdBlue agent is controlled by a sensor of exhaust gas chemical composition, located behind the SCR catalyst. AdBlue agent is filled into a special tank 1. AdBlue warm-up pipeline is attached to the tank 1, which is equipped with sensors of AdBlue temperature and AdBlue level. AdBlue consumption makes approximately 5 to 10% of diesel fuel consumption. To ensure a SCR optimal operation mode as well as SCR operation ability under low ambient temperatures, heating (cooling) of some parts and units of SCR system is provided.

Heating of AdBlue tank and cooling of the dosing module is performed by the engine cooling system. The dosing module is permanently connected to the tractor cooling system, and the AdBlue tank is connected by means of electromagnetic valve when required. The pipelines for urea transportation and pipelines of the feeding module are heated by means of electronic system of engine control when necessary. SCR system operation is functionally linked with the electronic system of engine control.

A general structural diagram, illustrating interconnection of SCR system units, is presented in figure 3.1.6. All lines of connection and flow directions of AdBlue as well as engine coolant are shown in the diagram.

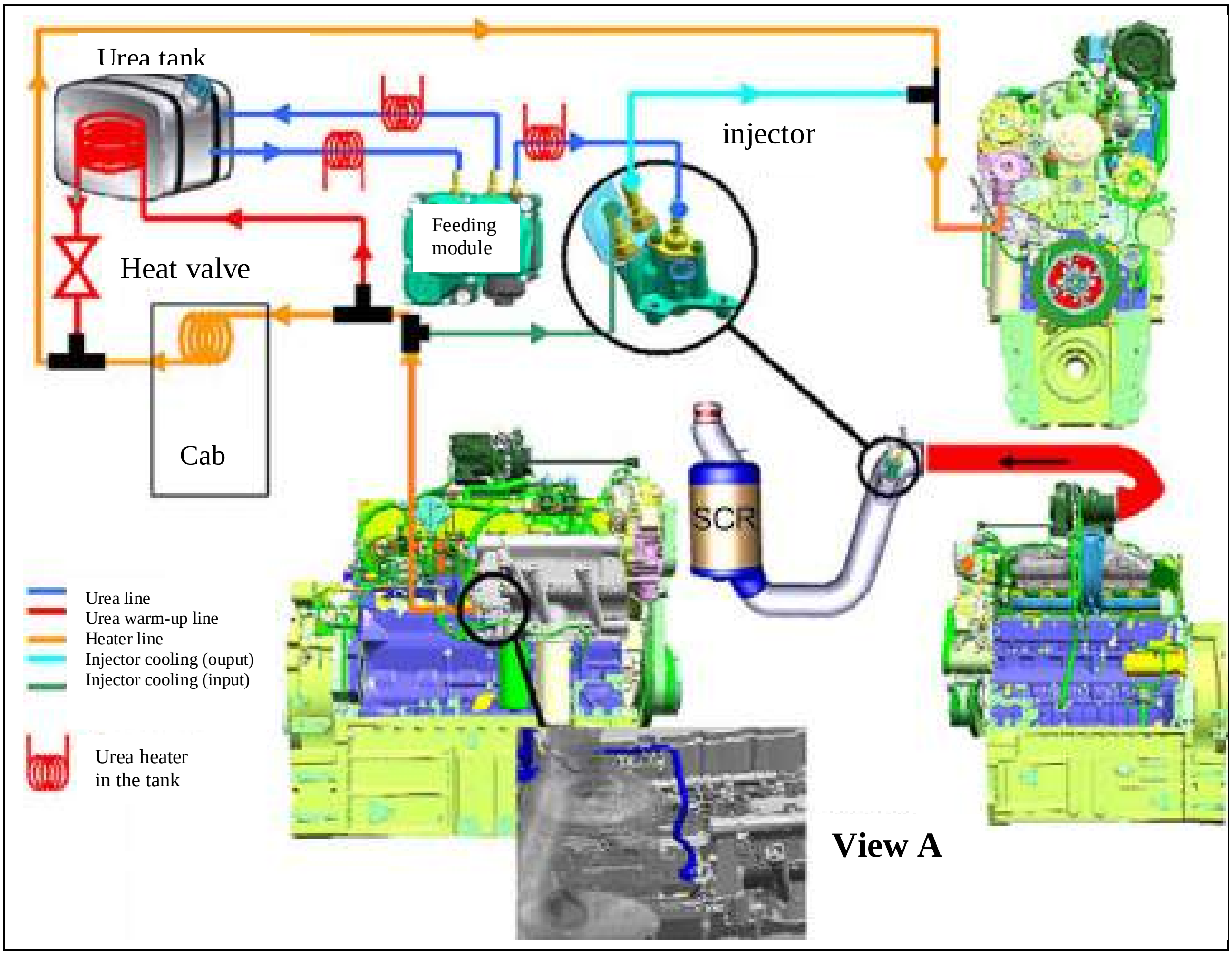


Figure 3.1.6 – Structural diagram of SCR system

3.2 Engine electronic control system

The engine electronic control system (EECS) is powered directly by the accumulator battery through two 30 A fuses which are located in the PASU.

The EECS electical connection diagram is presented in figure Б1 of the Annex B (basic units of the electrical part of SCR system are given on sheet 2 of figure Б1 in Annex B).

The EECS consists of an engine electronic control unit 10 (figure 3.2.1), an information display 6, an integrated electronic panel 7, a switching and protection unit 8; a handle of fuel feed manual control 5, electronic foot pedals of fuel feed 4 and 11 at direct motion and on reverse, respectively, all located in tractor cab, and also a sensor of coolant level 1 and a sensor of water presence in the coarse fuel filter 14, mounted to the left on the expansion tank.

The enumerated units are interconnected by harnesses 13. The engine electronic control unit 10 is connected with the engine by the engine harness extender 2. The EECS also includes the electrical part of the SCR (Selective Catalytic Reduction) system, which is connected via the harness 3 (figure 3.2.1) and is powered by the accumulator battery through the protection and switching unit 8.

The system of selective catalytic reduction (SCR) includes a tank with urea (AdBlue agent) 7 (figure 3.2.2), a catalyst 2, a dosing module 8, which is an atomizer to inject urea, a sensor of exhaust gas temperature in front of a catalyst 4, NOx (nitrogen oxide) sensor in front of a catalyst 5, NOx sensor after a catalyst 3, a feeding module 1, urea heat valve in the tank 3 (figure 3.2.5). Also the system includes an ambient temperature sensor 12 (figure 3.2.1), mounted behind under the cab. The urea tank, the feeding module and the dosing module are interconnected by means of urea supply pipes with inbuilt electrical heaters (figures 3.2.3 and 3.2.4). A combined level and temperature sensor 6 is mounted on the urea tank (figure 3.2.2). The NOx (nitrogen oxides) sensor after the catalyst 3 (figure 3.2.2) is mounted on the catalyst outlet pipe. The NOx sensor modules are mounted on the bracket, fixed to right of the hood frame. Urea warm-up valve connection is shown in figure 3.2.5.

Information on exhaust gas temperature before the catalyst, on the lever and temperature of urea (AdBlue agent), water presence in the coarse fuel filter is shown on the information display.

Description of EECS response to decrease of urea level in the tank is provided in table 3.1.

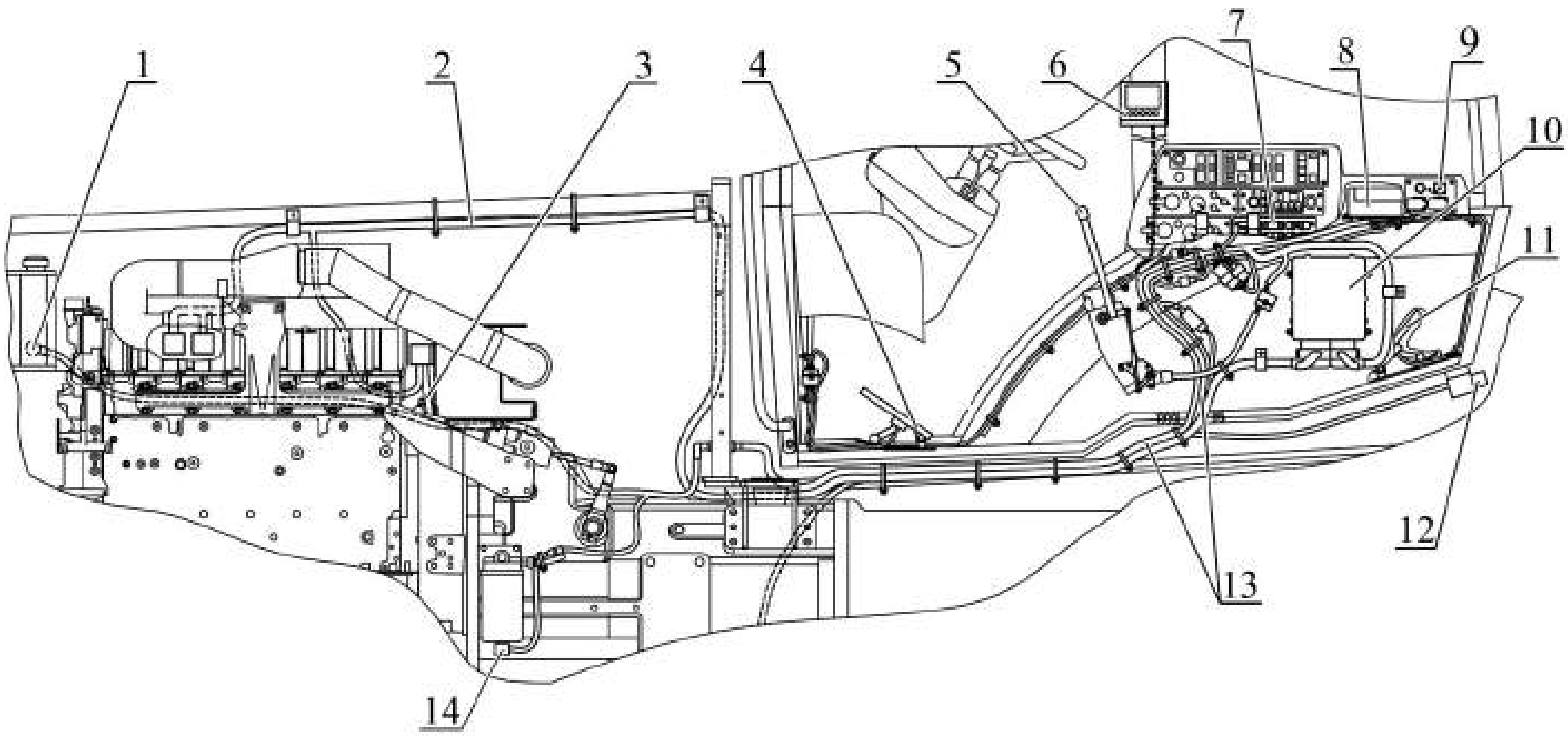
SCR electrical connection is shown in figure 3.2.6.

A general structural diagram, illustrating interconnection of SCR system units, is presented in figure 3.1.6.

Description of operation of SCR units as well as EECS elements, included into the engine composition, is given in the Engine operation manual, attached to your tractor.

The electronic foot pedals of fuel feed and the handle of fuel feed manual control are units to control modes of engine operation according to the speed. If two units are operated simultaneously (the pedal is pressed and the handle is shifted), the preference is given to the unit with a bigger rate of displacement.

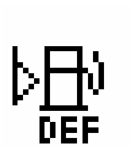
A special test jack 9 (figure 3.2.1) is intended to connect a testing system SERDIA2010 with an adapter of various access levels to carry out an extended service testing of the engine in operation. The specified testing system is recommended for dealer centers.

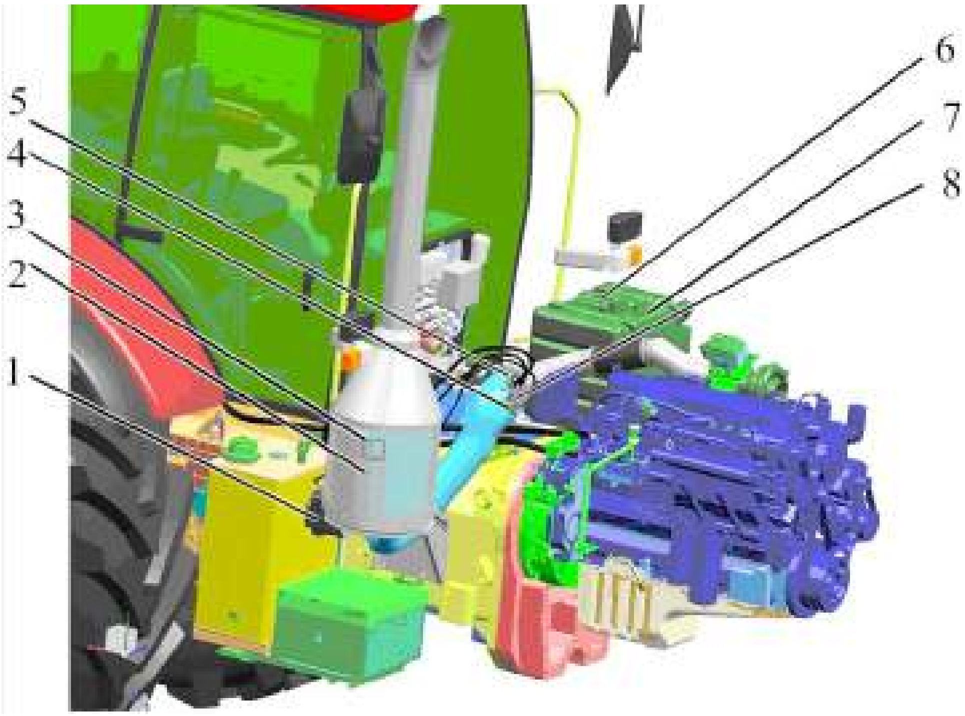


1 – coolant level sensor; 2 – engine harness extender; 3 – SCR connecting harness; 4 – electronic foot pedal to control engine operation mode at direct motion; 5 – handle for manual control of engine operation mode; 6 – information display; 7 – integrated electronic panel (IEP); 8 – protection and switching unit; 9 – test jack ; 10 – engine electronic control unit; 11 – electronic foot pedal to control engine operation mode on reverse; 12 – ambient temperature sensor; 13 – connecting harnesses; 14 – sensor of water presence in fuel filter.

Figure 3.2.1 – Engine electronic control system.

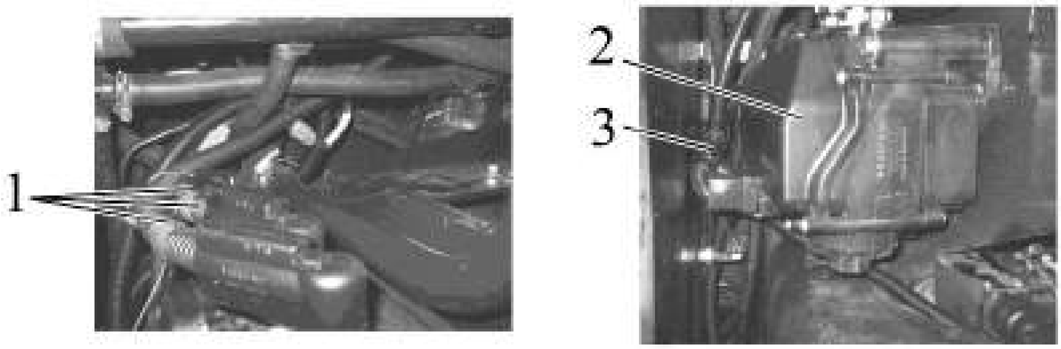
Table 3.1 – Description of EECS response to decrease of urea level

Urea level in the tank	Indication on the information display			Response of the engine control system
	Symbol of urea level	Symbol warning of low urea level	Availability of failure code	
> 15%		No	No	No
< 15%		 Level < 15%	No	No
< 10%		 Level < 10%	No	No
< 5%		 Restriction	Yes / error text	Engine power loss, level 1
< 5%		 Restriction	Yes / error text	Engine power loss, level 2
empty		 Restriction	Yes / error text	



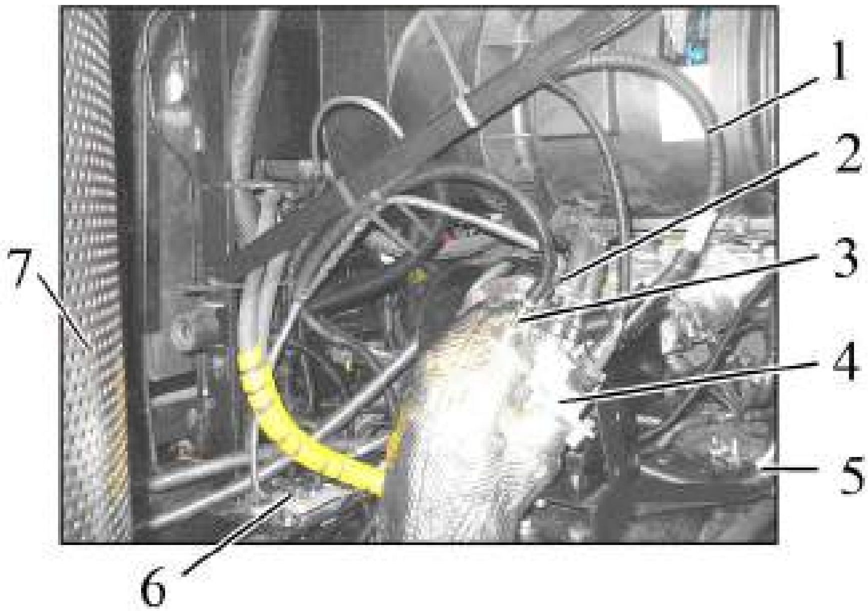
1 – feeding module; 2 – catalyst; 3 – NOx sensor after catalyst; 4 – sensor of exhaust gas temperature in front of a catalyst; 5 – NOx sensor in front of a catalyst; 6 – sensor of urea temperature and level in the tank; 7 – urea tank; 8 – dosing module (atomizer to inject urea).

Figure 3.2.2 – Selective catalytic reduction system SCR



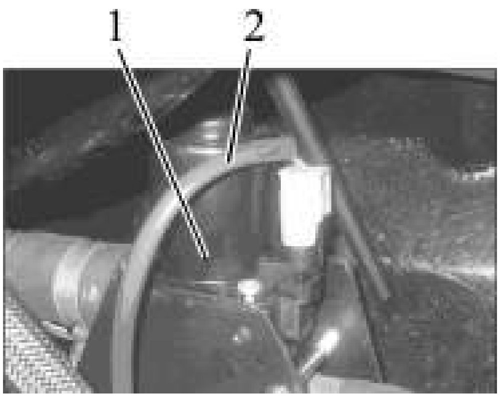
1 – hoses for urea supply; 2 – feeding module; 3 – SCR harness.

Figure 3.2.3 – Connection to feeding module, hose heaters and urea tank



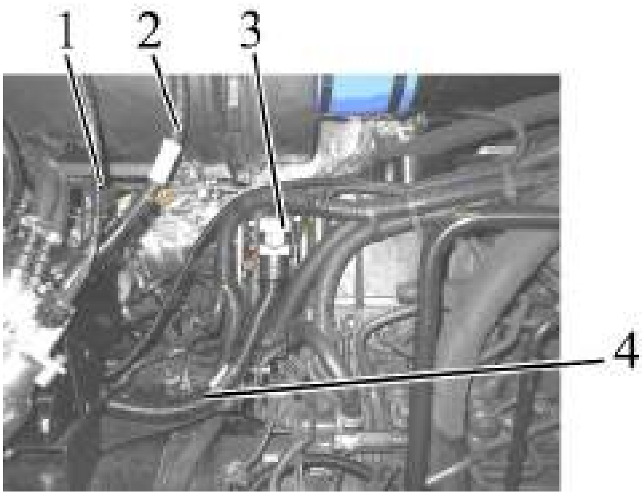
1 – delivery hose; 2 – NOx sensor before catalyst; 3 – sensor of exhaust gas temperature before catalyst; 4 – dosing module; 5 – SCR system harness; 6 – module of NOx sensor before catalyst; 7 – catalyst.

Figure 3.2.4 – Connection to dosing module



1 – valve of urea warm-up in the tank; 2 – SCR system harness.

Figure 3.2.5 – Connection to valve of urea warm-up in the tank



1 – branch of SCR harness to dosing module; 2 – urea delivery hose; 3 – main 42-pin connector of SCR system; 4 – SCR system harness.

Figure 3.2.6 – Electrical connection of SCR system

3.3 Clutch

3.3.1 Coupling clutch

A dry-friction double-disk spring-loaded coupling clutch is mounted on the engine flywheel through a spacer.

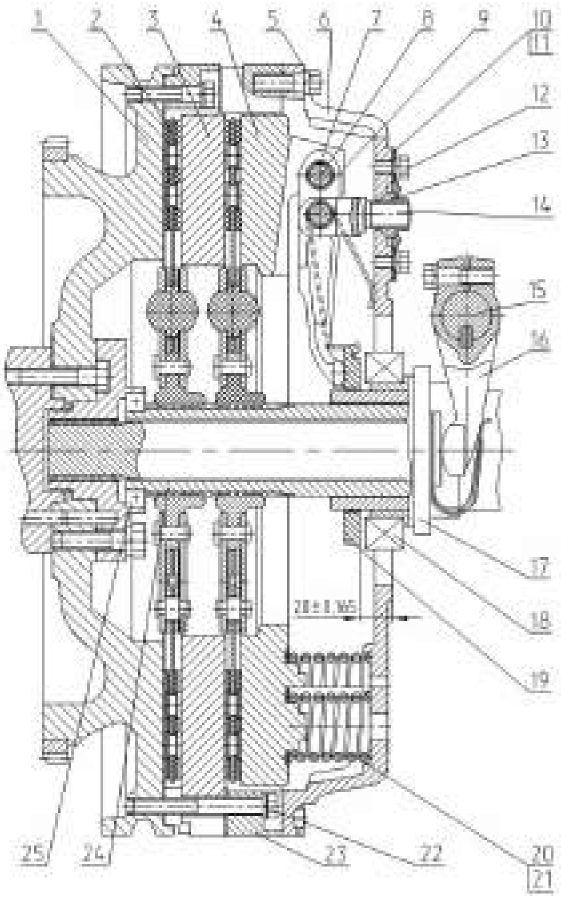
The clutch driving part is a flywheel 1 (figure 3.3.1), a pressure plate 4 and a center plate 3, having four tenons on outer surfaces, which intrude into special mortises of the spacer 23.

Twelve pressure springs 20 with heat-insulating washers 21 are mounted between the back plate and the pressure plate. The back plate 6 is mounted on the flywheel spacer on two pins and is fixed to it with bolts 5.

Four release levers 7 are mounted on the pressure disk juts on axes 8 and rollers 9. The release levers rest on the forks 14, fixed on the back plate by means of adjusting nuts 13, locked by the plates 10, 11. The plates are attached to the back plate by bolts 12. Two driven disks 2, transferring turning torque from the engine through a power shaft 24 to the tractor transmission, are mounted between the flywheel, the center and the pressure plates. At the front the power shaft 24 rests on a bearing 25, permanently greased and mounted in the flywheel.

The driven disk has a hub with splines to fix to the power shaft, a damping device consisting of eight rubber elements and friction liners as metal-ceramic segments.

The clutch is engaged and disengaged by means of a throw-out 17 with a release bearing 18, attached to a yoke 16, located on a shaft 15, mounted on needle bearings in the clutch casing. A lever, connected with the clutch drive, is mounted on the end of the shaft 15.

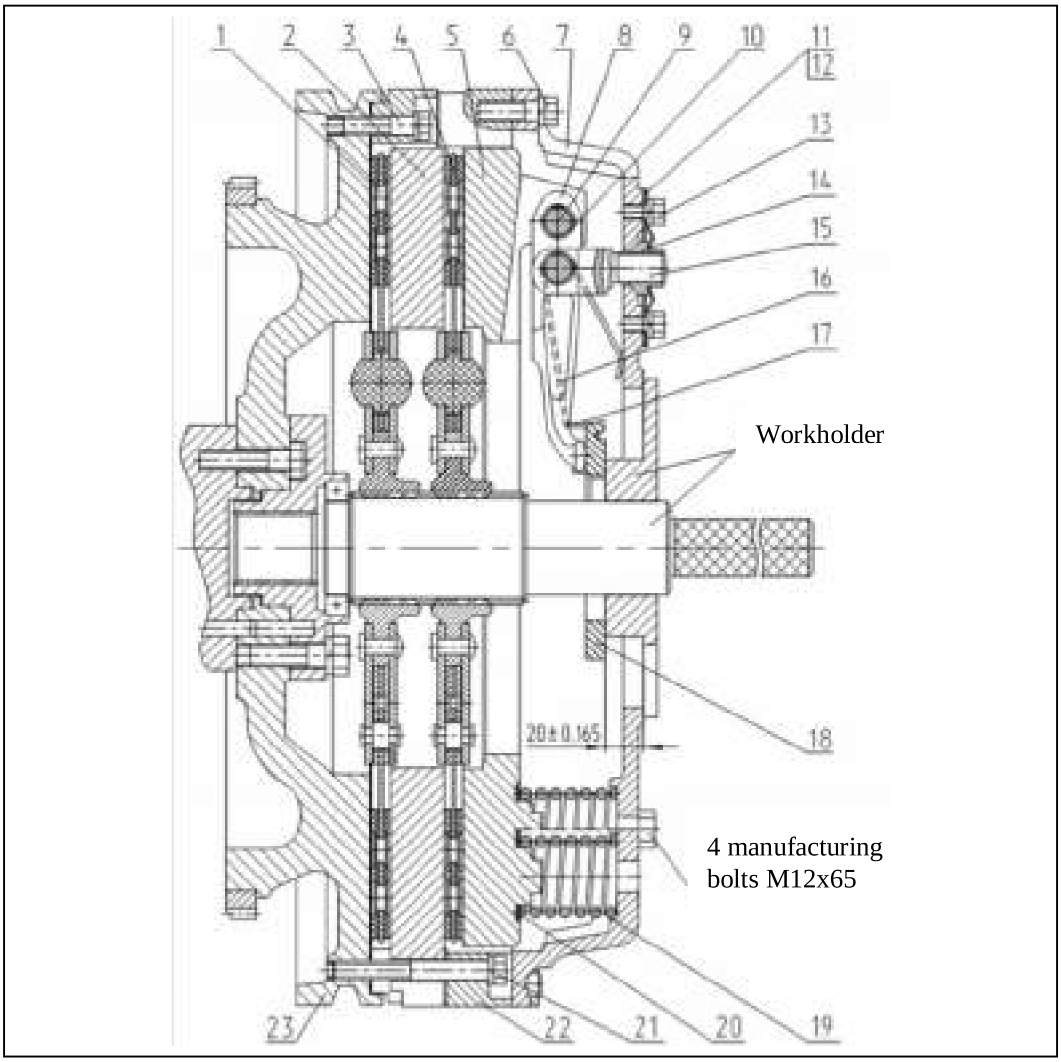


1 – flywheel; 2 – driven disk; 3 – center plate; 4 – pressure plate; 5 – bolt; 6 – back plate; 7 – release lever; 8 – release lever axis; 9 – rollers; 10,11 – lock plates; 12 – bolt; 13 – adjusting nut; 14 – fork; 15 – shaft, 16 – throw-out yoke; 17 – throw-out; 18 – release bearing; 19 – rest of release levers; 20 – pressure springs; 21 – heat-insulating washers; 22 – bolt, 23 – spacer; 24 – power shaft; 25 – bearing.

Figure 3.3.1 – Coupling clutch

3.3.2 Peculiarities of clutch installation, dismantling and adjustment

3.3.2.1 Clutch arrangement



1 – driven disk; 2 – center plate; 3 – bolt; 4 – driven disk; 5 – pressure plate; 6 – bolt; 7 – back plate; 8 – release lever; 9 – release lever axis; 10 – rollers; 11 – lock plate; 12 – lock plate; 13 – bolt; 14 – adjusting nut; 15 – fork; 16 – supporting spring; 17 – hinge; 18 – rest of release levers; 19 – pressure spring; 20 – heat-insulating washers; 21 – bolt; 22 – spacer; 23 – flywheel.

Figure 3.3.2 – Installation, dismantling and adjustment of clutch release levers

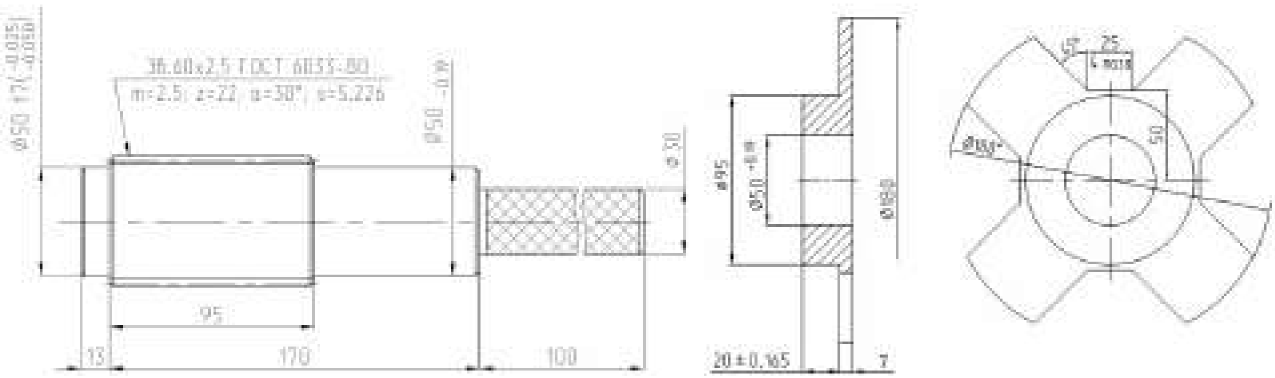


Figure 3.3.3 – Workholder

3.3.2.2 Clutch dismantling

Clutch is dismantled after the engine has been detached from the transmission in the following order:

- mount four manufacturing bolts (M12x65), having screwed them into the pressure disk 5 (figure 3.3.2) through the manufacturing orifices of the back plate 7;
- unscrew the bolts 6 and remove the clutch plates assembly (the back plate 7 together with the pressure plate 5);
- remove the first driven disk 4;
- unscrew the bolts 3 and 21 and remove the spacer 22 with the center plate 2;
- remove the second driven disk 1.

ATTENTION: BEFORE STARTING TO DISMANTLE THE CLUTCH IT IS RECOMMENDED THAT YOU MAKE MARKS, IDENTIFYING MUTUAL ARRANGEMENT OF THE FLYWHEEL 23, THE CENTER PLATE 2, THE SPACER 22, THE PRESSURE PLATE 5 AND THE BACK PLATE 7. ASSEMBLE THE CLUTCH IN ACCORDANCE WITH THE MARKS!

3.3.2.3 Clutch installation

The clutch is installed in the following order:

o mount a splined workholder in the bearings of the flywheel 23 (figure 3.3.2);

o mount the first driven disk 1 on the workholder with the hub short end facing the flywheel 23;

o mount the center plate 2 in the slots of the spacer 22 so that the cavity on the outer surface is directed towards the flywheel;

o mount the spacer 22 with the center plate 2 on the flywheel and fix with bolts 3 and 21;

o mount the driven disk 4 on the workholder with the hub short end facing the flywheel;

o mount the clutch plate assembly (the back plate with the pressure plate 5) on the spacer pins, fix with bolts 6 and unscrew the manufacturing bolts.

3.3.2.4 Adjustment of clutch release levers

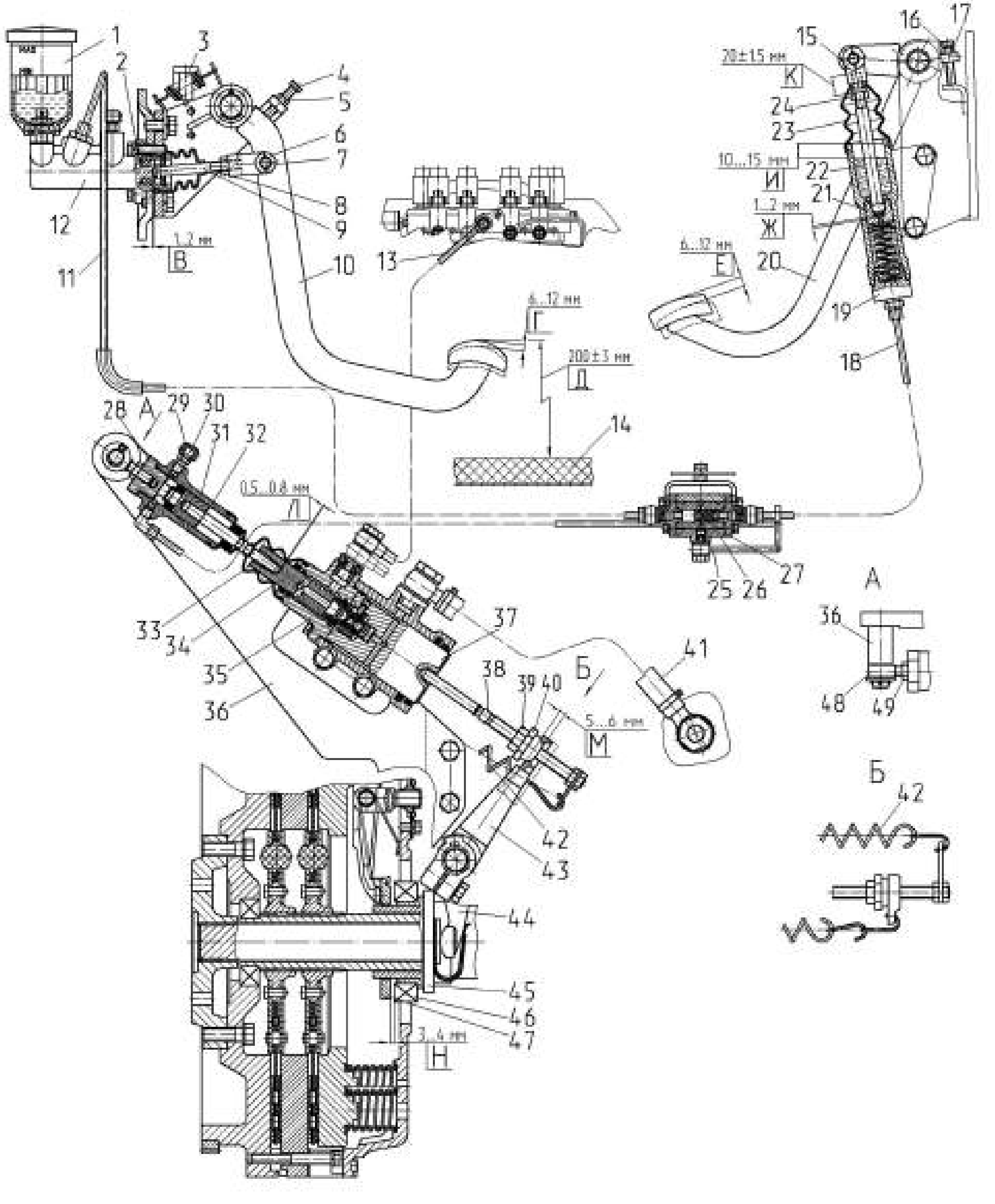
- screwing the adjusting nut 14 (figure 3.3.2) in or out, adjust the position of the rest of release levers 18 for the dimension of (20±0,165) mm from the rest mounting surface to the outer surface of the back plate 7. Pressing the rest 18 with your hand, check the adherence of the release levers to it: all levers shall touch the rest;
- after adjustment mount the lock plates 11 and 12;
- remove the workholder;

3.3.3 Clutch drive

The clutch drive is intended to control the coupling clutch, on forward motion and on reverse. The clutch drive type is hydrostatic with suspended pedals, with a hydraulic booster (figure 3.3.4).

The drive consists of main cylinders 12 (for forward motion) and 19 (for reverse mode), suspended pedals 10 (for forward motion) and 20 (for reverse mode), a cock 27 (for automatic switching between modes of tractor operation on forward motion and on reverse), an operating cylinder 32, a hydraulic booster 35, a lever 43, a tank 1, pipelines 11, 13, 18, 25, 41.

The hydraulic booster 35 of a non-circulation type is intended to reduce force applied to pedals 10 and 20 in the course of clutch engagement. The hydraulic booster is connected with a transmission hydraulic system pump by means of a pipeline 13 via a distributor, and by means of a pipeline 41 with a drain group. In the mode of forward motion when the pedal 10 is pressed, the braking fluid is delivered from the main cylinder 12 to the cock 27 through the pipeline 11. The piston 26 in the cock 27 moves into the right extreme position and shuts the inlet of the pipeline 18. Then the braking fluid is supplied to the operating cylinder 32 through the pipeline 25, thus moving a pusher 33. The pusher 33 works on a rod 34 of the hydraulic booster 35, as a result the hydraulic booster 35 goes off and moves out a piston 37 as well as a pusher 38 with a spherical nut 40, rotating a lever 43, linked with a clutch throw-out 45 through a shaft, resulting in engine detachment from the transmission. In the mode of operation on reverse when the pedal 20 is depressed the braking fluid is delivered from the main cylinder 19 to the cock 27 through the pipeline 18. The piston 26 in the cock 27 moves into the extreme right position and shuts the inlet of the pipeline 11. Then the braking fluid is supplied to the operating cylinder 32 through the pipeline 25, performing the actions as described above.



1 – tank; 2, 21, 26, 31, 37 – piston; 3 – sensor of clutch disengaged state on forward; 4, 16 – bolt; 5, 8, 17, 24, 39, 49 – nut; 6, 15 – fork; 7 – pin; 9, 22, 33, 38 – pusher; 10 – clutch pedal for forward motion; 11, 13, 18, 25, 41 – pipeline; 12 – main cylinder for forward motion; 14 – cab carpet; 19 – main cylinder for reverse motion; 20 – clutch pedal for reverse motion; 23 – casing; 27 – cock; 28 – cover; 29 – cap; 30 – relief valve; 32 – operating cylinder; 34 – rod; 35 – hydraulic booster; 36 – bracket; 40 – spherical nut; 42 – spring; 43 – lever; 44 – yoke; 45 – throw-out; 46 – release bearing; 47 – rest of release levers; 48 – rest.

Figure 3.3.4 – Clutch control

3.3.4 Clutch control adjustment

3.3.4.1 Clutch control adjustment
The clutch control is adjusted in the following order:

1. Adjusting of a clearance gap "B" (figure 3.3.4) between the piston 2 and the pusher 9 of the main cylinder 12 (for forward motion):
- set the pedal 10 so as to observe "D" dimension by means of the bolt 4, tighten the nut 5;
- screw the pusher 9 into the fork 6;
- screwing the fork 6 in and out achieve the dimension "Г", defined as moving of the pedal 10 from the initial position to touch the pusher 9 to the piston 2, measured at the center of pedal casing;
- tighten the nut 8 and fasten the pin 7 by cotter.

2. Adjusting of a clearance gap "Ж" between the piston 21 and the pusher 22 of the main cylinder 19 (for operation on reverse):
- remove the casing 23 off the cylinder 19;
- unlock the fork 15;
- screw the pusher in the fork 15, holding to the dimension "K", tighten the nut 24;
- screwing the bolt 16 in and out achieve the dimension "E", defined as moving of the pedal 20 from the initial position to touch the pusher 22 into the piston 21, measured on the center of pedal pad;
- tighten the nut 17, put the casing 23 on.

3. Adjusting of a clearance gap "Л" between the pusher 33 of the operating cylinder 32 and the rod 34 of the hydraulic booster 35:
- remove the bracket 36 with the hydraulic booster 35 and the operating cylinder 32, having detached and blocked the pipelines 13, 25, 41;
- remove the cotter pin off the center line of the bracket 36, unlock the rest 48;
- fix the piston 37 of the hydraulic booster in the extreme lower position by means of aids at hand;
- remove the operating cylinder 32 off the center line of the bracket 36, set the pusher 33 of the operating cylinder into the extreme left position until the piston 31 stops against the cover 28;
- mount the operating cylinder until the pusher 33 touches the rod 34 of the hydraulic booster 35;
- screwing the rest 48 in or out, bring the rest orifice into coincidence with the center line of the bracket 36;
- screw the rest 48 into the cover 28 half-turn, tighten the nut 49;
- mount the operating cylinder 32 on the center line of the bracket 36 and cotter-pin;
- mount the bracket 36 with the hydraulic booster 35 and the operating cylinder 32 on the clutch body, attach the pipelines 13, 25, 41;

4. Adjusting of a clearance gap "H" between the release bearing 46 and the rest of release levers 47 of the clutch. This adjustment can be carried out in two ways:

First way:
- remove the pull-back spring 42;
- unlock the spherical nut 40;
- turn the lever 43 clockwise until the release bearing 46 stops against the rest of release levers 47;
- holding the pusher 38 stopped against the piston 37 of the hydraulic booster 35 (the piston shall stay in the extreme left position), unscrew the spherical nut 40 until touches the lever 43;
- screw the spherical nut 40 by 5 revolutions from the position of touching the lever 43, preventing the pusher 38 from turning;
- tighten the nut 39, put on the pullback springs 42.

Second way:
- depress the pedal 10 to reach high effort (300 to 400 N) and hold in this position. Herewith the pedal stroke on the pad shall be from 70 to 80 mm, the projection of the piston 37 of the hydraulic booster 35 shall make the dimension "M" (not including the chamfer);

- if the value of piston projection is different, do the following:
- unlock the spherical nut 40;
- screwing the spherical nut 40 in or out, attain the dimension “M” for piston 37 projection when depressing the pedal 10;
- tighten the nut 39;

5. Bleeding of the hydraulic system of clutch operating control in accordance with clause 3.3.4.2 of this manual.

6. Adjusting of response of sensors of clutch disengaged state on forward motion and on reverse, as specified in subsection 3.5 “Electrical part of gearbox control”.

3.3.4.2 Bleeding of the hydraulic system of clutch operating control

Before bleeding fill a tank 1 (figure 3.3.4) of the main cylinder 12 and a balance chamber of the main cylinder 19 with braking fluid. Then bleed the hydraulic system of clutch operating control on forward motion and on reverse:

1. Bleeding of the hydraulic system on forward motion:
- fill the tank 1 with braking fluid up to “MAX” mark;
- remove a protective cap 29 off the operating cylinder 32 and put a rubber hose on the head of the relief valve 30, immersing it a container with braking fluid;
- depress the clutch pedal for several times;
- holding it depressed, unscrew the relief valve 30 by a quarter of a turn, relieving the braking fluid surplus with air bubbles to the container with the braking fluid;
- screw the relief valve 30 in and release the clutch pedal;
- bleed the system until air bubbles fully disappear in the braking fluid relieved;
- remove the hose and put on the protective cap 29;
- check the braking fluid level in the tank 1 and add, if necessary.

ATTENTION: BLEEDING THE HYDRAULIC SYSTEM OF CLUTCH OPERATING CONTROL ON FORWARD MOTION, WATCH THE BRAKING FLUID LEVEL IN THE TANK 1 TO STAY BETWEEN “MIN” AND “MAX” MARKS!

2. Bleeding of the hydraulic system in reverse mode:
- remove the casing 23 of the main cylinder 19;
- check the braking fluid level in the balance chamber of the main cylinder 19, that must not go below the dimension “И” from the top edge of the balance chamber;
- the order of the hydraulic system bleeding is identical to the one on forward motion.

ATTENTION: BLEEDING THE HYDRAULIC SYSTEM OF CLUTCH OPERATING CONTROL ON REVERSE, WATCH THE BRAKING FLUID LEVEL IN THE BALANCE CHAMBER OF THE MAIN CYLINDER 19 NOT TO GO BELOW THE DIMENSION “И” FROM THE TOP EDGE OF THE BALANCE CHAMBER!

3.3.4.3 Clutch check for purity of disengagement

After the above stated adjustments on clutch operating control have been carried out, it is required to check the clutch for purity of disengagement, for this purpose do the following:
- engage the parking brake;
- start the engine and set the engine speed to (1400±100) rpm;
- fully depress the clutch pedal and not earlier than after five seconds engage the GB ranges, which shall be “pure”, i.e. without additional sounds and rasp.

In case there are additional sounds and rasp, it is needed to carry out a check and, if necessary, make repeated adjustments, listed in clause 3.3.4.1.

With the clutch pedal fully depressed the piston 37 projection (figure 3.3.4) of the hydraulic booster 35 shall make not less than 23 mm.

3.4 Gearbox

3.4.1 General information

The gearbox is mechanical with constant-mesh gears of a range type, it provides twenty four speeds for the front motion and twelve speeds for the reverse, continuous PTO and FDA drives. The ranges are shifted by means of gear clutches with use of the coupling clutch, and the speeds are shifted by means of electro-hydraulically operated friction clutches without use of the coupling clutch.

3.4.2 Speed unit

The speed unit, presented in figure 3.4.1, provides speed switching within the range. The speed unit is located in the coupling clutch body 20 and consists of a primary shaft 35, a shaft of even speeds 30, a shaft of odd speeds 37, an output shaft 44. The rolling-contact blocks of the shafts are located in the clutch body 20 from the one side, and in a plate 42 from the other one.

On the primary shaft 35 a gear 33 is mounted, which is responsible for torque transfer from the engine to the shaft of even speeds 30 and to the shaft of odd speeds 37. One of the rolling-contact blocks is two tapered bearings 32, mounted in a cage 31. The play in the taper bearings 32 is adjusted by means of an adjusting sleeve 36. The primary shaft 35 is hollow-bored, inside there is a PTO drive shaft 34. A needle bearing 8, which serves as a support for the PTO drive shaft 34, is mounted in the primary shaft 35. The primary shaft 35 is connected with the driven disks of the main coupling clutch 1 (figure 3.3.2) by means of a shaft 6 (figure 3.4.1)

A twin friction clutch 21 and a single friction clutch 25, gears 17, 24, 27 and 29 are mounted on the shaft of even speeds 30. The gear 29 is rigid-mounted on the shaft and participates in torque transfer from the primary shaft 35. The friction clutches 21 and 25 are mounted on the shaft rigidly. The gears 17, 24 and 27 rotate on the shaft on needle bearings 18, 23 and 26.

The needle bearings 18, 23 and 26 are lubricated forcedly through the channels, made in shafts 30 and 37. A lengthwise channel is located on the center line of the shafts executed 30 and 37, and radial channels are located in places of sleeves 19, 22, 28 installation for the needle bearings 18, 23 and 26. The sleeves 19, 22 and 28 also have holes for lubrication.

Forced oil supply to cool the friction disks is also executed through a lengthwise and radial channels, made in the shafts 30 and 37.

Oil supply to boosters of the friction clutches 21 and 25 is executed through three channels, which are shut with plugs 13 at the shaft end. Eight sealing rings 15 to deliver oil to the channels are mounted on the shaft journal at places of radial drillings. Oil delivery to the shaft radial channels is executed through channels, made in the cages 14, 2 and in the coupling clutch body 20.

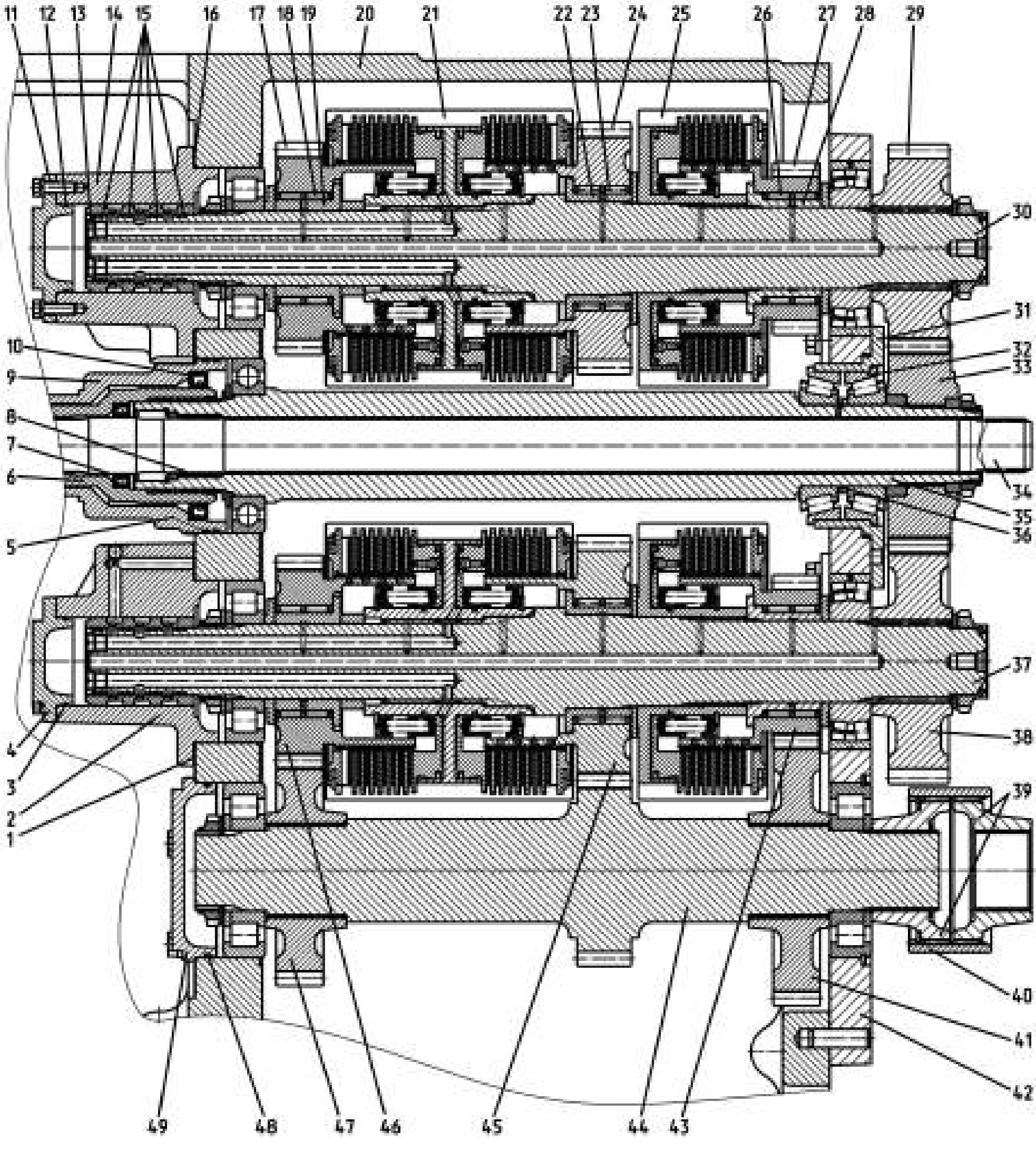
The shaft of odd speeds 37 is designed by analogy with the shaft of even speeds 30. The shafts of even speeds 30 and odd speeds 37 differ from each other in gears 29 and 38. The meshing of gears 33 and 38 transfers torque from the primary shaft 35 to the shaft of odd speeds 37, and the meshing of gears 33 and 29 transfers torque to the shaft of even speeds 30.

Gears 17, 24 and 27 on the shaft of even gears 30 are the gears of the fourth, the sixth and the second speeds, and gears 46, 45 and 43 on the odd shaft 37 are the gears of the third, the fifth and the first speeds, respectively.

The output shaft 44 transfers torque from the shaft of even speeds 30 and from the shaft of odd speeds 37 to the input shaft 12 (figure 3.4.3) of the gearbox by means of sleeves 39 and 40 (figure 3.4.1). Gears 47 and 41 are rigidly mounted on the output shaft 44.

Leak-proofness of a dry section of the coupling clutch is provided by collars 7 and 10, mounted to the shaft 6 and the bracket 9, by rubber rings 3, 5, 12 and 48, mounted to grooves of the bracket 9 and covers 4, 11 and 49, by paronite packings 1 and 16, mounted between the cages 2 and 14 and the coupling clutch body 20 with use of sealant.

The friction clutches 21 and 25 are intended to provide gear engagement without using the coupling clutch.



1, 16 – packing; 2, 14 – cage; 3, 5, 12, 48 – ring; 4, 11, 49 – cover; 6 –shaft; 7, 10 – collar; 8, 18, 23, 26 – needle bearing; 9 – bracket; 13 – plug; 15 – sealing ring; 17, 24, 27, 29, 33, 38, 41, 43, 45, 46, 47 – gear; 19, 22, 28, 39, 40 – sleeve; 20 – coupling clutch body; 21, 25 – friction clutch; 30 – shaft of even speeds; 31 – cage; 32 – tapered bearing; 34 – PTO drive shaft; 35 – primary shaft; 36 – adjusting sleeve; 37 – shaft of odd speeds; 42 – plate; 44 – output shaft.

Figure 3.4.1 – Speed unit (developed view)

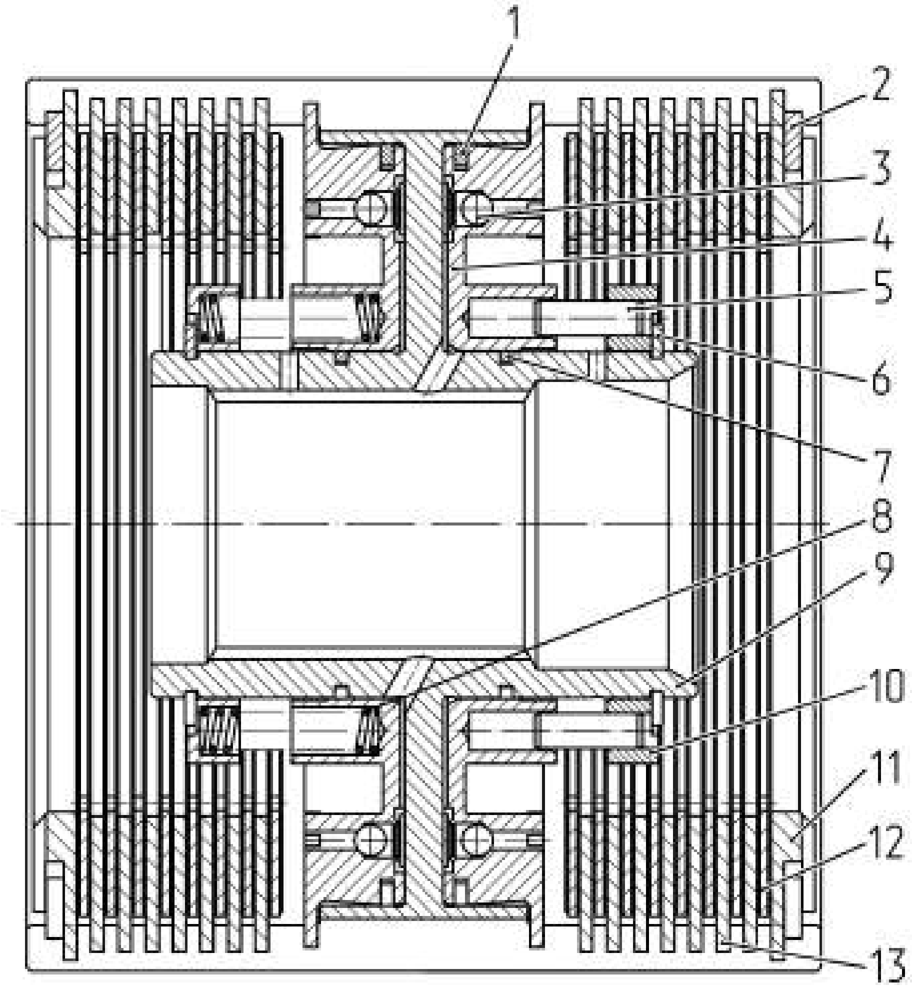
A drum 9 (figure 3.4.2) of the twinned friction clutch has bores (cavities) on both sides, into which movable pistons 4 are mounted, sealed by cast iron split rings 1 and 7.

In each piston cavities eighteen release springs 8 are mounted, which have previously been compressed by spring bolster 10, fixed on the hub of the drum 9 by a lock ring 6. Two guide pins 5 are pressed into the spring bolster 10.

There are two centrifugal ball valves 3 to collect working fluid from boosters of the friction clutch after they are detached from the discharge manifold of gearbox control.

Driving disks 13 are mounted in drum grooves, and in between there are metal-ceramic driven disks 12 with inner splines. The disk packs are completed with bearing disks 11, fixed by lock rings 2.

Arrangement of the friction clutch 25 is identical with the arrangement of the friction clutch 21.



1, 7 – sealing ring; 2, 6 – lock ring; 3 – centrifugal ball piston; 4 – piston; 5 – guide pin; 8 – spring; 9 – drum; 10 – spring bolster; 11 – bearing disk; 12 – driven disk; 13 – driving disk.

Figure 3.4.2 – Friction clutch

3.4.3 Range shifting reduction unit

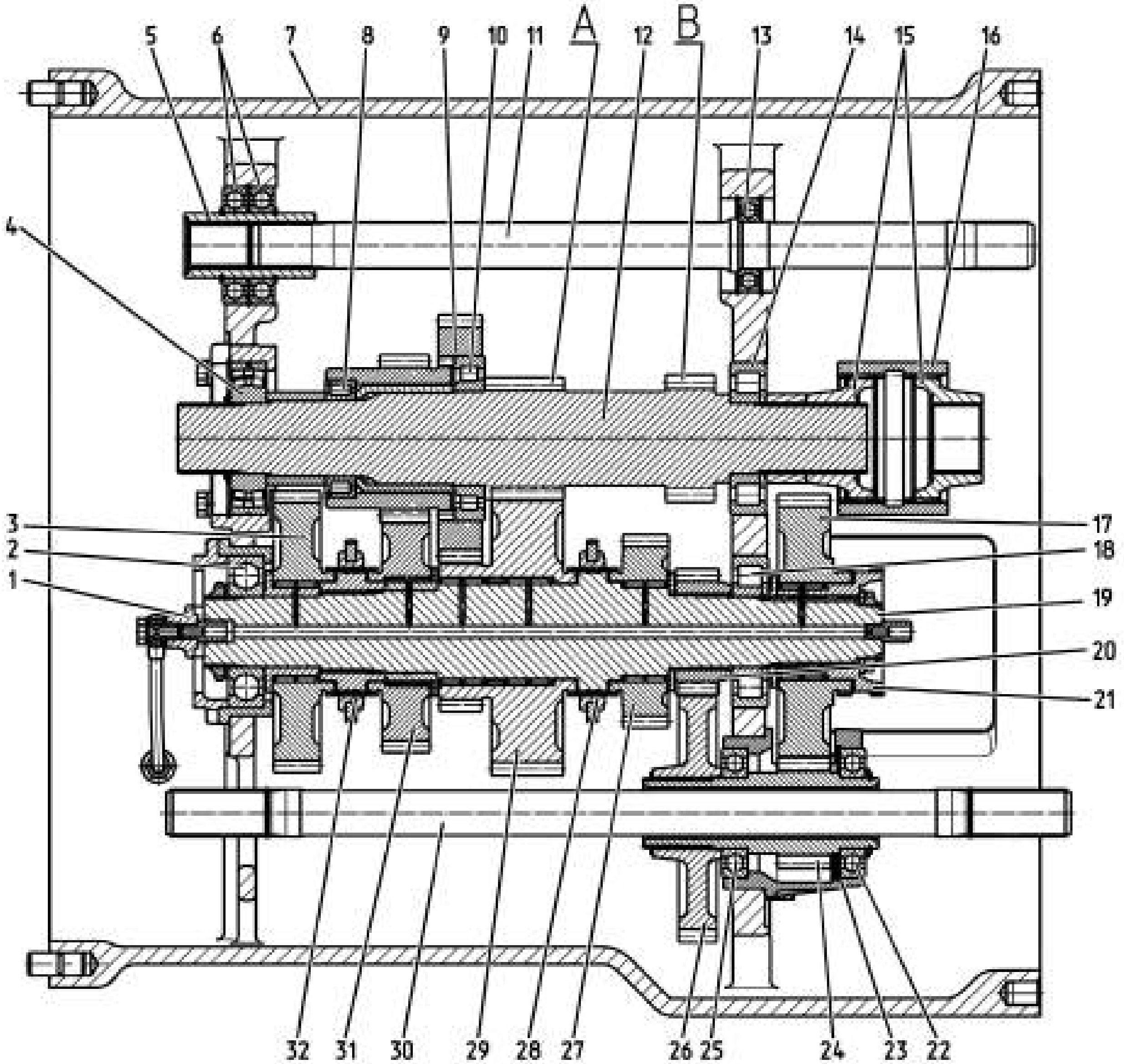
Range shifting reduction unit is a body 7 (figure 3.4.3) where the following shafts are mounted:

- input shaft 12;
- layshaft 19;
- reverse shaft 6 (figure 3.4.4);
- creeper shaft 24 (figure 3.4.3);
- PTO drive shaft 11;
- FDA drive shaft 30.

The input shaft 12 is mounted in the body 7 on bearings 4 and 14. It is made with two toothed rims A and B. The toothed rim A provides for forward motion, the toothed rim B provides for reverse of the tractor. A gearwheel unit 9 is mounted on the input shaft on roller bearings 8 and 10.

A layshaft 19 is mounted in the body 7 on bearings 2 and 18. Toothed clutches 28 and 32, gearwheel unit 29, gears 3, 17, 20, 27 and 31 are mounted on the shaft. The gears 3, 17, 27, 31 as well as the gearwheel unit 29 are mounted on needle bearings. The gear 20 is mounted on the splines.

Any range is engaged by moving the toothed clutch either forward along tractor movement or backwards, providing splined connection of the toothed clutch with the corresponding gears.



1 – cover; 2, 4, 6, 8, 10, 13, 14, 18, 22, 25 – bearings; 3, 17, 20, 26, 27, 31 – gears; 5, 15, 16, 21 – sleeve; 7 – body; 9, 29 – gearwheel unit; 11 – PTO drive shaft; 12 – input shaft; 19 – layshaft; 23 – cage; 24 – creeper shaft; 28, 32 – clutches; 30 – FDA drive shaft.

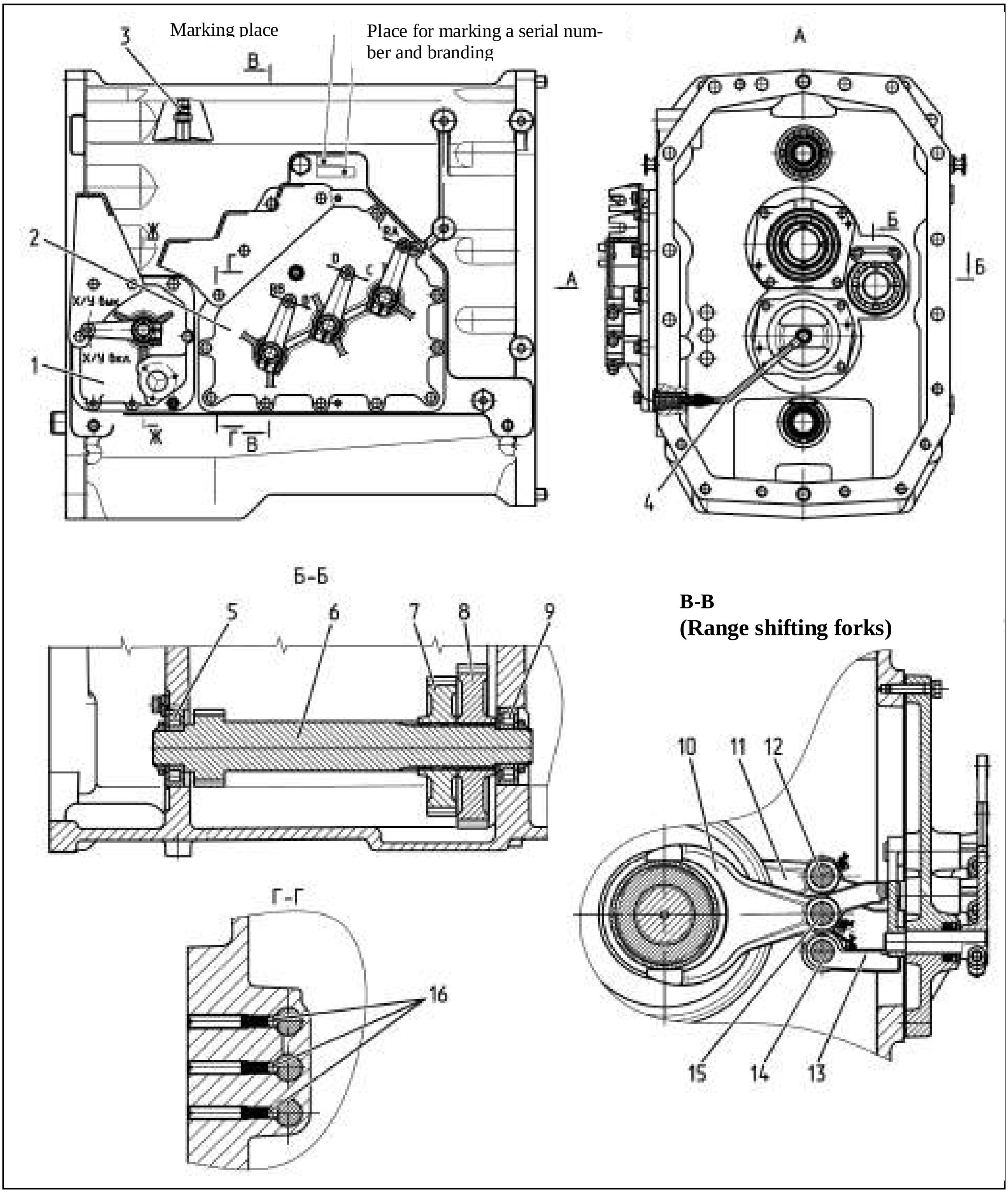
Figure 3.4.3 – Range shifting reduction unit (lengthwise cut)

Meshing of the clutch 32 with the gear 31 provides range I for forward motion, and with the gear 3 - range I for reverse. The clutch 32 of range I for forward and reverse motion is moved by means of a fork 11 (figure 3.4.4), mounted on a carrier 12.

The clutch 28 (figure 3.4.3) provides engagement of range II for forward and reverse motion. Its meshing with the toothed rim of the gear wheel unit 29 provides for forward motion, and its meshing with the gear 27 provides for reverse motion of the tractor. The clutch 28 of range II for forward and reverse motion is moved by means of a fork 10 (figure 3.4.4), mounted on a carrier 15.

Ranges III and IV are engaged by means of a toothed clutch, mounted on the shaft in the rear axle body. The carrier, on which the fork of switching between ranges III and IV is mounted, is moved by means of carriers 13 and 14. The carrier 14 is linked with the rear axle carrier by means of a rocker mechanism, mounted on the cover 1.

The forks 10, 11 and the carrier 13 are moved by means of lever motion, mounted on a cover 2. Position of the forks and of the toothed clutches in neutral and engaged condition is fixed by balls 16, located in dimples of carriers 12, 14, 15.



1, 2 – covers; 3 – switch of engine start-up lock; 4 – pipeline; 5, 9 – bearings; 6 – reverse shaft; 7, 8 – gears; 10, 11 – forks; 12, 13, 14, 15 – carriers; 16 – balls.

Figure 3.4.4 – Range shifting reduction unit (general view)

The switch 3 provides engine start-up lock with range on.

The reverse shaft is mounted in the body on bearings 5 and 9 and has a toothed rim. The gears 7 and 8 are mounted on the splines. The reverse shaft is driven by meshing the toothed rim B of the input shaft 12 (figure 3.4.3) with the gear 8 (figure 3.4.4). Engine torque is transferred by the toothed rim of the reverse shaft 6 when engaging the range I of the reverse, and by the gear 7 when engaging the range II of the reverse.

The gears 20 (figure 3.4.3) and 17 provide creeper operation in mesh with the gear 26 and the toothed rim of the creeper shaft 24. The creeper shaft 24 is mounted on the bearings 25 and 22, located in bores of the cage 3.

The gear 17 runs on a needle bearing, mounted on the sleeve 21. The sleeve 21 is mounted on splines of the layshaft 19.

The creeper is engaged by moving the toothed clutch 1 (figure 3.4.5) forward along tractor movement, disengaged by moving the toothed clutch in an opposite direction.

When the creeper is engaged, the inner splines of the toothed clutch 1 are meshed with the outer splines of the gear 17 (figure 3.4.3). When the creeper is disengaged, the inner splines of the toothed clutch 1 (figure 3.4.5) are in mesh with the outer splines of the sleeve 21 (figure 3.4.3).

The toothed clutch 1 (figure 3.4.5) is shifted into this or that position by means of the fork 2 and the lever motion, mounted on the cover 1 (figure 3.4.4).

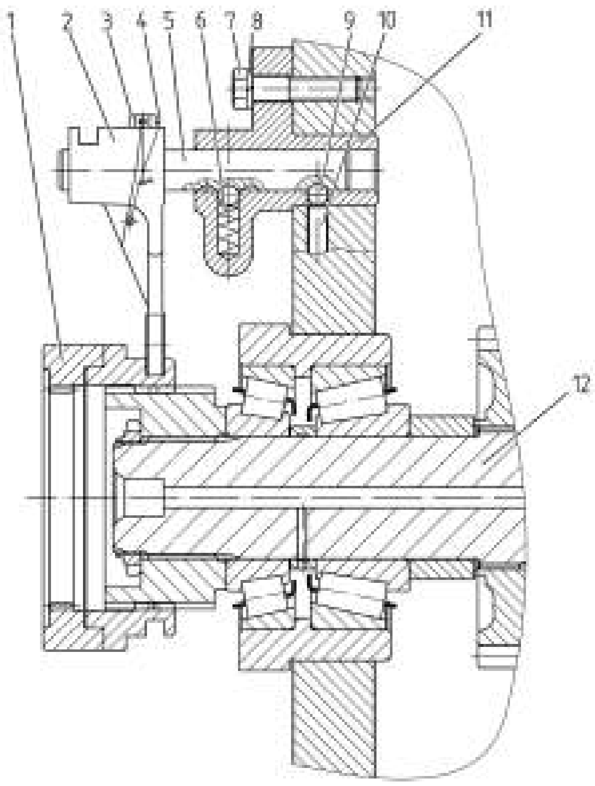
The fork 2 (figure 3.4.5) is mounted on a carrier 5. The carrier 5, mounted in a body 11 with a possibility of axial displacement, has three fixed positions. Movement of the carrier 5 is interlocked with movement of the carrier engaging the ranges III and IV by means of a ball 9 and a pusher 10. This locking mechanism precludes a possibility to engage the ranges II and IV of the gearbox with the creeper actuated, and vice versa, creeper actuation with these ranges engaged.

The needle bearings are forcedly lubricated via channels, made in the layshaft 19 (figure 3.4.3) through the cover 1. Oil is delivered to the cover via the pipeline 4 (figure 3.4.4).

PTO drive shaft 11 (figure 3.4.3) serves to transfer torque from the engine to implements. The PTO drive shaft 11 rests against the sleeve 5 from the one side and against the bearing 13 from the other side.

Ranges of the gearbox and of the creeper are shifted with levers. The levers to shift ranges of the gearbox and of the creeper as well as the joystick are located in cab to the right of a driver's seat.

Diagram of power flows when engaging various ranges is presented in figure 3.4.6.



1 – toothed clutch; 2 – fork; 3 – locking bolt; 4 – lockwire; 5 – carrier; 6 – spring; 7 – bolt; 8 – washer; 9 – ball; 10 – pusher; 11 – body; 12 – main gear drive shaft.

Figure 3.4.5 – Control of a creeper and locking mechanism of ranges III and IV

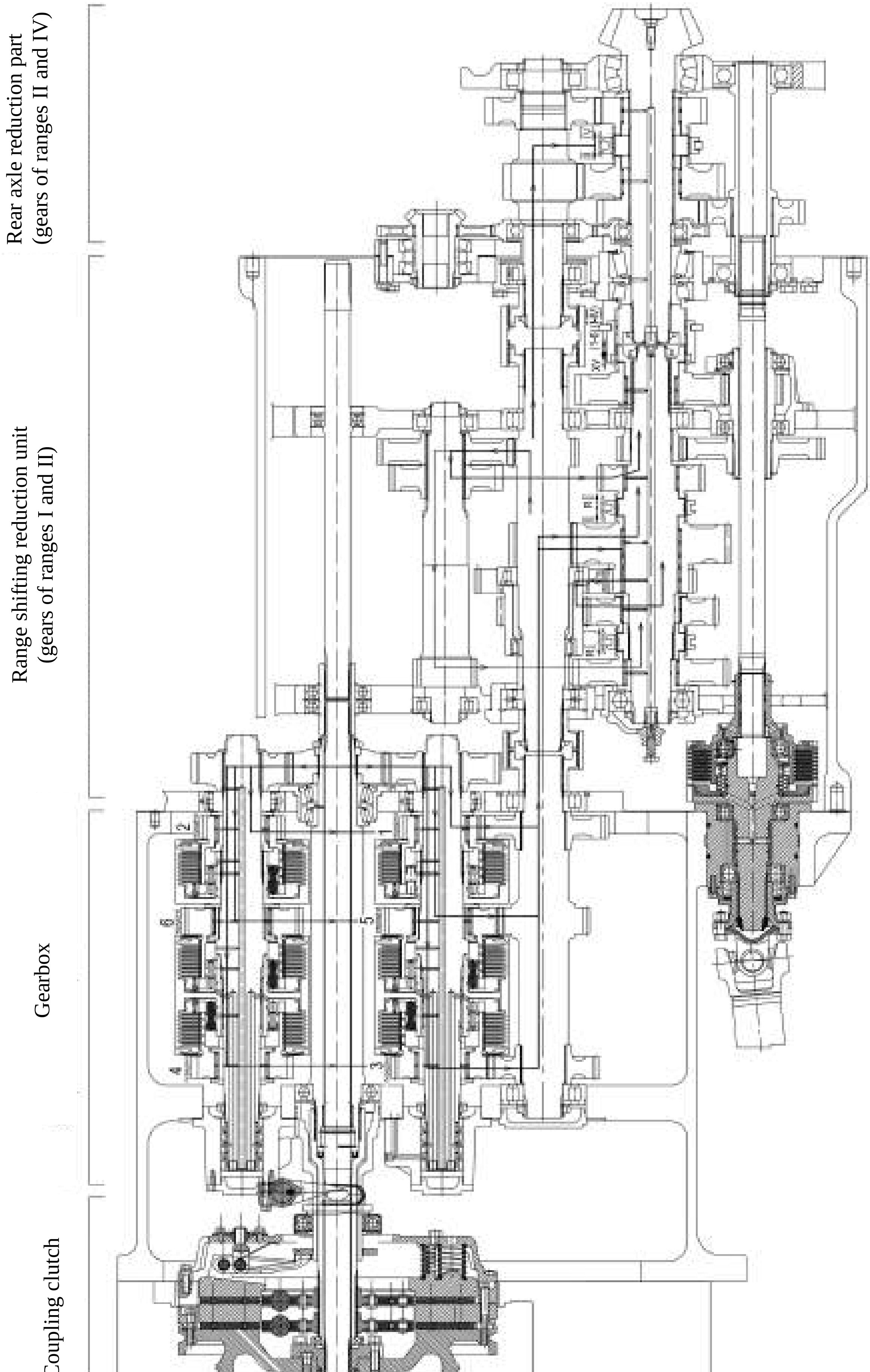


Figure 3.4.6 – Directional diagram of speed power flows per ranges

3.5 Electrical part of gearbox control

Speed shifting is controlled by means electronic-hydraulic control system.

The electrical part of speed shifting system consists of CECS electric unit 1 (figure 3.5.1), a gear shifting joystick 3, which are located in the cab to the right of the operator; of a button 14 to set up gearbox braking mode, located on the handle of the range shifting lever; of electrohydraulic distributors 15, 17, 19, 21, 23, 25 with electric magnets and of pressure sensors 16, 18, 20, 22, 24, 26, mounted on a plate 12 of transmission hydraulic system distributors, located above on the clutch body; of a sensor 11 of clutch disengaged condition on forward motion, mounted in the cab above the clutch pedal; of a sensor 2 (figure 3.5.1) of clutch disengaged condition on reverse; of a sensor 8 (figure 3.5.1) of a neutral condition of the range reduction unit, mounted on the right side on the reduction unit body and also used by the system of electrical equipment as a switch of engine start-up lock with the gearbox range engaged; of a sensor 13 of a travel range (IV), mounted in the cab near the range shifting lever; of connecting harnesses 9 with a socket connector 10, positioned under the cab, and with junction blocks.

Annunciators 36, 37, 27, 28, 29 of the gear engaged – 0, 1, 2, 3, 4, 5, 6, respectively; an annunciator 32 of emergency state of gear engagement hydraulic distributors; an indicator 33 of operation mode (light, medium, heavy); an indicator 35 of number of gear engaged and of gearbox braking mode are located on the front board of CECS unit 1.

The system is powered from on-board electrical line through the protection and switching unit 2 according the attached electrical circuit diagram of the complex system of DL, FDA, PTO and gear shifting control (Annex C). The power supply voltage is delivered to the system after the starter and instrument switch has been turned into position “Instruments on”.

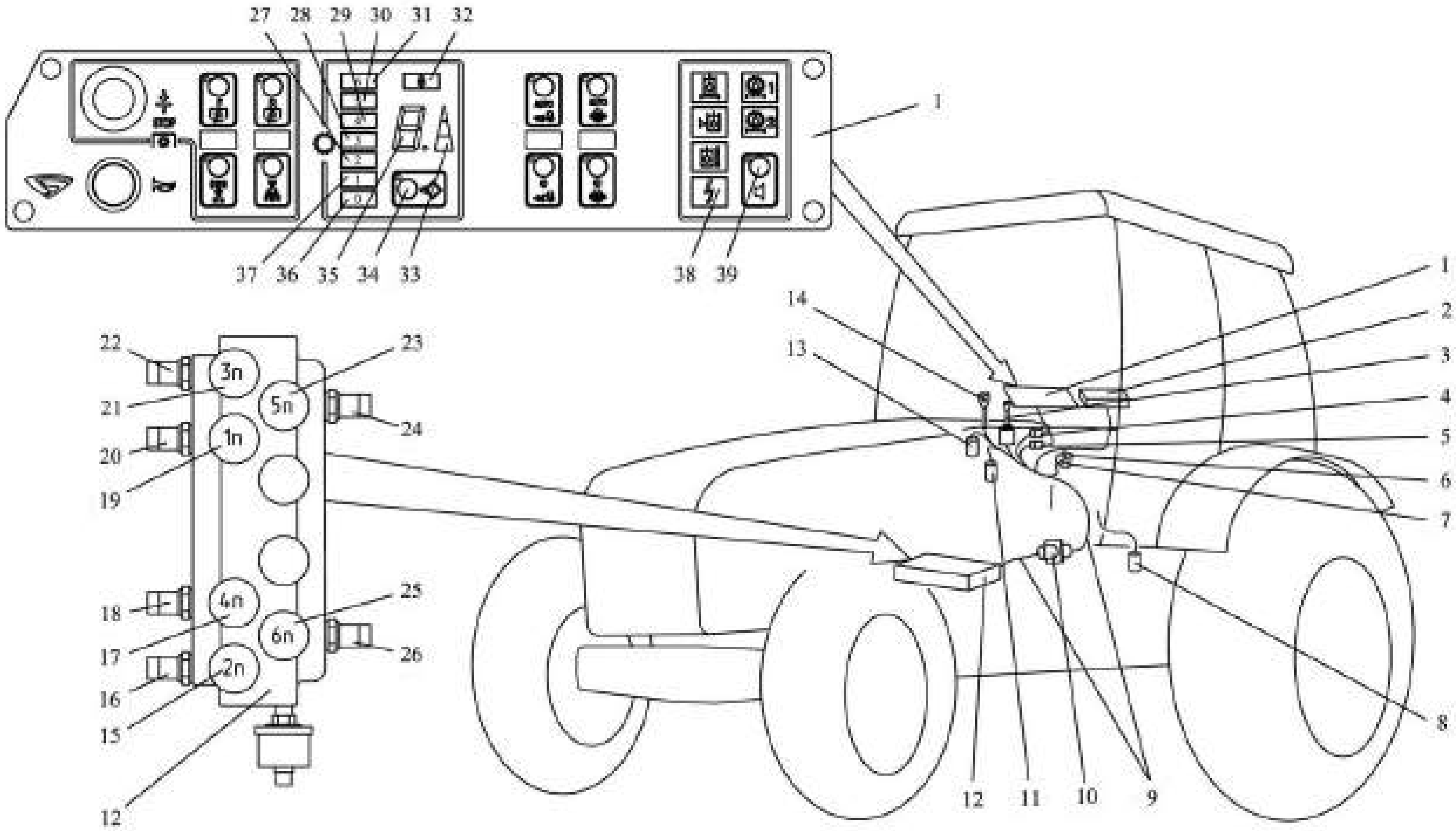
In the initial condition all gears are disengaged. The annunciator 36 (speed “0”) lights up on the front board of CECS panel and “0” digit lights up on the digital indicator 35. This testifies that the voltage is supplied to the gear shifting system, and the system does not generate a signal to any of electromagnets of gear shifting hydraulic distributors. After the engine is started, a pump of gear shifting hydraulic system is actuated. “0” speed indication remains.

To start movement first it is required to set a selected mode with the range shifting lever, having preliminary engaged the “braking” mode of the gearbox. The “braking” mode is actuated under the following conditions: the button 14 on the range shifting lever is pushed and held depressed, the range shifting lever is in neutral position (the sensor 8 of neutral position of the range reduction unit and the sensor 13 of the travel range (IV) go off), the clutch is disengaged (the sensor 11 goes off as the clutch is disengaged on forward motion or the sensor 2 (figure 3.5.3) goes off as the clutch pedal is depressed on reverse). With actuation of the “braking” mode a symbol “P” is displayed on the indicator 35 (figure 3.5.1) meaning the gearbox “braking” is on.

When setting a gear with the joystick 3, a sequential automatic gear shifting to reach the selected one (“drive” mode) is as follows: the digital indicator 35 displays a number of the gear selected, and the annunciators of the gears engaged turn on in accordance with actuation of the corresponding pressure sensors.

Under normal operation mode the indicator 35 displays a number of the gear selected and the corresponding annunciator 37, 27, 28, 29, 30, 31 is permanently on (approval of actuation under the required pressure).

As marker lights turn on, the indication illumination will decrease.



1 – CECS electronic unit; 2 – protection and switching unit; 3 – gear shifting joystick; 4, 5, 10 – socket connectors; 6, 7 – junction blocks; sensor of neutral position of the reduction unit; 9 – connecting harnesses; 11 – sensor of clutch disengaged condition on forward motion; 12 – plate with distributors; 13 – sensor of travel range (IV); 14 – button to engage “Braking” mode; 15, 17, 19, 21, 23, 25 – gear engagement distributors 2, 4, 1, 3, 5, 6 respectively; 16, 18, 20, 22, 24, 26 – sensors of gear engaged condition 2, 4, 1, 3, 5, 6 respectively; 27, 28, 29, 30, 31, 37 – annunciators of gear engaged; 32 – annunciator of gearbox emergency operation mode; 33 – indicators of gear shifting mode (light, medium, heavy); 34 – button to select gear shifting mode; 35 – digital indicator of gear engaged and of “braking” mode actuation; 36 – zero gear annunciator (“0” gear); 38 – annunciator of CECS emergency voltage supply; 39 – button to turn the acoustic annunciator off.

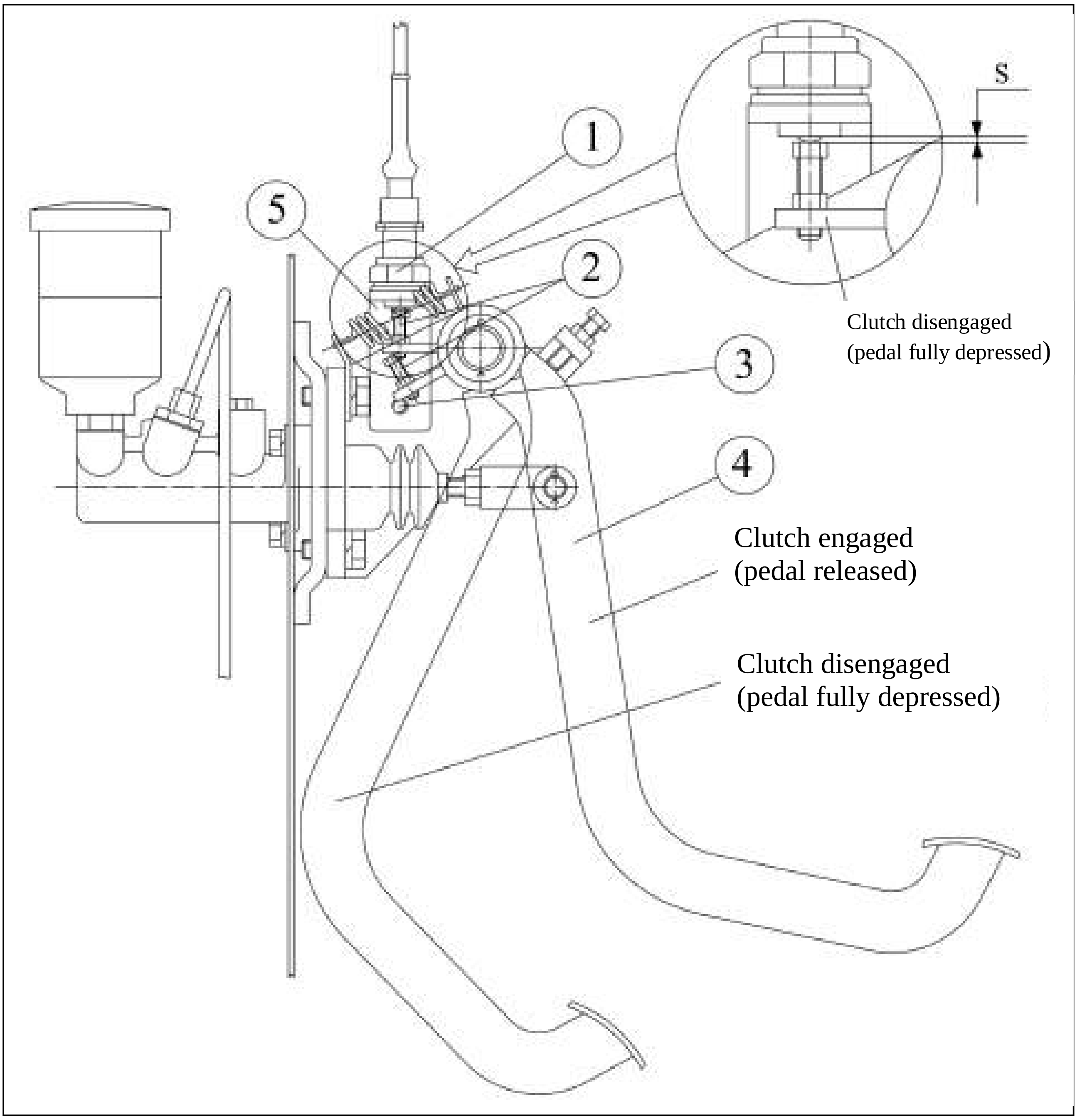
Figure 3.5.1 – Electrical part of gearbox control

ATTENTION: AFTER FINISHING ADJUSTMENTS IN CLUTCH DISENGAGEMENT DRIVE, CHECK RESPONSE ADJUSTMENT OF SENSORS OF CLUTCH DISENGAGED STATE ON FORWARD MOTION AND ON REVERSE!

Adjustment of the sensor 1 (figure 3.5.2) actuation shall be carried out with the engine running. Moving the sensor 1 together with its bracket 5 in its slot and adjusting bolt 2 position, adjust the actuation of the sensor 1 (contact closure).

After adjustment of the sensor of clutch disengaged state on forward motion 1 with the clutch pedal fully depressed the clearance S between the body of the sensor 1 and the head of the adjusting bolt 2 shall make 0,5 to 1,0 mm.

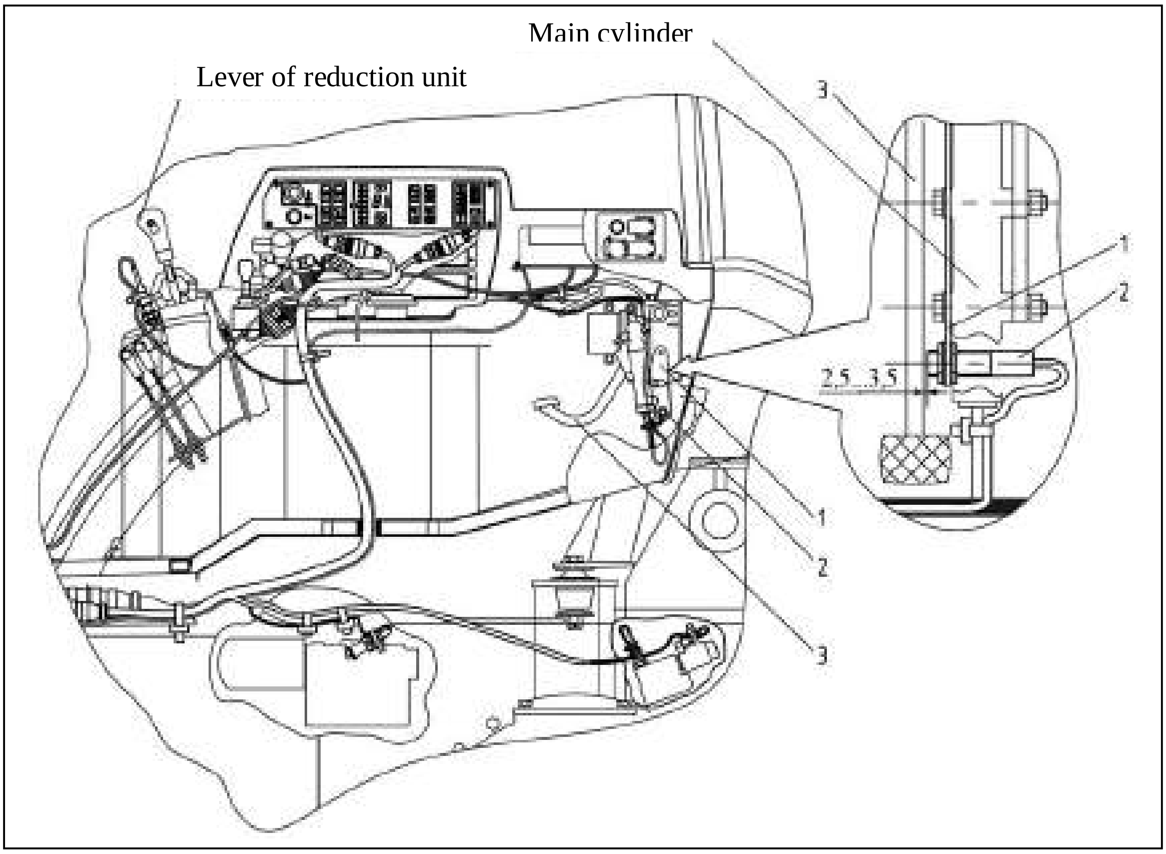
After the adjustment has been finished, fasten the bracket 5 with bolts 3, the bolt 2 shall be fastened with a nut.



1 – sensor of clutch disengaged state on forward motion; 2 – adjusting bolt; 3 – bracket mounting bolts; 4 – clutch pedal; 5 – bracket.

Figure 3.5.2 – Arrangement of sensor of clutch disengaged state on forward motion

The sensor of clutch disengaged state on reverse 2 (figure 3.5.3) is adjusted by way of turning the bracket 1 together with the sensor 2 in the slot in the bracket. The adjustment shall be carried out with the engine running. After adjustment with the clutch fully disengaged on reverse (the pedal is pressed against the stop), the square overlapping of the sensor 2 end face by the pedal 3 shall make not less than 60%, the distance from the sensor 1 end face to the clutch pedal 3 shall make 2,5 to 3,5 mm, as shown in figure 3.5.3.



1 – bracket; 2 – contactless position sensor; 3 – clutch pedal.

Figure 3.5.3 – Arrangement of sensor of clutch disengaged state on reverse

Connection of harnesses to electro-hydraulic distributors and pressure sensors, mounted on the plate, is presented in figure 3.5.4.

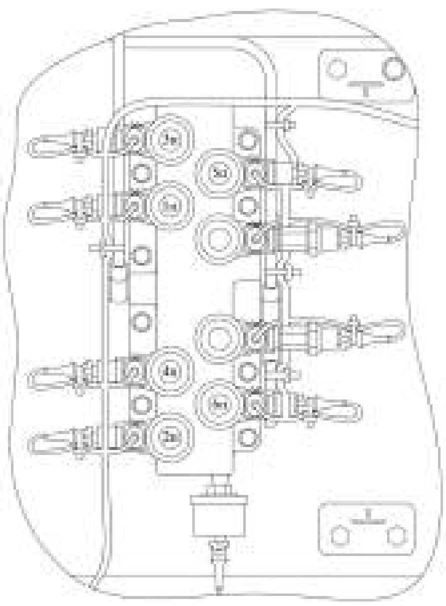


Figure 3.5.4 – Plate with slave electro-hydraulic distributors and pressure sensors

3.6 Rear axle

3.6.1 General information

The rear axle consists of a main gear, a differential with locking mechanism, final drive gears and brakes, arranged in one body.

A reduction part is located in the front section of the rear axle body, it consists of gears of ranges III and IV of the gearbox, FDA drive gears and a driving bevel gear with a circular tooth to drive pumps of HLL and of transmission hydraulic system, placed outside and mounted in one body.

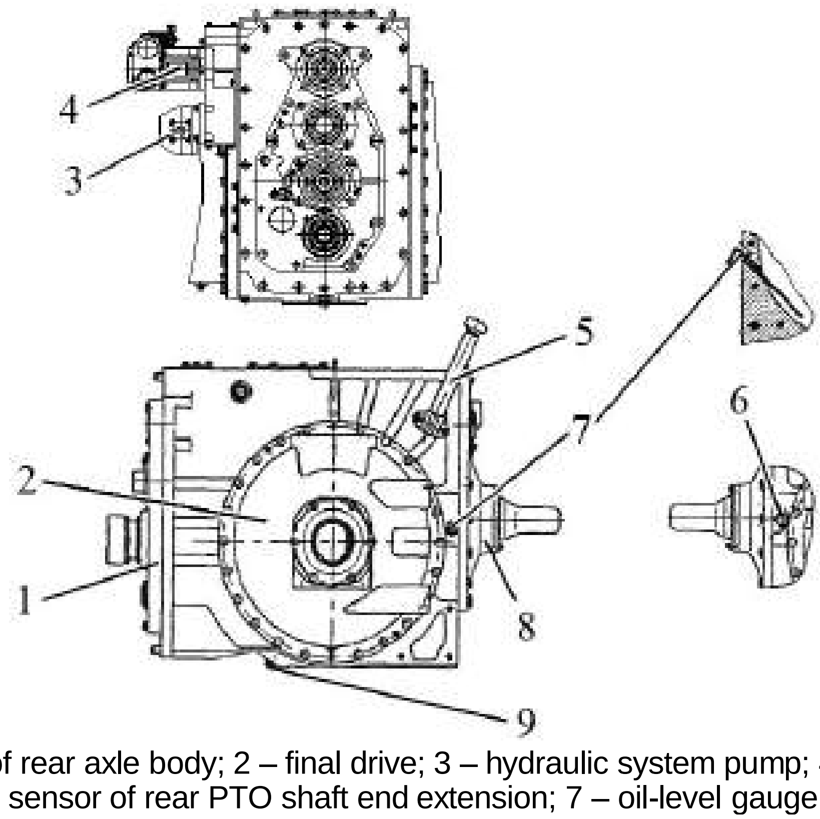
A clutch and a reduction unit of PTO are mounted in the rear section of the rear axle body.

Pumps of the transmission hydraulic system and of the HLL as well as a speed sensor of rear PTO shaft end extension are mounted on the right side of the rear axle body.

On the left side of the rear axle there is a filler to fill in transmission oil. Oil is filled up to the level of a pilot hole, located on the right side of the rear axle body.

The oil level is checked with an oil-level gauge 7 (figure 3.6.1). The oil level shall stay between lower and upper marks of the oil-level gauge. The oil is drained out from the transmission through a discharge hole with a plug 9.

Axle shaft speed sensors and drain plugs are mounted on the final drive tubes.



1 – plate of rear axle body; 2 – final drive; 3 – hydraulic system pump; 4 – HLL pump; 5 – filler; 6 – speed sensor of rear PTO shaft end extension; 7 – oil-level gauge; 8 – rear PTO; 9 – plug.

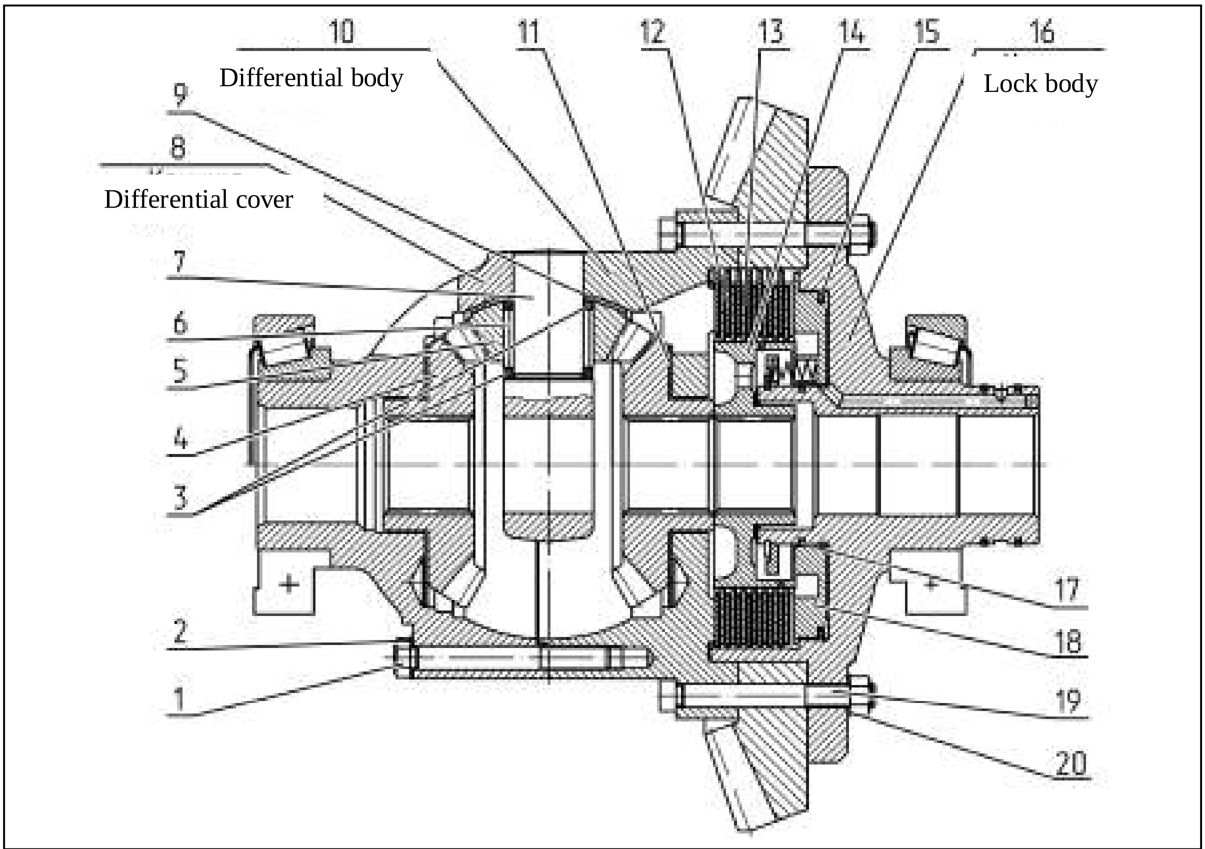
Figure 3.6.1 – Rear axle (outside view)

3.6.2 Main gear

The main gear (master pair) is intended to increase turning torque and to change turning direction from a longitudinal driving shaft to a differential transversally-located rotation of axis.

The main gear is a pair of bevel gears with circular teeth. The driving gear 24 (figure 3.6.3) is made all-in-one piece with the shaft, the driven gear 25 is attached by bolts 26 between the lock body and the differential body. Nuts 28 of the differential bolts are locked against self-unscrewing pairwise by locking plates 27.

3.6.3 Differential



1 – differential bolts; 2 – locking plates of differential bolts; 3 – sleeves; 4 – axle-shaft gears; 5 – spider pinions; 6 – rollers; 7 – differential center cross; 8 – differential cover; 9 – spider pinion washers; 10 – differential body; 11 – washers of axle-shaft gears; 12 – friction plates; 13 – center plates; 14 – clutch; 15 – cast iron ring; 16 – lock body; 17 – cast iron ring; 18 – piston; 19 – bolts; 20 – locking plates.

Figure 3.6.2 – Differential

The differential provides rotation of driving wheels with different speeds. The differential is of a closed type, taper, with four spider pinions.

The body 10 (figure 3.6.2) and the cover 8 of the differential are fixed to each other with bolts 1, which are locked against self-unscrewing by the locking plates 2. In the body and the cover of the differential a center cross 7 with four pins is mounted. Four spider pinions 5 staying in permanent engagement with axle-shaft gears 4 are mounted on center cross pins on rollers 6. Sleeves 3 serve to fix rollers in axial direction. To increase wear resistance of bodies, round washers 9 are mounted under the spider pinions, and washers 11 are mounted under the axle-shaft gears, locked against turning by juts in the body and in the cover of the differential.

In the differential lock body a multidisk friction clutch of the differential lock is mounted. The lock is actuated by pressurized oil supply under the piston 18, which when moving compresses the friction plate packs and locks the differential lock body with the axle-shaft gears 4 through the clutch 14 and the right sun gear 39 (figure 3.6.3) of the final drive.

The driven gear of the master pair is mounted on the groove of the lock body. The lock body with the driven gear is connected by the bolts 19 (figure 3.6.2) with the differential body 10. The bolts 19 are locked by the lock plates 20.

The friction plates 12 are sat on splines of the clutch 14, and the center plates 13 are locked against turning be means of their juts in grooves of the lock body 16. The piston is sealed by cast iron rings 15 and 17. Oil is delivered to the piston of the lock clutch through the holes in the body. Oil delivery to the differential is sealed by cast iron rings 38 (figure 3.6.3).

The differential lock control is electrohydraulic.

3.6.4 Final drives

The final drives (figure 3.6.3) are planetary gear reducers with double-rim satellite gears 21 and floating crown gears 20. The drive (sun) gears 22 and 39 with brake hubs 23 are connected with differential axle shaft gears by means of splines. Each sun gear is meshed with toothed rims (z=42) of three double satellite gears by means of its toothed rim (z=15).

The sun gears are not fixed in a radial direction and are self-installed (floating position) between crowns (z=42) of two satellite gears.

In the bores of the carrier 10 three satellite shafts 19 are mounted, on which double-rim satellite gears 21 rotate on rollers 18. The shafts are locked against moving and turning in the carrier by screwed-on pins 17. To increase wear resistance of end surfaces of the carrier 10, washers 16 are mounted between the carrier and the double-rim satellites 21.

The carrier is mounted on splines of the axle shaft 15 and is locked against movement by an axle shaft washer 31, which is attached to the axle shaft by means of a bolt 30. The bolt 30 is locked against turning with a lock washer 32.

The axle shaft is mounted in the tube on two taper rolling bearings 11 and 12, the play of which is adjusted by means of shims 29.

The three double-rim satellite gears 21 of each final drive engage the crown gear 20 with their smaller rims (z=24). The crown gear in a splined connection “crown gear-hub” is mounted according to the three small crown gears (z=24) of the double-rim satellite gear. The crown gear 20 is locked against axial movement by arresting stops 33, which are attached to the hub 36, mounted on pins 9 in the tube groove, by means of bolts 34 with locking plates 35.

To drain oil remainders from the final drives (after oil has been drained from the transmission through a drain hole in the underside of the rear axle body) there are holes in final drive tubes, shut with plugs 37.

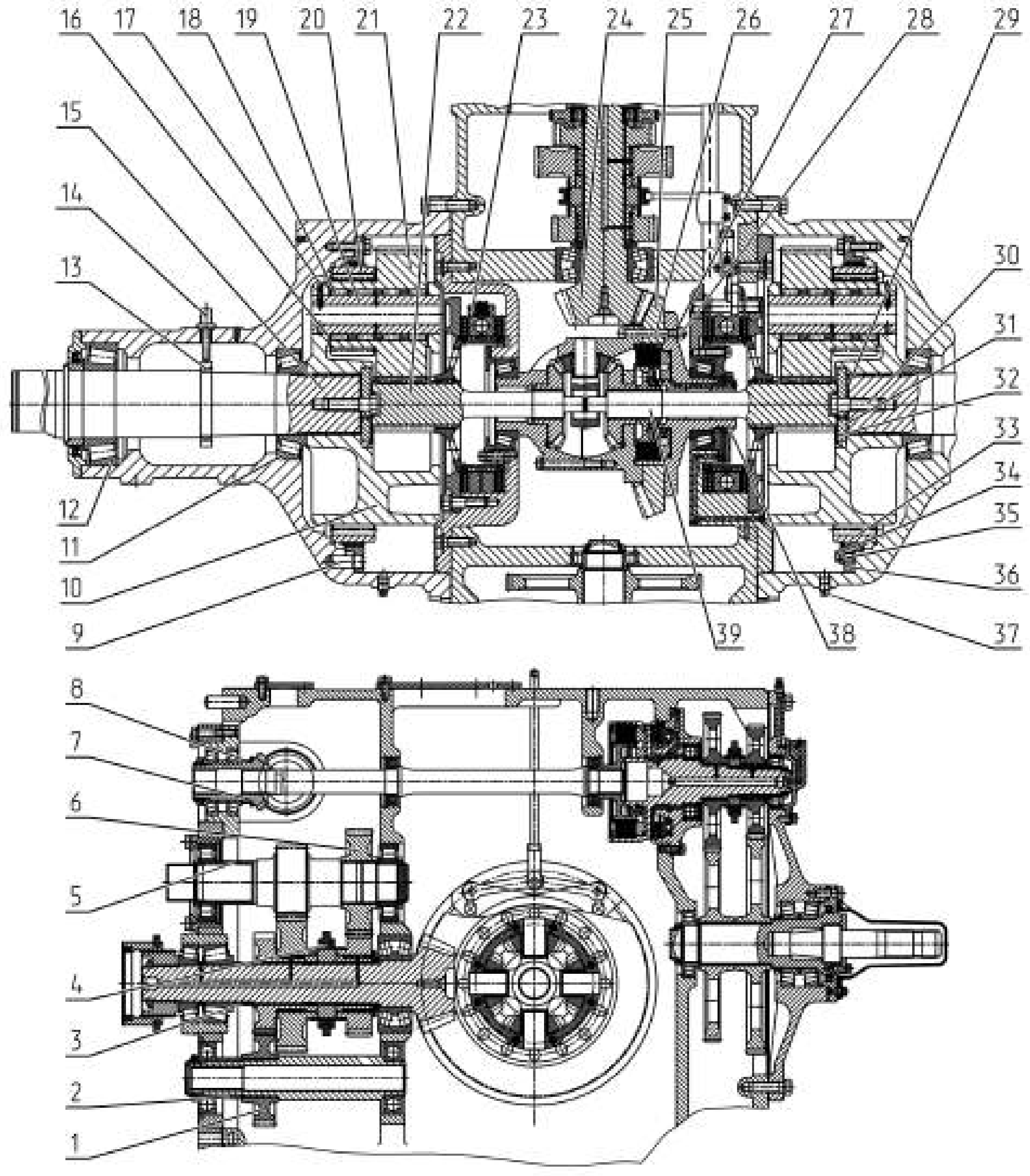
The axle shafts have toothed disks 13 mounted, their change of speed affects the axle shaft speed sensors mounted above on the tubes.

3.6.5 Rear axle reduction part

The reduction part of the rear axle transfers torque to the following units:

- to the drive of the outer pumps of the HHL and transmission hydraulic system through a drive gear 7 (figure 3.6.3) with a circular tooth;
- to the FDA drive through a gear 1;

Besides, gears of shifting of III and IV ranges of the gearbox by means of a clutch 4 as well as a creeper switching clutch are located in the front section of the rear axle body.



1, 6, 7 – gear; 2,3,5,8– sleeve; 4 – clutch; 9 – pin of epicycle hub; 10 – carrier; 11; 12 – axle shaft bearings; 13 – toothed disk; 14 – speed sensor; 15 – axle shaft; 16 – washer; 17 – screwed-on pin; 18 – rollers; 19 – satellite shaft; 20 – crown gear; 21 – satellite gear; 22 – left sun gear; 23 – brake hub; 24 – drive gear; 25 – driven gear; 26 – bolt; 27 – locking plate; 28 – nut; 29 – shims; 30 – axle shaft bolt; 31 – axle shaft washer; 32 – lock washer; 33 – arresting stop; 34 – hub bolt; 35 – locking plate; 36 – hub; 37 – plug; 38 – cast iron rings; 39 – right sun gear.

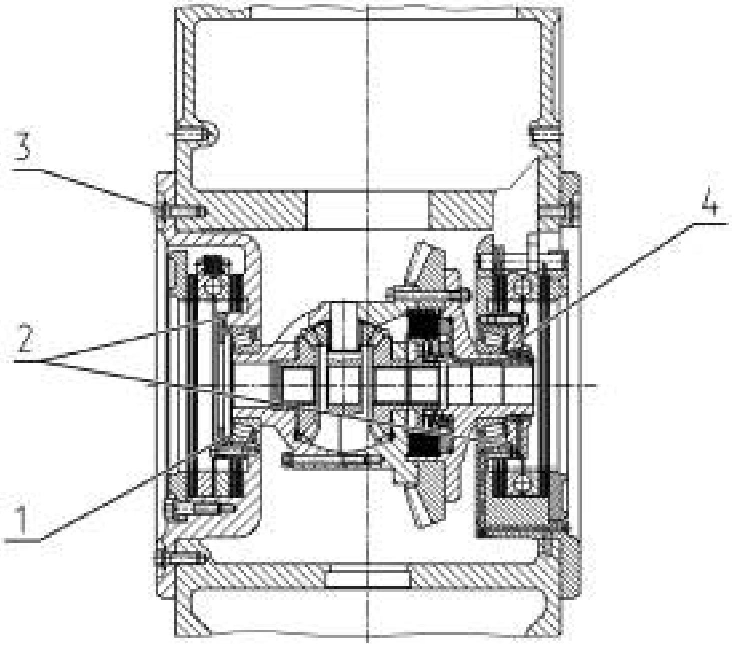
Figure 3.6.3 – Rear axle

3.6.6 Check and adjustment of play in differential tapered bearings

Axial play in the differential tapered bearings shall be 0,1 to 0,15 mm. Trying shims 2 (figure 3.6.4) under a cover 1, and if necessary under a cover 4, adjust bearing play.

The axial play shall be checked when moving the differential in axial direction with application of force from 500 to 600 N.

The differential shall turn without seizure. The adjustment shall be carried out on the rear axle body without the final drives 2 (figure 3.6.1) and the plate 1 in the rear axle assembly. When carrying out adjustment turn the differential in bearings so that the rollers took their position in cages.



1 – left cover; 2 – shims; 3 – bolt; 4 – right cover.

Figure 3.6.4 – Differential in rear axle body

3.6.7 Check and adjustment of the master pair backlash

The master pair backlash shall make 0,25 to 0,5 mm, the backlash variation shall not exceed 0,2 mm for one pair. The contact pattern shall be not less than 50% of the surface with impress location in the middle part of the tooth.

The backlash shall be adjusted by moving a certain amount of washers from under the cover 4 (figure 3.6.5) under the cover 1 or vice versa, without changing their total number.

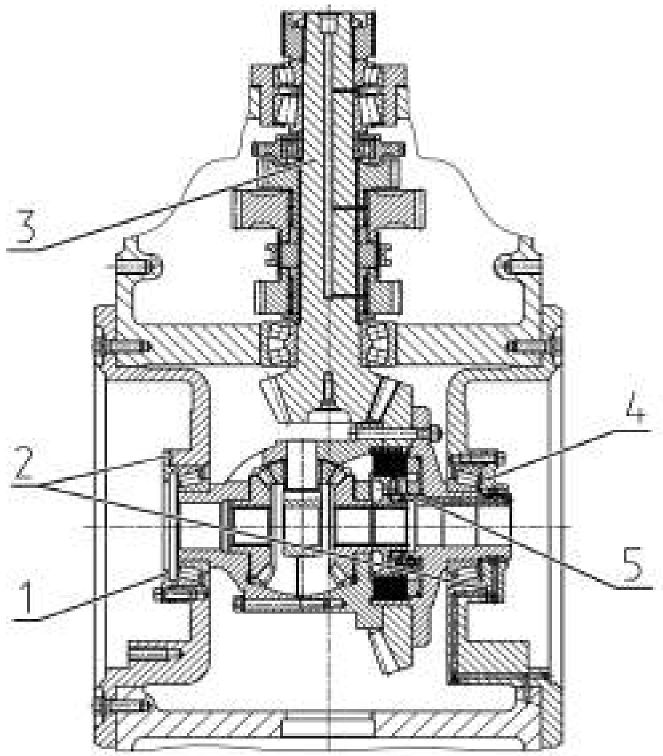
Before mounting the plate 3 ready-assembled with a drive gear of the master pair to the axle body, check and if necessary set an installation dimension of the plate equal to 380±0,1 mm at the cost of changing the number of shims 4 (figure 3.6.6).

When mounting the plate pay attention to a position of the outer ring of a double-row spherical bearing 9 (figure 3.6.6), turning and displacing on rollers. To prevent displacement of the outer ring use a fixture, which centers the bearing outer ring.

ATTENTION: REPLACE THE MASTER PAIR GEARS ONLY AS A SET. THE MASTER PAIR GEARS SHALL HAVE IDENTICAL NUMBERS!

ATTENTION: DIFFERENTIAL BODY, DIFFERENTIAL COVER AND LOCK BODY SHALL BE REPLACED ONLY AS A SET. THE BODIES SHALL HAVE IDENTICAL NUMBERS!

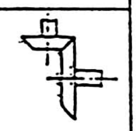
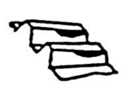
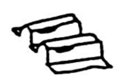
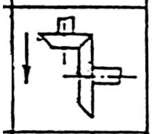
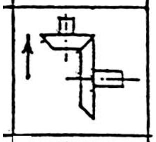
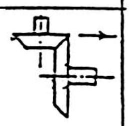
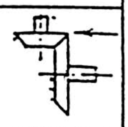
ATTENTION: CAST IRON RINGS 5 (FIGURE 3.6.5) SHALL BE MOUNTED (IN ORDER TO PREVENT RING DAMAGE DURING ADJUSTMENTS) AFTER ALL ADJUSTMENTS HAVE BEEN CARRIED OUT WITH THE FINAL MOUNTING OF THE COVER 4!



1 – left cover; 2 – shims; 3 – plate ready-assembled with drive master pair; 4 – right cover; 5 – cast iron rings.

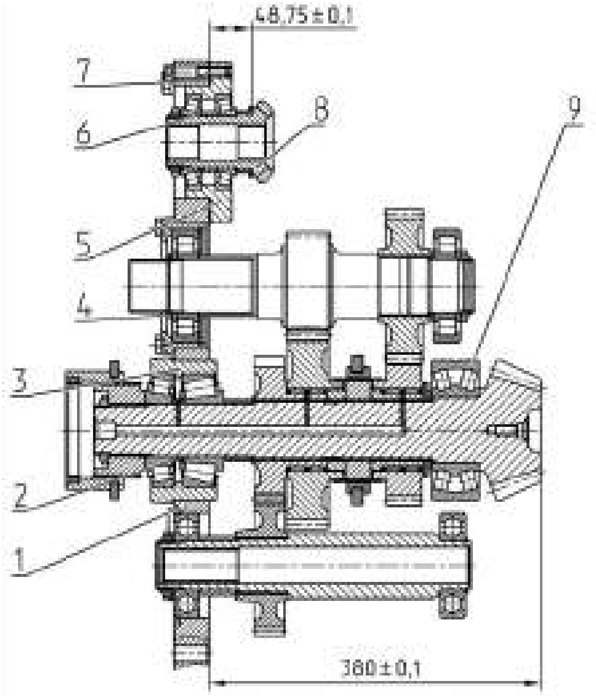
Figure 3.6.5 – Differential and plate ready-assembled with drive gear of master pair in rear axle body

3.6.8 Check of main drive gears for accuracy of engagement according to contact pattern

POSITION OF CONTACT PATTERN ON DRIVEN GEAR		WAY TO REACH CORRECT GEAR ENGAGEMENT	SCHEME
Front motion	Rear motion		
		CORRECT GEAR ENGAGEMENT WHEN CHECKED UNDER SMALL LOAD	
		MOVE THE DRIVE GEAR TOWARDS THE DRIVEN GEAR	
		MOVE THE DRIVE GEAR OFF THE DRIVEN GEAR	
		MOVE THE DRIVEN GEAR OFF THE DRIVE GEAR	
		MOVE THE DRIVEN GEAR TOWARDS THE DRIVE GEAR	

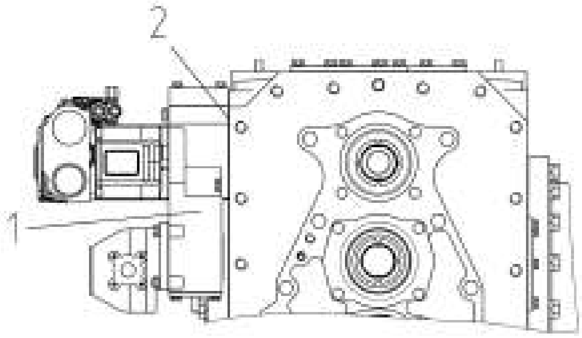
3.6.9 Check and adjustment of backlash in tapered gears with circular teeth to drive pumps of HHL and transmission hydraulic system.

The backlash in tapered bearings shall make 0,2 to 0,4 mm. The contact shall be not less than 50 % of the surface with impress location in the middle part. The adjustment shall be carried out by means of changing the number of shims 2 under the body of pump drive 1 (figure 3.6.7). Previously it is necessary to check and if required adjust the offset of the drive gear 8 to reach the dimension 48,75±0,1 mm on the plate 1 (figure 3.6.6) of the rear axle body at the cost of changing the amount of shims 7.



1 – plate of rear axle body; 2 – shim; 3 – cage of back rest; 4, 7 – shims; 5 – drive gear cage; 6 – shims; 8 – drive gear; 9 – bearing.

Figure 3.6.6 – Assembly plate



1 – body for drives of pumps of HHL and transmission hydraulic system; 2 – shims

Figure 3.6.7 – Installation of drives of pumps of HLL and transmission hydraulic system

ATTENTION: REPLACE TAPERED GEARS WITH CIRCULAR TEETH TO DRIVE PUMPS OF HLL AND TRANSMISSION HYDRAULIC SYSTEM ONLY AS A SET. THE GEARS SHALL HAVE IDENTICAL NUMBERS!

3.6.10 Check and adjustment of axial clearance in bearings of cages of drive gear to drive pumps of HLL and transmission hydraulic system

The axial clearance in the bearings shall not exceed 0,1 mm. The adjustment shall be carried out by means of changing the number of shims 6 (figure 3.6.6). When carrying out adjustment turn the cage 5 to make rollers take their position in the cage. Assembly and adjustment shall be carried out before mounting the cage 5 ready-assembled on the plate 1.

3.6.11 Check and adjustment of axial clearance in bearings of cage of back rest for drive gear-shaft of the master pair

The axial clearance in the bearings shall not exceed 0,1 mm. The adjustment shall be carried out by means of changing the number of shims 2 (figure 3.6.6). When carrying out adjustment turn the cage 3 to make rollers take their position in the cage. Assembly and adjustment shall be carried out before mounting the cage 3 ready-assembled on the plate 1.

3.6.12 Check and adjustment of axial clearance in axle shaft bearings

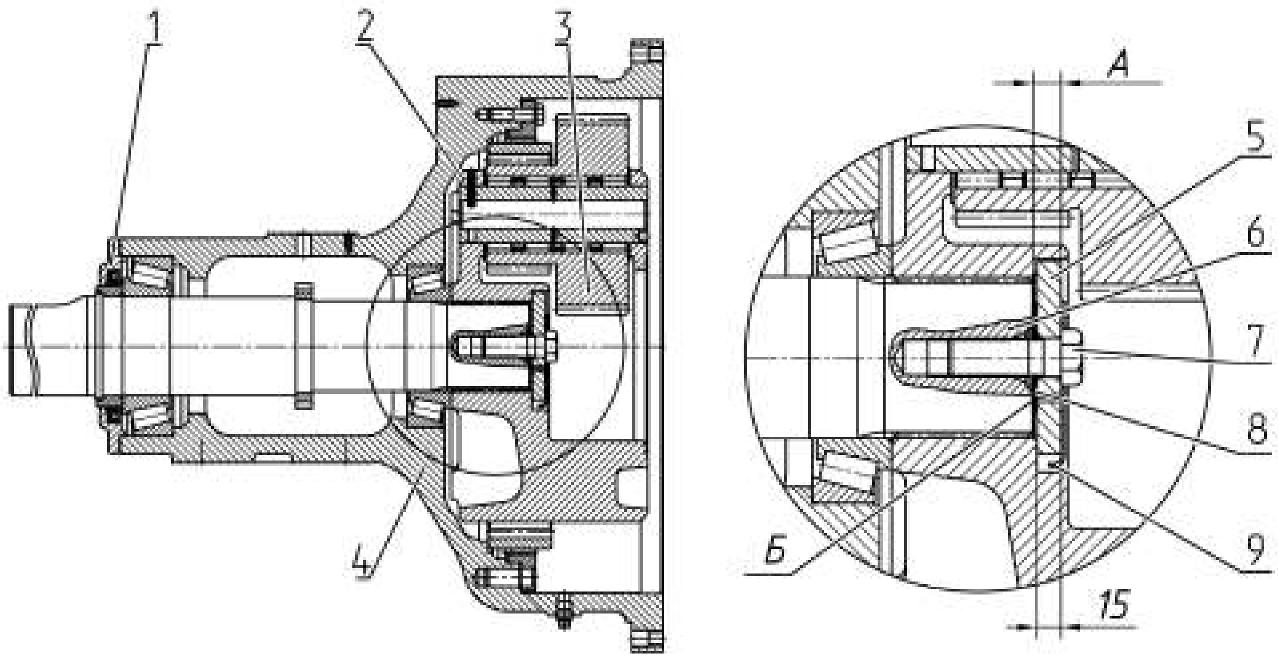
The axial clearance in the axle shaft bearings shall not exceed 0,1 mm. The adjustment shall be carried out by means of changing the number of shims 8 (figure 3.6.8) between an axle shaft 6 and a washer 5. To carry out adjustment it is needed to take a lock washer 9 out from the carrier, unscrew bolt 7 out of the axle shaft and remove the carrier 2 ready-assembled from splines of the axle shaft 6. Hereby the washer 5 remains in the carrier in a non-fixed position.

If the adjustment is carried out after replacement of one or two bearings of the axle shaft, the estimated thickness of a set of shims 8 is defined by means of deducting the washer thickness equal to 15 mm from a dimension “A” (between the end of the axle shaft 6 and an outer end of the washer 5), measured with a beam-compass through an orifice “Б”. The shims 8 shall not be mounted when measuring the dimension “A”.

When carrying out adjustment it is required to turn the axle shaft so that the rollers took their position in the bearings. The adjustment is performed without the cover with gland 1. After adjustment the axle shaft shall turn with small resistance (from 20 to 30 N·m) without seizure and jamming.

ATTENTION:

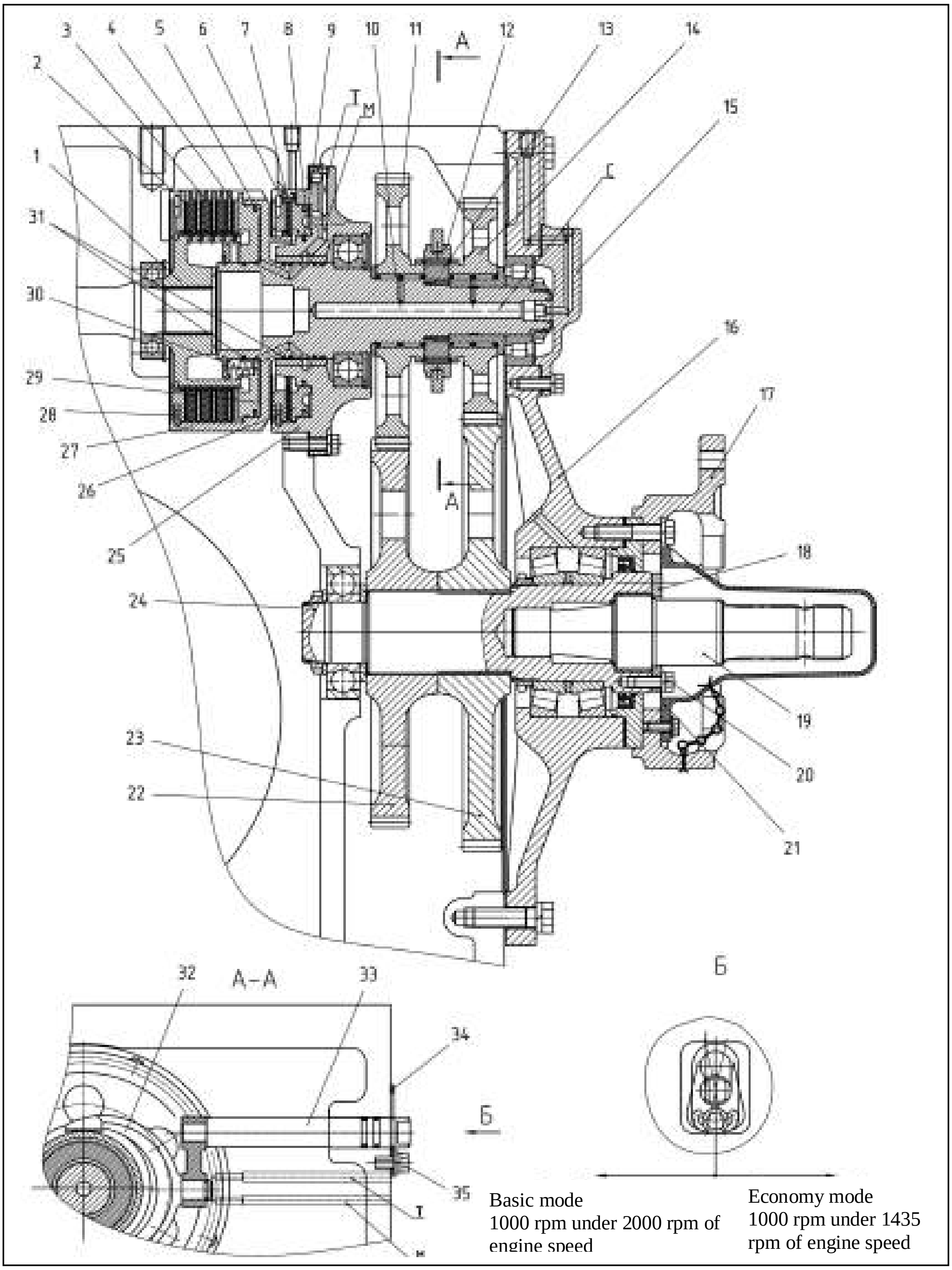
- MOUNTING THE CARRIER 2 (FIGURE 3.6.8) READY-ASSEMBLED WITH DOUBLE-RIM SATELLITE GEARS 3 INTO THE TUBE 4, SET THE MARKED TEETH ROOTS OF THE BIGGER RIMS (Z=42) OF DOUBLE-RIM SATELLITES 3, ON LINES PASSING THROUGH THE SATELLITE GEAR CENTER AXES AS WELL AS THROUGH THE CARRIER AXIS!
- THE FINAL TIGHTENING TORQUE FOR BOLT 7 OF THE AXLE SHAFT WITH SHIMS MOUNTED IS 650 TO 700 N·M!
- TO BRING THE NIB THE LOCK WASHER 9 INTO COINCIDENCE WITH CAVITIES IN THE CARRIER 2 IT IS NOT ALLOWED TO UNSCREW THE BOLT 7 OF THE AXLE SHAFT!



1 – cover with gland; 2 – carrier; 3 – double-rim satellite gears; 4 – tube; 5 – axle shaft washer; 6 – axle shaft; 7 – axle shaft bolt; 8 – shims; 9 – lock washer.

Figure 3.6.8 – Final drive

3.7 Rear power take-off shaft



1 – spline coupling; 2 – friction clutch thrust disk; 3 – friction clutch drive disk; 4 – driven disk; 5 – packing ring; 6 – brake thrust disk; 7 – brake drive disk; 8 – packing ring; 9 – packing ring; 10 – needle bearing; 11 – drive gear for economy mode; 12 – spline coupling; 13 – splined bushing; 14 – drive gear for basic mode; 15 – bearing cover; 16 – PTO cover; 17 – spacer; 18 – end washer; 19 – replaceable shaft end extension; 20 – bolt; 21 – cap; 22 – driven gear for economy mode; 23 – driven gear for basic mode; 24 – driven shaft; 25 – brake body; 26 – brake piston; 27 – friction clutch shaft; 28 – lock ring; 29 – friction clutch piston; 30 – springs; 31 – packing rings; 32 – fork; 33 – switching shaft; 34 – lock plate; 35 – securing bolt.

Figure 3.7.1 – Rear PTO

The rear power take-off shaft (PTO) (figure 3.7.1) has a separate 1000 rpm drive of the end extension for two modes – basic and economy. The torque to the rear PTO is transferred from the engine by means of connecting shafts and splined bushings in the gearbox and in the rear axle body. The rear PTO units are mounted in grooves of the rear axle body and PTO cover 16. The rear PTO consists of hydraulically operated engagement friction clutch and brake, two-speed gear reduction unit with mechanical shifting and replaceable end extensions 19. The friction clutch serves to attach and detach PTO drive shaft to/from the reduction unit. It consists of a shaft 27, which is simultaneously a friction clutch body, of a splined clutch 1, of a thrust disk 2, of drive disks 3, mounted on splines of the clutch 1, driven disks 4, mounted in grooves of the shaft 27 and of a spring-loaded piston 29, mounted in the friction clutch body and compacted with rings 5 and 31.

The brake serves to stop the PTO shaft end extension and consists of a body 25, in which a spring-loaded piston 26 is mounted, compacted with rings 8 and 9, of a thrust disk 6 and of a drive disk 7, mounted on the splines of the friction clutch shaft. The reduction unit consists of drive gears 11 and 14, mounted on needle bearings 10 and connected with the shaft 27 by means of a splined bushing 13, and of a movable coupling 12, of driven gears 22 and 23, mounted on splines of the shaft 24. The lubricant of the needle bearings 10 is delivered from the transmission lubrication system to channel “C” of the shaft 27 through bores in the covers 15 and 16. The PTO modes are switched over by means of a shaft 33 and a fork 32, entering the slot of the movable clutch 12.

The replaceable shaft end extensions 19 are mounted in the inner splines of the shaft 24 and are secured by means of the end washer 18 and bolts 20.

The PTO is actuated by the friction clutch. As oil is delivered through channel “M” from the PTO control distributor the piston 29 compresses the pack of disks 3 and 4 and rotation is transferred from the splined clutch 1 to the shaft 27, on the splines of which a sleeve 13 is mounted with a splined clutch 12. As the shaft 33 rotates clockwise the fork displaces the clutch 12 to the splines of the gear 14 (basic mode), as the shaft rotates contraclockwise the fork displaces the clutch to the splines of the gear 11 (economy mode). The shaft 33 is secured in engaged condition by means of the plate 34 and the bolt 35.

The economy mode is used to save fuel at engine partial modes when operating with implements not requiring full power. 1000 rpm on the PTO shaft end extension are provided by way of reducing engine speed to 1435 rpm.

As the oil delivery stops the piston 26 under the influence of the spring 30 returns to its initial position, releasing the disks 3 and 4. The linkage between the drive shaft and the shaft 27 gets broken and the PTO gets disengaged. The shaft end extension is stopped by the brake as the oil is supplied under pressure via channel “T” from the distributor. The spacer 17 serves to fix devices of cardanless power take-off drive (pulley, pump, etc.), coupled with the tractor. The shaft end extension is covered with a removable cap 21.

ATTENTION: IT IS FORBIDDEN TO USE THE REAR PTO WITH THE PRESSURE IN THE TRANSMISSION HYDRAULIC SYSTEM BELOW 1,3 MPA IN ORDER TO PREVENT BREAKDOWN OF THE PTO FRICTION CLUTCH!

3.8 Front power take-off shaft

The front power take-off shaft (FPTO) is intended to drive agricultural machines with active working attachments, located on the front lift linkage. The front PTO provides 1000 rpm of shaft end extension speed under (2100 ± 50) rpm of the engine crankshaft speed with 60 kW of power implementation. The rotation direction of the PTO shaft end extension is clockwise when looked at its end.

The front power take-off shaft is executed as an independent unit and is a planetary reduction unit with band brakes.

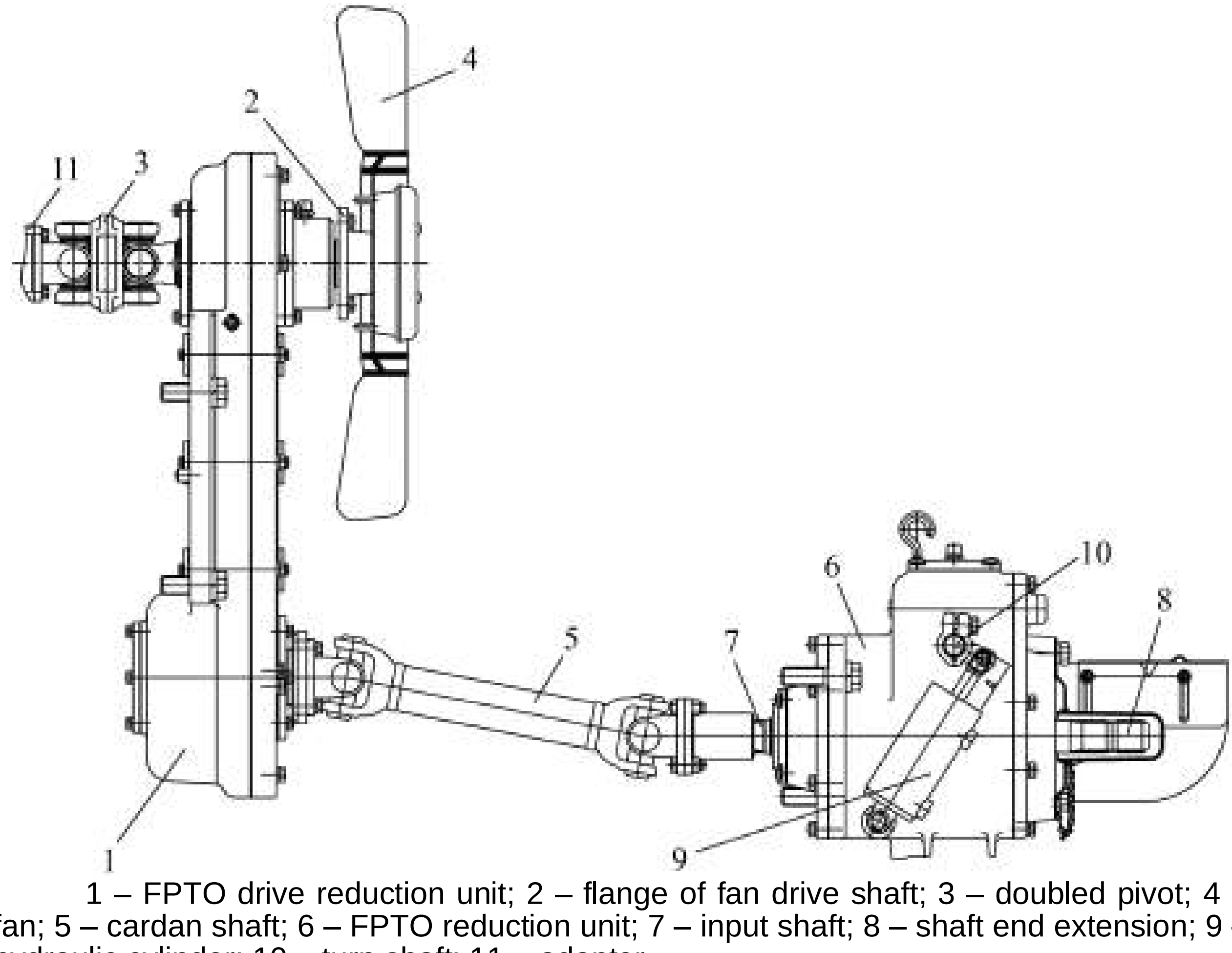
The torque to FPTO is transferred from the engine crankshaft to FPTO drive reduction unit 1 (figure 3.8.1) through an adapter 11 and a double pivot 3 with a splined shaft, staying in engagement with the input shaft of the FPTO drive reduction unit 1, and a cardan shaft 5, connecting the FPTO drive reduction unit 1 with FPTO reduction unit 6.

The power in the FPTO reduction unit is transferred from an input shaft 7 to an end extension 8 by means of the planetary drive.

The FPTO planetary reduction unit 6 is controlled by a hydraulic cylinder 9, linked to a turn shaft 10, affecting band brake levers.

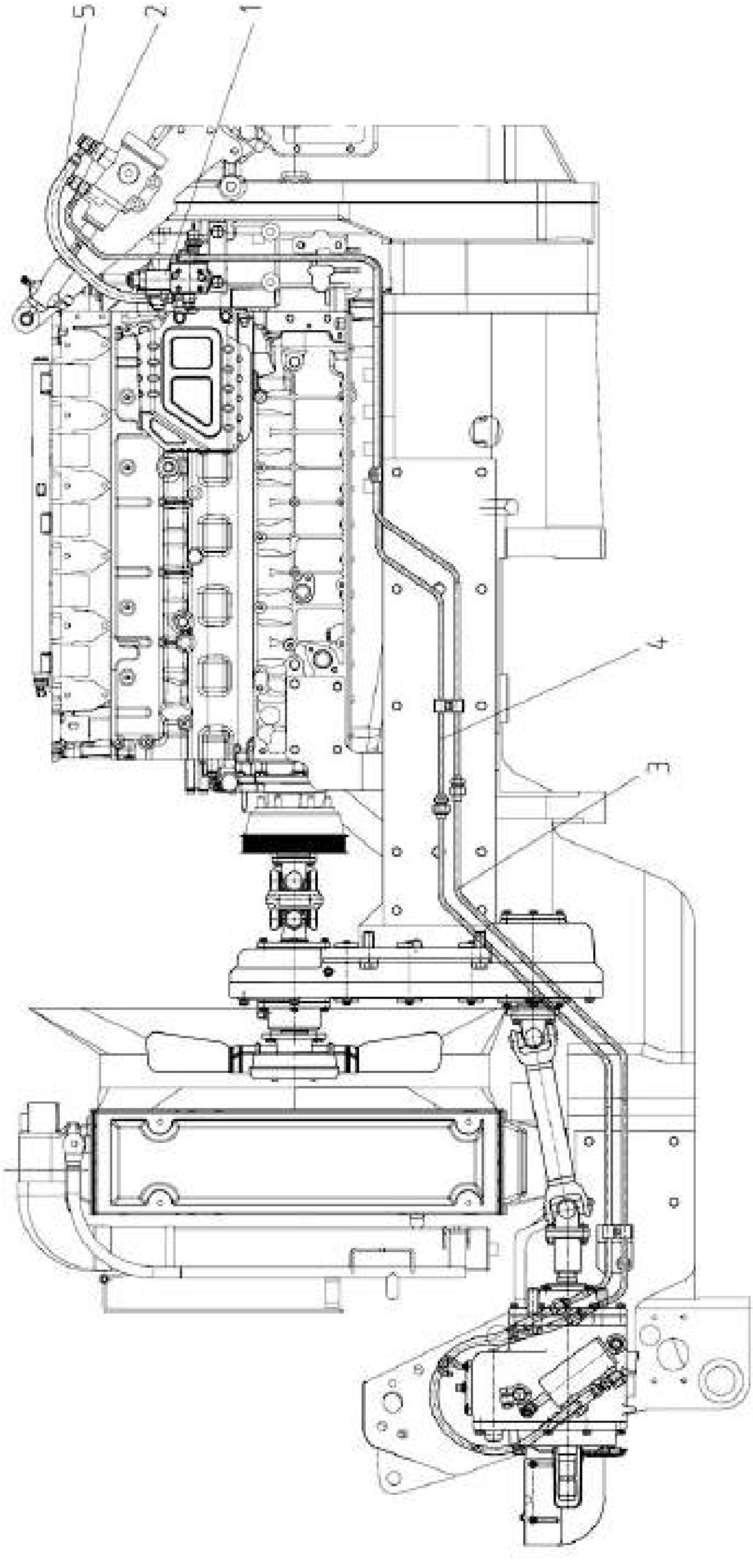
The hydraulic cylinder rod is moved as the oil flow direction in the distributor 1(figure 3.8.2) changes. The oil flow, coming via a delivery pipeline 2, goes either to a pipeline 3, linked to the hydraulic cylinder rod side (FPTO disengaged – rod retracted), or to a pipeline 4, linked to the hydraulic cylinder head end (FPTO engaged – rod extended).

A fan 4 (figure 3.8.1) is driven from the engine crankshaft tail through the adapter 11, the doubled pivot 3 with the splined shaft, the reduction unit 1, a flange of the fan drive shaft 2.



1 – FPTO drive reduction unit; 2 – flange of fan drive shaft; 3 – doubled pivot; 4 – fan; 5 – cardan shaft; 6 – FPTO reduction unit; 7 – input shaft; 8 – shaft end extension; 9 – hydraulic cylinder; 10 – turn shaft; 11 – adapter.

Figure 3.8.1 – Front PTO (mechanical part)



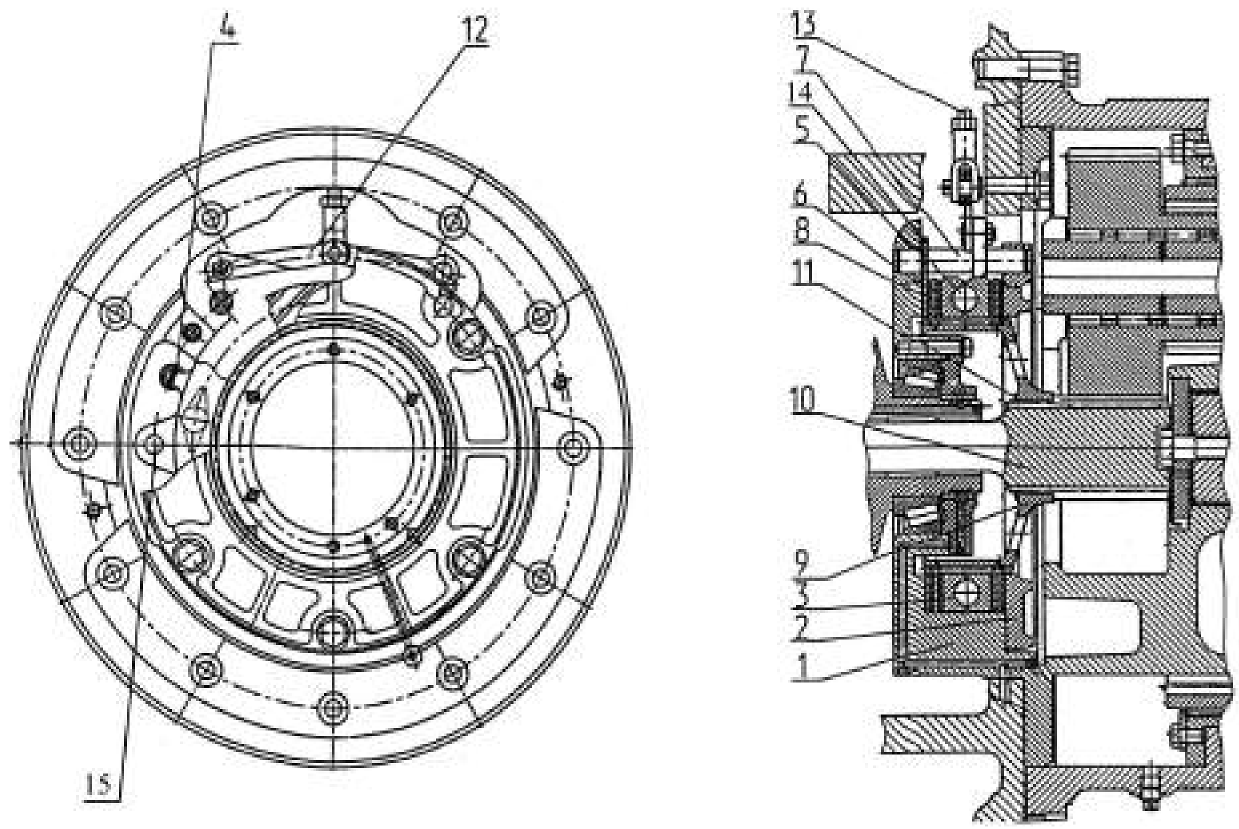
1 –distributor; 2 – delivery pipeline; 3 – pipeline; 4 – pipeline; 5 – drain pipeline.

Figure 3.8.2 – Front PTO (hydraulic part)

3.9 Brakes

3.9.1 General Information

The tractors BELARUS - 3522.5 are equipped with the disk brakes working in the oil bath.



1 – casing; 2 – cover; 3 – pressure disk; 4 – coupling springs; 5 – expanding balls; 6 –intermediate disk; 7 – pin; 8 – frictional disk ; 9 – hub; 10 – shaft; 11 – locking ring; 12,13 – rod; 14 – mounting disk; 15 – pin.

Figure 3.9.1 – Brake

The brake consists of the following parts: casing 1 (figure 3.9.1), cover 2, pressure disks 3 which are tightened together with springs 4, expanding balls 5, mounting disk 14 fixed by turn of pins 7, intermediate disks 6 mounted on pins 15 of pressure disks 3, frictional disks 8 with ceramic-metal pads, hub 9 mounted on splines of shaft 10 and fixed on it by locking ring 11, rods 12 and 13. The brakes are controlled by means of rods 12, 13 connected with brakes drive mechanisms. When pressed brake pedal, the fluid arrives in operating cylinder which piston influences through a push rod a lever connected with rods 13 and 12. The rod 13 during movement turns towards each other pressure disks 3 which being running on the balls 5 placed in the holes of variable section and made on non-working surfaces of pressure disks press the rotating frictional disks 8 between fixed details and in such way the tractor brakes.

3.9.2 Service Brakes Control

The brake drive is intended for brakes control as well as at forward motion andon reverse. The type of brake drive is hydrostatic with hanging pedals. The drive (figure 3.9.2) consists of main cylinders 4 (for forward motion) and 14 (for reverse), hanging pedals 9 (for forward motion) and 15 (for reverse), operating cylinders 16 (for forward motion) and 21 (for reverse) and tanks 5.

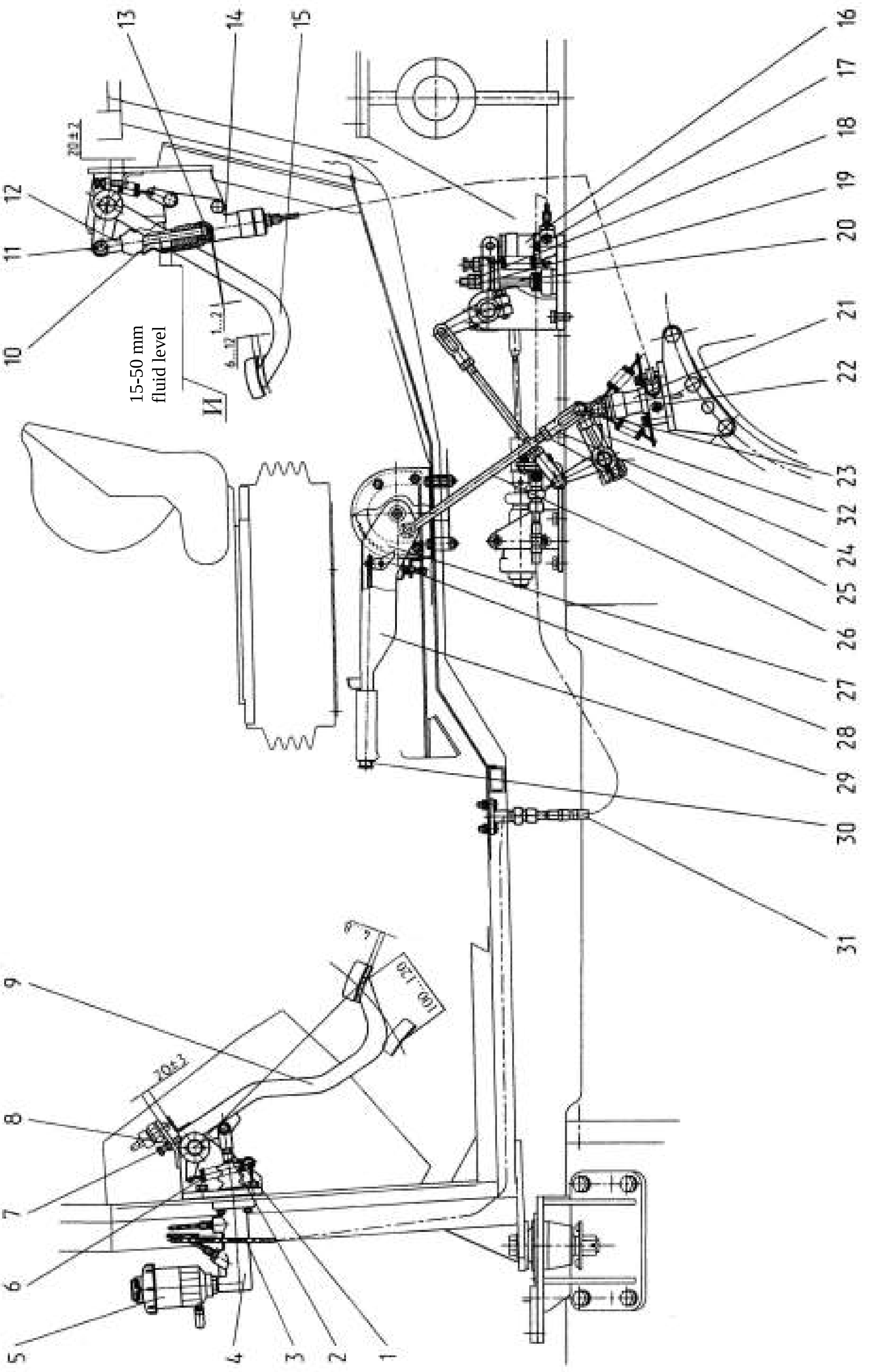


Figure 3.9.2 – Brakes control scheme

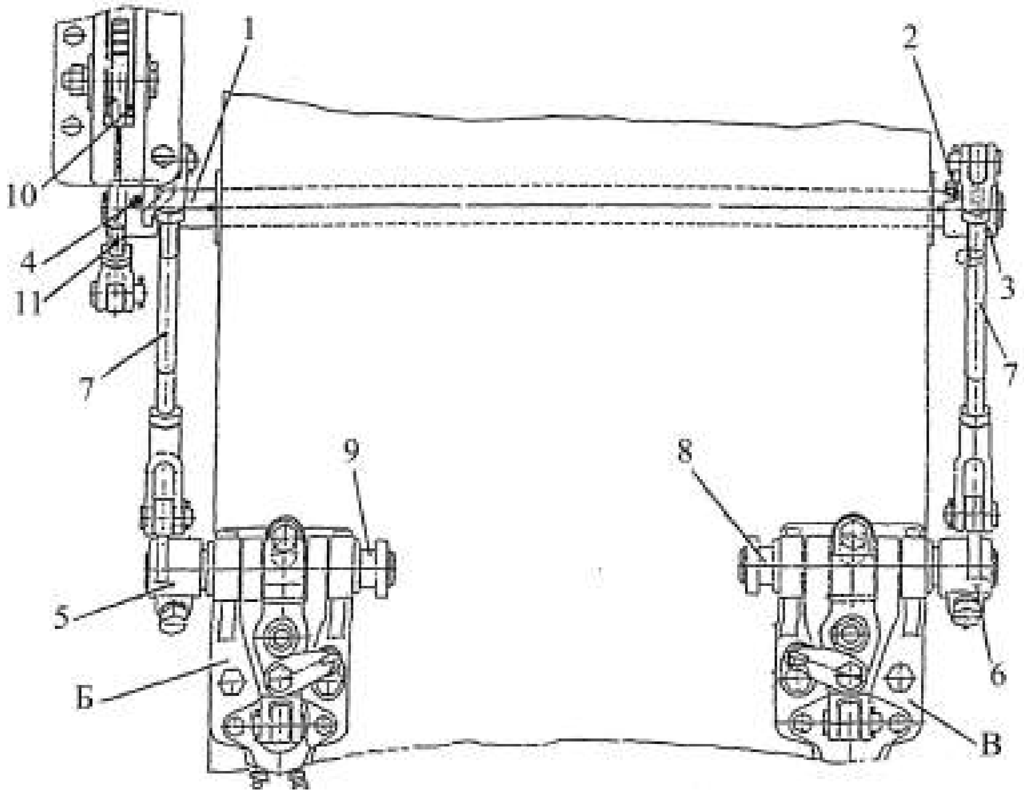
To the figure 3.9.2 –Brakes control scheme:

1 – locking nut; 2 – push rod; 3 – pipeline; 4 – main cylinder for forward motion; 5 – tank; 6 – spring; 7 – bolt; 8 – nut; 9 – forward motion pedal; 10 – push rod; 11 – pin; 12 – fork; 13 – piston; 14 – main cylinder for reverse; 15 – reverse motion pedal; 16 –operating cylinder for forward motion; 17 –bypass valve; 18 – locking nut; 19 – adjusting nut; 20 – rod; 21 – operating cylinder for reverse; 22 – bypass valve; 23 – pin; 24 – fork; 25 – locking nut; 26 – rod; 27 – sector; 28 – clamper; 29 – lever; 30 – button; 31 –flexible pipe; 32 – lever.

3.9.3 Brakes Drive Mechanisms

The brakes drive mechanisms are common as well as for pedal drive by hydraulic cylinders (at forward and reverse motion) and for mechanical manual drive from control lever through a system of rods and levers on both wheels through shaft 1 (figure 3.9.3). When pressed on pedals at forward motion is provided separate (on boards) brakes control and both brakes control at pedals locking.

When pressed on pedal for reverse motion and at manual control, the tractor brakes simultaneously with two rear wheels thanks to operating cylinder for reverse 21 and lever 32 (figure 3.9.2) (for reverse) and thanks to control lever 10 (figure 3.9.3), through rod 11 (for manual control) on brake shaft 1, levers 3, 4, mechanisms "Б" and "В". Left and right brakes drive mechanisms have an identical design. They differ from each other only in length of shafts 8, 9, in orientation of their position and in external levers. Besides, to the internal end of shaft 8 of right mechanism is welded an lever for pneumatic valve control.

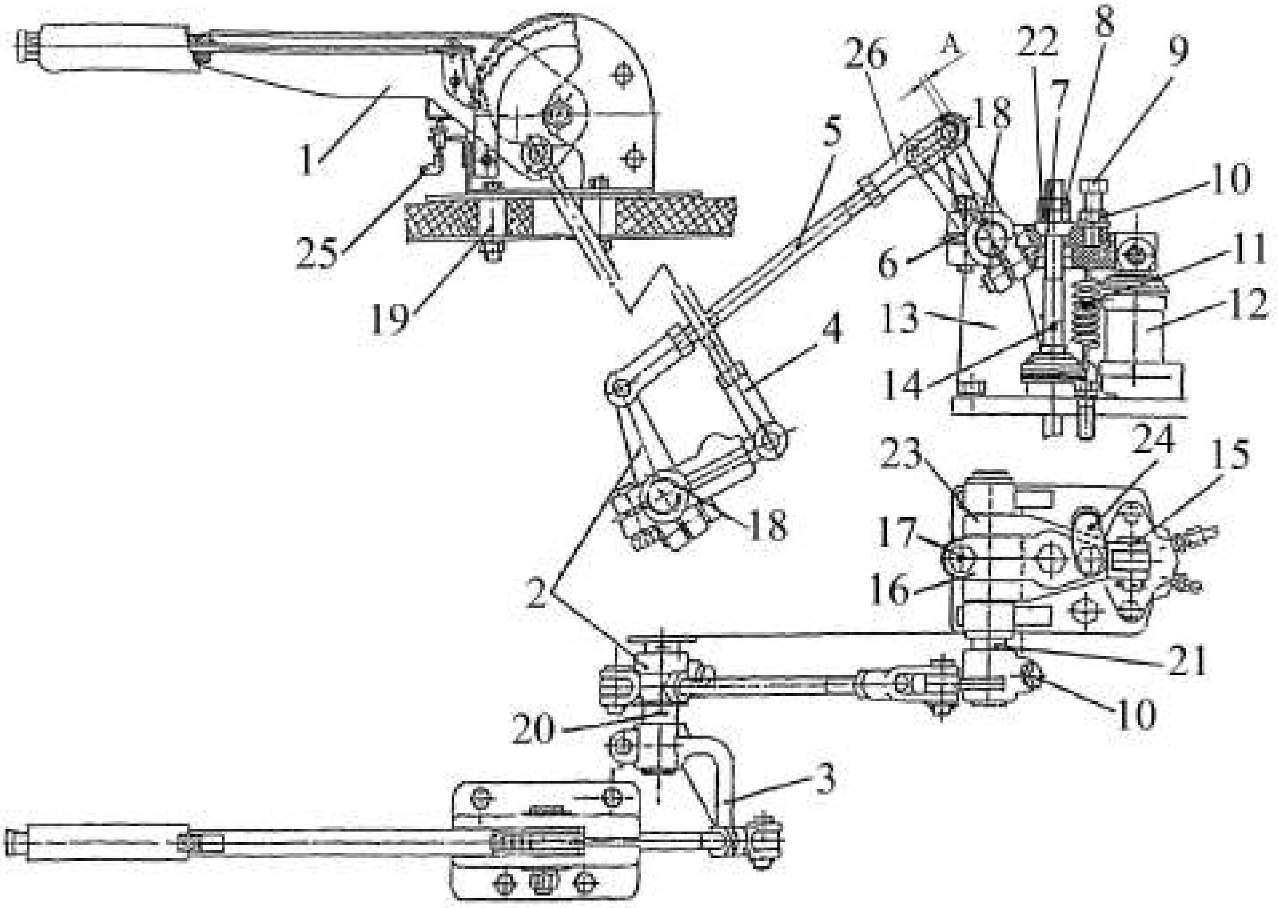


"Б"– left brake drive mechanism; "В" – right brake drive mechanism;

1 – brake shaft; 2 – semi-circular key; 3 – right lever; 4 – left lever; 5 – left back lever; 6 – right back lever; 7 – rod; 8 –shaft of right brake and pneumatic valve drive mechanism; 9 – shaft of left brake drive mechanism; 10 – control lever; 11 – brake control rod.

Figure 3.9.3 – Brakes drive

The brakes control includes manual control by lever 1 (figure 3.9.4) through the system of rods and levers and brakes drive mechanisms “Б” and “В”(figure 3.9.3).



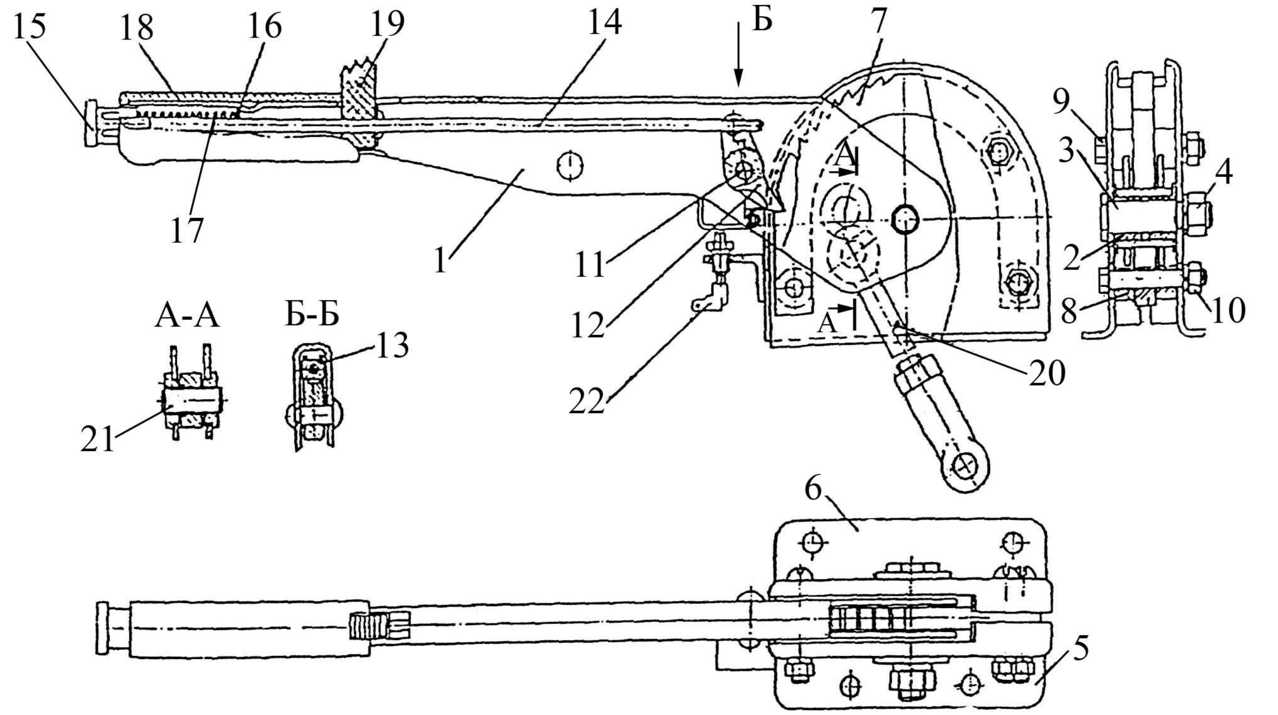
1 – control lever; 2 –left lever; 3 –external lever; 4 – control rod; 5 –intermediate rod; 6 –round key; 7 – spherical washer; 8 – locking nut; 9 – adjusting bolt; 10 – locking nut; 11 – back moving spring; 12 –operating cylinder; 13 – bracket; 14 – rod; 15 – pin; 16 – internal lever; 17 – coupling bolt; 18 – semi-circular key; 19 – bushing; 20 –brake shaft; 21 – shaft of left brakes drive mechanism; 22 – nut; 23 – lever; 24 – eye; 25 – hand brake control lamp switch, 26 – fork.

Figure 3.9.4 – Brakes control

The brakes drive mechanism (figure 3.9.4) consists of bracket 13, internal lever 16 mounted on shaft 21 on round key 6, tightened with bolt 17, of adjusting bolt 9 with locking nut 10, of lever 23 with bushings loosely fitted on the shaft 21 and connected to operating cylinder rod 12 with pin 15, of back moving spring 11, of spherical washer 7, of locking nut 8, of nut 22, of eyes 24 and of rod 14 connecting brakes drive mechanism with pressure disks.

3.9.4 Independent Mechanical Parking Brake

As parking brake is used service brake with independent hand rear wheel drive. The independent mechanical parking brake consists of: lever 1 (figure 3.9.5) mounted on bushings 2 on axle 3, tightened with nut 4 in bracket consisting of side members 5, 6, sector 7, distance pieces 8 and coupling bolts 9 with nuts 10.



1 – lever; 2 – bushing; 3 – axle; 4 – nut; 5 –left side member; 6 –right side member; 7 – sector; 8 –distance piece; 9 – bolt; 10 – nut; 11 – clamper axle; 12 – clamper; 13 – coupling; 14 – rod; 15 – button; 16 – washer; 17 – spring; 18 – handle; 19 –duplicating button (for reverse modification of tractor); 20 – rod; 21 – pin; 22 – hand brake control lamp switch.

Figure 3.9.5 – Independent mechanical parking brake

In the lever 1 (figure 3.9.5) on the axle 11 is situated the clamper 12 in top arm of which is located the coupling 13 in which is screwed-in rod 14. On the other end of the rod 14 is threaded button 15.

In tube part of the lever are bosses which serve as supports for washer 16 which is support for spring 17. The handle 18 is assembled by forced fit on tube part of lever. For reverse modification exists a possibility for installation of duplicating button19. The lever 1 is connected with rod 20 by means of pin 21.

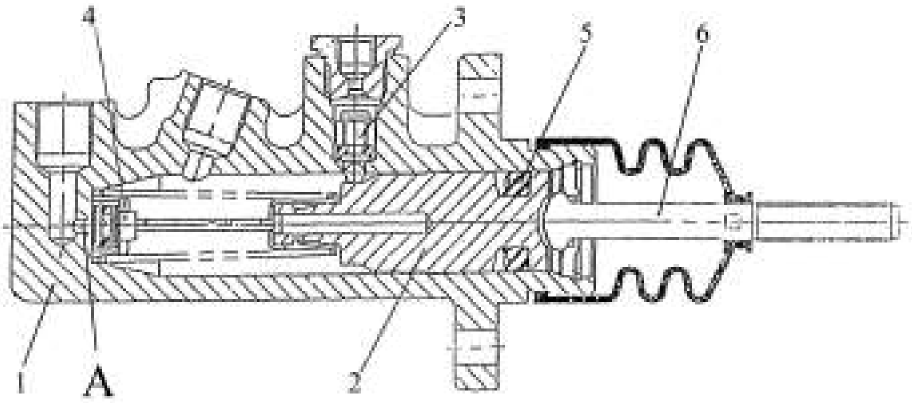
The rod 20 is connected to lever 3 (figure 3.9.4) mounted on key on shaft 20. Near to lever 3 on key is mounted lever 2 connected by rod 5 with lever 10 situated on key on shaft 21 of left brakes drive mechanism. On the other end of the shaft 1 (figure 3.9.3) on the semi-circular key 2 is mounted lever 3 connected by rod 7 with lever 6 of right brakes drive mechanism. The lever 1 (figure 3.9.5) assembled with bracket is fixed on the cab floor by four bolts.

3.9.5 Brake Operation with Forward Pedal Drive

When pressed on brake pedal, the push rod 6 (figure 3.9.6) of main brake cylinder connected with pedal lever moves forward. Meanwhile is closed the lock valve 4 through which in casing 1 arrives brake fluid from tank. The piston 2 moves forward, pushing compensation valve 3. The power fluid is pumped under pressure into operating cylinder of brake.

The piston of operating cylinder moves under pressure of power fluid and through a slide bar connected to lever 23 (figure 3.9.4) by means of a pin 15 turns lever 23, this lever bearings against the bolt 9, lifts lever 16 connected through spherical washer 7, fixed by nuts 22 and 8 on rod 14, lifts this rod, tightening brake by pressure disks. When there is no force on pedal, the spring 11 resets lever 16 and piston of operating cylinder 12 in starting position.

When pressed on interconnected pedals, the compensation valves 3 of main brake cylinders ensure fluid pressure balance in lines of left and right brake operating cylinders.

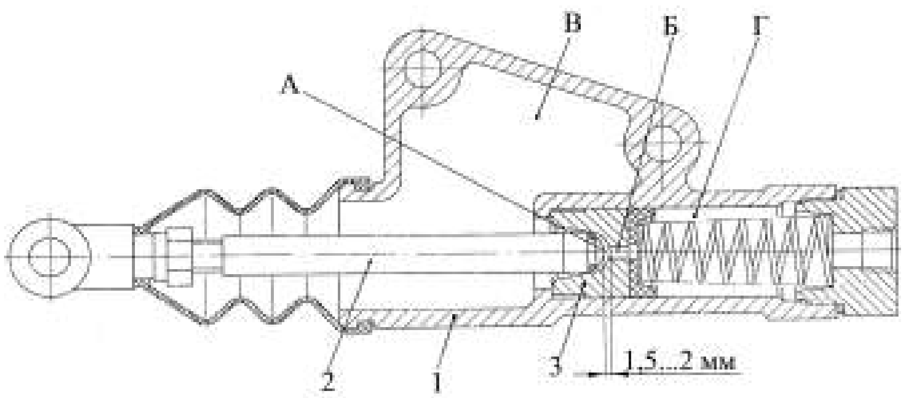


1 – casing; 2 – piston; 3 – compensation valve; 4 – lock valve; 5 – collar; 6 – push rod.

Figure 3.9.6 – Main brake cylinder

3.9.6 Brake Operation with Reverse Pedal Drive

When pressed on brake pedal, the push rod of main brake cylinder 2 for reverse (figure 3.9.7), connected with pedal lever, moves. Meanwhile is closed the hole “Б” connecting balance chamber "В" with chamber “Г”. The piston 3 moves creating pressure. Then power fluid is pumped under pressure into operating cylinder for reverse.The piston of operating cylinder for reverse thanks to pressure of fluid moves and through a rod connected with lever 32 (figure 3.9.2) by means of a pin 23 turns brakes shaft 20 (figure 3.9.4), which influences through intermediate rods 5 brakes drive mechanisms for forward motion, tightening brake by pressure disks.



1 – casing; 2 – push rod; 3 – piston.

Figure 3.9.7 – Main brake cylinder for reverse

3.9.7 Adjustment of Brake Controls at forward motion

Check and adjust brake controls at forward motion in the following order:

1. Set the pedal pads 9 (figure 3.9.2) in one plane with a help of stop bolts 7, screw them at depth 20±3 mm.

2. Adjust free travel of pedals 9 between 4 and 8 mm, that corresponds to clearance between push rod and plunger between 1 and 2 mm, therefore do the following:

- open rubber cover;
- release locking nut fixing fork on push rod;
- set clearance between push rod and plunger between 1 and 2 mm (figure 3.9.6) turning push rod;

3. Screw bolts 9 (figure 3.9.4) so that this bolts overhang 2 … 3 mm below bottom part of lever 16 and fix them with locking nuts;

4. Fill and let brake fluid circulate through hydraulic system in the following order:

- fill tanks 5 (figure 3.9.2) of main brake cylinders 4 with brake fluid up to level "Max". During circulation keep an eye on fluid level, level should not be lower than “Min”.
- clear from dust and dirt the bypass valve 17, take off caps of valves, put a tube on bypass valve head of left operating cylinder and its free end put down in a transparent tank with capacity not less than 0,5 l, that is half filled with brake fluid;
- interconnect pedals 9 with blocking lath;
- press 4 or 5 times interconnected brake pedals and keeping them in pressed condition, turn the valve of the left operating cylinder by 1/2 … 3/4 revolution and after a full pedal travel when some portion of fluid with air will comes out from the system,close the valve. Press the pedal quickly, release smoothly! Repeat this operation some times as long as all air comes out from system. Remove the tube from the valve and put on the protective cap. Bleed air in the same order in right brake hydraulic drive. Add fluid to both tanks up to level "Max".

5. Unlock pedals by tightening (or unscrewing) of adjusting nuts 19 of rods 20. Ensure movement of each pedal (110±10) mm by pressing with force of 300 N with a difference between the pedals no more than 10 … 15 mm. Lock adjusting nuts 19 with locking nuts 8. Interconnect pedals. The movement of interconnected pedals by force of 600N should be within the limits of (110±10) mm;

6. Check reliability of pipelines couplings of brake control hydraulic system;

7. Check brake efficiency by tractor motion on dry surface with a concrete or asphalt covering with disengaged coupling. In case of breaking delay by one of the wheels, tighten adjusting nut 19 (figure 3.9.2) of corresponding brake rod.

ATTENTION: NONSTRAIGHTLINEARITY OF MOVEMENT DURING THE BRAKING SHOULD NOT EXCEED 0,5 M!

3.9.8 Adjustment of Brake Controls on reverse

Check and adjust brake controls at reverse motion in the following order:

1. Adjust clearance between the piston 13 (figure 3.9.2) and the push rod 10 of piston of main brake cylinder 14, therefore disconnect the fork 12 from the pedal 15 and turning push rod 10 achieve the following: the pedal travel, measured on the centre of pedal pad, should make between 6 and 12 mm from upper stop till the moment of contact of push rod 10 with the piston.

2. Connect the lever 32 with the operating cylinder for reverse by means of the pin 23 in the bottom position of rod without clearance. By turn of the lever 32 the pin 23 should move in cylinder rod groove without jamming.

3. Let brake fluid circulate through hydraulic system in the following order:

- remove cover of main brake cylinder for reverse14;
- check up level of brake fluid in the compensation chamber of the main brake cylinder for reverse 1, this level should be 15 … 20 mm from the top of the compensation chamber;
- clear from dust and dirt the bypass valve 22, take off cap of valve, put a tube on bypass valve head of the operating cylinder for reverse 21, and its free end put down in a transparent tank with capacity not less than 0,5 l, that is half filled with brake fluid;
- press 4 or 5 times the reverse brake pedal and, keeping it in the pressed condition, turn the bypass valve of operating cylinder for reverse by 1/2 … 3/4 revolution and after full pedal travel when some portion of fluid with air will come out from the system, close the valve. Press the pedal quickly, release smoothly! Repeat this operation some times as long as all air comes out from system. Remove the tube from the valve and put on a protective cap.
- fill the compensation chamber of main brake cylinder for reverse 14 with brake fluid up to the necessary level, put on protective cover of the main cylinder.

3.9.9 Adjustment of Parking Brake Actuator

Before adjustment of parking brake actuator please adjust service brake drive mechanisms as it is specified in subsections 3.9.7 "Adjustment of brake controls at forward motion” and 3.9.8" Adjustment of brake controls on reverse”.

Adjust the parking brake actuator in the following order:

1. By change of rods 5 length (figure 3.9.4) make clearance "A" between the pin and the fork 26 sleet face of the rod 5 for the left brake (4+0,5) mm and for the right brake (2+0,5) mm.

2. By brake tightening with control lever 11 (figure 3.9.5) with force (350+10) N the clamper 12 of lever should be fixed in space of fourth or fifth tooth of sector 7.

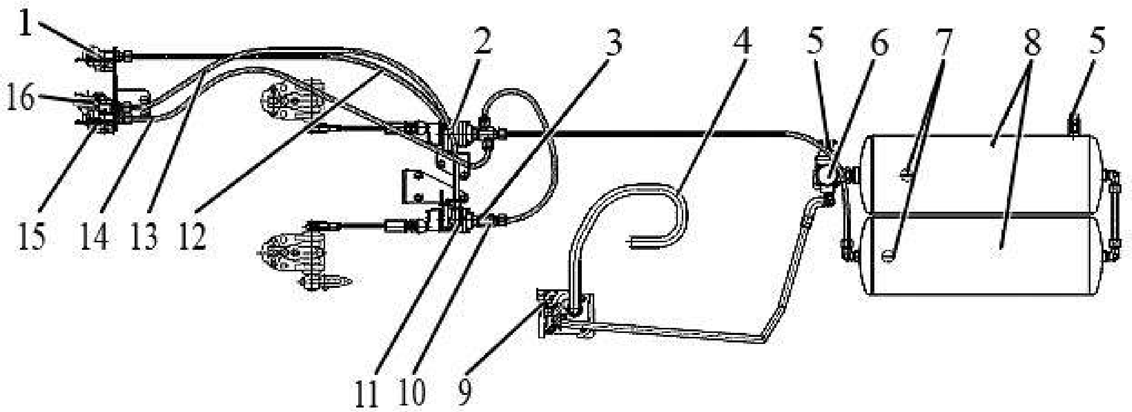
3. The tractor should be held reliably at hill of 18 %.

4. When hand brake is on, the control signal lamp should blink on indicator of combined instrument panel and should show that parking brake is active.

3.10 Pneumatic System

3.10.1 General information

The tractor BELARUS-3522.5 is equipped with the combined pneumatic drive providing brake control of trailers and agricultural machines, equipped both with single-wire and with two-wire pneumatic brake drive. The pneumatic drive is used also for tires charging and other purposes where energy of compressed air is required. The configuration of combined pneumatic drive is shown in figure 3.10.1.



1, 16, 15 – connecting heads; 2 – brake valve (two-wire); 3 –emergency air pressure sensor; 4 –line from diesel engine inlet manifold; 5 – air bleed valves; 6 – pressure regulator; 7 – condensate drain valve; 8 – cylinders; 9 – compressor; 10 – air pressure sensor; 11 – brake valve (single-wire); 12 –control line; 13 – connecting line; 14 – feeding line.

Figure 3.10.1 – Combined pneumatic drive of trailer brakes

The trailer brakes are driven in two modes – direct and automatic.

If the trailer with single-wire pneumatic drive should be connected, the trailer connecting head will be connected with the connecting head 16 (figure 3.10.1) with black cover and air will come in trailer pneumatic drive. When pressing brakes pedals or at parking brake application the compressed air will come out of the connecting line 13 in atmosphere through the brake valve 11. In the trailer will be actuated air distributor, delivering compressed air from trailer tanks to the brake chambers, and the trailer brakes. At emergency trailer detachment the connecting heads will be disconnected, air from the trailer line comes out in atmosphere and the trailer automatically brakes.

If the trailer with two-wire pneumatic drive should be connected, the trailer connecting heads will be connected with the connecting heads 1(with yellow cover) and 15 (with red cover), that means with feeding line 14 and control line 12. Meanwhile compressed air constantly comes to the trailer through the feeding line 14. When pressing brakes pedals or at parking brake application the compressed air comes through the brake valve 2 and the control line 12 to the trailer. In the trailer will be actuated air distributor, delivering compressed air from trailer tanks to the brake chambers, and the trailer brakes. Automatic brake control (automatic braking) happens in case of hitch break and trailer disconnection because of pressure loss in the feeding line.

In the pneumatic drive are installed the connecting heads 1, 15, 16 of valve type. The valves of connecting heads prevent air outlet, if pneumatic drive is used without trailer (for example, tire charging) and at emergency trailer disconnection. At connection of the trailer brake lines with tractor lines the valves of connecting heads open, providing passage of the compressed air from tractor pneumatic drive to the trailer. In this case it is necessary to connect pneumatic lines, if there is no pressure in the tanks 8 of the tractor.

Air pressure in the tanks 8 is controlled by the air pressure indicator and by emergency air pressure red alarm lamp on air pressure sensor 10 and on emergency air pressure sensor 3, respectively.

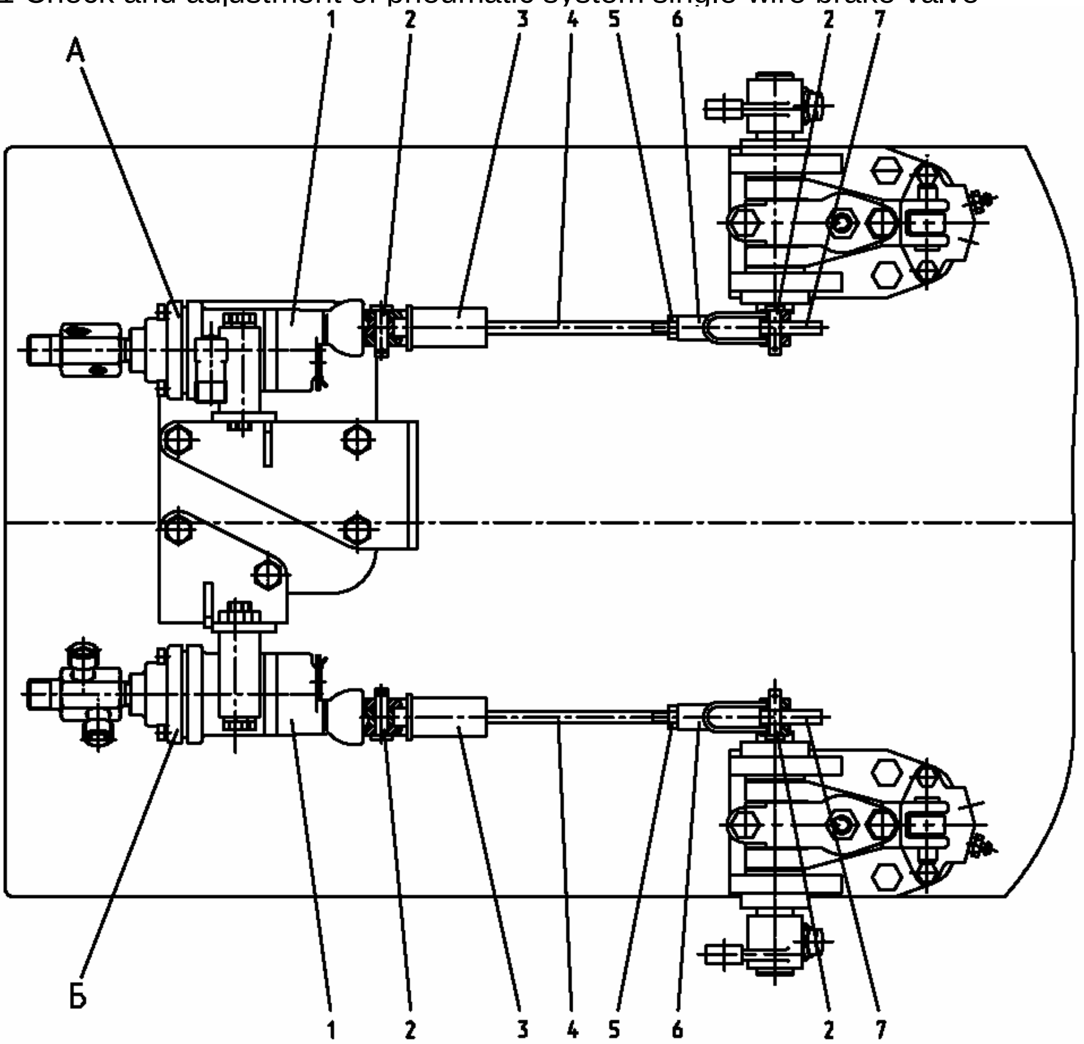
The system is provided with condensate drain valves 7 for drain of condensate from the tanks 8, this valves are located in the bottom part of the tanks. The condensate is drained thanks to sideways and up deviation of pusher.

The air is bleed from pneumatic drive (for tire charging, etc) through air bleed valves 5. One air bleeding valve is situated on pressure regulator, the second air bleeding valve is situated on one of the tanks.

ATTENTION: BEFORE CONNECT OR DISCONNECT TRACTOR AND TRAILER PNEUMATIC LINES, ENGAGE PARKING BRAKE! IT IS NECESSARY TO CONNECT TRACTOR AND TRAILER PNEUMATIC LINES WHEN THERE IS NO PRESSURE IN PNEUMATIC SYSTEM OF THE TRACTOR!

3.10.2 Check and Adjustment of Pneumatic System Brake Valves Actuators

3.10.2.1 Check and adjustment of pneumatic system single-wire brake valve



1 – brake valve; 2 – pins; 3 – travel compensator; 4 – rod; 5 – nut; 6 – fork; 7 – lever.

Figure 3.10.2 – Check and adjustment of pneumatic system brake valves actuators

Check and if necessary adjustment of pneumatic system single-wire brake valve actuator "A" (figure 3.10.2) should be made after adjustment operations of pedal brakes and control adjustments of parking brake.

ATTENTION: MAKE ADJUSTMENT OF SINGLE-WIRE BRAKE VALVE ACTUATOR AT NOT PRESSED PEDALS OF SERVICE BRAKES AND COMPLETELY SWITCHED OFF PARKING BRAKE!

Before check and adjust pneumatic system single-wire brake valve actuator put a tractor on flat ground. The engine should be switched off. Lock the wheels fore and aft with stop pieces which will exclude spontaneous moving of the tractor.

Check and, if it is necessary, adjustment of brake valve actuator "A" (figure 3.10.2) of single-wire pneumatic drive should be made in the following order:

- attach manometer with scale not less than 1 MPa to connecting head (with black cover) of tractor pneumatic drive;
- start the engine and fill tank with air till pressure of 0,77… 0,8 MPa according to pneumatic system air pressure indicator, situated on dashboard. Stop the engine;
- air pressure according to manometer attached to connecting head should not be lower than 0,77 MPa. If the pressure is lower, do the following operations:
  1. check the length of assembled rod 4 (figure 3.10.2).
  2. length of rod should provide its free (without tension) connection to the lever7 by pin 2. If it is necessary, adjust its length by turning of fork 6. Lock fork 6 with nut 5.
- if air pressure according to manometer attached to connecting head, has not reached necessary value, replace the brake valve.

ATTENTION: AT CORRECTLY ADJUSTED BRAKE VALVE "A" AND ITS ACTUATOR THE PRESSURE SHOULD FALL TILL ZERO AT INTERCONNECTED BRAKES PEDALS TRAVEL OF 100 … 120 MM OR AT FIXING OF PARKING BRAKE ON THE FOURTH-FIFTH TOOTH OF THE SECTOR!

3.10.2.2 Check and adjustment of pneumatic system two-wire brake valve actuator

Check and, if it is necessity, adjustment of pneumatic system two-wire brake valve actuator “Б” (figure 3.10.2) should be made after adjustment operations of pedal brakes and control adjustments of parking brake.

ATTENTION: MAKE ADJUSTMENT OF TWO-WIRE BRAKE VALVE ACTUATOR AT NOT PRESSED PEDALS OF SERVICE BRAKES AND AT COMPLETELY SWITCHED OFF PARKING BRAKE!

Before check and adjust pneumatic system two-wire brake valve actuator put a tractor on flat ground. The engine should not run. Lock the wheels fore and aft with stop pieces which will exclude spontaneous moving of the tractor.

Check and, if it is necessary, adjustment of the brake valve actuator "Б" (figure 3.10.2) of two-wire pneumatic drive should be made in the following order:

- attach manometer with scale not less than 1 MPa to connecting head (with yellow cover) of tractor pneumatic drive;
- start the engine and fill tank with air till pressure of 0,77…0,8 MPa according to pneumatic system air pressure indicator, situated on dashboard. Stop the engine;
- air pressure according to manometer attached to connecting head (with yellow cover) should not be lower than 0,77 MPa at completely pressed interconnected working brakes pedals or at completely switched on parking brake . If the pressure is lower, do the following operations:

1. check the length of assembled rod 4 (figure 3.10.2).
2. length of rod should provide its free (without tension) connection to lever7 by pin 2. If it is necessary, adjust its length by turning of fork 6. Lock fork 6 with nut 5.

- if air pressure according to manometer attached to connecting head, has not reached necessary value, replace the brake valve.

ATTENTION: AT CORRECTLY ADJUSTED BRAKE VALVE "Б" AND ITS ACTUATOR PRESSURE IN CONNECTING HEAD (WITH YELLOW COVER) SHOULD BE EQUAL TO ZERO AT NON PRESSED INTERCONNECTED SERVICE BRAKES PEDALS AND AT COMPLETELY SWITCHED OFF PARKING BRAKE!

3.10.3 Check and Adjustment of Pneumatic System Pressure Regulator

It is necessary to adjust pneumatic system pressure regulator during maintenance No 3 (M3), also if pressure regulator operation is disturbed and also after its disassembly for washing or replacement of worn out parts.

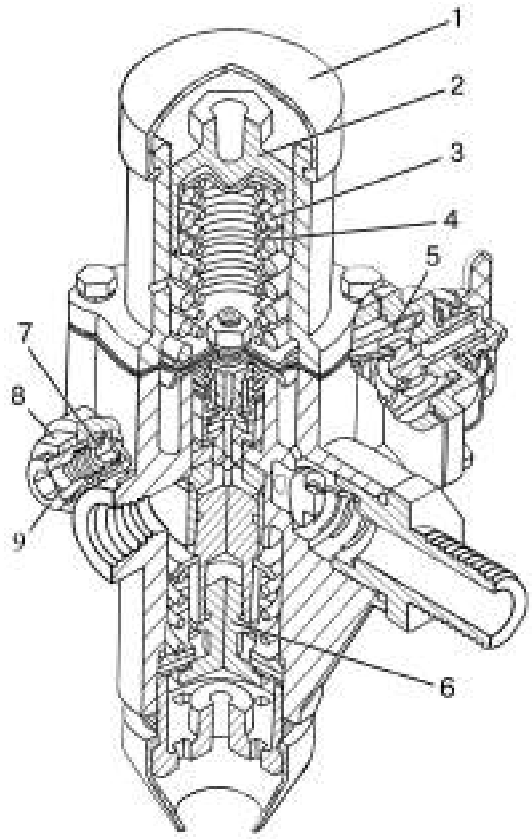
Check and adjustment of pneumatic system pressure regulator should be made after service brakes control adjustment operation, after parking brake control and brake valves actuators control adjustment.

Check pneumatic system pressure regulator in the following order:

- attach manometer (with scale factor of 0,01 …0,02 MPa) and scale at least 1,6 MPa) to connecting head with red cover;
- take off cap 1 (fig 3.10.3);
- using a wrench screw cover 2 to the casing against the stop;
- switch on pneumatic compressor;
- start diesel engine and fill tanks with compressed air until safety valve 7 is actuated at pressure 0,85… 1 MPa. If the valve is actuated at pressure less than 0,85 MPa or more than 1 MPa, make its adjustment with screw 9, preliminary having loosened and then having tightened the locking nut 8.

Adjust pneumatic system pressure regulator in the following order:

- by gradually unscrewing of the cover 2 adjust force of springs 3 and 4 so, that air pressure in tanks, at which the unloading valve 6 is actuated, make 0,77 to 0,8 MPa;
- fix this position of cover 2 with a help of paint applied on treaded casing part and put on the cap 1;
- slightly open condensate drain valve and lower air pressure to 0,65 …0,7 MPa. At this pressure values valve 6 should close and switch over pneumatic compressor for tanks filling with compressed air;
- disconnect control manometer from the connecting head.



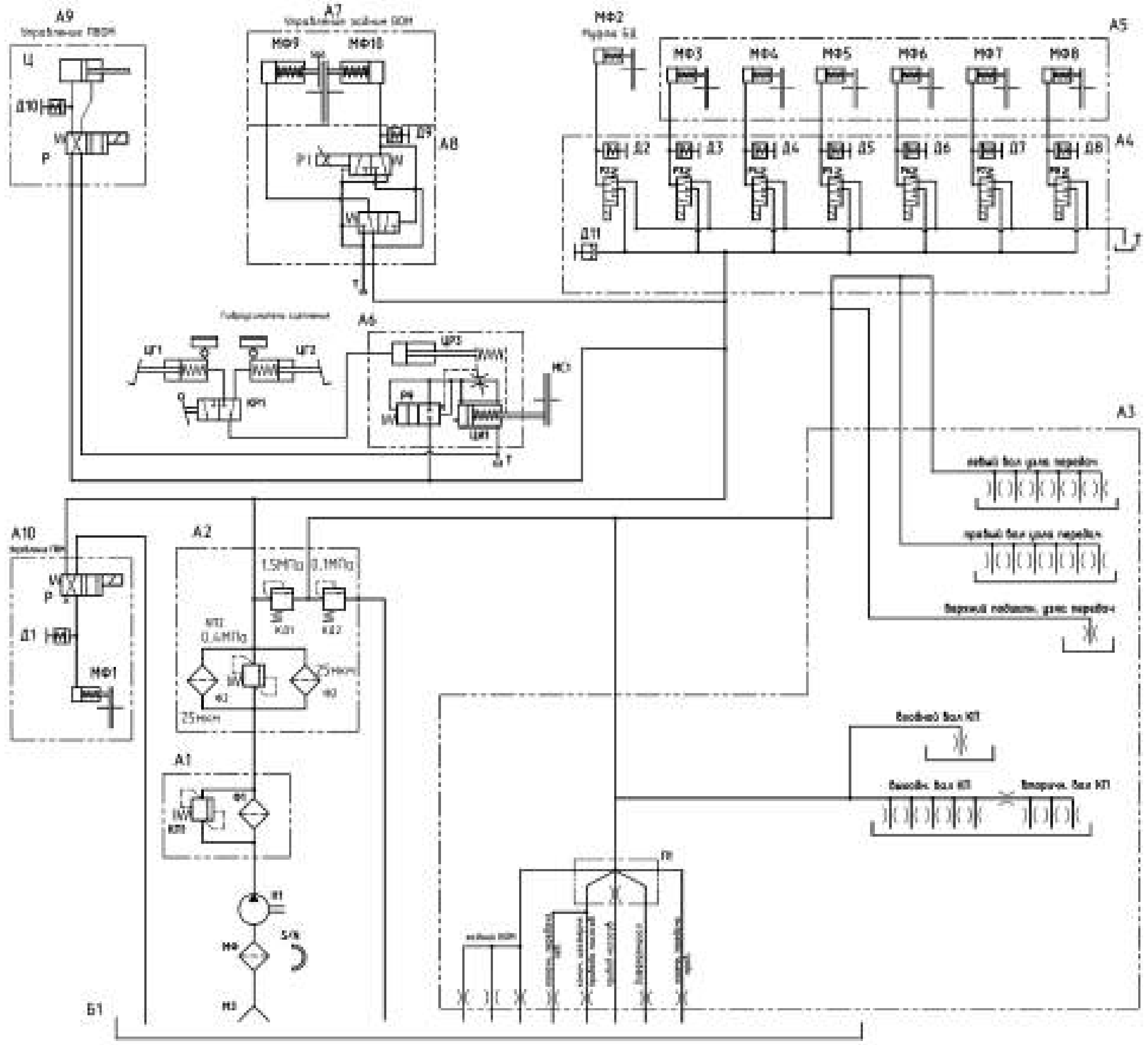
1 – cap; 2 – cover; 3 – outer spring; 4 – inner spring; 5 – filter; 6 – unloading valve; 7 – safety valve; 8 – locking nut; 9 –adjusting screw.

Figure 3.10.3 –Pneumatic system pressure regulator

3.11 Transmission Hydraulic System

3.11.1 General information

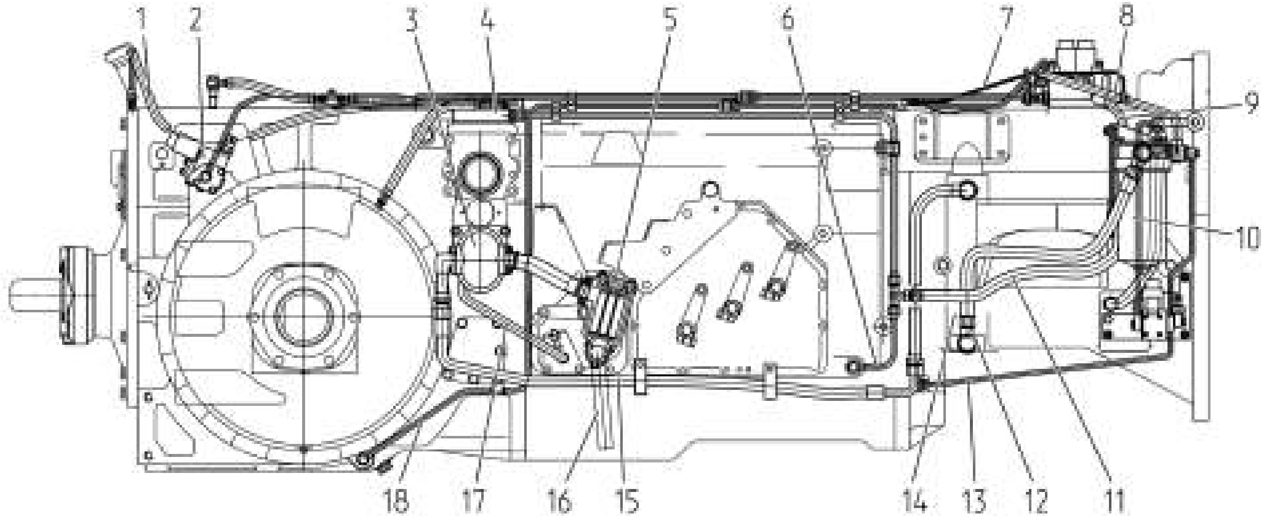
Hydraulic circuit diagram is shown in figure 3.11.1.



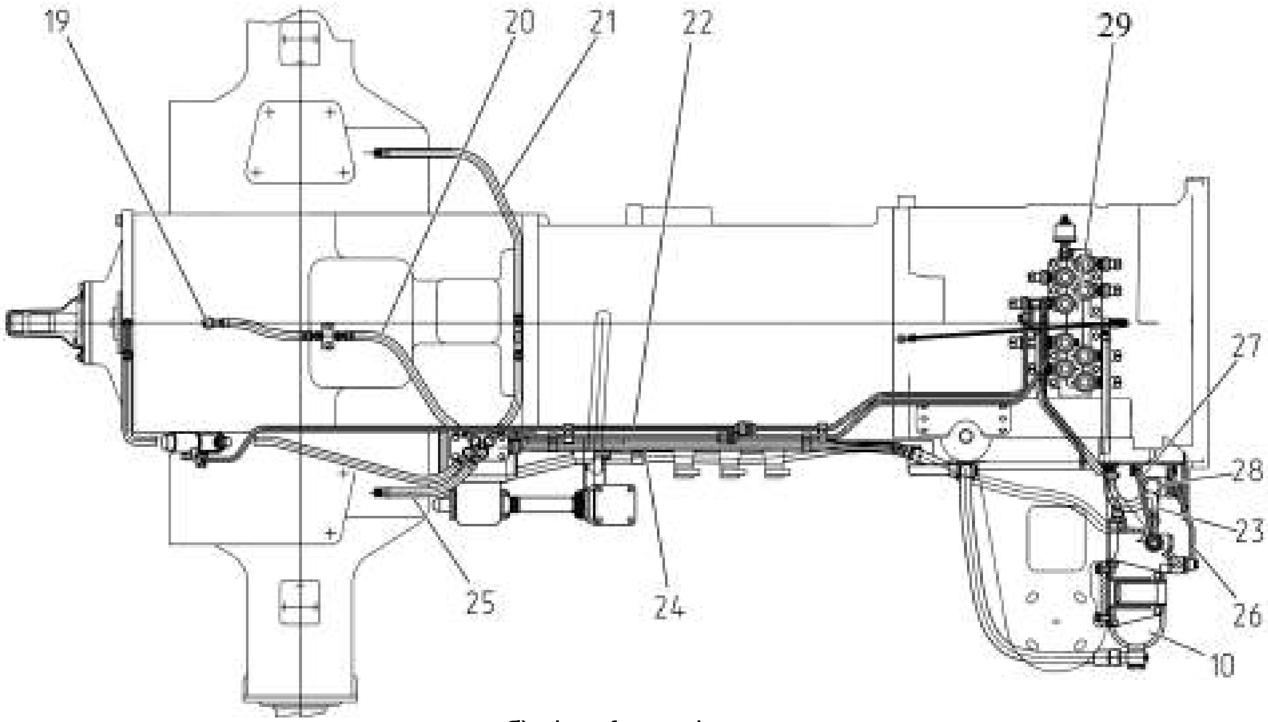
A1 –mesh filter; A2 – duplex filter; A3 – oil unit; A4 – electrohydraulic distributor; A5 – gear shift group; A6 –assembled coupling hydraulic booster; A7 –rear PTO control; A8 – hydraulic distributor; A9 –front PTO control; A10 – FDA (front driving axle) control; Б1 – transmission case; Д1 … Д10 – pressure sensors; Д11 – pressure sensor; КД1 –control valve; КД2 – lubrication valve; КП1, КП2 –safety valves; КР1 – forward and reverse motion selector valve; МЗ –suction bell; МС1 –coupling clutch; МФ – magnetic filter; МФ1 –FDA clutch; МФ2 –differential lock clutch; МФ3 … МФ8 – GB gear activation clutch; МФ9 – PTO brake actuating clutch, МФ10 – PTO friction engagement clutch, Н1 –gear wheel pump НШ25; П1 –distributor plate; Р – distributor; Р1 … Р8 –proportional valve; Р9– valve; Ф1 – mesh filter element; Ф2 – paper filter element; Ц – cylinder; ЦГ1 – the cylinder main on direct to a course; ЦГ2 –main cylinder for forward motion; ЦР3 – operating cylinder; ЦИ1 – hydraulic booster cylinder.

Figure 3.11.1 – Transmission hydraulic circuit diagram

The location of transmission hydraulic system components is shown in figure 3.11.2.



а) view from the right



б) view from above

1 – rear PTO bearings lubrication line ; 2 – rear PTO control distributor; 3 – transmission hydraulic system (HS) pump; 4 – distributing plate with an aperture for sprinkling of transmission HS and HLL (hydraulic lift linkage) pumps drive; 5 – magnetic filter; 6 –line for GB bearings lubrication; 7 –line for gear shift group top bearing lubrication; 8 – line from duplex filter to electrohydraulic distributor; 9 –line for gear shift group bearings lubrication; 10 – duplex filter; 11 –line for GB and rear axle lubrication; 12 – line from mesh filter to duplex filter; 13 – line for FDA engagement; 14 – mesh filter (inside of clutch case); 15 – line from transmission HS pump to elements of transmission HS; 16 – suction bell (inside of gear box); 17 – line from pumps drive casing to drain; 18 – line for differential lock engagement; 19 – rear PTO sprinkling; 20 –line for rear axle differential sprinkling; 21 – line for left final drive sprinkling; 22 – line from electrohydraulic distributor to rear PTO control distributor; 23 –drain after lubrication valve; 24 – line from T-piece to plate; 25 – line for right final drive sprinkling; 26 – line from duplex filter to distributor; 27 –drain after the distributor; 28 – FDA control distributor ; 29 –electrohydraulic distributor.

Figure 3.11.2 – Location of transmission hydraulic system components

The transmission hydraulic system, besides power shifting, provides power fluid filtration, lubrication of most loaded gears and transmission bearings under pressure, controls front and rear power take off(PTO)shaft, front driving axle (FDA) drive, rear axle differential lock and coupling clutch.

The transmission hydraulic system gear pump 3 (figure 3.11.2) with drive is mounted on rear axle casing on the right side of transmission and rotates by gear system from the engine.

The oil sucked by pump through suction bell 16, installed in gear box casing passes through magnetic filter 5 consisting of magnet traps, intended for oil clarification from metal particles.

Further oil is pumped in filtration system. The system consist of coarse mesh filter 14 (installed inside of GB), with filtering capacity of 80 microns and of consequently mounted duplex filter 10 with filtering capacity of 25 microns. Besides filtering elements mesh filter case is fitted with ball valve providing bypassing of power fluid at filter dirtiness when inlet and outlet pressure difference makes more than 0,35 MPa. When filtering elements of duplex filter are clogged and inlet and outlet pressure difference makes more than 0,4 MPa for bypassing of power fluid is installed warning valve At warning valve activation on CECS flashes control lamp, that indicates the necessity of change of filtering elements of duplex filter. In duplex filter casing are consequently installed control valve, adjusted on pressure in transmission control system of $1{,}5_{+0{,}1}$ MPa and lubrication valve, adjusted on pressure in lubrication system of 0,1-0,05 MPa. The valves are adjusted by adjusting washers. One part of filtered power fluid under pressure of 1,5 MPa comes from duplex filter through line 8 to electrohydraulic distributor 29, other part through line 26 comes to FDA control distributor 28. The distributor 28 is connected by line 13 with FDA engagement clutch. At electrical open to FDA control distributor 28 front driving axle is engaged. At the inlet of electrohydraulic distributor 29 stream splits-up. One part of the stream from electrohydraulic distributor 29 through system of apertures and channels (at operated proportional valves) comes to friction clutches that provides power shifting, DL engagement (oil supply from distributor 29 to DL engagement clutch occurs through oil pipeline 18 and further through system of apertures and channels in rear axle casing). Other part of stream from the electrohydraulic distributor through oil pipeline comes to clutch hydraulic booster (in figure 3.11.2 is not shown), and from it to a plate with front PTO control distributor (in figure 3.11.2 is not shown). The third part of stream through oil pipeline 22 from the electrohydraulic distributor 29 comes to rear PTO2 control distributor and further through system of apertures and channels in rear axle casing comes to friction clutches of PTO engagement and disengagement.

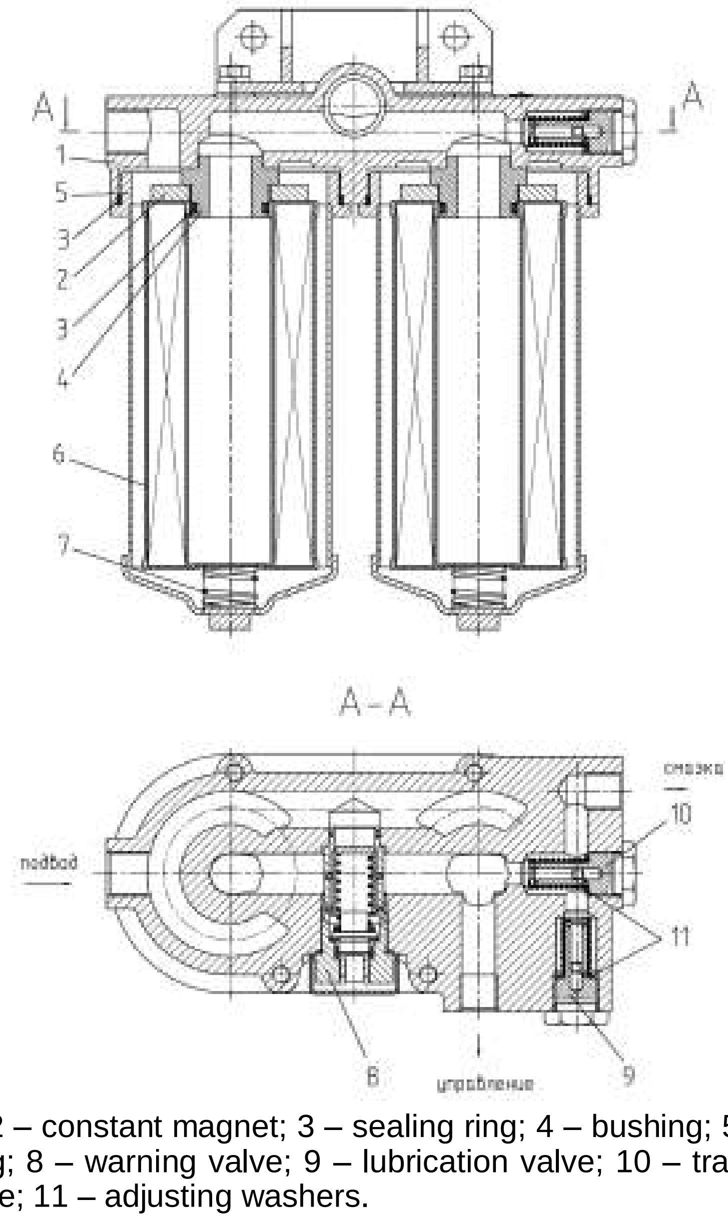
Also, part of a power fluid from duplex filter comes under pressure of 0,1 MPa through line 9 to electrohydraulic distributor and further through channels comes to disks of engaged and disengaged clutches and to gear shift group bearings lubrication. From electrohydraulic distributor through line 7 power fluid comes to gear shift group upper bearing lubrication. Other part of power fluid from duplex filter through line 11 through T-piece comes to line 6 for gear box input, output and main shaft bearings lubrication and through line 24 goes to a plate 4. In plate 4 body is throttle for sprinkling of HLL and transmission HS pupms drive. From line plate are directed to rear PTO bearings lubrication, to the differential 20 sprinkling and part to the rear PTO 19 sprinkling, to the pump drive bevel pinion sprinkling and further part to the left final drive 21 sprinkling, to the right final drive 25 sprinkling. The drain after the greasing valve is carried out through a line 23.

3.11.2 Duplex Filter

The duplex filter, mounted on silencer support to the right along tractor movement, is intended for clarification of oil pumped by transmission pump with filtering capacity of 0,025 mm, and also for pressure maintenance in transmission hydraulic system.

The filter consists of two cases 5 (figure 3.11.3), screwed in casing 1 with inlets and outlets. In the cases are located filtering elements 6 and the constant magnets 2 which are pressed by a spring 7 to bushing 4. Between filtering element 6 and magnet 2 is situated sealing ring 3. In casing 1 is installed warning valve 8, which gives a signal to CECS (light flashes), when filtering elements 6 are clogged. Also in the casing 1 are installed transmission hydraulic system control valve 10 which keep up control pressure and lubrication valve 9. The valves are adjusted by adjusting washers 11.

ATTENTION: THICKNESS OF ADJUSTING WASHERS SHOULD NOT EXCEED 7 MM FOR EACH VALVE!

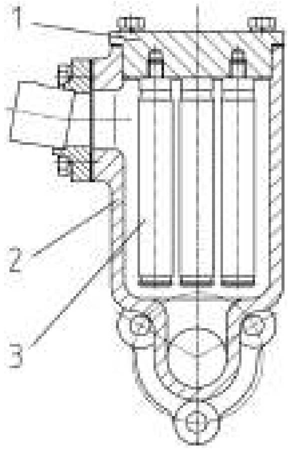


1 – casing; 2 – constant magnet; 3 – sealing ring; 4 – bushing; 5 –case; 6 – filtering element; 7 – spring; 8 – warning valve; 9 – lubrication valve; 10 – transmission hydraulic system control valve; 11 – adjusting washers.

Figure 3.11.3 – Duplex filter

3.11.3 Magnetic Filter

The magnetic filter (figure 3.11.4), intended for oil separation from ferromagnetic particles of transmission hydraulic system. It is situated to the right along tractor movement on GB cover of creeper control. The filter consists of the case 2 on which is mounted cover 1 with four magnet traps 3.



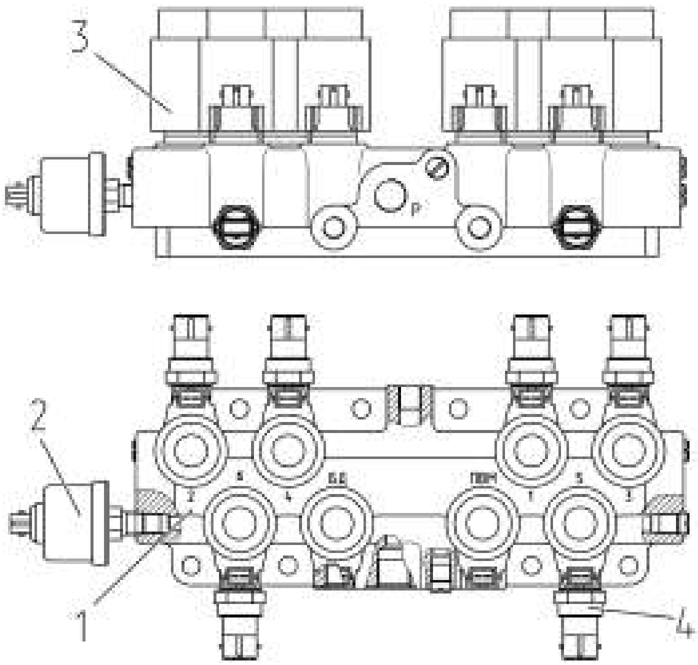
1 – cover; 2 – casing; 3. magnet trap.

Figure 3.11.4 – Magnetic filter

3.11.4 Electrohydraulic Transmission Hydraulic System Distributor

Electrohydraulic transmission hydraulic system distributor is intended for GB and rear axle differential lock friction clutches control The distributor is mounted on top plane of clutch casing. In distributor casing 1 (figure 3.11.5) are screwed:

- six distributors 3 for control of six gears of GB;
- distributor of rear axle differential lock;
- distributor marked «ПВМ»(it means FDA) is not used;
- seven oil pressure sensors 4 in GB and rear axle differential lock friction clutches;
- oil pressure indicator sensor 2 in transmission hydraulic system.



1 – casing; 2 –pressure indicator sensor; 3 –distributor; 4 – pressure sensor.

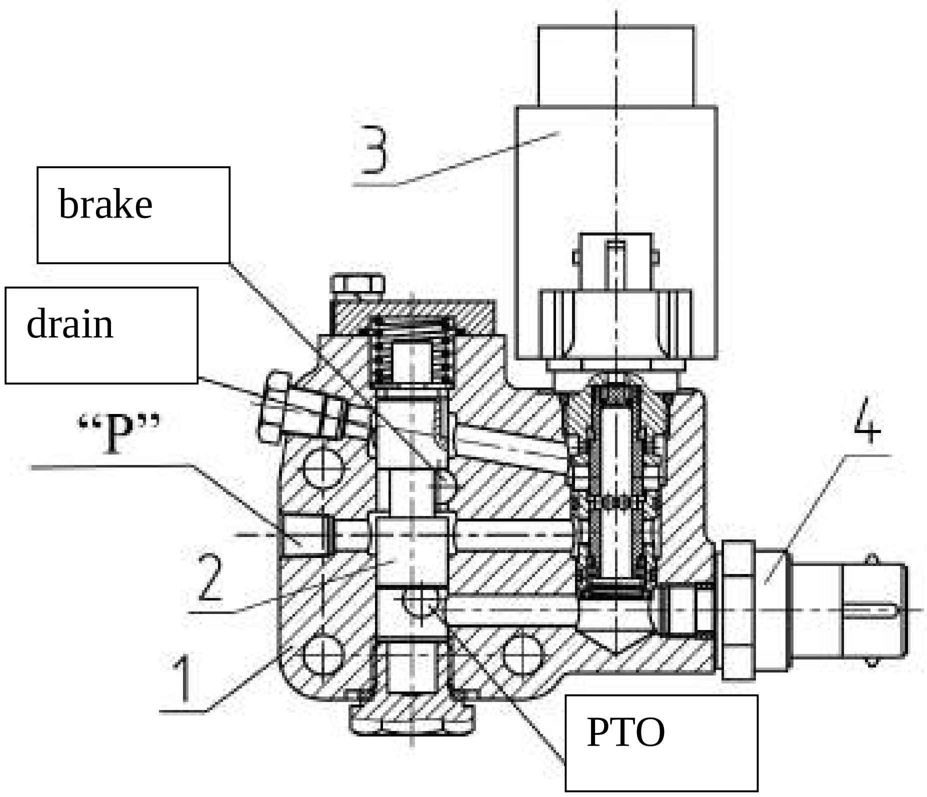
Figure 3.11.5 – Electrohydraulic transmission hydraulic system distributor

3.11.5 Rear PTO Control Distributor

The rear PTO control distributor is intended for rear PTO engagement and disengagement. The distributor consist of casing 1 (figure 3.11.6), in which are situated the spring loaded valve core 2, electrodriven proportional valve 3 and pressure sensor 4.

By pressing the button of rear PTO engagement in cabin on CECS face plate electric signal is given to proportional valve 3 which moves its core. Meanwile power fluid comes under pressure to the end face of valve core 2 which, compressing spring, moves upwards. The liquid comes under pressure in channel "PTO" and further in PTO friction clutch, channel "Brake" is connected with drain. At pressure increase above 0,8 MPa is activated pressure sensor 4 and on CECS face plate flashes indication light of rear PTO engaged condition.

By pressing the button of rear PTO disengagement happens deenergization of proportional valve 3 and moving of its core, therefore power fluid comes under pressure through channel "P" and through aperture "Brake" in distributor casing comes in PTO brakes booster. When this happens spring returns valve core 2 in starting position and channel “PTO" connects with drain. PTO brake is engaged and PTO friction is disengaged. BOM joins, and PTO friction clutch is switched off. The indication lamp of rear PTO engagement on CECS face plate goes out.

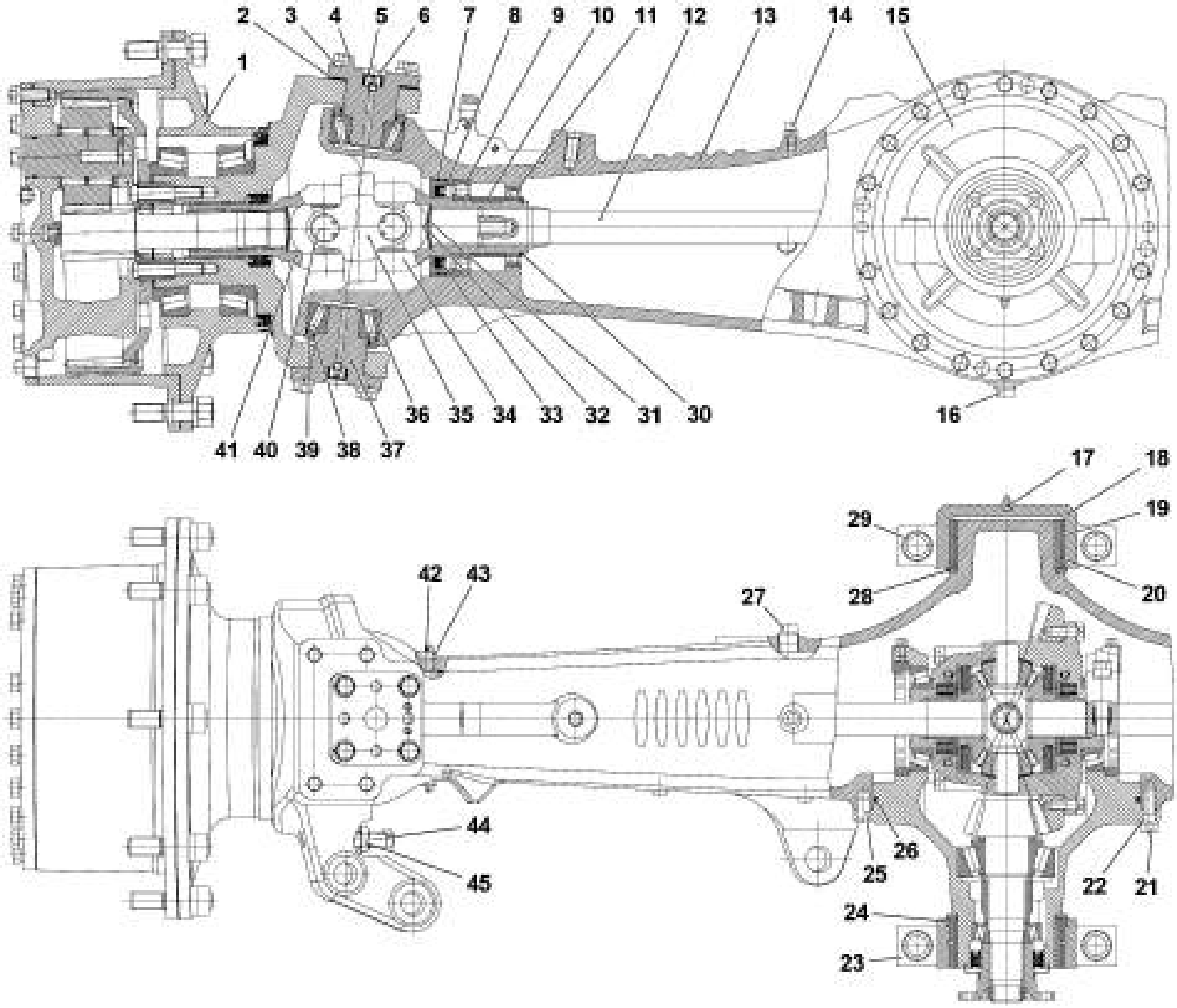


1 – casing; 2 – valve core; 3 –proportional valve; 4 – pressure sensor.

Figure 3.11.6 – Rear PTO control distributor

3.12 Front Driving Axle (FDA)

3.12.1 General information



1 –wheel hub drive; 2 –shim washer; 3 –spring washer; 4 – bolt; 5 – cap; 6 –oiler; 7 – ring; 8 – fixture; 9 – bearing; 10 – spacer; 11 – bearing; 12 – semiaxle shaft; 13 – FDA housing; 14 – ventilation valve; 15 – central reduction unit; 16 – plug;17 – oiler; 18 – clip; 19, 20 – bushing; 21 – bolt; 22 – spring washer; 23 – clip; 24 – bushing, 25 – lock pin; 26 – ring; 27 – plug; 28 –washer; 29 – bushing; 30 – locking ring; 31 – blind plug; 32 – gasket; 33 – sealing; 34, 41 – hinged fork; 35 – doubled fork; 36 – bearing; 37 – axle; 38 – ring; 39 – body; 40 – spider and bearing assembly; 42 – locking nut; 43 – screw; 44 – adjusting bolt; 45 – locking nut.

Figure 3.12.1 – Front driving axle

The front driving axle (FDA) is intended for torque transfer to front tractor wheels. The front driving axle consists of one-piece cast axle beam (of FDA housing) (figure 3.12.1), central reduction unit 15, doubled universal joints, semiaxle shafts 12 and planetary wheel hub drives 1. The central reduction unit 15 is mounted on FDA housing 13 with a help of two lock pins 25 and is fixed to housing by bolts 21. To seal joint between housing and central reduction unit is used rubber ring 26. The drive torque from central reduction unit to the wheel hub drives is transferred by semiaxle shafts 12 and by doubled universal joints. The doubled universal joint consists of forks 34 and 41; connected by fork 35, by two spiders 40 with nail bearings. The joint is mounted on front axle housing on two ball bearings 9 and 11 between which is mounted bearing spacer 10.

The fixture 8 with sealing 33 and rubber rings 7 serves for prevention of oil leakage from FDA housing along universal-joint fork 34. In axle housing 13 doubled universal joint is fixed by locking ring 30 and locking screws 43

The semiaxle shaft 12 with double-sided splines is mounted between the doubled joint and central reduction unit differential. On the splines from the side of doubled joint there is a collar, that prevent axial movement of semiaxle shaft. To prevent oil leakage along semiaxle shaft splines from FDA beam in fork 34 of doubled joint are mounted blind plug 31 and gasket 32. .

The planetary wheel hub drives 1 are connected with FDA housing with a help of axes 37 and can turn about FDA beam on two bearings 36. The axles are connected with axle swivel of wheel hub drive by bolts 4 a rotary fist of a wheel reducer is carried out by means of bolts 4. For adjustment of wheel hub drives turning angle are used bolts 44 and locking nuts 45.

The swivel bearings 36 are lubricated through oilers 6, mounted on axles 37. The oilers are protected from dirt with rubber caps 5. To prevent dirt entry to bearings, in FDA housing are mounted bodies 39 with rings 38. Bearings 36 adjustment is made by shim wasers 2. Oil is filled in FDA housing to the bottom edge of filler opening in which is mounted plug 27, you need to turn on drain plug 16 for drain. Front axle housing is equipped with ventilation valve 14, that keeps up normal pressure in FDA beam.

3.12.2 Central reduction unit

The central reduction unit represents pair of bevel gears with circle arc tooth and is intended for driving torque increase and torque transfer direction change. The drive gear shaft 20 of central reduction unit main pair (figure 3.12.2) is mounted on casing of central reduction unit on two conical roller bearings 12 and 14 between which are mounted distance piece 13 and adjusting washers 21.The follower gear 40 of main gear pair of central reduction unit seat on center pilot of differential housing and fastens to it by bolts 1. Bend off plates 2 serve for prevention of bolts unscrewing.

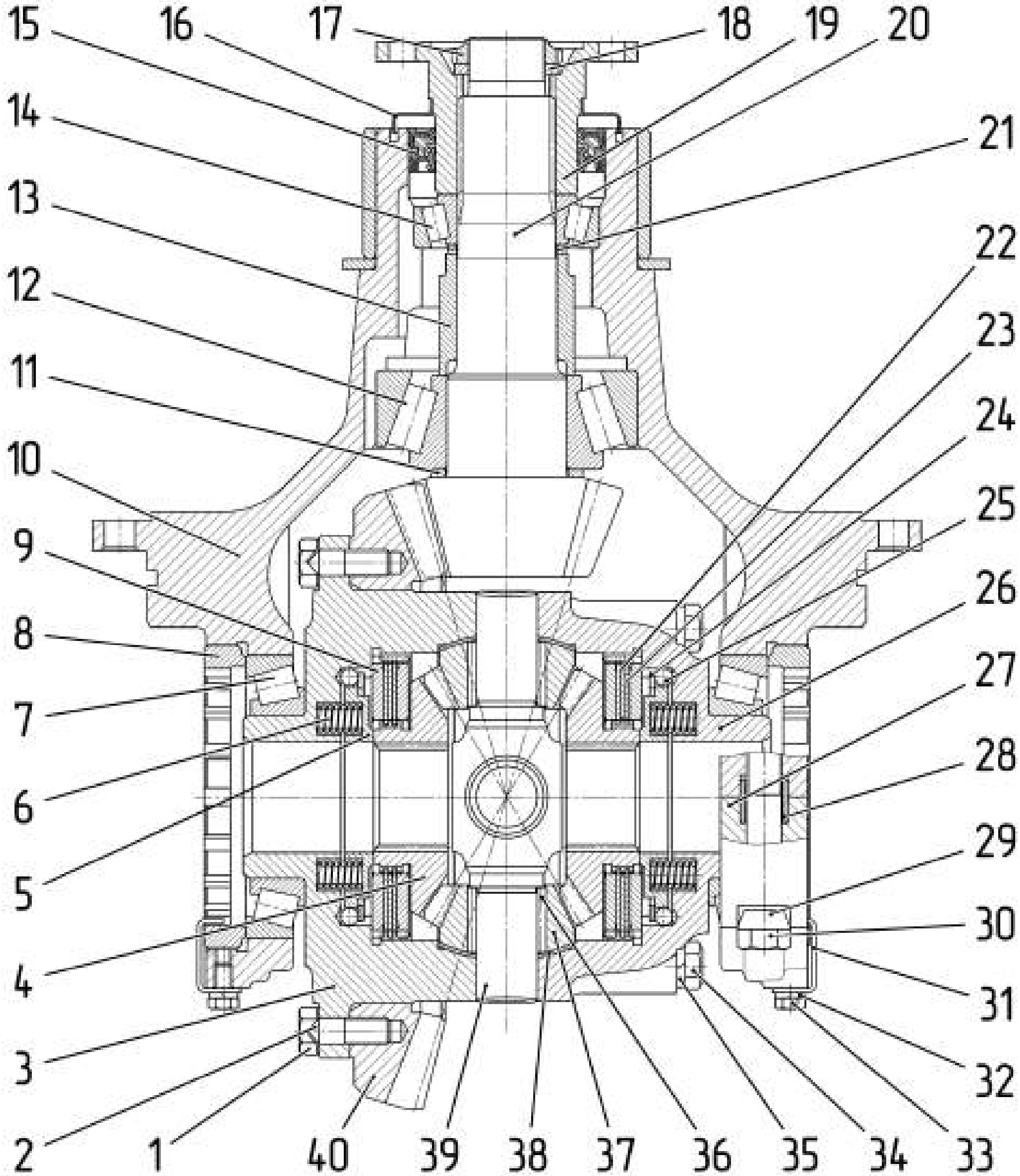
On end of drive gear shaft with splines is mounted flange 19 of forward driving axle drive which fastens to drive gear 20 with a help of nut 17. On flange 19 is mounted mud collector 16, that prevent dirt entry in work space of central reduction unit. To prevent oil leakage in housing 10 is mounted sealing 15. To guarantee correct position of drive gear, at assembling of central reduction unit is choose washer 11 of necessary size.

Differential is self-blocked, of excessive friction with displaced characteristic of blocking properties which are shown only at tractor work with high traction loadings (tilling, cultivation, etc.). There is no differential blocking at tractor movement on roads with hard-covering at small traction loadings.

In housing 3 and differential cover 26 connected by bolts 34 are situated four planet gears 37 on spider 39, side gears 4, frictional disks –9, driving frictional disks 22 and follower frictional disks 23, four spherical washers 38 and springs 6, that serve for differential blocking only by raised traction loadings of a tractor.

The differential is mounted on central reduction unit housing boring two conical roller bearings 7 and fix agaings axial movement by nuts 8.

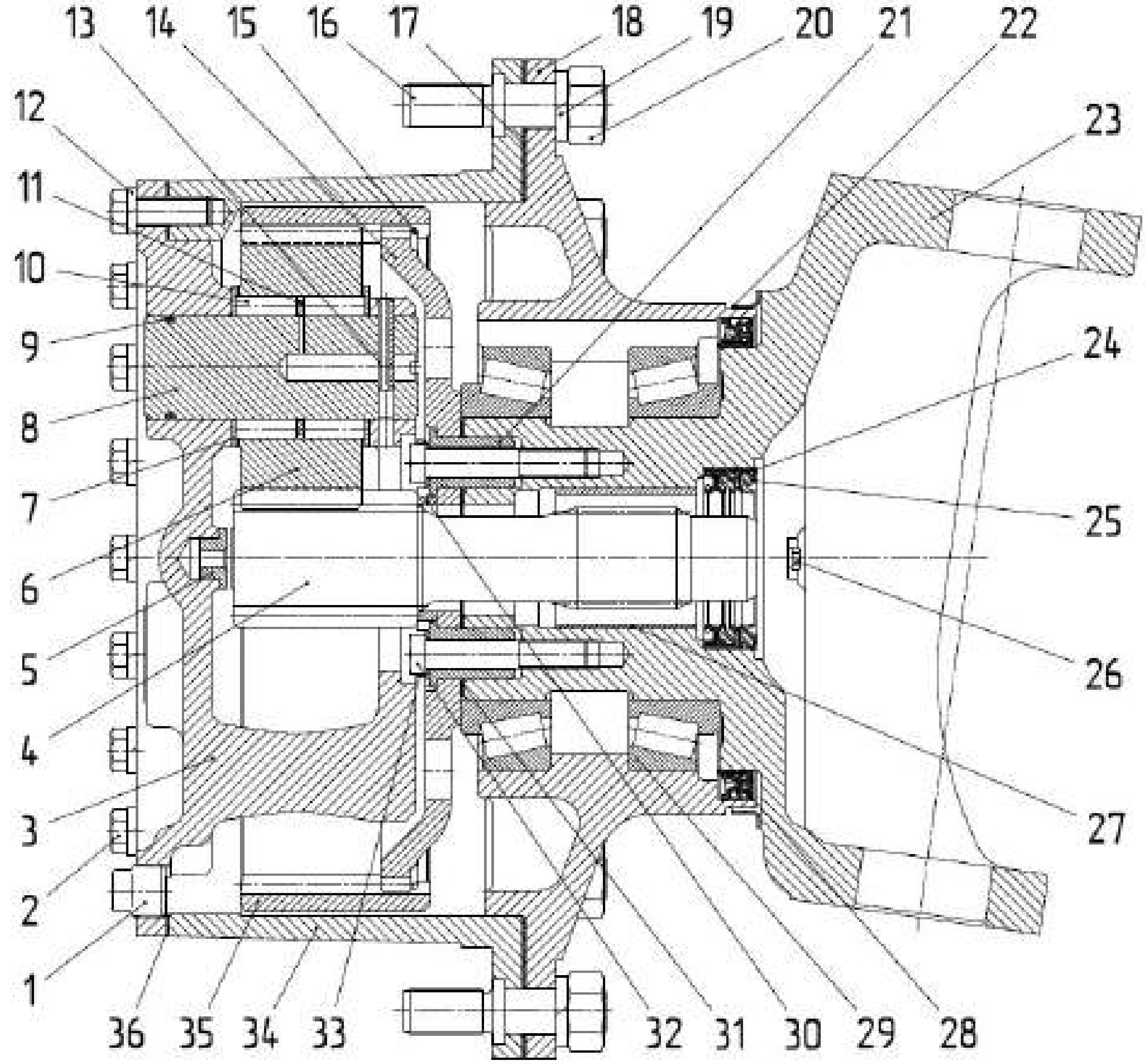
The nuts 8 also serve for main gear pair gearing adjustment and for necessary tooth-contact pattern assurance. The stop members 31 attached to bearing bodies 27 by bolts 33 through spring washers 32 fix nuts 8.



1 – bolt; 2 –bend off plate; 3 –differential housing;4 – side gear; 5 – spring seat; 6 – spring pack; 7 – bearing; 8 – nut; 9 –frictional disk; 10 – housing; 11 – washer; 12 – bearing; 13 –distance piece;14 –bearing; 15 –sealing ; 16 – mud collector; 17 – nut; 18 –washer; 19 – flange; 20 – follower gear; 21 – washer; 22 – driving frictional disk; 23 – follower frictional disk; 24 –locking ring; 25 – ball; 26 –differential cover; 27 –bearing body; 28 –bushing; 29 – bend off; 30 – bolt; 31 –stop member; 32 – spring washer; 33 – bolt; 34 – bolt; 35 – spring washer; 36 – roller; 37 –planet gear; 38 –spherical washer; 39 – spider; 40 – follower gear.

Figure 3.12.2 – Central reduction unit

3.12.3 Wheel hub drive



1 – plug; 2 – bolt; 3 – carrier; 4 –sun gear; 5 – bushing; 6 – planetary gear; 7 — backup washer; 8 – planetary gear shaft; 9 – sealing ring; 10 – roller; 11 –washer; 12 – spring washer; 13 – pin; 14 – disk; 15 – wire ring; 16 – pin; 17 – gasket; 18 – hub; 19 – spring washer; 20 – nut; 21 – bushing; 22 – mud collector; 23 – axle swivel; 24, 25 – sealing; 26 – plug; 27 – bushing; 28 – sealing; 29 – bearing; 30 – back up washer; 31 – shim washer; 32 – bolt; 33 – bend off plate; 34 – reduction unit casing; 35 – epycyclic gear; 36 – gasket.

Figure 3.12.3 – Wheel hub drive

The wheel hub drive is mounted on axle swivel 23 (figure 3.12.3). The sun gear 4 is drive gear of planetary gear set of wheelhub drive, the following part connected with tractor wheel is carrier 3 with tree planetary gears 6, and epycyclic gear 35 serve as locked gear, that take reactionary torque. The sun gear floats between teeth of three planetary gears, and its splined end shaft is connected with doubled universal joint fork, that have possibility to move. The bushing 5 and back up washer 30 fix sun gear from axial movement. The planetary gears run on axles 8 situated in carrier 3 bore. mounted on carriers 3 bore. The planetary gear bearings - cylindrical rollers 10 are disposed in two rows.

Both rows of rollers are divided by washer 11. As one roller race serve grinding surface of axis 8, and as another –inner grinding surface of planetary gear 6. The planetary gears and roller are locked from axial movement with washers 7. The planetary gear axles are fixed from axial movement in carrier seat with pins 13.

The carrier is attached to casing 34 by bolts 2 with spring washers 12. The carrier is centered by collar that fall into housing bore. On carrier flange is situated aperture for conic plug 1, that matches with aperture in casing flange and serves for filling of wheel hub drive with oil and for its drain. Between carrier 3 and casing 34 is located sealing gasket 36.

The reduction unit casing 34 is centered and attached by pins 16 to a hub 18 rotating on two conical roller bearings 29, as a support for bearings serve rotary axle swivel 23. Between casing and hub is fastened sealing gasket with nuts 20 and spring washers 19.

Thus, on bearings 29 rotates follower unit consisting from carrier with planetary gear, of casing and hub. To the face of axle swivel 23 with bushings 21 and bolts 32 is attached disk 14, which splined part grips crown epycyclic gear and thanks to this prevent its turning.

Between axle swivel face 23 and disk face 14 are situated gaskets 31, serving for bearing 29 adjustment. The spring ring 15 keeps epycyclic gear from axial moving, this spring ring is insert in gear 35 ring groove.

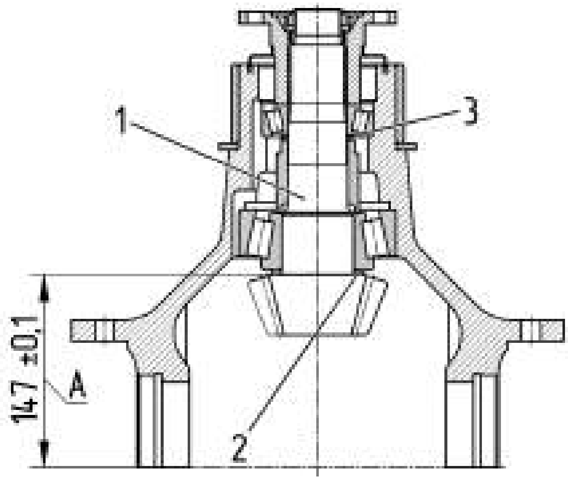
The wheel hub drive inner cavity is sealed with cup seals 24 and 28. To prevent dirt entry to working fringes of cup seals is mounted mud collector 22 and additionally sealing 25.Carrier 3 bore is sealed with rubber rings 9, and to prevent oil leakage along splines of sun gear 4 in fork of doubled universal joint 41 (figure 3.12.11) is mounted blind plug and gasket.

3.12.4 Check and Adjustment of Preload in Reduction Unit Drive Gear Conical Bearing

The axial preload in drive gear conical bearings should be between 0,01and 0,04 mm.

Before preload adjustment it is necessary to make installation of gear 1 (figure 3.12.4) and hold to the dimension “A”, that is ensured by means of choosing of one of the washers 2. Ensure the necessary bearing preload by washer 3 choosing.

It is necessary to control axial preload by turning of gear 1 without sealing installation. The starting torque should be 0,4 …1,6Nm. The gear should run without jammings.



1 – drive gear; 2 – washer; 3 – washer.

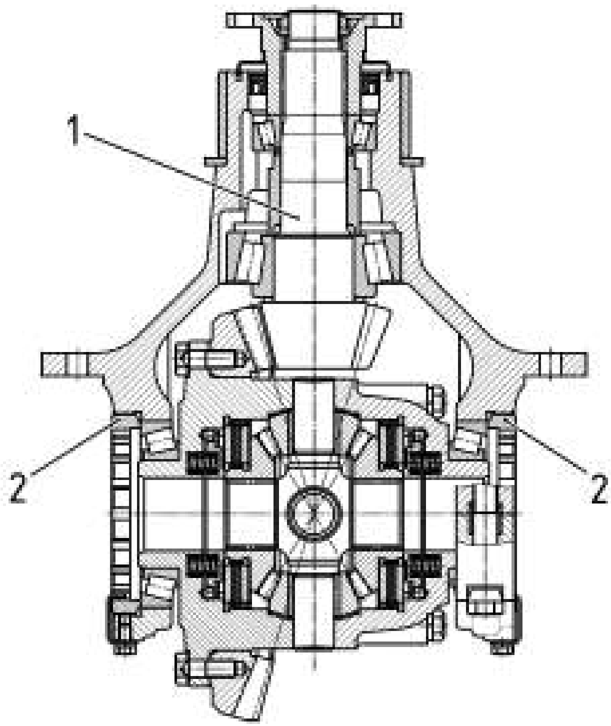
Figure 3.12.4 – Drive gear in central reduction unit casing

3.12.5 Check and Adjustment of Preload in differential conical bearings

The axial preload in differential conical bearings should be between 0,01 and 0,08 mm.

It is necessary to make adjustment by nuts 2 tightening (figure 3.12.5). The axial bearings preload should correspond to moment of differential rotating resistance between 0,6 and 6 Nm.

Total moment of rotating resistance together with gear 1 bearings preload should make between 1 and 7,6 Nm.



1 – drive gear; 2 – nut.

Figure 3.12.5 – Differential in central reduction unit casing

3.12.6 Check and Adjustment of Backlash in Main Gear Pair of Central Reduction Unit

The backlash in main gear pair of central reduction unit should be between 0,18 and 0,35 mm. The contact pattern should occupy not less than 50 % of tooth surface and contact pattern should be situated in the center of tooth or closer to cone point. Ensure backlash by means of nuts 2 (figure 3.12.5) keeping backlash adjusted before in differential conic bearings for this purpose the nuts located from the different sides of differential should be screwed or unscrewed with identical angle. At adjustment turn over differential in bearings, so that their rollers have taken correct position in race.

ATTENTION: MAIN PAIR GEARS 20 AND 40 (FIGURE 3.12.2) OF CENTRAL REDUCTION UNIT SHOULD BE REPLACED ONLY TOGETHER. GEARS OF MAIN PAIR ARE COUPLED AT FACTORY AND SHOULD HAVE IDENTICAL NUMBERS!

ATTENTION: IT IS NECESSARY TO REPLACE DIFFERENTIAL HOUSING 3 AND COVER 26 (FIGURE 3.12.2) ONLY AS A SET AND THIS PARTS SHOULD HAVE IDENTICAL NUMBERS. IT IS NECESSARY TO COMBINE THESE NUMBERS AT CONNECTION OF HOUSING 3 WITH CASE 26!

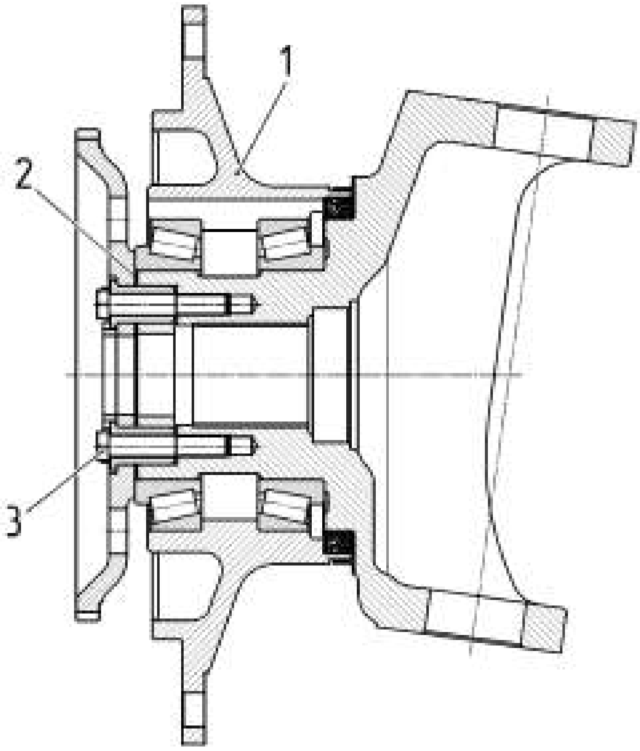
ATTENTION: CHECK MAIN PAIR GEAR ENGAGEMENT TRUTH ACCORDING TO THE CONTACT PATTERN AND WAYS OF CONTACT PATTERN CORRECTION ON THE ANALOGY OF REAR AXLE MAIN DRIVE AS IT IS SPECIFIED IN SUBSECTIONS 3.6.7 AND 3.6.8!

3.12.7 Check and Adjustment of Backlash (Preload) in Hub Conical Bearings

The axial backlash or preload in hub bearing should not exceed 0,05 mm.

Please adjust with a help of shim washers 2 (figure 3.12.6). At bolts 3 tightening turn over hub 1, so that bearing rollers have taken correct position in race.

It is necessary to control axial backlash at moving of hub 1 in axial direction with force between 500 and 600N. The moment of hub rotating resistance should not exceed 60 Nm at tension.



1 – hub; 2 – shim washer; 3 – bolt.

Figure 3.12.6 – Hub with swivel of wheel hub drive

3.12.8 Check and adjustment of axial preload in conical bearings of the pivot

Before adjustment it is necessary to do the following preparatory works:

- clear out FDA;
- put tractor on level ground, brake it and exclude possible moving;
- jack front part of tractor and put supports under FDA according to jacking points shown on the tractor;
- loose wheel retaining nut and remove wheels, observing safety measures;
- disconnect steering rod from left and right wheel hub drives and remove it from FDA;
- disconnect hydraulic cylinder mounting pins from eyes of wheel reduction gears;
- with a help of dynamometer with a scale factor of 300N define force of wheel hub drive turning in one direction and than in other direction. .

The force applied to the carrier mounting bolts should be between 140 and 160 N. . It is necessary to repeat force check operation three times in each direction to determine average value.

If force of wheel hub drive turning is under 60 N, before pivot bearings 36 preload adjustment it is necessary to dismount bottom axle 37 and to check technical condition of bottom pivot bearing.

If force of turning is between 60 N and120 N, it is necessary to make pivot bearings preload adjustment in the following order:

– check up bolts 4 tightening force, that should be between 160 and 180 Nm·;

– turn out four bolts 4 fastenings upper pivot axle;

– by means of extracting bolts raise upper axle 37 and reach the necessary bearings 36 preload by removal of shim washers 2 of identical thickness from both parties of axle flange;

– tighten axle fastenings bolts 4 with a moment of 160…180Nm and the bolts should be tightened crosswise with obligatory turning from side to side of wheel hub drive;

–check again pivot bearings preload by means of check of reduction unit turning force in both directions;

– repeat above mentioned work for the other wheel reducer.

After adjustment make lubrication of a wheel hub drive. Pump lubrication through oilier 6 as long as it will come through special hole located in end face of a sealing holder 39.

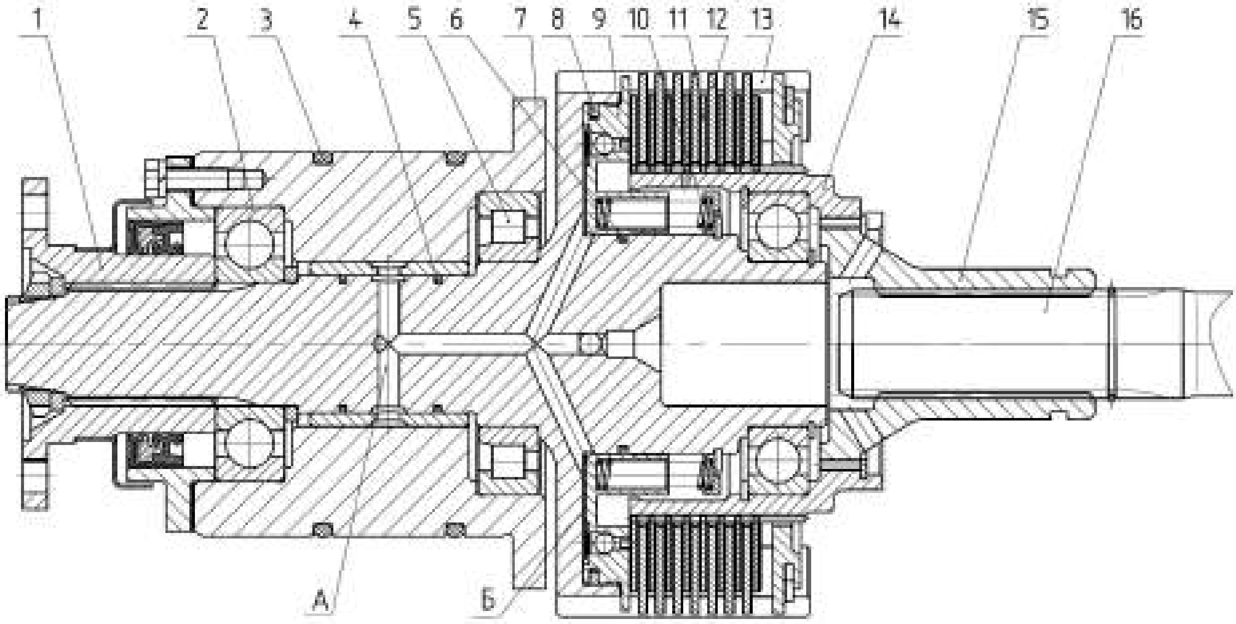
After bearings adjustment and lubrication of pivot connection mount removed from FDA parts in reverse order. Tighten nuts fastening steering cylinder with moment of 180 … 200 Nm and nuts fastening of steering rod with the moment of 110 …130 Nm·.

Next checkings and, if necessary, adjustments of axial preload in pivot conic bearings make every:

- 250 hours at tractor operation with doubled front wheels;
- 500 hours at operation with single wheels.

ATTENTION: NON-OBSERVANCE OF MAINTENANCE REGULATIONS FOR PIVOT BEARINGS CAN LEAD TO THEIR PREMATURE FAILURE, ESPECIALLY, AT USE OF DOUBLED FRONT WHEELS. AT OPERATION WITH DOUBLED FRONT WHEELS IT IS NECESSARY TO OBSERVE STRICTLY THE REQUIREMENTS STATED IN SUBSECTION 3.14 “UNDERCARIGE AND TRACTOR WHEELS “!

3.12.9 Front Driving Axle Drive



А – oil feed channel, Б – clutch booster;
1 – flange; 2,5 – bearings; 3 – rings; 4,6,8 – rings; 7 – sleeve; 9 – piston; 10 – spring; 11, 12 – disks; 13 – drum; 14, 15 – couplings; 16 – torsion bar;

Figure 3.12.7 – Front driving axle drive

The FDA drive is intended for torque transfer from gear box main shaft through pair of cylindrical gears, torsion shaft, multidisk frictional hydraulically operated clutch and cardan shaft to front driving axle. FDA drive is engaged (disengaged) with a help of hydraulically pressed clutch.

The clutch is mounted on coupling clutch housing bore. Sleeve 7 (figure 3.12.7) is fastened by bolts to coupling clutch housing from the side of gear box and is sealed by rubber rings.The drum 13 is mounted on bearings 2, 5 in sleeve 7. The piston 9 is sealed with special iron rings 6 and 8.

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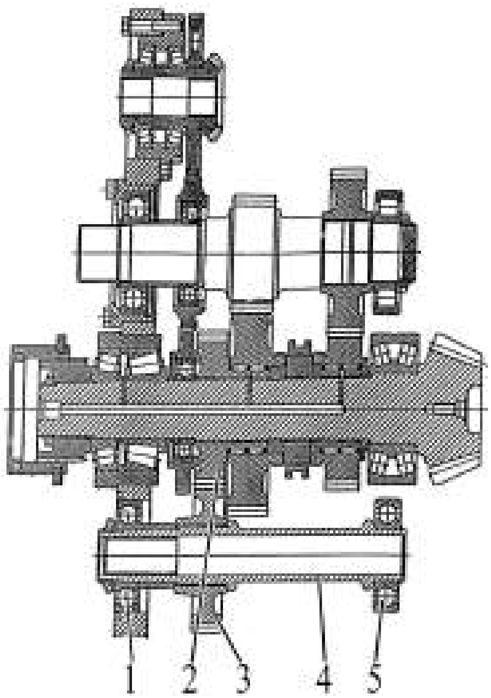


1, 5 – bearings; 2, 3 – gears; 4 – shaft

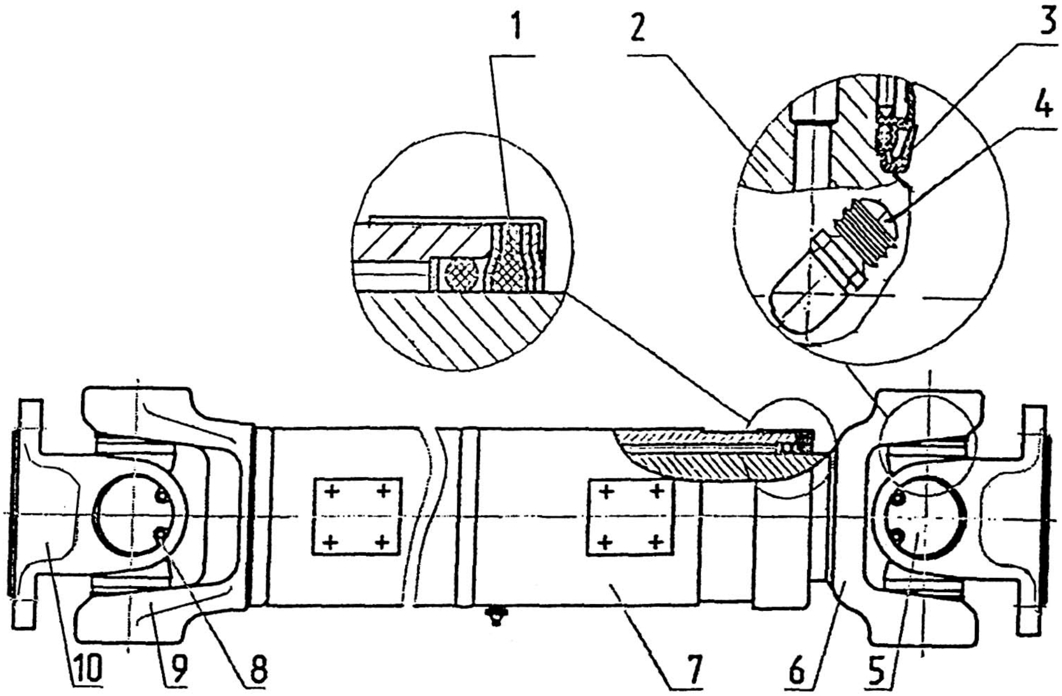
Figure 3.12.8 – FDA drive and rear axle unit

The gear 3 (figure 3.12.8) is mounted on shaft 4 splines and is in constant mesh with gear 2 located in rear axle. The shaft 4 is mounted on rear axle case on ball bearings 1 and 5 and through spline couplings 15, 14 (figure 3.12.7) is connected by torsion bar 16 with driving disks 11.

At engaged drive oil from the hydraulic distributor of FDA control system is pumped under pressure through channels "A" sealed with rings 4 in booster “Б”, piston 9 clamp disk11 and 12 pack, blocking driving and following parts of drive, torque moment is transferred through drum 13 splines to flange 1 and further through cardan shaft to main drive of FDA.

At disengaged drive control system hydraulic distributor shut off oil flow to clutch, oil from booster “Б” goes to drain, springs 10 return piston 9 in starting position and torque transfer stops.

3.12.10 Cardan Shaft



1, 3 – seals; 2 – cross; 4 – oilier; 5 – bearing; 6, 9 – forks; 7 – tube; 8 – locking ring; 10 – flange.

Figure 3.12.9 – Cardan shaft

The cardan shaft of open type consists of two cardan joints and a tube having spline connection. The cardan shaft is intended for torque transfer from drive clutch to FDA.

The cardan joint consists of flanges 10 (figure 3.12.9), forks 6, 9 and cross 2. In flange and forks holes are mounted needle bearings 5 of crosses. Bearings are kept in borings by lock rings 8. Thanks to lock rings of various standard sizes backlash in universal joints is adjusted at assembling. The manufacturer fills universal joints with long-term greasing.

On universal joint crosses are mounted oilier 4 to refill lubricant in joints during operation. To keep lubricant in bearings and to prevent moisture, dirt and dust ingress in them, there are special face seals 3. To prevent dirt, dust and moisture ingress in spline connection is mounted seal 1.

The cardan shaft in assembly is dynamically balanced. Flanges of cardan shaft are connected by self-locking nuts through paper gaskets with clutch coupling of drive and FDA main gear.

3.13 Electronic system for rear-axle differential lock control, front driving axle drive control, front and rear power take off shafts control

3.13.1 Rear-axle Differential Lock Control

The rear-axle DL is controlled by electrohydraulic system. The electronic part of DL is a part of complex control system and consists of electronic unit CECS 1 (figure 3.13.1), located in cabin on the panel to the right of the driver; of wheel turning angle sensor 11 mounted on the left side on FDA; of two sensors 15 and 16 of working brakes engaged condition, mounted in cabin over brakes pedals; of distributor 20 with electromagnet and pressure sensor 19 of DL engaged condition, mounted on plate 8 of transmission hydraulic system distributors, connecting harnesses 14 with plug-and-jack connection 7.

The system is powered from onboard power system through security and switching unit 2, according wiring scheme of complex control system for DL, FDA and PTO and gear changing (Appendix B). System supply voltage is delivered after turn of starter and instruments switch in position «Instruments ON».

On face plate of CECS are buttons 30 and 31 of on/off switching of automatic and positive operation mode, annunciators 22 of set operation mode and annunciator 23 of engaged condition of rear-axle differential lock.

Rear-axle differential lock is off in starting position. The pressure is not supplied to electromagnet of distributor 20, DL clutch is connected with drain, differential is unlocked. When during operation rear wheels will slip, it is necessary to switch on differential automatic locking.

It is necessary to press button 31 «AUTO» to switch on automatic operating mode for differential lock. At steering wheel position, corresponding to linear movement, distributor 20 is activated and it send oil flow in DL clutch and locks differential.

Differential unlocking occurs automatically at turn of steering wheels by angle from above 13º (sensor11 activation), or pressing both, or any of brakes pedals (brakes sensors 15, 16 activation, respectivily), or at driving speed over 16 km/h. When driving speed is under 13 km/h blocking should again switch on automatically.

Automatic mode of rear wheels differential locking is switched off at second pressing of button 31 «AUTO» or at pressing and release of positive blocking button 30.

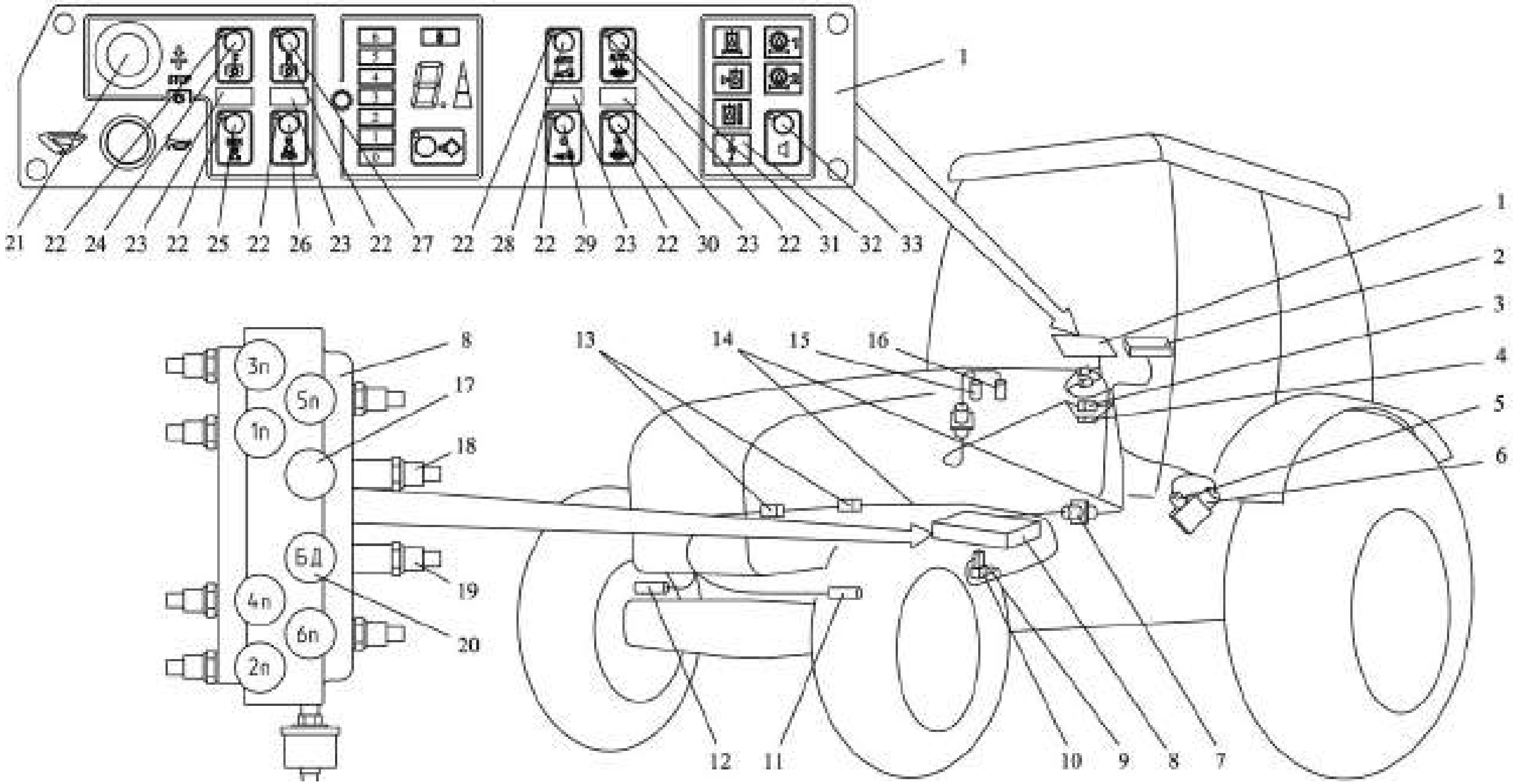
If it is necessary to lock positive rear wheels for short time, independent of any conditions, press and keep button 30. Blocking remains for the period of button 30 keeping in pressed position. When buttons 30 is up rear axle differential locking returns to the starting (disengaged) condition.

It is enough to press and keep button 30 for change of DL engagement automatic mode for positive mode.

As indicator for switching on of system operation mode serve annunciators 22 situated close to corresponding on/off mode switching buttons 30 and 31. Engaged condition of rear axle DL (pumping of oil under pressure into DL clutch) is indicated by annunciator 23, situated between buttons 31 and 30 of automatic and positive operation modes. Annunciator 23 is switched on according to signal from pressure sensor 19, that is actuated (contact closure) at pressure above 0,6 … 0,8 MPa.

When it is necessary to install wheel turning angle sensor 11(after dismantle or at replacement) keep an eye on installation truth:

- ensure backlash of 3±0,2 mm between end face of wheel turning angle sensor 11 and support, mounted on left FDA reduction unit;
- At steering wheels position, corresponding to linear movement, the axle of wheel turning angle sensor 11 should match with centre (axle) of support on FDA reduction unit (It should be provided symmetry of sensor activation at steering wheel turning in both directions by angle ±13º).



1 –electric unit CECS ; 2 – security and switching unit; 3, 4, 13 – receptacles; 5 – sensor of RPTO engaged condition; 6 – RPTO distributor 7 –plug-and-jack connection; 8 – plate with distributors; 9 – sensor of FPTO engaged condition; 10 – FPTO distributor; 11 – wheel turning angle sensor 13°; 12 – wheel turning angle sensor 25°; 14 – connecting harnesses; 15, 16 – working brakes sensors; 17 –duplicate distributor;18 – duplicate sensor; (can not be installed) 19 – sensor of rear-axle DL engaged condition; 20 – rear-axle DL distributor; 21 – FPTO and RPTO emergency stop button; 22 – annunciators for indication of on/off switching of corresponding drive; 23 – annunciators of engaged condition of corresponding drive; 24 – FPTO engagement button; 25 – FPTO disengagement button; 26 – RPTO disengagement button; 27 – RPTO engagement button; 28 – button for on/off switching of FDA drive automatic mode; 29 – button for on/off switching of FDA drive positive operating mode; 30 – button for on/off switching of positive operating mode of rear-axle DL control; 31 – button for on/off switching of automatic operating mode of rear-axle DL control; 32 – annunciator of CECS emergency supply voltage; 33 – button for alarm sound switching off.

Figure 3.13.1 – Electronic system for rear-axle differential lock control, front driving axle drive control, front and rear power take off shafts control

3.13.2 FDA drive control

The FDA drive is controlled by electrohydraulic system. The electronic part of FDA drive control system is a part of complex control system and consists of electronic unit CECS 1 (figure 3.13.1), located in cabin on the panel to the right of the driver; of wheel turning angle sensor 12 mounted on the right side on FDA; of two sensors 15 and 16 of working brakes engaged condition, mounted in cabin over brakes pedals; of FDA control distributor 28 (figure 3.11.2) with electromagnet and sensor of FDA drive engaged condition, of connecting harnesses 14 (figure 3.13.1) with plug-and-jack connection 7.

The system is powered from onboard power system through security and switching unit 2, according wiring scheme of complex control system for DL, FDA and PTO and gear changing (Appendix B). System supply voltage is delivered after turn of starter and instruments switch in position «Instruments ON».

On face plate of CECS unit 1 there are buttons 28 and 29 of on/off switching of automatic and positive operation mode, respectively, near to them are situated annunciators 22 for indication of set mode and between them is located annunciator 23 of FDA drive engaged condition (oil supply under pressure in FDA drive clutch).

FDA drive is off in starting position. The pressure is not supplied to electromagnet of FDA control distributor 28 (figure 3.11.2), FDA drive clutch is connected with drain and drive is switched off.

When pressed on button 28 (figure 3.13.1) “AUTO” at steering wheel position corresponding to linear movement, distributor 28 (figure 3.11.2) is activated, in FDA drive clutch is supplied oil under pressure and drive is switched off.

FDA drive is switched off automatically at steering wheel turning by angle above 25 ° (at sensor 12 activation (figure 3.13.1)) or at driving speed above16 km/h). When driving speed is under 13 km/h FDA drive should switch on automatically.

Automatic mode for FDA drive on/off switching is switched off at second pressing on button 28 “AUTO” or at pressing and release of button 29 of positive mode for FDA drive engagement.

If it is necessary to engage positive FDA drive for short time, independent of any conditions, press and keep button 29. FDA drive remains engaged for the period of button 29 keeping in pressed position. When button 29 is up, FDA drive returns to starting (disengaged) condition.

It is enough to press and keep button 29 for change of FDA drive engagement automatic mode for positive mode.

As indicator for switching on of system operation mode serve annunciators 22 situated close to corresponding on/off mode switching buttons 28 and 29. Engaged condition of FDA drive (pumping of oil under pressure in FDA drive clutch) is indicated by annunciator 23 located between button switches 28 and 29 of automatic and positive modes. Annunciator 23 is switched on according to signal from pressure sensor 18 that is actuated (contacts closing) at pressure from above 0,6 … 0,8 MPa.

When it is necessary to install wheel turning angle 12 (after dismantle or at replacement) keep an eye on installation truth:

- ensure backlash of 3±0,2 mm between end face of wheel turning angle 12 and support, mounted on right FDA reduction unit;

- at steering wheel position corresponding to linear movement, the axle of wheel turning angle sensor 12 should match with centre (axle) of support on FDA reduction unit (it should be provided symmetry of sensor activation at steering wheel turning in both directions by angle ±25º).

ATTENTION: AT WIRE BREAKAGE IN THE CONTROL CHAIN OF FDA DRIVE ELECTROMAGNET THE FDA DRIVE AUTOMATIC SWITCH ON, INDEPENDENT OF THE SET MODE (INCLUDING MODE “FDA DRIVE IS SWITCHED OFF)!

3.13.3 Front PTO shaft control

The front PTO shaft is controlled by the electronic hydraulic system. The electronic part of front PTO control system is a part of complex system of DL, FDA, PTO and gear shifting control and consists of CECS unit 1(figure 3.13.1), located in cabin on panel to the right of the driver, of discrete distributor 10 with electromagnet and of pressure sensor of FPTO drive engaged condition 9, fixed on bracket for coupling drive control, of connecting harnesses 14 with the plug socket 7 which is under the cabin.

The system is powered from onboard electric system through security and switching unit 2 according to electric circuit diagram of complex system of DL, FDA, PTO and gear shifting control (Annex C). Supply voltage comes into system after turn of starter and instruments switch in position “Instruments ON”.

On face plate of CECS unit 1 there are buttons 24 and 25 of on/off switching of front PTO drive, near to them are situated annunciators 22 for indication of set mode and between them is located annunciator 23 of FDA drive engaged condition (oil supply under pressure in FDA drive clutch) and button 21 of emergency stop of front and rear PTO.

The distributor 10 controls oil flow, that is supplied to hydraulic cylinder of bend brakes control mechanism of front PTO planetary reduction gear unit. The discrete pressure sensor 9, that is active (contacts closing) under pressure above 0,6…0,8 MPa is installed in hydraulic line for oil supply from distributor 10 to hydraulic cylinder. From sensor 9 is active annunciator 23.

It is necessary to press button 24 to engage front PTO. In this case voltage is supplied to electromagnet of distributor 10 and respectively oil is supplied into hydraulic cylinder chamber of front PTO control. Engagement of front PTO drive is displayed by annunciator 23. It is necessary to press button 25 to disengage front PTO. In this case the electromagnet of distributor 10 is deenergized, the hydraulic cylinder chamber joints with drain, annunciator 23 goes out and front PTO drive is disengaged.

At engine stop front PTO is automatically disengaged and after next engine start it is necessary to press button 24 to engage front PTO.

3.13.4 Rear PTO shaft control

The rear PTO shaft is controlled by the electronic hydraulic system. The electronic part of rear PTO control system is a part of complex system of DL, FDA, PTO and gear shifting control and consists of CECS unit 1 (figure 3.13.1), located in cabin on panel to the right of the driver, of distributor 6 with electromagnet and of pressure sensor of rear PTO drive engaged condition 5, fixed on rear axle on the right and connected with CECS unit 1 with harnesses 14.

The system is powered from onboard electric system through security and switching unit 2 according to electric circuit diagram of complex system of DL, FDA, PTO and gear shifting control (Annex C). Supply voltage comes into system after turn of starter and instruments switch in position “Instruments ON”.

On face plate of CECS unit 1 there are buttons 27 and 26 of on/off switching of rear PTO drive, near to them are situated annunciators 22 for indication of set mode and between buttons 27 and 26 is located annunciator 23 of rear FDA drive engaged condition (oil supply under pressure in rear FDA drive clutch) and button 21 of emergency stop of front and rear PTO.

The distributor 6 controls oil flow, that is supplied to hydraulic coupling of rear PTO drive engagement. The discrete pressure sensor 5, that is active (contacts closing) under pressure above 0,6…0,8 MPa, is installed in hydraulic line for oil supply from distributor 6 to hydraulic coupling of rear PTO drive engagement. From sensor 5 is active annunciator 23 situated between buttons 27 and 26.

It is necessary to press button 27 to engage rear PTO drive. In this case to electromagnet of electrical hydraulic distributor 6 is sent special control PWM signal, that make it possible oil supply from electrical hydraulic distributor into hydraulic coupling according to desired law and gentle start of rear PTO. Engagement of rear PTO drive is displayed by annunciator 23. It is necessary to press button 26 to disengage rear PTO. In this case control signal is removed from electromagnet of electric hydraulic distributor 6, hydraulic coupling chamber joints with drain, annunciator 23 goes out and rear PTO drive is disengaged, also brake of PTO shaft end extension is disengaged.

CECS admit reengagement of rear PTO only upon expiration of 30 seconds after its disengagement.

At engine stop rear PTO is automatically disengaged and after next engine start it is necessary to press button 27 to engage rear PTO.

3.14 Undercarriage and Tractor Wheels

Tractors BELARUS-3522.5 are equipped with front and rear wheels with tires of increased lift capacity:

- 650/75R42 – rear tires (single as well as doubled);
- 18.4R34– main front tires;
- 520/70R34– additional front tires, for doubling of front wheels.

It is technically permissible to mount on tractors BELARUS -3522.5 rear tires 710/70R42 (single as well as doubled) and front tires 600/65R34 (tires 520/70R34 – for doubling).

Parameters of tires used on tractors BELARUS 3522.5 are shown in table 3.2.

Table 3.2 – Tire parameters

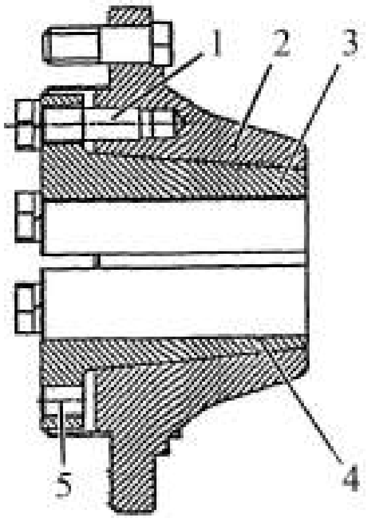
Tire size	Sectional width, mm	Rolling radius, mm [1)]
710/70R42	716	984
650/75R42	650	970
600/65R34	590	—
520/70R34	520	—
18.4R34	467	—

[1)] In present section are given rolling radiuses only for rear tires, which are necessary for programming of integrated speed indicator as it is specified in subsection 3.23.3 "Programming order of integrated indicator".

Front tractor wheels are mounted on flanges of FDA wheel-hub drives.

Rear tractor wheels are mounted on hubs, which consists of split cone inserts 3 and 4 (figure 3.14.1) and hub body 2.

The inserts are tightened into hub body by eight bolts 1 (M2) with torque 550…600 Nm and in such way press semiaxle.



1 –tie bolt; 2 –hub body; 3 – upper insert; 4 – lower insert; 5 – holes for disassembling.

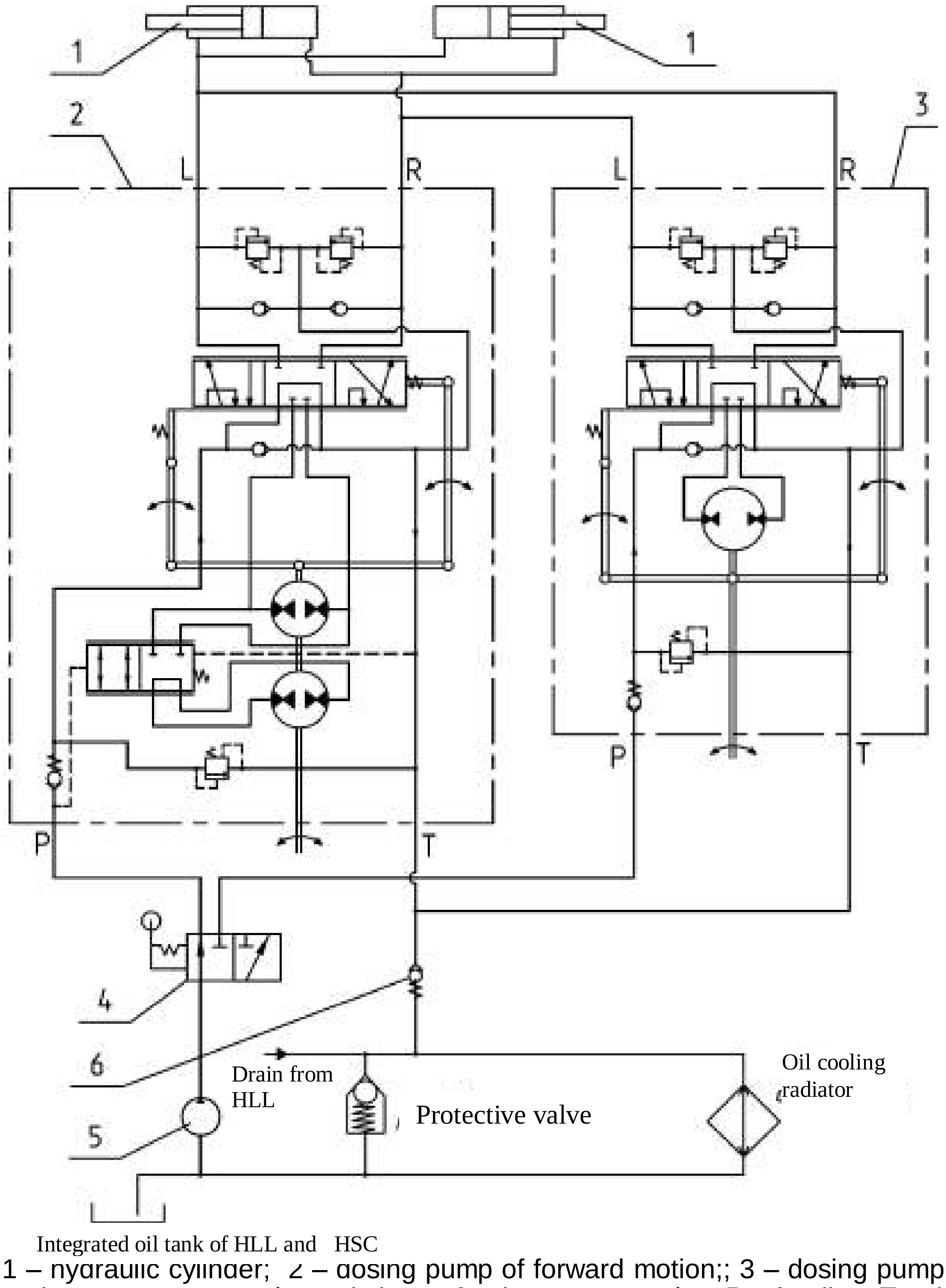
Figure 3.14.1 – Rear wheel hub

Tire operating rules, selection of best internal pressure in tires depending on working conditions and tractor axes loading and also method of track adjustment and of wheel doubling are described in subsection 4.2 "Use of tractor".

3.15 Hydrostatic Steering Control

3.15.1 General information

The hydrostatic steering control (HSC) is intended for control of guide wheels turn, for steering effort decrease at tractor turning. HSC consists of two dosing pumps 2 and 3 (figure 3.15.1), of reverse valve switch 4, of two differential hydraulic cylinders 1, making turning, of feed pump 5 with motor drive and of hydraulic fittings.
Hydraulic circuit diagram of HSC is shown in figure 3.15.1.



1 – hydraulic cylinder; 2 – dosing pump of forward motion;; 3 – dosing pump of reverse motion; 4 – reverse valve switch; 5 – feed pump; 6 – valve; P – feeding; T – drain; L –left-hand turn; R – right-hand turn.

Figure 3.15.1 – HSC hydraulic circuit diagram

Reverse valve switch 4 (figure 3.15.1) is installed for the purpose of HSC operation as well as by forward motion of the tractor and by reverse motion. Reverse valve 4 is mounted to the left under the hood at driver's cab on the left post of hood fixation bracket. The reverse valve 4 is controlled by shifting the handle into one of two positions until it gets fixed in one of them.

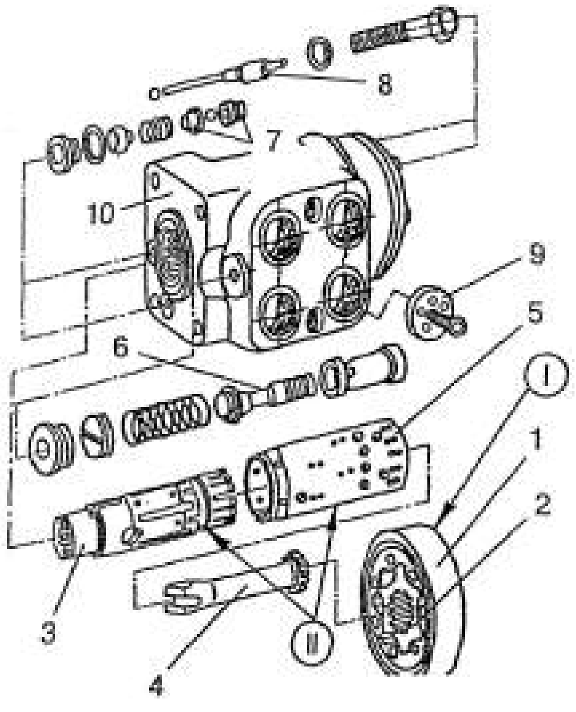
As oil reservoir serve general oil tank of HLL and HSC systems with 25 microns filter for working liquid clearing. In the system is installed the valve 6 which ensure operation of HSC emergency oil pressure sensor.

The dosing pumps 2 and 3 are mounted on steering columns, hydraulic rotation cylinders 1 are mounted on the front driving axle of the tractor, feed pump 5 is mounted on the engine. The dosing pumps 2 and 3 are connected by oil lines with chambers of hydraulic rotation cylinders, with feed pump and oil tank. At linear movement the chambers of cylinder 1 are locked by spool lands of dosing pump 2 or 3 and oil from feed pump 5 arriving to the dosing pump 2 or 3 comes back into oil tank. At steering wheel turn slider valve of dosing pump 2 or 3 shifts and oil comes into one of chambers of hydraulic rotation cylinder 1 in amount that correspond to the turn angle of steering wheel. Oil from the other chamber of hydraulic cylinder 1 comes back through dosing pump 2 or 3 in oil tank.

3.15.2 Dosing pump

The dosing pumps of forward and reverse motion are gerotor type pumps with ¨open center¨ and with no reaction to steering wheel. The dosing pump include tilting unit I (figure 3.15.2), distributor II, return valve 9, two anti-shock valves 7, protection valve 6 and two air-inlet valves 8.

The dosing pump of reverse motion is single-capacity pump and is shown in figure 3.15.2.



1 – stator; 2 – rotor; 3 – slide valve; 4 –driven shaft; 5 – liner; 6 – protection valve; 7 – anti-shock valves; 8 – air-inlet valves; 9 – return valve; 10 – casing. I – tilting unit; II – distributor

Figure 3.15.2 – Single capacity dosing pump

Gerotor tilt unit I (figure 3.15.2) consist of stator 1, which is fixed on casing 10, and of rotating rotor 2 connected with slide valve 3 through driven shaft 4. The distributor II consists of casing 10, liner 5 and sliding valve 3 connected by splines with driven shaft end extension of steering column.

The protective valve 6 limit maximal pressure in delivery line within the limits of 17,5... 18,0 MPa. The anti-shock valves 7 limit pressure in cylinder lines in impact conditions.

Pressure of anti-shock valves should be adjusted between 22 and 23 MPa.

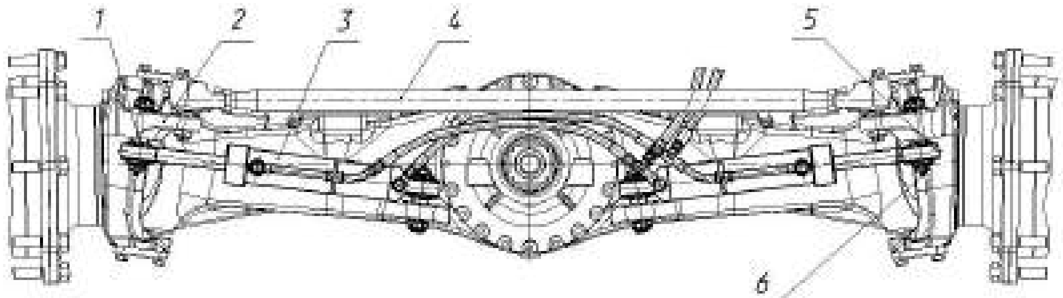
The air inlet valves 8 ensure necessary delivery of working liquid in hydraulic cylinder in emergency operation and at activation of anti-shock valves.

The dosing pump of forward motion 2 is double capacity pump and have additional gerotor tilt unit of smaller volume for control of guide wheels turn in emergency operation (when feed pump is out of run).

3.15.3 Steering hydraulic cylinder

The tractor is equipped with FDA with two hydraulic cylinders 3 (figure 3.15.3) and steering tie rod 4, mounted behind FDA.

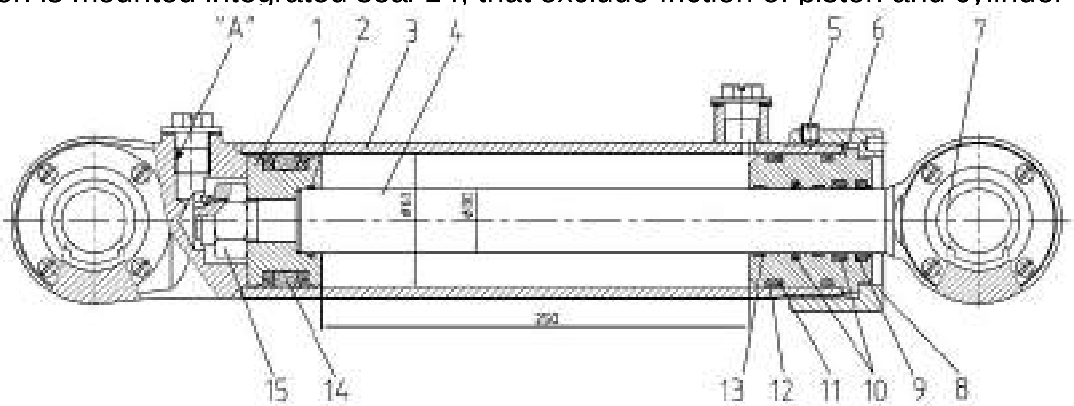
Cylinder rods are connected through cones 1 with pivoted levers 2 of wheel-hub drives housings and hydraulic cylinders bodies are connected with boss arrangements made on FDA casing. In eyes of hydraulic cylinders and in rod heads are installed spherical joints 5, that should be periodical lubricated through ball-valve oilers 6.



1 – cone; 2 – lever of wheel-hub drive; 3 – hydraulic cylinder; 4 – steering tie rod; 5 – sperical joint; 6 – ball-valve oiler.

Figure 3.15.3 – FDA with two hydraulic cylinders in steering linkage and steering tie rod.

Steering hydraulic cylinder consists of body 3 (figure3.15.4), rod 4, piston 1, cover 6 and cap nut 8. The piston is fixed on rod with nut 15, which is locked by punching of land in rod 4 slot. In eyes of body and rods are installed spherical bearings 7, that have channels in inner race for lubrication of slide surfaces though oiler. In cover 6 are installed seal 9 (wiper seal), rod guides 13, that exclude friction of rod and cover and rod packings 10. On piston is mounted integrated seal 14, that exclude friction of piston and cylinder liner.



1 – pison; 2, 12 – sealing ring; 3 – body; 4 – rod; 5 – lock screw; 6 – front cover; 7 – spherical bearing; 8 – cat nut; 9 – rod seal; 10 – rod packings; 11 – safety ring, 13 – rod guide, 14 – piston seal; 15 – piston nut.

Figure 3.15.4 – Steering hydraulic cylinder

3.16 Hydraulic lift linkage (HLL)

3.16.1 General information

The hydraulic lift linkage operates front and rear lift linkages and hydraulic working attachments of agricultural implements coupled with a tractor. Rear lift linkage is controlled by regulator with electromagnetic control, that ensure draft, position, combined and depth control during operation with mounted and semi-mounted implements. Automatic control system of front lift linkage is made with stand-alone electrohydraulic regulator EHR-5LS, that guarantee position and depth control of mounted and semi-mounted implements. In hydraulic lift linkage is built shuttle valve (valve OR) 10 (figure 3.16.2), that serve for choosing of actuating signal (pressure) from consumer to adjusting pump.

Hydraulic lift linkage shown in figures 3.16.1, 3.16.2, 3.16.3 include: oil tank 2 (figure 3.16.1), mounted on the right of gear box; variable-flow, axial-piston pump 11 (figure 3.16.2) with delivery gerotor type pump mounted on the right side of rear axle body on full-time two-pumps drive, that ensure 2600 rev/min of pump at rated engine speed; electrohydraulic unit with EHS sections, end control plate end EHR-23LS; two hydraulic cylinders 3 (figure 3.16.1) of rear lift linkage(Ц110x250), which rod ends are equipped with drainage 5;

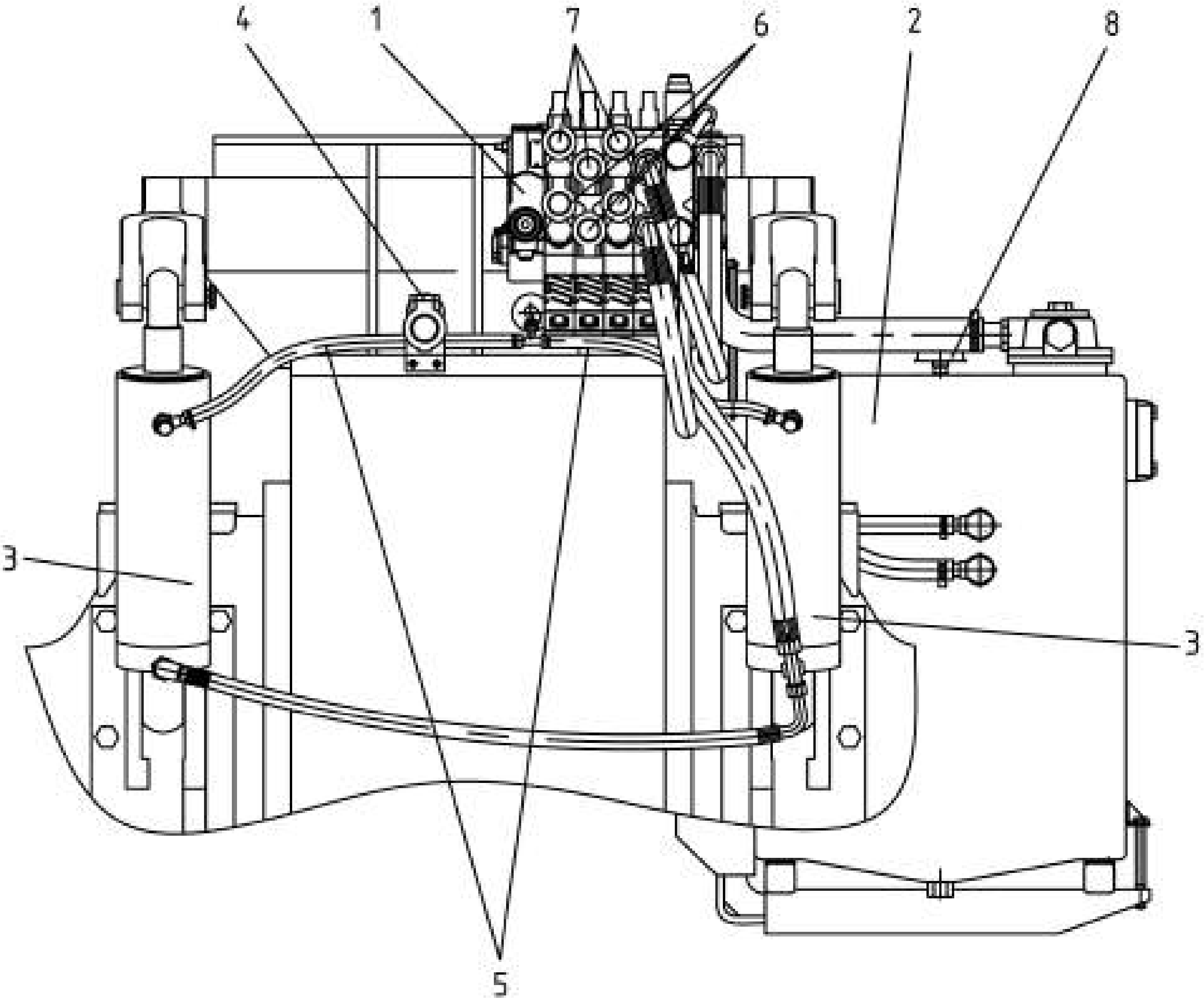
The presence of free oil drains 18 (figure 3.16.2) in rear part of the tractor and of drain lines 20 (figure 3.16.3) with fast couplings with blue protective caps at the front makes it possible to fulfill requirements of agricultural implements coupling, that have hydraulic drive of working implements continuous operation (hydraulic motor), for example – sawing units. The outputs of distributor are equipped with fast couplings with color protective caps 6 and 7, red plugs – uplift, green plugs – lowering. There are front outputs 21, which are connected with one of distributor sections, that simplify agricultural implements control, mounted in the front.

The variable flow pump is supplied with changeable filter 13 (figure 3.16.2) of the company 'Donaldson' with filtering capacity between 6 and 16 micron and with impurity and emergency temperature sensor 12. Signal from sensor 12 is sent to CECS annunciator. The lighted annunciator shows, that it is necessary to change filter. Impurity control according to annunciator should be made at warmed-up hydraulic system (min 45° C).

To prevent overheating of working liquid, into hydraulic system is built radiator 25, mounted in radiator box. The radiator is connected with hydraulic system by oil supply lines 26 and by lines 27 for oil offtake into oil tank of hydraulic system. Oil is supplied from free drain lines 18 (figure 3.16.2) and 20 (figure 3.16.3),oil drain line of delivery pump 19 (figure 3.16.2), drain from HSC. Between lines is situated protection valve 17, that decrease pressure in radiator in cold season.

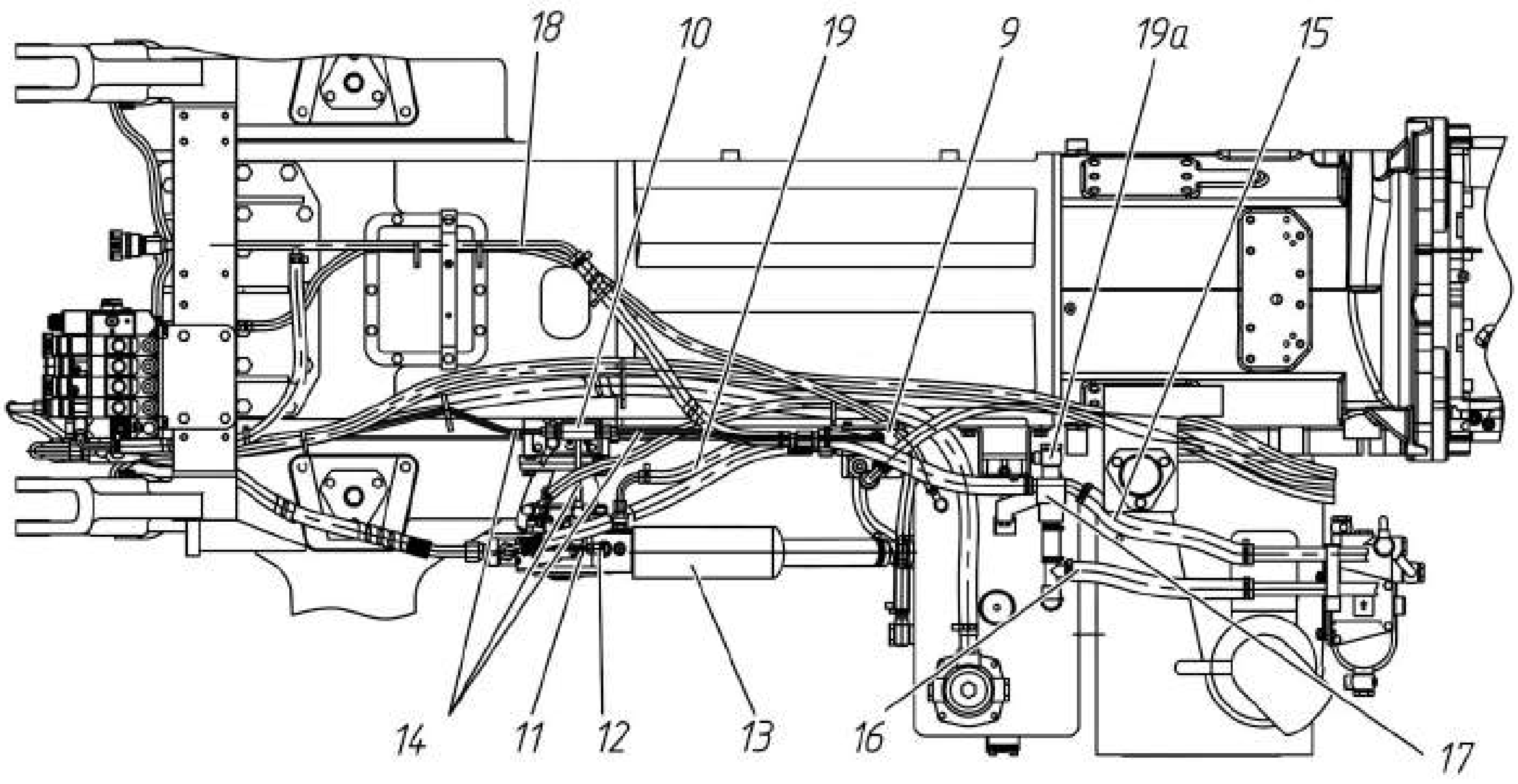
The HLL hydraulic circuit diagram (with cooling system) is shown in figure 3.16.4.

General arrangement of main electrohydraulic components of HLL (without cooling system) and HLL electronic control system is shown in figure 3.16.5.



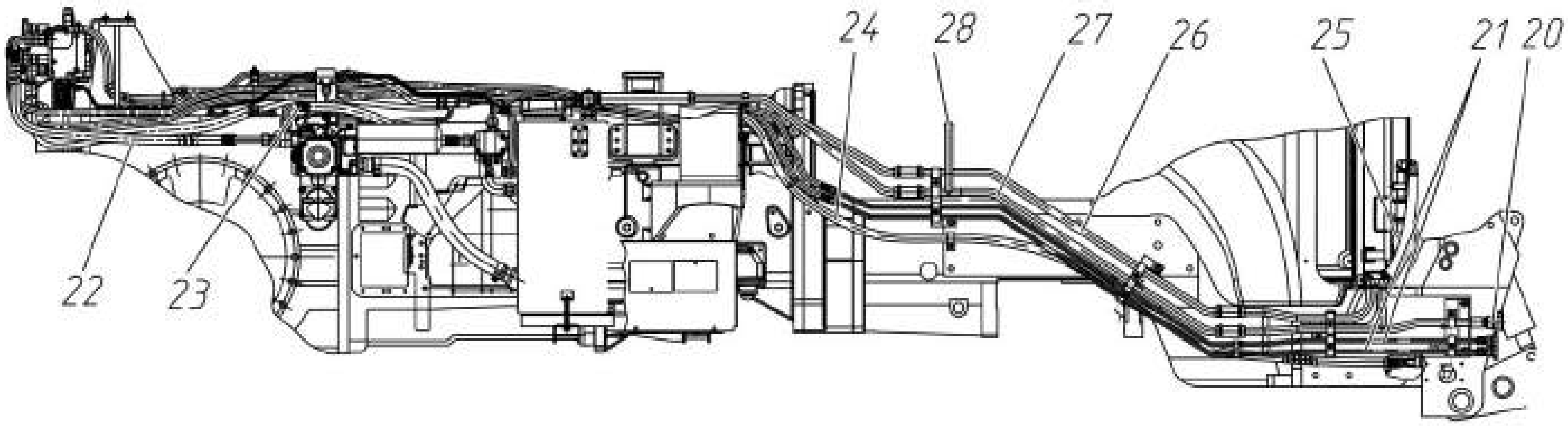
1 – electrohydraulic unit with EHS sections, end control plate and EHR23-LS; 2 – oil tank; 3 – hydraulic cylinders Ц110x250; 4 –fast coupling (FC); 5 – hydraulic cylinder drainage; 6 – uplift outputs (red protective plug); 7 – lowering outputs (green protective plug); 8 – breather with filtering element .

Figure 3.16.1 – Arrangement of hydraulic lift linkage units on tractor (view from behind)



9 – electrohydraulic regulator for FLL control; 10 – shuttle valve (valve OR); 11 – adjustable pump A10CN045; 12 – alarm impurity sensor; 13 – filter "Donaldson"; 14 –lines of control channel; 15 – line for oil supply to radiator; 16 – line for oil off-take from radiator; 17 –protection valve; 18 – free drain line (at the rear); 19 –drain line of gerotor pump; 19a- drain line of HSC.

Figure 3.16.2 – Arrangement of hydraulic lift linkage units on tractor (view from above).



20 – free drain line (in front) with coupling; 21 – front outputs of EHS distributor with couplings; 22 – delivery high-pressure hose from pump to EHS distributor; 23 – delivery high-pressure pump from pump to EHR-5LS; 24 –FLL control line; 25 – HLL and HSC cooling radiator; 26 – line for oil supply to radiator; 27 – line for oil takeoff from radiator; 28 – suction line of HSC pump.

Figure 3.16.3 – Arrangement of hydraulic lift linkage units on tractor (side view)

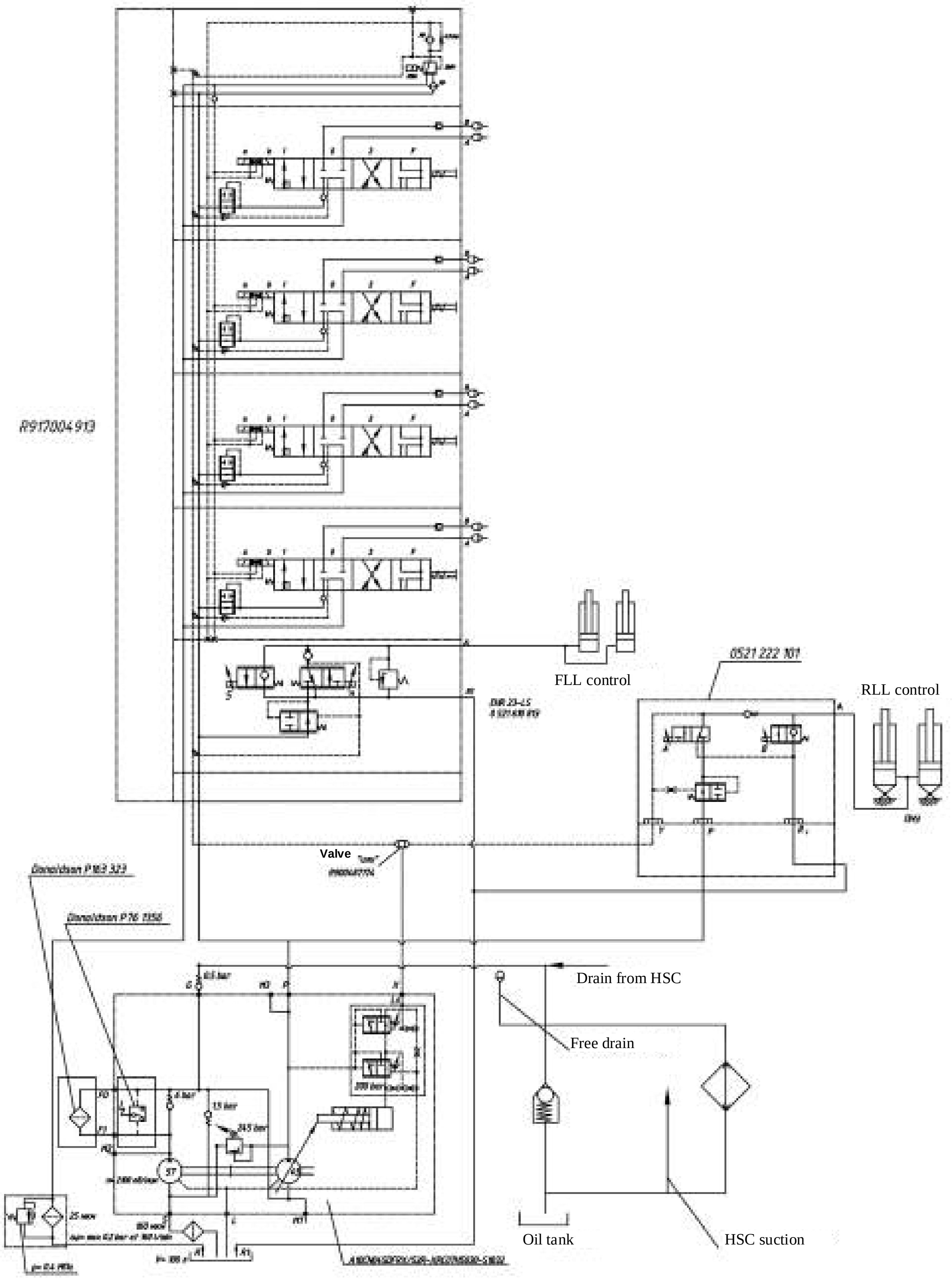


Figure 3.16.4 – HLL hydraulic circuit diagram

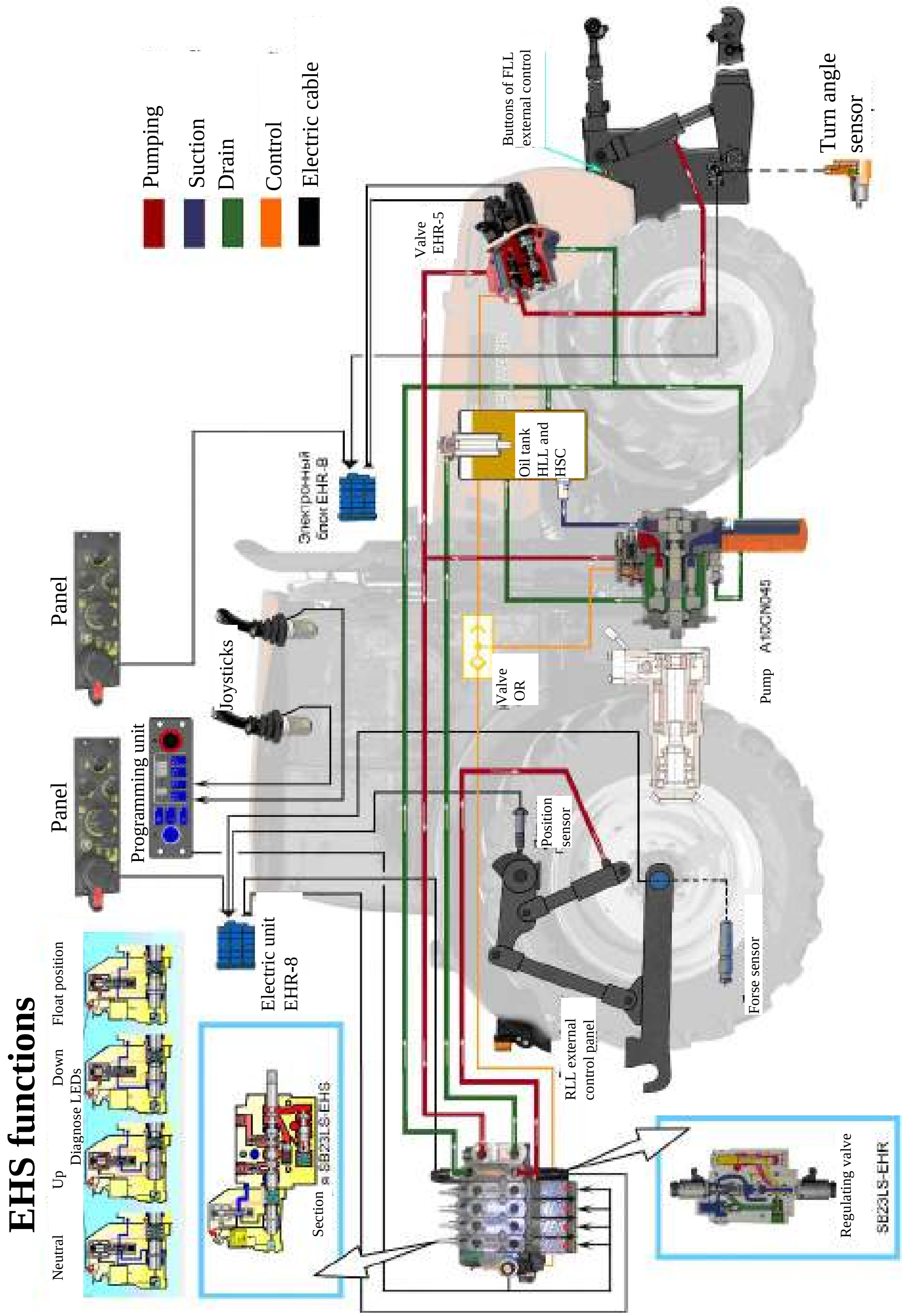


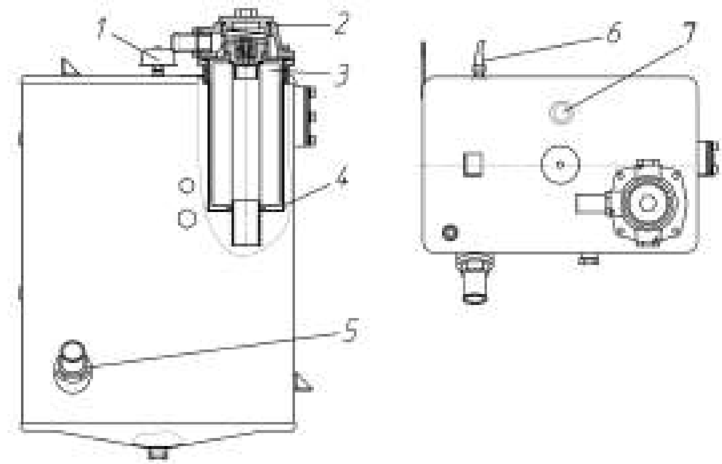
Figure 3.16.5 – General arrangement of main electrohydraulic components of HLL and HLL electronic control system

3.16.2 Oil tank

The tractor is mount with integrated oil tank of LL and HSC systems with a capacity of 100±0,5 l , this tank is equipped with breather 1 (figure 3.16.6) with changeable paper element. On front wall of oil tank are made two joints for free-flow pump drain and for EHR-5LS drain of FLL control. By intaking is placed intake filter 5 with mesh of 200 micron, this filter should be washed by oil change.

Draining from distributor is made through filler cap 2 of oil tank filter. On front wall of oil tank is situated emergency oil level/temperature sensor 6 that is actuated at oil temperature increase above 90°C or at oil level fall lower than permissible level.

Oil tank has also two drain holes, which guarantee full drain of waste oil during its scheduled change.



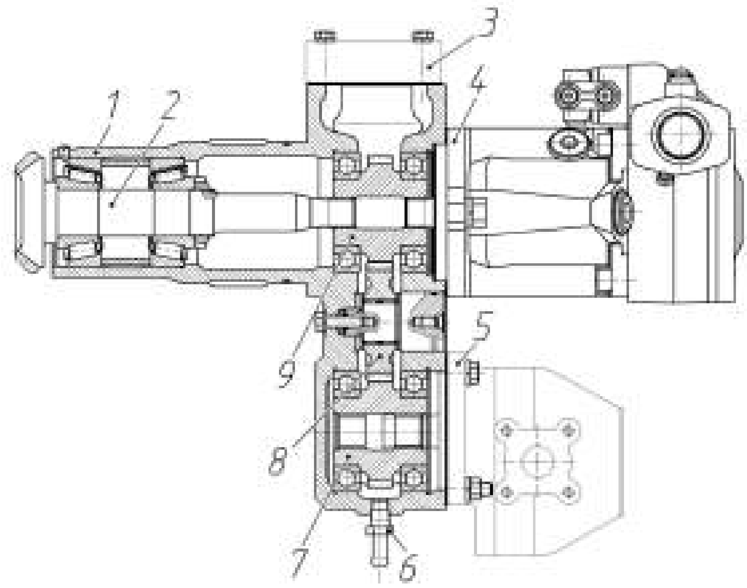
1 – breather; 2 – filter cap cover; 3 – filtering element; 4 – filter casing; 5 – intake filter; 6 – oil level/temperature sensor; 7 – drain from cooling radiator .

Figure 3.16.6 – Integrated oil tank of LL and HSC hydraulic systems

3.16.3 Drive of HLL pump and transmission hydraulic system pump.

On drive, which is shown in figure 3.16.7, are mounted together pumps of two hydraulic systems – of hydraulic lift linkage and transmission hydraulic system. Rotation is transmitted by cone gear shaft 2 from power take off shaft (PTO) of the tractor to gear 9 of pump 4 of hydraulic lift linkage and further by means of cylindrical gearing (gears 9,8,7) to pump 5 of transmission hydraulic system.

Drive parts are located in casing 1. Oil for its lubrication comes in drive through hole in cover 3. Oil is drained through nipple 6. This drive is full-time drive.



1 - casing; 2 –gear shaft; 3 – cover for lubricant supply into drive; 4 – variable displacement pump of lift linkage hydraulik system; 5 – fixed displacement pump of transmission hydraulic system; 6 – nippel for lubricant removal; 7, 8, 9 - gears.

Figure 3.16.7 – Pumps drive

3.16.4 Distributor

3.16.4.1 General information

The tractors BELARUS-3522.5 are equipped with integrated block, which consists of four distributive sections of EHS type, of electrohydraulic regulator EHR-23LS, of end plate with pressure reducing valve and of discharge cover.

Distributive section EHS represent integrated product that consists of hydraulic and electronic part. Structure of distributive section EHS, its operation principle and main functions are shown in figures 3.16.8 and 3.16.9.

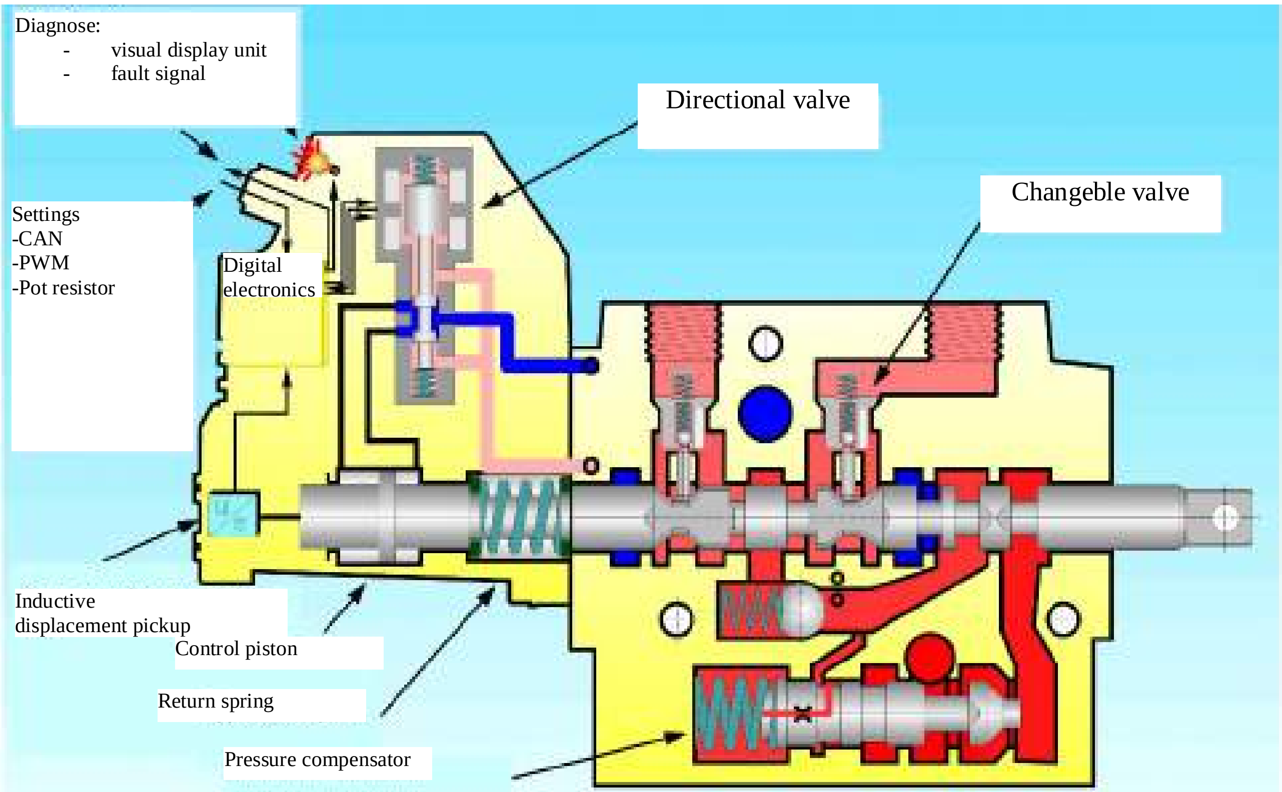


Figure 3.16.8 – Structure diagram of distributive section EHS.

The hydraulic part consists of operated center slide-valve that regulate flow value, necessary for agricultural implement (for external consumer of hydraulic flow). The center slide-valve is pressure-operated and pressure is regulated with a help of proportional electromagnet valve (directional valve), built into distributor. Built-in electronic card (digital electronics) receives control signal from tractor cab from the operator, than handles this signal and controls proportional electromagnet valve, that joints chambers of control piston with pressure or with drain and in such way ensure the movement of center slide-valve in following positions: “up”, “neutral”, “down”, “floating position” and make it possible to regulate flow in working positions.

The positions of slide-valve are controlled by means of inductive displacement pickup and digital electronics according to set program. In case of power-down, directive valve comes back in starting position. At this moment the spring of slide-valve moves it in neutral position. Different examples of EHS section conditions at performance of different functions are shown in figure 3.16.9.

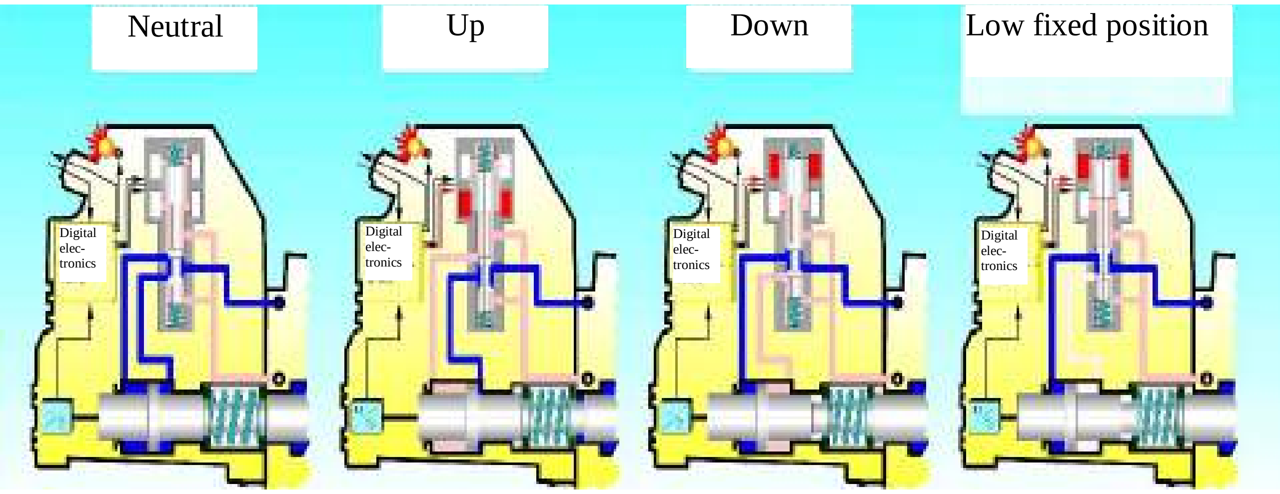


Figure 3.16.9 –Diagram of directive valve positioning and centre slide-valve positioning at performance of different functions.

Version of programmed flow regulation curve for tractors BELARUS-3522.5 is shown in figure 3.16.10.

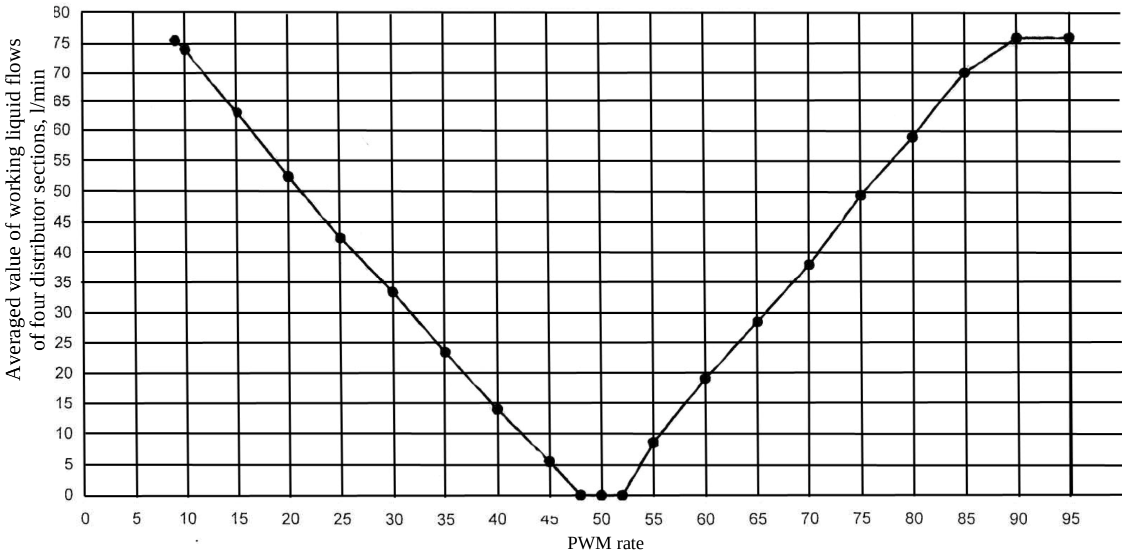


Figure 3.16.10 – Dependence of working liquid flow at outlet from SB 23LS-EHS distributor sections on control signal value at control by means of joysticks.

On electronic card is installed diagnostic LED (see figure 3.16.8), by flashing of this LED can be detected possible failures of electrohydraulic distributor EHS. When during operation of distributor appear failures, the operator should register by LED flashing failure code and inform dealer about presence of failure with this code and call dealer for distributor repair.

Note – Failure indication rules of EHS distributor and troubleshooting methods are described in subsection 7.3 «Possible failures of HLL and guidelines for troubleshooting”.

Electrohydraulic control of slide-valve position of EHS distributor sections allows automatize control functions according to set operation mode and control strategy of agricultural machines working implements. For this possibility in electronic control system of hydraulic distributor is included programming unit for programming of hydraulic lift linkage operations. Rules for EHS distributor control and programming order of sequence of operations are described in subsection 2.16 “Electronic System of Hydraulic Distributor EHS Sections Control”.

3.16.4.2 End control plate of EHS working sections

The position of center slide-valve is permanently controlled on a signal of inductive displacement pick-up (see figure 3.16.8) of center slide-vale and if it is necessary are made corrections in control signal, which is sent to proportional electromagnet valve that regulate control pressure. The sensor has central master primary coil and signal secondary coils. At movement of coil rod, which is mechanically connected with center slide-valve, electrical signal in signal coins is changed, than signal is handled by built-in electronic card and then is developed correction signal. For control of EHS working sections is used special end plate with electrical control of cross-over reducer valve (figure 3.16.11). The valve serve for pressure feed in EHS control system.

At the beginning of valve travel the pressure is increased with a help of electrically controlled reduction valve. Switching command is sent by control lever shifting (for example joystick). The pressure in the system is reduced between 0,21 and 0,24 MPa. The valve has emergency shutdown system (pressure decrease), that gives a possibility to return slide-valve of working section in neutral position in emergency situation.

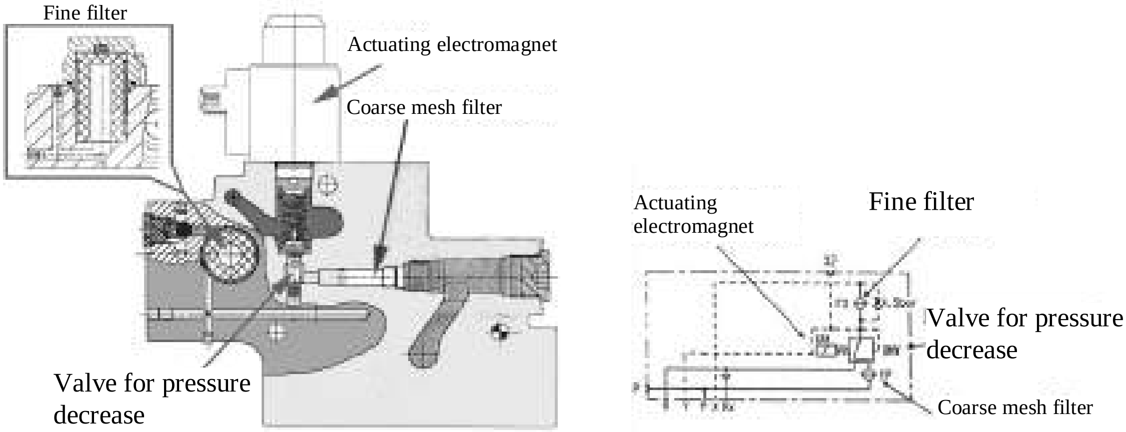


Figure 3.16.11 – Control scheme of EHS working sections with cross-over reduction valve

3.16.5 Hydraulic system of FLL control

3.16.5.1 General information

The tractors BELARUS-3522.5 are equipped with automatic control system of front lift linkage (FLL), using position control method. As actuator is used electrohydraulic regulator EHR-5LS of the company Bosch, its design and basic circuit diagrams are shown in figure 3.16.12. As position sensor is used angular sensor of the same company with angle ± 41˚of lift linkage position control. The sensor is driven by lever system from lift link. The sensor is installed to the right along tractor movement in special hole in bracket of front lift linkage. Lever control of the sensor is fixed on the one side by cotter pin on sensor end and on the other side on draft link with a help of nuts and pin.

The rules of FLL control are described in section 2.15 “Front lift linkage control”.

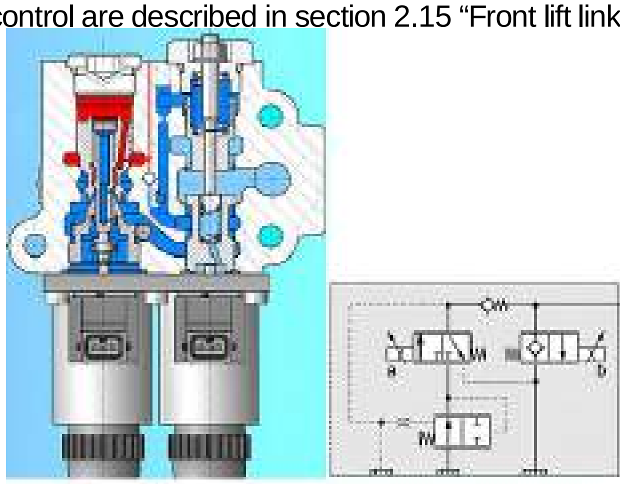


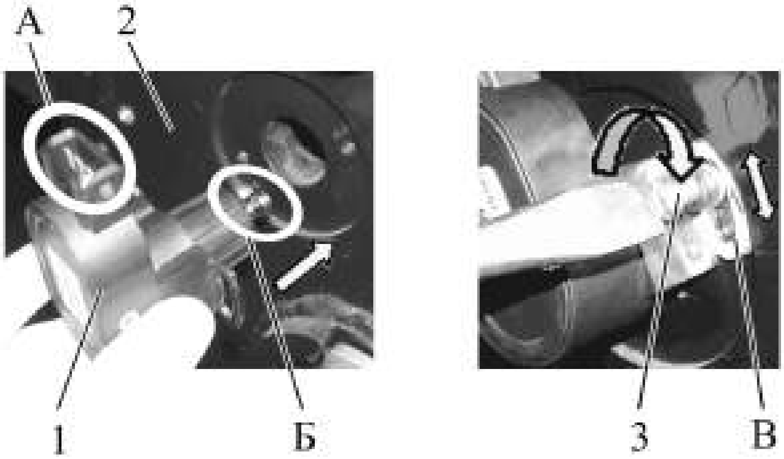
Figure 3.16.12 –Electrohydraulic regulator EHR-5LS

3.16.5.2 Installation and adjustment of FLL position sensor

As far as front lift linkage with position control doesn't have positive down movement, it is better to load front lift linkage additionally with weight 150…2500 kg for convenience by position sensor adjustment.

Installation and then adjustment of FLL position sensor should be made in the following order:

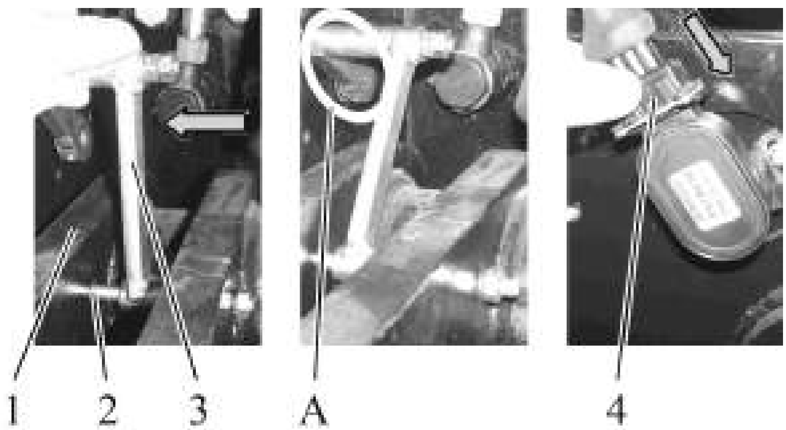
1. Install position sensor 1 (figure 3.16.13) in FLL bracket 2 in such way, that electronic connector "A" and marking (don't change with hole) on sensor 1 shaft end "Б" are directed at top. Screw two screws 3 (one at each side) through adjusting grooves in sensor 1 legs so that this screw could rotate freely within groove.



1 – position sensor; 2 – FLL bracket ; 3 – screw.

Figure 3.16.13 – Installation of FLL position sensor

2. Mount long lever of control mechanism 3 (figure 3.16.14) on axle 2, situated in holes of draft link unit 1, move control mechanism to sensor shaft end (point A in figure 3.16.14). Then turning by screwdriver shaft end of position sensor (or position sensor itself) by small angles match hole in shaft end of position sensor with hole in lever and fasten by cotter pin. Put harness connector 4 on sensor clamp. Set position sensor in such a way that screws 3 (figure 3.16.13) are in the middle of the grooves.



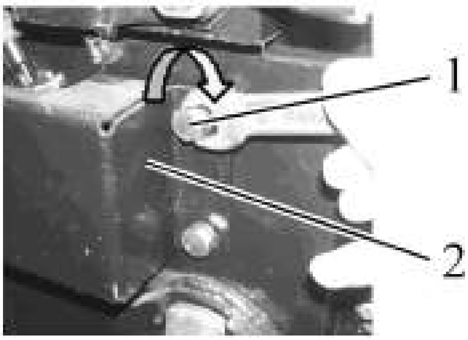
1 – draft link unit; 2 – axle; 3 –control mechanism lever; 4 – electric wiring harness connector of FLL control.

Figure 3.16.14 – Connection of control mechanism to FLL position sensor.

3. Start the engine. Lift up the handle 1 of lift linkage control (figure 3.16.5), when this happens annunciatior 2 of FLL uplift should shine redly. At the end of uplift the annunciator 2 should go out. In maximal raised position of FLL is allowed reflector zone value of cylinder rod between 1 and 10 mm. If at maximal raised position cylinder rods are extended for more than 10 mm, it is necessary to turn additionally the position sensor by small angle contraclockwise. If cylinder rods are fully retracted, but the annunciator 2 is lightening, turn the sensor clockwise. Repeat the operation ¨lowering/uplift¨. If the value of reflected zone of cylinder rod corresponds to above mentioned requirements, fix position sensor in adjusted position, turning against the stop screws 3(figure 3.16.13).

1 – handle to control lift linkage; 2 – annunciator of FLL uplift.
Figure 3.16.15 – FLL control panel

4. Check correct adjustment of position sensor by lifting and lowering of front lift linkage several times. Annunciator of uplifting should go out in extreme lifted-up position of FLL, cylinder rods are almost retracted (reflected zone value between 1 and 10 mm). After the end of control, place protective cap 2 (figure 3.16.16), turning four screws 1.



1 – screw; 2 – protective cap.

Figure 3.16.16 – Installation of protective cap on FLL position sensor

3.16.6 Electrical curcuit diagram of section distributor EHS control.

Electrical curcuit diagram of section distributor EHS control of tractors BELARUS-3522-5 (modifications with electronic joystick unit BOCORO and with electronic joystick unit EJU-1) is shown in figure 3.16.17.

The components list of electrical circuit diagram of section distributor EHS control, shown in figure 3.16.17, is given in table 3.3.

Table 3.3.

Pos. indication	Name	Q-ty	Note
	Connectors of the company “Deutz”		
XS2.1,XS2.2	Female reeptacle DT06-2SA	2	
XS12.1,XS12.2	Female reeptacle DT06-12SA	2	
	Connectors of the company AMP catalogue 889759		
XS2.3	Female receptacle 0-0282189-1	1	
XS4.1... XS4.4	Female receptacle 0-0282192-1	4	
XS4.5	Female receptacle 0-0282088-1	1	
XS6	Female receptacle 1-965640-1	1	
	Plug-and-jack of the company AMP		
XP7.1...XP7.3	Plug 0-1718230-1	3	
XS7.1...XS7.3	Cable receptacle 0-0967650-1	3	
A	Electromagnet 1 837 001 270 of drain section R917 000 841	1	
EHS1...EHS4	Distribution valve EHS-PWM R917 000b 145	4	
EJ1,EJ2	Joystick 4EJSWE-10/ST 03 5 BOCORO (08 352 076)	2	
EJ3	Electronic joystick unit EJU-1		
	TU BY 300044189.057-2009	1	
EJ3.1,EJ3.2	Joystick D-01 TU BY 300044189.057-2009	2	
P	Electronic unit BPO HLL TU BY 190431397.007-2006	1	

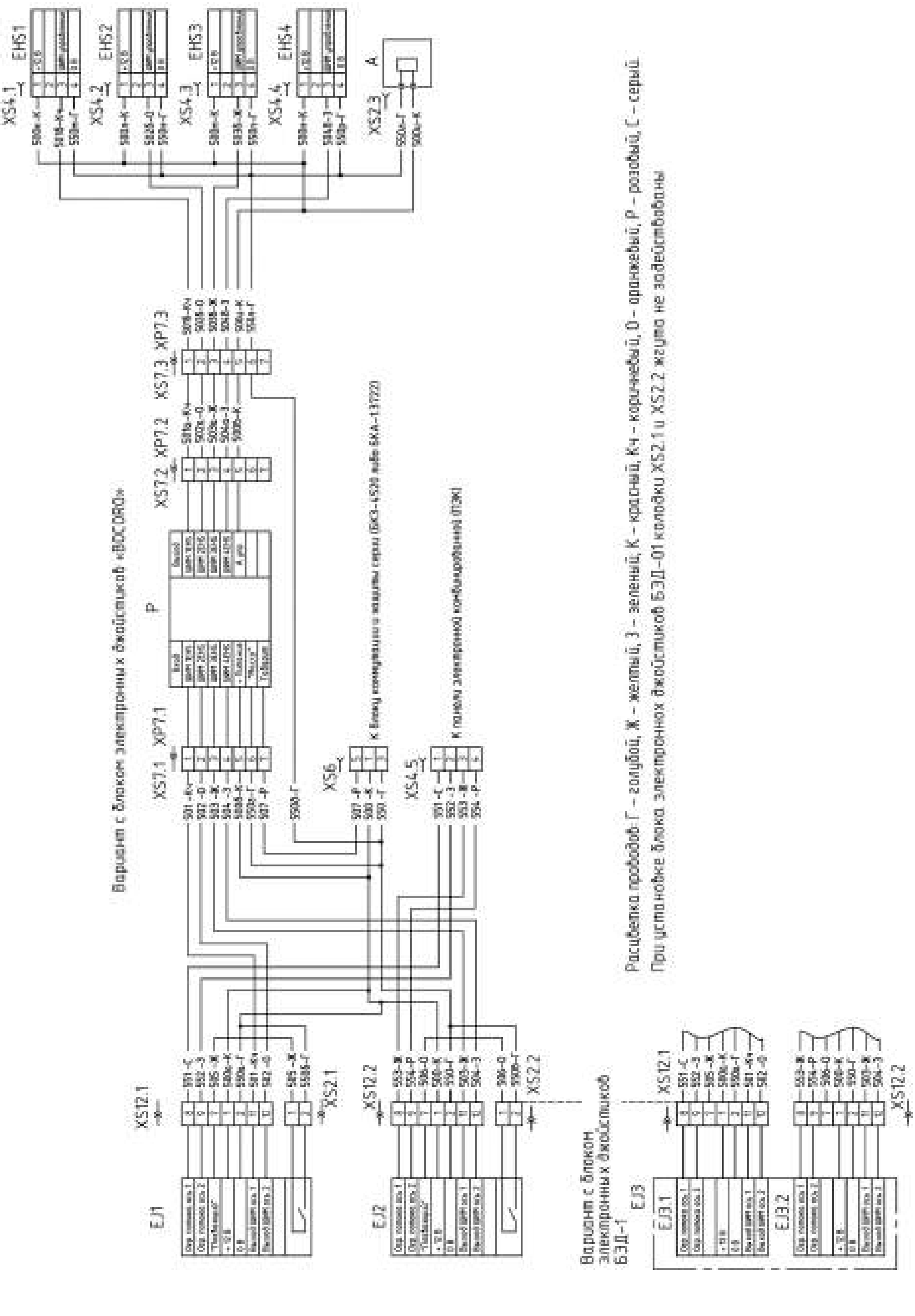


Figure 3.16.17 – **Electrical circuit diagram of section distributor EHS control**

3.17 Emergency conditions indication of hydraulic lift linkage and transmission hydraulic system.

At clogging of duplex filter used for oil clearing in transmission hydraulic system goes on sensor 3 (figure 3.17.1), on faceplate of CECS panel flashes on annunciatior 4. Annunciator 5 is standby annunciator. At clogging of HLL pump filter goes on multi-purpose sensor 1, on faceplate of CECS goes on (and then operates in steady light mode) annunciator 9. In case of clogging of any hydraulic system filter mentioned above, it is necessary to change corresponding filtering element.

The annunciator 4 and 9 can come into action for shot time because of cold oil in transmission and HLL, but it is not a failure.

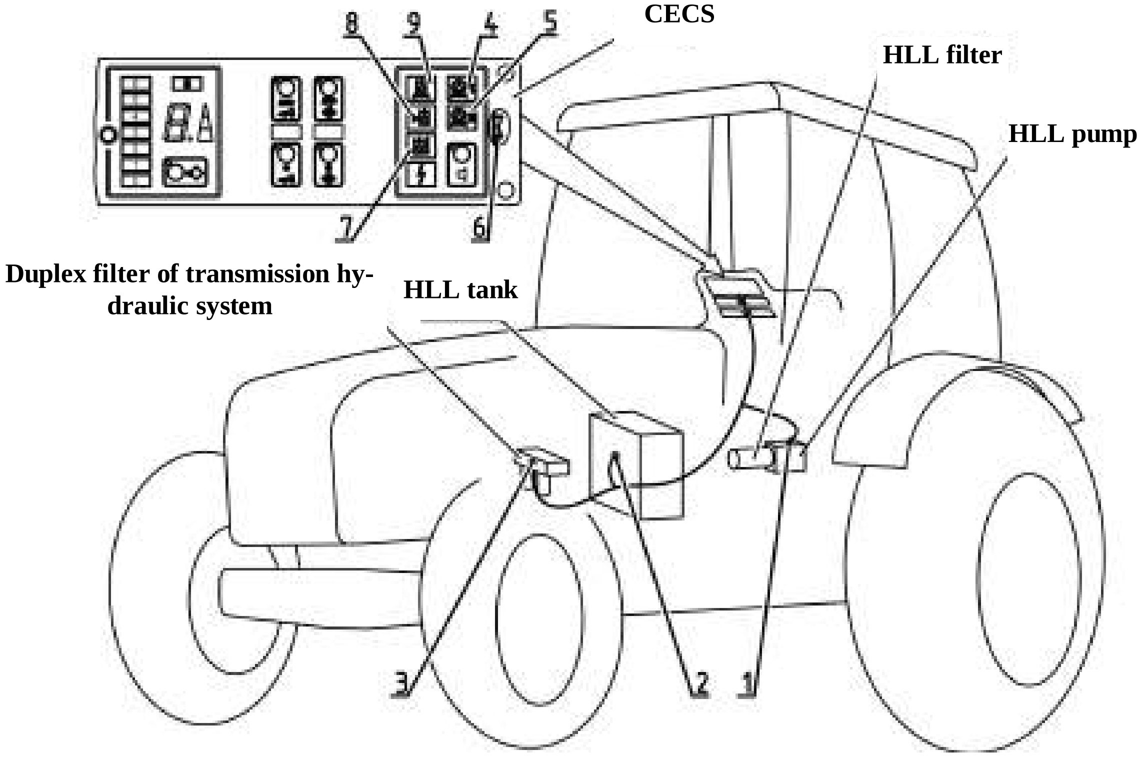
At emergency fall of oil level in HLL tank is active multi-purpose sensor 2, on faceplate of CECS lights up annunciator 8.

At oil overtemperature in HLL tank is active multi-purpose sensor 2 and on faceplate of CECS lights up annunciator 7.

At overtemperature of oil in HLL pump is active multi-purpose sensor 1 and on faceplate of CECS lights in flashing mode annunciator 9.

If appears any of abovementioned emergency modes, operation must be stopped, causes of emergency condition occurrence should be find out and removed in order to avoid failure and breakdown of hydraulic system assembly parts.

The regulations on the use of special switch "FAILURE" are described in section 4.5 "Actions in extreme conditions".

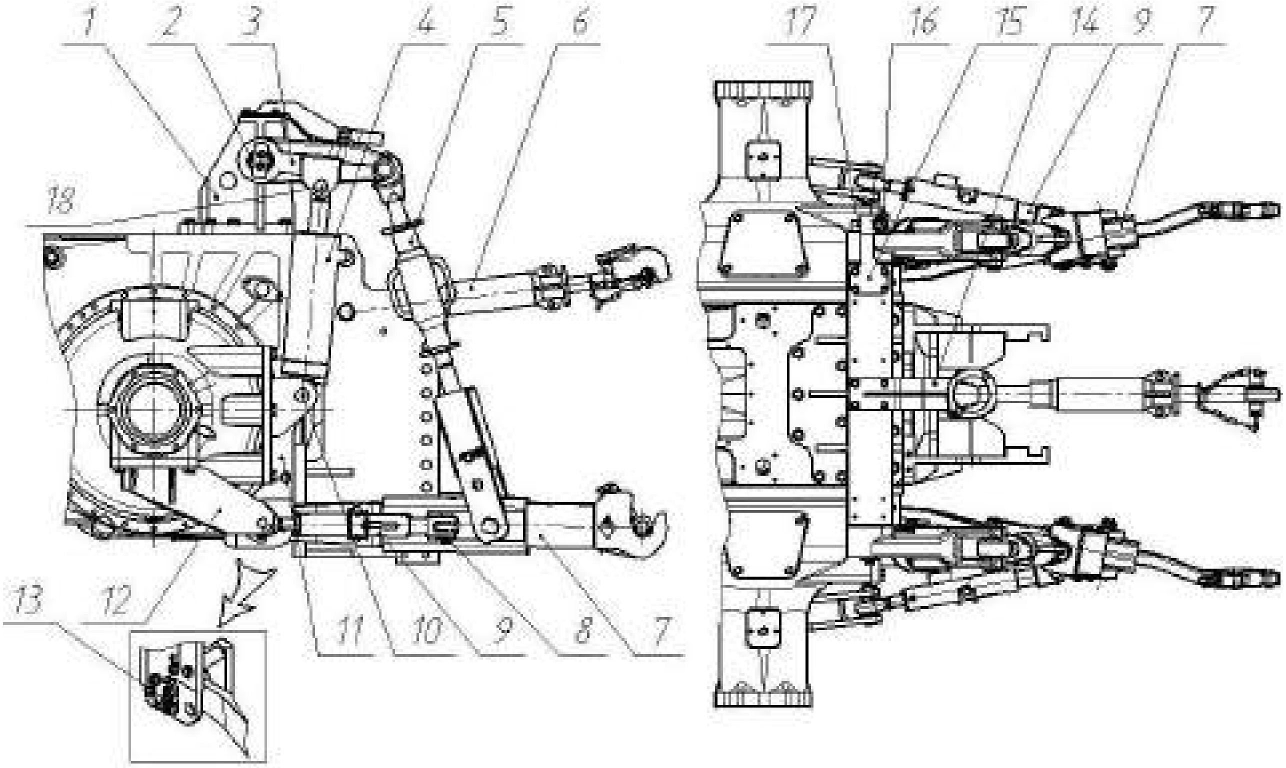


1 – multi-purpose sensor of HLL pump filter impurity and emergency oil temperature in HLL pump;; 2 – multi-purpose sensor of emergency fall of oil level and emergency oil temperature in HLL and HSC tank; 3 – impurity sensor of duplex filter of transmission hydraulic system; 4 – annunciator of transmission duplex filter impurity; 5 – standby annunciator; 6 – switch "FAILURE" 7 – annunciator of emergency oil temperature in HLL tank; 8 – annunciatior of emergency fall of oil level in HLL in HSC tank 9 – annunciator of HLL pump filter impurity and emergency oil temperature in HLL pump.

Figure 3.17.1 – Emergency conditions indication of hydraulic lift linkage and transmission hydraulic system.

3.18 Rear Lift Linkage

3.18.1 General information



1 – bracket of turning shaft; 2 – turning shaft; 3 – lever (left and right by 1 pcs.); 4 – hydraulic cylinder (2pcs.); 5 – crossbeam (2pcs.); 6 – top link; 7 – draft link (left and right by 1 pcs.); 8 – eyelets (2pcs.); 9 –drawbar (2pcs.); 10 – pin (2pcs.); 11 – bracket of hydraulic cylinders and draft links(left and right by 1 pcs.); 12 – bracket of drawbar (left and right by 1 pcs.); 13 – power sensor(2pcs.); 14 – top link bracket; 15 –position sensor bracket; 16 – position sensor; 17 –cam disk; 18 –pin (2pcs.).

Figure 3.18.1 – Rear lift linkage

Rear lift linkage is used for coupling to the tractor of mounted and semi mounted agricultural implements. Implement machines are attached to the tractor in three points: to draft links pivots and to top link or with a help of automatic coupler.

On rear axle tubes are mounted brackets 11 (figures 3.18.1), on which with a help of pins 10 are mounted two hydraulic cylinders 4. Cylinder rods are connected with pins 3a with external levers 3 (left and right). External levers by spline openings are mounted on shaft 2 that is installed in bracket 1, which is mounted on top face of rear axle. The levers 3 are connected with draft links 7 trough drawbars 5.

The draft links are mounted by front pivots in bracket 11 (right and left) on special sensors of draft control 13. The brackets 11 are fixed on tubes and side faces of rear axle. On draft links 7 there are eyelets 8, on which are mounted drawbars 9 by its forked part with a help of pins. The drawbars ensure adjustment and locking of cross travel of draft links 7 in operating and transport positions. The position sensor 16 installed in bracket 15 ensure draft control and at the cost of the contact with cam disk 17, fixed on turning shaft 2 end face.

The top link 6 is fastened in bracket of drawbar hitch. In nonworking position the top link 6 is fixed in bracket 14.

3.18.2 Drawbar

The drawbar 9 (figure 3.18.1) is fixed by one end to eyelets 8 of draft links 7. The other end of drawbars with pivot is installed in brackets of drawbars 12. The brackets of drawbars 12 are fastened on the bottom part of rear axle tubes.

The drawbar consist of screw 1 (figure 3.18.2), of guide 2, sliding bar 4 and cotter key 3. The guide 2 has on side face an through groove and on plane face perpendicular to it onoter thorough groove.

The slide bar 4 has two through grooves in one plain.

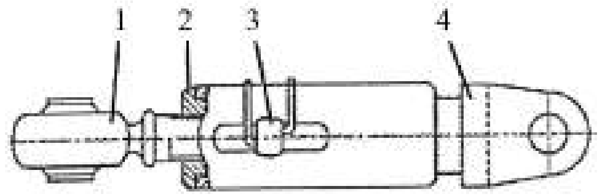
The drawbars have to been adjusted with agricultural machine mounted on rear ends of draft links, this machine should be put down on supporting surface.

The adjustment “drawbar locked” should be made in the following order:

- match the hole for cotter key 3 in guide 2 with hole in sliding bar 4;
- in case of mismatch turn guide 2 clockwise or contraclockwise till the holes are matched;
- put cotter key 3 in the hole and fix with spring clip.

The adjustment “drawbar unlocked” should be made in the following order:

- turn the guide by 90° and match groove on guide 2 with hole in sliding bar 4;
- turning the guide 2 place the hole in the sliding bar 4 on center of the groove (adjust the right and left drawbars);
-put cotter key 3 in the hole and fix with clip.



1 – screw; 2 –guide; 3 –cotter key; 4 – sliding bar.

Figure 3.18.2 – Drawbar

ATTENTION: IF THE TRACTOR WORKS WITH PLOUGH IT IS NECESSARY TO USE ADJUSTMENT “DRAWBAR UNLOCKED”, AT TRANSPORT OPERATION SHOULD BE USED ADJUSTMENT “DRAWBAR LOCKED”!

IT IS PROHIBIT TO USE DRAWBAR WITHOUT FIXATION OF SLIDING BAR BY COTTER KEY IN GUIDES.

3.18.3 Crossbeam

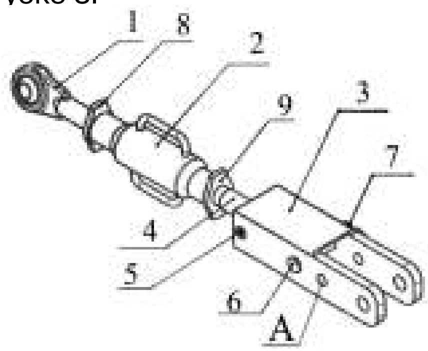
The crossbeam consists of screw with pivot 1, tube 2, yoke 3, screw 4, oiler 5, pin 6, splint pin 7 and locking nuts 8 and 9 (figure 3.18.3).

The adjustment of crossbeam length is made in the following order:

- turn off locking nuts 8 and 9;
- change crossbeam length turning tube 2 clockwise or contraclockwise;
- when crossbeam length is adjusted, locknut screw connections with locking nuts 8 and 9.

The adjustment of crossbeam is made in the following order:

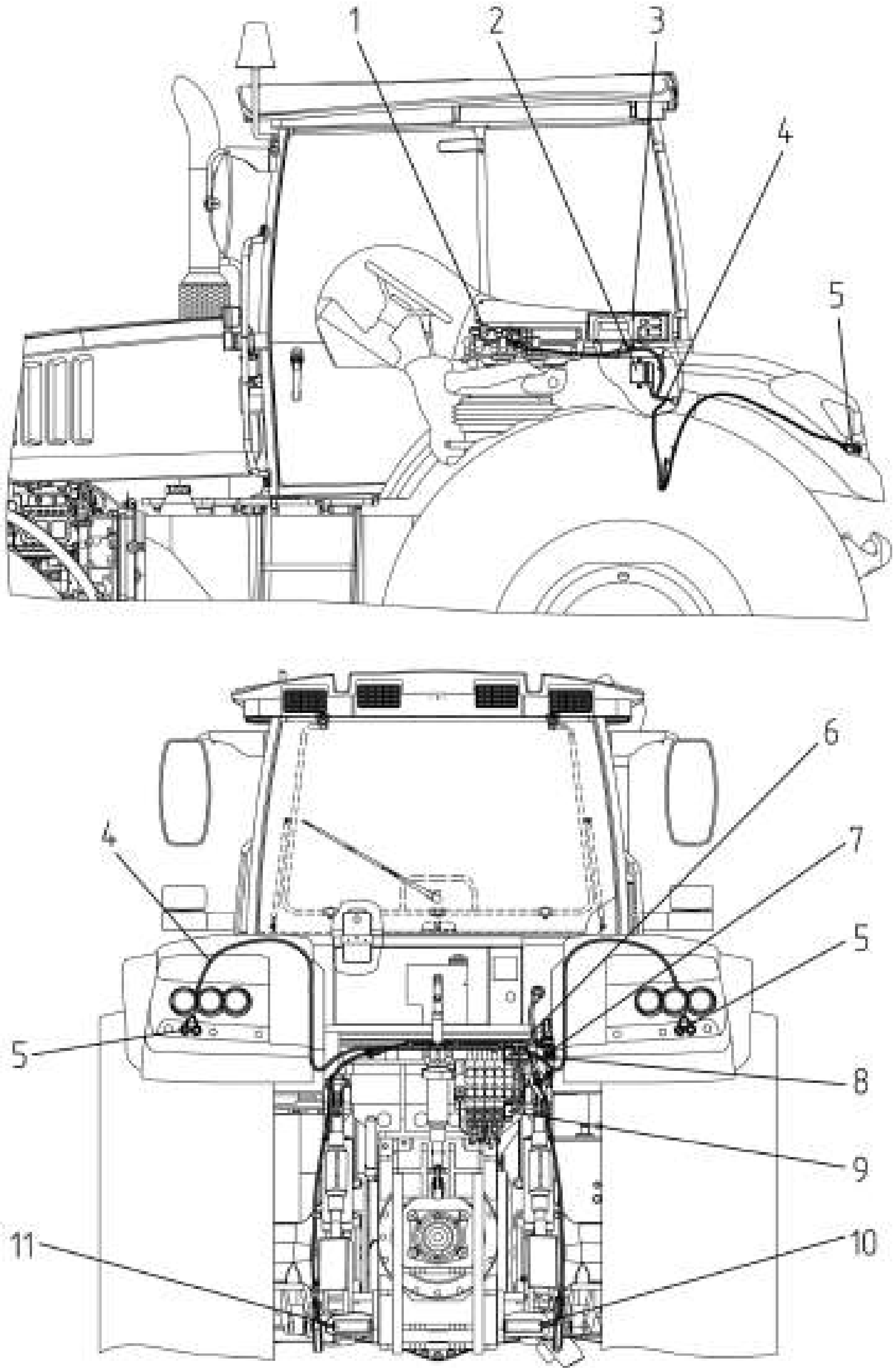
- for lift linkage operation with all machines and implements except wide-cut, fix screw 4 by pin 6 in yoke 3;
- for wide-cut agricultural implements pin 6 is moved in the hole “A” and is fixed by splint pin 7. The screw 4 can move free in yoke 3.



1 – screrw with pivot, 2 - tube, 3 - yoke, 4 - screw, 5 - oiler, 6 - pin,7 – splint pin, 8, 9 – locking nut.

Figure 3.18.3 – Crossbeam

3.19 Electronic control system of rear lift linkage



1 – RLL control unit; 2 – electronic control unit; 3 – safety device of RLL ECS in protection and switching unit (PASU); 4 –cabin harness; 5 – remote buttons; 6 – transmission harness; 7 – position sensor; 8 – electromagnet of lowering; 9 – electromagnet of uplift; 10 – right force sensor; 11 – left force sensor.

Figure 3.19.1 – Arrangement diagram of RLL electronic control system components

Electronic part of rear lift linkage control include the following components:
- RLL control unit 1 (figure 3.19.1);
- remote buttons 5 of RLL control;
- electronic control unit 2;
- force sensors 10 and 11 of rear lift linkage;
- RLL position sensor 7;
- electromagnetic valves of lowering 8 and uplift 9;
- connecting harness with electrical connectors 4 and 6;
- safety device of RLL ECS 3, situated in PASU.

Electronic part of rear lift linkage control operates in following order. After engine start supply voltage goes to electronic control unit 2 of RLL ECS. Electronic control unit inquire sensors, system controls and after analysis gives necessary commands to electromagnets of the regulator. The system is controlled either with a help of control unit 1 situated in the cabin or with a help of remote control buttons 5, situated on fenders of rear wheels.

According to position sensor the electronic control system identify the position of RLL relative to the tractor and at position control ensure keeping of mounting implement in the defined position relative to the tractor.

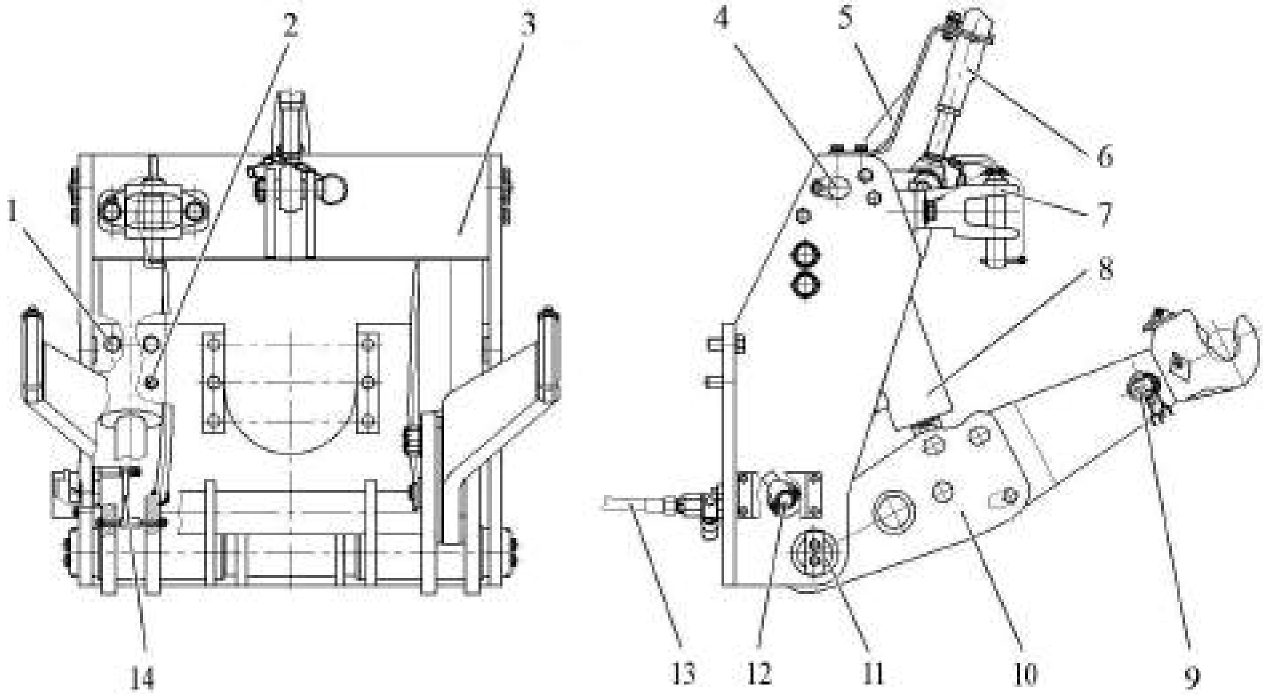
According to force sensors the RLL control electronic system determine the force applied during operation to lift linkage in horizontal axial direction from coupled implement. At draft control the tillage depth is kept in proportion to created resistance force of implement. Therefore at tillage e.g. in the mode of draft control, RLL ECS receiving signals from force sensors shallow up the implement of the tight soil and put the implement deeper in soft soil.

At combined control the RLL control electronic system take into account the signals from position and force sensors in proportion to the mode of control set by selector handle 2 (figure 2.14.1).

Note – The rules of RLL control are described in subsection 2.14 “Rear lift linkage control”. The electric circuit diagram of real lift linkage control is given in subsection 7.2. “Possible failures in the electronic control system of RLL and FLL guidelines for troubleshooting”.

3.20 Front lift linkage

3.20.1 General information



1 – screws (8pcs.); 2 – pin (2pcs.); 3 – bracket; 4 – pin (2pcs.); 5 –bracket; 6 – top link; 7 – буксир; 8-hydraulic cylinder (2pcs.); 9 –cotter key; 10 – draft links unit; 11 – shaft; 12 – position sensor; 13 – high-power hose; 14 –control mechanism.

Figure 3.20.1 – Front lift linkage

Front lift linkage is intended for operation of tractor coupled with multiple-purpose aggregates and serve for coupling to the tractor of agricultural mounted machines situated in the front of the tractor and also for installation of ballast weights.

The tractor with FLL is equipped with separate power-take-off, that is mounted on front plane of bracket 3 (figure 3.20.1).

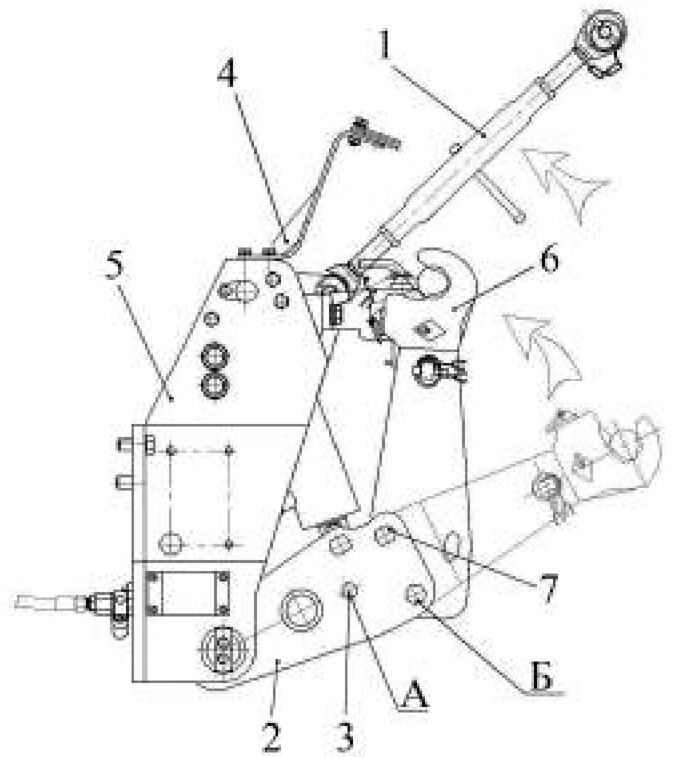
FLL is mounted on front plane of drawbar with a help of screws 1 and pins 2. The high-power hose 13 connects the integrated control unit EHS-5LS, situated under tractor cabin, with hydraulic cylinders 8 of lift linkage. The hydraulic cylinders 8 are fixed on the one side by pins 4 to the bracket 3, and on the other side are connected by rods with draft links unit 10, mounted on the shaft 11 at the bottom of the bracket 3. The position sensor 12 is connected through leverage (control mechanism 14) with draft links unit 10.

The top link 6 is connected by pin to the top of FLL bracket 3.

3.20.2 The rules of FLL shifting from operating position to transport position

The FLL shifting from operating position to transport position should be done in the following order:

- lift up the top link1 (figure 3.20.2) and fix in bracket 4 situated at the top of bracket 5;
- remove pins 3 from draft links unit 2 from the hole ¨A¨;
- turn the rods with clips 6 around the pin 7 till the holes ¨A¨in rotating ends of the rods are matched with holes ¨Б¨ in links unit;
- put in matched holes “Б” pin 3.



1 – top link; 2 – draft links unit; 3 – pin; 4 – bracket; 5 – bracket; 6 – rod; 7 – pin; 8 – plate.

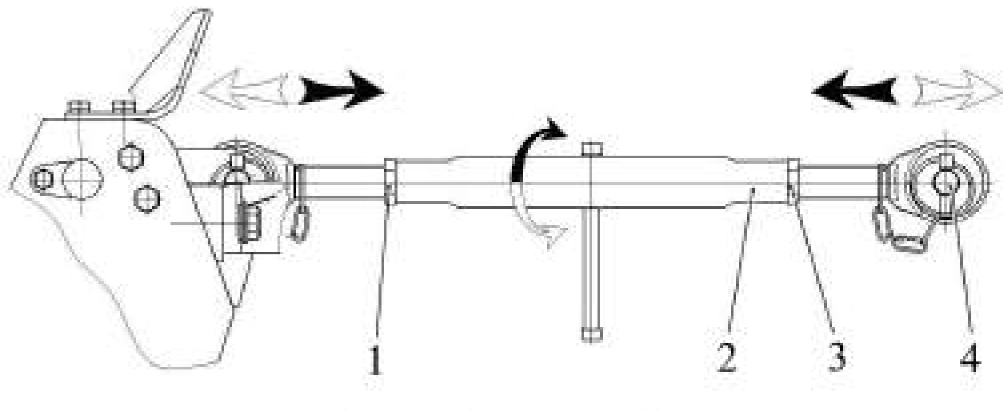
Figure 3.20.2 – FLL transport position

3.20.3 The rules to couple the agricultural machines with FLL

The coupling of agricultural machines with FLL is the same as for RLL.

The pivot joints of lift linkage draft links should be placed on lower axle of agricultural machine then drive slowly to the machine with max. lowered draft links clips till the jaw of the clip is situated under the pivot joints on axle of the machine. For coupling it is necessary to lift up front ends of rods until pivot joints are fixed in draft links clips. Install cotter key 9 (figure 3.20.1).

Attach top link 6 (figure 3.20.1) by pin 4 (figure 3.20.3) to the agricultural machine, lengthening or shortening at the same time screw parts with pivot joints, loose previously locking nuts 1 and 3. Further adjustment of machine operating position make with coupled machine at the expense of length change of top link 6 turning tube 2 (figure 3.20.3) with a help of handle. Tighten the locking nuts 1 and 3.



1 – tube; 2 – pin; 3, 4 – locking nut.

Figure 3.20.3 – FLL top link

3.21 Electronic control system of front lift linkage

The front lift linkage (FLL) is controlled by electrohydraulic system, the electronic part of which include control panel 4 (figure 3.21.1), electronic unit 5, position sensor 1, push-button switches 2, connecting harnesses 3 and 8, that connect among yourselves all system elements and transmit control signals to distributor electromagnets of uplifting 7 and lowering 6.

The system is controlled from control panel 4 (figure 3.21.1) similar to control of rear lift linkage with one difference, that in FLL control system are no force sensors, therefore there are no force and mixed control modes.

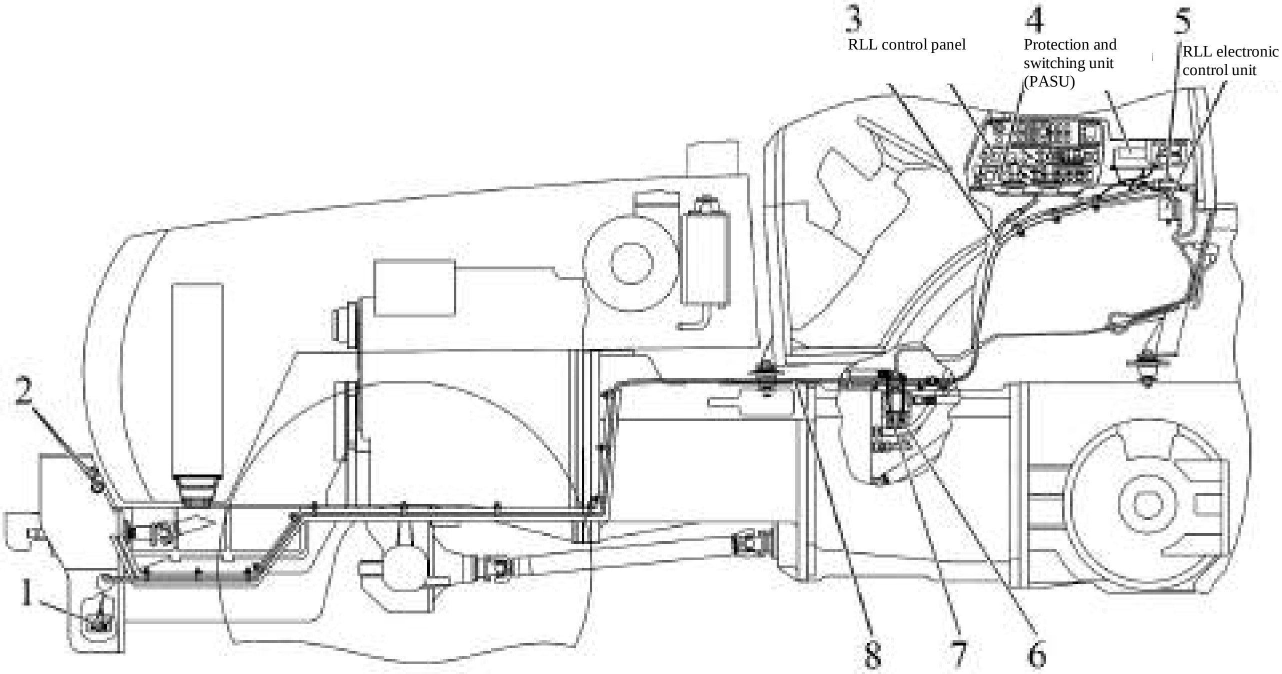
In FLL control system is installed position sensor 1 of rotating type. The adjustment of FLL position sensor is described in subsection 3.16.5 ¨ Hydraulic systemof FLL control ¨.

The other components of FLL control system – control panel, electronic unit, push-button switches are interchangeable with the corresponding components of RLL control system.

The electric circuit diagram of FLL electronic control system is shown in figure 3.21.2. The list of electric circuit diagram components of FLL electronic control system shown in figure 3.21.2 is given in the table 3.4.

The system is powered from protection and switching unit from connector X4 of PASU (figure 2.19.2) through connector XS6 (figure 3.21.2) of FLL ECS harness.

Note – The rules of FLL control are discribed in subsection 2.15 “Front lift linkage control”.



1 – position sensor; 2 – push-button switches; 3, 8 – connecting harnesses; 4 – control panel; 5 – electronic unit; 7 – electromagnet of uplifting; 6 – electromagnet of lowering.

Figure 3.21.1 – Front lift linkage control

Table 3.4 – The list of electric circuit diagramm connections of FLL ECS of the tractors BELARUS-3522.5

Pos. identif.	Name	Q-ty	Note
A1,A2	**Electromagnet of hydraulic distributor**		
	EHR4- 0 521 220 149	**2**	
M	**Control panel 0 538 201 611**	**1**	
P	**Electronic unit R 917 004 743**	**1**	
R1,R2	**Resistor С2-23-0.25-2,2kiloohm+10%ОЖО.467.104 TU**	**2**	
SB	**Position sensor 0 538 009 140**	**1**	
SA1...SA4	**Push-button switch 145 000 AB**	**4**	
	Female receptacles TC of the company AMP catalogue D/E-10 A 03/93		
XS2.1	**0-0282189-7**	**1**	**yellow, two-pin**
XS2.2	**0-0282189-1**	**1**	**black, two-pin**
XS3.1	**0-0282191-1**	**1**	**black, three-pin**
	Plug-and-jacks of the company AMP catalogue 889759		
XP10	**Male receptacle 1-0965423-1**	**1**	
XS10	**Female receptacle 1-0967240-1**	**1**	
	Connectors of the company AMP catalogue 6548110/98		
XS3.2…XS3.5	**Female receptacle 0-0282087-1**	**4**	
XS6	**Female receptacle 1-965640-1 of the company AMP catalogue 889759**	**1**	
XS17	**Cable receptacle C01610D0170021 of**		
	the company “Amphenol Tuchel” catalogue C16-1/C16-3	**1**	
XS25	**Cable receptacle 0-0827249-2**	**1**	

Note to the figure 3.21.2:

1. Voltages on sensor contacts SB relative to minus of electronic unit (terminal 15 on connector XS25), the other relative to the minus of power supply (terminal 1) of connector XS25.

2. Cable colours: Г - blue, Ж - yellow, З - green, К - red, Кч - brown, О - orange, Р - rose, С - grey, Ф - violet, Ч - black.

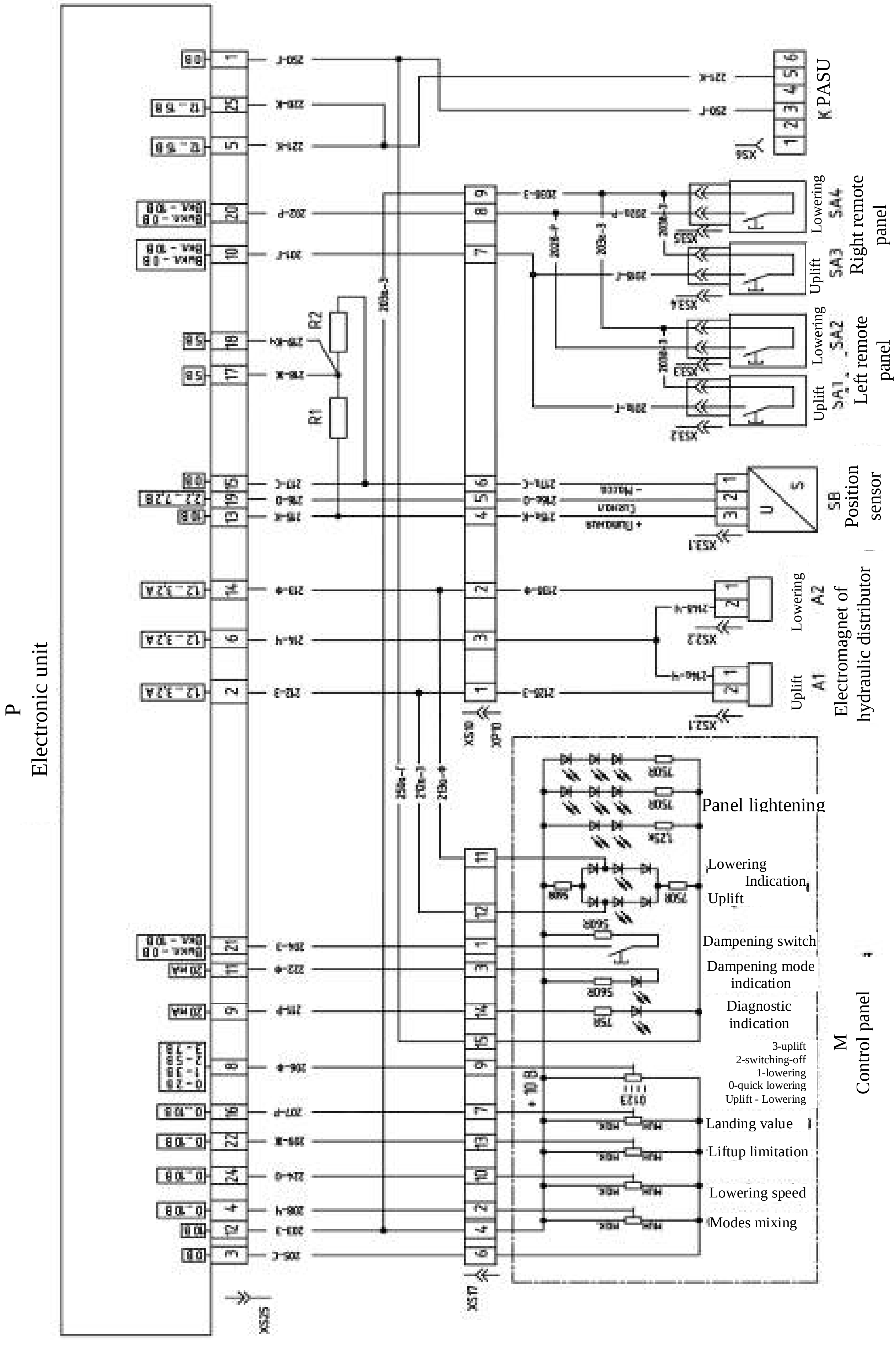
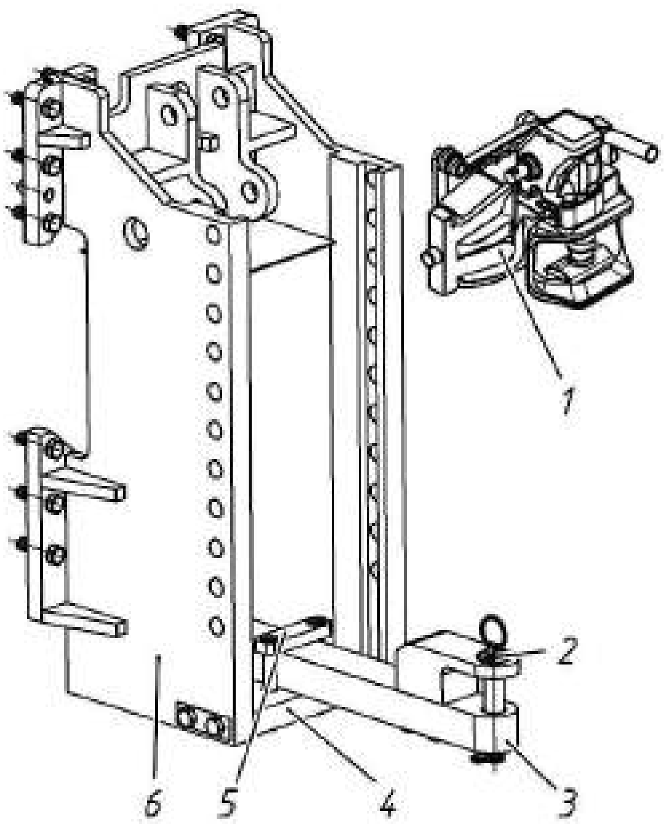


Figure 3.21.2 – Electric circuit diagram connections of FLL ECS of the tractors BELARUS-3522.5»

3.22 All-purpose drawbar hitch

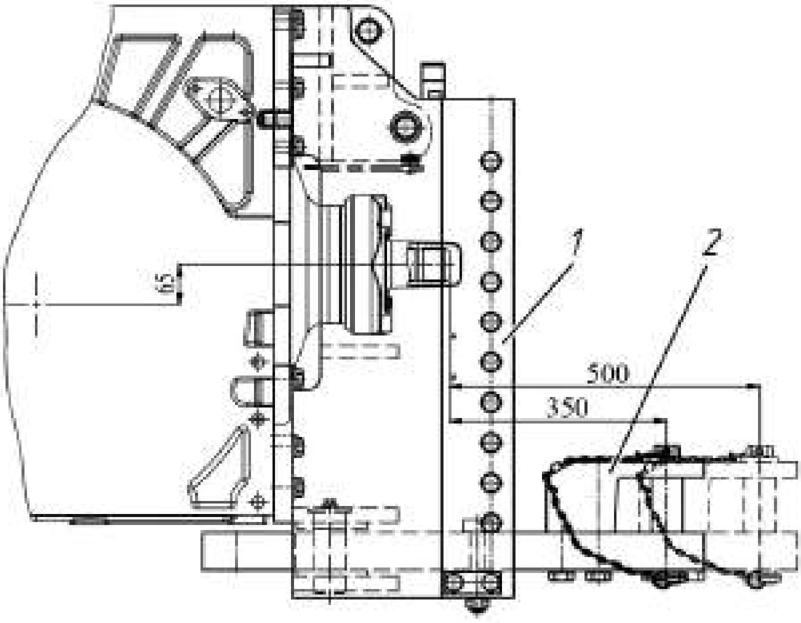
Drawbar hitch of lift type consist of bracket 6 with guides (figure 3.22.1) and of actuating devices: drawbar and towing yoke with coupling automation.
The drawbar is intended for operation with heavy mounted and semi-mounted machines. It consists of rod 3 and pivot 2 with splint pin. The front end of the rod is fixed in bracket 6 and its middle part leans against crossbeam 4, the rod 3 is fixed by clip 5 against axial movement on crossbeam.
The towing yoke 1 is intended for operation with heavy mounted and semi-mounted machines, trailers and semi-trailers. The yoke is mounted by means of own pins in guides of bracket 6, taking place useful for mounting of implements and corresponding to the height of trailer or semitrailer eye.



1 – towing yoke; 2 – pivot; 3 – rod; 4 – crossbeam; 5 – clip; 6 – bracket.

Figure 3.22.1 – All-purpose drawbar hitch

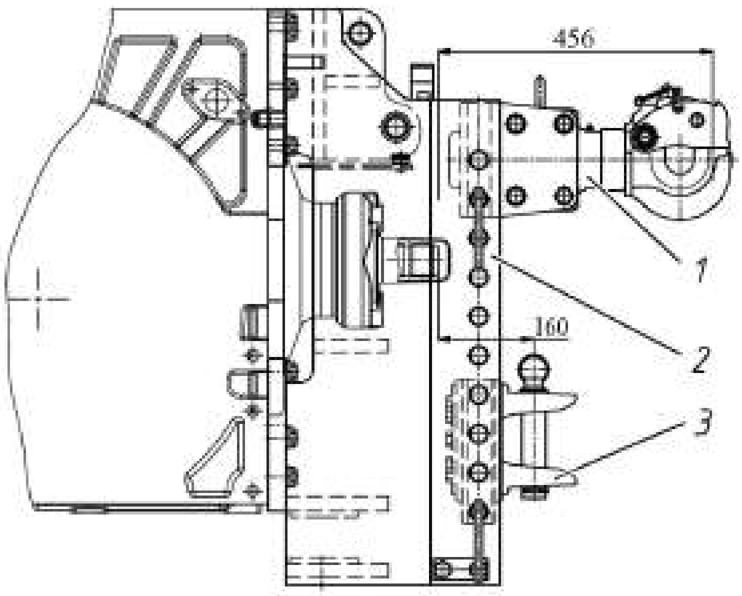
The drawbar has two variants of coupling points spacing at a distance of 350 mm and 500 mm from PTO end face, as shown in figure 3.22.2.



1 – DH bracket; 2 – drawbar.

Figure 3.22.2 – Variants of drawbar positions.

The extension of guide’s length in DH bracket ensures extension of installation zone of drawbar yoke vertically, as shown in figure 3.22.3.



1 – towing yoke; 2 – DH bracket.
Figure 3.22.3 – Installation zone of drawbar yoke vertically

Note – Detailed information about DH operating rules of drawbar hitch together with different types of coupled and transported implements is described in section 5 “Coupling of implements”.

3.23 Electrical equipment

3.23.1 General information

The electric circuit diagramm of tractors BELARUS-3522.5 is shown in annex D.

3.23.2 Operation principle of inlet air heater

The inlet air heater (IAH) is intended for air heating at inlet in compression chamber at start of cold engine.

The IAH is not active, if the temperature of the engine is more than +5°C.

Switching in of IAH occurs automatically when the starter switch key is shifted from position “0” (off) in position “I” (Instruments ON). Herewith on right side panel in integrated electronic panel (IEP) lights up indicator 10 of IAH operation (figure 2.9.1). The action period of IAH depend on engine temperature. The engine should be started after indicator 10 goes out. After engine start the inlet air heater is active for a shot time and then switches out automatically.

The motor control group control also IAH and its functioning. In case of fault beginning in IAH operation on information display appears corresponding message.

TRACTOR OPERATION IS FORBIDDEN TILL ALL FAILURES IN AIR INLET HEATER SYSTEM ARE FOUND AND CORRECTED, BECAUSE THE FAILURE CAN LEAD TO BURN-OUT OF HEATING ELEMENT OF IAH FLANGE AND TO BATTERY DISCHARGE!

3.23.3 Programming console of integrated indicator

3.23.3.1 Control panel of integrated indicator

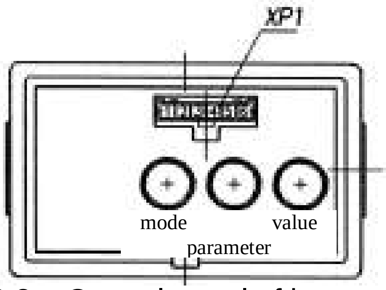


Figure 3.23.3 – Control panel of itegrated indicator

The control panel 16 (figure 2.1.1) makes it possible to perform the manual programming of the indicator by means of the “Parameter” and “Value” buttons (figure 3.23.3) and to change the mode of the parameters to be shown on the LCD.

The diagnostic connector **XP1** located on the front surface of the control panel makes it possible to perform the automatic programming (reprogramming) of the integrated indicator (II) by means of a special device (if provided). Should such an device be unavailable, the programming shall be performed by means of the abovementioned buttons. On the BELARUS-3522.5 tractors, the XP1 connector is not enabled.

3.23.3.2 Algorithm of Integrated Indicator programming

To choose a fixed value of a parameter of the Integrated Indicator programming the following shall be done:

- upon first pushing the button “Parameter” (figure 3.23.3) the multifunctional Indicator 17 (figure 2.7.1) transits into the mode of viewing a programmable parameter and its numeric value . Upon repeated pushings the button “Parameter” a cyclic change of parameters takes place;

- upon sequential pushing the button “Value” a change of a numeric value of the set programmable parameter takes place;
- the programming mode is exited automatically when the buttons “Parameter” and “Value” are not pushed within seven seconds.

When the programming mode is exited the last parameter values chosen with the button “Value” are stored.

To choose a nonfixed value of a parameter of the Integrated Indicator programming the following shall be done:

- with the button “Parameter” (figure 3.23.3)choose a parameter, the value of which is to be set;
- push the button “Mode” twice, after that on multi-functional indicator 17 (figure 2.17.1) the least significant digit of a numeric value will start flashing;
- the flashing digit of a parameter is changed by pushing the button “Value”;
- transit to the more significant digit is carried out by pushing the button “Parameter”;
- the mode of programming a nonfixed value of any parameter is exited by a double pressing the button “Mode”;
- after the given mode is exited (input of nonfixed parameter value) digits of the set parameter value stop flashing;

A newly entered value is set last in the list of parameter values permitted for programming.

Upon single pressing the button “Mode” in the programming mode entering an arbitrary value of a parameter is not possible.

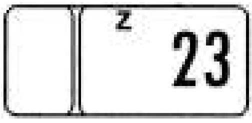
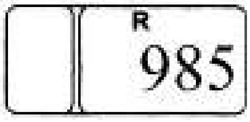
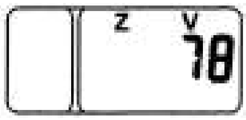
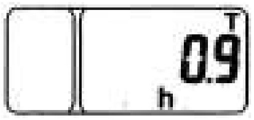
If the buttons “Mode”, “Parameter”, “Value” are not pressed within seven seconds in the mode of entering a nonfixed value, the Integrated Indicator transits into the main mode of multifunctional indicator storing the set parameter values.

It is allowed to enter one nonfixed value within the following range:

for “Z”parameter: from 23 to 69;
for “I”parameter: from 1.000 to 4.000;
for “R”parameter: from 400 to 1000;
for “KV2”parameter: from 0.346 to 0.600;
for “ZV”parameter: from 12 to 99;
for “V”parameter: from 0 to 1000.

List of programmable parameter values for tractors “BELARUS – 3522.5” (graphic samples of displaying parameters and their values on multi-functional indicator in the programming mode) is given in the table 3.5

Table 3.5 – List of programmable parameter values for tractors “BELARUS – 3522.5”

	Parameter «Z» Z – number of teeth of gears of final shafts of driving wheels (left and right), above which speed sensors are mounted.
	Parameter «I» I –is a step-up index of wheel-hub drive ratio.
	Parameter «R» R – is a rear wheel rolling radius, mm. In case of reprogramming this parameter may change with resolution of 5 mm. [1)]
	Parameter «KV2» KV2 – is a PTO ratio. [2)]
	Parameter «ZV» ZV – is a number of teeth of a washer of PTO speed sensor
----	Parameter «V» V – is a fuel tank volume, l [3)]
	Also upon pressing the button “Parameter” in the programming mode, an independent parameter “T” of the revised content of the counter of total apparent time of engine operation is displayed in the list of programmable parameters. This parameter is not available for alteration, it represents a precise value (up to 1/10 of an hour) of engine operation time.

[1)] “985” is a value for tyres 710/70R42. If other types of tyres are mounted it is necessary to set a value of the parameter “R”, corresponding to the rolling radius of the tyres mounted.

[2)] On tractors “BELARUS – 3522.5” rear PTO speed is calculated basing on the signal from PTO speed sensor. In this connection in parameter “KV2” is set any value except figure “000”

[3)] 355 l –metallic fuel tank volume;
550 l – plastic fuel tank volume.

During operation, it is permitted to vary the values of the parameter “wheel rolling radius R”, which is determined on the basis of the tyres fitted on the tractor wheels by measuring the distance from the wheel centre to the bearing surface.

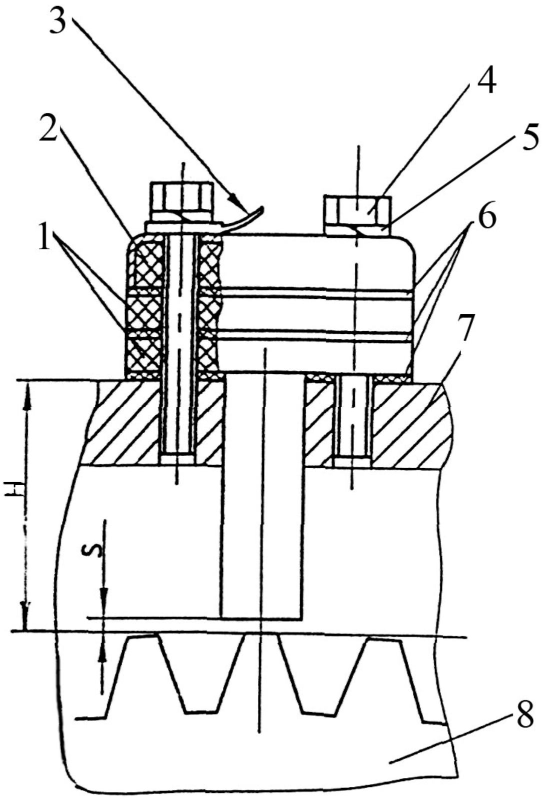
IT IS PROHIBITED TO VARY THE ENTERED VALUES OF THE OTHER PARAMETERS (FACTORY SETTINGS)!

3.23.4 Installation and adjustment of speed sensors and rear PTO RPM sensor

3.23.4.1 Speed sensor installation

For installation of speed sensor (either right or left) the following shall be done:

- put toothed disc 8 (figure 3.23.4) with tooth against the hole in semi axle tube 7;
- it is necessary to put necessary quantity of shim washers 6 according to the table 3.6 to ensure free play S;
- put “mass” wire 3 of the sensor 2 under any of screws 4;
- seal the screws 4 with sealing paste and tighten with the moment 10…15Nm.



1 – gasket; 2 – speed sensor; 3 –“mass” wire; 4 – screw M8; 5 – washer; 6 – shim washer in thickness of 1 mm; 7 – semi axle tube; 8 – toothed disc.

Figure 3.23.4 – Installation of speed sensor

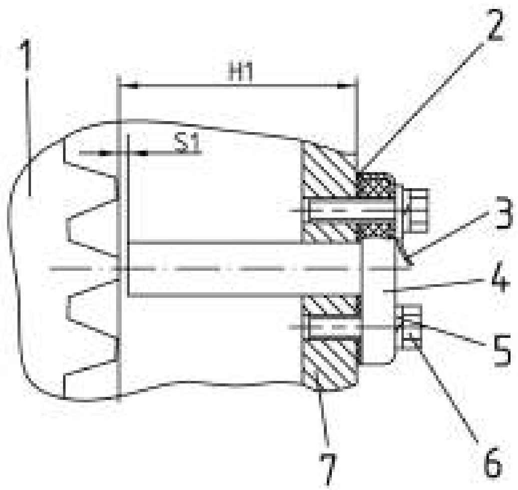
Table 3.6 – Speed sensor installation

H, mm	Q-ty of gaskets 6 (figure 3.23.4)	S, mm
53,5 – 54,8	3	1,5 – 2,8
54,9 – 55,8	2	1,9 – 2,8
55,9 – 56,5	1	1,9 – 2,8

3.23.4.2 Installation of rear PTO RPM sensor

For installation of rear PTO RPM sensor the following shall be done:

- put follower gear of PTO1 reduction unit (figure 3.23.5) with a tooth against the hole in rear axle housing 7;
- it is necessary to measure length H1 and to put necessary quantity of shim washers 2 according to the table 3.7 to ensure free play S1;
- put “mass” wire 3 of the sensor 4 under any of screws 6;
- seal the screws 6 with sealing paste and tighten with moment 10…15 Nm.



1 – follower gear of PTO reduction unit; 2 – shim washer in thickness of 1mm; 3 – ¨mass¨ wire; 4 – PTO RPM sensor; 5 – washer; 6 – screw M8; 7 – rear axle housing.

Figure 3.23.5 – Installation of rear PTO RPM sensor

Table 3.7 – Installation of rear PTO RPM sensor

H1, mm	Q-ty of washers 2 (figure 3.23.5)	S1, мм
67,0 – 67,8	2	2 – 2,8
67,9 – 68,36	1	1,9 – 2,36

3.24 Cab air conditioning and heating system

The cab air conditioning and heating system is intended for development and keeping of normal microclimate in the tractor cab. The air conditioning system consists of two circuits – heating and cooling. The system diagram is shown in figure 3.24.1.

The cooling circuit include compressor, condenser, filter-drain with pressure sensor, monobloque of evaporator and of heater radiator (heater/cooler), heater/cooler fan, connecting hoses with quick-couplings set, electric cables, air filters, regulator of cold air and fan switch. The heating circuit is amended by horses, connected with engine cooling system of the tractor and with shut-off valve.

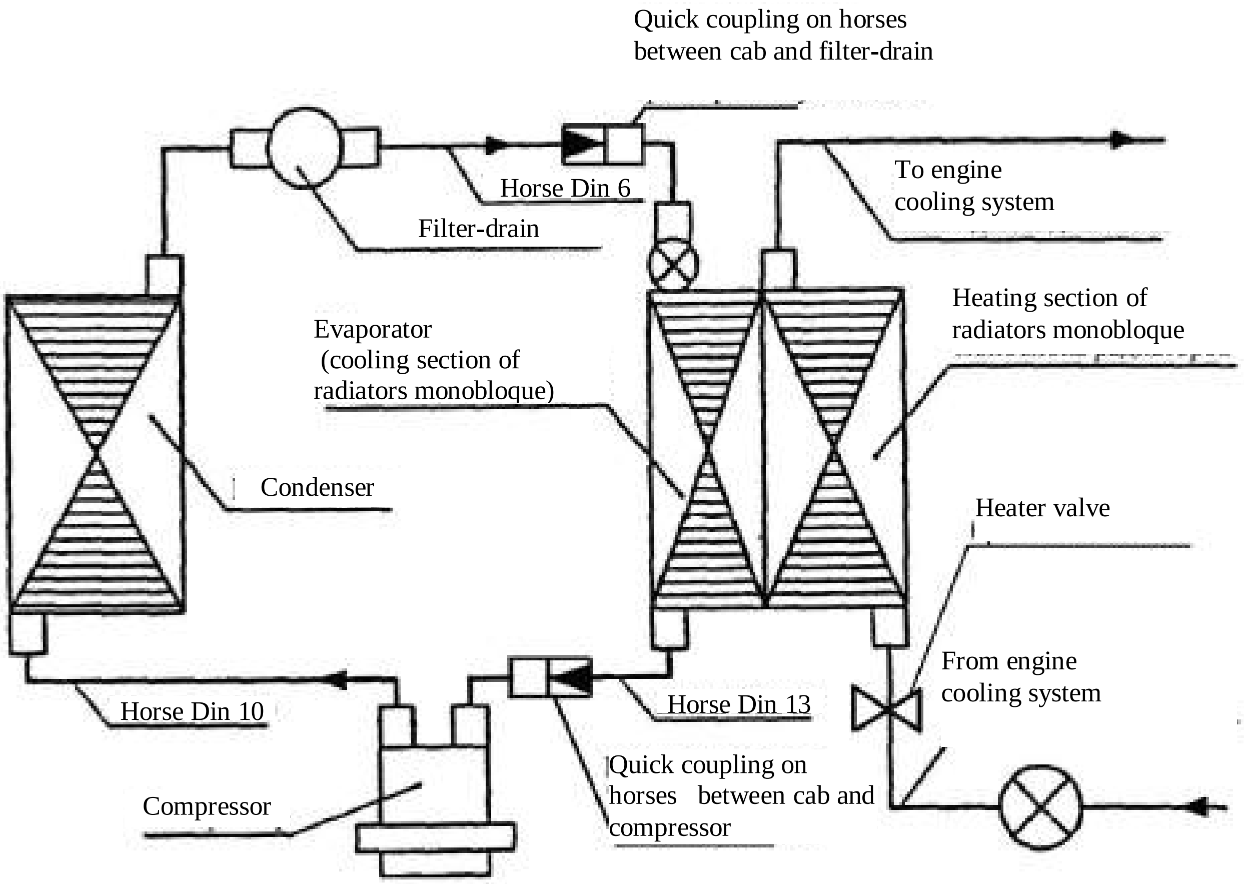
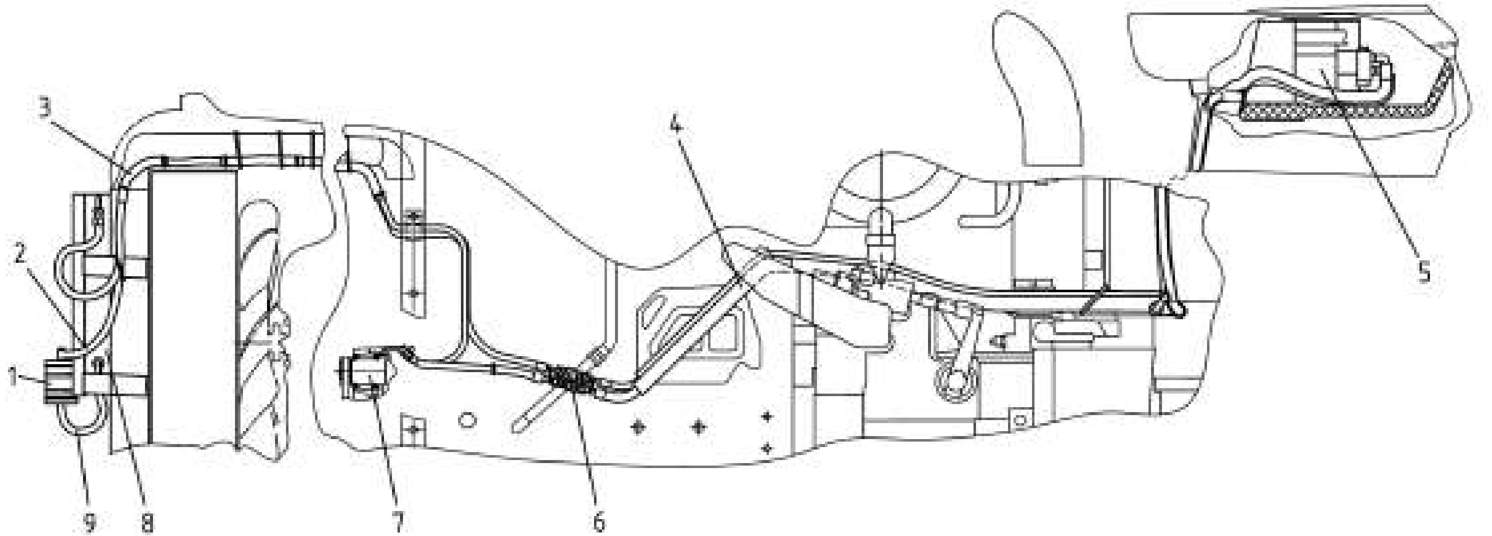
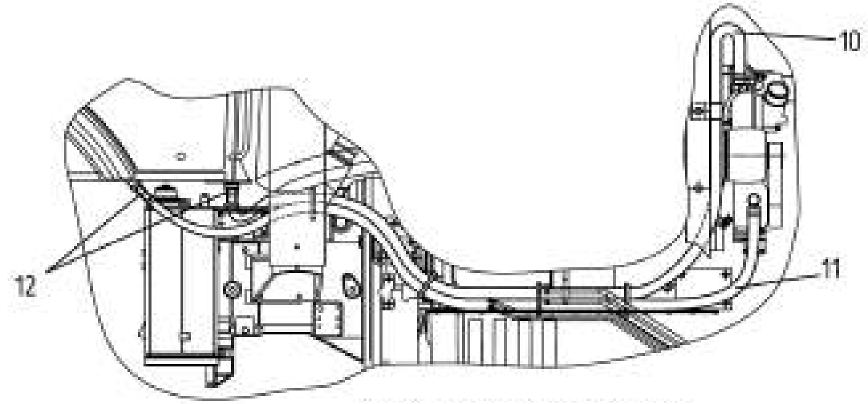


Figure 3.24.1 – Cab air conditioning and heating system

The compressor 7 (figure 3.24.2) is located on the left at the bottom part of the engine, condenser 8 is in front of CAC radiator, filter-drain 1 is on condenser frame, pressure sensor is on filter-drain 1, heater-cooler 5 is under the roof above ventilation box panel, regulator of cold air and fan switch is located on upper box panel , service valves are on fittings near to the compressor 7 and filter-drain 1.



a) View from the left along the tractor movement



b) View from the left along the tractor movement

1 – filter-drain; 2 – coolant supply line from filter drain to heater/cooler; 3 – coolant supply line from compressor to condenser; 4 – coolant supply line from heater/cooler to compressor ; 5 – heater/cooler; 6 – quick couplings; 7 – compressor; 8 – condenser; 9 –coolant supply line from condenser to filter-drain; 10 – coolant drain line from heater/cooler to engine cooling system; 11 –coolant supply line from engine cooling system to heater-cooler; 12 –reducing bushing.

Figure 3.24.2 –Configuration of main components of cab air conditioning and heating system

The climatic installation starts to operate in conditioning mode at operating engine, when by switch 1 (figure 2.4.1) are set required fan rpms and switch 2 is set in the beginning of blue color scale.

Thereat through control circuit goes power to electromagnetic clutch of compressor 7 (figure 3.24.2). The clutch engages and transmits rotation from engine crankshaft pulley to compressor shaft. The compressor pumps coolant through components of conditioning system. Herewith the coolant absorbs heat of air passing through heater/cooler 5, then give up heat in atmosphere through condenser 8.

The conditioning system can automatically keep the predetermined temperature, that is set by turn of switch 2 (figure 2.4.1), which controls thermostat. At clockwise turn the temperature falls and at contraclockwise turn the temperature rises. The protection against critical conditions is ensured by pressure sensor and by thermostat. The sensor switches off the system at excessive (more than 2,6+0,2MPa) or insufficient (less than 0,21±0,03 MPa) pressure. The thermostat switches off the system at excessive temperature fall in cooling section of radiators monobloque. The system capacity is adjusted by fan rpms and thermostat. The compressor 7 (figure 3.24.2) can operate in this case either constantly or cyclic.

Main parameters and technical data of cab air conditioning and heating system are given in the table 3.8.

Table 3.8

Parameter description (data)	Value
Cooling capacity, kW	6,4
Heating capacity, kW	8,7
Operating voltage, V	12
Electrical power consumption, W	260
Mechanical power consuption, kW	1,4 ... 8,0
Coolant	R134a, ozone friendly

At irregular operation it is recommended for keeping the air conditioning system in operating condition to switch on the system once in fifteen days in cooling mode (when the outside temperature is above +15°C) for time of 15…20 min.

Irrespective of operating conditions it is necessary to check once a year the air conditioning system operation in service station with a help of special equipment.

When the tractor is stored for a short time no preparatory works are needed for the conditioning system. During short-term storage it is necessary to switch on the conditioner once in fifteen days at operating engine for a time of 15…20 min. The air temperature in tractor cab should be not lower than +20°C.

When the tractor is stored for a long time it is necessary to check the air conditioning system operation with a help of special equipment. If it is necessary to top up the coolant. During storage no service works are made.

After long term storage it is necessary to make maintenance of conditioning system in specialized service station with use of diagnostic equipment.

3.25 Cab

3.25.1 General information

The cab of the tractors BELARUS-3522.5 ensure comfortable working conditions, heat and noise insulation, correspond to safety and observability requirements.

The cab has the following emergency exits:

- doors – left and right;
- rear screen;
- lateral screen – right and left.

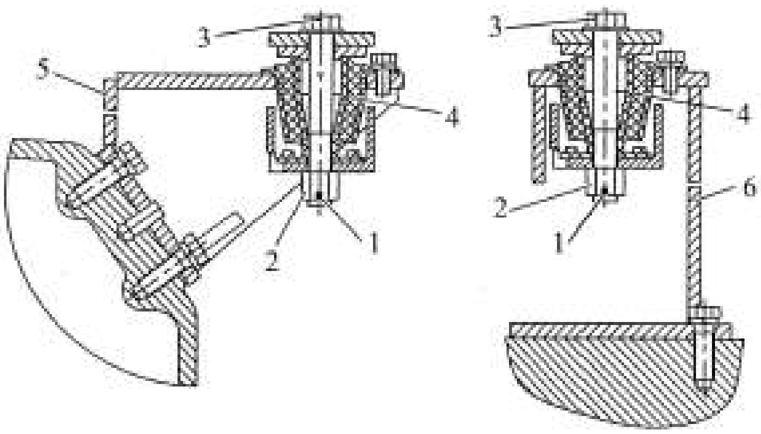
Natural ventilation of the cab is realized through opening side and rear glasses and through roof hatch. The cab glasses are safety and have bend form.

ATTENTION: DURING OPERATION AND REPAIR WORKS AVOID CAB GLASSES KNOCKS!

3.25.2 Cab installation

The cab is mounted on tractor frame through vibration isolators 4 (figure 3.25.1). In case of cab dismantling the following shall be done:

- unlock the splint pins 1;
- loosen the nuts 2;
- dismount bolts 3;
- take off the cab with a help of frame-craine with crane capacity not lower than 100 kg and using 3 eye screws M16, which are mounted on upper deck of the roof in points ¨A¨ (figure 3.25.2)



1 – splint pin ; 2 – nut; 3 – bolt, 4 – vibration isolator; 5 – bracket to fasten the cab with coupling clutch housing; 6 – bracket to fasten the cab with the rear axle shaft.

Figure 3.25.1 – Cab installation on vibration isolators

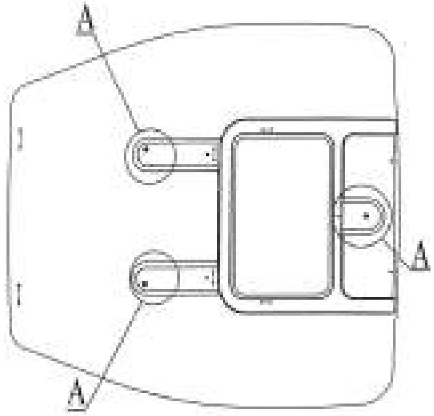


Figure 3.25.2 – Points of eye screws installation on the roof

3.25.3 Doors

The cab has one door opening backwards that make easier access to operators position. The door is hinged to the frame. The door in open position is fixed by pneumatic lifts.

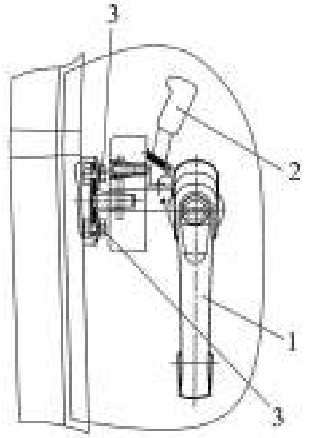
From the outside the left door comes unlocked by pressing the handle button 3 (figure 3.25.4). On the inside the door unlocks by shifting of lock handle 2 (figure 3.25.3). The lock of left and right door is blocked only from cab inside putting detent 1 (figure 3.25.4) in up position at closed door. From the outside the left door can be opened turning the key 2 by 180° and pushing the button 3. To lock left door from the outside it is necessary to turn the key by 180° in opposite direction.

To adjust the door positioning relative to door aperture the following shall be done:

- loosen bolts 1 (figure 3.25.5) fastening hinges 2 with cab frame supports, find necessary position of the door (between door contour and door aperture contour should be minimum positive allowance of 2 mm) tighten the bolts.

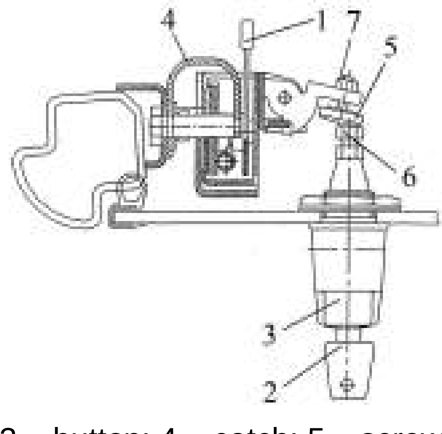
- adjust position of catch 4 (figure 3.25.4) loosen the bolts 3(figure 3.25.3), moving catch in vertical plane achieve optimal up/down position relative to the lock. In horizontal plane adjust door adjointing to the door aperture of cab frame (there should be no gaps between door weather strip and door apperture), after that tighten the bolts 3 (figure 3.25.3).

At turn of pusher 6 (figure 3.25.4) together with the key 2 by 180°(shift of door locking device in position “Open” or “Close”) no contact of pusher 6 with screw 5 head is allowed. The lock unlocking should be done only in position “Open”of door locking device by pushing the button 3 of the hand grip. In position “Close” of door locking device at pushing on button 3 no contact of hand grip parts with screw 5 head is allowed. Make adjustment with a help of screw 5, then screw 5 lock with nut 7.



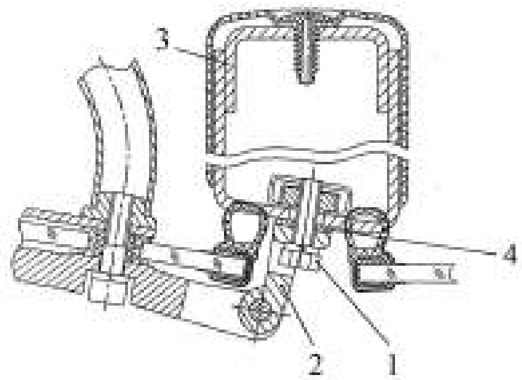
1 – hand grip; 2 – lever; 3 – bolt.

Figure 3.25.3 – Door locking device (view from outside the cab)



1 – detent; 2 – key; 3 – button; 4 – catch; 5 – screw; 6 – pusher; 7 – nut.

Figure 3.25.4 – Door locking device (view from above)



1 - bolt; 2 – hinge; 3 – center support of cab frame; 4 – plane.

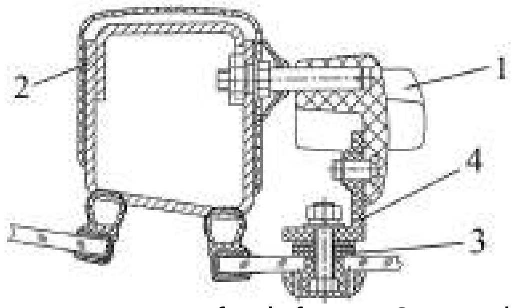
Figure 3.25.5 – Door fastening to cab frame

If necessary, the equal adjointing of the door to the door aperture can be achieved by installation of additional plates 4 (figure 3.25.5) between center support 3 of the cab and hinges 2.

3.25.4 Side windows

The side windows are opening, frameless windows, the windows are hinged to cab frame. The window in open and closed condition is fixed by handle 1 (figure 3.25.6).

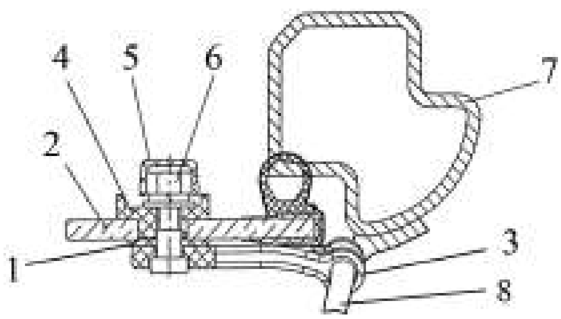
If necessary the equal adjointing of side window to the window apperture is ensured by installation of additional washers 3 between window and bracket 4 of window clamper.



1 – handle; 2 – center support of cab frame; 3 – washers; 4 – bracket.

Figure 3.25.6 – Fixation of side window

For side window position adjustment the following shall be done:
- take off cap 5 (figure 3.25.7);
- loosen the nut 6;
- turning eccentric bushing 4 find necessary window position (between side glass contour and window apperture contour should be minimum positive allowance of 2mm), tighten nut 6, put cap 5.
- for equal adjointing of side window to window apperture change quantity of washers 1, installed between glass 2 and hinge 3.



1 – washer; 2 – glass; 3 – hinge; 4 – eccentric bushing; 5 – cap; 6 – nut, 7 – rear support of cab frame; 8 – fixation pin.

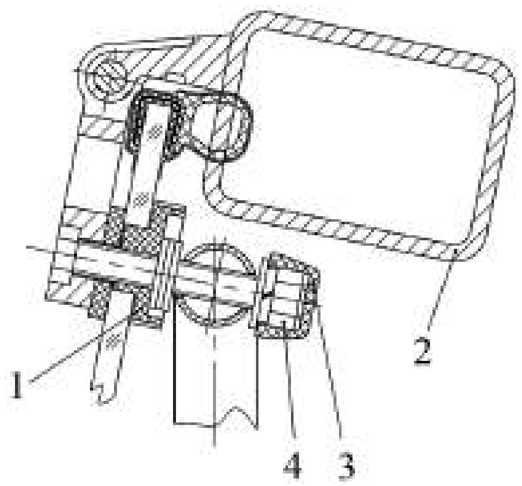
Figure 3.25.7 – Side window adjustment

3.25.5 Rear window

The rear window is opening window, which is hinged to cabin frame. The rear window in closed position is fixed by lock 1 (figure 3.25.9), in open position is fixed by two pneumatic lifts.

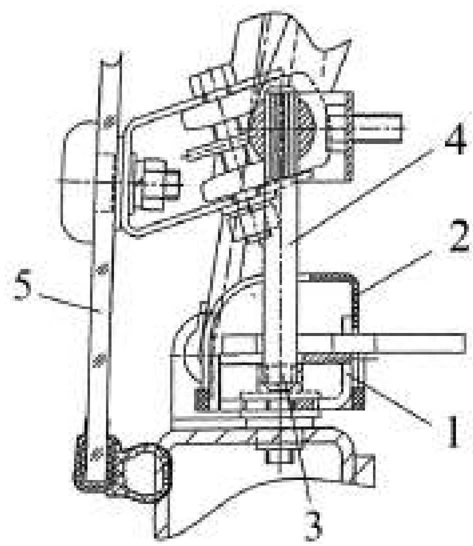
For rear window position adjustment the following shall be done:

- take off cap 3 (figure 3.25.8);
- loosen the nut 4;
- turning eccentric bushing 1 find necessary position of the window (between rear window contour and window apperture contour should be minimum positive allowance of 2 mm) thighten the nut 4, put the cap 3.
- adjust the position of lock 1 (figure 3.25.9) tacking off the cover 2, loosen the bolts 3, then moving lock in horizontal plane (in axial and cross directions) acieve optimal position relative to the pin 4, tighten the bolts 3, put cover 2.



1 – eccentric bushing; 2 – rear upper intermediate member; 3 – cap; 4 –nut.

Figure 3.25.8 – Rear window adjustment

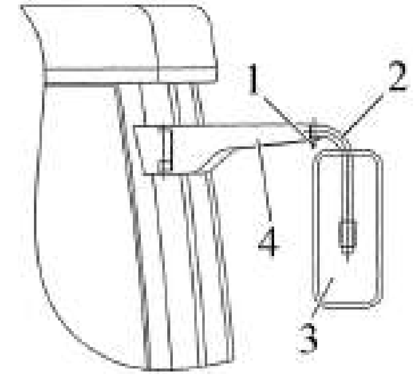


1 – lock; 2 – cover; 3 – bolt; 4 – pin; 5 – rear window.

Figure 3.25.9 – Rear window fixation

3.25.6 Outside mirror

For position adjustment of mirror 3 (figure 3.25.10) in horizontal plane it is necessary to loosen bolt 1, to put forward the tube 2 for necessary length and tighten bolt 1.



1 – bolt; 2 – tube; 3 – mirror; 4 – bracket.

Figure 3.25.10 – Mirror position adjustment in horizontal plane

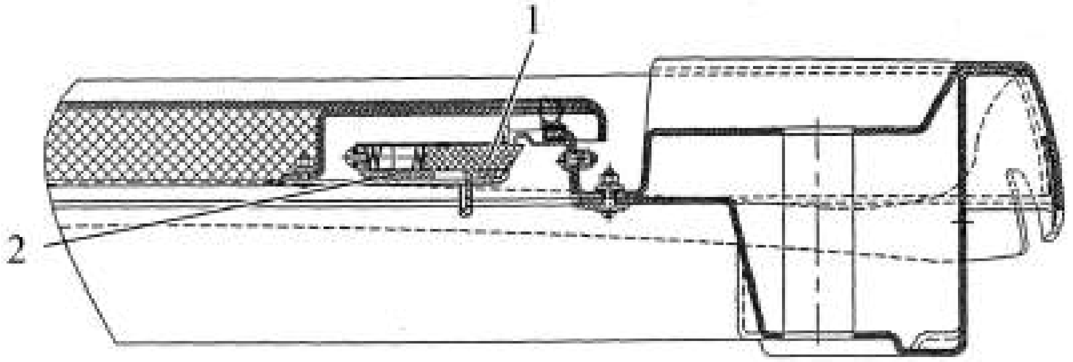
By turning bracket 4 (figure 3.25.10) is adjusted mirror 3 rotation angle in horizontal plane. Turning mirror body the other mirror positions can be achieved (left –right, down-up)

3.25.7 Roof with opening hatch

Tere are two modifications of the roof:

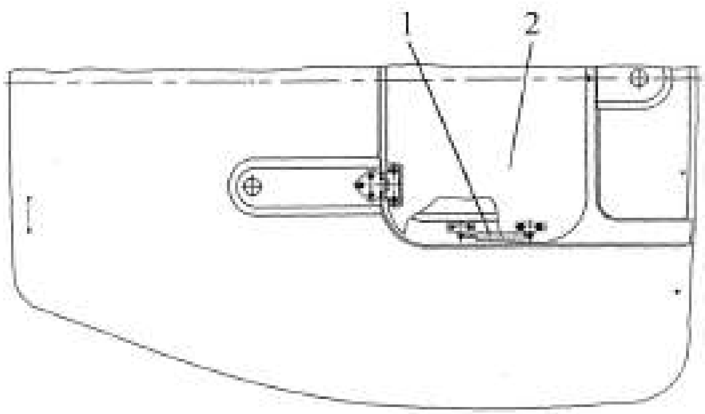
In first modification:

- the hatch in closed position is fixed with detent 1 (figure 3.25.11) of panel 2;
- the hatch in open position is fixed by pneumatic lifts 1 (figure 3.25.12).



1 – detent; 2 – panel.

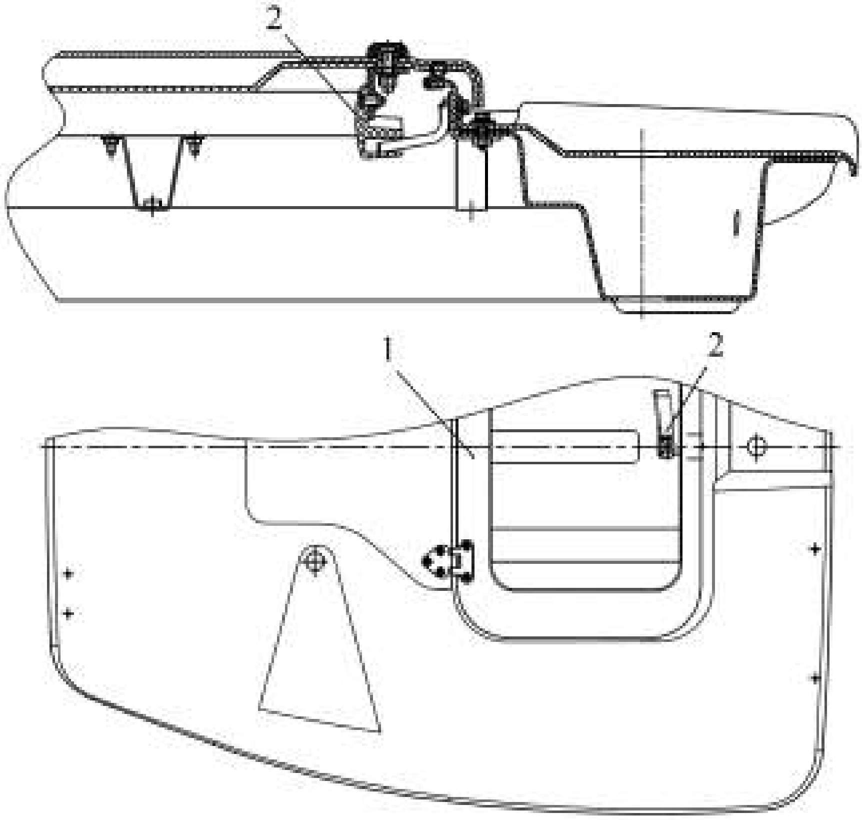
Figure 3.25.11 – Roof hatch fixation (first modification) in closed position



1 – pneumatic lift; 2 – hatch.

Figure 3.25.12 – Roof hatch fixation (first modification) in open position

In second modification the roof hatch is fixed in open and closed position with detent 2 (figure 3.25.13) mounted on hatch 1.

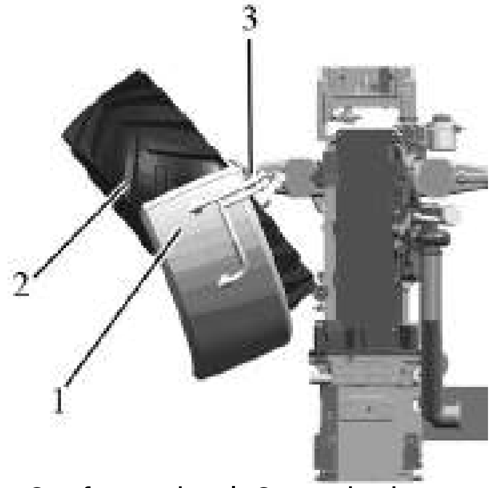


1 – hatch; 2 – detent;

Figure 3.25.13 – Roof hatch fixation (second modification) in open and closed position

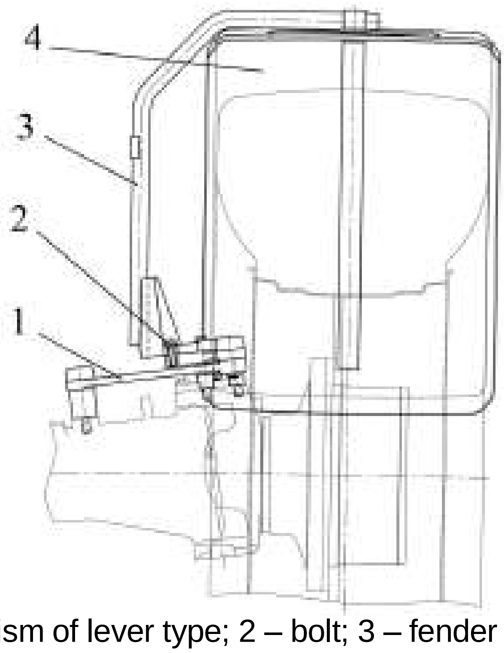
3.26 Front wheel fenders

On the tractors BELARUS are mounted front wheel fenders with swinging mechanism of lever type. This mechanism is intended for avoiding of contact between fender and tractor frame and for avoiding of fenders damage or their destruction as a result of such contact, this mechanism also allows not limit the turning angle of tractor wheels. The swinging mechanism of lever type 3 allows to decrease turning angle of fenders 1 relative to the turning angle of front wheels 2, as shown in figure 3.26.1.



1 – front wheel fender; 2 – front wheel; 3 – swinging mechanism of lever type.

Figure 3.26.1 – Operating principle of swinging mechanism of lever



1 – swinging mechanism of lever type; 2 – bolt; 3 – fender post; 4 – fender.

Figure 3.26.2 – Disassambling diagram of front whells fenders

At doubling of front wheels in order to avoid fender 4 damage and occurance of emergency situation it is necessary to remove post 3 (figure 3.26.2) together with fenders 4 of front wheels, loosen four bolts 2. After removal of posts 3 to avoid dirtying of treated holes build in bolts 2. At installation of fenders 4 back the bolts 2 should be tighten with moment between 67 and 85 Nm.

TRACTOR OPERATION WITH DOUBLED FRONT WHEELS IS FORBIDDEN IF FRONT WHEEL FENDERS ARE NOT DISMOUNTED.

IT IS FORBIDDEN TO USE FRONT WHEEL FENDERS AS SUPPORTING POINT!

3.27 Construction features of tractor BELARUS 3522.5 with non installed FLL and FPTO

On tractor BELARUS 3522.5 the FLL and FPTO can not be mounted against order. In this case in tractor cab instead of control panel of FLL 36 (figure 2.2.1) is placed a plug. The control elements2, 3, 32, 33, 34 of FPTO (figure 2.13.4) situated on the CECS are not used, remote buttons of FLL control are absent .

The ballast weights are mounted on front bar.

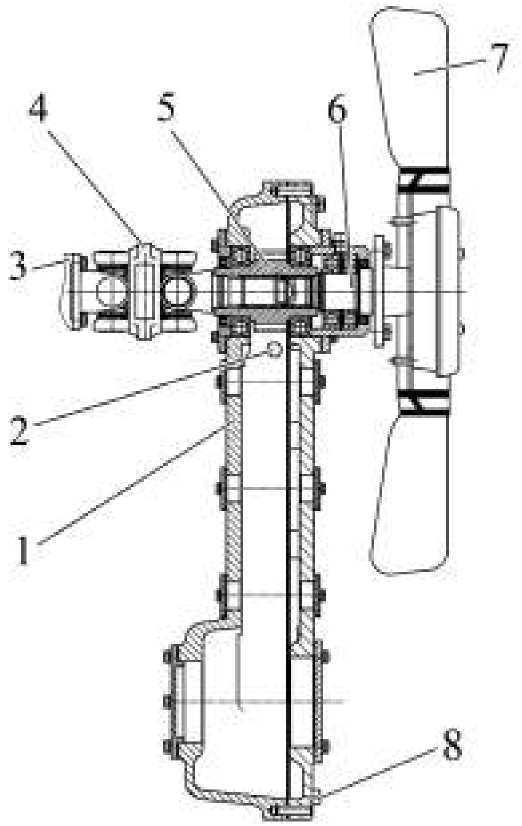
The fan 7 (figure 3.27.1) is driven from crank tailshaft through adaptor 3, through doubled pivot 4 with splane shaft, through gear-shaft 5, throught fan 6 drive shaft.

During operation the maintainance of fan drive is not necessary.

The fan drive is filled at production plant with oil ТАп-15В or ТЭп-15 GOST 23652-79 in the volume(6,9±0,1l).

If it’s become necessary to change oil in fan drive, the following shall be done:

- dismount fan drive housing 1 from the tractor;
- unscrew plug from the filling opening 2 and drain plug 8, drain oil;
- screw the drain plug 8;
- place fan drive housing 1 with filling opening 2 locking up and fill reduction unit with oil (6,9±0,1)l through filling opening 2;
- screw plug in filling opening 2;
- mount the fan drive housing 1 on the tractor;
- gear-shaft 5 should turn round without jammings.



1 – fan drive housing; 2 – filling opening; 3 – adaptor; 4 – doubled pivot; 5 – gear-shaft of fan drive; 6 – fan drive shaft; 7 – fan, 8 – drain plug.

Figure 3.27.1 – Dan drives on the tractors BELARUS-3522.5 without FLL and FPTO.

3.27 Marking of tractor components

3.27.1 Engine number and its parts
The engine number and its parts are indicated in operating manual of the engine.

3.27.2 Cab number
The metal plate with cab designation and cab number is fixed on the cab rear wall on the right under name plate with tractor number, as it is shown in figure 3.27.1.

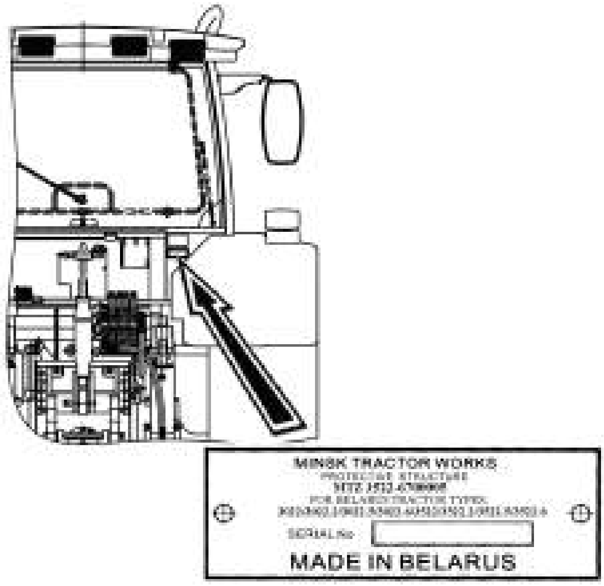


Figure 3.27.1 – Location of cab marking plate

3.27.3 Front driving axle number
The FDA number is stamped on FDA tube as shown in figure 3.27.2.

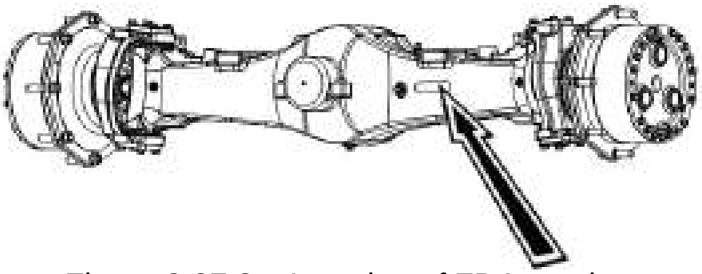


Figure 3.27.2 – Location of FDA number

3.27.4 Clutch housing number
Location of CC housing number is shown in figure 3.27.3

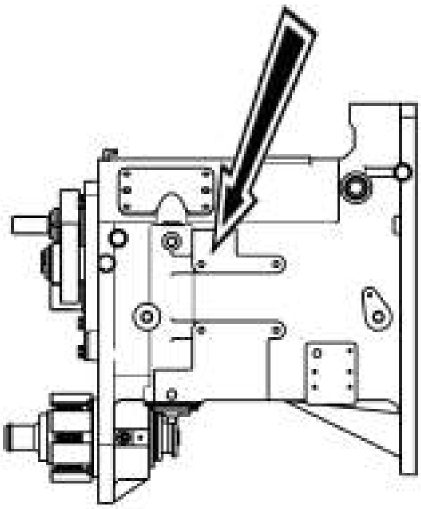


Figure 3.27.3 – Location of CC housing number

3.27.5 Gear box number
Location of gear box number is shown in figure 3.27.4.

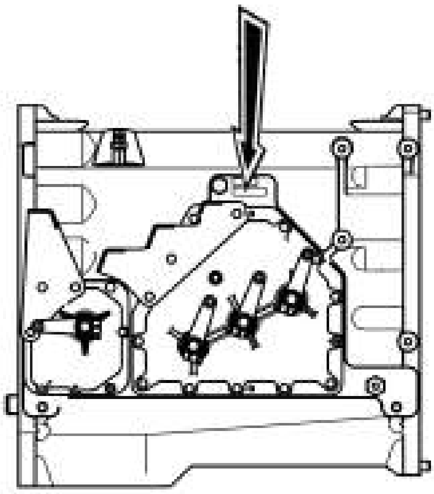


Figure 3.27.4 – Location of CC housing number

3.27.6 Rear axle number
Location of rear axle number is shown in figure 3.27.5.

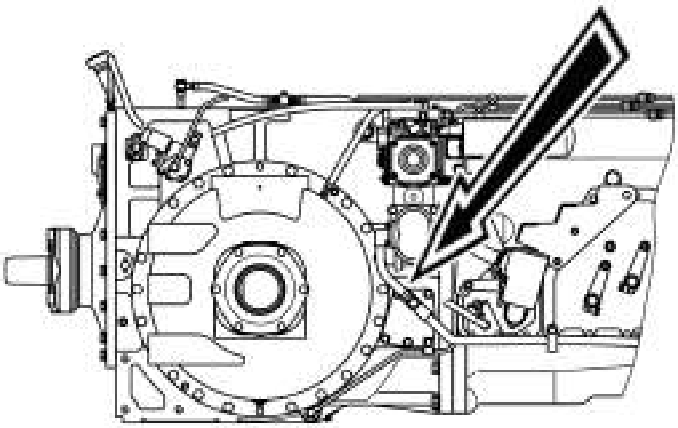


Figure 3.27.5 – Location of rear axle number

3.27.7 Transmission number
Location of transmission number is shown in figure 3.27.6.

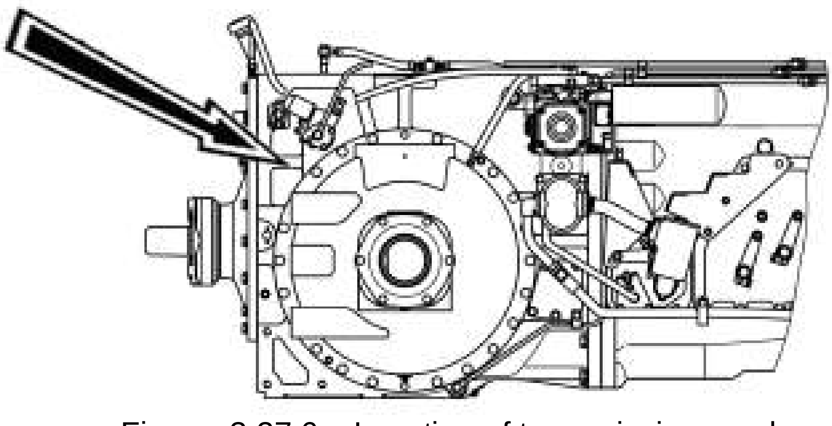


Figure 3.27.6 – Location of transmission number

4 Intended use of tractor

4.1. The instruction to be paid attention to before tractor operation

Please read carefully the following manual and operating manual of the engine before tractor use. Insufficient knowledge of tractor control and operation can be cause of the accidents.

The tractor operation without accumulator battery in the system of electrical equipment is not allowed.

The fuel tank should be filled with a fuel corresponding to the enviromental temperature. The AdBlue tank (urea tank) should be filled with reagent AdBlue.

4.2 Tractor use

4.2.1 Boarding the tractor

The tractor is boarded through the cab left door. To make tractor boarding easier there is a foot step.

4.2.2 Preparing for start and starting the engine

To start the engine of “BELARUS-3522.5” tractor carry out the following actions:

- engage tractor parking brake;
- if required, fill in fuel and bleed the fuel delivery system to remove air;
- set the fuel feed control handle into position, corresponding to a min. supply of fuel to the engine;
- make sure that the electronic pedal of fuel feed control is in its initial position and it is not affected by the physical influence. Do not press the fuel feed control pedal when starting the engine;
- set the GB range shifting lever 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”. Herewith:

1) On the integrated indicator both RPTO scale range annunciators as well as all RPTO scale segments will turn on for not more than one second, and the needles of speed and rpm indicators deviate from their initial positions (or the needles “shake” on indicator zero marks for not more than one second) – thus confirming workability of LED annunciators and needle indicators.

2) On CECS all LED annunciators and indicators light up for about two seconds, the digital indicator displays a figure “8”, the acoustic annunciator goes off – thus confirming workability of LED annunciators, indicators and of the acoustic annunciator. Then the LED indicators and annunciators, the digital indicator and the acoustic annunciator switch into the operating mode – the annunciators of zero gear (gear “0”), of FPTO disengagement and of RPTO disengagement remain on, the indicator of gear shifting mode displays a middle operating mode, and “0” digit is displayed on the digital indicator. All other LED annunciators as well as the acoustic annunciator go out.

3) On IEP all LED annunciators turn on for about two seconds and the acoustic annunciator goes off – thus confirming workability of LED and acoustic annunciators. Then the LED annunciators as well as the acoustic annunciator switch into the operating mode – only one of the annunciators of the electronic pedal of fuel feed control activation (on direct motion or on reverse) remains on as well as the annunciator of inlet air heater if the engine temperature is below plus 5°C, the acoustic annunciator goes out.

4) The information screen displays a company logo – thus confirming workability of the screen. Then in case there are no failures with EECS operation, the information screen functions in operation mode – it displays actually measured parameters of the engine. If failures are detected, the information screen produces an acoustic signal, and a flashing window in a rhombic form with an exclamatory mark emerges on the screen.

5) On the pilot lamp unit a pilot lamp of emergency oil pressure in HSC will light up. On the dashboard a signal lamp of oil emergency pressure in engine lubrication system (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 fuel in the tank is below min. acceptable level) light up. On the integrated indicator a pilot signal annunciator of engaged parking brake will turn on in a flashing mode with 1 Hz frequency.

- after the IAH annunciator goes out, start the engine, to do this it is required to depress the clutch pedal and turn the key of starter and instruments switch from “I” position into position “II” (engine start).
- hold the key of the starter switch turned until the engine is started, but not longer than 15…20 seconds; if the engine has not started, a repeated start-up shall be carried out not earlier than after one minute.

-after the engine is started check function of all signal lamps and gauge indications (coolant temperature, oil pressure in the engine and gearbox, 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 dashboard, on CECS, on IEP and the information screen. On RLL and FLL control panels the annunciators of testing electronic systems controlling RLL and FLL, light up respectively, thus indicating of the workability and of blocking of the FLL and RLL control systems.

IT IS FORBIDDEN TO OPERATE THE TRACTOR IN CLOSED ROOMS WITHOUT A 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 CONTROL GAUGES ONLY WHEN STAYING IN THE OPERATOR'S SEAT!

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

ATTENTION: WHEN THE TRACTOR IS STARTED THERE SHOULD BE NO PEOPLE UNDER IT, IN FRONT OR BEHIND AS WELL AS BETWEEN THE TRACTOR AND THE IMPLEMENT!

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

4.2.3 Tractor motion start, GB shifting

ATTENTION: YOUR TRACTOR IS EQUIPPED WITH TURBOCHARGED ENGINE. HIGH SPEED OF THE TURBOCHARGER REQUIRES GOOD LUBRICATION AT ENGINE START. AFTER ENGINE START FOR THE FIRST TIME AND AFTER LONG PRESERVATION LET THE ENGINE OPERATE 2…3 MIN AT IDLE, BEFORE LOAD IT!

TRACTOR OPERATION IS FORBIDDEN, IF AT OPEATING ENGINE THE ENGINE EMERGENCY OIL PRESSURE LAMP SHINES, STOP THE ENGINE IMMEDIATELY!

Before movement start determine the necessary speed of the tractor movement. The speed diagram of the tractor BELARUS-3522.5 with base design tyres is given in instruction table on right glass in the cab and also in subsection 2.13.4. “Tractor velocity diagramm”.

To put the tractor in motion the following shall be done:

- reduce engine rpm speed;
- set the necessary mode, pushing the button of gear shifting mode selection. The mode set will be displayed on indicator of gear shifting mode;
- depress the clutch pedal;
- set the necessary GB range with a help of range selector lever according to the scheme on lever handle, setting prelimitary mode “breaking”. When the mode “breaking” is ON the digital indicalor displayes sympol “P”. After installation of desired range release a button of “breaking” mode switching on.
- set the necessary GB range with a help of josticks for gear shifting according to the instruction table situated near to the joystick. Herewith on digital indictor appers first number of engaged gear, then will be activated corresponding annunciator of gear engagement.
- disengage parking break, release slowly clutch pedal increasing at the same time fuel delivery. The tractor starts to move.

If you need to switch on the creeper, please follow the instructions given in the subsection 2.13.3 “Creeper control”.

IT IS FORBIDDEN TO START MOVEMENT WITH BIG TRACTION LOAD!

IT IS FORBIDDEN TRACTOR MOVEMENT WITH OPEN DOOR!

ATTENTION: AT TRACTOR STARTING MAKE SURE THAT THE PARKING BREAK IS DISENGAGED!

ATTENTION: SWITCH ON THE RANGE ONLY AFTER ¨BREAKING¨ MODE OF GB SWITCHING ON! ВКЛЮЧАЙТЕ ДИАПАЗОН ТОЛЬКО ПОСЛЕ ВКЛЮЧЕНИЯ РЕЖИМА «ПОДТОРМАЖИВАНИЯ» КП! RANGE SWITCHING MAKE THROUGH NEUTRAL POSITION WITH SWITCHING ON OF THE GB ¨BREAKING¨ MODE!

ATTENTION: SETTING OF GB RANGE IN NEUTRAL POSITION MAKE AFTER GB SETTING ON GEAR ¨0¨!

ATTENTION: SWITCH ON THE RANGE ONLY AT STOPPED TRACTOR WITH FULLY DEPRESSED PEDAL CLUTCH! RANGE SWITCHING DURING TRACTOR MOVEMENT IS FORBIDDEN!

ATTENTION: IT IS ALLOWED TO ESCAPE THE CONDITION “GEARS DISENGAGED” (GEAR «0») ONLY WHEN CLUTCH PEDAL IS FULLY PRESSED AT FORWARD MOTION AND AT REVERSE MOTION AT FULLY PRESSED CLUTCH PEDAL OF REVERSE CONTROL POST!

ATTENTION: MAKE GEAR SHIFTING WITHIN ONE RANGE DURING TRACTOR MOVEMENT NOT PRESSING CLUTCH PEDAL!

ATTENTION: DON’T HOLD THE FOOD ON CLUTCH PEDAL DURING TRACTOR OPERATION, BECAUSE IT CAN LEAD TO CLUTCH SLIPPING, ITS OVERHEATING AND FAILURE!

ATTENTION: AT ENGAGED DIFFERENTIAL LOCK THE TRACTOR MOVEMENT SHOULD NOT EXCEED 13 KMH!

ATTENTION: AT OPERATION ON HARD SURFACE IT IS NECESSARY TO SWITCH OFF FDA DRIVE TO AVOID INCREASE WEAR OF FRONT WHEELS!

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

4.2.4 Tractor stop

To stop the tractor do the following:
- decrease engine speed;
- press fully pedal clutch;
- shift by gear shifting joystick of GB into gear “0” (gears disengaged) and set range switching lever in neutral position;
- release clutch pedal;
- stop the tractor with a help of food brake;
- engage parking brake.

ATTENTION: FOR TRACTOR EMERGENCY STOP PRESS SUDDEN CLUCH AND BREAKS PEDALS!

4.2.5 Engine stop

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

To stop the engine do the following:
- disengage RPTO and (or) FPTO;
- engage the rear axle differential lock, the FDA drive;
- turn off the operation programming unit of the HLL;
-shift the handles of the hydraulic distributor EHS control joysticks into a neutral position;
- set the handle to control the lift linkage into “disengaged” position;
- turn the conditioner off;
- 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”!

4.2.6 Getting off the tractor

Getting off the tractor is carried out through the cab left door, except for emergency situations. Rules on getting off the tractor at emergency situations are given in subsection 4.5.3 of section 4.5 “Emergency actions”.

Getting off the tractor, make sure that all actions, enumerated in subsection 4.2.5 “Engine stop” have been performed, lift linkages of the tractor and of coupled implements have been lowered. The parking brake shall be engaged.

4.2.7 PTO use

The rules of engagement and disengagement of front and rear power take off shafts are discribed in subsection 2.13.5 “Complex electronic control system”.

The rear power take off shaft operation is controlled by integrated indicator as described in subsection 2.7.2 “Assignement and operation principle of integrated inicator pointers”.

The rules of implements coupling with FPTO and RPTO with different types of agricultural machines and implements are described in section 5 “Coupling of implements”.

ATTENTION: AT FPTO AND RPTO OPERATION OBSERVE ALL SAFETY MEASURES OF PTO OPERATION, WHICH ARE LISTED IN THE FOLLOWING OPERATION MANUAL!

ATTENTION: POWER TAKE OFF THROUGH REAR PTO AT ECONOMY MODE SHOULD NOT EXCEED 110 kW!

To exclude impact loads engage rear PTO at engine speed close to minimum (between 1000 and 1100 rpm), then engine speed shoud be increased.

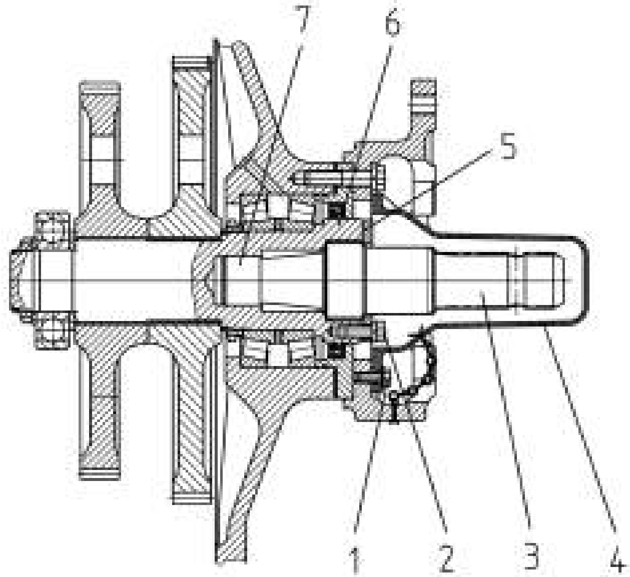
There are exchangeable shat end extensions of RPTO. One shaft end extension (type 3, 20 splines, ∅45mm) is mounted on the tractor, other shaft end extensions of RPTO are attached to the set of spare parts, tools and accessories (SPTA).

It is necessary to use correctly type of shaft end extension depending on power takeoff value on PTO shaft according to the instructions of section 5 “Coupling of implements”.

The RPTO modes (main mode and economy mode) should be switched only at nonrunning engine and switched off accumulator battery switch. Whererfore loose the fixing bolt and turn the shaft until the clutch is engaged, turning by hand PTO shaft end extension. After all this operations are done tighten the fixing bolt. To switch on the main mode it is necessary to turn the shaft clockwise and to switch on the economy mode it is necessary to turn the shaft contraclockwise. Detailed description of RPTO operation principle in main and economy modes is given in subsection 3.7. “Rear power take-off shaft”.

For operation with rear PTO, please take off protection cap 4 (figure 4.2.1.), that protect end shaft extension 3, therefore loosen two fixing bolts 1. After end of operation with RPTO do the following operations:

- take off cap 4, unscrew two bolts 1;
- unscrew six bolts 2 and remove washer 5;
- pull shaft end extension 3 from shaft housing 6.
- mount other shaft end extension into spline, having grease with grease lubricant center pilot 7;
- mount washer 5 and fix it by six bolts 2;
- put cap 4 of PTO, fix it with bolts1.



1, 2 – bolt; 3 – shaft end extension; 4 – protective cap; 5 – washer; 6 – shaft; 7 – center pilot.

Figure 4.2.1 – Cap removal and exchange of RPTO shaft end extension.

For operation with front PTO remove protective cap, therefore it is necessary to squeeze protective cap at the bottom, move down and pull. After ending operation with FPTO put obligatory protective cap into place, therefore it is necessary put the cap on shaft end extension and to press it lengthway till securely fixation of the cap in the aperture of the safeguard.

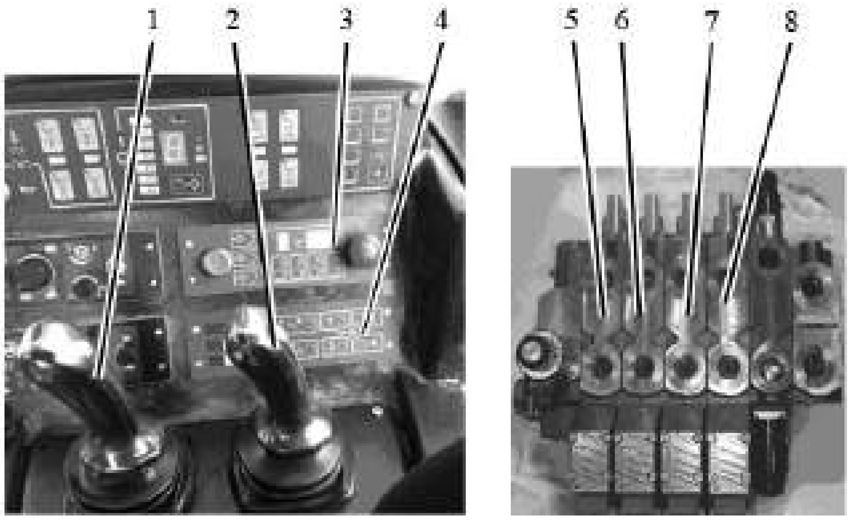
Detailed description of FPTO operation principle is given in subsection 3.8 “Front power takeoff shaft”.

4.2.8 Examples of programming operations in hydraulic distributor EHS section control

4.2.8.1 Elements to control and program the hydraulic distributor EHS sections

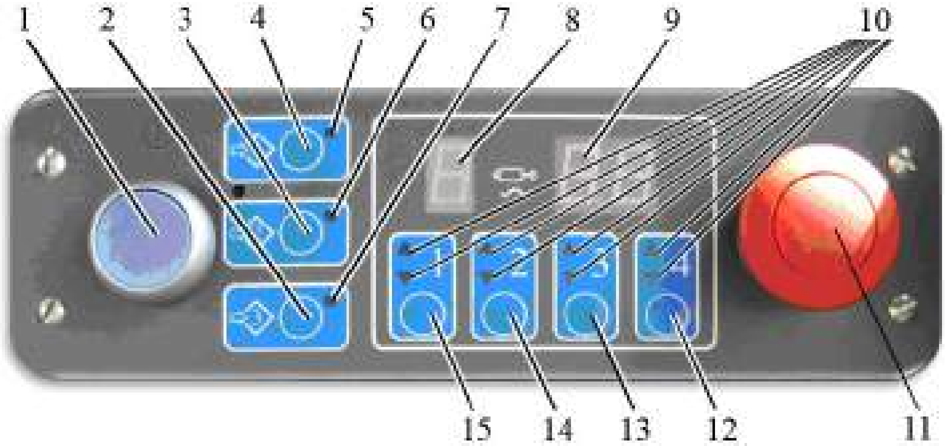
Elements to control and program the sections of the hydraulic distributor EHS are provided in figures 4.2.2, 4.2.3, 4.2.4.

Note – General data on rules of control and principles of programming the operation of the hydraulic distributor EHS sections are provided in subsection 2.16 “Electronic system of the hydraulic distributor EHS sections control”.



1 – joystick to control sections No 1 and No 2 of the hydraulic distributor; 2 – joystick to control sections No 3 and No 4 of the hydraulic distributor; 3 – operation programming unit of the HLL (OPU of the HLL); 4 – integrated electronic panel (IEP); 5 – section No 4 of the hydraulic distributor; 6 – section No 3 of the hydraulic distributor; 7 – section No 2 of the hydraulic distributor; 8 – section No 1 of the hydraulic distributor;

Figure 4.2.2 – Hydraulic distributor EHS section control



1 – power disconnect switch of the OPU of the HLL; 2 – button of program No 3; 3 – button of program No 2; 4 – button of program No 1; 5 – annunciator of program No 1; 6 – annunciator of program No 2; 7 – annunciator of program No 3; 8 – digital indicator of the number of section in action; 9 – digital indicator of oil flow value over the active section; 10 – annunciators of uplift and lowering of the corresponding sections of the hydraulic distributor; 11 – “STOP” switch for emergency deactivation of the hydraulic distributor; 12 – button to select section No 4 of the hydraulic distributor; 13 – button to select section No 3 of the hydraulic distributor; 14 – button to select section No 2 of the hydraulic distributor; 15 – button to select section No 1 of the hydraulic distributor.

Figure 4.2.3 – Operation programming unit of the HLL

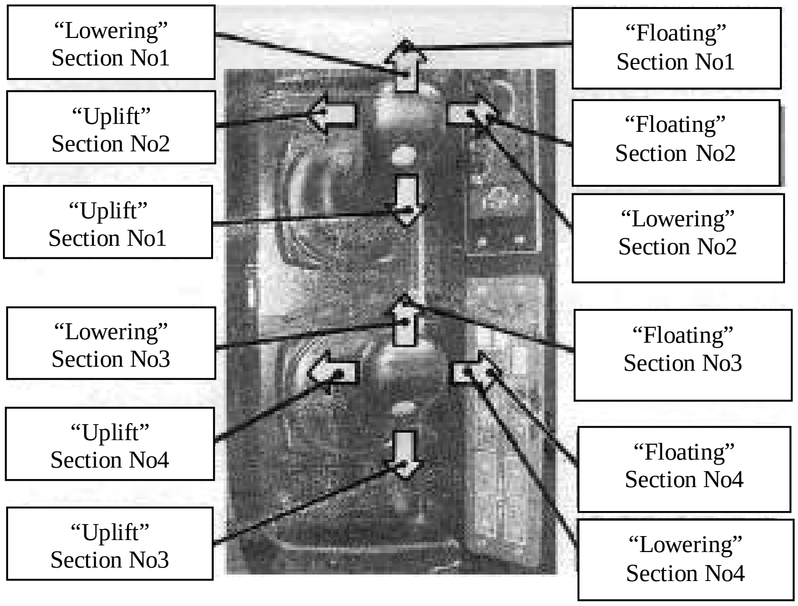


Figure 4.2.4 – Diagram of the hydraulic distributor section control with joysticks (manual mode)

Note – the figure 4.2.4 presents a diagram of the hydraulic distributor section control with the electronic joystick unit “BOCORO”. The diagram of control with joysticks of EJU-1 is similar to the diagram in figure 4.2.4. Rules for actuation of the floating position for both types of joysticks are provided in subsection 2.16.2 “Electronic joystick unit”.

4.2.8.2 Example of programming operations to control a reversible plough by means of OPU of the HLL

In this clause a variant of tractor operation coupled with a reversible plough is analyzed, when a cylinder, providing plough overturn, is connected to the section No1, a cylinder, providing measurement of plough width, is connected to the section No2, a cylinder, providing uplift-lowering of the plough, is connected to the section No3.

To operate in an automatic mode it is required to record two programs:

Program No1 provides automatic implementation of the following operations:
- plough uplift from its working position;
- decrease of plough width to a min. one;
- plough overturn into the working position (from left to right);
- increase of plough width to a required one;
- plough lowering into the working position.

To record the program No1 it is required to do the following:
- actuate the OPU of the HLL, pressing the button 1 (figure 4.2.3);

ATTENTION: BEFORE RECORDING THE PROGRAM NO1 IT IS REQUIRED TO SET THE PLOUGH INTO A CERTAIN CONDITION IN A MANUAL MODE (THE PLOUGH SHALL BE TURNED TO THE LEFT INTO ITS EXTREME POSITION, SET A REQUIRED WIDTH, LOWER THE PLOUGH INTO THE WORKING POSITION)!

- press and hold the button 4 (program No1). After two seconds the OPU of the HLL produces an acoustic signal, turns on the indicator 5 in the mode of fast blinking and passes into the programming mode (storing manipulations made with the joystick);
- press the buttons 13, 14, 15 to select sections No3, No2, No1 of the hydraulic distributor EHS, respectively. The annunciators 10 indicating uplift and lowering of these sections shall simultaneously turn on in the mode of slow blinking;

- raise the plough from the working position by means of the joystick 2 (figure 4.2.2), operating over the section No3;

- decrease the plough width to the min. by means of the joystick 1, operating over the section No2;

- turn the plough from the extreme left position to the extreme right position by means of the joystick 1, operating over the section No1;

- set a required width by means of the joystick 1, operating over the section No2;

- lower the plough into the working position by means of the joystick 2, setting the “floating” condition over the section No3 (herewith the indicator 9 (figure 4.2.3) will display “FL”);

- repeatedly press the buttons 13, 14, 15 (figure 4.2.3) to select sections No3, No2, No1 of the hydraulic distributor EHS (record over the sections is finished);

- to finish the programming press the button 4 of the recorded program No1.

The program No2 provides automatic implementation of the following operations:

- plough uplift from its working position;
- decrease of plough width to a min. one;
- plough overturn into a contrary extreme position (from left to right);
- increase of plough width to a required one;
- plough lowering into the working position.

To record the program No2 it is required to do the following:

- actuate the OPU of the HLL (if it is off), pressing the button 1 (figure 4.2.3);

ATTENTION: BEFORE RECORDING THE PROGRAM No1 IT IS REQUIRED TO SET THE PLOUGH INTO A CERTAIN CONDITION IN A MANUAL MODE (THE PLOUGH SHALL BE TURNED TO THE RIGHT INTO ITS EXTREME POSITION, SET A REQUIRED WIDTH, LOWER THE PLOUGH INTO THE WORKING POSITION)!

- press and hold the button 3 (program No2). After two seconds the OPU of the HLL produces an acoustic signal, turns on the indicator 6 in the mode of fast blinking and passes into the programming mode (storing manipulations made with the joystick);

- press the buttons 13, 14, 15 to select sections No3, No2, No1 of the hydraulic distributor EHS, respectively. The annunciators 10 indicating uplift and lowering of these sections shall simultaneously turn on in the mode of slow blinking;

- raise the plough from the working position by means of the joystick 2 (figure 4.2.2), operating over the section No3;

- decrease the plough width to the min. by means of the joystick 1, operating over the section No2;

- turn the plough from the extreme right position to the extreme left position by means of the joystick 1, operating over the section No1;

- set a required width by means of the joystick 1, operating over the section No2;

- lower the plough into the working position by means of the joystick 2, setting the “floating” condition over the section No3 (herewith the indicator 9 (figure 4.2.3) will display “FL”);

- repeatedly press the buttons 13, 14, 15 (figure 4.2.3) to select sections No3, No2, No1 of the hydraulic distributor EHS (record over the sections is finished);

- to finish the programming press the button 3 of the recorded program No2.

ATTENTION: MAX. POSSIBLE DURATION FOR EACH PROGRAM RECORD SHALL NOT EXCEED 200 SECONDS!

Taking into consideration the novelty of the joystick control, programming peculiarities and lack of experience when making programs, for the first time before the beginning of the programming process it is recommended to study a manual for the implement or the machine coupled and also to build up a sequence diagram of joystick control (algorithm of a program) with indication of directions of joystick movements. This will allow to reduce time for technological operations in implement or machine control in the working process.

Basing on the description of the program No1, provided above, the scheme of joystick control will be as shown in table 4.1:

Table 4.1 – Scheme of joystick control when creating the program No1

Joystick position (figure 4.2.2)	Direction of joystick movement				
1		←	↑	→	
2	↓				↑

The arrows show directions of joystick movement:
↓ - backward; ← - to the left; → - to the right; ↑ - forward.

For the program No2 the scheme of joystick control will be as shown in table 4.2:

Table 4.2 – Scheme of joystick control when creating the program No2

Joystick position (figure 4.2.2)	Direction of joystick movement				
1		←	↓	→	
2	↓				↑

The availability of these schemes will allow you to orientate yourself easily when operating the joysticks.

ATTENTION:

BEFORE THE PROGRAM NO1 IS CARRIED OUT MAKE SURE THE PLOUGH IS IN A CORRESPONDING CONDITION – THE PLOUGH HAS BEEN TURNED TO THE LEFT INTO ITS EXTREME POSITION, A REQUIRED WIDTH HAS BEEN SET, THE PLOUGH HAS BEEN LOWERED INTO THE WORKING POSITION!

BEFORE THE PROGRAM NO2 IS CARRIED OUT MAKE SURE THE PLOUGH IS IN A CORRESPONDING CONDITION – THE PLOUGH HAS BEEN TURNED TO THE RIGHT INTO ITS EXTREME POSITION, A REQUIRED WIDTH HAS BEEN SET, THE PLOUGH HAS BEEN LOWERED INTO THE WORKING POSITION!

To implement the recorded programs No1 and No2 during operation it is required to carry out the following actions:

- before entering the run it is required to press the button 4 shortly (for less than two seconds) (figure 4.2.3). The program No1 implementation will start automatically: the plough will raise from the working position, the width will decrease to the minimum one, the plough will start rotating from the left to the right. As the plough is in the upper (hauling) position it is required to deviate any of the joysticks, enabled in the program, from its neutral position shortly. The indicators 8, 9 will display “PAU” (pause), the annunciator 5 of the enabled program No1 will start blinking (the program implementation will temporary stop). In this condition it is required to drive to the edge of the field (begging of the first run) and repeatedly push the button 4 of the program No1 to finish (continue) its implementation. The plough continues further overturn to the right (to the working position), the width increases, the plough lowers to the working position;
- when entering the run it is required to lower the first part of the plough using the RLL control console 31 (figure 2.1.1), as this operation is impossible to program with the OPU of the HLL;
- when driving out of the run it is required to raise the first part of the plough using the RLL control console 31 (figure 2.1.1), as this operation is impossible to program with the OPU of the HLL;
- press the button 3 shortly (figure 4.2.3). The program No2 implementation will start automatically: the plough will raise from the working position, the width will decrease

to the minimum one, the plough will rotate to the contrary extreme position (from the right to the left). As the plough is in the upper (hauling) position it is required to deviate any of the joysticks to the direction of controlling over the section enabled in the program. The indicators 8, 9 will display “PAU” (pause), the annunciator 6 of the enabled program No2 will start blinking (the program implementation will temporary stop). As the tractor makes a U-turn (the plough is in a hauling position) and starts a new run it is necessary to push the button 3 of the program No2 repeatedly to finish (continue) its implementation. The plough continues further overturn to the right (to the working position), the width increases, the plough lowers to the working position;

- when entering the run it is required to lower the first part of the plough using the RLL control console 31 (figure 2.1.1), as this operation is impossible to program with the OPU of the HLL;
- when driving out of the run it is required to raise the first part of the plough using the RLL control console as this operation is impossible to program with the OPU of the HLL;
- pressing the button 4 shortly (figure 4.2.3) starts the program No1 implementation: the plough will raise from the working position, the width will decrease to the minimum one, the plough will rotate from the left to the right. As the plough is in the upper (hauling) position it is required to deviate any of the joysticks to the direction of controlling over the section enabled in the program (the program implementation will temporary stop). As the tractor makes a U-turn (the plough is in a hauling position) and starts a new run it is necessary to push the button 4 of the program No1 again to finish (continue) its implementation, having preliminary lowered the front part of the plough using the RLL control console 31 (figure 2.1.1), etc.

4.2.8.3 Example of programming operations to control a seeder using the OPU of the HLL

Programming operations to control a seeder, first it is needed to take into account seeder requirements, set forth in its operation manual. The algorithm of seeder control shall be made up with due account for requirements to its operation at entering the run and driving out of the run.

This clause includes overview of tractor operation coupled with a seeder, a hydraulic motor to drive a fan, which is connected to the section No1, a distributor of cylinders to raise-lower markers, which is connected to the section No2, a cylinder to raise-lower the seeder, which is connected to the section No3.

To operate in an automatic mode it is required to record three programs.

To carry out programming of operations to control the seeder it is required to turn on the OPU of the HLL by pressing the button 1 (figure 4.2.3).

The program No1 provides actuation of the fan driving hydraulic motor.

To record the program No1 proceed as follows:

- push the button 4 (figure 4.2.3) and hold it pressed until an acoustic signal goes off (approximately two seconds) and the annunciator 5 starts blinking;
- push the button 15 to select the section No1 of the hydraulic distributor EHS. The annunciators of uplift and lowering 10 of this section will start blinking;
- operating over the section No1 with the joystick 1 (figure 4.2.2), move it back to the level corresponding to the required speed of the fan. Holding the joystick 1 in this position, press the button 15 with your other hand (figure 4.2.3), and then press the button 4;

Now the programming of the fan drive control is finished.

On tractors, equipped with the electronic joystick unit EJU-01, it is possible to program the actuation of the hydraulic motor to drive the fan by means of the joystick without the OPU of the HLL. For this purpose operating over the section No1 move the joystick 1 (figure 4.2.2) back to a position, corresponding to the desired speed of the fan, and holding it in this position press the button on the joystick (on the top), after this move the joystick to its neutral position. The fan will rotate with the set speed until turned off (by means of repeated moving of the joystick 1 backward and pressing the top button).

The program No2 ensures automatic implementation of the following operations:

- o marker folding;
- o seeder uplift from the working position.

To record the program No2 proceed as follows:

- turn on the OPU of the HLL (if it is off), pressing the button 1 (figure 4.2.3);

ATTENTION: BEFORE STARTING TO RECORD THE PROGRAM NO2 IT IS REQUIRED TO SET THE SEEDER TO A CERTAIN CONDITION IN A MANUAL MODE (THE FAN DRIVE HYDRAULIC MOTOR TURNED ON, THE MARKERS UNFOLDED, THE SEEDER LOWERED TO A WORKING POSITION).

- push the button 3 (figure 4.2.3) and keep it pushed until an acoustic signal goes off (approximately two seconds) and the annunciator 6 starts blinking;
- push the buttons 13, 14 to select the sections No3 and No2 of the hydraulic distributor EHS respectively. The annunciators of uplift and lowering 10 of these sections will start blinking;
- operating over the section No2 with the joystick 1 (figure 4.2.2) raise the marker;
- operating over the section No3 with the joystick 2 (figure 4.2.2) raise the seeder;
- repeatedly push the buttons 13, 14 (figure 4.2.3) to select the sections No3 and No2 of the hydraulic distributor EHS (the record in respect of the sections is finished);
- to complete the programming push the button 3 of the recorded program No2.

The program No3 ensures automatic implementation of the following operations:

- seeder lowering and setting a floating position;
- o marker unfolding.

To record the program No3 proceed as follows:

- turn on the OPU of the HLL (if it is off), pressing the button 1 (figure 4.2.3);

ATTENTION: BEFORE STARTING TO RECORD THE PROGRAM NO3 IT IS REQUIRED TO SET THE SEEDER TO A CERTAIN CONDITION IN A MANUAL MODE (THE FAN DRIVE HYDRAULIC MOTOR TURNED ON, THE MARKERS FOLDED, THE SEEDER IN RAISED POSITION).

- push the button 2 and keep it pushed until an acoustic signal goes off (approximately two seconds) and the annunciator 7 starts blinking;
- push the buttons 13, 14 to select the sections No3 and No2 of the hydraulic distributor EHS respectively. The annunciators of uplift and lowering 10 of these sections will start blinking;
- operating over the section No3 with the joystick 2 (figure 4.2.2) set a “floating” position, herewith the indicator 9 (figure 4.2.3) will display “FL”;
- operating over the section No2 with the joystick 1 (figure 4.2.2) unfold the marker;
- repeatedly push the buttons 13, 14 (figure 4.2.3) to select the sections No3 and No2 of the hydraulic distributor EHS (the record in respect of the sections is finished);
- to complete the programming push the button 2.

ATTENTION:

BEFORE THE PROGRAM NO2 IS CARRIED OUT MAKE SURE THE SEEDER IS IN A CORRESPONDING CONDITION – THE FAN DRIVING HYDRAULIC MOTOR HAS BEEN TURNED ON, THE MARKERS HAVE BEEN UNFOLDED, THE SEEDER HAS BEEN LOWERED TO A WORKING POSITION!

BEFORE THE PROGRAM NO3 IS CARRIED OUT MAKE SURE THE SEEDER IS IN A CORRESPONDING CONDITION – THE FAN DRIVING HYDRAULIC MOTOR HAS BEEN TURNED ON, THE MARKERS HAVE BEEN FOLDED, THE SEEDER IS IN A RAISED POSITION!

To carry out the implementation of the recorded programs No1, No3 and No2 during the tractor operation proceed as follows:

Entering the first run, first it is required to actuate the fan drive (shortly push the button 4 (figure 4.2.3) for implementation of the program No1. At the beginning of the run (from the seeder hauling position) it is required to push the button 2 for the program No3 implementation, the seeder lowering and the marker unfolding.

Leaving the run it is required to convert the seeder from its working position to the hauling one (fold the marker, raise the seeder). To do this push the button 3 shortly to carry out the implementation of the program No2.

The fan driving hydraulic motor is disabled at the end of the field operation by repeated pushing the button 4 shortly.

4.2.9 Selection of optimal inner pressure in tires depending on operational conditions and load on tractor axles, instructions for tire use

4.2.9.1 Selection of optimal inner pressure in tyres depending on operational conditions and load on tractor axes.

Selection of optimal air pressure in tires of wheeled tractors and rate of its influence on gripping abilities depend on kinds of operations, soil type and load, applied to tractor axles. Air pressure in tyres 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 to select operation mode with various inner pressures and spees are set forth by a tire manufacturer and are provided in figure 4.3.

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

Inner pressure in tires for each specific case of tractor being coupled wih implements is different. Therefore 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 the tire pressure set below the required rate results in the following wheel failures:

- tire turning on rims;
- wearing of tire bead against rim adge;
- occurence of cracks on tire sides;
- ply separation or rupture of a tire;

Operation with tire pressure higher than the rated pressure results in the following wheel failures:

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

Extra duty operation resulting in excess of max. load capacity (for given pressure and speed) of tires and tractor axles is a reson for failures and damages not only to the undercarriage (tire carcass rupture) 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 LOADS AND SPEEDS EFFECTIVE FOR A KIND OF PERATION BEING CARRIED OUT!

Correct choosing tire pressure as well as identifying if it is necessary to mount ballast weights, their mass and type is possible only after defining a 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 determined only by way of practical weighing the tractor with the implement coupled.

The method of identifying load on front and rear wheels of the tractor by way of weighing is presented in section 5 “Cupling of implements”.

To check tire pressure use properly-functioning devices with scale interval not more than 10 kPa. This will ensure adequacy of measurements. The permissible limit deviations for tire pressure are ± 10 kPa according to pressure gage readings.

Table 4.3 – Rates of loads on tractor single tires for selection of operational modes with various speeds and tire inner pressures

Tire standard size	Speed, km/h	Load on a single tire, kg, and a corresponding pressure, kPa												
		40	60	80	100	120	140	160	180	200	220	240	300	320
520/70R34	10		2820	3120	3420	3700	4000	4300	4600	5360*				
	20		2545	2815	3085	3355	3625	3885						
	30		2220	2450	2680	2920	3160	3380						
	40		2070	2290	2510	2730	2950	3160						
600/65R34	10		2725	3145	3570	3945	4320	4695	5020	5865*				
	20		2700	3115	3535	3905	4280	4645						
	30		2305	2660	3020	3335	3655	3970						
	40		2195	2535	2875	3175	3480	3780						
710/70R42	10	4780	5180	5580	6000	6370	6900	7170	7600	7960	8400	8760	11050	
	20		4735	5090	5470	5815	6150	6540	6940	7300	7625	7995		
	30		4110	4430	4650	5060	5400	5700	6000	6330	6650	6960		
	40		3850	4140	4450	4730	5000	5320	5600	5910	6200	6500		
18.4R34	10 ***		2745	3030	3330	3615	3915	4200	4485	4740	4980	5220	5940	6185
	20		2250	2480	2730	2960	3210	3440	3675	3885	4080	4280	4870	5070
	30		1955	2160	2375	2575	2790	2995	3195	3380	3550	3720	4235	4410
	40		1830	2020	2220	2410	2610	2800	2990	3160	3320	3480	3960	4125
650/75R42	10	3935	4605	5245	5845	6405	6835	7210	7725**					
	30		3785	4305	4800	5260	5615	5925						
	40		3605	4100	4570	5010	5345	5600						

Notes: * - at 210kPa
** - at 200kPa
*** - inner pressure shall be increased by 25 %

1. Pressure shall be set in "cold" tyres.
2. Performing operations, requiring large pulling force on the hook, set the pressure as for the speed of 30 km/h. When performing transport operations on roads with solid surface increase the pressure by 30 kPa.

4.2.9.2 Instructions for tire use

To prevent premature wear of tires and tractor breakdown due to wrong use of tires, follow the below instructions for tire use:

- carry out operations in technical maintenance of tires and wheels;
- keep tires away from fuel, oil and other oil products;
- it not recommended to use pressure below 0,09 MPa. With tire pressure 0,08 MPa and less (inner pressure reduction below a required value due to possible air leakage) carry out a constant pressure control;
- data on loads for 10 km/h (in table 4.3) are used only in conditions, requiring low traction force: when coupling seeder and harvesting units. For operations requiring large turning torque (tillage, etc.) use instructions for speed of 30 km/h;
- do not operate the tractor with tire inner pressure not corresponding to a regulation rate for each specific case of its use;
- keep to the established rates of tire inner pressure in accordance with the instructions of the present manual;
- when it is necessary to check and inflate tires during operation do not do it straight after the tractor is stopped: time gap is required to let tires cool off;
- control air pressure in tires in cold condition with tire gage, which is to be periodically tested for precision of indications at stations or centers of cervice for any mechanical vehicles;
- if air pressure drop is constantly observed in tires, be sure to find out the fault and eliminate it;
- check pressure in tires, filled with a solution, with the valve staying in the extreme upper position;
- when mounting twinned wheels on one axis inner pressure shall be provided in accordance with the instructions of the table 4.3;
- use of tire sizes, not specified in the manual, is only possible upon agreement with the plant;
- choosing and buying new tires follow the instructions of this manual.

Wrong mounting and dismounting of tires results in damage to elements of tire structure. In household conditions tires are mounted and dismounted in a specially allocated area or in a room. As a rule, tires are mounted/dismounted on a special stand, but manual mounting/dismounting of tires is also possible (by means of tire levers and other fixtures).

Mount tires of the same size, model and design on one axis. Periodical wheel rearrangement precludes their uneven wear. Do not mount wheels with various wear rates on one axis;

- comply with a permitted axial load to reach max. pulling force in particular operational conditions during tillage and also to reach least soil compaction;
- when making a track it is obligatory to provide equal distance for counter wheels with relation to a vertical plane, crossing the center of the tractor. Mounting wheels remember of a correct direction of tire rotation and of a safe distance between the wheel and other elements of tractor design;

- do not use twin tires to increase lifting and pulling power: twin tires are used to improve gripping parameters of the tractor when operating with heavy agricultural implements on soils having low bearing capacity;

- do not operate the tractor with long wheel skidding and overload on the wheels: with heavy implements (having weight exceeding the values permitted for the tractor) or with soil processing implements, having resistance which is too much for the tractor in the given soil conditions.

- avoid abrupt taking off, hard braking, sharp turns, long wheel skidding as tractor gets trapped.

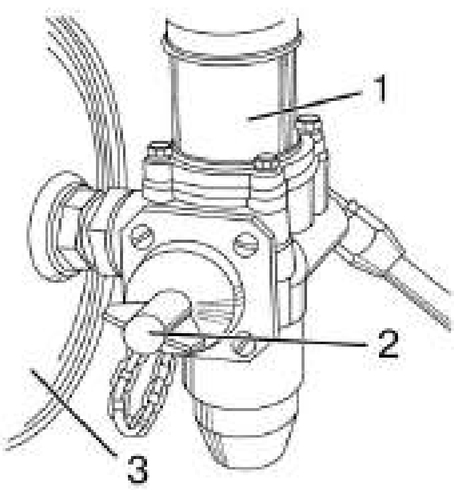
IT IS FORBIDDEN TO OPERATE THE TRACTOR AND TO PUT IT FOR LONG-TERM PARKING WITH TIRES DAMAGED OR DEFLATED.

4.2.9.3 Tire inflation

Inflate tires through an air bleed valve of a pressure regulator 1 (figure 4.2.5), for this do the following:

- let air out of a ballon 3 of the pneumatic system through a condensate removing valve;
- unscrew a winged nut 2 of the air bleed valve cap;
- connect a pipe to inflate tires to the air bleed valve cap and to a tire valve;
- start the engine and inflate the tire to reach a required pressure, controlling it with a pressure gage;
- detach the pipe from the tire valve and from the air bleed valve cap;
- screw the winged nut back on the air bleed valve.

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 – ballon of the pneumatic system.

Figure 4.2.5 – Tire inflation

4.2.10 Rear wheel track formation

The rear wheel track is changed by moving the hub together with the wheel over the axle shaft and by replacing the wheels from one sideboard to the other one.

To change the rear wheel track perform the following operations:

- put the tractor on a level ground, put the stops under the front and rear wheels, clean the axle shafts from dirt;
- jack up the corresponding tube of the axle;
- release four tie bolts 1 (figure 3.14.1) of the inserts 3 and 4 (two on each insert) by three full revolutions. The other bolts are to be screwed out. Screw the bolts of the inserts in the thread holes for disassembly;
- if it is impossible to squeeze the inserts out with disassembly bolts 1, fill kerosene or other liquid penetrant in places where inserts are detached from the hub body, wait for some time and then screw the disassembly bolts in, simultaneously knocking on the hub body until the inserts fully squeeze out;
- move the hub to a required track (use the table 4.4 to set the track “K” (figure 4.2.6) by way of measuring the dimension “L” from the axle shaft end to the insert end face);
- screw the tie bolts out of the disassembly holes and screw them into the inserts. Tighten the bolts with a torque of 550 to 600 N·m in several stages until all bolts are tightened with the required torque;
- set the track for the other wheel by analogy;
- check and tighten the tie bolts after the first operation hour, then aften the first eight – ten operation hours and after every consequtive 125 hours of operation. If the wheels were removed during changing the rear wheel track, mounting them back tighten the securing nuts with a torque of 700 to 750 N·m) and check the wheel securing nuts for tightening after the first operation hour, after the first eight – ten operation hours and every subsequent 125 hours of operation.

ATTENTION: AFTER TIGHTENING THE BOLTS MAKE SURE THE END SURFACES OF THE UPPER AND LOWER INSERTS DON’T JUT OUT WITH RESPECT TO EACH OTHER BY A VALUE OF 1…2 MM!

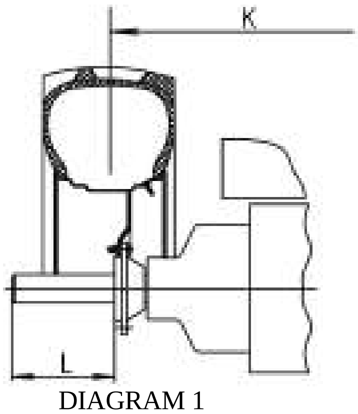


DIAGRAM 1

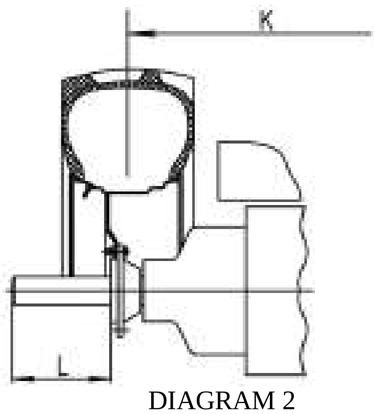


DIAGRAM 2

Figure 4.2.6 – Rear wheel track setting

Table 4.4 – Rear wheel track setting

Diagram No (figure 4.2.6)	Tire size	“K” track dimensions, mm	The installation dimension from the end surface of the hub insert to the axle shaft end “L”, mm
1	710/70 R42	2020…2140	45…0
2	710/70 R42	2316…2576	130…0
1	650/75 R42	2020…2140	45…0
2	650/75 R42	2316…2576	130…0

ATTENTION: EX-WORKS DELIVERED REAR WHEELS WITH TIRES 710/70 R42 ARE SET TO A TRACK UNDER THE DIAGRAM 1 (FIGURE 4.2.6), THE TRACK DIMENSION IS (2020±20) MM!

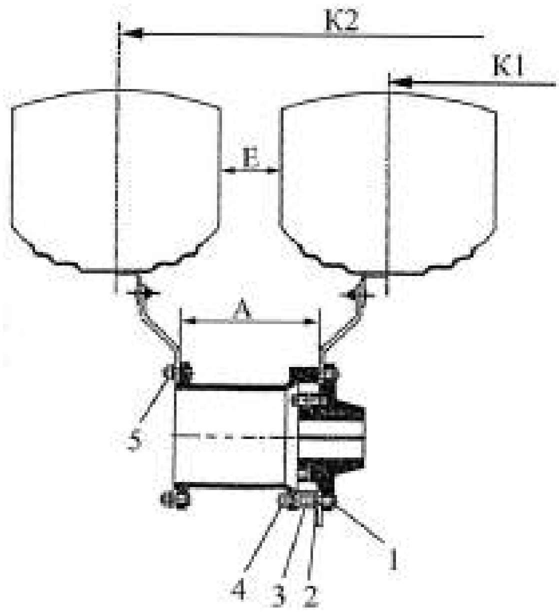
ATTENTION: EX-WORKS DELIVERED REAR WHEELS WITH TIRES 650/75 R42 ARE SET TO A TRACK UNDER THE DIAGRAM 1 (FIGURE 4.2.6), THE TRACK DIMENSION IS (2020±20) MM!

4.2.11 Rear wheel twinning

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

The additional wheels are mounted one by one, in the following way:

- set a min. permissible track for the main rear wheels, as specified in subsection 4.2.10 “Rear wheel track formation”;
- put stops under the front and the rear wheels;
- jack up the tractor rear part;
- unscrew the securing nuts of the right and the left rear wheels and put them aside;
- put washers 2, included into the spacer kit, on bolts 1 (figure 4.2.7);
- secure the inner wheel with special bolts 3, included into the spacer kit, with a torque of 700 to 750 N·m;
- mount the other supplementary wheel;



1 – hub bolt; 2 – washer; 3 – special bolt; 4 – nut; 5 – wheel nut.

Figure 4.2.7 – Diagram of rear wheel twinning

Dimensions for the track of the twinned rear wheels are given in table 4.5.

Table 4.5 – Dimensions for the track of the rear twinned wheels

Tires	A [1], mm	E [1], mm	К1, mm	К2, mm
650/75 R42	383	57	1900-2040	3314-3454
710/70 R42	600	120	2020-2140	3692-3812

[1] Referential dimensions

Information on choosing optimal inner pressure for tires when operating “BELARUS-3522.5” tractor with rear wheels twinned is presented in subsection 4.2.9 of this manual.

Operation pecularities of “BELARUS-3522.5” completed with twinned wheels are provided in section 5 “Coupling of implements”.

4.2.12 Front wheel track formation

The tractor track for front wheels can have two values – 2150 mm (diagram 1 in figure 4.2.8) and 2000 mm (diagram 2 in figure 4.2.8).

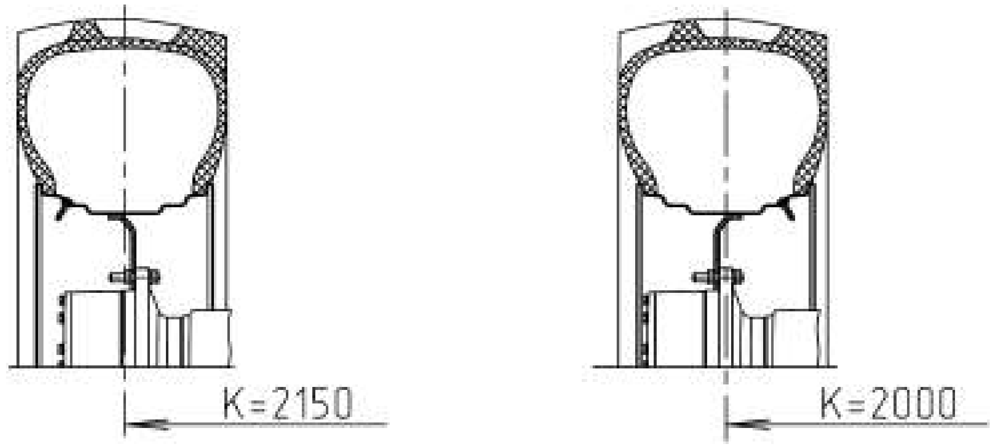


DIAGRAM 1 DIAGRAM 2

Figure 4.2.8 – Setting a track for tractor front wheels

The front wheel track is changed by moving the wheels from one sideboard to the other.

ATTENTION: EX-WORKS DELIVERED THE FRONT WHEELS ARE SET TO A TRACK UNDER THE DIAGRAM 1 (FIGURE 4.2.8)!

To set the wheels for 2000 mm track (digram 2) do the following:
- detach the wheels from flanges of FDA wheel-hub drives;
- displace the wheels from one sideboard to the other one, attaching them to the flanges of wheel-hub drives with the other side of the disk.

The nuts to secure the wheel on the flange of the FDA wheel-hub drive shall be tightened with a torque of 700 to 750 N· m.

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

ATTENTION: AFTER YOU HAVE CHANGED THE FRONT WHEEL TRACK CARRY OUT CHECK AND ADJUSTMENT OF FRONT WHEEL TOE-IN. BEFORE CHECKING THE TOE-IN MAKE SURE TO CHECK AND, IF NECESSARY, ADJUST PLAY IN STEERING JOINTS!

4.2.13 Front wheel twinning

Twin the front wheels only in exceptional cases, for instance, when gripping rates on waterlogged lands are not sufficient.

Operational restrictions as well as rules and pecularities on use of “BELARUS-3522.5” tractors with the front wheels twinned are provided in section 5 “Coupling of implements”.

ATTENTION: FAILURE TO COMPLY WITH RULES ON OPERATION OF TRACTORS COMPLETED WITH TWINNED FRONT WHEELS CAN RESULT IN FDA BREAKDOWN AND PREMATURE WEAR OF TRACTOR TIRES!

A customer can be provided with a set for front wheel twinning against order, it is packed into a separate box.

The set for front wheel twinning includes the following items:
- mechanisms for twinning – 8 pcs.;
- special (outer) wheels – 2 pcs.;
- tube wrench – 1 pc.;

A digram for front wheel twinning is provided in figure 4.2.9;
The mechanism for front wheel twinning is presented in figure 4.2.10;

To carry out operations in wheel twinning do the following:

1. Place the tractor on a horizontal surface so that it has a free access from all sides and is in a stable position.

2. Dismount the front wheel fenders in accordance with subsection 3.26 “Front wheel fenders”.

3. Prepare mechanisms for wheel twinning, set a dimension L1, screwing the hook bar in or out (figure 4.2.10).

4. Locate tires of tractor main wheels, staying under the action of vertical load, at equal height with tires for special wheels, for this reason it is required to move the tractor wheel onto boards with a total thickness of 80 mm.

4. Before installing the ring spacer of the special wheel into the main wheel rim it is necessary to fix lug-nuts of mechanisms for twinning by means of special bolts (figure 4.2.10), under the heads of which spring washers shall be mounted. The special bolts shall be tightened with a torque of 570 to 630 N·m. The holes of lug-nuts, where the bars are hooked, shall be positioned at a tangent to a diameter of their location.

5. Move the special wheel towards the main wheel of the tractor and put its ring spacer into the main wheel rim (figure 4.2.9). If this assembly is carried out for the first time, then it is required to lubricate the ring spacer edges at a length L2 (figure 4.2.9) with a grease Litol-24 GOST21150-87.

When moving the special wheel be cautious to avoid injury in case it falls down. It is desirable that the operation in wheel displacing is carried out by two people. Hereby before the operator mounts the first mechanism for twinning his assistant shall stand by the special wheel to prevent it from falling out of the main wheel rim.

6. Put the hook of the twinning mechanism into the lug-nut from the wheel center side. Link the bearing part of the twinning mechanism to the thrust ring of the special wheel rim, then latch it by means of the tube wrench. The mechanisms shall be tightened with a torque of 300 to 500 N·m.

To avoid detachment of the special wheel during tractor operation due to unlatching of mechanisms, put the securing pins in after their tightening.

7. After all twinning mechanisms have been mounted, put the tube wrench into the set of spare parts, tools and accessories. Check air pressure in all wheel tires and if necessary adjust it.

The pressure for each tire must be fixed according to the section of tractor manual, describing tractor operation with twinned wheels.

ATTENTION: PRESSURE IN OUTER (SPECIAL) WHEELS SHALL BE LESS THAN PRESSURE IN MAIN WHEELS OF THE TRACTOR!

The twinned wheels of the tractor shall be disassembled in a sequence, which is reverse to their assembly, herewith:

a) to detach the special wheels it is necessary to move the main wheels of the tractor one by one onto the boards with the total thickness of approximately 80 mm and remove the mechanisms. Make sure that it is possible to lay the wheel after the mechanisms have been removed. Use orifices “A” on the ring spacer (figure 4.2.9) to detach the special wheel from the rim;

b) in case it is not possible to dismount the special wheel, drive the tractor at first gear (with the speed not higher than 5 km/h) to move the special wheel onto the above mentioned boards and detach the wheels;

c) prevent the special wheels from falling and running away.

d) mount the front wheel fenders back in accordance with subsection 3.26 “Front wheel fenders”.

ATTENTION: OPERATING THE TRACTOR WITH THE FRONT WHEELS TWINNED STRICTRLY OBSERVE REQUIREMENTS OF THE SECTION 5 “COUPLING OF IMPLEMENTS”. FAILURE TO COMPLY WITH RULES ON TRACTOR OPERATION WITH TWINNED WHEELS MAY RESULT IN FDA BREAKDOWN AND PREMATURE WEAR OF TIRES!

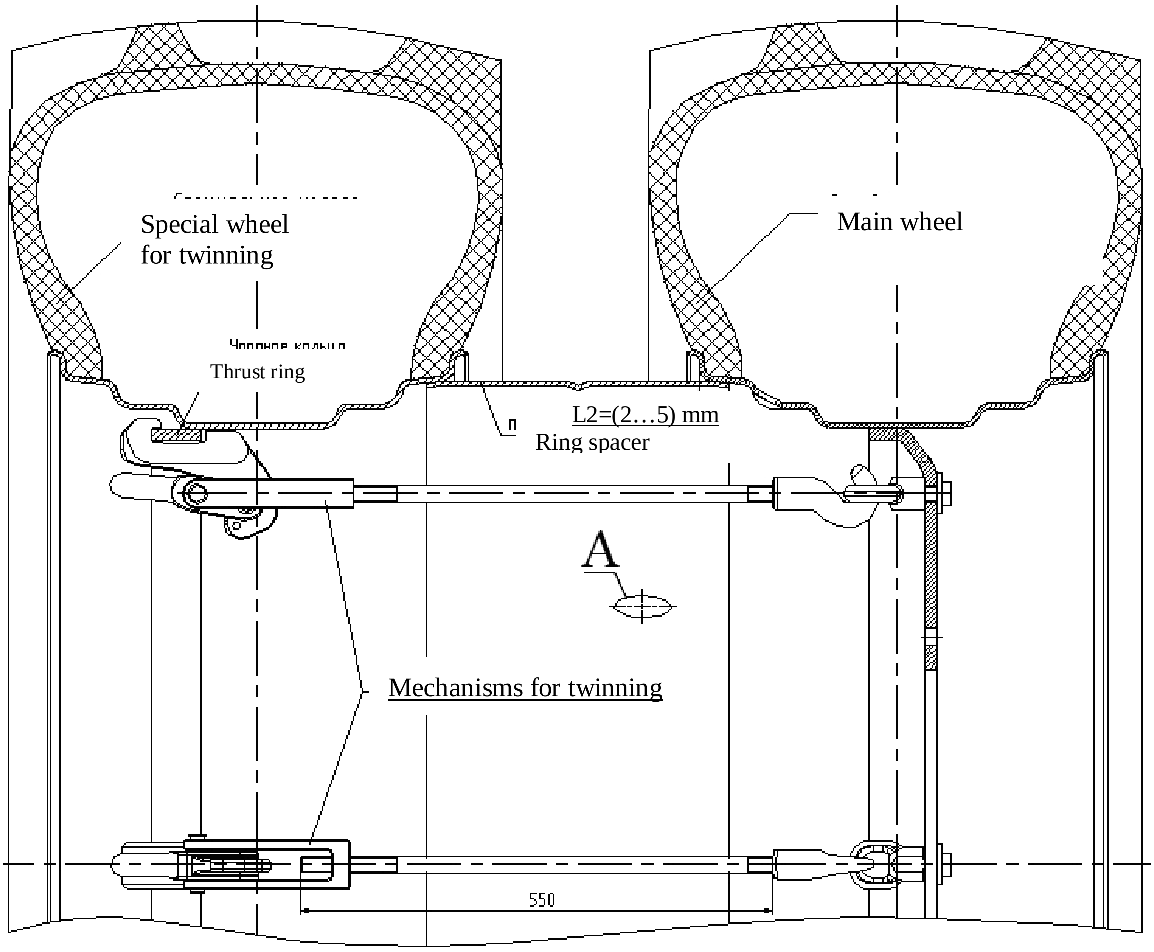


Figure 4.2.9 – Diagram of front wheel twinning

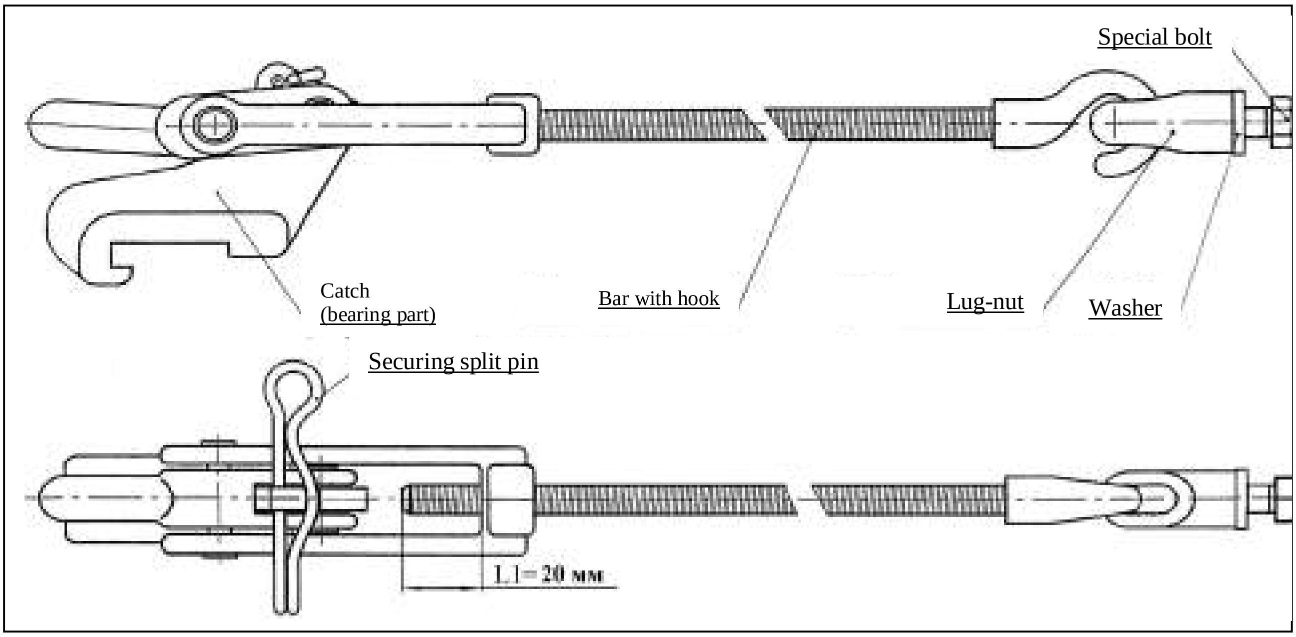


Figure 4.2.10 – Mechanism for front wheel twinning

4.3 Safety measures when operating the tractor

4.3.1 General safety measures when operating the tractor

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

Tractor start-up and operation with hood lateral sides removed and mask opened is not allowed.

It is forbidden to remove the hood lateral sides and (or) lift up the hood mask 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 gear range shifting lever shall be in “Neutral” position.

During tractor start there shall be no people under the tractor, in front of it or behind, as well as between the tractor and the coupled implement.

Before stopping the engine set “0” gear with the gear shifting joystick.

Before setting on the move warn people around including those operating the coupled implements using the horn, make sure the parking brake is off and start moving slowly. Use safety harnesses (supplied against order) at hauling operations.

Passenger staying in the cab during tractor operation is strictly forbidden. (Passenger may stay in the cab only when an additional seat is installed).

Do not leave the tractor on the move.

Performing hauling operations observe traffic requlations, adopted in your country.

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

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

Before using the tractor for hauling operations do the following:

- set a haulage track for rear wheels;
- check operation of brakes; interlock brake pedals, check and if necessary adjust the brakes for simultaneity of operation;
- check operation of the parking brake;
- check a condition of devices for light and sound indication; hauling trailers shall have rigid hitches and 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!

Hauling people inside trailers is forbidden.

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

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

- trailer brake on 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.

It is forbidden to drive on reverse on public roads.

Loading (unloading) the trailer engage the parking brake of the tractor.

The tractor, which is used with the trailer, on public roads shall operate with a road-train sign on in accordance with "Traffic regulations".

Driving on public roads turn on a flashing beacon, if available.

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

Working on the slopes increase the tractor track to the max.

Working on the slopes with a degree of more than 20° set the rear wheel track for 2320 mm.

Before exiting the cab disengage the front and rear PTOs, stop the engine, engage the parking brake and remove the key from the starter switch.

Do not operate the tractor with master instruments being out of order.

It is not allowed to inflate tires without pressure control.

If the engine or the steering are broken down, immediately stop the tractor. Keep in mind that with the engine stopped it is required to apply much greater force to the steering wheel to operate the tractor.

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

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 by means of the battery disconnect switch with the engine running.

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

If put to a wrong use, your tractor can be dangerous for you as well as for third persons. Avoid using equipment not indended for installation on the tractor.

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

It is not admitted to inflate tires without pressure control.

To prevent the tractor from turning over, keep up with 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 by 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 works where there is a possibility for the tractor to turn over.

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.

Coupling the tractor with agricultural implements comply addtionally with safety measures concerning use of these implements.

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

If the tractor front part rises off 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 up and down 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 is to be lowered down into its operating position and lifted up into the hauling position only with a straight-line motion 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 front and rear PTOs are disengaged.

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.

Linking the machine cardan shaft to the RPTO, disengage the RPTO, stop the tractor by means of the parking brake and stop the engine.

After disconnecting the machines driven by the rear or the front RPTO, remove cardan drives and cover the PTO end extensions with protective caps.

Cardan shafts, transferring torque from the front and rear PTOs of the tractor to the implement working units shall be safeguarded.

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

Make sure you mounted the safeguards of the front and rear PTOs 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 front and rear PTOs 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 the tractor assemblies are operating in column, they shall have an interval of 30 m between each other.

Avoid sharp turns when fully loaded and at a high speed of travel.

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 4.6.

Table 4.6

Line voltage, кV, up to	11	20-25	110	154-220	330-500
Horizontal distance, m, not less than	1,5	2	4	6	9
Vertical distance, m, not less than	1	2	3	4	6

4.3.2 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 in 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. Carrying out repair operations in field conditions using electric/gas welding, clean parts and assembly units from plant remains.

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

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

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 hot 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, pour some sand onto it, cover with 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 during engine running.

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

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

4.4 Tractor run-in

4.4.1 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);
- carefully inspect the tractor, check it for completeness and availability of instruction manuals;
- remove accumulator batteries, set them into working condition and mount back;
- check threaded jounts for tightness and tighten if necessary;
- check oil level in the engine oil sump, in the transmission, in FDA case, in cases of FDA wheel-hub drives and, if necessary, add as per section 6 “Technical maintenance”;
- drain the available fuel out of the fuel tank and fill the fuel tank with new settled fuel: in winter – winter grade, in summer – summer grade;
- check the level of braking fluid in tanks of main cylinders of hydrostatic drives of clutch and working brakes and if necessary add as per section 6 “Technical maintenance”;
- check the level of braking fluid in the compensation chamber of the clutch main cylinder and of the brake main cylinder on the reverse of clutch and brake control and, if necessary, add as per section 6 “Technical maintenance”;
- fill the engine cooling system with cooling fluid to the beginning of a damping cage of the extension tank;
- check and, if necessary, set a desired pressure in tyres according to table 4.3;
- make sure there are protective guard shields (for RPTO, FPTO, etc.);
- carry out operations in shift-time technical maintenance of the engine, listed in the engine operation manual;
- check engine running, operability of lighting and warning devices, action of brakes and steering control, and also check functioning of the other systems and units of the tractor over control and measuring instruments;

Before starting to run in, check tightness of nuts attaching rear wheels to the hub and also nuts attaching front wheels to FDA drive flanges. The tightening torque shall make 700 to 750 N·m.

4.4.2 Tractor run-in

ATTENTION: 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 IN TECHNICAL MAINTENANCE IN TERMS SPECIFIED IN SECTION 6 “TECHNICAL MAINTENANCE”!

ATTENTION: IT IS OBLIGATARY 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)!

Carrying out the 30-hour run-in follow the below instruction:

- constantly inspect instrument 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;
- 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 increase 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. Right selection of the gear for each specific condition of operation ensures fuel economy and reduces engine wear-out;
- 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 running-in process engage the clutch more often and more smoothly.

4.4.3 Technical maintenance during tractor run-in

After the first operation hour check tightening of nuts attaching rear wheels to the hub and also nuts attaching front wheels to FDA drive flanges. The tightening torque shall make 700 to 750 N·m. Then inspect the wheel tightening every eight hours during the run-in.

In the run-in process regularly carry out operations in shift-time technical maintenance according to the instructions, set forth in section 6 “Technical maintenance” of this manual.

4.4.4 Technical maintenance after tractor run-in

After the tractor run-in do the following:

- inspect and wash the tractor;
- listen to the operation of all tractor constituents;
- check tightening of nuts attaching rear wheels to the hub and also nuts attaching front wheels to FDA drive flanges;
- tighten two lock nuts M30x1,5 (with left and right thread) of the steering link tube with a torque of 150 to 170 N·m and two crown nuts M24x2 of the steering link ball pins with a torque of 100 to 140 N·m;
- check and if necessary tighten outer threaded links;
- drain condensate out of the pneumatic system reservoirs;
- drain sediment out of fuel tanks and the engine coarse filter;
- check the state of accumulator batteries, clean terminal connections and ventilation holes;
- check and if required adjust free movement of the clutch pedal, of the brake pedal and the pneumatic drive;
- drain oil out of the transmission. Then clean the gearbox net filter and a magnetic catcher of the magnetic filter, replace paper filtering elements of the twinned filter and clean permanent ring magnets. Fill the transmission with new oil;
- replace oil in the houses of the front PTO reduction units;
- replace oil in wheel-hub drives and in FDA beam housing;
- check lubrication in all assembly units according to clause 3 of table 6.3. Where required lubricate or replace the lubricant;
- check and if necessary restore hermiticity of the air cleaner and inlet line;
- control engine running, steering, brakes, operation controls, lighting and warning systems;

4.5 Actions in extreme conditions

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

4.5.2 For emergency stop of the engine 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.

4.5.3 In case of an accident immediately stop the engine, brake the tractor, deactivate accumulator batteries and get off the tractor through one of emergency exits, having opened left or right cab door, depending on the tractor position, or rear screen, or one of lateral screens. To open the lateral screens it is required to move the screen opening handle to an operating condition (operating condition – screen opened), then press this handle in the direction, which is contrary to the tractor forward motion, until the guide pin fully comes out from the handle, and then open the screen completely. If it is not possible to open the emergency exits, break the screen of one of the emergency exits with a heavy subject at hand and leave the tractor cab.

Note – Emergency exit allocation is given in subsection 2.20 “Cab locks and handles”.

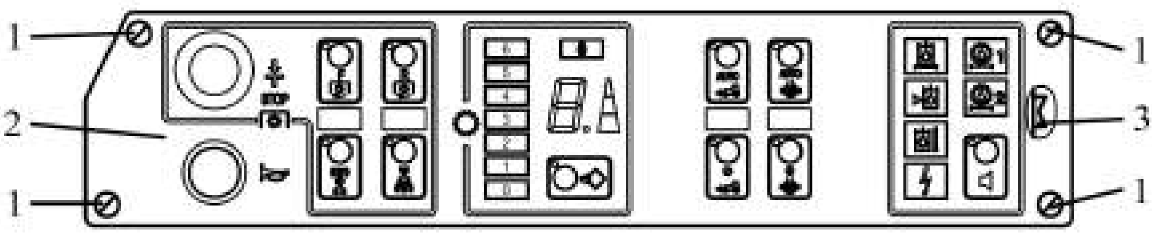
4.5.4 In case the engine crankshaft speed goes up excessively, kill the engine and brake the tractor.

4.5.5 To disengage the front power take-off shaft (FPTO) and the rear power take-off shaft (RPTO) immediately, press the button 1 (figure 2.13.4).

4.5.6 For emergency deactivation of all sections of the EHS hydraulic distributor it is required to press the emergency “STOP” switch 7 on the panel of the operation programming unit of the HLL (figure 2.16.6).

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

4.5.8 If there is a failure of CECS in respect of inability to shift gears of the gearbox, a special switch “Failure” 3 (figure 4.5.1), located on the CECS body 2 from its backside, is provided. To turn on the switch, first it is required to untighten 4 screws 1 attaching the CECS to the side console and lift up the unit from the console. On activating the switch 3 the operation of the CECS is fully blocked, the supply voltage is delivered to the electric magnet of the second gear and the electric magnet of FDA drive, the annunciator of the gearbox emergency operation mode 8 is on (figure 2.13.4).



1 – screw, attaching the CECS to the side console; 2 – CECS; 3 – switch “FAILURE”.

Figure 4.5.1 – Access to “FAILURE” switch on CECS body

5 Coupling of Implements

5.1 General Information

In section 5 "Coupling of implements" necessary instructions and data on features of application of an agricultural tractor “BELARUS-3522.5” are given.

Permitted field of application for tractor “BELARUS-3522.5” includes places with unrestricted air exchange, sufficient flotation and overall passing ability.

Tractors “BELARUS-3522.5” are designed for performance of the mechanized works in plant growing and fodder production.

Tractors “BELARUS-3522.5” are packaged by necessary work equipment for coupling of implements i.e. lift linkage and drawbar hitches (RLL, FLL, DM), RPTO and FPTO, hydraulic feed-outs, pneumatic heads and electrical outlet receptacles.

The tractor implements listed above allow coupling of implements of various machines in structure of MTU (machine and tractor unit or tractor-mounted units).

ATTENTION: TRACTORS “BELARUS-3522.5” ARE DESIGNED FOR COUPLING OF MOUNTED, SEMIMOUNTED, SEMITRAILED AND TRAILED IMPLEMENTS IN STRUCTURE OF MTU ONLY, TECHNICAL CHARACTERISTICS OF WHICH, RELATED TO ABILITY TO BE COUPLED, ARE COMPARABLE TO TRACTOR SPECIFICATIONS! OTHER APPLICATION OF TRACTOR IS NOT ALLOWED!

Selection and buying of agricultural implements (fertilizer distributors, plungers, motor cultivators, harrows, seeding machines, rotary tooling and other implements) for tractors “BELARUS-3522.5” is carried out by the customer itself according to its needs, and with consideration of the implement and tractor performance specifications, and local conditions also e.i. agrotechnical requirements, soil conditions, personal experience, guidelines of corresponding regional advisory centers and institutions for agricultural industry.

ATTENTION: GUIDELINES AND DATA ON SPECIFIC ASPECTS OF USAGE OF IMPLEMENTS WITH A TRACTOR AND DATA ON THE RECOMMENDED TRACTOR PERFOMANCE SPECIFICATIONS ARE PRESENTED IN OPERATIONAL DOCUMENTATION FOR IMPLEMENTS COUPLED!

Possibilities of agricultural tractors applications in the specified use environment are limited by tolerance range of force, exerted on hook rating and engine power, tractor maximum permissible load, roadhold of chassis, frictional sliding, operation driving speed, size power take-off value and operating weight of the implements coupled.

ATTENTION: WHILE OPERATING TRACTOR IN STRUCTURE OF MTU IT IS REQUIRED TO STUDY AND FOLLOW THE INSTRUCTIONS SET FORTH IN THE OPERATIONAL DOCUMENTATION OF IMPLEMENTS COUPLED WITH A TRACTOR CAREFULLY! PERSONNEL NOT HAVING STUDIED DOCUMENTATION AND SAFE MACHINE OPERATING PROCEDURES, AND HAVING NO DOCUMENTS ON-SITE, IS NOT ALLOWED!

ATTENTION: WHEN COUPLING OF MOUNTED, SEMIMOUNTED, SEMITRAILED AND TRAILED IMPLEMENTS WITH TRACTORS “BELARUS-3522.5”, INSTALLATION OF AUTOMATED CONTROL SYSTEMS, BEING THE PART OF THE MACHINE KIT, FOR TRACING OF OPERATIONS SEQUENCE IN THE CABIN, AND ITS CONNECTION TO THE BOARD NETWORK IS ALLOWED IF IT IS PROVIDED FOR IN THE OPERATIONAL DOCEMENTS FOR THE IMPLEMENTS.

Tractors “BELARUS-3522.5” belong to the category of motor vehicles covered by traffic regulations proceedings and other regulatory documents on the operation of off-track vehicles.

Tractor operator is personally liable for abidance by traffic regulations and safe operation requirements, and safety measures and correctness of tractor “BELARUS-3522.5” operation, set forth in this operation manual.

Service stuff qualification requirements for tractor “BELARUS-3522.5” operation:

- only qualified personnel that is aware of safety arrangement and precautions matters, having license documents of due form, determined by the legislation for tractor driving and having got admission to operate certain tractor, is allowed.
- if tractor owner (or any person liable for tractor operation) does not operates tractor himself, he must ensure that before starting operations all persons related to the tractor have been duly instructed on safety operation requirements and on correct coupling of implements with the tractor, and have studied the operation manuals for the tractor and the engine enclosed.

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

ATTENTION: BEFORE STARTING THE TRACTOR IN STRUCTURE OF MTU ENSURE THAT THERE IS NO PEOPLE IN CLOSE VICINITY TO THE TRACTOR INCLUDING THE AREA BETWEEN THE TRACTOR AND IMPLEMENTS OR TRAILERS (SEMITRAILERS) COUPLED!

5.2 Types of implements coupled with tractor “BELARUS-3522.5”

According to the type of coupling with tractors «BELARUS-3522.5» the implements are divided into the following types:

- mounted implement is fixed in three points to the upper and lower draft arms of LL. The tractor can carry weight of an implement in full. Implement structural components at carry is not in touch with ground contact area. While changing the implement position from operating to transport the point in which the implement is connected to the tractor is forcedly displaced to the new point along the full vertical extent;
- semimounted implement is fixed in three points to the upper and lower draft arms of LL or just in two points to the upper and lower draft arms of LL only. The tractor can carry weight of an implement in part and mostly by its traveling wheels (usually by one or two wheels). While changing the implement position from operating to transport, the point in which the implement is connected to the tractor is forcedly displaced to the new point along the full vertical extent. Two-point articulated linkage is effected by way of connection of suspension axis link pin to the lower draft arms hinges of LL (upper draft arm is not used). It is also possible to use a cross arm from the tractor or implement kit.
- semitrailed implement is usually fixed in one point by means of tractor drawbar clevis to the DH. It is also possible to use a two-point connection with lift linkage (upper draft arm is not used). The tractor can carry weight of an implement in part and mostly by its traveling wheels (usually not less than by two). While changing the implement position from operating to transport, position of the point in which the implement is connected to the tractor remains unchanged. Semitrailed implements include various vehicles for general and special purposes: general purpose semitrailers, tank semitrailers and dampers, and special purpose semitrailed vehicles for mechanizing of technological process in the agricultural sector.
- trailed implement is usually fixed in one point by means of tractor drawbar clevis to the DH. It is also possible to use a two-point connection with lift linkage (upper draft arm is not used). The chassis can carry weight of an implement in full, hitch mechanism (DH or LL) is loaded only by weight of implement connector. While changing the implement position from operating to transport, position of the point in which the implement is connected to the tractor remains unchanged. Semitrailed implements include various vehicles for general and special purposes: general purpose semitrailers, tank semitrailers, and dampers, and special purpose semitrailed vehicles for mechanizing of technological process in the agricultural sector.

5.3 Lift Linkage

5.3.1 General Information

While operating front and rear lift linkage via the ground control console the operator shall stay beyond the reach of three-point lift linkage and take to the account the external dimensions of projecting parts of the lifted implement.

ATTENTION: BEFORE LEAVING THE TRACTOR FOR ANY TIME PERION, THE LINKED IMPLEMENT SHALL BE PUT ON THE GROUNG INDISPENSABLY!

ATTENTION: MAXIMUM LIFTING POWER VALUE OF A HINGE MECHANISM (FLL OR RLL) AT THE SUSPENSION AXIS DETERMINATES TECHNICAL OPERABILITY OF THE LIFT LINKAGE, BUT NOT PERMISSIBLE MASS OF THE IMPLEMENT COUPLED THROUGH IT. PERMISSIBLE MASS OF THE IMPLEMENT DEPENDS ON THE CENTROID OVERHANGING LENGTH AGAINST THE SUSPENSION AXIS, AND IT IS LIMITED BY PERMISSIBLE LOADS ON THE TRACTOR AND BY CONTROLLABILITY CRITERION!

5.3.2 Three-Point Rear Lift Linkage

Basic parameters of RLL, specified in Table 5.1 and in Figures 5.3.1, 5.3.2, are given with rear tires 650/75R42 both single and doubled, mounted to the tractor and with standard static radius, specified by the manufacturer.

ATTENTION: FOR GENERAL USE LIFT LINKAGE OF LL-4 TYPE IS RECOMMENDED!

Rear lift linkage as defined by subsection 3.18 “Rear lift linkage”, consists of three drawbars (upper one and two lower drawbars) with front ends articulated via hinged joint with the tractor, and with rear ends articulated with free hinged joint for the purpose of connection to the attachment pins of the implements coupled. RLL is designed for connection of implements for tail positioning to a tractor, for drawbar power transfer during operation and adjustment of their position during operation, or run at transport position. RLL provides for coupling of the following types of implements and instruments:

- mounted implement fixed in three points (upper one and lower drawbars);
- semimounted (lower drawbars);
- semimounted with a cross arm to the suspension axis of lower drawbars (when mounting of LL “LL-3”).

ATTENTION: MOUNTING OF A CROSS ARM OR TRAILING SUSPENSION AXIS, BEING THE PART OF IMPLEMENTS SET FOR COUPLING OF SEMIMOUNTED, SEMITRAILED AND TRAILED IMPLEMENTS FOR FULFILLMENT OF DIFFERENT WORKS WHEN SPEED DOES NOT EXCEEDS 15 KM/H, TO THE ENDS OF LOWER DRAWBARS OF REAR LIFT LINKAGE!

There is a possibility of completing a tractor with several standard sizes and versions of lift linkages.

Sizes and structure of RLL of tractors “BELARUS-3522.5” make it possible to couple all implements, having the corresponding dimensions of attachment elements of connection triangle shown in RLL diagram.

Rear lift linkage diagram of type “LL-3” is shown in Figure 5.3.1.

Rear lift linkage diagram of type “LL-4” is shown in Figure 5.3.2.

In construction of rear LL a possibility of use of an adjusting rod which by fixing of the lower drawbars of a certain size among themselves ensures necessary length of a suspension axis and facilitates their connection to an implement. For protection of coupled implements from rocking length adjustable limit external rods are used.

To ensure the implement is in the right position the following adjustments of RLL by means of upper drawbar, crossbeams and limit rods are provided in vertical and horizontal plane:

1 Modification of length of upper drawbar.

Modification of length of upper drawbar is carried out in order to ensure penetration of operative parts (alignment of running depth of operative parts located one after another along the tractor run). If mounted plough carriage reaches forward along the tractor run and the front plough body cuts deeper than the rear one, extend the upper drawbar; and if the front plough body cuts for the more shallow depth than the rear one, the upper drawbar shall be shortened.

2 Modification of length of left or right crossbeam.

The modification is carried out in the following cases:

- to ensure the implement is in the horizontal plane;
- to ensure the even depth processing with operative parts of tractor-mounted machine across the width of cut;

3 Modification of length of both crossbeams, upper drawbar for transport position of the implement.

The modification is carried out in the following cases:

- to ensure the road clearance is not less than 300 mm;
- to ensure the sufficient safe clearance between the elements of the tractor and the implement, excluding the contact of parts of the tractor implements (clearance is not less than 100 mm).

4. Modification of length of both.

The modification is applied for the following purposes:

- during transportation of the implement, fasteners shall be blocked for the limitation of the implement rocking at run for the avoidance of the tractor elements damaging in case of an incidence;
- during operation of mounted, semimounted tilling machines with passively operated parts for the full processing (share and chisel ploughs, shallow ploughs, rippers and other implements), free movement in horizontal plane (rocking) shall be ensured, and the fasteners shall be unblocked as indicated in subsection 3.18.2 “Drawbar”;

IT IS FORBIDDEN TO OFFSET THE LONGITUDINAL AXIS OF THE IMPLEMENT, CONCERNING THE LONGITUDINAL AXIS OF THE TRACTOR BY MEANS OF ADJUSTMENT OF FASTENERS.

Note – Rules on adjustment of the crossbeams are specified in subsection 3.18 “Rear lift linkage”.

ATTENTION: LENGTH OF THE LEFT CROSSBEAM OF THE REAR LIFT LINKAGE MAKES 1020 MM, WHICH SHALL NOT BE CHANGED WITHOUT PARTICULAR NEED. IT IS USUALLY THE RIGHT CROSSBEAM THAT IS LENGH ADJUSTABLE. WHEN THE CROSSBEAM IS USED ON THE SUSPENSION AXIS AND WHEN REVERSIBLE PLOUGH IS USED THE LENGH OF CROSSBEAMS SHALL BE ALL THE SAME!

ATTENTION: NONCOMPLIANCE WITH THE REQUIREMENTS FOR ADJUSTMENT OF FASTENERS AND CROSSBEAMS MAY RESULT IN FASTENERS OR SUPPORT BRACKET BREAK OR OTHER BREAKAGE!

ATTENTION: ESSENTIAL FEATURES AND WAYS OF ADJUSTMENT OF POSITION OF THE IMPLEMENT 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 INFORMATION IN OPERATIONAL DOCUMENTATION, YOU SHALL OBTAIL IT FROM THE MANUFACTURER OR SELLER OF THE IMPLEMENT!

During operation of wide-cut implements in order to facilitate crossover contour following (planting cultivator and etc.,) and reduction of load on the RLL, free movement in vertical plane of one lower drawbar relative to another is to be ensured. To achieve this you have to adjust the crossbeams in order to make one lower drawbar move freely in vertical plane relative to another. Such an adjustment is made by exchange of pins, mounted on the fork as set forth in subsection 3.18.3 “Crossbeam”. RLL is controlled by RLL control panel located in the cabin and via the remote buttons on rear wheels panel ensuring positioning of lower drawbars of rear LL at the required height. Operator chooses the way to adjust the position of the rear lift linkage in manual mode by turning the lever of adjustment on the control panel of RLL. 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 drawbars lifting and lowering speed;
- limiting of lower drawbars rising height;
- choice of the required way of adjustment of lower drawbars positions;
- adjustment of soil processing depth;
- possibility to work with implements with depth control of operated parts movements (depth adjustment is carried out by an implement support wheel).

Note – Rules on RLL control are specified in subsection 2.14 «Rear lift linkage control».

RLL control system provides for the following ways of adjustment of mounted and semimounted implements and their operated parts:

1 For the implements and aggregated units having no support wheels:

- power-operated adjustment (depth adjustment is carried out according to drawbar resistance of the implement);
- position-controlled adjustment (the implement is hold in the predetermined position in relation to the tractor frame);
- mixed type (power-operated with position-controlled in any combination);

2 For the implements and aggregated units, having support wheels:

- mixed type (power-operated with position-controlled in any combination).

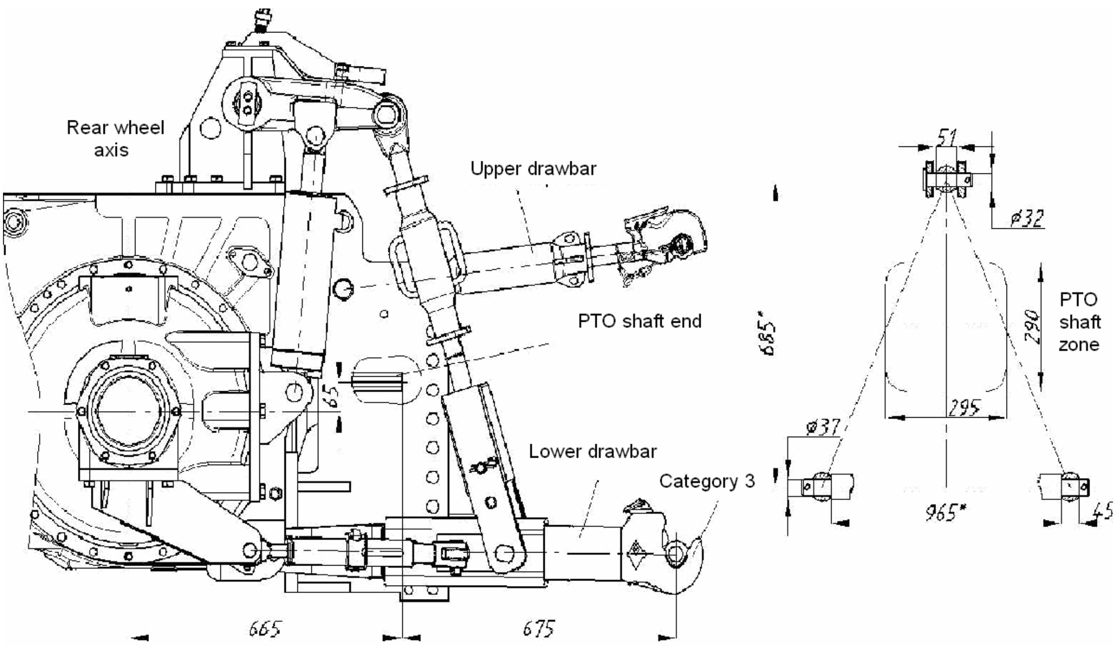


Figure 5.3.1 – Rear lift linkage diagramm of “LL-3” type

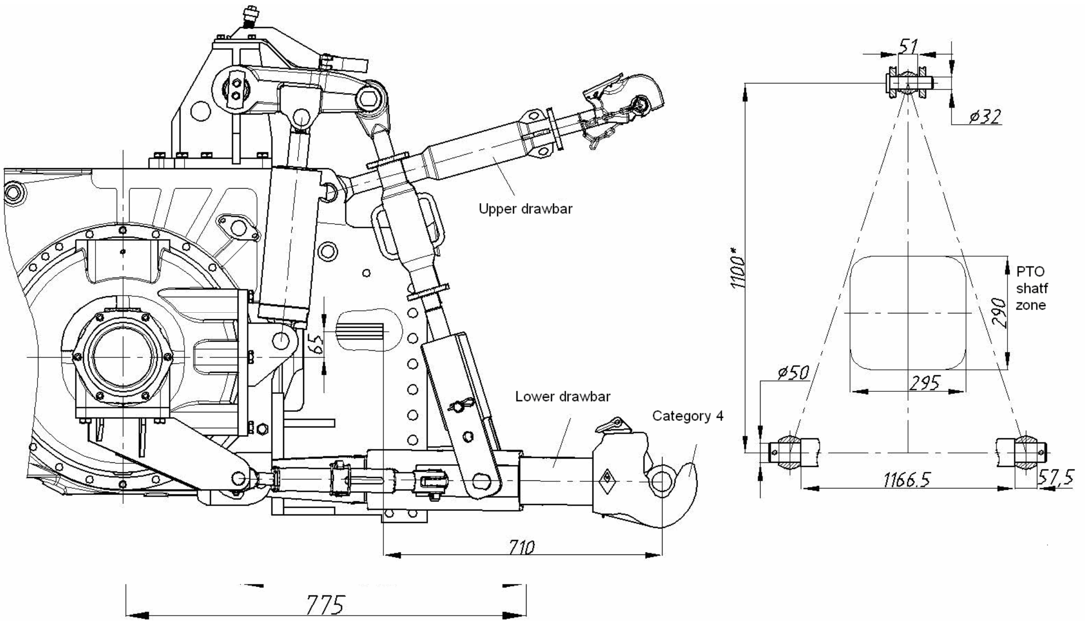
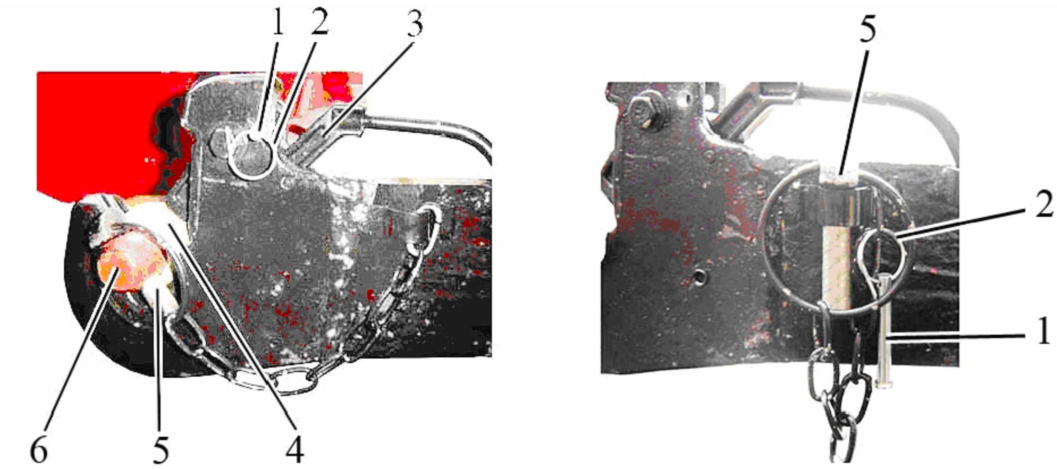


Figure 5.3.2 – Rear lift linkage diagramm of “LL-4” type

ATTENTION: AFTER COUPLING OF A TRACTOR, EQUIPPED WITH GRIPPER TOOL MANUFACTURED BY MTW, WITH MOUNTED OR SEMIMOUNTED IMPLEMENTS, LOCK THE GRIPPERS OF THE LOWER DRAWBARS OF REAR LIFT LINKAGE BY MEANS OF PIN 1 (FIGURE 5.3.3a) WITH RING 2!

ATTENTION! AFTER UNCOUPLING OF THE IMPLEMENT FROM THE TRACTOR IT IS NESESSARY TO DRAW THE FORELOCK 5 OUT OF THE AXIS 6 OF THE IMPLEMENT (FIGURE 5.3.3a), FIXING HINGED JOINT 4 ON THE AXIS OF THE IMPLEMENT, AND THE PIN 1 WITH THE RING 2 OUT OF THE GRIPPER, AND THEN RISE THE HANDLE OF THE GRIPPER 3 UP TO THE STOP 6. SET THE PIN AND THE FORELOCK AS SHOWN IN FIGURE 5.3.3 b!



a) position of the pin and forelock when the implement is coupled

b) position of the pin and forelock when the implement is uncoupled

1 – pin; 2 – ring; 3 – gripper handle; 4 – hinged joint; 5 – forelock; 6 – axis of implement.

Figure 5.3.3 a – Locking of the lower drawbars gripper of RLL

Table 5.1 – Basic parameters и coupling dimensions of RLL

Standard size (configuration) of the device	"LL-3" (Figure 5.3.1)	"LL-4" [2] (Figure 5.3.2)	
1 Design features	Device consisting of three drawbars (upper one and two lower ones), articulated by the front ends with the tractor, and by rear ends with coupling elements of the implement during operation		
2 Purpose	To connect (mount) or coupling of mounted, semi-mounted and semitrailed implements [4]		
3 Length of lower drawbars, mm	1060	1118	
4 Hinged joint width of the upper (lower) drawbar, mm	51 (45)	51 (57,5)	
5 Diameter of a pin of a rear-end hinged joint of the upper drawbar, mm	32	32	
6 Diameter of pin bore of a rear-end hinged joint of the lower drawbar, mm	37	50	
7. Distance between PTO shaft end extension face and suspension axis, mm	675	710	
8 Column height [1], mm	685	1100	
9 Length of the suspension axis along the collar [1], mm	965	1166,5	
10 Distance between PTO shaft end extension face and rear wheel axis, mm	665	665	
11 Lifting power of the device, кН [5]: a) on the suspension axis; b) at overhang of 610 mm from the suspension axis	 100 65	 100 65	

[1] Dimension refers to the implement coupling.

[2] Basic variant recommended for the continuous application.

[3] Semitrailed implements are coupled by means of the crossbeam at the ends of the lower drawbars of rear LL only at towards moving of main traverse, but not reversing.

[4] It is not allowed to give RLL load exceeding loading of tires specified by loading instructions set forth in Table 4.3.

5.3.3 Front three-point lift linkage

Front lift linkage with dimensions corresponding to standard size “LL-2”, is similar on critical parameters to the rear lift linkage. Front lift linkage is designed for the following purposes:

- forming of combined units (tiller is in front of the machine, and seeder is behind and etc.);
- forming of echelon linkage mounting (front and side-cut mower and etc.);
- transportation of implements detached from the combined units located in the rear end during long-distance transportation;
- for mounting of front hanging ballast.

Front lift linkage of a tractor is used with tilling machines only in a propelling condition, FLL is not designed for use with tilling machines on reverse.

IT IS PROHIBITED TO OPERATE FLL WITH LOGGING BLADES, AND FOR JACKING OF TACTOR FRONT ELEMENT.

Note – Rules on coupling of implements with FLL, guidance on changing of FLL operating position into the transport position, and also the general information about the design of FLL are set forth in subsection 3.20 “Front lift linkage”.

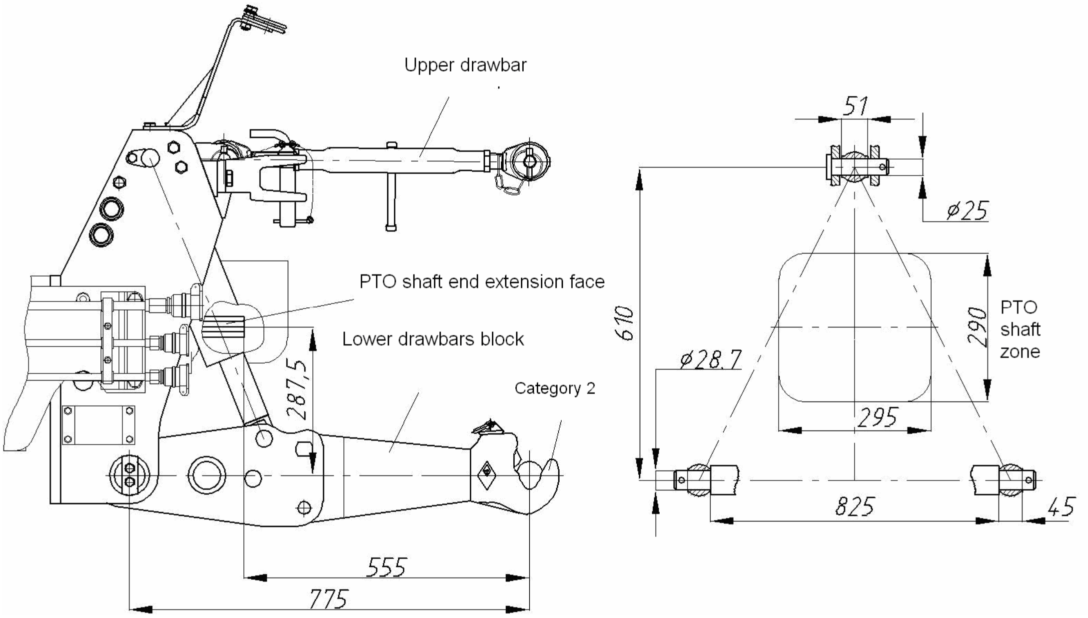


Figure 5.3.4 – Front lift linkage diagram

Scheme of installation of linkage-mounted ballast weights assembled with mounted bracket to FLL is shown in Figure 5.3.4a. Information about installation of linkage-mounted ballast weights to FLL is shown in Table 5.2a.

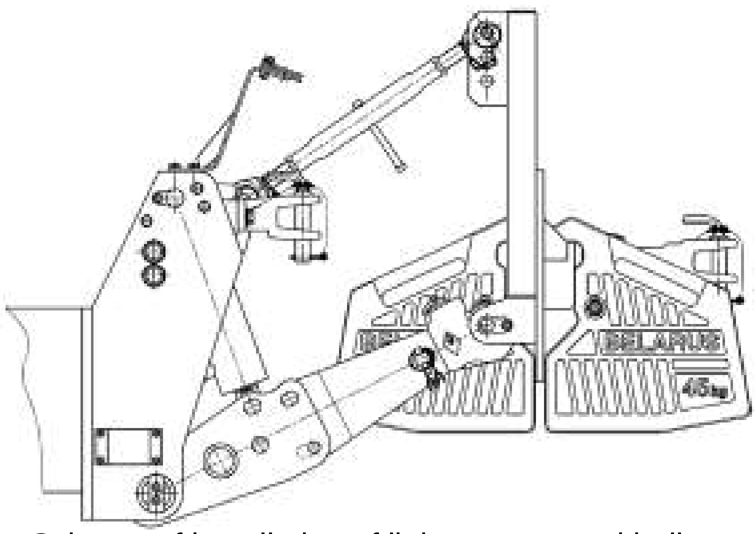


Figure 5.3.4a – Scheme of installation of linkage-mounted ballast weights to FLL

Table 5.2 – Basic parameters и coupling dimensions of FLL

Standard size (configuration) of the device	“LL-2”
Design features	Device consisting of three drawbars (upper one and two lower ones), articulated by the front ends with the tractor, and by rear ends with coupling elements of the implement during operation
2 Purpose	To connect (mount) or coupling of mounted, and semimounted implements
3 Length of lower drawbars, mm	775
4 Unblocked Hinged joint width of the upper (lower) drawbar, mm	51 (45)
5 Diameter of a pin of hinged joint of upper drawbar, mm	25
6 Diameter of pin bore of a hinged joint of the lower drawbar, mm	28,7
7 Distance between PTO shaft end extension face and suspension axis, mm	555
8 Column height [1], mm	610
9 Length of the suspension axis along the collar [1], mm	825
10 Lifting power of the device, кН [5]: a) on the suspension axis; b) at overhang of 610 mm from the suspension axis	 50 30

[1] Dimension refers to the implement coupling.

[2] It is not allowed to give FLL load exceeding loading of tires specified by loading instructions set forth in Table 4.3.

Table 5.2a – Information about installation of linkage-mounted ballast weights to FLL

1 Equipment title	Linkage-mounted ballast weights kit assembled with a bracket
2 Primary purpose	Additional loading of front driving axis, facilitating the tractor weight distribution by coupling to a tractor lift linkage
3 Design features	It consists of Linkage-mounted ballast weights kit assembled with a mounted bracket
4 Type LL (accord. to GOST 10677) [1]	“LL-2”
5 Category (accord. to GOST 730-1) [1]	Category 2
6 Maximum weight of bracket with ballast weights, kg	1320
7 Minimum weight of bracket with ballast weights, kg	250
8 Weight of bracket without ballast weights, kg	160

[1] Refers to the coupling dimensions of mounted bracket.

5.4 Drawbar hitch

5.4.1 General information

Tractors “BELARUS - 3522.5” are packaged with drawbar hitches, towing yoke and draw bar ensuring coupling and transporting of trailed and semitrailed implements coupling 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 drawbar hitch of a tractor easier;
- drawbar hitches of semitrailers have an adjustable support.

Tractor “BELARUS - 3522.5” has special-purpose rear mounting arrangement of lift type in the form of guide plates with several borings fixed to the rear joint face of a rear axis body. The arrangement is meant for mounting of drawbar hitches and allows height adjustment of towing yoke.

Installation variants scheme of towing yoke is shown in Figure 5.4.1.
Installation variants scheme of towing yoke is shown in Figure 5.4.2.

Basic parameters of drawbar hitches shown in Tables 5.3, 5.4, and in Figures 5.4.1, 5.4.2, are given with rear tires 650/75R42 both single and dual mounted to the tractor and with standard static radius, specified by the manufacturer.

Note – General information about DH is set forth in subsection 3.22 “All-purpose drawbar hitch”.

5.4.2 Drawbar Hitch “Towing yoke”

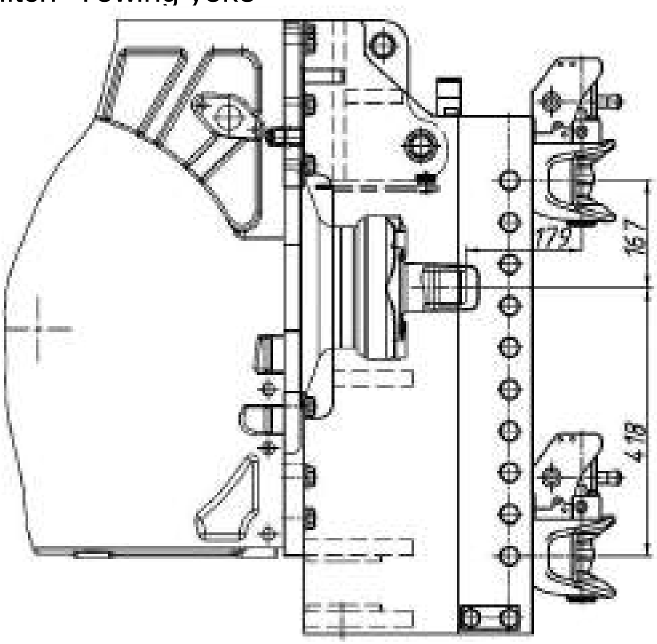


Figure 5.4.1 – Installation variants scheme of “Towing yoke”

Table 5.3 – Basic parameters и coupling dimensions of “Towing yoke”

Standard size (configuration) of the device	“Towing yoke”
1 Mounting location	Rear lifting device
2 Design features	Towing yoke is rotational, located on lifting device, up/down modifiable, with coupling automation
3 Purpose	For connection and coupling of trailed, semitrailed implements with traveling wheels including of tractor semitrailer type
4 Trailing appliance for connection to DH:	
a) type	Rigid, with tractor drawbar clevis
b) vertical load in hitch point, kN, not more than	20
c) trailing appliance steering angle in horizontal plane, degrees, not less than	±65
d) protective mean type	Safety chain (rope) [1)]
e) connection point of protective mean of tractor	Lifting device bore
[1)] Implement accessories.	

5.4.3. Drawbar hitch “Draw bar”

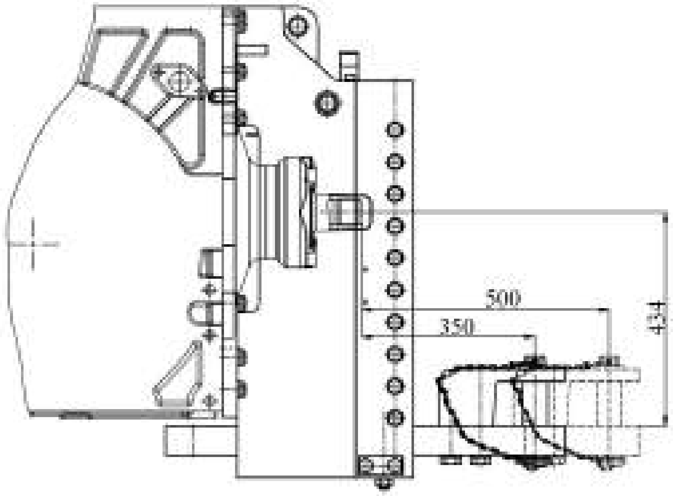


Figure 5.4.3 – Installation variants scheme of “Draw bar”

Table 5.5 – Basic parameters и coupling dimensions of “Draw bar”

Standard size (configuration) of the device	Draw bar
1 Mounting location	At the bottom of rear axis body and rear lifting device
2 Design features	Towing yoke, nonrotational, located on a longitudinal beam blocked against tractor frame, with possibility to set the hitch point in two points against PTO shaft end butt
3 Purpose	For connection and coupling of trailed, semitrailed implements with traveling wheels excluding tractor trailers and semitrailers
4 DH hook dimensions, mm:	
a) connecting pin diameter	50
b) towing yoke gap height	90
c) towing yoke gap width from a bolt	R90
d) distance between towing yoke gap in vertical position and ground contact area, mm	541
e) towing yoke position[1] for the implements driven by rear PTO shaft	Unchangeable [2]
f) distance between PTO shaft end and connection pin axis	350, 500
5 Trailing appliance for connection to DH:	
a) type	Rigid, with tractor drawbar clevis
b) vertical load in hitch point, kN, not more than	30 (for 350), 21 (for 500)
c) trailing appliance steering angle in horizontal plane, degrees, not less than	±65
d) protective mean type	Safety chain (rope) [2]
e) connection point of a protective mean of the tractor	Lifting device bore

[1] Recommended.

[2] It is not allowed to locate a pad on the bottom of the draw bar (with overturn) to lower the towing yoke against ground contact area.

[3] Implement accessories.

5.5 Usage patterns of tractor hydraulic system for driving of operated parts and other elements of unitized hydraulically operated machines and aggregates

Hydraulic control system for implements mounted on tractor “BELARUS-3522.5” provides means for oil extraction for operation of the implements coupled. Meanwhile the following variants are possible:

- oil extraction by unilateral and bidirectional hydraulic cylinders (hereinafter referred to as hydraulic cylinders);
- replenishment of oil volume in a tank caused by flooding of cylinder and fittings chambers shall be assured after trial of performance of the hydraulic system of the tractor with an implement;
- oil extraction for hydraulic motors drives (hereinafter referred to as hydromotors).

Application for coupling of hydraulically operated machines for their connection to the oil pipeline channel and high pressure hoses of less diameter (refers to flow passage) than on tractors is not allowed as it will result in premature failure of tractor pump and oil overheating.

While operating hydraulically operated machines having hydromotors it is required to connect a hydromotor drain line to a special output of a tractor for free non-ramming oil drain in a tank past a distribution valve.

ATTENTION: FOR ENSURING OF THE REQUIRED ROTATIONAL SPEED OF THE HYDROMOTOR OF THE IMPLEMENTS COUPLED CERTAIN OIL SUPPLY IS NECESSARY. HYDRAULIC FLUID FEEDING ON THE TRACTOR “BELARUS-3522.5” IS REGULATED BY MEANS OF JOYSTICKS. THEREFORE, IF THE IMPLEMENT HYDRAULIC DRIVE HAS ITS OWN FLOW CONTROL VALVE THE FLOW ADJUSTER OF THE IMPLEMENT HYDROMOTOR SHALL BE SET ON FULL SPEED RPM, NAMELY TO EXCLUDE FROM OPERATION!

Tractor hydraulic systems and the implements coupled must be joined via special joint sleeves (fast-coupling, cut-off) that should be cleared of dirt before joining. In case of absence of the required plug contacts on the implements coupled, it is necessary to use the plug contacts from a tractor spare parts tools and accessories (SPTA) kit (there are eight plug contacts available for connection to a distribution valve and two plug contacts for connection to free non-ramming drain line).

In case of use of outputs of tractor hydraulic lift linkage for service of the implement coupled, it is necessary to ensure the required volume of oil in a tank. Extraction of oil by cylinders of the implement coupled should not exceed 30 liters.

Excessive oil extraction during coupling causes load increase on hydraulic lift linkage of a tractor. Therefore it is recommended to land the working attachment after working operation accomplishment. Do not leave the implement coupled in raised position for a long period. At long-term use of a hydraulic drive it is necessary to track a temperature range in a hydraulic system.

Level check in a tractor hydraulic tank shall be carried out with RLL and FLL lower drawbars landed and retracted cylinder of the implements coupled. You must not fill in the oil when working attachments of the implement coupled are in raised position as it can result in the tank overflow and blow-out of elements of a hydraulic drive by the excessive oil being displaced from cylinders at the subsequent landing of the working attachments.

Major characteristics of tractor “BELARUS-3522.5” HLL for working attachments drive of other components of the hydraulically operated implements and units coupled are shown in Table 5.6.

Table.5.6 – Major characteristics of tractor hydraulic drive “BELARUS-3522.5”

Parameter Description	Parameter Value (characteristic)	
	Front	Rear
1 Paired hydraulic outputs (free)	One pair [1] (duplicated with rear outputs)	Four pairs [2]
2 Oil drain line for hydromotors (free drain line)	One item [1]	One item [2]
3 Total oil consumption through hydraulic outputs, l/min	From 0 to 120,0, steplessly variable	
4 Oil consumption per one hydraulic output, l/min	From 0 to 80,0, steplessly variable	
5 Rated minimum diameter of oil pipeline, mm:		
- oil pressure pipeline	12,0	
- oil drain pipeline	16,0	
- free-drain	18,0	
6 Hydraulic system working pressure, MPa	16,0	
7 Pressure relief cracking pressure, MPa	From 20,0 to 21,0	
8 Allowable extraction of hydraulic fluid from a tank, l, not more than	30,0	
9 Allowable hydrostatic power take-off (GSPTO) kW, not more than	20,0	
10 Coupling thread of fast-coupling joint sleeves, mm:		
- oil pressure pipeline and oil drain pipeline	M20×1,5	
- free-drain oil pipeline	M24×1,5	

[1] Refers to front outputs.
[2] Refers to rear outputs.

ATTENTION: INSTALLATION OF ADDITIONAL COMPONENTS AND CHANGE OF HYDRAULIK LIFT LINKAGE PIPELINES ROUTE IS ALLOWED ONLY AFTER CONSULTATION WITH THE PLANT OR THE DEALER!

Note – Scheme of connection of hydraulic lift linkage outputs to an external consuming system is shown in Figure 2.16.2.

5.6. Power take-off shaft end type

External spline drives (Figure 5.6.1) of the front and rear power take-off shaft (PTO shaft) of the tractors “BELARUS-3522.5” correspond in design and arrangement to regulatory document and standards covering the specified equipment. FPTO shaft and RPTO shaft ends parameters of the tractor, and also FPTO shaft and RPTO shaft drives specifications are shown in Table 5.7.

Front PTO shaft is packaged with PTO shaft end of type 2.

Rear PTO shaft is packaged with PTO shaft end of type 1, 2, 3,

The tractor is equipped with PTO shaft end of type 3. The remaining ones shall be put into the SPTA kit of the tractor.

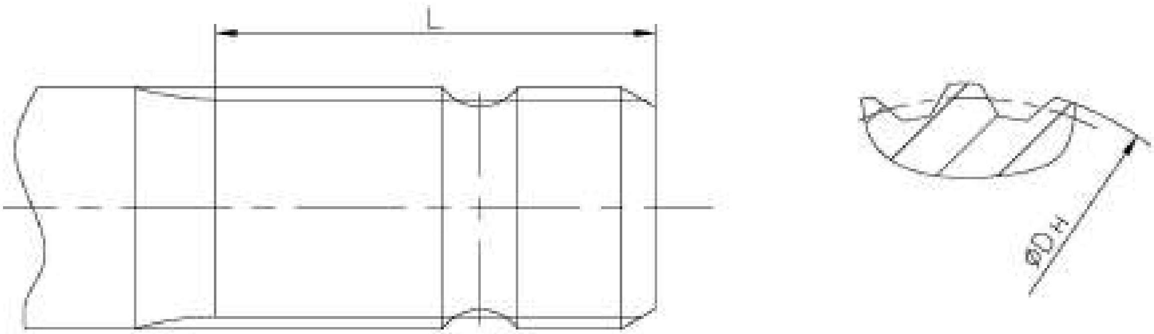


Figure 5.9.1 – Power take-off shaft end

Table 5.7

FPTO shaft and RPTO shaft ends and drives parameters	Power take-off shaft end type			
	Type 1	Type 2	Type 3	
1 Splines lengths L, mm	76	64	89	
2 External diameter D_H, mm	35	35	45	
3 Spline quantity, n	6	21	20	
4 PTO shaft end rotation frequency, rpm	For rear PTO shaft – 1000 (1530) [1)] For front PTO shaft – 1000			
5 Power transmitted by RPTO shaft end, kW, not more than	60,0	92,0	185	
6 Power transmitted by FPTO shaft end, kW, not more than		44		
7 Type of drive	Independent drive			
8 Direction of RPTO shaft end rotation (see the butt)	Clockwise			

[1)] PTO shaft end rotation frequency for economy mode of RPTO shaft when the rated frequency of the engine crankshaft is 2200 min^{-1}.

5.7 Determination of PTO shaft and cardan shaft capabilities

Critical parameters for determination of possibility of application of rear or front PTO shaft of the tractor, and cardan shaft and safety clutch performances also in the course of the implements selection for coupling with the tractor are the following: coupling method; distance from a connection point to PTO shaft end butt and PRS shaft end; PTO shaft rotational speed, PRS torque and power consumption of the implement.

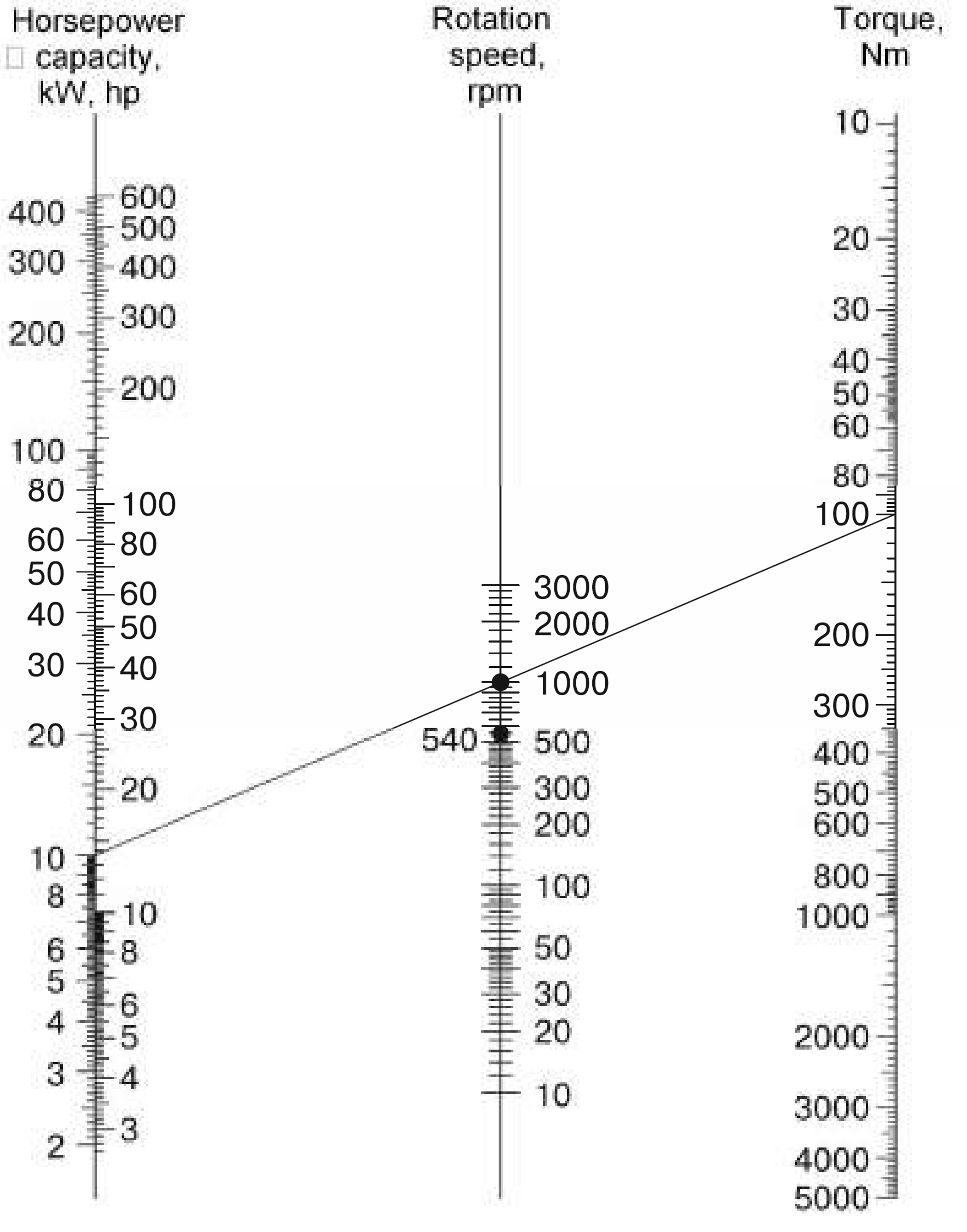


Figure 5.7.1 – Nomographic chart for torque test on PRS

Manufacturers of the implements with active working attachments designed for tillage and grass cutting (rotary tooling, mulchers, mowing machines and other implements) usually present data on the implement coupling method, PRS rotation speed, gear transmission ratio of the implement mechanical drive, minimum take-off value and maximum required tractor horsepower ensuring the implement operation.

For the purpose of torque test on PRS and in case you know PTO shaft rotation speed and PRS takeoff power nomographic chart (Figure 5.7.1) or the following formula can be used:

$$M = 9549 \cdot \frac{P}{n}$$

where *M* is torque, Nm; *P* is PRS takeoff power, kW; *n* is PTO shaft rotation speed, min^{-1}.

ATTENTION: NOMINAL ROTATION SPEED OF PRS END OF THE IMPLEMENT COUPLED SHALL NOT EXCEED 1000 MIN^{-1}!

If there is a need to improve the PRS rotation speed or rotation speed of working attachments for the implements coupled the following formula can be used:

$$n_{pic} = un_s$$

where n_{pic} is PRS rotation speed, min^{-1}; n_s is working attachments rotation speed, min^{-1}; u is gear transmission ratio of the implement drive.

To avoid failures of PTO shaft and PRS in several implements with active working attachments (tilling rotary implements, combine harvester, mowers, cattle-feeders, pickup balers and etc.) mechanical safety clutches are used.

Functional purpose 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 of (locks) the working attachments and loads fluctuations on the PRS drive.

Response time of the implement cardan shaft safety clutch can be by the following formula:

$$M_c = k \cdot M_1 \le M_{PTO}$$

where M_{PTO} is maximum permissible PTO shaft torque, Nm; M_c is response time of the safety clutch, after which the implement shall not operate, Nm; M_1 is nominal operating torque, permissible for the implement drive in the specified operating conditions, Nm; k = 1.25…1.5 is design factor (smaller values are taken for low-duty conditions and the bigger ones – for heavy conditions).

ATTENTION: THE IMPLEMENT COUPLED SAFETY CLUTCH RESPONSE TIME SHALL EXCEED THE NOMINAL 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 IMPLEMENT SAFETY CLUTCH RESPONSE TIME EXCEEDS THE PERMISSIBLE PTO SHAFT TORQUE SUCH IMPLEMENT MUST NOT BE COUPLED WITH THE TRACTOR.

Among safety clutches there are cam clutch, frictional clutch, disk clutch, they can be subdivided to two basic types – with destructible and indestructible working components. Clutches with a destructible component are used as overload control device.

ATTENTION: IT IS NOT RECOMMENDED TO USE CARDAN SHAFTS WITH SAFETY CLUTCHES WITH A DESTRUCTIBLE COMPONENT ON THE TRACTORS “BELARUS-3522.5”!

In several implements freewheeling clutches are used. The freewheeling clutches (sprag clutches) are automatically closed if the rotating direction is straight, and are unclosed if the rotating direction is opposite. The freewheeling clutches ensure operation of the implements with the increased inertia moment of the implement rotating masses to prevent it from the drive failure when the PTO shaft is switched off.

There are also combination safety clutches. A combination safety clutch is the safety clutch which is structurally combined with a clutch of other type, for example with a freewheeling clutch.

ATTENTION: MANUFACTURER OF THE IMPLEMENT CARDAN-DRIVEN FROM THE TRACTOR PTO SHAFT, SHAL INFORM YOU IN ADVANCE ABOUT THE NECESSITY OF APPLICATION OF A SAFETY CLUTCH, CLUTCH DESIGN FEATURES AND CONSEQUENSES OF THE IMPLEMENTS APPLICATIONS WITHOUT THE SAFETY CLUTCH!

When you need to decide on the purchase or operation of the cardan shaft follow the implements and cardan shaft manufacturers' guidelines first of all. It is recommended to apply with the tractor the implements with active working attachments where the length between the articulations of the fully off-set cardan shaft does not exceed 1 m.

When coupling the implements with RLL or FLL (Figure 5.7.2), the length of the cardan shaft is determined by distance L (fully off-set cardan shaft) with the lower drawbars placed horizontally. Shaft extension occurs when the implement is lifted therefore in up position it is necessary to check overlapping of extensible components. In joint of the cardan shaft large angularity appears in transport position of the implement when the tractor PTO shaft is disabled. Cardan joints are not large and equal to each other in operating position, and usually L_1=L_2 is assured. Therefore in this case an extensible cardan shaft with gimbal joint with guard housing can be used.

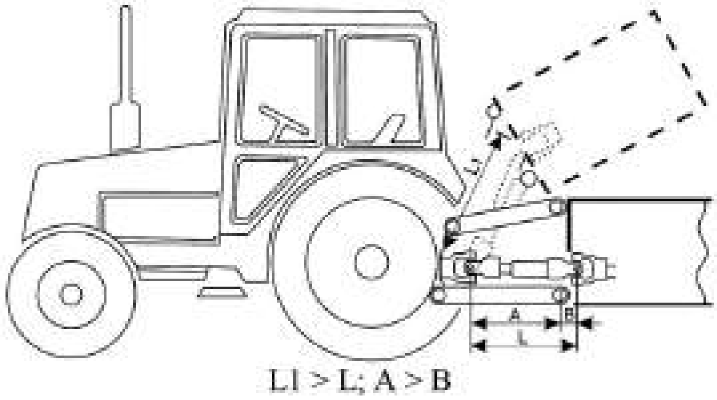


Figure 5.7.2 – Cardan shaft length finding scheme in course of the tractor coupling with the implements connected via RLL and FLL.

In course of the implements coupling via "Draw bar" (Figure 5.7.3) where PTO shaft and PRS are parallel and not shifted relative to each other in fore-and-aft plane (right and left), distances A and B from the connection point to PTO shaft and to PRS are approximately equal, and maximum length of cardan shaft L is determined when the implement turns around maximum angle turn relative to the tractor, an extensible cardan shaft with gimbal joint with guard housing can be used.

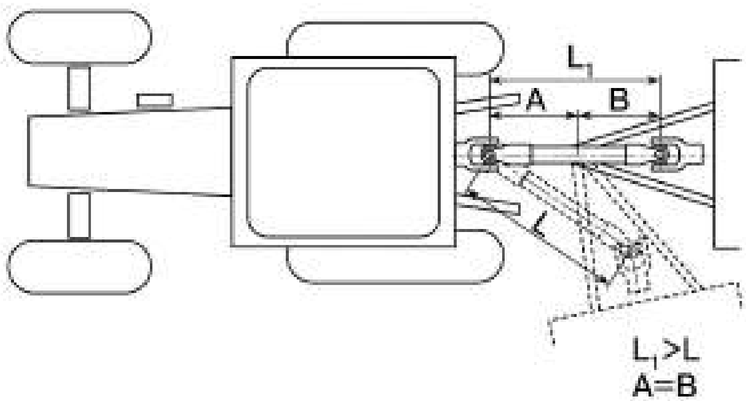


Figure 5.7.3 – Cardan shaft length finding scheme in course of the implements coupling via (Figure 5.7.3).

In course of the implements coupling via “towing yoke” (figure 5.7.4), when distance equality from the implement connection point to PTO shaft and PRS is not maintained, PTO shaft and PRS axles are shifted relative to each other in fore-and-aft plane (right and left) when the implement turns the cardan shaft length is varied lengthwise, an extensible cardan shaft with gimbal joint and constant-velocity universal joint with guard housing shall be used. Meanwhile the constant-velocity universal joint shall be located on the part of PTO shaft.

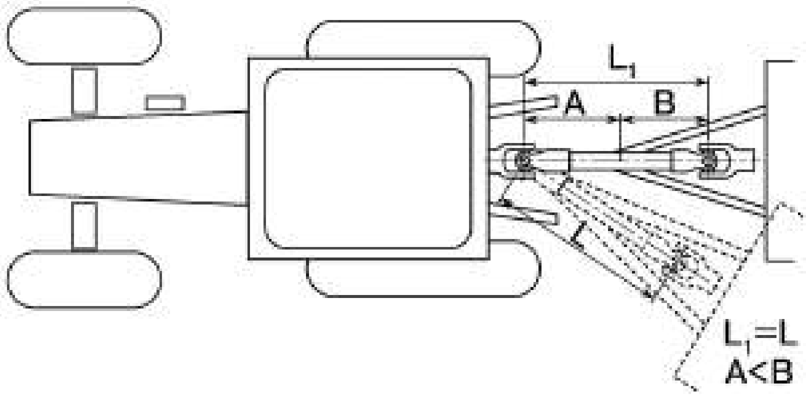


Figure 5.7.4 – Shaft length finding scheme in course of the tractor coupling with the implements connected via “towing yoke”.

5.8 Features of application of PTO shafts and cardan shafts

WARNING: BE CAREFUL WHEN PTO SHAFT IS ACTIVATED AND THE CARDAN SHAFT OF THE IMPLEMENT COUPLED IS ROTATING. IN CASE THER ARE PEOPLE IN AREA OF OPERATION OF PTO SHAFT THEY OR THEIR CLOTH CAN BE CLAMPED BETWEEN THE IMPLEMENT ROTATING PARTS AND OTHER MOVING MACHINERY, THAT CAN RESULT IN PERMANENT INJURY INCLUDING WITH FATAL OUTCOME, THEREFORE BEFORE STARTING THE PTO SHAFT ENSURE THERE IS NO PEOPLE IN DANGEROUS AREA BETWEEN THE TRACTOR AND THE IMPLEMENT. WORKS ASSOSIATED 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 DISABLED. BEFORE STARTING THE CARDAN SHAFT MOUNTING, STOP THE ENGINE, GET THE IGNITION KEY OUT OF STARTER SWITCH AND THE DEVICES, AND SET THE PARKING BRAKE!

ATTENTION: TRACTOR MANUFACTURER SHALL NOT BE LIABLE FOR THE IMPLEMENTS COUPLED CARDAN SHAFTS FAILURES. CARDAN SHAFTS SPECIFICATIONS AND DESIGN ARE IN SPHERE OF RESPONSIBILITY OF THE IMPLEMENTS AND CARDAN SHAFT MANUFACTURERS!

ATTENTION: DO NOT USE THE CARDAN SHAFTS WITHOUT THE APPROPRIATE PROTECTIVE DEVICES AND IF THEY ARE SELF-MANUFACTURED OR DAMAGED!

ATTENTION: BE CAREFUL WHEN COUPLING OF THE IMPLEMENTS WITH THE CARDAN DRIVE: DEFLECTION ANGLES OF THE CARDAN SHAFT ARE LIMITED BY THE TRACTOR STRACTURAL COMPONENTS, FOR EXAMPLE, BY LIFTING DEVICE GUIDING RODS OR TRACTOR WHEELS. DUE TO MUTUAL TOUCH-DOWN OF THE CARDAN SHAFT AND OTHER STRACTURAL COMPONENTS, SOME BREACKAGE OF THE IMPLEMENT TRAILING APPLIANCE CAN OCCURE OR, FOR EXAMPLE, TRACTOR TIRES OR THE CARDAN SHAFT DAMAGE!

ATTENTION: WHEN THE IMPLEMENT IS OPERATED WITH THE CARDAN SHAFT THERE IS A HAZARD OF PROCESS MATERIAL OR THE IMPLEMENT COMPONENTS RELEASE, THEREFORE IT IS NESESSARY TO OBSERVE SAFE DISTANCE!

When the implement cardan shaft is coupled to the PTO shaft end the following rules and requirements shall be observed:

1. Check the engaged RPTO shaft mode (basic or economy mode) for compliance;
2. Before engagement detach the cardan shaft into two parts.
3. Inspect the cardan shaft, PTO shaft and PRS for absence of mechanical damage and for completeness of the set. Clear the PTO shaft ends of dirt when needed, and lubricate it according to the lubrication chart, specified in the implement operation manual.
4. The cardan shaft part having the icon of “Tractor” on it, shall be coupled to the PTO shaft end, and the second part – to the implement PRS accordingly. Do not forget to fasten contactor splined bushings on the PTO and PRS shaft ends properly: fastening method shall be specified by the cardan shaft manufacturer.
5. The implement cardan shaft end yoke from the side of PTO shaft and PRS shall be in the same plane as indicated in Figure 5.8.1.

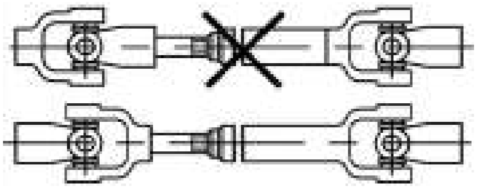


Figure 5.8.1 – Cardan shaft mounting scheme

6. Safety clutch, as indicated in Figure 5.8.2 shall be installed only from the side of PRS of the drive of the implement coupled, other method of mounting will not ensure the excess of timely protection of the tractor PTO shaft from the maximum permissible torque. After lengthy downtime check the implement safety clutch technical condition.

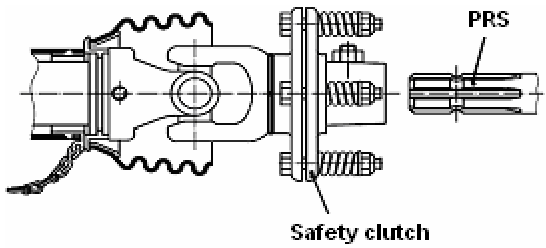


Figure 5.8.2 – Safety clutch mounting scheme

7. Mounting of the cardan shaft with 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 indicated in Figure 5.8.3, ensures cardan joint safety.

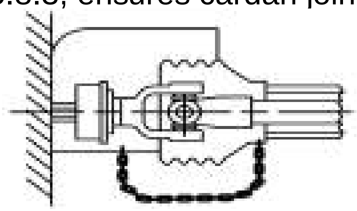


Figure 5.8.3 – Safety cardan shaft mounting scheme

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-3522.5” when needed. For more detailed guidelines on cardan shafts see the technical documentation enclosed. Contact the cardan shaft manufacturer when needed.

9. The length of the cardan shaft maximum driven apart (which is permitted for operation) shall be of such type when the one part of the cardan shaft enters another for not less than L_2=150 mm. If the value is below L_2=150 mm (Figure 5.8.4, view A) the cardan shaft must not be operated. Sufficiency of overlapping L_2 can be checked by rotation or lifting of the implement coupled.

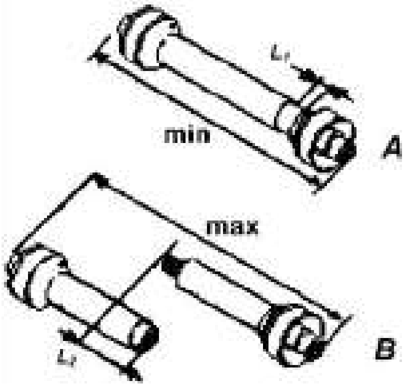


Figure 5.8.4 – Choice of the cardan shaft length

10. If the tractor and the implement coupled are positioned linearly when the cardan shaft is pushed in full, check if there is a sufficient clearance L_1 (Figure 5.8.4, view B) between tube face and universal joint yoke end butt. Minimum permissible clearance L_1 shall make not less than 50 mm.

11. After the cardan shaft coupling regularize all the protective devices, meanwhile fix the guard shaft housing from rotation with the chains as indicated in Figure 5.8.3.

12. Limit the RLL or FLL lifting to the uppermost position along with the implement lifting when needed. It is essential for slope angle decrease, for exclusion of possibility of contact and damage of the cardan shaft, and for providing of safety clearance between the tractor and the implement.

13. Maximum permissible slope angles and steering angle (Figure 5.8.5) of the cardan shaft hinged joints are shown in Table 5.8.

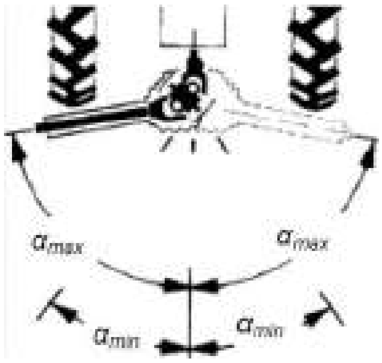


Figure 5.8.5 – Maximum permissible slope angles and steering angle of the cardan shaft hinged joints

Table 5.8

Tractor power take-off shaft position	Maximum permissible slope angles (steering angle) α_{max}[1)], in degrees	
	Cardan shaft hinged joints type	
	Universal	Equivalent angular rates
"On" position:		
- under load	20	25
- no-load [2)]	50	50
"Off" position [3)]	50	50

[1)] Other variations are possible (see the cardan shafts and the implements manufacturers' documentation).
[2)] In the short run, for the PTO shaft operated with no load.
[3)] For the implements transport position when the PTO shaft is disabled.

14. In case of mounted and semimounted implements operation with the cardan drive, block the lower drawbars of the lift linkage.

15. After the cardan shaft dismounting it is necessary to put guard hoods on the PTO shaft and PRS ends!

16. After the PTO shaft is disabled consider the hazard of the cardan shaft and individual mechanisms of the implement coupled coasting. Therefore the dangerous area between the tractor and the implement can be entered only after the PTO shaft is completely despinned!

17. Check for 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. At transporting of the tractor with the trailed, semitrailed and semimounted implements for considerable distances, including from one field to another, 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 disabled.

The PTO shaft shall be disabled in the following cases:

- after the tractor has stopped, but only after the implement coupled has came full duty cycle;
- on turns, when the implement is lifted to the transport position;
- when moving on the sharp climb and sharp descent.

Do not engage PTO shaft in the following cases:

- when the tractor engine is disengaged;
- the implement coupled to the tractor is in transport position;
- when the working attachments are sunken into the soil;
- if a process material overlays the implement working attachments or if the working attachments are clogged or wedged;
- if the slope angle (refraction angle) in any plane of cardan shaft hinged joint is a considerable.

During operation of the rotation tilling machine with the active working attachments comply with the following guidelines:

- do not engage the PTO shaft when the implement is grounded. The PTO shaft shall be engaged only when the ready-to operate implement is lowered down with the working attachments staying off the ground with clearance making not less than 20…35 mm;
- lowering down of the implement with rotating working attachments shall be carried out in a smooth manner when the tractor is moving forward;
- prevent the tractor from moving in the direction not corresponding the implement working travel during operation, when the working attachments are sunken with engaged and disengaged PTO shaft;
- during operation on strong soils at first carry out processing of cross ranges for moving in the disclosure, and than the lengthwise tillage can be started;
- it is recommended to work at minimum processing depth, required for the specific crop. It is necessary for load on the tractor PTO shaft reduction and reduction of fuel consumption during the tractor operation. Particularly it is important to consider it at the tractor operation with multiple-purpose till-plant outfits.

5.9 Features of the tractor application in special conditions

5.9.1 Tractor operation in areas with rugged topography. Possibility of the tractor application for haylage allocation for reserve.

Operator working in the fields and roads with a slope coming downwards or upwards, 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 field spaces with a slope not exceeding 9 degrees.

ATTENTION: TRACTORS “BELARUS-3522.5” ARE UNAPPROPRIATED FOR OPERATION WITH THE GENERAL-PURPOSE IMPLEMENTS AT UPLAND ENVIRONMENT INCLUDING ON SHARP INCLINES. THEREFORE TRACTORS ARE NOT COMPLETED WITH SPECIAL-PURPOSE DEVICES, FOR EXAMPLE INCLINATION OF THE FRONT PART SIGNALLING DEVICE!

ATTENTION: APPLICATION OF TRACTORS “BELARUS-3522.5” FOR GRASS STACKING (SILAGE OR HAYLAGE) IN TRENCHES AND PITS IS NOT ALLOWED!

5.9.2 Application of substances for the purpose of chemical treatment

Cabin corresponds to category 2 under EN 15695-1:2009. The cabin of this category protects from dust and vapor ingress, 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 performance capabilities according to GOST ISO 14269-5. Cabin design ensures its proofness under GOST ISO 14269.

ATTENTION: CABIN OF THE TRACTOR “BELARUS-3522.5” CAN NOT PROTECT FROM POSSIBLE DAMAGING EFFECT OF SUBSTANCES USED FOR CHEMICAL TREATMENT OF AGRICULTURAL PLANTS AND SOILS INCLUSIVE OF SPRAY TREATMENT. THEREFORE, WHEN TREATING CHEMICAL SUBSTANSES, THE OPERATOR SHALL WEAR INDIVIDUAL PROTECTIVE EQUIPMENT IN ACCORDANCE WITH OPERATING CONDITIONS!

IT IS FORBIDDEN TO PLACE SUBSTANSES USED FOR CHEMICAL TREATMENT OF AGRICULTURAL PLANTS AND SOILS IN THE CABIN.

THE OPERATOR MUST NOT ENTER THE 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 comply with instructions written on the labels and documents accompanying the substances.

All individual protective equipment and specialized clothing (knockabout suit and foot gear, etc), corresponding to the operating conditions and current safety requirements are required.

If the use of a breathing mask inhaler is required for chemical treatment by the application data sheet of the substance, it shall be used inside the tractor cabin.

5.9.3 Operation in a forest

To use tractor “BELARUS-3522.5” for performance of any work in a forest, including for clamshell loader coupling, trailing equipment, special-purpose forestry machinery designed for gathering, loading, and transport of trees, and their unloading, sorting and warehousing.

ATTENTION: ACCORDING TO THE PURPOSE THE TRACTOR “BELARUS-3522.5” IS DESIGNED FOR, SPECIAL OPERATOR POSITION PROTECTION DEVICE (OPS) IS NOT PROVIDED IN ITS DESIGN, INCLUSIVE OF SPECIAL ATTACHING POINT FOR THE DEVICE. THEREFORE THE TRACTOR SHALL NOT BE OPERATED IN CONDITIONS WHEN THERE IS A HAZARD OF TREES, ITS BRANCHES, AND SINGLE PARTS OF THE EQUIPMENT COUPLED PENETRATION INTO THE OPERATORS CABIN!

5.10 Finding of total weight, loads on the front and rear axles, tires holding capacity and required minimum ballast

Amount of load on the tractor axles in structure of MTU may be found by means of proximate weighting on truck scales of the corresponding carrying capacity.

Tractor weighting allows possibility to consider weight distribution of MTU masses along the tractor axles completed by you in different operating conditions: “main operation” and “transport”. During load sensing on the tractor axles, the technological load weight, for example weight of seeds, distributed by a seeder, must be considered.

ATTENTION: TO REDUCE OVERLOAD OF THE REAR WHEELS AND FDA DURING COMPOUND UNITS COUPLING TOGETHER WITH USE OF RLL AND FLL, IT IS NECESSARY TO LIFT RLL WITH THE IMPLEMENT FIRST, AND FLL WITH THE IMPLEMENT NEXT. GROUNDING SHALL BE CARRIED OUT IN REVERSE ORDER.

For finding of a load on the tractor axis by means of weighting on truck scales, it is necessary to place the measured axis wheels of the tractor on a weighing platform, and other axis wheels shall be kept out of the area of weighting on a level with the platform.

The following formula is used for load sensing

$T = m \cdot g$, where

- T is load, H;
- M is mass, kg, and
- g=9.8 is gravity acceleration, m/s^2

Calculation of load on the front tractor axis

$T_f = m_1 \cdot g$, where

- T_f is load on the front tractor axis, H;
- m_1 is amount of the tractor operating weight with ballast (unit installed), distributed on the tractor front axis, kg;
- g=9.8 is gravity acceleration, m/s^2.

Calculation of load on the rear tractor axis

$T_z = m_2 \cdot g$, where

T_z is load on the rear tractor axis, H;

m_2 is amount of the tractor operating weight with unit installed (ballast), distributed on the tractor rear axis, kg.

- g=9.8 is gravity acceleration, m/s^2.

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

$G_f = \frac{T_f}{2}$; $G_Z = \frac{T_Z}{2}$, where G_f and G_Z are loads, acting on one front or one rear tractor tire accordingly.

б) during operation of tires on doubled wheels:
(considering a permissible load on a tire during operation of tires on doubled wheels):

$1.7\,G_f$ doubl.$= G_f$ $\qquad\qquad$ $1.7\,G_Z$ doubl.$= G_Z$

G_f doubl.$= \dfrac{G_f}{1{,}7}$ $\qquad\qquad$ G_Z doubl.$= \dfrac{G_Z}{1{,}7}$

where G_f doubl. and G_Z doubl. are calculated loads for pressurization of tires during operation of tires on doubled wheels.

Further according to the calculated loads from Table 4.3 of loading instructions, tire pressure shall be determined (subsection 4.2.9 "Selection of tires internal pressure in depending on operating conditions and load on the tractor axles, and tires operating rules").

Tractor controllability criterion calculation:
- without water solution in the front tires

$$k_f = \frac{T_f}{M_{\square}}$$

T_f is load on the tractor front axis, H;
k_f is tractor controllability criterion;
M is tractor operating weight (during calculation ballasts weights in the tractor operating weight M are not taken into account), kg;

ATTENTION: COUPLING OF THE IMPLEMENTS TO THE TRACTOR SHALL NOT RESULT IN EXCESS OF PERMISSIBLE AXIS LOADING AND LOADS ON THE TRACTOR TIRES!

ATTENTION: MINIMUM WEIGHT OF THE IMPLEMENTS COUPLED AND BALLAST WEIGHTS USED SHALL ALWAYS MAKE NOT LESS THAN VALUES AT WHICH LOAD ON THE FRONT TRACTOR WHEELS IN STRUCTURE OF MTU SHOULD ALWAYS MAKE NOT LESS THAN 20% OF THE TRACTOR OPERATING WEIGHT, AND THE CONTROLABILITY CRETERION SHOULD MAKE NOT LESS THAN 0.2!

5.11 Possibility to install front loader

ATTENTION: INSTALLATION OF ANY MOUNTABLE EQUIPMENT ON THE TRACTOR "BELARUS-3522.5" (INCLUDING MOUNTABLE FRONT LOADERS) WHICH IN NOT RALATED TO MOUNTED, SEMIMOUNTED, SEMITRAILED OR TRAILED IMPLEMENTS, BY MEANS OF FASTENING OF SPESIAL-PUPOSE ASSENBLY UNITS FROM THE MOUNTABLE EQUIPMENT KIT TO THE TRACTOR MOUNTING HOLES, IS NOT PROVIDED!

6. Maintenance

6.1 General instructions

ATTENTION: ALL ENGINE MAINTENANCE SERVICES, INCLUDING DAILY MAINTENANCE SERVICES ARE SET FORTH IN THE ENGINE TCD 7.8 L06 OPERATION MANUAL ATTACHED TO YOUR TRACTOR! IN THE PRESENT SECTION OF THE OPERATION MANUAL ONLY MAINTENANCE SERVICES FOR EXTERIOR PARTS OF WATER COOLING, SUPERCHARGED AIR COOLING, ENGINE AIR CLEANING SYSTEMS DEVELOPED AT MTW!

Maintenance services (MS) is needed to maintain the tractor in operable state during operation. Non compliance with the specified intervals and bad quality of MS may result in reduction of tractor life, increase of failure number, engine power loss and increase in expenses for tractor operation. Operator must carry out daily inspection of the tractor, excluding fasteners torque-retention loss, 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.

Comply with storage precautions and waste recovery rules. Never discharge used liquid on the ground. Use special tanks for safe storage of waste.

WARNING: DURING CARRYING OUT OF MAINTENANCE AND REPAIR SERVICES COMPLY WITH SAFETY PRECAUTIONS, LISTED IN SUBSECTION 6.5 “SAFETY PRECAUTIONS IN THE COURSE OF MAINTENANCE AND REPAIR SERVICES”!

ATTENTION: IF THERE IS NO SPECIAL INSTRUCTIONS, BEFORE STARTING ANY MAINTENANCE OR ADJUSTMENT SERVICES, ETC., STOP THE ENGINE AND ENGAGE PARKING BREAKS. IN CASE SAFETY GUARDS AND COVERS ARE OFF, ENSURE THEY ARE MOUNTED BACK AFTER MAINTENANCE SERVICES HAS COMPLETED, BEFORE YOU START OPERATING THE TRACTOR!

During hydraulic lift system, steering, and transmission line hydraulic system maintenance services, oil change and filters replacement intervals should be observed. It is not allowed to use oil, not specified in the tractor operation manual for filling (refilling).

Before refilling and replacement of filter cartridges clean filler plugs, necks, and caps, and adjoining surfaces from dirt and dust. During replacement of filter cartridges, wash the internal surfaces of filter housings and caps with the diesel fuel.

When the tractor is coupled with hydraulically-operated implements, 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 must be replaced by the oil, primed into the tractor hydraulic lift system.

Purity of the hydraulic system oil ensures its fail-safe operation.

Types of scheduled maintenance service are shown in Table 6.1

Table 6.1 – Types of scheduled maintenance service

Types of maintenance service	Intervals, h
Maintenance service during run-in [1)]	MS before, during and after run-in (after 30 hours of operation)
On a shift basis (SBMS)	8-10
First maintenance service (MS-1)	125
Additional maintenance service (2 MS -1)	250
Second maintenance service (MS -2)	500
Third maintenance service (MS -3)	1000
Special maintenance service	2000
General maintenance service	as it may be required
Seasonal maintenance service (MS-SS and MS-AW)	In course of transfer to autumn and winter operation (MS-AW) and spring and summer (MS-SS) [2)]
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 the tractor operation in special conditions
Maintenance service or storage [3)]	In case of long-term storage

[1)] Data on the maintenance services, carried out by the operator before, during and after the tractor run-in are shown in subsection 4.4 “Tractor run-in”.

[2)] MS-SS and MS-AW shall not be performed on tractors “BELARUS-3522.5”, inclusive of the engine.

[3)] Data on maintenance services performed by the operator on long storage of the tractor, are shown in section 8 “Tractor storage” of the 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 (advancing or delayed MS) depending on the operating conditions for the chassis.

6.2 Affording access to the components for maintenance services

Before starting maintenance work open facing mask, remove the both side walls, the cladding panel, and both protecting covers.

To remove the side walls 8 and 9 (Figure 6.2.1) it is necessary to act as follows:
- release the side walls from locking mechanisms 14 engagement with a ferrule 13;
- remove the side walls 8 and 9, having hefted them before.

To remove panel 7 act as follows:
- unscrew four bolts 6;
- remove the panel 7.

To afford access to the units and parts located under the mask 4, the following actions shall be performed:
- open a lock 1 by pulling control cable handle 2;
- lift the mask 4 up;
- anchor the mask 4 in the opened position by means of a rod 3 in a supporting bracket 5;
- ensure that the mask 4 is fixed properly in raised position.

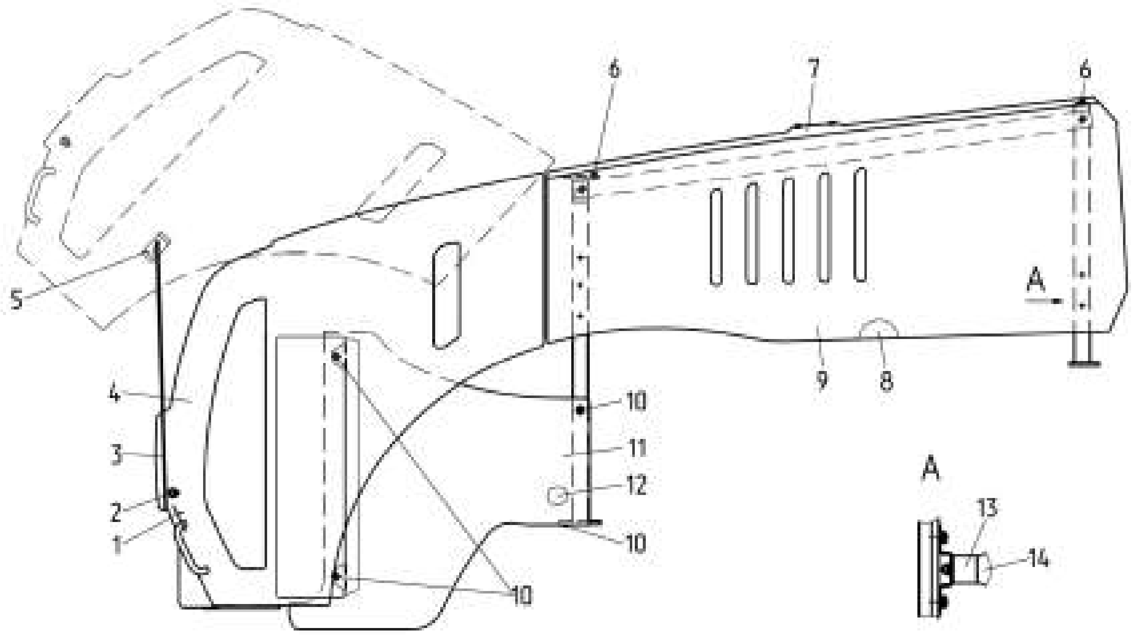
To afford access to the units and parts located under the protecting covers 11 and 12 (if they are mounted) the following actions shall be performed:
- unscrew four bolts 10 on each protecting cover;
- remove the protecting covers 11 and 12.

To anchor the panel 7 on the tractor perform the following actions:
- put the panel 7 on top and fix with four bolts 6;

To anchor the protecting covers 11 and 12 the following actions shall be performed:
- put the protecting covers 11 and 12 back and screw four bolts per each protecting cover;

To mount the side walls 8 and 9 the following actions shall be performed:
- mount the side walls 8 and 9 into the groove in the panel 7;
- snap locking mechanism 14 in ferrule 13;

To level down the mask 4 the following actions shall be performed:
- heft the mask 4 to release the rod 3 out of the bracket 5;
- fix the rod 3 in a clamp on the mask 4;
- to lower the mask 4 to the down position until the relevant to characteristic click (lock 1 response).



1 – lock; 2 –control cable handle; 3 – rod; 4 – mask; 5 – bracket; 6 – bolt; 7 – panel; 8, 9 – side wall; 10 – bolt; 11, 12 – protecting cover; 13 – ferrule; 14 – locking mechanism.

Figure 6.2.1 – Opening of the mask and removal of the facing

6.3 Maintenance procedure

Contents of scheduled servicing operations for chassis, external part of water cooling systems, charged air cooling and engine air cleaning of tractors “BELARUS-3522.5” in course of operation are listed in Table 6.2.

Table 6.2

Operation №	Operation description	Periodicity, h				
		8-10	125	250	500	1000
1	Check oil level in the transmission line	X				
2	Check oil level in an integrated tank of HLL and HSC	X				
3	Check hydraulic-brake fluid level in tanks of master cylinders of hydraulic drive of clutch and breaks operating control	X				
4	Check hydraulic-brake fluid level in the mail cylinders housings of clutch and breaks operating control	X				
5	Check tires state	X				
6	Check air conditioner hose fixtures	X				
7	Inspect hydraulic system components	X				
8	Inspect/clean air conditioner drainage pipes from the condensate water	X				
9	Inspect/clean air conditioner condenser and oil cooling radiator of HLL and HSC systems	X				
10	Inspect/clean engine water radiator and engine CAC-radiator	X				
11	Check/rinse gripper tools of FLL and RLL	X				
12	Inspect/clean position sensor control gear of FLL	X				
13	Check breaks functioning in running order, engine, steering, light/alarm devices operability	X				
14	Drain condensate water from the pneumatic system balloon	X				
15	Drain condensate water from the radiator tanks of CAC	X winter	X summer			
16 [1)]	Check threaded joint torquing of wheels mounting	X	X			
17	Wash tractor and clean cabin inside surfaces		X			
18	Check bolts torquing of air duct clamps of CAC		X			
19 [2)]	Check pneumatic pressure in tires		X			
20	Check/adjust clutch operating control		X			
21	Drain sediment from a fuel tank		X			
22	Maintain engine air cleaner		X			
23	Clean filter cartridges of ventilation and air heating systems		X			

Continuation of Table 6.2

Operation №	Operation description	Periodicity, h				
		8-10	125	250	500	1000
24	Check oil level in the main gear housing and wheel-hub drive of the FDA		X			
25	Lubricate holding-down clip bearings of FDA		X			
26	Lubricate splines and universal-joint bearings of FDA drive		X			
27 [3)]	Lubricate and check/adjust FDA bolts bearings		X			
28 [4)]	Carry on maintenance of the accumulator batteries			X		
29	Check oil level in FPTO shaft gearhead			X		
30	Check oil level in FPTO reducing gear			X		
31	Lubricate HSC hydraulic cylinders and steering link hinged joints			X		
32	Rinse mesh filter of transmission hydraulic system			X		
33	Clean filter cartridge of breather filter of HLL and HSC integrated tank			X		
34	Check/adjust clearances in steering joints			X		
35	Check and adjust wheels convergency			X		
36	Lubricate RLL cylinder pins			X		
37	Clean filter cartridge of air pressure regulating filter in the pneumatic system				X	
38	Adjust service brake control				X	
39	Adjust parking brake control				X	
40	Check pneumatic system line proofness				X	
41	Check/adjust pneumatic system brake valve actuator				X	
42	Lubricate RLL turning shaft bushings				X	
43	Lubricate towing gear (hook with shock absorber)				X	
44	Lubricate RLL crossbeam yokes				X	
45	Clean and lubricate sline joints of the front PTO shaft				X	
46	Clean magnetic filter of the transmission hydraulic system				X	
47 [5)]	Replace exchangeable filter cartridge of HLL and HSC integrated tank				X	X
48	Change oil in HLL and HSC integrated tank					X
49 [6)]	Change oil in transmission line					X
50	Change oil in the main gear housing and wheel-hub drive casing of the FDA					X

End of Table 6.2

Operation №	Operation description	Periodicity, h				
		8-10	125	250	500	1000
51	Change oil in FPTO shaft gearhead					X
52	Change oil in FPTO reducing gear					X
53	Change hydraulic-brake fluid in clutch operating control drive					X
54	Change hydraulic-brake fluid in break control drive					X
55	Lubricate bushings serving for swinging motion of the front link of FLL					X
56	Change grease in steering joints and rinse the steering joints components					X
57	Check/adjust pneumatic pressure regulator					X
58	Replace filter cartridge of breather filter of HLL and HSC integrated tank					X
59	Check gripping of tractor external threaded joints					X
60	Change the coolant in the engine cooling system	Every 2000 hours of operation				
61	Replace filter cartridge in the cabine ventilation and air heating systems	Every 2000 hours of operation				
62	Replace filter-drier of the air-conditioning system	Every 800 hours of operation or once in a year				
63	Refill coolant in the engine cooling system	As it becomes dirty				
64	Replace changeable filter cartridges of the transmission hydraulic system duplex filter	As it becomes dirty				
65	Replace HLL pump filter	As it becomes dirty				

1) Operations shall be carried out once during the first maintenance on a shift basis (in every 8-10 hours), which is carried out by the customer and hereinafter in 125 hours of tractor operation.

2) Control and bringing to the internal pressure norm in the tractor tires is carried out each time when one mode of the tractor operation is changed in another operation mode, and when the implements and tools coupled with the tractor are replaced.

3) Intervals for further check/adjustments of FDA bolt bearings:
- in 250 hours, if the tractor is operated with front wheels coupled;
- in 500 hours, if the tractor is operated with simplex front wheels.

4) AB inspection and maintenance shall be carried out once per 3 months and not less.

5) First and second change is carried out in 500 hours of tractor operation. Then the change shall be carried out in every 1000 hours of operation simultaneously with oil change.

6) Simultaneously with oil change in the transmission line, exchangeable filter cartridges of the transmission hydraulic system duplex filter shall be replaced regardless of the intervals of the previous replacement.

6.4 Scheduled maintenance servicing operations

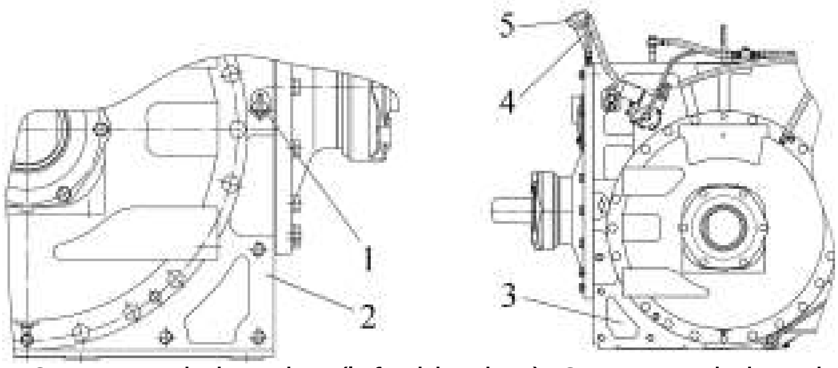
6.4.1 Maintenance on a shift basis (SBMS) in every 8 – 10 hours of operation or per shift

6.4.1.1 General guidelines

Every 8 – 10 hours of the tractor operation or at the end of a shift (whichever comes first) perform the following operations:

6.4.1.2 Task 1. Check of oil level in the transmission line

Check oil level in the transmission line by means of a probe 1 (Figure 6.1.4) which is located on the rear axis housing 2 on the left side. Oil level shall stay between the probe marks. When necessary turn off a cap 5 and refill the oil up to the required level through the filler neck 4.



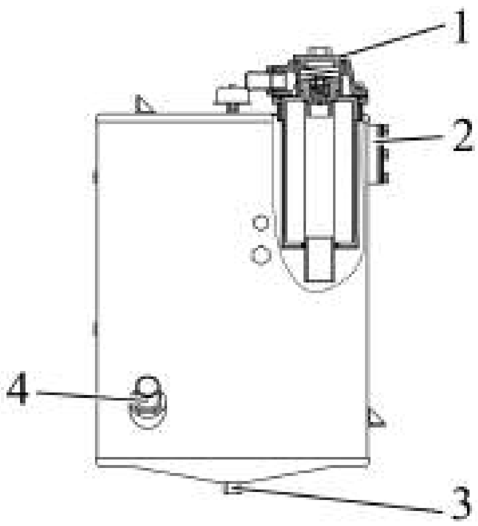
1 – probe; 2 – rear axis housing (left-side view); 3 – rear axis housing (right-side view); 4 – filler neck; 5 – cap;

Figure 6.4.1 – Check of oil level in the transmission line

6.4.1.3 Task 2. Check of oil level in the HLL and HSC integrated tank

Before checking the oil level set the tractor on the flat horizontal ground. Stop the engine and put the parking brakes on.

Carry out visual inspection of the oil level according to the oil-level gauge 2 (Figure 6.4.2) on the tank. Level shall be between marks “O” and “П” of the oil level gauge. When necessary refill the oil up to the “П” mark through an oil filler opening, for which turn off the plug 1.



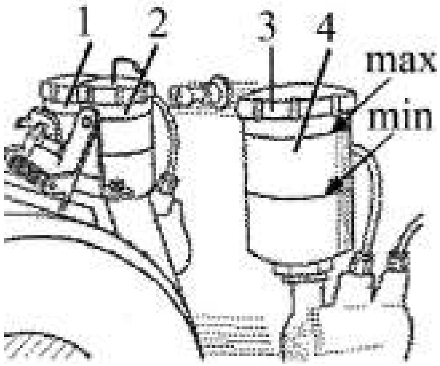
1 – oil filler plug; 2 – oil-level gauge; 3 – drain plug; 4 – intake filter.

Figure 6.4.2 – Check of oil level and change of oil in the HLL and HSC integrated tank

ATTENTION: OIL LEVEL CHECKING OPERATIONS IN THE HYDRAULIC LIFT LINKAGE TANK SHALL BE CARRIED OUT ONLY WITH THE RETRACTED ROD OF FLL, RLL HYDRAULIC CYLINDERS, AND CYLINDERS OF THE IMPLEMENTS COUPLED WITH THE TRACTOR!

6.4.1.4 Task 3. Check hydraulic-brake fluid level in tanks of master cylinders of hydraulic drive of clutch and breaks operating control

Carry out visual inspection of the hydraulic-brake fluid level in the tank 4 (Figure 6.4.3) of the main clutch coupling cylinder and tanks 1, 2 of the main break cylinders. Level shall be between “min” and “max” marks, made on the tanks housing. If necessary add the hydraulic-brake fluid up to the “max” mark, having turned off the tank caps 3.



1, 2 – tank of the main brake cylinder; 3 – tank cap; 4 – tank of the main clutch coupling cylinder.

6.4.1.5 Task 4. Check of hydraulic-brake fluid level in the mail cylinders housings of clutch and breaks operating control on reverse

To check the hydraulic-brake fluid level in the mail cylinders housings of clutch 19 (Figure 3.3.4) and breaks 14 (Figure 3.9.2) operating control on reverse, it is necessary to open housing envelopes. Liquid level shall be not less then 10…20 mm from the top edge of the main cylinder housing on reverse, which corresponds to a size “И” in Figure 3.3.4 and 3.9.2. Refill the hydraulic-brake fluid up to the required level. Put the envelopes back.

ATTENTION: WHEN THE TRACTOR IS USED DURING HAULING OPERATIONS, CHECK OF THE HYDRAULIC-BRAKE FLUID IN THE MAIN CYLINDERS HOUSINGS OF CLUTCH AND BREAKS OPERATING CONTROL ON REVERSE, CAN BE CARRIED OUT WITH LESS FREQUENCY!

6.4.1.6 Task 5. Check of tires state

Carry out inspection of outside appearance and conditions of the tires in order to detect faults or objects getting stuck in the tires (tacks, rocks and etc.,). If necessary clear the tires of the 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 is beyond repair, replace the tire. Defective tire shall be sent to recycling.

6.4.1.7 Task 6. Check air conditioner hose fixtures

Carry out visual inspection of air conditioner hose fixtures. Air conditioner hoses shall be properly fixed with coupling bands. The hoses shall not be in contact with moving parts of the tractor.

6.4.1.8 Task 7. Inspection of hydraulic system components

Carry out inspection of the tractor hydraulic system components, when the condensation and downflows are detected eliminate them by means of threaded joints retorque.

6.4.1.9 Task 8. Inspect/clean air conditioner drainage pipes from the condensate water

Light-blue drain pipes are placed to the right and to the left of the heating and cooling device under the under ceiling panel. To avoid clogging the drain pipes shall be checked and cleared when necessary. Cleanness of a drain pipe is indicated by water dripping when the work air conditioner is used in hot weather.

6.4.1.10 Task 9. Inspect/clean air conditioner condenser and oil cooling radiator of HLL and HSC systems

Check cleanness air conditioner condenser core and oil cooling heat radiator of HLL and HSC systems. If they are clogged, it is necessary to clean the condenser and the radiator with a compressed air. Open the hood and direct an air flow perpendicular to the condenser plane from top downward. Jammed finning must be planished by means of special comb or plastic (wooden) plate. In case of severe condenser clogging rinse it with hot water under pressure not more than 0.2 MPa and blow it off by a compressed air.

- condenser cores must be cleaned both from the hood mask side and from the engine fan side. To do this, heft the air conditioner condenser as indicated in figure 6.4.1.11.

USE OF CORROSIVE DETERGENT COMPOSITION IS FORBIDDEN!

6.4.1.11 Task 10. Inspect/clean the engine water radiator and the engine CAC-radiator.

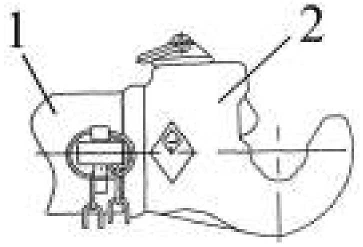
Check cleanness of the engine CAC-radiator 1 core (Figure 3.1.3). In case it is clogged perform the following actions:

- turn off the two air conditioner condensers screws fastening it to the CAC lifting mechanism;
- pull the lower part of the condenser and anchor it in hefted position by means of limit stop, placed to the right along the tractor run;
- carry out the CAC-radiator cleaning with the compressed air. Direct an 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 not more than 0.2 MPa and blow it off by a compressed air;
- put the air conditioner condenser back;
- unscrew two winged nuts 10 for 3…5 turns;
- by means of lifting mechanism heft the air conditioner condenser, oil cooling system of HLL and HSC systems, CAC, and clean the water radiator with a compressed air. Direct an air flow perpendicular to the water radiator from top downward. In case of severe water radiator clogging rinse it with hot water under pressure not more than 0.2 MPa and blow it off by a compressed air;
- radiator cores must be cleaned both from the hood mask side and from the engine fan side;
- put the radiators and tighten the winged nut up.

ALKALINE SOLUTIONS AND CORROSIVE DETERGENT COMPOSITION MUST NOT BE USED!

6.4.1.12 Task 11. Check/rinse of gripper tools of FLL and RLL

Check the pockets where the hinged joint locking mechanism in the gripper tools 2 (Figure 6.4.4) of the RLL. In case of dirt accumulation, clear the internal pockets and rinse it with water.

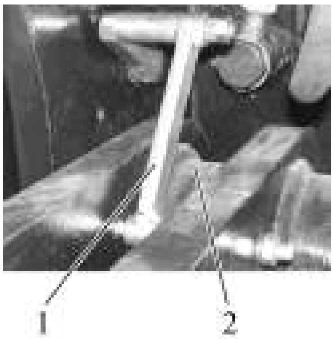


1 – link; 2 – gripper tool.

Figure 6.4.4 – Gripper tool of RLL (FLL)

6.4.1.13 Task 12. Inspect/clean position sensor control gear of FLL

Ensure that the control gear 1 (Figure 6.4.5) is clean by means of a position sensor of FLL, and ensure that the FLL components, being close to the operating control gear, are in running order also. Clean it if it is clogged.



1 – control gear; 2 – frame of the lower links of the FLL.

Figure 6.4.5 – Cleaning of the control gear by means of the position sensor of the FLL

ATTENTION: WHEN THE TRACTOR IS OPERATED WITH A FRONT LIFT LINKAGE, THERE SHALL BE NO SOIL, SNOW, ICE AND ETC., ON THE POSITION SENSOR CONTROL GEAR AND ON THE LOWER LINKS FRAME OF THE FRONT LIFT LINKAGE!

6.4.1.14 Task 13. Check breaks functioning in running order, the engine, steering, light/alarm devices operability

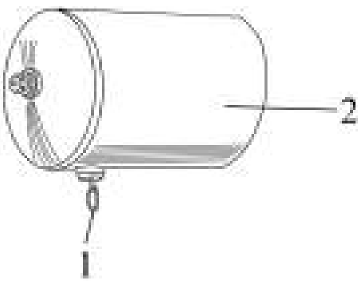
The following tractor operating conditions shall be ensured:

- the engine shall percolate in all modes;
- control elements, light warning and acoustic alarm devices shall be properly operating;
- simultaneous engagement of the right and left service brake.

In case the abovementioned conditions were not observed adjust as required or perform repair of the required tractor systems.

6.4.1.15 Task 14. Drainage of the condensate water from the pneumatic system balloon

To condensate drainage from the both balloons 2 (Figure 6.4.6) of the pneumatic system pull the ring drain valve ring 1, installed on each balloon towards the horizontal direction of any side and hold it until full drainage of condensate.



1 – ring; 2 – pneumatic system balloon.

Figure 6.4.6 – Drainage of the condensate water from the pneumatic system balloon

6.4.1.16 Task 15. Drainage of the condensate water from the radiator tanks of CAC

Operation shall be carried out during the autumn and spring period in every 8-10 hours of the tractor operation or in shift time basis, and in spring and summer period – in every 125 hours of the tractor operation.

In order to drainage the condensate water from the radiator tank of the engine CAC it is necessary to perform the following actions:

- turn off two plugs 5 (Figure 3.1.3) in the bottom of the CAC radiator 1;
- let the condensate drain away;
- screw the plug 5.

6.4.2 Maintenance services in every 125 hours of operation

6.4.2.1 General guidelines

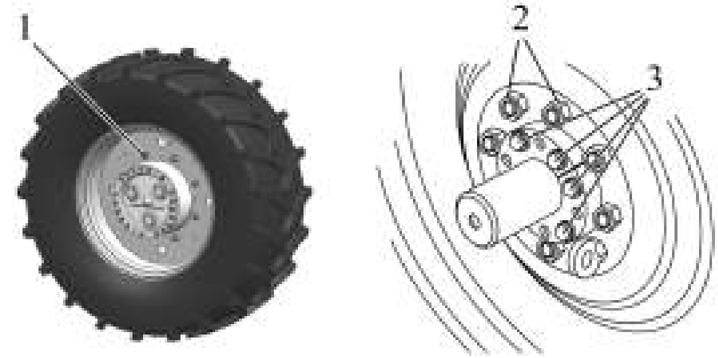
Perform the following operations and the operations, listed in this subsector 6.4.2.

6.4.2.2 Task 16. Check of threaded joint torquing of wheels mounting

Check threaded joint torquing of wheels mounting shall be carried out one time along with first MS on a shift basis (in 8-10 hours of operation), which is carried out by a customer and then in every 125 hours of operation.

Check the torquing of torquing wheel nuts and hub bolts, and, if necessary, tighten them up:

- rear wheels hub bolts 3 (6.4.7) tightening torque shall be from 550 to 600 N·m;
- tightening torque of nuts for rear wheels mounting on hubs shall be from 700 to 750 N·m;
- tightening torque of nuts for front wheels mounting on gear case flanges of FDA shall be from 700 to 750 N·m;



1 – nuts for front wheels mounting on gear case flanges of FDA; 2 – nuts for rear wheels mounting on hubs; 3 – rear wheels hub bolt.

Figure 6.4.7 – Check of threaded joint torquing of wheels mounting

6.4.2.3 Task 17. Washing of the tractor and cleaning of the cabin inside

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.

During tractor washing take steps to protect the electronic components, plugs and sockets against entry of water jets. Water jet must not be pointed at electric and electronic work-pieces, cables connectors.

Maximum water temperature shall not exceed 50^0C. It is forbidden to add corrosive agents (detergents).

After the tractor washing clear the electric and electronic work-pieces and cables connectors with a compressed air.

6.4.2.4 Task 18. Check of bolts torquing of air duct clamps of CAC

Check and tighten the clamp bolts 4 (Figure 3.1.3) of CAC air ducts, if necessary, with torque from 10 to 15 N·m.

6.4.2.5 Task 19. Check of pneumatic pressure in tires

Pressure in the front and rear tires is determined from load per single tire, driving speed and operations performed. If it is necessary bring the pressure up to the required value in compliance with subsection 4.2.9 “Selection of optimal internal pressure in tires, depending on the operating conditions and load on the tractor axles, and tires operating rules”.

ATTENTION: CONTROL AND BRINGING THE TIRES INTERNAL PRESSURE UP TO THE NORMAL VALUE, WHEN NEEDED, SHALL BE CARRIED OUT EACH TIME THE TRACTOR IS CONVERTED FROM ONE OPERATION TO ANOTHER AND IS REEQUIPPED WITH OTHER IMPLEMENTS ANA INSTRUMENTS COUPLED!

6.4.2.6 Task 20. Check/adjustment of clutch operating control

Checking of a clutch coupling operating control shall be carried out when the engine is shut-down by two persons.

Check the state of the expansion chamber, main (forward and reverse line) and operating cylinders, hydraulic amplifier and valves. The systems shall be liquid- and-oil-tight.

Clear the clutch coupling operating control drive and control pedals out.

ATTENTION: THE TRACTOR SHALL NOT BE OPERATED WITH FOREIGN OBJECTS (TOOLS, CLOTHES AND ETC.) AND ON OVERLAYING THE CLUTCH CONTROL PEDAL AND ON REVERSE STATION (FIGURE 6.4.8)!

Figure 6.4.8

Check the clearance between a piston and the piston follower of the main cylinder on the forward and reverse stroke (Figures 3.3.4, 6.4.9).

By hand. Shifting of the pedal from the starting point until the piston follower has stricken against the piston, measured in the pedal pad center point, shall make from 6 to 12 mm. In case the pedal movements are in excess of or less than the required range, adjust it as indicated in sub section 3.3.4 “Adjustment of clutch operating control”!

Figure 6.4.9

Check the clearance between the plastic skirt of the gauge panel and pedal pin (Figure 6.4.10).

Figure 6.4.10

Contact of the pedal with the plastic skirt is not allowed. In case the contact is detected adjust the pedal position (Figure 6.4.1) in compliance with subsection 3.3.4.

Figure 6.4.11

Check the clearance between a clutch release bearing and clutch release levers fulcrum (Figures 3.3.4, 6.4.12).

Depress the pedal up to the appearance of traction between 300 and 400 N, and hold it in the position; the pedal movement by its pad shall make from 70 to 80 mm, and the hydraulic amplifier piston projection shall make from 5 to 6 mm (without regard to a bevel).

If the piston projection is in excess of or less than the required value, adjust the clutch coupling control in compliance with subsection 3.3.4.

Figure 6.4.12

Check the full stroke of the clutch pedal (Figure 3.3.4, 6.4.13).

When the pedal is fully depressed, the piston projection shall make not less than 23 mm (without regard to a bevel). If the piston projection is less than the required value, adjust the clutch operating control in compliance with subsection 3.3.4.

ATTENTION: DECREASE OF PISTON STROKE IS ALLOWED WHEN THE PEDAL IS FULLY DEPRESSED, IF THE CLUTCH COUPLING IS SLIPPING (TRANSMISSION RANGES ARE NOT SHIFTED WITHOUT SKIRR)!

Figure 6.4.13

Check the clutch coupling control drive for wedging.

Release the clutch coupling control pedal: hydraulic amplifier piston shall completely fit the housing (only bevel shall stand out (Figure 3.3.4, 6.4.14)). Check for not less than 5 times in cold and in warmed-up oil. Wedging, and piston hanging is not permitted.

Figure 6.4.14

Check the clearance between the piston follower and the hydraulic amplifier centre guide (Figure 3.3.4, 6.4.15).

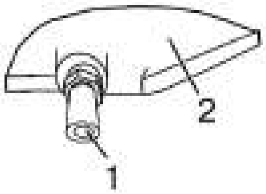
By hand. The clearance shall make from 0.5 to 0.8 mm, absence of clearance is not permitted. When the clearance is excessive or absent, make adjustments in compliance with subsection 3.3.4.

Figure 6.4.15

6.4.2.7 Task 21. Drain of the sediment from the fuel tank

To drain the sediment from the fuel tank it is necessary to perform the following:

- screw out the tank adapter 1 by a screw key S 17 (Figure 6.4.16), holding metallic embedded part of the fuel tank 2 by a screw key S 24 (the tank adapter 1 is placed in the bottom of the fuel tank 2);
- drain the sediment until the clean fuel will appear;
- after the clear fuel without water and dirt appearance screw in the tank adapter 1, holding metallic embedded part of the fuel tank 2.



1 – tank adapter; 2 – fuel tank.

Figure 6.4.16 – Drainage of the sediment from the fuel tank

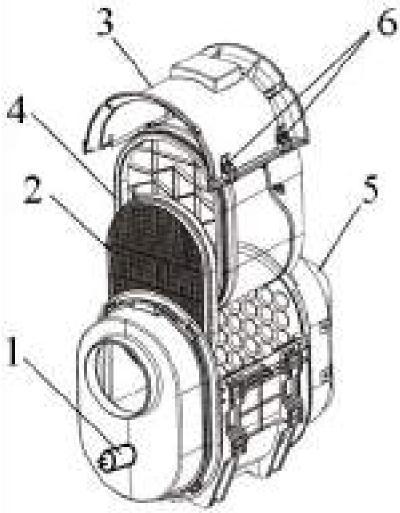
6.4.2.8 Task 22. Maintain the engine air cleaner

Maintenance service (MS) of air cleaner is carried out when the filter cartridge period of service has expired. The first maintenance of the air cleaner is carried out in 125 hours of operation. The following maintenance shall be carried out each time the filter clogging indicator lights up, which is located on the control indicator unit of the gauge board.

When the filter clogging indicator lights up, replace the main filter cartridge (MFC).

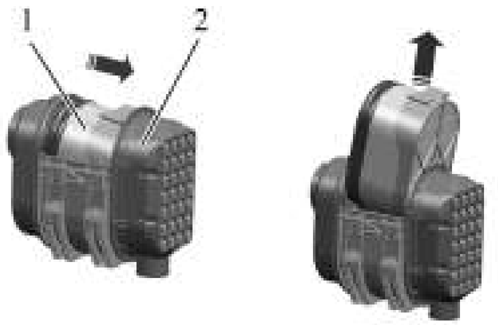
To replace the MFC perform the following:

- pull four locking devices 6 (Figure 6.4.17);
- dismount the main filter cartridge 4 by rack the cartridge towards the integrated "multicyclone” unit and pull the MFC up and on, as indicated in Figure 6.4.18.
- check for safety filter cartridge 2 for clogging (Figure 6.4.17), not withdrawing it of the housing;
- clean the inside surface and sealing surface of the housing from dust and dirt with wet cloth. Ensure that no dust and dirt enters an air duct.
- check the O-rings condition;
- assembly of air cleaner with a new MFC shall be carried out in at reverse sequence;
- ensure that the MFC is correctly installed in the housing, and lock the locking devices 6;



1 – air cleaner filter clogging indicator; 2 – safety filter cartridge; 3 – air cleaner service cover; 4 – main filter cartridge; 5 – integrated "multicyclone” unit; 6 – air cleaner service cover locking devices.

Figure 6.4.17 – Check and maintenance of the engine air cleaner



1 – main filter cartridge; 2 – integrated "multicyclone” unit.

Figure 6.4.18 – Check and maintenance of the engine air cleaner

ATTENTION: AIR CLEANER MANUFACTURER STRONGLY RECOMMENDS REPLACEMENT OF MFC, BUT NOT CLEANING, TO AVOID DAMAGE AND TO SECURE THE ENGINE!

When the filter clogging indicator responds and if it is not possible to replace MFC immediately, cleaning of MFC is allowed.

ATTENTION: PERIOD OF SERVICE OF CLEAN MFC IS NOT THE SAME AS OF THE NEW MFC!

To clean MFC perform the following:

- blow the main filter cartridge 4 with a compressed air until the filter is fully dedusted. In order to avoid breakout of MFC material the air pressure shall be from 0.2 to 0.3 MPa. The air jet shall be pointed at the front surface of the filter cartridge, facing the turbocompressor. During maintenance it is necessary to protect the filter cartridge from the mechanical damages and oiling-up.
- check the MFC for possible damage (the blind breakout, the base coming unstuck);
- wipe the MFC O-ring with wet cloth and install the MFC into the air cleaner housing (see above).

IT IS FORBIDDEN TO BLOW OFF WITH THE EXHAUST GASES, RINSE AND DUST THE MFC OFF.

ATTENTION: AFTER AIR CLEANER ASSEMBLY CHECK THE PROOFNESS OF ALL COUPLINGS OF THE INTAKE DUCT. DAMAGED COUPLING MEMBERS SHALL BE REPLACED!

Decompression of circuit of air supply into the turbocompressor can influence negatively on the reliability of the data provided by the filter clogging indicator as a result of which a significant portion of unpurified air with heavy concentration of dust can enter the cylinders via turbocompressor. The dust ingress in the oil results in accelerated wear and tear of cylinder and piston unit of the engine.

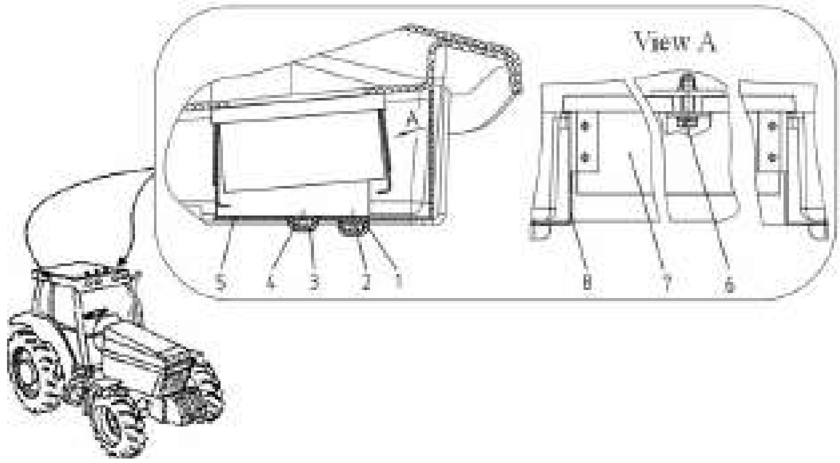
IT IS FORBIDDEN TO OPERATE THE TRACTOR WITH AN UNSEALED INTAKE DUCT.

6.4.2.9 Task 23. Cleaning of the filter cartridges of ventilation and air heating systems

Ventilation system filters are located on both sides of the tractor cabin as indicated in Figure 6.4.19. Filter consists of two filter cartridges.

To clean the ventilation system and cabin heating filter it is necessary to perform the following:

- to get access to the filter install the leg support or a small step ladder;
- remove two caps 1 (Figure 6.4.19) from the bolts 2 and two caps 3 from the bolts 4 under the overhanging verge of the cabin roof;
- dismount a protection grid 5 by unscrewing two bolts 2;
- dismount a frame 8 with filter cartridges 7 by unscrewing two bolts 4 and one bolt 6;
- withdraw the filter cartridges 7 from the frame 8;
- clean the filter cartridge with a compressed air under pressure of not more than 0.1 MPa. Keep the hose spray head not closer than 300 mm to the filter cartridge in order not to damage it.
- install the filter cartridges 7 in the frame 8, than mount the frame 8 and the protection grid 5 on the cabin, put the caps 1 and 3 on the bolts 2 and 4 accordingly;
- perform the listed operations relating to the filter, located on the other side of the cabin.



1, 3 – cap; 2, 4, 6 – bolt; 5 – protection grid; 7 – filter cartridge; 8 – frame.

Figure 6.4.19 – Cleaning of the filter cartridges of ventilation and air heating systems

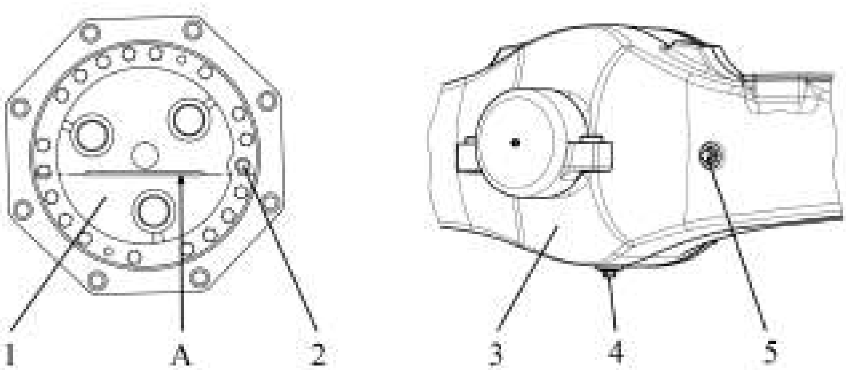
ATTENTION: DURING THE TRACTOR OPERATION IN HEAVY DUSTING CONDITIONS CLEAN THE FILTER IN EVERY 8-10 HOURS OF OPERATION, I.E. ON A SHIFT BASIS!

ATTENTION: DO NOT SWITCH THE FAN ON BEFORE CLEANING THE FILTERS AT HIGH HUMIDITY OF THE ENVIRONMENT, AS IT IS HARD TO REMOVE DUST FROM A WET PAPER FILTER CARTRIGE!

6.4.2.10 Task 24. Check of oil level in the main gear housing and wheel-hub drive of the FDA

To check oil level in the housings of the main gear and FDA wheel-hub drives, perform the following:

- place the tractor at the level horizontal ground in such way that the arrow “A” (Figure 6.4.20), casted in the FDA housing, is in horizontal position;
- engage the parking brake and lock the wheels against movement fore and aft by anti-recoil limit stops, excluding tractor self-movement. The engine must be stopped.
- unscrew the plugs 2 (Figure 6.4.20) in the wheel-hub drives casings 1 and a level check/fill plug 5 in the main gear housing 3;
- oil level in the wheel-hub drives casings 1 and the main gear 3 shall reach the lower edges of threaded openings in the plugs 2 and 5 accordingly;
- if it is necessary, refill the oil up to the lower edges of threaded openings in the plugs 2 and 5;
- insert the plugs 2 and 5 in their places.



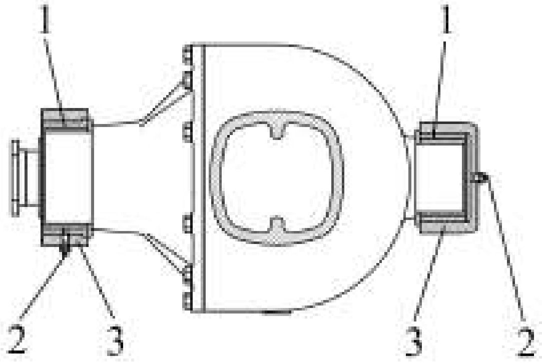
1 – wheel-hub drives casing; 2 – plug; 3 – main gear housing; 4 – drain plug; 5 – level check/fill plug.

Figure 6.4.20 – Check of oil level in the FDA wheel-hub drives casings

6.4.2.11 Task 25. Oiling of holding-down clip bearings of FDA

To oil holding-down clip bearings of FDA perform the following:

- clean lubricating box 2 (Figure 6.4.21) from accumulated dirt and consolidated lubricant;
- squirt lubricating box 2 with lubricant until the lubrication appears from the clearance spaces between holding-down clip and trunnion of FDA.



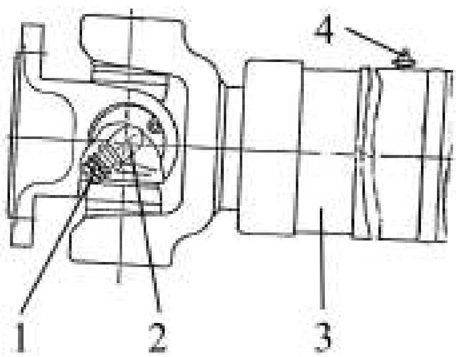
1 – bearings; 2 – lubricating box; 3 – holding-down clip.

Figure 6.4.21 – C heck of oil level in FDA wheel-hub drives casings

6.4.2.12 Task 26. Oiling of splines and universal-joint bearings of FDA drive

To oil splines and universal-joint bearings of FDA drive, perform the following actions:

- remove the caps 1 (Figure 6.4.22) from two lubricating boxes 2 of universal-joint bearings and from one lubricating box 4 of the splines;
- clean lubricating boxes 2 and 4 from accumulated dirt and consolidated lubricant;
- squirt lubricating boxes 2 and 4 with lubricant.



1 – caps; 2, 4 – lubricating boxes; 3 – cardan shaft;

Figure 6.4.22 – Oiling of splines and universal-joint bearings of FDA drive

6.4.2.13 Task 27. Oiling and check/adjustment of FDA bolts bearings

Check and adjust, when necessary, negative allowance of axles in bearings 36 (Figure 3.12.1) as indicated in subsection 3.12.8 “Check and adjustment of axial preload in conical bearings of the pivot”. Oil bearings 36 (Figure 3.12.1).

To oil pivot spline bearings of FDA drive perform the following actions:

- remove the caps 5 (Figure 3.12.1) from four lubricating boxes 6 of the bearings 36;
- clean lubricating boxes 6 out of accumulated dirt and consolidated lubricant;
- squirt lubricating box 6 until the lubricant appears from the holes (diameter 3 mm) in the ferrule.

Notes:

Intervals of subsequent inspections/adjustments of FDA pivot spindle bearing:

- in 250 hours of tractor operation with coupled front wheels;
- in 500 hours of tractor operation with single front wheels.

Oiling of FDA pivot spindle bearing shall be carried out in every 125 hours of tractor operation.

6.4.3 Maintenance services in every 250 hours of operation

6.4.3.1 General guidelines

Perform the following operations, and the operations listed in the subsections 6.4.3.

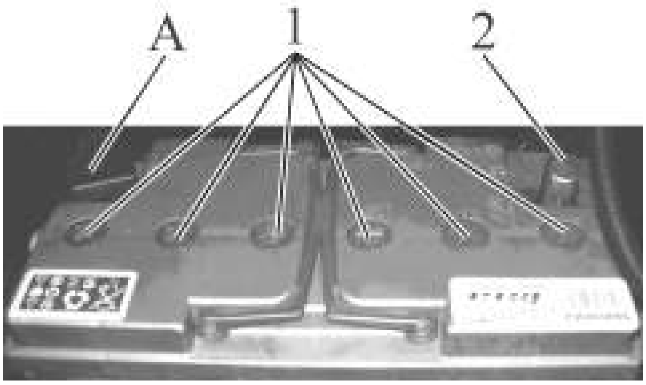
6.4.3.2 Task 28. Maintenance of accumulator batteries

Maintenance shall be carried out in every 250 hours of tractor operation, but not less than once in a month.

To carry out AB maintenance, perform the following actions:

- clean the battery from dirt and dust;
- check conditions of the terminals 2 (Figure 6.4.23) of the output pin connectors, placed under the protecting cover “A” (Figure 6.4.23), and ventilating openings in plugs 1. When necessary, grease the terminals with technical petroleum jelly and purge the ventilating openings;
- unscrew the plugs 1 of the filler openings of the accumulator batteries and check:

1. Check electrolyte level, refill the distilled water in order to increase the electrolyte level by 10…15 mm above the protective grid or up to the level of mark on the battery case.
2. Check the degree of battery discharge by the electrolyte density and recharge the battery if necessary. Degree of battery discharge shall not be lower than 50% in summer and 25% in winter.



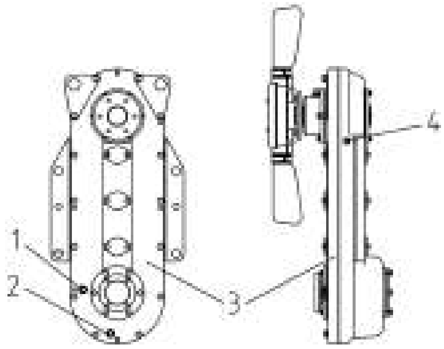
1 – terminal of output pin connector; 2 – filler plug.

Figure 6.4.23 – Maintenance of accumulator battery

6.4.3.3 Task 29. Check of oil level in FPTO shaft gearhead

To check oil level in FPTO shaft gearhead, perform the following actions:

- place the tractor at the level horizontal ground, engage the parking brake and lock the wheels against movement fore and aft by anti-recoil limit stops, excluding tractor self-movement. The engine must be stopped.
- unscrew the level check plug 1 (Figure 6.4.24);
- oil level shall reach the lower edges of the threaded opening of the plug 1;
- if it is necessary, unscrew the filler plug 4 and refill a new oil up to the lower edge of the level check plug 1;
- screw plugs 1 and 4.



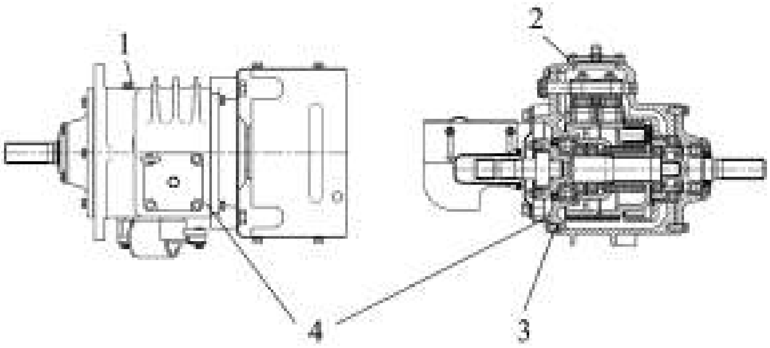
1 – level check plug; 2 – drain plug; 3 – FPTO gearhead;   4 – filler plug.

Figure 6.4.24 – Check of oil level and oil change in FPTO shaft gearhead

6.4.3.4 Task 30. Check of oil level in FPTO reducing gear

To check the oil level in FPTO reducing gear, perform the following:

- place the tractor at the level horizontal ground, engage the parking brake and lock the wheels against movement fore and aft by anti-recoil limit stops, excluding tractor self-movement. The engine must be stopped.
- unscrew the level check plug 1 (Figure 6.4.25);
- oil level shall reach the lower edges of the threaded opening of the plug 1;
- if it is necessary to unscrew the hook and three bolts for cap 2 fastening, remove the cap 2 and refill a new oil up to the lower edge of the level check plug 1;
- insert plug 1 and mount cap 2 in its place.



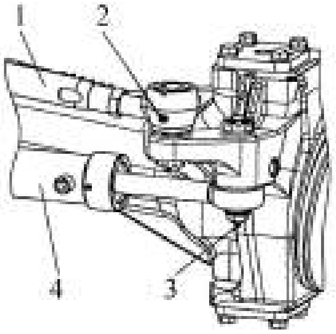
1 – level check plug; 2 – cap; 3 – drain plug; 4 – FPTO reducing gear.

Figure 6.4.25 – Check of oil level and oil change in FPTO reducing gear.

6.4.3.5 Task 31. Oiling of HSC hydraulic cylinders and steering link hinged joints

To oil HSC hydraulic cylinders and steering link hinged joints, perform the following:

- clean two lubricating boxes 2 (Figure 6.4.26), mounted on steering link 1 hinged joints, and four lubricating boxes 3, mounted on the HSC hydraulic cylinders hinged joints, out of an accumulated dirt and consolidated lubricant;
- squirt the lubricating boxes 2 and 3 until the lubricant appears from the holes.



1 – steering link; 2, 3 – lubricating box; 4 – HSC hydraulic cylinder.

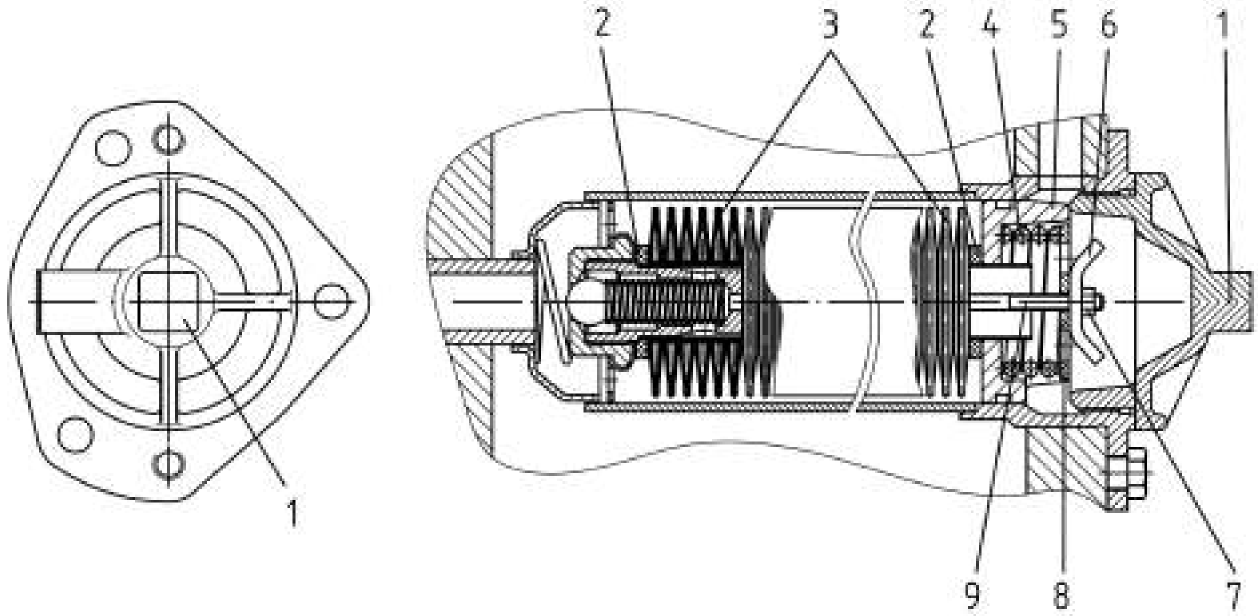
Figure 6.4.26 – Oiling of HSC hydraulic cylinders and steering link hinged joints

6.4.3.6 Task 32. Rinsing of mesh filter of transmission hydraulic system

To rinse the mesh filter 14 (Figure 3.11.2) of the transmission hydraulic system, perform the following actions:

- unscrew cap 1 (Figure 6.4.27) of the mesh filter and withdraw the filter assembly pulling the bracket 6;
- disassemble the filter by wrenching the counter nut 7 and the bracket 6 one-by-one off the stud-bolt 9. Remove the washer 8, spring 4, piston 5, O-ring 2, filter cartridges 3, and O-ring 2;
- rinse components with diesel fuel until they become clean;
- assembly the filter in reverse sequence, paying attention to obligatory installation of O-rings 2 on either sides of filter cartridges set.

ATTENTION: SCREW THE BRACKET 6 (FIGURE 6.4.27) ON THE STUD-BOLT 9 UNTIL THE WASHER 8 FULLY FITS THE PISTON 5 END!



1 – cap; 2 – O-ring; 3 – filter cartridges; 4 – spring; 5 – piston; 6 – bracket; 7 – counter nut; 8 – washer; 9 – stud-bolt.

Figure 6.4.27 – Rinsing of mesh filter of transmission hydraulic system

6.4.3.7 Task 33. Cleaning of filter cartridge of breather filter of HLL and HSC integrated tank

To clean filter cartridge of breather filter 1 (Figure 3.16.6) of HLL and HSC integrated tank, perform the following actions:

- unscrew a bolt fastening the breather safety cap;
- remove the safety cap, withdraw the filter cartridge with the O-rings out of the housing;
- blow off the filter cartridge with a compressed air;
- insert the O-ring, a new filter cartridge, the second O-ring into the housing, put the safety cap on, tighten the bolt fastening the safety cap (if the “Sofima” breather is mounted on the oil tank, the filter cartridge has no O-rings).

ATTENTION: WHEN TRACTOR IS OPERATED IN CONDITIONS OF HIGH DUST LEVEL, THE BREATHER FILTER CARTRIDGE CHANGE SHALL BE CARRIED OUT IN EVERY 8-10 HOURS, I.E. ON THE SHIFT BASIS!

6.4.3.8 Task 34. Check/adjustment of clearances in steering joints

To check the backlash and clearances in steering joints 2 (figure 6.4.29) of the steering link 1, it is necessary to turn the steering wheel either side when the engine is running. In case the steering wheel angular play is more than 25°, as indicated in Figure 6.4.28, remove the steering joints play by performing the following actions:

- stop the engine;
- unscrew the bolts 3 (Figure 6.4.29), remove the cap 4 and the gasket 5;
- screw the plug 6 in to remove the steering joints play;
- start the engine and turn the steering wheel either side. In case the steering wheel play is less than 25°, stop the engine, put the cap 4 back in its place fastening it with the bolts 3, and centre-punch it into the hinge housing slot to prevent it from turning.
- if the steering wheel angular play is more than 25°, i.e. the steering joints play can not be eliminated by retorque of the threaded plug 6, stop the engine, disassemble the hinge and replace its worn-out parts. Assemble the hinge, the plug 6 shall be tightened with torque of 120 to 160 N·m, than unscrew it by 1/12…1/8 of turn and assembly the hinge completely, putting the cap back in its place, and centre-punching the cap 4 into the hinge housing slot.
- after installation of the steering link tighten the ball pins castle nuts 14 with torque of 100 to 140 N·m and fasten them by cotter, in case if the nut driving slot is matched with ball pin bore unscrewing of a nut is not allowed.

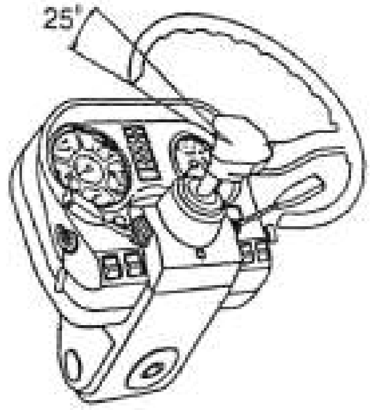
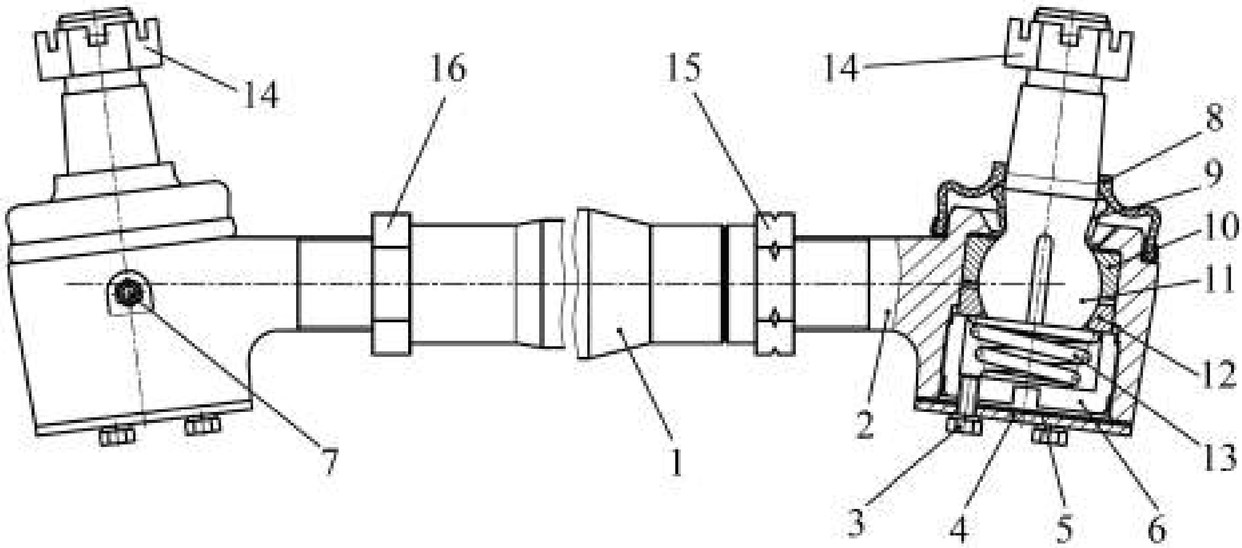


Figure 6.4.28 – Check of clearances in steering joints



1 – steering link; 2 – hinged joint; 3 – bolt; 4 – cap; 5 – gasket; 6 – plug; 7 – oil box; 8 - envelope; 9 – limiting device; 10 – liner; 11 – ball pin; 12 – liner; 13 – spring; 14 – castle nut; 15 – left castle nut, 16 – right castle nut.

Figure 6.4.29 – Maintenance of steering joints

6.4.3.9 Task 35. Check and adjustment of wheels toe-in

Adjustment of front wheels toe-in is carried out to prevent the front tires from premature breakdown.

ATTENTION: CHECK AND ADJUSTMENT OF FRONT WHEELS TOE-IN SHALL BE CARRIED OUT IN EVERY 250 HOURS OF TRACTOR OPERATION, AND AFTER EACH TIME THE FRONT WHEELS TRACK WIDTH IS CHANGED. BEFORE CHECKING THE FRONT WHEELS TOE-IN, CHECK AND ADJUST, IF NECESSARY, THE STEERING JOINTS PLAYS!

To make adjustments, perform the following:

1. Ensure that there is no clearance space in the steering joints, centre bearings and wheels.

2. Set the front wheels in straight position by way of running the tractor straight ahead for not less than 3 meters along the horizontal level ground. Engage the parking break to avoid tractor movement.

3. Measure distance “A” (Figure 6.4.30) between rim edges of front wheels 1 and 5 (Figure 6.4.30) on wheel centre level at the front and make visible marks in locations of measurements.

4. Disengage the parking break, drive the tractor ahead in such a way that the front wheels turn by half revolution and measure distance “B” between rim edges on wheel centre level from behind in the point determined and marked before.

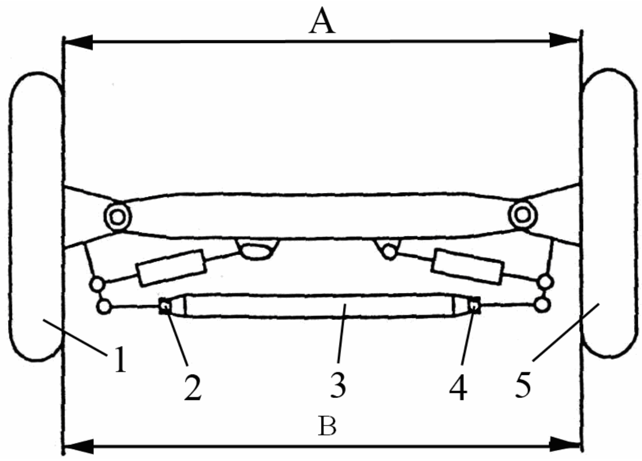
5. If the value (“B”-“A”) ranges within 0 to 8 mm that means that the toe-in is correctly adjusted:

a) leaving the tractor position unchanged, unscrew nuts 2 and 4;

b) rotating steering link tube 3 try to get value (“B”-“A”) ranging within 0 to 8 mm;

c) repeat operations, described in subclauses 4 and 5.

d) if value (“B”-“A”) falls within the limits of 0 to 8 mm, tighten steering link nuts 2 and 4 with torque of 150 to 170 N·m, leaving steering link length unchanged.



1, 5 – front wheel rim edge; 2, 4 – nut; 3 – regulating tube.

Figure 6.4.30 – Front wheels toe-in adjustment scheme

6.4.3.10 Task 36. Lubrication of RLL cylinder pins

To two lubricate RLL cylinder pins 1 (Figure 6.4.32) perform the following actions:

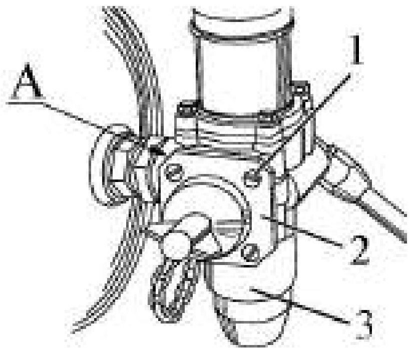
- clean two lubricating boxes 2, located at the heads of the cylinder rods from accumulated dirt and consolidated lubricant;

- squirt lubricating boxes 2 with a lubricant.

6.4.4 Maintenance services in every 500 hours of operation

6.4.4.1 General guidelines
Complete the abovementioned tasks, and the tasks, listed in the present subclause 6.4.4 also.

6.4.4.2 Task 37. Cleaning of filter cartridge of air pressure regulating filter in the pneumatic system.
To clean filter cartridge of air pressure regulating filter 3 (Figure 6.4.31) in the pneumatic system, perform the following actions:
- unscrew bolts 1 and remove cap 2;
- withdraw filter cartridge, rinse it with cleaning solution and blow it off with a compressed air;
- insert the filter cartridge and than mount the cap in its place.



1 – bolt, 2 – cap; 3 – air pressure regulator in the pneumatic system.

Figure 6.4.31 – Cleaning of filter cartridge of air pressure regulating filter

6.4.4.3 Task 38. Adjustment of service brake control
Check and adjust when necessary service brake control, as indicated in subsections 3.9.7 “Adjustment of brake controls at forward motion” and 3.9.8 “Adjustment of brake controls on reverse”.

6.4.4.4 Task 39. Adjustment of parking brake control
Check and adjust if necessary parking brake control, as specified in subsection 3.9.9 “Adjustment of parking brake actuator”.

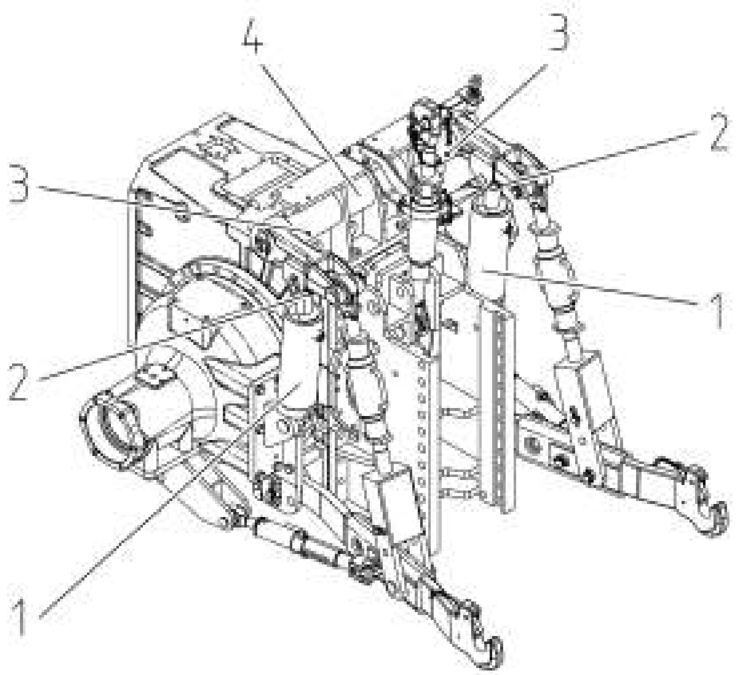
6.4.4.5 Task 40. Check of the pneumatic system line proofness
To check the pneumatic system line proofness, perform the following:
- adjust pressure in the pneumatic system up to the value of 0.6 to 0.65 MPa (according to the air pressure gauge mounted on the gauge board) and stop the engine;
- connect a manometer scaled not less than 1 MPa to a coupling head with red cap.
- check according to the manometer that the air pressure drop does not exceed 0.2 MPa during 30 min. Otherwise detect air leakage and correct the trouble.

6.4.4.6 Task 41. Adjustment of pneumatic system brake valve actuator
Check and adjust if necessary brake valve actuators, as specified in subsection 3.10.2 “Check and adjustment of pneumatic system brake valve actuators”.

6.4.4.7 Task 42. Oiling of the RLL turning shaft bushings

To oil the RLL turning shaft bushings perform the following actions:

- clean lubricating boxes 3, mounted on RLL supporting bracket 4, from accumulated dirt and consolidated lubricant;
- squirt lubricating boxes 3 with a lubricant until the lubricant appears from the holes.



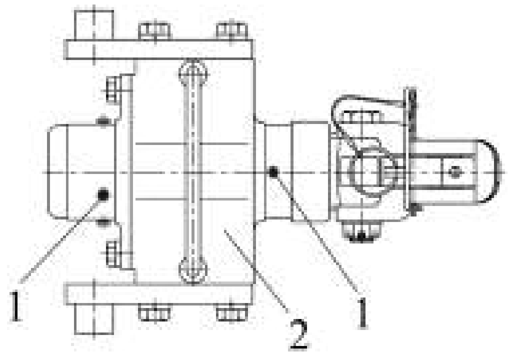
1 – cylinder; 2, 3 – lubricating boxes; 4 – RLL supporting bracket.

Figure 6.4.32 – Oiling of RLL turning shaft bushings and RLL cylinder pins

6.4.4.8 Task 43. Oiling of towing gear (in case it is mounted on order)

To oil towing gear (a hook with shock absorber), perform the following actions:

- clean two lubricating boxes 1 (Figure 6.4.33), mounted on towing gear, from accumulated dirt and consolidated lubricant;
- squirt lubricating boxes 1 with a lubricant.



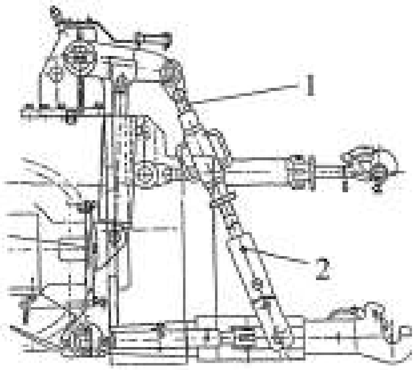
1 – lubricating box; 2 – towing gear.

Figure 6.4.33 – Oiling of towing gear

6.4.4.9 Task 44. Oiling of the RLL crossbeam yokes

To oil RLL crossbeam yokes perform the following actions:

- clean lubricating boxes 2 (Figure 6.4.34), located on the crossbeams 1, from accumulated dirt and consolidated lubricant;
- squirt lubricating boxes 2 with a lubricant until the lubrication appears from the holes.



1 – crossbeam; 2 – lubricating box.
Figure 6.4.34 – Oil RLL crossbeam yokes

6.4.4.10 Task 45. Cleaning and oiling of sline joints of the front PTO shaft
Lubricate sline joints “A” and “B” with some graphite grease (Figure 6.4.35) GOST 3333-80, or similar.

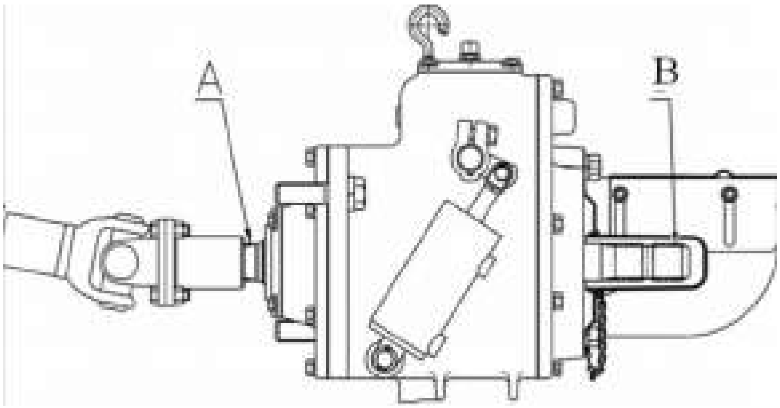
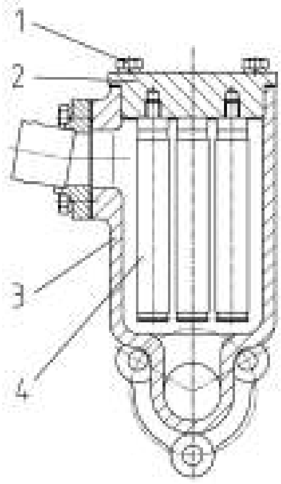


Figure 6.4.35 – Oiling of sline joints of the front PTO shaft scheme

6.4.4.12 Task 46. Cleaning of magnetic filter of the transmission hydraulic system
To clean magnetic filter, perform the following actions:
- unscrew four bolts 1 (Figure 6.4.36) and remove cap 2;
- clean with rags four magnetic arresters 4;
- install the cap 2 into the housing 3 and fix it with bolts 1.



1 – bolt; 2 – cap; 3 – housing; 4 – magnetic arrester.

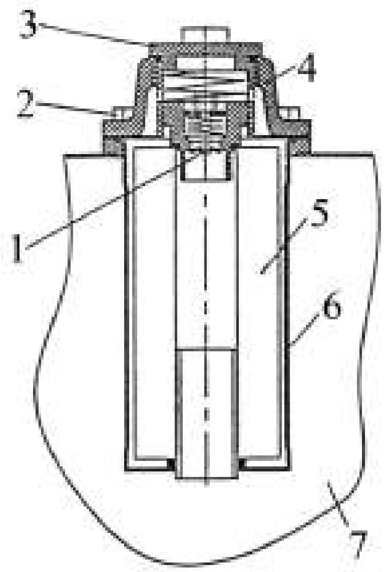
Figure 6.4.36 – Cleaning of magnetic filter of the transmission hydraulic system

6.4.4.13 Task 47. Replacement of an exchangeable filter cartridge of HLL and HSC integrated tank

The first and second exchangeable filter cartridges of HLL and HSC integrated tank shall be carried out in every 500 hours of tractor operation. Further replacement shall be carried out in every 1000 hours of operation simultaneously with change of oil.

To replace exchangeable filter cartridge of HLL and HSC integrated tank perform the following actions:

- unscrew bolts 2 (Figure 6.4.37) fastening caps 4 and remove the cap 4 assembled with plug 3 and valve 1;
- withdraw the filter cartrige 5;
- clean internal space of the bowl 6;
- insert a new filter cartrige 5;
- put the cap 4 back in its place assembled, tightening bolts 3;
- check level of oil in the tank 7, as specified in clause 6.4.1.3, refill the oil if necessary.



1 – valve; 2 – bolt; 3 – plug; 4 – cap; 5 – filter cartridge; 6 – bowl; 7 – HLL and HSC integrated tank.

Figure 6.4.37 – Replacement of an exchangeable filter cartridge of HLL and HSC integrated tank

6.4.5 Maintenance service in every 1000 hours of operation

6.4.5.1 General guidelines

Complete the abovementioned tasks, and the tasks, listed in the present subclause 6.4.5 also.

6.4.4.14 Task 48. Change of oil in HLL and HSC integrated tank

Before changing oil, in order to warm up the oil in HLL and HSC systems set the steering wheel into the extreme position with the motor running and keep it this position until the oil is warmed up to the temperature not less than 45 °C.

To change the oil in the HLL and HSC integrated tank perform the following actions:

- set the tractor in level surface, set the RLL links into the lowermost position, FLL links into the uppermost position, put the parking brakes on and stop the engine;
- unscrew the plug of the oil filler 1 (Figure 6.4.2) and the drain plug (plugs) 3 of the oil tank, drain the oil into a special tank for an exhaust oil;
- withdraw the intake filter 4, rinse the intake filler strainer in a clean diesel engine, and blow it off with a compressed air;
- build the intake filter 4 in;
- insert the drain plug back in its place (plugs) 3 and fill the system with a new oil to the required mark «П» according to the oil-level gauge 2;
- insert the oil filler 1 plug back in its place.

ATTENTION: OIL CHANGE OPERATION IN THE HLL AND HSC HYDRAULIC SYSTEM SHALL BE CARRIED OUT ONLY WITH RLL CYLINDER RODS RETRACTED AND THE IMPLEMENTS COUPLED WITH THE TRACTOR!

WARNING: BE CAREFUL IN ORDER TO AVOID CONTACT WITH HOT OIL!

6.4.5.2 Task 49. Change of oil in transmission line

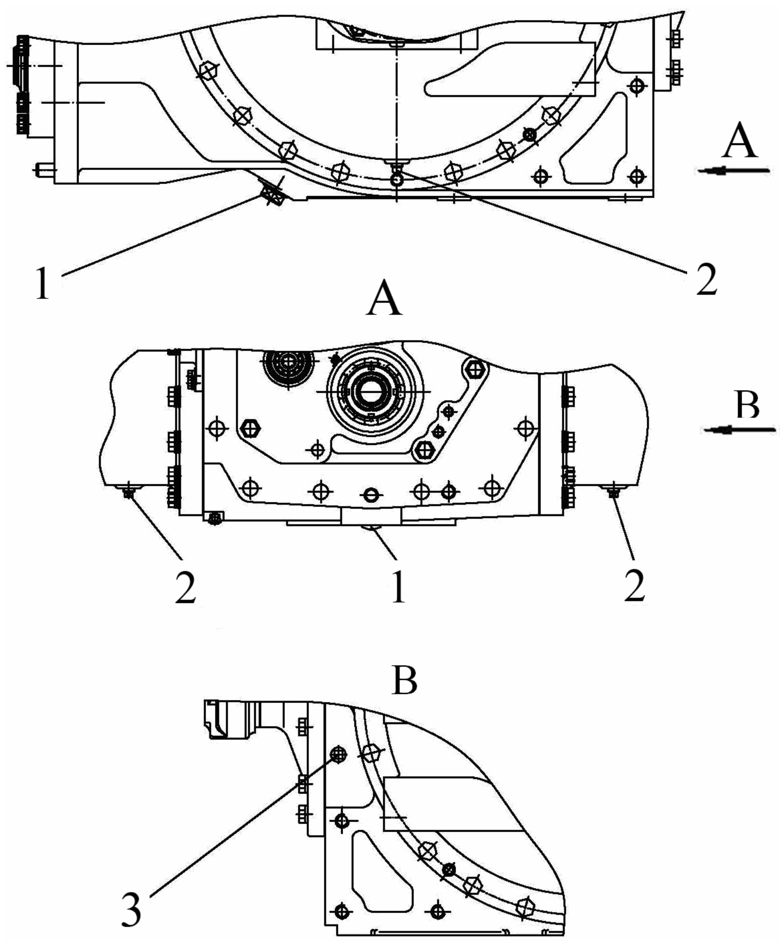
Before changing oil, warm up the transmission line up to the normal operating temperature by means of driving the tractor.

To change the oil in the transmission line, perform the following actions:

- place the tractor on level horizontal ground, engage the parking brake and lock the wheels against movement fore and aft by anti-recoil limit stops, excluding tractor self-movement. The engine must be stopped.
- unscrew the rear axle drain plug 1 (Figure 6.4.38) and the sleeves drain plugs 2;
- drain the oil from the gear-box, rear axle and final drive sleeve casings;
- unscrew the oil level check plug 3 in the transmission line;
- screw the drain plugs 1 and 2 in;
- unscrew the plug 5 (Figure 6.4.1) and fill in with a new oil up to the oil level check plug level 3 through the filler neck 4 (Figure 6.4.38);
- screw the oil level check plug 3;
- check the oil level in the transmission with the examining probe 1 (Figure 6.4.1), fill in with a new oil up to the required level (oil level shall be between the probe marks) through the filler neck 4.

ATTENTION: SIMULTANEOUSLY WITH OIL CHANGE IN THE TRANSMISSION LINE IT IS NECESSARY TO REPLACE THE EXCHANGEABLE FILTER CARTRIDGES OF THE DUPLEX FILTER OF THE TRANSMISSION HYDRAULIC SYSTEM, REGARDLESS OF HOW MANY TIME HAS PASSED FROM THE DATE OF PREVIOUS REPLACEMENT!

ATTENTION: AFTER OIL CHANGE IN THE TRANSMISSION LINE, START THE ENGINE, LET IT WORK AT IDLE SPEED FOR TWO OR THREE MINUTES. THEN, NOT SOONER THAN IN 8 MINUTES AFTER THE ENGINE IS STOPPED, CHECK THE OIL LEVEL IN THE TRANSMISSION LINE ONCE AGAIN. REFILL THE OIL IF NECESSARY!



1 – rear axle drain plug; 2 – semi-axis tube drain plug; 3 – oil level check plug.

Figure 6.4.38 – Change of oil in transmission line

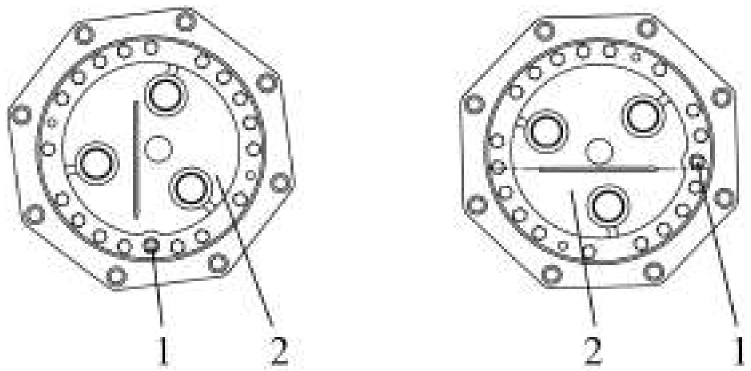
ATTENTION: BE CAREFUL IN ORDER TO AVOID CONTACT WITH HOT OIL!

6.4.5.3 Task 50. Change of oil in main gear housing and wheel-hub drive casing of the FDA

Before changing oil, warm up the main gear housing up to the normal operating temperature by means of driving the tractor.

To change oil in the housings, perform the following actions:

- place the tractor on level horizontal ground with plug 1 locating in the lowermost position (position “a” in Figure 6.4.39);
- engage the parking brake and lock the wheels against movement fore and aft by anti-recoil limit stops, excluding tractor self-movement. The engine must be stopped.
- unscrew level check/fill plug 5 (Figure 6.4.20) and drain plug 4 of the main gear housing 3, drain the oil from the main gear housing;
- unscrew the plug 1 (Figure 6.4.39) of the wheel-hub drive casing 2, drain the oil from the wheel-hub drive casing 2.
- by rotating a wheel set the FDA in such a way that the arrow casted in the wheel-hub drive casing takes up a horizontal position (position «b» in Figure 6.4.39);
- fill in a new oil through the hole in the plug 1 up to the lower edge of the hole in the plug 1;
- screw the drain plug 4 (Figure 6.4.20) in the main gear housing 3 and fill a new oil through the hole in the level check/fill plug 5 up to the lower edge of the hole in the plug 5;
- screw the plug 1 in (Figure 6.4.39) and the plug 5 (Figure 6.4.20).



a) position of wheel-hub drive for oil draining

b) position of wheel-hub drive for oil filling

1 – plug; 2 – wheel-hub drive casing.

Figure 6.4.39 – Change of oil in wheel-hub drive casing

WARNING: BE CAREFUL IN ORDER TO AVOID CONTACT WITH HOT OIL!

6.4.5.4 Task 51. Change of oil in FPTO shaft gearhead

Before starting change procedure, warm up the oil in FPTO shaft gearhead up to the normal operating temperature by means of starting the engine.

To change oil in FPTO shaft gearhead, perform the following actions:

- place the tractor on level horizontal ground, engage the parking brake and lock the wheels against movement fore and aft by anti-recoil limit stops, excluding tractor self-movement. The engine must be stopped.
- unscrew the plugs 1, 2 and 4 (Figure 6.4.24), drain the oil from the FPTO shaft gearhead;
- screw the drain plug 2;
- fill in a new oil through the hole in the plug 4 up to the lower edge of the level check plug hole 1;
- screw the plugs 1 and 4.

WARNING: BE CAREFUL IN ORDER TO AVOID CONTACT WITH HOT OIL!

6.4.5.5 Task 52. Change of oil in FPTO reducing gear

Before starting change procedure, warm up the oil in the FPTO reducing gear up to the normal operating temperature by means of starting the engine.

To change the oil in the FPTO reducing gear, perform the following actions:

- place the tractor on level horizontal ground, engage the parking brake and lock the wheels against movement fore and aft by anti-recoil limit stops, excluding tractor self-movement. The engine must be stopped.
- unscrew the plugs 1 and 3 (Figure 6.4.25), remove the cap 2 by unscrewing the hook and three bolts, then drain the oil from the FPTO reducing gear;
- screw the drain plug 3;
- fill in a new oil through the hole in the plug 2 up to the lower edge of the level check plug hole 1;
- screw the plug 1 and put the cap 2 back in its place.

WARNING: BE CAREFUL IN ORDER TO AVOID CONTACT WITH HOT OIL!

6.4.5.6 Task 53. Change of hydraulic-brake fluid in clutch operating control drive

Change of hydraulic-brake fluid in clutch operating control hydraulic system on forward drive and on reverse is required.

WARNING: EXCLUDE CONTACT OF HYDRAULIC-BRAKE FLUID WITH EYES AND UNCOVERED SKIN AREAS!

ATENTION: EXCLUDE INGRESS OF MINERAL OIL, PETROLEUM, KEROSINE AND DIESEL FUEL, AS THESE SUBSTANCES RESULT IN SWELL OF THE RUBBER GASKETS!

1. Drain hydraulic-brake fluid from the hydraulic system performing the following actions:

- unscrew the cap (Figure 3.3.4) of the reservoir 1 of the forward drive master cylinder 12 and remove the envelope 23 of the main reverse cylinder19;
- dismount the safety cap 29 from the bypass valve 30;
- pivot the rubber hose on the bypass valve dipping its loose end into an empty container;
- release the bypass valve 30 by one turn;
- press clutch pedal for forward drive 10 down several times until the hydraulic-brake fluid is fully extracted from the forward drive hydraulic system;
- press the reverse clutch pedal 20 down several times until the hydraulic-brake fluid is fully extracted from the reverse motion hydraulic system;
- screw the bypass valve 30, dismount the hose, put on the safety cap 29 back in its place.

2. Fill forward drive main cylinder 12 tank 1 with the hydraulic-brake fluid up to the “Max” level marked on the tank, and fill the compensating chamber of the reverse main cylinder with the hydraulic-brake fluid up to the level of 10…15 mm from the top of the compensating chamber.

3. Circulate fluid through the clutch operation control hydraulic system as it is required in clause 3.3.4.2 of subsection 3.3.4 “Clutch control adjustment”.

4. Place the reservoir cap 1 and the envelope 23 back in their places.

6.4.5.7 Task 54. Change of hydraulic-brake fluid in break control drive

Change of hydraulic-brake fluid in break control hydraulic system on forward drive and on reverse is required.

WARNING: EXCLUDE CONTACT OF HYDRAULIC-BRAKE FLUID WITH EYES AND UNCOVERED SKIN AREAS!

ATENTION: EXCLUDE INGRESS OF THE MINERAL OIL, PETROLEUM, KEROSINE AND DIESEL FUEL, AS THESE SUBSTANCES CAUSE THE SWELL OF THE RUBBER GASKETS!

To change hydraulic-brake fluid in break control hydraulic system on forward drive, perform the following:

1. Drain hydraulic-brake fluid from hydraulic system performing the following actions:

- unscrew the reservoir caps 1 and 2 and (Figure 6.4.40) of the main brake cylinders of forward drive 3 and 4;
- remove the safety caps from the fittings 5 of the left 6 and right wheel brake cylinders;
- pivot the hoses on the both fittings 5 one by one (beginning from the left) or synchronously dipping their loose ends into an empty container;
- unscrew the both fittings 5 by ½ of a turn;
- press the pedals 7 and 8 synchronously until the fluid is fully extracted from the hydraulic system;
- screw in the both fittings 5, dismount the hose, put on the safety caps back in their places.

2. Fill the tanks 1 and 2 of the main cylinders of forward drive 3 and 4 with the hydraulic-brake fluid up to the “Max” level marked on the tanks.

3. Circulate fluid through the break control hydraulic system in compliance with the task №4 in subsection 3.9.7 “Adjustment of brake controls at forward motion ”.

4. Place back the reservoir caps 1 and 2.

To change the hydraulic-brake fluid in the break control hydraulic system on reverse, perform the following:

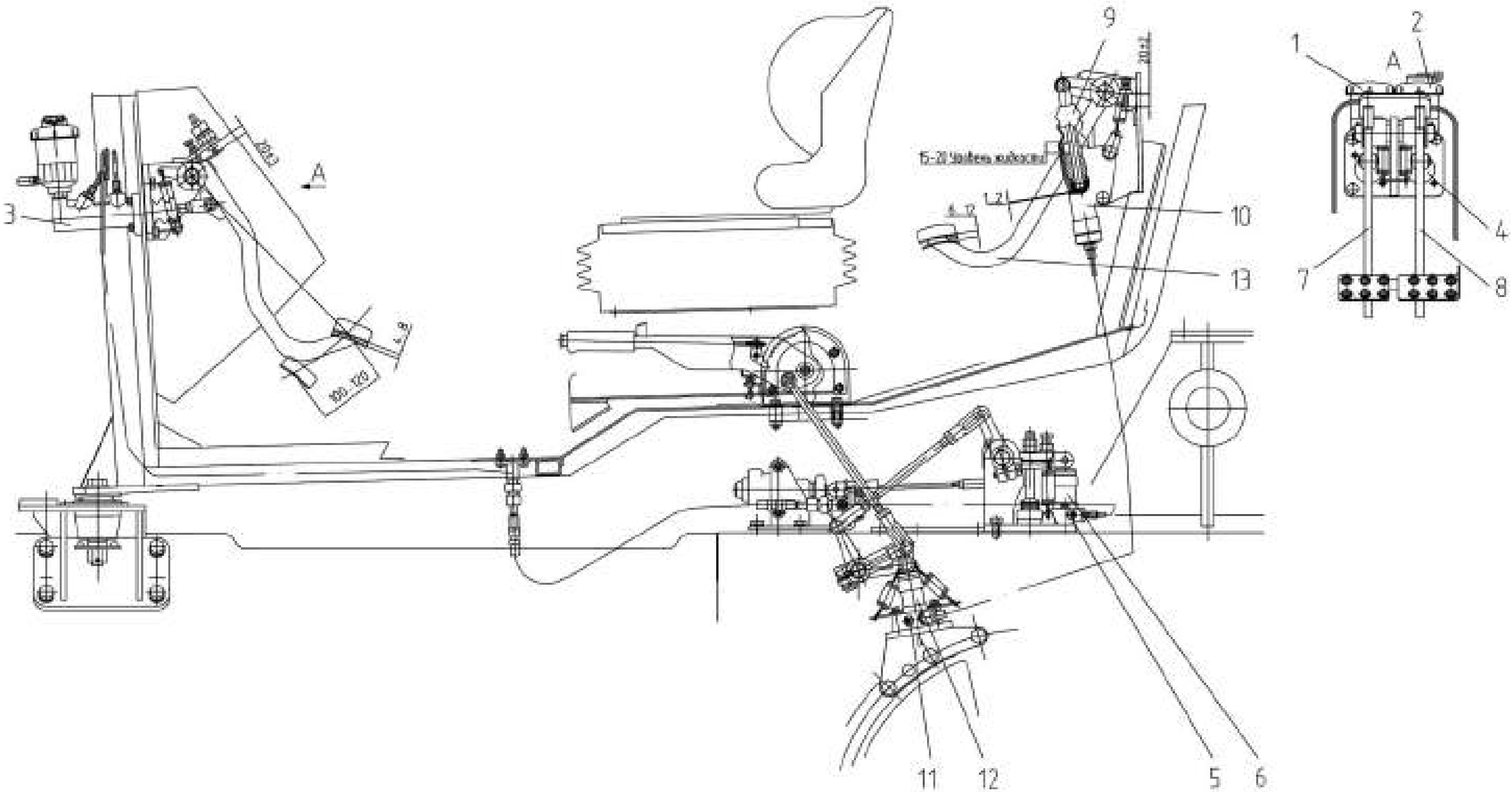
1. Drain the hydraulic-brake fluid from the hydraulic system performing the following actions:

- remove the envelope 9 (Figure 6.4.40) of the main brake cylinder of reverse 10;
- remove the safety cap from the fittings 11 of the wheel brake cylinder on reverse 12;
- pivot the rubber hose on the fitting 11 dipping its loose end into an empty container;
- unscrew the fitting 5 by ½ of a turn;
- press the pedal 13 down for a while until the hydraulic-brake fluid is fully extracted from the hydraulic system on reverse;
- screw in the fitting 11, dismount the hose, put on the safety cap back in its place.

2. Fill the compensating chamber main brake cylinder of reverse 12 with the hydraulic-brake fluid up to the level 15…20 mm from the top of the compensation chamber.

3. Circulate fluid through the break control hydraulic system in compliance with the task №3 of subsection 3.9.8 “Adjustment of the brake controls on reverse”

4. Cover it with the envelope 9.



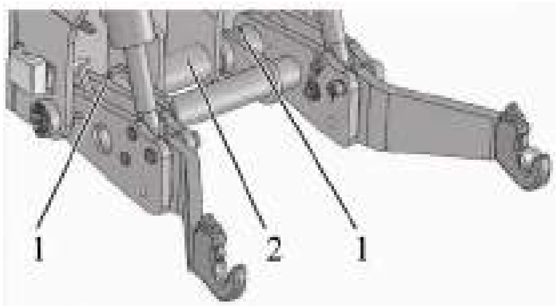
1, 2 – reservoir cap; 3, 4 – main brake cylinder of forward motion; 5 – fitting; 6 – left wheel brake cylinder of forward drive; 7, 8 – break pedals of forward drive; 9 – envelope; 10 – main brake cylinder of reverse; 11 – fitting; 12 – wheel brake cylinder of reverse; 13 – break pedals of reverse.

Figure 6.4.40 – Change of the hydraulic-brake fluid in the break control drive

6.4.5.9 Task 55. Lubrication of bushings serving for swinging motion of a front link of FLL

To oil bushings serving for swinging motion of the front link of FLL, perform the following:

- clean two lubricating boxes 1 (Figure 6.4.41), located on an oscillating pin of the FLL front links 2, from accumulated dirt and consolidated lubricant;
- squirt the lubricating boxes 1 with a lubricant until the lubrication appears from the holes.



1 – lubricating box; 2 – oscillating pin of the FLL front links.

Figure 6.4.41 – Lubrication of RLL turning shaft bushing

6.4.5.10 Task 56. Change of grease in steering joints

- dismount steering link 1 (Figure 6.4.29) from the tractor and unscrew hinged joints 2;
- remove envelope 8 and limiting device 9;
- unscrew bolts 3, remove cap 4 and gasket 5;
- unscrew plug 6;
- withdraw spring 13, liner 12, ball pin 11, liner 10;
- rinse all parts with diesel fuel, dry with rags and lubricate the ball pin 11 and the liners 10, 12 with a greasing;
- assemble the hinged joint, torque the plug 6 with force from 120 to 160 N·m, then release it by 1/12…1/8 of turn and carry out final assembling, returning and center-pinning the cap 4 into the slot of the hinge housing.
- after installation of the steering link on the tractor, torque the castle nuts 14 of the ball pins with force from 100 to 140 N·m and fasten it by cotter, where unscrewing of the nut, if the driving slot of the nut and ball pin bore is matched, is not allowed.

6.4.5.11 Task 57. Check and adjustment of pneumatic pressure regulator

Check and adjust if necessary pneumatic pressure regulator, as indicated in subsection 3.10.3 “Check and adjustment of pneumatic system pressure regulator”.

6.4.5.12 Task 58. Replacement of filter cartridge of breather filter of HLL and HSC integrated tank

To change filter cartridge of breather 1 (Figure 3.16.6) of HLL and HSC integrated tank, perform the following:

- unscrew bolt fastening breather cap;
- remove the cap, withdraw the filter cartridge from the housing with O-rings;
- insert the O-ring, a new filter cartridge, the second O-ring into the housing, put the safety cap on, tighten the bolt fastening the safety cap (if the “Sofima” breather is mounted on the oil tank, the filter cartridge has no O-rings).

6.4.5.13 Task 59. Check of gripping of tractor external threaded joints

Check and tighten up if necessary the following most important threaded joints:
1 - frame — rear plate;
2 - rear plate — clutch casing;
3 - clutch casing — gearbox casing;
4 - gearbox casing — rear axle body;
5 - rear axle body — the rear semi axle tube;
6 – brace brackets of RLL of the rear semi axle tube;
7 - eye ring fastening the RLL lower drawbars;
8 – front and rear cab mounting supports;
9 – front wheels wings pivot mechanism;
10 – FDA body — central reducing gear;
11 – pivot pin — wheel-hub drive;
12 - steering cylinders pins;
13 – locking nuts of the steering link tube.

1. Check and tighten up if necessary ten accessible bolts M20 (by five bolts on each side) fastening the frame to the rear plate with torque of 350 to 380 N·m;

2. Check and tighten up if necessary sixteen accessible bolts M20 fastening the rear plate to the clutch casing with torque of 350 to 380 N·m.

3. Check and tighten up if necessary eighteen bolts M20 at the joint of gearbox casing and the clutch casing with torque of 350 to 400 N·m.

4. Check and tighten up if necessary twenty bolts M20 at the joint of gearbox casing and the rear axle body with torque of 350 to 400 N·m.

5. Check and tighten up if necessary thirty seven bolts M18 at both joints of the rear axle body and the rear semi axle tube (nineteen bolts to the right side along the direction of the tractor motion, and eighteen bolts to the left side along the direction of the tractor motion) with torque of 400 to 500 N·m.

6. Check and tighten up if necessary eight bolts M20 (by four bolts on each side) fastening the brace brackets of RLL to the rear semi axle tubes with torque of 320 to 360 N·m.

7. Check and tighten up if necessary two castle nuts M27 (by one nut on each link) fastening the eye ring to the lower drawbars for which perform the following actions:

- unfasten the cotter pin holding the castle nuts;
- tighten up two castle nuts with torque of not less than 50 N·m,
- then make castle nut further to the moment when the nut's nearest slot matches the pin bore, and fasten it with cotter pin then.

8. Check and tighten up if necessary the accessory fastening the cab mounting supports (front and rear) to the tractor frame. Sixteen bolts M16 shall be tightened with torque from 160 to 200 N·m (by four bolts per each supporting bracket.

Inspect the reliability of locking by a locking pin of the castle nut M20 fastening the bottom vibration isolator (four places).

9. Check and tighten up if necessary two nuts M16 and the axis M16 on each wings pivot mechanism of the front wheels with torque from 160 to 200 N·m. To check and tighten up the nuts and axles remove the rubber caps, protecting the attrition area. To make this unscrew the bolts M6 fastening the safety caps.

10. Check and tighten up if necessary eighteen bolts M14 connecting the FDA bodies and the central gearbox with torque from 100 to 135 N·m.

11. Check and tighten up if necessary sixteen bolts M16 (by eight bolts on each side) fastening the pivot and wheel-hub drive axis with torque from 160 to 200 N·m.

12. Check and tighten up if necessary four castle nuts M27x1.5 of a cone-shaped pin of the hydraulic steering cylinder, for which perform the following actions:

- unfasten the cotter pin holding the castle nuts;
- tighten up four castle nuts with torque from 180 to 200 N·m;
- then make castle nut further to the moment when the nut's nearest slot matches the pin bore, and fasten it with cotter pin then.

13. Check and tighten up if necessary two locking nuts M30x1.5 (with thread on the right and on the left side) of the steering link tube with torque from 15 to 170 N·m.

6.4.6 Maintenance service in every 2000 hours of operation

6.4.6.1 General guidelines

Complete the abovementioned tasks, and the tasks, listed in the present subclause 6.4.6.

6.4.6.2 Task 60. Change of coolant in the engine cooling system

To change liquid coolant (LC) in the engine cooling system, perform the following:

- place the tractor on level horizontal ground, engage the parking brake and lock the wheels against movement fore and aft by anti-recoil limit stops, excluding tractor self-movement. The engine must be stopped.
- unscrew the drain plug 12 of the water radiator 8 (Figure 3.1.4) 12 and drain the coolant;
- screw the drain plug 12 of the water radiator;
- open the plug 13 of the expansion chamber 1;
- fill the coolant through the expansion chamber neck. Filling shall be carried out up to the moment, when the coolant level in the expansion chamber is below by 50…60 mm the level of the filler neck upper edge;
- start the engine. Warm it up to the moment, when the temperature of LC reaches 92 to 95°C. Check the pressure in the system (by hand in the tube 4 from the water pump to the water radiator). Stop the engine.
- check the uniformity of upper and lower radiator tanks warming-up, and radiator core. Let the engine cool down;
- check the level of the coolant (it shall be below the level of the expansion chamber filler neck upper edge), refill the LC if necessary;
- cork the expansion chamber 1 with the plug 13.

WARNING: COOLING SYSTEM OPERATES UNDER PRESSURE, WHICH IS MAINTAINED BY THE VALVE IN THE EXPANSION CHAMBER PLUG. IT IS DANGEROUS TO REMOVE THE PLUG WHEN THE ENGINE IS HOT. LET THE ENGINE COOL DOWN, COVER THE PLUG WITH THICK FABRIC AND TURN IT SLOW TO REDUCE PRESSURE IN A SMOOTH MANNER, BEFORE THE PLUG IS FULLY UNSCREWED. BE CAREFUL IN ORDER TO AVOID CONTACT WITH HOT OIL!

6.4.6.3 Task 61. Replacement of filter cartridge in the cabine ventilation and air heating systems

Replace filter cartridges of the ventilation system filters and cab heating. Method of removing and installation of the filter cartridge on the tractor is specified in clause 6.4.2.9 “Task 23. Cleaning of filter cartridges of ventilation and air heating systems”.

6.4.7 Maintenance service that is inconsistent with intervals of MS-1, 2MS-1, MS-2, MS-3 and special MS

Task 62. Replacement of filter-drier of the air-conditioning system

Replacement of filter-drier shall be carried out in every 800 hours of operation or once in a year, whichever comes first.

ATTENTION: TO REPLACE A FILTER-DRIER CONTACT SPECIAL SERVICE STATION. REPLACEMENT SHALL BE CARRIED OUT USING SPECIAL-PURPOSE EQUIPMENT!

6.4.8 General maintenance services

6.4.8.1 General guidelines

Carry out maintenance service operations, listed in subsection 6.4.8 as may be necessary (i.e. when level sensor or dirtiness sensor responds).

6.4.8.2 Task 63. Refill of coolant in the engine cooling system

Refill of LC in the engine cooling system shall be carried out when the lamp indicating low level of the coolant 16 (Figure 2.7.) lights up on the multifunction display (with the indicator 9 (Figure 2.9.1) lighting up simultaneously on the multifunction electronic panel).

To refill coolant (LC) in the engine cooling system, perform the following actions:

- place the tractor on level horizontal ground, engage the parking brake. The engine must be stopped.
- open the plug 13 (Figure 3.1.4) of the expansion chamber 1;
- refill the liquid coolant through the expansion chamber neck. Filling shall be carried out up to the moment, when the coolant level in the expansion chamber is below by 50…60 mm the level of the filler neck upper edge;
- cork the expansion chamber 1 with the plug 13.

WARNING: COOLING SYSTEM OPERATES UNDER PRESSURE, WHICH IS MAINTAINED BY THE VALVE IN THE EXPANSION CHAMBER PLUG. IT IS DANGEROUS TO REMOVE THE PLUG WHEN THE ENGINE IS HOT. LET THE ENGINE COOL DOWN, COVER THE PLUG WITH THICK FABRIC AND TURN IT SLOW TO REDUCE PRESSURE IN A SMOOTH MANNER, BEFORE THE PLUG IS FULLY UNSCREWED. BE CAREFUL IN ORDER TO AVOID CONTACT WITH HOT OIL!

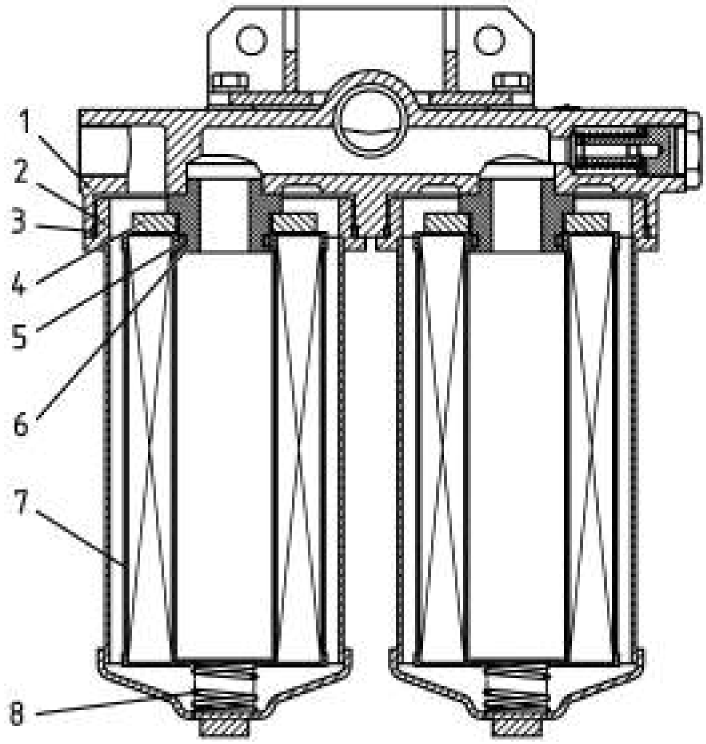
6.4.7.3 Task 64. Replacement of changeable filter cartridges of the transmission hydraulic system duplex filter

Replacement of changeable filter cartridges of the transmission hydraulic system duplex filter shall be carried out when the lamp indicating clogging of the duplex filter 4 (Figure 3.17.1), placed on the CECS, lights up.

ATTENTION: BOTH FILTERS SHALL BE REPLACED SIMULTANEOUSLY!

Replacement of changeable filter cartridges shall be carried out as follows:

- stop the engine after the indicator 4 lights up (Figure 3.17.1), engage the parking brake;
- unscrew the duplex filter bowl 2 (Figure 6.4.42);
- withdraw dirty filter cartridge 7;
- clear the permanent magnet 4 from the metal particles;
- put the clean permanent magnet 4 on the bushing 6;
- insert the O-rings 3, 5 and a new filter cartridge 7;
- then insert the spring 8 into the bowl 2 and screw it in the housing 1;
- replace another filter cartridge in the same way.



1 – duplex filter housing; 2 – bowl; 3, 5 – O-ring; 4 – permanent magnet; 6 – bushing; 7 – filter cartridge; 8 – spring.

Figure 6.4.42 – Replacement of changeable filter cartridges of the transmission hydraulic system duplex filter

ATTENTION: ALONG WITH REPLACEMENT OF THE DUPLEX FILTER CARTRIDGES CLEAN THE MAGNETIC ARRESTERS OF THE MAGNETIC FILTER AND RINSE THE MESH FILTER!

6.4.7.4 Task 65. Replacement of HLL pump filter

Replacement of HLL pump filter shall be carried out when the indicator 9 lights up (and remains shining), placed on the CECS.

Replacement of HLL pump filter shall be carried out as follows:

- stop the engine after the indicator 9 lights up and remains shining (Figure 3.17.1) engage the parking brake;
- clear place where HLL pump filter is to be mounted, from accumulated dirt;
- screw back the HLL pump filter.
- wipe dry the joint face of the pump and lubricate it with clean oil applicable in HLL;
- fill a new HLL pump filter with clean filtered oil applicable in HLL and screw the filter back in its place.

Note – Place where the HLL pump filter is to be mounted, is shown in Figure 3.17.1.

6.5 Safety measures during maintenance and repair operations

6.5.1 General safety requirements

It is forbidden to dismount the hood side panels and/or open the hood mask of the tractor with the engine running.

Maintenance (repair) operations shall be carried out only if the engine is not running and FPTO and RPTO are disengaged. Hinged implements shall be grounded, the tractor shall be stopped with the parking break.

Adhere to the safety requirements during application of the lift-and-carry means.

During inspection of units under control and adjustment use the portable lamp with voltage of 36V. The lamp shall be protected by wire guard.

Tools and accessories for MS shall be properly operating, answer the purpose and ensure safe operation.

In order to avoid injury be careful draining (refilling) the coolant from the engine cooling system, the hot oil from the engine, hydraulic systems of LL and HSC, transmission bodies, and FPTO and FDA reducing gears. Avoid contact with hot surfaces of the abovementioned 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.

6.5.2 Safety precautions for exclusion of hazardous situations, related to an accumulator battery and a fuel tank

During maintenance of the accumulator battery perform the following:

- avoid skin contact with electrolyte;
- clean the batteries with wiping material moistened with aqua ammonia solution (ammonium hydroxide);
- during examination of electrolyte level use distilled water only;
- do not check the battery charge condition 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 adhere to the following safety precaution:

- do not connect the AB outputs with the engine running. It will cause the peak voltage in charging circuit and will result in inevitable failure of the diodes and transistors;
- do not disconnect the electric wires when the engine is running and electric switches are “on”;
- do not cause short circuit by incorrect wires connection. Short circuit or incorrect polarity will result in failure of the diodes and transistors;
- do not connect the AB in the electrical facilities systems 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 the transistors;

Repair operations associated 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.

6.5.3 Guidelines for safe use of leveling jacks and statement of places where they shall be installed

To lift the tractor use leveling jacks, and after lifting insert backing blocks and limit stops under the front axle beam, rear wheels semi-axles, or base components of the tractor frame.

Places for a leveling jack installation on the tractor are marked by a sign shown in Figure 6.5.1.

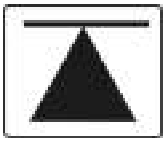


Figure 6.5.1 – Sign of a place for a leveling jack installation

To lift rear elements of the tractor set leveling jacks (or single jack) under the rear-axle tube as illustrated in Figure 6.5.2.

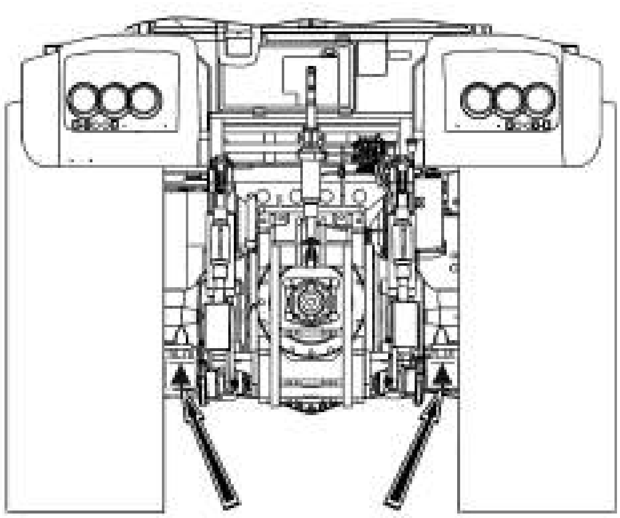


Figure 6.5.2 – Scheme of leveling jacks installation for lifting of the rear elements of the tractor

To lift front elements of the tractor set leveling jacks (or single jack) under the front driving axle beam as illustrated in Figure 6.5.3.

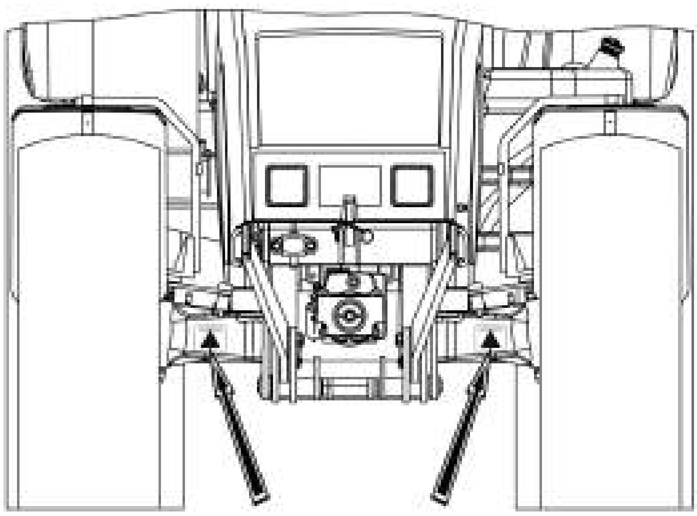


Figure 6.5.3 – Scheme of leveling jacks installation for lifting of the front elements of the tractor

When using leveling jacks comply with the following safety requirements:

- in the course of tractors “BELARUS-3522” lifting use properly operating leveling jacks with lifting capacity of 10 ton-forces only;
- before tractor jacking kill the engine and engage the parking break;
- in course of the front elements jacking put scotches under the rear wheels;
- in course of the rear elements jacking engage the gear and put scotches under the front wheels;
- do not put the jack on soft or slippery surface as it may cause the tractor fall off the jack. When needed, use steady and relatively large foot;
- after the tractor is lifted, insert the limit stops under the front axle beam, rear wheels semi-axles, or base components of the tractor frame, to exclude tractor fall or rolling movement.

IT IS FORBIDDEN TO START THE ENGINE WHEN THE TRACTOR IS JACKED.

ATTENTION: ONLY PERSONNEL PROPERLY INSTRUCTED ON SAFE USE OF LEVELING JACKS, AND HAVING LEARNED METHODS OF LEVELING JACK SAFE OPERATION ARE ALLOWED!

6.6 Filling and lubrication of the tractor with fuel and lubrication materials

In Table 6.3 titles and trademarks of fuel and lubrication materials (FLM) used during the tractor “BELARUS-3522.5” operation and maintenance are listed, their quantity and change intervals are specified also.

Table 6.3 – List of the tractor “BELARUS-3522.5” FLM

<table>
<tr><th rowspan="2">Item reference</th><th rowspan="2">Title of the assembly unit</th><th rowspan="2">Quantity of assembly units, items.</th><th colspan="4">Name and designation of fuel and lubrication materials</th><th rowspan="2">Weight (volume) of FLM, Filled in the tractor when change or refill is needed, kg (dm^3)</th><th rowspan="2">Change intervals FLM, hours</th><th rowspan="2">Remarks</th></tr>
<tr><th>Basic components</th><th>Backup components</th><th>Auxiliary components</th><th>Foreign-made</th></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr>
<tr><td rowspan="6">1.1</td><td rowspan="6">Fuel tank</td><td rowspan="6">1</td><td colspan="2">At ambient temperature of 0ºC and more</td><td colspan="2">At ambient temperature of 5ºC and more</td><td rowspan="6">(640±2) 1)</td><td rowspan="6">Filled in every shift</td><td rowspan="6"></td></tr>
<tr><td>Diesel fuel СТБ 1658-2006 with sulfur content not exceeding 10 mg/kg (0.001%) Grade B</td><td>Not available</td><td>Not available</td><td>Diesel fuel EH 590:2004 with sulfur content not exceeding 10 mg/kg (0.001%)</td></tr>
<tr><td colspan="2">At ambient temperature of minus 5 ºC and more</td><td colspan="2">At ambient temperature of minus 15 ºC and more</td></tr>
<tr><td>Diesel fuel СТБ 1658-2006 with sulfur content not exceeding 10 mg/kg (0.001%) Grade C</td><td>Not available</td><td rowspan="3">Not available</td><td rowspan="3">Diesel fuel EH 590:2004 with sulfur content not exceeding 10 mg/kg (0.001%)</td></tr>
<tr><td colspan="2">At ambient temperature of minus 20 ºC and more</td></tr>
<tr><td>Diesel fuel СТБ 1658-2006 with sulfur content not exceeding 10 mg/kg (0.001%) Grade F</td><td>Not available</td></tr>
<tr><td colspan="10">2 Oils</td></tr>
<tr><td>2.1</td><td>Engine oil crankcase</td><td>1</td><td colspan="4">According to the engine operation manual</td><td>(26.5±0.5) Inclusive of the filter (0.5±0.05 l)</td><td>500</td><td></td></tr>
<tr><td>2.2</td><td>Transmission housing (CC, GB and RA)</td><td>1</td><td>REPSOL CERES STOU 10W-40</td><td>Agro STOU 10W-30</td><td>The same as filled in the engine crankcase</td><td></td><td>(130±0.9) Between the marks (scales) of the probe</td><td>1000</td><td></td></tr>
</table>

Continuation of Table 6.3

1	2	3	4	5	6	7	8	9	10
2.3	FDA body (coaxial, planetary)	1	Transmission oil ТАп-15В GOST 23652-79	Transmission oil ТАД – 17и, ТСп-15К GOST 23652-79 ТЭ$_П$-15М ТУ 38.401-58-305-2002	Not available	HESSOL BECHEM HYPOID SAE 80W-90 API GL5; GL4	(16±0.2)	1000	
2.4	Wheel-hub drive casing of FDA	2	Transmission oil ТАп-15В GOST 23652-79	Transmission oil ТАД –17и, ТСп-15К GOST 23652-79, ТЭ$_П$-15М ТУ 38.401-58-305-2002	Not available	HESSOL BECHEM HYPOID SAE 80W-90 API GL5; GL4	(6.4±0.06)	1000	
2.5	FPTO reducing gear	1	Transmission oil ТАп-15В, ТЭп-15 GOST 23652-79	Transmission oil ТАД –17и, ТСп-15К, GOST 23652-79; ТЭ$_П$-15М ТУ 38.401-58-305-2002	Engine oil М-10Г$_2$ GOST 8581-78	HESSOL BECHEM HYPOID SAE 80W-90 API GL5; GL4	(2.6±0.25)	1000	(fill into the vertical reducing gear (1.6± 0.15); Or in the planetary PTO shaft reducing gear (1.0±0.1)
2.6	HLL and HSC tank with hydraulic unit	1	Hydraulic oil BECHEM Staroil №32 ADDINOL Hydraulikol HLP 32 “ТНК Гидравлик” HLP 32 HYDROL HLP 32	Industrial oil ИГП-18 ТУ 0253-053-00151911-2008 (in winter) МГЕ-46В ТУ 38. 001347-00 (in summer)	Not available	Not available	(116.5±0.5)	1000	

Continuation of Table 6.3

1	2	3	4	5	6	7	8	9	10
3 Lubricants									
3.1	Hinged joint of the steering hydraulic cylinder	4	Lubricant Lithol-24 GOST 21150-87	BECHEM LCP-GM	Not available	BECHEM LCP-GM	0.05 ±0.003	250	
3.2	Hinged joint of the steering link	2	Lubricant Lithol-24 GOST 21150-87	Not available	Not available	Not available	0.06 ±0.003	1000	
3.3	Bushing of the turning shaft of the rear lift linkage	2	Lubricant Lithol-24 GOST 21150-87	BECHEM LCP-GM	Lubricant Solid oil C GOST 4366-76 or Lubricant Solid oil Ж GOST 1033-79	BECHEM LCP-GM	0.02 ±0.001	500	
3.4	Rear lift linkage crossbeam yoke	2	Lubricant Lithol-24 GOST 21150-87	BECHEM LCP-GM	Lubricant Solid oil C GOST 4366-76 or Lubricant Solid oil Ж GOST 1033-79	BECHEM LCP-GM Mobil Grease MP ISO-L-XDCIB2	0.015 ±0.003	500	
3.5	Towing gear (a drawhook with a shock absorber)	2	Lubricant Lithol-24 GOST 21150-87	BECHEM LCP-GM	Lubricant Solid oil C GOST 4366-76 or Lubricant Solid oil Ж GOST 1033-79	BECHEM LCP-GM Mobil Grease MP ISO-L-XDCIB2	0.02 ±0.001	500	
3.6	Oscillating pin bushing of the front link of the FLL	2	Lubricant Lithol-24 GOST 21150-87	BECHEM LCP-GM	Lubricant Solid oil C GOST 4366-76 or Lubricant Solid oil Ж GOST 1033-79	BECHEM LCP-GM Mobil Grease MP ISO-L-XDCIB2	0.1 ±0.005	1000	
3.7	Cylinder pin of RLL	2	Lubricant Lithol-24 GOST 21150-87	BECHEM LCP-GM	Lubricant Solid oil C GOST 4366-76 or Lubricant Solid oil Ж GOST 1033-79	BECHEM LCP-GM Mobil Grease MP ISO-L-XDCIB2	0.002 ±0.001	250	
3.8	Holding-down clip bearing of FDA	2	Lubricant Lithol-24 GOST 21150-87	BECHEM LCP-GM	Lubricant Solid oil C GOST 4366-76 or Lubricant Solid oil Ж GOST 1033-79	BECHEM LCP-GM	0.08 ±0.004	125	
3.9	Front drive shaft spider bearing of the twin hinged joint	2	Lubricant №158M ТУ 38.301-40-25-94	Lubricant АЗМОЛ №158 ТУ У 00152365. 118-2000	Not available		0.0112 ±0.001	One time	Filled by the manufacturer, and refill during the operation is not required

End of Table 6.3

1	2	3	4	5	6	7	8	9	10
3.10	FDA drive propeller shaft slip joint	1	Lubricant Lithol -24 GOST 21150-87	BECHEM LCP-GM	Lubri-cantSolid oil C GOST 4366-76 or Lubri-cantSolid oil Ж GOST 1033-79	BECHEM LCP-GM	0.1 ±0.005	125	Filled by the manufacturer off the cardan shaft
3.11	FDA drive propeller shaft slip joint	1	Lubricant №158M ТУ 38.301-40-25-94	Lubricant ИТМОЛ-150Н ТУ ВУ 100029077. 005-2006	Not availabl e		0.056 ±0.001	125	Filled by the manufacturer off the cardan shaft
3.12	FDA reduc-ing gear pivot axle bearing	4	Lubricant Lithol -24 GOST 21150-87	BECHEM LCP-GM	Lubri-cantSolid oil C GOST 4366-76 or Lubri-cantSolid oil Ж GOST 1033-79	BECHEM LCP-GM	0.12 ±0.006	125	
3.13	Sline joints of FPTO	3	Graphite grease GOST 3333-80	Not available	Not available	Not available	0.01 ±0.001	500	
4 Специальные жидкости									
4.1	Clutch cou-pling hy-draulic drive reservoir and cylin-ders	2	Hydraulic-brake fluid «Нева-М» ТУ 2451-053-36732629-2003	Not available	Not available	DOT3, DOT4 (Germany)	(0.8±0.2)	1000	
4.2	Break hy-draulic drive reservoir and cylinders	3	Hydraulic-brake fluid «Нева-М» ТУ 2451-053-36732629-2003	Not available	Not available	DOT3; DOT4 (Germany)	(1.2±0.3)	1000	
4.3	Engine cooling system	1	According to the engine operation manual				(56.0±0. 5)	1 time in 2 years	
4.4	Tank for chemical agent AdBlue (ureas)	1	Chemical agent AdBlue AUS 32, STB ISO 22241-1-2009 or analogous as agreed upon with RUE "MTW"				(85±1) [2]	Each shift	

[1] The tanks in the tractors "BALARUS-3522.5" that were produced later might be increased.

[2] The tanks for chemical agent AdBlue in the tractors "BALARUS-3522.5" that were produced later might be changed.

7. Failures that may possibly emerge in the electrical facilities, hydraulic lift linkage and guidelines for troubleshooting

7.1 Possible failures in the electronic system for gearbox, rear axle differential lock, front driving axle drive, front and rear power take off shaft control, and guidelines for troubleshooting

List of possible failures in the electronic system for gearbox, rear axle differential lock, front driving axle drive, front and rear power take off shaft control, and guidelines for troubleshooting are shown in Table 7.1.

Table 7.1

<table>
<tr><th>Failure,
external manifestations, cause</th><th>Troubleshooting</th></tr>
<tr><td colspan="2">One of the drives (RA DL, FDA, FPTO, RPTO) or a gear can not be engaged, or becomes disengaged after engagement</td></tr>
<tr><td>Short circuit in control valve solenoid of a drive or a gear that is displayed by single flash of the corresponding power-on indicator (actuated by the pressure sensor at the control valve output)</td><td>- check the electric circuit for normal operation from CECS to the respective control valve solenoid according to the diagram (Annex C). In case a failure is detected eliminate it.
- test the coil resistance of the respective control valve solenoid, it shall be within the range from 4 to 6 Ohm. If the coil resistance is close to 0 Ohm, replace the solenoid</td></tr>
<tr><td>Open circuit in the control valve solenoid of a drive or a gear – that is displayed by two-times flash of the corresponding power-on indicator (actuated by the pressure sensor at the control valve output)</td><td>- check the electric circuit for normal operation from CECS to the respective control valve solenoid according to the diagram (Annex C). In case a failure is detected eliminate it.
- test the coil resistance of the respective control valve solenoid, it shall be within the range from 4 to 6 Ohm. If the coil resistance is close to infinite distance, replace the solenoid</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">One of the drives (RA DL, FDA, FPTO, RPTO) or a gear can be engaged only for a very short period (from 1 to 6 sec), or becomes disengaged after engagement</td></tr>
<tr><td rowspan="2">Pressure sensor, installed at a control valve output of a drive or a gear, does not respond. The failure is displayed by three-times flash of the corresponding power-on indicator</td><td>If the pressure in the transmission hydraulic system is below the standard (pressure in the transmission hydraulic system shall make from 1.3 to 1.5 MPa), eliminate the failure</td></tr>
<tr><td>If the transmission hydraulic system is under a standard pressure, remove the cable socket with the sensor pressure and insert the bonding strip to simulate the sensor response:
- if the error code indicator (three-times flash) is still blinking, it is necessary to check the circuit to the pressure sensor according to the diagram;
- if the error code indicator went out, the pressure sensor shall be replaced by a new properly operating one</td></tr>
</table>

End of the Table 7.1

Failure, external manifestations, cause	Troubleshooting
It is impossible to shift a gear or disengage (RA DL, FDA, FPTO, RPTO)	
Deadlock of the control valve of a drive or a gear that is displayed by four-times flash of the corresponding power-on indicator	The failure can be eliminated by disassembly and rinsing of the control valve with a diesel fuel
When application of gearbox braking is engaged on forward motion, the engine is stopped	
The clutch coupling is not thrown in on forward motion	Adjust clutch linkage for proper operation on forward motion
The clutch coupling off-state indicator is not adjusted for proper operation on forward motion	Adjust the clutch coupling off-state indicator for proper operation on forward motion
When application of gearbox braking is engaged on reverse, the engine is stopped	
The clutch coupling is not thrown in on reverse	Adjust clutch linkage for proper operation on reverse
The clutch coupling off-state indicator is not adjusted for proper operation on reverse	Adjust the clutch coupling off-state indicator for proper operation on reverse
FDA drive is permanently engaged irrespective of the CECS mode, chosen manually by key buttons	
Open circuits leading to the FDA drive control valve solenoid	Check the electric circuit for normal operation leading to the respective FDA drive control valve solenoid according to the diagram (Annex C). In case an open circuit is detected eliminate it.
The FDA drive control valve spool was blocked abroach	Rinse the FDA drive control valve
FDA drive or RA DL can not be engaged in an automated mode when the directive wheels are in forward motion position	
The respective directive wheels angular position sensor of the FDA or RA DL controls was nor adjusted for proper operation	Adjust the clearance of 3±0.2 mm between the respective angular position sensor and the supporting bracket, mounted on the FDA revolving gear
Break of wire (wires) leading to the respective angular position sensor	Check the respective electric circuit for normal operation according to the diagram (Annex C)

7.2 **Possible failures in the electronic control system of RLL and FLL guidelines for troubleshooting**

Cables and control system of RLL connecting diagrams is shown in Figures 7.2.1, 7.2.2, 7.2.3. Rules of failure diagnostics of the RLL ECS are specified in clause 2.14.4 “Failure diagnostics of RLL electronic control system” of subsection 2.14 “Rear lift linkage control”. Possible RLL electronic control system errors codes and guidelines for troubleshooting are shown in Table 7.2.

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!

For FLL ECS error codes and troubleshooting methods are similar to error codes and troubleshooting methods RLL ECS, specified in Table 7.2, with one exception:

FLL is not provided with a draft control, therefore it is not provided with force sensors. In the electronic unit voltage of 5V is applied through the dividing circuit (R1 and R2 resistors) to the signal paths of the force sensors (terminals 17 and 18, Figure 3.21.2). In case error codes “31” and “32”, indicating incorrect operation of the force sensors, are detected in the FLL control panel, check resistors R1 and R2 for open circuit or short circuit according to the electric circuit diagram of FLL ECS (Figure 3.21.2). Rated resistance of R1 and R2 is 2.2 kOhm.

Note – Sensor installation and adjustment rules of the FLL position sensor are listed in subsection 3.16.5 “Hydraulic system of FLL control“. Location of FLL ECS is shown in Figure 3.21.1.

Table 7.2

Error code	Description, anticipated problem	Failure inspection method
Complex defects		
11	Failure in the electro-magnetic lift valve control circuit. Break in the solenoid coil 9 (Figure 3.19.1) 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 7.2.1, 7.2.2, 7.2.3)
12	Failure in the electro-magnetic lowering valve control circuit. Break in the solenoid coil 8 (Figure 3.19.1) 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 7.2.1, 7.2.2, 7.2.3)
13	Failure in the electro-magnetic 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 (Figure 3.19.1)	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 7.2.1, 7.2.2, 7.2.3)
14	Failure in remote control buttons for lift 4 (Figure 2.14.2). 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 7.2.1, 7. 2.2, 7.2.3)
15	Failure in remote control buttons for lowering 3 (Figure 2.14.2). 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 7.12.1, 7.12.2, 7.12.3)

Continuation of the Table 7.2

Error code	Description, anticipated 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 (Figure 3.19.1) 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 (Figures 3.19.1, 7.2.3)
Moderate defects		
22	Failure of the position sensor 7 (Figure 3.19.1). Break of the sensor wire, the sensor was not connected or adjusted	1. Adjustment of the position sensor is faulted. 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. To check the position sensor for proper operation you can dismount it from the tractor. According to the electric circuit diagram of the RLL control system (Figure 7.2.3), voltage of 10V (if the power supply unit is not available a voltage of 12V can be supplied from the accumulator battery) shall be applied to: output 1 “load” (minus), and to the output 3 “+” (plus) and, pressing by a finger the sensor migrating rod, measure the voltage at the sensor output by the testing apparatus: between the output 2 – “signal” and the output 1 – “minus”. When the rod (core) of the sensor is shifting in full, 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. 3. Failure (break) in the cable in the sensor circuit. Check the cable according to the diagram (Figure 7.2.3)

End of the Table 7.2

Error code	Description, anticipated problem	Failure inspection method
23	Failure of the control panel. Potentiometer of the depth control lever 4 is damaged (Figure 2.14.1)	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 7.2.3)
24	Failure of the control panel. The RLL uppermost end position lever 3 is damaged (Figure 2.14.1)	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 7.12.3)
28	Failure of the control panel. The RLL operation lever 7 (Figure 2.14.1) 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 7.2.3)
31	Failure of the right force sensor 10 (Figure 3.19.1). 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 11 (Figure 3.19.1). Cable breaking or the sensor short circuit	
Easy defects		
34	Failure of the control panel. Potentiometer of the RLL speed control lever 1 (Figure 2.14.1) 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 7.2.3)
36	Failure of the control panel. Potentiometer of the control method choice lever 2 (Figure 2.14.1) 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 7.2.3)
Code is not displayed	spontaneous lift of RLL after the engine start	“Lift” forward/reverse spool was blocked abroach. Disconnect the cable sockets from the “Lifting” and “Lowering” solenoids. If the failure is still displayed, eliminate the failure in the RLL hydraulic system.

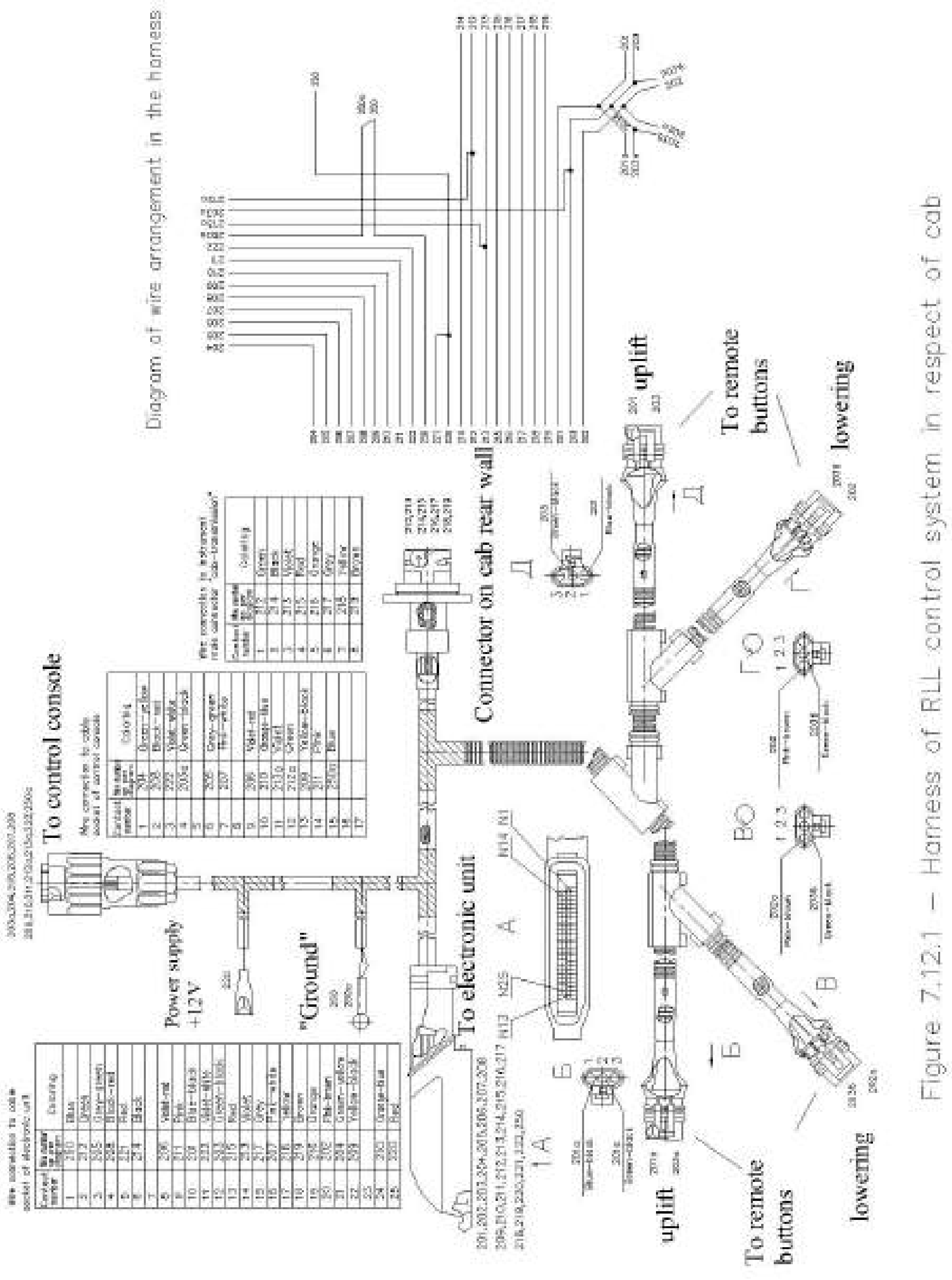


Figure 7.2.1 – . Harness of RLL control system in respect of cab

Wire connecton to cabel receptacle

Contact number	Wire number on diagram	Color
1	212б	Green
2	214a	Black
3	213б	Violet
4	215a	Red
5	216a	Orange
6	217a	Grey
7	218a	Yellow
8	219a	Brown

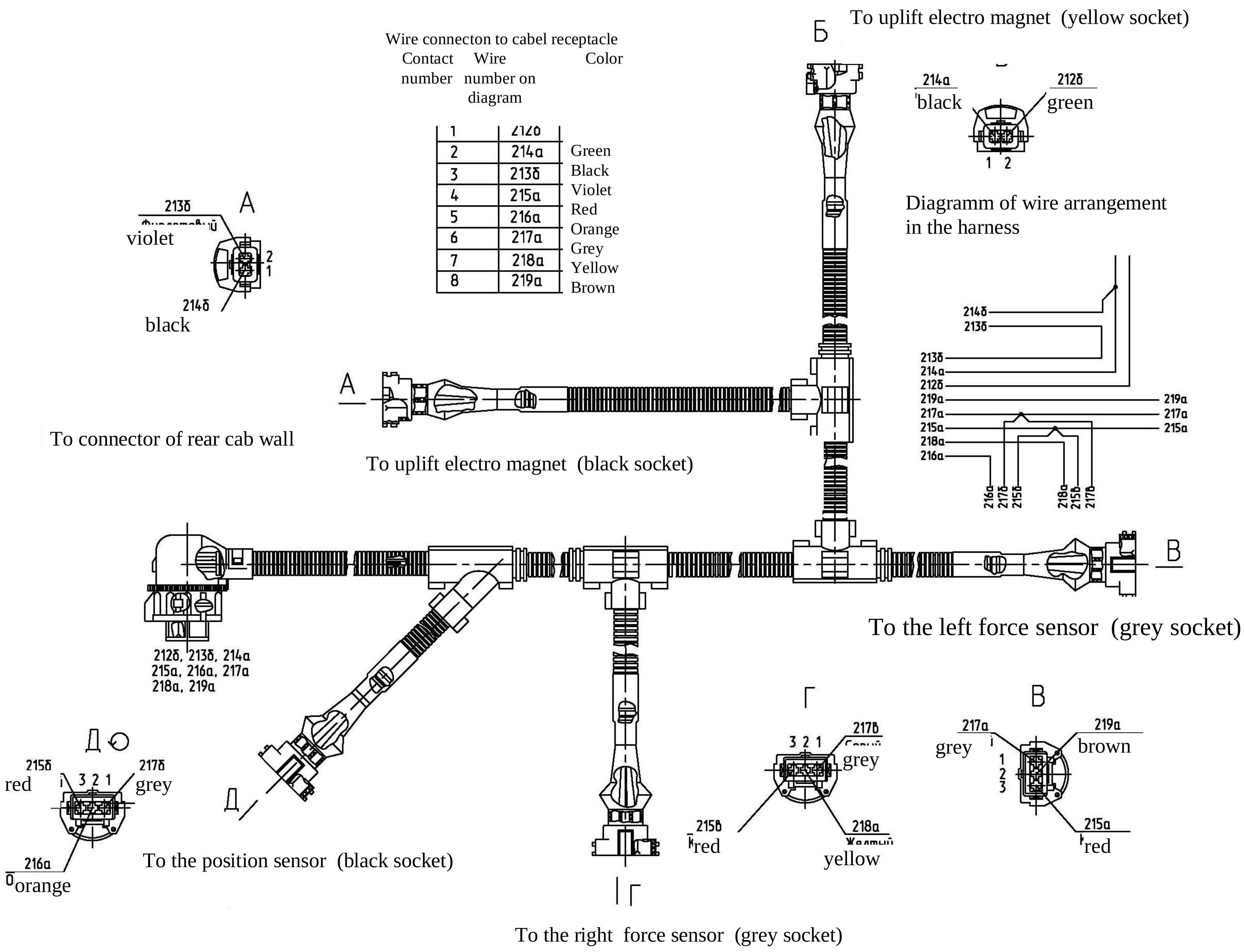


Figure 7.2.2 – Harness of RLL control system in respect of transmission

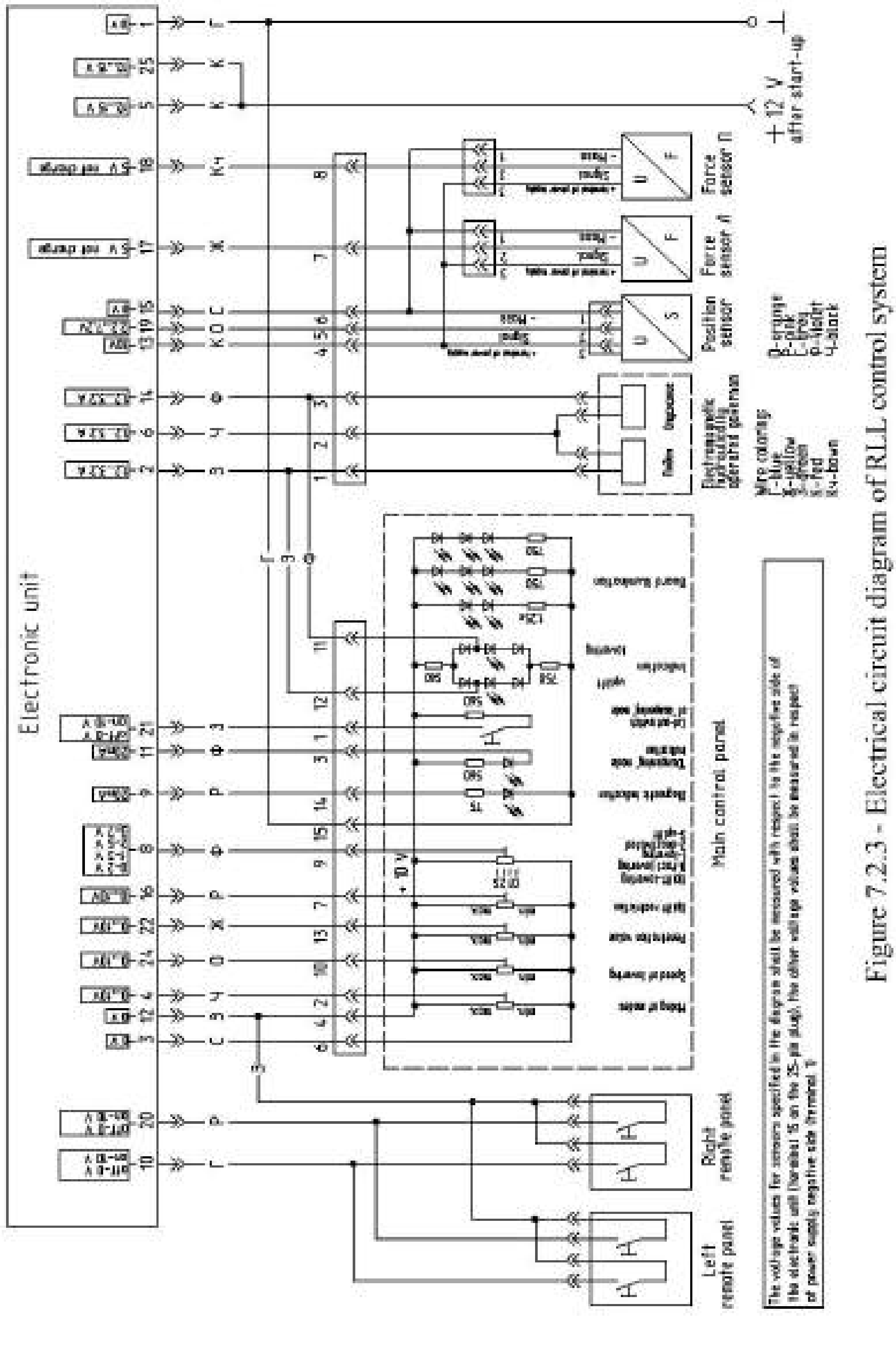


Figure 7.2.3 – Electrical circuit diagramm of RLL control system

7.3 Possible failures of the hydraulic lift linkage and guidelines for trouble-shooting

7.3.1 Failures of EHS distributor, failures indication, causes and troubleshooting method

The tractors “BELARUS” are equipped with electrohydraulic integral block consisting of four sections of EHS type with electrohydraulic control of liquid consumption, electrohydraulic regulator (HER), end plate with solenoid operated pressure reducing valve and discharge cap.

A four-pin connector conducting the signal is connected to each section:

- pin №1 – plus of the board network supply;
- pin №2 – is not used;
- pin №3 – actuating signal;
- pin №4 – load of the board network supply.

Distribution sections via the pin №3 is controlled by the pulse width modulated signal (PWM), generated by the electronic joysticks or programmable operation unit in the hydraulic lift linkage (HLL POU).

Each section is equipped with error codes indicator, located at the bottom part in area of the electrical connector (see Figure 7.3.1). In case any failures have detected in the section, the indicator displays the error code for that very section. The error code consists of two digits (see Table 7.3a). The code is read by calculation of how many times the indicator has blinked, that is the quantity of flashes with short intervals between them indicating the first digit - long indicator - the quantity of flashes with short intervals between them indicating the second digit. For example, to indicate the digit “23” the system will operate as follows: two flashes – an interval – three flashes. If there is no fault in the distribution panel, the indicator will be off.

Depending on degree of failure complexity, operation of this section or a number of sections can be blocked in the same time (if the faults begin in several sections).

In case there are several failures in one section, only one error code is displayed by the indicator with the following priorities:

1 – position sensor failure;

2 – power supply voltage level is beyond a permissible level (permissible level ranges from 10.5V to 18B);

3 – intensity of current in the control valve coils is beyond a permissible level;

4 – other failures.

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. TO DETERMINE THE CENTRAL SPOOL POSITION, REMOVE THE SAFETY CAP. AFTER THE REPAIR OPERATIONS ARE COMPLETED, PUT THE SAFETY CAP BACK IN ITS PLACE!

ATTENTION: IN CASE IF REPLACEMENT OF THE COARSE AND FINE OIL FILTER CARTRIDGES, INCLUDED IN THE LIST OF TRACTOR`S STANDARD EQUIPMENT, IS CARRIED OUT BY THE QUALIFIED PERSONNEL, THE WARRANTY FOR DISTRIBUTION VALVE REMAINS VALID!

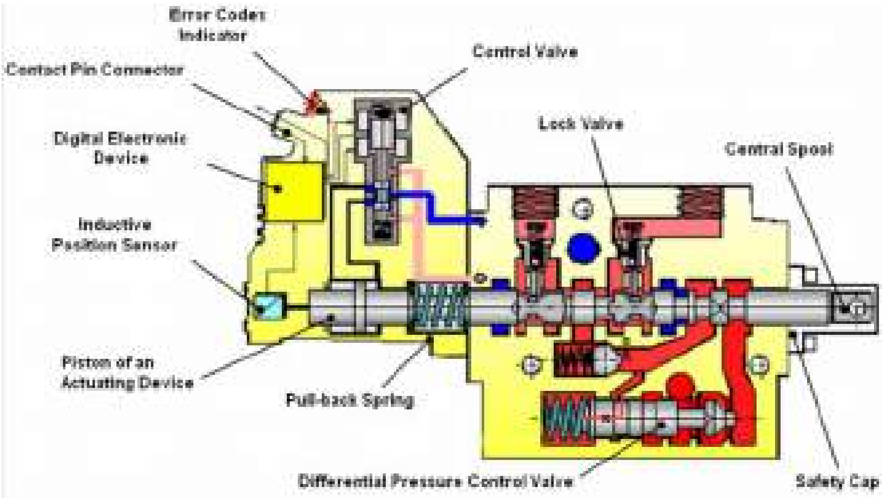


Figure 7.3.1 – EHS distribution valve section

Figure 7.3.2 – Fine filter cap

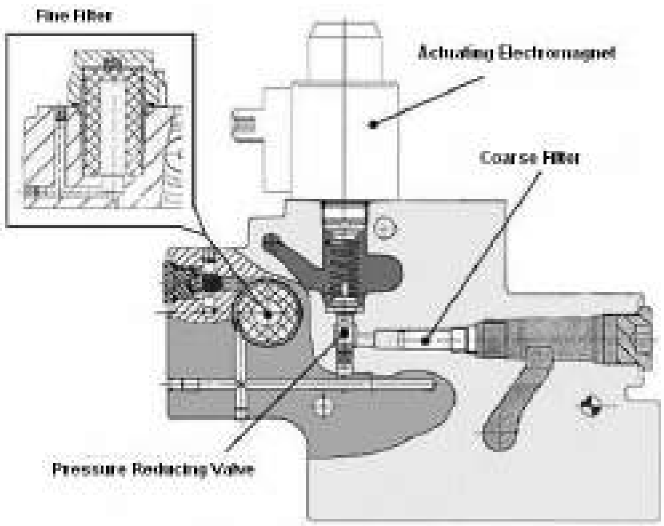


Figure 7.3.3 – End plate with pressure reducing valve

Figure 7.3.4 – Coarse filter plug

Table 7.3a – Search and elimination of failures in the EHS distribution valve and EHS electric and hydraulic distribution valve electronic control system

<table>
<tr><th>Error code</th><th>Cause of suspicion and malfunction nature</th><th>Test and elimination method</th></tr>
<tr><td>15</td><td>Control by the joystick or by the HLL POU can not be executed. It is possible when actuating PWM-signal, coming from the joystick (in the manual control mode) or HLL POU (in the automated control mode), is absent or is beyond the permissible parameter values:
а) frequency (200±5) Hz;
б) pulse range (less than 10.5 V);
в) PWM (5.7-94.3) %.</td><td>1. Check:
- the system cables for mechanical damage;
- pin 3 wires of a jack connector leading to the distribution valve section up to the pins of HLL POU sockets and joysticks according to the electrical connections diagram, shown in Figure 3.16.17, to detect if there is a breakage;

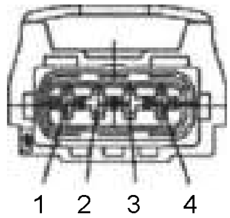



Figure 7.3.5 – connection of wires to the socket
<table><tr><th colspan="2">Cable jack pin terminals coming to the distribution valve section:</th></tr><tr><td>Pin №</td><td>Designation</td></tr><tr><td>1</td><td>+ power supply</td></tr><tr><td>2</td><td>Not used</td></tr><tr><td>3</td><td>PWM - signal</td></tr><tr><td>4</td><td>Load</td></tr></table>- condition of the distribution section socket for pins corrosion;
- joysticks by means of change of their position (if the failure is only in one section)

2. Check the distribution valve sections control directly from the joysticks by connecting the sockets for coupling with HLL POU unit. If the error code has disappeared HLL POU unit shall be replaced.

3. In case the special-purpose testing devices are available, test the signal data</td></tr>
</table>

Continuation of the Table 7.3a

Error code	Cause of suspicion and malfunction nature	Test and elimination method
21	Low power supply voltage (less than 11 V). Meanwhile the central spool of the distribution valve section spontaneously goes back to the “neutral” position. Control by the joystick or by the HLL POU can not be executed. If the voltage is below 11 V and if an actuating signal is available, the code “17” will be initiated instead of code “21” until the control is stopped	Check the power supply voltage level in the gauge board and in the pins 1, 4 (Figure 7.3.5) of the distribution valve socket for section. If the voltage is below 11 V or is absent, check the system cables for mechanical damage and power wires for breakage, pins corrosion
22	High power supply voltage (more than 18 V). Meanwhile the central spool of the distribution valve section spontaneously goes back to the “neutral” position. Control by the joystick or by the HLL POU can not be executed. If the voltage is below 18 V and if an actuating signal is available, the code “17” will be initiated instead of code “22” until the control is stopped	Check the power supply voltage level in the gauge board and in the pins 1, 4 (Figure 7.3.5) of the distribution valve socket for section. In case of high voltage check the generator performance
23	Clogging of the fine filter or sintered metal coarse filter, or absence of voltage on the pressure reducing valve actuating electromagnet, or clogging of the pressure reducing valve. Meanwhile the central spool of the distribution valve section when operated by the joystick or by the HLL POU does not move or moves slow and not in full stroke. The code is indicated in all sections, receiving the actuating signal. When the actuating signal is absent or interrupted the code indication drops out	Check the voltage level (board network voltage), measure the coil resistance [(5±1) Ohm at (20±3)^{0}C] of the actuating electromagnet socket. Rinse the sintered metal coarse filter, located under the plug (Figure 7.3.4). Replace fine filter, located behind the cap (Figure 7.3.2), rinse the pressure reduction valve

Continuation of the Table 7.3a

Error code	Cause of suspicion and malfunction nature	Test and elimination method
25	“Floating” position can not be engaged during the set period of time due to mechanical blocking of the central spool or the control valve failure. Meanwhile the central spool of the distribution valve section spontaneously goes back to the “neutral” position. The section operation controlled by the joystick or HLL POU becomes blocked. The error code is indicated only in the damaged section.	Check the voltage level (board network voltage), measure the coil resistance [(5±1) Ohm at (20±3)^{0}C] of the actuating electromagnet socket. Rinse the sintered metal coarse filter, located under the plug (Figure 7.3.4). If the specified parameters do not comply with standard requirements, eliminate the failure in the electric circuit. In case the electric circuit failure perform the following actions: - rinse the sintered metal coarse filter; - replace the fine filter; - in case of deadlock use manual control to shift the central spool with effort not exceeding 450 N. If this actions require more efforts that the central spool shall be rinsed. When determination of the position of the central spool is carried out, it is forbidden to rotate the central spool around its axis
26	Switching on of the central spool into position “lowering” or “floating” was caused by the control valve blocking in the “lowering” or “floating” position. If the control valve blocking in the position corresponding to oil supply for shifting of the central spool into the “lift” position occurs, than after the tractor is started the central spool is shifted to the “lift” position	The code disappears after shifting of the central spool into the “neutral” position. It is necessary to perform the following actions: - use manual control to shift the central spool with effort not exceeding 450 N. If this actions require more efforts that the central spool shall be rinsed; - disassemble the cabinet in the section with electrical equipment. Withdraw and rinse the control valve from the section; When determination of the position of the central spool is carried out, it is forbidden to rotate it around its axis

Continuation of the Table 7.3a

Error code	Cause of suspicion and malfunction nature	Test and elimination method
41	High power supply voltage (more than 45 V). Meanwhile the central spool of the distribution valve section spontaneously goes back to the “neutral” position. Control by the joystick or by the HLL POU can not be executed. The error code is indicated in all sections regardless of presence (absence) of the actuating signal	Check the power supply voltage level in the gauge board and in the pins 1, 4 (Figure 7.3.5) of the distribution valve socket for section. In case of high voltage check the generator performance
42	Intensity of current in the control valve is beyond the permissible or desirable range. Meanwhile the central spool of the section is permanently in the “neutral” position. Control by the joystick or by the HLL POU can not be executed. The error code is indicated in the damaged sections when there is an actuating signal	Disassemble the cabinet in the section with electrical equipment. Check the coupling cable, coming from the digital electronic device to the control valve, for failures. Check the control valve coils for breakage or short circuit. Resistance of each one shall be (7±1) Ohm at $(20±3)^0$C. In case of mismatch replace the control valve or the whole section
43	Failure of the inductive position sensor of the central spool. The error code is indicated in the damaged sections only immediately after voltage supply	Disassemble the cabinet in the section with electrical equipment. Check the coupling cable, coming from the digital electronic device to the inductive position sensor. Check the control valve coils for breakage or short circuit. Resistance of the primary coil shall be (92±15) Ohm, secondary (184±15) Ohm at $(20±3)^0$C. In case of failure replace the sensor
		In case of deadlock in the “lowering” position use manual control to shift the central spool with effort not exceeding 450 N. If this actions require more efforts that the section shall be rinsed. In case these actions have no beneficial effect, the section is subject to replacement When determination of the position of the central spool is carried out, it is forbidden to rotate it around its axis

Continuation of the Table 7.3a

Error code	Cause of suspicion and malfunction nature	Test and elimination method
81	The central spool of the distribution valve section does not shift back in “neutral” position. Control by the joystick or by the HLL POU can not be executed. The central spool is blocked in “lift” “lowering” or “floating” position. If the abovementioned failures occur the error code “24” is indicated once, and then code “81” is indicated permanently	Use manual control to shift the central spool with effort not exceeding 450 N. If this actions require more efforts that the distribution valve section shall be rinsed. In case these actions have no beneficial effect, the section is subject to replacement. When determination of the position of the central spool is carried out, it is forbidden to rotate it around its axis
82	Before the controls are engaged, the central spool of the section is in the “lift” position. Control by the joystick or by the HLL POU can not be executed. The error code is indicated in the damaged sections only immediately after voltage supply. The error code is indicated only if the central spool of the section is in the “lift” position before the controls are engaged. If the spool is in ”lowering” position, code “43” is indicated	Disassemble the cabinet in the section with electrical equipment. Check if the inductive position sensor is properly fixed. Use manual control to shift the central spool with effort not exceeding 450 N. If this actions require more efforts that the distribution valve section shall be rinsed. In case these actions have no beneficial effect, the section is subject to replacement. When determination of the position of the central spool is carried out, it is forbidden to rotate it around its axis
83	Software error. In this case control by the joystick or by the HLL POU can not be executed	Reprogramming or replacement of the damaged section is required

7.3.2 Possible failures in hydraulic system for RLL and FLL control, guidelines for troubleshooting

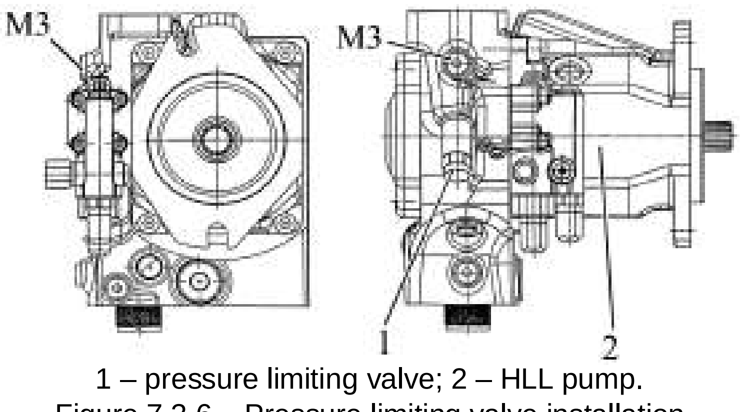
Possible failures in hydraulic system for RLL and FLL control, guidelines for troubleshooting are shown in Table 7.3b.

Table 7.3b

Failure, external manifestations, cause	Troubleshooting
LL hydraulic-system pressure loss (both RLL and FLL can not be lifted), pressure loss is accompanied by extraneous noise and slaps	
LL hydraulic-system pump collapsing	Replace the pump
Hydraulic-system pressure loss, a loaded lift linkage (both RLL and FLL) can not be lifted at all or can not be lifted in an uppermost position, extraneous noise is not heard	
Deadlock of the pressure limiting valve (P=24.5MPa) 1 (Figure 7.3.6)	To carry out the tests set the manometer with scale of 25 MPa into the pressure tap hole “M3” (Figure 7.3.6) on the pump housing. Set the EHS distribution valve Section №1 into the “lift” position by the joystick and measure pressure, which shall be within the range from 20.5±0.5MPa. If the pressure is lower, unscrew the valve 1 (Figure 7.3.6), rinse the valve and its seat. Put the valve back in its place, set the EHS distribution valve Section №1 into the “lift” position by the joystick and check the pressure in point “M3”, which shall be 20.5±0.5 MPa.
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	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 according to subsection 7.3.3 “Lowering valve of the section EHR-23LS disassembly procedure”; - put the electro hydraulic section (EHR) back in its place

Continuation of the Table 7.3b

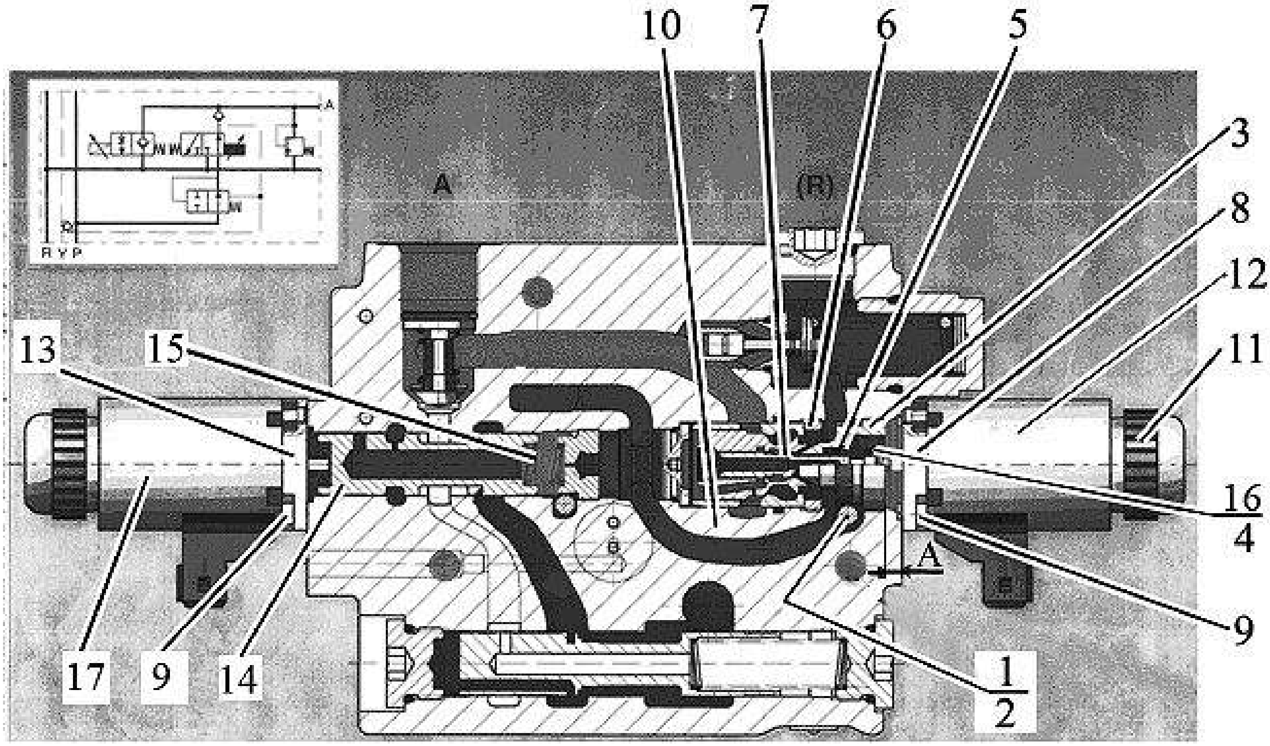
Failure, external manifestations, cause	Troubleshooting
Spontaneous lifting of RLL (lifting without a command received from the instrument panel or remote control buttons)	
Deadlock of the lift spool of a regulatory section EHR-23LS	Failure elimination shall be carried out directly on the tractor, without the need of the integral unit disassembly. To eliminate the failure perform the following: - clean the work area; - remove the coil 17 (Figure 7.3.7), unscrew four screws 9 fastening the lower electromagnet 13 and then withdraw the electromagnet; - withdraw the lift spool 14 and the spring 15, rinse the mentioned components and the bore in the section housing 10; - assemble the lift valve in reverse sequence.
Hydraulic system overheat	
Loss of the LL hydraulic system efficiency	Replace the pump
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 7.2 (code 22)
Lighting up of the lift indicator located in the FLL control panel after the lifting is completed means that the FLL position sensor is not adjusted	Perform the FLL position sensor adjustment according to subsection 3.16.5 “Hydraulic system of FLL control”
When the system is warmed up (not less that 45° C), the lamp, indicating the LL hydraulic system pump filter clogging, lights up in the CECS	
The filter is clogged	Replace the filter
Oil foaming in the LL and HSC hydraulic systems tanks	
Air inflow in the hydraulic system suction line	Tighten the suction line clamps. If the failure can not be eliminated, replace the oil suction line
Low level of the oil in the LL and HSC hydraulic system tank	Refill the oil up to the mark on the oil gauge glass
Failure diagnostics signaling device located on the RLL control panel or in the FLL control panel reports numerical codes	
Damage in electrical wiring, solenoids, corrosion of terminals, sensors failure (force or position) of RLL ECS or FLL ECS	Eliminate the failure according to the subsection 7.2 “Possible failures in the electronic control system of RLL and FLL guidelines for troubleshooting”



1 – pressure limiting valve; 2 – HLL pump.

Figure 7.3.6 – Pressure limiting valve installation

7.3.3 Section EHR-23LS lowering valve disassembly procedure



1 – counter nut; 2 – worm; 3 – worm gear wheel; 4 – washer; 5 – spring; 6 – lock nut; 7 – lowering valve assembled; 8 – solenoid; 9 – screw; 10 – section housing; 11 – cap; 12 – coil; 13 – solenoid; 14 – lift spool; 15 – spring; 16 – lock ring; 17 – coil.

Figure 7.3.7 – Regulatory section EHR-23LS

Lowering valve EHR-23LS disassembly in the dismounted section is carried out according to the procedure stated below:

1. Unscrew four screws 9 (Figure 7.3.7) by hexagon wrench 3 mm, removing the coil 12 before by unscrewing the cap 11, withdraw the upper solenoid 8 from the section housingc 10.
2. Measure the dimension “A” with accuracy of not less than 0.1 mm.
3. Unscrew the counter nut 1 of the warm 2 locking, screw the warm out (hexagon wrenches with 6mm head).
4. Screw the worm gear wheel 3 in up to the stop, ensuring the reduction of spring pressing up force 5 by a hexagon wrench with 16mm head.
5. Remove the lock ring 16 and the washer 4 from the valve spindle 7.
6. Withdraw the spring from the valve 5.
7. Screw out the worm gear wheel 3 from the section housing by hexagon wrench with 17 mm head.
8. Screw out the lock nut 6 of the lowering valve assembled from the section housing 10 hexagon wrench with 17 mm head.
9. Withdraw the lowering valve assembled 7 from the section housing 10.
10. Disassemble the lowering valve assembled 7.
11. Rinse all the components withdrawn from the section housing 10, and rinse the section housing with the diesel fuel or petroleum also.
12. Assemble all components in reverse sequence, ensuring the dimension “A” value? Measured before disassembly procedure.

ATTENTION: SECTION EHR-23LS LOWERING VALVE DISASSEMBLY PROCEDURE SHALL BE CARRIED OUT ONLY BY DEALERS!

7.4 Possible failures in the electrical equipment and guidelines for troubleshooting

7.4.1 General information

The structure of an electrical equipment of the tractor «BELARUS-3522.5» includes electric elements (switches, relays, electric motors, instruments, flashlights, headlights, fuses, break-in relays, sensors and etc.) and also wiring system and the electrical connectors for coupling of an element with power supply and with body ground. For facilitation of the task fulfillment and of search for failures in the electrical equipment the electric circuit diagram is enclosed to the present operation manual (Annex D).

Before starting the troubleshooting procedure for any loop, take a good look at the electric circuit diagram to clearly realize the functional purpose of the loop. A search may be narrowed by gradual identification and exclusion of the proper operating components of the single loop. In case several electrical elements are disabled, blow out of the respective fuse or null “ground” (in many cases distinct electrical elements may be closed on a single fuse or on the unified “ground” terminal) is the most probable cause of failure.

Electrical equipment failure can often be explained by the simplest reasons like terminal corrosion, fuse breakdown, fusible element burn-out or transfer relay defect. Carry out the visual inspection of all the fuses, wires and loop electrical connector before starting more certain fault checking of its components.

If the diagnostic instruments are used for failures search, use the electric circuit diagram enclosed to decide carefully on which points of the loop the instrument shall be connected to in order to improve the localization of failures. Among the main diagnostic instruments there are electric circuits testing apparatus (multimeter), voltmeter (12 V-test lamp (about 21 W) with connecting wires set can also be used), loop interval conductivity indicator (tester) with the lamp, own power supply unit and connecting wires set.

Electrical circuits failure diagnostics is not a difficult task in case of clear notion of the fact that circuit is supplied to all electrical components (lamps, electric motor and the like) from the AB от АКБ by wires through the switches, relays, fuses, fusible elements, and then goes back to the AB through the tractor “ground”. Any problems related to the failure of the electrical equipment can be determined by stopping of the electric current supply from AB or current return to the AB.

Note. The information specified in the present subsection 7.4 “Possible failures in the electrical equipment and guidelines for troubleshooting” shall be used during troubleshooting of the gearbox electronic control system, rear axle differential lock, front driving axle drive, front and rear power take-off shafts (Annex C) and partially during troubleshooting of the engine electronic control system (Annex B).

7.4.2 Voltage presence testing

Voltage presence testing is carried out in case of the loop malfunction. Connect one of the tester's wires to the battery negative pole or safe tractor "ground". Another tester's wire shall be connected to the loop circuit coupling terminal which shall preferably be the closest to the AB or the fuse. Flashing of the test lamp indicates the voltage presence in this circuit interval, which confirms the loop operability between the given terminal and the AB. Continuing the operation in the similar manner inspect the remaining loop interval. Detection of null voltage indicates the occurrence of the failure along the interval between the given loop point and the last of the recently checked points (under the voltage). In most cases the electrical connections slacking and defects in contacts quality are the causes of failures. Note that power for some of the loops of the board electrical equipment is supplied only when the starter switch and the instruments are in position "**I"** (the instruments are switched on) or "**II"** (the starter is switched on (unfixed position)).

7.4.3 Short circuit detection

One method of short circuit detection is withdrawal of the fuse and connection of a test lamp or a voltmeter instead of it. There shall not be voltage in the loop. Jerk the wiring looking at the test lamp. Blinking lamp indicates the occurrence of the ground failure somewhere in this cable caused by worn out wire insulation. Similar check can be carried out for each loop component including the loop switch.

7.4.3 "Ground" presence in the electrical element testing

The check is intended for detection of the stable "ground" of the electrical element. Disable it by the accumulator battery disconnect switch and connect one of the wires, equipped with an independent power supply of the test lamp, to the knowingly stable "ground". Another test lamp wire shall be connected to the cable or the terminal being under test. Flashing lamp indicates the working earthing (and vice versa). If the high-current load negative power supply circuit is tested the application of the test lamp with power of not less the 21 W is recommended, as in case of poor contact of the "ground" the high-current load will not work and the low-power lamp will light up.

7.4.4 Electrical circuit breaks testing

Testing is carried out with a purpose to detect the electrical circuit breaks. After the loop power supply shutoff check it by the test lamp, equipped with the local battery. Connect the tester's wires to the both loop ends (or to the "power" end (+) and to the stable tractor "ground"); if the test lamp lights up there is no break in the loop. No light indicates bad circuit conductivity. Operability of the switch can be checked in the same way by connecting the tester to its terminals. When setting the switch into the "On" position the test lamp shall light up. If the switch commutating the power supply to the high-current load is tested the application of the test lamp with power of not less the 21 W is recommended also, as in case of poor contacts inside the switch, the high-current load will not work and the low-power lamp will light up.

7.4.5 Break localization

When testing for the possible loop breaks it is hard to detect a failure by means of visual inspection, as it is hard to reach the terminals in order to see if there is any corrosion or defect in their quality, due to limited access (usually the terminals are covered by a backshell). Jerking of a sensor backshell or its cable with wires will result in many cases in conductivity reconditioning conductivity. Remember this when you try to localize the cause of failure which is suspected to be the loop break. The emerging failures that are not common may be caused by terminals corrosion or defect in terminals quality.

8. Tractor storage

8.1 General instruction

ATTENTION: THE PRESENT SECTION CONTAINS THE STORAGE REGULATIONS FOR TRACTOR “BELARUS-3522.5” CHASSIS SYSTEMS AND UNITS. ENGINE STORAGE, PRESERVATION, REPRESERVATION, DEPRESERVATION REGULATIONS ARE SPECIFIED IN THE ENGINE OPERATION MANUAL!

The tractors shall be stored according to the requirements of GOST 7751-85 in the indoor area or under a shed.

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

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

It is forbidden to store a nonworking tractor on tires for more than 10 days. In case if out-of-service time exceeds 10 days the tractors shall be put on the supporting block, pressure in tire should be reduce down to 70%...80% of the rated value. To protect the tires from the insolation and atmospheric precipitation they must be covered with whitish covers made of dense texture or with special protective substance (limewashing, metal and casein mixture and the like). To protect spools from the clogging and damage, the tire valves shall be covered with metal or rubber caps.

8.2 Requirements for inter-shift storage of machines

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

8.3 Requirements for short-term tractors storage

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

Tires storage is regulated by provisions of subsection 8.1 “General instructions”.

Disconnect the accumulator batteries. Electrolyte level and density should comply with recommendations for storage and maintenance of accumulator batteries, listed in clause 6.4.3.2 of subsection 6.4.3 “Maintenance services in every 250 hours of operation” If tractor is stored at low temperatures or over one month, accumulator batteries must be dismounted and sent to warehouse.

8.4 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 tractor on supporting blocks (plates)).

Tires storage is regulated by provisions of subsection 8.1 “General instructions”.

After operation the tractor must be cleaned off dust, mud, oil leaks, vegetation and other remains. Components where water is not allowed (generators, relays, etc.), are protected with protecting cover. After tractor is cleaned and washed, it must be blown off with compressed air to remove moisture. Damaged painting is 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), are dismounted, prepared for storage and sent to warehouse. Fastening parts of dismounted tractor components shall be mounted back in their places. Electrical equipment (headlights, generator, starter, accumulator batteries) are cleaned, blown with compressed air, terminals are coated with protective grease.

When preparing a tractor for long-term storage, 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 6.3 of the p resent operation manual. Drain oil and fill fresh oil with the required amount of additives up to the control level on the transmission body, FDA and FPTO reducing gears, HLL and HSC 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 and of cardan shafts, and projecting parts of cylinder rods and shock absorbers, front and rear track adjusting mechanism should be preserved. Cover carefully fuel tank filling neck, diesel breathers’ openings, transmission, hydraulic systems, engine exhaust pipe and inlet air purifier pipe, relative openings after starter removal, and other cavities, through which atmospheric precipitation may get inside inner cavities of a 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.

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 should be closed.

During long-term storage in a cold season lubricate cylinder mechanism, located in a button 3 (Figure 3.25.4) of the door lock knob by way of injection of agents HG 5503 (HG5501, WD-40);

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 should be corrected.

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.

8.5 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.

Tires preservation is regulated by provisions of subsection 8.1 “General instructions”.

Clean tractor surfaces subject to preservation from mechanical staining, degreased and dried up. 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) is carried out by polyethylene film.

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

Outside tractor and its assemblies preservation is made by lubrication of surfaces using brush or sputtering by means of paint sprayer. Inside tractor preservation is carried out by filling cavities with preservation mixture and subsequent engine operation.

During tractor inter-shift, short-term and long-term storage, the enterprise operating the tractor is liable for compliance with preservation methods and storage conditions specified in GOST 7751-85. Inside tractor surfaces preservation is carried out by preservation grease КС-У according to TU RB 600125053.019-2004. When a tractor is stored outside, specific surfaces must be preserved with grease “BELA-COR» of type “A” according to TU RB 600125053-020-2004.

8.6 Depreservation and representation

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

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

8.7 Putting tractor into operation after long-term storage

Perform depreservation of an engine according to the engine operation manual.

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

Lubricate all tractor mechanisms according to clause 3 of Table 6.3 of the present operation manual. Carry out scheduled maintenance. Run tractor for 15-20 minutes. Correct detected faults if necessary.

8.8 Safety requirements for preservation

The preservation procedure, comprising surfaces preparation, coating with preservation materials, paper marking and cutting, packing, shall be carried out only by persons who attained at the age of eighteen, subjected to medical examination, properly instructed instruction on labor and fire safety, and receiving primary instructions on the working place. Preservation remises and sections should be separated from other production premises and equipped with plenum-exhaust ventilation. Materials used for preservation are combustible substances with flash temperature from 170 to 270°C, and should comply with state standards, technical specifications and have quality certificate.

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

With prolonged exposure of skin to preservation oils, greases and liquids, it may be injured. White spirit vapors in small concentrations act as 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 put on cotton overalls, robe or 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, claim for safety inductions.

9. Tractor transportation and towing

9.1 Tractor transportation

Tractors are transported by railroad, motor vehicles or under its own power. However when a tractor is transported by motor vehicles or under its own power on public roads, its transportation shall be agreed with road services as related to tractor bulkiness.

Engage the parking breaks for tractor transportation.

Fasten the tractor to the platform with four sling ropes.

Fasten one sling rope on each side to a nut located on rear wheel hub by one end, and to binder bracket by another end. Also fasten one sling rope on each side of the tractor to the FLL supporting bracket by one rope end and to binder bracket by another end.

During tractor loading/unloading use lifting mechanisms with load-carrying capacity of at least 15 ton-force.

Tie steel ropes down to front axle beam and rear wheels semiaxle, as shown in the scheme roping diagram in Figure 9.1.1.

For tractor roping the following accessories are:

- loops on the rope (or on other accessory) shall be put on semiaxles with lock nuts and rear axles washers;
- rope hooks shall be put on front driving axle semiaxles.

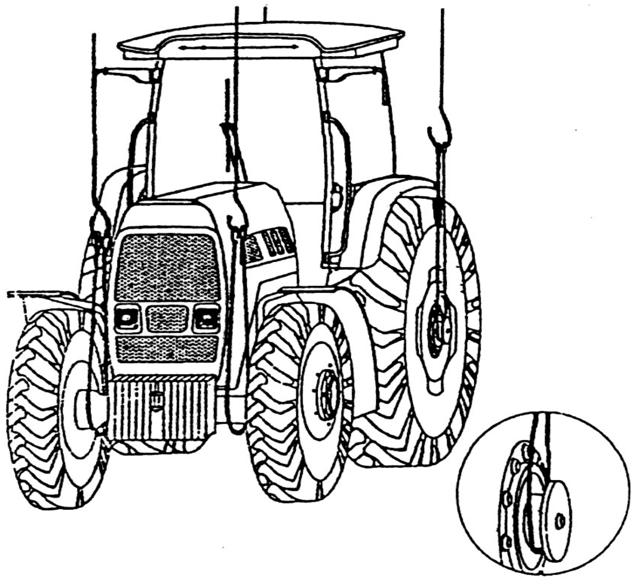


Figure 9.1.1 – Tractor roping diagram

9.2 Towing of tractor

Towing of tractor is allowed at a speed of not more than 10 km/h for a distance of 5 km. Before starting tractor towing set the range selector lever to a “Neutral” position.

In order to connect a towing rope there is a towing yoke located on a supporting bracket along with front ballast weights.

In case the tractor is towed without the front ballast weights, the towing rope shall be fastened to the towing yoke located on a supporting bracket of a FLL.

In case the tractor is towed with no FLL and FPTO mounted, the towing rope shall be fastened to the towing yoke located on the ballast weights.

THE TOWING SHACKLE MUST NOT BE USED TO LIFT THE TRACTOR!

ATTANTION: DURING TOWING OF THE TRACTOR OBSERVE THE TRAFFIC REGULATIONS RIGIDLY!

10. Tractor disposal

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

Drain and in the established order send for processing oils from engine lubrication system, main gear housing, and wheel reduction HLL and HSC integrated tank, FDA wheel-hub drives, transmission line, FPTO reduction gears, and HLL and HSC integrated tank.

- Drain cooling fluid from engine cooling system, cabin heating system and send it for reprocessing in a prescribed manner;
- Drain hydraulic-brake fluid from break hydraulic control system, clutch control system, and send it for reprocessing in a prescribed manner;
- Drain electrolyte from tractor AB, put it special storage reservoir and send for reprocessing in a prescribed manner;
- Drain sediment from fuel coarse and fine filters;
- Drain diesel fuel from fuel tank and put it in special storage reservoirs;
- Drain chemical agent AdBlue from a tank and put it in special storage reservoirs;
- Dismount glassworks and mirrors from a tractor and send it for reprocessing in a prescribed manner;
- Disassemble the tractor into parts, having sorted them out into non-metal, steel, cast iron, non-ferrous and precious metals, and send them for reprocessing in a prescribed manner.

Dismounting of parts and assembly units, maintenance of air conditioning system should be carried out by specially trained personnel using equipment for servicing freon refrigerating machines

During maintenance and regular repair services, fuel and lubricants subject to change and, if necessary, parts and assembly units, being sorted out into groups of materials, should be sent for reprocessing.

Service bulletins

Annex A
(compulsory)

Electrical circuit diagramm of PASU

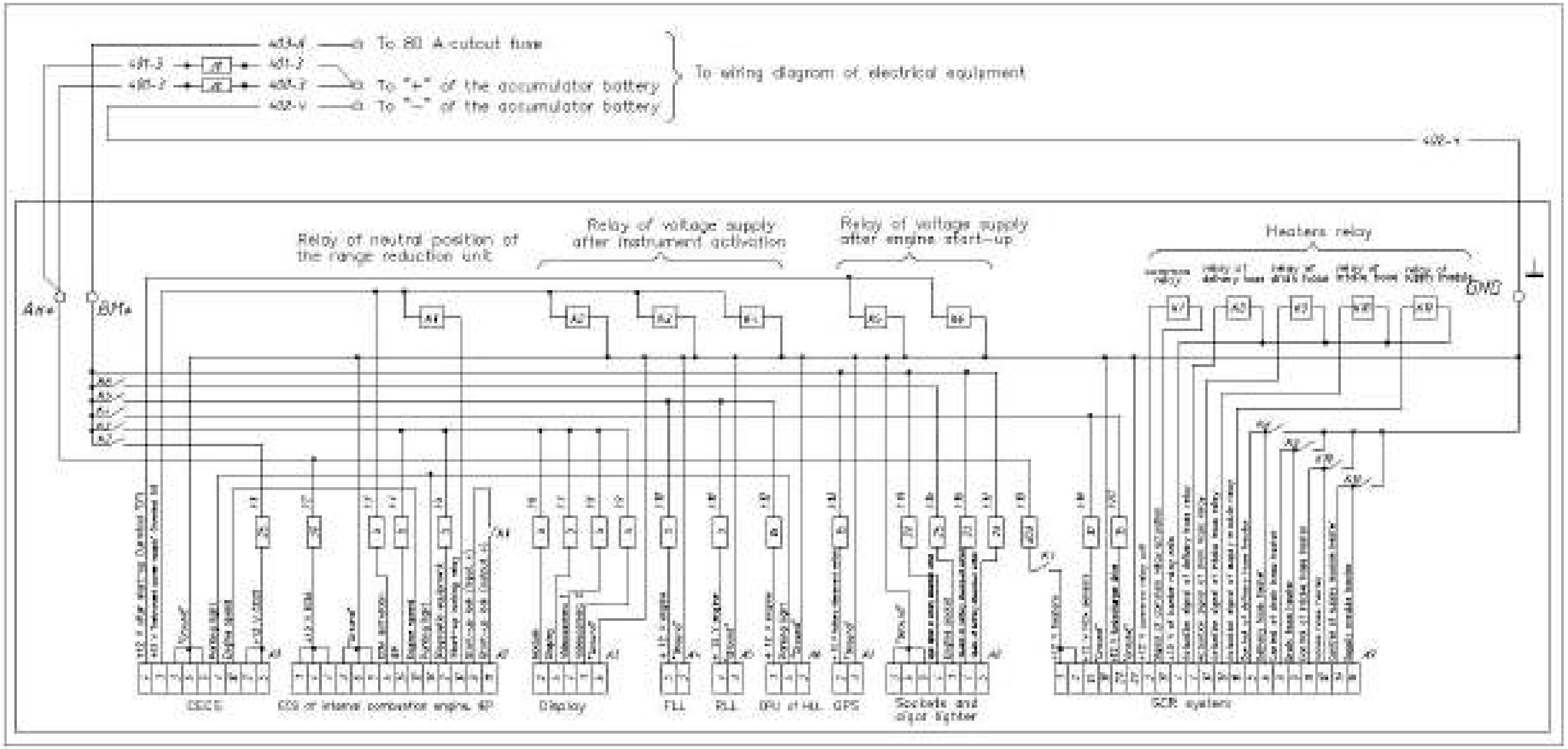
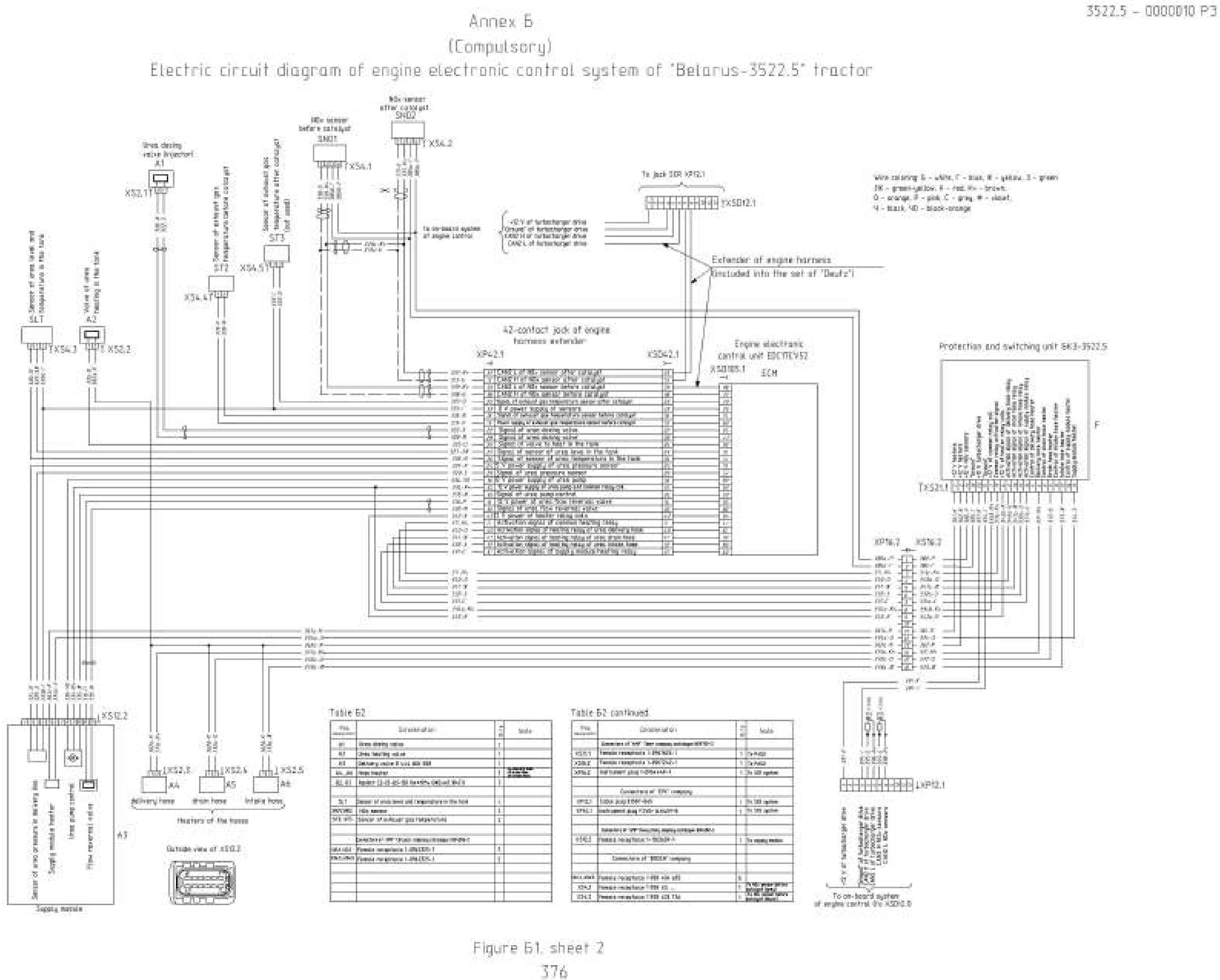
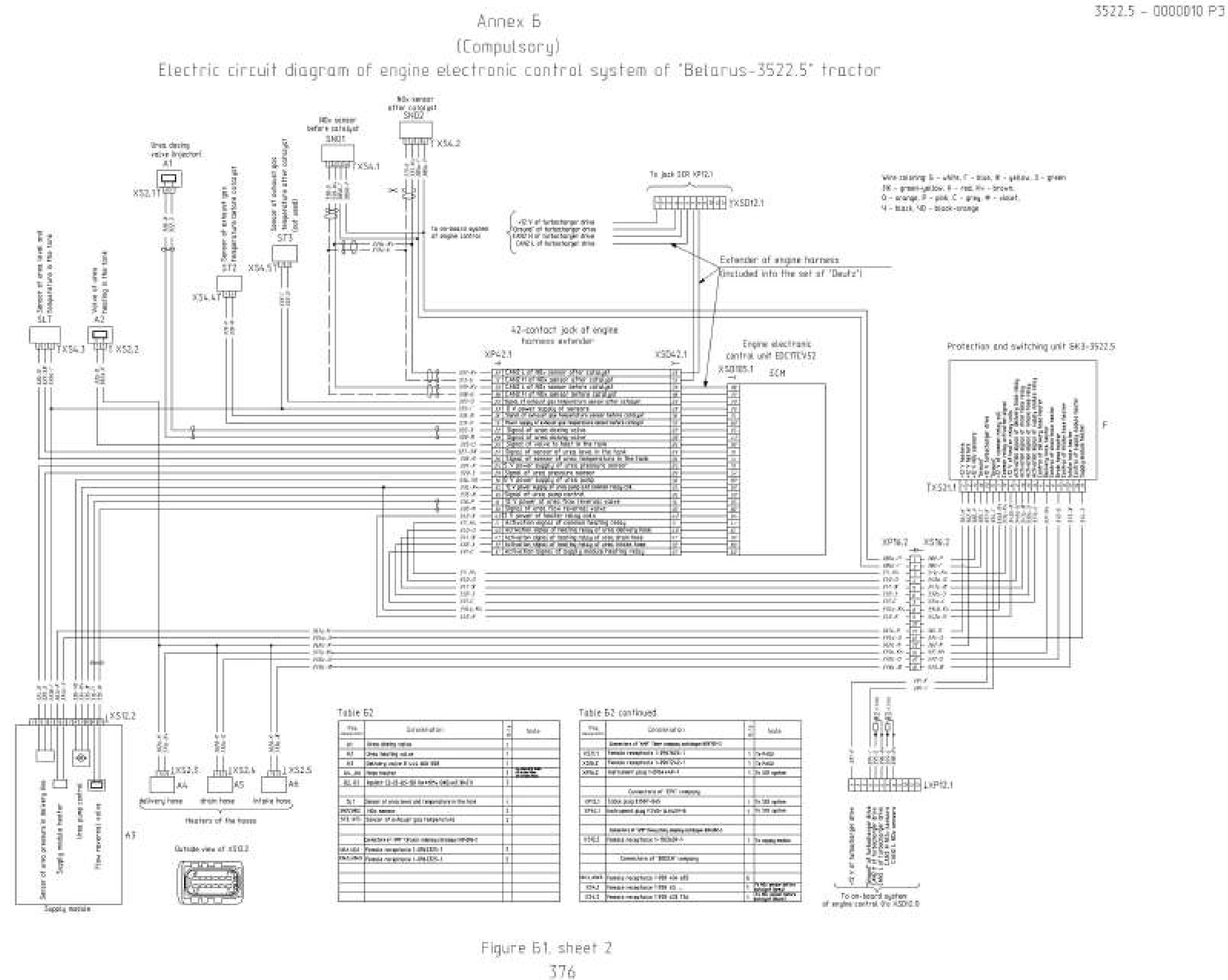


Figure A.1 – Electrical circuit diagramm of PASU

Annex B
(compulsory)



Annex B
(obligatory)



Annex C
(obligatory)

Annex B
(Compulsory)

Electrical circuit diagram of complex of DL, FDA, PTO and gear shifting control of "BELARUS-3522.5" traktor

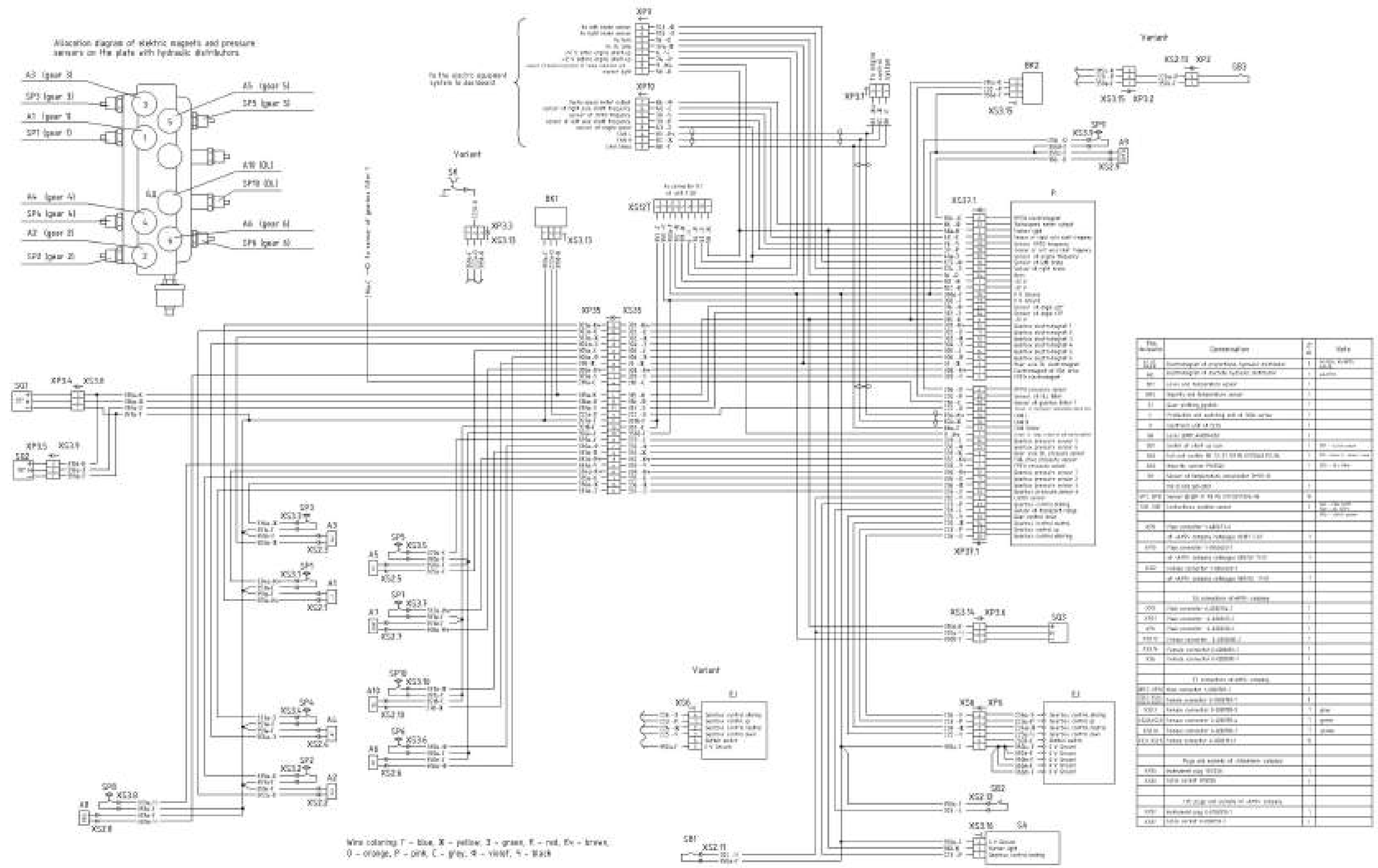


Figure B1 - Electrical circuit diagram of complex of DL, FDA, PTO and gear shifting control of "BELARUS-3522.5" traktor

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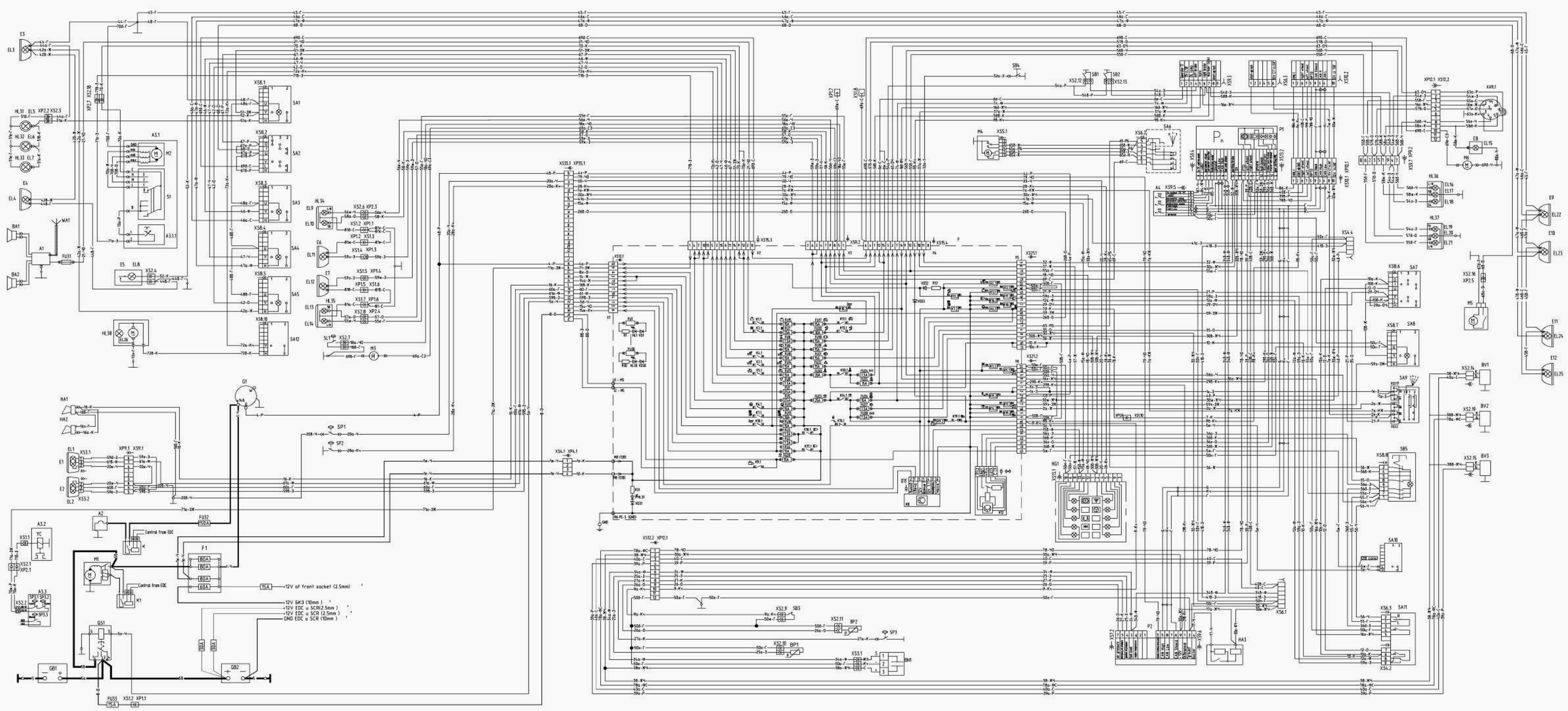
Annex D
(obligatory)

Annex Г
(Commpulsory)
Electrical circuit diagram of «Belarus – 3522.5» tractor equipment

3522.5 – 0000010 РЭ



2. Wire coloring:
Г –blue, Ж –yellow, З –green, К –red, Кч –brown, Р –pink, С–grey,
О –orange, Ф –violet, Ч –black, ЖЧ –yellow-black, КЖ –red-yellow,
ЗЖ –green-yellow, ОЧ –orange-black, СЗ-grey-green.

Figure A1 – Electrical circuit diagram of «Belarus – 3522.5» tractor equipment

Table Г1 – List of elements for circuit diagram of "Belarus-3522.5" electrical equipment

Designation	Denomination	Quantity	Note
A1	Stereo tape recoder	1	
A2	Starting of heater	1	Included into engine set
A3	Conditioner	1	
A3.1	Air handling unit	1	Included into conditioner set
A3.1.1	Controller of air outlet temperature	1	
M2	Electric fan motor	1	
S1	Fan mode switch	1	
A3.2	Condensing unit	1	Included into conditioner set
YC	Electro-magnetic clutch of the compressor	1	
A3.3	Unit of pressure sensors	1	Included into conditioner set
SP3.1	Min. pressure sensor	1	0.4 MPa
SP3.2	Working pressure sensor	1	1.2 MPa
SP3.3	Max. pressure sensor	1	1.6 MPa
A4	Integrated indicator control panel	1	
BA1,BA2	Loud speaker	2	Included into tape recoder set
BK1	Glow plug sensor	1	
BN1	Fuel volume sensor	1	
BP1	Sensor of oil pressure in gearbox	1	
BP2	Air pressure sensor	1	
BV1...BV3	Speed sensor	3	
E1, E2	Road light	2	

Table Г1 continued

Designation	Denomination	Quantity	Note
E3, E4, E6, E7, E9...E12	Working light	8	
E5	Cabin light	1	
E8	License plate light	1	
EL1, EL2	Lamp АКГ12-60+55-1	2	Included into the set E1, E2
EL5...EL7, EL10, EL13	Lamp A12-5	5	Included into the set HL31...HL35
[illegible]	Lamp A12-10	3	Included into the set E8,HL36,HL37.
[illegible]	Lamp A12-21-3	7	Included into the set E5,HL34...HL37
[illegible]	Lamp АКГ12-55-1	9	Included into the set E3, E4, E6, E7, E9...E12, HL38
F	Switching unit	1	
FU1...FU30	Cut-out fuse	30	Included into the switching unit set
J1, J2	Pin M5	2	Included into the switching unit set
M6	Pin M6	1	Included into the switching unit set
M8	Pin M8	2	Included into the switching unit set
[illegible]	Relay power contacts for 25A	15	Included into the switching unit set
[illegible]	Relay electromagnetic coil of fof 25A	15	Included into the switching unit set
K7.1	Relay power contacts for 45A	1	Included into the switching unit set
K7.2	Relay electromagnetic coil of for 45A	1	Included into the switching unit set
K8	Glow plugs unit	1	Not used in traktor on-board circuit
K9.1	Starter relay power contacts	1	Included into the switching unit set
K9.2	Starter relay electromagnetic coil	1	Included into the switching unit set
K12	Turn flasher unit	1	Included into the switching unit set
HL1...HL31	LED indication	31	Included into the switching unit set

Table Г1 continued

Designation	Denomination	Quantity	Note
R32	Added alternator resistance	1	Included into the switching unit set
R1...R31	Resistance	31	Included into the switching unit set
VD1...VD33	Rectifier diode	33	Included into the switching unit set
F1, F2	Fuse blosk	2	
FU31	Fuse link	1	Included into the tape recoder set
FU32	150A rated cut-out	1	Included into the engine set
FU33	15A rated cut-out	1	Included into the harness set
G1	Alternator 14V, 2kW	1	Included into the engine set
GB1, GB2	Accumulator battery 12/120	2	
HA1	Low-pitch horn	1	
HA2	High-pitch horn	1	
HA3	Acoustic annunciating relay	1	
HG1	Pilot lamp block	1	
HL31...HL33	Road-train light	3	
HL34, HL35	Front light	2	
HL36, HL37	Rear light	2	
HL38	Beacon	1	
K	Heating flange contactor	1	Included into the engine set
K1	Starter actuation contactor	1	Included into the engine set
KT1	Starter control unit	1	Included into the engine set
M1	24V starter	1	
M3, M6	Elecric washer	2	

Table Г1 continued

Designation	Denomination	Quantity	Note
M4	Parallel-motion screen wiper	1	
M5	Screen wiper	1	
P1	Integrated indicator	1	
P2	Dashboard	1	
QS1	Battery switch 24V remote	1	
SA1	Road-train sign switch	1	
SA2	Switch of screen wiper and washer	1	
SA3	Switch of working lights (external rear on the roof)	1	
SA4	Switch of working lights (internal rear on the roof)	1	
SA5	Switch of working lights (front on the roof)	1	
SA6	Screen wiper switch	1	
SA7	Central light switch	1	
SA8	Switch of working lights (on the grip)	1	
SA9	Starter and instrument disconnect switch with start-up lock	1	"COBO" (Италия).
SA10	Ground switch	1	
SA11	Underwheel switch (for turns and road lights)	1	
SA12	Beacon switch	1	
SB1,SB2	Stop signal switch	2	
SB3	Lock signal switch	1	
SB4	Manual brake lamp switch	1	
SB5	Emergensy switch	1	
SL1	Sensor of brake fluid emergency level	1	

Table Г1 continued

Designation	Denomination	Quantity	Note
SP1	Sensor of air cleaner filter impurity	1	
SP2	Sensor of oil emergency pressure (in HSC)	1	
SP3	Sensor of emergency air pressure	1	
UZ1	Voltage converter	1	
XA9.1	Connector for agricultural implements	1	
	Male connectors		
XP1.1...XP1.10	Male receptacle 502601	10	
XP2.1...XP2.7	Male receptacle 502602	7	
XP4.1	Plug ШС32П4Ш-М	1	
XP4.2,XP4.3	Male receptacle 502604	2	
XP9.1,XP9.2	Male receptacle 1-480673-0	2	"AMP" (Germany).
XP10.1	Male receptacle 1-0965423-1	1	"AMP" (Germany).
XP12.1	Plug ШС32П12Ш-М-7	2	
XP35.1	Plug 7811230	1	"Schlemmer" (Germany).
	Female connectors		
XS1.1...XS1.10	Female receptacle 602601	10	
[illegible]	Female receptacle 602602	7	
[illegible]	Female receptacle 601202	10	
XS2.17	Female receptacle 30-16-06570	1	"COBO" (Italy).
XS2.20	Female receptacle 0-180907-1	1	"AMP" (Germany).
XS2.21	Female receptacle 282080-1	1	"AMP" (Germany)

Table Г1 continued

Designation	Denomination	Quantity	Note
XS3.1	Female receptacle 601203	1	
XS3.2	Female receptacle 30-16-06571	1	"COBO" (Italy).
XS4.1	Socket ШС32ПК4Г-МТ	1	
XS4.2...XS4.4	Female receptacle 602604	3	
XS5.1	Female receptacle 607605	1	
XS6.1	Female receptacle 602606-XX-10	2	
XS6.2,XS6.3	Female receptacle 602606	2	
XS7.1, XS7.2	Female receptacle 602207	2	
XS7.3	Cable socket 0-0967650-1	1	"AMP" (Germany).
XS8.1...XS8.7, XS8.9, XS8.10	Female receptacle 605608	9	
XS8.8	Female receptacle 610608	1	
[illegible]	Female receptacle 1-480672-0	1	"AMP" (Germany).
XS9.2	Female receptacle 1-967621-1	1	"AMP" (Germany).
XS9.4...XS9.6	Female receptacle 602209	3	
XS10.1, XS10.2	Female receptacle 1-0967240-1	2	"AMP" (Germany).
XS12.1	Female receptacle 1-967622-1	1	"AMP" (Germany).
XS12.2	Socket ШС32УК12Г-МТ-7	2	
XS13.1,XS13.2	Female receptacle 602213	2	
XS15.1,XS15.2	Female receptacle 1-967623-1	2	"AMP" (Germany).
XS21.1,XS21.2	Female receptacle 1-967625-1	2	"AMP" (Germany).
XS35.1	Socket 7812226	1	"Schlemmer" (Germany).
WA1	Aerial	1	

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