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**MTZ**  
**821/821.2/821.3**  
**921/921.2/921.3/921.4**

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**OPERATION**  
**MANUAL**

**921 – 0000010 RE**

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## **IMPORTANT!**

In case of tractor being used by a customer or is lent or leased prior to starting operating it ensure the operator:

- A. . Is aware of safety measures and correct use.
- B. . Has read and understood contents of the present operation manual.

## **NOTICE!**

Due to constant product improvement structure of certain assembly units and parts may contain alterations not mentioned in the present edition.

Some technical data and figures in the present documents may differ from actual for your machine. Dimensions and weights are approximate (for reference only). Contact MTZ dealer for details.

General note: “Left” and “Right” terms in the present document are referenced from point of view of a viewer behind the tractor moving forward.

## **TO OPERATOR’S ATTENTION!**

1. Carefully read the present manual prior to running the tractor and strictly observe its regulations.
2. Use seasonal diesel fuel according to the manual. Reduce engine oil change interval twice when using fuel with up to 1% sulphur content.
3. Never allow idle engine operation exceed 15 minutes.
4. Keep in mind that diesel engine may be started with gear lever in most left position only (in drive range engagement positions I or II).
5. With the tractor operating without rear PTO free two-speed PTO drive switch should be set to position I (540rpm), free synchronous PTO drive lever should be set to neutral (middle) position, control lever should be set to “PTO off” position (see “Controls and instruments” section).
6. Synchronous drive of rear PTO should not be used with track unit moving faster than 8 km/h. Otherwise tractor powertrain may be badly damaged.
7. Operation at 9<sup>th</sup> gear is allowed in overdrive only (range II).
8. Tractor cab is equipped with a single seat and only operator is allowed to stay into.
9. Certain tractor components are placed into SPS case, toolbox or cab at dispatch from the factory. These should be installed by the user himself.
10. When commissioning new batteries remove sealing film from vents or cut afflux out of polyethylene plugs.
11. Do not allow tractor operation with friction clutch engaged or not completely disengaged.
12. To start moving ensure hand parking reserve brake disengaged.
13. Set FDA switch knob to “driven” position in order to operate the tractor with no cardan shafts.
14. Never operate tractor in closed compartments with insufficient ventilation (air exchange): exhaust gases may be fatal.
15. Never tow tractor with front wheel lifted up, otherwise FDA drive may fail leading to emergency conditions.
16. Never lift machine front up with a towing shackle. Use the shackle to tow the tractor only.
17. Never perform maintenance or other works in fan or drive belt area with running engine.
18. Manufacturer never stops improving the machine, thus machine structure or operation rules may be subject to alterations not reflected in the present manual.

## Section 1. INTRODUCTION. INTERNATIONAL MARKS

The present manual contains basic technical data, description of structure features, controls, operation and maintenance for the following tractor models:

MTZ-821 (D243; 4x4), MTZ-821.2 (D243.S; 4x4),  
MTZ-821.3 (D245.43S2; 4x4)  
MTZ-921 (D245.5; 4x4), MTZ-921.2 (D245.5S; 4x4),  
MTZ-921.3 (D245.5S2; 4x4).  
MTZ-921.4 (D245.5S3A; 4x4)




4x4 tractors MTZ 821/821.2/921/921.2/921.3/921.4 is a garden-and-vineyard version of universal wheeled tractor-cultivator MTZ-822/922 featuring smaller dimensions and ground clearance. These tractors are aimed at performing different works at fruit plantations, in gardens and vineyards, as well as in industry, construction, public services and transport, equipped with rigs, semihinged machines, towing machine and appliances.

### Used abbreviations and acronyms

AB	- accumulator battery
DL	- differential lockup
QC	- quick coupler
PFE	- paper filter element
UBGP	- upper bevel gear and pinion of front driving axle reduction gears
UDP	- upper dead point of engine piston
PTO	- power take-off
PIC	- power input connection
HMS	- hydraulic mounted system
HPS	- hydrostatic power steering
SM	- shift maintenance
SPS	- spare parts set
RH	- rear hookup
CFE	- control filter element for diesel engine air filter
MFE	- main filter element
GB	- gearbox
TMA	- tractor machine assembly
FC	- friction clutch
H	- hookup
FDA	- front driving axle
TM	- technical maintenance
TC	- towing coupler

## International symbols

In relation to instruments and controls use manufacturer uses standard international symbols. Symbols and their descriptions are given below.

	- See manual		- Controls operation
	- Brake		- Fast
	- Hand brake		- Slow
	- Horn		- Forward
	- Alarm signaling		- Backward
	- Fuel		- Battery charging
	- Coolant		- Cab limp
	- Electric starting preheater		- Side lights
	- Engine speed		- Turn indicators
	- Engine oil pressure		- Upper beam
	- Engine coolant temperature		- Lower beam
	- Open		- Operation lights
	- Close		- Differential lockup
	- Gradual change		- Power take-off engaged
	- RH lever down		- Front axle engaged
	- RH lever up		- Fan
	- External cylinder, push-out		- Screen washer
	- External cylinder, retraction		- Windshield wiper
	- External cylinder, floating		- Rear window washer and wiper
	- Clogging air filter		- Trailer turn indicator
-	-		- Engine start (starter control unit indicating lamp)
			

## Section 2. SAFETY REGULATIONS

Carefully follow precautions and regulations in tractor operation and maintenance to ensure work safety.

### General notes

1. Carefully study the present operator's manual prior to operating the tractor. Insufficient knowledge on driving and operating the tractor may cause accidents.
2. Specially trained and qualified operators are allowed to use the tractor, only.
3. Use tractor's safety belt, if any, in operation. Contact dealer otherwise.
4. Never take passengers into the tractor's cab as there is no seat provided.
5. Keep all warning labels clean. Replace damaged or missing labels.
6. Thoroughly inspect the tractor, trailed machinery, rigs and coupling prior to commencing work. Ensure its complete operability prior to commencing work. Trailed agricultural machines and transporting trailers should be equipped with rigid hitches to prevent them swaying and tractor being run down while transporting, and with safety chains and cables.
7. Prior to starting the engine engage parking brake, free PTO switch should be turned OFF, PTO gear changing rod ("Synchronous/Free") should be set neutral, range and gear changing lever should be set neutral.

### Safety regulations for tractor operation

<b>ATTENTION!</b> Do not start engine from outside operator's place. Always stay in the cab at operator's seat when starting the engine and operating controls.
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8. Never start engine with towing to avoid intensive engine parts wear.
9. Never start engine and never operate controls from outside operator's place.
10. Warn surrounding and working on trailed machinery persons prior to commencing work.
11. Never leave tractor in motion.
12. Turn PTO off, stop the engine, set PTO switching rod neutral, engage parking brake and pull starter key out.
13. Do not operate the tractor in enclosed compartments with insufficient ventilation – exhaust gases may lead to death!
14. In case of engine or steering fail during operation immediately stop the machine. Steering with stopped engine required much greater force applied. Non-operating engine with no pressure in steering system lights oil pressure indicator.
15. Do not stay under lifted agricultural machines. Never leave rigs lifted up for long stops.
16. Be careful not to exceed maximum total weight of tractor and coupled machinery and axles loads as per Section 3: "Technical specifications".
17. Be careful not to injure a person or damage property while lifting agricultural digs up and down and turning the tractor.
18. Cardan shaft transferring torque from PTO to machinery tips should be enclosed.
19. Ensure any supplementary equipment and auxiliaries are installed correctly and fit your tractor. Keep in mind danger of misusing a tractor for yourself and other persons. Do not use equipment not designed to be installed onto a tractor.
20. Be careful not to roll over. Choose safe speed according to road condition, especially when driving off-road, crossing trenches and slopes and in sharp turns.
21. Widen tractor's wheel track as much as possible for driving at slopes.
22. Avoid sharp turns with full load and at high speed.
23. To use the tractor for transporting:
  - Widen wheel track as much as possible;
  - Interconnect brake pedals, adjust simultaneous braking, if necessary;
  - Check parking brake operability;
  - Check light and sound signaling devices;
  - Transporting trailers should be equipped with rigid hitches and safety chains or ropes;

- **Never drive down the hill with gear disengaged (coasting)!**

Drive the same gear up and down the hill.

- Never drive down the hill with engine stopped. Oil pump should operate for safe steering;
  - Never use trailers weighing more than a half of tractor's actual weight without independent braking system. The faster you are driving and the greater is towed weight, the longer should be safe distance;
  - Disengage PTO to avoid excessive drive parts and front tires wear;
  - Do not lock rear axle differential when turning or driving faster than 10 km/h;
  - Never stop at slope. In need to stop engage the 1<sup>st</sup> gear and parking brake.
24. Stop the engine and ensure PTO end stop prior to leaving the cab and disconnecting machinery when working with PTO-driven attachments.
25. Never wear loose cloths when operating PTO or near rotating machines.
26. Always engage parking brake and block rear wheels with wedges on both sides. Ensure secure fixation of the machine.
27. Use synchronous PTO drive for lower GB gears at speed not exceeding 8 km/h, otherwise tractor's powertrain may be badly damaged.  
Set independent and synchronous drives rod to middle (OFF) position and replace PTO end cap.
28. Never clean, adjust or service PTO-driven machines with running engine.
29. Driving with installed agricultural rigs faster than 15 km/h is not allowed.

### **Safety regulations for maintenance**

- 30. Never fuel the tractor up with running engine.
- 31. Never smoke when fuelling the tractor up.
- 32. Do not fill fuel tanks to the full – leave enough space for fuel to expand.
- 33. Never add gasoline or mixes to diesel fuel to avoid increased fire or explosion hazard.
- 34. Timely apply summer and winter fuels. Fill fuel tank in the end of each day to reduce condensation at night.

- 35. All operations related to engine or tractor cleaning, preparation to work, servicing, etc. should be done with stopped engine and braked tractor.
- 36. Engine cooling system is constantly pressurized with a valve in radiator's filler cap. Do not remove the cap with hot engine. Always slowly turn the cap to depressurize.
- 37. Be careful not to burn yourself when discharging coolant or water from cooling system, hot oil from engine, hydraulics or transmission.
- 38. Be careful when servicing batteries – spoiled electrolyte shall burn skin.
- 39. Avoid open fire close to the engine fuel system and batteries to prevent explosion hazard.
- 40. Keep tractor and its systems, particularly brakes and steering, operable to ensure personal safety for operator and surrounding people.
- 41. Modifications to the tractor or its certain components without prior approval by a dealer and manufacturer are prohibited.
- 42. Remove filter mesh from fuel tank filler neck to avoid fuel spillover when fueling the machine up mechanically.  
The filter mesh is provided for manual fueling the tractor up in the field only.
- 43. Charge the tractor with oils and grease recommended by the manufacturer only. Application of other lubricants **IS STRICTLY PROHIBITED!**

### **Safety regulations for electrics operation and maintenance**

- 44. Adhere the following safety regulations to prevent damage to semiconductor devices and resistors:
  - Never disconnect battery terminals with running engine – that would cause voltage crest in charging circuit and damage to electric devices.
  - Never disconnect electric wires prior to stopping the engine and turning all electric switches off.
  - Observe polarity when connecting wires to the battery. Incorrect connection shall lead to short-circuit and damage to electric systems.

- Do not connect AB to electric system until terminals and voltage polarity is verified.
- Never check for current with “a spark” method that causes damage to electrical equipment and fuses and wiring burn-out.

<p><b>IMPORTANT!</b> Do not turn starter and instrument switch prior to full engine stop.</p>
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- Do not operate the tractor without battery installed in electric system.

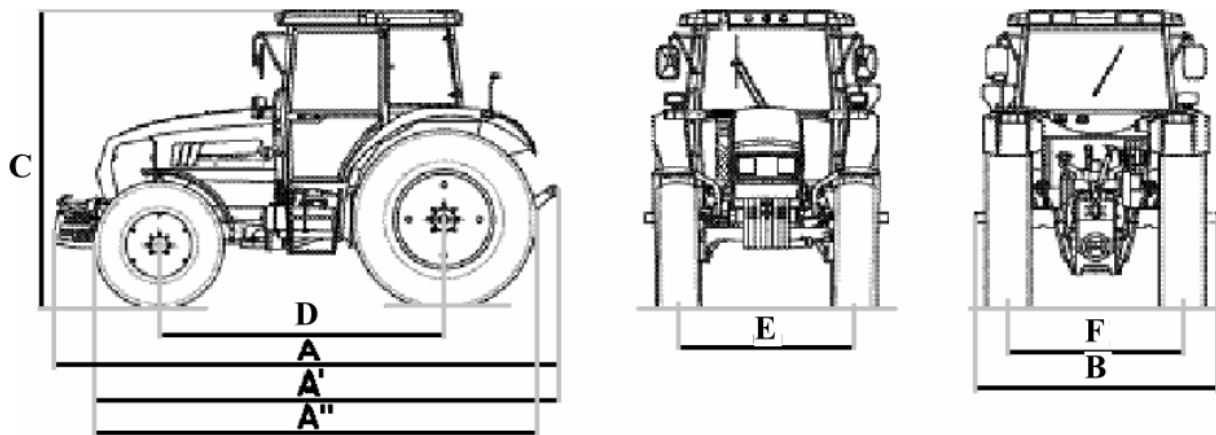
### **Fire safety regulations**

45. The tractor should be equipped with fire-fighting equipment, particularly with spade and fire-extinguisher. Operating tractor with no fire-fighting means is not allowed.
46. Areas for storing tractors and fuels and lubricants should be rounded with not less than 3 m wide ploughed strip and provided with fire-fighting means.
47. Charge tractors with fuels and lubricants mechanically with engine stopped. Use light at nights. Try to avoid fueling tanks up from buckets.
48. Clean parts and assembly units from plant residues prior to perform repair with electro-gas welding in the field.
49. Prevent manifold and exhaust pipe clogging with dust, fuel, straw, etc.
50. Prevent straw winding round rotating parts of machinery coupled to the tractor.
51. Take appropriate fire-safety measures when rinsing parts and assemblies with kerosene or gasoline to avoid vapors ignition.
52. Never operate the tractor in fire-hazardous areas with removed bonnet and other protective devices from hot engine parts.
53. Never use open fire to warm up oil in the engine oil pan, when filling tanks with fuel, or to burn radiator core contaminants out.
54. Emerging fire seats should be buried under sand, covered with tarpaulin, bagging or other compact material.
55. Avoid inflammable materials being close to exhaust manifold and pipe with running engine.
56. Apply silencer or separate spark preventers in exhaust system when harvesting hay or straw or working in areas of high fire hazard.



### Section 3. TECHNICAL SPECIFICATIONS

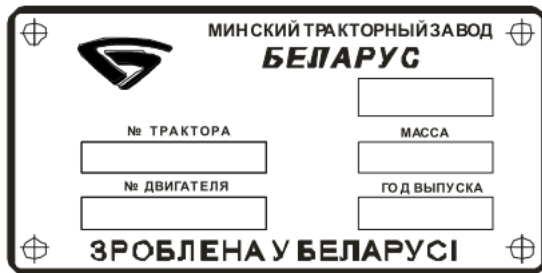
#### Overall dimensions and weight



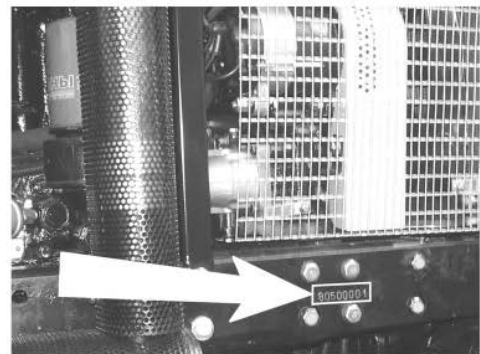
Parameters		Value	
<b>Front and rear tires</b>		265/70R16 (f)	12,4L16 (f)
		420/70R24 (r)	14,9R30 (r)
<b>A</b>	Length with loads and rig attachment, mm	4280	
<b>A'</b>	Length without loads with rig attachment in transporting position, mm	4225	
<b>A''</b>	Length at overall wheels diameters, mm	3450	
	Width with front and rear rig attachment in transporting position, mm	4500	
<b>B</b>	Width, mm	1550	
<b>C</b>	Height, mm	2350	
<b>D</b>	Wheel base, mm	2440	
<b>E</b>	Front axle track, mm	1220-1420	
<b>F</b>	Rear axle track, mm	1160-1585	
	Ground clearance under the rear axle, mm	257	
	Ground clearance under the front axle, mm	325	
	Delivery weight, kg	4000±100	

## Tractor component numbers

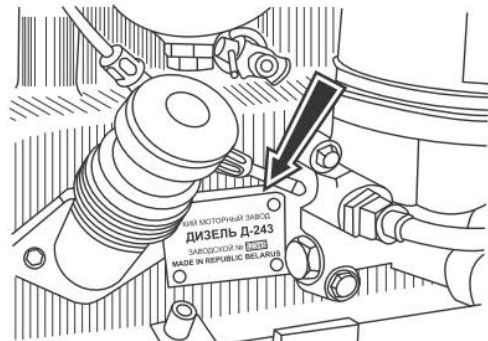
Tractor's nameplate with stated machine and engine serial numbers (outside the right cab side).



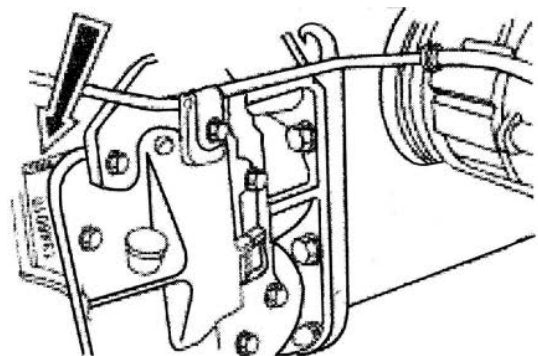
Serial number of the tractor is repeated on the left rail of the half-frame or at front loads plate.



Engine number (repeated at the engine nameplate fixed to the engine head).\*

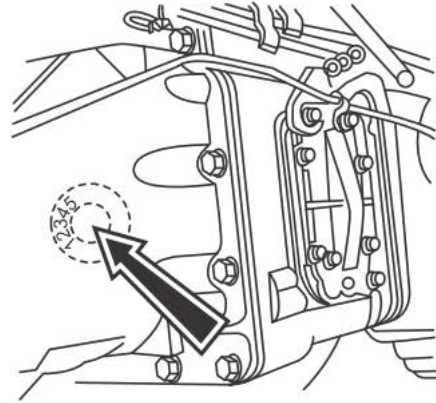


Gearbox number (at the left side of gearbox casing).

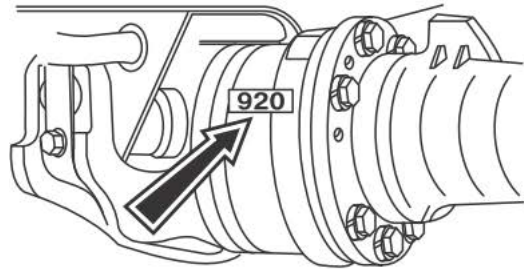


\* D-243.S for MTZ-821.2; D-245.43S2 for MTZ-821.3; D-245.5 FOR MTZ-921; D-245.5S for MTZ-921.2, D-245.5S2 for MTZ-921.3., D245.5S3A for MTZ-921.4

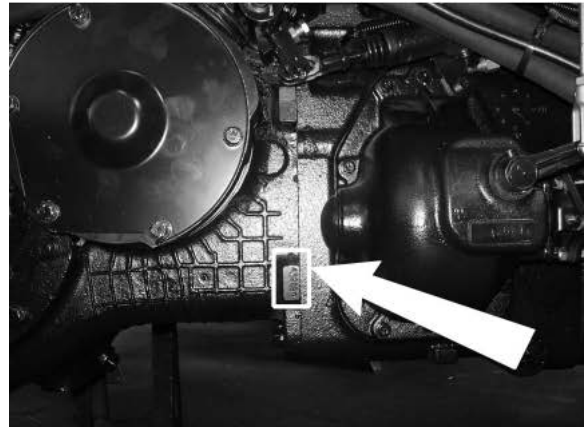
Friction clutch number (on the left side of clutch casing).



Front driving axle number (on the left front side of FDA casing).



Transmission number (to the right from rear view at connection to gearbox).



## Diesel engine

Model	D-243 (MTZ-821)	D-243.S (MTZ-821.2)	D-245.43S2 (MTZ-821.3)	D-245.5 (MTZ-921)	D-245.5S (MTZ-921.2)	D-245.5S2 (MTZ-921.3)	D-245.5S3AM (MTZ-921.4)
Type	4-tact, in-line, naturally aspirated		4 tact, in-line, turbocharger, intercooler	4 tact, in-line, turbocharger	4-tact, in-line, turbocharger, intercooler		
Number of cylinders, pcs.	4						
Carburetion mode	Direct fuel injection						
Compression ratio (estimated)	16±1		17±1	15±1		17±1	
Cylinder diameter, mm	110						
Piston stroke, mm	125						
Displacement, l	4.75						
Operation sequence	1-3-4-2						
Cooling system	Water-cooled						
Rated speed, rpm	2200		1800				
Max. speed, rpm	2380		2070	1980		2070	
Min. speed, RPM	600		800	700		800	
Rated power, kW	60		62	65		70	
Max. torque, Nm	298 (at 1400 RPM)		411 (at 1400 RPM)	397 (at 1000 RPM)		464 (at 1400 RPM)	
Lash between inlet (outlet) valve and rocker at cold engine, mm	0.20-0.35 (0.20-0.35)		0.15-0.30 (0.35-0.50)				
Fuel injection lead angle to UDP, deg.	19-21	15-17	3-5	(8-10)* (7-9)**		3-5	
Fuel injection pressure, MPa	21.6-22.4		23.5-24.7	21.6-22.4		23.5-24.7	

\* With fuel injection pump "Motorpal"

\*\* With fuel injection pump "Yazda"

## Diesel engine feed system

**Fuel pump:** 4-plunger, in-line, with boost pump.

**Regulator:** mechanical all-mode.

**Fuel filters:** coarse filter and fine filter (with replaceable paper filter element).

**Turbocharger\*:** centrifugal radial turbine on a single shaft with centrifugal compressor. Type: C14-126-01 (Czech Republic).

**Fuel type:** diesel:

Basic:

- L-0.2-40, L-0.2-62 (summer)
- Z-0.2 -35°C, Z 0.2 -45°C (winter)
- A-0.2 (up to -45°C)

Substitutes:

- L-0.5-40, L-0.5-62 (summer)
- Z-0.5 -35°C, Z 0.5 -45°C (winter)
- A-0.4 (up to -45°C)

Foreign:

- BS-2869, ASTM-D-VV-F-800 and other (summer)
- DEF 2402B, SAE and other (winter)
- SAE VV-F-800 (up to -45°C)

**Fuel tank capacity:** 95 l.

**Air filter:** "Donaldson" with dry paper filter element.

## Engine lubrication system

**Type:** combined, with oil cooler (with water-oil heat exchanger)\*\*.

**Oil filtering:** prefilter mesh and fine centrifugal filter (paper filter element)\*\*.

**Min. oil pressure:** 0.08 MPa (0.8 kgf/cm<sup>2</sup>) at 600 RPM.

**Normal oil pressure:** 0.25-0.35 MPa (2.5-3.5 kgf/cm<sup>2</sup>) at 1800 RPM.

**Max. pressure at cold engine:** up to 0.6 MPa (6 kgf/cm<sup>2</sup>).

**Refill capacity:** 12 l.

**Motor oil brands:**

Basic:

+5°C to +50°C:

- M-10DM;

-40°C to +5°C:

- M-8DM;

Substitutes:

+5°C to +50°C:

- M-10G<sub>2k</sub>;

-40°C to +5°C:

- M-8G<sub>2k</sub>;

Foreign:

+5°C to +50°C:

- Shell, Rotella, TX 30, HESSOL and other;

-40°C to +5°C:

- Shell, Rotella, TX 20W/20, HESSOL and other;

## Friction clutch

**Type:** friction, dry, single-disk, with tangentially suspended pressure plate. Plate diameter – 340 mm.

**Drive:** hydrostatic with suspended pedal.

## Engine cooling system

**Type:** water-cooled, closed, with forced water circulation, with temperature control by thermostat.

**Normal operating temperature:** 75°C to 95°C.

**Thermostat:** TS-107.

**Cooling system capacity:** 17 l (19 l) \*\*.

**Coolants:**

Basic:

- OJ-40, OJ-65.

Substitute:

- Tosol A40M, Tocol A65M.

Foreign:

- MIL-E-5559, FL-3 Sort, S-735.

## Steering

**Type:** hydraulic displacement with hydraulic cylinder in steering trapezium.

**Pump performance:**

31 l/min for MTZ-821/821.2;

25 l/min for MTZ-821.3/921/921.2/921.3/921.4.

**Hydraulic cylinder:** double-acting, cylinder diameter 50 mm, piston stroke 250 mm.

\* Not for MTZ-821.

\*\* For MTZ-821.3/921.3.

**Metering pump:** volumetric constant 160 cm<sup>3</sup>/turn, operating pressure up to 14 MPa. Installed at front cab side.

**Steering column:** stepless height adjustment within 100 mm.

**Inclination adjustment:** 25° to 40° with 5° pitch. Steering wheel free move up to 25°.

### **Gearbox**

**Type:** 18x4, mechanical, fixed-ratio, dual-ranged, sliding gear transmission. 14x4 synchronized at request.

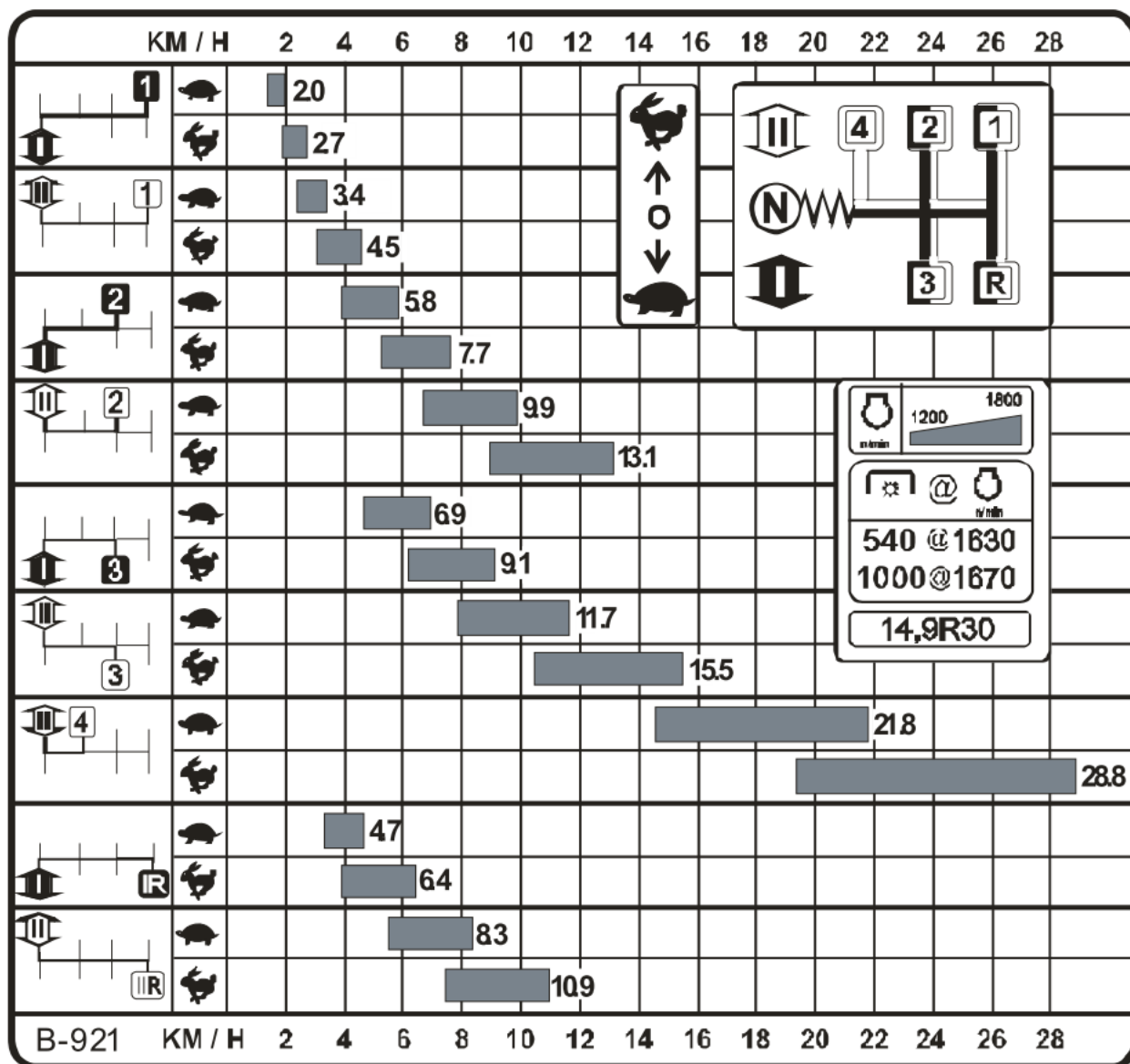
### **Multiplier\***

**Type of both assemblies:** mechanical with direct and 1.36 step-up gears at multiplier and direct and 1.32 step-down gears at back gear. Form 18 forward-driving and 4 rearward-driving gears.

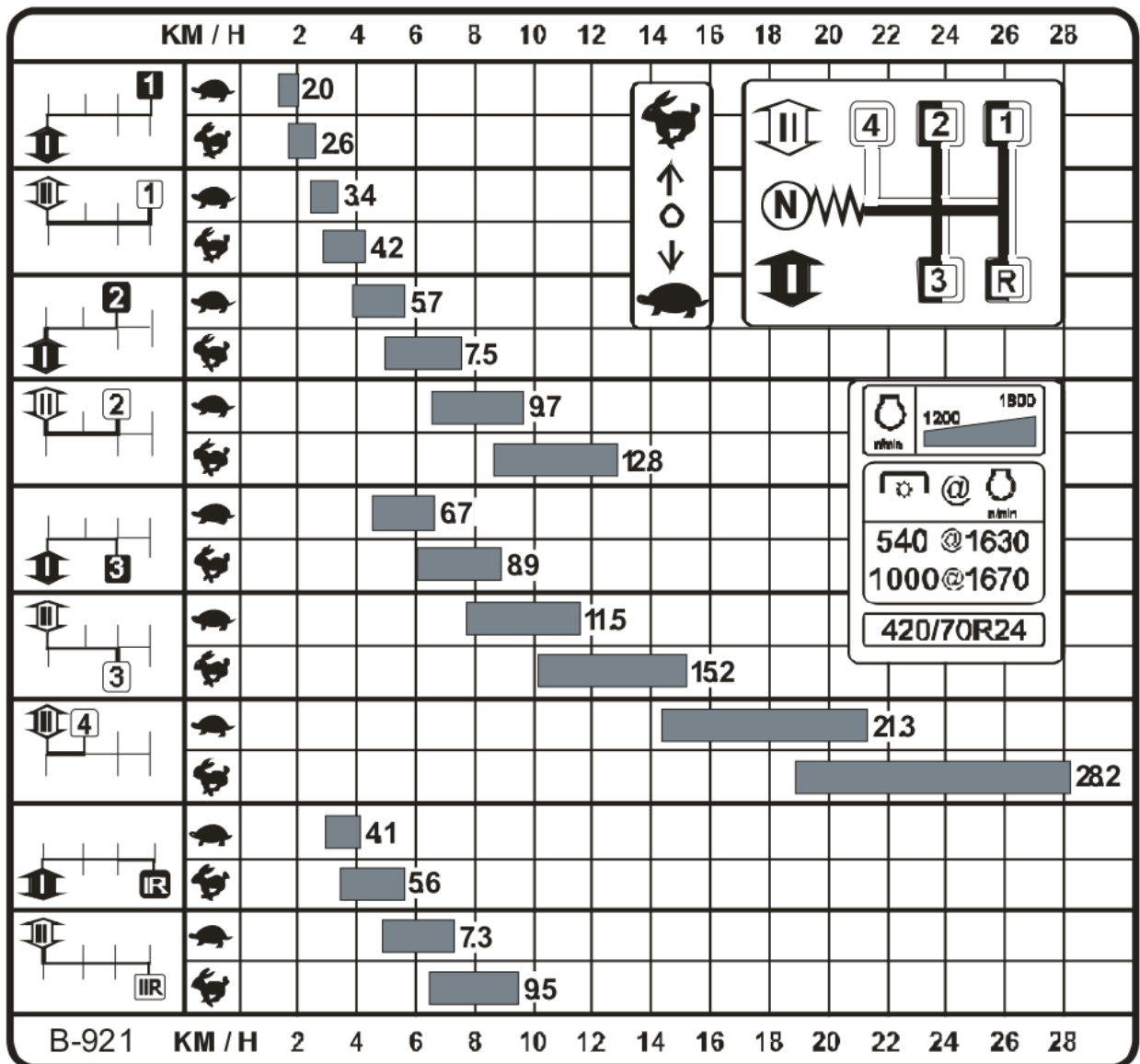
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\* Back gear for MTZ-821/821.2.

Estimated tractor speeds in km/h at rated diesel engine crankshaft speed 1800 RPM (GB – 9/2 + multiplier; rear tires 14.9R30). MTZ-821.3/921.2/921.3/921.4.

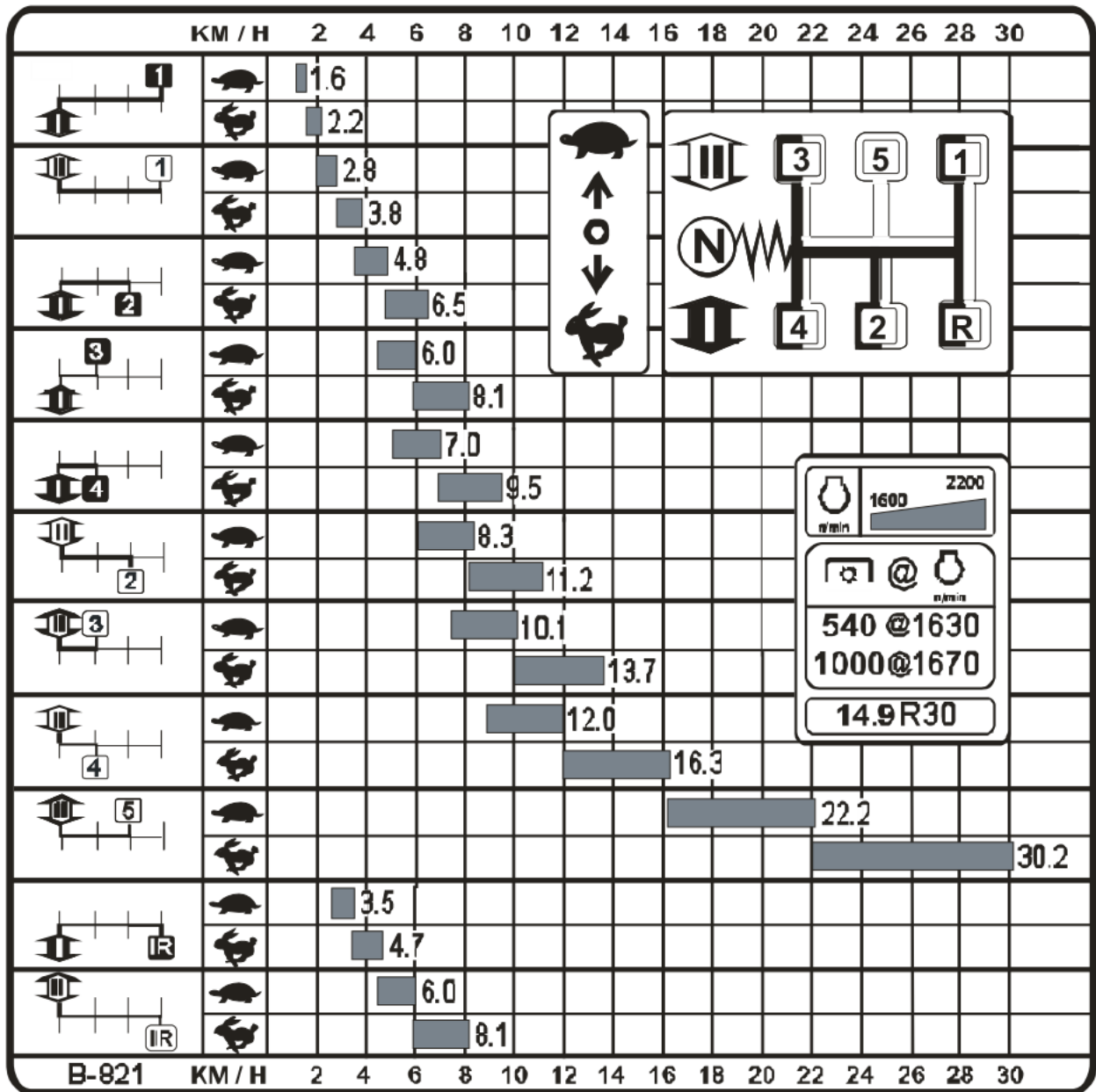


Estimated tractor speeds in km/h at rated diesel engine crankshaft speed 1800 RPM (GB – 9/2 + multiplier; rear tires 420/70R24). MTZ-821.3/921/921.2/921.3/921.4.

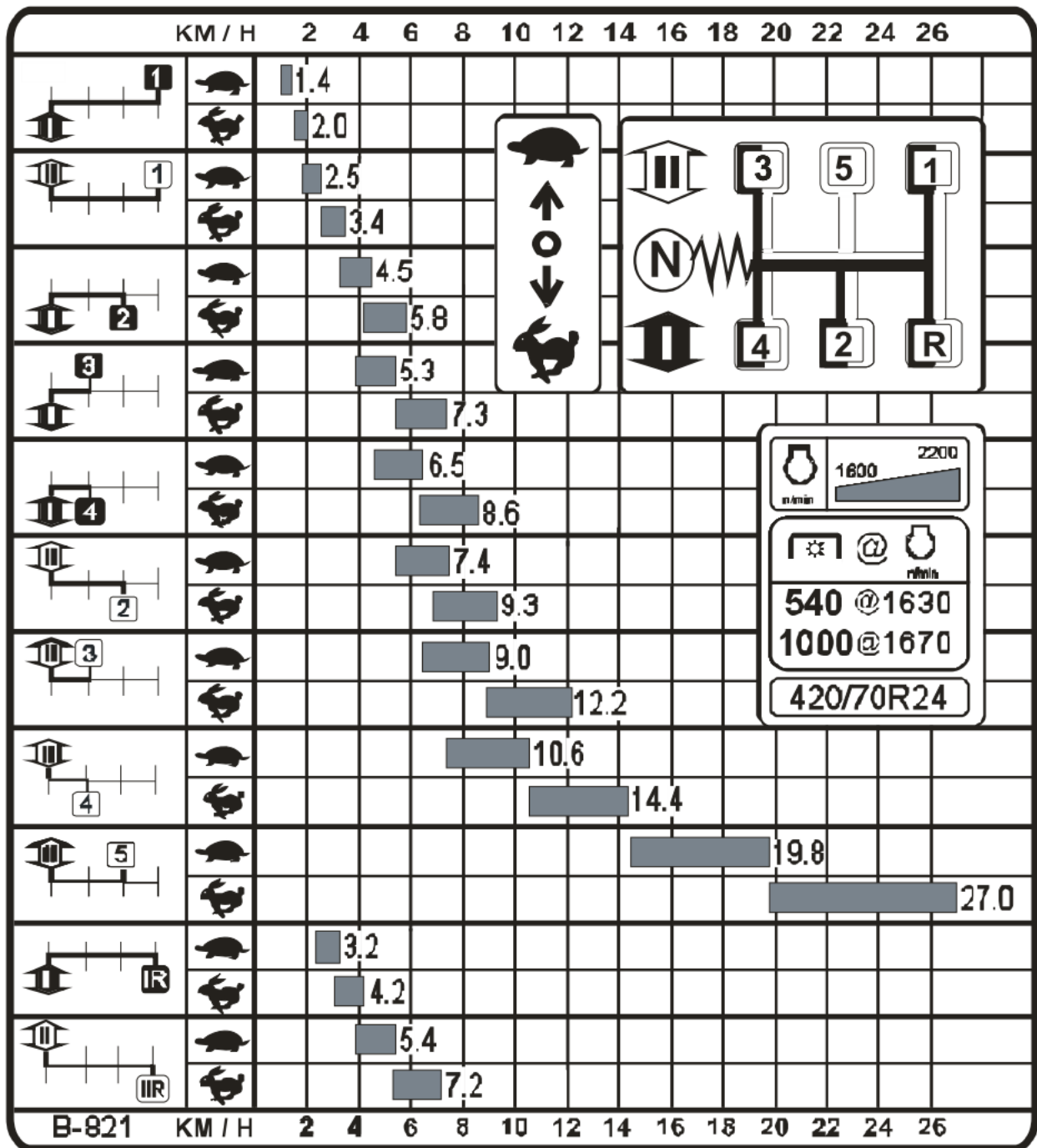




Estimated tractor speeds in km/h at rated diesel engine crankshaft speed 2200 RPM (GB – 9/2 + back gear; rear tires 14.9R30). MTZ-821/821.2.



Estimated tractor speeds in km/h at rated diesel engine crankshaft speed 2200 RPM (GB – 9/2 + back gear; rear tires 420/70R24). MTZ-821/821.2.



**IMPORTANT!**

1. Never exceed tire pressure recommended by the manufacturer.
2. Do not perform welding or other repair works on a disk with pressurized tire. Contact workshops with specially trained personnel to dismount and repair tires.

Table of permissible tire load changes relative to tractor speed:

Max. permissible speed, km/h	Permissible load change, ±%
	Drive axle
8*	+40
20	+20
25	+7
30	0
35	-10

**IMPORTANT!** Use appropriate front and rear tires. Correctly chosen front and rear tires ensure maximal performance, elongate tires service life and reduce powertrain components wear. Combination of worn and new tires or tires with different diameters or rolling radiuses may result in kinematic discrepancy and excessive tire wear.

Tire combinations:

Rear tires	Front tires	
	265/70R16	12.4L16
14.9R30	-	+
420/70R24	+	-

Permissible loads on tractor tires in relation to tire pressure:

Tire	Load on tire, N (kgf) at internal pressure kPa (kgf/cm <sup>2</sup> ) at 30 km/h						
	80 (0.8)	100 (1.0)	120 (1.2)	140 (1.4)	160 (1.6)	180 (1.8)	200 (2.0)
265/70R16	4900 (500)	5586 (570)	6272 (640)	6958 (710)	7644 (780)	8330 (850)	9015 (920)
12.4L-16	5684 (580)	6566 (670)	7252 (740)	7939 (810)	8673 (885)	9359 (955)	9996 (1020)
420/70R24	14700 (1500)	15729 (1605)	17297 (1765)	18865 (1925)	19943 (2035)	-	-
14.9-30	-	13328 (1360)	14798 (1510)	16317 (1665)	17689 (1805)	19110 (1950)	-

To get optimal operational parameters set tire pressure within ranges from minimal to maximal in relation to actual loads acting on tires and speed according to tables.

For machines requiring dig tractive effort set pressure as for 30 km/h.

\* Increase tire pressure by 25%.

## Ballast liquid

Additional wheel loading by filling wheel tubes with liquid is applied in case of insufficient wheel traction to the ground in adverse conditions (overwet soils, etc.).

**Note:** it is preferably not to ballast from wheels as it affects tractor steerability.

In cold weather we recommend using calcium chloride and water mix according to the following table:

Ambient temperature	Calcium chloride proportion, g/l of water
Up to -15°C	200
Up to -25°C	300
Up to -35°C	435

Application of such a mix ensures low freezing point, increased solution density and safe and efficient ballast. A tire should be filled with liquid up to 75% of its volume. While filling up with liquid the tire valve should take the highest position.

The following table provides quantities of liquid to put in:

Tire	Quantity of liquid to put in, l
14.9-30	190
420/70R24	170

**ATTENTION:** Preparing a mix for ballast liquid always add calcium chloride to water and keep stirring until it is completely dissolved. Use goggles when preparing a mix. In case of the mix contact to eyes rinse the eyes with cold clean water within 5 minutes and call for medical care as soon as possible.

## Rear axle

**Main gear:** pair of bevel circle-arc toothed gears.

**Final drives:** pair of straight gears.

**Differential locking mechanism:** mechanical with manual control (for operator's left hand).

## Brakes

**Main brakes:** rear wheels, twin-disc, dry, hydrostatically-driven, with suspended pedal.

**Parking brake:** combined with main brakes, with independent mechanical actuator.

## Front driving axle

**Type:** portal.

**Main gear:** bevel circle-arc toothed gears.

## Differential

**Type:** self-locking, limited-slip.

**Final drives:** two-support reduction gears with bevel gearing.

### Recommended transmission oils:

Basic:

- Tap-15V

Substitute:

- TSp-15K, TSp-10, TAD-17I

Foreign:

- HESSOL, BECHEM, HYPOID

**Drive:** from transfer box by two cardan shafts with intermediate support.

**FDA control:** mechanical.

### Operation modes:

- FDA off;
- FDA on forcedly;
- FDA on/off automatically.

## PTO drive

**Type:** independent two-speed synchronous.

**Master clutch:** planetary reduction gear with band brake.

**PTO control:** mechanical.

### PTO end rotation speed:

Independent drive:

I – 540 RPM for PTO at 1631 (2081)\* RPM for engine;

II – 1000 RPM for PTO at 1673 (2184)\*\* RPM for engine.

Synchronous drive:

- 3,90 rotations per path meter with synchronous drive (tires 14.9R30);
- 4,45 rotations per path meter with synchronous drive (tires 420/70R24).

**PTO end:** 6- or 8-splined (540 RPM) and with 21 splines (1000 RPM).

**Rotation direction:** clockwise.

## Hydraulic mounted system (HMS)

**Type:** remote-cylinder system with hydraulic jack featuring two actuating hydraulic cylinders built in the rear hitch. HMS ensures height, power and combined control.

**Hydraulic system outputs;** two side and two rear outputs (rear side output is linked to the rear right output).

## Oil pump

**Type:** gear pump delivery discharge rate not less than 45 l/min at engine speed of 1800 RPM.

**Hydraulic distributor:** RP 70.

**Type:** running-through, three-sectional, four-position.

**Actuating cylinder:** two plunger hydraulic cylinders Ø80 mm, plunger stroke 220 mm.

### Recommended oils for HMS:

- Motor oils: M-10G<sub>2</sub> updated, M-8G<sub>2k</sub>, M-10G<sub>2k</sub>;
- Industrial oil: BECHEM Staroil No.32, HUNOLD Hydraulikoel HLP 32.

**Hydraulic system oil tank capacity:** 45 l.

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\* For MTZ-821/821.2

## **Pneumatic system**

### **Compressor**

Type: single-cylinder, piston-type, air-cooled.  
Dimensions: 72x38 mm (diameter – 72 mm, stroke – 38 mm).

### **Trailer brakes control**

**Type:** pneumatic, single- or double-line, blocked with tractor brakes.

Pressure: 6.5-8.0 kgf/cm<sup>2</sup> (0.65-0.8 MPa).

Pressure limited with safety valve: 8.5-10.0 kgf/cm<sup>2</sup> (0.85-1.0 MPa).

## **Rear rigging mechanism**

**Type:** jointed four-section of Cat.2.

**Load capacity:** 25 kN (at 610 mm from suspension axle.

Suspension axle adjustment from 680 mm to 870 mm at request.

## **Electric equipment**

**Vehicle network voltage:** 12V.

**Starting system voltage:** 12V.

**Battery:** 12V, 2x90 A·h (located on the upper half-frame rail).

**Feeding system:** one 12V battery. 12V starter feeding.

**Generator:** 12V, 1000W.

**Starting aids**\*: glow plugs.

## **Lighting and warning light system**

- Front embedded road headlamps with upper and lower beams;
- Front and rear operation lights;
- Front and rear lights;
- Alarm lights;
- Tractor-and-trailer lights;
- Beacon light.

## **Tires**

Front: 12.4L16; 265/70R16.

Rear: 14.9R30; 420/70R24.

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\* For MTZ-821.3/921.3.

## Section 4. GENERAL INFORMATION. TRACTOR LAYOUT AND OPERATION

Garden-and-vineyard tractors MTZ-821, MTZ-821.2, MTZ-821.3, MTZ-921, MTZ-921.2, MTZ-921.3 and MTZ-921.4 are versions of universal cultivating tractor MTZ-922 and have the following distinctive features:

- Independent fuel tank for 95 l located near the left cab footboard;
- Gearbox – mechanical, with two operation modes (synchronized 14x4 at request);
- Hydraulic system oil pump actuator located to the right from clutch casing;
- Rear axle differential lock – is mechanical with two operation modes:
  1. Lock
  2. Forced lockLocking clutch is splined.
- Front driving axle featured with two-support bevel reducing gears;
- Rear PTO is mechanically controlled.

**Tractor frame** consists of half-frame, friction clutch casings, gearbox and rear axle.

Diesel engine is rigidly fixed to the friction clutch casing through the rear plate and is mounted onto the front rail with hinged bearing.

Following powertrain components are located behind the engine:

- Single-disk friction clutch;
- Mechanical 9/2 gearbox with gear-change lever to the right. Mechanical multiplier\* (step-up gear) is located between clutch and gearbox to double numbers of forward and rearward gears. The multiplier is controlled with a lever at the left operator's hand;
- Rear PTO with 2-speed independent and synchronous drives. PTO is engaged and disengaged with a lever at the right operator's hand;
- Front driving axle (FDA) with two-support bevel reduction gears has increased load-carrying capacity due to bevel roller bearings into the reduction gear pivot supports.

FDA drive consists of a transfer box, intermediate and front cardan shafts and intermediate bearing with multidisc wet

friction clutch. FDA is driven by the secondary gearbox shaft to ensure synchronic rotation of the front and rear wheels at every gear. FDA is mechanically controlled by a lever with three fixed positions: "FDA on", "FDA on/off automatically" and "FDA on forcedly". FDA is connected to a beam by two hollow axles allowing the axle with wheels to swing transversely.

- Parking brake includes main brakes with independent mechanical control.

**Hydraulic rigging system** consists of a hydraulic jack with two vertical cylinders and embedded regulator, of a rigging mechanism and a distributor to control external consumers (external cylinders).

Hydraulic jack performs the following functions:

- Tractor suspension lifting up and down with its dead weight;
- Automatic lifting suspension down to the set position relative to the tractor (positioning adjustment);
- Adjusting ploughing depth according to soil resistance (force adjustment);
- Ploughing depth force adjustment with positionally limited maximal depth (combined adjustment);
- Automatic pump discharge in transport condition.

The hydraulic jack is controlled with two handles of force and positioning adjustment, accordingly.

Force adjustment handle is the closest to the seat at the side board. Its movement range corresponds to full ploughing depth range from minimal to maximal.

Positioning handle is located to the right from force adjustment handle. Its movement range corresponds to suspension positions from the lowest to the transport.

Distributor is of flowing through type without bypass valve. It consists of 3 sections, each having four positions: "neutral", "lifting up", "lifting down", and "floating".

The tractor is equipped with pneumatic system to control braking systems of trailers in single-driven mode.

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\* Back reduction gear (back gear) for MTZ-821/821.2.

**Towing coupler:** double crossbeam (TCY-1Ж-01) is united with rear digging mechanism into a single assembly unit. At request a single crossbeam may be mounted meeting DIN requirements and fixed on the lower rod jaws.

**Tractor cab** is safe and comfortable.

The cab is equipped with venting and heating system with air intake through filters over the side windows. Design of filters in venting system allows its partial self-cleaning in motion.

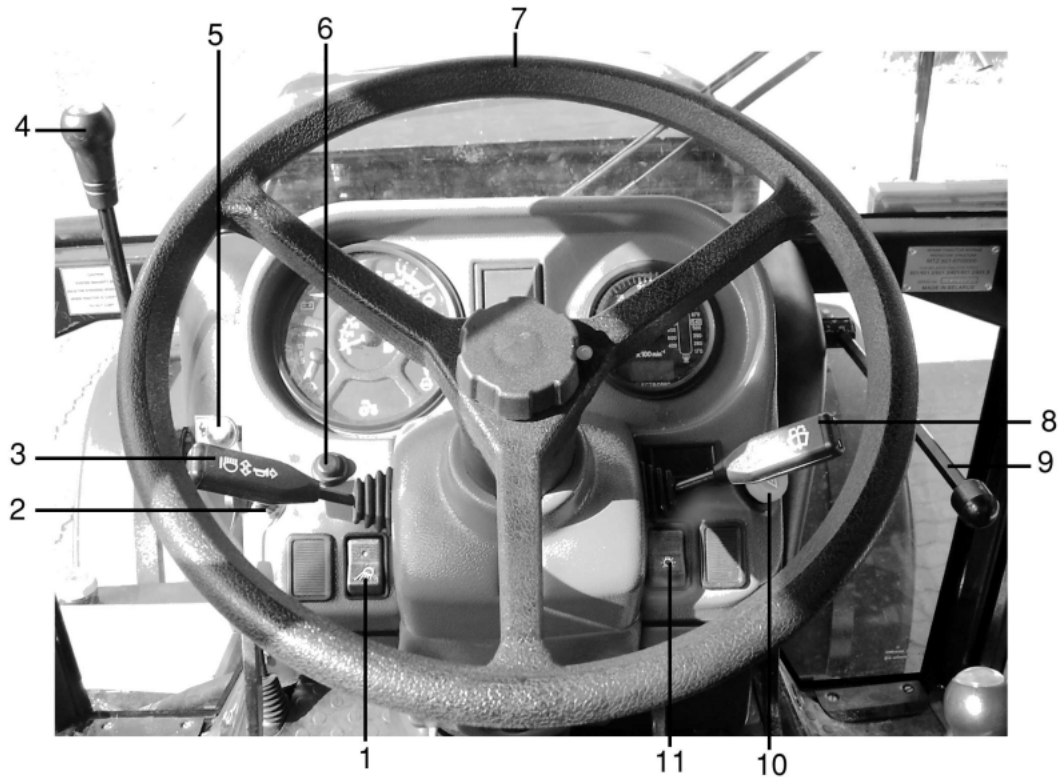
Naturally the cab is vented through a hatch in the roof and opening rear and side windows. The cab is equipped with a comfortable seat with mechanic suspension and hydraulic damper (the seat is adjusted per operator's height and weight). Steering wheel is located right in front of the seat and may be thrown over to ease getting into and out of the cab. The steering wheel is height-adjusted by 100 mm.

**Control station** is designed to ensure comfort working conditions for operator and as convenient tractor control as possible.

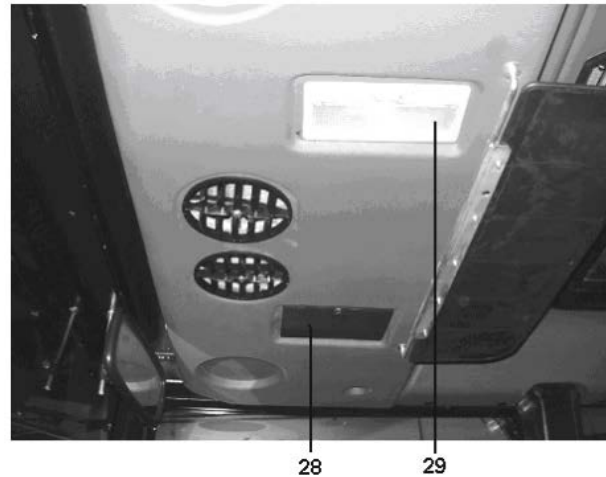
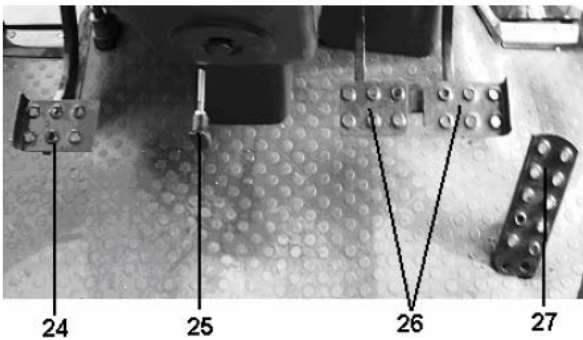
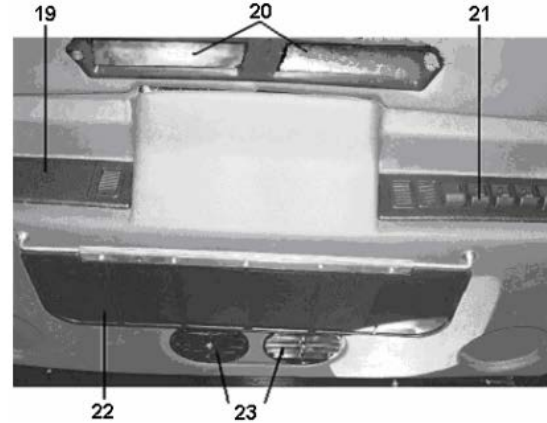
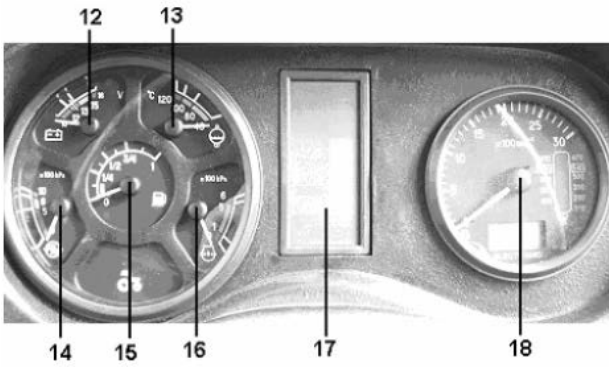
Instrumental board with fundamentally new electric dashboards and electronic tachometer are located on the steering column, cable-driven fuel supply control handle is located at the right wing of the dashboard, gearbox control arm is located to the right, hydraulic jack control arms are situated at the right control board, parking brake control lever is located to the left, rear PTO control arm is situated at operator's right hand, multiplier control arm is located to the left from the dashboard, distributor control arms are located to the right from operator's seat. A board with (from the left to the right) heater, front and rear working lights, rear window washer and wiper switching keys. Electric circuit fuses block is situated near the board under a cover. Rear-view mirrors are located on both sides of the cab. Additional working lights are mounted on the roof. Tractor design allows installation of additional process equipment (available at request) and extra loads.



## Section 5. CONTROLS AND INSTRUMENTS



1. Switch for working lights at front brackets
2. Starter and instruments switch
3. Turn indicators, upper and lower beam and horn switch
4. Multiplier (step-up gear) switching handle
5. Engine stop knob
6. Remote ground switch
7. Steering wheel
8. Front screen washer and wiper switch
9. Fuel supply control arm
10. Alarm lights switch
11. Central light switch



12. Voltage indicator
13. Engine coolant temperature indicator
14. Pneumatic system pressure indicator
15. Fuel tank level indicator
16. Engine oil pressure indicator
17. Control lights block
18. Tacho-speedometer
19. Radio or audio receiver (if any)
20. Recirculating flaps
21. Heater, front and rear working lights, rear screen washer and wiper keys board
22. Sun visor
23. Air deflector
24. Clutch pedal
25. Steering wheel inclination control rod
26. Brake pedals
27. Fuel supply control pedal
28. Heater, front and rear working lights, rear screen washer and wiper circuit fuse block cover
29. Cab lamp

**Fuel supply is controlled** with a handle (9) or pedal (27) (see fig. at page 5-1). Moving the handle up (push) increase fuel supply and engine speed, and vice versa.

**IMPORTANT!** To control with a pedal (27) set the handle (9) to the middle position.

**Multiplier\* is controlled** with a lever (1) with two fixed positions:

- ON – most rear position (pull).
- OFF – most forward position (push) (direct drive).

**IMPORTANT!** For synchronized multiplier\* (1) ON and OFF positions are reversed.

**NOTE!**

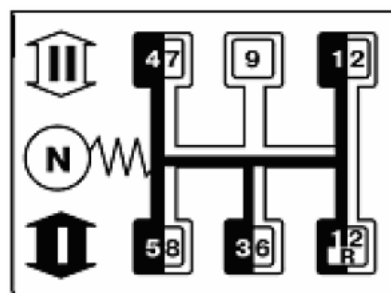
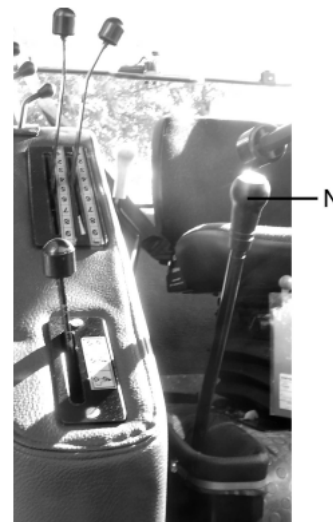
1. The multiplier\* (1) is switched at minimal stable engine speed with pressed clutch pedal.
2. The multiplier\* (1) lever has no fixed neutral position. Setting it to the middle position is allowed in winter to aid engine start only.



**Gearbox is controlled** with a lever (N) as follows:

- Chose required range (I or II) by turning the lever from neutral to the most left (pull) and pushing it forward or pulling back to engage required range. Return the lever to neutral position;
- Select required gear according to switching layout and engage.

\* Back gear for MTZ-821/821.2.



**Rear axle differential lock** is controlled with a handle at the left operator's hand. Move the handle fully up to lock the differential. The differential is locked automatically after the handle is released.

**IMPORTANT!** Activate the pump at low idle run of the engine only. Turn the pump off for cold engine start or for maintenance.

**Rear PTO control**

Independent and synchronous drives switching handle.

The handle (2) has three positions:

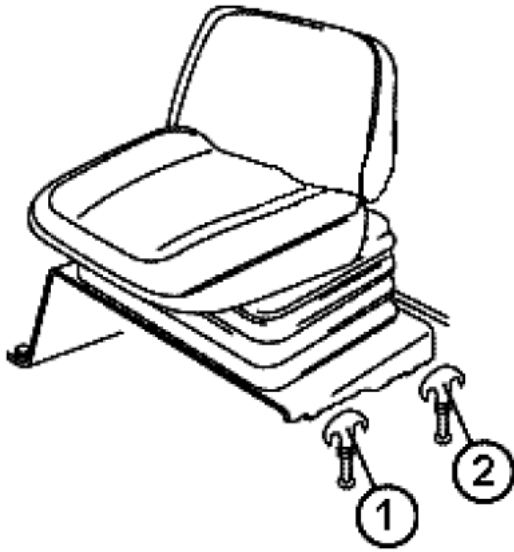
- “Independent drive ON” – utmost up position;
- “Drive OFF” – middle position;
- “Synchronous drive ON” –lowest position.

Engage independent and synchronous drives at lowest stable engine speed.

To engage synchronous drive:

- Start the engine;
- Fully press clutch pedal and engage 1<sup>st</sup> gear;

- Slowly release the clutch pedal and simultaneously move the handle to the lowest position.

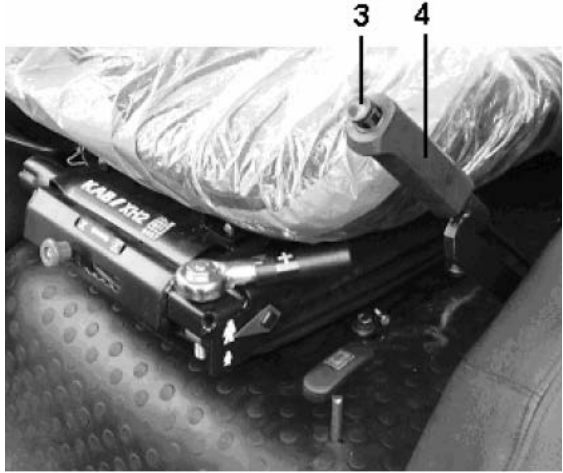


**IMPORTANT!** Synchronous PTO drive shall be use at lower gears at speed not exceeding 8 km/h only. Otherwise the tractor’s powertrain may be badly damaged.  
Set the handle (2) to the middle position “Drive OFF” and replace PTO end cap when not using PTO.

**Parking brake control arm**

- Upper position of lever (4) – parking brake ON;
- Lower position of lever (4) – parking brake OFF.

To disengage the parking brake press button (3) of the control arm and press the lever fully down.

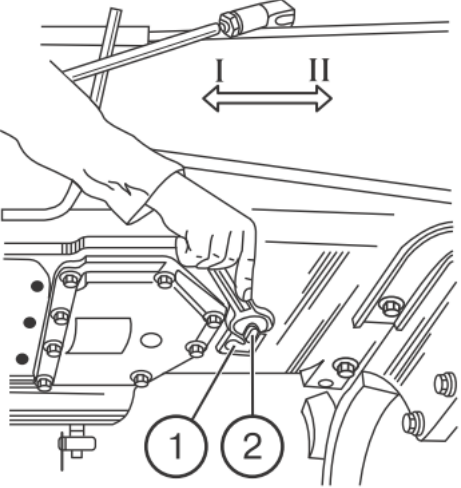


**Two-speed independent PTO drive switch**

Independent PTO drive lever (2) has two positions:

- I – 540 RPM – fully clockwise (down view);
- II – 1000 RPM – fully counterclockwise.

To set required PTO end rotation speed loosen bolt (1), turn the lever (2) to I or II position and tighten the bolt (1).



**Turning rear PTO on and off**

Rear PTO is controlled with a lever (3) with two positions:

- PTO ON – utmost rear position;
- PTO OFF – utmost forward position.

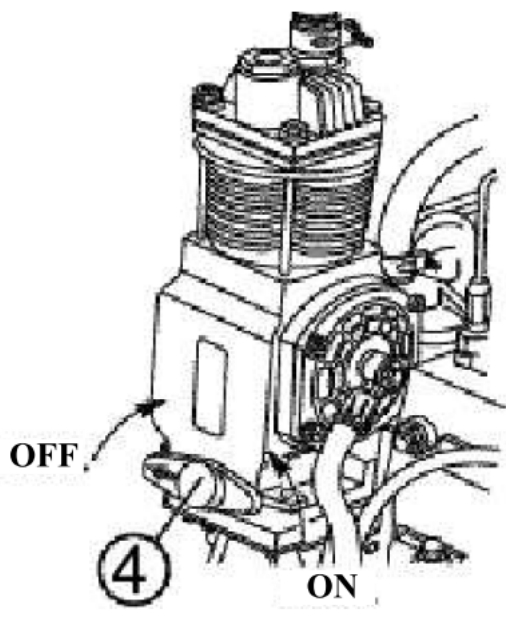


**Compressor control**

The handle (4) has two positions:

- Compressor ON – turn the knob by 180° to orient an arrow at the knob against tractor driving direction;
- Compressor OFF - turn the knob by 180° to orient an arrow at the knob along tractor driving direction.

**ATTENTION!** Switch the compressor with engine stopped or low idling.



**FDA drive control**

PMV drive transfer box control arm (1) has three fixed positions:

- FDA OFF – upper position. Used for driving hard roads;
- FDA ON/OFF automatically – middle position. FDA is automatically switched on and off by freewheeling clutch depending on rear wheels slippage. Used for various field works;
- FDA ON forcedly – lower position. Used briefly for performing works on loose or wet soils and, if necessary, at backing.

**IMPORTANT!** Set lever (1) to “FDA ON forcedly” position to operate tractor without cardan shafts.

**RH jack control**

Hydraulic jack is controlled with two arms (5, 6) at the right board for the right operator’s hand.

Force adjustment handle is located closer to the operator and has the following positions:

- Most forward – maximal tillage depth;
- Most rearward – minimal tillage depth.

Positioning adjustment (5) handle has the following positions:

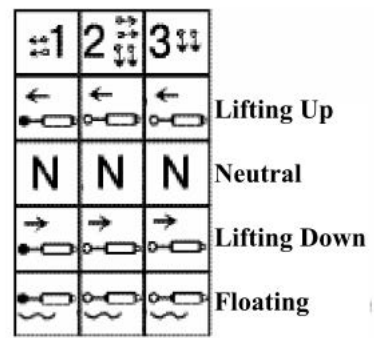
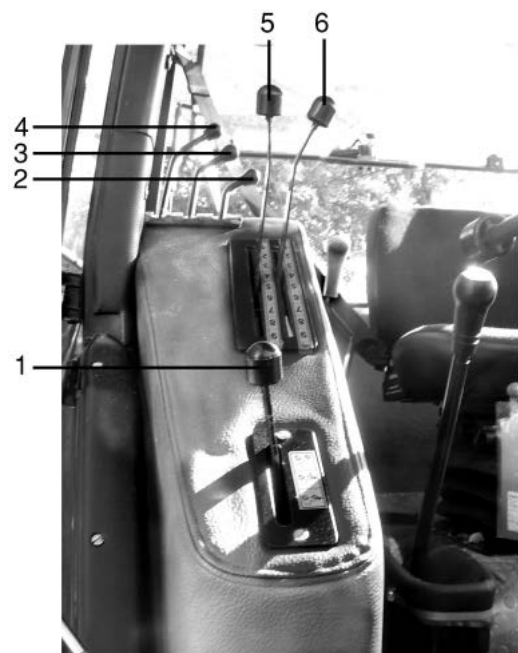
- Most forward – minimal tool height over the ground surface;

- Most rearward – transporting position.

**Hydraulic system distributor control**

Each of three levers (2, 3, 4) controls external cylinders and has four positions:

- Neutral – upper middle position (fixed);
- Lifting Up – upper non-fixed position. Released handle returns to Neutral (lever (4) has fixed Lifting Up position);
- Forced Lifting Down – lower middle non-fixed position between Floating and Neutral positions. Released handle automatically returns to Neutral;
- Floating – lower fixed position.



**NOTE!** Handles (5, 6) allow combined adjustment with tilting depth limited by handle (5) and control by handle (6).

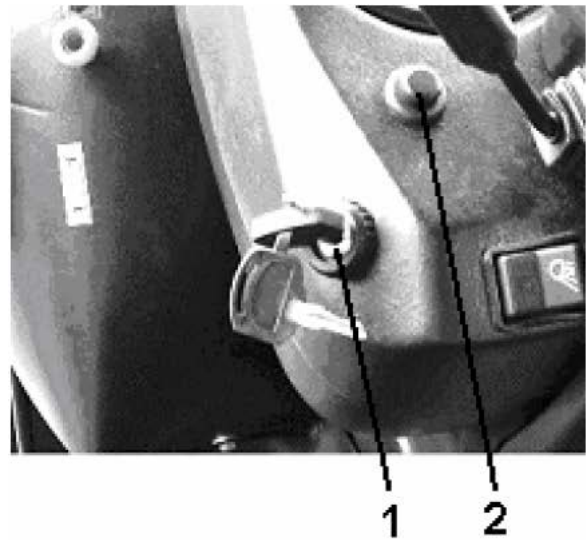
**IMPORTANT!** Hydraulic jack cannot be controlled with arms (5, 6) with any of handles (2, 3, 4) in Lifting Up or Lifting Down position.

## Indicators and switches

### Starter and indicators switch (1)

Has four positions:

- 0 – “OFF”;
- I – “Indicators and control lights block ON”. Oil pressure alarm lights at engine oil pressure indicator (16), page 5-1, and alarm buzzer sounds;
- II – “Starter ON” (non-fixed position). Control light and alarm buzzer go off after engine is started;
- III – “Radio feeding”. Turn the key counterclockwise.



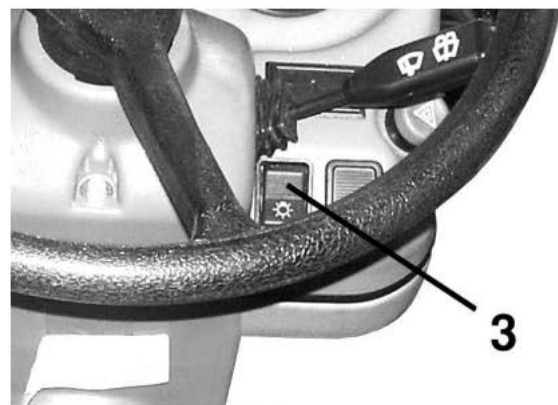
### Remote AB switch (2)

The switch is on with button (2) pressed. Repeated pressing switched the battery off.

### Central light switch (3)

Has three positions:

- I – OFF (right part of the key is recessed);
- II – Front and rear sidelights, license plate lighting, dashboard instruments lighting and additional lights at trailed machine are ON (middle position);
- III – All consumers of position II and road lights are ON (left part of the key is recessed).



### Understeering switch (left) (1)

Allows switching on turn indicators, switching between upper/lower beam of headlamps, upper beam signaling, horn activation.

Turn indicators are switched by moving the arm forward/rearward.

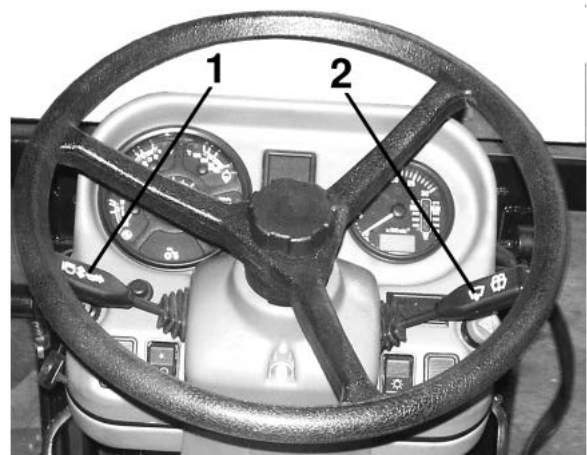
### Lower/upper beam of headlamps

To light headlamps on set the central light switch (1) to position III (see above) and set the switching arm to the middle position “Lower Beam”. Upper beam is activated with pushing the switching arm to stop. Arm positions for upper and lower beams are fixed. To blink with upper beam pull the arm to stop from Lower Beam position regardless the light switch position.



### Understeering switch (right) (2)

Allows switching-on windshield washer and wiper at 1<sup>st</sup> (low) or 2<sup>nd</sup> (high) speed.



Windshield wiper switch has three fixed positions:

- 0 – OFF
- I – Low speed
- II – High speed

**NOTE:** The arm has to be manually returned to OFF position.

Windshield washer is switched on by pulling the arm up and simultaneous switching wiper at the 2<sup>nd</sup> speed. The arm may be positioned anyway.

Positions for switching windshield washer on in not fixed, and the arm is returned to initial position. To activate horn press the arm axially in any switching arm position.

**Dashboard**

**(1) Engine coolant temperature indicator with alarm light**

Indicator scale has three sections:

- Operating temperature – 80-100°C – green;
- Not operating temperature (two) – 40-80°C and 100-120°C – red.

**(2) Engine oil pressure indicator with red low pressure alarm light.**

Indicator scale has three sections:

- Operating pressure – 100 kPa to 500 kPa – green;
- Not operating pressure (two) – 0 kPa to 100 kPa and 500 kPa to 600 kPa – red;
- Pressure up to 600 kPa is permissible for cold engine start. If the pressure alarm light is on at running engine immediately stop it and correct the fault.

**(3) Fuel tank level indicator (with reserve level alarm light).**

**The instrument has the following divisions: 0 – 1/4 - 1/2 - 3/4 – 1.**

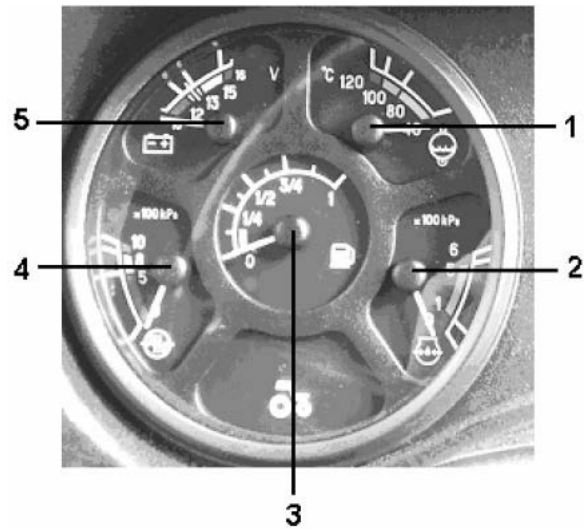
Never consume fuel to “empty tank” (with the pointer in orange section).

**(4) pneumatic system pressure indicator (with pressure alarm light)**

Indicator scale has three sections:

- Operating pressure – 500 kPa to 800 kPa – green;

- Not operating pressure (two) – 0 kPa to 500 kPa and 800 kPa to 1000 kPa – red.



**(5) Voltage indicator**

Shows battery voltage with stopped engine and with starter key in position I. with running engine the indicator shows voltage at generator terminals. Voltage indicator scale has the following sections:

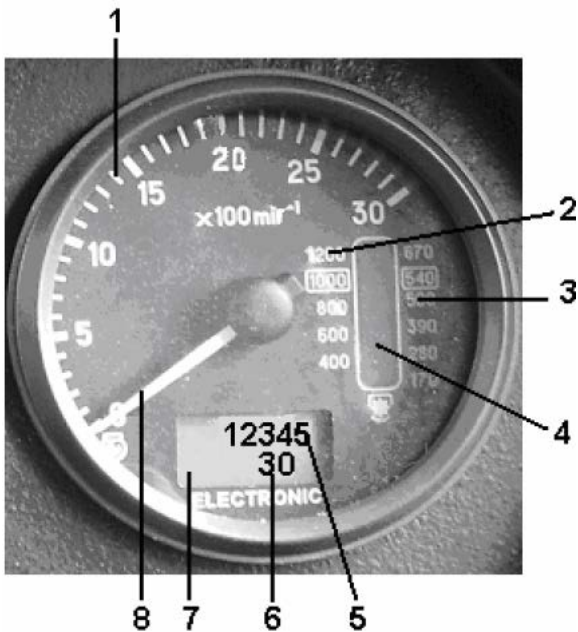
Scale section, color	Feeding system state	
	With running engine	With stopped engine
13.0 – 15.0 V green	Normal charging mode	
10.0 – 12.0 V red	Generator will not operate	Discharged battery
12.0 – 13.0 V yellow	No AB charging (low charging voltage)	Normal battery charging
15.0 – 16.0 V red	Overcharged battery	
White mark in yellow section		Rated battery voltage – 12.7 V

**Tacho-speedometer**

Electric tacho-speedometer at the dashboard operates as follows:

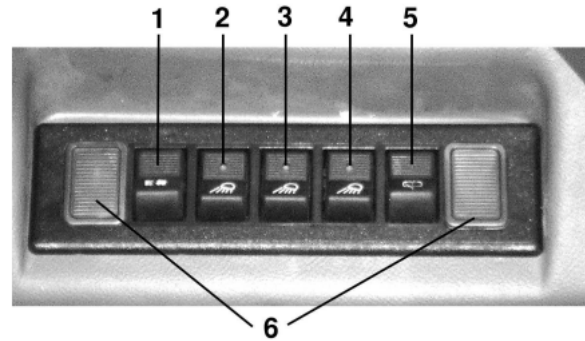
- After stopping the tractor and turning starter and indicators switch key to position I display (7) shows engine working hours (5);
- After starting the engine the pointer (8) goes round the scale (1) to indicate engine crankshaft rotation speed. The display (4) shows PTO rotation speed (RPM). Scale (3) is for PTO I, and scale (2) is for PTO II. Electric signal of rotation speed is fed from generator phase winding;

- In motion display (7) indicates (6) tractor speed (km/h), indication (5) disappears. Speed electric signal is fed from speed sensors on the rear axle caps.



1. Engine crankshaft rotation speed scale, RPM.
2. PTO II rotation speed scale – 1000 RPM.
3. PTO I rotation speed scale – 540 RPM.
4. PTO rotation speed indicating display.
5. Engine working hours indication, h.
6. Tractor speed, km/h.
7. Engine working hours and tractor speed indication display.
8. Engine crankshaft rotation speed needle indicator.

**Board with cab venting and heating system, front and rear operating lights, rear screen washer and wiper switching keys.**



**Cab venting and heating system switch (1)**

Is used to switch venting and heating system fan on.

The switch has three positions:

- OFF;
- Low speed ON – light air feed;
- High speed ON – heavy air feed;

**Front operating lights switch (2)**

Press the key to light front operating lights on. The key light will on.

**First pair of rear operating lights switch (3)**

Press the key to light the first pair of rear operating lights on. The key light will on.

**Second pair of rear operating lights switch (4)**

Press the key to light the second pair of rear operating lights on. The key light will on.

**Rear screen washer and wiper switch (5)**

The switch has three positions:

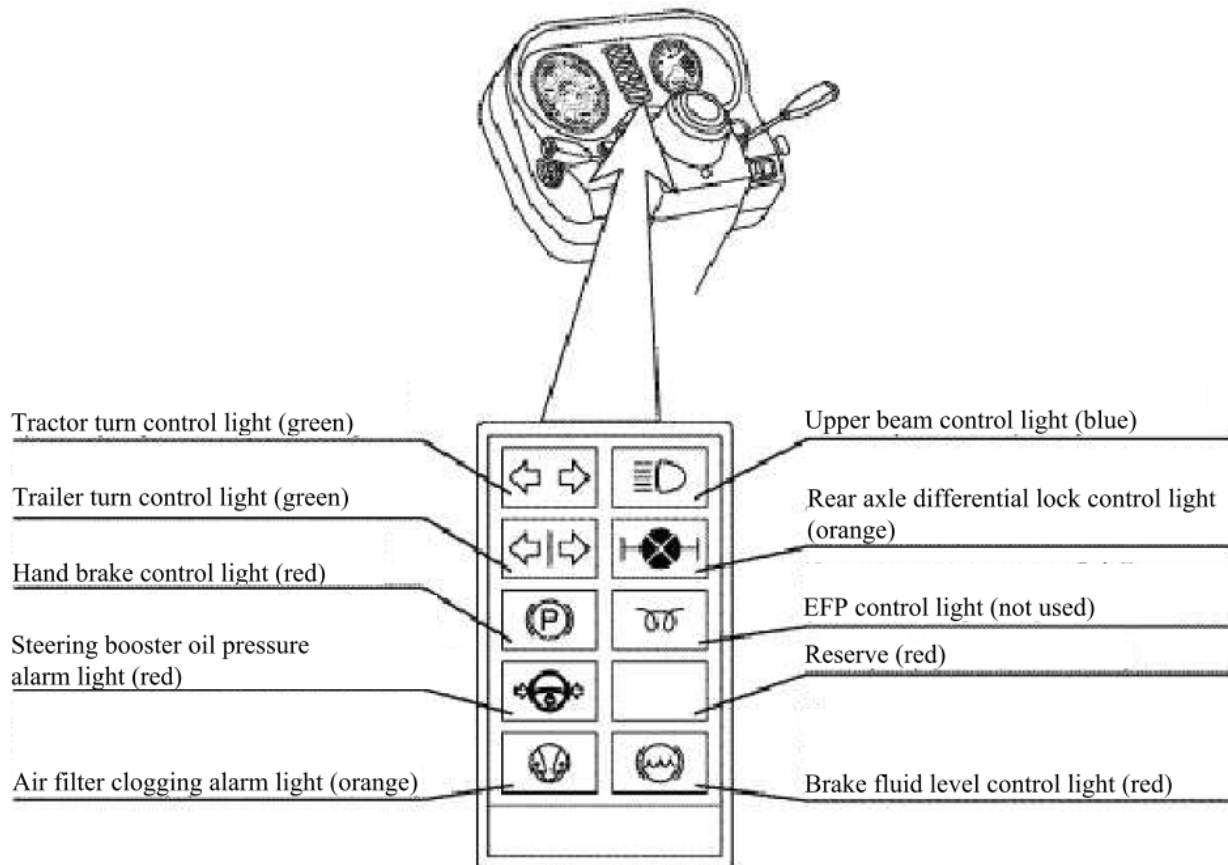
- OFF;
- Screen wiper ON – fixed position;
- Screen wiper and washer ON – non-fixed position.

**Plugs (6)**

For additional switches.



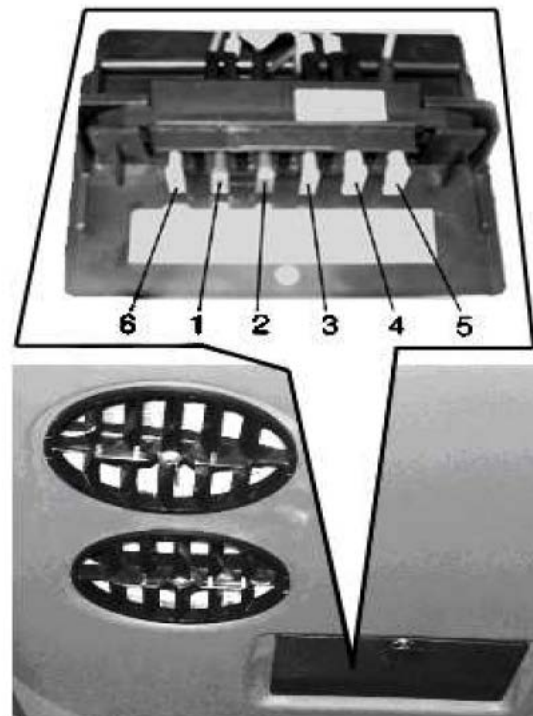
## Control lights block



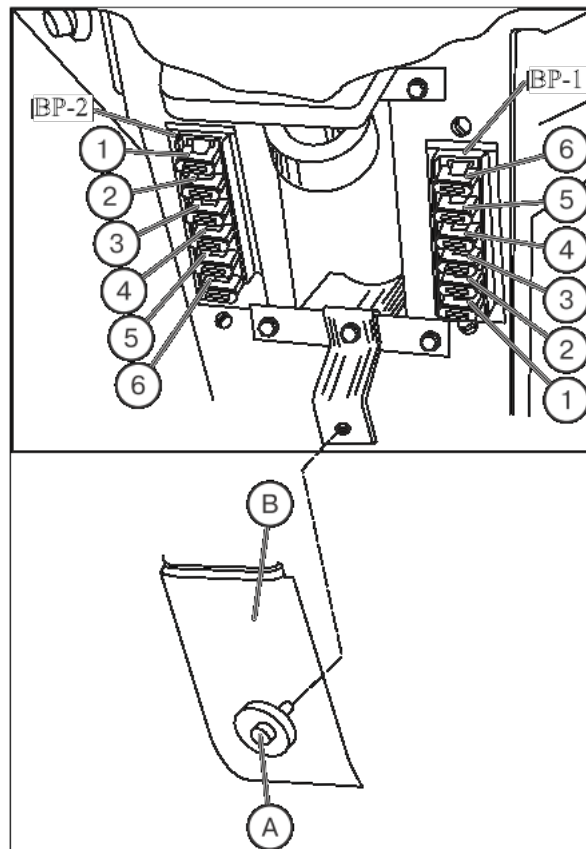
## Fuses

A fuse block is located under a cover (28), page 5-1. Five fuses protect the following circuits from overload:

1. Cab lamp (7.5 A)
2. Rear screen washer and wiper (7.5 A)
3. Two pairs of rear operating lights (15 A)
4. Headlamps (25 A)
5. Venting and heating system (25 A)
6. Beacon (15 A)



Two fuse blocks for BP-1 and BP-2 circuits are mounted under the dashboard. Unscrew bolt (A) under the steering column and remove casing (B) to access fuses. Twelve fuses protect the following electric circuits from overload:



**BP-2:**

1. Road lights upper beam (25 A)
2. Horn (15 A)
3. Portable lamp socket (25 A)
4. Alarm lights (15 A)
5. Stop-light (15 A)
6. Windscreen washer and wiper (15 A)

**BP-1:**

1. Instruments feeding (7.5 A)
2. Turn indicators breaker (7.5 A)
3. Right road light lower beam (7.5 A)
4. Left road light lower beam (7.5 A)
5. Right side lights, instruments lighting (15 A)
6. Left side lights (7.5 A)

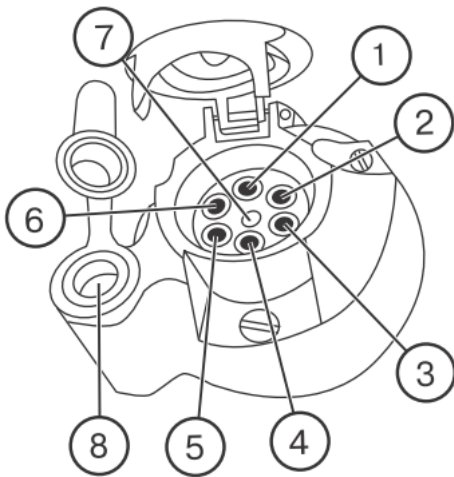
**WARNING!** Never use fuses of higher rated current to prevent electric wires burn. Frequent fuse burning requires fault investigation and elimination.

## Connected electrics

A standard multipurpose socket is provided for connecting current consumers of a trailer or towed agricultural machines. It is located behind the rear cab panel. The socket is connected to the plug of connected machine harness.

Socket terminals are designated as follows:

1. Left turn indicator
2. Horn
3. Ground
4. Right turn indicator
5. Right side light
6. Stop-light
7. Left side light
8. Portable lamp socket



## Operator's seat

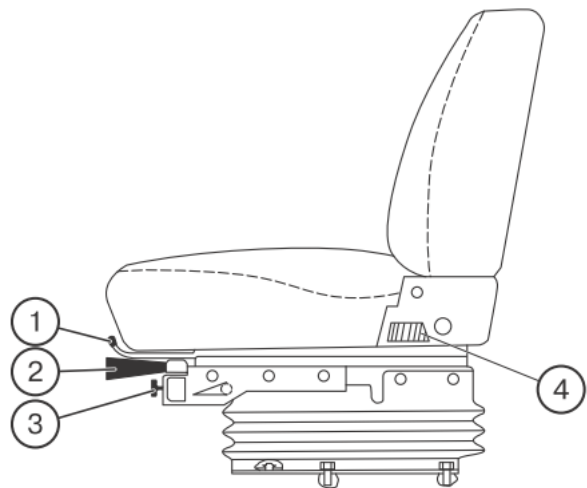
**IMPORTANT!** Adjust the seat prior to starting tractor operation. Stay present in the seat while adjusting.

The seat has mechanical suspension with 90 mm stroke and hydraulic damper. Suspension is protected with a rubber cover.

The seat may be adjusted as follows:

1. Longitudinal adjustment – within 150 mm range.
2. Weight adjustment – 50 kg to 120 kg stepless.
3. Height adjustment -  $\pm 35$ mm.
4. Back inclination adjustment  $5^\circ$  to  $20^\circ$ .

**Longitudinally** the seat is adjusted with a handle (1). Turn it counterclockwise to stop, move the seat and release the handle.



**Operator's weight adjustment** requires alternate motion of handle (2). The handle has two positions: "+" – to increase weight, "-" – to decrease. To change handle direction move it fully forward and turn by  $180^\circ$ .

**Seat height** is adjusted with handle (3). Move it to the right to lift the seat down, and to the left to lift the seat up.

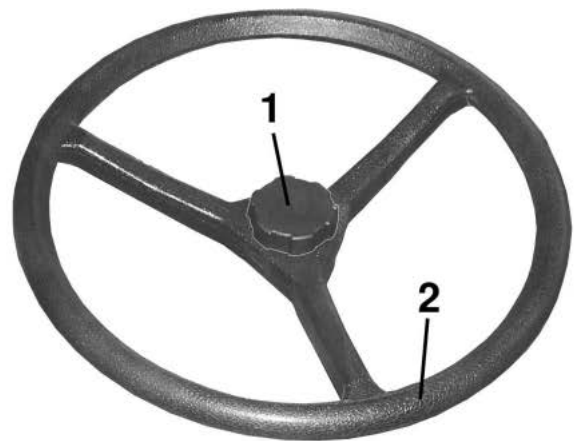
**Back inclination** is adjusted by pulling adjusting arm (4) up and lowering and fixing the back as required.

**NOTE!** Do not clean the seat upholstery with solvents. Use warm water with small amount of detergent only.

### Steering wheel adjustment

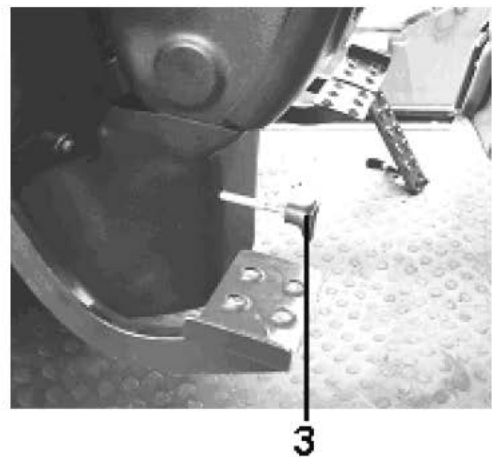
To adjust steering wheel by height:

- Unscrew clamp (1) by 3-5 turns;
- Move the wheel (2) as required;
- Tighten the clamp (1) by hand as possible.



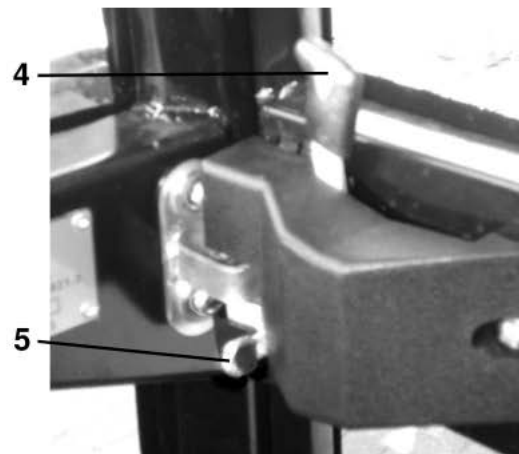
**NOTE!** The steering wheel can be adjusted by height within 100 mm.

Steering column may be inclined and fixed in four positions from 20° to 40° with 5° pitch. To adjust the column pull handle (3), incline the steering column as required and release handle (3).



### Cab door latch

Handle (4) is used to open the cab door from inside by pulling. Handle (5) disable cab door opening from outside (when pulled).



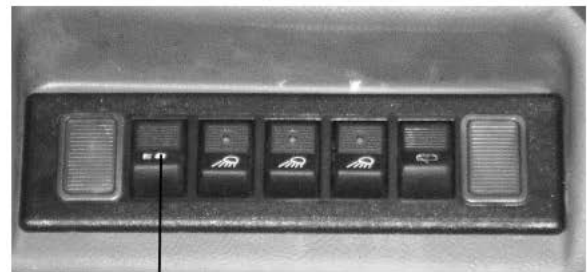
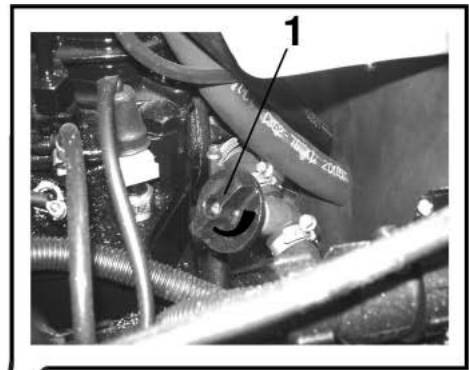
### Cab heater control

To activate cab heater:

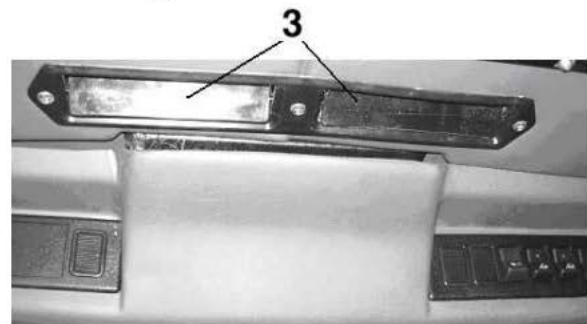
- Open the valve turning handle (1) counterclockwise to stop;
- Turn heater fan on with a switch (2) and adjust air direction as required with regulated flaps (air deflectors) (4). Opening and closing recirculation flaps (3) amount of fresh air entering the cab may be regulated.

**NOTE!** Fully open recirculation flaps (3) and run the heater fan at high speed with a switch (2) to quickly warm-up the cab.

**NOTE!** Close the valve to run the system for venting at warm weather.



2



3



4

## Section 6. PREPARATION TO WORK AND WORK ORDER

### Preparing tractor to work

Depreserve tractor to prepare it for work as follows:

- Remove protective covers and plugs from the engine;
- Fill all refill capacities;
- Remove sediments from rough and fine fuel filters and from fuel tank;
- Fill and flush fuel supply system with fuel to remove air;
- Check fan belt tension;
- Check and adjust tire pressure;
- Service the battery;
- Tighten fasteners;
- Squirt all lubrication points;
- Check and, if necessary, adjust front wheels toe-in.

**WARNING!** Ensure all protective guards are in place prior to start the engine in order to avoid personal injury.

**ATTENTION! NEVER** start new unbroken-in engine by towing to avoid excessive engine parts wear.

### Breaking-in

Your new tractor shall show safe and long-term operation in case of performing correct breaking-in and necessary maintenance works in due time. Observe following when performing 30-hours breaking-in:

- Constantly observe indicators information, lubrication, cooling and feeding systems operation. Observe oil and liquid levels in refill capacities;
- Check tightening and retighten external fixing connections;
- Break-in the engine at easy transporting and field works (harrowing, cultivation, sowing, etc.) gradually increasing load at different gears;
- Do not overload the engine, do not allow fuming or speed reduction. Signs of overload are following: sharp speed reduction, engine fuming and ignorance to increased fuel supply;
- Tractor operation at too low gear with little load at high engine speed causes fuel overconsumption. Correctly chosen gear for each given operation condition allows fuel saving and reduced engine wear;
- Regularly perform monthly maintenance according to recommendations of the present manual;
- Perform maintenance operations after breaking-in (see page 10-2).

## Starting the engine

### Starting in normal conditions

Check oil level in engine oil pan and coolant level in radiator, check for fuel in the tank.

**IMPORTANT!** Never start engine with empty cooling system!

**IMPORTANT!** Stay at operator's seat when starting the engine and controlling instruments.

1. Brake the tractor with parking brake.
2. Set gear-switch lever to neutral position and multiplier\* arm to any of two fixed positions (ON or OFF).
3. Set PTO lever to OFF position.
4. Turn remote battery switch on.
5. Set fuel supply lever to the middle position.
6. Press clutch pedal, shift gear-switch lever to the most left position (pull) and keep it there.
7. Turn starter switch key to position II ("Start") and keep it until the engine is started, but not more than 15 s. Starting control light shall on at control lights block and off after engine start. Repeat starting not sooner than in 30-40 s after the first unsuccessful, in any, attempt.
8. After engine start:
  1. Release clutch pedal and gear-switch lever;
  2. Check operation of all indicator lights and indicator readings (coolant temperature, engine oil pressure, battery charge).

## Starting at low temperature (+5°C and below)

**IMPORTANT!** Never push or tow the tractor to start the engine by towing to avoid damage to powertrain.

- Keep the battery fully charged;
- Use clean winter diesel fuel without water admixture;
- Fill fuel tanks in the end of each working day to prevent condensation into the tanks.

### Starting procedure

1. Switch off drive of hydraulic system oil pump and compressor to reduce resistance to crankshaft rotation.
2. Set multiplier† lever to the middle position (between ON and OFF positions) to aid start.
3. Lift (close) water cooler blind to quicken engine warm-up.
4. Check oil level in the engine oil pan and coolant level in the cooler.
5. Perform steps 1 to 7 (page 6-2).
6. As soon as the engine is started and its speed is stable set speed at 1000 RPM to stabilize oil pressure in operating range. Release clutch pedal. Warm the engine up.
7. Check instruments operation. Adjust water cooler blind to maintain normal thermal conditions.

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\* Back gear for MTZ-821/821.2

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† Back gear for MTZ-821.821.2

## Getting away and driving the tractor

Perform the following to move the tractor:

1. Set minimal speed for the engine crankshaft.
2. Fully press clutch pedal and wait until all rotating parts stop.
3. Shift the gear-switch lever from neutral to the most left (to operator) position and push it forward or pull rearward to engage required range (I or II). Then return the lever to Neutral position.
4. Select required gear according to the gear shifting scheme and engage. If it is not possible, release clutch pedal lightly and press it again.
5. Select and fix required multiplier lever position.
6. Engage parking brake and smoothly release clutch pedal increasing fuel supply lightly. Keep it increasing as motion begins.

**IMPORTANT!** Avoid starting with heavy traction load (e.g. plough deepened in soil).

**IMPORTANT!** Always press clutch pedal prior to engaging range and gear in the gearbox. Do not keep your leg on the clutch pedal while operating the tractor as it leads to clutch slip, overheating and breakdown.

## Steering

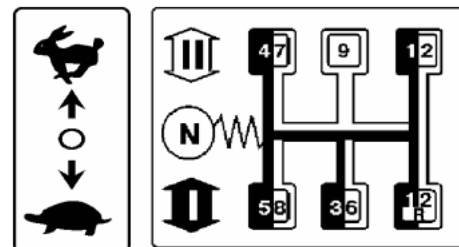
**IMPORTANT!** Tractors are equipped with hydrostatic power steering. Pump does not feed the system with the engine stopped and the system automatically switches to manual mode requiring much effort to turn steering wheel.

## Stopping the tractor

Act as follows to stop the tractor:

- Reduce engine crankshaft rotation speed;
- Fully press clutch pedal;
- Shift gearbox switch-lever to Neutral position;
- Release clutch pedal;
- Press working brakes pedals to stop the tractor.  
Never stop the tractor with brakes with engaged clutch;
- Engage parking brake.

**ATTENTION!** For emergency tractor stop press simultaneously clutch pedal and both working brakes pedals.



## Stopping the engine

Act as follows to stop the engine:

- Let the engine run at low speed after releasing load to cool down. It is preferable not to stop hot engine;
- Set minimal idle speed by pulling the fuel supply control handle down;
- Stop the engine by pulling a stop handle to stop;

Turn remote battery switch off to avoid battery discharge.



## Power take-off (PTO)

**IMPORTANT!** Turn PTO on and off at low engine speed and with no working load at agricultural machines transporters and tools. Use free-running clutch for machines with great inertia moment.

PTO ends with 6 or 8 square-sided splines are available for PTO 540 RPM and with 21 involute splines are available for PTO 1000 RPM.

Set required drive speed and install an end corresponding to the speed prior to starting operating PTO.

**WARNING!** Turn PTO off after each use for the sake of safety.

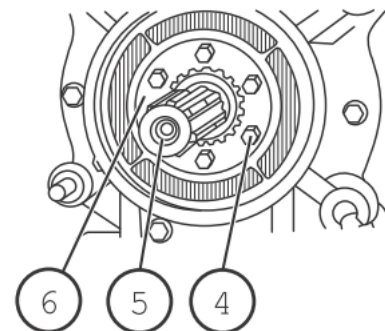
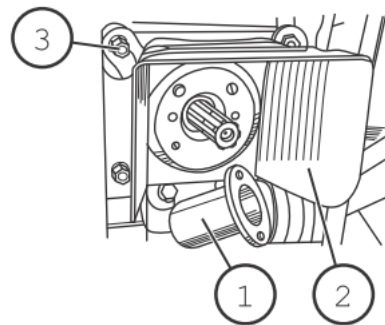
Two-speed PTO switch position	Engine RPM	PTO RPM
Force mode (6 or 8 splines, speed I)	1631 (2081)*	540
Heavy duty mode (21 splines, speed II)	1673 (2184)*	1000

**IMPORTANT!** Shift independent/synchronous PTO switching rod to the middle position (Drive OFF) on completion the work and not using PTO.

**WARNING!** Use synchronous PTO at lower gears at tractor speed not exceeding 8 km/h only. Otherwise powertrain may be badly damaged.

## PTO end replacement

1. Unscrew two bolts and remove cap (1).
2. Unscrew four nuts (3) and remove cover (2).
3. Unscrew six bolts (4), remove plate (6) and end (5).
4. Install another end into the splined bore, install the plate (6).
5. Assemble other parts in order reverse to disassembly.
6. Replace guard and cap and fix with nuts.



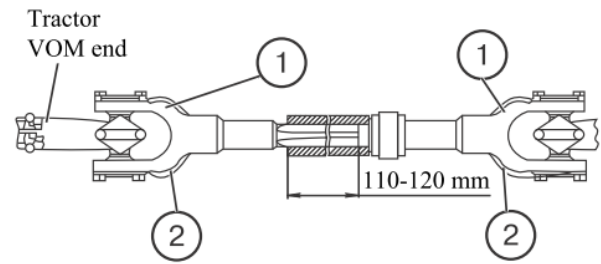
\* For MTZ-821/821.2

## Special features of using rear PTO-driven machines

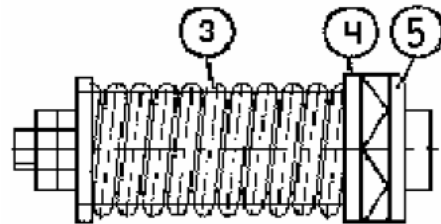
### General notes:

1. To connect a machine to the tractor ensure correct rear PTO control adjustment.
2. Install and secure required (6-, 8- or 21-splined) PTO end and engage appropriate drive.
3. **Grease the shaft and cardan slip joint pipe. Install cardan pivot joint at PTO end and secure it in a fixing groove. Ensure intermediate (telescopic) shaft pivot fork (1) eyes (2) being planar, otherwise the cardan drive and PTO would be overloaded.**
4. **Install cover for agricultural machine cardan shaft.**
5. Having installed cardan drive ensure no collision at cardan slip joint elements at extreme machine positions relatively to the tractor. Minimal overlap at cardan telescopic part should be equal to 110-120 mm. Lesser overlap may result in drive disengagement.

Agricultural machine safety coupling spring (3) length should be adjusted so as to allow cam half-couplings (4 and 5) rotate in relation to each other at overload. Overtightened spring result in coupling failure and cardan drive and PTO overload.

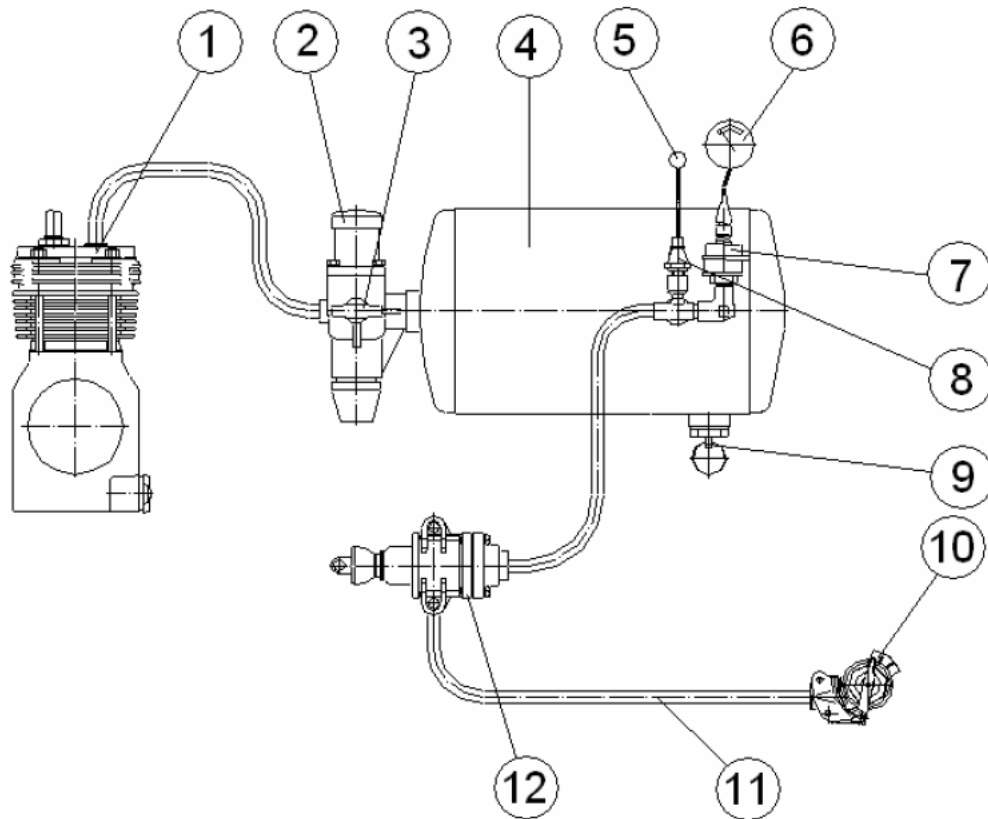


**IMPORTANT!** Engage independent PTO drive at minimal speed or with the engine stopped.  
Engage synchronous PTO drive with running engine and at smooth clutch coupling engagement.  
Operating the tractor without PTO set PTO control arm to “PTO OFF” position and two-speed PTO drive switching coupling – to position I (540 RPM). Shift lever switching between independent and synchronous PTO drive to the middle (neutral) position.



## Pneumatic system to control trailer's brakes

### Single-line pneumatic drive



1 – Compressor; 2 – Pressure regulator; 3 – Air bleed valve; 4 – Tank; 5 – Alarm pressure signaling light; 6 – Pressure indicator; 7 – Pressure cell; 8 – Alarm pressure cell; 9 – Condensate discharge valve; 10 – Coupling head; 11 – Control line; 12 – Brake valve.

Tract is equipped with pneumatic system to control brakes of trailers and other towed machines with air brakes.

The system is as well used to pump-up tires and for other applications requiring pressurized air energy.

Air is taken into the system from the engine's intake manifold. Compressor (1) compresses and passes air to the tank (4) through pressure regulator (2) keeping required pressure in the tank.

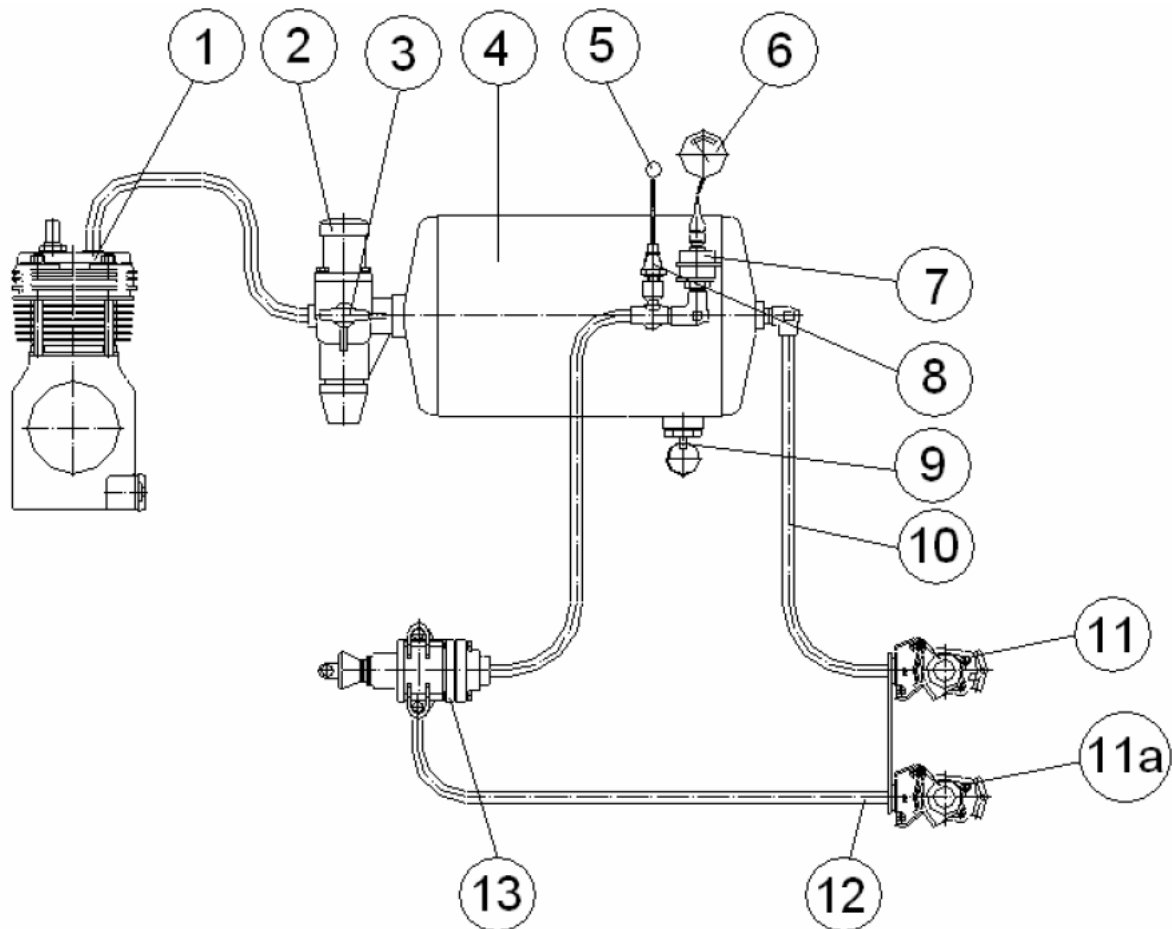
Compressed air passes from the tank to the brake valve (12) via the piping. From the brake valve the air passes via control line (11) to the coupling head (10) and farther to the trailer's air system.

Pressure regulator is equipped with air bleed valve (3) used to pump-up tires and for other applications. There is a pressure cell (7) and alarm pressure cell (8) to control air pressure in the system. Dashboard features pressure indicator (6) and red alarm light (5). Valve (9) is provided to remove condensate from the tank.

## Double-line pneumatic drive

Tractors may have double-line pneumatic drives to control air brakes of trailers.

The system is as well used to pump-up tires and for other applications requiring pressurized air energy.



1 – Compressor; 2 – Pressure regulator; 3 – Air bleed valve; 4 – Tank; 5 – Alarm pressure signaling light; 6 – Pressure indicator; 7 – Pressure cell; 8 – Alarm pressure cell; 9 – Condensate discharge valve; 10 – Feeding line; 11, 11a – Coupling heads; 12 – Control line; 13 – Brake valve.

Air is taken into the system from the engine's intake manifold. Compressor (1) compresses and passes air to the tank (4) through pressure regulator (2) keeping required pressure in the tank. Compressed air passes from the tank to the brake valve (13) and to the feeding line (10) with constantly pressurized coupling head (11) (with red cap).

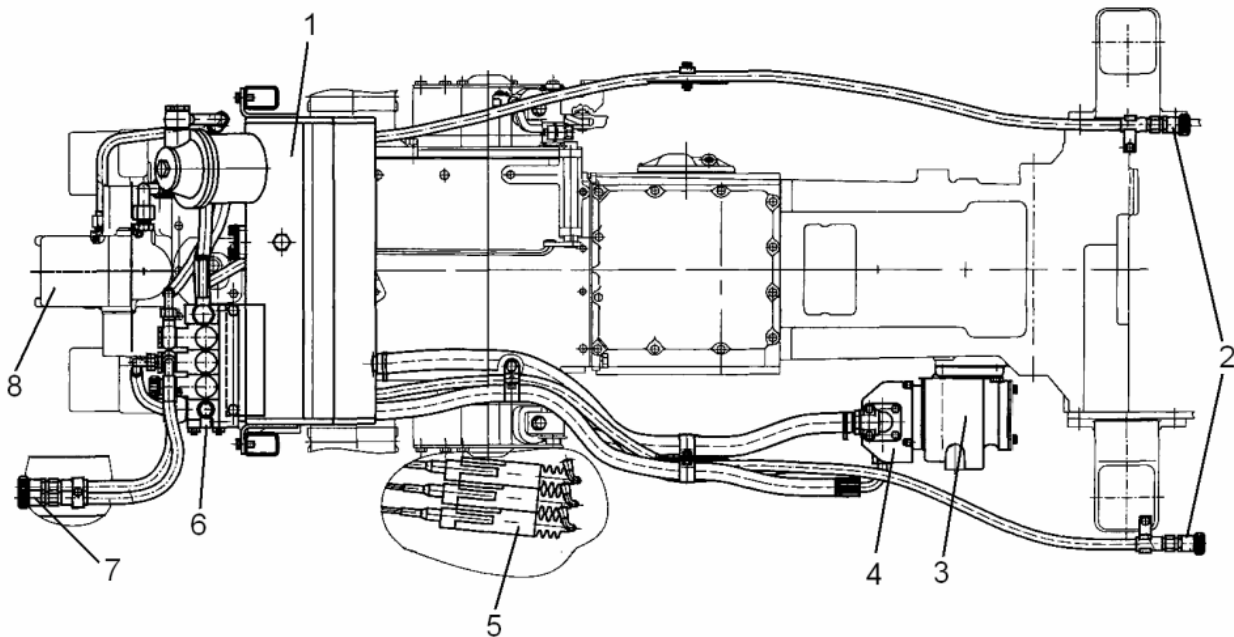
The brake valve is connected via the control line to non-pressurized coupling head (11a) (with yellow cap). Brakes of trailers and agricultural machines are controlled in two modes: direct and automatic.

Direct brakes control uses control line (12) pressure increase up to 6.5-8.0 kgf/cm<sup>2</sup> to stop the tractor.

Feeding line (10) keeps pressurized and continues pressurized air supply to the trailer's pneumatic system.

## Hydraulic system

Hydraulic system includes oil tank (1), gear pump (4), pump drive (3), side outputs (2), rear outputs (7), external cylinder control handles (5), follow-through distributor (6), and hydraulic jack (8). Components layout is given below (top view).

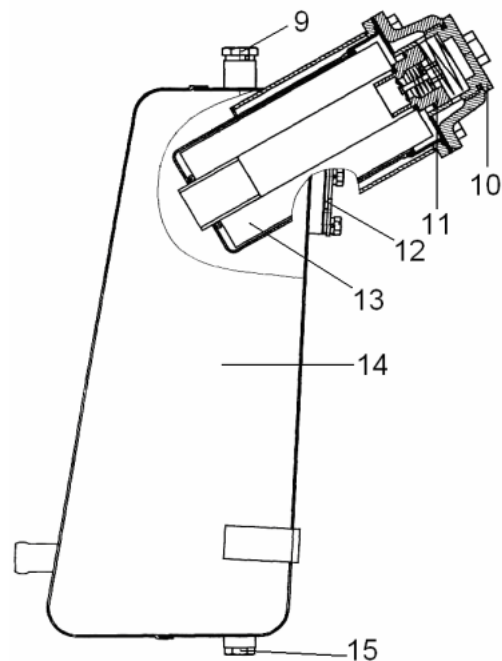


**Hydraulic distributor (6)** is located at the right of the tractor's rear and is controlled with three handles (5) at operator's right hand.

**Oil tank (14)** of welded structure has capacity of 25 l. The tank features filling cap (10) with safety valve (11), oil level indicator (12), filter element (13), breather (9) and discharge cap (15).

**Hydraulic system oil pump** is of right-hand rotation, is located at the drive. Pump drive is switchable, is independent from friction clutch and is located to right from the clutch casing.

The drive consists of casing (1), gear (2) on splines (3) of a shaft rotating in within two ball bearings. Balls (4) inserted into the shaft (3) bore lock or unlock the shaft with spline bushings (5, 7) with a fixture (6) controlled by a fork through the roller (11) tetrahedron.

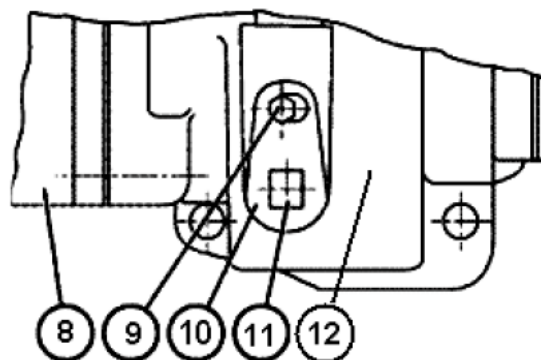
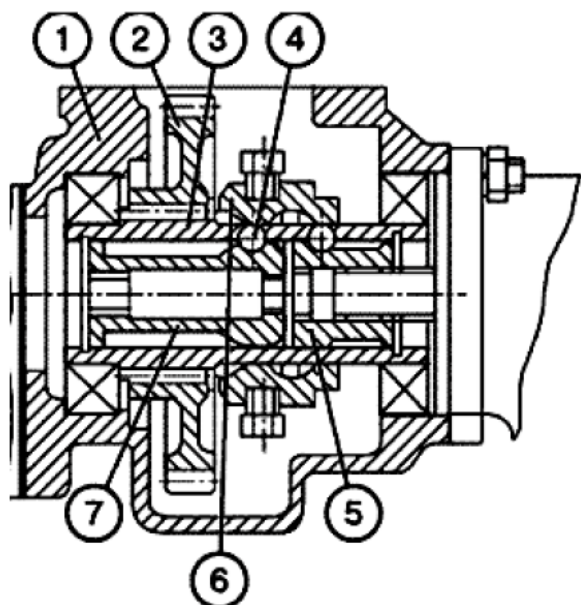


Drive (12) ensures 1800 (1830)\* RPM for the pump shaft (8) at rated engine speed. Ball-type clutch (3, 4, 5, 6, 7) allows switching the pump on and off with engine running at minimal idling speed. To switch the pump on/off:

- Loosen bolt (9) by 1.5-2 turns;
- Turn switching roller (11) with a wrench by the tetrahedron CW/CCW to stop;
- Tighten bolt (9).

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\* For MTZ-821/821.2



Gear (2) is constantly engaged with PTO drive gear. In disengaged state (see activation scheme) fixing (6) is shifted to the most right position, balls (4) disengage with bushing (5) under centrifugal force and shaft (3) and gear (2) freely rotate in bearings. In engages state (fixing shifted to the most left position) balls (4) are guided into the bushing (5) holes by the fixing (6) taper and torque is transferred from gear (2) through shaft (3) and splined bushing (5) to the pump shaft. The drive is suitable for another pump (NHs10/16) driven by the splined bushing (7).

**ATTENTION!** Never try to couple machines with hookup or with TC and hydraulic brakes, for machines of service weight exceeding half of the tractor's one, if hookup hydraulic system is failed.

**ATTENTION!**

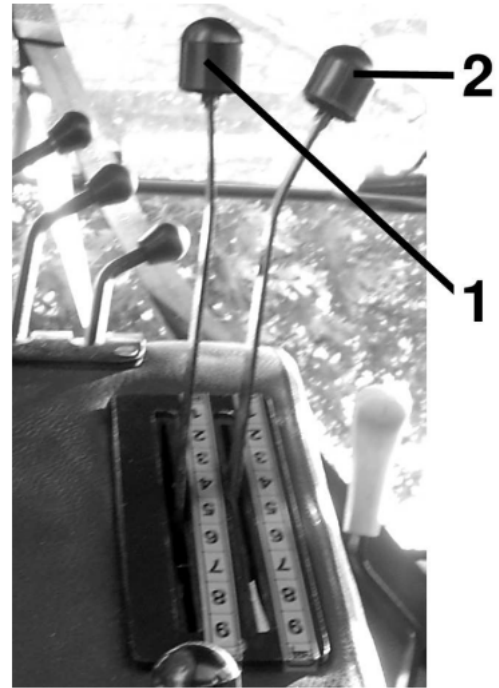
1. Hookup hydraulic system pump should be always on. OFF function for the pump is for emergency only. Pump drive may be disconnected in case of the pump failure or broken oil lines connected by the pump.
2. Stop the engine prior to switching hookup hydraulic system pump off. Having disconnected the pump drive, decouple the following:
  - Hitched or semihitched machine from hookup;
  - Hitched or semihitched machine with hydraulic brakes, for machines of service weight exceeding half of the tractor's one, from TC.

### **HMS hydraulic jack**

Hydraulic mounted system is equipped with hydraulic jack and ensures operation in the following modes:

- Lifting hanging platform up and down with its dead weight;
- Positioning adjustment – automatically maintained position of the hanging platform in relation to the tractor;
- Force adjustment – tillage depth adjustment in relation to soil resistance;
- Combined adjustment – tillage depth adjustment in relation to soil resistance with maximal tillage depth limited by positioning adjustment.

Positioning adjustment handle (2) is used to control hanging platform with coupled tool.



### **Positioning adjustment**

Force adjustment handle (1) should be set to the front position (“9” figure at the board) when connecting a tool.

It allows accurate and delicate control over connected rigs over the ground like spraying machine, leveler, etc. Positioning adjustment may be applied with tillers at plain fields.

Using positioning adjustment at uneven surfaces is limited due to inevitable vertical movements of the tool while tractor driving the field.

1. Set force adjustment handle (1) to extreme (front) position along the driving direction (“9” figure at the board).
2. Set required machine elevation over the ground with positioning adjustment handle (2).

“1” figure at the board corresponds to transporting position of RH, and “9” figure corresponds to minimal tool elevation over the ground.

## Section 7. OPERATION AND ADJUSTMENT REGULATIONS

### Setting front track

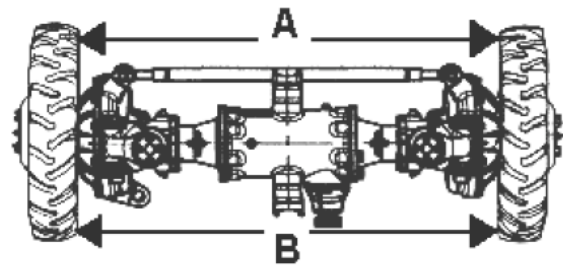
Front track of the tractor may be altered with exchanging left and right wheels only. Front track is equal to 1220 and 1365 mm.

To adjust the track:

1. Engage parking brake. Put blocks on both sides of rear wheels.
2. Jack the front axle up (or front wheels alternately) to ensure clearance between wheels and ground.
3. Remove front wheels.
4. Unscrew nuts fixing the wheel disk to FDA reduction gear flange.

Exchange wheels complete at both sides to get required track. Pay special attention to ensure wheels rotation direction correspondence to an arrow at the tire side, i.e. lugs direction should be the same.

Tighten wheel fixing nuts to 250-300 Nm.



### Front axle toe-in adjustment

Wheels toe-in is adjusted by changing steering rod length as follows:

1. Drive the tractor not less than 3 meters straight at a plain ground.
2. Measure dimension A between two opposite points at the rim shoulder in the front part of the front axle at the wheel axle level.
3. Move the tractor forward to rotate front wheels by 180° approximately and measure dimension B in the rear part of the front axle between the same points as when measuring A dimension. A dimension should be less than B dimension. Measured difference constitutes wheels toe-in and should be equal to 0-8 mm.

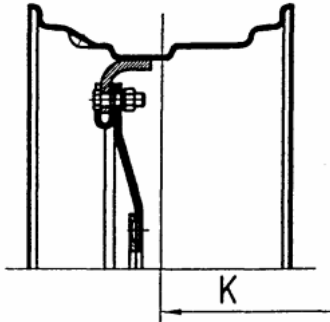
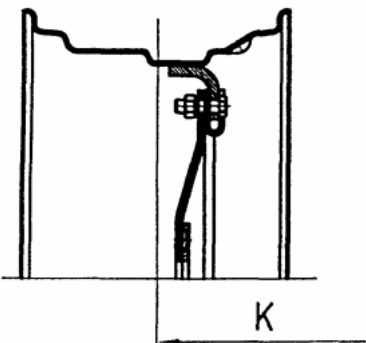
To correct toe-in:

1. Loosen nuts of adjusting tube at the steering rod.
2. Set required toe-in rotating the tube.
3. Tighten the nuts.

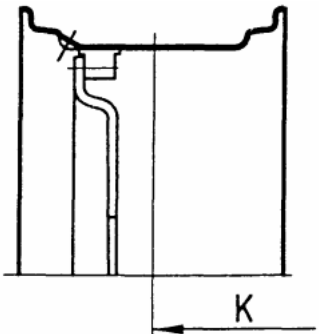


**Setting rear track**

**14.9-30 tire  
DW12-30 wheel**

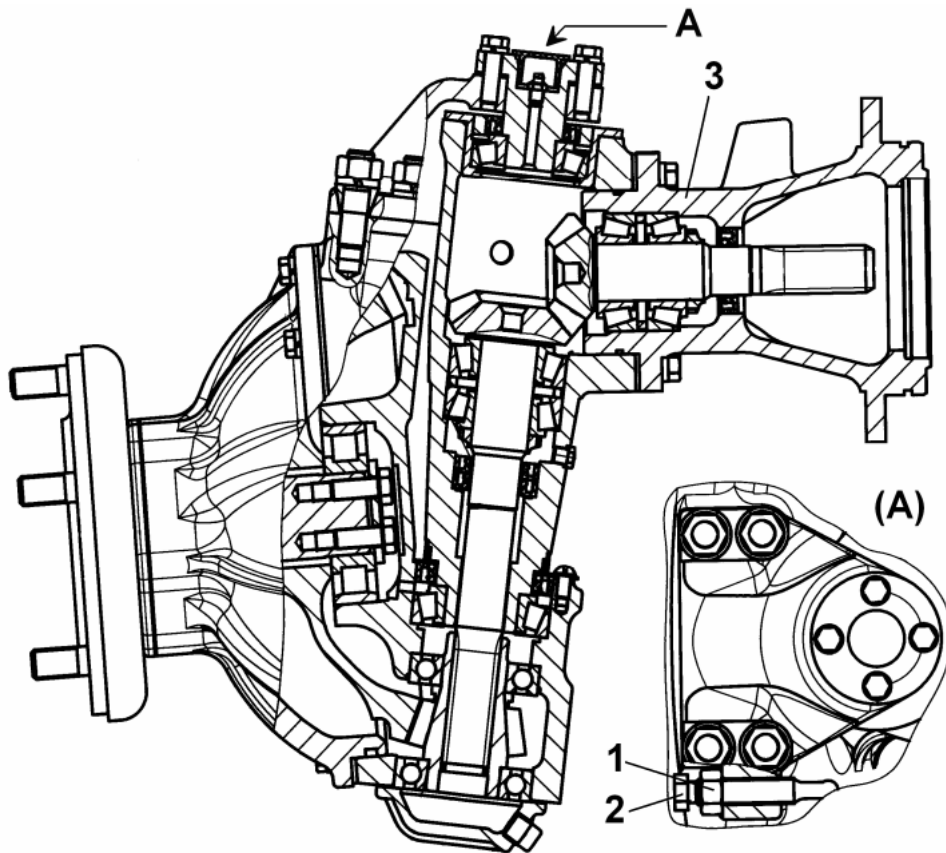
Wheel mounting scheme	Track width, K, mm	Notes
	1220	Disk is interfacing with the hub. Disk enforcing ring is outside. Rim bracket is installed at recess at the disk face.
	1432	Wheels are interchanged between sides. Disk enforcing ring is interfacing with the hub. Rim bracket is installed at recess inside.

**420/70R24 tire  
W12x24 wheel**

Wheel mounting scheme	Track width, K, mm	Notes
	1220	Other variants are not recommended.

## FDA reduction gear turning angle adjustment

Angle of upper pair (3) turn to the neutral position should be equal to  $55^{\circ} \pm 1^{\circ}$ . It is adjusted by screwing bolt (2) in. After adjustment lock the bolt (2) with nut (1) to 70-80 Nm.



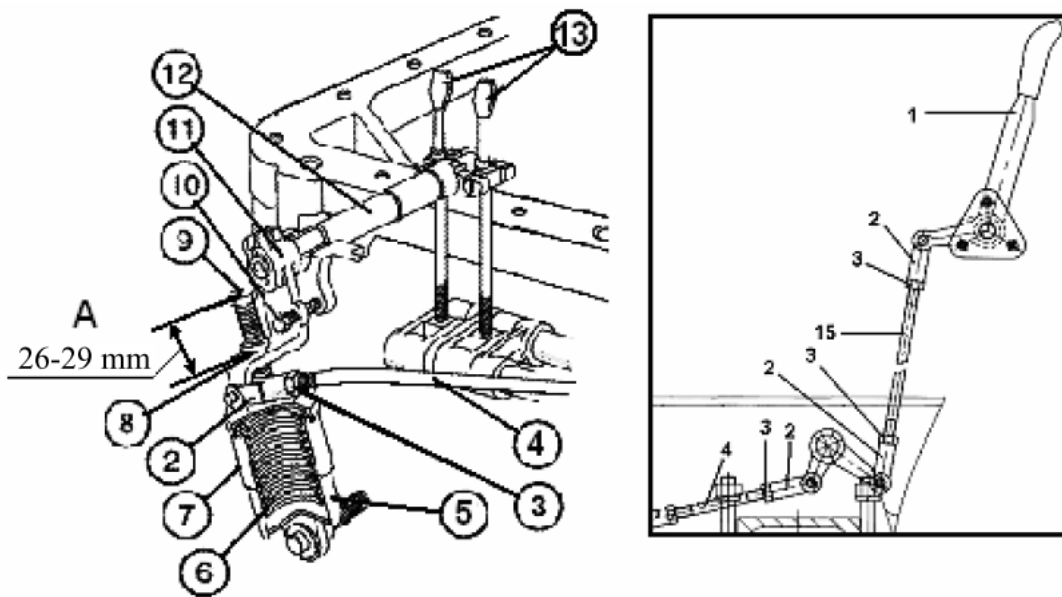
## Adjusting rear PTO control mechanism

At assembly at the factory or after repair (e.g. after brake band replacement) control mechanism should be adjusted as follows:

1. Set eccentric axle (15) (fig. 2) to initial position with flattened surface B vertical and fasten with lock bar (17) and bolt (17).
2. Disconnect rod (4) (fig. 1).
3. Unscrew bolt (9) to release spring (6).
4. For the sake of safe unit disassembly ensure constant contact between upper sleeve (7) and bolt (9) while unscrewing the bolt until the spring is completely released.
5. Remove the rear axle cap to access screws (13) (fig. 1).
6. Fix arm (11) neutral inserting M10x10 bolt or  $\varnothing 8$ mm stud (10) into a bore in

the arm and corresponding hole in the rear axle case.

7. Remove lock bar (26) (fig. 2), tighten screws (21) to 10 kgf (1 kgf·m) with a wrench or 100mm pliers. Then loosen each screw by 2-2.5 turns.
8. Remove bolt (stud) (10) (fig. 1) holding arm (11) in initial position for adjustment.
9. Screw bolt (9) in directing its tip into a recess at the sleeve cap (7) to get A dimension equal to 26-29 mm.
10. Shift arm (11) back to ON position.
11. Install rod (4) (fig. 1). Adjusting rods (4) and (15) ensure arm (1) rocking area in the middle of the control board opening. Upon completion of adjustment replace the stop plate (26) (fig. 2) and rear axle cap, lock rods (4) and (15) and bolt (9) (fig. 1).



**Fig.1. Rear PTO control:**

1 – Control arm; 2 – Adjusting fork; 3, 8 – Locknuts; 4 – Rod; 6 – Springs; 7 – Outer sleeve; 9 – Stop bolt; 10 – Adjusting bolt (for adjustment only); 11 – Control roller arm; 12 – Control roller; 13 – Adjusting screws; 14 – Inner sleeve; 15 – Rod.

If

- PTO slips,
  - Switching force at arm (1) exceeds 12-15 kgf (120-150 Nm),
  - Brake bands are partially worn,
- then adjust band brakes (PTO cap allows external adjustment to ensure maximum efficiency of external readjustment by turning eccentric shaft by 180°) as follows:

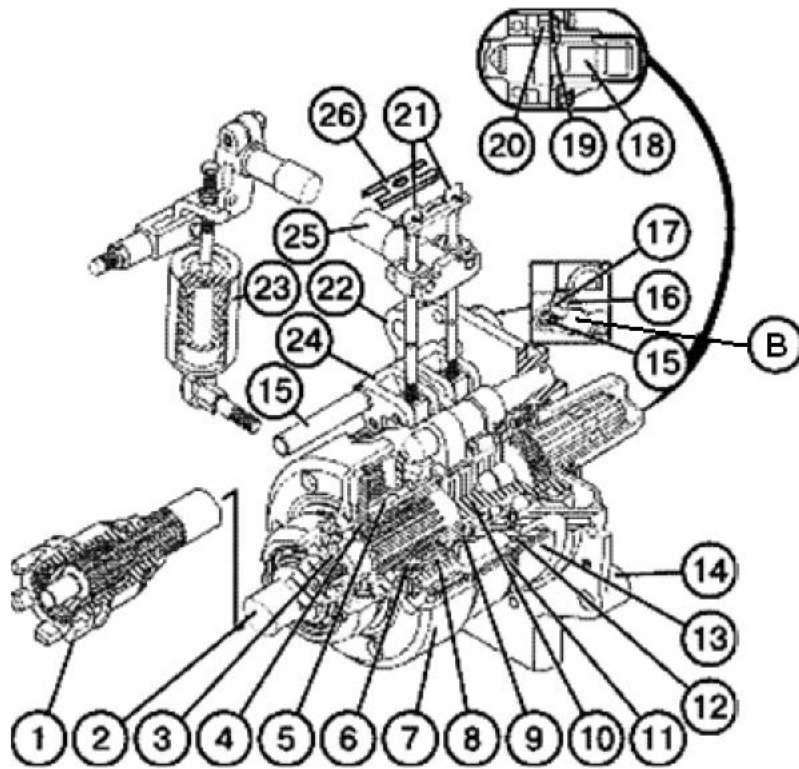
1. Set arm (11) (fig. 1) to neutral position and fix it inserting Ø8mm stud (10) or M10x60 bolt into a bore in the arm (11) and corresponding hole in the rear axle case.
2. Unscrew bolt (16) (fig. 2), remove plate (17) from splined end at axle (15).
3. Turn eccentric axle (15) clockwise with S=13mm wrench to get required clearance between brake band and PTO drum (PTO end cannot be turn by hand).

4. Replace plate (17) and tighten bolt (16).
5. Remove stopping bolt or stud from arm (11) (fig. 1).

After several external adjustments eccentric axle may take the most left position (with flattened surface B placed vertically to the left), indicating used external adjustment reserve.

In that case set eccentric axle to initial position turning it counterclockwise (flattened surface vertically to the right). Then perform adjustment as describe above (during assembly at the factory or after repair to PTO).

In other cases it is preferably to correct fault by changing rod length and basic adjustment.



**Fig. 2. Planetary reduction gear of rear PTO:**

1 – Drive switching clutch; 2 – Crown gear shaft; 3 – Nut; 4 – Carrier; 5 – Sun gear; 6 – Satellite; 7 – Crown gear; 8 – Satellite axle; 9 – Brake drum; 10 – PTO; 11, 13 – Brake band; 12 – Switching drum; 14 – Rear cover; 15 – Eccentric axle; 16 – Lock bar fixing bolt; 17 – Lock bar; 18 – Removable end; 19 – Lock bar of removable plate; 20 – End fixing bolt; 21 – Adjusting screws; 22, 24 – Arm; 23 – Spring unit; 25 – Control roller; 26 – Adjusting screw lock bar.

### Clutch drive

Clutch drive is used to control friction clutch. It is of hydrostatic type, with suspended pedal. Drive consists of the main cylinder (1) (fig. 3), suspended pedal (9), elbow (12), actuating cylinder (19), arm (14), tank (2), piping (11), flexible sleeve (13), bracket (22), and backward springs (3), (23).

Pressing pedal (9) makes brake fluid pass from the main cylinder (1) via piping (11), elbow (12), and flexible sleeve (13) to actuating cylinder (19), moving rod (18). Rod (18) turns arm (14) connected to the friction clutch shifter through the shaft disconnecting engine and transmission.

Brake fluid “Neva-M” (TU 2451-053-37632629-2003) is used as working fluid in clutch actuating system.

### Clutch control adjustment

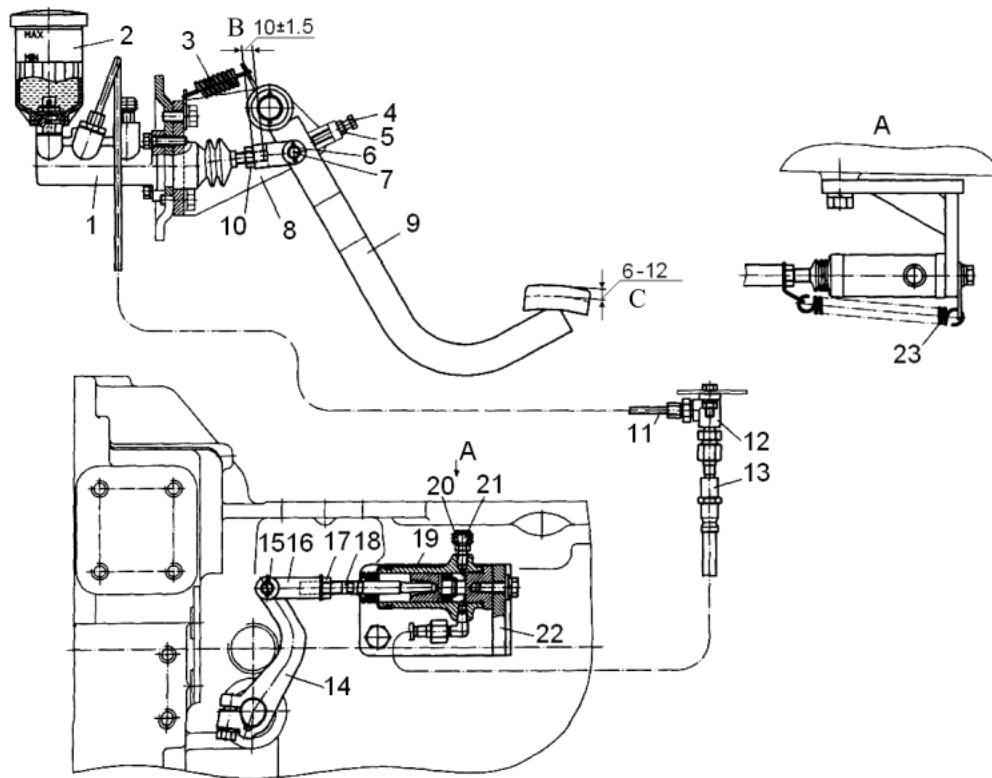
Clutch control is adjusted as follows:

#### 1. Adjusting clearance between piston and piston tappet of the main cylinder (1):

1. Screw main cylinder (1) (fig. 3) tappet into the fork (6) observing B dimension ( $10 \pm 1.5\text{mm}$ ), tighten nut (10).
2. Rotating bolt (4) adjust free travel of pedal (9) measured at the cover center within C dimension (6-12mm) to ensure clearance between piston and piston tappet of the main cylinder (1).
3. Tighten nut (5).

#### 2. Adjusting free travel of clutch shifter:

1. Remove backward spring (23) from actuating cylinder (19).
2. Remove pin (15) to disconnect rod (18) from arm (14).



**Fig. 3. Clutch control:**

1 – Main cylinder; 2 – Tank; 3, 23 – Backward spring; 4 – Bolt; 5, 10, 17 – Nut; 6, 16 – Fork; 7, 15 – Pin; 8, 22 – Bracket; 9 – Pedal; 11 – Piping; 12 – Elbow; 13 – Flexible sleeve; 14 – Arm; 18 – Rod; 19 – Actuating cylinder; 20 – Protective cap; 21 – Bypass valve.

3. Turn arm (14) counterclockwise until release bearing thrusts against release lever.
4. Holding rod (18) into actuating cylinder (19) piston to stop turn fork (16) to align bores in arm (14) and the fork. Screw fork (16) in by 5-5.5 turns (6-7 mm) and connect to the arm with pin (15).
5. Tighten locknut (17), cotter pin (15), and put backward spring (23) on.

3. Tighten bypass valve (21) and release clutch pedal.
4. Flush the system until there are no air bubbles in discharged brake fluid.
5. Remove the hose and put protective cap (20) on.
6. Check brake fluid level in tank (2) and add, if necessary.

### Flushing clutch control hydraulic system

1. Fill tank (2) with brake fluid to MAX mark. Remove protective cap (20) and put rubber hose onto bypass valve (21) head. Put the other end of the hose into a reservoir with brake fluid.
2. Press clutch pedal several times. Holding it pressed unscrew bypass valve (21) by a quarter-turn to discharge excessive brake fluid with air bubbles into a reservoir with brake fluid.

**ATTENTION!** Keep brake fluid level in tank (2) between MIN and MAX marks while flushing the system.

Having verified clutch control adjustment, check clutch engagement fineness as follows:

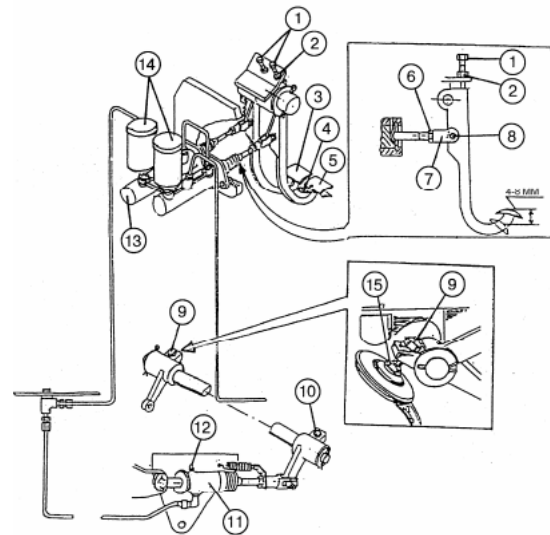
1. Start the engine and set its speed at  $1400 \pm 100$  RPM.
2. Engage parking brake.
3. Fully press friction clutch pedal and in 5 seconds, not less, engage gears. Engagement should be “fine”, with no unwanted sounds, otherwise repeat adjustment check.

## Adjusting main brakes

**IMPORTANT!** Adjust working pressure with parking brake rod and pneumatic valve rod disconnected.

Adjust working brakes as follows:

1. Loosen locknuts (2) and set left and right brake pedal (3), (5) pads coplanar with stop bolts (1) so as to allow easy pedal junction with junction plate (4). Tighten locknuts (2).
2. Adjust free travel of the right brake pedal (clearance between piston and piston tappet of the main cylinder for the right brake) with fork (7) as follows:
  - Loosen locknut (6), uncotter and remove pin (8);
  - Turn fork (7) to ensure free travel of the pedal from initial position to the moment of the tappet contact to the piston, measured at the pedal pad center, equal to 4-8 mm;
  - Connect fork (7) to the brake pedal with pin (8), tighten locknut (6) and cotter the pin.
3. Repeat above operations for the left brake pedal (5).
4. Flush brake actuating hydraulic system as follows:
  - Fill tanks (14) with recommended brake fluid to MAX mark or to the level of  $15 \pm 5$  mm to the upper edge of the tank;
  - Remove dust and dirt from valves (12), remove caps from the valves and put hoses onto actuating cylinder valve heads. Put the other ends of the hoses into transparent containers half-full of brake fluid;
  - Interconnect pedals with junction plate (4);
  - Unscrew valves (12) of the left and right actuating cylinders (11) by 1/2-3/4 turn, press brake pedals several times and tighten valves of the both cylinders holding the pedals pressed. Release pedals (press quickly, release smoothly);
  - Flush the system until there are no more bubbles leaving the hose put into container with brake fluid;



- Press interconnected pedals several times until it starting to resist. Keep pedals pressed and open valve (12) of the left actuating cylinder by 1/2-3/4 turn to discharge fluid with air bubbles from the system through the hose. Shift pedals forward to stop, close the valve and release pedals.

Repeat the procedure several times to completely remove air.

Repeat the procedures above for the right actuating cylinder.

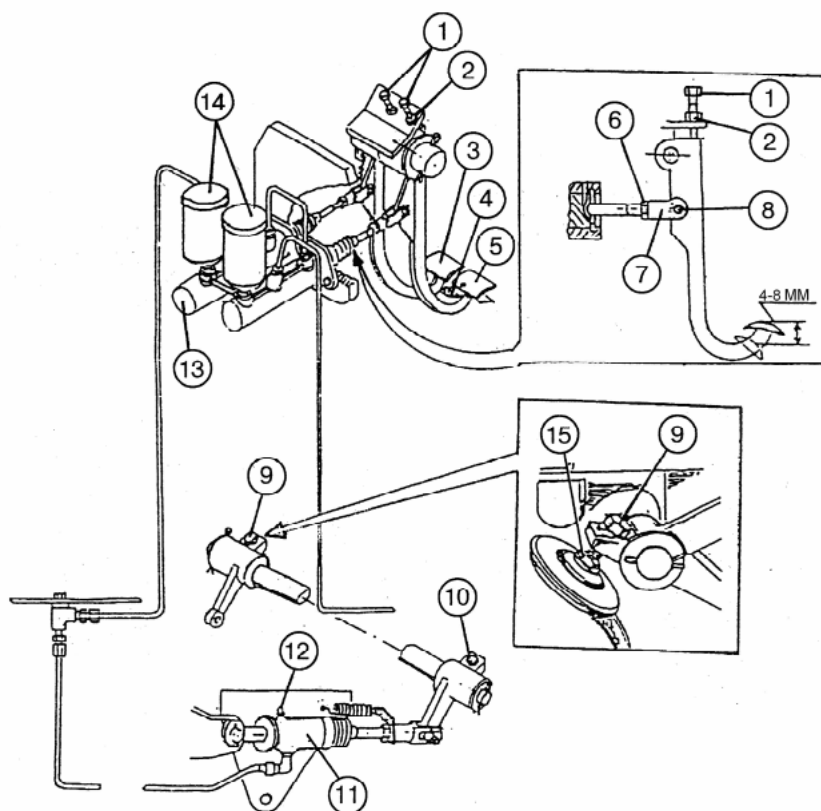
Observe fluid level in the tanks while flushing, do not let it down below MIN mark (1/3-1/4 of the tank capacity).

Having completed flushing, put protective caps on and add fluid to MAX mark or to the level at  $15 \pm 5$  mm from the top edge of the tank.

Verify free pedals stroke separately with force equal to  $300 \pm 10$  N ( $30 \pm 1$  kgf). The stroke should be equal to 100-120 mm, otherwise adjust the stroke as follows:

1. Unscrew locknuts (15) of bolts (9) and (10) by several turns.
2. Rotate bolts (9) and (10) to set required pedal stroke.
3. Lock the bolts.

Check brakes operability in motion and, if necessary, readjust to ensure simultaneous braking start for both wheels with bolts (9) and (10) as follows: unscrew locknut (15) of lagging wheel brake and screw adjusting bolt in to make braking start simultaneous; tighten locknuts (15).



**IMPORTANT!** Braking distance should not exceed 6 m when driving at 20 km/h at dry asphalt with interconnected brake pedals. Braking nonsimultaneity should not exceed 0.5 m, driving path should keep straight.

## Parking brake

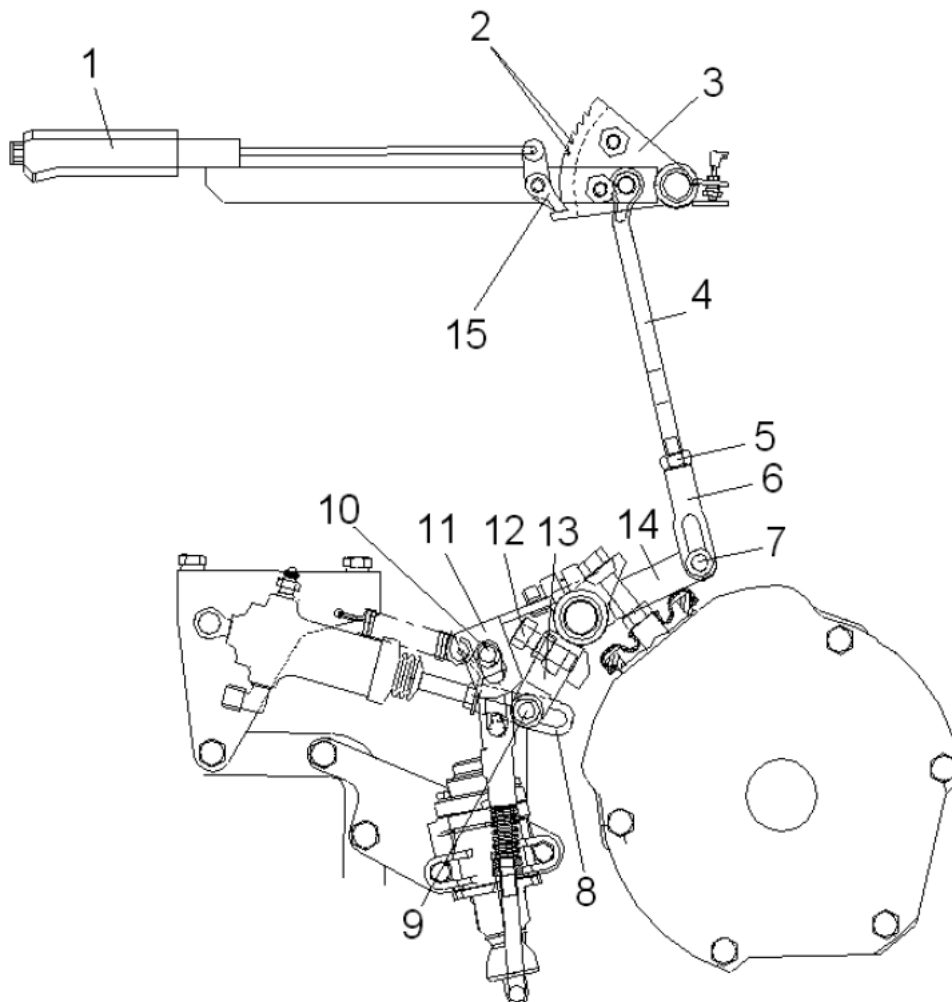
**IMPORTANT!** Parking brake should be adjusted after main brake pedals only.

Parking brake should be adjusted as follows:

1. Uncotter and remove pin (7). Disconnect fork (6) from arm (14).
2. Uncotter and remove pin (10) with washers to disconnect brake valve rod from arm (11).
3. Screw bolts (12) into parking brake control arms (13) to set clearance between their edges and brake lever plates. Ensure no gap between actuating cylinder fork (8) groove edge and brake lever pin (9).

4. Loosen locknut (5) and turn fork (6) to change rod (4) length so that pin (7) freely connects the rod to the lever (14). Lock the rod with locknut (5) and cotter the pin.
5. Connect brake valve rod to lever (11) placing washers and ensuring 1-2 mm gap between pin (10) and upper edge of lever (11) groove. Cotter the pin (see adjusting brake valve and its actuator).

With correctly adjusted brake 400N force at handle (1) should make latch (15) secure the handle at tooth 2-4 of sector (3) and ensure tractor holding at 18% slope.

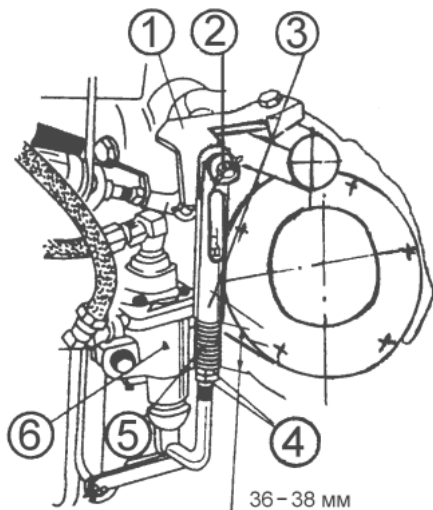




## Checking and adjusting brake valve of pneumatic system and its actuator

Pneumatic line of trailer brakes features brake valve (6). Check and adjust, if necessary, brake valve operation to ensure correct operation of the brake valve and brakes of trailers connected to the tractor.

Perform adjustment with free brake controls after main brakes and parking brake adjustment.



### For single-line pneumatic drive:

1. Connect pressure gauge of not less than 10 kgf/cm<sup>2</sup> capacity to a connection head of the tractor's pneumatic system.
2. Switch compressor on and pressurize the tank up to 7.7-8.0 kgf/cm<sup>2</sup> according to an air pressure gauge at the dashboard. Pressure gauge connected to connection head should indicate pressure of not less than 7.7 kgf/cm<sup>2</sup>, otherwise act as follows:
  - Verify 1-2 mm gap between pin (2) and upper edge of lever (1) groove;
  - If there is no gap, uncotter and remove pin (2) and rotate tip (3) to set rod length;
  - Check and adjust, if necessary, spring (5) precompression to 36-38 mm rotating nuts (4). Then lock the nuts.

Pressure readings at pressure gauge connected to the connection head should fall to null with correctly adjusted brake valve actuator when interconnected brake pedals are fully pressed or parking brake is engaged to stop at tooth 2-4.

3. Disconnect pressure gauge from connection head.

### For double-line pneumatic drive:

1. Connect pressure gauge of not less than 10 kgf/cm<sup>2</sup> capacity to the control line connection head with yellow cap.
2. Switch compressor on and pressurize the tank up to 7.7-8.0 kgf/cm<sup>2</sup> according to an air pressure gauge at the dashboard. Pressure gauge connected to connection head should indicate pressure of 0 kgf/cm<sup>2</sup>, otherwise act as follows:
  - Verify 1-2 mm gap between pin (2) and upper edge of lever (1) groove;
  - If there is no gap, uncotter and remove pin (2) and rotate tip (3) to set rod length;
  - Check and adjust, if necessary, spring (5) precompression to 36-38 mm rotating nuts (4). Then lock the nuts.
  - Pressure readings at pressure gauge connected to the connection head should rise to 6.5-8.0 kgf/cm<sup>2</sup> with correctly adjusted brake valve actuator when interconnected brake pedals are fully pressed or parking brake is engaged to stop at tooth 2-4.
  - Disconnect pressure gauge from connection head.

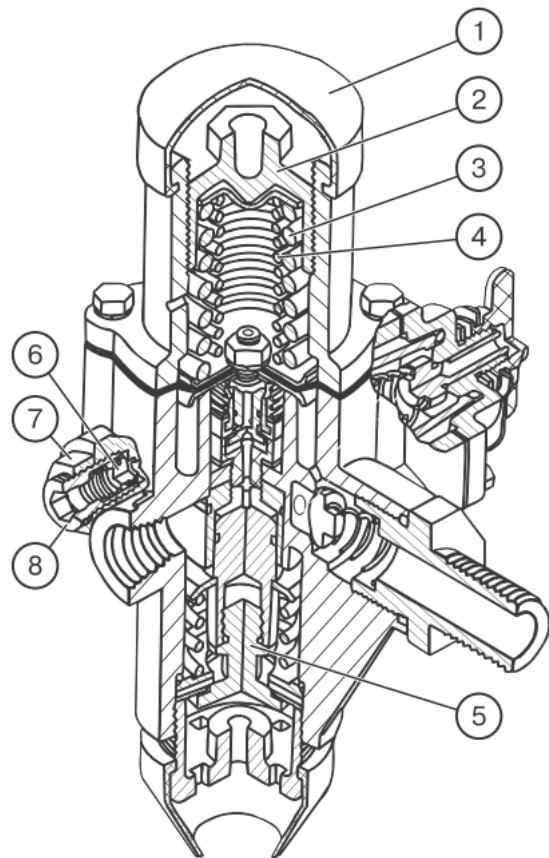
If brake valve actuator adjustment cannot ensure the above pressure settings dismount the brake valve and send to a workshop for repair.

**IMPORTANT!** Pressure readings at pressure gauge connected to the connection head should fall to null for a single-line system and to rise to 6.5-8.0 kgf/cm<sup>2</sup> for a double-line system with correctly adjusted brake valve actuator when interconnected brake pedals are fully pressed or parking brake is engaged.

### Checking and adjusting pressure regulator of pneumatic system

After 100 working hours (TM-3), in case of incorrect pressure regulator operation or after its disassembly for cleaning or worn parts replacement the pressure regulator should be adjusted as follows:

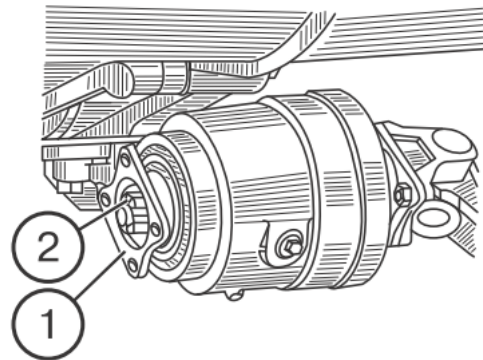
1. Connect a pressure gauge with 0.1-0.2 kgf/cm<sup>2</sup> graduating marks and not less than 16 kgf/cm<sup>2</sup> capacity to perform check and adjustment.
2. Remove cap (1).
3. Fully screw cap (2) into the casing with a wrench.
4. Start engine. Switch compressor on and pressurize the tank with air until safety valve (6) is activated at pressure of 8.5-10 kgf/cm<sup>2</sup>. Loose locknut (7) and adjust the safety valve activated at pressure exceeding the said range with screw (8). Tighten the locknut.
5. Screw cap (2) in gradually to adjust force of springs (3, 4) to ensure discharge valve (5) opening at 7.7-8.0 kgf/cm<sup>2</sup> in the tank.
6. Fasten the cap (2) the required position with paint applied to the casing thread, put cover (1) on.
7. Partly open condensate discharge valve of the tank and depressurize the tank to 6.5-7.0 kgf/cm<sup>2</sup>. Valve (5) should close and switch the compressor to tank pressurization mode.
8. Disconnect control pressure gauge from the tank.



## Adjusting FDA cardan shaft

Adjust safety coupling in intermediate bearing and verify cardan bearings play for the cardan drive.

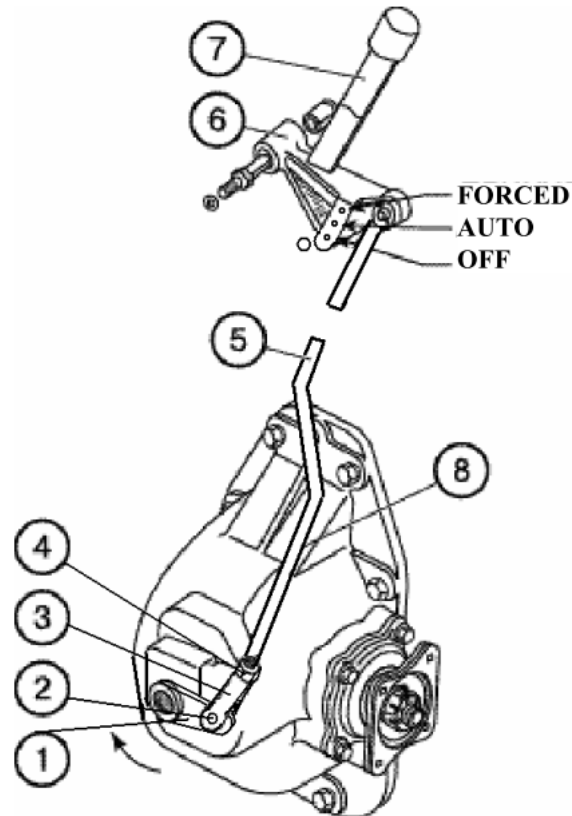
Tighten flange (1) nut (2) of the rear intermediate bearing shaft end to set the safety coupling to transfer 40-80 kgf·m (400-800 Nm) of torque.



## Adjusting FDA drive transfer box control rod

Adjust the rod as follows:

1. Set lever (7) to “FDA ON forcedly” position (upper fixed position).
2. Loosen locknut (4) by 2-3 turns, uncotter and remove pin (2).
3. Turn lever (1) clockwise to the lowest position (to completely engage transfer box (8)).
4. Rotate fork (3) to adjust rod (5) length so that pin (2) freely enters bores in fork (3) and lever (1) turned clockwise to stop.
5. Tighten locknut (4) and cotter pin (2).



## Section 8. RIGGING

### Hitches and towing couples

#### Rear hitch NU-2

Is used for the following applications: hitched machines (ploughs, cultivators, mills, etc.), semihitched machines (ploughs, tillers, etc.).

Hitch with quick coupler		Rear three-point device
Type (category)		NU-2 (cat. 2)
Lower rods		Solids
Lower rod length*, mm		885
Rod pivot length, mm	Upper	51
	Lower	45
Rated length of connection elements, mm	Upper rod pin	25
	Lower rod pivot bores	28.7
Distance between PTO edge and platform axle, mm		587
Platform axle load capacity, kN		45

\* With platform axle length equal to 870 mm.

#### TCY-1Ж-01 (double crossbar)

Is used for the following applications: semihitched machines (seeders, vegetables harvester, etc.), semitrailed machines (croppers, balers, etc.)

	TCY-1Ж-01 (double crossbar)	TCY-1 (single crossbar)*	TCY-3B (fork)
	RH element	Mounted on platform axle (on request)	Mounted independently (on request)
Distance between PTO edge and link pin axle, mm	400	596	400
Link pin diameter, mm	30	30	40
Vertical load on TC, kN	12	6.5	6.5
Machine turn angle in relation to the tractor with removed jaws, degree	60	80	80

\* Crossbar for platform axle per DIN 9676.

Rear hitch NU-2 is produced per cat. 2 and allows coupling machines from cl. 1.4 and 0.9 tractor sets. The hitch features solid lower rods connected to TCY-1Ж-01 crossbar (double crossbar for agricultural machine lugs) for cat. 2 PTO drive.

Lower rods are transversally locked with internal telescopic drawbars capable to allow lower rods rocking within  $\pm 55$  mm.

Hookup rods feature automatic jaws allowing quick machine and tool coupling.

Hitch platform axle may be equipped with a crossbar for agricultural machines with TCY-1 fork. Using PTO requires cardan shaft of 1000mm rated length so that machine coupling point in relation to the crossbar is in the cardan shaft center. Otherwise PTO drive would be overloaded.

TCY-3B fork is used for trailers.

The tractor has 4 pairs of free hydraulic outputs (right side is connected to the right rear one) to service coupled machinery with included high-pressure sleeves. Outputs ensure not less than 45 l/min oil flow rate (depending on hydraulic pump technical state). Oil takeoff by hydraulic cylinders

of the coupled machine should not exceed 16 l. check oil level in hydraulic tank with working cylinder rods retracted.

Locking and interrupting devices (enveloping half-couplings and interrupters included into SPS) are provided to prevent oil loss during machinery coupling or at unpredictable disconnection.

Power may be hydrostatically taken off through an output (see “Section 5. Controls and instruments”, handle (4) at p. 5-6) with fixed “Lifting Up” position to actuate auxiliary hydraulic motors. Working pressure should not exceed 11 MPa to avoid hydraulic system overheating. Use separate line to discharge oil from hydraulic motor bypassing the distributor.

The tractor is equipped with fittings with phantom flow section  $D_U=12\text{mm}$  and M20x1.5 thread. Use appropriate adapters with phantom flow section of not less than  $D_U=12\text{mm}$  in order to connect machines with other fittings.

### Steerability and axle load criteria

Hitching with the rear hitch is one of the most widely used ways to couple machinery. It creates need to ensure longitudinal stability of TMA without prejudice to tractor steerability.

Longitudinal stability is measured with steerability criterion being a ratio of steering axle load to the tractor’s service weight:

$$K_U = \frac{M_P}{M_{EM}} \geq 0.2$$

$K_U$  – tractor steerability factor;

$M_P$  – share of full service weight of tractor acting on the front wheels of a tractor coupled with machine;

$M_{EM}$  – tractor service weight without machine.

Required steerability factor is achieved with placing ballast weights (available on request). However, the ballast may be used to improve towing capacity of the tractor.

Permissible axle loads:

Tractor axle	$M_{MIN} \dots M_{MAX}$ , t
Front	$M_P = 2$ t
Rear	$M_Z = 4$ t

but not exceeding overall load capacity of single front or rear wheel tires. Overall load acting on the tractor wheels should never exceed  $M_P + M_Z \leq 6$  t.

**Rear hitch (RH).**  
**Towing coupler (TC) – crossbar.**  
 (standard version)

RH and TC are united into a single assembly mounted on brackets at the rear axle casing sides (fig. 1). RH connection points are represented by Walterscheid automatic jaws and correspond to the second category. RH is lifted up and down with hydraulic jack levers. Distance between connection points of the lower rods is the platform axle length at jaw pivots and is equal to 870 mm. The crossbar is used for trailed agricultural machines, connection pin (kingpin) diameter is 30 mm. The crossbar ensures standard distance between jaws.

Tip are fastened to the lower rod ends with pins 6 and split pins with rings. Pins may be inserted into either upper or lower, biased, bores at the tips to ensure the platform axle length equal to 870 mm. Telescopic drawbars (TS) (fig. 2) lock the lower rods (tool) or rocking within  $\pm 55$  mm.

Locked position is used for operation with hitched and trailed agricultural machines and tools, save for machines with active operating elements (mills, etc.).

To lock insert splined pin (4) into the outer tube (2) bore (5) and the inner tube (2) bore aligned by rotating screw (1) with a handle (6).

To ensure RH rocking:

- Remove splined pin (4) from the tube;
- Install crossbar (9) (fig. 1) symmetrically to longitudinal axis of the tractor;
- Turn a screw to align the inner tube bore at the groove center of the outer one;
- Insert the splined pin into the groove and the bore to lock;
- Lock handle 6 (fig. 2) on flattened surfaces of the inner tube.

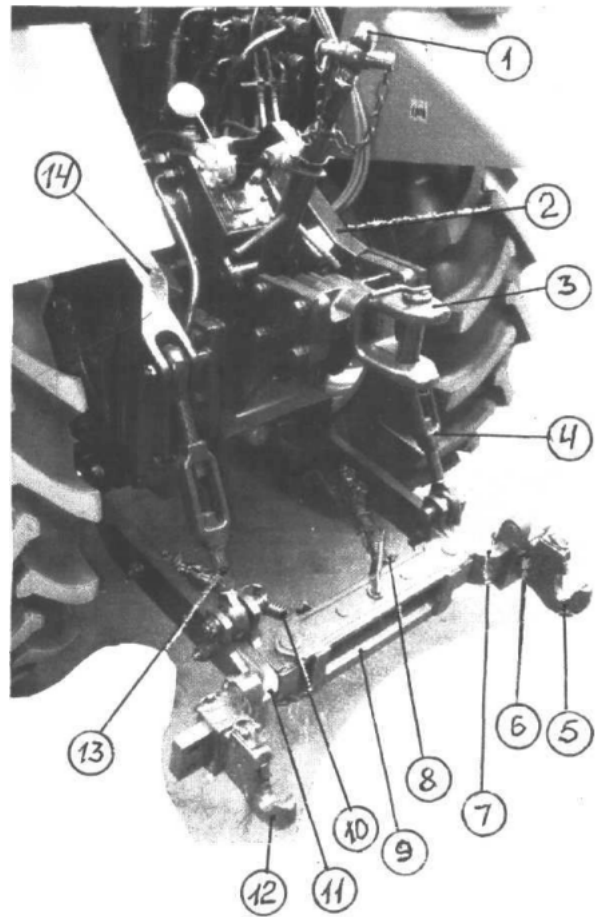


Fig. 1. RH and TC

- 1 – Upper rod;
- 2 – Hydraulic jack lever, right;
- 3 – TC fork;
- 4 – Right brace;
- 5 – Right tip;
- 6 – Pin;
- 7 – Right lower rod;
- 8 – Right telescopic drawbar;
- 9 – Crossbar;
- 10 – Left telescopic drawbar (TS);
- 11 – Left lower rod;
- 12 – Left tip;
- 13 – Left brace;
- 14 – Hydraulic jack lever, left.

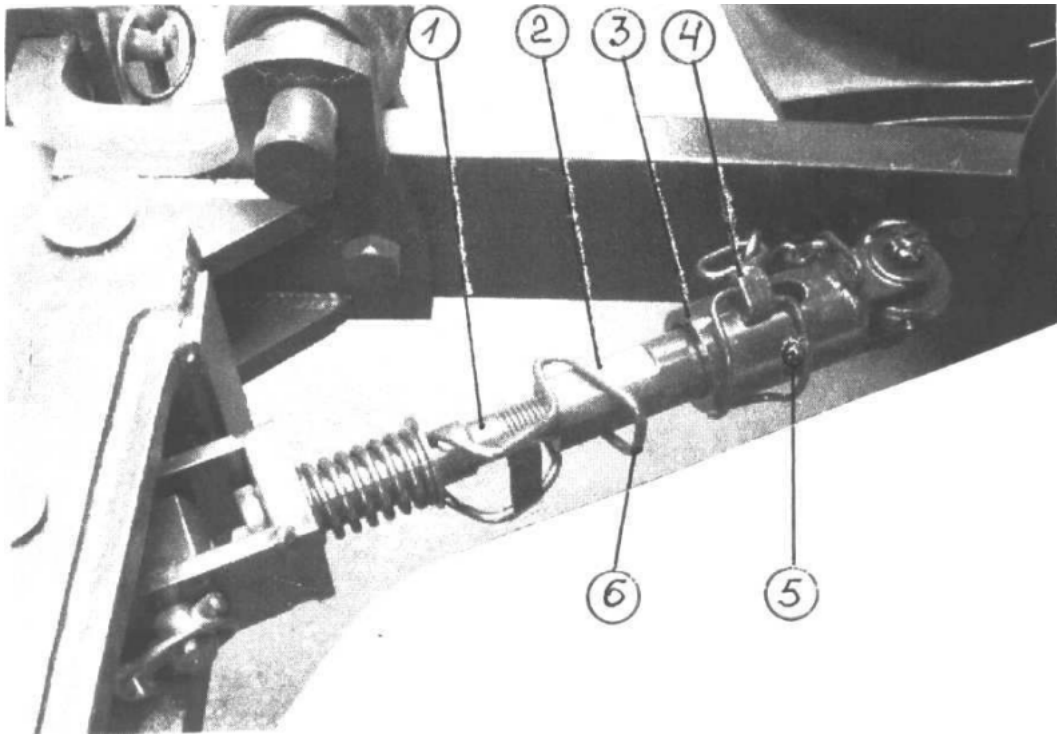


Fig. 2. Telescopic drawbar

1 – Screw; 2 – Inner tube; 3 – Outer tube; 4 – Splined pin; 5 – Outer tube bore; 6 – Handle.

### EQUIPMENT ON REQUEST

**Towing fork (3)** (fig. 1) is used for trailed applications. It is installed at guiding sides fixed to the rear axle casing. The fork is supplied mounted onto a tractor.

**Hitch platform length adjusting mechanism** (fig. 3) is used for applications involving machines and tools with platform axle length within 600-870 mm.

**ATTENTION!** Dismount towing fork when operating RH as follows: unscrew 4 bolts and nuts fixing it to the sides, pull the fork out of the guides.

**ATTENTION!** Dismount the towing fork prior to installing the hitch platform length adjusting mechanism.

In need to work with agricultural machines and tools featuring **irregular hitch axle** install the mechanism as follows according to fig. 3:

- Install drawbar split pins onto the grooves;
- Fasten shackle (10) to plate (7) with pin (8);
- Fasten the fix with a split pin with ring;
- Insert bushing (14) into the shackle eye;
- Push screw (11) through the shackle and bushing. Screw thread should be located to the left. Machined plate edges should be oriented to the tractor;
- Push stud (9) into the bushing and screw bores flush with the bushing surface;
- Put locknuts (13) onto both threaded ends of the screw;
- Put tips (5) and (12) with jaws onto plate (7) (fig. 3). Symmetrically take the tips to threaded ends of screw (11) and insert the screw into eyes (6) of the tips (by hand or with a wrench (S=46), rotating bushing (14));

**ATTENTION!** Removing tips from ends of rods (2) insert pins (1) into the bores in the rods as per fig. 3. Fasten the pins with split pins. Split pins on eyes (6) and (13) of tips (5) and (12) are used to fasten lower rod pivots at their installation onto the tool hitch platform axle. Pivots are included into RH set and supplied with the tractor.

- Fasten the plate and lugs (2) to the rod ends with bolts (4) and nuts and washers tightened to 320-360 Nm.

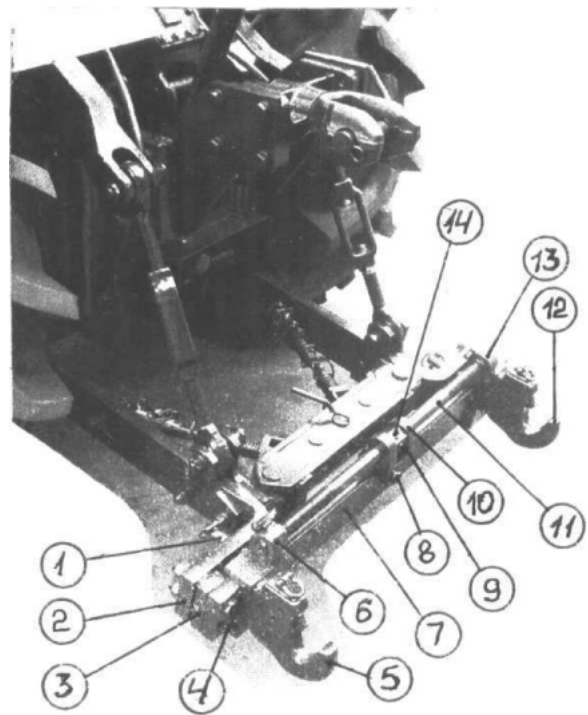


Fig. 3. Tool hitch platform axle length adjusting mechanism

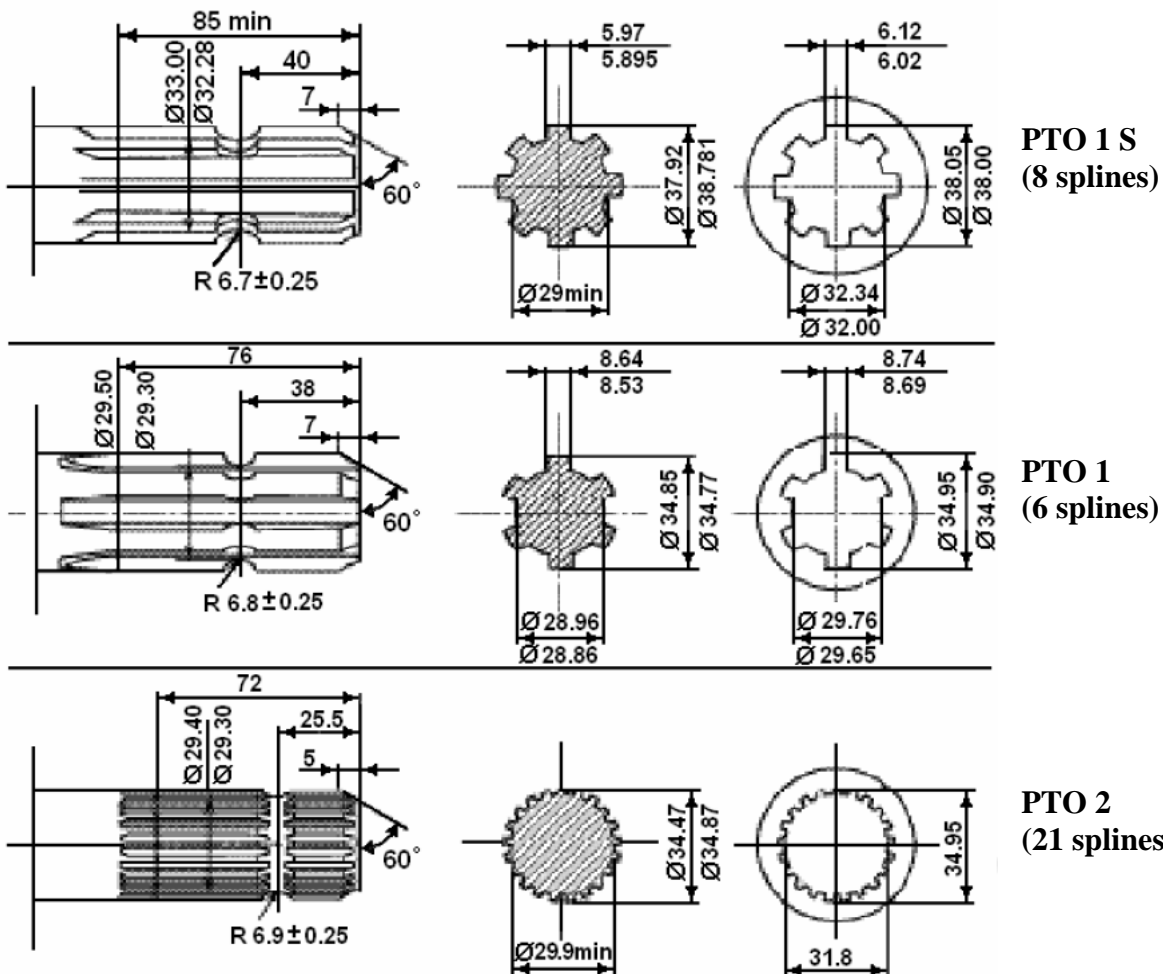
- 1 – Pin;
- 2 – Rod;
- 3 – Spacer;
- 4 – Bolts and nuts;
- 5 – Left tip;
- 6 – Left tip eye;
- 7 – Plate;
- 8 – Pin;
- 9 – Stud;
- 10 – Shackle;
- 11 – Screw;
- 12 – Right tip;
- 13 – Right tip eye;
- 14 – Bushing with hexahedron.



## PTO and machine drive

Tractor: PTO end

Machine: PIC bushing



PTO	End type	Rotation speed, RPM		Transferred power, kW (HP)
		PTO	Engine	
Independent drive	PTO 1S	540	1631 (2081 <sup>*</sup> )	59.4 (80.91) (53.4 (72.5)) <sup>*</sup>
	PTO 1	540	1631 (2081 <sup>*</sup> )	
	PTO 2	1000	1673 (2184 <sup>*</sup> )	
Synchronous drive	PTO 1S PTO 1 PTO 2	3.9 rotations per meter 14.9R30 tires		

<sup>\*</sup> For MTZ-821/821.2

Such position of the hitched machine PIC in relation to the tractor's PTO allows using standard cardan shafts.

Rear PTO ensures synchronous machine actuation (active semitrailers, planting machines, etc.) regardless applied end type. Drive speed should not exceed 8 km/h.

In order to avoid overloading PTO drive with coupled inertia machines (balers, harvesting combines, etc.) use cardan shafts with overrunning clutches on PIC side.

Using rear PTO for 540 RPM install safety coupling on PIC side to limit power takeoff over permissible values. Safety coupling may be used as well for overload protection of the drive.

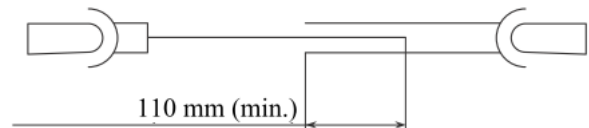
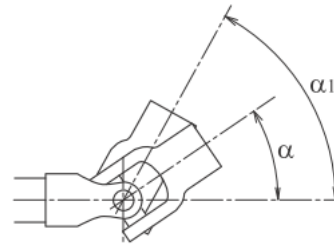
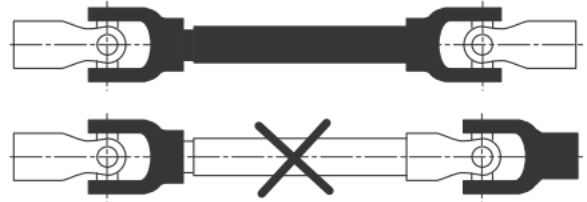
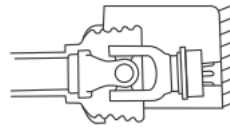
### Cardan shaft installation

Using cardan shaft with protective covering and PTO protecting bridge ensures safe connection.

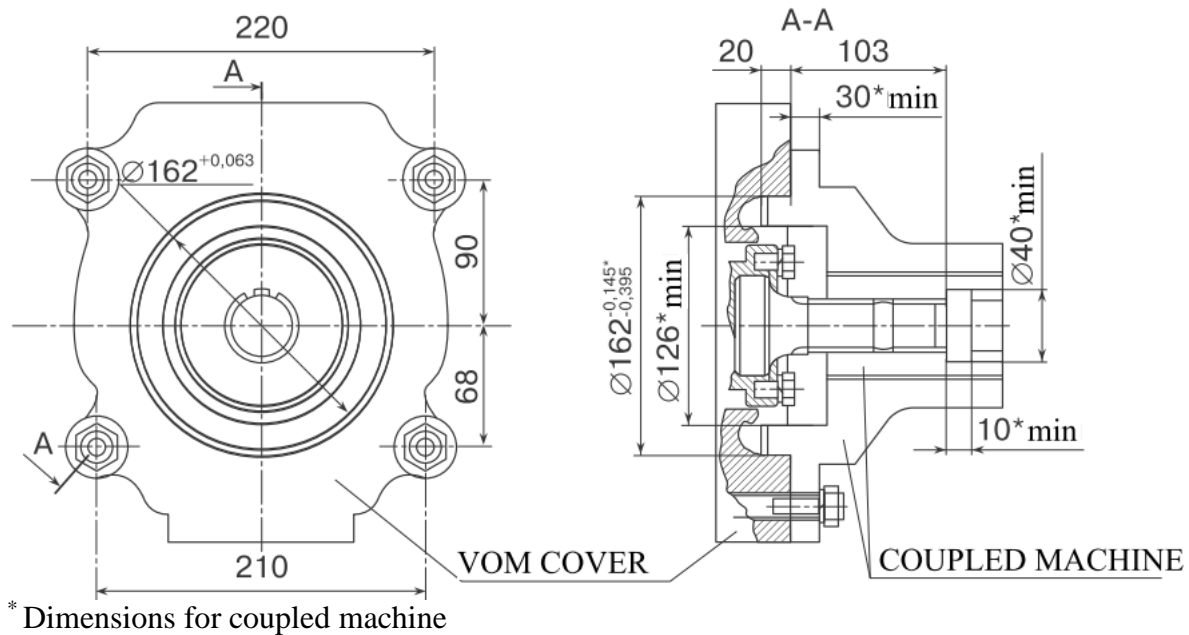
End forks should be coplanar.

PTO	Cardan ball joint inclination angle (deg., max.)	
	Universal	Constant-velocity
Engaged	22	25
Disengaged	55	(50 briefly)

Telescopic elements of cardan shaft should overlap by not less than 110 mm in order to avoid disconnection and jamming.



## Shaftless PTO drive



Certain machines may be installed on PTO directly, without cardan shaft (reduction gears, hydraulic pumps, etc.). Ensure case centering per  $\varnothing 162\text{mm}$  in PTO cover. Provide grooves on the edge side and at PTO end spline out in order to avoid damage. PTO cover fixing studs may be replaced with longer ones of the same size, if necessary.

### Mounted machine installation

**ATTENTION!** Mounted machine installation should be agreed with RUPE “MTZ” beforehand.

To connect mounted technical appliances (spraying tanks, loaders, stackers, etc.) the tractor is provided with a series of installation holes suitable for strapping frames (half-frames) and other elements.

### Selecting agricultural machines

There is wide range of various machines and agricultural tools for agricultural tractors. Such technical appliances have various technical performance determined by its type and application. Thus tractor’s operation manual (RE) provides information on tractor’s structure, operational machinery abilities for coupling, loading modes and safety regulations allowing correct machine selection and connection. Anyway, manufacturer’s recommendations are not universal for all operation cases, as even if coupled with the same machine, tractor’s energy performance and machine and soil effect on the tractor may vary greatly in different operation conditions.

**ATTENTION!**

Selecting agricultural machines with active working elements keep in mind, that VON end rotates clockwise (PTO edge view).

When coupling or purchasing certain machines ensure its compatibility with MTZ tractor as follows:

1. Get recommendation by machine's supplier (manufacturer), if possible.
2. Examine machine and tractor operation manuals.
3. Check compatibility:
  - In power consumption;
  - In hitch load capacity;
  - In connection dimensions, including correspondence of PTO and machine's cardan coordinates;
  - In permissible TC, tire and axle loads.
4. Ensure availability of required operational equipment to connect the machine (appropriate PTO end type and dimensions, hoses, cutoff clutches, etc.). Order and purchase equipment for additional charge, if required.
5. Check possibility of tractor driving within TMA: assess steerability and cross-country ability.
6. Check possibility of tractor driving at required by application speeds.
7. Check possibility of common operation (in transport and operating state) of tractor and machine.

The tractor may be coupled with machines of 1.4 drawbar category and of class 2 wheeled tractor's set. Besides, machines of class 0.9 tractor's set may be used in harsh conditions or at heavy soils. Hitches and towing devices, PTOs and hydraulic outputs are internationally standardized, allowing connection of foreign machines.

Tool coverage and tillage depth generally depend on specific soil resistance that determines working speed diagnosis considering agricultural requirements. The heavier soil, the higher specific resistance.

Technical appliance	Specific resistance, kN (kgf)	Possible coverage, M
Ploughs		
Soils: heavy	18-25 (1800-2500)	0.7
medium	12-14 (1200-1400)	1.0
light	6-8 (600-800)	To 1.7
Disk harrows	1.6-2.1 (160-210)	To 6.0
Share scufflers	6.0-10.0 (600-1000)	To 1.4-2.0
Cultivators	1.6-3.0 (160-300)	4-8
Seeding machines	1.2-1.8 (120-180)	To 7.2
Harvesters	1.2-1.5 (120-150)	To 9
Combines:		
clippers	2.6-3.3 (260-330)	1.4
Potato combines	10-12 (1000-1200)	1.4

Two bores for self-tapping screws may be drilled inside the cab side panel to install coupled machine operation control board.

**ATTENTION!**

Consider the following when connecting TMA:

In any case of tractor operation with or without the machine overall axle loads may exceed maximum permissible tractor's service weight;

Front axle load should always (with or without the coupled machine) be equal to not less than 20% (0.2) of tractor's service weight;

Using safety chains (ropes) for trailers and semitrailers is obligatory;

Hydraulic systems of the tractor and coupled machines should always be connected with cutoff clutches;

Never use connecting oil lines with flow section less than 12 mm as it causes oil overheating in hydraulic system and early pump breakdown;

Coupled machine's cardan should be equipped with safety devices (safety cover or guards).

**Transport works**

Almost half time the tractor is used in transport and has access to public roads. Thus transport TMAs are subject to higher safety requirements.

According to GOST tractor trailers and semitrailers should be equipped with main and parking brakes, safety chains or ropes. Main brakes system is of single-line type and is controlled from operator's working place. Parking brake actuator should be located at the machine.

Vehicles are connected via TCY-1Ж-01 at TMA driving speed not exceeding 15 km/h.

Trailers and semitrailers should have maximum speed limit sign located at the rear to the left.

TMA overall dimensions should not exceed 2.5 m in width and 3.8 m in height to have access to public roads, otherwise it should be agreed with road police.

Vehicle's load capacity depends on land relief, road slope and condition. Overall semitrailer (trailer) weight should not exceed 6000 kg considering permissible longitudinal slope in 12°.

The tractor is provided with combined multipin socket with coupled machine equipment feeding jack according to GOST and ISO standard.

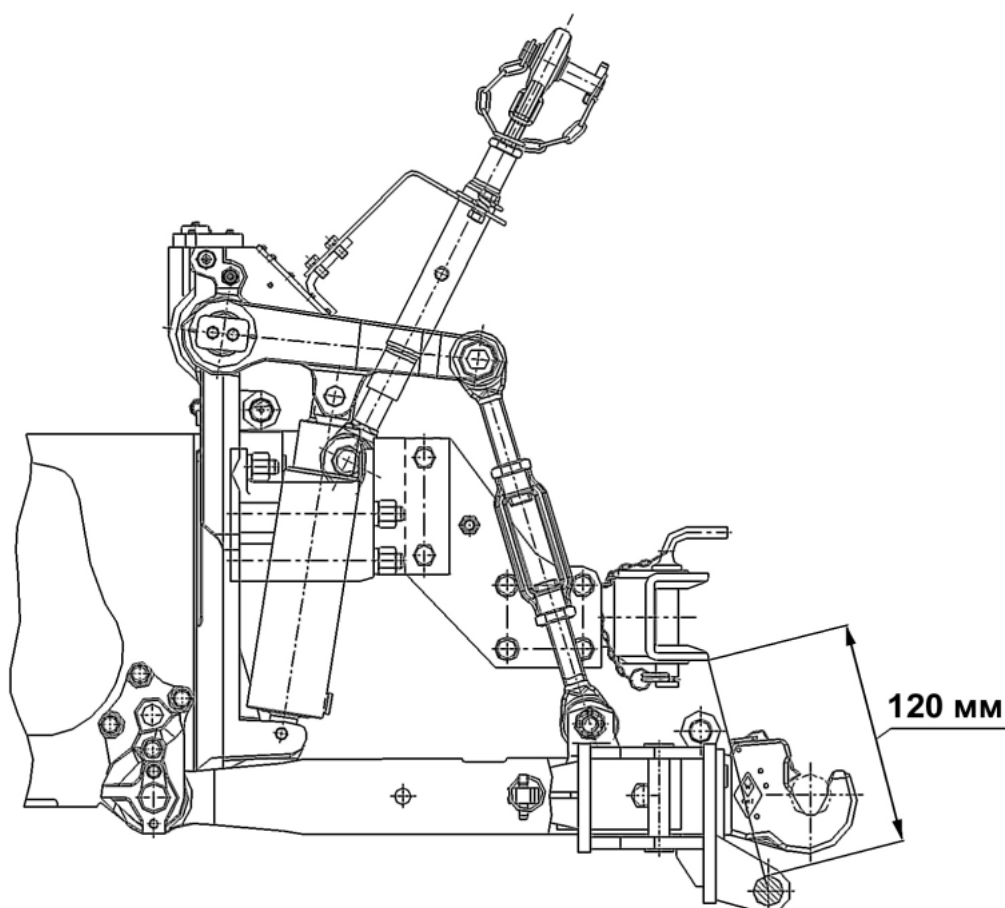
## Driving speed selection

Vehicle's driving speed may be limited by the coupled machine possibilities according to a sign applied.

Choosing driving speed the operator should consider driving intensity, state and features of coupled machines and carried load, road and weather conditions, tractor's abilities and limitations by traffic regulations and working processes. Operator should reduce speed or stop in front of any obstacle to ensure safety.

Operation	Tractor packaging	Speed, km/h	Note
Working on slopes		10 max.	
TMA in sharp turns		5 max.	
Actuation through synchronous PTO		8 max.	
Transporting TMA to operation site (save for vehicles)		15 max.	On public roads
Transport works	TCY-1	15 max.	

Machine speed may be limited by the coupled machine abilities according to a sign applied.



## Section 9. TROUBLESHOOTING

FAULT, SYMPTOMS	REMEDY
<b>ENGINE</b>	
<b>Engine will not start</b>	
Air in fuel system	Flush the system with manual pump. Eliminate air inflow, if necessary.
Faulty fuel pump	Remove fuel pump from the engine and send to repair workshop
<b>Engine shows insufficient power</b>	
No full fuel supply due to misadjusted fuel pump control rods	Adjust control rods
Clogged filter element of fine fuel filter	Replace filter element
Faulty injectors	Reveal faulty injectors, wash and adjust
Incorrect fuel injection lead angle	Set recommended fuel injection lead angle
Clogged engine air filter	Service air filter
<b>Unstable cold operation of the engine</b>	
Air intake into fuel system	Remove air from the fuel system
Misadjusted idling spring in the fuel pump	Adjust idling spring
Faulty fuel pump	Disassemble fuel pump from the engine and send to repair workshop
<b>Engine fuming in all operation modes</b>	
<b>A. Black fume from exhaust pipe</b>	
Clogged engine air filter	Service the air filter
Injector sprayer needle hanging-up	Reveal faulty injector, wash or replace sprayer, adjust the injector, if necessary
Low-quality fuel	Replace fuel with recommended one
Faulty fuel pump	Disassemble fuel pump from the engine and send to repair workshop
<b>B. White smoke from exhaust pipe</b>	
Cold engine	Warm the engine up, keep coolant temperature within 75-95°C range at operation
Misadjusted clearances between valves and rockers	Adjust clearances
Water in fuel	Replace fuel
Incorrect fuel injection lead angle	Set recommended fuel injection lead angle
<b>C. Blue smoke from exhaust pipe</b>	
Oil in combustion chamber due to worn parts of piston-cylinder group	Replace worn parts of piston-cylinder group
Excessive oil in engine oil pan	Discharge excessive oil to set the level at the upper mark of oil dipstick
<b>Engine overheating</b>	
Boiling coolant in cooler	Clean the cooler of dirt and dust. Clean cooling system of scale, if necessary. Adjust fan belt tension
Poor fuel dispersion by injectors	Reveal faulty injectors, clean, wash, adjust

<b>FAULT, SYMPTOMS</b>	<b>REMEDY</b>
<b>Too low oil pressure at warm engine</b>	
Pressure gauge or cell malfunction	Replace
Engine lubrication system pump malfunction	Correct malfunction or replace the pump
Too low oil level in oil pan	Add oil to the upper mark at oil dipstick
Hanged discharge valve of centrifugal oil filter*	Rinse the valve and adjust pressure
Extremely worn junctions “crankshaft necks – bearings”	Send engine for repair
<b>POWERTRAIN, CLUTCH</b>	
<b>Clutch shall not transfer full torque</b>	
No free travel of clutch pedal	Adjust free travel of the pedal
Worn driven plate pads	Replace drive plate assembly
<b>Clutch shall not fully disengage</b>	
Excessive free travel of the pedal	Adjust free travel of the pedal
<b>Oil in dry compartment of friction clutch</b>	
Worn crankshaft sealing collar	Replace collar
<b>MAIN DRIVE</b>	
<b>Increase noise in conical pair</b>	
Misadjusted main drive gear teeth and differential bearings engagement	Adjust gear engagement and bearing gaps
<b>BRAKES</b>	
<b>Ineffective braking (brakes do not hold)</b>	
Incorrect brakes control adjustment	Adjust brakes control
Oiled or worn brake disk pads	Remove oil leaks. Replace disks, if necessary
<b>REAR PTO</b>	
<b>Rear PTO shall not transfer full torque (slips)</b>	
Misadjusted control mechanism due to badly worn brake band friction pads or otherwise	Adjust PTO control mechanisms
Unclear PTO control arm shifting (jams, rests, dirt, etc. in mechanism connections)	Eliminate impediments to free control mechanism parts moving. Control arm should be clearly fixed in “PTO ON” and “PTO OFF” positions
<b>FRONT DRIVING AXLE</b>	
<b>Front axle is not automatically activated with slipping rear wheels during tractor move forward</b>	
Worn free-wheeling clutch parts	Replace free-wheeling clutch
Jamming grooves at free-wheeling clutch outer ring are contaminated with oil oxidation or part wear products	Disassemble the clutch and wash its parts
Deformed springs at roller cushion mechanism	Replace springs
Transfer box control rod is too long	Adjust rod length according to “Section 7. Adjustments”

\* Not for MTZ-921.3 with D245.5S2 engine.



<b>FAULT, SYMPTOMS</b>	<b>REMEDY</b>
<b>Front tires are quickly worn or ply-separated</b>	
Front and rear tire pressure does not correspond to recommended	Keep front and rear tire pressure consistent with recommended to prevent malfunctions
Misadjusted wheel toe-in	Adjust
FDA is constantly activated due to breakdown or jamming in transfer box control	Check forced FDA activation operation. Correct malfunction. Adjust transfer box control mechanism
<b>Safety clutch of intermediate bearing shall not transfer required torque</b>	
Misadjusted torque transfer of the clutch	Adjust
Worn driving and driven clutch plates	Replace disks
Disk springs lost elasticity or broke	Replace springs
<b>HYDROSTATIC POWER STEERING</b>	
<b>Increase effort on steering wheel</b>	
Insufficient oil pressure in power steering hydraulic system. Faulty feeding pump	Send feeding pump for repair or replace
Insufficient oil in oil tank	Add oil to the level
Excessive friction between mechanical parts of steering column	Repair
<b>No thrust at steering wheel turning</b>	
Insufficient oil in the tank	Add oil and flush the system
<b>Spontaneous steering wheel turning (“motoring”) with no operator’s action</b>	
Dosing pump slide valve shall not return to neutral position	
a) splined end of steering column shaft jams in dosing pump driving shaft	Adjust steering column
b) excessive friction between mechanical parts of steering column	Repair
<b>Guide wheels turn does not correspond to the steering wheel rotation direction</b>	
Incorrect dosing pump cylinder outputs connection to the turning cylinder	Change connection
<b>HYDRAULIC HITCH</b>	
Hitch platform does not lift up or its load capacity is drastically reduced. Pump “squeals” with one of external distributor handles set to “Lift Up” position. Oil is generally overheated	1. Insufficient oil in the tank – add oil to the tank to correct level. 2. Air intake to the pump suction line – eliminate air intake.
Load capacity reduces as oil warm up. Load capacity restores as oil cools	Worn or damaged oil pump – replace the pump
Hitch platform does not lift down with the handles set to the front position, additional pusher pressing is required	Slide valve jams in hydraulic jack distributor casing in “Lift Up” or “Neutral” position due to contaminated oil – rinse the system, replace discharge filter and fill the tank with clean oil
Mounted plough pops-up out of soil or deepens excessively with little handle shift in force adjustment mode	Destroyed power cell spring – replace the spring
Handles shall not hold the set position	Worn friction washers fixing handles to the bracket
Heavy hydraulic system vibration with the tool going down	1. Destroyed or shrunk spring – replace the spring. 2. Destroyed stop – replace the stop.

<b>FAULT, SYMPTOMS</b>	<b>REMEDY</b>
<b>ELECTRICALS</b>	
<b>Low charge of the battery</b>	
Low level of regulated voltage	Replace voltage regulator at generator
Slipping generator drive belt	Adjust belt tension
Increased transition voltage between battery terminals and wire tips due to slackening or oxidation	Strip connection terminals, tighten and lubricate noncontact areas with petrolatum. Tighten “ground” switch fixation and “ground” bridges
Faulty battery	Replace
<b>Battery “boils” and requires frequent distilled water additions</b>	
High level of regulated voltage	Replace voltage regulator at generator
Faulty battery	Replace
<b>Starter shall not start and rotate engine crankshaft</b>	
Disconnected one of wire terminals to the battery	Secure tips at battery terminals
Heavily oxidized wire tips and battery terminals	Strip battery terminals and wire tips, lubricate their noncontact areas with petrolatum
Activated engine starting interlock or faulty interlock switch	Set gearbox lever to the most left position or replace the switch
Insufficient starting torque of the starter due to battery discharge	Charge the battery correctly
Faulty starter	Disassemble the starter and send for repair
<b>Generator shall not show full power</b>	
Slipping generator drive belt	Adjust belt tension
Faulty generator	Disassemble generator and send for repair
<b>Generator noise</b>	
Slipping or overtight fan belt	Adjust belt tension
Worn bearing	Disassemble generator and send for repair
<b>Starting preheater control light is not on</b>	
Starting preheater circuit break	Repair
Heater circuit parts malfunction	Replace
<b>CAB HEATING AND VENTING UNIT</b>	
<b>Warm air shall not enter the cab</b>	
Water shall not circulate through the heating unit	Closed valve – open. Clogged hoses – clean. Air or ice plugs in heater hoses – remove. Fan shall not operate – consult qualified technician
<b>Warm wet air enters the cab</b>	
Water leak from heating cooler and from heating system connections. Damaged hoses	Repair
<b>PNEUMATIC SYSTEM</b>	
<b>Insufficient air pressure in the tank, pressure slowly rises and quickly drops at engine stop</b>	
Air leak in the system	Repair
Compressor malfunction	Disassemble and send for repair
<b>Air pressure in the tank quickly drops with pressed brake pedals</b>	
Brake valve malfunction	Disassemble and send for repair
<b>Excessive oil discharge to pneumatic system</b>	
Compressor malfunction	Disassemble and send for repair

<b>FAULT, SYMPTOMS</b>	<b>REMEDY</b>
<b>No air bleeding to pump tires up</b>	
Air bleeding valve rod is insufficiently flush with pressure regulator	Fully tighten connection hose but to connection pipe
Pressure regulator switches compressor to idling	Depressurize the tank by 1.5...2 kgf/cm <sup>2</sup>
<b>Ineffective or slowly releasing trailer brakes</b>	
Misadjusted brake valve actuator	Adjust
Misadjusted brake valve	Disassemble and send for repair
Trailer braking system malfunction	Repair

## **Section 10. MAINTENANCE**

Maintenance represents a system of preventive measures aimed at premature tractor wear prevention by creating and maintaining normal operational conditions and by adjusting wear parts and assemblies.

Generally maintenance does not require tractor disassembly is performed by operators. Scheduled scope and intervals are binding.

Shift maintenance plays great role in measure system for holding tractor operability on.

### **TYPES OF TRACTOR MAINTENANCE**

<b>Maintenance type</b>	<b>Servicing intervals or times in operating hours</b>
Maintenance to prepare the tractor for operation:	
Maintenance to prepare tractor for break-in	
Maintenance during breaking-in	SM (8-10)
Maintenance after breaking-in	After 30 operating hours
Scheduled maintenance:	
Shift (SM)	8-10
Maintenance No.1 (TM-1)	125
Maintenance No.2 (TM-2)	500
Maintenance No.3 (TM-3)	1000
Special maintenance	2000
Seasonal maintenance (TM-SS and TO-O3)	At starting autumn and winter (TO-O3) or spring and summer (TO-SS) operation
Maintenance in special operating conditions	While preparing for operation in special conditions
Maintenance at storage	

## MAINTENANCE TO PREPARE TRACTOR FOR OPERATION

Observe “Section 6. Preparation to work and work order” while preparing the tractor to operational break-in.

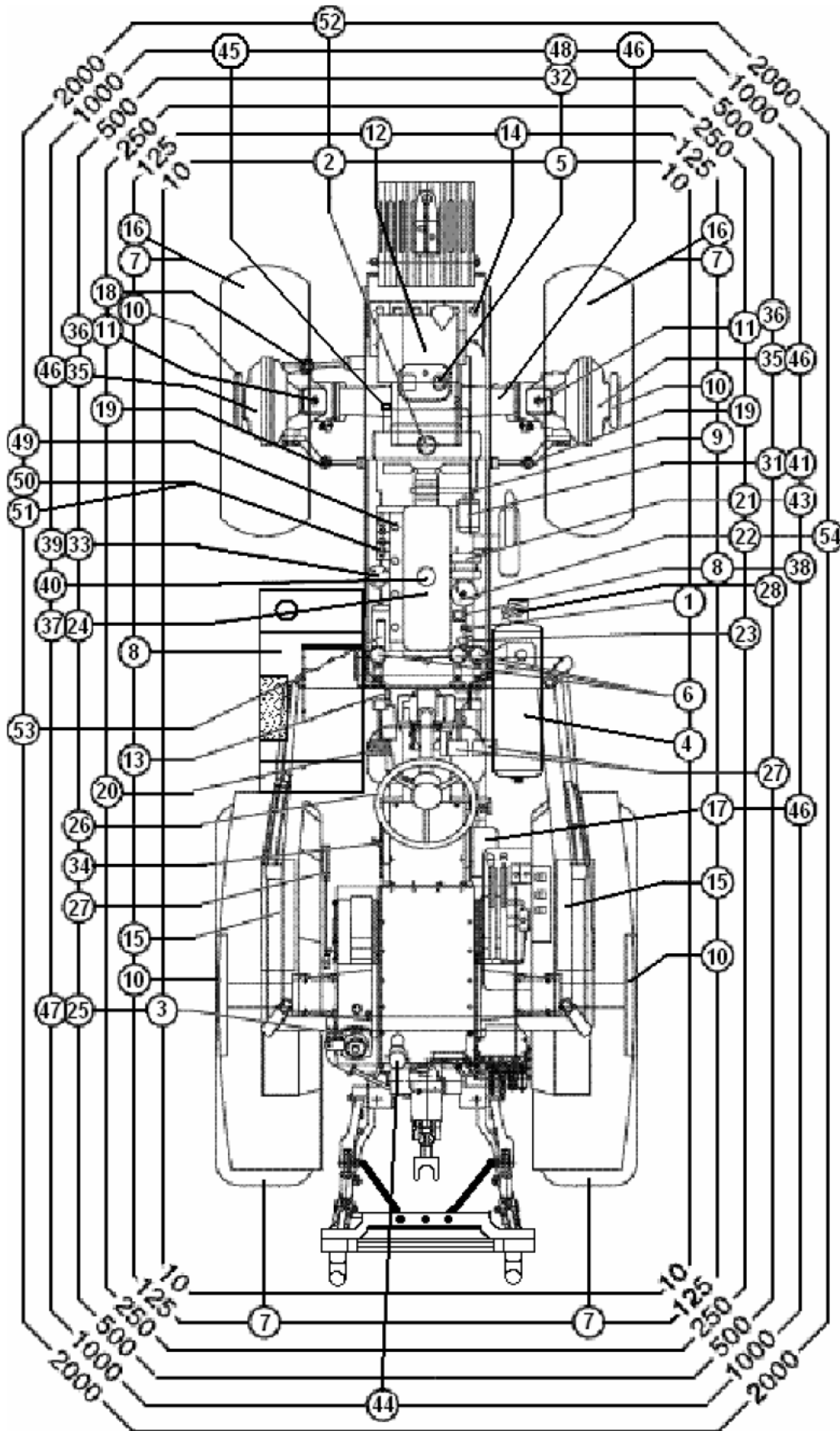
### **Maintenance during break-in:**

Perform shift maintenance while breaking the tractor in (see SM operations below).

### **Maintenance after break-in (after 30 operating hours):**

1. Examine and clean the tractor;
2. Listen to engine and other components operation;
3. Verify cylinder head bolts tension. Tighten, if necessary;
4. Verify and adjust, if necessary, gaps between engine valves and rockers;
5. Clean centrifugal oil filter rotor;
6. Check and adjust, if necessary, fan belt tension;
7. Discharge sediment from the fuel tank and rough fuel filters;
8. Check operability of clutch, brakes, pneumatic drive. Service, if necessary;
9. Check and service, if necessary, the battery;
10. Change oil in:
  - Engine oil pan;
  - Powertrain casings;
  - Wheel reduction gears and main FDA drive and intermediate bearing.
11. Replace filter element of RH hydraulic system;
12. Clean engine oil prefilter mesh;
13. Squirt all lubrication points;
14. Remove condensate from pneumatic system tank;
15. Service air filter, if necessary;
16. Check front tire pressure and toe-in;
17. Check and tighten, if necessary, external bolted connections, including that of FDA cardan drive intermediate bearing bracket fixation, powertrain casings, rear wheel hubs, hydraulic jack and front and rear wheel nuts;
18. Check air filter and engine intake leaks. Repair, if any;
19. Check operability of engine, lighting and signaling systems, screen washer and wiper.

### Lubrication and maintenance layout



## SCHEDULED MAINTENANCE TABLE

Pos.	Maintained area	Check	Flush	Lubricate, add	Remove, replace	Adjust
<b>Shift maintenance (SM) each 10 operating hours</b>						
1	Engine oil level	+				
2	Coolant level in cooler	+				
3	Oil level in hydraulic system oil tank	+				
4	Condensate removal from pneumatic tank				+	
5	Oil level in power steering oil tank	+				
6	Brake fluid level in main clutch cylinder and main brakes tanks	+				
7	Tire pressure	+				
<b>Maintenance No.1 (TM-1) after 125 operating hours</b>						
8	Sediments from fuel tank and rough fuel filter				+	
9	Fan belt					+
10	Rear wheel hubs. Front and rear wheels (wheel nuts torque)	+				
11*	FDA reduction gear bearings			+		
12	Air filter	+				
13	Shifter bearing			+		
14	Battery	+				
15	Cab venting and heating filter		+			
16	Front wheels toe-in	+				+
17	Intermediate bearing** and reduction gear of front driving axle (UBGP)	+				
18*	Steering hydraulic cylinder ball joints			+		
19*	Steering rod ball joints	+				
20*	Clutch pedal free travel adjustment					+
21*	Turbocompressor***	+				
22*	Centrifugal oil filter		+			
23*	Engine oil				+	
<b>Maintenance No.2 (TM-2) after 500 operating hours</b>						
24	Engine valve gaps	+				+
25	RH hydraulic system filters				+	
26	Steering wheel	+				+
27	Brakes	+				+
28	Pressure regulator filter		+			
29**	Pneumatic system leaks	+				
30**	PTO control	+				+
31	Generator	+				
32	Filter element in power steering oil tank				+	
33	Fine fuel filter				+	
34	Transmission oil (level check)	+				
35	FDA casings oil (level check)	+		+		
36	FDA reduction gear axis bearing clearances	+				+

\* Perform maintenance operations after 250 hours.

\*\* Not shown at lubrication layout.

\*\*\* For MTZ-821.3/921/921.2/921.3/921/4.

Table continued

Pos.	Maintained area	Check	Flush	Lubricate, add	Remove, replace	Adjust
<b>Maintenance No.3 (TM-3) after 1000 operating hours</b>						
37	Engine head fixing bolts	+				
38	Rough fuel filter		+			
39	Fine fuel filter				+	
40	Engine breather		+			
41	Generator	+				
42**	External bolted connections	+				
43	Turbocompressor*		+			
44	Transmission oil				+	
45	Engine oil prefilter		+			
46	Oil in intermediate bearing, wheel reduction gear casings and main drive casing				+	
47	Oil in hydraulic system tank				+	
48	Oil in power steering tank				+	
<b>Special maintenance after 2000 operating hours</b>						
49	Engine injectors	+				+
50	Fuel pump. Injection lead angle	+				+
51	Fuel pump. Bench adjustment	+				+
52	Engine cooling system		+			
53	Starter	+				
54	Centrifugal engine oil filter*** discharge valve	+				+

\* For MTZ-821.3/921/921.2/921.3/921.4.

\*\* Not shown at lubrication layout.

\*\*\* Paper filter element for MTZ-921.3/921.4.

Seasonal maintenance should be combined with scheduled maintenance works.

<b>Operations</b>	
At shifting to autumn and winter conditions (with stable daily average temperature below +5°C)	At shifting to spring and summer conditions (with stable daily average temperature over +5°C)
Change summer oil brands for winter ones (see table on lubricants):	Change winter oil brands for summer ones
in engine oil pan	in engine oil pan
in RH and HPS hydraulic tanks	in RH and HPS hydraulic tanks
in transmission casings	in transmission casings
in main FDA drive casing	in main FDA drive casing
in wheel reduction gear casings	in wheel reduction gear casings
in intermediate FDA drive bearing	in intermediate FDA drive bearing
Check battery state, recharge, if necessary.	Check density of acid in the batteries per summer standards
Flush engine cooling system and fill with antifreeze coolant	
Disassemble cardan shafts and check axial flange tightness at transfer box axles, intermediate bearing axles and main drive gear. Tighten nuts to remove axial play	

### **Refill capacities, l**

Engine cooling system	17 (19)*
Engine lubrication system	12
Transmission casings	40
FDA casing	1.6
Reduction gear casing at FDA final drive (each)	1.5
Casing of PVD reduction gear upper conical pair (each)	0.3
Hydraulic system oil tank	25.0
Power steering oil tank	6.0
Fuel tank	95
FDA cardan drive intermediate bearing housing	0.15

\* For MTZ-921.3/921.4

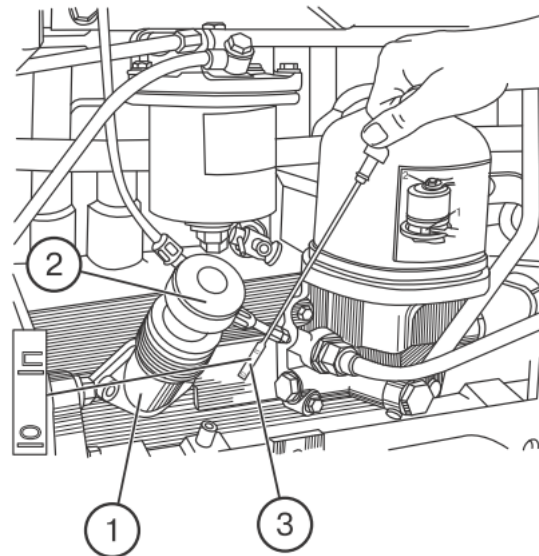


**Shift maintenance (SM) each 8-10 operating hours or daily**

**Operation 1. Engine pan oil level check.**

Stop the engine and check oil level in 15 minutes. Oil level should locate between the upper and the lower marks at oil dipstick (3). Remove oil filler neck (1) cap (2) and add oil to the upper mark at the dipstick (3), if necessary.

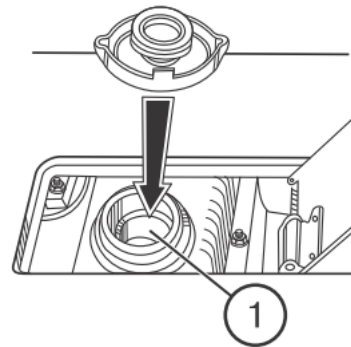
**IMPORTANT!** Do not overfill engine with oil. Burning excessive oil may be erroneously interpreted as great oil consumption. Never allow the engine run with oil level below the lower mark at the dipstick.



**Operation 2. Coolant level in cooler check.**

Remove cooler cap and check coolant level. Coolant level should be 50-60 mm below the filler neck edge (1). Add coolant, if necessary.

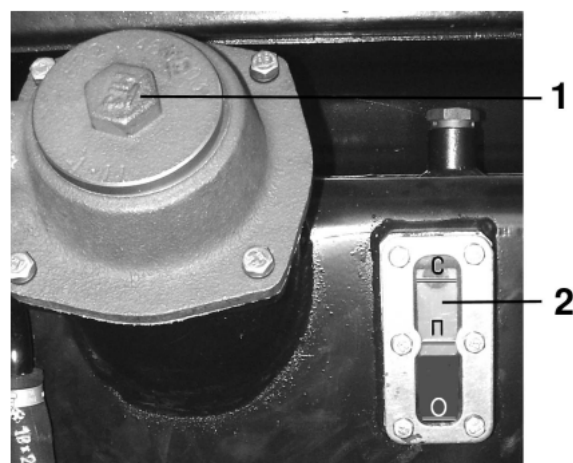
**WARNING!** Cooling system is pressurized. Pressure is controlled by the cooler cap valve. **Removing the cap from hot engine is dangerous!** Leave the engine to cool down. Cover the cap with cloth and turn the cap slowly to depressurize gradually prior to complete cap removal. Avoid burning by hot liquid.



**Operation 3. Hydraulic system oil tank level check.**

Place the tractor on a plain horizontal ground prior to check oil level. Check oil level with an oil meter (2). The level should locate between "0" and "П" marks. If necessary, remove filler cap (1) and add oil to "П" mark with hitch in the lowest position.

**NOTE!** If using machines requiring great oil takeoff, add oil to the level corresponding to the upper "C" mark with retracted rods of hydraulic cylinders at mounted machine.



#### Operation 4. Condensate discharge from air tank.

On completion of the work, with pressurized air tank, pull horizontally discharge valve ring (1) to remove condensate.

#### Operation 5. Power steering oil tank level check.

Place the tractor on a plain horizontal ground and stop the engine prior to checking oil level.

**NOTE!** Loosen two fasteners and remove left side facing grill to access the power steering oil tank (the tank is installed onto the front brace in front of the oil cooler).

Check power steering oil tank level with an oil metering dipstick (1). Oil level should locate between the upper and the lower marks at the dipstick. Remove oil filler neck cap (2) and add oil to the upper mark, if necessary.

#### Operation 6. Checking brake fluid levels in main clutch cylinder tank and main brake tanks.

Visually check fluid levels in the main clutch cylinder tank (1) and in main brake cylinder tanks (3).

Oil level should locate between MIN and MAX marks at the tank shells. If necessary, remove caps (4) and add brake fluid to MAX level, i.e. to  $15 \pm 5$  mm from the upper tank edge.

“Neva-M”, “ROSDOT” or analogous brake fluids are recommended for use.

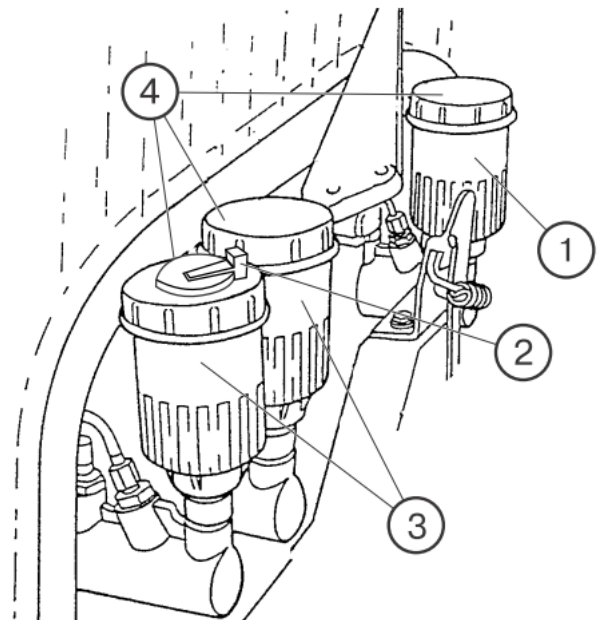
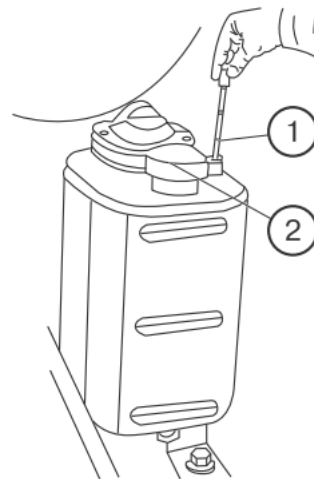
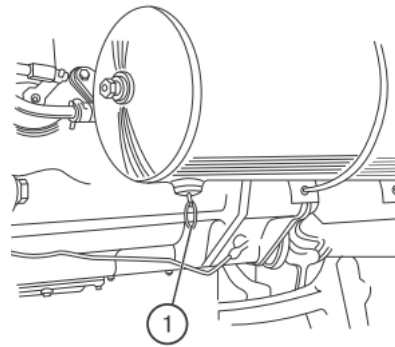
Level sensor (2) is installed on the cylinder cap to control brake fluid level in main brake cylinder tanks.

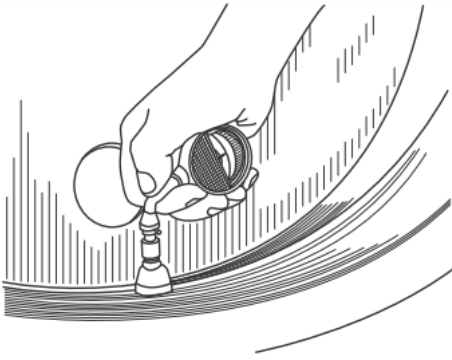
**WARNING!** Filling with or adding other fluids may disturb operation of clutch and brakes control hydraulic actuators.

#### Operation 7. Tire pressure check

Check cold tire pressure and examine tire tread for damages. If necessary, make front and rear

tire pressure consistent with regulation of “Section 3. Technical specifications”.





**Maintenance No.1 (TM-1) each 125 operating hours.**

Includes operations of the previous maintenance and the following:

**Operation 8. Removing sediments from fuel tank and rough fuel filter.**

Unscrew discharge caps (1) of the fuel tank (2) and filter (3) and remove sediments until clean fuel starts to discharge. Gather the sediments into a suitable container for used oils and liquids. Tighten discharge caps after clean fuel with no water or dirt start to flow.

**Operation 9. Engine cooling fan belt tension check.**

Examine the belt for wear or damage. Replace, if necessary.

To check generator belt tension at an engine with elongated guard apply approximately 40N to the middle of “generator pulley – water pump pulley” belt fragment (1). Sagging should constitute 6-10 mm. If necessary, turn generator housing to adjust the belt tension, with previously loosened and then tightened plate fixing bolts and nuts of generator fixing bolts.

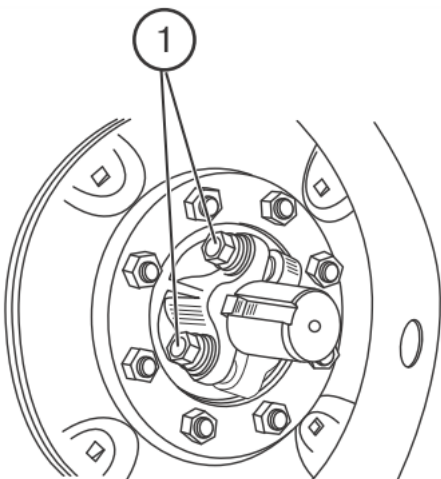
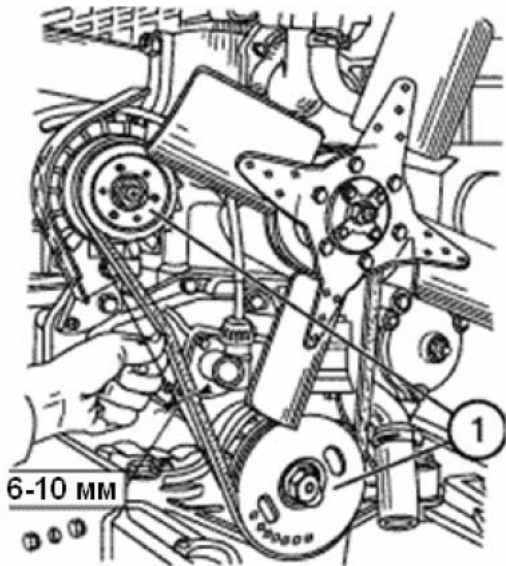
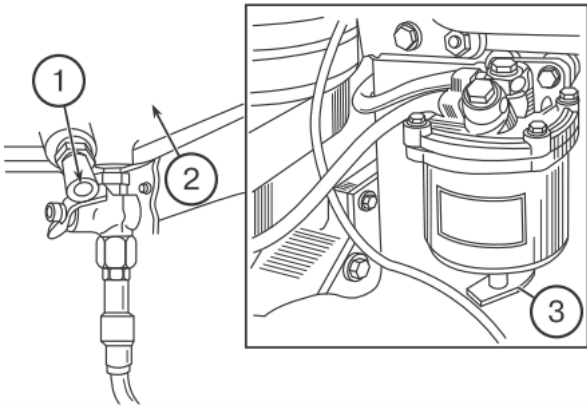
**NOTE!** Check generator belt tension at “generator pulley – crankshaft pulley” fragment with ordinary generator guard. Belt sagging should constitute 15-20 mm with 40N force applied to the belt fragment middle.

**Operation 10. Rear wheel hubs. Front and rear wheels (wheel nuts torque).**

Verify torque and tighten bolts (1) fixing rear wheel hubs (four bolts per each hub), if

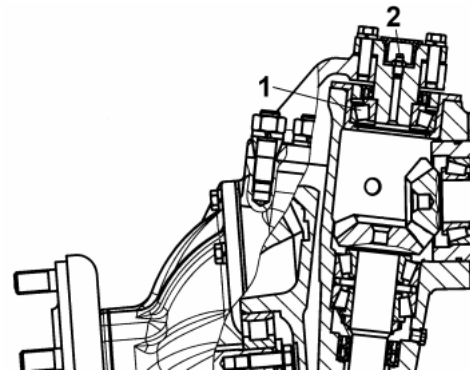
necessary, with a torque wrench. Torque should be equal to 230-330 Nm.

Verify torque and tighten front and rear wheel nuts to 250-300 Nm, if necessary. Disk-to-rim fasteners for rear wheels should be tightened to 160-200 Nm. Wheel-to-hub fixing nuts should be tightened to 200-250 Nm for the front wheels, and 300-350 Nm – for the rear ones.



### Operation 11. Lubricating FDA reduction gear bearings.

Lubricate bearings (1) with grease fittings through opening (2). Make 4-5 pressings.



### Operation 12. Servicing air filter.

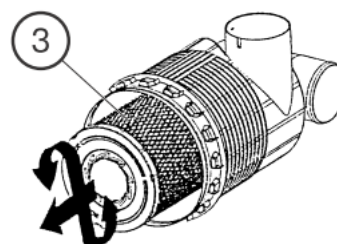
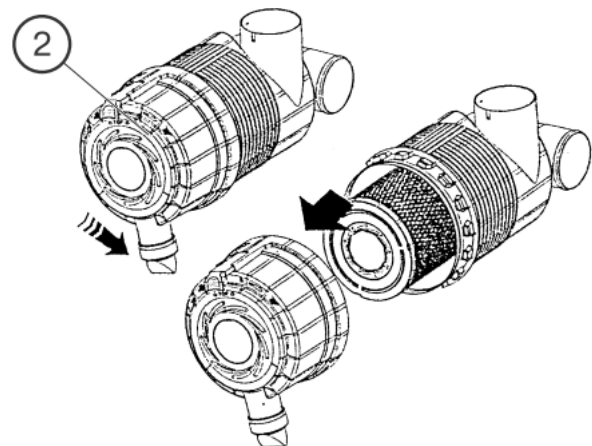
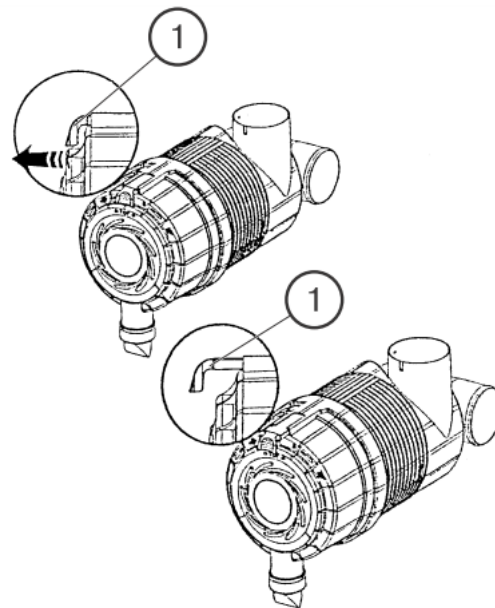
Air filter element clogging is controlled with clogging indicator. A lamp at the dashboard signals of increased contamination.

Air filter is serviced as follows:

- Remove right side front grill and facing to access the air filter;
- Pull latch (1) (yellow), turn cap (2) counterclockwise by 12.5° and remove the cap;
- Remove main filter element (3);
- Examine control filter element (CFE) for contamination without removing it from housing.

**ATTENTION!** We do not recommend removing control filter element from the housing. Contaminated control filter element indicates damage to the main filter element (MFE) (broken paper blind, unstuck bottom plate). In such a case rinse CFE and replace MFE.

- Blow the main filter element with compressed air inside and outside to completely remove dust. Air pressure should not exceed 0.2-0.3 MPa (2-3 kgf/cm<sup>2</sup>) to avoid paper blind breakage;
- Direct air flow angularly to the filter element surface. Avoid damaging and oiling filter element while servicing;
- Wash oiled or contaminated filter elements, that cannot be cleaned with compressed air, with OP-7 or OP-10 soapy paste water solution at temperature of 40-50°C;
- The solution should be prepared from 20g of paste per 1l of water. Missing paste may be replaced with domestic powder detergent with the same concentration;



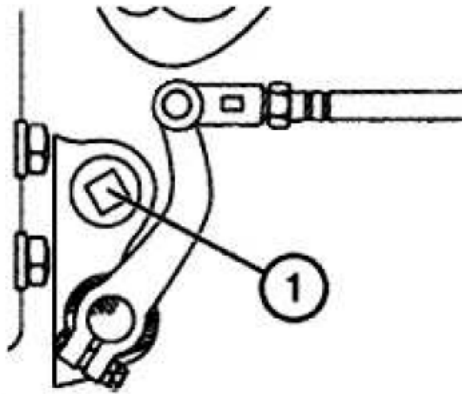
- Wash the element by dipping into the cleaning solution for half-hour. Then rinse the element with the same solution within 15 minutes and with clean water at 35-45°C. dry within 24 hours. Never use open fire and air hotter than +70°C to dry the filter element out;
- Assemble the air filter in reverse order.

**NOTE!** Check MFE state every 20 operating hours in dusty conditions.

**Operation 13. Clutch shifter bearing lubrication.**

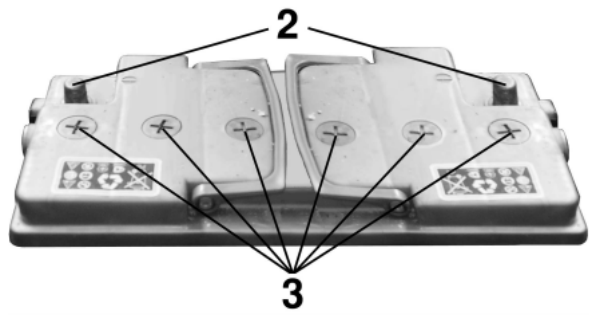
- Remove plug (1) at the left side of clutch housing;
- Insert a tip of piston gun into the hole to get full contact with the grease-fitting and make 4-6 pressings of “Litol-24” grease through a grease-fitting in shifter casing.

**NOTE!** Do not overfill the shifter with grease. Excessive grease may get to friction surface of the friction clutch.



**Operation 14. Batteries.**

**WARNING!** Batteries contain sulfuric acid that causes burns at contacts with skin, eyes or cloths. In case of acid contact with external body surface rinse it with much clean water. Drink much water or milk if acid is swallowed. Wash eyes with much water within 15 minutes and take medical advice in case of contact with eyes.  
Do not allow sparks or fire get close to the acid area as it may provoke explosion. Charge batteries in vented room. Wear goggles and protective gloves when servicing batteries.



- Remove left and right side grills at the front facing to access batteries;
- Clean the batteries of dust and dirt;
- Keep the batteries clean and dry;
- Ensure secure battery fixation. Clear surrounding surface prior to removing caps;
- Check electrolyte level. It should be 12-15 mm over protective mesh (or between level marks at transparent battery casing);

- Check acid density in each battery cell. Density should correspond to fully charged battery;
- Add distilled water, if necessary;
- Ensure cleanness of terminals (2) and plugs (3).
- Grease terminals with petrolatum and clean plug vents (3), if necessary.

### Operation 15. Cleaning cab heating and venting system filter.

**ATTENTION!** Do not switch the fan on prior to cleaning filters in wet ambient as dust sticks to wet paper filter element.

Filter elements of venting system are located on both sides of the cab.

- Get a pedestal or small stepladder to access the filter;
- Unscrew two screws (2) with plastic caps under prominent edge of the roof;
- Remove panel (1) and filter (3);
- Remove dust from the filter by tapping;

**ATTENTION!** Be careful not to damage paper filter element.

- Clean the filter with compressed air under pressure not exceeding 1 MPa. Keep the hose tip not closer than 300 mm to the filter in order not to damage paper filter element. Direct air flow through the filter oppositely to ordinary air flow direction indicated by arrows at the filter;
- Replace the filter in reverse order. Repeat procedure to clean filter at the other side of the cab.

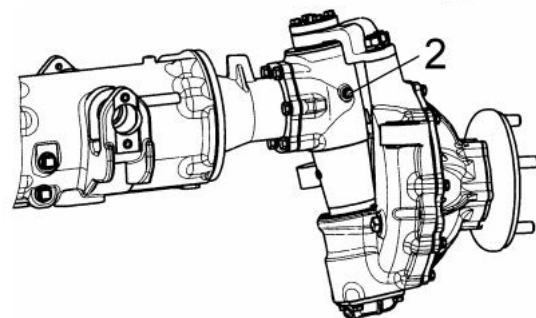
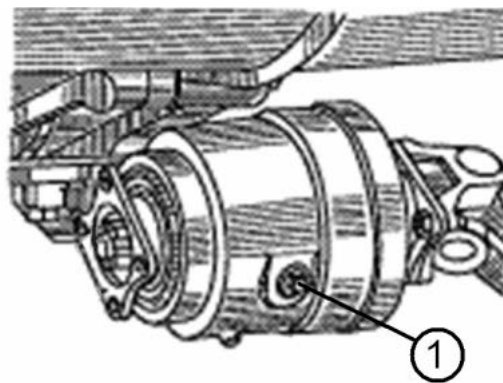
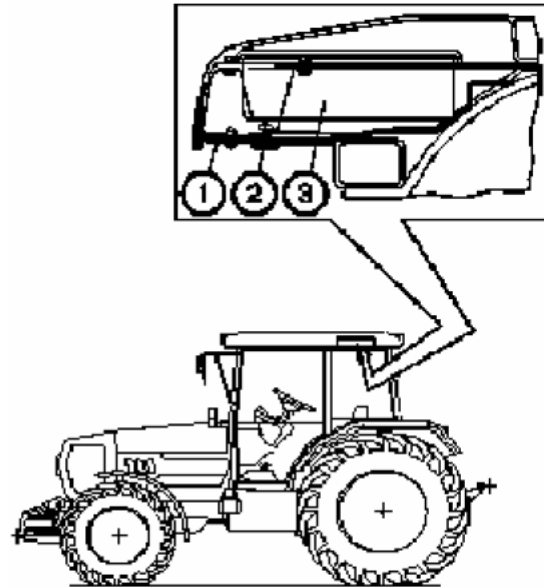
**NOTE!** Clean filter each 8-10 operating hours, i.e. each shift, in dusty conditions.

### Operation 16. Front wheels toe-in (each second TM-1).

Front wheels should toe in within 0-8 mm. adjust, if necessary, according to regulations of “Section 7. Adjustments”.

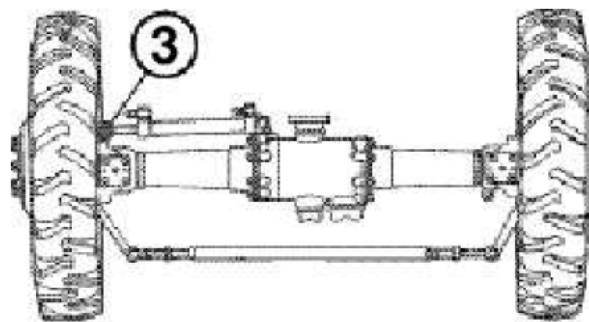
### Operation 17. Checking oil level in intermediated cardan drive bearing and in the upper FDA reduction gear conical pair hollow.

Check oil levels in hollows of intermediate bearing and FDA reduction gear upper conical pairs. Add oil, if necessary, to the lower edges of inspection and filler openings closed with plugs (1, 2). Replace and tighten the plugs.



**Operation 18. Lubricating steering hydraulic cylinder ball joints (each second TM-1).**

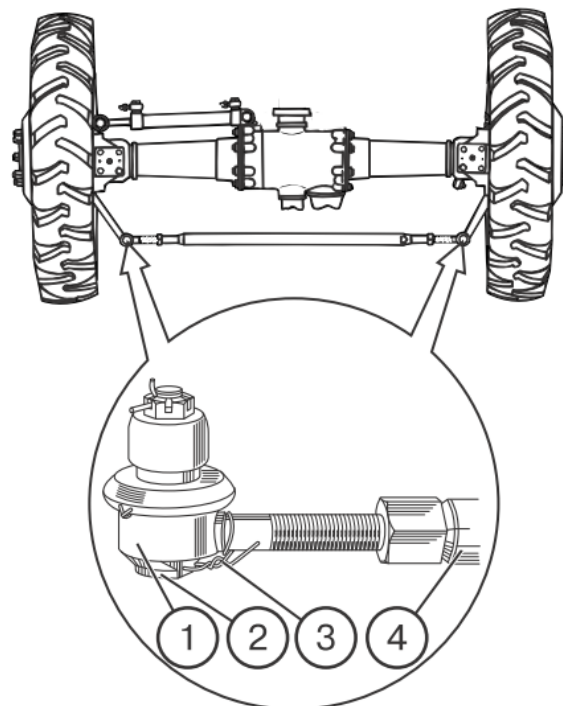
Using a syringe lubricate ball joints through grease-fittings (3) (two grease-fittings) with “Litol-24” grease or recommended substitute until the grease comes out in gaps.



**Operation 19. Checking play is steering ball joints (each second TM-1).**

Turn steering wheel in both directions with running engine to check free travel and play in ball joints (1) of steering rod (4). Perform the following in case of playing ball joints:

- Remove safety wire (3);
- Tighten threaded plug (2) so as to eliminate gap in the ball joint. Lock the plug.



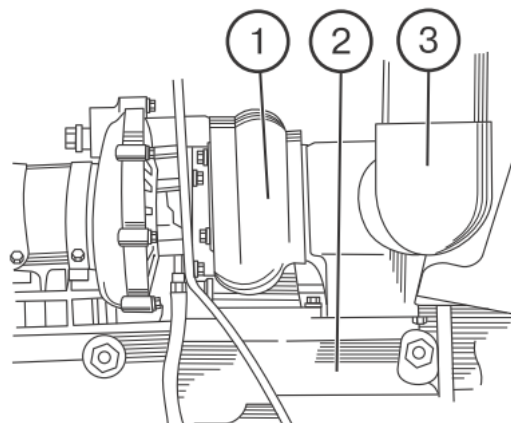
**NOTE!** If play cannot be removed by tightening threaded plugs, disassemble the ball joint and replace worn parts.

**Operation 20. Adjusting free travel of friction clutch pedal (each second TM-1).**

Adjust free travel of the friction clutch pedal (see “Section 7. Adjustments”).

**Operation 21. Turbocompressor\* (MTZ-821.2/921/921.2/921.3/921.4).**

Verify turbocompressor (1), exhaust manifold (2) and exhaust pipe bracket (3) fixing bolts torque. Tighten the bolts to 35-40 Nm (3.5-4.0 kgf·m), if necessary.



\* Perform maintenance operation after 250 hours.



## Maintenance No.2 (TM-2) each 500 operating hours.

Includes mentioned above and the following operations:

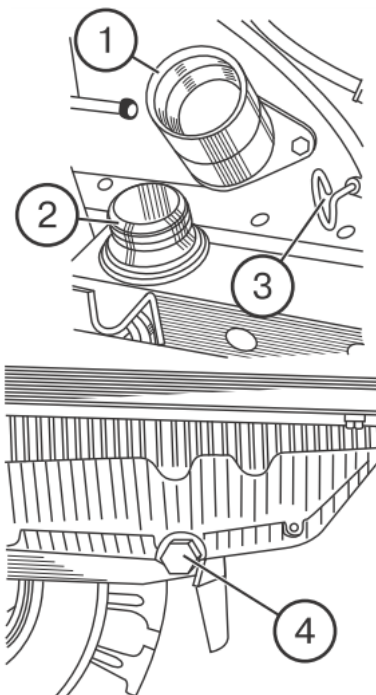
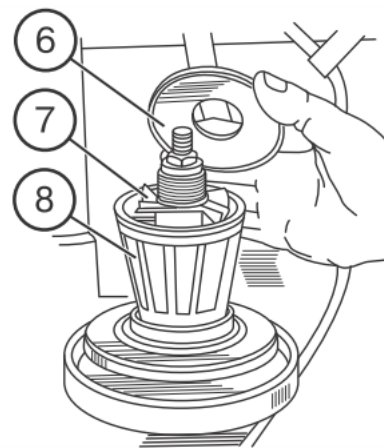
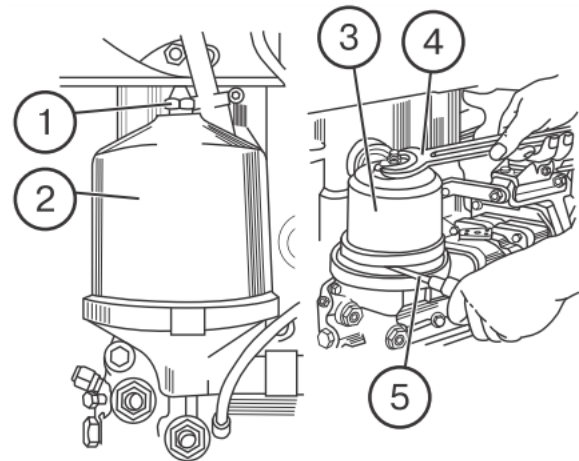
### Operation 22. Cleaning centrifugal engine oil filter.

- Remove nut (1) and cap (2);
- Lift rotor (3) up to stop to insert screw driver (5) to prevent rotor rotation. Rotate rotor nut with wrench (4) to remove rotor housing (3);
- Remove cover (6), impeller (7) and filter mesh (8);
- Clean all parts of sediments, wash them with diesel fuel and blow with compressed air;
- Align balancing marks at rotor cup and housing to assemble the rotor. Tighten the nut fixing the cup with little force to completely settle the cup into the rotor. Ensure free rotation of the rotor;
- Replace filter cap, tighten cap nut to 35-40 Nm (3.5-40 kgf·m).

**ATTENTION!** Engine filter operates properly if sound of rotating rotor can be heard from under the filter cap within 30-60 seconds after warm engine stop.

### Operation 23. Engine oil change.

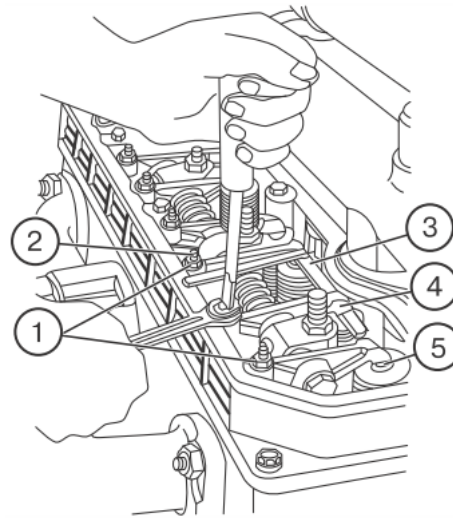
- Place the tractor on a plain ground. Engage parking brake;
- Warm the engine up to normal operating temperature (not less than 70°C);
- Remove cap (2) from filler neck (1);
- Remove drain plug (4) from the engine oil pan and discharge oil to appropriate container for used oil;
- Replace drain plug (4);
- Fill the oil pan with oil recommended by the present manual (see “Table of lubricants”);
- Check oil level with dipstick (3);
- Replace oil filler cap, start and run the engine within 1-2 minutes. Add oil to required level, if necessary.



## Operation 24. Engine valve clearances.

**ATTENTION!** Verify and adjust clearances at cold engine.

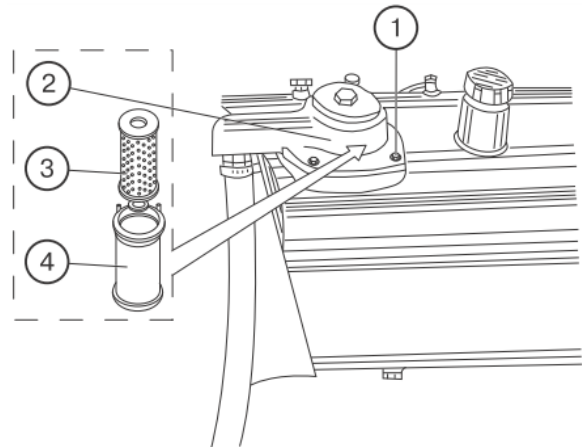
- Disassemble cylinder head cover;
- Verify and, if necessary, tighten bolts and nuts fastening rocker arm shaft brackets to 60-90 Nm (6-9 kgf·m);
- Rotate crankshaft clockwise until 1<sup>st</sup> cylinder valves overlap (exhaust valve starts to open, inlet valve completes closing);
- Verify and adjust, if necessary, clearances in valves 4, 6, 7 and 8 (valves are numbered in direction from the fan). For clearances for inlet and exhaust valves see “Section 3. Technical specifications”;
- Rotate crankshaft by 360° until 4<sup>th</sup> cylinder valves overlap and adjust clearances of valves 1, 2, 3 and 5;
- Tighten screw locknuts and replace disassemble parts.



## Operation 25. Replacing PFE filter of RH hydraulics.

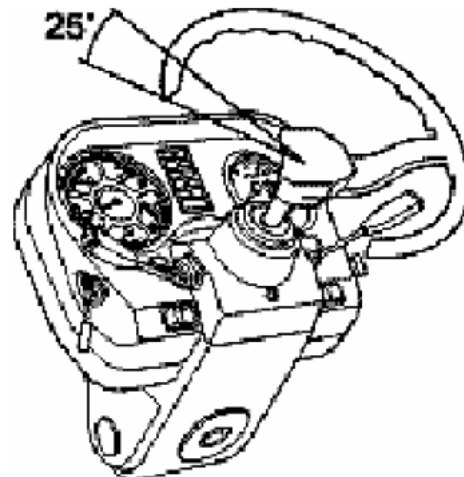
**NOTE!** In the following hydraulic system PFE should be replaced each 1000 operating hours.

- Remove screws (1) and remove cover (2);
- Remove housing (4) with PFE (3);
- Rinse housing (4) with cleaning solution;
- Install new PFE complete with housing (4) into the tank of hydraulic system;
- Replace cover (2) and fasten with bolts (1).



## Operation 26. Free travel of steering wheel.

Steering wheel free travel should not exceed 25° with running engine. Otherwise eliminate play in steering ball joints, tighten pivot arm nuts, eliminate play in steering column and steering linkage.



### Operation 27. Brakes check and adjustment

Check and adjust brake pedal in operation in case of:

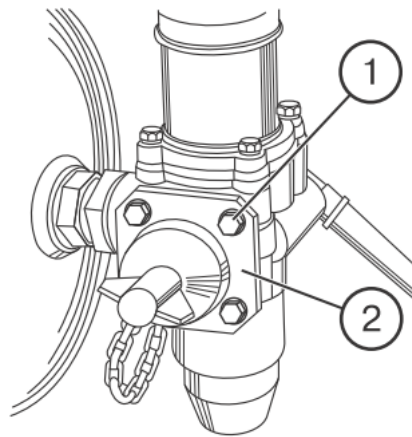
- Nonsimultaneous braking of left and right wheels;
- Ineffective wheel braking (large braking distance);
- Excessive brake housing heating and other signs of brakes malfunction.

Adjust, if necessary, according to instructions of “Section 7. Adjustments”.

### Operation 28. Cleaning pressure regulator filter.

To clean the filter:

- Unscrew bolts (1) and remove cover (2);
- Remove the filter, rinse it with cleaning solution and blow with compressed air;
- Replace the filter and the cover, tighten bolts (1).



### Operation 29. Pneumatic system leak test.

- Pressurize pneumatic system to 6.0-6.5 kgf/cm<sup>2</sup> (per dashboard air pressure indicator) and stop the engine;
- Observe pressure drop with air pressure indicator. Pressure drop should not exceed 2.0 kgf/cm<sup>2</sup> after 30 minutes. Otherwise locate and repair air leak.

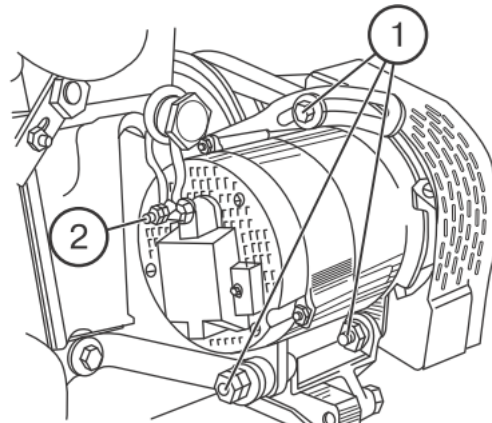
### Operation 30. Rear PTO control check.

Lever (1) should not require force exceeding 120-150 Nm (12-15 kgf) to switch between ON and OFF positions. Shifts should be clear. If necessary, adjust according to regulations of “Section 7. Adjustments”.



### Operation 31. Cleaning generator.

Clean generator of dirt and dust. Verify and tighten, if necessary, generator fixing bolts (1). Check state and tension of generator (2) connections. Tighten, if necessary.

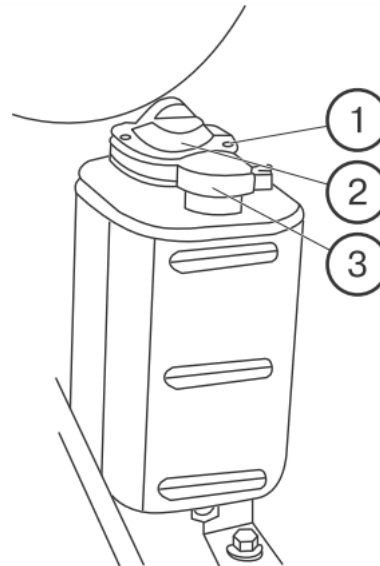


### Operation 32. Replacing filter element in power steering oil tank.

Turn and remove side grill at front facing to access the oil tank.

- Unscrew bolts (1), remove cover (2) and filter element assembly;
- Install new filter element into the oil tank, close the cover and fasten with bolts.

Remove oil filler cap (3) and add oil to the upper mark at oil meter, if necessary.



**NOTE!** If the following replace filter element in the power steering oil tank each 1000 operating hours.

### Operation 33\*. Removing sediment from fine fuel filter.

Unscrew drain plug (1) and discharge sediment until clean fuel with no signs of water or dirt flows out. Install drain plug (1). Flush the fuel system, if necessary.

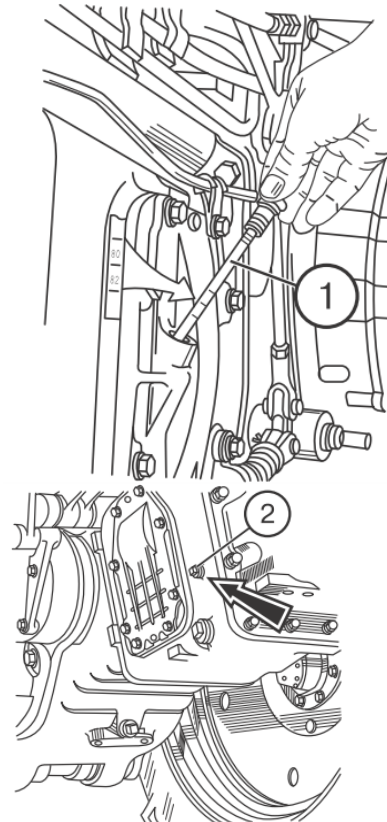


### Operation 34. Transmission oil change.

Check transmission oil level with a dipstick (1) to the left of the gearbox. Normal operating oil level should be between the middle and the lower marks at the dipstick.

In case of transmission oil level below the lower mark at the dipstick remove transmission oil filler cap (2) and add oil to normal operating level.

Remove transmission oil filler cap and add oil to correct transmission oil level, if necessary.



\* Perform maintenance after 250 hours.

should be equal to 160-180 Nm (16-18 kgf·m).

### **Operation 35. FDA housing oil level check.**

- Check oil level in left and right housings of lower FDA reduction gear conical pairs. Add oil to the level of inspection and filler ports closed with plugs (2), if necessary;
- Check oil level in FDA differential case. Add oil to the level of inspection and filler port closed with plug (1), if necessary.

### **Operation 36. Reduction gear support bearings (axis) check and adjustment.**

Verify tightness in bearings (4, 5). Adjust, if necessary.

Bearing preload should be equal 0.03-0.06mm. Stub axle turning force applied to flange (6) should be equal to 60-80 N with correctly adjusted bearings.

If necessary, adjust as follows:

- Unscrew four bolts (2), screw two disassembling bolts into threaded bores in axle (1) and press the axle out to allow adjusting shims (3) removal and installation;
- Remove or install required number of adjusting shims from under the upper axis (1) flange. Diametrical shims should be of equal thickness;
- Screw disassembling bolts out and tighten bolts (2) to 120-140 Nm.

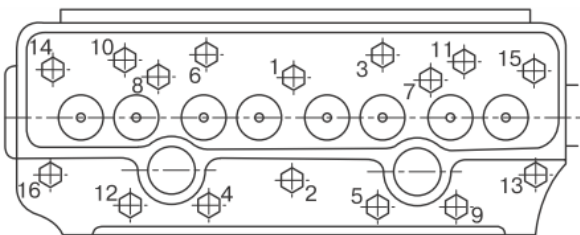
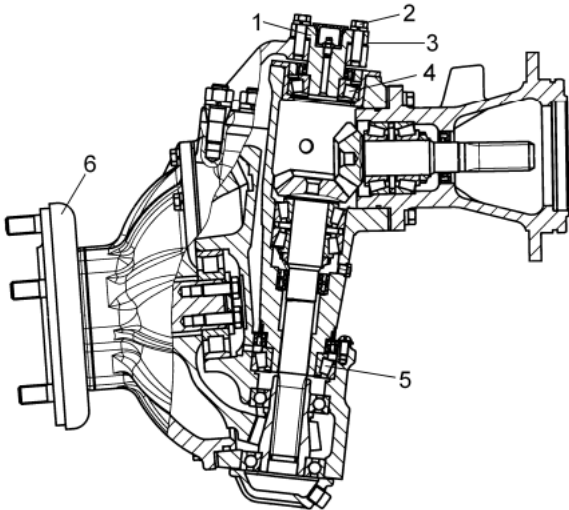
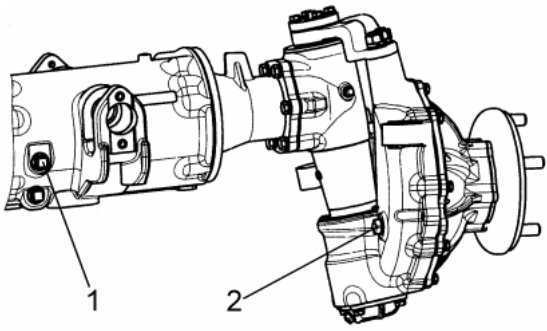
### **Maintenance No.3 (TM-3) each 1000 operating hours.**

Includes mentioned above and the following operations:

### **Operation 37. Engine cylinder head bolts torque verification.**

**NOTE!** Perform this operation at warm engine only.

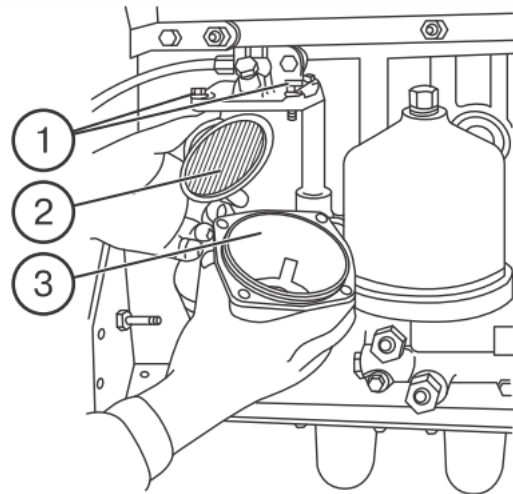
- Disassemble rocker cover, cylinder head cover and rocker shaft assembly;
- Using a torque wrench verify and tighten cylinder head bolts in sequence according after the figure to the right. Bolt torque



**IMPORTANT!** Verify and adjust, if necessary, valve clearances after this operation.

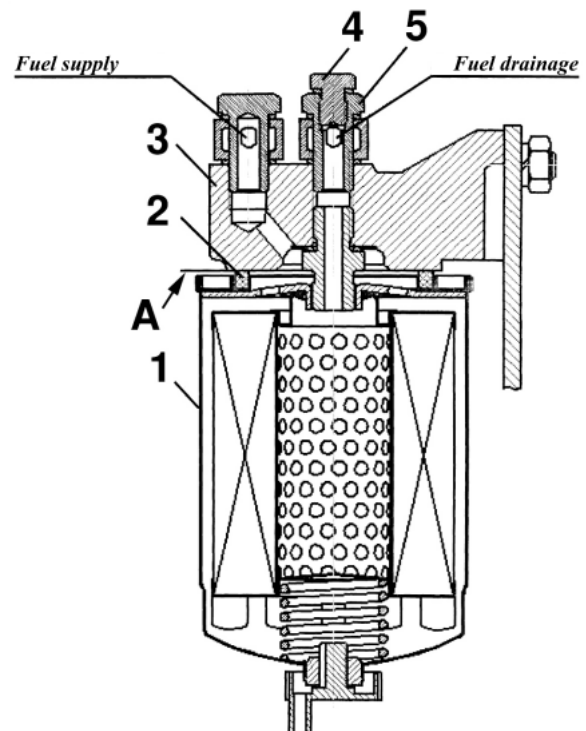
### Operation 38. Flushing rough fuel filter.

- Close fuel tank valve;
- Remove upper filter surface and unscrew four bolts (1). Remove cup (3);
- Remove filter element (2) screwing it out of the housing;
- Flush all parts with diesel fuel and assemble the filter;
- Open fuel tank valve and fill the system with fuel.



### Operation 39. Replacing filter element of fine fuel filter.

- Unscrew filter (1) from connection pipe (5) at housing (3);
- Install new filter complete with gasket (2) preliminarily lubricated with motor oil;
- Turn the filter by  $\frac{3}{4}$  turn as soon as gasket (2) touches mounting area A at housing (3). Turn the filter by hand only.



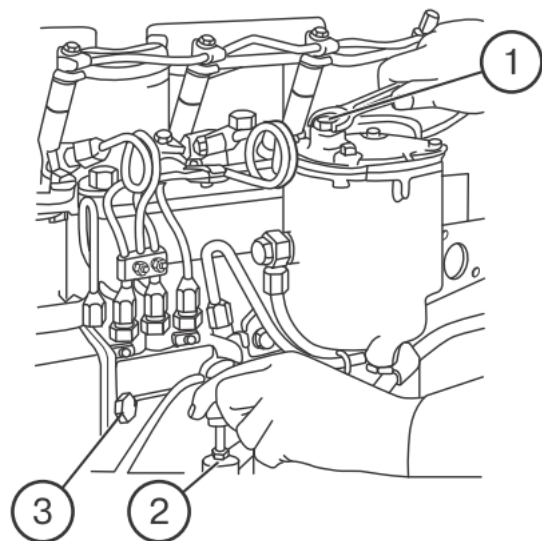
**IMPORTANT!** After filter replacement flush fuel system with manual pump with air bleed plug (4) unscrewed by 2-3 turns.

Other nonseparable fuel filters with the following parameters may be used:

- Filtering completeness not less than 90%;
- 150 l/h relative flow at 0.01 MPa pressure drop;
- Diameter – 95-105 mm;
- Height – 140-160 mm;
- Connection thread M16x1.6;
- Sealing gasket outer diameter – 70-75 mm.

### To remove air from the system:

- Loosen fine filter cap (1);
- Unscrew flushing pump handle (3);
- Ensure fuel tank valve is open and there is fuel in the tank;
- Loosen plug (2) at the fuel tank;
- Quickly flush the system with flushing pump until clean fuel with no air bubbles comes out from under the plugs. Tighten fuel pump cap (2). Keep flushing the system until fuel with no air bubbles comes out from under the fine fuel filter cap (1);
- Install flushing pump handle.



**NOTE!** In case of hindered engine start loosen sleeve nut of each injector fuel line and remove air from the system cranking the engine within 10-15 s. Tighten the sleeve nut.

- TCY-3B towing fork plates fastening bolts and nuts;

#### **Operation 40. Flushing engine breather.**

- Unscrew bolts (1) and remove breather housing (2);
- Remove the breather from the housing, flush it with diesel fuel and blow with compressed air. Add some oil into the breather filter, let it drain and reinstall the filter.

#### **Operation 41. Generator check.**

Remove drive belt (1) from generator pulley (2) and check free rotation of generator rotor and play in bearings. Check state and tightness of terminal connections. Tighten terminal connections and generator fasteners, if necessary. Contact qualified specialist in case of excessive play in rotor bearings.

#### **Operation 42\* . Outer bolted connections.**

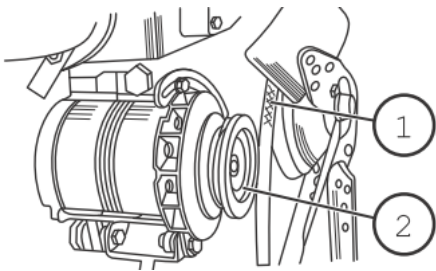
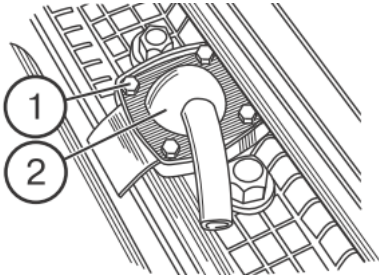
Check and tighten, if necessary, the most important bolted connection:

- Front and rear wheel nuts; rear wheel hub nuts;
- Front brace – half-frame girders – ballast weights;
- Engine – clutch casing;
- Clutch casing – gearbox casing;
- Gearbox casing – rear axle casing;
- Rear axle casing – brackets of rear hitch and towing coupler;
- Front and rear cab supports;
- Rear axle casing – half-axle sleeves;
- Cardan shaft flange nuts;
- Cardan drive intermediate bearing casing – clutch casing;
- Steering hydraulic cylinder brackets and pins;
- Sleeves – FDA casing;
- Adjustable brace cover fixing bolts;

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\* Not shown at lubrication diagram.

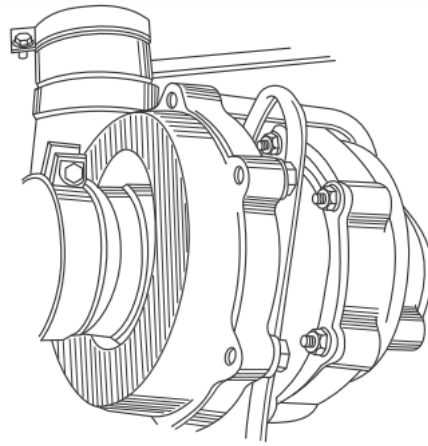




- Towing coupler and hydraulic jack guide brackets fixing bolts and nuts.

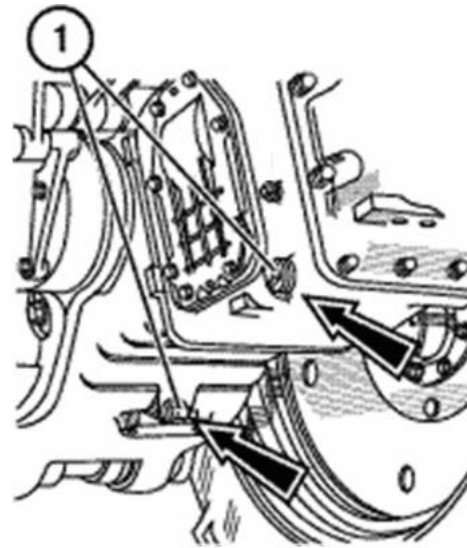
**Operation 43. Turbocompressor (MTZ 821.2/821.3/921/921.2/921.3/921.4).**

- Disassemble turbocompressor assembly and dip it into a diesel fuel bath for two hours;
- Blow turbocompressor with dry compressed air and reinstall.



**Operation 44. Transmission oil change.**

- Warm transmission up prior to changing oil;
- Place tractor on a plain ground, lower the tool and stop the engine;
- Engage parking brake and use shims to prevent wheel move;
- Unscrew drain plugs (1) from the gearbox and rear axle casing and filler cap (see Lubrication diagram, pos.44). Drain oil to a special container for use oil. Dispose of used oil in proper way.



**ATTENTION!** Be careful to avoid contact to hot oil.

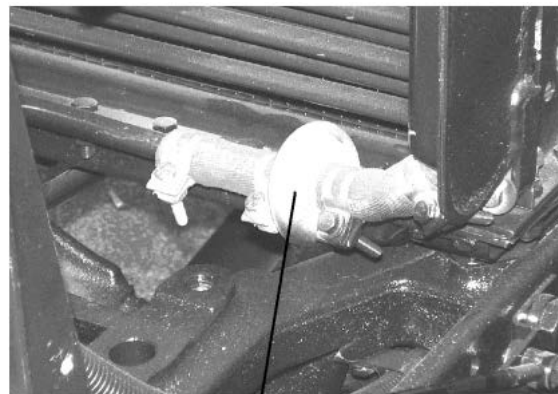
Reinstall drain plugs and add fresh oil to the transmission.

**Operation 45. Flushing engine oil prefilter.**

- Loosen four clamps at connection sleeves and remove filter (1) from oil line in front of engine oil cooler;

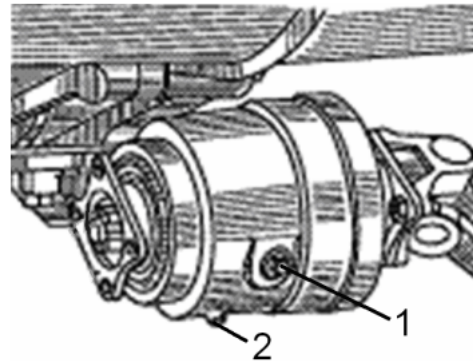
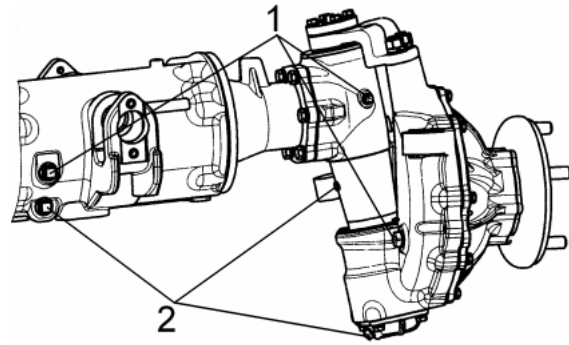
**IMPORTANT!** Note filter positioning in the oil line. Random installation is not allowed.

- Rinse the filter with diesel fuel and blow with compressed air in direction of an arrow at the filter housing;
- Install the filter considering correct positioning in the oil line;
- Tighten clamp bolts.



**Operation 46. Changing oil in wheel reduction gear housings, main drive and intermediate bearing of FDA cardan drive.**

- Run the tractor and warm oil in FDA housings up;
- Place the tractor on a plain ground. Stop the engine. Engage parking brake and block the wheel with shims of both sides;
- Unscrew inspection and filler plugs (1) from wheel reduction gears, main gear, upper conical pair and intermediate bearing;
- Unscrew drain plugs (2) of the main gear, upper conical pair, reduction gears and intermediate bearing. Drain oil into a special container and dispose of in a due manner;
- Reinstall and tighten drain plugs;
- Fill housings with fresh transmission oil to the lower edges of inspection and filler openings;
- Reinstall and tighten inspection and filler plugs.

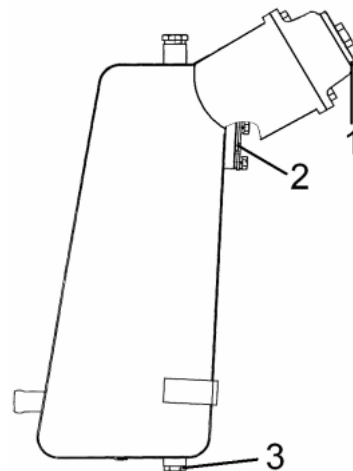


**Operation 47. Hydraulic system tank oil change.**

Warm hydraulic system oil up prior to changing.

Place the tractor on a plain ground, stop the engine and retract hydraulic cylinder rods. Change oil as follows:

- Remove filler cap (1) and drain plug (3) from hydraulic system tank and drain oil into a container for used oil. Dispose of the oil in a suitable manner;
- Reinstall drain plug (3) and fill in new oil according to lubrication diagram and table of lubricants;
- Check oil level with oil meter (2). The level should be between “O” and “P” marks;
- Reinstall filler cap (1).



concentrations. Injection start and end should be clearly distinguished.

### **Operation 48. Changing oil in power steering tank.**

Follow instructions of Operation 47. Turn fasteners and remove left side grill of the tractor's facing to access power steering tank.

Change oil in power steering tank as follows:

- Remove filler cap (2) and drain plug (3). Drain oil from the tank into a container for used oil;
- Reinstall drain plug (3) and add new oil to the upper mark at dipstick (1);
- Reinstall cap (2) and left facing grill.

### **Special maintenance after each 2000 operating hours**

Includes above and the following operations:

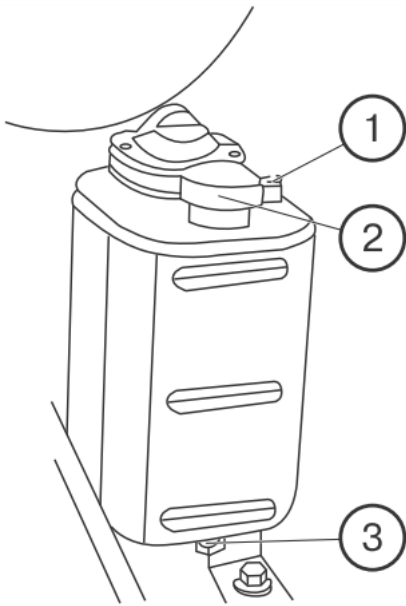
### **Operation 49. Engine injector check.**

**IMPORTANT!** Check and adjust injectors in a specialized workshop.

**WARNING!** Diesel fuel is sprayed and jet-injected and may be a source of bad injury if to check injector spraying by hand. Use paper or cardboard for that purpose. Wear goggles. Tighten all fuel line connections prior to starting the engine. Immediately apply for medical care in case of fuel spraying to skin.

Remove and replace injectors as follows:

- Completely clear adjoining working surface prior to disconnecting or loosening any fuel system parts;
- Unscrew nuts (4) and disconnect high-pressure fuel lines (5) from injectors (3) and fuel pump;
- Disassemble fuel lines (5);
- Unscrew four banjo-bolts (1) of drain line and disassemble drain fuel line (2). Replace sealing copper washers (two per each bolt);
- Unscrew bolts (6) fixing injectors and remove injectors (3);
- Send injectors to a specialized workshop for inspection. An injector is considered to be good in case of creating fuel fog with no separate drops, continuous jets or



There should be no drops at the sprayer tip. Replace sprayer in case of impossibility to adjust injector. Depressure a sprayer prior to installing it into an injector by flushing with gasoline or warm diesel fuel;

- Install inspected, clean and adjusted injectors performing above operations in reverse order. Remove air form the system.

**IMPORTANT!** Use new copper washers each time installing injectors.

### **Operation 50. Fuel pump injection lead angle.**

Fuel pump injection lead angle should be set within indicated in “Section 3. Technical specifications” range.

Verify and adjust fuel pump lead angle in a specialized workshop.

**IMPORTANT!** Fuel equipment adjustment by tractor operator (owner) is the basis for manufacturer’s warranty termination.

### **Operation 51. Fuel pump bench adjustment**

Fuel pump is adjusted in a specialized workshop with a bench.

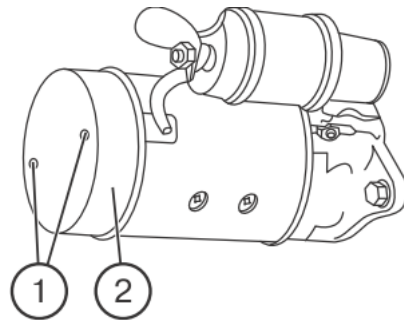
### Operation 52. Engine cooling system flush.

Use solution of 50-60g of soda ash in 1l water to flush cooling system.

Flush the system as follows:

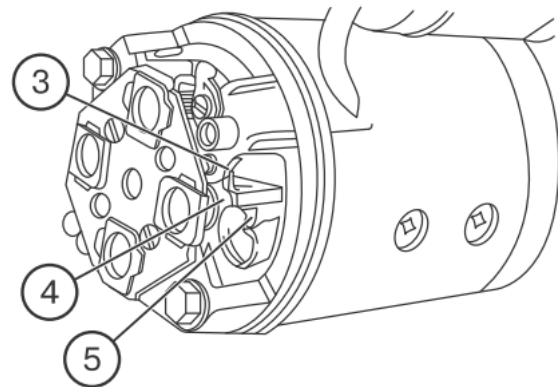
- Add 2l kerosene into the cooler and fill the system with prepared solution;
- Start and run the engine within 8-10 hours. Drain the solution and flush cooling system with clean water;
- Inspect cooler core cleanness. Wash the cooler and blow the core with compressed air, if necessary (air flow directed from the engine side).

**IMPORTANT!** Clogged cooler, loose fan belt or contaminated system inside may provoke engine overheating and breakdown.



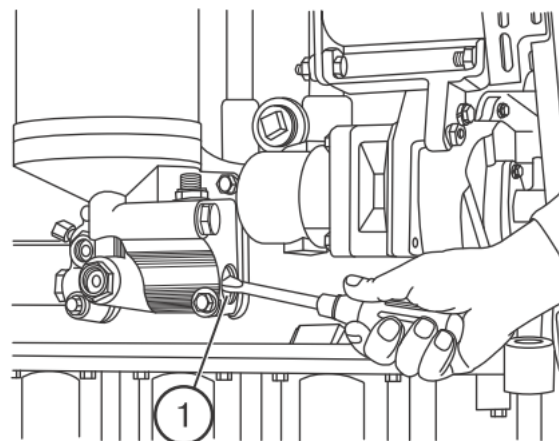
### Operation 53. Engine starter maintenance.

- Remove screws (1) and cover (2);
- Inspect collector (3) surface state;
- Ensure free travel of brushes (5) inside the holder. Brush pressure over the collector surface should be equal to 0.75-1.00 kgf. Otherwise replace brush holder (4) assembly;
- Send the starter to a repair workshop in case of significant collector surface burn.



### Operation 54. Centrifugal engine oil filter drain valve adjustment.

In case of engine oil pressure drop below 0.10MPa (1.0 kgf/cm<sup>2</sup>) at rated engine speed and normal operating temperature stop the engine and remove the cause of pressure drop. Lubricating system oil pressure may be adjusted by tightening adjustment screw (1) of centrifugal oil filter drain valve\* with removed threaded plug (not shown).



\* Paper filter element for MTZ-921.3./921.4

## TABLE OF LUBRICANTS

Lubricated points and assemblies	Name, grade and code of lubricants and liquids standard		Operation capacity	Storage capacity (up to 6 month)	Number of lubricated points
	Basic	Substitute			
Engine oil pan	M-8DM motor oil (-40°C to +5°C)	M-8G <sub>2K</sub> M-8DM (-40°C to +5°C)	12.0	12.0	1
	M-10DM motor oil (+5°C to +50°C)	M-10G <sub>2K</sub> (+5°C to +50°C)			
Powertrain housing	Transmission oil TAp-15V*	TAD-17i, TSp-15K, TSp-10 transmission oil	40	40	1
FDA wheel reduction gear housings			1.5	1.5	2
FDA housing			1.6	1.6	1
Upper FDA conical pair housings			0.3	0.3	2
FDA drive intermediate bearing			0.15	0.15	1
Hydraulic system oil tank	Motor oil: M-10G <sub>2</sub> updated, M-10G <sub>2K</sub> (summer), M-8G <sub>2K</sub> (winter)		25,0	25.0	1 1
Power steering oil tank	Industrial oil: Bechem Staroil No.32		6,0	6.0	1
Clutch shifter bearing	Grease: «Litol-24»	Consistent grease: "Bechem" universal LCP GM	4-6 syringe pressings	4-6 syringe pressings	1
Steering hydraulic cylinder ball joints			0.0125	0.0125	2

\* Dilute with AU spindle oil (GOST 1642-75) or I-12A industrial oil (GOST 20799-75) up to 30% at temperature -15°C to -20°C. Dilute with up to 15% winter diesel fuel at temperature to -55°C.

## Section 11. STORAGE

### Tractor storage

#### Perform the following prior to long-term storing the tractor:

- Wash the tractor;
- Place the tractor in shelter or room;
- Squirt all lubricated points (see “Section 10. Maintenance”);
- Drain oil from the engine oil pan, powertrain, hydraulic system and power steering tanks, FDA housing wheel reduction gears and intermediate bearing, fill with fresh clean oil;
- Drain fuel from fuel tanks and add 5l preservation fuel;
- Run engine within 3-5min. to fill fuel system with fuel;
- Lift RH rods to the highest position;
- Disconnect and charge batteries, store them in a dry vented room at 15-20°C. Check and charge, if necessary, them monthly;
- Jack front and rear axles and place supports to unload tires. Depressurize the tires to 70% of normal pressure;
- Drain coolant from engine cooling and cab heating systems;
- Loosen fan belt;
- Cover exhaust pipe opening;

- Drain sediment from rough and fine fuel filters;
- Preserve steering hydraulic cylinder rod or turn wheel to the most left position to retract the rod;
- Lift lower RH rods to the lowest position;
- Rotate engine crankshaft by 1-2 not less than monthly.

**IMPORTANT!** Engine storing and destoring should follow engine operation manual.

#### To destore the tractor:

- Jack the tractor and remove supports from under the machine. Pump tires up to normal pressure;
- Fuel tank up;
- Check coolant and oil levels in all refill capacities;
- Install fully charged battery to the tractor;
- Take cover off the exhaust pipe;
- Start the engine and check operability of all instruments, controls and systems of the tractor;
- Check operability of light and sound signaling devices;
- Run the tractor without load to ensure its correct operation.



## Section 13. APPENDIX

### Electrical connections diagram

A1	Stereo radio
BA1, BA2	Loudspeaker
FU1	Fuse
A2	Control board
BK1	Coolant temperature indicator
BP1	Oil pressure cell
BP2	Air pressure cell
BN1	Fuel level sensor
BV1, BV2	Speed sensor
E1, E2	Headlamp
E3, E4, E7, E8, E9, E10	Operation light
E5	Cab lamp
E6	Registration plate light
EL1, EL2	Lamp
EL3, EL4, EL19, EL20, EL21, EL22	Lamp
EL9, EL10, EL15	Lamp
EL13, EL17	Lamp
EL8, EL11, EL12, EL14, EL16, EL18	Lamp
EL5	Lamp
F1	Fuse block
F2	Distribution block
F3	Fuse block
F4	Fuse block
G1	Generator
GB1	Accumulator battery
HA1	Horn
HA2	Signaling relay
HG1	Indicator light block
HL1, HL2	Front light
HL3, HL4	Rear light

K1, K3, K4	Relay
K2	Relay
KH1	Control hand brake lamp breaker
KH2	Turn indicator breaker
M1	Starter
M2	Fan
M3	Screen washer
M4	Screen wiper
M5	Screen wiper
P1	Tacho-speedometer
P2	Dashboard
QS1	Ground switch
SA1	Rear screen wipe switch
SA2, SA3, SA4	Operation lights switch
SA5	Heater switch
SA6	Start block switch
SA7	Right understeering switch
SA8	Left understeering switch
SA9	CPS switch
SA10	Starter and instruments dswitch
SB1, SB2	Brake switch
SB3	Alarm lights switch
SB4	Ground switch
SB5	Hand brake switch
SK1	Alarm coolant temperature indicator cell
SL1	Alarm brake fluid level indicator cell
SP1	Alarm air filter clogging indicator cell
SP2, SP3	Alarm oil pressure indicator cell
SP4	Alarm air pressure cell
XA9.1	Socket

Pin connectors	
XP1.1, XP1.2, XP1.3, XP1.4	Block
XP2.1, XP2.2, XP2.5	Block
XP2.3, XP2.4	Block
XP9.1, XP9.2, XP9.3	Block
XP12.1	Plug
XP12.2	Plug
XP15.1, XP15.2	Plug
Socket connectors	
XS1.1, XS1.2, XS1.3, XS1.4, XS1.5	Block
XS2.1, XS2.5, XS2.9, XS2.10	Block
XS2.2, XS2.3, XS2.4, XS2.6	Block
XS2.7, XS2.8	Block
XS3.1, XS3.3	Block
XS4.1	Block
XS5.1, XS5.2, XS5.4, XS5.5, XS5.6	Block
XS5.3	Block
XS6.1, XS6.2, XS6.3	Block
XS7.1	Block
XS8.1, XS8.2, XS8.3, XS8.4, XS8.5, XS8.7	Block
XS8.6	Block
XP9.1, XP9.3, XP9.4	Block
XS9.2, XS9.3	Block
XS13.1	Block
XS12.1	Socket
XS12.2	Socket
XS15.1	Socket
XS15.2	Socket
XT1	Distribution board
WA1	Antenna