SKY FLUX

SKY FLUX AUTO PARTS

URAL-4320-10 · 4320-31

Operation Manual

4320-3902035 RE · 9th edition, revised and expanded

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URAL-4320-10 and URAL-4320-31 Trucks and Their Modifications

Operation Manual

4320-3902035 RE (ninth edition, revised and expanded)

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Miass, 2003

This manual is intended for drivers and road transport personnel involved in the operation of URAL trucks. The manual gives the technical specifications of the trucks, brief descriptions of units and assemblies with illustrations, operating requirements, a list of maintenance operations, and reference data.

Because the product is continually being improved to increase its reliability and to improve operating conditions, individual changes may be made to the design that are not reflected in this manual.

When operating the trucks, use this operation manual, the instructions for the powertrain of the Yaroslavl Motor Plant (YaMZ), and the technical description and installation instructions "Air Heater".

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Introduction

URAL trucks (6x6) with YaMZ-236M2 and YaMZ-238M2 diesel engines made by JSC "Avtodizel", Yaroslavl, and with a three-seat all-metal cab located behind the engine, are designed for carrying cargo and people and for towing trailers on all types of roads and terrain. The base models are the URAL-4320-10 (Fig. 1) and URAL-4320-31 (Fig. 2) multipurpose trucks, created by modernizing the URAL-4320 truck; the dash numbers 10 and 31 (30) indicate the model of the engine installed on the truck (YaMZ-236M2 or YaMZ-238M2, respectively).

URAL-4320-10 and URAL-4320-31 trucks comply with the requirements of TU 37.165.223-93 "Ural-4320-10 Multipurpose Truck and Its Modifications" and TU 37.165.246-94 "Ural-4320-31 Multipurpose Truck and Its Modifications".

The service life before the first overhaul under the first category of operating conditions, in accordance with the "Regulations on Maintenance and Repair of Road Transport Rolling Stock", provided that all rules given in the operation manual are observed, must be not less than:

— for URAL-4320-10 and URAL-4320-31 trucks and their modifications: 250,000 km;

— for the URAL-44202-0311-31 truck: 200,000 km.

During this period, units and assemblies that have reached their specified mileage may be replaced, as well as purchased components whose service life, as set by the technical documentation of the supplier enterprises and by standards, is shorter than the service life of the truck.

The service life of the product is not less than 10 years.



Fig. 2. URAL-4320-31 truck

URAL trucks are designed for operation at ambient air temperatures from plus 50 to minus 45 °C (for short periods down to minus 50 °C).

The following modifications are produced on the basis of the URAL-4320-31 and URAL-4320-10 trucks:

- URAL-43202-0351-31 general-purpose truck with a wooden cargo body;
- URAL-4420-10 and URAL-4420-31 tractor trucks, designed for towing special semitrailers on all types of roads and terrain;
- URAL-44202-0311-31 tractor truck, designed for towing semitrailers on all types of roads;
- URAL-44202-0612-30 tractor truck, designed for towing semitrailers on airfields and level surfaces;
- URAL-4320-0911-30 long-wheelbase truck, designed for carrying cargo and people on all types of roads and terrain;
- URAL-4320-0611-10 and URAL-4320-0611-31 trucks with a wooden cargo body and a tilt, designed for carrying cargo.

Chassis with similar specifications are produced on the basis of the trucks (including chassis for van bodies). Various configurations are possible: with or without a winch; with the spare wheel carrier located behind the cab or at the rear of the frame (mounted vertically or horizontally), or without a carrier (with temporary factory fastening on the frame); with or without mechanical power take-offs from the gearbox (power take-off, PTO) and from the transfer case (auxiliary power take-off, auxiliary PTO); and with or without a towing hitch for towing trailers.

The trucks may be operated with trailer systems that have pneumatic connections per GOST R 50023 (Russian national standard) and electrical connections per GOST 9200 (version II), a brake system pneumatic connection per GOST 4364, brake systems per GOST R 41.13, a gross vehicle weight corresponding to the technical specification, and a coupling device per GOST 2349 for trailers, or a coupling kingpin per GOST R 41.55 for semitrailers with a diameter A per GOST 12017 equal to 50.8 mm and connection dimensions per GOST 12105 for a rated fifth wheel load from 49.0 kN (5.0 tf) to 83.4 kN (8.5 tf).

The principal trailers and semitrailers for the trucks and tractor trucks listed are trailer models 782B (2PN-4M) and GKB-8350, and semitrailers OdAZ-935 and OdAZ-9370 for the URAL-44202-0311-31.

Various products are also built on the basis of URAL trucks and chassis (tanks, truck cranes, oilfield equipment, van bodies, etc.). All comments and suggestions on their operation should be sent to the manufacturers of these products.

The installation of various equipment and mechanisms on the truck and its chassis is allowed only with the approval of the plant's Chief Designer's Department. Otherwise, the consumer loses the right to file claims for premature failure of truck parts.

Marking of the URAL Truck and Chassis

The marking includes the marking of the truck as a whole as a vehicle, the marking of the chassis and the cab as components of the vehicle, and the marking of the engine.

The structure of the marking complies with OST 37.001.269-96. The truck as a whole, as a vehicle, is marked on a data plate attached to the right side panel of the cab near the sill. The plate shows: the trademark, the truck model with the equipment designation, the vehicle identification number (VIN, 17 characters), and the engine model.

Structure and content of the vehicle identification number:

* - variable data

Pos. 1-3: X1P - Russia, Chelyabinsk Region, Miass, OJSC "Ural Automobile Plant" (international manufacturer identification code)

Pos. 4-9: product designation

Pos. 10: year of manufacture

Pos. 11-17: serial production number of the vehicle

Digits used to designate the year of manufacture:

1 - 2001 3 - 2003 5 - 2005

2 - 2002 4 - 2004 6 - 2006

The chassis, as a component of the vehicle, is marked on the frame at the rear of the right side rail, 1000-1250 mm rearward from the axis of the balancer bogie and 40-60 mm down from the upper flange of the side rail. The marking consists of 14 characters and is applied by stamping.

The cab, as a component of the vehicle, is marked on the side panel on the right in the direction of travel, in the lower part of the door opening between the two front holes. The marking consists of 14 characters and is applied by stamping.

Information on the engine marking is given in the operating instructions "YaMZ-236M2 and YaMZ-238M2 Engines".

Safety Requirements and Warnings

Safety Requirements

1. WARNING: Before starting work, make sure the truck and its coupling devices are in good working order.

2. WARNING: Service and repair the truck on flat level ground. Apply the parking brake, disconnect the batteries with the battery disconnect switch, shut off the fuel supply by pulling the engine stop knob toward you as far as it will go, and place wheel chocks under the wheels.

3. WARNING: Keep the engine and the preheater clean and in good working order. Do not allow fuel or oil to leak, because this can cause a fire. The driver must stay with the truck while the preheater is operating.

4. WARNING: Do not warm up the engine in enclosed spaces with poor ventilation.

5. WARNING: Coolants (antifreeze) and brake fluids are poisonous; handle them with care.

6. WARNING: When servicing the engine, secure the hood lifting mechanism with safety hook 1 (Fig. 3).

7. WARNING: To climb onto the front bumper of the truck or get down from it, use the step and the center rib and the leftmost rib (in the direction of travel) of the radiator grille, which have inserts on the inner side (Fig. 4).

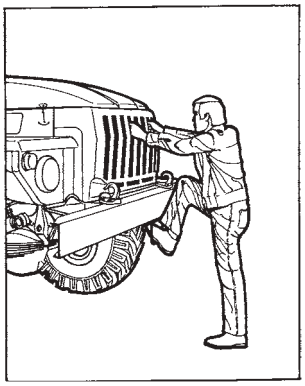


Fig. 4. Technique for using the step and the radiator grille ribs to climb onto the bumper and get down from it

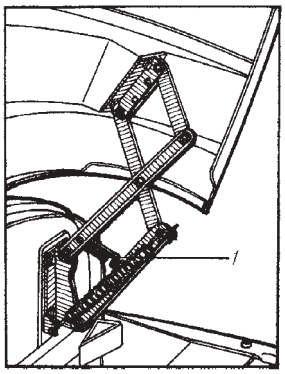


Fig. 3. Hood lifting mechanism safety

1 - safety hook

8. WARNING: Before removing a wheel by lifting it with a jack, secure the truck against rolling by placing chocks under the other wheels. Loosen the wheel nuts, and only then lift the wheel with a jack or another lifting device.

To lift the front axle with a jack, place the jack screw head in the seat of the spring U-bolt clamp; to lift the rear or middle axle, place it under the spring support bracket.

9. WARNING: Do not remove a wheel from the truck without first releasing all the air from the tire.

10. WARNING: Do not install a newly assembled, uninflated wheel with a tire on the truck and inflate it with the tire inflation system.

> **WARNING: The plant specifically warns that strict compliance is mandatory with the safety rules for tire mounting and demounting (see the section "Wheels and Tires").**

11. WARNING: When lowering the spare wheel, do not stay within the swing area of the swing-out bracket of the carrier.

12. WARNING: Operation of the truck without spring ring 14 (see Fig. 92) of the latch and without wing nut 7 of the battery box cover is prohibited.

13. WARNING: To prevent the batteries from falling when they are serviced on the truck, slide the batteries out of the box only onto the folded-down cover of the box, after making sure that it is securely held in a horizontal position.

14. WARNING: Check the condition of the insulation of the wire from the "+" terminal of the battery to the starter: damaged insulation can cause a fire.

15. WARNING: When climbing grades, select the required gear in advance.

16. WARNING: When carrying passengers, lock the latch of the right cab door by turning the latch handle down.

17. WARNING: When driving through roadside drains and over uneven ground, do not allow the front of the semitrailer to rest against parts of the tractor truck, because the semitrailer kingpin may be pulled out of the fifth wheel jaws (spontaneous uncoupling).

18. WARNING: Couple and uncouple the trailer (semitrailer) on flat level ground.

19. WARNING: Before uncoupling tractor trucks, the rollers of the semitrailer landing gear must rest firmly on the ground. If there are gaps between the rollers and the ground, uncoupling is not allowed.

20. WARNING: When working with the winch:

— do not stand in front of the load being moved or near a taut cable;

— do not allow kinks or knots in the cable, which damage it and cause it to break. When pulling the cable across a road, post a guard and set up signs prohibiting traffic.

21. WARNING: Perform welding on the truck in compliance with fire safety measures. Connect the ground cable of the welding machine close to the place of welding, so that no electric current passes through bearings and friction pairs.

22. WARNING: On URAL-4320-10 trucks with a diaphragm clutch, if the powertrain must be removed, screw an eyebolt into the rear end face of the left cylinder head. The eyebolt is supplied in the spares kit (ZIP) of the truck.

23. WARNING: When working with the autonomous heating unit (AHU), the following is not allowed:

— sleeping in the cab while the AHU is operating;

— operating the unit with the intake and exhaust pipes fully or partially blocked;

— starting and operating the unit when it is soaked with fuel;

— refueling the truck while the unit is operating;

— leaving the operating unit unattended;

— operating the unit without the exhaust gas pipe.

WARNING: During operation, remember that careless handling of the unit, as well as its faults, can cause a fire or poisoning by exhaust gases.

Warnings

Normal operation of the truck and its long service life can be ensured only if all the recommendations given in this manual are followed.

1. During the first 1000 km of mileage (50 engine hours), follow the rules given in the section "Break-In (Operation) of a New Truck".

2. After starting a cold engine, do not allow it to run at high engine speed.

3. When the engine is running at full load, an instant shutdown is not allowed; the engine must run for 1-3 min at minimum idle speed.

4. To prevent air from entering the fuel system, do not use up all the fuel in the fuel tank.

5. After 1000 km of mileage (50 engine hours) of the truck, during maintenance (TO) in the initial period of operation, be sure to remove the assembly screen between the intake adapter and the connecting pipe of the engine intake manifolds, keeping the sealing gasket.

6. Make sure the preheater fuel pump is adjusted correctly, and do not allow an open flame from the flue of the boiler.

7. Do not allow the preheater to run for more than 15 s without coolant in the boiler. After washing the truck or fording, turn on the pump unit for 2-3 min to remove water from the air passage of the preheater.

8. Start driving after the engine coolant has warmed up to a temperature of not less than 40 °C. The optimum coolant temperature is 75-100 °C.

9. To drain the coolant from the engine cooling system completely, park the truck level or tilted forward.

10. Drain the coolant from the engine cooling system through three drain cocks (on the preheater boiler, on the preheater pump unit, and on the coolant inlet pipe of the water pump) with the cab heater valve open and with the radiator cap and the cap of the preheater filler pipe open. To prevent the impeller from freezing (if water has been used in the engine cooling system in an emergency), remove the remaining water from the preheater coolant pump by running the pump unit for 10-15 s. After the coolant has been drained, close the drain cocks.

11. At an ambient air temperature below minus 10 °C, shut off the oil cooler by closing the valve located on the cylinder block.

12. It is not recommended to drive with the transfer case differential locked on hard, dry roads, because this leads to accelerated tire wear and increased fuel consumption. With the differential unlocked, the lock lever must be in the fully forward position.

13. When driving the truck out of a rut, do not drive for a long time with the steering wheel turned to its extreme position, because this can overheat the oil in the steering hydraulic system and, as a result, cause the pump to fail. For the same reason, when power is taken off the engine during stationary operation, relieve the load on the steering shaft by turning the steering wheel until free play appears.

14. Before starting off, the air pressure in the brake system must be not less than 400 kPa (4 kgf/cm2). If warning light 4 (see Fig. 13) on the instrument panel comes on and an audible signal (buzzer) sounds, eliminate the fault in the pneumatic part of the actuation.

15. When operating the truck, especially in difficult road conditions (sandy, muddy roads, etc.), monitor the condition of the brakes and adjust the clearances between the shoes and the drums in good time. If there is a fault, warning light 3 (see Fig. 13) on the instrument panel comes on. In this case, eliminate the fault in the hydraulic part of the brake actuation or adjust the clearances in the service brakes. If the parking brake is not effective enough, do not adjust the clearances between the shoes and the drum of the parking brake with rod 4 (see Fig. 84), to avoid damaging parking brake parts.

16. Before starting off, check that the indicator lights of the warning light clusters work (see Fig. 13).

17. Do not operate the truck with the tailgate lowered, because in this position it covers the rear signal lamps.

18. When re-engaging the starter (after a pause of 1-2 min) because the engine has not started or has stalled for any reason, first return the key to its original vertical position. Frequent engine starts with short engine running cause the batteries to discharge quickly.

19. CAUTION: Do not move the truck using the starter, because this can cause the starter to fail and the batteries to discharge quickly.

20. CAUTION: To prevent alternator failure, connect the wire from the starter to the positive terminal of the battery and the wire from the battery disconnect switch to the negative terminal.

21. Connect the wires to the alternator and the voltage regulator in accordance with the markings on these units.

22. Before removing the alternator from the engine, disconnect the batteries.

23. During a long parking period of the truck, disconnect the batteries from "ground" with the button (see Fig. 21) of the ground switch (battery disconnect switch).

24. When starting the engine from an external power source through the external start socket, the batteries must be switched on. Do not use a direct-current source with characteristics exceeding 24 V at a current of 0 (zero) A and 18.3 V at a current of 1000 A, or batteries whose rated capacity differs from 190 A*h by more than ±20 A*h.

25. Removing the seals on the flexible speedometer drive shaft (2 pcs.) deprives the consumer of the right to make claims.

26. At air temperatures below minus 15 °C, use the auxiliary PTO only after a short run (approximately 15 km) or after warming the oil in the transfer case by another method, for example with hot air.

27. When towing a trailer that restricts the maneuvering of the truck, remove the rear bumpers.

28. While the truck is moving, the wheel valves of the tire pressure control system must be open.

For a long parking period, close the wheel valves. At an ambient air temperature below minus 35 °C, open the wheel valves 15-20 km after starting to drive.

After opening the wheel valves, blow out the tire pressure control system with air from the tires (see the section "Central Tire Inflation System").

29. CAUTION: When the truck is towed with the engine not running, the input and intermediate shafts of the gearbox do not rotate; in this case the oil pump does not operate and does not supply lubricant to the bearings of the output shaft gears and to the cone surfaces of the synchronizers, which will cause scoring of the sliding surfaces and wear of the synchronizer rings, and leads to failure of the entire gearbox.

To tow the truck, engage neutral in the transfer case and any gear in the gearbox to prevent the intermediate drive shaft from rotating.

30. CAUTION: When maneuvering, especially in reverse, do not allow large articulation angles of the road train, so as not to damage the towing device.

31. When working with a trailer at an ambient air temperature below minus 25 °C, before a long parking period, to prevent the rubber buffer from freezing in the compressed state and axial play from appearing in the towing device, do not leave the rubber buffer of the towing device under load. Disconnect the trailer or relieve the axial load on the rubber buffer by moving the truck forward and backward.

32. When a loader with a gross weight of more than 3200 kg drives onto the cargo body of the truck, place shields (boards) under its wheels.

33. CAUTION: Place heavy small-sized loads, which when moved can cause local bending of the cargo body floor or damage the sides and seat parts, on skids (boards) and secure them firmly. Position the load so that its center of mass is in the middle of the cargo body.

34. The loading height of the URAL-4320-0611-10 truck is increased. Because of the increased height of the center of mass of the truck, its static lateral stability is reduced.

35. Because the force on the pedal of the diaphragm clutch actuation without an air-hydraulic booster (PGU) is increased, and because the clutch cannot be disengaged when there is no pressure in the supply tank of the clutch release air cylinder, it is not recommended to leave the truck in gear for a long parking period (more than four hours).

If, after a long parking period or because of increased air leaks, all the compressed air has leaked out and a gear is engaged in the gearbox of the truck, before starting the engine you must get the gear disengaged (neutral set) by turning the engine crankshaft alternately to the right and to the left through approximately 180° by the method described in the section "Valve Mechanism Adjustment" of the operating instructions for the YaMZ-236M2 and YaMZ-238M2 engines, or by filling the pneumatic system with compressed air from an assisting truck through the towing valve, and disengage the clutch.

36. URAL-44202-0311-31* tractor trucks equipped with rear lighting devices in accordance with GOST R 41.48 may be operated only with semitrailers in which the distance from the kingpin to the nearest part of the semitrailer landing gear is not less than 2000 mm.

* For trucks supplied to the national economy (NE).

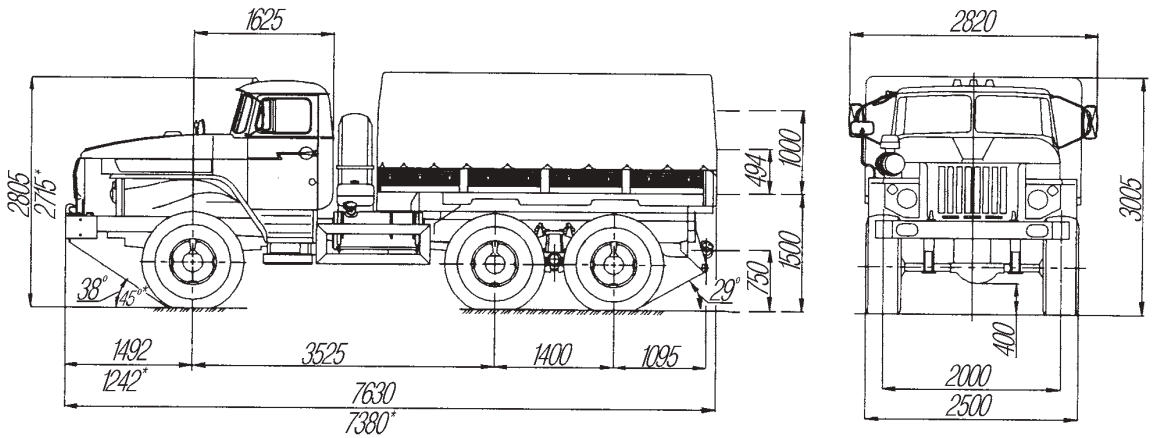


Fig. 5. Overall dimensions of URAL-4320-31 and URAL-4320-10 trucks

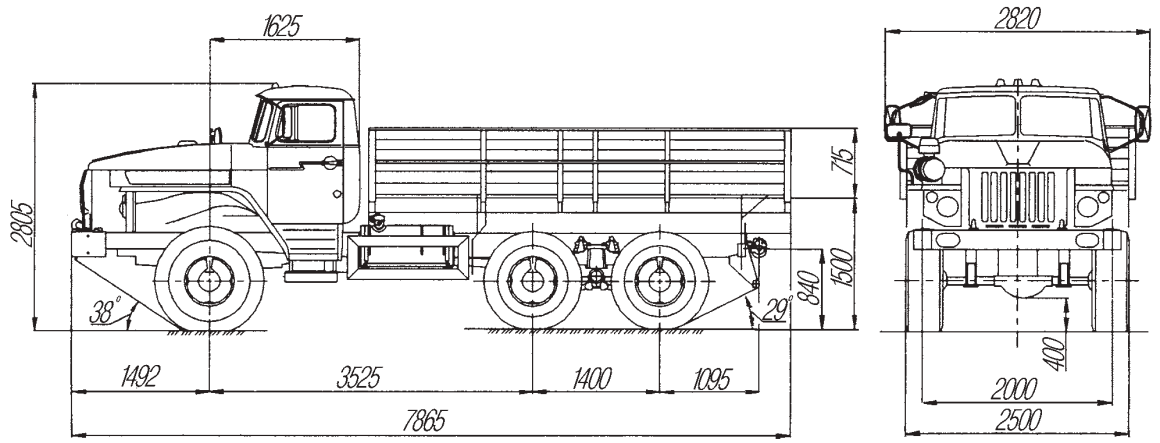


Fig. 6. Overall dimensions of URAL-43202-0351-31 trucks

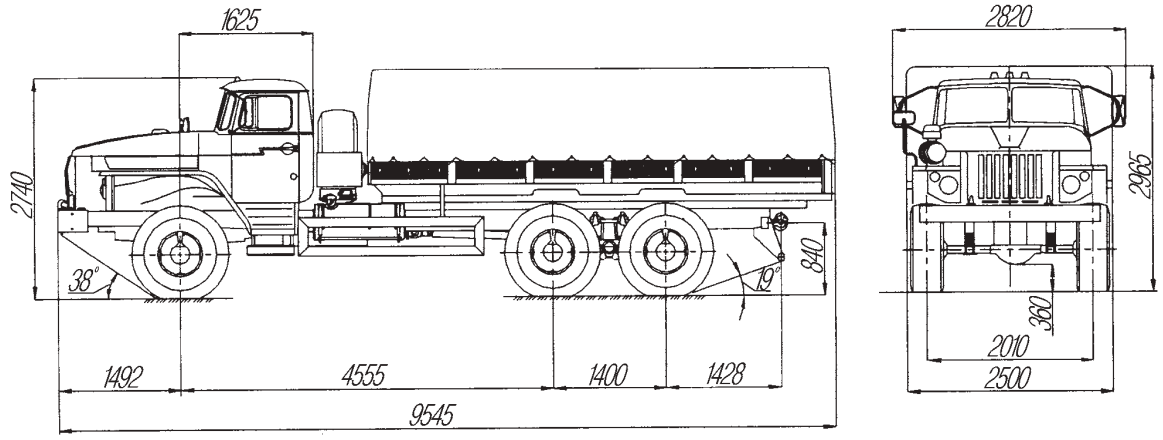


Fig. 7. Overall dimensions of the URAL-4320-0911-30 truck

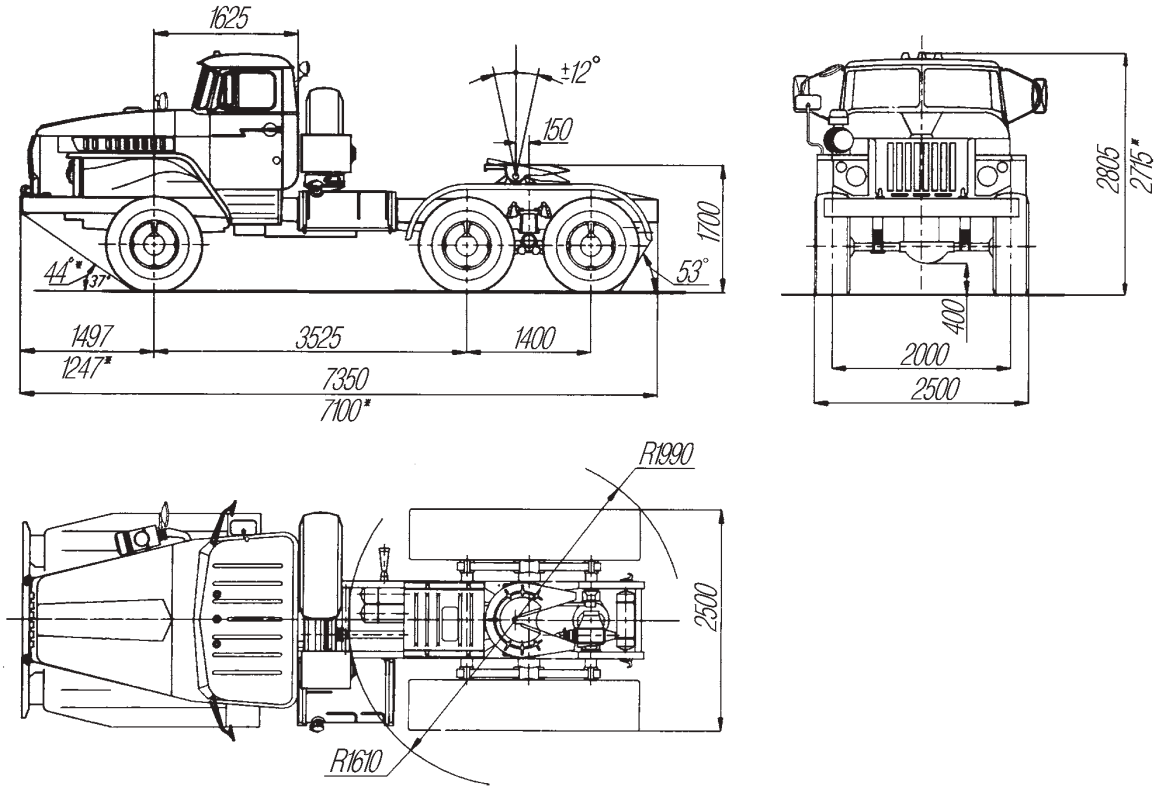


Fig. 8. Overall dimensions of URAL-4420-31 and URAL-4420-10 tractor trucks

Рис. 8. Габаритные размеры седельных тягачей Урал-4420-31, Урал-4420-10

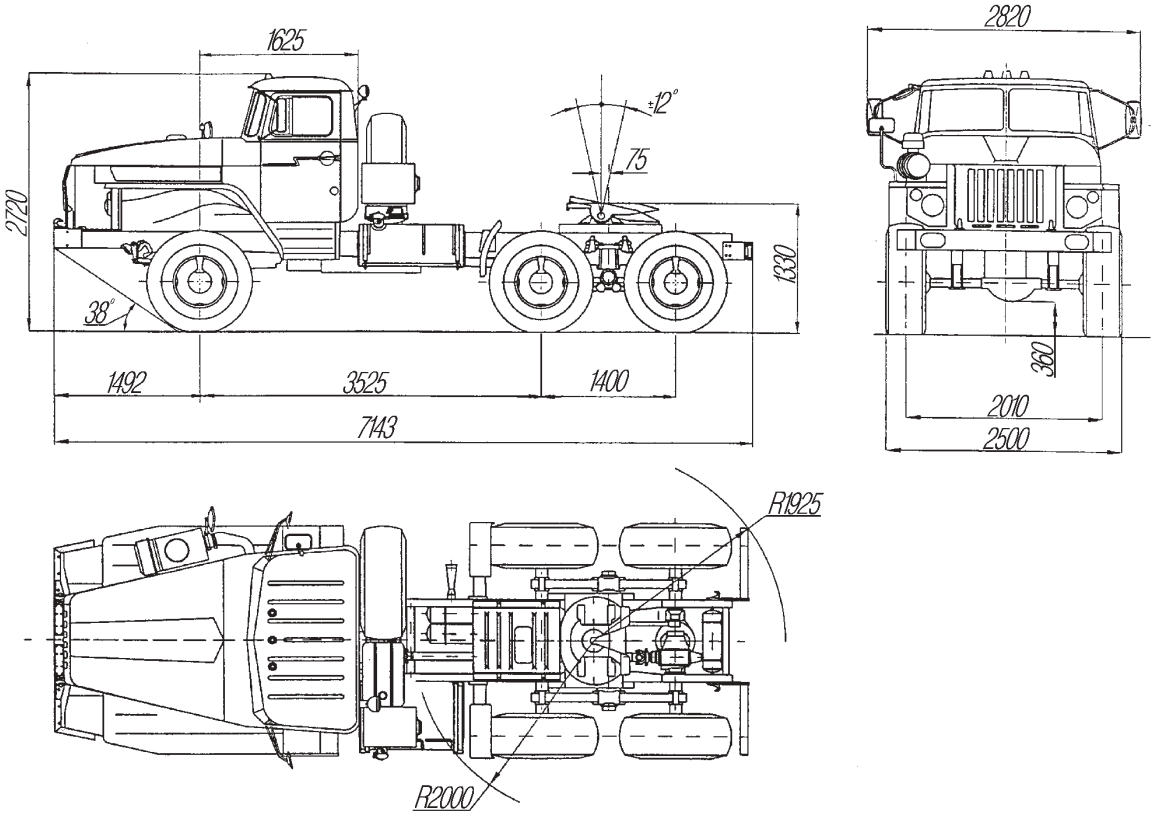


Fig. 9. Overall dimensions of the URAL-44202-0311-31 tractor truck

Controls and Instruments

The controls and instruments located in the truck cab are shown in Figs. 10-13.

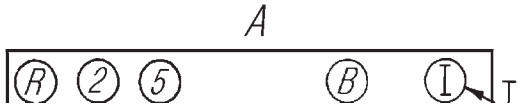


Fig. 10. Plates inside the truck cab

A - gearbox and transfer case plate, located inside the cab on the front panel on the right side; 1, 2, 3, 4, 5 - gearbox gears; R - gearbox reverse; B - transfer case high range engaged; H - transfer case low range engaged; I - differential unlocked; II - differential locked; C - brake force regulator plate, located on the inner panel of the left cab door

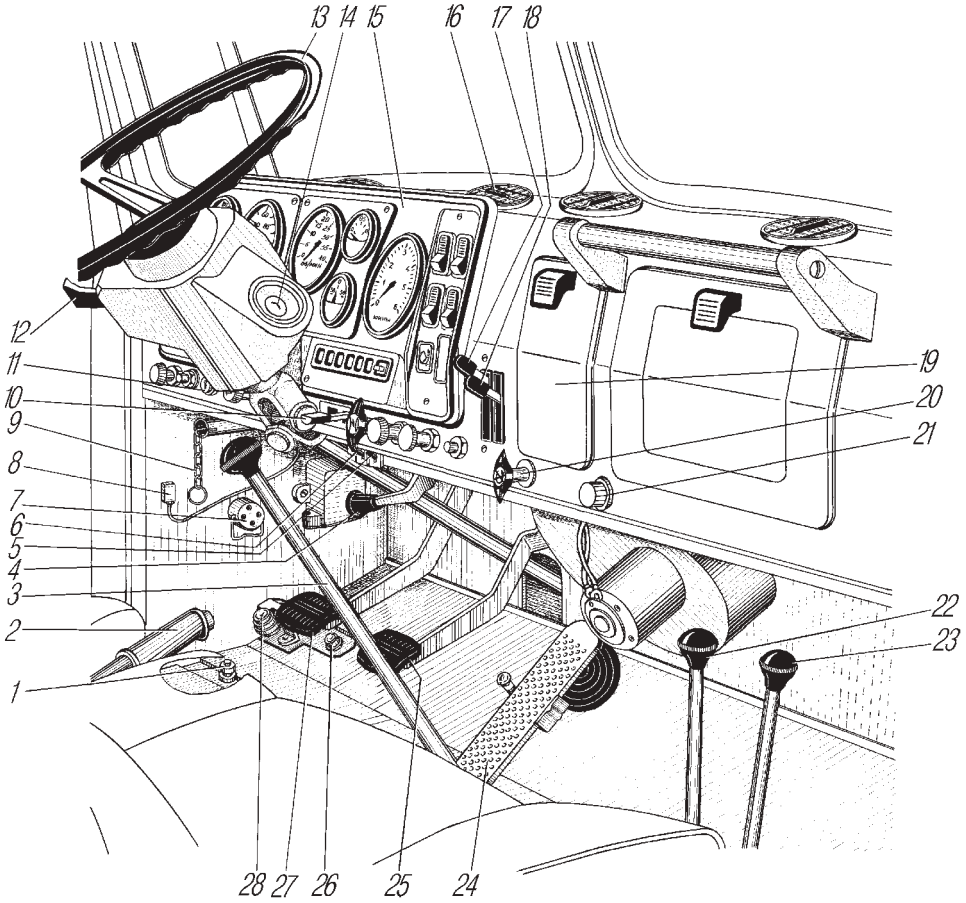


Fig. 11. Controls and instruments

Fig. 11. Controls and instruments

1 - horn switch; 2 - parking brake lever; 3 - gear shift lever; 4 - outside air vent control handle; 5 - PTO engagement valve; 6 - auxiliary PTO engagement valve; 7 - portable lamp socket; 8 - air cleaner restriction indicator; 9 - radiator shutter control chain; 10 - pressure control valve lever; 11 - starter and instrument switch; 12 - turn signal switch; 13 - steering wheel; 14 - starter and instrument switch*; 15 - instrument panel; 16 - defroster outlet; 17 - air distribution damper control lever; 18 - inside air vent control lever; 19 - fuse block access cover; 20 - manual engine stop pull knob; 21 - trailer brake cutoff valve button; 22 - transfer case gear shift lever; 23 - transfer case differential lock lever; 24 - accelerator pedal; 25 - brake pedal; 26 - auxiliary brake pneumatic valve button; 27 - clutch pedal; 28 - foot headlamp dimmer switch

Engage the gearbox, the transfer case and the differential lock, as well as the PTO and the auxiliary PTO, in accordance with the plates inside the cab and the instructions in the section "Driving the Truck".

When button 26 (Fig. 11) is pressed, the auxiliary brake (exhaust brake) is engaged; when the foot is taken off the button, braking stops. When parking brake lever 2 is moved up, the truck is braked and the trailer brake system is applied.

The supply of outside air is adjusted by moving handle 4. With lever 17 in the upper position, air flows through the defroster outlets to the windows; in the lower position, it is directed to warm the feet of the driver and passengers. With lever 18 in the upper position, the inside air vent is open; in the lower position, it is closed.

To stop the engine, pull knob 20 toward you as far as it will go. When the handle of switch 12 is moved clockwise, the right turn signals are turned on; when it is moved counterclockwise, the left turn signals are turned on.

When switch 28 is pressed, the headlamp beam is switched (high beam to low beam and vice versa).

On trucks equipped with a central tire inflation system (CTIS), a plate of the tire inflation system for selecting the tire air pressure and the driving speed depending on the type of road is installed inside the cab on the front panel on the left side of the truck.

The lever of the tire air pressure control valve has three positions:

— left - tire inflation;

— center - neutral; pressure gauge 11 (Fig. 12) shows the actual tire air pressure;

— right - air release from the tires.

* For trucks supplied to the NE (instead of item 11).

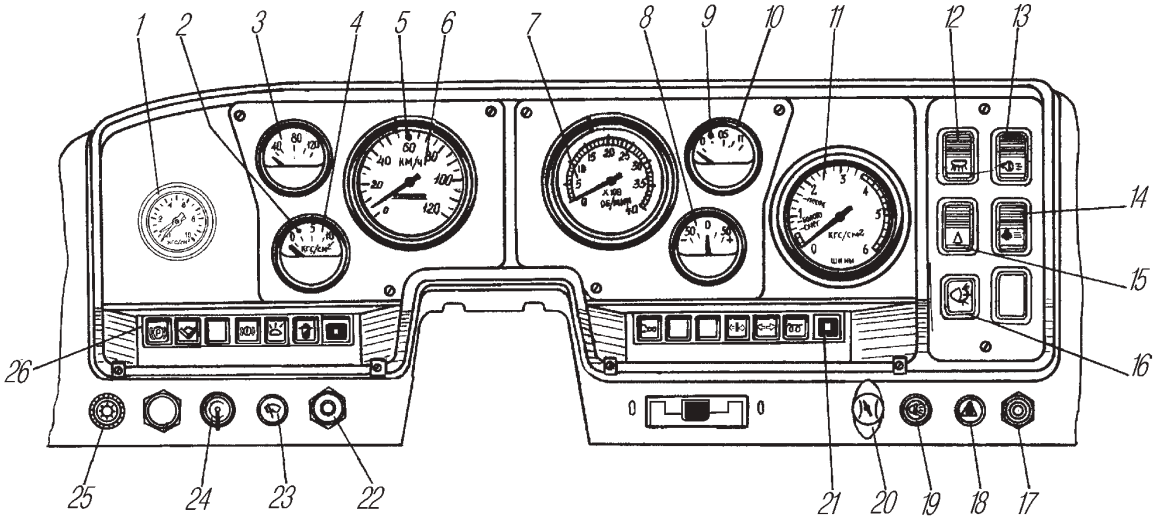


Fig. 12. Instrument panel

1 - dual-needle pressure gauge; 2 - emergency low oil pressure indicator light; 3 - coolant temperature gauge; 4 - oil pressure gauge; 5 - high beam indicator light; 6 - speedometer; 7 - tachometer; 8 - ammeter; 9 - low fuel warning light; 10 - fuel level gauge; 11 - tire pressure gauge; 12 - cab dome light switch; 13 - spotlight switch; 14 - cab heater switch; 15 - road train identification lamps switch; 16 - rear fog lamp switch (with built-in indicator light); 17 - electric flame starting aid (EFU) button; 18 - hazard warning lights switch; 19 - central headlamp switch; 20 - manual fuel control pull knob; 21, 26 - warning light clusters, right and left; 22 - battery disconnect switch button; 23 - windshield wiper and washer switch; 24 - starter and instrument switch; 25 - instrument illumination rheostat switch

The radiator shutter is controlled with chain 9 (see Fig. 11). When the chain is pulled, the shutter rises.

To switch the truck batteries on or off, press button 22 (see Fig. 12) located on the instrument panel.

The engine preheater is controlled from a control panel located on the left side panel of the radiator under the hood.

The hazard warning lights are turned on by pressing button 18; all the turn signals and the lamp in the button itself begin to flash.

A constant engine speed is set by pulling knob 20 toward you; to avoid damaging the linkage, it is recommended to press the accelerator pedal first. The engine speed is monitored with tachometer 7. If the tachometer shows no reading, turn on any load (the heater, instrument illumination, etc.); the tachometer will then begin to show the engine speed in rpm.

The operation of the power supply system is monitored with ammeter 8. A needle position between the "0" and "-" marks indicates battery discharge, and a position between "0" and "+" indicates charging. The air pressure in the pneumatic brake actuation of the truck is monitored with dual-needle pressure gauge 1; for monitoring

the pressure in each circuit of the pneumatic actuation there are test port valves to which portable pressure gauges are connected.

On trucks supplied to the NE, the starter and instrument switch is located on the steering column and has four key positions:

— 0 - off, locked position, the key cannot be removed;

— I - instruments on, locked position, the key cannot be removed;

— II - starter on, automatic return to position I, the key cannot be removed;

— III - parking, locked position, the key can be removed when the engine is not running and the batteries are switched off.

The starter and instrument switch consists of a contact part and a lock part. The lock part has an anti-theft device and an interlock that prevents the starter from being engaged again.

The anti-theft device works as follows: after the key is removed from the lock, a locking pin extends, enters a groove in the steering shaft, and locks the shaft.

After the key has been removed from the lock, make sure that the steering is locked by turning the steering wheel to the left and to the right. If excessive effort is needed to turn the key from the "Parking" position, rock the steering wheel to the left and to the right.

When the key of the starter and instrument switch is set to position III, power is supplied to the solenoid coil of the electro-pneumatic valve; the solenoid core, as it moves, actuates the system of valves in the pneumatic part, and air from the air take-off cross fitting of the brake system is supplied to the engine stop air cylinder, thereby cutting off the fuel supply to the engine cylinders.

Terminal markings on the starter and instrument switch (wire color - terminal): light blue - 15/2, light blue with black - 15/1, yellow - P, red - 50, brown - 30/1, pink - 30, black - INT.

The key of starter and instrument switch 24, located on the instrument panel, has three positions:

— 0 - vertical: everything is off, the key can be removed;

— I - middle: the key is turned clockwise to the first locked position - instruments on;

— II - extreme: the key is turned clockwise as far as it will go - instruments and starter on.

When starter and instrument switch 24 is turned on, indicator light 2 (red) for emergency low oil pressure comes on; it goes out after the engine is started, when the engine speed rises above the minimum.

The illumination of the instrument scales is adjusted by turning the knob of switch 25.

The windshield wiper and washer are turned on with switch 23. The switch has four positions: I - off; II and III - low and high wiper speeds; IV - high wiper speed with the windshield washer pump on.

The electric flame starting aid operates while button 17 is held pressed. Indicator light 8 (Fig. 13) comes on to show that the EFU is ready for starting the engine. When buttons 6 and 7 are pressed, all working indicator lights of the left or right cluster come on. Indicator light 9 comes on with an intermittent green light when the right or left turn signals of the truck are turned on; indicator light 10 comes on when the right or left turn signals of the trailer are turned on. These indicator lights also serve to monitor that the turn signal lamps are working.

Fig. 13. Warning light clusters

I - left; II - right; indicator lights: 1 - parking brake; 2 - emergency high coolant temperature; 3 - brake fault; 4 - minimum air pressure in the pneumatic system; 5 - clogged oil filter; 6, 7 - buttons for testing the indicator lights; 8 - EFU on; 9 - truck turn signals; 10 - trailer turn signals

When the air pressure in the tanks drops below 450 kPa (4.5 kgf/cm2), indicator light 4 comes on red and an audible signal sounds.

If the clearances between the brake shoes and drums are excessive, or if there are faults in the hydraulic part of the actuation, indicator light 3 comes on red when the brake pedal is pressed and goes out after the fault is eliminated.

The need to service the cardboard filter element of the air cleaner is determined by the reading of restriction indicator 8 (see Fig. 11), installed on the lower side brace of the cab front panel.

When the resistance of the oil filter increases (clogging of the filter elements, increased oil viscosity at low temperature), indicator light 5 (see Fig. 13) comes on red. It may stay lit only while the engine is being started and warmed up.

Indicator light 2 comes on red when the coolant temperature rises to an emergency level above 98 °C. Short-term operation of the engine (not more than two hours) at temperatures up to 105 °C is allowed.

Indicator light 1 flashes red when the parking brake is applied.

Gauge 10 (see Fig. 12) shows the fuel level in the main fuel tank. Indicator light 9, which comes on when the fuel volume drops to 60 L, is built into the gauge scale.

Oil Cooler Shutoff Valve

The oil cooler shutoff valve (Fig. 14) is located on the cylinder block on the left (in the direction of travel). To shut off the oil cooler, turn the valve handle clockwise as far as it will go.

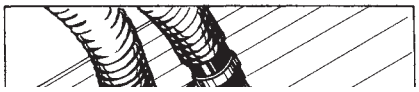


Fig. 14. Oil cooler shutoff valve

1 - valve

Auxiliary Fuel Tank Valve

When using fuel from the auxiliary fuel tank, transfer it to the main fuel tank by opening the valve with control handle 1 (Fig. 15).

Hand Fuel Priming Pump

The hand fuel priming pump is mounted on the body of the low-pressure fuel transfer pump. To supply fuel to the high-pressure pump when the engine is not running, press handle 1 (Fig. 16) down lightly, turn it counter-clockwise until it is released from its locked position, and operate it with an up-and-down reciprocating motion. After priming the fuel by hand, push the handle in and lock it by turning it clockwise as far as it will go.

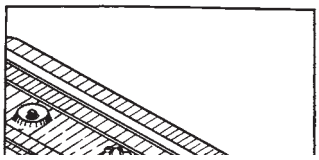


Fig. 15. Auxiliary fuel tank

1 - valve control handle

Coupling Head

The coupling head (Fig. 17) is used to connect the pneumatic system of the truck to the pneumatic system of a trailer or semitrailer.

Air Take-Off Valve

The air take-off valve is installed under the hood on the cab panel. To take off air, unscrew cap 1 (Fig. 18) of the valve and screw the union nut of the hose from the tool kit onto the valve body.

Towing Valve

The towing valve (Fig. 19), installed on the right bracket of the front bumper, is used to supply air to the brake system of the truck when the truck is towed with a faulty engine.

To connect the towing truck to the air line of the truck being towed, unscrew plug 1 of the towing valve. Connect an air hose with a coupling head (from the spares kit) to the supply line of the towing truck (red coupling head) and to the towing valve of the towed truck.

Winch Control Levers

The winch control levers are shown in Fig. 20. Operation of the winch is described in the section "Winch".

Battery Disconnect Switch

The battery disconnect switch (Fig. 21) is located on the bracket of the battery box. If the remote control system fails, the switch can be turned off or on by pressing the button under the rubber cover.

External Start Socket

The external start socket is located on the bracket of the battery box. If necessary, the engine can be started from an external direct-current source using the plug supplied with each truck.

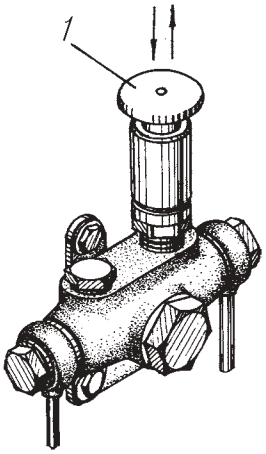


Fig. 16. Hand fuel priming pump

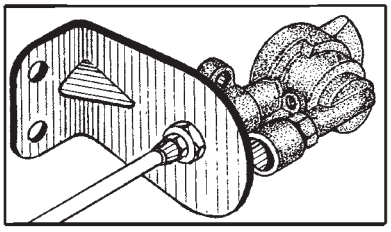


Fig. 17. Coupling head

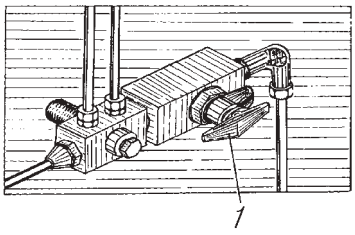


Рис. 18. Клапан отбора

Fig. 21. Battery disconnect switch

1 - plug; 2 - valve; 3 - right side rail

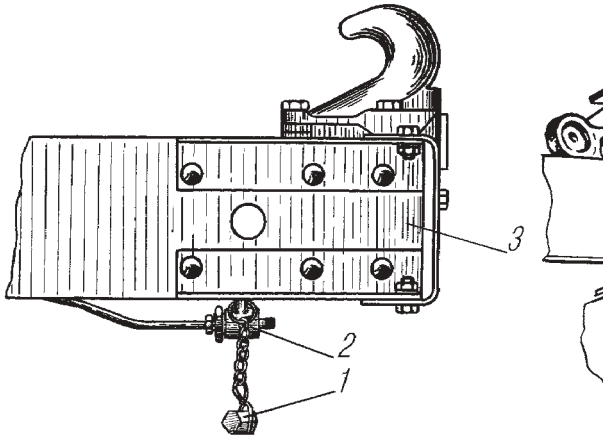


Fig. 19. Towing valve

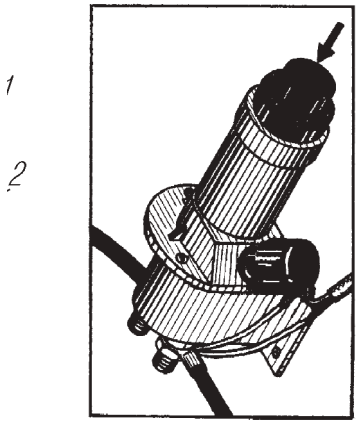


Fig. 20. Winch control levers

1 - control lever; 2 - rod; 3 - engagement lever

Fig. 18. Air take-off valve; coupling

1 - cap; 1 - pump handle

Brief Description of the Design and Operation of the Truck Components, Their Adjustment and Maintenance

Engine

The truck is equipped with an engine made by the Yaroslavl Motor Plant (YaMZ). A description of the engine design, as well as instructions for operation and maintenance, is given in the engine operating instructions of the Yaroslavl Motor Plant supplied with the truck.

Fuel System

Engine Fuel Supply System

Fuel from the main fuel tank 1 (Fig. 22) is drawn in by the fuel transfer pump 8 and passes through the primary fuel filter 22 and the secondary fuel filter 13 to the high-pressure fuel pump 10.

The pump delivers fuel through lines to the injectors, which inject the fuel into the engine cylinders in firing order. Excess fuel, together with any air that has entered the system, is returned to the fuel tank through the orifice valve of the secondary fuel filter via fuel lines 15 and 17. Fuel that has leaked past the precision parts of the injectors is also returned to the fuel tank through lines 6 and 23. The amount of fuel in the main fuel tank is measured by an electric level sender installed in the tank and is shown by the gauge on the instrument panel.

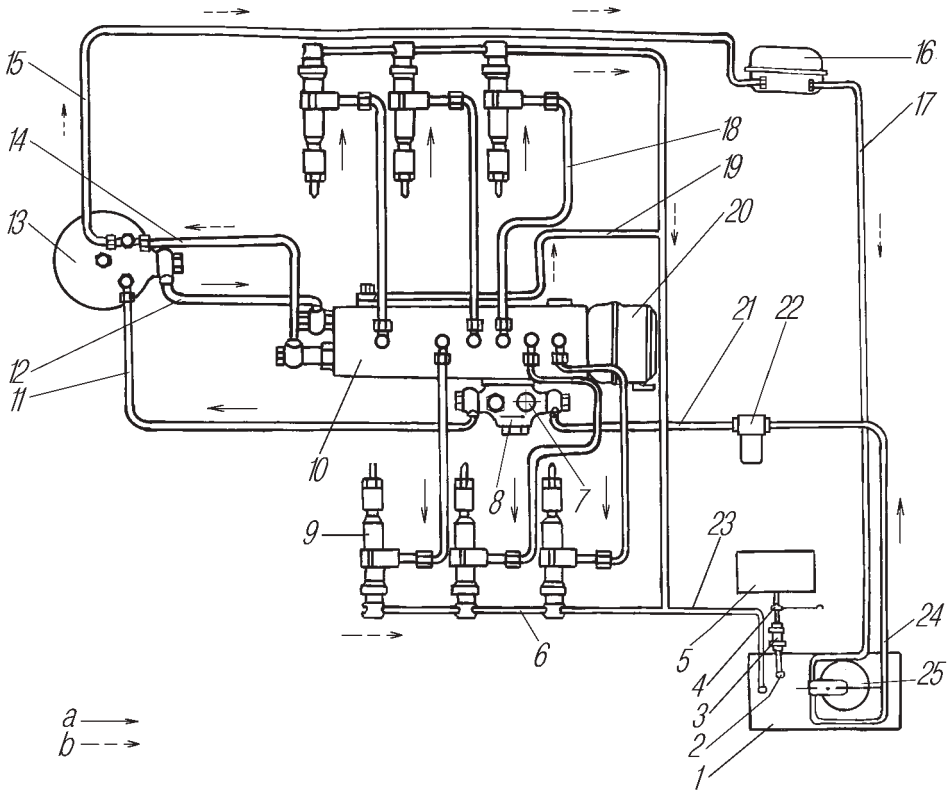


Fig. 22. Fuel system diagram

1 - main fuel tank; 2,6,14,15,17,19,23 - fuel return lines; 3 - fuel drain hose; 4 - fuel drain valve; 5 - auxiliary fuel tank; 7 - hand priming pump; 8 - low-pressure fuel transfer pump; 9 - injector; 10 - high-pressure fuel pump; 11,12,21,24 - low-pressure fuel lines; 13 - secondary fuel filter; 16 - preheater fuel tank; 18 - high-pressure fuel lines; 20 - engine speed governor; 22 - primary fuel filter; 25 - fuel pickup; a - fuel supply; b - fuel return

Fuel Supply Control Linkage

The fuel supply control linkage is mechanical and consists of a pedal, rods, levers, and a mechanism for manual fuel supply and engine stop. With the pedal released, the control lever must rest against the minimum idle speed limit bolt on the governor of the high-pressure fuel pump; this is ensured by adjusting the length of rod 2 (Fig. 23). With the pedal fully depressed, gap "b" must be 2-3 mm at maximum engine speed.

To adjust the manual fuel supply control, move rod 6 until knob 7 stops against the panel and ensure that gap "a" between hand control lever 5 and cable core clamp 4 is within 2-3 mm.

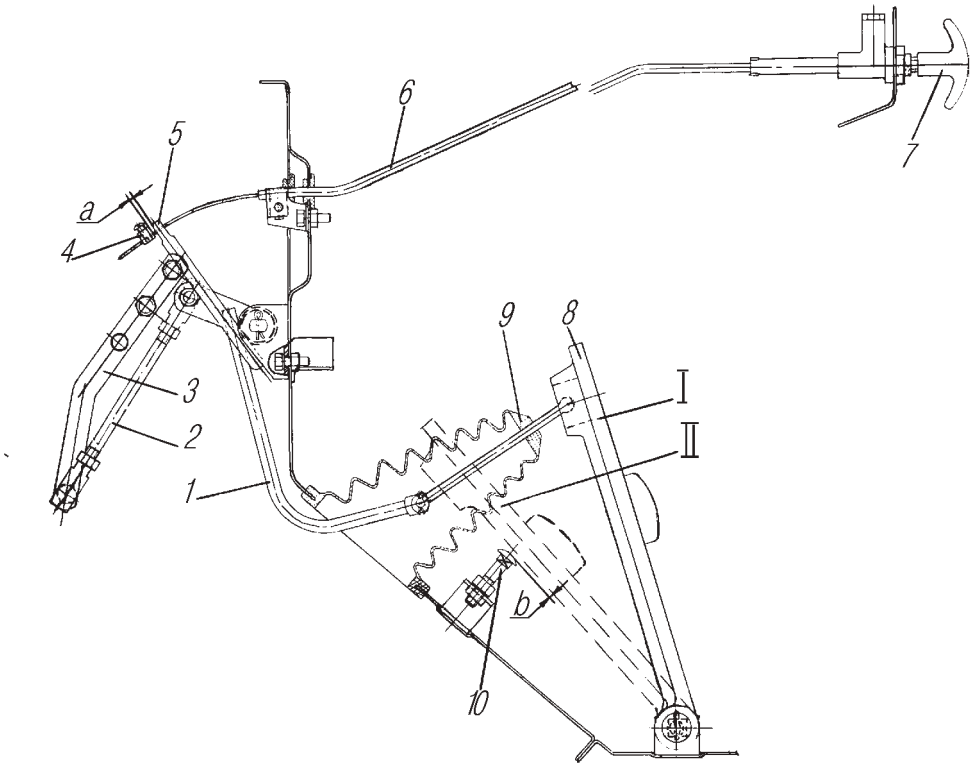


Fig. 23. Fuel supply control linkage

1 - fuel supply control shaft lever; 2 - rod; 3 - fuel supply control lever; 4 - cable core clamp; 5 - hand control lever; 6 - hand control rod; 7 - rod knob; 8 - pedal; 9 - seal; 10 - adjusting bolt; I - pedal position with the engine at minimum idle speed; II - pedal position with the engine at maximum speed at maximum power; a, b - gaps

To stop a running engine, pull knob 4 (Fig. 24) toward you as far as it will go. To adjust the stop control, push knob 4 all the way into the panel and ensure that gap "a" between stop lever 7 and cable clamp 6 is within 2-3 mm.

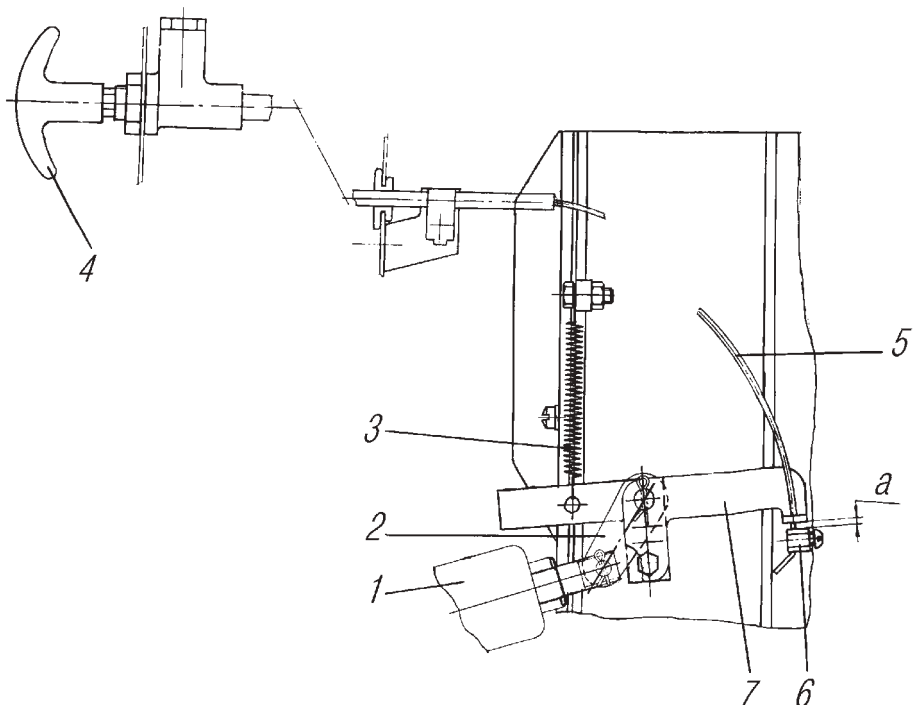


Fig. 24. Manual engine stop control

1 - air cylinder; 2 - air cylinder lever; 3 - stop lever return spring; 4 - rod knob; 5 - stop rod; 6 - cable clamp; 7 - stop lever; a - gap

Engine Air Intake System

The engine air intake system consists of an air cleaner, supply pipes, connecting hoses, and mounting parts. The air cleaner is mounted on the right fender by brackets and clamps. The supply pipes are located on the engine.

An assembly screen with a sealing gasket is installed between the adapter and the connecting pipe of the intake manifolds. After the engine break-in, the screen must be removed, leaving the sealing gasket in place.

Air is supplied to the air cleaner through the air intake pipe. The air entering the cleaner passes through the swirl vane and acquires a rotary motion in the annular gap between the housing and the filter element; under the action of centrifugal force, dust particles are thrown against the housing wall and collect in the dust bin through a slot in the partition. The precleaned air then passes through the filter element, where it is finally cleaned.

To extend the service life of the filter element, a precleaner in the form of a nonwoven fabric sleeve is installed on its outer surface.

The need to service the air cleaner is determined by the reading of the restriction indicator located in the cab. During servicing, the dust is removed from the dust bin, and the precleaner and the filter element are cleaned.

To service the air cleaner, unfasten the four latches and remove the cover, unscrew the filter element retaining nut, and remove the cardboard filter element.

Untie the tape and remove the precleaner. Remove the plastic air swirl vane from the housing. Inspect the filter element. A deposit on the inner side of the element indicates that the element or the sealing gaskets are leaking; in that case, replace the element.

Wash the plastic swirl vane removed from the air cleaner housing in hot water.

If the air cleaner housing needs washing, remove it from the truck, wash it in hot water, and dry it.

Clean the dust from the precleaner by shaking it or by blowing it out with dry compressed air. If, after inspection, the cardboard filter element shows no soot (the element is gray) and has no mechanical damage, blow it out with dry compressed air until all dust is removed.

To avoid tearing the cardboard, the compressed air pressure must not be more than 200-300 kPa (2-3 kgf/cm2). Direct the air jet at an angle to the surface, and regulate the force of the jet by changing the distance of the hose from the element.

If the cardboard has soot or oil on it, or if blowing with compressed air is ineffective, wash the element in warm water (40-50 °C) with a detergent dissolved in it.

Immerse the element in this solution for half an hour, then rotate it vigorously or swish it for 10-15 min. After washing in the solution, rinse the element in clean water and dry it. Do not dry it over an open flame or with air at a temperature above 70 °C.

After each servicing of the element, or when installing a new one, check its condition visually by lighting it with a lamp.

If there is mechanical damage, torn pleats, or delamination of the cardboard, replace the element.

When assembling the air cleaner, check the quality of the seal by the continuous imprint on the gasket.

The approximate service life of the filter element is 30,000 km. Excessively frequent cleaning of the filter element shortens its service life, because the total number of servicings of the element is limited (5-7 times, of which washing no more than three times) due to possible breakdown of the cardboard.

After servicing the air cleaner, set the indicator drum to the working position.

Engine Preheater System

The engine preheater system is intended to warm up the engine at subzero ambient air temperatures.

Technical specifications of the preheater

The engine preheater system includes:

— boiler 12 (Fig. 25), located on the first crossmember of the truck frame;

— pump unit 17 (electric motor, fan, coolant pump, and fuel pump), located on the right side rail of the truck frame;

— fuel tank 4 with valve 5;

— high-voltage source;

— spark plug 7 installed on the boiler;

— preheater control panel, consisting of switches for the fuel electric heater, the spark plug, the pump unit, and the solenoid valve. The panel is located on the left side of the cooling system radiator;

— lines;

— exhaust gas duct 9;

— oil pan shroud 8 (may not be installed on some truck modifications).

The removable burner is attached to the boiler with bolts. Spark plug 7, solenoid valve 11 complete with the injector, and fuel electric heater 10 are installed on the burner.

The solenoid valve turns the fuel supply to the burner on or off. The injector, installed in the solenoid valve body, provides the fuel atomization required for combustion.

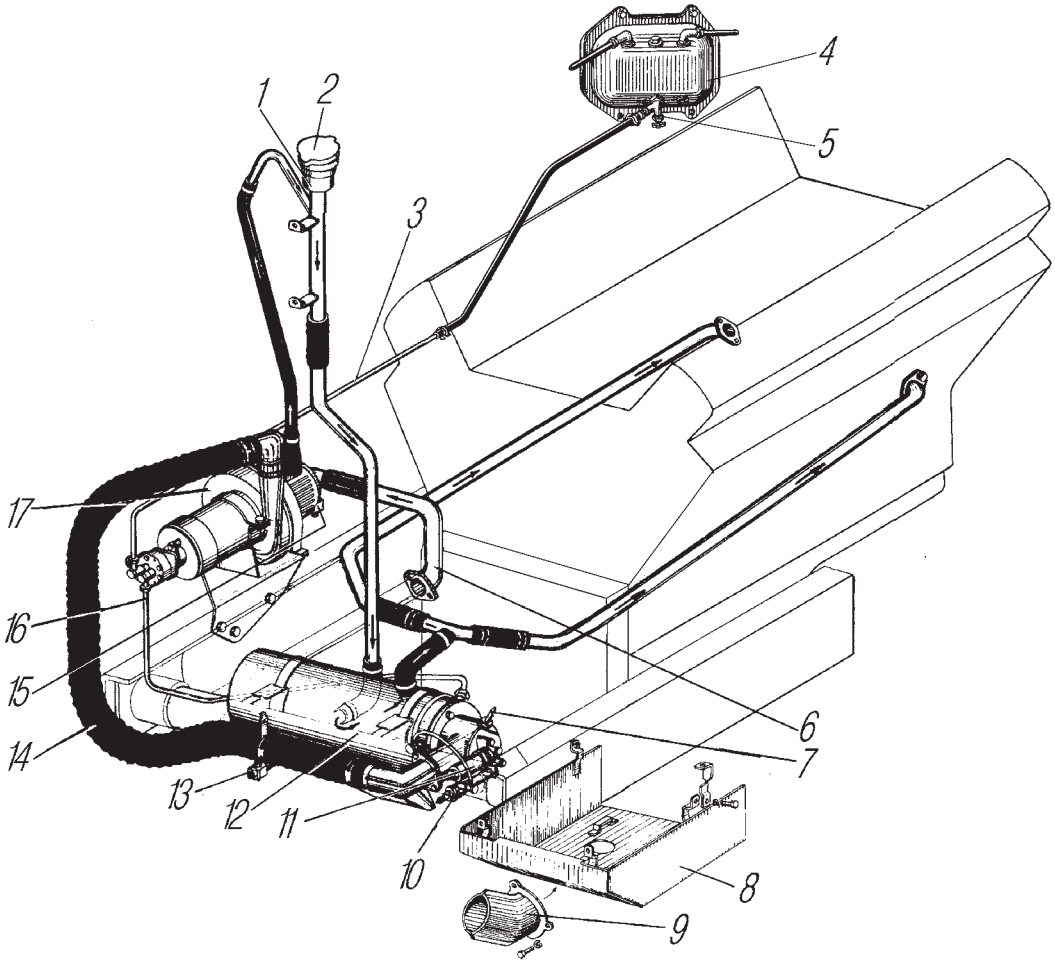


Fig. 25. Engine preheater system

1 - filler neck; 2 - filler neck cap; 3 - fuel line from the preheater tank to the pump unit; 4 - fuel tank; 5 - straight-through valve; 6 - inlet pipe from the water pump; 7 - spark plug; 8 - oil pan shroud; 9 - exhaust gas duct; 10 - fuel electric heater; 11 - solenoid valve; 12 - preheater boiler; 13,15 - drain valves; 14 - electric fan air duct hose; 16 - fuel line from the pump unit to the boiler; 17 - pump unit

The electric heater heats a portion of fuel before the preheater is started. The electric spark ignition system ensures ignition of the fuel-air mixture during starting.

The fuel tank holds the fuel reserve required for the preheater to operate. It is connected by fuel lines to the engine fuel system and is always full of fuel while the engine is running. If necessary, it can be filled with the hand priming pump of the engine.

The preheater operates as follows. The fuel pump draws fuel from the preheater tank and, under pressure, with the solenoid valve open, injects it through the injector into the burner, where the atomized fuel mixes with air, ignites, and burns, heating the coolant in the boiler. Driven by the pump, the coolant circulates through the lines and the cylinder block in the direction shown by the arrows in Fig. 25.

The combustion products are directed through the exhaust gas duct of the boiler under the engine oil pan and heat the oil in it. The fuel is filtered as it passes through the filters in the solenoid valve and the injector.

Preheater Maintenance

> **WARNING: Remember that violation of the operating rules, as well as operation with a faulty preheater, can cause a fire.**

Make sure there is no leakage of coolant or fuel at the connections of pipes, hoses, and valves, and check the tightness of the clamps on the preheater pipes and lines.

> **CAUTION: Do not pour water into an overheated preheater boiler (overheated because of a lack of coolant), to avoid damaging it. Allow the preheater boiler to cool before filling it with water.**

After washing the truck or fording a stream, remove any water that has entered the preheater air passage by running the pump unit for 2-3 min.

Keep the preheater fuel pump correctly adjusted. When preparing the truck for winter operation:

- unscrew the shipping plug from the drain hole on the lower end of the fuel pump. When switching to summer operation, install the plug back in place;
- open the valve of the preheater fuel tank and leave it open for the entire winter operation period. When switching to summer operation, close the fuel valve;
- check the mounting of the boiler and pump unit and clean all components of dirt. Check the condition of the wires and the mounting of the preheater control panel. Clean the boiler flue and combustion chamber: for this, disconnect the air supply hose and blow out the boiler, the combustion chamber, and the flue with compressed air. Clear the drain tube of the preheater boiler burner to prevent fuel from accumulating;
- remove carbon deposits from the electrode and insulator of the spark plug. Disassemble the injector and its fuel filter, and also the fuel filter of the solenoid valve, and wash them in kerosene or acetone;
- check that the preheater fuel pump is correctly adjusted. The optimal fuel delivery to the combustion chamber in service is determined by stable preheater operation without flame being ejected from the boiler.

Adjust the fuel consumption with the pressure reducing valve of the fuel pump (Fig. 26). To change the amount of fuel supplied through the injector to the preheater, unscrew cap nut 7 on the fuel pump, unlock adjusting screw 6, and turn it to the right to increase the amount of fuel or to the left to decrease the fuel supply.

Operation of the preheater with an open flame at the exhaust is not permitted. After the adjustment is complete, lock the adjusting screw with locknut 5 and screw on cap nut 7.

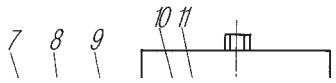


Fig. 26. Pressure reducing valve of the fuel pump

1 - fuel line bolt; 2 - swivel elbow; 3,8,9,13 - sealing rings; 4 - fitting; 5,7 - nuts; 6 - adjusting screw; 10 - spring; 11 - ball; 12 - fuel pump housing; 14 - spacer; 15 - fuel pump cover

Exhaust System

The exhaust system is intended to remove exhaust gases and reduce exhaust noise. Installation and operational displacements of the inlet pipes relative to the muffler are absorbed by expansion joints 3 (Fig. 27). Reliable operation of the expansion joints is ensured by positioning their axes in one plane. This is achieved by turning muffler 4.

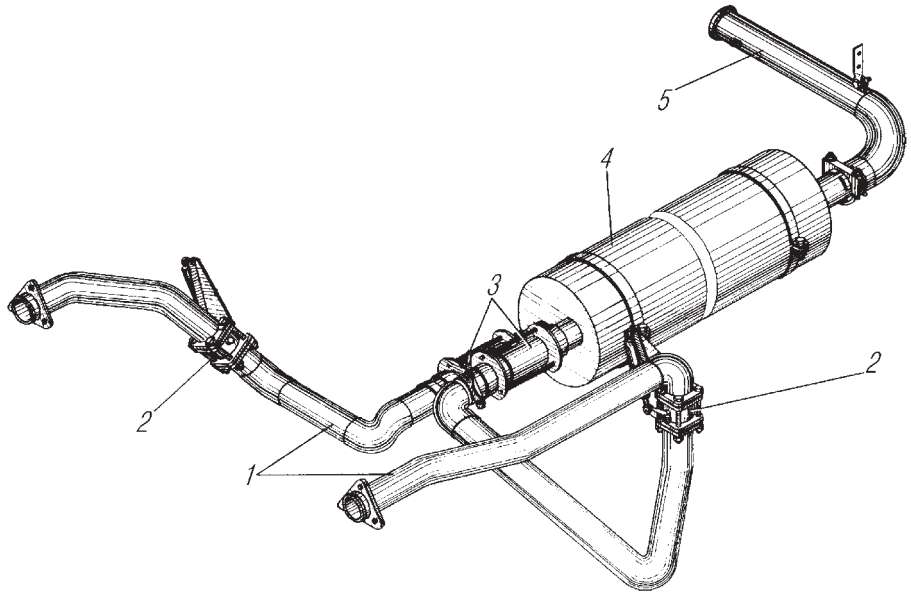


Fig. 27. Exhaust system

1 - exhaust inlet pipes; 2 - auxiliary brake (exhaust brake); 3 - expansion joints; 4 - muffler; 5 - exhaust pipe

Cooling System

The engine cooling system is liquid-type, closed, with forced circulation of the coolant, and is designed for use with antifreeze coolants (Fig. 28).

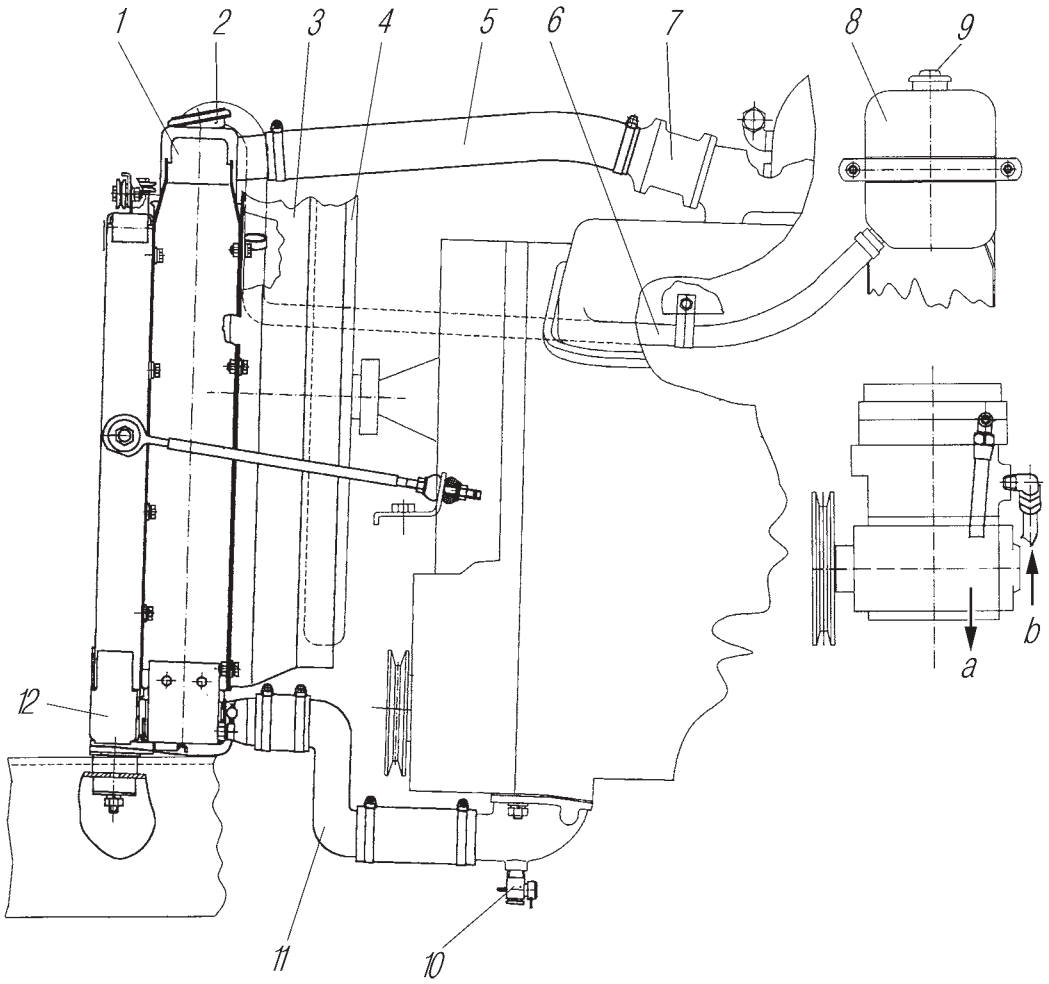


Fig. 28. Cooling system diagram

1 - radiator; 2 - filler neck with radiator cap; 3 - shroud; 4 - fan; 5 - coolant outlet hose; 6 - bypass hose to the expansion tank; 7 - thermostat housing; 8 - expansion tank; 9 - expansion tank cap; 10 - drain cock; 11 - coolant inlet pipe; 12 - shutter frame with shutter; a - coolant return from the compressor; b - coolant supply to the compressor

At ambient air temperatures down to minus 40 °C, use OZh-40 "Lena" coolant or TOSOL-A40M coolant. At 20 °C, the density of OZh-40 "Lena" coolant must be 1.075-1.085 g/cm3, and that of TOSOL-A40M, 1.078-1.085 g/cm3.

At air temperatures of minus 40 °C and below, use OZh-65 "Lena" coolant or TOSOL-A65M coolant. At 20 °C, the density of OZh-65 "Lena" coolant must be 1.085-1.100 g/cm3, and that of TOSOL-A65M, 1.085-1.095 g/cm3.

Water may be used in case of sudden loss of coolant. At the first opportunity, drain the water and fill the system with antifreeze coolant.

The coolant temperature in the cooling system must be within 75-100 °C.

Tube-and-Fin Radiator

The tube-and-fin radiator is four-row. A sealed cap with two valves is installed on the filler neck of the radiator top tank. The pressure relief valve opens at an excess pressure in the system of 65 kPa (0.65 kgf/cm2) and releases excess coolant and vapor into the expansion tank; the vacuum (intake) valve opens at a vacuum of 1-1.2 kPa (0.01-0.012 kgf/cm2) and admits coolant from the tank into the radiator.

Expansion Tank

The expansion tank is made of plastic and is located on a bracket on the right side panel of the hood of the truck. It is connected by a pipe to the filler neck of the radiator top tank. The expansion tank compensates for the change in coolant volume as the coolant expands when heated.

Coolant Temperature Monitoring

The coolant temperature in the cooling system is monitored by a gauge installed on the instrument panel. The gauge sender is installed in the water collector pipe.

When the temperature in the cooling system rises to 98 °C, the coolant overheat indicator light comes on. This signal warns that the cause of the engine overheating must be found and eliminated.

With the indicator light on, in special cases it is possible to continue driving while carefully watching the coolant temperature gauge. A short-term rise in temperature to 105 °C, lasting not more than 120 min, is permitted.

Adjust the tension of the water pump drive belts in the following sequence:

— drain the water from the cooling system;

— disconnect the coolant inlet pipe from the water pump;

— unscrew the nuts securing the pulley side plate, turning the pulley. Remove one or two adjusting shims (Fig. 29). Place the shims on the outer side of the side plate and tighten the nuts one after another, turning the pulley after tightening each nut.

Fig. 29. Removing the adjusting shims

Then check that the belt tension is correct. When replacing an old belt with a new one, place all the shims between the hub and the removable pulley side plate and adjust the belt tension as described above.

Checking the Antifreeze Coolant Level

Check the coolant level on a cold engine, because the volume of the coolant changes at different temperatures (see the lubricants and operating fluids chart).

Fill the cooling system of a cold engine with coolant through the radiator filler neck. When filling the system, the cap of the preheater filler pipe and the cab heater valve must be open. Before checking the fluid level, run the engine for 1-2 min to remove air from the system. After stopping the engine, top up the coolant if necessary.

During the initial fill, pour 23 g of NIISS-1 sealing powder (TU 38.10270-78) into the radiator neck.

After disassembling any joint of the cooling system, add the powder as necessary.

Check the water level in the cooling system on a cold engine. Fill the cooling system with water through the radiator filler neck with the caps of the preheater filler pipe and the cab heater valve open. At temperatures below 0 °C, open the cab heater valve only after the engine has warmed up, and add water to the radiator up to the upper edge of the radiator neck. In cold weather, disconnect the connecting hose from the expansion tank and direct it downward, securing the clamp under the fan shroud mounting bolt. In warm weather, do not disconnect the hose from the tank.

To drain the coolant from the cooling system, park the truck on a level surface or on a forward incline and open the three valves located on the preheater boiler, on the preheater pump unit, and on the coolant inlet pipe of the water pump (on the right side in the direction of travel).

The radiator filler neck cap and the preheater filler pipe cap must be open during this.

The volume of coolant that cannot be drained, with the cab heater valve open, is approximately 2 L.

If water has been used in the cooling system, do the following when draining it:

— after draining the water from the cooling system and the engine preheater, run the pump unit for 10-15 s to remove the water from the pump, to avoid freezing of the impeller; close all three drain valves after the water has drained completely;

— after draining the water from the cooling system, do not close the radiator neck and the preheater filler pipe with the caps, because they may freeze in place.

> **CAUTION: Do not start the engine after draining the coolant in order to remove coolant residues from the system; this can destroy the rubber sealing rings of the cylinder liners, cause the valve seats to fall out, and burn and warp the cylinder heads.**

Powertrain Mounting

The powertrain is mounted on four flexible mounts: front, rear, and two middle ones, left and right.

The front and middle mounts are load-bearing. The rear mount is a supporting one and is installed in the unloaded position using adjusting plates 9 (Fig. 30). At the front and rear mounts, the powertrain rests on beams 3 and 11; at the middle mounts, on brackets fastened to the truck frame.

Brackets 2, 7, and 12 serve as the powertrain supports. Front mount bracket 12 is attached to the front cover of the engine block, middle mount brackets 2 to the flywheel housing, and rear mount bracket 7 to the rear end of the gearbox.

Middle mount cushions 1, left and right, are interchangeable with each other. Cushions 4 and shock absorbers 5 of the front and rear mounts are also interchangeable.

To install the rear mount in the unloaded position, maintain a clearance of 0-1 mm between cushion 4 and rear mount bracket 7. To do this, perform the adjustment in the following sequence:

1. Unscrew nuts 8 and remove bolts 10.

2. Remove adjusting shims 9.

3. Measure the clearance between bracket 7 and cushion 4. A clearance of more than 1 mm must be eliminated by installing adjusting shims 9.

4. Install bolts 10 and tighten nuts 8.

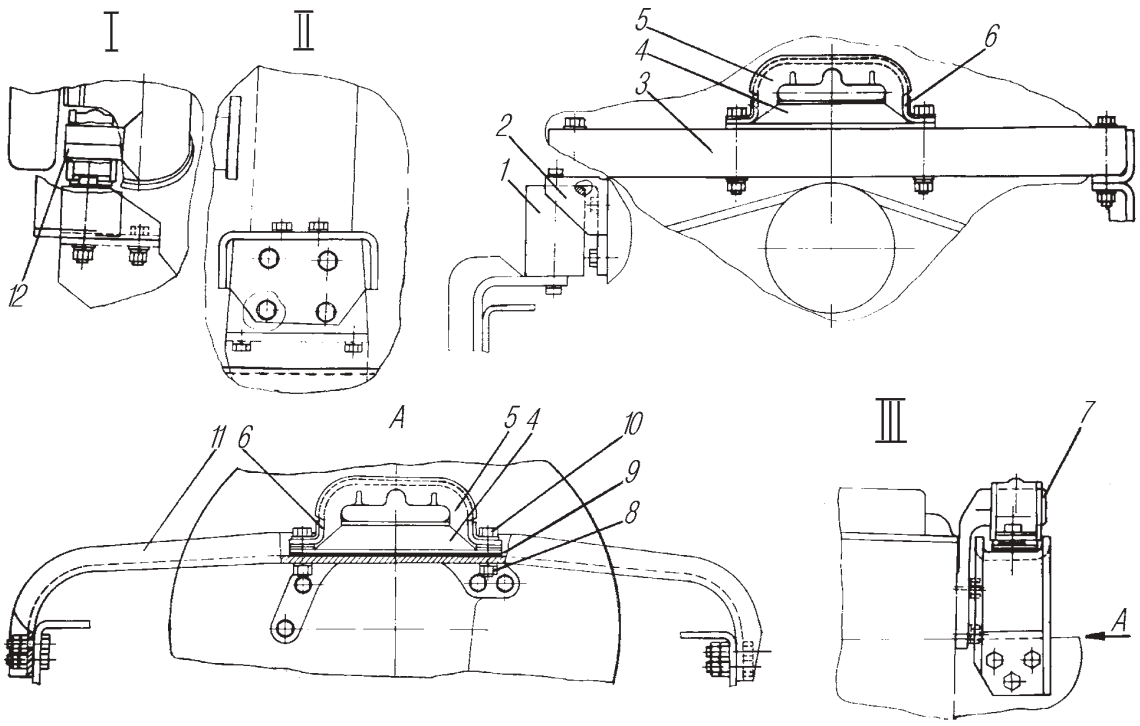


Fig. 30. Powertrain mounting

1 - middle mount cushion; 2 - middle mount bracket; 3 - front mount beam; 4 - front and rear mount cushion; 5 - front and rear mount shock absorber; 6 - front and rear mount strap; 7 - rear mount bracket; 8 - nut; 9 - adjusting plates; 10 - bolt; 11 - rear mount beam; 12 - front mount bracket; I - front mount; II - middle mounts; III - rear mount

Drivetrain

A description of the design of the clutch and gearbox, as well as instructions for operation and maintenance, is given in the operating instructions of the Yaroslavl Motor Plant.

Clutch Release Control

The clutch release linkage is mechanical, with a pneumatic booster. Air cylinder 20 (Fig. 31) of the booster is installed on the gearbox housing and acts on lever 18 of the clutch release fork shaft. The cylinder is controlled by air valve 1, which is mounted on rod 4. Hose 8 connects valve 1 to the pneumatic system of the truck.

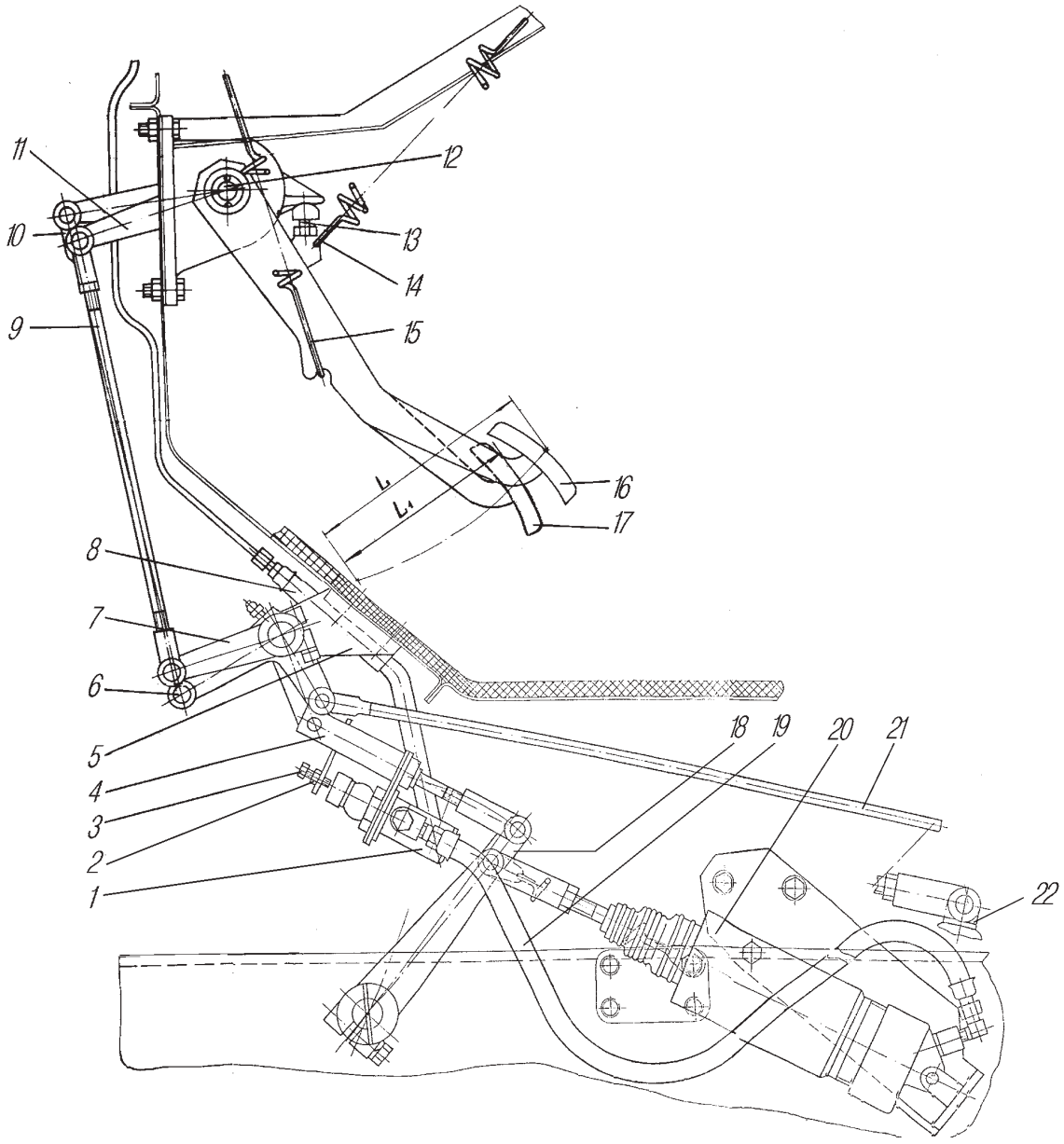


Fig. 31. Clutch and brake valve control linkage

1 - air valve; 2 - locknut; 3 - adjusting bolt; 4 - rod with compensator; 5 - bracket; 6,22 - brake valve levers; 7 - clutch linkage lever; 8,19 - hoses; 9 - clutch pedal rod; 10 - brake pedal rod; 11 - clutch pedal shaft lever; 12 - clutch pedal shaft; 13 - clutch pedal travel stop; 14 - brake pedal return spring; 15 - clutch pedal spring; 16 - clutch pedal; 17 - brake pedal; 18 - clutch release fork shaft lever; 20 - air cylinder; 21 - brake valve rod; L - full travel of the clutch pedal; L1 - full travel of the brake pedal

When clutch pedal 16 is pressed, the force is transmitted through lever 11 and the parts of rod 9 to the stem of air valve 1, opening its valve. Air pressure from the pneumatic system of the truck passes through hose 19 into cylinder 20, which additionally acts on lever 18.

To adjust the point at which the air valve engages when there is air in the pneumatic system of the truck:

— disconnect hose 19 from valve 1;

— unscrew adjusting bolt 3 to create a clearance between the bolt and the valve stem;

— press clutch pedal 16 until the effort increases significantly;
— screw in bolt 3 until the air valve opens (air escapes from the control line of valve 1);
— turn adjusting bolt 3 a further 0.5-1.0 turn and lock it with locknut 2.

Adjusting the Full Travel and Free Play of the Clutch Pedal

The full travel of the clutch pedal is 195-220 mm. It is adjusted with the adjusting bolt of clutch pedal travel stop 13 and is done only when the air pressure in the pneumatic system of the truck is at least 0.6 MPa (6 kgf/cm2). The free play of the clutch pedal must be within 50-60 mm.

The amount of clutch pedal free play is determined with no air pressure in the pneumatic system of the truck by pressing the pedal by hand; the start of clutch disengagement is felt as a significant increase in effort.

Adjust the pedal free play by changing the length of rod 9. To do this:

— disconnect rod 9 from lever 11;
— loosen the locknut of the rod clevis and unscrew the clevis to increase the free play, or screw it in to decrease it;
— connect the rod to the lever and tighten the clevis locknut, keeping a thread engagement length of not less than the thread diameter;
— check the pedal free play. If the rod thread has been used up completely, move lever 18 one spline counter-clockwise and additionally adjust rod 4.

Transfer Case

The transfer case (Fig. 32) is mechanical, two-range, with an asymmetric interaxle differential, and is mounted on the truck frame on four rubber cushions.

The differential is of the planetary type, with four planet gears, sun gear 30, and crown gear 29. Torque from sun gear 30 is transmitted to front axle drive shaft 35, and from crown gear 29 to rear axle drive shaft 21.

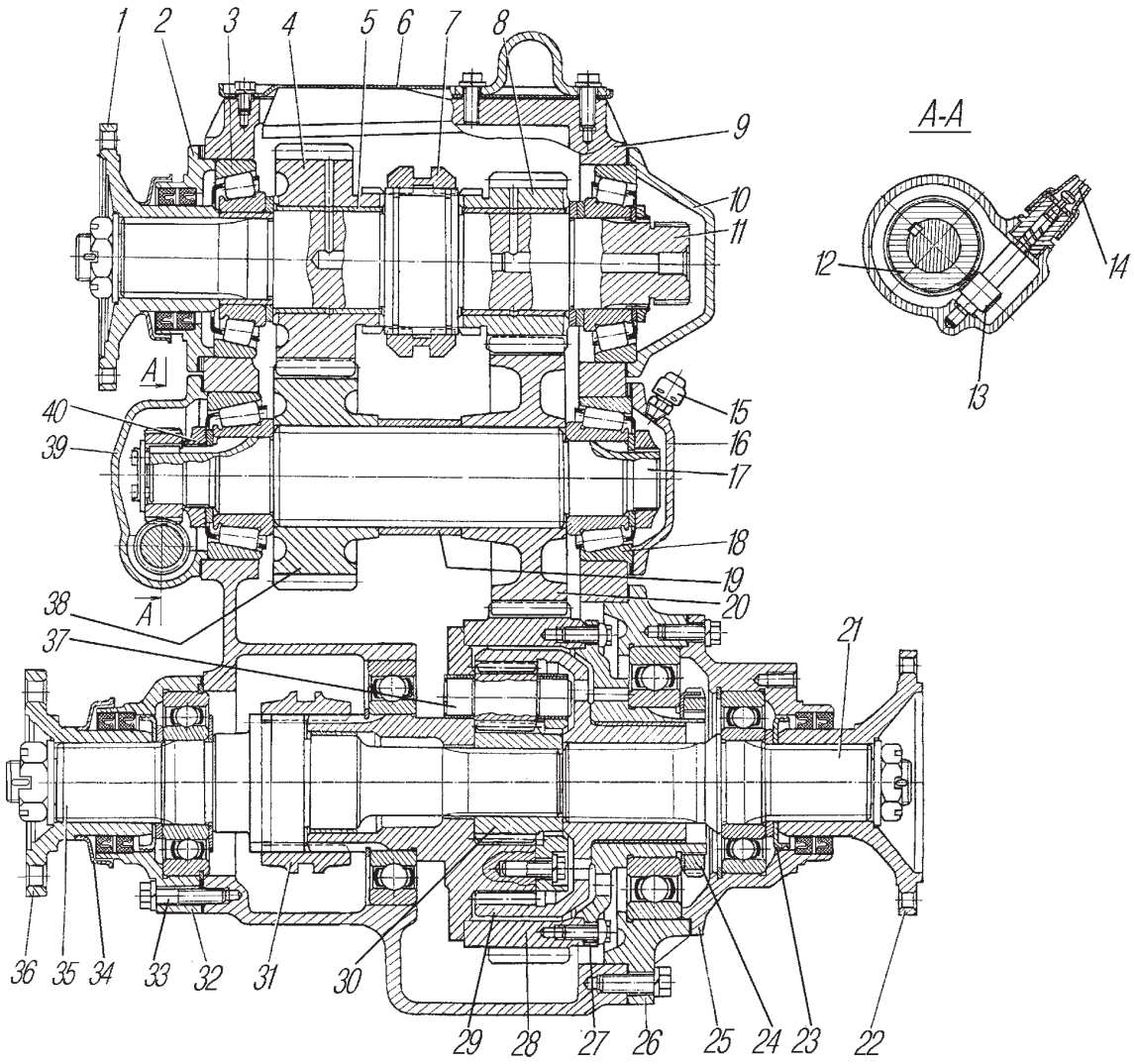


Fig. 32. Transfer case

1,22,36 - flanges; 2,10,16,25,32,39 - bearing covers; 3,18 - tapered roller bearings; 4,38 - high-range gears; 5 - bushing; 6 - top hatch cover; 7 - gear shift coupling; 8,20 - low-range gears; 9 - transfer case housing; 11 - input shaft; 12,13 - speedometer drive gears (drive and driven); 14 - speedometer drive flexible shaft; 15 - breather; 17 - intermediate shaft; 19 - spacer bushing; 21 - rear axle drive shaft; 23 - oil slinger ring; 24,40 - bearing nuts; 26 - differential rear bearing housing; 27 - differential rear carrier; 28 - differential carrier with lower shaft gear; 29 - crown gear; 30 - sun gear; 31 - differential lock coupling; 33 - bolt; 34 - flange deflector; 35 - front axle drive shaft; 37 - planet gear

When the differential is operating (unlocked), the traction is distributed evenly among all axles and additional loads in the drivetrain are eliminated. Depending on road conditions, the differential can be switched off (locked), in which case the front and rear axle drive shafts rotate as one unit.

Oil slinger rings 23 are installed on the front and rear axle drive shafts. Helical grooves are cut on the outer surfaces of the oil slinger rings; they direct oil from the lip seals back into the housing as the shafts rotate. The helical groove is cut in different directions: left-hand for the front axle drive shaft and right-hand for the rear axle drive shaft. According to their purpose, the letters "П" (front) and "З" (rear) are stamped on the oil slinger rings.

When assembling the transfer case, make sure the oil slinger rings are installed correctly; otherwise, oil leakage through the lip seals is unavoidable.

The transfer cases of URAL-43202-0351-31 and URAL-4320-0911-30 trucks and of URAL-4420-10, URAL-4420-31, URAL-44202-0311-31, and URAL-44202-0612-30 tractor trucks differ from the transfer case of URAL-4320-10 and URAL-4320-31 trucks in the speedometer drive gears.

The transfer case on which the reinforced auxiliary power take-off (auxiliary PTO) is installed has an extended input shaft and a housing modified in the area where the auxiliary power take-off is attached.

The parameters of the speedometer drive gears depend on the gear ratio of the main drive of the drive axle and on the size of the tires installed on the truck. This dependence, as well as the distinguishing features of the gears, is given in Table 1.

Adjusting the Transfer Case and Its Control Linkage

The tapered bearings are adjusted by changing the number of shims under the covers, with the transfer case removed from the truck. Before adjusting the bearings, position the case so that the top hatch is horizontal, and remove its cover. The axial movement of the input and intermediate shafts must be 0.03-0.08 mm; check the axial movement of the shafts with a dial indicator.

To adjust the input shaft bearings:

— check the tightness of the flange retaining nut and, if necessary (tightening torque less than 200 N*m (20 kgf*m)), tighten it;

— install the indicator stand on the flat surface of the housing hatch so that its stem rests against the end of the spline of the middle part of the input shaft;

— using a mounting bar as a lever, move the input shaft through the gear until the indicator needle stops completely, smoothly reduce the axial force applied at a lever length of 0.5 m to 2-5 N (0.2-0.5 kgf), and record the indicator reading;

— applying axial force in the opposite direction, record the second indicator reading in the same way.

The total movement of the indicator stem must be 0.03-0.08 mm; if it is greater, remove adjusting shims from under the front bearing cover.

Table 1. Dependence of the speedometer drive gear parameters on the gear ratio of the main drive and the tire sizes

To adjust the intermediate shaft bearings:

— remove the rear bearing cover of the intermediate shaft;

— unlock and tighten the intermediate shaft bearing retaining nut, clamping the gear spacer bushing tightly;

— lock the nut and install the cover;

— check the axial movement of the intermediate shaft in the same way as for the input shaft, resting the indicator stem against the end of one of the gears; the total movement of the indicator stem must be 0.03-0.08 mm;

— adjust the bearings by removing adjusting shims from under the rear cover of the intermediate shaft.

To avoid measurement errors, check the axial movement of the shafts two or three times before and after adjustment, first turning the shafts.

Check and, if necessary, adjust the position of the differential lock coupling and the gear shift coupling. Adjust the position of differential lock coupling 31 (see Fig. 32) by turning the rod. When checking the coupling position, set the rod in the front fixed position and turn the front axle drive shaft by the flange. If the coupling does not touch the splined end face of the front differential carrier, it is positioned correctly. If the coupling touches the carrier, move it forward by turning the rod clockwise.

Adjust the position of gear shift coupling 7 by selecting the thickness of adjusting shim pack 11 (Fig. 33). The coupling position is considered normal if, with the shift fork rod in the fixed neutral position, the difference in free spline length of the middle part of the input shaft on both sides of the carriage does not exceed 1 mm.

—

Fig. 33. Transfer case control linkage

1 - differential lock lever; 2 - gear shift lever; 3 - pressure spring; 4 - lever shaft; 5,6 - rods; 7,8 - drivers; 9 - bracket; 10 - gear shift fork rod; 11 - adjusting shims; 12 - transfer case differential lock fork rod; I - differential unlocked; II - differential locked; A - front lever position (high range engaged); B - middle lever position (neutral); C - rear lever position (low range engaged)

Transfer Case Control Linkage

Adjust the transfer case control linkage by changing the length of rods 5 and 6 with the adjusting clevises so that, with the rod in the middle position, corresponding to the neutral position of the gear shift coupling, lever 2 is in the middle of the slot in the cab floor. With the high range engaged and the differential unlocked, levers 1

and 2 must be in the same plane. After adjustment, check that the gears shift easily, secure the pins with cotter pins, and tighten the clevis locknuts.

Driveshafts

Torque is transmitted from the gearbox to the transfer case and to the drive axles of the truck by drive shafts (Fig. 34). The drive shafts are of the open type, with combined sealing (Fig. 35) of the needle bearings in the joints.

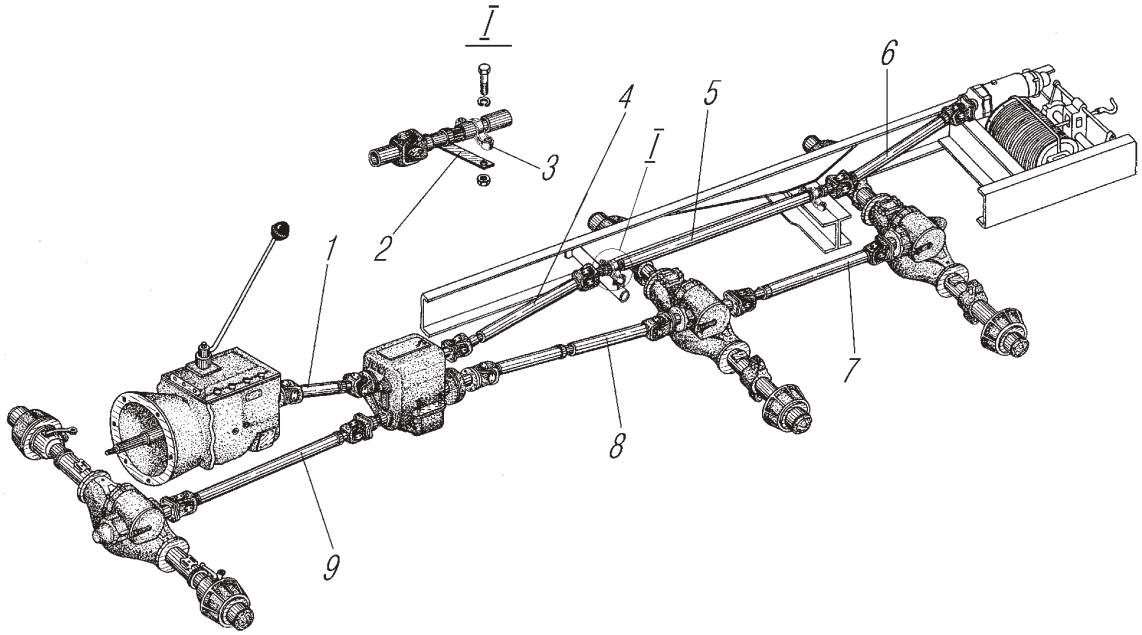


Fig. 34. Layout of the drive shafts of the drivetrain and the winch drive of URAL-4320-10, URAL-4320-31 trucks

1 - intermediate drive shaft; 2 - support plate; 3 - intermediate support; 4, 5, 6 - winch drive shafts; 7, 8, 9 - axle drive shafts

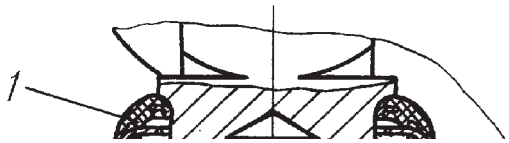


Fig. 35. Combination needle bearing seal

1 - end face seal; 2 - balancing plate; 3 - cover; 4 - spider; 5 - lock plate; 6 - needle bearing

The drive shafts of the front and rear axle drives are identical in design but differ in length and in the dimension on the attached flange from the axis of the bearing bores to the mating surface. The design of the intermediate shaft is shown in Fig. 36.

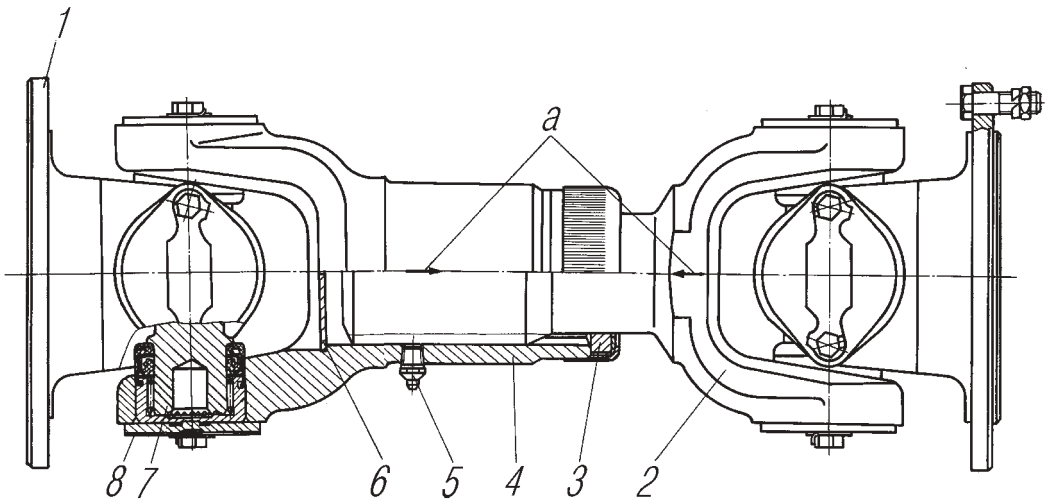


Fig. 36. Intermediate drive shaft

1 - flange; 2 - intermediate drive shaft; 3 - sealing ring; 4 - slip yoke; 5 - grease fitting; 6 - plug; 7 - spider; 8 - balancing plate; a - alignment arrows

When operating the truck:

— Regularly check the mounting of the drive shaft flanges;

— If the radial clearance (more than 0.25 mm) or the axial (end) clearance (more than 0.35 mm) in the spider bearings is excessive, disassemble the joints and, if necessary, replace the spider bearings.

During disassembly, take care not to damage the seals; replace damaged seals.

Before assembling the joints, pack grease into the cavity between the working lips of the end face seal. After assembly, the spiders must turn smoothly in the bearings, without binding.

Periodically check the clearance of the splined joint. If the clearance exceeds 1.2 mm (front and rear axle drive shafts) or 0.55 mm (intermediate shaft and middle axle drive shaft), replace the shafts.

When assembling a drive shaft, make sure that the arrows stamped on the tubular shaft and on the slip yoke face each other, and that the flanges, yokes, and balancing plates 8 are installed in the position they occupied before disassembly. To meet these conditions, mark the parts of the drive shaft before disassembling it.

After replacing the flanges, weld-on yokes, or slip yokes, the drive shafts must be dynamically balanced again. Imbalance causes shaft vibration, which has an adverse effect on the operation of the drivetrain.

Before installing on the truck, coat the mating surfaces of the flanges with sealing paste.

The driveshafts of trucks and special chassis with an extended wheelbase differ from the driveshafts of URAL-4320-10, URAL-4320-31 trucks in a modified middle axle drive, which consists of an intermediate drive shaft 2 (Fig. 37), an intermediate support 3, and a middle axle drive shaft 4 of increased length.

Maintenance of the drive shafts is the same as that adopted for URAL-4320-10, URAL-4320-31 trucks.

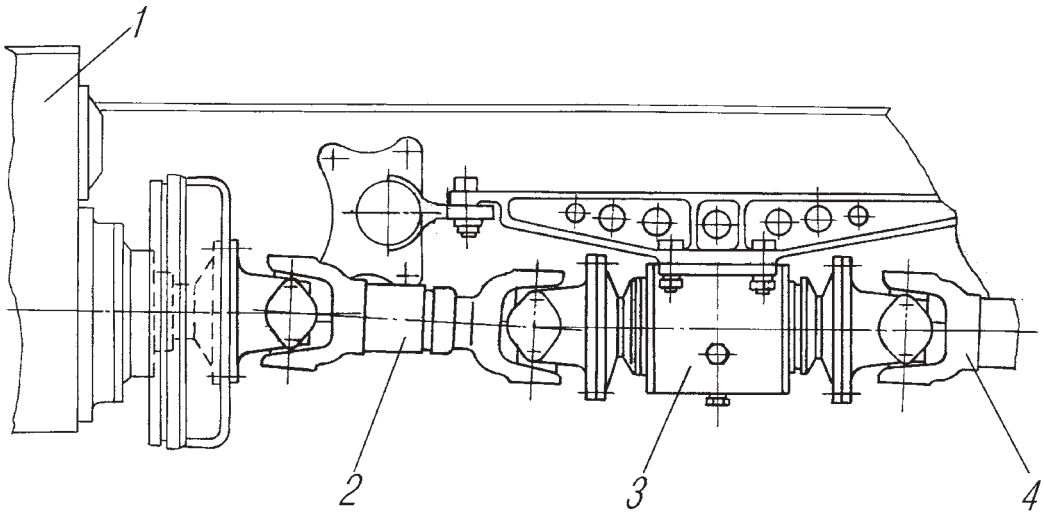


Fig. 37. Driveshafts of trucks and special chassis with an extended wheelbase

1 - transfer case; 2 - intermediate drive shaft; 3 - intermediate support; 4 - middle axle drive shaft

Pour oil into the intermediate support through check hole 8 (Fig. 38) until it reaches the level of the check hole.

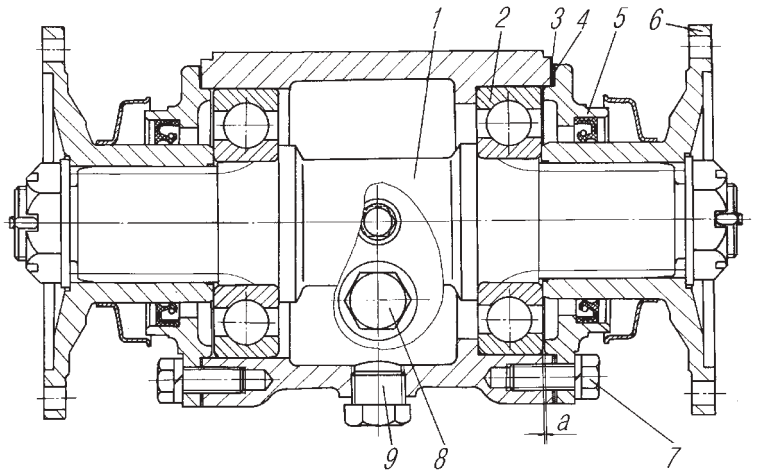


Fig. 38. Intermediate support

1 - intermediate support shaft; 2 - intermediate support bearing; 3 - adjusting shims; 4 - sealing gaskets (2 pcs, one on each side of the adjusting shim pack); 5 - bearing cover; 6 - flange; 7 - cover mounting bolt; 8 - check hole plug; 9 - drain plug; a - axial clearance

The oils used, as well as the intervals for checking the level and changing the oil, are the same as those specified for the transfer case of URAL-4320-10, URAL-4320-31 trucks.

When changing the oil, check the axial movement of shaft 1 as follows:

— Disconnect the drive shafts from flanges 6 of the intermediate support;

— Move shaft 1 of the intermediate support along its axis and measure the maximum amount of its movement relative to the housing of the intermediate support.

If the movement exceeds 0.8 mm, replace the bearings of the intermediate support.

To adjust the axial clearance "a" after replacing bearings 2 of the intermediate support, proceed as follows:

— Assemble the intermediate support without installing the adjusting shim pack 3 (both sealing gaskets 4 must be installed); screw in cover mounting bolts 7 of cover 5 until they stop, but do not tighten them;

— Measure the gap between sealing gaskets 4;

— Assemble the intermediate support, installing the adjusting shim pack 3 with a thickness 0.3-0.4 mm greater than the gap between sealing gaskets 4.

Fill the assembled and adjusted intermediate support with oil in accordance with the lubricants and operating fluids chart.

During operation of the truck, monitor the intermediate support for leaks. Oil leakage from under the oil seals, sealing gaskets, and threaded joints is not allowed.

Drive Axles

The drive axles of the truck are of the through-drive type, with the main drive mounted at the top.

Main Drive

The main drive of the axle is a double-reduction type. It consists of a pair of bevel gears 1 and 14 (Fig. 39) with spiral teeth and a pair of cylindrical gears 4 and 32 with helical teeth. A symmetrical bevel differential with four differential pinions is bolted to the driven cylindrical gear.

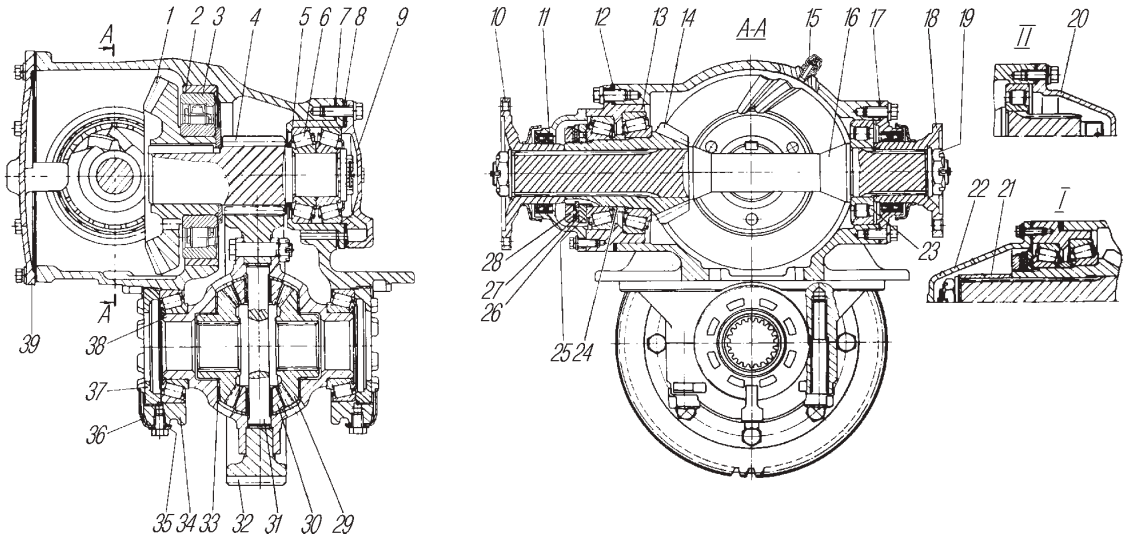
Depending on the technical requirements for the truck, the main drives have ratios of 7.32, 6.7, 8.9, and 8.05.

To distinguish the main drives from one another, they are marked with plates showing the ratio, installed under the mounting bolt of the bearing carrier cover of the drive cylindrical gear. Main drives with a ratio of 8.9 have no marking plates. The gears of the main drives differ by marks on the drive and driven cylindrical gears (Table 2).

Table 2

Таблица 2

Передаточное число	Метки на торце ведущей цилиндрической шестерни со стороны установки конической шестерни	Метка на ведомой цилиндрической шестерне
6,7	Два сверления ∅10 мм на расстоянии 12 мм от края на глубину 2 мм	Фаски с двух сторон под венцом шестерни
7,32	Сверление ∅10 мм на глубину 2 мм	Фаска под зубчатым венцом
8,05	Цилиндрическая проточка ∅52 мм	Риска на торце ∅290 мм
8,9	нет	нет



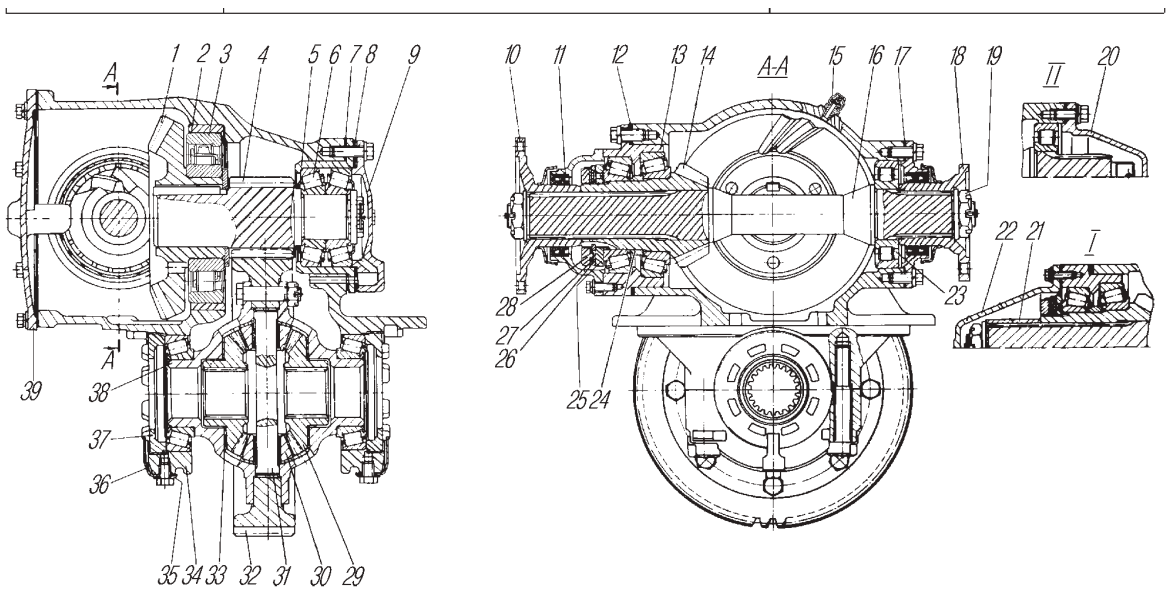


Fig. 39. Main drive

1 - driven bevel gear; 2, 23 - cylindrical roller bearings; 3 - main drive housing; 4 - drive cylindrical gear; 5 - bearing carrier; 6 - tapered roller bearing; 7, 8, 12 - adjusting shims; 9 - bearing carrier cover; 10 - middle axle drive flange; 11 - lip seal; 13 - drive bevel gear bearing carrier; 14 - drive bevel gear; 15 - breather; 16 - drive gear shaft; 17 - gasket; 18 - rear axle drive flange; 19 - flange nut; 20 - rear bearing cover; 21 - spacer sleeve; 22 - front bearing cover; 24 - adjusting washer; 25 - nut; 26 - lock washer; 27 - tab washer; 28 - locknut; 29 - side gear; 30 - differential pinion; 31 - differential spider; 32 - driven cylindrical gear; 33 - thrust washer; 34 - differential bearing cap; 35 - lock plate; 36 - tab plate; 37 - differential bearing adjusting nut; 38 - differential case; 39 - housing cover; I - for front axle; II - for rear axle

The main drive is installed on axle housing 10 (Fig. 40) through a paronite sealing gasket 9 0.8 mm thick and is secured with thirteen bolts and two studs. Eleven bolts and the studs are installed from the outside, and two bolts are in the bevel gear cavity. The inner bolts can be reached only after the side cover 6 is removed. Spring washers are installed under the outer bolts and the stud nuts. The inner bolts are secured with locking wire.

The gears and bearings of the main drive are lubricated with oil, which is poured into the axle housing and the main drive housing up to the level of the check hole.

The oil is picked up by the gears, splashed, and through roller bearing 2 (see Fig. 39) enters the bevel gear cavity of the main drive housing, from which it drains into the axle housing.

The bearings of the drive bevel gear are lubricated with oil from the bevel gear cavity, which is fed to the bearing carrier through a pocket in the housing cover and an oil supply fitting.

Main Drives of the Front and Rear Axles

The main drives of the front and rear axles differ from the main drive of the middle axle in the drive flanges. A spacer sleeve 21 with a cover 22 is installed on the front end of the drive gear shaft of the front axle, and a flange 18 on the rear end.

The main drive of the rear axle has one flange on the side of the drive bevel gear. The splines on the opposite end of the drive gear shaft may be omitted.

Axle housings 10 (see Fig. 40) are of combined construction and consist of a cast center section with tubular axle shaft housings pressed into it. The axle shafts are fully floating, and the axle shaft is connected to the hub by splines.

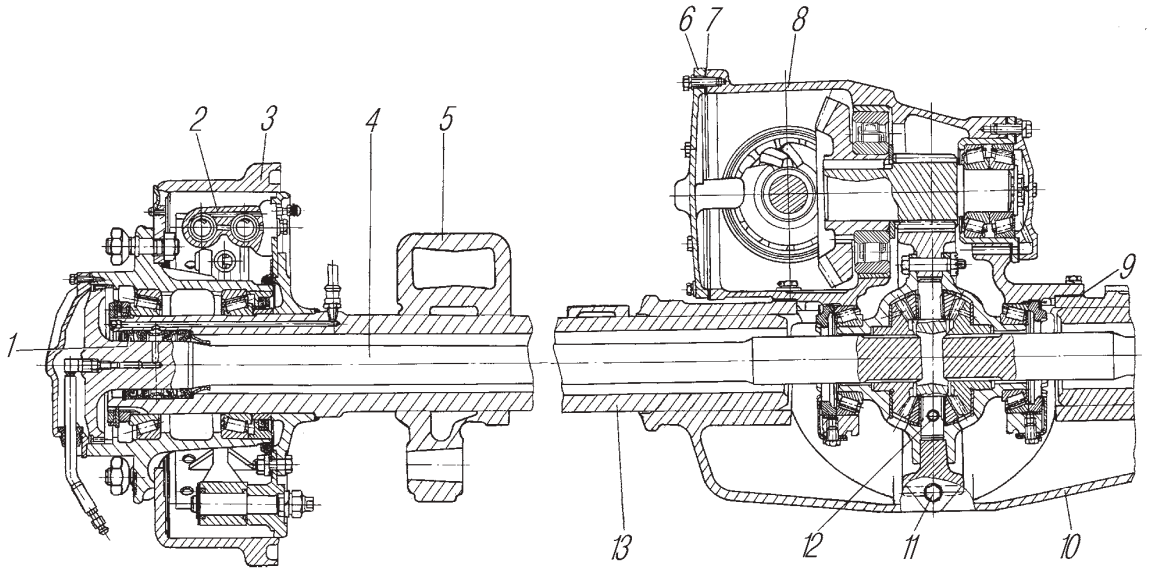


Fig. 40. Middle (rear) drive axle

1 - air supply lip seals; 2 - wheel cylinder; 3 - brake drum; 4 - axle shaft; 5 - spring support bracket; 6 - housing cover; 7, 9 - gaskets; 8 - main drive; 10 - axle housing; 11 - drain plug; 12 - check plug; 13 - axle shaft housing

Front Axle

The front axle of the truck is both a drive axle and a steering axle. The design of the drive to the steered wheels of the front drive axle is shown in Fig. 41. Torque is transmitted to the front drive wheels through the axle shafts and constant-velocity (CV) joints (Fig. 42).

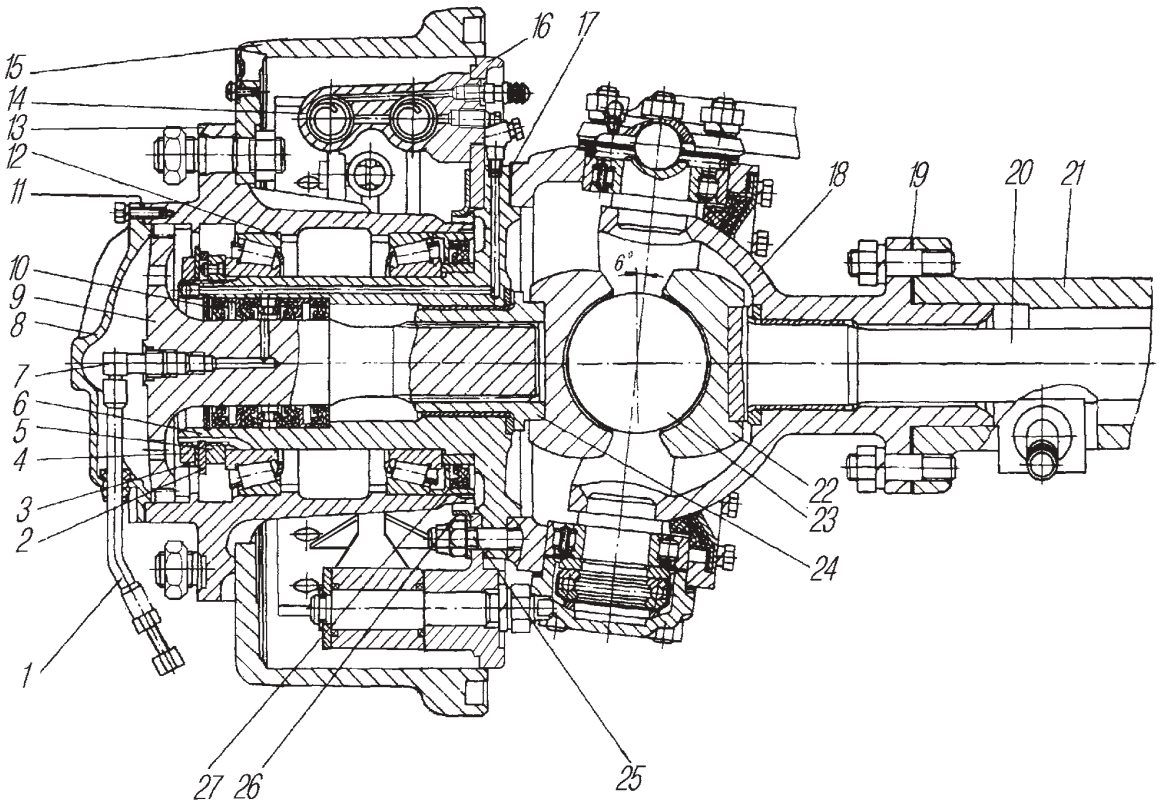


Fig. 41. Drive to the steered wheels of the front drive axle

1 - air supply hose; 2 - tab washer; 3 - lock washer; 4 - locknut; 5 - wheel bearing nut; 6 - spindle; 7 - air supply elbow; 8 - wheel hub cover; 9 - outer axle shaft; 10 - lip seal block; 11, 17, 19 - sealing gaskets; 12 - bearing; 13 - hub; 14 - wheel brake cylinder; 15 - brake drum; 16 - brake support; 18 - ball joint; 20 - inner axle shaft; 21 - axle shaft housing; 22 - joint cam; 23 - joint disc; 24 - outer axle shaft yoke; 25 - stud; 26 - deflector; 27 - lip seal

For reliable and durable operation of the drive axles, use the oils specified in the lubricants and operating fluids chart and maintain the required oil level in the housings. To replace the grease in the joints of the front axle shafts, remove the wheel, the brake drum together with the hub, the brake support, and the swivel spindle. Remove the grease and wash the parts of the constant-velocity joint.

If the ball joint must be removed from the front axle housing, use the puller bolts supplied in the large tool bag. To do this, install them in the threaded holes of the ball joint flange and, tightening them evenly, withdraw the shank of the ball joint from engagement with the axle shaft housing.

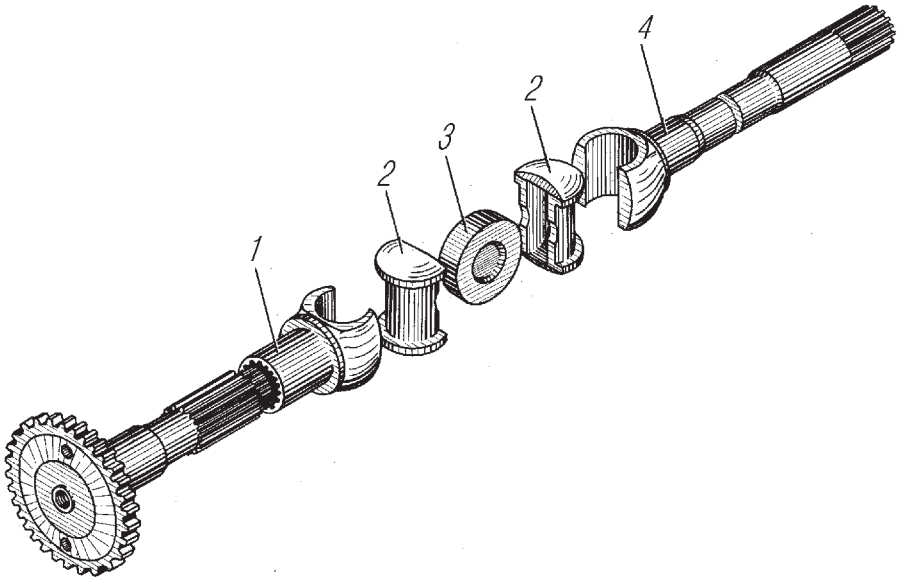


Fig. 42. Constant-velocity joint

1 - yoke; 2 - cam; 3 - disc; 4 - inner axle shaft

Regularly check the tightness of the bolts that secure the main drive to the axle housing. Loose bolts cause the housing to bend.

When adjusting the main drive, adjust the preload of the tapered bearings and check the contact pattern in the mesh of the bevel gear pair of the main drive. Perform the adjustments with the main drive removed from the truck. Check the preload by the torque required to turn the shaft. Determine the resistance torque with a dynamometer.

Measure the torque on the shaft while turning it smoothly in one direction and after not less than five full revolutions. Keep in mind that incorrect bearing adjustment can destroy not only the bearings themselves but also the gears of the main drive.

Adjust the main drive in the following sequence:

1. Mount the main drive in a fixture and remove the differential and the flanges. Unscrew the mounting bolts of the bearing carrier of the drive bevel gear. Remove the drive gear shaft together with the carrier and the gear.

Clamp the drive gear in a vise by its toothed rim. Unscrew the cover mounting bolts and remove the cover. Unlock the locknut and unscrew it. Remove the lock washer and the tab washer. Tighten the nut to a torque of 450-500 N*m (45-50 kgf*m).

Install the dial indicator fixture and determine the bearing clearance. If there is no clearance after the nut is tightened, the bearings of the carrier need no adjustment.

Calculate the amount by which the thickness of adjusting washer 24 (see Fig. 39) must be reduced (the clearance plus 0.03-0.05 mm of preload). Unscrew the nut and remove the bearing and the adjusting washer. Grind the washer (or select one) to the required size, install the washer, and assemble the bearing unit of the drive bevel gear. The tightening torque of the nuts is 450-500 N*m (45-50 kgf*m).

Lock the locknut by bending the washer onto one of its flats.

The torque required to turn the drive bevel gear in the bearings must be 0.6-1.4 N*m (0.06-0.14 kgf*m). The force on the dynamometer when unwinding the cord from the surface of the carrier is 7.5-17.5 N (0.75-1.75 kgf) (Fig. 43).

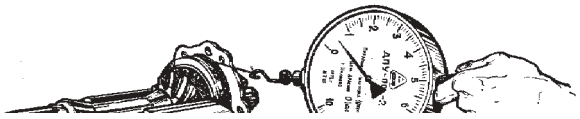


Fig. 43. Checking the adjustment of the drive bevel gear bearings

2. Adjust the preload of the bearings of the drive cylindrical gear. Adjust the bearings by selecting the shim pack 8 (see Fig. 39) under cover 9 of carrier 5. The torque required to turn the intermediate shaft must be 0.9-1.5 N*m (0.09-0.15 kgf*m). When measuring the torque with a dynamometer, wind the cord around the rim of the cylindrical gear; the dynamometer readings must be as given in Table 3.

Table 3

Main drive ratio / Dynamometer reading, N (kgf)

— 6.7 - 16.5-27.6 (1.65-2.76)

— 7.32 - 17.6-29.3 (1.76-2.93)

— 8.05 - 18.8-31.3 (1.88-3.13)

— 8.9 - 20-33.4 (2.0-3.34)

Keep in mind that removing shims from under the carrier cover during bearing adjustment shifts the driven bevel gear in the direction of reduced backlash; therefore, to maintain the backlash, install additional shims under bearing carrier 5.

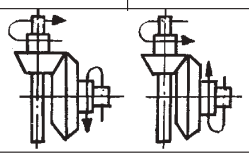
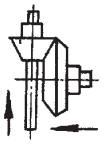
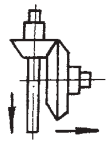
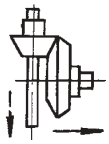
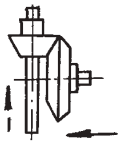
3. Install the carrier with the drive bevel gear in the main drive housing. Tighten the carrier mounting bolts to 60-80 N (6-8 kgf).

Check the mesh of the bevel gears for correct engagement using marking paint. The length of the contact pattern must be not less than 60 % of the tooth length (Table 4).

Table 4. Adjusting the tooth contact of the main drive bevel gears

Таблица 4

Регулирование контакта в зацеплении конических шестерен главной передачи

Положение пятна контакта на зубе ведомой конической шестерни		Способы достижения правильного зацепления конических шестерен	Направление перемещения конических шестерен
Передний ход	Задний ход		
			
		Правильный контакт	
		Придвиньте ведомую шестерню к ведущей. Если при этом получится слишком малый боковой зазор между зубьями, отодвиньте ведущую шестерню	
		Отодвиньте ведомую шестерню от ведущей. Если при этом получится слишком большой боковой зазор между зубьями, придвиньте ведущую шестерню	
		Придвиньте ведущую шестерню к ведомой. Если боковой зазор будет слишком мал, отодвиньте ведомую шестерню	
		Отодвиньте ведущую шестерню от ведомой. Если боковой зазор будет слишком велик, придвиньте ведомую шестерню	

The contact pattern must be not closer than 5 mm to the edges of the tooth. In this case, the backlash in the teeth (at the wide end) must be 0.1-0.4 mm. To change the backlash of the bevel gears without distorting the contact pattern, move both gears by a distance proportional to the number of teeth of each gear, i.e., move the driven bevel gear 2.2 times (24:11) farther than the drive gear.

4. Install the differential and adjust the differential bearings. Tighten the differential bearing cap bolts to a torque of 250-320 N*m (25-32 kgf*m). Adjust the differential bearings with nuts 37 (see Fig. 39). After the nuts are tightened, the distance between the differential bearing caps must increase by 0.04-0.14 mm. While adjusting, turn the differential to seat the rollers in the bearings. The rim of the driven cylindrical gear must be positioned symmetrically relative to the rim of the drive gear.

Because the manufacturing technology of the differential gears has been improved, the tooth profile of the side gears and differential pinions has changed. The modified gears are not interchangeable with those produced earlier and must be replaced only as a set. To distinguish them, marks have been introduced on the small-module side: a recess 90 mm in diameter on the side gear and a stepped end face on the differential pinion.

When assembling the main drive, install the inner race and cage of roller bearing 2 of the driven bevel gear as shown in Fig. 39.

Adjust the kingpin bearings of the steering knuckles during the sixth second maintenance (TO-2) (after 96,000 km) in the following order:

— Remove the wheels and install supports under the lower covers of the steering knuckles;
— Remove the arm of the left steering knuckle and the upper cover of the right steering knuckle;
— Remove two shims from the shim pack under the arm and under the cover: one 0.05 mm thick and the other 0.1 mm; pack 50 g of Litol-24 grease (GOST (Russian national standard) 21150-87) into the cavity of the arm and the cavity of the cover, and install the arm and the cover; tighten the nuts to a torque of 160-280 N*m (16-28 kgf*m);
— Remove the supports and remove the lower covers;
— Remove from under each cover the shim pack 0.15 mm thick [(0.05+0.1) mm];
— Install the covers and tighten the nuts to a torque of 160-280 N*m (16-28 kgf*m);
— Install the wheels.

Adjusting the Wheel Hub Bearings

— Raise the axle with a jack on the side of the wheel being adjusted;
— Remove the cover;
— Using a puller, disengage the axle shaft splines from the hub and remove the axle shaft;
— Unscrew the outer nut and remove the lock washer and the tab washer;
— Turning the wheel by hand, make sure that the brake drum does not rub against the shoes;
— Tighten the nut to a torque of 200-250 N*m (20-25 kgf*m); while tightening the nut, turn the hub so that the rollers seat themselves in the bearings, then loosen the nut by approximately 1/5-1/6 of a turn. Install the tab washer.

If the pin of the nut does not line up with the holes of the tab washer, it is allowed to loosen the nut by an amount not exceeding the distance between two adjacent holes. Install the lock washer, tighten the locknut to a torque of 400-500 N*m (40-50 kgf*m), and lock it.

To ensure that the wheel inflation hose can be connected to the wheel valve, install the axle shaft with the hub cover so that the inflation hose points toward the wheel valve, symmetrically between the wheel mounting studs.

After assembly, check the wheel bearing adjustment during a run of 10-20 km. If the adjustment is correct, the hub must be cold or slightly warm. If the hub is noticeably hot to the touch, check the bearing adjustment.

Chassis

Frame

The truck frame is riveted and consists of two stamped side rails of variable cross-section connected to each other by crossmembers and the front bumper.

Frame maintenance consists of monitoring the condition of the bolted and riveted joints. Make sure that the geometry of the frame and the strength of its elements are not impaired. If rivets are loose, cut them off and replace them with new ones. It is allowed to replace loose or sheared rivets with threaded joints using bolts of strength class 8.8 and nuts with locknuts.

Towing Device

The towing device of the truck is mounted in a special crossmember. Maintenance of the towing device consists of lubricating it and cleaning off dirt. The guides of the tow hook shank are lubricated through grease fittings during maintenance of the truck. The hook must turn freely by hand in the support of housing 2 (Fig. 44) and in sleeve 6.

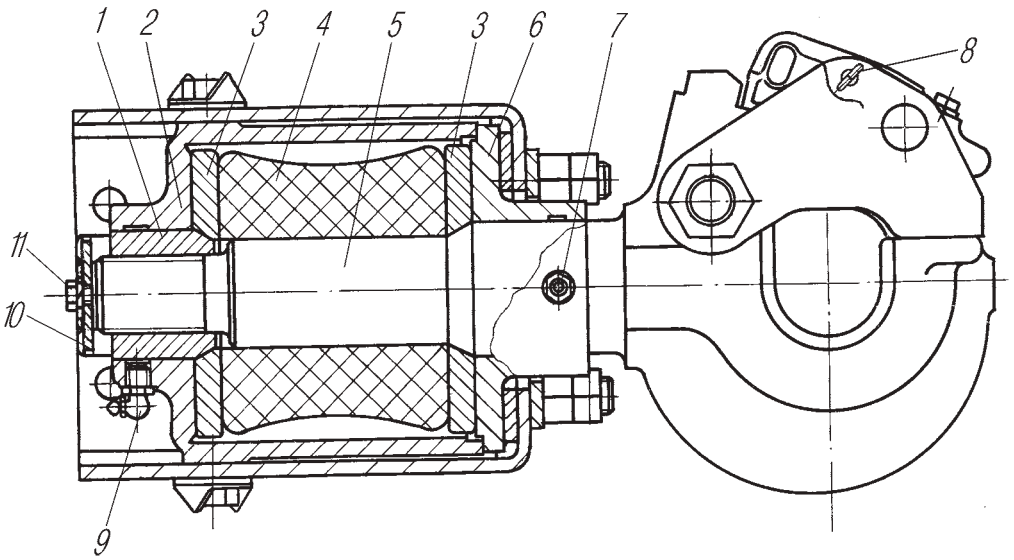


Fig. 44. Towing device

1 - nut; 2 - housing; 3 - pressure ring; 4 - elastic element; 5 - tow hook; 6 - guide sleeve; 7, 9 - grease fittings; 8 - locking cotter pin; 10 - lock plate; 11 - bolt

The axial movement of the hook in the housing is allowed to be not more than 0.5 mm. To achieve this, tighten nut 1 until a gap appears between housing 2 and pressure ring 3 owing to deformation of the elastic element (this is determined by the free movement of the tow hook). Then unscrew the nut until the axial movement of the hook is eliminated and secure it with the lock plate and bolt. Lock plate 10 together with bolt 11 screwed into its hole, and the tow hook shank, can move by the amount of the clearances in the joint.

When towing a trailer, install locking cotter pin 8.

Truck Suspension

Front Suspension

The front suspension (Fig. 45) consists of two longitudinal semi-elliptic leaf springs working together with hydraulic telescopic double-acting shock absorbers. The upper eyes of the shock absorbers are attached through rubber bushings to the yokes of brackets 5; the lower eyes are attached to brackets 17 welded to the axle housing.

In the middle section, the leaf springs are secured to the axle housing with U-bolts. Upward axle travel is limited by rubber bumpers 2 mounted in spring plates 20 and in holders 13 of the auxiliary bumpers. Holder 13 is connected to bracket 6, which is attached to the frame side rail. The auxiliary bumpers also reduce stress in the springs during hard braking by limiting spring wind-up.

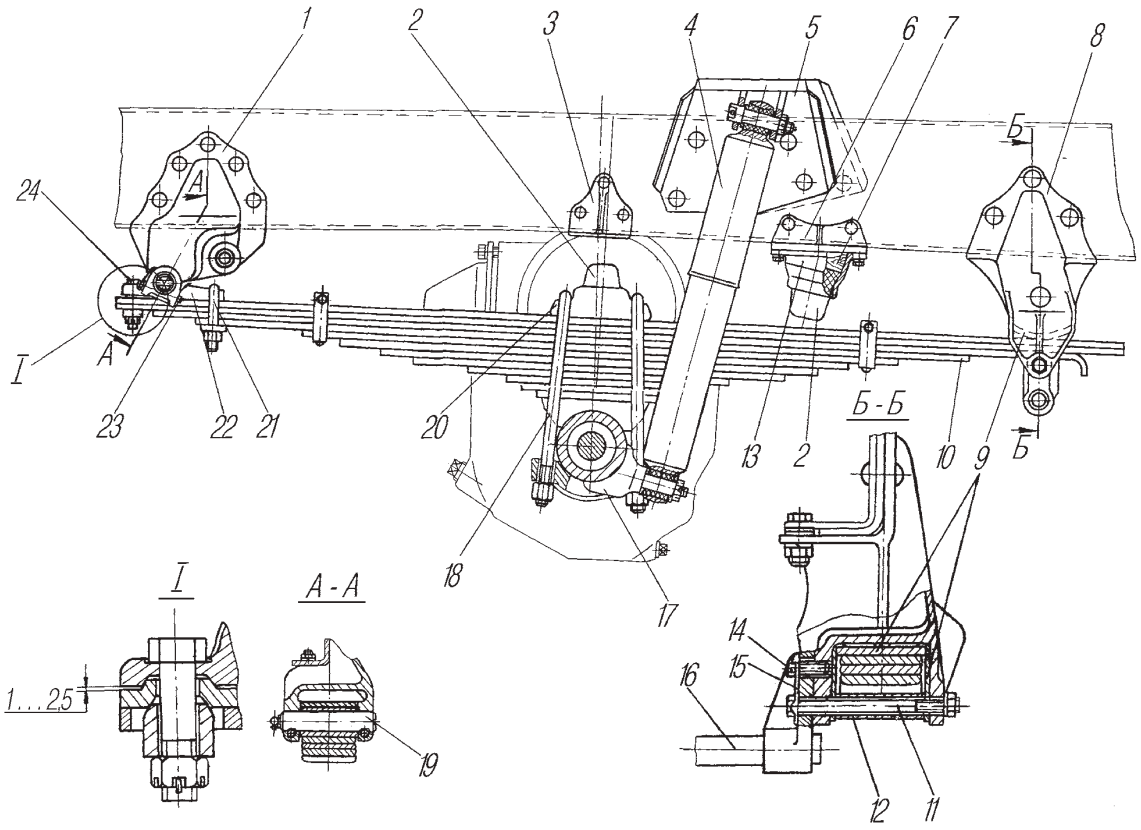


Fig. 45. Front suspension

1, 8 - brackets (front, rear); 2 - spring bumpers; 3 - bumper thrust bracket; 4 - shock absorber; 5, 17 - shock absorber brackets; 6 - auxiliary bumper bracket; 7 - backing plate; 9 - liners; 10 - leaf spring; 11 - lower tie mounting bolt; 12 - spacer sleeve; 13 - auxiliary bumper holder; 14 - upper tie mounting bolt; 15 - lock plate; 16 - rear bracket tie; 18 - spring U-bolt; 19 - spring eye pin; 20 - plate; 21 - eye U-bolt; 22 - spring eye; 23 - wedge; 24 - bolt

Eyes 22 are attached to the front ends of the leaf springs with U-bolts 21 and bolts 24. Through the eyes, the springs are connected to front brackets 1 by pins 19, which are fixed in the brackets by wedges 23.

The rear ends of the springs fit freely into the eyes of rear brackets 8. Downward axle travel is limited by the bent-over end of the third spring leaf catching on lower bolt 11 of the rear spring bracket tie, on which spacer sleeve 12 is installed.

To reduce stress in the frame side rails in the area of the second crossmember, the rear spring brackets are connected by tie 16, which is attached to the brackets with bolts. The bolts are locked with plates 15.

The front suspension of trucks with the YaMZ-238M2 engine differs in having a reinforced leaf spring. The third and fourth leaves of this spring are 12 mm thick; the remaining leaves, 10 mm thick, are no different from the leaves of the spring of trucks with the YaMZ-236M2 engine.

Hydraulic Shock Absorbers

Hydraulic shock absorbers (Fig. 46) are designed to damp vibrations that result from elastic deformation of the suspension elements of the truck when driving on an uneven road. The principle of operation of hydraulic shock absorbers is as follows. When the sprung and unsprung parts of the truck move relative to each other, the fluid in the shock absorber, flowing from one of its chambers to another through small orifices, resists the vertical movement of the rod and damps the vibrations of the truck.

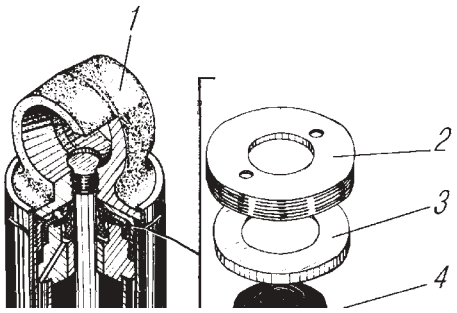


Fig. 46. Shock absorber

1 - upper head; 2 - housing nut; 3 - washer; 4 - rod oil seal; 5 - housing bushing; 6 - washer; 7 - sealing ring; 8 - oil seal housing; 9 - shock absorber housing; 10 - cylinder; 11 - piston rod; 12 - limiter plates; 13, 15, 18 - valve discs; 14 - piston; 16 - piston nut; 17 - valve body; 19 - compression throttle disc; 20 - pressure disc; 21 - spring; 22 - cover

Rear Suspension

The rear suspension is of the equalizer beam type; the ends of the leaf springs fit into the eyes of support brackets 8 (Fig. 47). The springs are attached with U-bolts 2 to equalizer beams 25, which pivot on equalizer beam axle 21. Brackets 22 are press-fitted onto the axle, and through them axle 21 is secured with bolts 17 to equalizer beam brackets 20. Thrust and braking forces are transmitted from the axles to the frame through two upper 7 and four lower 9 torque rods. Lateral forces are transmitted through the leaf springs.

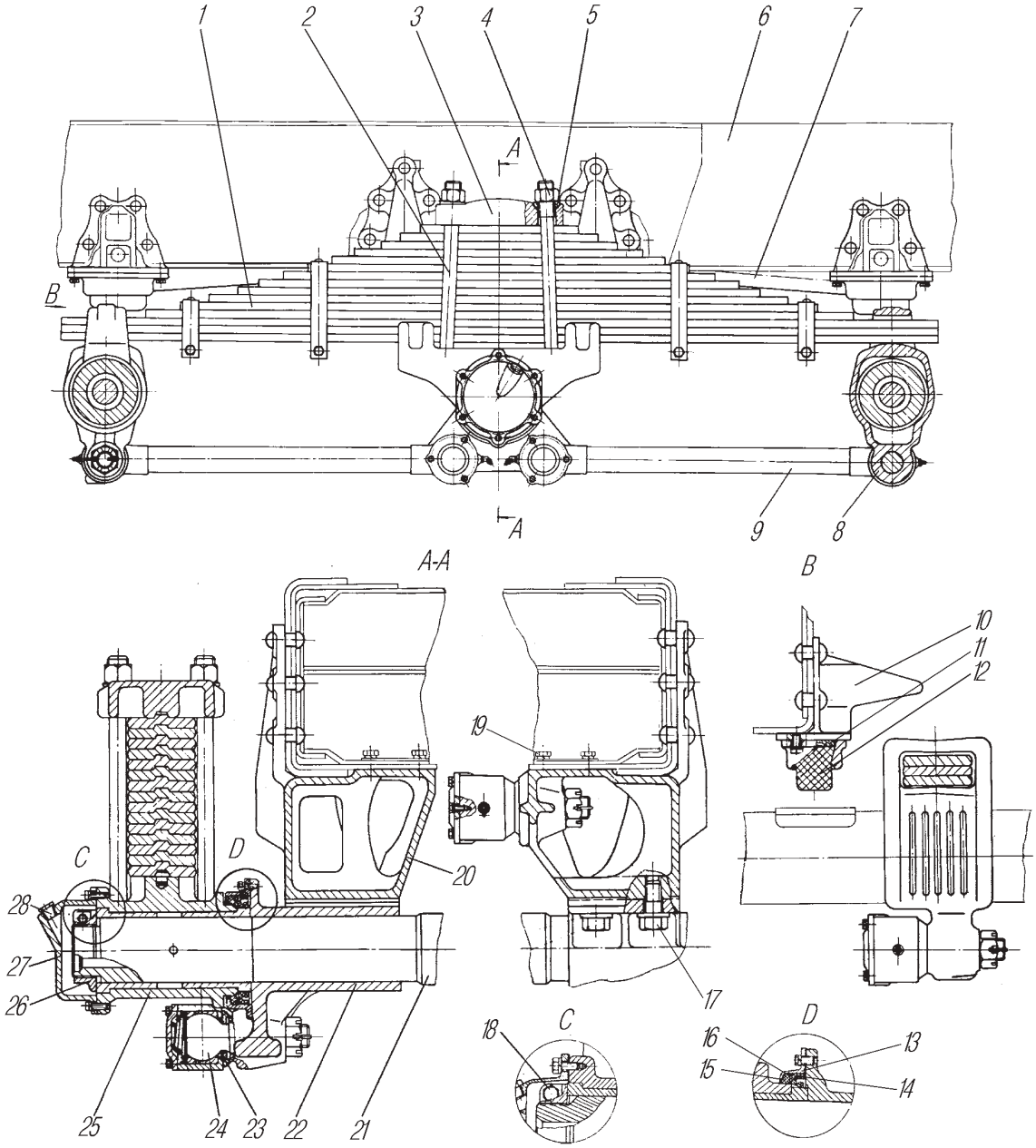


Fig. 47. Suspension of the middle and rear axles

1 - leaf spring; 2 - U-bolt; 3 - spring plate; 4 - U-bolt nut; 5 - spherical washer; 6 - frame; 7, 9 - torque rods (upper and lower); 8 - spring support bracket; 10 - bumper bracket; 11 - bumper backing plate; 12 - bumper; 13 - lip seal housing; 14 - lip seal; 15 - felt sealing ring; 16 - spacer ring; 17 - equalizer beam axle mounting bolt; 18 - clamping bolt; 19 - bolts securing the equalizer beam bracket to the fifth crossmember; 20 - equalizer beam bracket; 21 - equalizer beam suspension axle; 22 - axle bracket; 23 - sealing ring; 24 - ball pin; 25 - equalizer beam; 26 - nut; 27 - equalizer beam cap; 28 - filler hole plug

The torque rod joints are ball joints. On the upper torque rods, on the axle side, pins with a shortened taper are installed, which are kept from turning in the brackets by Woodruff keys. The torque rod head is sealed on one side by a gasket installed under the cover and on the other side by sealing ring 23.

The impact of the axles against the frame when a wheel of the truck hits an obstacle is cushioned by bumper 12. Downward axle travel is limited by the end of the spring becoming wedged in support bracket 8.

The suspension of trucks with a rear bogie load over 12,000 kg differs in the installation of reinforced leaf springs (with thicker leaves) and correspondingly longer U-bolts.

Maintenance

To prevent shearing of the center bolt of the front spring and of the centering embossment of the rear spring, tighten the spring U-bolt nuts in good time with the truck loaded. If the springs squeak, lift the truck by the frame and apply grease into the gaps that open between the leaves. Each time the springs are disassembled, lubricate the leaves after first removing old grease, dirt, and traces of corrosion. Wash and lubricate the eyes and pins of the front springs.

Tighten the spring U-bolt nuts as shown in Fig. 48:

— front springs: first to a torque of 200-250 N*m (20-25 kgf*m), then finally to a torque of 400-500 N*m (40-50 kgf*m);

— rear springs: first to a torque of 250-300 N*m (25-30 kgf*m), then finally to a torque of 580-660 N*m (58-66 kgf*m).



Fig. 48. Tightening sequence of the spring U-bolt nuts

1 - leaf spring; 2 - rear spring plate (front axle beam clamp); I-IV - tightening order of the U-bolt nuts

During assembly, lubricate the threads of the U-bolts with graphite grease or TSgip-type grease.

Tighten the nuts of U-bolt 21 (see Fig. 45) that secures the add-on eye of the front spring with the truck loaded, in the following order:

— Screw the nut on until it stops;

— Unscrew the nut by 1.5-2 turns;

— Stake the thread at two opposite points on each shank.

Fully tightening the U-bolt nut is not allowed, because it prevents movement of the leaves and will quickly destroy the U-bolt and the eye attachment in service. If there is no clearance (less than 0.2 mm) between the front part of the eye and the top leaf, repair or replace the eye.

If the leaf spring has been removed from the truck, tighten the nuts of U-bolt 21 to a torque of 20-28 N*m (2.0-2.8 kgf*m) and stake them at two opposite points. Keep bolt 24 that secures the add-on eye tight. Tighten the nuts to a torque of 280 N*m (28 kgf*m). If the cotter pin hole in the bolt does not line up with the slots in the nut, tighten the nut further and secure it with a cotter pin.

If the attachment of the tie of the rear brackets of the front springs loosens, tighten its mounting bolts. The tightening torque of upper bolt 14 is 120-160 N*m (12-16 kgf*m), and of the nut of the lower bolt, 180-220 N*m (18-22 kgf*m). Lock the bolts by bending the lock plate onto the bolt heads.

When the ends of the first leaf of the rear spring are worn to half of their thickness, swap the first and second leaves. On the springs of trucks with a rear bogie load over 12,000 kg, swapping the leaves is not recommended.

To remove U-bolts 2 (see Fig. 47) without disconnecting the torque rods, jack up the truck and place a stand under the equalizer beam axle or the frame. Unscrew the U-bolt nuts and remove the spring plate. Lower the truck onto the stand so that a gap forms between the spring and the equalizer beam. Turn the equalizer beam through a small angle and remove the U-bolt.

To eliminate axial play of the equalizer beam, unload the equalizer beams by raising the truck frame so that the spring ends are not wedged in the support brackets. Remove equalizer beam cap 27. Loosen clamping bolt 18, unscrew nut 26, wipe the threaded portions of the nut and of the equalizer beam axle dry, and coat them with UG-6 sealant (Loctite-243 or Loctite-573 is permitted). Screw nut 26 on until it stops, then unscrew it by 1/6-1/4 of a turn. Sealant must not be squeezed out into the gap between the end faces of the equalizer beam nut and the bushing.

After the adjustment, tighten clamping bolt 18 to a torque of 44-56 N*m (4.4-5.6 kgf*m). Replace a damaged cap gasket after first coating it on both sides with UN-25 sealant (Loctite-573). Fill the equalizer beam hubs with lubricant to the level of the filler hole in the cap. Do not allow the lubricant level to fall below the mark on the equalizer beam caps.

Because the oil poured into the equalizer beam hubs during assembly gradually fills the clearances in the joints and is absorbed by the wooden plugs pressed into the axle tube from both sides, a slight drop in the oil level is possible.

When preparing a new truck for service, check the lubricant level in the equalizer beam hubs and, if necessary, top it up to the level of the filler hole in the caps.

Tighten the torque rod pin nuts to a torque of 600 N*m (60 kgf*m). If the hole in the pin does not line up with the slots in the nut, turn the nut further until they line up and secure it with a cotter pin. Fill the torque rod joints with grease until fresh grease is squeezed out or until the rubber sealing rings begin to deform; squeezing out of grease is not mandatory in this case.

Loose bolted joints of the suspension parts are not allowed. If working fluid leaks from the shock absorber, tighten nut 2 (see Fig. 46). In extension and compression, the shock absorber must offer uniform resistance. The force on the rebound stroke must be within 5.9-8.0 kN (595-805 kgf), and on the compression stroke, 1.5-2.2 kN (152-228 kgf); the force is checked on a press with a rod stroke of 100 mm and a frequency of 100 cycles per minute. Free movement of the shock absorber rod indicates that it is faulty.

Disassemble and assemble the shock absorber in a repair shop, observing the necessary cleanliness. Protect the polished surfaces of the rod, the working cylinder, and other parts from nicks and other damage.

Procedure for replacing the working fluid:

1. Clamp the shock absorber by its lower head in a vise and pull the rod out completely.
2. Insert a special wrench into the gap between the cover and the housing and unscrew the housing nut.
3. By gently rocking the upper end of the rod, pull it out of the working cylinder together with the piston.
4. Remove the working cylinder from the reservoir and drain the working fluid completely.

Each time the shock absorber is disassembled, and also when the fluid is replaced, wash all parts of the shock absorber in kerosene and dry them. Lubricate the inner surface of the lip seals with shock absorber fluid. Fill the cylinder with fluid in accordance with the lubricants and operating fluids chart. If there is too little fluid, the shock absorber does not develop force, and if there is too much, it may fail. Using other fluids as shock absorber fluid is not allowed. Insert the piston and rod assembly into the cylinder, install the oil seal housing, the sealing ring, and the washer, move the remaining parts into place, and tighten the housing nut to a torque of 120-150 N*m (12-15 kgf*m).

On a shock absorber with a plastic cover, access to the housing nut is blocked when the shock absorber is extended. To tighten the housing nut, remove the shock absorber from the truck and, pressing against the end of the cover, push the cover toward the upper head. After tightening the housing nut, put the cover back in place.

Wheels and Tires

The wheels are multi-piece wheels and consist of rim bases 2 (Fig. 49), side rings 5, lock rings 4, and lock ring stops 3.

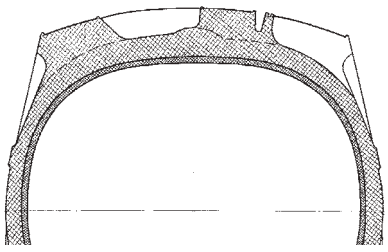


Fig. 49. Wheel and tire assembly

1 - wheel valve; 2 - rim base with disc; 3 - lock ring stop; 4 - lock ring; 5 - side ring; 6 - tire casing; 7 - inner tube; 8 - rim flap; 9 - valve slot seal; 10 - balancing weight spring; 11 - balancing weight

The rim bases include toroidal bead seats on which the tire beads rest, drop centers (mounting wells) that allow the tires to be mounted on and demounted from the rims, and discs by which the wheels are attached to the truck hubs. 400G-508 wheels may be used with either a removable or a non-removable flange on the side opposite the lock ring end.

The side rings and lock rings of 254G-508 and 400G-508 wheels are interchangeable and are installed on these wheels in a strictly defined position by means of the lock ring stops welded to the rim and the embossments on the lock rings, which fit into the corresponding recess (slot) in the side rings. The second slot in the side rings is used when demounting the wheels. A slot is made at one end of the lock ring for gripping the ring when removing it from the lock ring groove of the rim.

The lock ring stops serve to prevent the rings from turning in service when the truck is driven with reduced tire pressure, and at the same time they act as the brackets on which wheel valves 1 are mounted and as additional supports for the protective covers of the air supply hoses.

On 254G-508 wheels, the wheel valve is mounted on the outer side of the stop bracket; on 400G-508 wheels, on the inner side.

The rubber seals 9 of the wheel valve slot prevent dirt from entering the tires and ensure that the inner tube valves are installed in a defined position.

The wheels with tires are balanced. The wheels are balanced with weights 11, which are held by spring 10. The wheel nuts and studs on both the right and left sides have right-hand threads.

Care of Wheels and Tires

The fullest use of the service life of wheels and tires and their safe operation can be ensured only by regular care and by compliance with all the requirements of the rules for the operation of automobile tires, traffic regulations, and safety and occupational health rules in road transport.

Observe the following general requirements:

— Strictly observe the specified tire inflation pressures;

— Do not allow the tires to be overloaded by the weight of the cargo;

— Service the wheels and tires on time;

— Keep the chassis units, the steering system, and the brakes in good working order;

— Follow the rules and use rational driving techniques appropriate to the road conditions; strictly follow the rules for operating tires with adjustable pressure at reduced tire pressure, which are set out in the section "Driving the Truck".

Maintenance

Every day before leaving, check the tire pressure and, if necessary, bring it to the specified value.

During daily maintenance, check the condition of the tires, the wheels, and their fastening parts. The tires must have no ruptures or fractures, unrepaired local damage (punctures, cuts), or local separation of the tread and sidewall, and the wheels must have no mechanical damage, corrosion, or cracks on their parts. The tires must be fit for service in terms of wear. Remove foreign objects lodged in the tread and sidewall of the tire. The inner tube valves must always be in good condition.

Make sure that fuel, oils, and other petroleum products do not get on the tires, because this quickly ruins them.

If any defects in the tires or wheels are found, take measures to eliminate them and carry out repair or replacement.

Loose wheel mounting is not allowed, and the truck must not be operated if at least one wheel nut or stud is missing or the mounting holes in the discs are worn.

At TO-2, check the tightness of the wheel nuts. Within the first 1000 km of truck mileage, the wheel nuts should be retightened the first time after 100-150 km and the second time after 200-300 km, and likewise each time a wheel is installed on the hub, regardless of the reason it was removed.

When the second maintenance of the truck as a whole is performed, check the condition of the tires and wheels and, if necessary, if a fault is found, repair or replace them, balance or rotate them, and retighten the wheel nuts if the wheel and tire assemblies have not been removed from the truck. In addition, at TO-2 check the toe-in and the alignment angles of the front wheels, and blow out all the lines and hoses of the tire pressure control system.

If intensive and uneven tire tread wear is detected, which, as a rule, apart from incorrect driving, results from a fault in the chassis, steering, or brakes of the truck, determine its causes and eliminate the faults regardless of the truck mileage.

Tire Mounting and Demounting

When mounting and demounting tires, observe the following rules:

— Perform tire mounting and demounting at a specially equipped area using specialized equipment, fixtures, and tools; in the field, use the tools from the driver's tool kit, and take measures to prevent sand and dirt from getting inside the tire;

— Tire casings, inner tubes, and rim flaps must be clean and dry;

— Tires that have been stored at temperatures below 0 °C should be warmed up to a temperature above 0 °C in a warm room before mounting;

— The direction of wheel rotation must match the direction of the tread pattern (for tire casings with a directional pattern);

— Rims and their components must have no damage or bends, cracks, sharp edges or burrs, or corrosion, either on the outside or on the inside and at the points of contact with the tire, and no worn mounting holes;

— When tires are mounted in a workshop, check the rim for radial and axial runout, which must not exceed 4 mm.

Before assembling the wheel, check the condition of the tire casing, inner tube, rim flap, rim, lock ring, and side ring.

Inspect the tire casing outside and inside using a bead spreader, and remove foreign objects (sand, small stones, etc.) from its interior; wipe the inside surface and the bead seating surface of the casing and repair damage and scoring on the beads. Trim rubber sags and flash flush with the main surface of the bead rubber. Dust the inside of the casing with talc, and the inner tube and rim flap on the outside.

To make assembly easier and to ensure that the tire seats fully on the bead seating surfaces of the rim, it is recommended to lubricate the casing beads with soap solution, glycerin, or paraffin. Do not use mineral oils (Solidol (calcium) grease, engine oil, etc.) as a lubricant.

Tires found to have manufacturing or service defects must not be used for mounting.

Check the inner tubes and valves for air tightness; do not use inner tubes with separation at the splice or with a damaged valve.

Remove dirt, rust, and rubber residue from the wheel surface, especially from the surface of the rim, the side ring, and the seat ring that faces the tire. Paint the cleaned areas and the areas where the paint coating is damaged with quick-drying enamel, after first removing burrs and scoring of the metal.

Check the fit of the lock ring on the rim or on a test cylinder of the same diameter:

— the gap at the joint between the ends of the ring must be 45-55 mm, and the ends of the ring must stand off from the rim by 1.5 mm over an arc length of up to 50 mm;

— local gaps between the lock ring and the rim must not exceed 1.5 mm and must decrease smoothly in both directions over an arc of not more than 1/4 of the circumference;

— the twist ("screw") of the lock ring must not exceed 15 mm.

If the gaps and the twist of the lock ring exceed the specified values, the ring is not suitable for assembly and must be straightened and compressed or replaced with a new one.

Wheel parts that are out of shape or geometry, or that have cracks, are also rejected.

Only serviceable wheels and tires may be mounted (put into operation).

During tire mounting and demounting, observe the following safety rules:

— do not remove a wheel and tire from the truck or install it on the truck without making sure the wheel is securely raised. Loosen and tighten the wheel nuts with the truck on the ground (not raised) and braked;

— do not remove a faulty wheel (cracks in the weld zones, damage to the lock ring or its incorrect position on the rim, a bent side ring, wheel runout of more than 6 mm, tire cuts that expose the cord, etc.) from the hub without first releasing all the air from the tire, and do not begin demounting the tire from the rim without making sure that all the air has been released from it;

— do not install bias-ply tires together with radial tires on the truck, or tires of different sizes, models, or load capacities;

— do not use sledgehammers, crowbars, or tire tools that are faulty or not specified in the technical documentation and that could deform or mechanically damage wheel parts, cut or tear the casing beads, or damage inner tubes and rim flaps;
— do not mount a tire on a rim whose dimensions do not match that tire;
— do not use side rings and lock rings from wheels of another type, because they may have different design dimensions (diameter, profile) even on trucks of the same model that were produced at different times and have wheels of a different design;
— do not install additional side rings on a rim to reduce its width;
— do not use rims, side rings, or lock rings that have surface damage, out-of-roundness, local dents, or cracks, or that have dirt, corrosion, or paint buildup;
— do not use tires whose tread pattern is worn to the limit (remaining block height less than 1 mm) or tires with carcass separation, separation of the tread or sidewall, unrepaired local damage or tears down to the cord threads, through punctures, or damage to the metal bead rings of the casings;
— do not allow casings to be mounted whose beads have buildup, extruded rubber, or flash on the toe, or scoring and damage that prevent mounting;
— perform mounting and demounting without sudden application of physical force to the tire levers; the force applied must not cause them to slip or the ends of the tire levers to break;
— do not begin inflating the tire without making sure that the lock ring is in the correct position in the groove of the rim base, corresponding to an inflated wheel;
— do not inflate a tire outside a special protective cage or while it is installed on the truck, and on the road use safety devices that prevent parts from being ejected if the wheel comes apart on its own or fails;
— do not inflate tires from cylinders of compressed air or gas, because this will cause the tire to burst and may injure bystanders.

Remember that correct performance of the operations when disassembling and assembling wheels ensures safety, reduces the labor required, and extends the service life of tires, wheels, and tire tools.

Inflating the Tire

Inflate the tire from a compressor; it is recommended to place the tire horizontally. If necessary, center the side ring and the lock ring relative to each other. Inflate to a pressure of 0.05-0.1 MPa (0.5-1 kgf/cm2) and check the position of the lock ring: if it is installed incorrectly, release the air, correct the position of the ring, and repeat the operation. Inspect the tire; it must have no bulges or deformations. Inflate the tire to the pressure that seats the tire beads on the bead seats, 0.45-0.50 MPa (4.5-5.0 kgf/cm2), and then set the required pressure. If the tire beads do not seat firmly on the bead seats of the wheel after inflation, release the air from the tire, remove it from the wheel, eliminate the cause of the poor seating, then install it on the wheel again, inflate it, and check that the beads are seated firmly.

Disassembling the Wheel

1. Lay the wheel on a flat, clean surface with the lock ring side up and release all the air from the tire. On tires with adjustable pressure, disconnect the valve stem from the wheel valve, push it together with the seal into the cavity of the casing, and remove the wheel valve. On a balanced wheel, mark the positions of the balancing weights on the rim and tire and remove the weights.

2. Remove the tire bead from the bead seat of the rim. To do so, insert the flat end of the short tire lever into the removal slot between the side ring and the lock ring and press the side ring down; into the gap that forms, insert the flat end of the second tire lever next to it (Fig. 50, I). Pressing on both levers and moving them in turn around the circumference at a distance of 50-100 mm from each other, push the side ring together with the tire bead down somewhat, and then, using the hooked end of the large tire lever, push the tire bead (seat it down) completely off the bead seat of the rim along its entire length.

If the tire bead is difficult to remove from the bead seat of the rim after long service, and also when removing it on the side of the nondetachable rim flange on 400G-508 wheels, remove the bead from the bead seat by acting directly on it with the tire levers. To do this:

— insert the flat end of the short tire lever as deep as possible between the tire bead and the side ring of the wheel and press the lever down;

— then insert the hooked end of the large tire lever between it and the rim flange (side ring) so that the flat end of the short tire lever sits in its slot (a hammer may be used) and, resting the heel of the second lever against the first and hooking its hooked end securely onto the side ring, press both levers down at the same time (Fig. 50, II) to push the tire bead down;

— repeating this procedure in sequence and moving around the circumference, remove the tire bead from the bead seat of the rim. At the start, the distance between the points where the tool is inserted must be not more than 100 mm.

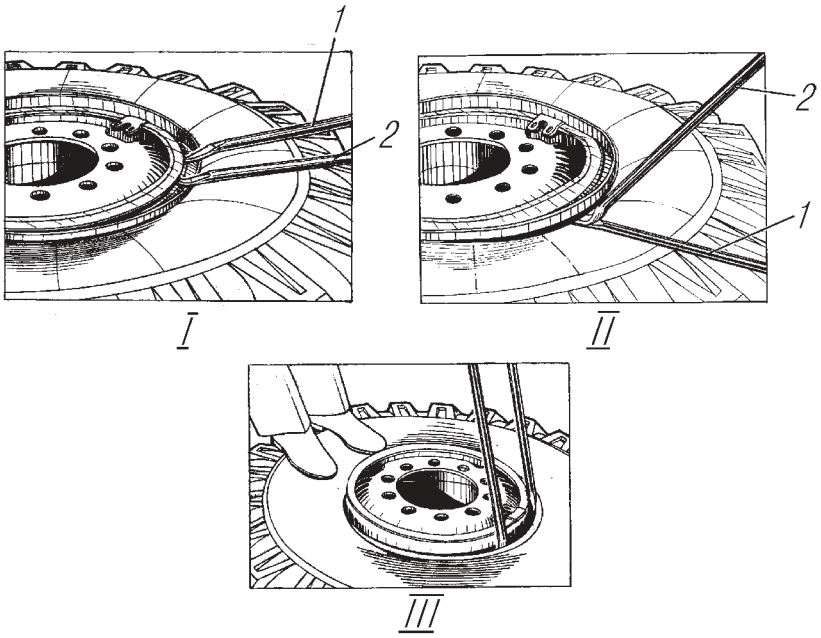


Fig. 50. Disassembling the wheel

I, II - removing the tire bead from the bead seat; III - demounting the tire bead from the rim; 1, 2 - tire levers

The toroidal shape of the bead seat surface of the rim does not allow the casing beads to be removed locally, so the labor and time required for disassembly are significantly reduced if the casing bead is pushed down gradually by applying force two to three times around the circumference of the wheel.

3. Remove the lock ring. To do so, insert the flat end of the short tire lever into the removal slot of the lock ring and pry its end away from the rim; then, moving it upward with the second lever while prying it away from the rim with the first, and working in sequence around the circumference of the wheel, disengage the ring completely from the rim.

4. Remove the side ring from the rim.

5. Demount the tire bead:

— stand on the tire on the side opposite the inner tube valve, push the casing down to the drop center, and work a section of the tire bead into it;

— insert the flat ends of the tire levers between the rim and the tire bead in the valve area, 200-250 mm apart (Fig. 50, III), and, pressing on them, move part of the bead up over the bead seat (bring it out over the rim). The opposite part of the tire bead must always remain in the drop center of the rim;

— holding the demounted part of the tire bead with one lever, use the other lever to move the bead completely up along its entire length, inserting its flat end in sequence between the rim and the tire 70-100 mm to the right and left of the point where the tire bead comes out. To avoid damaging the bead, insert the tire levers across the full width of the bead.

6. Turn the tire and wheel over with the lock ring side down and remove the tire bead from the second bead seat using the methods described in item 2.

7. Remove the rim from the tire:

— stand the wheel and tire upright with the lock ring side facing away from you so that the inner tube valve is at the bottom, and push the valve with its seal into the tire;

— holding the tire upright with one hand or leaning it against a support, use the other hand to shift the rim toward you without tilting it, so that the tire bead at the bottom enters the drop center;

— taking hold of the disc or the upper part of the rim, lift the rim out of the tire, preventing it from falling.

If the rim flap has stuck, separate it with a tire lever.

Assembling the Wheel

1. Place the inner tube and the rim flap in the casing and inflate the tube slightly so that it takes its natural shape without fitting tightly against the casing. On tires with adjustable pressure, place the tube in the casing taking the direction of wheel rotation into account, and fit the seal onto the valve so that its stem sits in the seal body.

2. On the rim, positioned with the lock ring side up, place one of the side rings with its flange down.

3. Fit the tire onto the rim:

— lay the tire at an angle on the rim so that its lower part, with the valve pointing up, stands somewhat away from the rim. Align the valve (with the seal) exactly opposite the valve slot of the wheel and insert the valve stem and nut into the valve slot, moving the tire toward or away from the rim as necessary;

— lift the lower part of the tire on the valve slot side and slide it onto the rim so that the lower bead enters the drop center; the tire then drops onto the rim under its own weight. If the tire hangs on the bead seat of the rim, rock it down, and make sure that the valve does not tilt in the valve slot and that the rim flap is not pinched;

— insert the guide part of the seal with the valve into the slot of the rim, after first pressing the lower part of the seal slightly into the tire with a tire lever.

4. To mount the second tire bead on the rim, stand on the tire on the side opposite the valve and push this part of the casing bead into the drop center; the tire bead in the area of the stop must be on top, above the rim. If this is difficult, push part of the tire bead past the bead seat with the tire levers, as shown in Fig. 51.

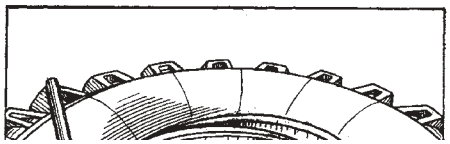


Fig. 51. Placing the tire bead into the drop center of the rim

Holding the bead with the short tire lever, first in the area of the bracket, to keep it from moving toward the center, and then in the drop center of the rim with the other lever, starting from the side opposite the bracket and using alternately the flat and the hooked end, move the bead along its entire length over the bead seat. Push down the section of the tire bead in the valve area last, somewhat below the edge of the rim, to a level that allows the lock ring to be installed; otherwise the seal of the valve slot will shift and further assembly will be impossible.

5. Install the side ring and the lock ring; on wheels with adjustable-pressure tires, align embossing B (Fig. 52) on the lock ring with one of the slots A on the side ring, and make sure that the split of the lock ring coincides with the stop on the rim.



Fig. 52. Position of the lock ring and side ring of 254G-508 and 400G-508 wheels

1 - side ring; 2 - lock ring; 3 - bracket; A - slots on the side ring; B - embossing on the lock ring

6. Check the position of the valve and the seal in the valve slot and correct them if necessary; connect the inner tube valve to the wheel valve. Install the wheel valve on the outer or inner side of the lock ring stop, depending on the wheel design, and after connecting the valve and inflating the tires, secure it in the position farthest from the center of the wheel.

7. Inflate the tire in the following sequence:

— center the side ring and the lock ring relative to each other;

— inflate the tire to a pressure of 50 kPa (0.5 kgf/cm2) and make sure that the lock ring and the side ring have not shifted from their working position. It is recommended to fill the tire with air with the wheel in a horizontal position.

If the wheel is installed incorrectly, release the air from the tire, correct the position of the rings, and inflate the tire again to a pressure of 50 kPa (0.5 kgf/cm2). When releasing air, disconnect the air supply hose not from the wheel but from the source of compressed air. The hose may be disconnected from the wheel only after the air has been completely released from the tire.

If the rings are installed incorrectly a second time, replace the defective parts and, after making sure that the lock ring and the side ring are installed correctly, at a pressure of 50 kPa (0.5 kgf/cm2), inflate the tire to the pressure that seats the tire beads on the bead seats of the rim, and then set the nominal tire pressure.

Unlike the common wheel designs with tapered bead seats, the seating of the tire beads on the toroidal bead seats of the wheel rim under rising internal pressure occurs not gradually but instantaneously, usually at a pressure of 450-500 kPa (4.5-5.0 kgf/cm2), slightly above the nominal pressure.

8. Balance the wheel and tire assembly.

9. Install the wheel on the hub and secure it; the tightening torque of the wheel nuts is 400-500 N*m (40-50 kgf*m).

To allow the wheel inflation hose to be connected to the wheel valve, install the wheel relative to the hub cap so that the inflation hose is located symmetrically between the wheel studs on the wheel valve side.

When installing the wheel, tighten the nuts that secure the disc to the hub in the following sequence:

— screw all the nuts onto the studs by hand;

— preliminarily tighten the nuts with a wrench while the wheel is raised. Tighten the nuts every other one or in a crisscross pattern. While tightening the first five nuts, make sure that the nuts center with their spherical chamfers in the spherical chamfers of the mounting holes of the wheel discs. The nuts must be tightened firmly, because insufficient and uneven tightening can lead to lateral runout of the wheel and tire assemblies.

Balancing the Wheel and Tire Assemblies

The permissible imbalance is 5.2 kgf*m. In service, as the tires wear and for other reasons (remounting of tires), the original balance is lost, so oscillations and vibrations, especially of the front wheels, may occur while the truck is moving.

Imbalance leads to accelerated tread wear and to wear of steering and suspension parts, and it also makes the truck harder to control.

It is recommended to perform static balancing of the wheel together with the tire.

Imbalance is eliminated by installing balancing weights held on the side ring by a flat spring. The mass of one weight with its spring is 0.38 kg. To eliminate an imbalance of 5.2 to 15.2 kgf*cm, install one weight; for 15.2 to 25.2 kgf*cm, two weights; for 25.2 to 35.2 kgf*cm, three weights; for 35.2 to 45.2 kgf*cm, four weights. The permissible imbalance is 5.2 kgf*m.

Before balancing, clean the wheel and tire of dirt and foreign objects.

The tire pressure must be nominal. During balancing, the wheel and tire on the special fixture are located by the plane of the disc and by the spherical chamfers of the mounting holes.

Procedure for installing balancing weights:

1. Release the air from the tires.

2. Using a tire lever, press the tire bead away from the side ring at the weight location until a gap of 1-2 mm appears.

3. Place the weight with its spring on the side ring and, holding them by hand, drive the spring over the flange of the side ring with light hammer blows and seat it completely. If the spring is placed incorrectly, it may snap off the side ring suddenly, so be careful.

4. Inflate the tire to the nominal pressure.

5. Correct the position of the balancing weights if they have shifted around the perimeter or have twisted out of position on the radius of the side ring.

To remove balancing weights, insert a screwdriver between the spring and the weight, press the spring away from the side ring until the weight is released, and remove the weight and the spring.

Balance and rotate the wheels as necessary. The tire rotation diagram is given in Fig. 53.

When operating tires, follow the "Rules for the Operation of Automotive Tires" (Moscow, 1997).

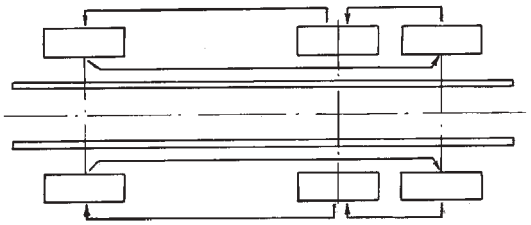


Fig. 53. Tire rotation diagram of the truck.

Spare Wheel Carrier

The spare wheel carrier on the trucks may be installed vertically or horizontally. The design of the vertical spare wheel carrier is shown in Fig. 54.

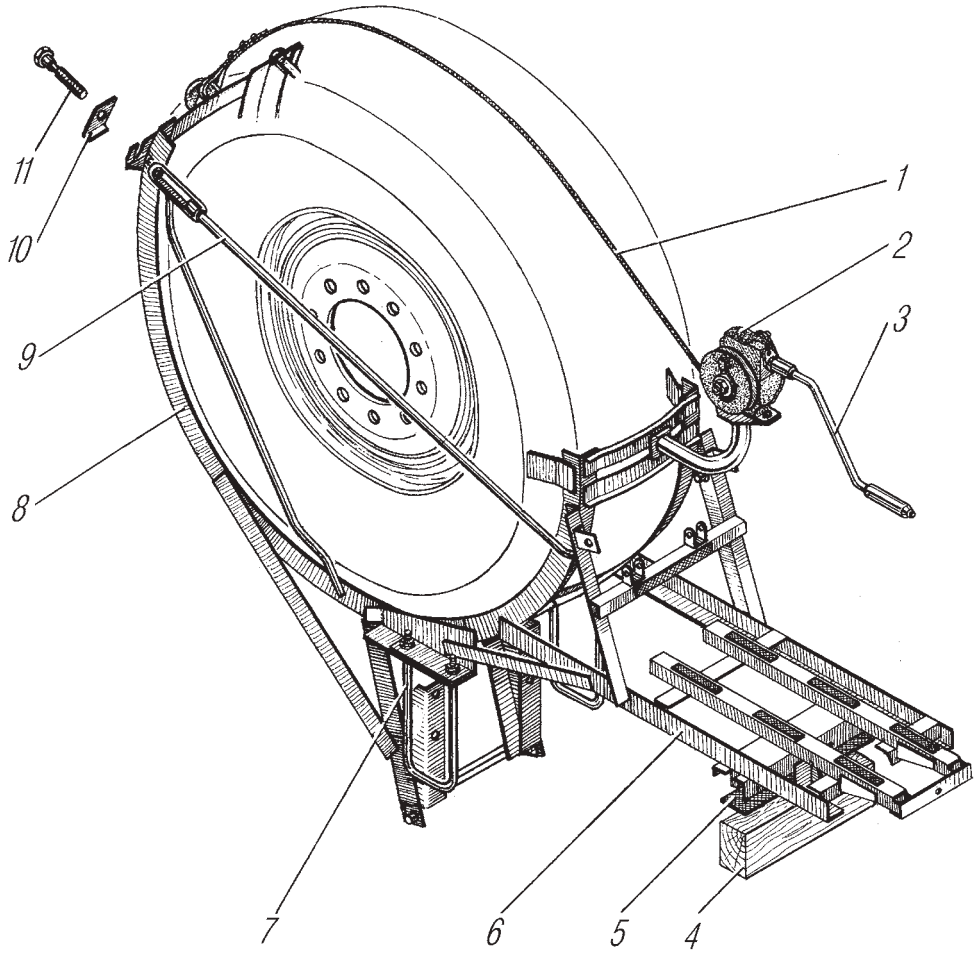


Fig. 54. Vertical spare wheel carrier

1 - cable; 2 - reduction gear *; 3 - handle; 4 - base beam; 5 - beam pad; 6 - carrier base; 7 - U-bolt; 8 - swing-out bracket; 9 - tie; 10 - clevis; 11 - bolt

* On URAL-44202-0311-31 and URAL-44202-0612-30 tractor trucks, the reduction gear is installed under the carrier base.

The base of the spare wheel carrier and the swing-out bracket are made of rolled sections welded together.

The spare wheel is raised and lowered by a worm reduction gear. In the transport position, the spare wheel is held by ties 9 and bolts 11. To lower the spare wheel, release swing-out bracket 8 from ties 9, after first checking the attachment of cable 1 to the swing-out bracket. Fit the removable handle onto the reduction gear shaft.

Turn the handle to lower the swing-out bracket with the spare wheel. With the bracket lowered, remove cable 1 from the spare wheel, without disconnecting it from swing-out bracket 8 unless necessary, and roll the wheel out.

Raise and secure the spare wheel in the transport position in the reverse order, after which relax the cable tension.

Maintenance of the spare wheel carrier consists of checking the attachment of the carrier to the truck frame and of the wheel in the carrier.

The design of the horizontal spare wheel carrier is shown in Fig. 55.

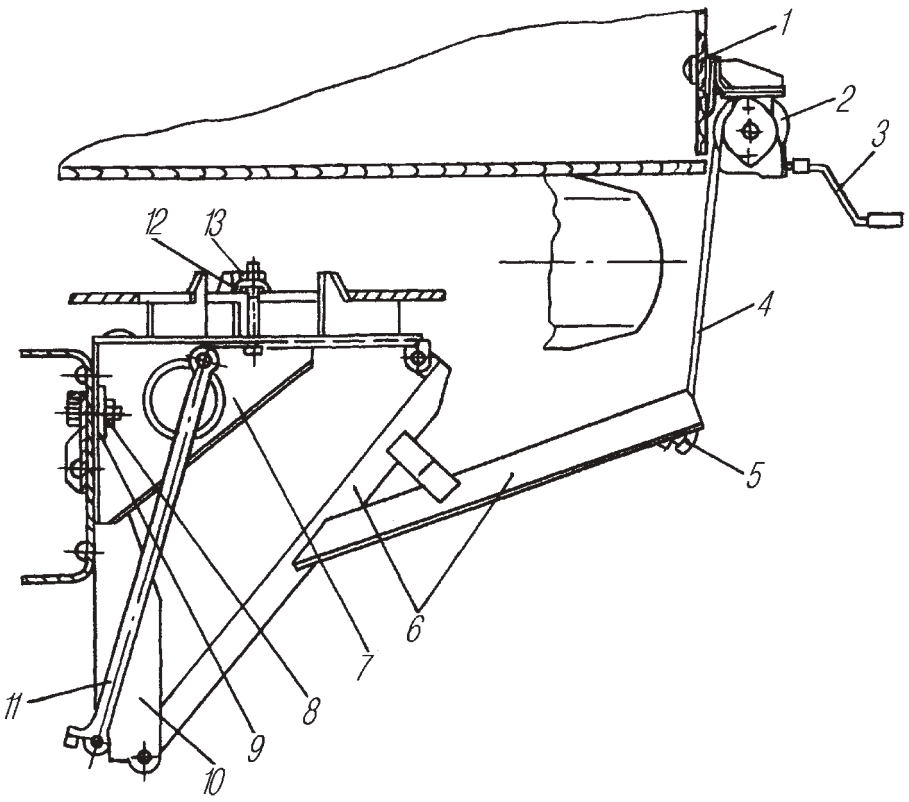


Fig. 55. Horizontal spare wheel carrier

1 - bracket attaching the reduction gear to the cargo body; 2 - reduction gear; 3 - handle; 4 - cable; 5 - cable catch; 6 - lever; 7 - swing-out bracket; 8, 13 - nuts; 9, 12 - plates; 10 - fixed bracket; 11 - post

In the transport position, swing-out bracket 7 with the spare wheel is secured to the truck frame with nuts 8.

To lower the spare wheel, hang reduction gear 2 on bracket 1 of the cargo body side, and fasten the loop of cable 4 on catch 5 located on lever 6.

For safe operation, tension the reduction gear cable by turning removable handle 3. Unscrew nuts 8 and remove plates 9 that secure swing-out bracket 7 to the frame. Relax the cable tension slightly and release swing-out bracket 7 from the latch. Turn handle 3 of reduction gear 2 to lower the spare wheel.

Slacken the cable, remove reduction gear 2 from the cargo body side and, without disconnecting cable 4 from cable catch 5, remove the spare wheel from the swing-out bracket.

Raise and secure the spare wheel in the transport position in the reverse order.

The latch that locks the swing-out bracket is located on the truck frame, to the right of the spare wheel carrier.

Steering

The steering system consists of the steering column, the steering gear, the steering linkage, and the hydraulic power steering booster.

Two versions of the steering system can be installed on the trucks: with a worm-and-side-sector steering gear or with a screw-ball nut-rack-sector steering gear; the drive shafts 7 (Fig. 56) and 10 (Fig. 57) differ in length.

On the spool housing of the worm-and-side-sector steering gear, between the lower fittings, there is a blind drilled hole 12 mm in diameter and 5 mm deep, which serves as a distinguishing mark. Do not use steering gears without this hole in a steering system with a power steering booster mounted on the left frame side rail.

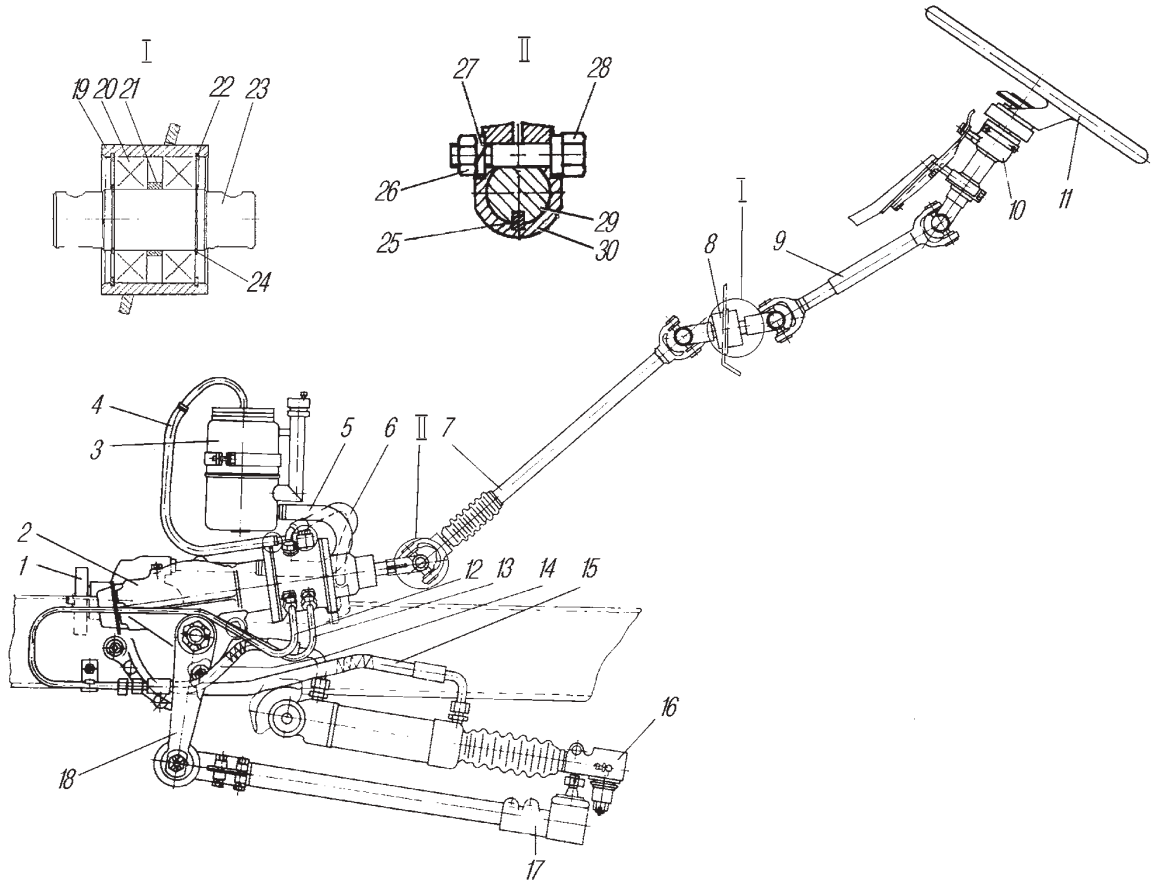


Fig. 56. Steering system with worm-and-side-sector steering gear

1 - pump; 2 - steering gear; 3 - oil reservoir; 4, 5 - low-pressure hoses; 6, 14, 15 - high-pressure hoses; 7, 9 - steering drive shafts; 8 - intermediate support; 10 - steering column; 11 - steering wheel; 12, 13 - high-pressure tubes; 16 - power steering booster; 17 - pitman arm drag link; 18 - pitman arm; 19 - housing; 20 - bearings; 21 - spacer sleeve; 22, 24 - retaining rings; 23 - shaft; 25 - key; 26 - nut; 27 - washer; 28 - bolt; 29 - shaft; 30 - universal joint yoke

Steering Column

The steering column is connected to the steering gear by drive shafts through intermediate support 8 (see Fig. 56). Sealed bearings that require no lubrication are used in the intermediate support.

The steering gear with the control valve of the power steering booster consists of worm 3 (Fig. 58) and worm sector 5 with helical teeth. Pitman arm 25 of the steering system is connected to the sector shaft by a tapered splined joint. The sector bears against side housing cover 18 through adjusting washers 19. Deflection of the sector is limited by pin 17 installed in the housing cover. A spool-type control valve of the power steering booster is installed on the steering gear housing.

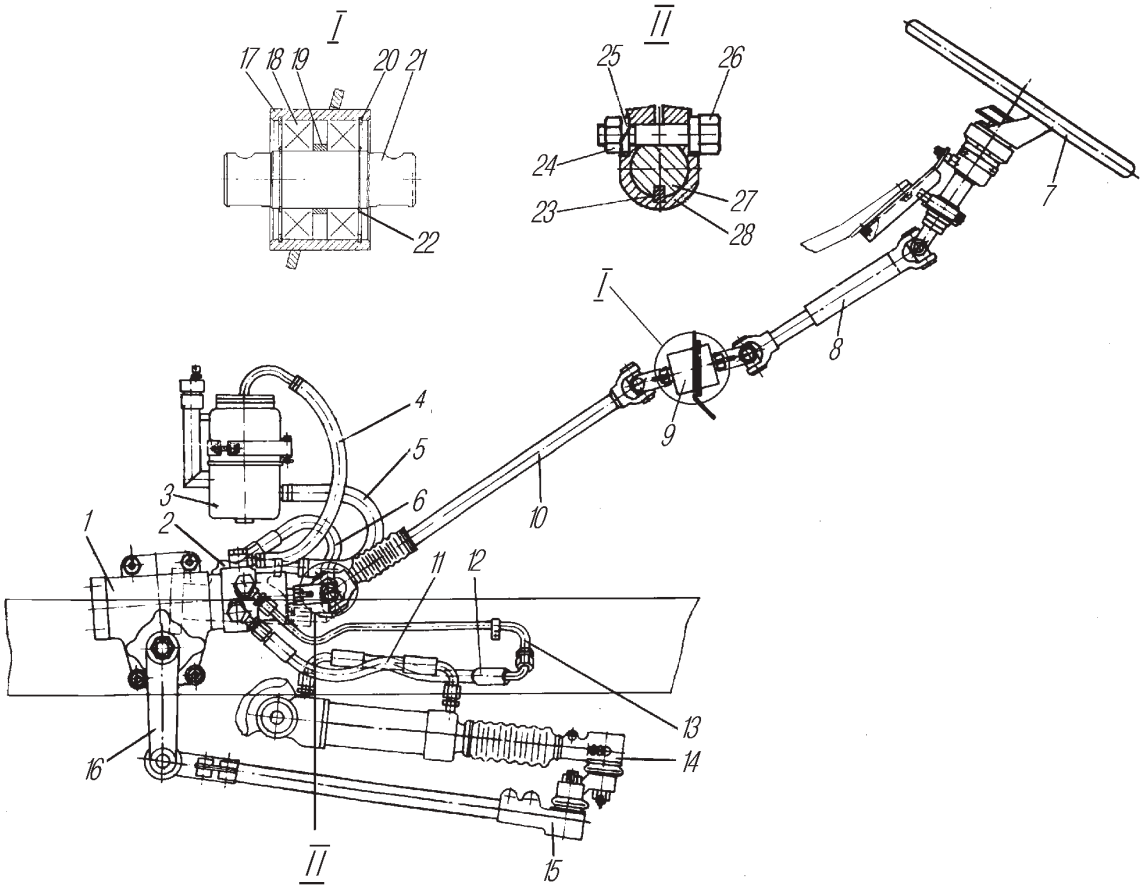


Fig. 57. Steering system with screw-ball nut-rack-sector steering gear

1 - steering gear; 2 - pump; 3 - oil reservoir; 4, 5 - low-pressure hoses; 6, 11, 12 - high-pressure hoses; 7 - steering wheel; 8, 10 - steering drive shafts; 9 - intermediate support; 13 - high-pressure tube; 14 - power steering booster; 15 - pitman arm drag link; 16 - pitman arm; 17 - housing; 18 - bearings; 19 - spacer sleeve; 20, 22 - retaining rings; 21 - shaft; 23 - key; 24 - nut; 25 - washer; 26 - bolt; 27 - shaft; 28 - universal joint yoke

The valve body is connected by lines to the pump and to the cylinder of the power steering booster. When the truck drives straight, the spool is in the neutral position; oil from the pump then enters the spool housing and flows through the clearances between it and the spool, via the return line, into the reservoir. In this case the cavities of the power steering booster cylinder are under equal pressure, and the piston remains stationary.

When the steering wheel is turned, as a result of the reaction forces that arise in the worm-sector pair, the worm and the steering shaft with the spool move axially. The required movement of the shaft is provided by the design of bearing 2. Since the spool moves relative to the stationary spool housing 30, one cavity of the power steering booster cylinder is connected to the high-pressure line and the other to the return line. As a result, the rod of the power steering booster cylinder will move until rotation of the steering wheel stops. The movement of the rod is transmitted to the steered wheels through the ball pin and the steering knuckle arm. When the steering wheel is turned to the left and to the right, the direction of oil flow in the power steering booster changes.

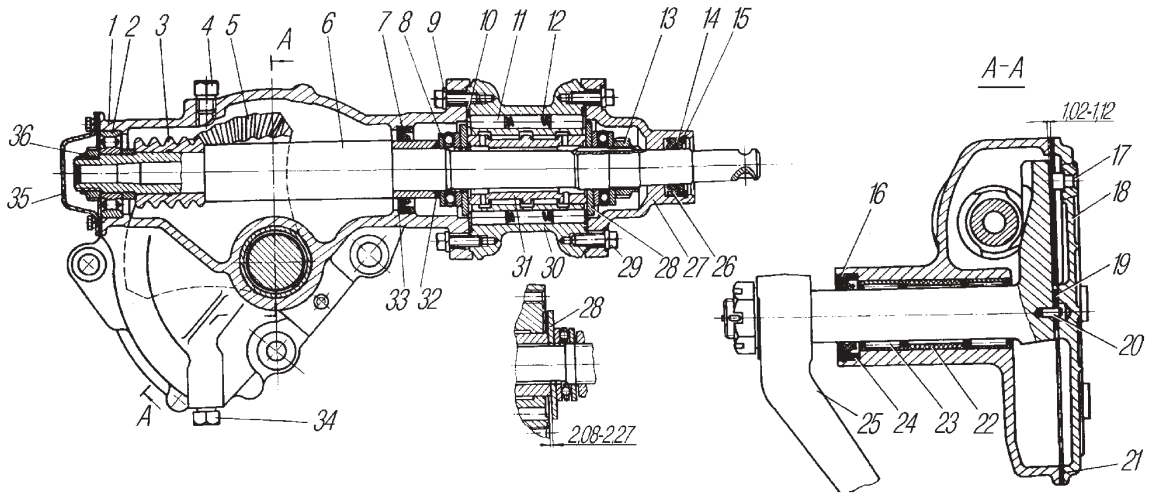


Fig. 58. Steering gear (worm and side sector)

1 - steering gear housing; 2 - radial roller bearing; 3 - worm; 4, 34 - filler and drain hole plugs; 5 - steering sector; 6 - steering shaft; 7, 24, 26 - lip seals; 8 - thrust bearing; 9 - spring washer; 10 - sealing ring; 11 - plunger; 12 - spring; 13 - spool nut; 14 - sealing ring; 15, 16 - retaining rings; 17, 20 - pins; 18 - side housing cover; 19 - adjusting washers; 21 - gasket; 22 - spacer sleeve; 23 - needle bearing; 25 - steering pitman arm; 27 - spool housing cover; 28 - movable plunger ring; 29 - bolt; 30 - spool housing; 31 - spool; 32 - sealing ring; 33 - thrust washer; 35 - cover; 36 - worm nut

Steering Gear

The steering gear with the control valve (Fig. 59) includes screw 7 and ball nut-rack 8, which meshes with sector 1. The semicircular helical grooves on the screw and the nut-rack form a channel that is filled with high-precision balls 6 when the gear is assembled.

Toothed sector 1 is mounted in bearings 18, which in turn are pressed into inserts 21; the inserts have a series of holes on their end faces for adjusting the gear mesh.

The axes of the outer surfaces of inserts 21 are offset relative to the axes of the bearing bores 18 by the amount of eccentricity "e", which makes it possible to adjust the gear mesh of the sector and the nut-rack by turning inserts 21.

On the end face of the splined end of sector 1 there is a mark that is aligned with the mark on the end face of the pitman arm.

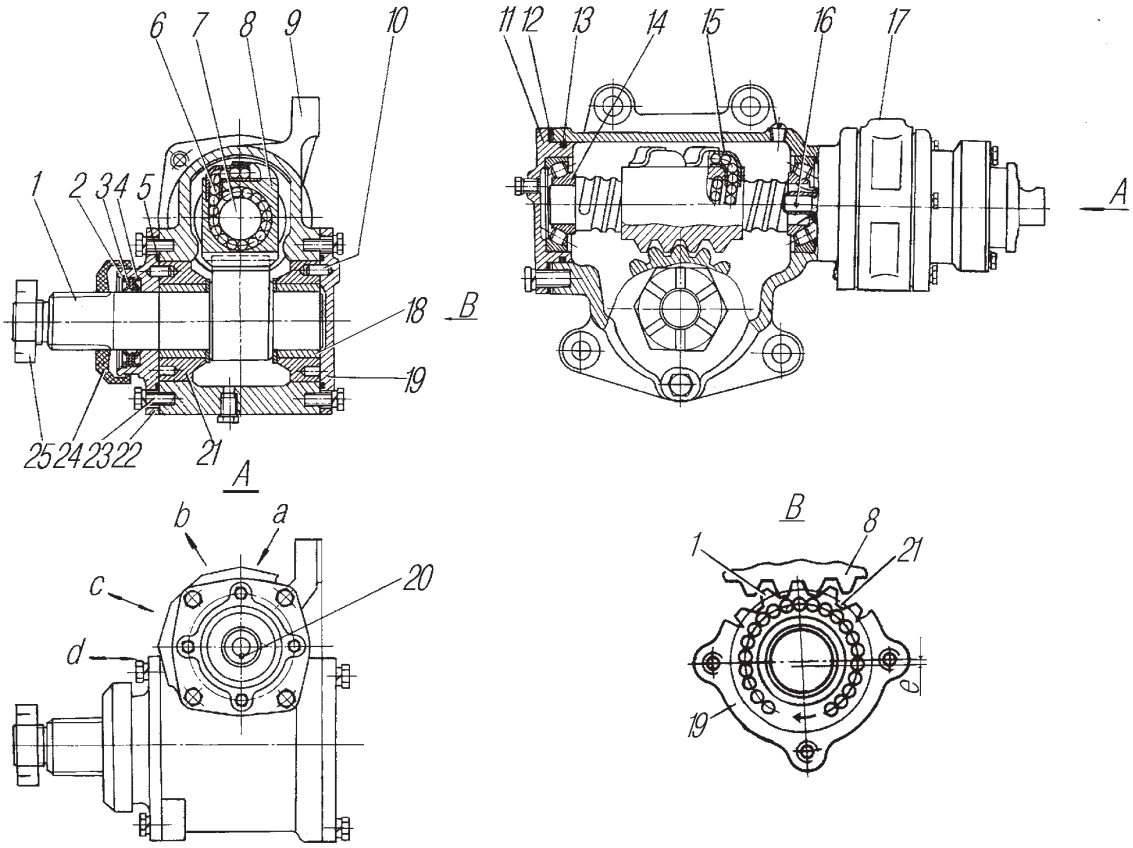


Fig. 59. Steering gear (screw, ball nut-rack, sector)

1 - sector; 2 - retaining ring; 3 - protective ring; 4 - lip seal; 5, 13 - sealing rings; 6 - balls; 7 - screw; 8 - nut-rack; 9 - housing; 10 - retainer; 11, 19, 22 - covers; 12 - adjusting shims; 14 - bearings; 15 - guide; 16, 20 - pins; 17 - control valve; 18 - bearings; 21 - insert; 23 - bolt; 24 - seal; 25 - nut; a - from the pump; b - return; c, d - to the power cylinder

Control Valve

The control valve (Fig. 60) is installed on the steering gear.

Spool housing 5 has three annular grooves "e", "k", and "f". The middle groove "e" is connected to passage "a" for supplying working fluid from the pump; the outer grooves "k" and "f" are connected to passage "b" for draining the working fluid to the return.

Plungers 21, which can move axially in their bores, are located in the three reaction chambers of housing 5.

Spool 22 is secured through bearings 3 by nut 2 on sleeve 9. Sleeve 9 is connected by splines, without side clearance, to screw 24 of the steering gear, with the possibility of axial movement, and by a helical joint to input shaft 15. The splined joint of shaft 15 and screw 24 is made with a side clearance "t". The clearance is chosen so as to ensure the full travel of the spool.

Input shaft 15 is also connected to screw 24 of the steering gear by torsion bar 17.

Check valve 6 is screwed into the passage of the middle groove "e".

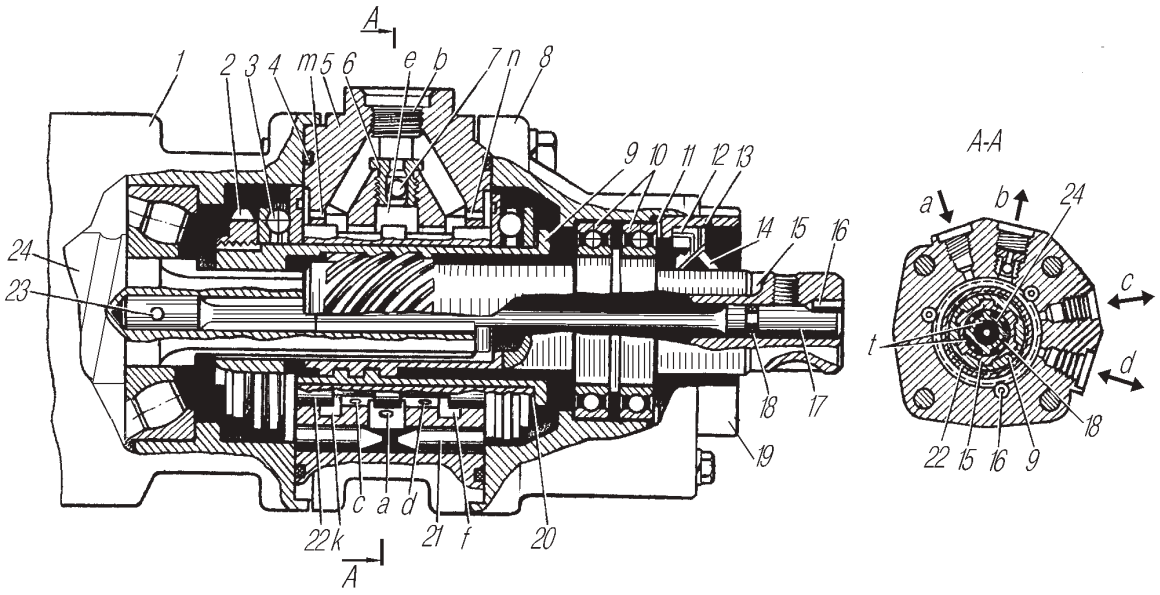


Fig. 60. Power steering control valve

1 - steering gear housing; 2 - nut; 3, 10 - bearings; 4 - sealing rings; 5 - spool housing; 6 - check valve; 7 - ball; 8 - control valve cover; 9 - sleeve; 11, 20 - adjusting shims; 12 - lip seal; 13 - retaining ring; 14 - ring; 15 - shaft; 16, 23 - pins; 17 - torsion bar; 18 - sealing ring; 19 - cover; 21 - plungers; 22 - spool; 24 - screw; a - passage for supplying working fluid from the pump; b - passage for draining working fluid from the pump; c, d - passages for supplying (draining) working fluid to the cavities of the power steering booster; e, k, f - annular grooves; m, n - drilled holes connecting the cavities of the control valve housing and cover to the return; t - clearance

Operation of the Steering System

When the truck drives straight and no force is applied to the steering wheel, the spool is in the neutral position in the housing.

Working fluid from the pump flows to the middle groove "e" (see Fig. 60). Because in this position of the spool grooves "e", "k", and "f" are connected to one another, the oil fills them and the reaction chambers and drains from the control valve through the outer grooves "k" and "f" and hole "b" into the oil reservoir.

When the steering wheel is turned, for example to the right, sleeve 9, with spool 22 secured to it, moves in the axial direction to the left (toward the steering gear) by means of the helical joint.

At the initial moment of movement, when the pressure in the hydraulic system is low, the force on the steering wheel is created mainly by twisting of the torsion bar, which acts directly on shaft 15. The helical joint, at the same time, moves the spool and is practically unloaded. When the spool is displaced, by an amount limited by clearance "t" in the splined joint, the supply of working fluid to annular groove "f" is cut off. Fluid from the pump is delivered to the middle groove "e", then through passage "d" in the housing and on through the line into the rodless cavity of power steering booster 14 (see Fig. 57).

The force from the power steering booster is transmitted to the steering knuckle arm of the front steering axle. The steered wheels turn to the right. From the rod cavity of the power steering booster, fluid flows through the lines and through passage "c" (see Fig. 60) of the control valve into annular groove "k" and then drains through hole "b" into the reservoir.

When the resistance to turning of the steered wheels increases, the pressure in the hydraulic system, and consequently in the reaction chambers, rises, which causes a proportional increase in the force on the steering wheel.

In this way the driver receives feedback about the increase in resistance to turning of the steered wheels.

When the steering wheel stops turning further (the force is removed from it), torsion bar 17 and plungers 21 return the spool to the neutral position. The flow of fluid into the rodless cavity of the power steering booster stops, and the truck moves along a circle of the set radius.

When the steering wheel is turned to the left, sleeve 9 and spool 22 move in the axial direction to the right (away from the steering gear). Fluid from the pump under pressure flows through groove "e" and passage "c" into the rod cavity of the power steering booster.

If the power steering booster is faulty, check valve 6 allows oil to bypass from one cavity of the power steering booster to the other, which makes the truck easier to steer.

Power Steering Booster

The power steering booster softens the shocks transmitted to the steering wheel when driving on a rough road, increases driving safety, makes it possible to keep the original direction of travel if a front tire is punctured, and reduces the effort needed to turn the front wheels.

The power steering booster is pivotally connected to the frame and to the steering knuckle arm of the front axle. The length of the rod is adjusted within limits that provide the specified steering angles of the front wheels. To change the length of the rod, loosen clamp bolt 14 (Fig. 61) of the end fitting, remove protective boot 12 from the end fitting, and turn the rod in one direction or the other with a wrench. If there is a leak along the rod, tighten the seal with nut 11.

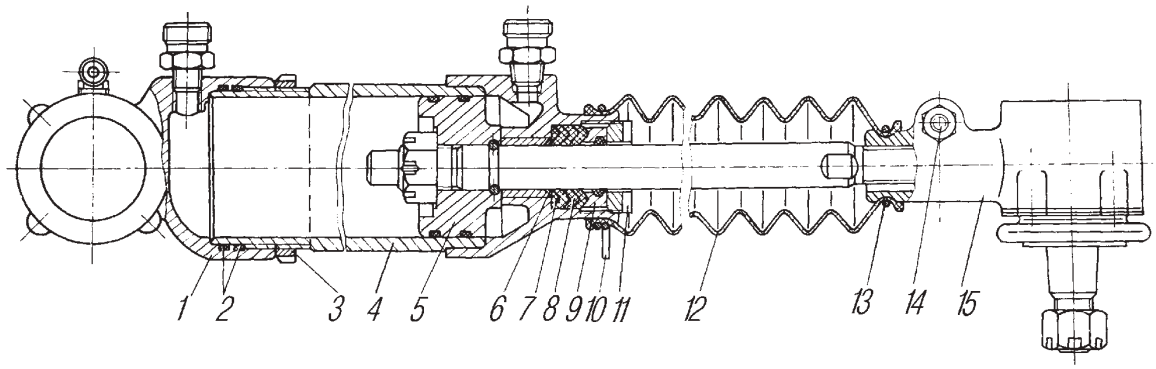


Fig. 61. Power steering booster

1 - cylinder end fitting; 2, 6 - sealing rings; 3 - end fitting nut; 4 - cylinder; 5 - piston and rod assembly; 7 - back-up ring; 8 - lip seal; 9 - pressure ring; 10, 13 - clamps; 11 - nut; 12 - protective boot; 14 - bolt; 15 - rod end fitting

Power Steering Pump

The power steering pump (Fig. 62) is a double-acting vane type. When the pump shaft rotates, the vanes are pressed against the curved surface of the stator by centrifugal force and by the oil pressure beneath them. In the suction cavities, oil enters the space between the vanes and is then forced out of the discharge cavity as the rotor turns.

The end faces of the housing and of the distribution disc are ground. Nicks and burrs on them, as well as on the rotor, stator, and vanes, are not allowed. Two valves are located in the pump cover. The bypass valve limits the amount of oil delivered by the pump to the power cylinder. The relief valve, located inside the bypass valve, limits the oil pressure in the system by opening at a pressure of 7500-8500 kPa (75-85 kgf/cm2).

Check the tension of the power steering pump drive belt by applying a force of 40 N (4 kgf) at the middle of the belt span in the direction of arrow b. The permissible deflection under this force must be 7-13 mm. Adjust the belt tension with screw 18, which has a square shank.

Steering Oil Reservoir

The reservoir is mounted separately from the pump. The reservoir has a filler filter 3 (Fig. 63). Oil returning to the reservoir passes through filter 2. If the filter elements become clogged, valve 8 opens. The oil level in the reservoir must be within the flat section of the indicator and is measured with the indicator (dipstick) with plug 4 not screwed in.

находиться в пределах белого участка на указателе и замеряет при незавернутой пробке 4.

Для промывки фильтра бака вывернуть болты крепления фильт разобрать фильтр. Промыть фильтрующие элементы дизельным топл и установить фильтр.

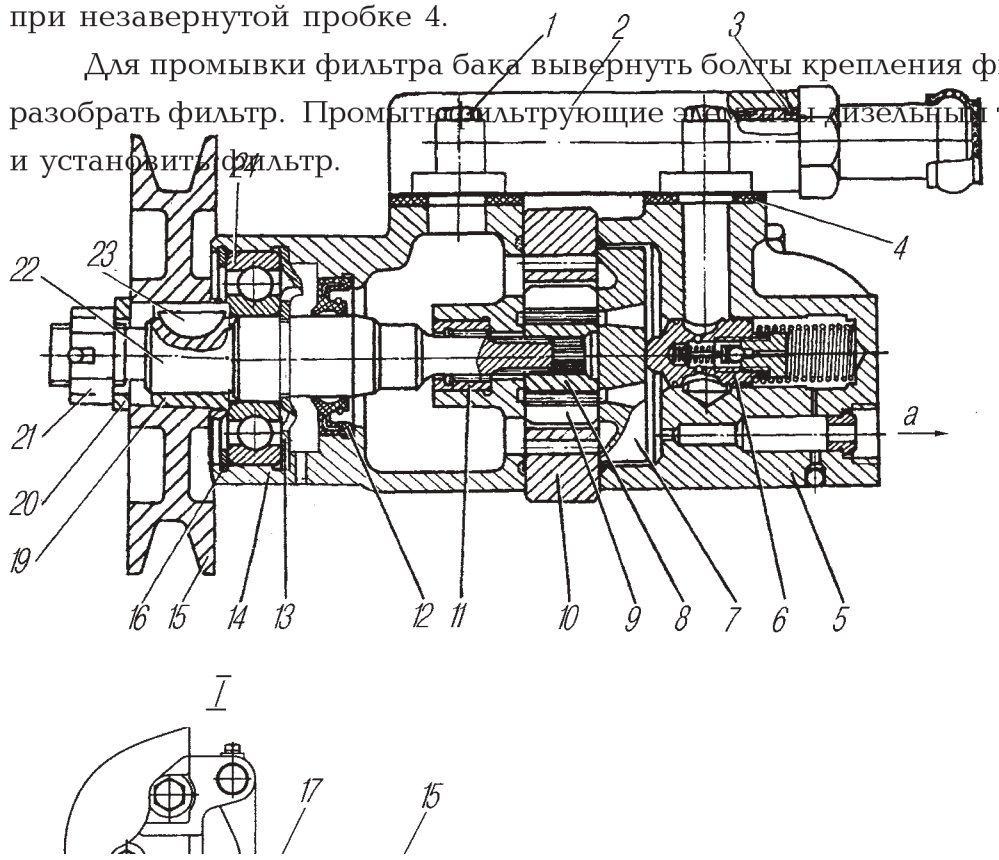


Fig. 62. Power steering pump

1 - bolt; 2 - manifold; 3 - sealing ring; 4 - gasket; 5 - cover; 6 - bypass valve assembly with relief valve; 7 - distribution disc; 8 - rotor; 9 - vane; 10 - stator; 11 - needle bearing; 12 - lip seal; 13 - spacer; 14 - housing; 15 - pulley; 16 - snap ring; 17 - belt; 18 - screw; 19 - bushing; 20 - washer; 21 - nut; 22 - shaft; 23 - Woodruff key; 24 - ball bearings; a - to the steering gear; b - direction of force; I - pump installation

To flush the reservoir filter, unscrew the filter mounting bolts, remove the filter, and disassemble it. Wash the filter elements in diesel fuel, then assemble and install the filter.

Steering Linkage

The drag link of the pitman arm and the rods of the steering trapezoid are adjustable in length.

The joints of the steering linkage and of the power steering booster have annular bearing shells 9 and 10 (Fig. 64). The joints are not adjusted during operation. In new joints, a total play of up to 0.3 mm is allowed in the direction perpendicular to the axis of the ball stud.

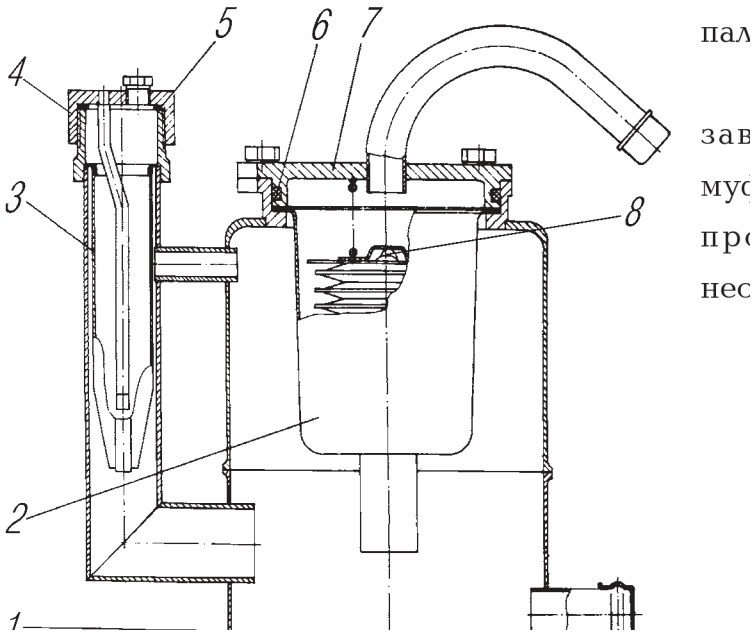


Fig. 63. Steering oil reservoir

1 - housing; 2 - filter; 3 - filler filter; 4 - filler neck plug with dipstick; 5, 6 - sealing rings; 7 - filter cover; 8 - bypass valve

The service life of the joints depends on the condition of the protective boots 12; therefore, boots damaged during operation must be replaced.

крышка фильтра; 8 — клапан перепускной

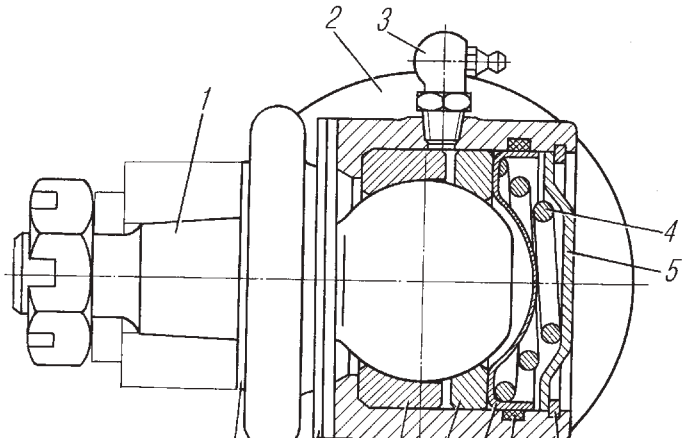


Fig. 64. Steering linkage joint

1 - ball stud; 2 - tie rod end; 3 - grease fitting; 4 - spring; 5 - plug; 6 - snap ring; 7 - seal; 8 - spring retainer; 9 - lower bearing shell; 10 - upper bearing shell; 11 - cover plate; 12 - protective boot; 13 - washer

Steering System Maintenance

Maintenance of the steering system consists of periodically checking the mounting of the steering gear, the pipes, the protective boot of the power steering booster rod, and the steering wheel free play, as well as servicing the units of the hydraulic system. Assemble and disassemble the units only when necessary and under conditions of complete cleanliness. Replace rubber rings that have lost their elasticity and sealing properties.

Before disassembling the pump, mark the position of the distribution disc relative to the stator and the position of the stator relative to the pump housing (the arrow on the stator indicates the direction of rotation of the pump shaft).

The stator, rotor, and vanes of the power steering pump are individually matched to one another, as are the bypass valve and the pump cover; therefore, do not break up these matched sets.

If there is minor scoring, lap the end faces of the rotor, housing, and distribution disc against one another. When disassembling the pump, make sure the rubber sealing rings are not damaged. Before assembly, wash the parts of the pump, the power steering booster, and the control valve in kerosene or gasoline, let them dry (but do not wipe them), and coat them with oil.

When filling the steering linkage joints with grease, make sure that the grease pressure does not noticeably deform the protective boot.

Changing the Oil in the Steering Hydraulic System

1. Warm up the engine; the oil in the steering hydraulic system must be at a temperature of at least 20 °C.
2. Raise the front axle with a jack.
3. Turn the wheels to the right as far as they will go.
4. Disconnect the hoses of the power steering booster from the pipes running from the steering gear.
5. Remove cover 7 (see Fig. 63) of the oil reservoir and filter 2, and wash the filter.
6. Drain the oil from the power steering booster by turning the steered wheels to the left as far as they will go.
7. Connect the hoses of the power steering booster to the pipes of the steering gear.
8. Remove the remaining oil from the pump reservoir and reinstall the mesh filter and the reservoir cover.
9. Flush the hydraulic system as follows:

— pour 1.5 L of clean oil into the reservoir;

— start the engine and top up the oil to the upper mark on the dipstick, then, with the engine idling, turn the steered wheels to both sides as far as they will go (two to three times) and set the wheels to the extreme right position; then perform the operations in items 4, 6, and 7.

10. Fill the hydraulic system with oil as follows:

— pour 1.5 L of clean oil into the reservoir;

— start the engine and top up the oil to the upper mark, then, with the engine idling, bleed the air from the hydraulic system by turning the steering wheel as far as it will go in both directions (until air bubbles stop appearing in the reservoir);

— stop the engine;

— check the oil level in the reservoir and top up if necessary;

— reinstall the reservoir filler neck plug.

Checking the Steering Wheel Free Play

Check the angular free play of the steering wheel by rocking the steering wheel in one direction and then the other until the steered wheels begin to turn.

Perform the check on the truck at curb weight with the engine running at idle. The truck must stand on level ground with a hard, dry surface (asphalt or concrete). The steered wheels must be in the straight-ahead position, the steering hydraulic system must be filled, and the air must be removed from the working fluid.

The angular free play of the steering wheel must not exceed 25°. If the free play exceeds this value and the clearances in the steering linkage elements have been taken up, adjust the engagement of the steering gear. Drain the oil from the mechanism before adjusting it.

Adjust the engagement of the steering gear (see Fig. 58) only after the control valve of the power steering booster has been completely assembled. With a correctly assembled control valve, the clearance between the end face of the valve housing and the end face of the movable plunger ring must be 2.08-2.27 mm. When checking this clearance with a feeler gauge, engage the sector with the worm and apply a torque of 17-19 N*m (1.7-1.9 kgf*m) to the worm shaft.

The total travel of the spool relative to the housing is 4.16-4.54 mm. The engagement is designed so that the axial clearance between the worm and sector teeth is at its minimum when the sector is in the middle position and gradually increases as the sector is turned in either direction.

In a new steering gear, the axial travel of the sector at the extreme positions is within 0.30-0.65 mm, and in the middle position within 0.05-0.10 mm. When adjusting the engagement, set the axial travel of the sector in the middle position to the minimum possible (not less than 0.01 mm); the axial travel of the sector at its extreme positions must then be greater. The engagement is adjusted by selecting adjusting washers 19; the 0.8 mm

thickness of sealing gasket 21 under the side cover of the housing must be maintained. Check the correctness of the axial clearance adjustment on the assembled steering gear with a dial indicator, by the amount of axial travel of the sector shaft.

After adjusting the steering gear, make sure that the steering shaft turns freely without binding. There are marks on the end face of the sector opposite the second tooth and on the worm. When assembling, align these marks so as not to disturb the wear-in of the worm and sector.

In the steering gear (see Fig. 59), adjust the bearing preload in bearings 14 and the backlash in the engagement of nut-rack 8 with sector 1. The screw joint (screw 7, balls 6, nut-rack 8) and the control valve are not adjusted during operation. The matched set of these parts, established during factory assembly, must not be broken up.

1. Before adjusting the preload in bearings 14, clamp the steering gear in a vise by the lugs of the housing and disconnect universal joint 28 (see Fig. 57). By turning shaft 15 (see Fig. 60), set nut-rack 8 (see Fig. 59) and sector 1 to one of the extreme positions. Determine the torque needed to turn shaft 15 (see Fig. 60) from the extreme position to the middle one (turn the shaft through an angle of approximately 30°). If the torque is less than 0.9 N*m (0.1 kgf*m), adjust the preload in bearings 14 (see Fig. 59) by reducing the number of shims 12. After the adjustment, the torque needed to turn shaft 15 (see Fig. 60) must be within 0.9-1.5 N*m (0.1-0.15 kgf*m).

2. To check for backlash in the gear engagement, turn shaft 15 to set the nut-rack and the gear sector to the middle position (divide the total number of turns of shaft 15 by two). Determine whether there is backlash by rocking the pitman arm in both directions (if there is backlash, a knock can be heard in the gear engagement). Also determine the presence of backlash by turning shaft 15 to the left and to the right, with the sector held fixed, until the torsion bar 17 begins to twist.

To adjust the gear engagement, remove the pitman arm and covers 19 (see Fig. 59) and 22, and turn inserts 21 with bearings 18 clockwise (viewed from the sector shaft side) through the same angle so as to eliminate the backlash in the gear engagement. After the inserts are turned, one of the holes in the inserts must lie in the plane passing through the diametrically opposite threaded holes in housing 9 for mounting covers 19 and 22. Install the covers so that locating pins 10 enter the holes in inserts 21 and are positioned opposite each other. If the locating pins and holes are slightly misaligned, turn the inserts in one direction or the other until the pins and holes line up, making sure there is no backlash in the gear engagement. After the adjustment, covers 19 and 22 may be rotated by 90°, 180°, and 270° relative to their original position.

After installing the covers, the torque needed to turn shaft 15 (see Fig. 60) in the middle position must be within 2.7-4.1 N*m (0.27-0.41 kgf*m).

Adjusting the Front Wheel Toe-In

Check the toe-in of the front wheels at nominal tire pressure by measuring the difference between distances B1 and B (Fig. 65) taken at the rim flanges of the wheels. Checking procedure:

— park the truck on flat level ground with a hard surface so that the front wheels are in the straight-ahead position;

— using a telescoping rule, measure distance B1 between the rim flanges of the wheels at the rear, at the level of the wheel centers, and mark the measuring points. Roll the truck forward so that the marked points are at the front, and measure distance B.

The distance at the front must be 1-3 mm smaller than at the rear. If the difference between distances B1 and B is outside the limits given above, adjust the toe-in of the wheels by changing the length of the tie rod after loosening the bolts of the steering trapezoid tie rod ends. After adjusting the toe-in, tighten the tie rod end bolts.

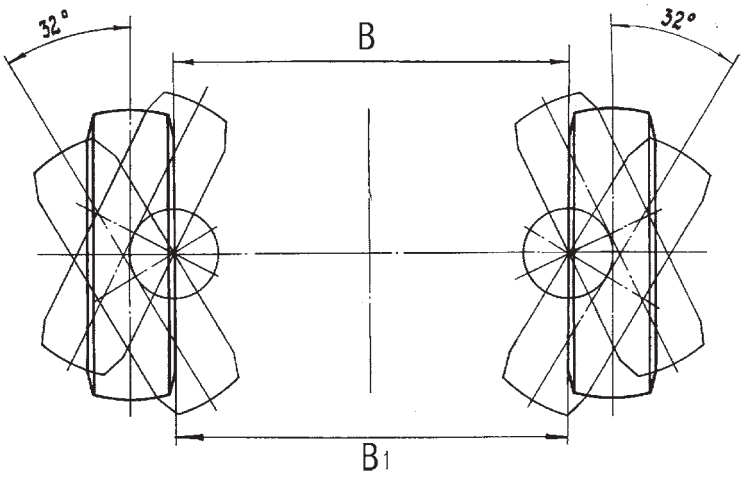


Fig. 65. Steered wheel settings

The steering angles are limited by fixed, non-adjustable stops; their values are given in Fig. 65.

Brake Systems

The truck is equipped with separate brake systems: the service brake system, the emergency brake system, the parking brake system, and the auxiliary brake (exhaust brake) system.

Service Brake System

The service brake system must reduce the speed of the truck and bring it to a stop regardless of its speed, load, and the grades of the roads for which it is intended.

The actuation of the brake assemblies is combined (air-over-hydraulic) and dual-circuit, with separate braking of the wheels of the front axle and of the two rear axles. It is controlled by a pedal in the driver's cab, connected by levers and rods to the dual-section brake valve.

The service brake assembly is of the drum type with internal shoes 5 (Fig. 66), which are interchangeable for all wheels. Each brake assembly has two hydraulic cylinders 1 built into one housing. The brake shoes are mounted on shoe pins 7. The service brake assembly is adjusted as the linings wear by reducing the clearance between the lining and the drum with the adjusting cams 3.

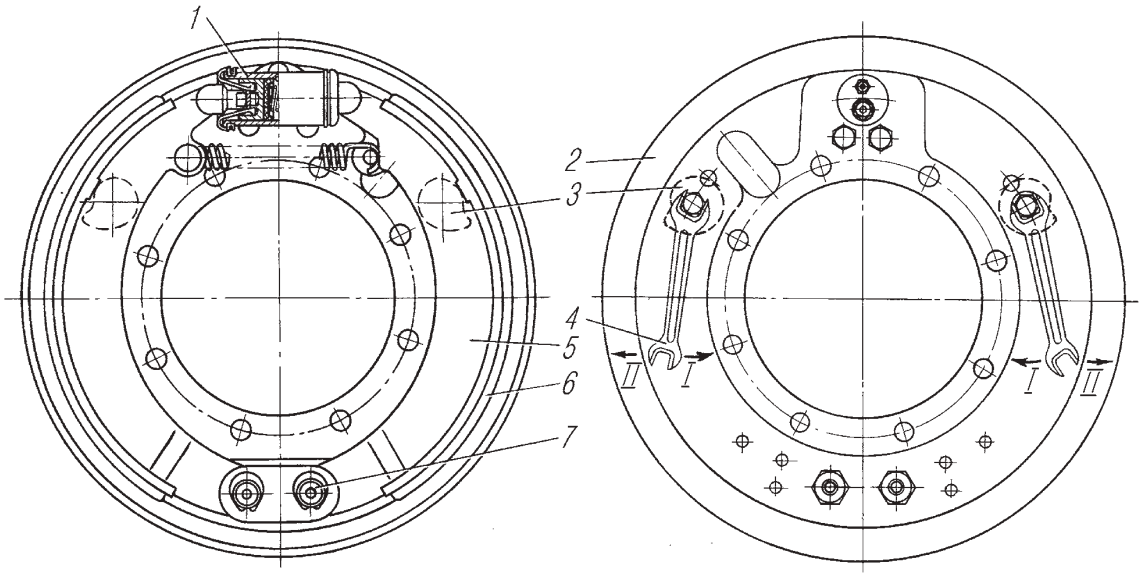


Fig. 66. Service brake assembly

1 - wheel cylinder; 2 - brake backing plate; 3 - adjusting cam; 4 - wrench; 5 - brake shoe; 6 - friction lining; 7 - brake shoe pin; I - decreasing the clearance; II - increasing the clearance

Brake adjustment procedure:

- using a 22 mm wrench, turn the shoe adjusting cams as far as they will go, turning the right cam (on the backing plate side) clockwise and the left cam counterclockwise;
- release the cams by turning them back approximately 30°, which corresponds to turning the head of the cam shaft by half a flat.

After performing these operations on all wheels, check whether the brake drums heat up while the truck is driven.

When adjusting the brakes, do not disturb the factory setting of shoe pins 7 of the brake shoes.

Adjust the clearances between the brake shoe and the drum with the shoe pins only when replacing the friction linings or complete brake shoes. In that case, first set the shoe pins with the marks on their ends facing each other. Through the inspection hole in the brake drum, insert a feeler gauge 0.2 mm thick and 200 mm long between the drum and the shoe at a distance of 30 mm from the lower edge of the lining. Lightly clamp the feeler gauge by turning shoe pin 7. Remove the feeler gauge, turn the drum, and, using another feeler gauge and adjusting cam 3, set a clearance of 0.35 mm between the shoe and the drum at a distance of 30 mm from the upper edge of the lining. Secure the shoe pins and check the clearances between the shoe and the drum again.

Replace the linings when they have worn down to the level of the rivet heads. If the brake linings are contaminated with oil, wash them with gasoline. If the brake drum is worn and has annular grooves more than 2 mm deep, bore the working surface of the drum, locating it on the outer races of the wheel hub bearings. The runout of the working surface of the drum must not exceed 0.25 mm, and the drum diameter must not exceed 424.38 mm.

Combined (Air-Over-Hydraulic) Service Brake Actuation

The truck is equipped with a dual-circuit brake actuation with a combined or two-line trailer brake actuation. The actuation allows the brake systems of towed vehicles having single-line or two-line brake actuation to be connected. A schematic diagram of the brake actuation is shown in Fig. 67.

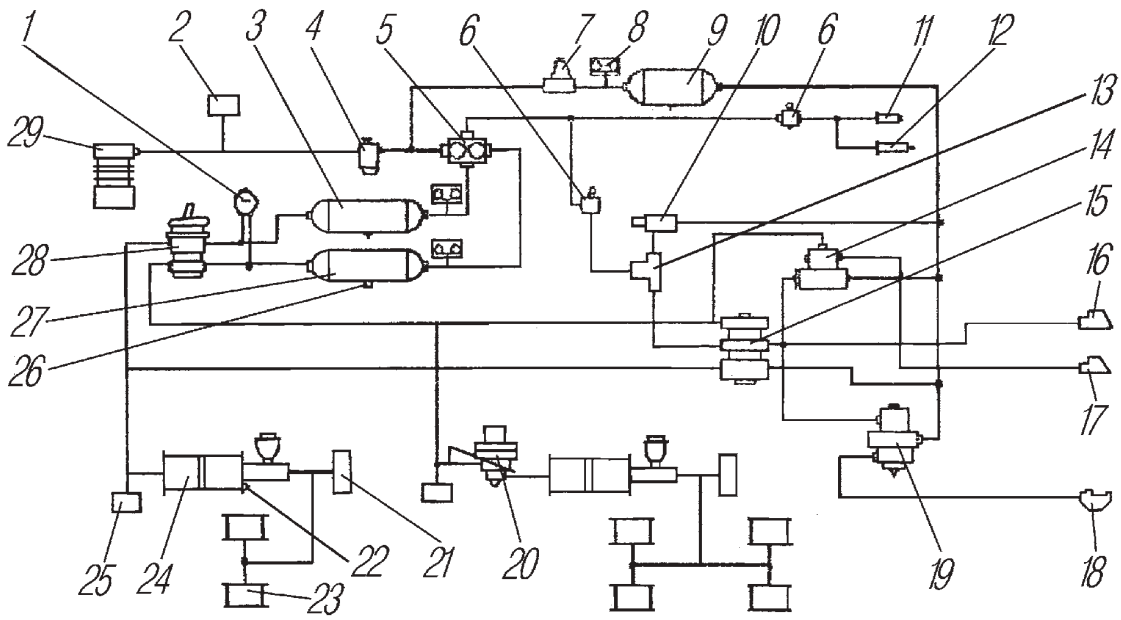


Fig. 67. Diagram of the service brake actuation and the combined trailer brake actuation

1 - dual-needle pressure gauge; 2 - towing valve; 3, 9, 27 - air tanks; 4 - pressure regulator; 5 - triple protection valve; 6 - pneumatic trailer brake cutoff valve; 7 - single protection valve; 8 - pressure drop sensors; 10 - trailer parking brake control valve; 11 - fuel supply cutoff pneumatic cylinder; 12 - exhaust shutter closing pneumatic cylinder; 13 - double check valve; 14 - protection valve; 15 - trailer brake control valve with two-line actuation; 16 - control (yellow) automatic coupling head; 17 - supply (red) automatic coupling head; 18 - type "A" coupling head*; 19 - trailer brake control valve with single-line actuation*; 20 - brake force regulator; 21 - brake light switches; 22 - brake fault indicator sensors; 23 - wheel cylinders; 24 - pneumatic brake booster; 25 - test port valves; 26 - condensate drain valves; 28 - brake valve; 29 - air compressor. * Not installed on trucks supplied to the national economy (NE) with two-line trailer actuation

Air compressor 29 delivers compressed air through pressure regulator 4 to the protection valve block. The block consists of triple protection valve 5 and single protection valve 7, which distribute compressed air to and fill air tanks 3, 9, and 27 of the independent circuits:

— actuation of the brake assemblies of the front wheels;

— actuation of the brake assemblies of the middle and rear wheels;

— combined actuation of the brake assemblies of the trailer wheels.

The first main circuit consists of air tank 3, the upper section of brake valve 28, pneumatic brake booster 24, and wheel cylinders 23, and the second main circuit consists of air tank 27, the lower section of brake valve 28, brake force regulator 20, pneumatic brake booster 24, and wheel cylinders 23.

The third circuit consists of air tank 9, trailer brake control valves 19 (single-line actuation) and 15 (two-line actuation), type "A" coupling head 18 for connecting trailers with single-line actuation, and automatic coupling heads 16 and 17 for connecting trailers with two-line brake actuation.

Air is drawn from air tanks 3 and 27 through triple protection valve 5 to operate the electric signal sensor and other consumers.

To check the air pressure in each circuit, test port valves 25 are installed, to which a portable pressure gauge can be connected.

When the truck drives with a trailer that has single-line brake actuation, the truck is connected to the trailer by coupling head 18; with two-line actuation, by coupling heads 16 and 17.

When the brake pedal is pressed, the first and second circuits of the truck's brake actuation and the third circuit, the trailer brake actuation, are activated. If one of the circuits fails, the others remain operational.

To hold the truck with a trailer stationary when parked, set the parking brake lever to the upper locked position. Trailer parking brake control valve 10 then releases compressed air from port II (see Fig. 75) of valve 15 (see Fig. 67) and applies the trailer brake assemblies.

The truck has a system for signaling and monitoring the condition of the brakes (see the section "Controls and Instruments"). Minimum air pressure sensors are installed in the air tanks. Sensors of the service brake system fault indicators are installed in the pneumatic brake boosters (brake fluid leakage or large clearances between the shoes and the drum).

The components of the pneumatic brake actuation serve to create a supply of compressed air on the truck and to operate the brakes of the truck and the trailer.

Air Compressor

The air compressor (Fig. 68) is a piston-type, non-uniflow, two-cylinder, single-stage compression unit.

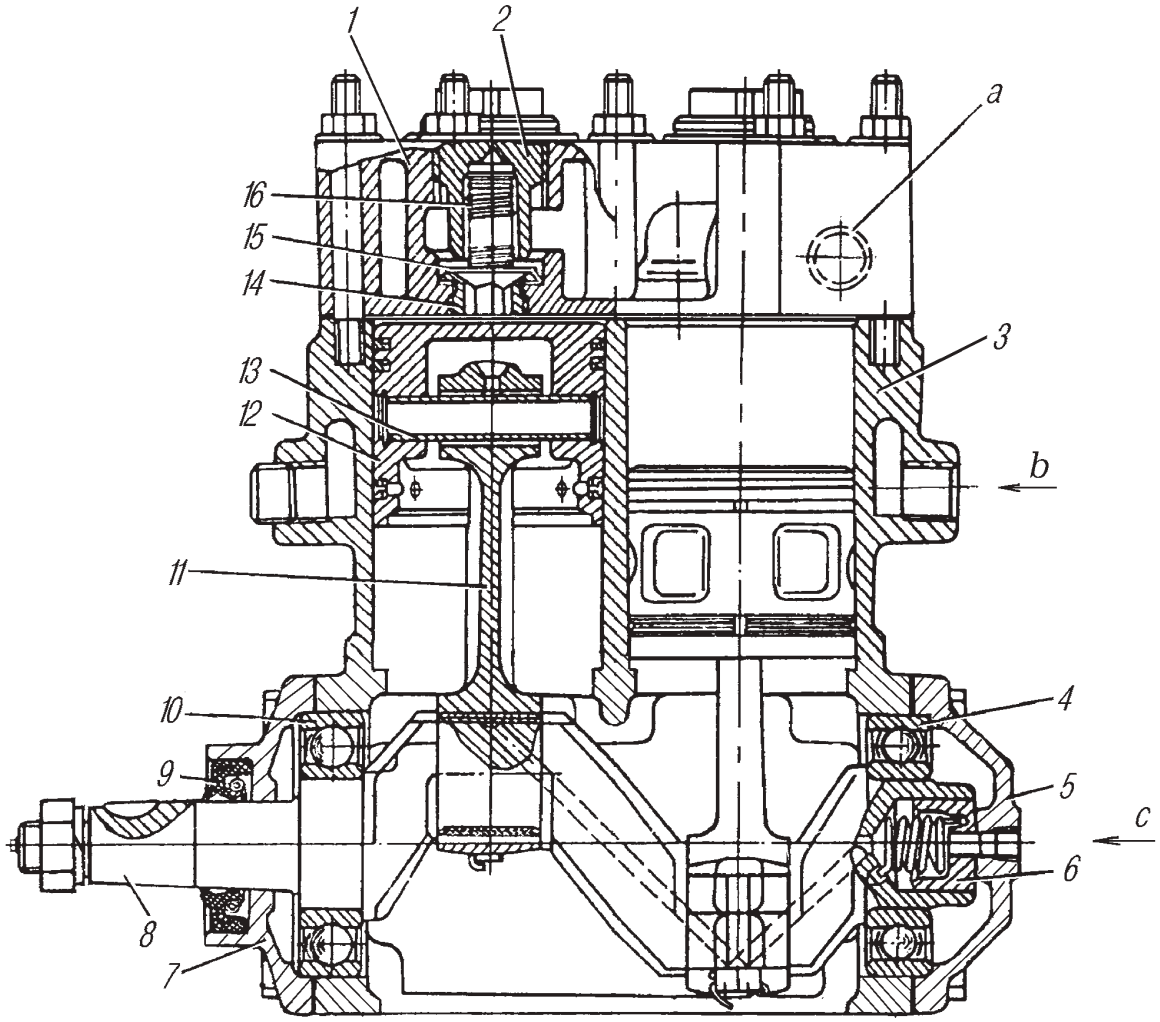


Fig. 68. Air compressor

1 - cylinder head; 2 - discharge valve plug; 3 - block-crankcase; 4, 10 - bearings; 5, 7 - crankcase covers; 6 - seal; 8 - crankshaft; 9 - crankshaft lip seal; 11 - connecting rod; 12 - piston; 13 - piston pin; 14 - discharge valve seat; 15 - discharge valve; 16 - valve spring; a - coolant outlet; b - coolant inlet; c - oil supply

Air from the engine air cleaner enters the compressor cylinders through plate-type intake valves. Air compressed by the pistons is forced into the pneumatic system through the plate-type discharge valves located in the cylinder head.

The block and head are cooled by coolant supplied from the engine cooling system. The compressor cooling system fills only while the engine is running.

Oil is delivered to the rubbing surfaces of the compressor through a tube from the engine oil gallery to the rear cover of the compressor crankcase and then through the seal and the passages in the crankshaft to the connecting rod bearings.

Air Compressor Maintenance

Lap valves that do not seal properly to their seats; replace worn or damaged valves. Lap new valves to their seats until a continuous annular contact pattern is obtained when checked with marking dye.

Tighten the nuts of the cylinder head studs in pairs, starting with the middle diametrically opposite pair. Tighten the nuts in two steps; the final tightening torque must be 12-16 N*m (1.2-1.6 kgf*m).

Signs of a compressor fault: noise and knocking, excessive heating, and an increased oil content in the condensate, which is usually the result of wear of the piston rings, of the seal at the rear end of the crankshaft, and of the connecting rod bearings. Check and adjust the tension of the compressor drive belt according to the operating instructions for the YaMZ-236M2 and YaMZ-238M2 engines.

Pressure Regulator

The pressure regulator is designed to regulate the pressure of the compressed air coming from the compressor. Compressed air from the compressor passes through port IV (Fig. 69) of the regulator, filter 2, and passage 12 into annular passage 9. Through check valve 10, the compressed air flows to port II and then to the air tanks of the truck. At the same time, compressed air flows through passage 8 into cavity A under piston 7, which is loaded by balancing spring 5. In this state, exhaust valve 4 is open and intake valve 11 is closed.

Unloader valve 1 is held closed by spring force. In this state of the regulator, the pneumatic system of the truck is filled with compressed air from the compressor. When the pressure in cavity A reaches 800 kPa (8.0 kgf/cm2), piston 7 overcomes the force of spring 5 and rises, valve 4 closes, intake valve 11 opens, and compressed air from cavity A enters cavity B.

Under the action of the compressed air, unloader piston 13 moves down, valve 1 opens, and compressed air from the compressor is released to the atmosphere through port III together with the condensate that has accumulated in the cavity; check valve 10 closes at the same time.

When the pressure at port II and in cavity A drops to 637 kPa (6.5 kgf/cm2), piston 7 moves down under the force of spring 5, valve 11 closes, and exhaust valve 4 connects cavity B to the atmosphere through port I. Unloader piston 13 then closes under spring force, and the compressor again delivers compressed air into the pneumatic system.

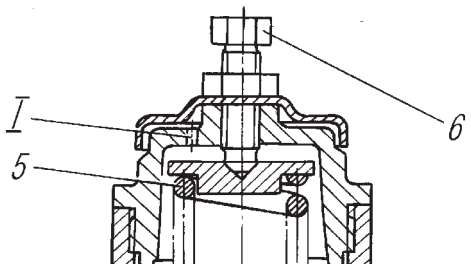


Fig. 69. Pressure regulator

1 - unloader valve; 2 - filter; 3 - air take-off passage plug; 4 - exhaust valve; 5 - balancing spring; 6 - bolt; 7 - balancing piston; 8, 12 - passages; 9 - annular passage; 10 - check valve; 11 - intake valve; 13 - unloader piston; 14 - unloader valve seat; A - cavity under the balancing piston; B - cavity above the unloader piston; I, III - atmospheric ports; II - port to the pneumatic system; IV - supply from the compressor

Unloader valve 1 also serves as a relief valve. If the regulator does not operate at a pressure of 800 kPa (8.0 kgf/cm2), valve 1 opens when the pressure rises to 1000-1300 kPa (10-13 kgf/cm2), and the pressure is relieved.

The regulator is adjusted with bolt 6: screwing it in raises the actuation pressure, and unscrewing it lowers the pressure. The operating pressure of the relief valve is adjusted by changing the number of shims installed under the spring of valve 1.

Correct operation of the pressure regulator is determined by periodically monitoring the air pressure on the dual-needle pressure gauge on the instrument panel while the engine is running and by the frequency with which the regulator cycles.

Dual-Section Brake Valve

The dual-section brake valve (Fig. 70) is designed to control the actuators of the truck's service brake system and also to control the trailer brake actuation valve.

Fig. 70. Brake Valve

1 - lever; 2 - stop screw; 3 - protective boot; 4 - roller; 5 - lever housing; 6 - pusher; 7 - stud; 8 - plate; 9 - flange; 10, 12, 16, 21 - springs; 11 - upper housing; 13, 18 - support rings; 14 - small piston; 15 - lower housing; 17 - lower section valve; 19, 22, 27 - sealing rings; 20 - atmospheric port valve; 23 - large piston; 24 - upper section valve; 25 - upper follower piston; 26 - elastic element; Z1 - port to the pneumatic brake booster of the front axle brake circuit; Z2 - port to the brake force regulator and to the pneumatic brake booster of the middle and rear axle brake circuit; V1 and V2 - ports to the air tanks; a - hole

The brake valve consists of an upper and a lower housing. The lever mechanism of the valve is attached to the upper housing. The lever housing is protected from dirt and moisture by a boot. Small piston 14 is installed in lower housing 15 and is pressed against large piston 23 by spring 21. Valve 24 of the upper section of the valve is pressed against the seat in the lower housing by spring 16.

Ports V1 and V2 of the valve are connected to the air tanks of the two separate circuits of the service brake actuation. From port Z1, compressed air flows to the pneumatic brake booster of the front axle brake circuit, and from port Z2 to the brake force regulator and to the pneumatic brake booster of the middle and rear axle brake circuit.

When the brake pedal is pressed, the force is transmitted through the system of levers and rods of the linkage to lever 1 of the valve and then through pusher 6, plate 8, and the elastic element to follower piston 25. Moving down, piston 25 first closes the exhaust opening of valve 24 of the upper section of the brake valve and then lifts valve 24 off its seat in upper housing 11, opening a passage for compressed air from port V1 to port Z1 and on to the actuators of one of the circuits. The pressure at port Z1 rises until the force applied to lever 1 is balanced by the force created by the pressure on upper piston 25. This is how the follower action is achieved in the upper section of the brake valve.

As the pressure at port Z1 rises, compressed air passes through hole "a" into the cavity above large piston 23 of the lower section of the brake valve. Moving down, the large piston closes the exhaust opening of valve 17 and lifts it off its seat in lower housing 15. Compressed air from port V2 flows to port Z2 and on to the actuators of the second circuit of the service brake.

As the pressure at port Z2 rises, the pressure under pistons 14 and 23 also rises, which balances the force acting on piston 23 from above. As a result, a pressure corresponding to the force on the brake valve lever is also established at port Z2. This is how the follower action is achieved in the lower section of the brake valve.

If the upper section of the brake valve fails, the lower section is controlled mechanically through stud 7 and the pusher of small piston 14 and remains fully operational. If the lower section of the brake valve fails, the upper section operates as described above.

Care of the dual-section brake valve consists of periodic inspection, cleaning off dirt, and leak testing. Monitor the condition of the protective rubber boot of the valve and the tightness of its fit on the housing, because dirt getting onto the pusher and the rubbing surfaces of the valve causes the brake valve to fail.

The tightness of the brake valve is checked with soapy water in two positions: braked and released. Air leaking through the atmospheric port of the brake valve in the released position indicates a leaking intake valve in one of the sections, and air leaking in the braked position indicates a leaking exhaust valve in one of the sections of the brake valve. If there are leaks, replace the brake valve.

Brake Valve Control Linkage

The brake valve control linkage is mechanical. Brake pedal 17 (see Fig. 31), installed with its bracket in the cab, is connected by rod 10 to lever 6, which is mounted with bracket 5 on the cab floor panel. The other end of the lever is connected by adjustable rod 21 to lever 22 of the brake valve, which is mounted on the left side rail of the truck frame.

The brake valve control linkage must be adjusted to provide the free play of the brake control valve lever, which corresponds to a brake pedal free play of 20-30 mm, and the full travel of the lever, which corresponds to a full pedal travel of 150-180 mm, required to build up working pressure in the brake pneumatic system.

The brake pedal free play is adjusted by changing the length of the rod. To do so, loosen the locknut, remove the cotter pin, take out the pin, and, turning the fork in one direction or the other, set the required rod length and tighten the locknut.

Determine the brake pedal free play with nominal air pressure in the truck's pneumatic system by pressing the pedal until one of the needles of pressure gauge 1 (see Fig. 12) begins to move.

The full brake pedal travel is determined by the design of the linkage and is not adjustable.

Pneumatic Brake Boosters

The pneumatic brake boosters with master brake cylinders are installed under the cab: the first on the left side rail, the second on the fuel tank bracket. When the brake pedal is pressed, the valve in the brake valve opens, and air flows through the line under pistons 8 and 12 (Fig. 71) of the pneumatic brake booster.

Under air pressure, the rod with the pistons moves and acts through the pusher on piston 16 of the master brake cylinder, which forces fluid into the brake line.

When the brakes are released, air escapes from the pneumatic brake booster to the atmosphere through the brake valve. The pistons of the master brake cylinder and of the pneumatic brake booster return to their initial position under spring force.

If the pneumatic brake boosters lose their air tightness, replace worn or damaged lip seals. When assembling the pneumatic brake boosters, to avoid deforming the covers, do not tighten tie bar nuts 9 to a torque exceeding 8-12 N*m (0.8-1.2 kgf*m). Check the air tightness of the pneumatic brake boosters at an air pressure of 600-700 kPa (6-7 kgf/cm2), supplying it through the fitting of the booster.

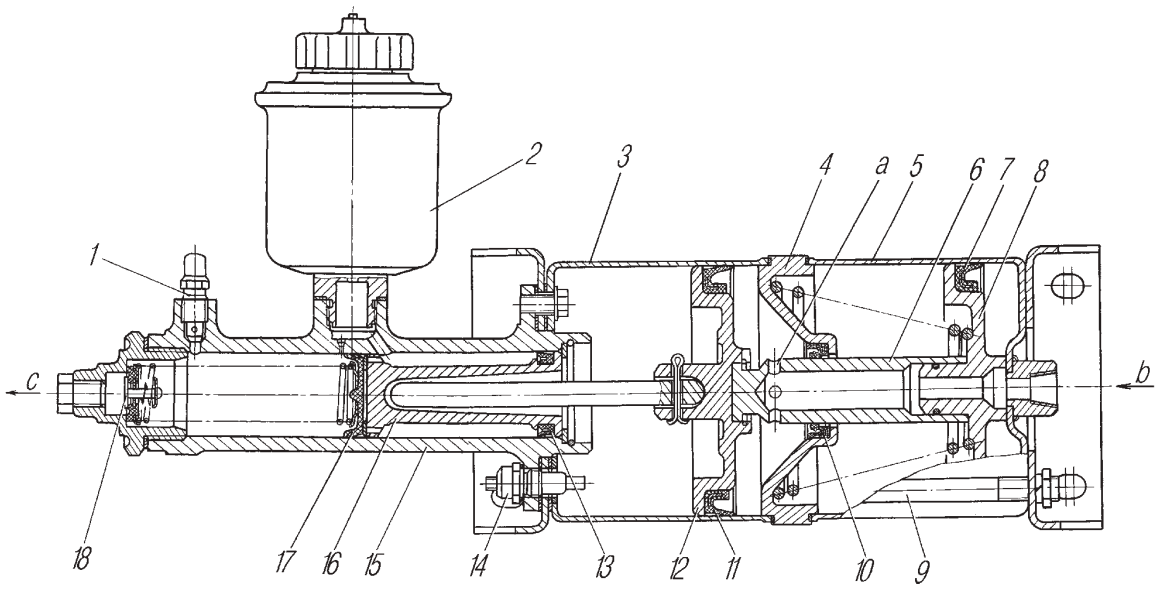


Fig. 71. Pneumatic brake booster with master brake cylinder

1 - bypass valve; 2 - brake fluid reservoir; 3, 5 - air cylinders; 4 - spacer; 6 - rod; 7, 10, 11, 13, 17 - lip seals; 8, 12, 16 - pistons; 9 - tie bar; 14 - brake malfunction warning switch; 15 - master brake cylinder; 18 - check valve; a - radial hole; в - from the brake valve; c - to the brake system

Single Protection Valve

The single protection valve (Fig. 72) protects the brake system of the truck from loss of compressed air when the trailer brake circuit is being supplied. The valve is installed in the pneumatic system in accordance with the arrow marked on valve cover 6, which shows the direction of air flow through the valve.

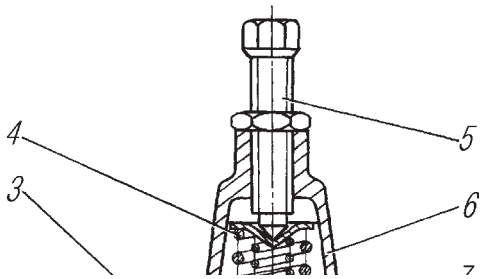


Fig. 72. Single protection valve

1 - check valve; 2 - diaphragm; 3 - piston; 4 - spring; 5 - adjusting screw; 6 - cover; 7 - screw; 8 - body; a - inlet passage; b - outlet passage

Adjusting screw 5, secured by a locknut, is installed in the cover. The adjusting screw changes the spring force and thereby sets the opening pressure: screwing the screw in raises the opening pressure, and unscrewing it lowers the opening pressure.

Compressed air enters through passage "a" under diaphragm 2, which the springs press through the piston against the seat, blocking the air from the chamber upstream of the valve. When the pressure reaches 530-550 kPa (5.3-5.5 kgf/cm2), the compressed air overcomes the force of springs 4, lifts diaphragm 2, opens check valve 1, and flows into the air tank. When the pressure in passage "a" drops below the opening pressure, the diaphragm is lowered onto the seat by the spring and isolates the passages from each other.

Triple Protection Valve

The triple protection valve (Fig. 73) is designed to divide the compressed air coming from the air compressor into two main circuits and one auxiliary circuit; to shut off one of the circuits automatically if its air tightness is lost; to retain compressed air in all circuits if the supply line is damaged or loses air tightness; and to supply the auxiliary circuit from the two main circuits.

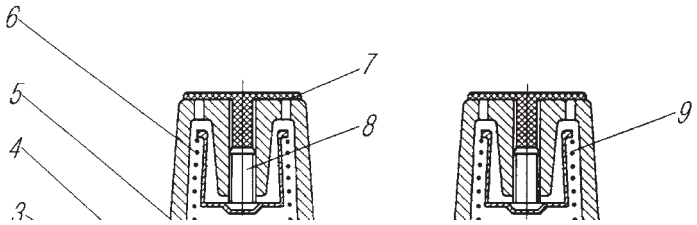


Fig. 73. Triple protection valve

1 - body; 2 - cover; 3, 12, 15 - valves; 4, 10, 17 - spring guides; 5, 11, 16 - diaphragms; 6, 9, 18 - springs; 7 - protective cap; 8 - adjusting screw; 13, 14 - check valves; 19 - spring seat; 20 - guide; 21 - check valve spring; 22 - check valve spring seat; 23 - valve spring

The compressed air entering the triple protection valve from the supply line, upon reaching the specified opening pressure set by the force of springs 6 and 9, opens valves 3 and 12 and flows through the ports into the two main circuits. At the same time, the compressed air acts on diaphragms 5 and 11 and lifts them. After check valves 13 and 14 open, the compressed air opens valve 15 and flows through the port into the auxiliary circuit.

If one of the main circuits fails, the pressure in it and in the body chamber drops; the valve of the intact main circuit and the check valve of the auxiliary circuit close, which prevents a pressure drop in the intact main circuit and in the auxiliary circuit. When the air pressure in the body chamber falls to the limit value, the valve of the failed circuit closes. Compressed air from the air compressor replenishes the intact circuit through check valve 13 or 14. No air enters the damaged circuit. When the air pressure at the valve inlet rises above the specified level, the valve of the failed circuit opens and the excess air escapes through it to the atmosphere. The pressure is thereby kept constant, and no air enters the intact circuits. The intact circuits are filled further with compressed air only after the pressure in them has dropped as air is used. The valves in the intact circuits open under the pressure of the compressed air in the chamber under the valves. In this way, the intact circuits are maintained at a pressure corresponding to the opening pressure of the valve of the failed circuit, and the excess compressed air escapes through the failed circuit.

If the auxiliary circuit fails, the pressure in the two main circuits and in the body chamber drops until valve 15 of the auxiliary circuit closes. With further compressed air supply to the triple protection valve, the main circuits are maintained at the opening pressure of the auxiliary circuit valve. If the compressed air supply to the triple protection valve stops, valves 3 and 12 of the main circuits close, thereby preventing a pressure drop in all three circuits.

Trailer Brake Control Valve (Single-Line Type)

The trailer brake control valve shown in Fig. 74 is designed to control the single-line trailer brake actuation system and also to limit the pressure of the compressed air supplied to the trailer pneumatic brake system to a specified level.

Compressed air from the air tank of the truck is supplied to port I and passes through passage A into the chamber above stepped piston 8. With the brakes released, spring 14 acts on washer 15 and holds diaphragm 16, together with plunger 19, in the lower position. In this state exhaust valve 20 is closed and inlet valve 21 is open, and compressed air passes from port I to port II and on to the trailer connecting line. When a certain pressure, set with adjusting screw 24, is reached at port II, piston 4 overcomes the force of spring 23 and moves down, so that inlet valve 21 seats against the seat in piston 4. In this way, with the brakes released, the pressure maintained automatically in the trailer line is lower than that in the pneumatic actuation of the towing truck.

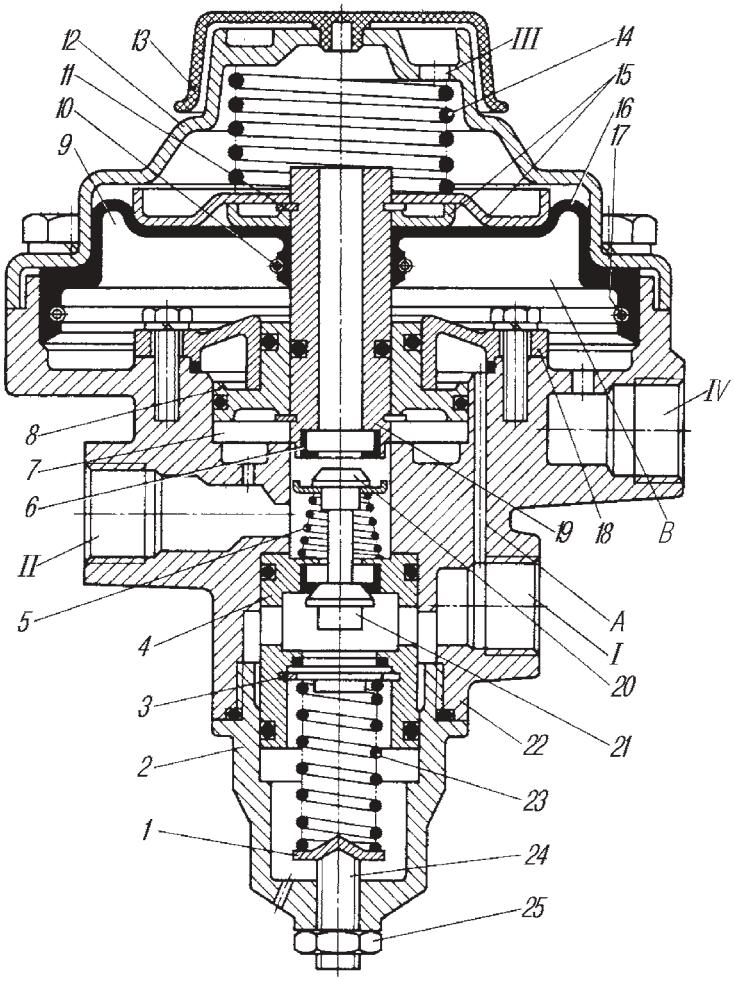


Fig. 74. Trailer brake control valve

1 - spring seat; 2 - lower cover; 3, 11 - retaining rings; 4 - lower piston; 5 - valve spring; 6 - valve exhaust seat; 7 - follow-up chamber; 8 - stepped piston; 9 - working chamber; 10, 17 - ring springs; 12 - upper cover; 13 - protective cap; 14 - diaphragm spring; 15 - washer; 16 - diaphragm; 18 - support; 19 - plunger; 20 - exhaust valve; 21 - inlet valve; 22 - body; 23 - spring; 24 - adjusting screw; 25 - locknut; I - port to the air tank; II - port to the trailer connecting line; III - port to atmosphere; IV - port to the trailer brake control valve with two-line actuation; A - supply passage; B - chamber under the diaphragm

When the towing truck brakes, compressed air is supplied to port IV and fills chamber B under the diaphragm. Overcoming the force of spring 14, diaphragm 16 rises together with plunger 19. Inlet valve 21 closes, then exhaust valve 20 opens, and air from the trailer connecting line escapes to the atmosphere through port II, plunger 19, and port III in cover 12, until the pressure in chamber B under diaphragm 16 and in chamber 7 under stepped piston 8 is balanced by the pressure in the chamber above the stepped piston.

As the pressure at port II continues to fall, piston 8 moves down and moves plunger 19 down, which closes exhaust valve 20, so that the release of air from port II stops. This is how the follow-up action is achieved.

Braking of the trailer (semitrailer) takes place with an effectiveness proportional to the compressed air pressure supplied to port IV. A further rise in pressure at port IV leads to complete release of the compressed air from port II and thus to maximum effective braking of the trailer. When the brakes of the towing truck are released, that is, when the pressure at port IV and in chamber B under diaphragm 16 falls, the diaphragm returns to its initial lower position under the action of spring 14. Plunger 19 moves down together with the diaphragm. As a result, exhaust valve 20 closes and inlet valve 21 opens. Compressed air from port I flows to port II and on to the trailer connecting line, as a result of which the trailer (semitrailer) brakes are released.

Trailer Brake Control Valve with Two-Line Actuation

The trailer brake control valve with two-line actuation is shown in Fig. 75. Air is constantly supplied to ports II and V of the control valve; acting on diaphragm 11 from above and on middle piston 10 from below, it holds piston 12 in the lower position. In this state port IV connects the trailer brake control line to atmospheric port VI through the central hole of valve 3 and of lower piston 12.

Trailer braking is effected when air is delivered through port IV into the trailer line, when air is supplied to ports I and III, and also when the air pressure at port II falls (braking with the parking brake).

When air is supplied to port III, pistons 4 and 7 move down, inlet valve 3 opens, and air from the tank flows through port V and open inlet valve 3 to port IV, which is connected to the trailer control line by coupling head 16 (see Fig. 67); the air also flows at the same time to the trailer brake control valve with single-line actuation.

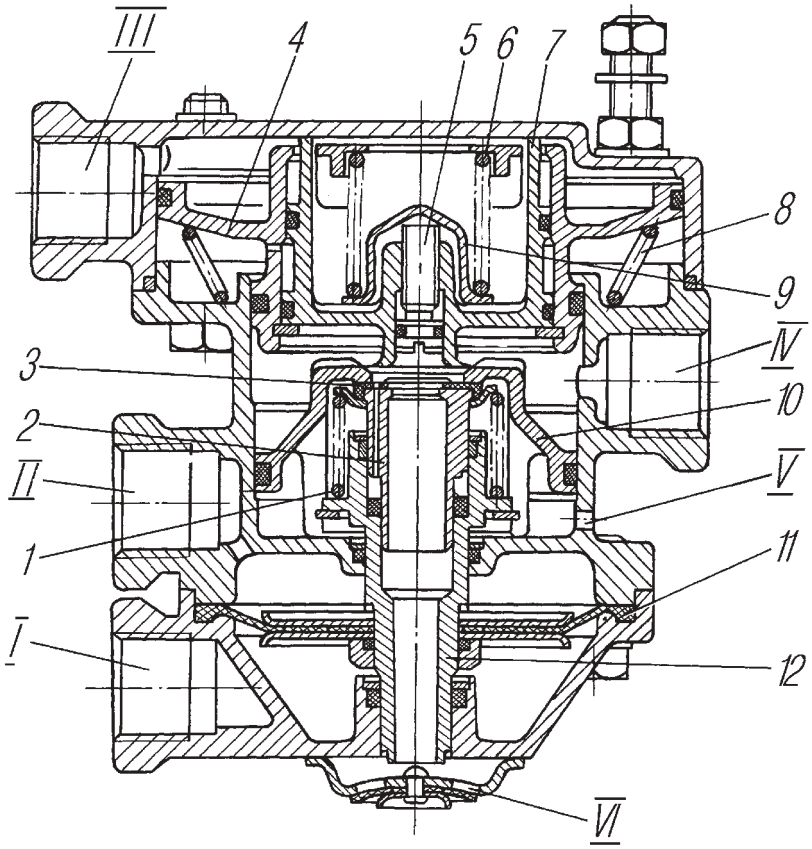


Fig. 75. Trailer brake control valve with two-line actuation

1, 8 - springs; 2 - unloading valve; 3 - inlet valve; 4 - large piston; 5 - adjusting screw; 6 - balancing spring; 7 - small piston; 9 - spring seat; 10 - middle piston; 11 - diaphragm; 12 - lower piston; I, III - ports to the brake valve section; II - port to the trailer brake control valve; IV - port to the trailer brake line; V - port to the air tank; VI - port to atmosphere

The follow-up action takes effect when the forces on piston 7 (see Fig. 75) from below and from above are balanced. In this state the pressure of the air supplied to port IV is proportional to the pressure of the air supplied to port III.

When braking ends, the air from port III is released to the atmosphere through the brake valve. Pistons 4 and 7 return to the initial position (by spring 8 and the air pressure at port IV), and inlet valve 3 closes. At that moment port IV is connected to the atmosphere through the hole in valve 3, piston 12, and port VI.

When air is supplied to port I, diaphragm 11 with pistons 12 and 10 and valve 3 moves up. Valve 3 reaches the seat in small upper piston 7 and closes the atmospheric outlet; as middle piston 10 continues to move, valve 3 lifts off the inlet seat of piston 10. Air flows from port V, which is connected to the air tank, to port IV and on to the trailer brake control line.

The follow-up action takes effect when the forces acting on diaphragm 11 from below and on piston 10 from above are balanced.

When braking ends, the air from port I is released to the atmosphere through the brake valve. Diaphragm 11 with pistons 12 and 10 returns to its initial position, and inlet valve 3 closes. The air from the trailer control line is released to the atmosphere through port IV, the hole in valve 3, piston 12, and port VI.

When air is supplied to ports I and III at the same time, the sequence of operation is similar to that described above.

When the parking brake is applied, control valve 10 (see Fig. 67) is actuated, and the air from port II (see Fig. 75) is released to the atmosphere through the control valve. As the air leaves port II and the chamber above the diaphragm, pistons 10 and 12 move up under the pressure of the air supplied from the tank through port V, opening valve 3, which ensures the supply of air through port IV to the trailer control line.

The follow-up action takes effect when the forces exerted by the air pressure on diaphragm 11 from above and on piston 10 from below are balanced. To make the trailer brakes apply ahead of the truck brakes, screw 5 is installed in piston 7; it changes the preload of spring 6. When the force of spring 6 is increased, the air pressure at port IV rises relative to the air pressure supplied to ports I and III by 20-100 kPa (0.2-1.0 kgf/cm2), and this achieves earlier application of the trailer brakes.

Protection Valve

The protection valve is designed to apply the trailer brakes automatically if the control (brake) line ruptures.

When the truck is not being braked, the compressed air supplied to port I (Fig. 76) passes freely through the vertical passages in lower body 1 to port II and on to the trailer supply line. Plunger 5 is held in the upper position by spring 6. When the truck is braked with the trailer supply and control lines intact, port III receives pressure from the trailer brake control valve via the two-line actuation, and port IV receives pressure from the brake valve. Because these pressures are sufficiently close to the pressure supplied to port I, plunger 5 remains in the upper position under the action of spring 6. The compressed air passes from port I to port II.

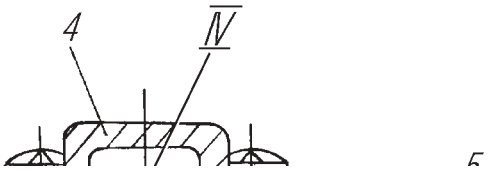


Fig. 76. Protection valve

1 - lower body; 2 - middle body; 3 - diaphragm; 4 - upper body; 5 - plunger; 6 - spring; 7 - sealing ring; I - compressed air inlet; II - port to the trailer supply line; III - port to the trailer control line; IV - port from the service brakes of the towing truck

If the trailer control (brake) line breaks, the pressure at port III becomes zero during braking, while the pressure at port IV remains at its previous level. The pressure at port IV acts on plunger 5 through diaphragm 3 and moves it down. The central hole in lower body 1 closes. The flow of compressed air from inlet I to port II stops. The pressure drop at port II (the trailer supply line) causes the trailer to be braked automatically.

Brake Force Regulator

The brake force regulator (Fig. 77) is mounted on frame crossmember No. 5 (Fig. 78) and is mechanically linked to the axles of the rear bogie. The brake force regulator automatically regulates the pressure of the compressed air supplied to the actuators of the rear bogie (the rear bogie pneumatic booster) according to the axle load.

To set the length of the lever, loosen the lever mounting bolt on the regulator, position the center of the joint of the coupling sleeve 155 mm from the lever pivot axis, and tighten the bolt.

To adjust the brake force regulator on an unladen truck, bring the air pressure in the pneumatic system to 0.6 MPa (6 kgf/cm2) with the brake pedal depressed (as read on the gauge in the cab). Then, by changing the length of vertical rod 8 (see Fig. 77) by moving the coupling sleeve along it, set the design pressure at the outlet of the brake force regulator as given on the brake force regulator plate (see Fig. 10), depending on the truck configuration.

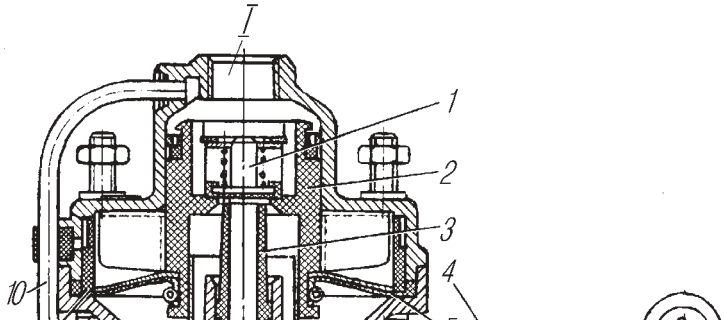


Fig. 77. Brake force regulator

1 - valve; 2 - piston; 3 - plunger; 4 - lever (position for an unladen truck); 5 - diaphragm; 6 - ball stud; 7 - locking piston; 8 - adjusting rod; 9 - ring with inclined ribs; 10 - connecting tube; I - inlet from the brake valve; II - port to the pneumatic booster of the middle and rear axle brake circuit; III - port to atmosphere

The outlet pressure is checked with a portable pressure gauge connected to the test port valve in the air supply line to the pneumatic booster of the axle bogie.

Check the stability of the pressure produced by the brake force regulator by filling the pneumatic system with air and releasing it three times, then tighten the clamps on the coupling sleeve. Rod 8, which connects the regulator lever to the elastic element, must be installed vertically.

Trailer Brake Cutoff Valve

The trailer brake cutoff valve is located in the cab on the instrument panel and allows the driver to check that the parking brake system of the towing truck can hold the road train on a grade. To do this, apply the parking brake to hold the road train, then press the button of the trailer brake cutoff valve; this releases the air from the trailer brake chambers. Keeping the button pressed in, make sure for several seconds that the road train is held securely on the grade. Release the button.

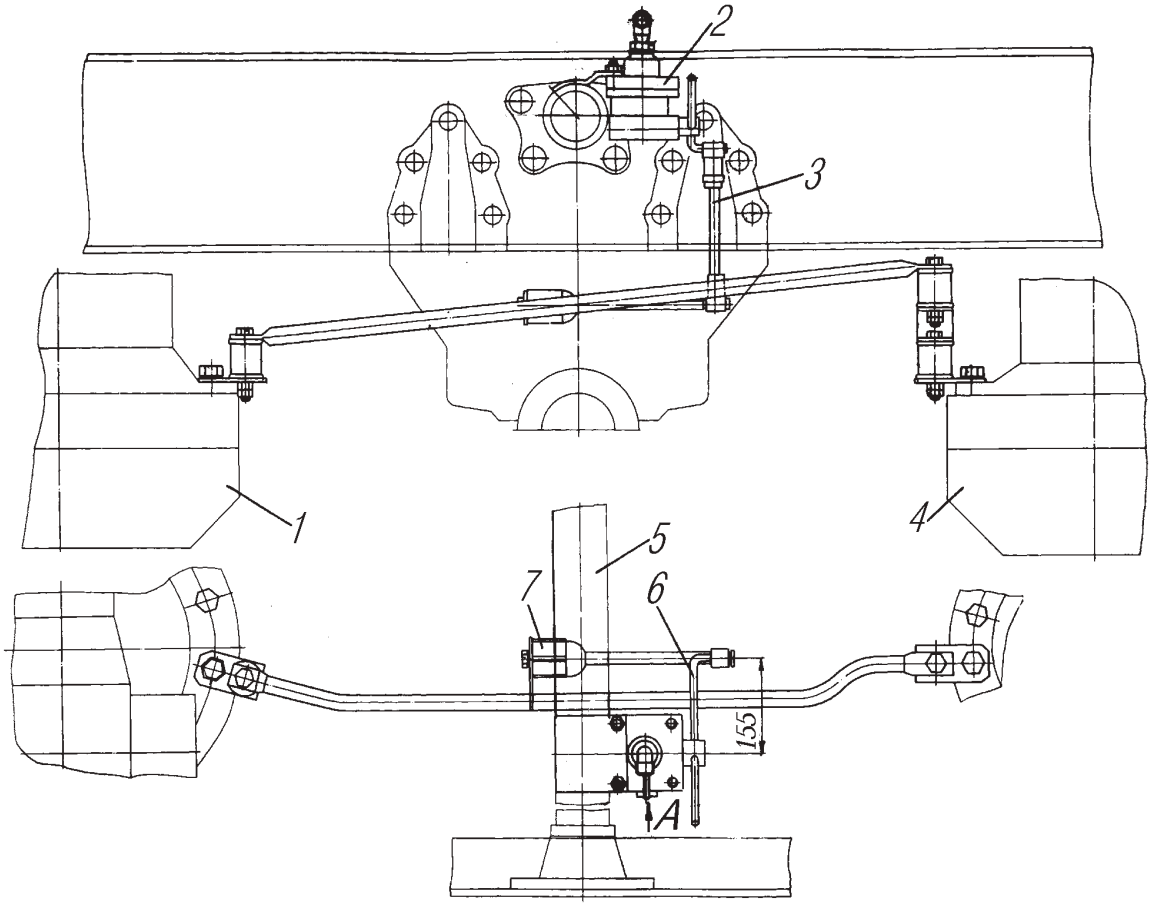


Fig. 78. Installation of the brake force regulator

1 - middle axle; 2 - brake force regulator; 3 - adjusting rod; 4 - rear axle; 5 - crossmember No. 5; 6 - brake force regulator lever; 7 - elastic element; A - from the brake valve

Double Check Valve

The double check valve (Fig. 79) serves to supply air to the trailer valve when the button of the trailer brake cutoff valve is used.

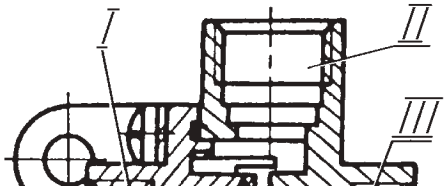


Fig. 79. Double check valve

1 - seal; 2 - body; 3 - cover; 4 - sealing ring; I, III - ports to the control lines; II - port to the actuating device

Trailer Parking Brake Control Valve

The trailer parking brake control valve (Fig. 80) is designed to control the trailer brakes when the truck is held by the parking brake and is mounted on frame crossmember No. 3. It is connected to the parking brake actuation rod by a rod with a spring compensator. With the parking brake lever lowered, air from the tank flows through port "в" of the control valve to port II of the trailer brake control valve with two-line actuation. When the parking brake is applied, the spool of the control valve shifts, connecting port II to the atmosphere through port "c"; the trailer brake actuation then operates as described above. To check the installation of the control valve, place

the parking brake lever in the down position. Turn clevis 3 (Fig. 81) to align the holes of the clevis and the eye of rod 1, install pin 2, and lock clevis 3, maintaining dimension L=122-124 mm.

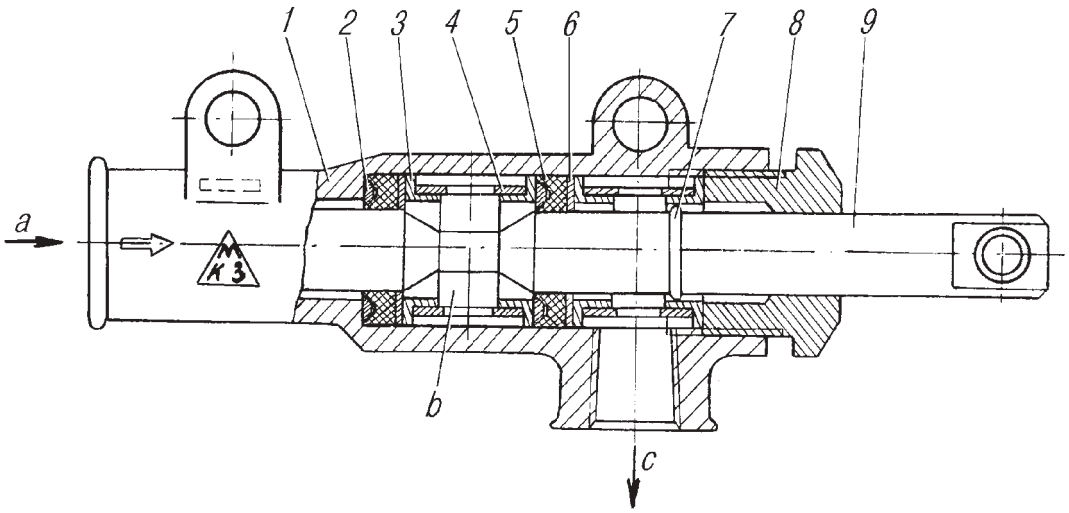


Fig. 80. Parking brake control valve

1 - body; 2 - lip seal spacer ring; 3 - bushing; 4 - centering washer; 5 - lip seal; 6 - support washer; 7 - lock ring; 8 - spool guide; 9 - spool; a - from the air tank; в - to the trailer brake control valve; c - to atmosphere

Coupling Heads

The heads have covers that protect the system from dust and dirt. Coupling head 18 (see Fig. 67) is painted black. The cover of supply head 17 is painted red, and that of control head 16 yellow. To connect the trailer brake system correctly, couple the heads according to their color. Connect the control head (yellow) first, then the supply head (red). Disconnect the trailer pneumatic actuation in the reverse order.

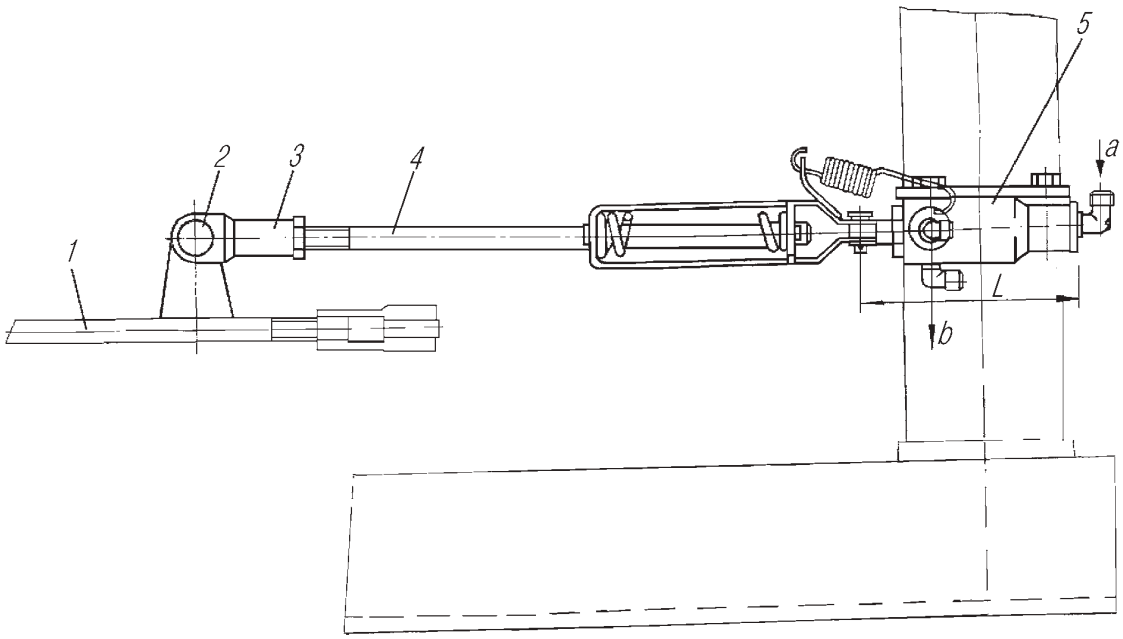


Fig. 81. Installation of the trailer parking brake control valve

1 - actuation rod; 2 - pin; 3 - clevis; 4 - valve actuation rod; 5 - parking brake control valve; a - from the air tank; b - to the trailer brake control valve

If the trailer becomes uncoupled from the truck in an emergency while driving, the coupling heads automatically disconnect the pneumatic system, and the trailer brake system is applied.

Test Port Valves

The test port valves (Fig. 82) are designed to determine the output air pressure values in the individual circuits using test pressure gauges. To connect to a valve, use hoses with a union nut M16x1.5 and pressure gauges with a measuring range of 0-1000 kPa (0-10 kgf/cm2) and accuracy class 1.5. The test port valves are installed:

— in the service brake circuit of the front axle, on the front pneumatic brake booster in the direction of travel;

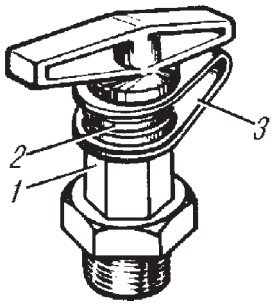


Fig. 82. Test port valves

1 - body; 2 - cap; 3 - loop

— in the service brake circuit of the rear bogie, on the second pneumatic brake booster;

— in the trailer brake circuit, on the third air tank (mounted on the outside of the right frame side rail).

Maintenance of the Air-Hydraulic Brake Actuation

The devices of the pneumatic brake actuation do not require special maintenance or adjustment.

In case of a fault, the devices are disassembled only by qualified specialists in workshops.

Check the air tightness of the pneumatic system by the pressure drop on the dual-needle pressure gauge. The pressure in the system must be at least 700 kPa (7 kgf/cm2). After the engine is shut off with the brake pedal released, there must be no noticeable movement of either gauge needle. The same must hold when the brake pedal is fully depressed and held in that position for 15-20 s. The leak tightness of the hydraulic part of the brake system is checked at the same time.

Air leaks at pipe connections are eliminated by tightening the union nuts to a torque of:

— for pipes with a diameter of 6 mm — 13-18 N*m (1.3-1.8 kgf*m);

— for pipes with a diameter of 10 mm — 20-35 N*m (2.0-3.5 kgf*m);

— for pipes with a diameter of 14 mm — 30-45 N*m (3.0-4.5 kgf*m).

To avoid breaking the connection bosses on the brake devices, the tightening torque of fittings and plugs must not exceed 30-50 N*m (3-5 kgf*m).

Check the brake light by pressing the brake pedal while there is air pressure in the pneumatic system.

Check the operation of the brake malfunction warning indicator as follows:

— check that warning lamp (indicator) 3 is working (see Fig. 13);

— loosen the nuts securing the wire to switch VK503 of the brake malfunction warning indicator;

— unscrew the switch from the pneumatic booster and tighten the wire securing nuts;

— turn on the instruments, connect the switch body to the truck ground, and press the button all the way in;

— warning lamp 3 on the instrument panel must light up, which indicates that the indicator is working;

— repeat the same with the second switch. If a switch is faulty, replace it.

Check the operability of the pneumatic actuation in the following sequence:

— connect test pressure gauges to the test port valves;

— fill the pneumatic system with air until the pressure regulator cuts out. The pressure in the working circuits of the brake actuation must then be 650-800 kPa (6.5-8.0 kgf/cm2) on the dual-needle pressure gauge in the driver's cab, and the same pressure must be shown on the test pressure gauge installed on the third tank;

— with the brake pedal fully depressed, the air pressure on the test pressure gauges installed on the pneumatic brake boosters must be as follows: on the gauge of the first circuit, equal to the system pressure; on the gauge of the second circuit, equal to the response pressure of the brake force regulator.

Checking the operability of the brake devices:

1. Check the outlet pressure of both sections of the brake valve and the operation of the triple protection valve. To do this, connect test pressure gauges to the line from the brake valve to the pneumatic booster, and with the air pressure in the pneumatic system at 650-800 kPa (6.5-8.0 kgf/cm2) depress the brake pedal all the way. The air pressure on the test pressure gauges must be equal to the system pressure (as read on the dual-needle pressure gauge).

If, when the brake pedal is depressed, the test pressure gauge does not show a pressure equal to the pressure in the tank of that circuit, check and adjust the free play and full travel of the brake pedal.

After that, bring the system pressure to 800 kPa (8.0 kgf/cm2), that is, until the pressure regulator cuts out, shut off the engine, and release the air from the tank of the front axle brake circuit. When the pedal is depressed, the air pressure on one test pressure gauge must be equal to the system air pressure, and on the other 0. Then, by pressing the brake pedal several times, reduce the pressure on the pressure gauge to 500 kPa (5.0 kgf/cm2) and start the engine. At a pressure of 560-600 kPa (5.6-6.0 kgf/cm2) the air pressure in the tank of the front axle brake circuit must begin to rise. Do the same with the brake circuit of the middle and rear axles.

2. Check the operation of the single protection valve. First release the air from all three tanks, then connect a test pressure gauge to tank 9 (see Fig. 67). Then fill the tanks with compressed air, comparing the readings of the dual-needle pressure gauge. Compressed air must begin to enter tank 9 after the air pressure reaches 550 kPa (5.5 kgf/cm2).

3. Check the pressure at the coupling heads. To do this, connect a type "Б" head with a test pressure gauge, which is part of the spares kit (ZIP), to type "A" coupling head 18. Fill the brake system with compressed air to the compressor cut-out pressure. The air pressure on the test pressure gauge must be 500-520 kPa (5.0-5.2 kgf/cm2). Then depress the brake pedal or apply the parking brake. The test pressure gauge must then show 0.

Check the pressure at control head 16 and supply head 17 of the two-line actuation. The air pressure in the supply coupling head must be equal to the system pressure, and in the control head the pressure must be 0. When the brake pedal is depressed or the parking brake is applied, the air pressure in the control head must be equal to the system pressure.

To ensure normal operation of the pneumatic actuation, drain the condensate from the air tanks. Perform this operation while there is air in the pneumatic system. In cold weather, drain the condensate when leaving a heated garage. After draining the condensate from the tanks, fill the system with compressed air to the rated pressure.

When the ambient air temperature is below 0 °C and when trucks are parked outdoors without a garage, it is especially important to drain the condensate from the air tanks carefully. If the condensate freezes, the frozen areas must be thawed with hot water or steam.

> **WARNING: Do not heat the units with an open flame (torch, blowtorch, etc.).**

Fill the hydraulic actuation system with fluid and bleed the brakes while there is air pressure in the pneumatic system of the truck. Before filling the system, remove dirt from the master cylinders and reservoirs. Then remove the pressurization tube, unscrew the filler hole plug, fill the reservoirs with brake fluid, and remove the air from the hydraulic system.

Procedure for bleeding the master cylinders and the wheel cylinders of the service brakes:

— remove the rubber cap from the bleeder valve of the master cylinder, fit the tube from the tool kit onto the valve, and immerse the open end of the tube in brake fluid poured into a glass container with a capacity of at least 0.2 L. Fill the container with fluid to half its height;

— unscrew the bleeder valve by 1/2-3/4 turn, then press the brake pedal several times (press quickly, release slowly). Repeat the pressing until air bubbles stop coming out of the tube immersed in the container with brake fluid. During bleeding, top up the fluid in the reservoirs so that no air enters the system;

— with the pedal depressed, screw the bleeder valve of the cylinder in tightly, remove the tube, and put on the cap;

— bleed the wheel brake cylinders in the following order: middle left, rear left, rear right, middle right, front right, front left;
— after bleeding all the cylinders, top up the fluid in the reservoirs to a level 15-20 mm below the upper edge of the filler neck and screw the filler hole plug in tightly.

When replacing the brake fluid, disassemble the wheel and master cylinders and wash the working surfaces of the parts. When assembling the wheel cylinders, lubricate the piston and the inner surface of the cylinder with brake fluid. To increase the corrosion resistance of the wheel cylinders, apply 4-5 g of DT-1 grease to the cylinder bore under each wheel cylinder boot.

Emergency Brake System

The functions of the emergency brake system are performed by one of the circuits of the service brake system. If one of the circuits fails, the emergency brake system provides braking of the truck with sufficient effectiveness.

Parking Brake System

The system is designed to keep the truck stationary on grades. The parking brake actuation is mechanical. It is controlled by a lever located to the right of the driver seat.

The parking brake is a drum brake with two shoes and self-energizing action. When the brake is applied, the force is transmitted from adjusting lever 11 (Fig. 83) through lever 10 and shackle 12 to expanding lever 13.

When the brake drum rotates clockwise, the actuating force is transmitted from lever 13 through rod 1 to right shoe 2. The shoe moves away from the anchor pin and is pressed against the brake drum. The shoe is then caught by the drum because of friction, shifts in the direction of rotation, and through adjusting device 3 presses left shoe 14 against the anchor pin and the drum.

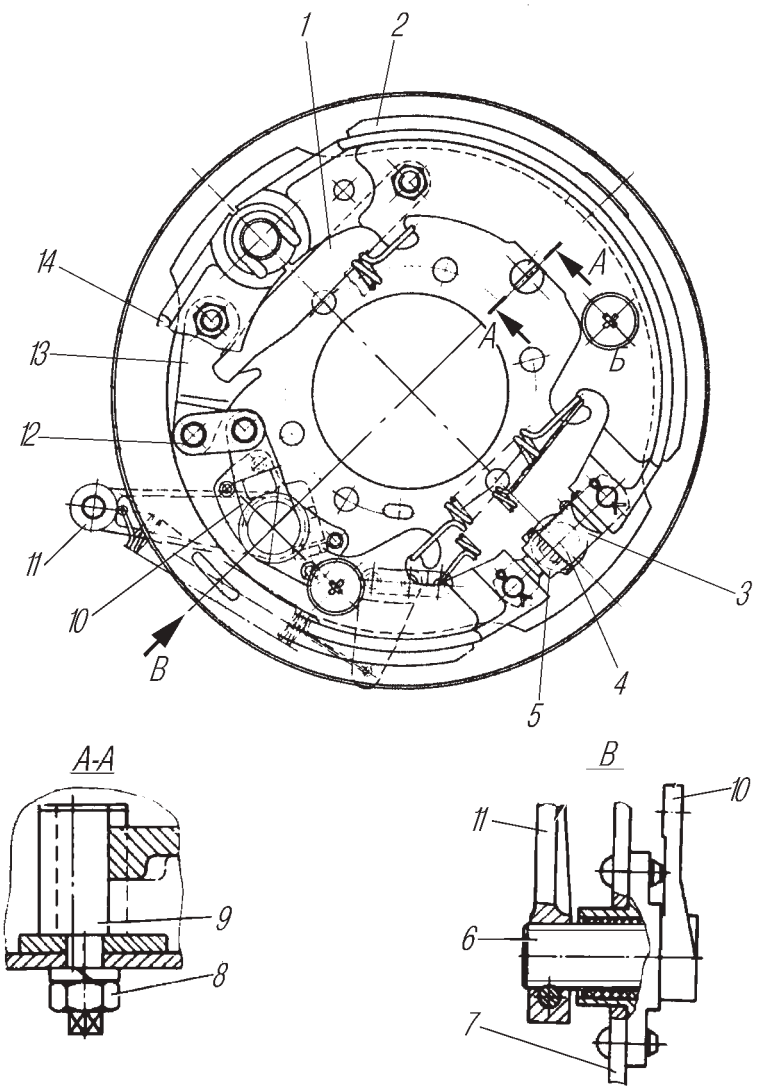


Fig. 83. Parking brake

1 - rod; 2, 14 - shoes (right and left); 3 - adjusting device; 4 - plug; 5 - star wheel; 6 - shaft; 7 - backing plate; 8 - locknut; 9 - eccentric pin; 10 - lever; 11 - adjusting lever; 12 - shackle; 13 - expanding lever

When the brake drum rotates counterclockwise, lever 13, bearing against rod 1, transmits the actuating force to left shoe 14. The shoe moves away from the anchor pin and is pressed against the brake drum. The shoe is caught by the drum because of friction, shifts in the direction of rotation, and through the adjusting device presses right shoe 2 against the anchor pin and the drum.

As the linings wear, the travel of lever 1 (Fig. 84) increases and the brake effectiveness may decrease. If lever 1 latches at the twelfth tooth of the sector, adjust the clearances between the linings and the drum using the eccentric and the star wheel. To adjust the brake:

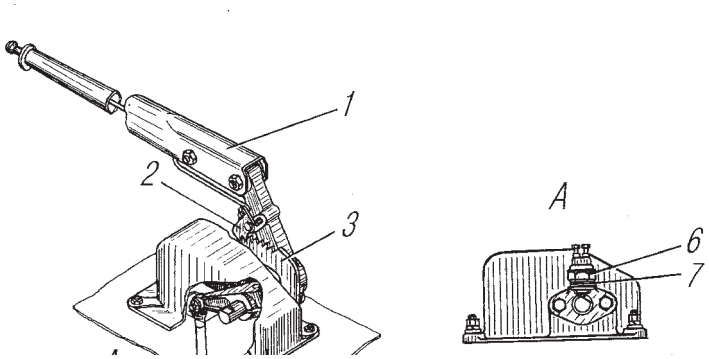


Fig. 84. Parking brake actuation

1 - parking brake lever; 2 - pawl; 3 - sector; 4, 9 - actuation rods; 5 - rod to the trailer brake control valve; 6 - parking brake indicator switch; 7 - adjusting shims; 8 - lever; 10 - adjusting lever

1. Lower lever 1 in the cab all the way down.

2. Disconnect rod 4 from lever 8 on the transfer case.

Do not adjust the clearances between the linings and the drum by changing the length of rod 4, because this causes the parking brake to fail.

3. Adjust the clearance between the right shoe and the drum: loosen locknut 8 (see Fig. 83) on eccentric pin 9 by half a turn on the backing plate side and, turning the pin clockwise with a wrench, set a clearance of 0.3-0.5 mm. Check the clearance with a feeler gauge through the slot in the brake deflector. Tighten the locknut, preventing the pin from turning.

4. Adjust the clearance between the left shoe and the drum. To do this, remove plug 4. Through the hole in the brake backing plate, turn star wheel 5 from top to bottom with a screwdriver to set a clearance of 0.3-0.5 mm. Install the plug.

5. Take up the free play of lever 8 (see Fig. 84) on the transfer case by turning it counterclockwise until the force increases noticeably, and check that the hole in the clevis of rod 4 lines up with the hole in lever 8. If necessary, rotate the clevis of rod 4 to align the holes. Install the pin and secure it with a cotter pin.

With a force of 350-400 N (35-40 kgf) on the lever in the cab, the pawl of lever 1 must latch at the 4th-8th tooth of sector 3. When the pawl passes the 2nd-4th tooth of the sector, the parking brake engagement warning lamp on the instrument panel must light up. The moment of engagement is adjusted by changing the number of shims 7 under switch 6 of the indicator.

Auxiliary Brake System

The compression-type auxiliary brake (exhaust brake) is designed to reduce the speed of the truck on long descents. Braking is achieved by creating back pressure in the engine exhaust gas lines by closing them with shutters.

The brake consists of a housing 3 (Fig. 85) and a shutter. The shutters are actuated by air cylinders 1, which are mounted on the auxiliary brake housing by means of a bracket.

Fig. 85. Auxiliary brake

1 - air cylinder; 2 - actuating rod yoke; 3 - housing; 4 - shutter; 5 - shutter shaft lever; 6 - key; 7 - pin; 8 - cotter pin

When braking is needed, press the button of the pneumatic auxiliary brake control valve located on the cab floor. Compressed air is supplied to the air cylinders, and the pistons move, closing the shutters. At the same time, a signal is sent to the trailer brake actuation, and the trailer brakes are applied lightly.

When you take your foot off the valve button, the air escapes from the cylinders to the atmosphere, and the rods, under the action of the return spring, turn the levers and shutters back to their original position.

The interlocked actuation cuts off the fuel supply at the same time as the auxiliary brake is engaged. The air cylinder that shuts off the fuel supply is similar in design to the air cylinder of the auxiliary brake. When driving with the auxiliary brake engaged:

— Do not let the engine speed exceed 2100 rpm;

— Do not shift the gearbox from a higher gear to a lower gear when the engine speed is close to 2100 rpm.

If necessary, reduce the engine speed with the service brake and engage a lower gear.

If the shutter 4 of the auxiliary brake turns stiffly, remove the brake housing with the shutter, wash it in kerosene, and blow it out with compressed air. If the air cylinder rods or the valve button stick, disassemble the assemblies, wash them in kerosene, replace faulty parts, lubricate the rubbing surfaces with grease, and reinstall them.

Adjust the position of the shutters by changing the screw-in length L of the air cylinder rod with the yoke. When the shutter is set correctly, the key is aligned with the axis of the exhaust inlet pipe with the air cylinder piston in its uppermost position.

Electrical Equipment

The electrical system is single-wire; the negative pole of the power sources and consumers is connected to the truck "ground". The negative terminal of the battery is connected to the truck ground by a remote switch.

The power sources are two batteries connected in series and an alternator working together with a voltage regulator.

The units and devices of the electrical equipment are interconnected with wires with polyvinyl chloride insulation of various cross sections. The wires in bundles are made in specific colors to make them easier to find and to simplify installation. Single wires may be of any color. The wire color may be indicated by the first letter of the color on the sleeves installed at both ends of the wire.

Wires are connected to each other and to devices with plug connectors. The wire color coding of the truck is given in Appendix 4.

The truck is equipped with a speedometer with a mechanical drive and with electronic devices and systems: a tachometer, an alternator with a rectifier unit, and others.

To avoid breaking the flexible shaft of the speedometer ГВ300-05, when installing and removing the instrument panel, route the flexible shaft so that the paint mark on the shaft sheath is located outside the cab, immediately behind the sealing bushing of the flexible shaft pass-through hole; the flexible shaft must also be routed without forming a loop behind the instrument panel.

For reliable operation of these devices and systems, monitor the condition of the fuses installed in the fuse blocks. Do not use non-standard fuses made of bent wire, bolts, or washers, because in the event of a short circuit in the electrical circuit this will immediately put electronics-based products out of service. Replace a blown fuse with another of the same rated current.

On URAL-4420-10, URAL-4420-31, URAL-44202-0311-31, and URAL-44202-0612-30 tractor trucks, the spotlight for illuminating the fifth wheel coupling is installed on the rear panel of the cab.

On URAL-43202-0351-31 trucks and URAL-44202-0311-31 tractor trucks, the light signaling devices are of non-sealed design; the cab heater capacitor, the 11.7904 capacitor filter, the preheater electric motor capacitor, and the tire pressure gauge with its illumination lamp are not installed.

The wiring diagram of URAL-4320-10 and URAL-4320-31 trucks in the versions for the Ministry of Defense (MoD) and for the national economy (NE) is shown in Fig. 86 (fold-out insert). The legend for Fig. 86 is given in Table 5.

Table 5

Таблица 5

Приборы электрооборудования автомобилей Урал-4320-10, Урал-4320-31

Позиция на рис. 86	Наименование	Тип или номер прибора
1	Фонарь передний правый	ПФ133АБ(ПФ130Б или ПФ130АБ-01)*1
2	Повторитель боковой указателя поворота правый	УП101-Б1 (511-3726010)*1
3	Фара правая	401.3711(671.3711)*1
4	Панель соединительная правая	17.3723
5	Фара противотуманная правая	ФГ152А*2
6	Электродвигатель предпускового подогревателя	МЭ252
7	Конденсатор	КБП-С
8	Сигнал звуковой низкого тона	С306Д
9	Сигнал звуковой высокого тона	С307Д
10	Фара противотуманная левая	ФГ152А*2
11	Панель соединительная левая	17.3723
12	Фара левая	401.3711(671.3711)*1
13	Повторитель боковой указателя поворота левый	УП101-Б1 (511-3726010) *1
14	Фонарь передний левый	ПФ133АБ(ПФ130Б или ПФ130АБ-01)*1
15	Стеклоочиститель	16.3730
16	Стеклоомыватель	1112.5208000-14 или 1212.5208000-12
17	Реле звуковых сигналов	901.3747
18	Лампа подкапотная	ПД308Б
19	Выключатель звуковых сигналов	2802.3829 или ДЕ-Т или ММ125Д
20	Клапан электромагнитный ЭФУ	11.3741
21	Предохранитель плавкий 6А	ПР119-01
22	Свеча факельная ЭФУ	11.3740
	Датчики:	
23	— указателя температуры охлаждающей жидкости	ТМ100А
24	— сигнализатора масляного фильтра	—
25	— аварийного падения давления масла	2602.3729 или ДЕ-М или ММ111Д
26	— указателя давления масла	ММ370
27	Свеча искровая предпускового подогревателя	СН423
28	Датчик аварийного перегрева охлаждающей жидкости	ТМ111-01
29	Генератор	Г288Е или 1702.3771
30	Источник высокого напряжения	ТК107А или 9301.3734
31	Нагреватель топлива предпускового подогревателя	11.3741060
32	Клапан электромагнитный предпускового подогревателя	ПЖД30-1015501-04
33	Стартер	25.3708-01

Electrical equipment devices of URAL-4320-10 and URAL-4320-31 trucks 401.3711(671.3711) * 1

Alternator

The water-resistant alternating-current alternator (Fig. 87) is a 12-pole synchronous electrical machine with a built-in rectifier unit ВБГ-7Г or БПВ7-100, with forced-air ventilation. The alternator has the following terminals: "+" for connection to the batteries and the load; two "Ш" terminals for connection to the "Ш" and "+" terminals of the voltage regulator; the "Ш" terminals are made as a two-contact plug block; "-" for connection to the voltage regulator housing; the "~" terminal for connection to the tachometer.

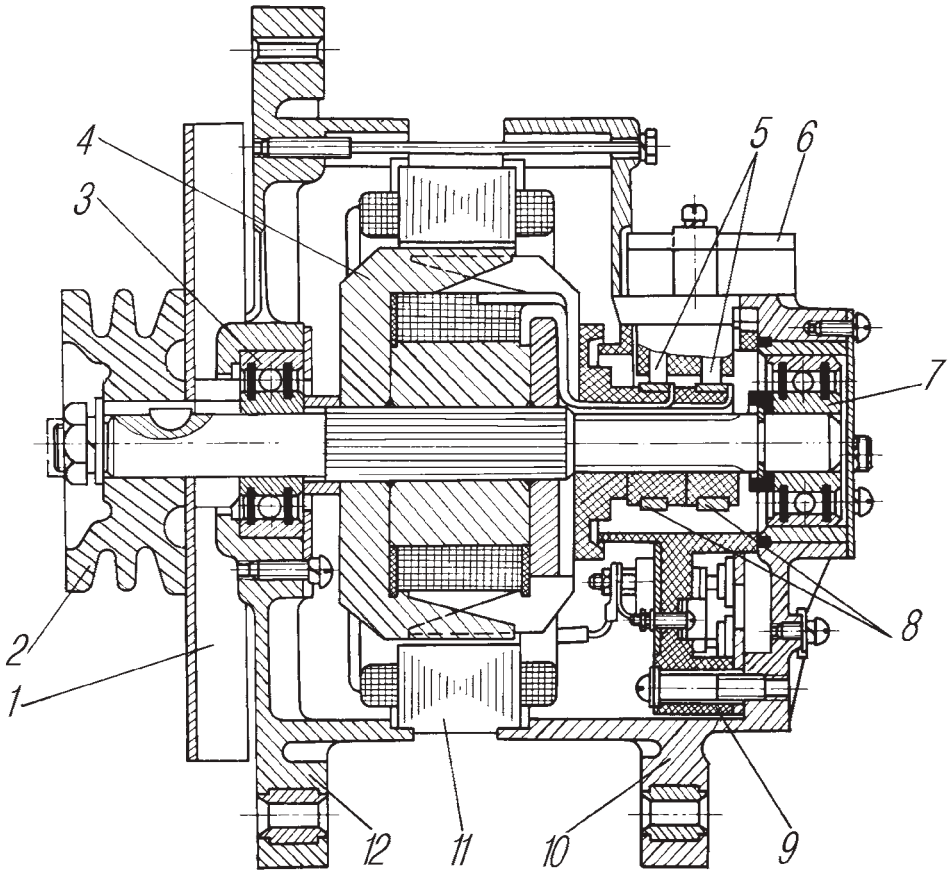


Fig. 87. Alternator

1 - fan; 2 - pulley; 3, 7 - ball bearings; 4 - rotor; 5 - brushes; 6 - brush holder cover; 8 - slip rings; 9 - rectifier unit; 10 - slip ring end cover; 11 - stator; 12 - drive end cover

Specifications at an ambient temperature of 15-35 °C

- Nominal voltage, V: 28
- Nominal current, A: 47
- Nominal power, W: 1000
- Rotor speed at a voltage of 28 V, rpm: without load - 1180; at a load current of not more than 30 A - 1900
- Maximum speed, rpm: 8000
- Field current, A: 1.5-1.7

To avoid damaging the alternator assembly, do not:

- run the engine with the battery disconnect switch turned off;
- disconnect the wires from the positive and negative terminals of the alternator or separate the plug connectors of the alternator and the voltage regulator while the engine is running;
- check the serviceability of the alternator assembly by bridging with a jumper wire the "+" and "-" terminals of the plug connectors at the alternator and the voltage regulator;
- check the alternator with a test lamp or a megohmmeter;
- connect the battery with reversed polarity or connect the positive terminal of the alternator to the negative terminal of the battery;
- short the voltage regulator terminals "+" and "Ш" together.

To keep the alternator in working order, keep it clean.

Check the alternator operation by the ammeter reading. At medium engine speed, the ammeter must show a charging current, which decreases as the battery charge is restored. With a serviceable and fully charged

battery, a serviceable alternator, and a correctly selected regulated voltage level, the ammeter needle must be at the "0" mark.

Clean dust off the alternator by blowing it out with compressed air. The alternator should be repaired in a specialized workshop.

To check the condition of the brush assembly, remove the brush holder. Check that the brushes move freely in the brush holders. Replace brushes that protrude less than 5 mm from the brush holder channel. The force pressing the brushes against the slip rings with the spring compressed to 17.5 mm must be 0.19-0.25 N (19-25 gf). If the wear of the slip rings exceeds 0.5 mm in diameter, turn them down. The minimum permissible diameter of the slip rings after turning is 29.3 mm.

The ball bearings are sealed and packed with grease for their entire service life. If the bearings seize or become very noisy, replace them.

To check the alternator on the truck, you need a DC voltmeter of accuracy class 1.5 or better. Connect the voltmeter between the "+" and "-" terminals of the alternator. Perform the check with the batteries connected at medium engine speed (about 2000 rpm). After the engine has run for ten minutes, turn on the high beams and record the voltmeter reading, which must be 26.6-29.2 V.

Perform the control check of the alternator on a special test bench that provides smooth variation of the alternator rotor speed up to 5000 rpm and has measuring instruments of accuracy class 1.5 or better. The alternator test circuit is shown in Fig. 88. If the alternator is serviceable, its parameters must correspond to the specifications.

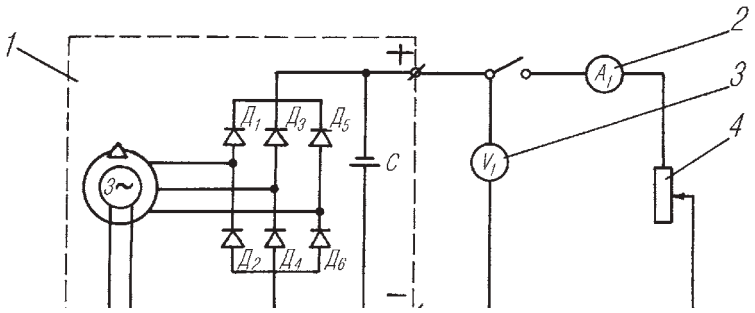


Fig. 88. Circuit for checking the electrical characteristics of the alternator on a test bench

1 - alternator; 2 - ammeter; 3 - voltmeter; 4 - load; 5 - battery; 6 - additional resistor

The alternator may fail because of a failed rectifier unit. The unit is checked on a disassembled alternator with the stator winding disconnected (Fig. 89). Check the rectifier unit from a battery connected to its terminals through a test lamp. When checking the positive diodes, connect the battery wire to the positive bus of the rectifier unit, and connect the second wire through the test lamp to the diode terminals one at a time. When checking the negative diodes, connect the battery to the negative bus and the test lamp to the diode terminals.

Serviceable diodes of the rectifier unit conduct current in one direction only; therefore, the lamp lights only when the diodes are connected in the conducting direction. If the test lamp lights or does not light in both directions of connection, the diode of the unit is faulty. If faulty diodes are found, replace the rectifier unit.



Fig. 89. Circuit for checking the rectifier unit

a - checking the positive diodes; b - checking the negative diodes; I - diodes connected in the non-conducting direction; II - diodes connected in the conducting direction

Do not check the rectifier unit:

— from a voltage source above 24 V;

— from an alternating-current source.

When installing the alternator on the engine, note that the rear mounting bolt of the alternator to the bracket is secured in a split support, and the foot of the front cover of the alternator is attached without clearance. Therefore, when installing the alternator, before tightening its mounting bolts, loosen the clamping bolt of the split support, tighten the alternator mounting bolts, and only then fully tighten the clamping bolt of the rear support of the alternator.

Alternator disassembly procedure:

- unscrew the two brush holder mounting screws and remove the brush holder;
- unscrew the tie bolts and remove the slip ring end cover together with the stator;
- unscrew the nuts securing the phase leads to the rectifier unit and separate the stator from the cover;
- unscrew the pulley mounting nut and remove the pulley, fan, and support bushing. Remove the cover from the shaft.

Assemble the alternator in the reverse order. Check and adjust the alternator drive belt tension in accordance with the operating instructions for the YaMZ-236M2 and YaMZ-238M2 engines.

Voltage Regulator

The contactless voltage regulator with three adjustment levels maintains a constant voltage in the electrical system of the truck. It is an electronic device built on semiconductor elements.

Set the voltage with the switch located on the front cover of the regulator (Fig. 90). The position of the switch lever corresponds to the following voltages: horizontal right (medium), horizontal left (maximum), vertical (minimum).

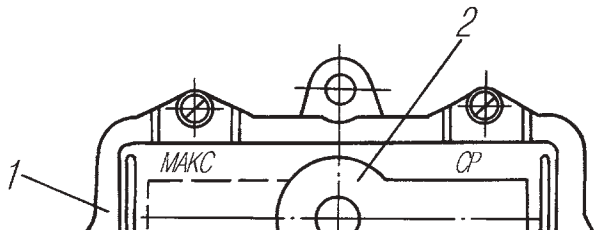


Fig. 90. Voltage regulator

1 - housing; 2 - switch; 3, 4, 5 - terminals

The voltage level markings are located on the front cover of the regulator. The regulator leaves the plant set to the medium level. If the ambient temperature has settled at 0 °C or below, move the switch lever to the position "МАКС" (maximum) to prevent undercharging of the batteries. At a temperature of 0 °C or above, move the lever to the position "МИН" (minimum) to prevent boiling off of the electrolyte. In case of undercharged batteries or boiled-off electrolyte, set the lever to the position "СР" (medium).

To avoid damaging the voltage regulator, do not short the "+" and "Ш" terminals together. Connect the wires according to the markings on the alternator and the regulator.

To check the regulated voltage on the truck:

- connect a voltmeter of accuracy class 0.5 or better with a 0-30 V scale between the "+" terminal and the regulator housing;
- start the engine and set a medium engine speed;
- turn on the high beams as a load and record the regulated voltage from the voltmeter reading.

The voltage maintained by the regulator at 15-35 °C must be 26.5-27.9 V at the minimum setting, 28.1-28.7 V at the medium setting, and 28.7-30.1 V at the maximum setting.

When checking on a test bench (Fig. 91), the alternator rotor speed at which the regulated voltage is checked must be 3500 rpm, and the load current must be 18 A. If the voltage is outside the specified limits, replace the regulator.

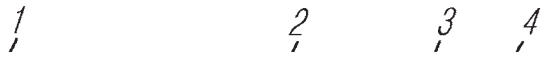


Fig. 91. Connection diagram of the voltage regulator and alternator when checking the regulated voltage on a test bench

1 - alternator; 2 - ignition switch; 3 - voltage regulator; 4 - ammeter; 5 - battery; 6 - voltmeter; 7 - load; 8 - ground switch

Batteries

The batteries are intended for starting the engine with the starter and for working together with the alternator at maximum loads. The truck is equipped with batteries filled with electrolyte. On special request, dry-charged batteries can be installed, which are able to retain their original charge for one year from the date of manufacture.

Basic data of the batteries

— Nominal voltage, V: 12

— Capacity at the 20-hour discharge rate and an electrolyte temperature of +25 °C, A*h: 190

— Discharge current at the 20-hour discharge rate, A: 9.5

— Total electrolyte volume in the battery, L: 12

— Charging current, A: 19

— Mass of the battery with electrolyte, kg: 71

Battery Mounting

The batteries 1 (Fig. 92) are installed in the container 10 on two side supports and a center support. After installation in the container, the batteries are secured by two upper clamps 13 and a front stop 4. The upper clamps 13 are held in place by the front 9 and rear 12 wedge stops. The front wedge stops 9 are adjustable and are fastened to the container cover 6 with bolts 8. The rear stop 12 is welded in the upper rear part of the container 10. Guides 11 are welded to the top panel of the container 10 to position the clamp 13 correctly relative to the stops 9 and 12.

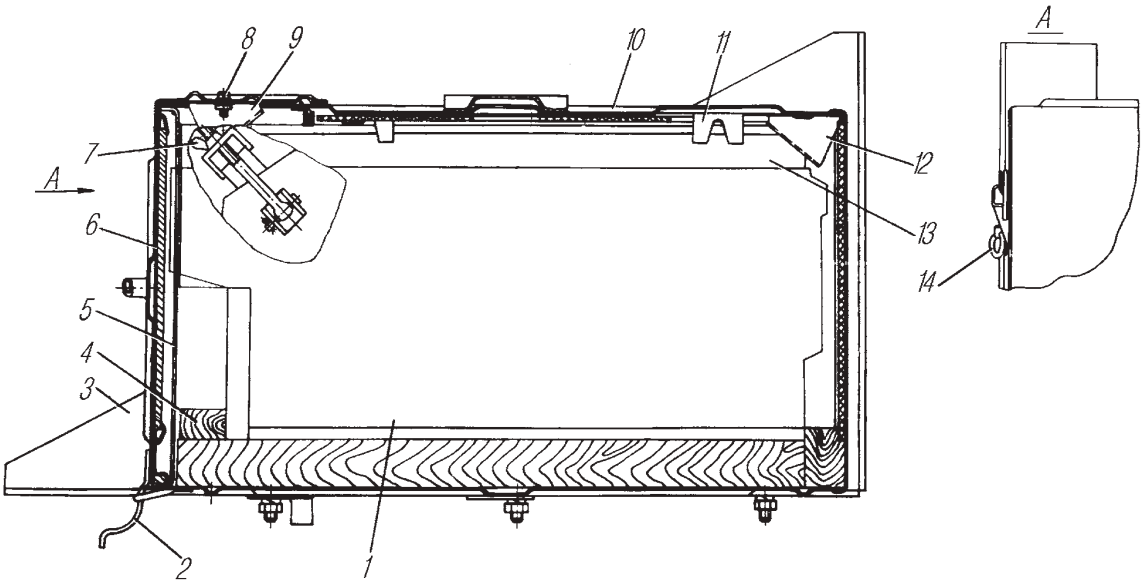


Fig. 92. Installation of the batteries

1 - battery; 2 - clip; 3 - battery brackets; 4 - front stop; 5 - box body reinforcement; 6 - container cover; 7 - wing nut; 8 - bolt; 9, 12 - wedge stops, front and rear; 10 - container; 11 - guides; 13 - upper clamp; 14 - latch ring

To perform maintenance of the batteries on the truck without removing them from the truck:

— disconnect the batteries from the on-board electrical system with the ground switch;

— remove the spring ring 14 of the latches of the cover 6 and open the latches;

— raise the cover 6 and tilt it down onto the bracket 3. Make sure the cover 6 is securely held in the horizontal position;
— loosen the fastening of the wires and of the jumper between the batteries, first removing the protective covers of the battery terminals, if fitted;
— take the front stop 4 out of the container 10 by lifting one end of the stop 4 until it clears the reinforcement 5;
— take the upper clamps 13 out of the container 10. If a clamp is jammed between the battery 1 and the rear wedge stop 12, use a screwdriver or a punch, inserting it into the hole at the end of the clamp, to remove the clamp;
— slide the batteries out onto the swing-down cover 6 of the container.

To remove the batteries from the truck, perform the above operations in the same order, except that the cover 6 must be removed from the container, and the wires must not be loosened but disconnected from the battery terminals. Slide the batteries out one at a time onto the bracket 3 and remove them from the truck.

When sliding the batteries 1 out of the container 10 onto the bracket 3 and removing them from the truck, take precautions to prevent an unsecured battery from falling.

Install the batteries on the truck and secure them in the reverse order.

Make sure the upper clamps are seated in the guides 11. Otherwise the clamp 13 will not engage with the wedge stops 9 and 12, and the battery will not be secured, which may cause it to be destroyed. Do not allow the guides 11 to be deformed when installing and securing the battery.

When installing and securing the battery, do not allow the wires to the starter and the ground switch to be pinched or sharply bent, the terminal lugs to be bent, or the wires to make harmful contact with the metal parts of the container.

After installing the batteries on the truck, adjust the position of the front wedge stops 9: loosen the bolts 8 securing the stops 9 to the cover 6, move the stops 9 away from you along the slotted holes of the cover 6 as far as they will go, and tighten the bolts 8. Adjust the position of the front wedge stops 9 with the cover 6 of the container 10 closed, after the batteries 1 and the upper clamps 13 have been installed in the container.

Preparing Dry-Charged Batteries for Service

Procedure for preparing the batteries for service:

— remove the protective cover and the lid, clean the dust off the batteries and the grease off the terminal bolts;
— unscrew the plugs from the filler holes, remove the sealing gaskets, and clean the vent holes in the plugs. On polyethylene plugs that have a protrusion, cut it off and clean the vent channels;
— fill with electrolyte of the density given in Table 6.

Table 6

Таблица 6

Плотность электролита

Климатические зоны и районы. Средняя месячная температура воздуха в январе, °С (ГОСТ 16350-70)	Время года	Плотность электролита, приведенная к 25 °С, г/см³	
		заливаемого	полностью заряженной батареи
Холодная с климатическими районами:			
очень холодный (от минус 50 до минус 30)	Зима	1,28	1,30
	Лето	1,24	1,26
холодный (от минус 30 до минус 15)	Круглый год	1,26	1,28
Умеренная (от минус 15 до минус 8)	Круглый год	1,24	1,26
Жаркая (от минус 15 до плюс 4)		1,22	1,24
Теплая, влажная (от 0 до плюс 4)		1,20	1,22
Примечание. Допускается отклонение плотности электролита от значений, приведенных в таблице, на ± 0,01 г/см³.			

Electrolyte Density

Prepare the electrolyte by diluting battery-grade sulfuric acid per GOST 667-73 (Russian national standard), not technical-grade acid, in distilled water per GOST 6709-72. Follow Table 7 when doing so.

Table 7

Таблица 7

Приготовление 1 л электролита необходимой плотности

Плотность электролита, приведенная к 25 °С, г/см³	Количество воды, л	Количество кислоты, плотностью 1,83 г/см³ при температуре 25 °С	
		л	кг
1,20	0,859	0,200	0,360
1,22	0,839	0,221	0,404
1,24	0,819	0,242	0,444
1,26	0,800	0,263	0,484
1,28	0,781	0,285	0,523
1,40	0,650	0,423	0,776

Preparing 1 L of Electrolyte of the Required Density

When preparing the electrolyte, pour the acid into the water, not the other way around. The temperature of the electrolyte poured into the batteries must be 15-30 °C. After soaking for 2 h, bring the electrolyte level to 10-15 mm above the protective shield. The temperature of the electrolyte before the battery is put on charge must not exceed 30 °C.

Charge the battery at a current of 19 A until heavy gassing occurs in all the batteries and the voltage and the electrolyte density remain constant for 2 h.

During charging, the electrolyte temperature must not exceed 45 °C. When the electrolyte temperature reaches 45 °C, reduce the charging current by half and increase the charging time accordingly, or stop charging until the electrolyte cools to 30-35 °C. During charging the electrolyte density rises and by the end of charging reaches the value given in Table 6, with the temperature correction according to Table 8.

At the end of charging, if the electrolyte density, measured with the temperature correction (see Table 8), differs from the norm, correct the electrolyte density: if it is above the norm, add distilled water; if it is below the norm, add electrolyte with a density of 1.40 g/cm3. After the correction (to mix the electrolyte), continue charging for 30-40 min.

Table 8

Таблица 8

Зависимость плотности электролита от температурной поправки

Температура электролита, °С	Поправки к показаниям денсиметра,г/см³
46 — 60	плюс 0,02
45 — 31	плюс 0,01
30 — 20	0,01
19 — 5	0,00
от плюс 4 до минус 10	минус 0,02
от минус 11 до минус 25	минус 0,03
от минус 26 до минус 40	минус 0,04
от минус 41 до минус 55	минус 0,05

Temperature Correction of Electrolyte Density

0.5 h after the end of charging, set the electrolyte level to 10-15 mm above the protective shield, screw in the plugs, and thoroughly wipe the battery surface with a rag moistened with a 10 % solution of ammonia or soda ash, then wipe it with a rag moistened with water and dry it. Install the lid and the protective cover.

In special cases, when dry-charged batteries must be put into service very quickly, it is allowed to install them on trucks without checking the electrolyte density after 20 min of soaking, provided that the battery storage period does not exceed one year and the batteries are brought into working condition at a battery and electrolyte temperature of not less than plus 15 °C.

If dry-charged batteries stored at negative temperatures down to minus 30 °C must be put into service urgently, fill them with electrolyte of a density of 1.26-1.28 g/cm3 at a temperature of 38-42 °C. In this case, prepare the electrolyte in two stages according to Table 9. Install the batteries filled with electrolyte on the truck after one hour of standing.

Table 9 Preparing the Electrolyte

Таблица 9

Приготовление электролита

Наименование этапа	Плотность получаемого электролита, г/см³	Количество добавляемой серной кислоты плотностью 1,83 г/см³
Предварительное разведение производится заранее, с учетом времени, необходимого для остывания электролита до плюс 15 °С, и хранящегося далее в отапливаемом помещении	1,20 — 1,21 при плюс 15 °С	0,24 на литр воды
Окончательное приготовление производится непосредственно перед заливкой	1,26 — 1,28 при плюс 40 °С	0,13 на литр полученного электролита

The electrolyte level must be 10-15 mm above the protective shield. At the first opportunity, fully charge the battery and bring the density to normal.

Battery Operating Procedure

During operation, do not connect the battery terminals to each other to test for a "spark".

Determine the state of charge of the battery from the electrolyte density with the temperature correction (Table 10). Take a battery that is discharged by more than 25 % in winter or by more than 50 % in summer out of service and put it on charge.

In winter, add water immediately before starting the engine. If the electrolyte level drops because the electrolyte has splashed out, top it up. The density of the electrolyte added must match the density of the electrolyte in the battery. If electrolyte gets on the surface of the battery, remove it with a clean rag moistened in a 10 % solution of ammonia or soda ash. Then wipe the surface with a rag moistened in water and dry it.

Table 10

Таблица 10

Определение допустимого разряда батарей

Климатические зоны и районы. Средняя месячная температура воздуха в январе, °С	Времена года	Плотность электролита батареи, заряженной на 100 %, г/см³	Допустимое снижение плотности электролита при разрядке батарей	
			на 50 % летом, г/см³	на 25 % зимой, г/см³
Холодная, с климатическими районами:	Круглый год			
очень холодный от минус 50 до минус 30;		1,30	1,22	1,26
холодный от минус 30 до минус 15		1,28	1,20	1,24
Умеренная: от минус 15 до минус 8		1,26	1,18	1,22
Жаркая: от минус 15 до плюс 4		1,24	1,16	1,20
Теплая, влажная: от 0 до плюс 4		1,22	1,14	1,18

Determining the Permissible Battery Discharge

Store batteries in the dry-charged state at an indoor air temperature of from minus 40 to plus 60 °C. The plugs with sealing discs must be screwed tightly into the batteries, and the bolts and nuts at the terminals must be coated with a thin layer of grease.

The main faults of the batteries and their remedies are given in the section "Possible Faults and Remedies".

Lighting and Signaling System

The lighting and light signaling devices include two headlamps, front and rear lamps, the license plate lamp, the spotlight, the backup lamp, the cab dome light, the underhood lamp, the instrument illumination lamps, and the warning lights located on the instrument panel.

The front lamps*1 serve as front position lamps and front turn signals; the rear lamps serve as rear position lamps, rear turn signals, and the STOP signal (brake light).

The front lamps*2 serve as front position lamps and front turn signals; the rear lamps serve as rear position lamps, rear turn signals, rear outline (position) lamps, the STOP signal, backup lamps, rear fog lamps, a retroreflector, and side position lamps and side retroreflectors.

*1 For trucks supplied to the MoD. *2 For trucks supplied to the NE.

The headlamps are turned on with the main light switch 19 (see Fig. 12) in position II; the high beam or low beam is selected with the foot dimmer switch.

In positions I and II of the main switch, the position lamps and the instrument illumination lamps are turned on.

The spotlight is turned on with a separate switch only in position I of the main light switch.

When installing a body dome light, connect it to the circuit of the under-body illumination lamp.

Audible Signals

Audible signaling is provided by electric horns of high and low tone. The horn switch is installed in a pneumatic valve. Air is supplied to the valve from the pneumatic system through the air take-off valve.

Turn Signals and Brake Lights

The turn signals are turned on by a switch mounted on the steering column. When the switch handle is turned clockwise, the right turn signal lamps come on: in the front lamp, in the side repeater, and in the rear lamp. When the handle is turned counterclockwise, the left turn signal lamps come on. The switch returns to its initial position automatically.

The transistor flasher relay provides intermittent light signaling. If a bulb in the lamps is faulty, the turn signal indicator light on the instrument panel does not light up. When the brake pedal is pressed, the brake light bulbs of the rear lamps come on.

All turn signals are switched to flashing mode (hazard warning for an emergency state of the truck) with a special switch; an indicator lamp in the handle lights up at the same time. The other audible and light indicators are activated by the corresponding sensors or switches.

Headlamps

The direction of the headlamp beam is adjusted with two screws located under the headlamp rim. Screw 10 (Fig. 93) adjusts the direction of the beam in the vertical plane (up and down), and screw 9 adjusts it in the horizontal plane (right and left).

Headlamp adjustment. Setting the initial tilt angle of the low beam of the headlamps.

Adjust the headlamps and check the adjustment using a screen. The screen may be stationary or portable. The screen surface must be flat and matte. The screen width must be not less than 2.5 m.

Mark the screen by drawing three vertical lines (Fig. 94). The middle (center) line corresponds to the intersection with the median longitudinal plane of the screen; the two lines to the left and right of it are the lines onto which the headlamp centers are projected. A horizontal line A-A is also drawn on the screen. The distance h from line A-A to the surface on which the truck is placed is equal to the distance from the headlamp center to the surface of this area.

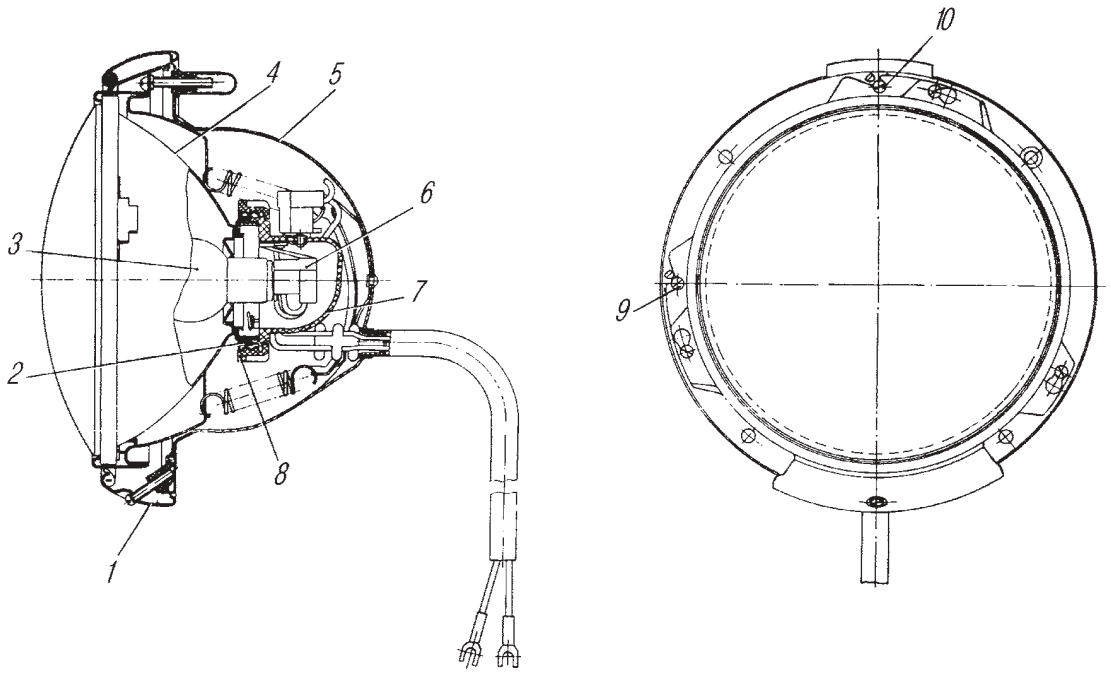


Fig. 93. Headlamp 401.3711 (671.3711)

1 - outer rim; 2 - gasket; 3 - bulb; 4 - optical unit; 5 - headlamp housing; 6 - connector block; 7 - cover; 8 - cover holder; 9, 10 - adjusting screws

б — колодка; 7 — кожух; 8 — держатель кожуха; 9,10

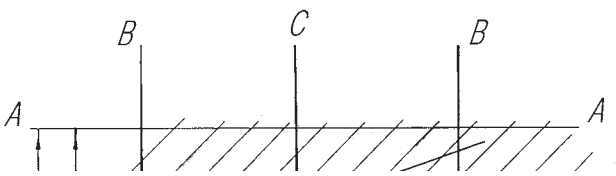


Fig. 94. Screen marking diagram for headlamp adjustment

A - horizontal line of the screen; B - lines of projection of the headlamp centers; C - line of intersection with the median longitudinal plane of the screen; I - line of the surface of the area; L=190 mm

The plane of the screen must be perpendicular to the plane of the surface. The deviation from perpendicularity must not exceed 5 mm per 1 m. The area on which the measurements are made must be level and horizontal, with an unevenness height of not more than 5 mm and a deviation from flatness of not more than 5 mm per 1 m. Measurements must be made in the dark (for example, in a dark room). The ambient air temperature during the measurements must be from 10 to 30 °C.

Headlamp adjustment is performed on a truck in curb condition, i.e., the truck must be fully fueled and equipped with all auxiliary accessories and tools. The wheels must be inflated to the pressure that corresponds to full load. The truck must stand at the temperature specified above for eight hours. For more accurate results, the lenses may be removed from the headlamps.

Headlamp adjustment consists of setting the initial tilt angle of the low beam of the headlamps to 1.9 %.

Position the truck, prepared as described above, so that its longitudinal plane of symmetry is perpendicular to the plane of the screen and the line of intersection with the plane of the screen coincides with the middle vertical line on the screen. The distance between the centers of the headlamps and the screen must be 10 m.

Adjust the headlamps one at a time; the headlamp that is not being adjusted must be covered with opaque material.

When the headlamps are turned on, the light beam produces a light zone in the lower part of the screen and a dark zone in the upper part; the cutoff line between the light and dark zones is parallel to line A-A in the left part of the screen and rises at an angle of 15° from the point of intersection with the vertical lines of the headlamp centers in the right part of the screen.

Turn the adjusting screws on the headlamp to shift the cutoff line between the light and dark zones so that it is positioned 190 mm below line A-A. Completing these actions means that the requirements for setting the initial tilt angle of the low beam of the headlamps are met.

When the adjustment is finished, install the lenses. The initial tilt angle of the low beam of the headlamps may be adjusted with special instruments designed for this purpose, in accordance with the operating instructions for these instruments. Verify such an adjustment by adjusting the low beam tilt angle of the headlamps with the screen and, if necessary, make corrections to the headlamp adjustment procedure with the special instruments.

Adjusting the Headlamps According to the Truck Load (if an electromechanical low beam headlamp corrector is fitted)

To adjust the tilt angle of the low beam of the headlamps according to the load, an electromechanical low beam headlamp corrector is installed. The corrector control unit is located in the cab. The control unit has a corrector selector knob, which on a truck in curb condition must be set to position "0".

For URAL-4320-10 and URAL-4320-31 trucks and URAL-4420-10, URAL-44202-0311-31, and URAL-44202-0612-30 tractor trucks, when driving in the dark with a load of up to 75 % of the maximum load mass, the corrector selector knob must be in position "0"; when driving with the maximum load, move the knob to position "I", which provides sufficient illumination and prevents dazzling the drivers of oncoming traffic.

On products built on the chassis of URAL trucks, adjust the tilt angle of the low beam of the headlamps with the corrector in accordance with UNECE Regulation No. 48-01; in this case, the positions of the selector knob of the corrector control unit may differ from those given above.

Install and remove the connector blocks of the actuators and control units only with the truck ground switch turned off.

Replace headlamp bulbs with darkened envelopes without waiting for them to burn out. When replacing a burned-out bulb, restore the seal of the optical unit. The bulbs used on the truck and their specifications are given in Appendix 7.

Replace the bulbs in the headlamps as follows: unscrew the bolts securing the rubber headlamp rim, unscrew the screws securing the rim of the optical unit, remove the rim and the optical unit, remove the spring that retains the bulb, and replace the bulb. Assemble in the reverse order.

Fuses

The preheater power circuit is protected against short circuits by a 30 A bimetallic fuse 291.3722.

The upper fuse block (Fig. 95) protects: fuse 1 - the fog lamp circuit; fuse 2 - the spotlight lamp circuit; fuse 3 - the circuit of the portable and underhood lamps and the power supply circuit of the warning light clusters; 4 -

the circuit of the cab dome light, the road train identification lamps, and the brake light bulbs; 5 - the circuit of the heater electric motor and the backup lamp; 6 - the power supply circuit of the instruments and the buzzer. The lower block protects the circuits: fuse 1 - the left position lamp; 2 - the right position lamp and instrument illumination; 3 - the left headlamp low beam; 4 - the right headlamp low beam; 5 - the left headlamp high beam; 6 - the right headlamp high beam.

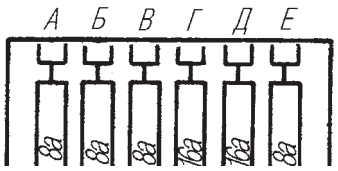


Fig. 95. Electrical diagram of the fuse block

1-6 - fuses

Cab and Sheet Metal

Cab

The truck cab is enclosed, three-seat, with a fixed windshield and with thermal insulation. It is located behind the engine and is equipped with rear-view mirrors on the left and right sides, a wide-angle mirror mounted on a special bracket on the right fender, and a side-view mirror on the right door.

Adjust the spherical mirrors, with the bolts securing the holders and mirrors loosened, so that the fields of view through them comply with Figs. 96, 97, and 98, and then secure them firmly.

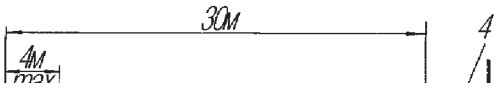


Fig. 96. Fields of view through the exterior rear-view mirrors

1, 3 - rear-view mirrors (left, right); 2 - driver eye point; 4 - road surface visibility zone; I - horizon line

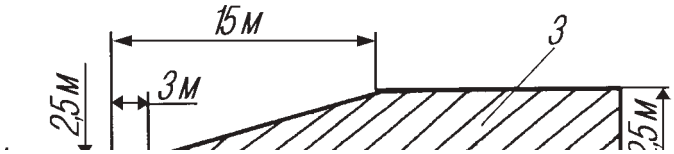


Fig. 97. Field of view through the wide-angle mirror

1 - wide-angle mirror; 2 - driver eye point; 3 - road surface visibility zone

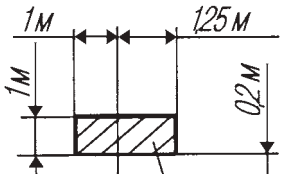


Fig. 98. Field of view through the side-view mirror

1 - side-view mirror; 2 - driver eye point; 3 - road surface visibility zone

The cab is equipped with mounting points for the seat belts of the driver and passengers.

The cab is attached to the truck frame at four points on rubber mounts. When the frame deforms, the flexible mounting protects the cab parts from overstress.

Cab Doors

The doors are equipped with locks and window regulators. When the door is closed, lock pawl 12 (Fig. 99) contacts door striker 11 and, rotating, locks the door. In this position the pawl is held by latch 13 and latch retainer 14. At the same time, upper guide pin 9 of the lock enters the slot of the striker and keeps the door from sagging.

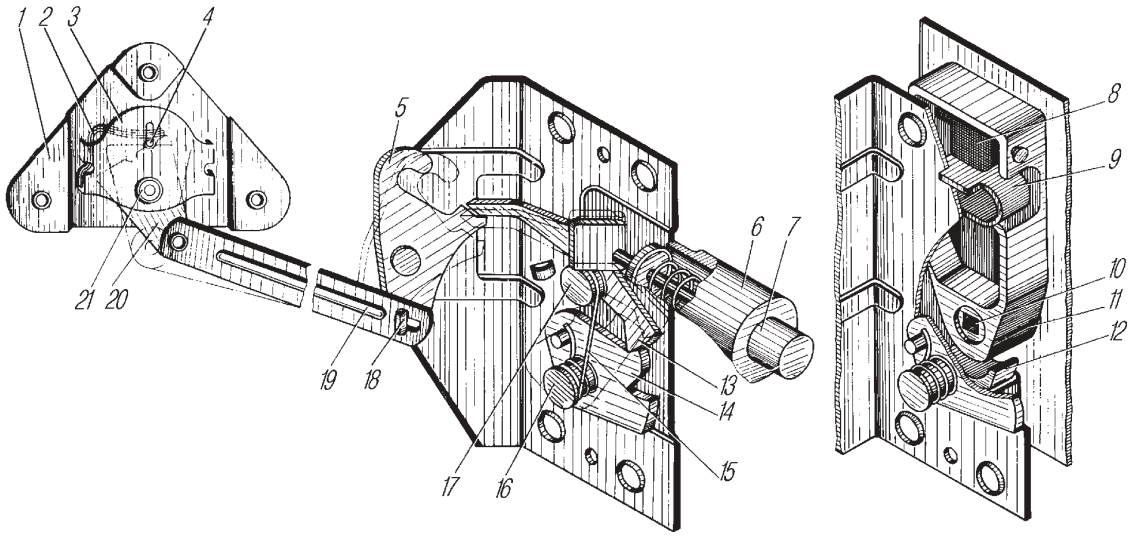


Fig. 99. Door lock

1 - drive housing; 2 - drive spring; 3 - drive bracket; 4 - roller; 5 - driver link; 6 - outside door handle; 7 - button; 8 - striker block; 9 - guide pin; 10 - bolt; 11 - door striker (install.); 12 - pawl; 13 - latch; 14 - latch retainer; 15 - spring; 16 - pawl pin; 17 - latch pin; 18 - drive rod pin; 19 - drive rod; 20 - drive ratchet; 21 - drive pin

The door lock drive handles must be positioned horizontally and point forward. The door locks can be locked against opening from the outside by turning the inside lock drive handle downward. When the lock is locked, driver link 5 of the lock holds the latch, preventing it from coming out of engagement with the striker. In addition, the lock of the left door can be locked from the outside with a key.

To open the door lock, turn the lock drive handle upward or press the button of the outside handle. The latch then releases the striker, and the pawl returns to its initial position under the force of spring 15. The door striker is secured to the lock pillar by a screw and two bolts, which allow it to be adjusted for height and for depth.

When adjusting, make sure that guide pin 9 of the lock enters the slot of striker 11 correctly. If the striker is adjusted correctly for height, the door must not drop or rise when it is opened. Adjustment for depth allows the lower lug of the striker to fit tightly against pawl 12 while avoiding excessive effort when closing the door.

Adjust for depth so that the door opening seals are deformed as little as possible while still sealing sufficiently tightly and preventing the doors from rattling while the truck is moving. If the door closes too tightly, move the striker outward; if the door rattles, move it toward the inside of the cab. The doors must be closed tightly while the truck is moving.

If the door seals are damaged, glue them back with 88NP adhesive. First clean the surfaces to be bonded with emery cloth and wipe them with a clean cotton rag moistened with gasoline.

The door windows have drop-down and pivoting glass panes. The door glass is raised and lowered by window regulators. The glass must move freely in the guides, without binding.

During disassembly, lubricate all rubbing surfaces of the parts of the locks, window regulators, hinges, and fasteners, and the spring pins, with Litol-24 grease or Solidol (calcium) grease.

Windshield Wiper and Washer

The cab is equipped with a windshield washer and wiper. The two-speed electric windshield wiper consists of an electric drive, two links, wiper arms, and two wiper blades. The wiper is turned on by a switch located on the instrument panel. When the wiper is turned off, the blades automatically park along the lower edge of the glass.

The windshield washer reservoir, with a pump and an electric motor, is mounted on the left side panel of the hood. The reservoir capacity is 2 L. The washer fluid is delivered to the glass through hoses and two nozzles.

Washer fluid is delivered when the washer control button, located on the instrument panel to the left of the steering wheel, is pressed.

At ambient air temperatures above plus 5 °C, filtered water is used to fill the reservoir. At temperatures from plus 5 °C to minus 40 °C, it is recommended to use a solution of distilled water and a solution of sulfanol in isopropyl alcohol (NIISS-4 fluid, TU 38.10230-76) in the proportions given in Table 11.

Table 11. Concentration of the NIISS-4 aqueous solution as a function of ambient air temperature

Таблица 11

Концентрация водного раствора НИИСС-4 в зависимости от температуры окружающего воздуха

Температура окружающего воздуха, 0 °С	Состав по объему в частях	
	НИИСС-4	Вода
До плюс 5	0	10
От плюс 5 до минус 5	1	9
От минус 5 до минус 10	1	5
От минус 10 до минус 20	1	2
От минус 20 до минус 30	1	1
От минус 30 до минус 40	2	1

Do not use NIISS-4 undiluted with water, because the combined action of the concentrate, atmospheric pollution, and ultraviolet radiation alters the paint coating of the truck.

Wash the glass with the wipers turned on at the same time. Change the direction of the fluid jet by turning the guide in the nozzle.

Cab Heating

The cab is heated by air warmed in the heater, which is connected to the engine cooling system. The supply of outside air to the heater core is controlled by cover 12 (Fig. 100) of the outside air vent, and the supply of air from inside the cab is controlled by cover 7 of the inside air vent. With the heater fan on, the heated air enters air distributor 3, from which it is distributed through the cab by controllable dampers.

The dampers are controlled by lever 4. With the lever in the upper position, air flows through defroster outlets 13 to the windshields; with the lever in the lower position, it flows to heat the feet of the driver and passengers. When the lever is moved away from its extreme positions, the amount of air directed to the glass and to the feet of the driver and passengers changes accordingly.

Inside vent cover 7 is controlled by lever 5. With the lever in the upper position, the vent is open; in the lower position, it is closed.

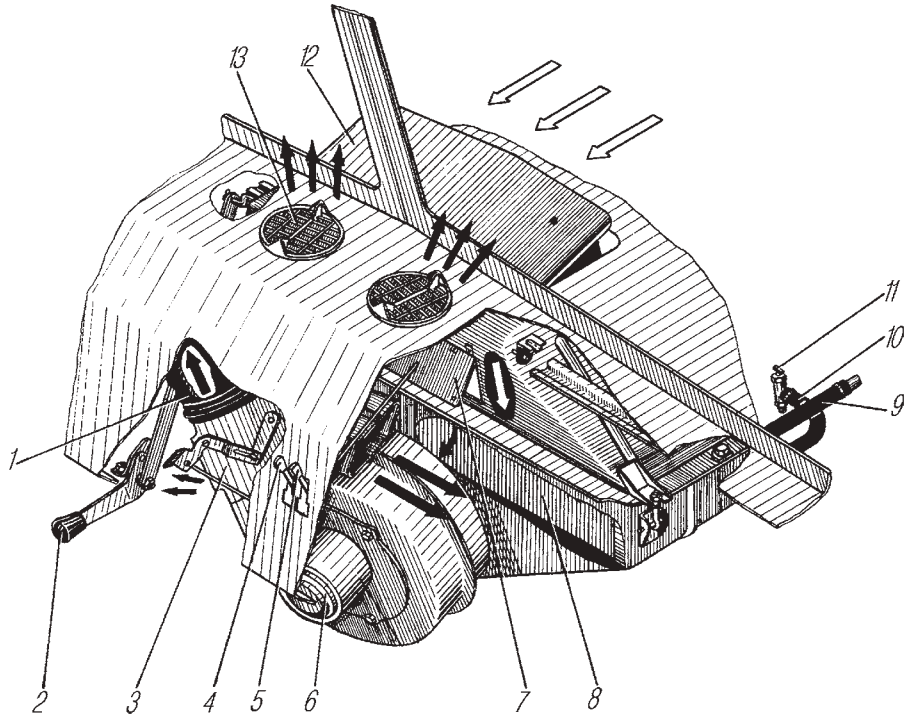


Fig. 100. Operation diagram of the cab heater and windshield defrosting

1 - warm air duct for defrosting the windshields; 2 - outside vent control handle; 3 - air distributor; 4 - air distributor damper control lever; 5 - inside vent control lever; 6 - electric motor with fan assembly; 7 - inside vent cover; 8 - heater core; 9 - coolant outlet pipe from the heater core; 10 - coolant inlet pipe; 11 - heater valve; 12 - outside vent cover; 13 - defroster outlet

The optimum setting of the heating controls is simultaneous intake of air from outside through the vent controlled by cover 12 and from the cab through the inside vent closed by cover 7, with heated air delivered to the windshields and to the feet of the driver and passengers by setting lever 4 to the middle position.

The fan switch is located on the instrument panel.

Valve 11, located on the right water pipe of the engine, must be open during operation at subzero air temperatures. In summer, the heater must be disconnected from the cooling system by closing valve 11.

If water is used as the coolant at subzero temperatures, the heater valve should be closed before the cooling system is filled to prevent cold water from entering the heater core and freezing.

For additional heating, the cab is equipped with an autonomous heating unit (AHU). The autonomous heating unit is located inside the cab, on the floor under the passenger seat.

The design of the AHU and the operating instructions are given in the technical description of the AHU supplied with the truck.

The cab is ventilated through the heating system vents and the openings of the pivoting and drop-down door windows. If natural ventilation of the cab is insufficient, open the outside vent and turn on the fan.

Driver and Passenger Seats

The seats are separate; the cushioning element is rubber straps and sponge rubber. The driver seat position can be adjusted by moving it forward or backward. The adjustment range is 110 mm. The seat is locked in the desired position with knob 4 (Fig. 101), located on the left side of the seat base (Fig. 101, I) or on the right side of the base (Fig. 101, II). The driver seat has a mechanism for changing the cushion tilt and the seat height, with an adjustment range of 80 mm.

To change the seat height, unscrew the two front screws 3 on the left and right sides of the seat. After setting the required height of the front of the seat, screw the screws in a few turns, but not tight, and loosen the mounting of the rear of the seat by unscrewing the two screws 2 by four to five turns.

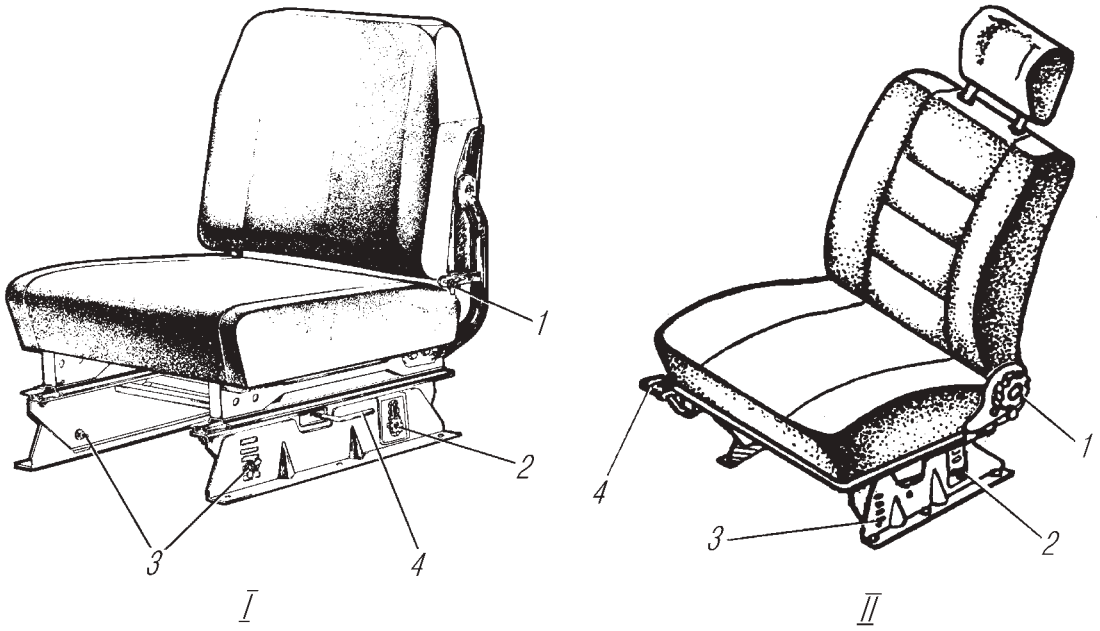


Fig. 101. Driver seat

1 - wing nut (I), handle (II) for backrest tilt adjustment; 2, 3 - screws for seat height and tilt adjustment; 4 - knob for moving the seat forward or backward; I - for trucks supplied to the Ministry of Defense (MoD); II - for trucks supplied to the national economy (NE)

After the final adjustment of the seat position, secure the screws firmly. The conical part of the screw must be seated in one of the five conical recesses.

The backrest of the driver seat has tilt angle adjustment. To change the backrest tilt angle, unscrew nuts 1 (Fig. 101, I) on the left and right sides of the seat by two to three turns, select the required backrest position, and tighten the nuts firmly again, or use handle 1 (Fig. 101, II) located on the left side of the seat.

Sheet Metal (Hood and Fenders)

For ease of engine maintenance and repair, individual sheet metal assemblies are made detachable. The sheet metal is attached to the truck frame through a rubber support mount and to the cab through rubber bumpers. The hood is of the alligator type, with an opening angle of 90°.

Cargo Body

The cargo body of URAL-4320-10, URAL-4320-31, and URAL-4320-0911-30 trucks has one drop tailgate. The general view and the mounting elements of the cargo body on the frame are shown in Fig. 102.

The cargo body is equipped with seats for carrying people, extension racks for the front side and the lateral sides, and tilt bows with spacers. The center seat can be removed and secured to the front side (Fig. 103); the side seats can be folded to free up space when carrying cargo. The truck is supplied with a cargo body tilt.

The tilt in the installed position is shown in Fig. 104. The procedure for stowing a removed tilt is shown in Fig. 105. The tilt must be dried before stowing.

Cargo Body of URAL-43202-0351-31 Trucks

The cargo body of URAL-43202-0351-31, URAL-4320-0611-10, and URAL-4320-0611-31 trucks is wooden, with three drop sides. The lateral sides are tied together at their middle by two chains.

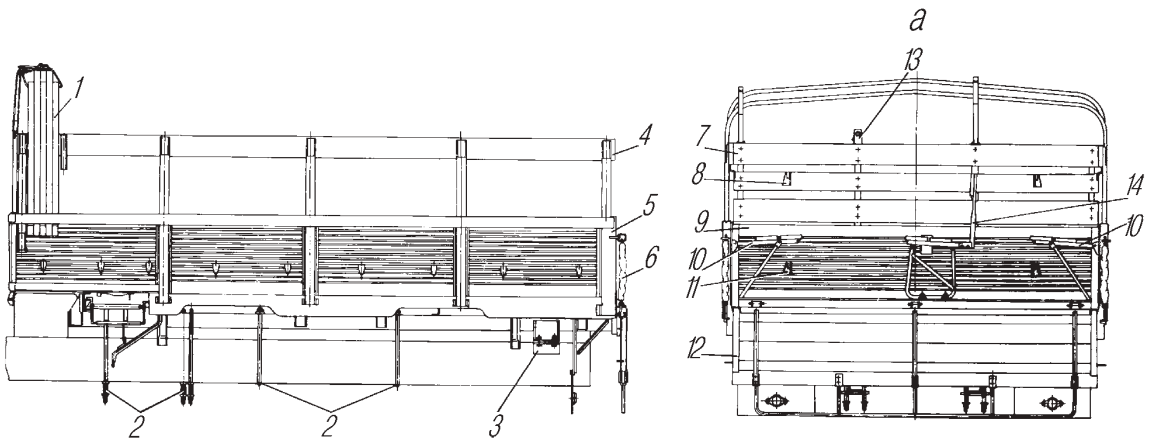


Fig. 102. Mounting of the cargo body on the frame

1 - tilt bows in transport position; 2 - U-bolts; 3 - bracket for mounting the cargo body to the truck frame; 4 - side extension; 5 - side; 6 - tailgate lock chain; 7 - front extension; 8 - front center seat mounting bracket; 9 - front side; 10 - side seats of the cargo body; 11 - rear center seat mounting brackets; 12 - tailgate (rear side); 13 - driver signal button; 14 - center seat of the cargo body; a - rear view

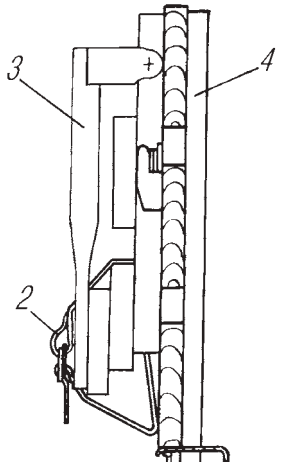


Fig. 103. Stowing the center seat

1 - rear center seat; 2 - securing strap; 3 - front center seat; 4 - front rack of the cargo body; 5 - front side of the cargo body

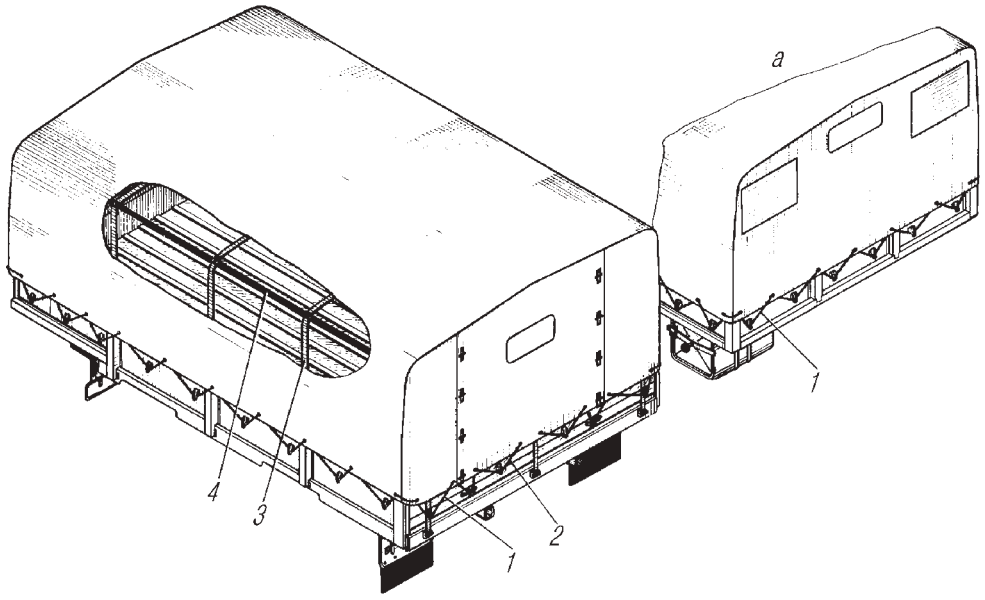


Fig. 104. Cargo body with tilt

1 - tilt securing rope; 2 - tilt curtain securing rope; 3 - tilt bow; 4 - bow spacer tube; a - front view

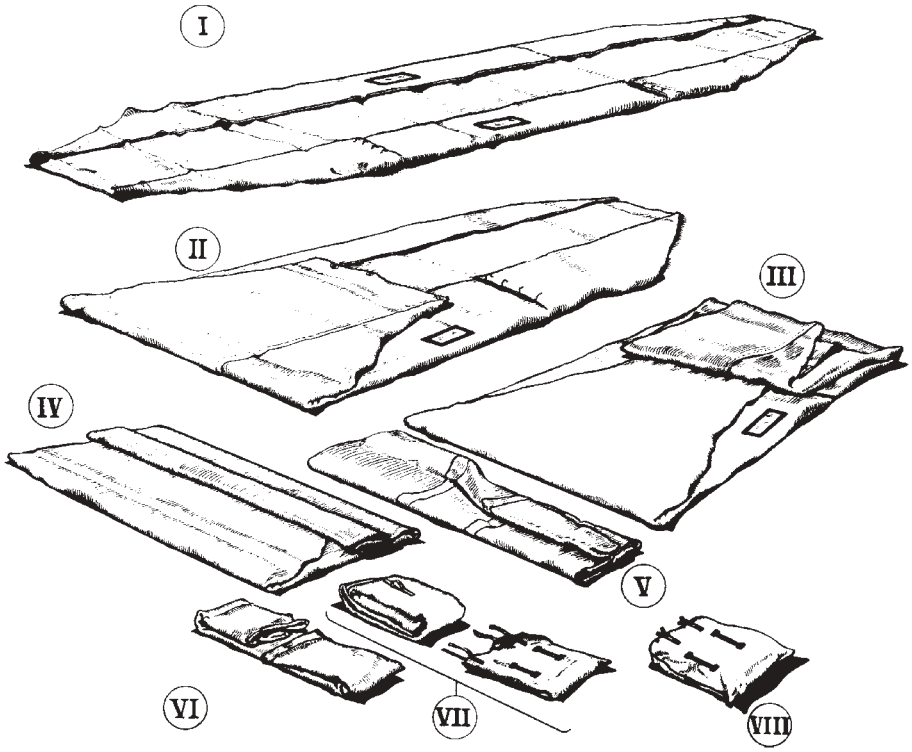


Fig. 105. Method of stowing the tilt

I-VIII - sequence of stowing the tilt

During operation of the truck, periodically check the bolted connections of the cab, sheet metal, and cargo body parts and their attachment to the frame; if cracks are found in the parts, weld them and paint them.

If welding is required, strip the old paint from the surfaces of the parts. Before touching up damaged areas (mechanical damage, cracks, chips, rust, welding soot, spatter), the old paint coating must be sanded with fine-grit or waterproof abrasive paper.

Wipe the cleaned surface with a rag moistened with gasoline or solvent, dry it, and paint it with enamel of the same color in two coats, using a spray gun or a soft brush, allowing 5-10 min between coats.

Periodically remove and dry the cab floor mat, because a damp mat loses its thermal insulation properties and promotes corrosion of the cab floor.

Fifth Wheel Coupling

The tractor trucks are fitted with a fifth wheel coupling with a locking hole in the jaws 50.8 mm in diameter. The device is designed for the articulated connection of the tractor truck to a semitrailer that has a standard coupling kingpin.

The fifth wheel coupling is attached to the frame by means of brackets 13 (Fig. 106). The fifth wheel is attached to brackets 13 by means of brackets 14. The brackets of the fifth wheel rest on mounts 15, which are located in the sockets of the fifth wheel.

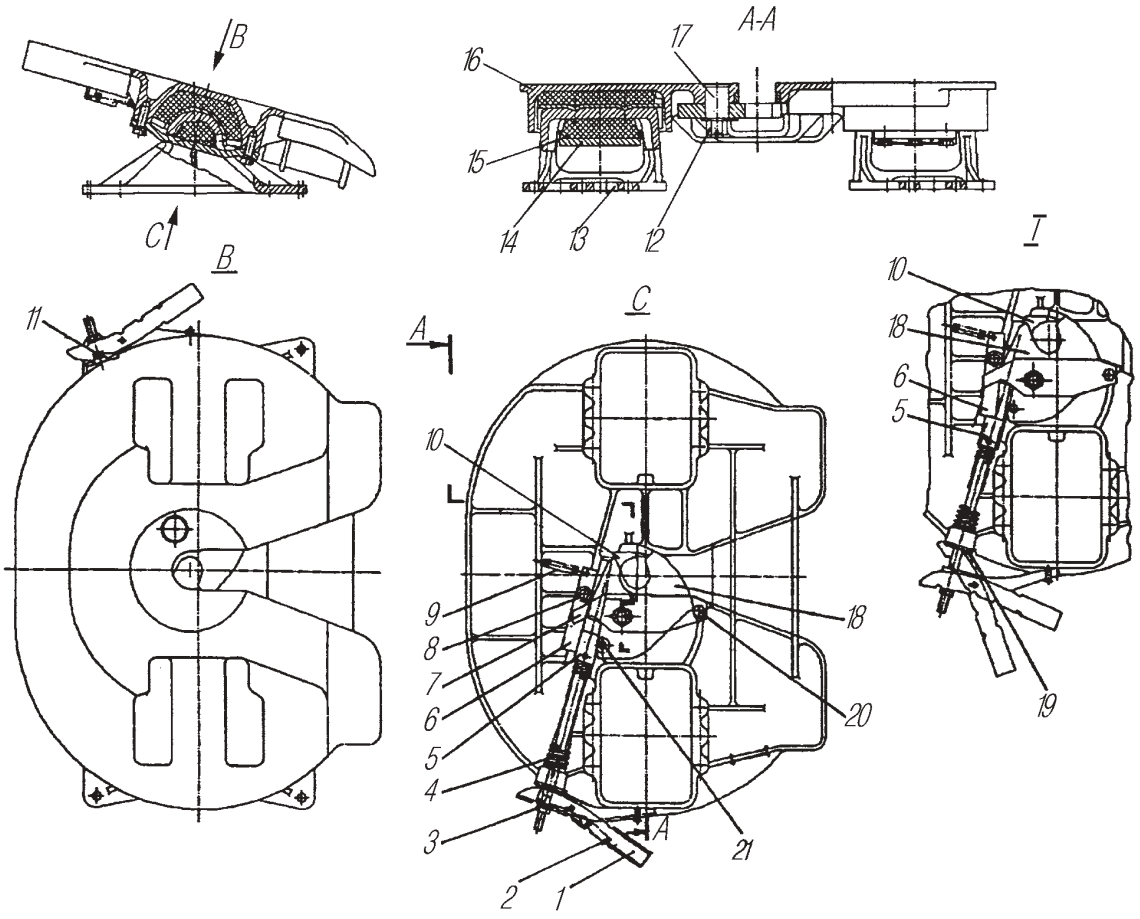


Fig. 106. Fifth wheel coupling

1 - handle; 2, 4, 9 - springs; 3, 12 - nuts; 5 - locking cam; 6 - latch; 7 - cover; 8, 11, 20 - bolts; 10 - front jaw; 13, 14 - brackets; 15 - mount; 16 - fifth wheel; 17 - pin; 18 - rear jaw; 19 - safety bar; 21 - rotating support; I - handle position before uncoupling

Under the fifth wheel is the coupling and release mechanism, which consists of rear jaw 18, front jaw 10, and locking cam 5, which has two positions, open and closed. Spring 4 is mounted on the rod of locking cam 5 and holds the cam in the closed position. To open (move) the cam, there is handle 1 at the end of the rod, secured by nuts 3. Nuts 3 also serve to adjust the clearance in the jaws with the semitrailer kingpin. In the open position, the cam is held by latch 6 with the help of springs 9.

Rear jaw 18 rotates on pin 17, which is covered by cover 7 secured with nut 12. Safety bar 19, attached to the fifth wheel with bolt 11, keeps the cam from opening accidentally. Spring 4 presses the rod of locking cam 5, with its locating shoulder, against the wall of the hole.

To prevent a loose fit of the end of rear jaw 18 against cam 5, a rotating support 21 is built into the jaw.

The design of the fifth wheel coupling provides for adjustment of the diameter of the kingpin hole in order to eliminate clearances between the jaws and the kingpin.

To eliminate clearances in the jaws during operation, unscrew nuts 3, drive the road train 100-200 m with light braking until the clearances disappear, and then screw in the nut until it contacts handle 1, which must rest against the fifth wheel. After that, tighten the nut another 1/2 turn and lock it.

To uncouple the tractor truck from the semitrailer, turn handle 1 toward you by hand (or with a tire lever inserted into the end of the handle) until locking cam 5 is locked in the extended position by latch 6. This automatically releases the rod of locking cam 5, its locking shoulder enters the guide hole of the fifth wheel boss, and at the same time a lug on handle 1 moves safety bar 19 aside.

If it is difficult to move the handle toward you [with a force applied to the handle of 0.25-0.40 kN (25-40 kgf)], it is recommended to move the handle up and down several times while turning it toward you at the same time. Latch 6, bearing against the end of locking cam 5, then holds it in the open position. When the tractor truck pulls away, the semitrailer kingpin turns rear jaw 18 about pin 17; the end of jaw 18 presses on latch 6 and turns it, releasing locking cam 5, which, moving under the force of spring 9, bears against the end of rear jaw 18 and holds it in the open position.

Coupling of the tractor truck to the semitrailer takes place automatically. After coupling, make sure that the safety bar is in the vertical position, which indicates that the tractor truck and semitrailer have coupled.

Care of the Fifth Wheel Coupling

Before setting out on a trip, check that the fifth wheel coupling is securely attached to the truck frame and that the jaw lock is secured. Check the condition of the jaws, the locking cam, and the latch spring. Worn and deformed parts must be replaced with new ones in good time.

Coupling and Uncoupling the Tractor Truck and Semitrailer

Before coupling, make sure that the fifth wheel coupling and its mounting are in good condition, that the fifth wheel is not dirty, and that there are no foreign objects on it; if necessary, clean contaminated grease from the top surface of the fifth wheel and apply a thin layer of fresh grease. Apply the semitrailer parking brake firmly and set the semitrailer on its landing gear so that the supporting surface of the semitrailer, measured from the ground, is level with the fifth wheel of the tractor truck or not more than 10 mm below it.

Perform coupling and uncoupling on flat, level ground with a hard surface. The longitudinal axes of the tractor truck and semitrailer must be in a straight line.

If the jaws are closed, turn handle 1 toward you; the handle must be held by latch 6 in the retracted position. Then turn jaw 18 counterclockwise until the front end of the jaw is out of the path of the semitrailer kingpin. As it turns, the jaw acts on the latch and turns it, releasing the locking cam, which, as it moves, bears against the jaw and holds it in the open position.

Couple in the following sequence:

- Back the tractor truck at low speed toward the semitrailer so that the semitrailer kingpin enters the jaws of the fifth wheel coupling. Coupling of the tractor truck to the semitrailer takes place automatically;
- Apply the tractor truck parking brake. Make sure that safety bar 19 has moved to the vertical position and prevents the handle from being moved toward you;
- Raise the semitrailer landing gear to its uppermost position and secure it firmly;
- Connect the semitrailer wiring cable to the plug socket;
- Connect the air hoses of the tractor truck pneumatic brake actuation to the coupling heads of the semitrailer;
- Release the semitrailer parking brake;
- Move the road train forward a short distance and make sure that the coupling is sound and that the brakes and electrical equipment of the semitrailer work properly.

When coupling the tractor truck with semitrailers of different makes, adjust the distance between the clamps on the hoses to prevent them from rupturing as a result of rubbing against protruding parts of the tractor truck, and make sure that there is no clearance or interference in the kingpin-jaw connection. If necessary, adjust the clearances between the jaws and the kingpin as described above.

Before uncoupling, choose a level place to park the semitrailer. Uncouple in the following order:

- Apply the semitrailer parking brake;
- Lower the semitrailer landing gear until it rests on the ground, relieving the tractor truck springs. If uncoupling is unavoidable on loose ground, place pads under the semitrailer landing gear;
- Disconnect the semitrailer wiring cable from the plug socket;
- Disconnect the coupling heads of the pneumatic brake actuation (first the supply line, then the control line) and close them with the protective covers. Secure the coupling heads with the hoses on the platform of the tractor truck;
- Turn handle 1 toward you; safety bar 19 then moves to the retracted position, and latch 6, bearing against the end of locking cam 5, holds it in the open position;
- Engage first gear and move the tractor truck forward at low speed until it is completely uncoupled from the semitrailer.

Special Equipment

The installation layout of additional units and the power take-off (PTO) modes must be agreed with the plant. Drive shafts installed by the customer to drive additional units must have an imbalance of not more than 40 g*cm and a sliding force in the splined joints of not more than 150 N (15 kgf).

Power Take-Off

The PTO is single-stage, is attached to the right side of the gearbox housing, and is designed to drive auxiliary units. It is made in two versions: with a pump (Fig. 107) and with a flange (Fig. 108).

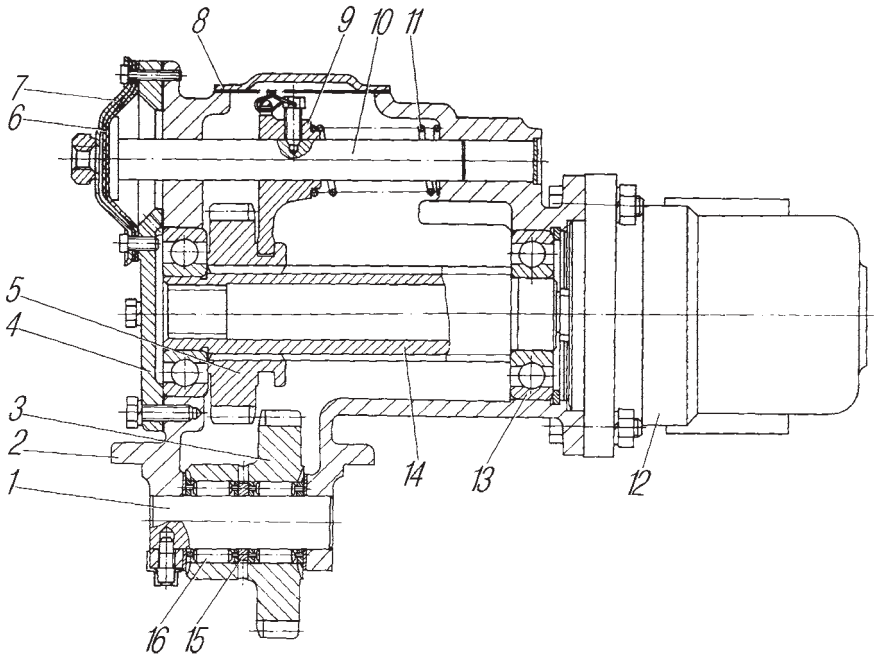


Fig. 107. Power take-off with pump

1 - drive gear axle; 2 - housing; 3 - drive gear; 4 - housing cover; 5 - driven shaft gear; 6 - engagement chamber diaphragm; 7 - engagement chamber cover; 8 - cover; 9 - fork; 10 - shift fork rod; 11 - spring; 12 - pump; 13 - ball bearings; 14 - driven shaft; 15 - bearing spacer ring; 16 - roller bearings

Engage the PTO when the air pressure in the truck pneumatic system is not less than 500 kPa (5 kgf/cm2) and the clutch is disengaged. Adjusting shims are installed between the flanges of the gearbox housing and the PTO housing; they set the gear backlash, which is adjusted by the noise of the gears. If the shims have to be replaced with new ones, their thickness must be preserved.

The PTO is controlled remotely and pneumatically; the control consists of a control valve, an engagement mechanism, and air lines. To allow remote engagement of the PTO, a control valve is mounted on a bracket in the cab to the right of the driver, on the lower edge of the instrument panel.

With the PTO disengaged, lever 8 (Fig. 109) is in the upper position and rod 7 is in the right position. Valve 3 is pressed against seat 4 by spring 2, and no air passes through the valve.

To engage the PTO, valve lever 8 is moved to the lower position. Rod 7 moves to the extreme left position, presses on valve 3, and moves it away from seat 4. Compressed air flows through the air lines into the diaphragm chamber of the engagement mechanism. Diaphragm 6 (see Fig. 107), through rod 10 with fork 9, brings driven shaft gear 5 into mesh with drive gear 3.

To disengage the PTO, valve lever 8 (see Fig. 109) is moved to the upper position. Rod 7, under the force of spring 5, moves to the extreme right position and thereby moves away from valve 3. Through the hole in rod 10 (see Fig. 107), the chamber of the engagement mechanism is connected to the atmosphere, the air is released from the chamber, and, under spring force, the rod with fork 9 moves the gear of driven shaft 14 out of mesh with drive gear 3. At the same time as the air is released to the atmosphere, valve 3 (see Fig. 109) is pressed against seat 4 by spring 2 and shuts off the inlet and outlet ports of the valve.

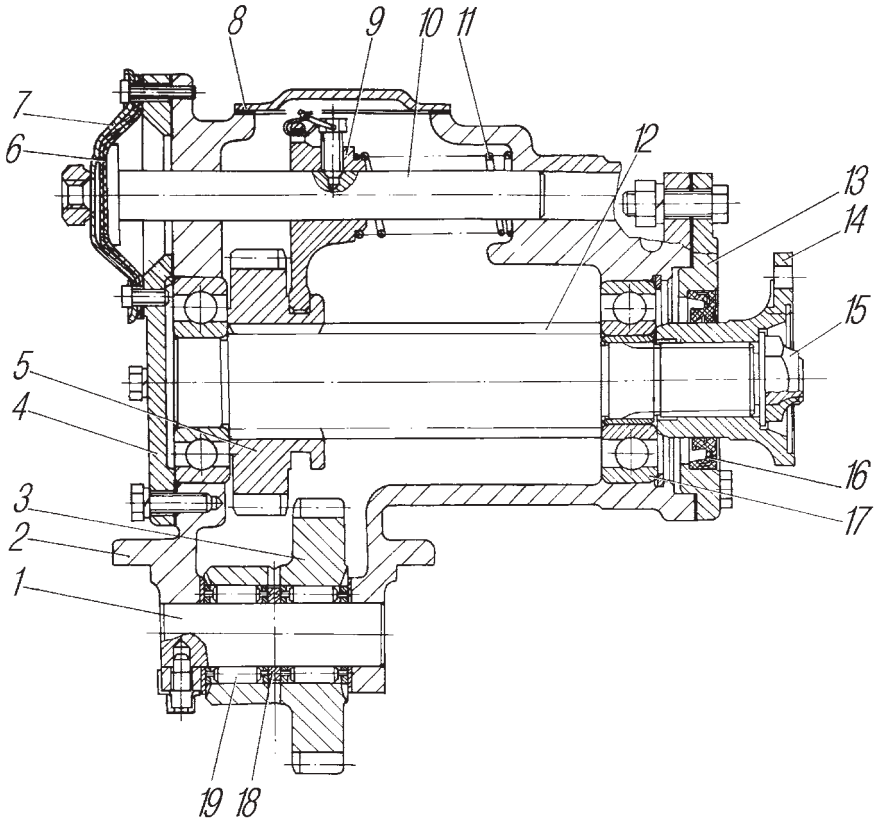


Fig. 108. Power take-off with flange

1 - drive gear axle; 2 - housing; 3 - drive gear; 4 - housing cover; 5 - driven shaft gear; 6 - engagement chamber diaphragm; 7 - engagement chamber cover; 8 - cover; 9 - fork; 10 - shift fork rod; 11 - spring; 12 - driven shaft; 13 - cover; 14 - flange; 15 - nut; 16 - lip seal; 17 - ball bearings; 18 - bearing spacer ring; 19 - roller bearings

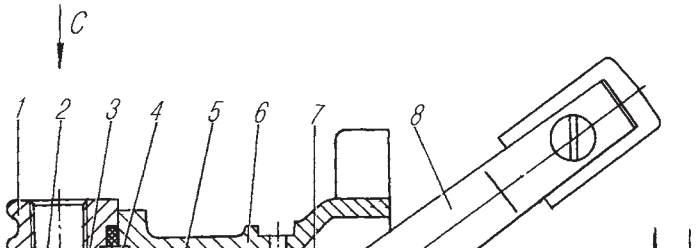


Fig. 109. Pneumatic valve

1 - cover; 2 - valve spring; 3 - valve; 4 - valve seat; 5 - rod spring; 6 - body; 7 - valve rod; 8 - lever; a - off; b - on; c - air supply

Auxiliary Power Take-Off

Power is taken off from the input shaft of the transfer case through sliding coupling 2 (Fig. 110) and is intended to drive the winch and other units. The design of the heavy-duty unit is similar.

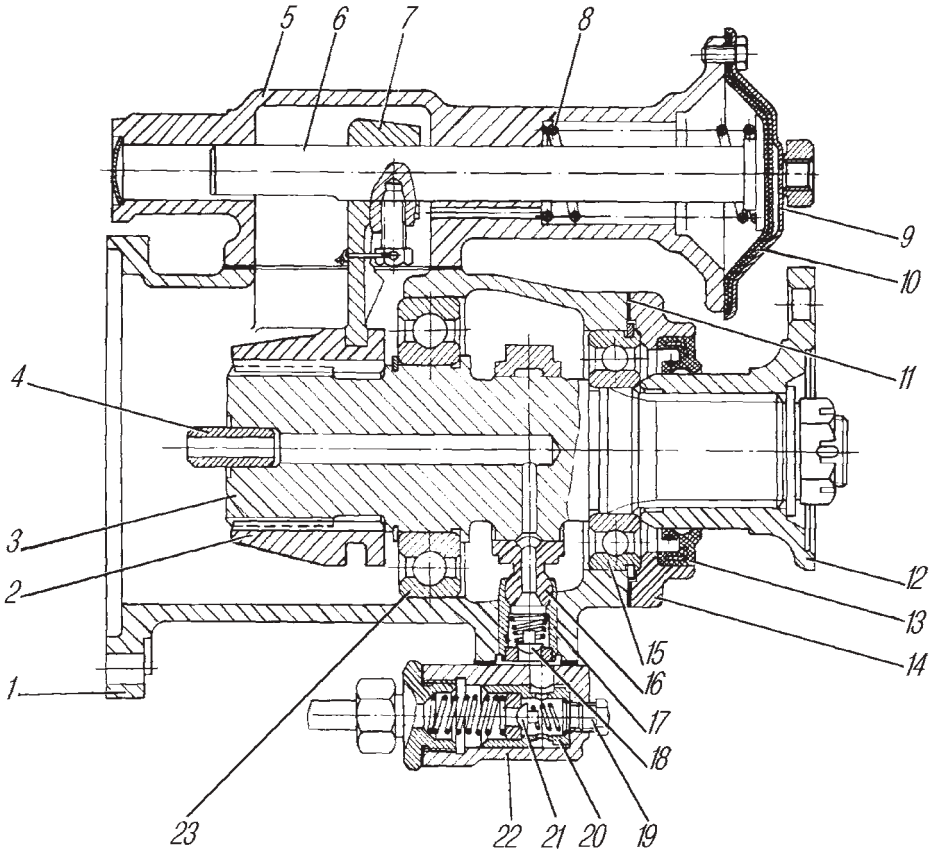


Fig. 110. Auxiliary power take-off

1 - housing; 2 - coupling; 3 - shaft; 4 - shaft bushing; 5 - engagement chamber body; 6 - engagement rod; 7 - fork; 8 - spring; 9 - cover; 10 - diaphragm; 11 - gasket; 12 - flange; 13 - lip seal; 14 - cover; 15, 23 - ball bearings; 16 - pump connecting rod; 17 - piston; 18, 21 - pump valves; 19 - plug; 20 - relief valve; 22 - pump body

The auxiliary power take-off (auxiliary PTO) can operate in any gear of the transfer case, including neutral. A plunger pump is installed in the auxiliary PTO to lubricate the gear and shaft bearings.

The pump consists of piston 17 with discharge valve 18, relief valve 20, and body 22. The piston with its connecting rod is mounted on the eccentric of shaft 3 and moves back and forth as the shaft rotates. To prevent excessive pressure as the rotation speed increases, the suction valve is of the differential type with a cylindrical spring. Oil is drawn through a tube connected to the oil sump of the transfer case and is delivered from the pump to the gear bearings through passages in shaft 3 and in the input shaft of the transfer case. Part of the oil seeps through the clearances and lubricates the shaft bearings.

To allow remote engagement of the auxiliary PTO, control valve 6 (see Fig. 11) is mounted on a bracket in the cab to the right of the driver on the lower edge of the instrument panel. The control valve lever is locked in the off position by a screw installed on the valve bracket.

During prolonged operation of the auxiliary PTO, the bearings of the transfer case input shaft and of the power take-off shaft must not overheat. Excessive heating indicates a fault in the oil pump.

Check the pump with two people. To check pump operation:

— Pull the parking brake lever as far as it will go;
— Set the transfer case gear shift lever to the neutral position;
— Disengage the winch by lowering the lever on the right frame side rail;
— Unscrew plug 19 (see Fig. 110) in the pump body;
— Start the engine and engage the auxiliary PTO and one of the gears in the gearbox;
— Check the pump by closing the plug 19 hole with a finger. If the pump is working properly, oil pulsation is felt in the plug hole.

> **WARNING: Do not operate with a faulty pump.**

Winch

The winch (Fig. 111) is designed for self-recovery and for recovering trucks and trailers on difficult terrain. It consists of a worm gearbox, a drum with a cable attached to it, and a cable spooler.

The gearbox mechanism consists of a globoid gear pair with a ratio of 31:1. Worm wheel 20 is riveted to a hub, which can be connected to drum shaft 10 by sliding coupling 22.

An automatic band brake 1 (Fig. 112) is installed on the gearbox worm; it prevents spontaneous rotation of the winch drum and unwinding of the cable when the truck clutch is disengaged and when the shear pin has sheared.

Adjust the brake with the drive running in reverse gear and the drum sliding coupling disengaged. If within 1-3 min the brake heats up above the temperature that the hand can bear (about 60 °C), loosen nut 3 and locknut 4 of the band mounting by two to three turns.

Adjusting the Winch Gearbox

Adjust the gearbox bearings when end play appears in them and when a new worm gear set is installed.

Adjust the bearings only if tightening the bearing cover bolts has not eliminated the end play. The bearings must be adjusted with preload.

The torque required to turn the gearbox worm in bearings 29, 31, and 32 (see Fig. 111) must be 1.0-2.5 N*m (0.1-0.25 kgf*m). If the shaft turns too freely or has end play, remove some of shims 28 and 33, of equal thickness, from under the front and rear bearing covers. If a torque of more than 2.5 N*m (0.25 kgf*m) is required to turn the shaft, add shims of equal thickness under the covers. When checking the turning torque of the worm shaft, the cover mounting bolts must be tightened all the way.

After adjustment, the number of shims under the rear and front covers should be approximately equal, which makes the subsequent adjustment of the worm gear mesh easier.

Adjust the tapered bearings of the worm wheel shaft by changing the number of shims 16 and 24 under the bearing covers.

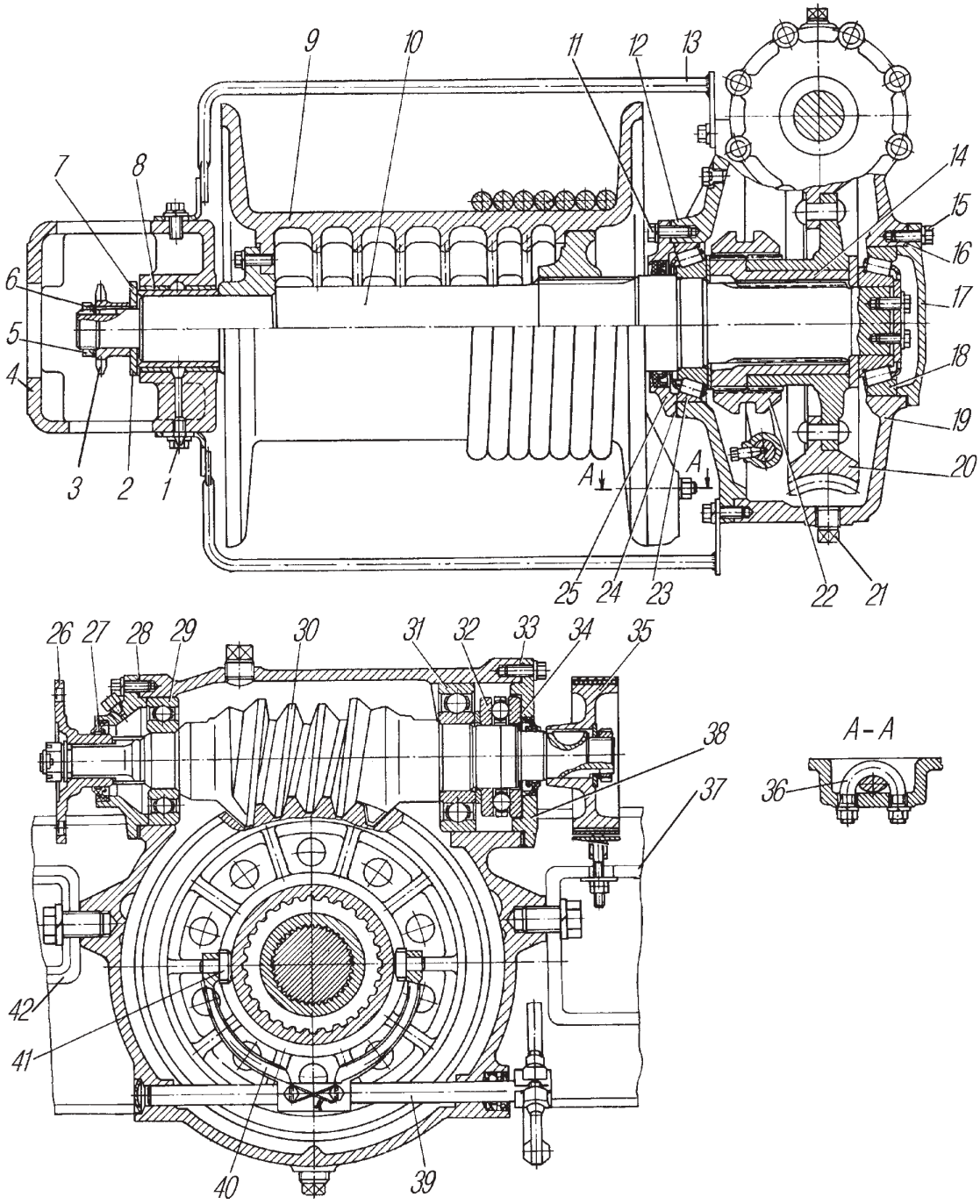


Fig. 111. Winch gearbox

1 - grease fitting; 2 - thrust washer; 3 - sprocket; 4 - drum shaft bracket; 5 - lock washer; 6 - nut; 7 - plain bearing; 8 - spacer sleeve; 9 - drum; 10 - drum shaft; 11, 15 - bolts; 12 - gearbox cover; 13 - cable stop; 14 - fixed coupling; 16, 24, 28, 33 - adjusting shims; 17, 25, 27, 37 - bearing covers; 18, 23, 29, 31, 32 - bearings; 19 - gearbox housing; 20 - worm wheel; 21 - plug; 22 - sliding coupling; 26 - flange; 30 - gearbox worm; 34 - gasket; 35 - band brake; 36 - cable anchor clevis; 38 - right lead screw bracket; 39 - coupling rod; 40 - fork; 41 - block; 42 - winch suspension crossmember

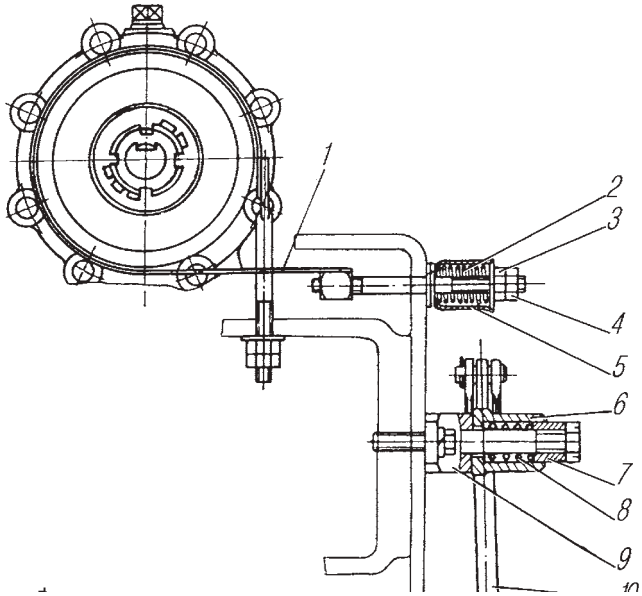


Fig. 112. Winch control

1 - band brake; 2, 8 - springs; 3 - nut; 4 - locknut; 5 - crimp sleeve; 6 - winch control lever; 7 - bushing; 9 - bracket; 10 - rod; 11 - winch engagement lever

Check the preload of the worm wheel shaft bearings with the wheel meshed with the worm. The torque required to turn the worm wheel shaft in the bearings must be 3-6 N*m (0.3-0.6 kgf*m). After adjusting the bearings, check the correctness of the worm gear set mesh by the tooth contact pattern, using marking compound. In a correctly adjusted gear set, the contact pattern on the working surface of the wheel tooth without load must be located in the middle of the tooth and must be at least 5 mm wide and 2/3 of the tooth height.

The position of the contact pattern along the tooth height is changed by moving worm 30 axially with shims accordingly. To shift the contact pattern toward the tooth root, remove some of shims 28 from under cover 27 on the flange side; to shift the contact pattern toward the tooth tip, add shims. At the same time, change the number of shims 33 under cover 37 on the brake side accordingly, so that the total thickness of the shims on both sides is preserved. The contact pattern across the width of the wheel tooth is shifted by moving the worm wheel axially in the same direction in which the pattern is displaced.

The globoid worm gear set can operate well only if the mesh is adjusted correctly. Incorrect adjustment causes severe heating of the gear set and rapid wear of the worm wheel teeth.

Winch Drive

Power is transmitted from the transfer case through the auxiliary power take-off to the winch gearbox by three drive shafts. A shear pin 2 (Fig. 113) is installed on the front drive shaft to protect the winch parts from overload; it shears at a load above the permissible value.

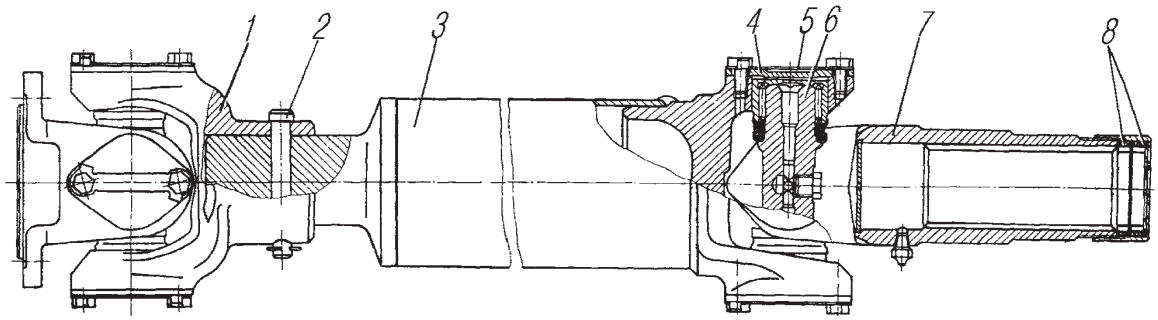


Fig. 113. Front drive shaft of the winch drive

1 - universal joint yoke; 2 - shear pin; 3 - drive shaft; 4 - needle bearing cover; 5 - lock plate; 6 - spider; 7 - slip yoke; 8 - sealing rings

All universal joints are identical in design and are interchangeable with the joints of the GAZ-53A truck. The universal joint bearings may be retained by snap rings instead of retaining plates and lock plates.

The intermediate drive shaft is mounted on two supports. To compensate for inaccuracies during installation, slip yokes 7 of the front and rear shafts are installed on the splined ends of the intermediate drive shaft. The grease in the splined joint is retained by sealing rings 8. To reduce the nonuniformity of rotation of the winch gearbox worm, the drive shafts are installed so that the axes of the bearing holes in the slip yokes of the front 4 (see Fig. 34) and rear 6 shafts lie in one plane.

Cable Spooler

The winch is equipped with a cable spooler (Fig. 114), which ensures that the cable is laid correctly on the drum at cable angles to the truck axis not exceeding 15°. The cable is secured to the drum by a clevis and is paid out only to the rear.

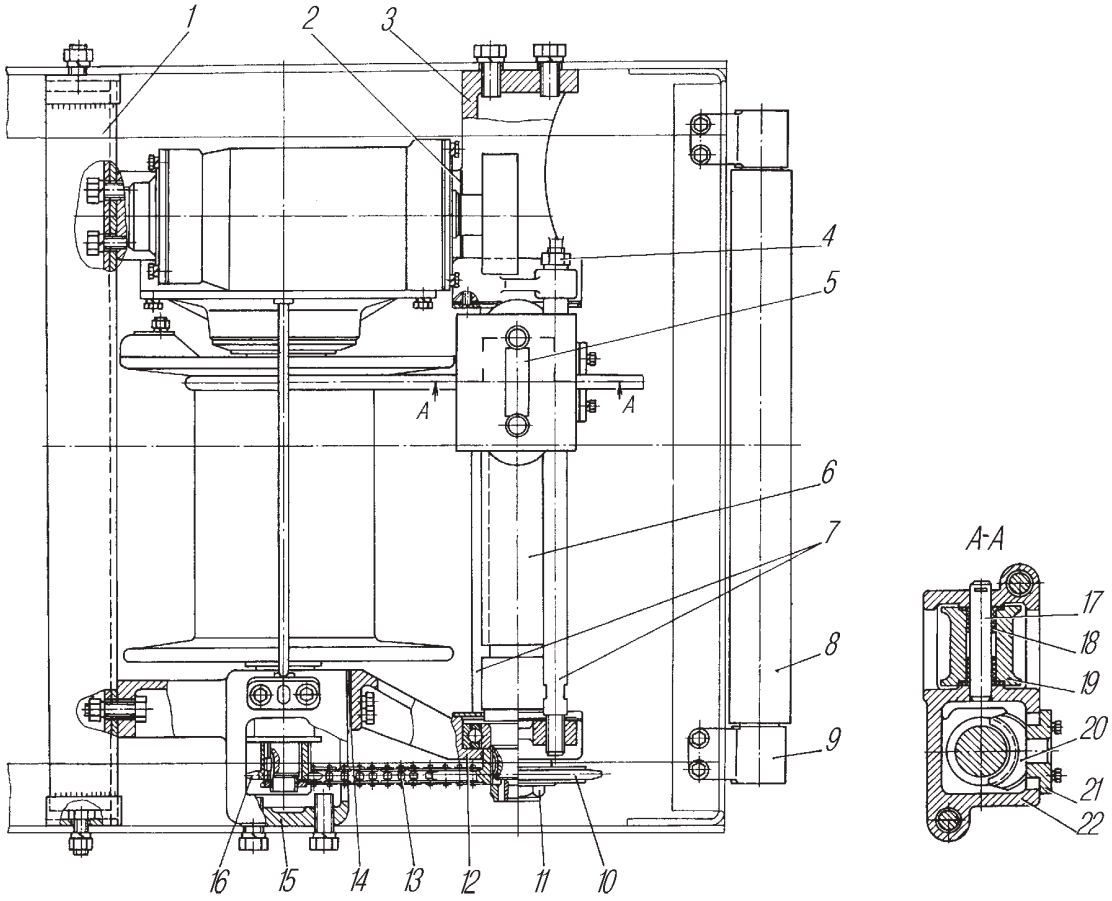


Fig. 114. Winch cable spooler

1 - winch crossmember; 2, 14 - adjusting shims for chain tension (right and left); 3, 12 - lead screw brackets (right and left); 4, 11 - nuts; 5 - lock plate; 6 - lead screw; 7 - guide rods; 8 - horizontal roller; 9 - horizontal roller bracket; 10, 16 - driven and drive sprockets; 13 - chain; 15 - drum shaft bracket; 17 - guide roller pin; 18 - bushing; 19 - guide roller; 20 - lead screw block; 21 - block support cover; 22 - guide roller holder body

Guide roller holder body 22 lays the cable by reciprocating along lead screw 6 and along the two guide rods 7. The screw, which has left-hand and right-hand threads and is mounted on two bearings, is rotated by a chain drive from the drum shaft through drive sprocket 16 and driven sprocket 10. Chain tension is adjusted with shims 2 and 14; the chain sag is 3-10 mm.

The axial force from lead screw 6 is transmitted to the guide roller holder body through lead screw block 20. The block is installed in the guide roller holder body and is retained by cover 21.

Guide rollers 19 are mounted on polyamide bushings 18 and rotate on pins 17, which are retained by lock plate 5.

Winch Operating Rules

Before using the winch, make sure that the drum engagement and disengagement drive works correctly, that the cable is wound correctly, and that the cable is securely fastened. With a correctly adjusted drive, the length of rod 10 (see Fig. 112), measured between the axes of the holes of the adjusting yokes, must be 228-232 mm.

If engagement of the winch drum is difficult in cold weather, warm up the winch gearbox at idle for 3-5 min.

Do not use the winch cable to tow a truck or trailer, or at cable angles to the truck axis exceeding 15°.

To engage the winch:

— Set the transfer case and gearbox levers to the neutral position;

— Using a 30 mm wrench, set the sliding coupling lever to the upper (engaged) position for power cable pay-out. For manual unwinding of the cable, the sliding coupling lever must be in the lower (disengaged) position;

— Engage the auxiliary PTO with control valve 6 (see Fig. 11);
— Engage first or second gear and pay out the cable to the required length; take up the slack in the cable by hand. Before pulling begins, at least three to four turns of cable must remain on the drum;
— Engage reverse gear to pull in the load;
— For self-recovery of the truck, engage the transfer case low range and the gearbox reverse gear.

Increase the engine speed smoothly. A sudden increase in engine speed does not increase the line pull on the cable but can cause the shear pin to shear. After the pin shears, immediately disengage the clutch and move the gear shift lever to the neutral position; otherwise the shaft may seize in the flange. Replace the sheared pin with a new one.

Do not use bolts or other parts in place of the shear pin.

In service it is difficult to determine the force on the cable, so before using the winch, estimate roughly whether using a pulley block is advisable under the specific conditions.

Use of the winch with a pulley block is shown in Fig. 115. When a pulley block without a hook is used, use the tow rope supplied with the truck.

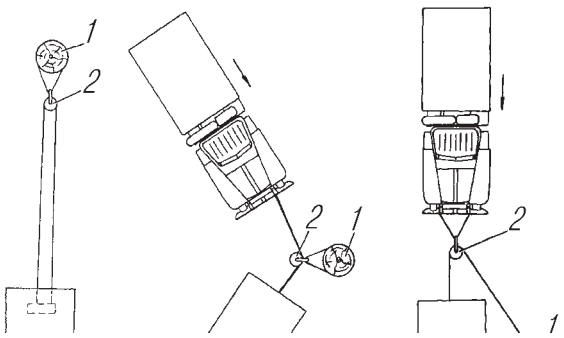


Fig. 115. Using the Winch Pulley Block

1 - stationary object; 2 - pulley block; I - increase of pulling force when self-recovering the truck; II - change of direction of pulling force when recovering a truck; III - increase of pulling force when recovering a truck; IV - stowing the cable in the transport position

If the pulley block is used to increase the pulling force when self-recovering the truck (position I), it is attached with a tow rope to an object chosen as an anchor, and the hook of the winch cable is attached to the hook of the towing device. If the pulley block is used to change the direction of pull when recovering another truck (position II), it is attached with a tow rope to an object serving as an anchor, and the hook of the winch cable is attached to the tow hook of the truck being recovered. If the pulley block is used to increase the pulling force when recovering another truck (position III), it is attached to the tow hook, or to a tow rope looped over the tow hooks, of the truck being recovered, and the hook of the winch cable is attached to a stationary object with a second tow rope. It is allowed to attach the winch cable directly to a stationary object; in this case the hook is hooked onto the cable after it has been pulled taut beforehand.

To avoid overheating the winch gearbox, do not pull a load using the full length of the cable more than three times in a row at the maximum or near-maximum load.

Stow the winch hook in the transport position as shown in Fig. 115, IV.

Central Tire Inflation System (CTIS)

The central tire inflation system (Fig. 116) makes it possible to monitor the tire pressure and keep it within the norm, and also to improve the off-road mobility of the truck by reducing the tire pressure. It allows the truck to continue driving with a punctured inner tube without changing the wheel (the wheel valves of the undamaged wheels must be closed), provided that the air supplied is sufficient to maintain the required pressure in the tires continuously.

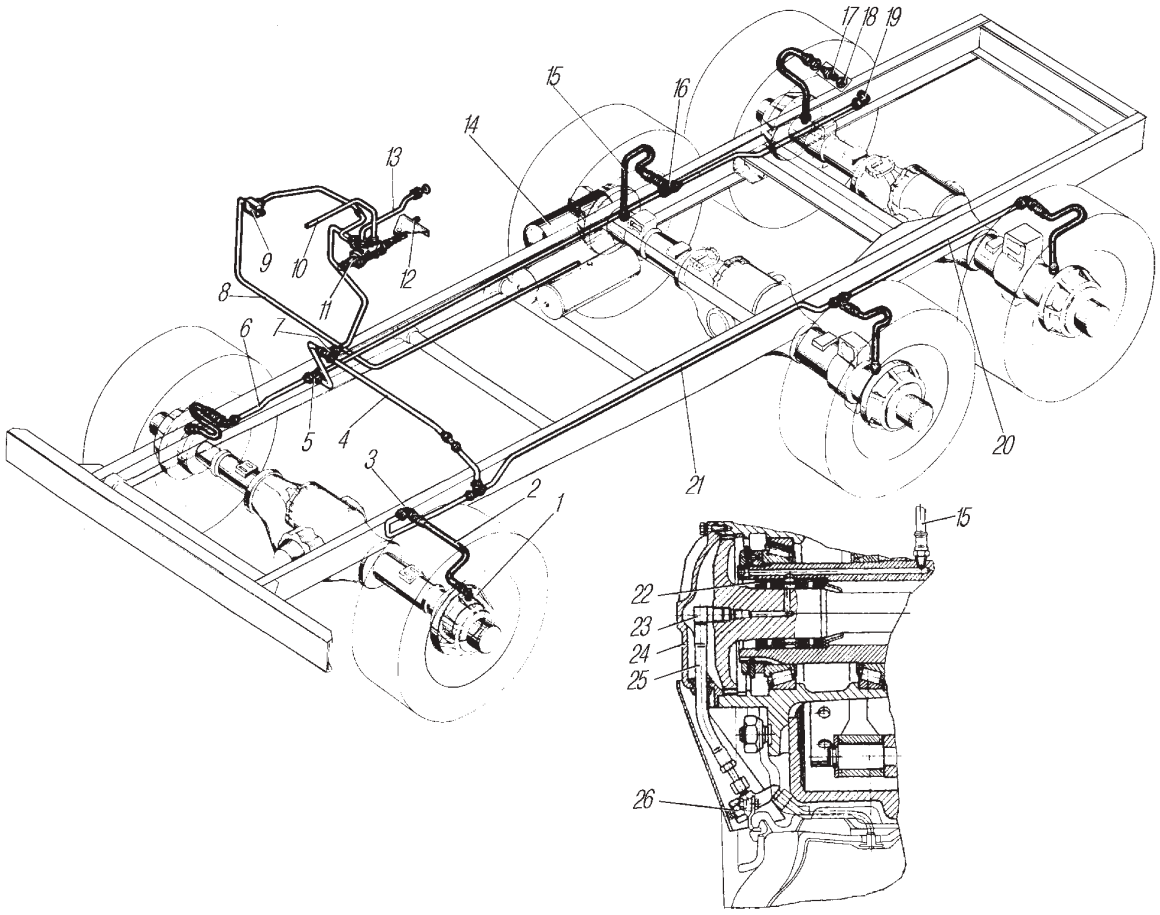


Fig. 116. Central Tire Inflation System

1 - inlet fitting; 2, 15, 25 - hoses; 3, 5, 16 - tees; 4, 6, 8, 20, 21 - pipes; 7 - center tee; 9 - cross fitting; 10 - outlet tube; 11 - pressure control valve; 12 - valve control lever; 13 - tube to the pressure gauge fitting; 14 - air tank; 17 - fitting; 18 - nut; 19, 23 - elbow fittings; 22 - air supply lip seal block; 24 - hub cover; 26 - wheel valve

On the trucks, air is supplied to the tires through a single-line circuit; all the tires are connected to each other and the pressure is adjusted simultaneously.

On URAL-4320-0911-30 trucks and URAL-44202-0612-30 tractor trucks, the tire pressure of the front axle and of the rear bogie is different (see the section "Technical Specifications").

Before starting to drive, open the wheel valves of the rear bogie, set the lever of the pressure control valve to the neutral position, and check the tire pressure; if necessary, bring the pressure to the required value and close the wheel valves.

Open the wheel valves of the front axle and check the tire pressure; if necessary, bring the pressure to the required value.

When driving with the nominal tire pressure, the wheel valves of the front axle must be open and those of the rear bogie closed.

On URAL-4320-31 and URAL-4320-0611-31 trucks and URAL-4420-31 tractor trucks, the tire pressure of the front axle and of the rear bogie is different; check the tire pressure as described above. When driving with the nominal tire pressure, the wheel valves of the front axle must be closed and those of the rear bogie open.

On difficult sections of swampy terrain, virgin snow, and loose sand, it is allowed to reduce the tire pressure to 0.1 MPa (1.0 kgf/cm2); to do this, open the wheel valves of the rear bogie and reduce the pressure in all tires simultaneously.

After crossing a difficult section, bring the tire pressure to the required value (see Table 12 in the section "Driving the Truck").

Pressure Control Valve

The valve is of the spool type and consists of body 6 (Fig. 117), in which lip seals 9 and spool 10 are installed.

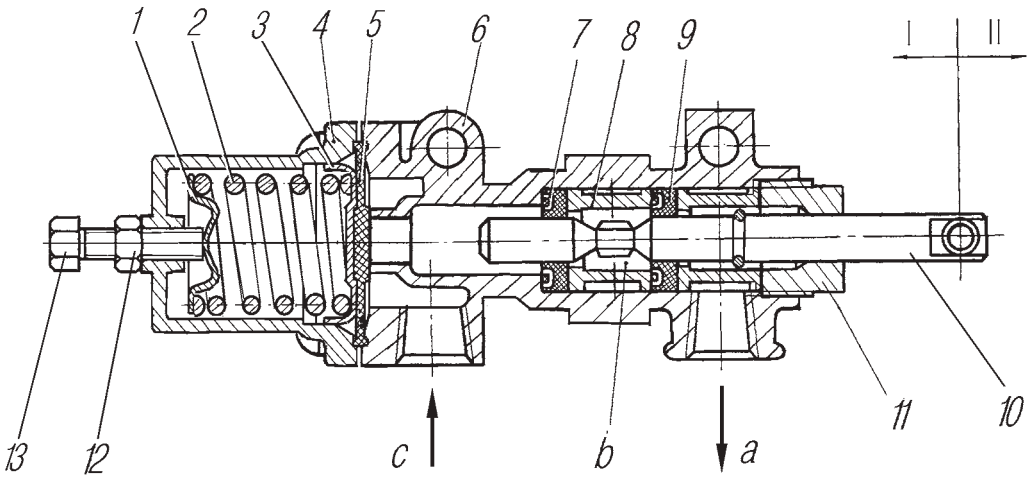


Fig. 117. Pressure Control Valve

1 - thrust washer; 2 - limiter valve spring; 3 - guide cup; 4 - valve cover; 5 - valve diaphragm; 6 - valve body; 7 - lip seal spacer ring; 8 - spacer sleeve; 9 - lip seal; 10 - spool; 11 - spool guide; 12 - nut; 13 - bolt; a - to atmosphere; b - to tires; c - from air tank; I - inflation; II - deflation

When the spool moves along its axis, the annular groove on it connects the cavity of the valve with the atmosphere or with the pressure line. Adjust the limiter valve, which serves to shut off the tire inflation system when the air pressure in the truck pneumatic system drops below 600 kPa (6 kgf/cm2), with bolt 13.

Air Supply Lip Seal Block 22

The block (see Fig. 116) consists of four lip seals installed in the spindle (housing) of the axle. The lip seals provide a tight joint between the passages of the stationary spindle (housing) and the passages of the rotating axle shaft.

Using the System and Its Maintenance

After opening the wheel valves, blow out the central tire inflation system with air from the tires. To do this, set the lever of the control valve to the "DEFLATION" position, reduce the tire pressure by 0.03-0.05 MPa (0.3-0.5 kgf/cm2), and then bring the tire pressure to the pressure appropriate to the road surface.

Also blow out the central tire inflation system before parking the truck and after each departure from a heated garage.

Determine the tire pressure by the pressure gauge with the lever of the pressure control valve in the neutral position and the wheel valves open.

When the tire pressure of the front and rear axles is different, to check the tire pressure of one axle, close the wheel valves on the other axles.

To avoid damaging the tire pressure gauge by a sudden rise in air pressure, move the control valve lever to the "Inflation" position with a smooth motion, especially at low tire pressure, and always with the wheel valves open.

If a pressure drop is observed, close the wheel valves and, opening them one at a time, determine which tire is leaking air.

If the tire pressure needs to be reduced, set it according to Table 12 depending on the driving conditions (see the section "Driving the Truck").

System Maintenance

Maintenance of the system consists of checking its air tightness. Check the system for leaks after the tires have cooled to ambient air temperature. Locate large leaks by sound and small leaks with soap solution. Eliminate air leaks through the joints by tightening or by replacing the individual joint component.

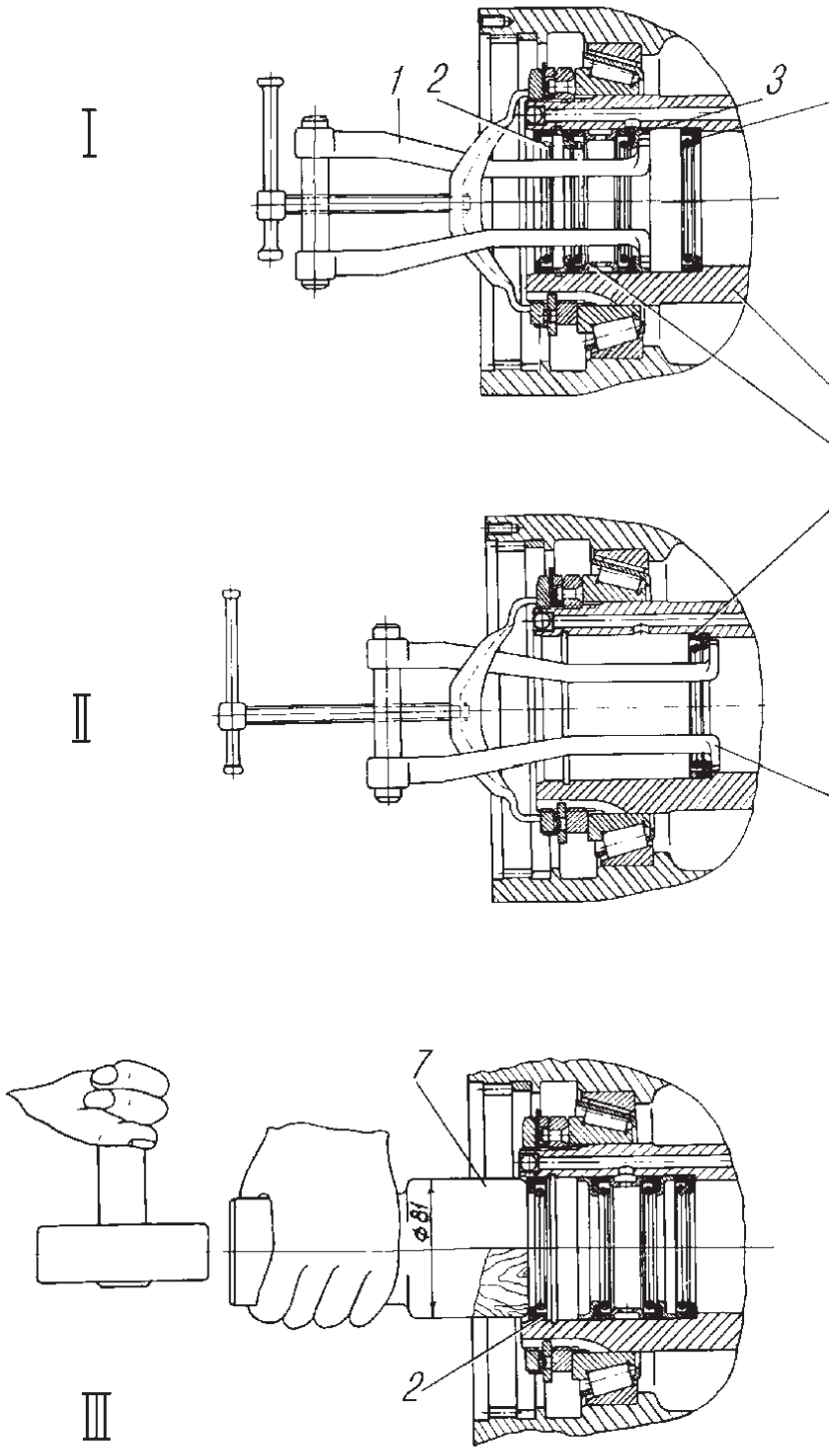
If the pressure control valve, the wheel valves, and the pipe joints prove to be airtight on checking, the leak is therefore through the air supply lip seals. In case of a large leak, replace the lip seals.

The reliability of the air supply lip seal block depends first of all on the presence and condition of grease on the rubbing surfaces of the lip seals. When installing the lip seals, lubricate these surfaces and pack grease into the cavities between the first and second and between the third and fourth lip seals. When installing the axle shaft, also lubricate the surface of the working journal thoroughly; the grease must not get into the air supply hole.

Install the lip seals with a special mandrel (position III in Fig. 118) that rules out the possibility of damaging them when they are pressed in. Remove the lip seals with a special puller (positions I and II) supplied in the tool kit.

Install the axle shafts with the hub cover in accordance with the instructions given in the section "Drive Axles. Adjusting the Wheel Hub Bearings".

In case of significant damage to the central tire inflation system, inflate the tire using the hose supplied in the driver's tool kit, connecting it to the air take-off valve and then to the wheel valves in turn.



Pressurization (Sealing) System

On trucks equipped with the pressurization system, to ensure reliable operation of the units and systems of the truck that are exposed to water when fording, and to maintain constant pressure in the internal cavities of the units and in the fuel tanks, a system is provided

Possible Faults and Remedies

- Preheater
- Transfer Case
- Drive Axles
- Wheels and Tires
- Steering
- Brake System
- Batteries
- Power Take-Off
- Auxiliary Power Take-Off

Operating Features

Preparing a New Truck for Service

Before putting a new truck into operation, study this operation manual, perform daily maintenance, and in addition:

1. Install on the truck, in accordance with the operation manual, the accessories packed in the spares kit (ZIP) box.
2. Check and, if necessary, adjust the tension of the drive belts.
3. Check the oil level in the engine crankcase, gearbox, transfer case, axle housings, rear balancer suspension hubs, power steering pump reservoir, steering gear housing, and fuel injection advance coupling, and top up if necessary.
4. Check the coolant level and top up if necessary.
5. After filling the fuel tank, fill the engine fuel system with fuel using the hand priming pump.
6. Check the level and density of the electrolyte in the batteries and, if necessary, add distilled water and recharge the batteries.
7. Open the wheel valves and bring the tire pressure to normal.
8. Check the operation of the door locks.
9. Check the operation of the cab door window regulators.
10. Make a test drive.

Starting and Stopping the Engine

The starting procedure depends on the thermal state of the engine and on the ambient air temperature. The electric starting system of the engine ensures starting at temperatures down to minus 10 °C without preheating. At outside air temperatures below minus 10 °C, use the preheater.

With insufficiently charged batteries, and to extend engine life, the plant recommends using the preheater at outside air temperatures above minus 10 °C as well.

Starting the Engine Without Preheating

Procedure for starting a cold engine at temperatures from 0 to minus 10 °C:

1. Prime the engine fuel system with fuel using the hand priming pump.
2. Set the gearbox control lever to the neutral position.

3. Close the radiator shutter.

4. Turn on the batteries.

5. Set the engine stop knob to the operating position (push it in as far as it will go into the panel).

6. Press the clutch pedal all the way down.

7. Press the accelerator pedal to the position corresponding to medium engine speed.

8. Without releasing the pedal, engage the starter by turning the key clockwise as far as it will go to the right.

9. After the engine starts, disengage the starter by releasing the key of the starter and instrument switch; hold the accelerator pedal in the position corresponding to medium engine speed until the engine runs steadily, and then smoothly release the clutch pedal (the gear shift lever must be in the neutral position). Set the minimum engine speed with the hand throttle knob.

A constant engine speed is set by pulling knob 7 (see Fig. 23) toward you. The knob is connected by rods to the control lever of the high-pressure fuel injection pump governor and is located in the cab on the front panel.

If the engine does not start, repeat the start in the sequence given above. If the engine does not start after three attempts, find and eliminate the fault. The starter engagement time must not exceed 15 s, and the intervals between start attempts must be at least 1 min.

Before Starting a Warm Engine

Set the accelerator pedal to the position corresponding to medium engine speed. Engage the starter and, after the engine starts, release the key of the starter and instrument switch.

Starting a Cold Engine with the Preheater

When an antifreeze fluid is used in the engine cooling system, preheat and start the engine in the following sequence:

1. Raise the hood and make sure that the valve of the preheater fuel tank is open.

2. Turn on the pump unit with the switch located on the preheater control panel for 10-15 s.

3. Turn on the fuel electric heater with the switch located on the preheater control panel (spring-loaded switch) and hold the switch knob for the following time, depending on the ambient air temperature: 30 s for temperatures above minus 30 °C, 60 s for temperatures from minus 30 to minus 50 °C.

4. Turn on the spark plug with the switch located on the preheater control panel (spring-loaded switch) and immediately, without turning it off, turn on the pump unit and the solenoid valve with their switches. Hold the spark plug switch knob (not more than 20 s) until a characteristic roar appears in the boiler, indicating ignition of the fuel in the burner. A serviceable preheater must start within 10-15 s.

5. Release the spark plug switch knob (the spark plug turns off). A continuing steady roar in the boiler indicates that the preheater has reached stable operation. If the preheater fails to start, turn off the solenoid valve and the pump unit and, after one minute, repeat the start in the sequence given above. If the preheater has not started in two consecutive attempts, find and eliminate the cause of the fault.

6. Lower the hood.

7. When the coolant in the engine cooling system has heated to 80-100 °C according to the coolant temperature gauge on the instrument panel, turn off the solenoid valve, blow out the boiler flues for 20-30 s, and turn off the pump unit.

8. Start the engine as described in the section "Starting the Engine Without Preheating".

When water is used in the engine cooling system,*1 preheat and start the engine in the following sequence:

1. Prepare 32.5 L of clean water (for the YaMZ-236M2 engine) or 38 L (for the YaMZ-238M2 engine).

2. Make sure that the two drain valves of the preheating system, the drain valve of the cooling system, and the heater valve are closed after the water was completely drained when the truck was parked, and that the valve of the preheater fuel tank is open. After starting the preheater, watch that no water leaks out of the drain valves. If water leaks out, close the valves.

3. Open the filler necks of the radiator and the preheater boiler.

4. Start the preheater in the sequence given above and immediately pour 14 L of water into the boiler through the filler neck of the preheater; close the filler neck with the cap. The radiator filler neck must remain open. If

the preheater stops by itself, repeat the start, and if it fails, drain the water from the system immediately. Find and eliminate the faults in the operation of the preheater, then start the preheater and continue warming up in the sequence given above.

5. Warm up the engine until steam is released abundantly from the radiator filler neck.

6. Top up water through the radiator filler neck until the system is full and close the neck with the cap.

7. Continue warming up the engine until the water temperature reaches 80-100 °C according to the coolant temperature gauge on the instrument panel.

*1 For trucks supplied to the Ministry of Defense (MoD) of Russia.

8. Turn off the solenoid valve, blow out the boiler flues for 20-30 s, and turn off the pump unit.

9. Open the cab heater valve.

10. Start the engine as described in the section "Starting the Engine Without Preheating".

Stopping the Engine

A running engine is stopped with the stop knob, which is connected to lever 7 by rod 5 (see Fig. 24). The stop knob is located in the cab on the front panel.

Before stopping, let the engine run for 1-3 min under no load at medium speed, then reduce the engine speed to the minimum value and pull the stop knob out as far as it will go.

Break-In of the Truck

The service life of the truck, as well as the reliability and economy of its operation, depend on the break-in of the parts in the initial period of operation. Break-in can be performed before a new truck is put into operation, as well as during its operation. During this period, careful maintenance of the new truck and strict compliance with the operating rules given below are required.

During operation, monitor the thermal condition of the truck units. During the first 1000 km of mileage (50 engine hours):

— warm up the engine at an engine speed of 1300-1600 rpm;

— do not exceed a driving speed of 5 km/h in first gear, 10 km/h in second, 20 km/h in third, 40 km/h in fourth, and 50 km/h in fifth;

— do not operate the truck in difficult road conditions or with a trailer;

— retighten the wheel nuts twice, after 100-150 km and after 200-300 km, and each time the wheels are removed from and installed on the truck hub;

— do not reduce the tire pressure.

Operate URAL-4420-10, URAL-4420-31, and URAL-44202-0311-31 tractor trucks during the first 1000 km of mileage on paved roads with a semitrailer of gross weight not more than 12 t.

After 1000 km of mileage (50 engine hours), perform the work specified in the section "Maintenance. Maintenance in the Initial Period of Operation".

Driving the Truck

Correct driving is one of the most important conditions for extending the service life of the truck and for trouble-free operation, and it also makes it possible to achieve high average speeds with minimum fuel consumption.

Difficult sections of the route can be crossed successfully only with skillful operation of all the controls of the truck. When working with a trailer and in difficult road conditions (snow, mud, soft ground, sand, etc.), start off in first gear only. On soft ground, wet meadow, virgin snow, and sandy sections, drive smoothly, without jerks, wheel spin, or stops. Cross small snowdrifts and short climbs with a running start.

On especially difficult sections (snow, mud, soft ground, sand, etc.), if necessary, reduce the tire pressure to a certain value corresponding to the best off-road mobility on the given section (for trucks equipped with the central tire inflation system) and lock the transfer case differential, because spinning of the drive wheels when

the truck has lost mobility, or driving with wheel spin with the differential unlocked, leads to intense wear of the transfer case differential and of the tires.

In all other driving conditions, when there is no wheel spin, unlock the transfer case differential to avoid additional loads in the drivetrain. Engage the transfer case low range when driving over difficult sections of the route and also on steep climbs.

Shift gears in the transfer case only after the truck has come to a complete stop; do not set the transfer case control lever to the neutral position with a gear engaged in the gearbox and with the auxiliary power take-off (auxiliary PTO) disengaged.

Engage the auxiliary PTO and the power take-off (PTO) with the truck stopped, with the clutch disengaged and at an air pressure in the pneumatic system of not less than 500 kPa (5 kgf/cm2). After moving the valve lever to the "engaged" position, release the clutch pedal smoothly.

Brake the truck smoothly, gradually increasing the pressure on the pedal.

On long descents, use engine braking with the auxiliary brake (exhaust brake). In this case the engine speed may be close to the rated speed but must not exceed 2100 rpm. If the engine speed rises above 2100 rpm, periodically apply the service brakes firmly.

> **CAUTION: Do not switch off the engine on long descents.**

It is not recommended to stop the truck on a slope. If a stop is unavoidable, take measures that rule out the possibility of the truck rolling away: cut off the fuel supply by pulling the engine stop knob toward you as far as it will go, apply the parking brake, engage first gear in the gearbox, and place chocks under the wheels.

> **To avoid skidding sideways, drive carefully on slippery and icy roads.**

On trucks equipped with the central tire inflation system, when driving on roads with an improved surface at rated load, the tire pressure must be the nominal pressure.

On difficult sections of the route, a short-term reduction of the internal tire pressure is allowed on the trucks. In this case the maximum mileage and the maximum speed must not exceed the values given in Table 12.

Do not reduce the tire pressure more than is necessary for the road conditions. Remember that the mileage at reduced pressure is limited; reduce the pressure only in case of extreme necessity.

When driving with reduced pressure, monitor the readings of the tire pressure gauge.

Driving with reduced pressure to improve ride smoothness is prohibited. During prolonged driving, the tire pressure may rise because of tire heating. To reduce rolling resistance and save fuel, do not reduce the pressure in heated tires.

Table 12. Tires 14.00-20 model OI-25

Таблица 12

Шины 14.00-20 мод. ОИ-25

Вид дорог	Допускаемое сниженное давление, МПа (кгс/см^2)	Макси— мальная скорость, км/ч	Максимальный пробег в течение гарантийного срока службы шин, км
Тяжелые участки заболоченной местности, снежной целины и сыпучих песков	0,07 (0,7) 0,10 (1,0) 0,15 (1,5)	15 25 30	600 800 1400
Дороги всех типов на период подкачки шин после тяжелых участков пути	0,15...ном. (1,5...ном.)	40	1400

Tires 390R20 model O-65; Tires 390/95R20 KAMA-URAL; Tires 1200x500-508, 500/70-508 (1200x500-508), 500/70-20 (1200x500-508) model ID-P284

When driving with the nominal tire pressure:

— on URAL-4320-31 and URAL-4320-0611-31 trucks and URAL-4420-31 tractor trucks, the wheel valves of the front axle must be closed and those of the rear bogie open;

— on URAL-4320-0911-30 trucks and URAL-44202-0612-30 tractor trucks, the wheel valves of the front axle must be open and those of the rear bogie closed.

The truck crosses a ford 0.7 m deep.

Fording

A truck equipped with the pressurization system can, after special preparation, cross a ford up to 1.2 m or 1.7 m deep (including the bow wave).

Crossing a deep ford requires great care. Before crossing a ford, you must carefully measure its depth, check the condition of the bottom, make sure there are no holes, large stones, or boggy places, select and check the places where the truck enters and leaves the water, and mark the deep places with markers.

To cross a ford up to 1 m deep:

— close the radiator with the shutter;

— set the nominal tire pressure.

For a greater ford depth, additionally:

— on trucks equipped with a fan clutch, set the fan friction drive switch to the forced disengagement position by setting the knob of the fan clutch control valve to the position marked with the letter "O";

— seal the batteries by installing rubber gaskets under the battery filler plugs and tightening the plugs firmly;

— clean the mating surface of the exhaust pipe flange of dirt and install the fording valve with the flap hinge facing up;

— check that the exhaust system joints are secure.

Cross the ford in first or second gear of the gearbox, in the transfer case low range, and with the interaxle differential locked. Enter the water at low speed without creating a wave, avoid maneuvering, and do not stop. The time the truck stays in the water must not exceed 15 min.

To prevent water and dirt from getting into the tool box, press the tool box cover down firmly with the center screw. After crossing the ford, open the tool box, remove the water, and dry the tools.

After crossing the ford, check the oil level in the engine and in the units of the truck. A raised oil level, water drops on the oil level indicator, or a change in the color of the oil are signs of water penetration. If water has entered the engine oil pan, replace the oil.

Check for water in the fuel system by unscrewing the drain plugs of the fuel tank and the primary fuel filter until fuel begins to flow out. If water has entered, drain the sediment from the tank and replace the secondary fuel filter elements.

Remove the water from the air line of the pump unit and the boiler of the preheater by running the pump unit for 2-3 min.

Check the cavities of the engine flywheel housing and the clutch housing for water by removing the cover of the flywheel turning hatch and unscrewing the tapered plug from the lower hatch of the clutch housing. After the check, reinstall the removed parts. Perform the check as soon as possible after crossing the ford, and do not leave the truck standing for a long time without this check.

Lubricate the plain bearings and articulated joints with a grease gun at the first opportunity.

When driving after crossing the ford, take special care because of the reduced effectiveness of the brakes due to wetting of the linings. Dry the brake assemblies by applying the brakes lightly 3-5 times while driving.

If the engine stalls while crossing the ford, make two or three attempts to start the engine with the starter, with 1 min pauses between attempts. If the engine does not start, the truck must be pulled out of the water.

If a stuck truck has stayed in the water for more than 20 min, tow it to the nearest point where maintenance can be performed. If the truck is driven under its own power, check all the main assemblies, as well as the cavities of the wheel hubs and steering knuckles of the front axle (whether water has entered them). If the oil level in the units is raised, reduce it to the required level and replace the oil at the first opportunity.

After crossing the ford, prepare all the assemblies of the truck for operation in normal road conditions and eliminate the causes of water penetration into the units. To keep the truck ready for fording, systematically monitor the condition of the hoses, tubes, their joints, and the unit seals, and eliminate faults promptly.

Crossing Ditches, Roadside Drains, and Trenches

Drive at low speed and, in especially difficult conditions, lock the transfer case differential. Cross ditches at a right angle; otherwise, when the truck tilts, the redistribution of load will cause the unloaded wheels to spin.

Driving with a Trailer or Semitrailer

To ensure the serviceability of the towing hitch, use a trailer coupling eye with an inside diameter of 90 mm and a cross-section size of 42 mm, and a towing device hook with a throat diameter of 48 mm and a width at the throat of 69 mm. Permissible limit dimensions: eye cross-section 38 mm, hook throat 52 mm, hook width 66 mm.

Tow hooks and coupling eyes whose dimensions differ from those given above must be replaced with new ones.

When maneuvering, avoid jackknifing the trailer until the trailer drawbar hits the end of the frame side rail or other parts of the truck. Failure to observe these requirements may cause the trailer coupling eye to jam in the throat of the tow hook and the tow hook to break.

When crossing especially difficult sections, uncouple the trailer and, after crossing the section, pull it up to the truck with the winch. In doing so, remember that three or four turns of cable must remain on the drum. Pull the trailer up at medium engine speed. Do not tow the trailer with the winch cable.

The center of gravity of tractor trucks is higher than that of flatbed trucks, so take special care when driving. Brake the road train smoothly.

Remember that in difficult road conditions a road train moves well when the tractor truck and the semitrailer have no articulation angle in the horizontal plane or when this angle is very small. As the articulation angle increases, a lateral force begins to act that tends to overturn the tractor truck or cause it to skid sideways.

> **CAUTION: When driving with the auxiliary brake engaged on a slippery road with a low coefficient of adhesion, and when the trailers have no solenoid valve in the brake system, the trailer may jackknife and skid.**

Maintenance

Maintenance is intended to keep the truck in working condition and in proper appearance, to reduce the rate of wear of parts, to prevent failures and faults, and to detect them so that they can be eliminated in good time. Maintenance is a preventive measure carried out compulsorily, on a scheduled basis, after certain mileages or periods of operation of the truck.

Observing the intervals and performing maintenance well and in the specified scope ensures constant technical readiness of the truck and reduces the need for repairs. To ensure good quality of the work, it is recommended to perform maintenance at special stations equipped with the necessary tools and fixtures.

Work involving the adjustment and servicing of the engine fuel system components, electrical equipment, and hydraulic systems must be performed by qualified specialists.

Types of Maintenance

By interval and labor intensity of the work performed, maintenance is divided into the following types:

— daily maintenance (EO);
— maintenance in the initial period of operation;
— first maintenance (TO-1);
— second maintenance (TO-2);
— seasonal maintenance (SO).

Maintenance Intervals

Daily maintenance is performed before the truck leaves for its run and on its return.

Maintenance in the initial period of operation is performed after the first 1000 km of mileage (50 engine hours).

Seasonal maintenance is performed twice a year, in spring and fall, and is combined with the next scheduled maintenance.

The intervals of TO-1 and TO-2 are adjusted depending on the category of operating conditions of the truck and on the climatic regions in accordance with GOST 21624-81 (Russian national standard) and the "Regulations on the Maintenance and Repair of Road Transport Rolling Stock", Moscow, Transport, 1986. For the first category of operating conditions, first maintenance (TO-1) is performed every 4000 km of mileage (125 engine hours) and second maintenance (TO-2) every 16,000 km of mileage (500 engine hours).

Maintenance Task List

Daily Maintenance (EO)

Service Before Departure

Service on Return from a Trip

Maintenance in the Initial Period of Operation

after the first 1000 km of mileage (50 engine hours)

Engine

Drivetrain

Chassis

Steering

Service Brake System

Electrical Equipment

Special Equipment

Lubrication Operations

First Maintenance (TO-1)

On a new truck, at the first TO-1, wash the power steering pump filter, tighten the nut of the telescopic shock absorber housing (afterward, tighten it when a leak appears), and lubricate the clutch release bearing and the bushings of the clutch release fork shaft.

Engine

Chassis

Steering

Brake Systems

Electrical Equipment

Lubrication Operations

At Every Second TO-1

Second Maintenance (TO-2)

Engine

Drivetrain

Chassis

Steering

Electrical Equipment

Cab, Cargo Body

Special Equipment

Lubrication Operations

Carry out lubrication according to the lubrication table in the operation manual for YaMZ-236M2 and YaMZ-238M2 engines.

Lubricate according to the lubricants and operating fluids chart:

At every second TO-2, additionally do the following:

Engine

Drivetrain

Chassis

Brake System

Lubrication Operations

At every third TO-2, additionally do the following:

Chassis

Lubrication Operations

At every fourth TO-2, additionally do the following:

Brake System

At every sixth TO-2, additionally do the following:

Drivetrain

Lubrication Operations

Seasonal Maintenance (SO)

Engine

Electrical Equipment

Lubrication Operations

Additionally, once a year, in the fall:

Engine

Special Equipment

Frame, Cab, Sheet Metal, Cargo Body

Lubrication Operations

Lubrication of the Truck

General

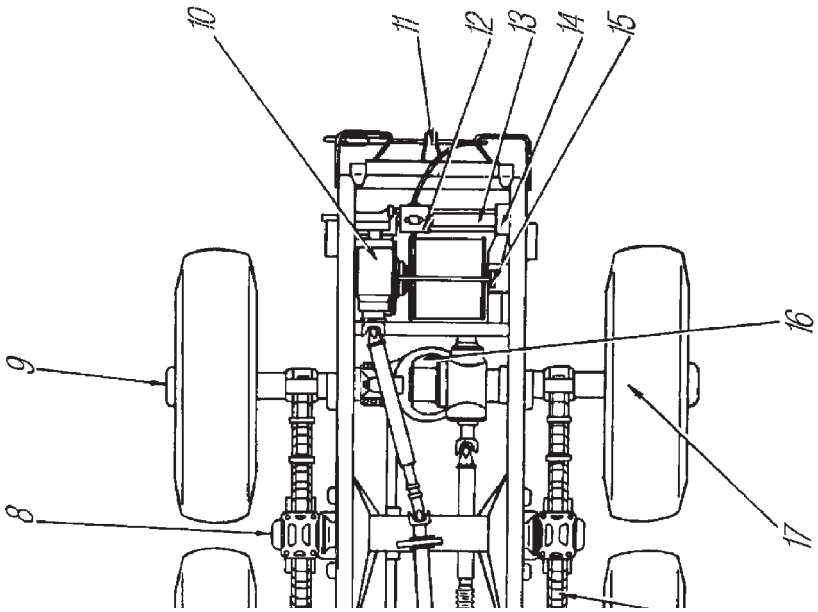


Fig. 119. Truck lubrication diagram

Storage

General

A new truck that is not put into operation can be stored without preservation for three months from the date of shipment from the plant. In this case, after placing the truck in the storage location, protect the unpainted surfaces of the front axle ball joints with a thin layer of Litol-24 or Solidol (calcium) grease, and provide maintenance of the batteries and tires in accordance with the instructions in their operation manuals.

If the truck must be stored for longer than the specified period, it should be preserved and protected in accordance with the requirements of this section.

Store the truck in a clean, dry, ventilated, shaded building or under a shelter. When storing the truck in an open area, protect the tires, steering wheel, and rubber and plastic parts from sunlight, and cover the engine and its systems with waterproof packaging paper, colored film, tarpaulin, etc. Keep the tires inflated.

The procedures for preparing trucks belonging to the Ministry of Defense (MoD) for storage, keeping them in storage, and removing them from storage must be carried out in accordance with the requirements of the manual "Storage of Trucks and Equipment in the Soviet Army and Navy."

Preparing for Storage

Perform daily maintenance and the next scheduled TO-1, TO-2, or SO, depending on the mileage of the truck and the time of year.

Fill the housings of the transfer case, axle gearboxes, and steering gear, and the hubs of the rear suspension equalizer beams, to the specified level with operating/preservative oils or operating oils; fill the winch housing with operating oil.

With the engine running, engage the auxiliary power take-off (auxiliary PTO) drive for 3-5 min, after first making sure that the winch engagement lever is in the disengaged position.

To preserve the YaMZ-236 (238) powertrain, perform the following operations:

— if antifreeze per GOST 159-52 or water is used in the cooling system instead of TOSOL coolant, add to the system one of the anti-corrosion additive compositions listed in Table 13 of the truck operation manual;

— drain the oil from the engine and the gearbox;

— pour operating/preservative oil into the engine oil pan and the gearbox housing;

— start the engine and let it run for 3-5 min at medium speed;

— seal the air intake and exhaust pipes, the crankcase ventilation pipe, the water pump drain hole, the slot in the flywheel housing (at the pointer), and the gearbox breather;

— drain the fuel from the primary and secondary fuel filters;

— disconnect the return line from the secondary fuel filter and the supply line from the primary fuel filter;

— connect a special fuel pickup and immerse it in a container of filtered preservative fuel mixture;

— bleed the fuel system with the hand priming pump until clean preservative mixture, free of air bubbles, flows from the return line on the secondary fuel filter;

— turn the crankshaft two to three revolutions; the governor lever must be in the position corresponding to fuel delivery;

— pour 60-70 ml of operating/preservative oil at a temperature of 70-100 °C into each engine cylinder. Pour the oil through the holes in the intake manifolds with the connecting pipe removed;

— crank the engine, without fuel delivery, with two or three brief starter engagements;

— remove the cylinder head covers and unscrew by two turns the bolts that secure the lines to the injectors of the third and fourth cylinders of the YaMZ-236M2 engine and of the fourth and fifth cylinders of the YaMZ-238M2 engine;

— pump preservative fuel mixture through the return line (M10 fitting) until it appears from under the loosened bolts without air bubbles, then tighten the bolts;

— remove the lower cover of the clutch housing inspection hole, install a plug, and put the cover back in place;

— loosen the tension of the belts of the water pump, alternator, air compressor, and power steering pump.

Close the wheel valves.

Drain the water from the windshield washer reservoir.

Turn off the battery disconnect switch.

Clean, wash, and dry the rubber floor mats of the cab, dust them with talc, roll them up, and place them on the seats.

When storing the truck in an open area, remove the cargo body tilt, the windshield wiper blades, and the rear-view, wide-angle, and side-view mirrors, pack them, and store them in a closed building.

Dry the tilt before packing. Coat the rubber products with a protective compound according to Table 13 or wrap them in packaging material. Close the cab ventilation hatch tightly, close the door windows and the pivoting vent windows of the doors, and raise the radiator shutter.

Apply a thin layer of grease, according to the table, to the following:

— the plug connectors of the rear lamps, the license plate lamp, the backup lamps, and the connections of the air tank pressure sensors;

— the terminal connections of the brake system fault sensors and of the brake light switches;

— the battery post terminals together with the wire lugs.

Apply a thin layer of Litol-24 grease to the outer unpainted surfaces of the front axle ball joints and to the exposed surfaces of the rods of the transfer case and of the auxiliary PTO.

Lubricate the exposed sections of threaded connections, the outer handles of the cab doors, the frames of the pivoting vent windows, the washer nozzle heads, the headlamp rims, the chain drive, the lead screw, the guide shafts, the cable rollers of the winch cable spooler, the cable, and the hook-and-nut thread pair of the towing device with preservative grease, and the exposed surfaces of the rods with Litol-24 or Solidol (calcium) grease. Lubricate with preservative grease the tire levers supplied with the truck, the inner surfaces of the socket wrench heads, the holes for the wrench handle, the feeler gauge, and the pullers, and wrap these items in waxed or other paper.

Lubricate the hinged joints of the auxiliary brake, the tool box, the battery box, the cargo body sides, the cab doors, and the hood, and the door and hood latches, with operating/preservative (engine or gear) oil. Seal with adhesive tape the holes that connect the internal cavities with the atmosphere on the brake valve, the pressure regulator, the trailer brake control valves, the condensate drain valves, and the pressurization tubes behind the cab.

If water was used in the cooling system, drain it after placing the truck in the storage location.

Take the load off the wheels by raising them 80-100 mm off the ground, and off the suspension of the truck, in the sequence given below and following these instructions:

— to take the load off the front axle wheels, place support stands 620 mm high under the flanges of the ball joint 18 (see Fig. 41) of the steering knuckles;

— to take the load off the middle and rear axle wheels, place support stands 560 mm high under the spring support brackets 8 (see Fig. 47); first take the load off the middle axle wheels;

— to take the load off the rear suspension, place support stands 770 mm high under the cylindrical part of the rear suspension axle bracket 21;

— to take the load off the front suspension, place support stands 220 mm high between the leaf springs and the frame side rails.

Table 13

Таблица 13

Консервирующие и защитные материалы

Назначение материала	Наименование и состав
Для консервации двигателя	Рабоче-консервационное масло М-4з/8ГРк или смесь масла М-6з/10В ТУ 38 101155-76 или М-8Г2к или М-10Г2к ГОСТ 8581-78 с 10 % (по объему) присадки АКОР-1 ГОСТ 15171-78
Консервационная смесь топлива	Смесь топлива дизельного ГОСТ 305-82 с 2 % (по объему) присадки АКОР-1
Противокоррозионная присадка для охлаждающей жидкости	Смесь по 162 г нитрита натрия ГОСТ 19906-74, двухромовокислого калия ГОСТ 4220-75 и тринатрия фосфата ГОСТ 201-76 или 770 г буры ГОСТ 8429-77, 77 г бензотризола ТУ 6-14-860-72 и 31 г нитрита натрия
Для консервации агрегатов трансмиссии и балансиров подвески	Масло рабоче-консервационное ТМ5-12рк ТУ 38 101 844-88 или смесь трансмиссионного масла ТСп-15К ГОСТ 23652—79 с 10 % (по объему) присадки АКОР-1
Для консервации наружных неокрашенных и окрашенных поверхностей и резьбовых участков	Смазка пушечная ГОСТ 19537-83
Для консервации штекерных разъемов и клеммовых соединений электрооборудования	Технический вазелин ВТ13-1 ТУ 38 101 180-76, смазка Литол-24 или солидол
Для подкрашивания поврежденных металлических поверхностей	Эмали МЛ-12 оранжевого, песочного, защитного цветов ГОСТ 9754—76; эмали МЛ-152 оранжевого, песочного, золотисто-желтого цветов ГОСТ 18099—78; эмаль МЧ-145 оранжевого цвета ГОСТ 23760—79; эмаль МЧ-123 черного цвета ТУ 6-10-979-84; эмаль МС-17 черного цвета ТУ 6-10-1012-78
Для защиты от светового воздействия шин, рукавов, приводных ремней и других резиновых изделий	Смесь алюминиевой пудры со светлым масляным лаком или алюминиевой пасты с уайт-спиритом в отношении 1:4 или 1:5 (по массе). Мелоказеиновый состав — смесь из мела 75 % (по массе), казеинового клея 20 %, гашеной извести 4,5 %, кальцинированной соды 0,25 %, фенола 0,25 %.
Упаковочный материал для герметизации и частичной упаковки	Парафинированная бумага ГОСТ 9569-79, конденсаторная бумага ГОСТ 1908-82, пропитанная парафином двухслойная упаковочная бумага ГОСТ 8828-75, упаковочная битумированная и дегтевая бумага ГОСТ 10354-82, прорезиненная ткань и др.

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Preservative and Protective Materials

Maintenance of Trucks in Storage

Every month, check the tire pressure, the condition of the protective coatings and devices, and whether there are any leaks of fuel, oils, and special fluids. Correct any defects found.

Periodically remove any corrosion products found on unpainted and painted surfaces, restore damaged paint coatings, and coat unpainted surfaces with preservative grease after removing the corrosion. Clean damaged paint coatings with fine-grit or waterproof abrasive paper, then wipe the surface with a rag moistened with

unleaded gasoline or solvent, dry it, and in summer paint it with enamel of the same color in two coats with a 5-10 min drying interval between coats; in winter, coat it with preservative grease.

If the units of a truck stored in an open area are filled with operating oils, once a month check the operation of all units, assemblies, and systems by starting the engine at the storage location and turning the units over (with the wheels raised) or by driving the truck (see the section "Preparing for Storage"), pressing the brake pedal five to seven times without fail and engaging the auxiliary PTO for 3-5 min (without engaging the winch drum lever).

After finishing the work that involved starting the engine, loosen the drive belts again, seal the fuel and exhaust systems, and release the air from the tanks through the condensate drain valves. Renew the grease on the surfaces of the ball joints.

On trucks stored in unheated buildings or under a shelter, perform the above check of the operation of assemblies, units, and systems once a quarter.

On a truck stored in an open area or under a shelter whose units are filled with operating/preservative oils, once every six months check the operation of the service brake and clutch controls and of the control linkages of the gearbox, transfer case, and parking brake by moving the corresponding levers to various positions. If the control rods stick (seize), find the cause and eliminate it.

When the check is finished, put all levers in the neutral position.

Check the operation of the fuel supply control linkage and of the radiator shutter. If necessary, check the operation of the truck by starting the engine and turning the units over, as described above.

Prepare operating/preservative oils by thoroughly mixing operating oils with AKOR-1 additive at a temperature of not more than 60 °C. It is strictly prohibited to pour AKOR-1 additive directly into the housings of the units.

To add anti-corrosion additives to the engine cooling system, drain 4-5 L of coolant from the system, dissolve one of the above additive compositions in this volume, and pour the concentrated solution into the cooling system using a funnel with a strainer. Then start the engine and warm it up to 80-90 °C.

To preserve the engines and maintain their warranty, start the engine and warm it up to 80 °C at least once every three months; this must be recorded in the product passport.

Removing the Truck from Storage

Before putting the truck into operation after storage:

- check the tire pressure and bring it to the specified value;
- take the truck off the stands and release the leaf springs;
- unseal the fuel, exhaust, and engine ventilation systems and the oil tank;
- remove the protective grease from the outer surfaces with a soft cloth moistened with kerosene or unleaded gasoline;
- check and adjust the tension of the air compressor, alternator, and water pump drive belts according to the operation manual for YaMZ-236M2 and YaMZ-238M2 engines;
- check the oil levels in the drivetrain units, the power steering pump reservoir, the hubs of the rear suspension equalizer beams, and the oil tank, and top up to the specified level if necessary;
- inspect the truck and perform maintenance to the extent of daily maintenance;
- if any of the operating/preservative oils or operating oils and fluids filled into the units and systems do not suit the operating season or have passed their shelf life, refill them;
- before starting the engine, bleed the fuel system with the fuel priming pump;
- remove the lower cover of the clutch housing inspection hole, remove the plug, and put the cover back in place.

Transportation

Trucks can be transported by rail, water, and air. The following preparatory work must be carried out:

1. Before loading, check the tire pressure, bring it to the specified value if necessary, and close the wheel valves. On trucks without a tire inflation system, the tire pressure must be nominal.

2. After placing the truck on the transport vehicle:

— apply the parking brake;

— engage first gear in the gearbox and low range in the transfer case;

— shut off the fuel supply (by pulling the engine stop knob toward you as far as it will go);

— disconnect the batteries.

3. Load and unload the truck using a special slinging device (Fig. 120) or under its own power.

If water is filled into the cooling system, whether it needs to be drained is decided on the basis of the actual transport conditions.

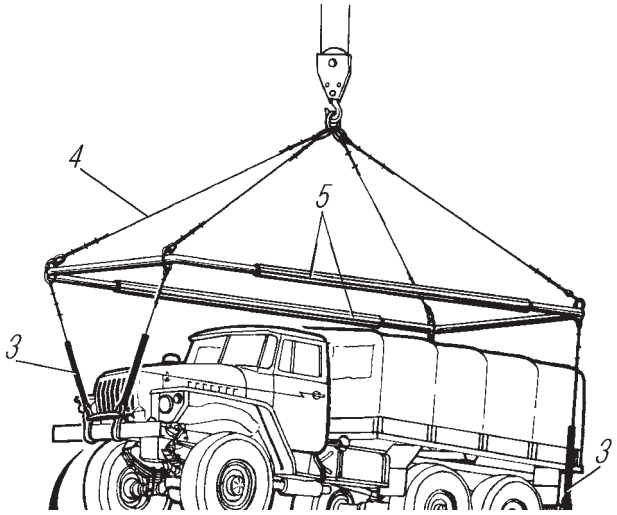


Fig. 120. Truck slinging diagram

1 - front bumper of the truck; 2 - bumper grab; 3 - rubber protective hoses; 4 - rope; 5 - frame; 6 - clevis; 7 - rear beam

Transporting Trucks by Rail

The placement and securing of the truck on open rolling stock must comply with the requirements set out in the "Technical Specifications for Loading and Securing of Cargo" of the USSR Ministry of Railways (MPS), Moscow, Transport, 1990.

Secure a truck placed on a flatcar with two tie-down wires to the rear towing device and two to the front tow hooks; fasten stop blocks measuring 100x160x760 mm in front of the front wheels and behind the rear wheels.

Secure a truck placed over the coupling of two flatcars (Fig. 121) with two tie-down wires to the rear towing device and two tie-down wires to the spring support brackets of the middle axle. Fasten stop blocks in front of the middle axle wheels and behind the rear axle wheels. Fix the front wheels with side stop blocks on the outer sides of the wheels.

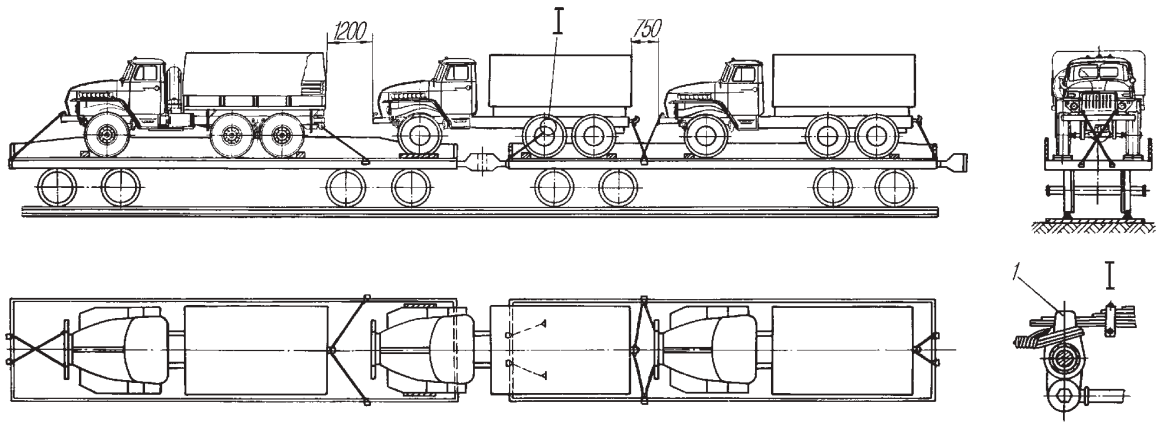


Fig. 121. Diagram of loading and securing three trucks on two four-axle flatcars

1 - spring support bracket

Select the number of wire strands in the tie-down wire, its diameter, and the number of nails needed to fasten the stop blocks in accordance with the "Technical Specifications for Loading and Securing of Cargo" of the Ministry of Railways of the Russian Federation (MPS), taking into account the weight of the transported truck (loaded or unloaded).

In each individual case, agree the transportation conditions with the railway departure station. To fit the trucks within the 02-VM railway loading gauge per GOST 9238-83, remove the bows and the tilt of the cargo body.

Transporting Trucks by Air

The preparatory work must be carried out, and the suspension must in addition be locked out with special devices made and supplied by the shipper. The design of the suspension lockouts must prevent them from falling out under vibration, and the material chosen must prevent crushing, which could loosen the securing of the truck.

Fill the fuel tanks of the truck to half of their capacity. Place and secure the truck according to special diagrams.

Transporting by Water

Load the truck with no cargo in the body.

Loading, placement, and securing of a truck with equipment mounted on the chassis are described in the manual for that product.

Trucks are carried on seagoing vessels in all cargo spaces (holds, 'tween decks); carrying trucks on the upper deck is done with the consent of the cargo owner-shipper.

In the hold and on the deck, position the trucks so that the distance between them is not less than 250 mm on the radiator side and not less than 130 mm on the other sides.

After placing the truck on the vessel, carry out the preparatory work and secure the truck against longitudinal and transverse movement with the special lashing fittings available on the vessel or with wire tie-downs. Tension the wire tie-downs by twisting the strands with pry bars until the truck is securely fastened. Loosening of tie-downs or of individual wire strands is not allowed.

Attach the tie-downs to the front tow hooks, the balancer suspension axle, and the rear towing device. Securing options are shown in Figs. 122 and 123.

On a tractor truck, attach the tie-downs to the rear tow hooks. The lashing fittings or tie-downs must not touch the tires of the truck. When trucks are placed crosswise on the vessel, place wheel chocks under the wheels of the trucks.

Place and secure the trucks according to the vessel's diagram.

The carrier is responsible for the placement and securing of the truck during transportation.

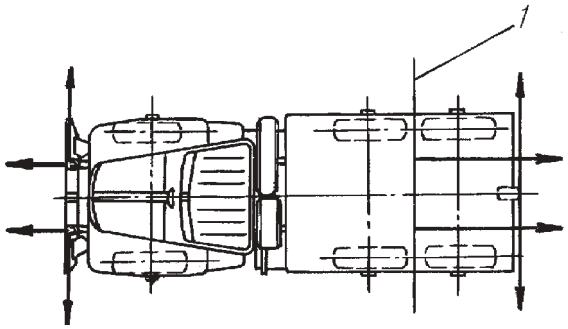


Fig. 122. Securing the truck

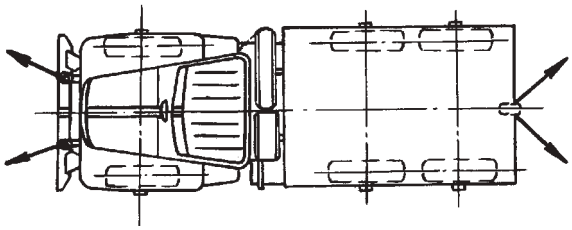


Fig. 123. Securing the truck in the hold, on the upper deck

1 - balancer suspension axle

Disposal

At the end of its service life, the truck must be disposed of; to do this, carry out the following:

- wash and dry the truck;
- remove the batteries and check them for suitability for further use; if they are unsuitable, drain the electrolyte into a special glass container and hand the batteries in at a collection point;
- drain the coolant from the engine cooling system into a special container;
- drain the oils from the units of the truck and clean the oil residues from the filling cavities of the units with a steam-air unit;
- remove the electrical wiring from the truck and hand it in at a collection point;
- remove the wheels and the plastic and rubber parts from the truck and hand them in at a collection point;
- remove the units of the truck, disassemble them, inspect them for defects, and hand in at a collection point those unsuitable for use as spare parts.

Brake valves and devices to be disposed of are disassembled. The parts are sorted by type of material. Depending on the degree of wear, individual parts can be used to repair similar devices; the remaining metal parts are handed in as scrap metal.

During disposal work, observe the safety measures given in the section "Safety Requirements."

When working with poisonous and hazardous materials, comply with the general technical requirements for handling them.