

PARTIAL POWERSHIFT TRANSMISSION of MTZ-1523.4 model tractor



**MTZ 1523 - 155 H.P.
Drive System: 4WD
Engine: 155 HP
PTO: 145 HP
Rated Speed: 2100
No. of Cylinders: 6**

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

PARTIAL POWERSHIFT TRANSMISSION

of MTZ-1523.4 model tractor

Supplement to Operator's Manual

Introduction

The following is additional and specifically for the introduction of the Partial Powershift Transmission for MTZ 1523.4 model tractors. This information is an addition to the Operator's Manual supplied with MTZ 1523.4 model tractors.

As tractors can be supplied with two versions of Partial Powershift Transmission control, distinguishing features of Partial Powershift Transmission, with joystick, gearshift control are explained in Sections 9-11)

Table of Contents

1	Transmission Controls & Instruments	4
1.1	Location	4
2	Short Operating Instructions	4
2.1	Mounting and dismounting the tractor	4
2.2	Before starting the engine	4
2.3	Engine starting procedure	4
2.4	Driving the tractor, shifting the gearbox	6
2.4.1	In order to start to move, proceed as follows:	7
2.4.2	Reducer step shift	7
2.4.3	Gearbox range shift	7
2.4.4	Gearshift	8
2.5	Starting to move	8
2.6	Stopping the tractor	9
2.7	Stopping the engine	9
2.8	PTO use	10
3	Description of Partial Powershift Gearbox	11
3.1	Partial Powershift Gearbox design	11
3.2	Double frictional clutch	13
3.3	Gearbox control mechanism	14
3.4	Mechanism of range reducer High and Low steps changeover	15
3.4.1	Mechanism of range reducer steps changeover adjustment	15
3.5	Gearshift and reducer steps shift control	16
3.6	Gearshift control board PU-3MG	16
3.7	Selection of gears and ranges	20
3.7.1	Initial positions	20
3.7.2	Gearshifting	20
3.7.3	Adjustment of disengaged clutch condition sensor	21
3.8	Diagnostics of electric & hydraulic circuit's condition	22
3.9	Emergency second gear engagement.	23
3.10	Diagram of gearshift system electric connections	24
4.	Transmission Hydraulic System	25

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

4.1	Major elements of Transmission Hydraulic System.	25
4.2	Duplex filter.	26
4.3	Electro-hydraulic distributor of transmission hydraulic system	27
5.	Selection of Gearbox reducer steps, ranges, and gears (detailed description)	28
5.1	General information	28
5.2	Gearbox reducer steps changeover	28
5.3	Selection of gearbox ranges	29
5.3.1	Engagement of “slow down” mode	29
5.4	Gearshifting	30
5.5	Engaged gear indicator panel	31
5.6	Setting and displaying of gearshift mode	32
5.7	Emergency 2-nd gear engagement switch	33
6.	Routine Maintenance operations	34
6.1	Specific Maintenance operations after tractor break-in period (30 hrs. of operation)	34
6.2	Specific Routine Maintenance operations	34
6.3	Description of Specific Routine Maintenance operations (General instructions)	34
6.3.1	Operation 2. Check transmission oil level	34
6.3.2	Operation 33. Wash off transmission hydraulic screen filter	35
6.3.3	Operation 82. Adjustment of operational pressure valve in transmission hydraulic system	35
6.3.4	Operation 83. Replacement of filtering elements in transmission hydraulic filter	36
7	Troubleshooting and remedies	39
7.1	Troubleshooting of gearbox	39
7.2	Troubleshooting of gearbox electronic control system	41
7.3	Troubleshooting of transmission hydraulic system	43
8	Towing the tractor	44
9	Selection of ranges, gears and gearbox reducer steps (version with joystick gearshift control)	45
9.1	General information	45
9.2	Selection of gearbox ranges	45
9.3	Gearbox gears changeover	47
9.4	Gearbox reducer steps changeover	47
9.5	Velocity diagram for tractor "MTZ-1523.4	48
10	Integrated Electronic Control System (IECS; version available only with gearshift joystick control)	49
10.1	General information about Integrated Electronic Control System (IECS)	49
10.2	Indication of gearbox engaged gear and gearshift mode control	50
10.3	Rear Power Take Off (PTO) control	50
10.4	Front PTO control	51
10.5	Front drive axle (FDA) control	51
10.6	Rear axle differential lock control	52
10.7	Signaling of transmission and tractor hydraulic systems emergency state, diagnostics of emergency power supply voltage	53
10.8	Diagnostics of Electronic control systems of rear and front PTO, FDA, rear axle Dif. Lock and gearshift	54
10.9	IECS functioning check	55
11	Additional information concerning to rear PTO control	56

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

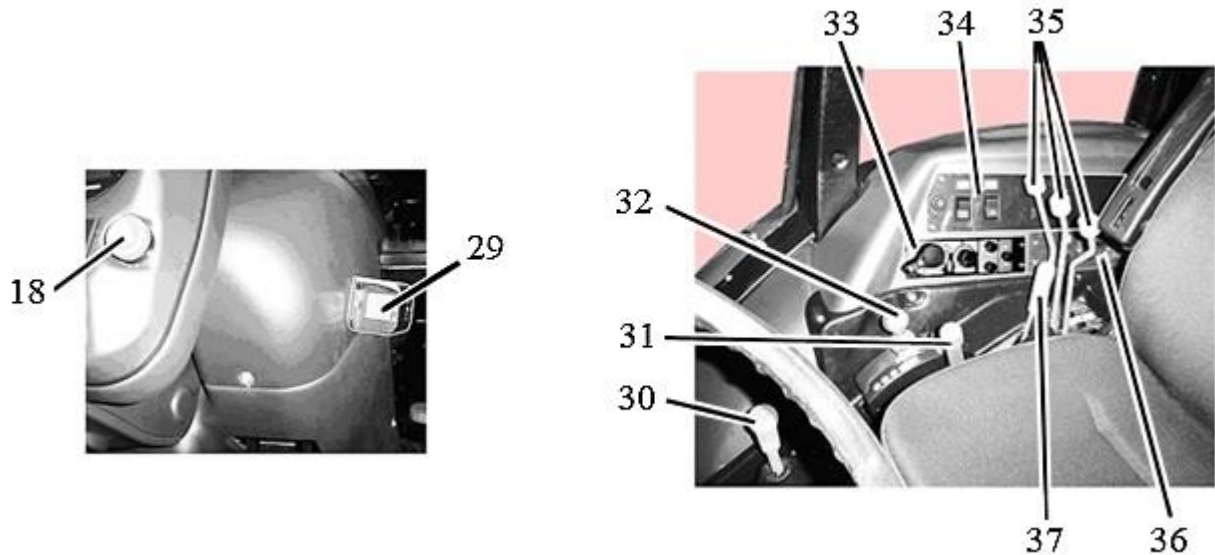
Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

1 Transmission Controls & Instruments

1.1 Location

Specific Partial Powershift transmission controls in tractor cab are shown in Picture 1.1



Picture 1.1 - Location of gearbox controls and instruments

18 - starter and instruments switch; 29 – engaged gear indication panel; 30 – gearbox range shift lever; 31 – engine fuel delivery control handle; 32 – gearbox gear and reducer step shift block; 33 – rear 3-pt. hitch control board; 34 – panel of rear axle differential lock and front drive axle control; 35 – handles of distributor control; 36 – panel of engine control; 37 – lever of rear PTO control.

2 Short Operating Instructions

2.1 Mounting and dismounting the tractor

Mount and dismount the tractor on the left hand side. Always face the tractor when mounting or dismounting. Grip the hand holds firmly and use the steps provided whenever mounting or dismounting from the tractor.

2.2 Before starting the engine

Before starting the engine for the first time, perform all required 10 hour service and maintenance requirements. Fill the fuel tank with clean diesel fuel. Be sure that all persons that operate the tractor understand that clean fuel and fuel handling equipment is very important.

2.3 Engine starting procedure

WARNING: Start and operate the tractor only when sitting in the operator's seat with the seat belt securely fastened. Do not permit others to ride!

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

Starting sequence:

1. Apply the parking brake.
 2. Fill in and bleed the fuel system of all air if required.
 3. Move the hand operated engine control handle 31 (picture 1.1) into position of minimum fuel delivery.
 4. Make sure that foot operated engine throttle is not depressed and is at initial position. Do not depress foot operated engine throttle when starting the engine.
 5. Set the rear PTO control lever 37 into position "Disengaged". Set PTO drive control handle into position "PTO drive off".
 6. Check for neutral position of hydraulic distributor and 3-point hitch control levers. Switches of Rear axle Dif. Lock, Front Drive axle, Front PTO engagement shall be set into position "disengaged".
 7. Put the gearbox range shift lever 30 (picture 1.1) in neutral.
 8. Set the gearbox gear shift hand knob 32 to "0" position.
 9. Turn on the battery ground switch.
 10. Turn on the starter and instruments switch from position OFF into position "I" - Instruments are ON.
- At that:
- 1) LED and needle indicators workability on the integrated indicator will be checked and confirmed.
 - 2) Engine control panel will be self-diagnosed. If errors are detected, failure indicator will inform by light error code. Detected errors shall be repaired.
 - 3) Engine data display unit will confirm it's operating conditions. Then it functions in the operating mode - it displays actually measured parameters of the engine. If failures are detected, the data unit produces an acoustic signal and brief description of the detected failures appears on the screen. The detected faults shall be eliminated before the engine start.
 - 4) A signal light of emergency oil pressure in Volumetric Steering system lights up on the pilot lamp unit. On the instrument cluster illuminate:
 - signal light of emergency engine oil pressure (and a buzzer sounds);
 - signal lamp of fuel reserve capacity;
 - control lamp of additional battery charge at 24V.
 - a pilot indicator lamp of applied parking brake (lamp turns on in a flashing mode on the integrated indicator).
 - 5) Gear "0" and light mode of gearshift are displayed in constant yellow color on engaged gear indication panel 29 (picture 1.1).
 - 6) A pilot lamp indicating glow plug operation, lights up on the pilot lamps unit. When glow plug pilot lamp goes out, depress the clutch pedal and turn the key of starter and instruments switch from position "I" ("instruments are on") into position "II" (engine start).
Turning and holding the switch fully clockwise will energize the cranking motor. Hold the switch until the engine starts, but no more than 20 seconds. Release the key switch. When switch is released it will return to the position "I".
IMPORTANT: do not use the starter motor for more than 15 - 20 seconds without interruption. Wait for 1 – 2 minutes between starting attempts to allow the starter to cool.
 - 7) When the engine is running, release the clutch pedal, check functioning of all signal lamps and gauge indications (coolant temperature, engine oil pressure, etc.). Let the engine run at low rpm until pressure stabilizes within gauge operational range.
 - 8) Indicators of "Low" gearbox reducer step and gear "0" will turn on gear and reducer step shift block.
 - 9) A pilot lamp indicating the charge of additional battery at 24 V shall go out after the engine start. Otherwise it indicates that the additional battery is not being charged and malfunction is to be repaired.

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

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

IT IS FORBIDDEN TO START THE ENGINE WITH THE COOLING AND/OR LUBRICATING SYSTEMS UNFILLED!

ATTENTION: START THE ENGINE AND OPERATE CONTROLS ONLY WHEN SEATED IN THE OPERATOR'S SEAT, WITH ALL OPERATING CONTROLS IN NEWTRAL POSITION!

ATTENTION: BEFORE STARTING THE TRACTOR OR PTO DRIVEN EQUIPMENT ALWAYS CHECK THE AREA AROUND YOU TO MAKE SURE NO ONE IS STANDING NEAR, UNDER, IN FRONT OF AND BEHIND THE TRACTOR, AS WELL AS BETWEEN THE TRACTOR AND AN ATTACHED IMPLEMENT!

DO NOT PUSH OR TOW THE TRACTOR TO START THE ENGINE. SEVER ENGINE DAMAGE OR ACCIDENT MAY RESULT IF THE TRACTOR IS PUSHED OR TOWED FOR STARTING!

2.4 Driving the tractor, shifting the gearbox

ATTENTION: YOUR TRACTOR IS EQUIPPED WITH TURBOCHARGED ENGINE. HIGH SPEED OF THE TURBOCHARGER REQUIRES DEPENDABLE LUBRICATION AT ENGINE START. WARM UP THE ENGINE AT 1000-1300 RPM WITHIN 2-3 MIN TO ACHIEVE STABLE OPERATION, AND THEN LET IT RUN AT HIGHER RPM, GRADUALLY INCREASING THE SPEED UP TO 1600 RPM (NOT MORE) UNTIL THE COOLANT TEMPERATURE REACHES 40°C!

TRACTOR OPERATION IS STRICTLY PROHIBITED IF THE ENGINE EMERGENCY OIL PRESSURE LAMP TURNS ON AT THE ENGINE RUNNING. STOP THE ENGINE IMMEDIATELY!

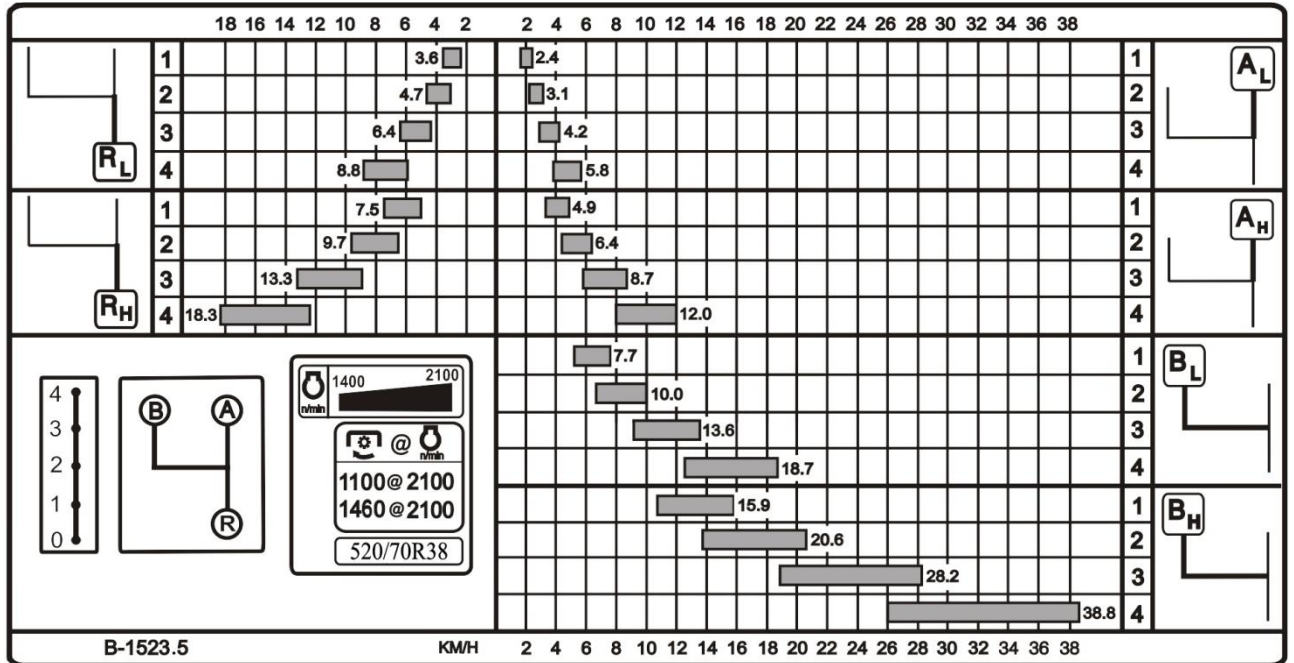
Determine the required travel speed before driving the tractor. Velocity diagram for Tractor "MTZ-1523.4" with Partial Powershift transmission, using basic tires, is located on right cab window and also on Velocity diagram (Picture 2.1).

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com



Picture 2.1 Velocity diagram of “MTZ-1523.4” tractor with Partial Powershift Transmission

2.4.1 In order to start to move, proceed as follows:

NOTE: DETAILED PROCEDURE OF GEARBOX REDUCER STEPS, RANGES AND GEARS ENGAGEMENT SEE IN SECTION 5.

- Engage medium or heavy gearshift mode (see below) instead of light mode if required;
- Slow down the engine speed;
- Depress the clutch pedal;
- Press down the set button of “slow down” mode in order to shift gearbox in “slow down” mode;
- After symbol “P” lights on panel, proceed to reducer step shift if required.

2.4.2 Reducer step shift

When symbol "P" illuminates on panel, push down reducer step shift button to set High (H) step if required. High (H) reducer step engagement indicator and reducer step shift button will illuminate on gear and reducer shift block at that.

2.4.3 Gearbox range shift

At engaged gearbox “slow down” mode set up required gearbox range with range shift lever in accordance with velocity diagram (picture 2.1).

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

2.4.4 Gearshift

Set up the 1st gear from gear "0": depress clutch pedal, lift gearshift hand knob, move it into position "1" and release. 1st gear engagement indicator will illuminate on shift block, figure "1" in yellow color will constantly illuminate on panel and set mode of gearshift engagement is displayed.

2.5 Starting to move

Disengage parking brake, release clutch pedal smoothly increasing fuel delivery rate simultaneously. Tractor starts to move.

DO NOT ENGAGE THE CLUTCH AGAINST A HEAVY DEAD LOAD, SUCH AS IMPLEMENTS OR TILLAGE EQUIPMENT IN THE GROUND. RAISE THE IMPLEMENT BEFORE ENGAGING THE CLUTCH!

IT IS FORBIDDEN TO DRIVE THE TRACTOR WITH OPEN DOOR!

ATTENTION: ENGAGE RANGE ONLY AFTER ENGAGEMENT OF GEARBOX «SLOW DOWN» MODE ON STOPPED TRACTOR! CARRY OUT SELECTION OF RANGES, ONLY WITH DISENGAGED IN NEUTRAL RANGE LEVER AND ENGAGEMENT OF GEARBOX "SLOW DOWN" MODE!

ATTENTION: DISENGAGE GEARBOX RANGE LEVER INTO NEUTRAL POSITION, ONLY AFTER SETTING GEARBOX TO "0" GEAR AT DISENGAGED CLUTCH, ON STOPPED TRACTOR!

ATTENTION: SWITCHOVER FROM POSITION "GEARS DISENGAGED" (GEAR "0") IS ONLY PERMITTED AT FULLY DEPRESSED CLUTCH PEDAL!

ATTENTION: CARRY OUT GEARSHIFT OPERATIONS WITHIN ONE RANGE ON MOVING TRACTOR WITHOUT CLUTCH PEDAL DEPRESSION!

ATTENTION: GEARBOX REDUCER, STEP SWITCHOVER SHOULD BE CARRIED OUT ONLY AT SWITCHED ON "SLOW DOWN" GEARSHIFT MODE AFTER GEAR "0" IS SET, ON STOPPED TRACTOR!

ATTENTION! DISENGAGE THE CLUTCH PEDAL QUICKLY TO REFUSAL, RELEASE THE CLUTCH SMOOTHLY AND GRADUALLY, THAT WILL CONTRIBUTE TO ACCURATE GEARSHIFTING AND SMOOTH START TO LOAD. SLOW AND INCOMPLETE PEDAL DEPRESSION WILL RESULT IN CLUTCH OVERHEATING AND POOR GEARSHIFT. IF CLUTCH PEDAL IS RELEASED QUICKLY, IT WILL RESULT IN SHARP LOAD INCREASE ON TRANSMISSION AND SHAKY TRACTOR MOVEMENT.

DO NOT RIDE THE CLUTCH PEDAL DURING OPERATION TO AVOID CLUTCH SLIPPAGE AND OVERHEATING! THAT WILL ENSURE RECOVERY OF CLEARANCES IN HYDRAULIC CLUTCH ACTUATOR.

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

ATTENTION! MAKE SURE THAT PARKING BRAKE IS DISENGAGED WHEN STARTING TO MOVE!

ATTENTION! DO NOT DRIVE AT SPEED OVER 13 KM/HR AT REAR AXLE DIF. LOCK ENGAGED!

ATTENTION! DISENGAGE FRONT DRIVE AXLE OPERATING ON HARD-SURFACED ROADS, IN ORDER TO AVOID FRONT TYRES WEAR!

ATTENTION! ENGINE FULL POWER USE IS ONLY PERMITTED AT COOLANT TEMPERATURE NOT LESS THAN 70° C!

2.6 Stopping the tractor

In order to stop tractor proceed as follows:

- slow down the engine speed;
- depress the clutch pedal completely;
- stop the tractor with service brakes;
- set the gearbox hand knob to gear "0" position;
- set the gearbox range lever to neutral position;
- release clutch and brake pedals;
- apply the parking brake

ATTENTION: FOR TRACTOR EMERGENCY STOP, DEPRESS DEEPLY THE CLUTCH AND BREAK PEDALS TOGETHER!

2.7 Stopping the engine

ATTENTION: BEFORE STOPPING THE ENGINE, LOWER IMPLEMENT ON GROUND, LET THE ENGINE RUN AT (1000±100) RPM FOR 3 TO 5 MINUTES. THIS ALLOWS TO REDUCE ENGINE COOLANT TEMPERATURE!

In order to stop the engine proceed as follows:

- shift rear PTO control lever to "disengaged" position, set rear PTO drive control handle to position "PTO drive disengaged";
- switch off rear axle Dif. Lock, front drive axle, front PTO (if installed);
- set hydraulic system distributor levers to neutral position;

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

- set 3-point hitch control handle to position “disengaged”;
- turn off air conditioner or heater;
- turn starter and instrument switch from position “I” to position “0”.
- switch off the battery when engine is stopped for a long time.

ATTENTION: FOR ENGINE EMERGENCY STOP, TURN THE STARTER AND INSTRUMENTS SWITCH FROM POSITION "I" INTO THE POSITION "0"!

2.8 PTO use

See 1523.4 Operation Manual for directions on PTO use.

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

ATTENTION: IT IS PROHIBITED TO USE REAR PTO SHAFT ENDS OF THE CORRESPONDING TYPES WHILE ATTACHING “MTZ-1523.4” TRACTORS WITH IMPLEMENTS WITH POWER REQUIREMENTS ABOVE SPECIFIED IN OPERATION MANUAL!

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

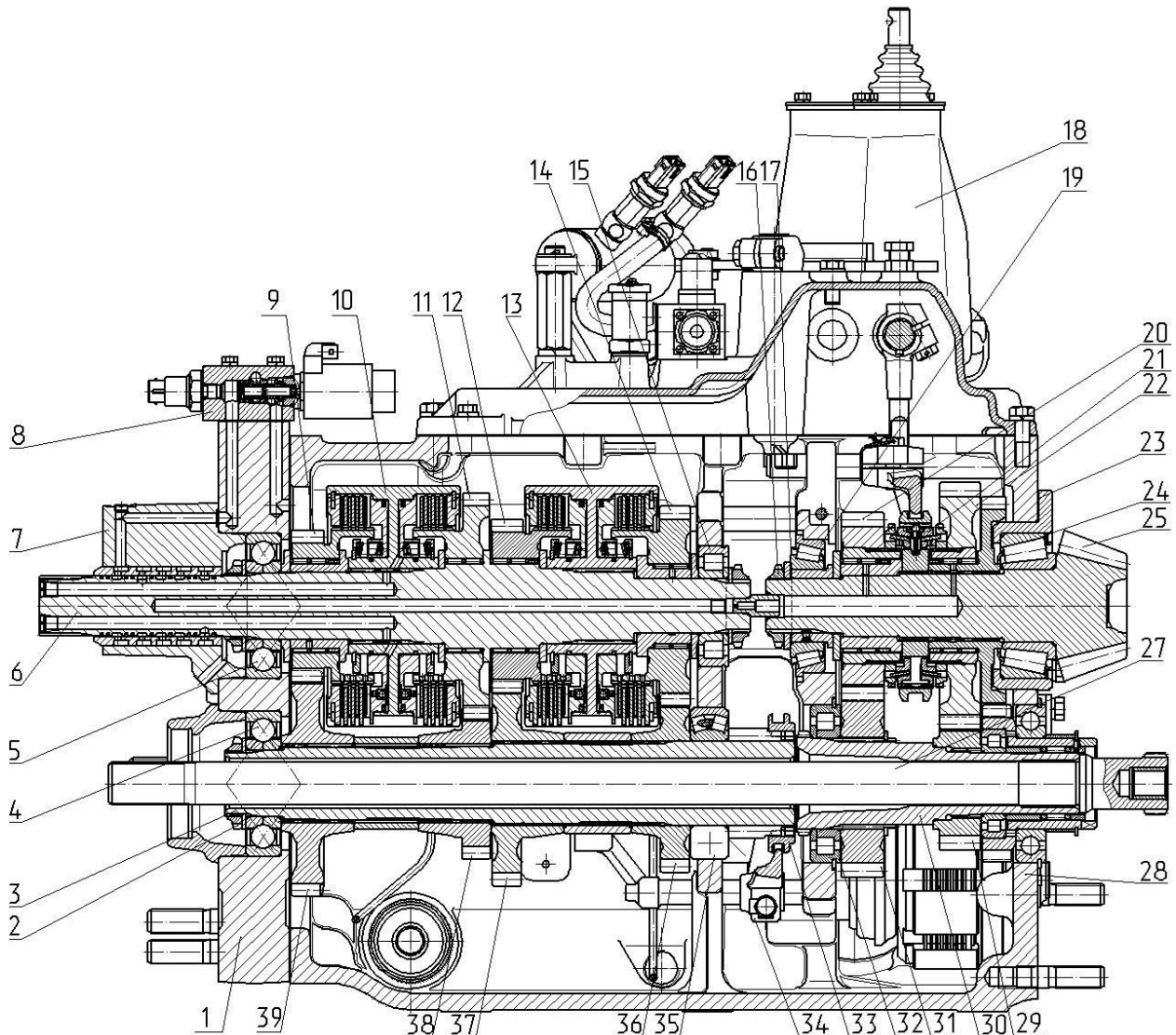
Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

3 Description of Partial Powershift Gearbox

3.1 Partial Powershift Gearbox design

Gearbox consists of installed in housing gear unit, including input and intermediate shafts, low and revers ranges shaft, gears block, secondary shaft, control mechanism and units of transmission hydraulic system.



Picture 3.1 - Gearbox longitudinal profile:

1 - plate; 2, 16 - nuts; 3 - intermediate shaft; 4, 5, 15, 19, 24, 26, 32, 35 - bearings; 6 - input shaft; 7 - sleeve; 8 - distributor; 9, 11, 12, 14 - gear unit drive pinions; 10, 13 - frictional clutches; 17, 23 - adjustment gaskets; 18 - cover of gearshift control mechanism; 20, 22 - secondary shaft gears; 21 - synchronizer; 25 - secondary shaft; 27 - PTO drive shaft; 28 - housing; 29, 31 - reducer driven gears; 30 - gear block shaft; 33 - toothed half-coupling; 34 - range shift yoke; 36, 37, 38, 39 - gear unit driven pinions.

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

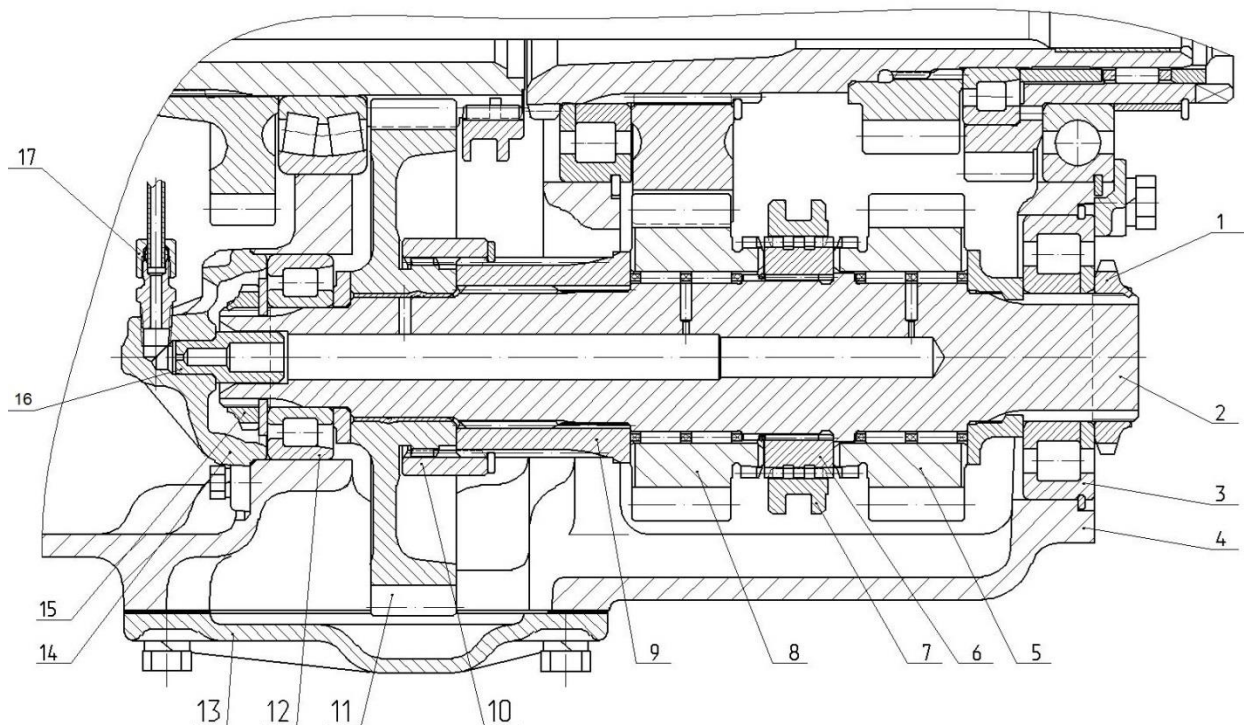
Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

Gear unit is assembled on plate (1) and consists of input shaft (6), on which drive pinions (9), (11), (12), (14) providing engagement of 1-st, 4-th, 2-nd, 3-rd gears correspondingly are installed on needle roller bearings. Needle bearings are lubricated under pressure with oil, coming out of distributor (8) through the opening in plate (1), sleeve (7) and openings in input shaft (7). Two double frictional clutches (10) and (13), providing gearshift change over within one range are installed on shaft's splines. Input shaft supports in plate (1) and housing (28) are ball (5) and roller (15) bearings.

Driven pinions (36), (37), (38), (39) of the 3-rd, 2-nd, 4-th and 1-st gears are pressed on intermediate shaft (3). Bearings (4), (35) supports intermediate shaft. Intermediate shaft could be connected with gear block shaft by range shift yoke (33) and with gear on low & revers gears shaft by solid gear on right end of intermediate shaft.

Shaft of low and revers gears



Picture 3.2 - Shaft of low and revers gears

1, 15 – nuts; 2 – shaft; 3, 12 – bearings; 4 – gearbox housing; 5 – reverse gear; 6 – splined bushing; 7 – splined collar; 8 – low gear pinion; 9, 10 – bushing; 11 – super reducer drive pinion; 13, 14 – cover; 16 – throttle; 17 – union.

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

Bearings (3) and (12) support shaft in housing. The following parts are installed on bearings on the shaft: driven gear (11) connected with shaft via bushings (10) and (9); forward running driven gear (8) and reverse gear (5). Gears (5) and (8) could be connected with shaft via splined collar (7). Bushing (6), connected with shaft via splines are fixed on shaft with snap ring. Nuts (1) and (15) tighten the parts on shaft; nut's edges are punched into slots after tightening. Opening in gearbox housing, used for super reducer installation are closed with cover (13).

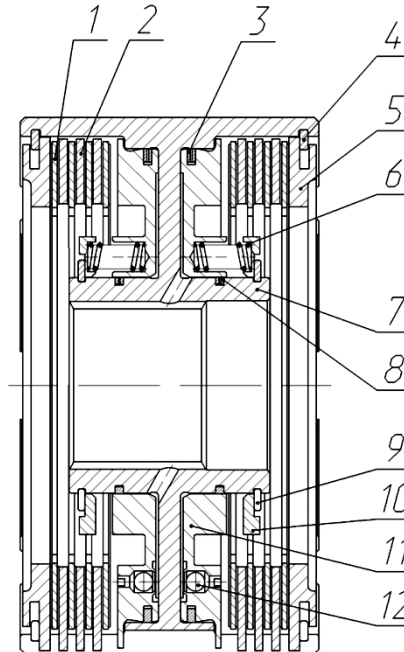
Positive oiling under pressure is provided for needle roller bearings (5), (8) and gear (11) bushing. Oil is delivered through union (17), cover (14), throttle (16) and orifices in shaft (2).

Gear block shaft (30) - see picture "Gearbox longitudinal profile" - is installed on bearings in housing. Gears (29) and (31) are connected with shaft by splines and are fixed by snap ring.

Secondary shaft (25) - see picture "Gearbox longitudinal profile"- is installed in housing (28) on cone bearings (19) and (24), adjusted with shims (17) and (23). Synchronizer's (21) hub is fixed on shaft. Driven gears (20) and (22) are installed on needle roller bearings lubricated under pressure through orifices in shaft. Synchronizer (21), controlled by yoke, fixed on axle is used to engage gears. Axle is installed in openings of housing (280) and is fixed with ball holder.

Set of parts on input, intermediate, secondary shafts are tightened with nuts; nut's edges are punched into slots after tightening.

3.2 Double frictional clutch



Picture 3.3 - Double frictional clutch

1 – driven disk; 2 – drive disk; 3, 8 – seal rings; 4, 9 – snap ring; 5 – locking disk; 6 – spring; 7 – drum; 10 – spring support; 11 – piston; 12 – ball.

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

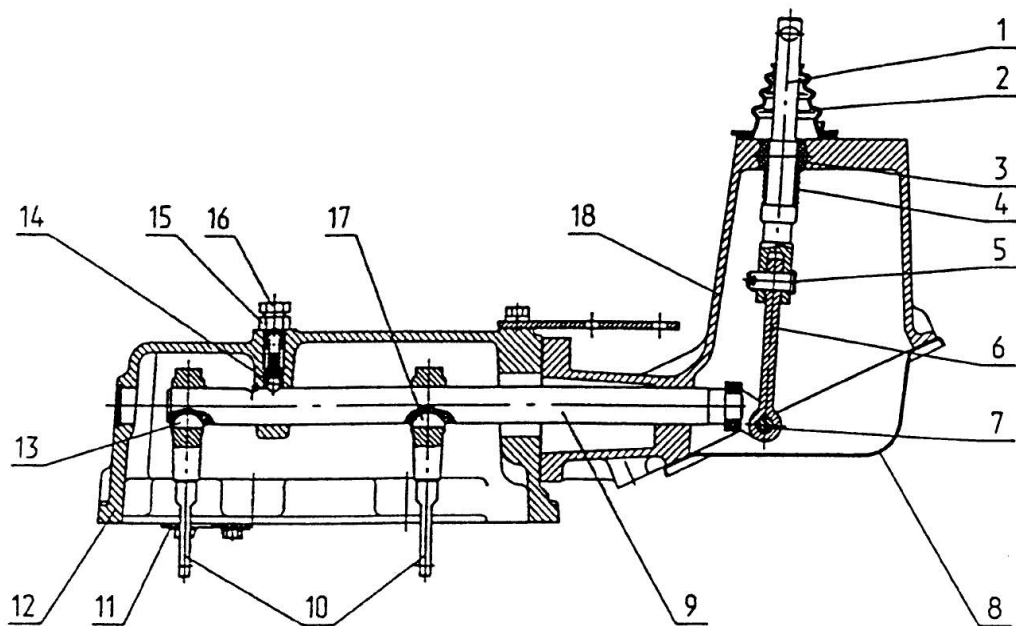
Double frictional clutch consists of drum (7) with borings from both sides. Pistons (11) sealed with cast iron split rings (8) and (3) are installed into borings.

16 springs (6) compressed previously by locking disk (10) fixed on drum hub by snap ring (9), are installed into openings of each piston. There are two centrifugal ball valves (12) in each piston for pressure relieve of service fluid out of cylinder cavities after cylinder is disconnected from pressure line of gearbox control.

Drive steel discs (2) are installed into drum slots with driven discs (1) with linings and inner splines in between. Sets of discs are locked with locking discs (5) fixed by snap rings (4).

PTO drive shaft (27) is installed into borings of intermediate shaft (3) and gear block shaft (30).

3.3 Gearbox control mechanism



Picture 3.4 - Range change over mechanism

1 — yoke, 2 — hood, 3 — sphere, 4 — spring, 5, 7 — pins, 6, 10 — levers, 8, 12 — covers, 9 — shaft, 11 — slotted plate, 13, 17 — keys, 14 — ball holder, 15 — nut, 16 — bolt, 18 — housing.

Gearbox control mechanism includes gearshift device and range change over mechanism with electro hydraulic system of range steps changeover: High «H» and Low «L» gearbox reducer steps.

Range change over mechanism is assembled in gearbox housing and gearshift cover (18) - see picture "Gearbox longitudinal profile". Shaft (9) with fixed on keys levers (10) is installed in control mechanism cover (12) supports (see picture "Gearshift change over mechanism" and housing (18)). Shaft (9) is fixed by ball holder (14) and connects by pins (5) and (7), lever (6) to yoke (1) with fixed range change lever. Yoke (1) is installed in sphere (3) in housing (1) and is supported by spring (4).

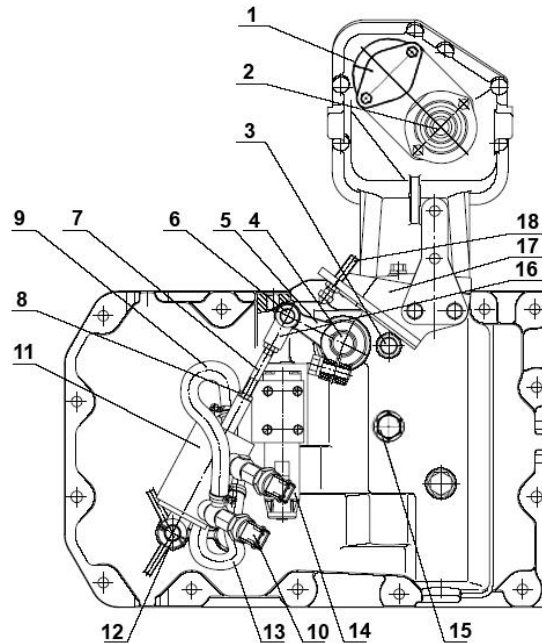
MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

3.4 Mechanism of range reducer High and Low steps changeover



Picture 3.5 - Mechanism of High and Low gearbox reducer steps change over

1 — cover; 2 — range change over yoke; 3 — bolt; 4 — axle; 5 — lever; 6 — pin; 7 — pusher; 8 — locknut; 9, 13 — oil lines; 10 — pressure sensor; 11 — hydraulic cylinder; 12 — axle; 14 — electro hydraulic valve; 15 — plug; 16 — yoke; 17 — bracket; 18 — adjust screw.

Mechanism of gearbox range reducer High and Low steps changeover is mounted on cover of control mechanism and consists of cylinder (11), fixed on axle (12), stud (7), lever (5) fixed on axle (4). Yoke (16) is connected to lever (5) by pin (6). Axle (4) lever interlocks with yoke axle and moves synchronizer (21) collar (see picture "Gearbox longitudinal profile") when turning. Position of lever (5) is adjusted by change of stud (7) length; locknuts (8) are to be tightened after adjustment. Connection of cylinder (11) to hydraulic system is effected by electro hydraulic valve (14). Retracted in position of rod (11) corresponds to Low "L" gearbox reducer step. Sensors (10) serve for indexation of reducer steps engagement.

3.4.1 Mechanism of range reducer steps changeover adjustment:

For adjustment of cylinder (11) disconnect piston stud (7) and lever (5) and move the piston inside the cylinder until stop. Turn lever (5) counterclockwise fully (engage Low ("L") step in gearbox reducer). Screw in until stop stud (7), lock it with nut (8). Turning in or out yoke (16), align openings in lever (5) and yoke (16), lock the yoke with locknut. Turn lever (5) clockwise fully (engage High ("H") step in gearbox reducer). Move out cylinder (11) rod, align openings in lever (5) and yoke (16). Connect lever (5) and yoke (16) using pin, install washer and cotter pin. Turning in or out bolt (18), rest spherical part of bolt against lever (5), lock it with nut.

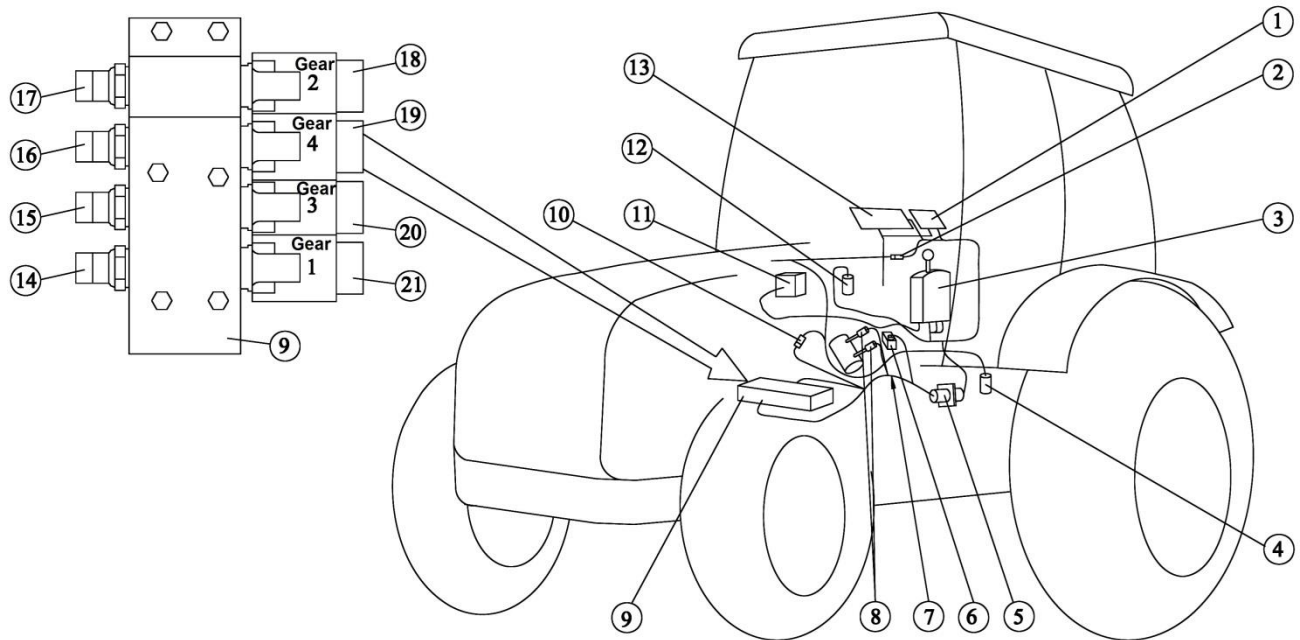
MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

3.5 Gearshift and reducer steps shift control



Picture 3.6 - Control system of gearshift and reducer steps shift

1 - safety fuses board; 2, 10 - connective socket; 3 - control board; 4 - sensor of neutral position in range reducer (starter interlock); 5 - plug connector; 6 - electro hydraulic reducer distributor; 7 - harness; 8 - High and Low reducer step pressure sensors; 9 - plate with pressure sensors and electro hydraulic distributors; 11 - indicator panel; 12 - sensor of disengaged clutch condition; 13 - differential lock and front drive axle control board; 14, 15, 16, 17 - pressure sensors in hydraulic lines of 1-st, 3-rd, 4-th, 2-nd gears correspondingly; 18, 19, 20, 21 - electro hydraulic distributors of 2-nd, 4-th, 3-rd, 1-st gears correspondingly.

Gearshift and reducer control is carried out by electro hydraulic control system.

Electric part of control system consists of control board (3), located in cab to the right from operator; electro hydraulic distributors (18, 19, 20, 21) with electromagnets and pressure sensors (14, 15, 16, 17) installed on plate (9) of transmission hydraulic system distributor, located on top of space plate between clutch housing and gearbox; reducer control (8) with two pressure sensors and electro hydraulic distributor (6) with electromagnet; indicator panel (11), placed to the right from dashboard; sensor (12) of disengaged clutch condition, installed in cab nearby the clutch pedal; sensor (4) of neutral position in range reducer, installed from the left side on gearbox housing and used also in electric system for starter interlock; harnesses (7) with 37-pin plug connector (5), placed under cab, and of connective sockets (2, 10).

Signals from sensor (4) of neutral position in range reducer (starter interlock) and clearance lights switching on enters from Dif. Lock and FDA control system through the socket (2).

System is powered from onboard electric network after safety fuses board 1. System is powered from dashboard after starter and instrument switch is set to position "Instrument power supply".

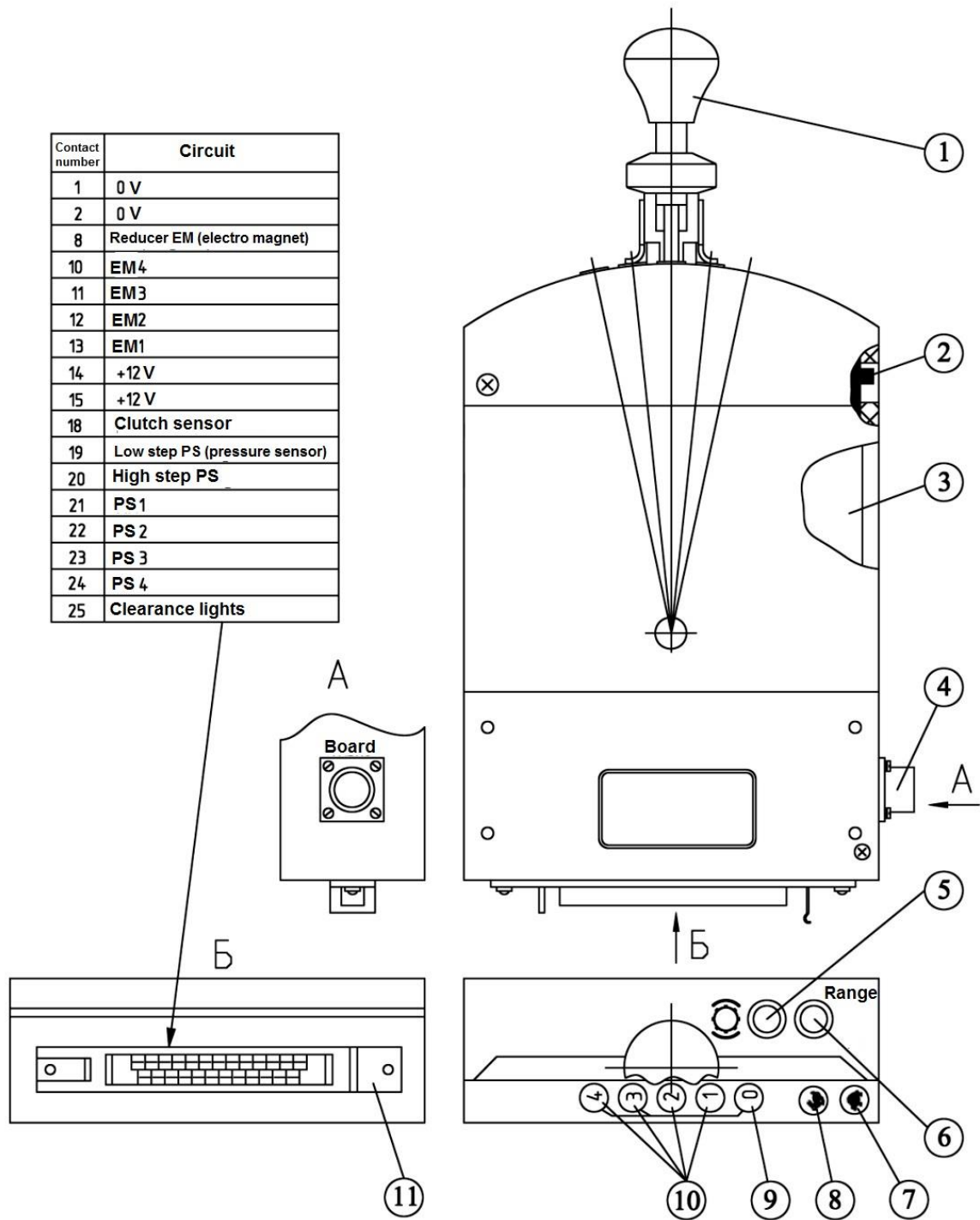
3.6 Gearshift control board PU-3MG

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com



Picture 3.7 - Gearshift control board PU-3MG

1 - gearshift handle; 2 - 2-nd gear emergency engagement switch; 3 - microprocessor -based controller; 4, 11 - connectors; 5 - button of gearbox "slow down" mode set up; 6 - button of reducer r engagement angles shift; 7, 8 - indicators of steps pressure sensors condition in two-step reducer; 9 - gear "0" position indicator; 10 - indicators of pressure availability in hydraulic lines to gear engagement frictional clutches. 11 - connector.

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

Gearshift control board PU-3MG with built in controller (3) contains gearshift handle (1) which could have 5 fixed positions: 0-1-2-3-4.

On the underside of board there are connector (4) for connection board and connector (11) for connection of power supply, clearance lights, electric magnets of electro hydraulic distributors and sensors of disengaged clutch condition, of neutral position in range reducer and discrete pressure sensors.

On top of the board there are buttons 5 – (of "slow down" mode set up) and 6 – (of steps shift in two-step reducer) and green color light-emitting diode indicators: (7, 8) –indicators of pressure sensors condition in two-step reducer; (10) – indicators of pressure availability on outlets of electro hydraulic distributors in lines to 1st ... 4-th gears frictional clutches.

Emergency 2nd gear engagement switch is placed under special cover on rear wall of board.

Indicator panel (11) (see picture "Control system of gearshift and reducer steps shift") represents color matrix LED indicator. There is gearshift mode selector key on rear side of panel. Indicator panel is designated to display number of engaged gear, chosen gearshift mode, diagnostic information. Indication dehighlighting of panel at clearance lights switched on is provided.

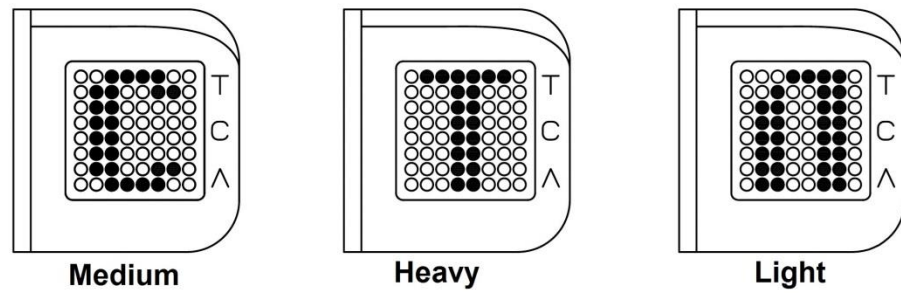
Examples of displaying on panel are provided on next page.

MTZ Equipment Ltd.

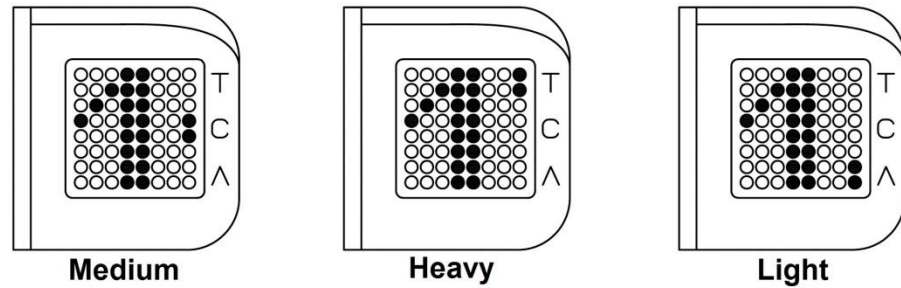
Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

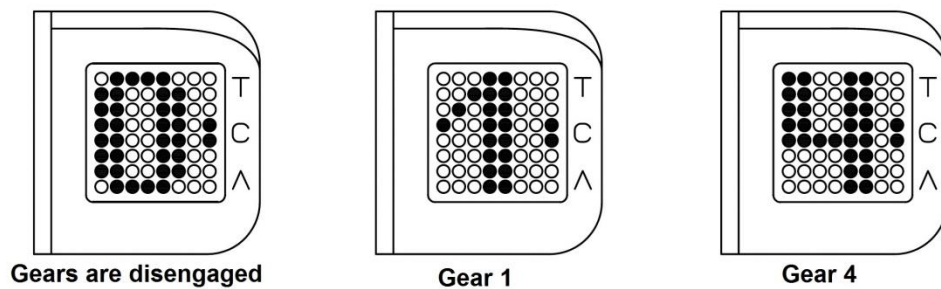
Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com



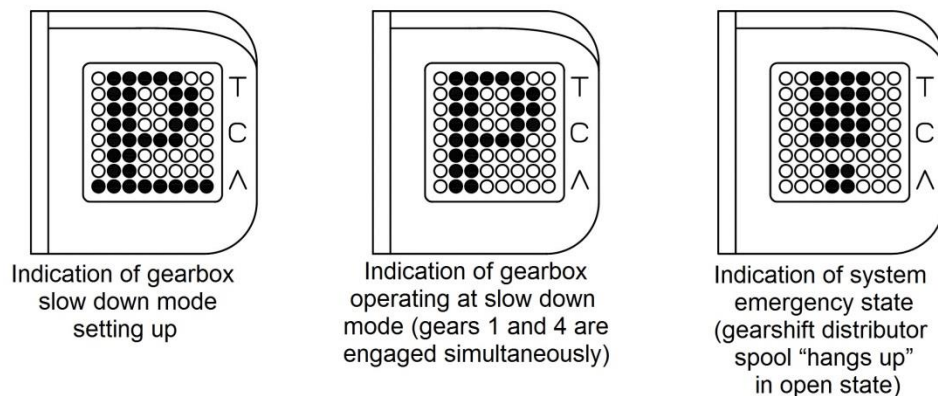
Indication of gearshift modes setting up during modes selection by button



Indication of selected gearshift modes after selection
(example of gear 1 indication)



Indication of engaged gear number



Picture 3.8 - Displaying on panel

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

Electro hydraulic distributors (18, 19, 20, 21) (see picture" 3.1 - Control system of gearshift and reducer steps shift") controls oil flow delivered to frictional clutches. Discrete pressure sensors (14, 15, 16, 17), actuating (closing contact) at pressure over 0,6...0,8 МПа, are installed on outlets of corresponding electro hydraulic distributors in hydraulic lines to frictional clutches.

3.7 Selection of gears and ranges

3.7.1 Initial positions

When power is supplied to system after starter and instrument switch is set from position "Off" to position "Instrument power supply" number of engaged gear and gearshift mode are displaying in yellow color on panel (11).

Initially system sets up light mode of gearshift. (Л – Light). Pushing down button of mode selection repeatedly operator can set up another mode: C – Medium, T– Heavy. It is recommended to set gear change modes depending on load and kind of operations performed:

T – at tillage, complete cultivation operations.

C – at sowing, harvesting operations;

Л – at transport operations.

Initial position of panel handle - "0". In order to engage 1-st gear it's required to depress clutch pedal, to lift hand knob, move into position "1" and release.

3.7.2 Gearshifting

Gears change-over within the range from 1st to 2nd and following gears and back is carried out by depression hand knob down with it's simultaneous shift forward (in higher gear) or backward (in lower gear) without depressing the clutch pedal. At that number of engaged gear and chosen change-over mode are displayed in yellow color on indicator panel and corresponding indicator of green color, actuated from pressure sensor of engaged gear, illuminates on board.

Board is designed in such a way that gear shifting is possible only in serious on the nearby gear. In order to speed up switchover to position "0" from 3rd or 4th gear it is required to lift gearshift hand knob on board and move it to position "0".

In order to facilitate range step shift, "slow down" mode is provided by way of simultaneous engagement of two gears - 1st and 4th. "Slow down" mode is functioning for approx. 5 seconds after short depression of "slow down" mode setting button (5) (see picture 3.2 "Gearshift control board PU-3MG ") and operation of sensor of disengaged clutch condition (12) (see picture "3.1 Control system of gearshift and reducer steps shift") and sensor of range reducer neutral position (4).

When this happens the letter "**P**" on panel will highlight and indicators "1" and "4", operating from corresponding pressure sensors (14) and (17) will illuminate. If button is depressed but even one of above listed conditions fails to be fulfilled, symbol "**P**" will highlight on display panel. Considering that in "slow down" mode two gears (first and fourth) are simultaneously engaged, it's very important to watch for correct adjustment of disengaged clutch condition and neutral position of range reducer sensors during operation.

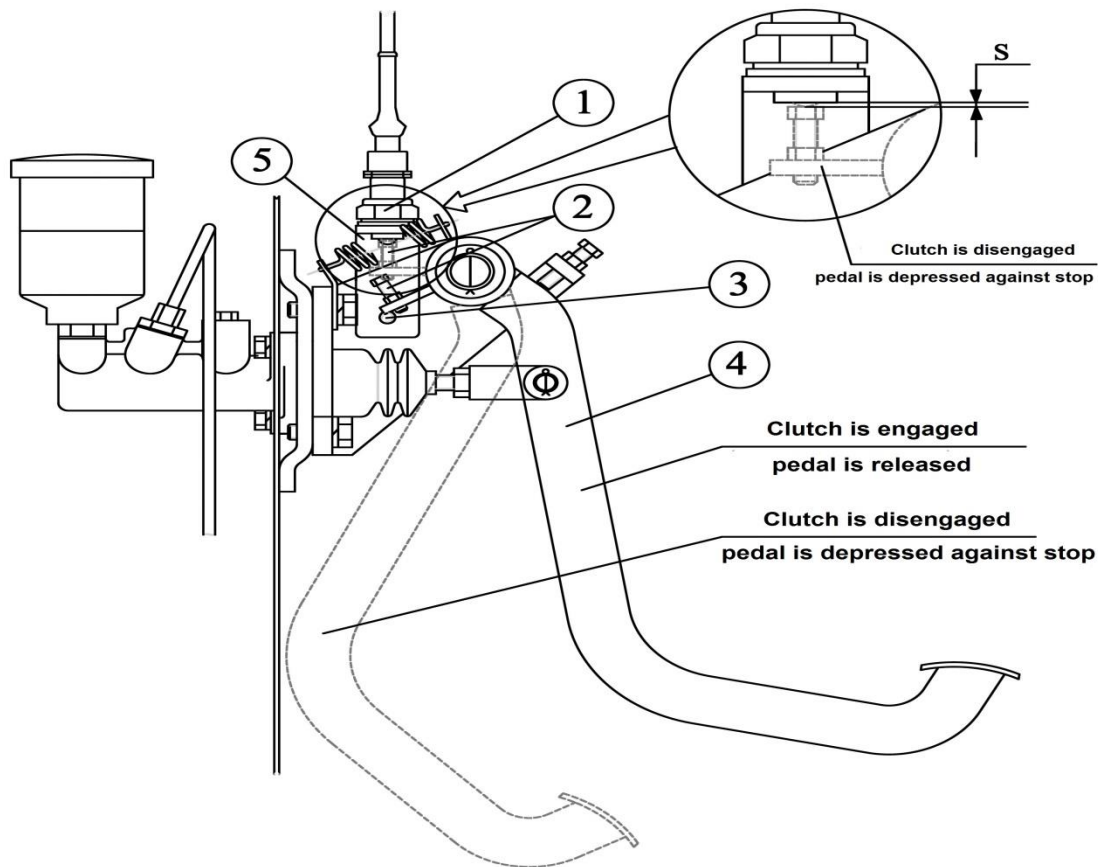
MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

3.7.3 Adjustment of disengaged clutch condition sensor



**Picture 3.9 Installation of disengaged clutch condition sensor
(switch BK12-51 with normally opened contacts)**

1 - disengaged clutch condition sensor (switch BK12-51); 2 - adjustment bolt; 3 - bolts of bracket fastening; 4 - clutch pedal; 5 - bracket

Sensor (1) is installed on bracket (5). Adjustment of sensor's operation is performed with adjustment bolt (2). Sensor adjustment is fulfilled at disengaged clutch (at depressed against the stop clutch pedal). Clearance "S" between sensor's flat end and bolt (2) within approx. 1 mm should be adjusted by bolt (2); sensor's (1) closed contact condition should be checked at that (either with tester or on symbol "P" display instead of "P" symbol on panel at constantly depressed button (5) of gearshift "Slow down" mode set up ("see picture 3.7). It is necessary to lock adjust bolt (2) with locknut.

In order to switchover gearbox two-step reducer, it is required, having clutch disengaged to push button (6) ("see picture 3.7). At system power supply (the starter and instruments switch is turned from position "OFF" into position "Instruments are ON", lower step is engaged in two-step reducer. With engagement of High step button (6) will illuminate. Operation of indicator (7) corresponds to engagement of Low step, operation of indicator (8) corresponds to engagement of High step in two-step reducer.

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

3.8 Diagnostics of electric & hydraulic circuit's condition

Diagnostics of following circuit's condition is provided in the gearshift control system:

- of electric circuits from control board to electro-hydraulic distributor's magnets;
- of hydraulic circuits pressure at electro-hydraulic distributor's outlets, using discrete pressure sensors.

At the gear electric and hydraulic circuits faultless state corresponding gear number will permanently illuminate on panel in yellow color.

If electric circuit of some gear electro magnet is damaged (due to magnet coil wire rupture, poor contact in connectors), it's number will illuminate in blinking yellow color on panel with engagement of this gear. In case of shorts failure in circuit to electromagnet, the number of corresponding gear will illuminate in red blinking color when that gear is engaged. In last case protection operates: electric signal to electromagnet is deenergized and further movement on that gear is impossible.

In case of discrete pressure sensor failure to operate when electric distributor electromagnet has been switched on, corresponding gear number on panel will illuminate in green blinking color when that gear is engaged. Such indication exists at stopped diesel engine when there is no pressure in hydraulic system. At engine running lack of confirming hydraulic signal when electric signal exists may be connected with "hang up" of hydraulic distributor's spool in position "closed". In that case movement in this gear is impossible. If tractor drives in the gear on which said signaling happens, operability of electric circuit to corresponding pressure sensor (rupture or poor contact) should be checked, as well as sensor's operability.

If after delay on gears overlap during gearshift, system detects pressure in hydraulic line to friction clutch of disengaged gear (electro hydraulic distributor's spool "hangs up" in open position), symbol "!" will illuminate in green blinking color on panel. In this case all electro magnets are deenergized. Further tractor movement on "hanged" gear only is possible.

Condition of hydraulic circuits of all gears (presence or lack of pressure at outlets of electric distributors) is displayed by indicators on gearshift board.

If symbol "U" is displayed on panel in red blinking color and operation of gear and reducer step shift block is stopped - this implies that voltage applied in tractor electric circuits is above 18 V.

The System provides engagement of gearshift electromagnets in accordance with the following table.

Position of gearshift handle	(Numbers of electro hydraulic distributor's position corresponds to picture "Control system of gearshift and reducer steps shift")			
	21	18	20	19
0				
1	+			
2		+		
3			+	
4				+

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

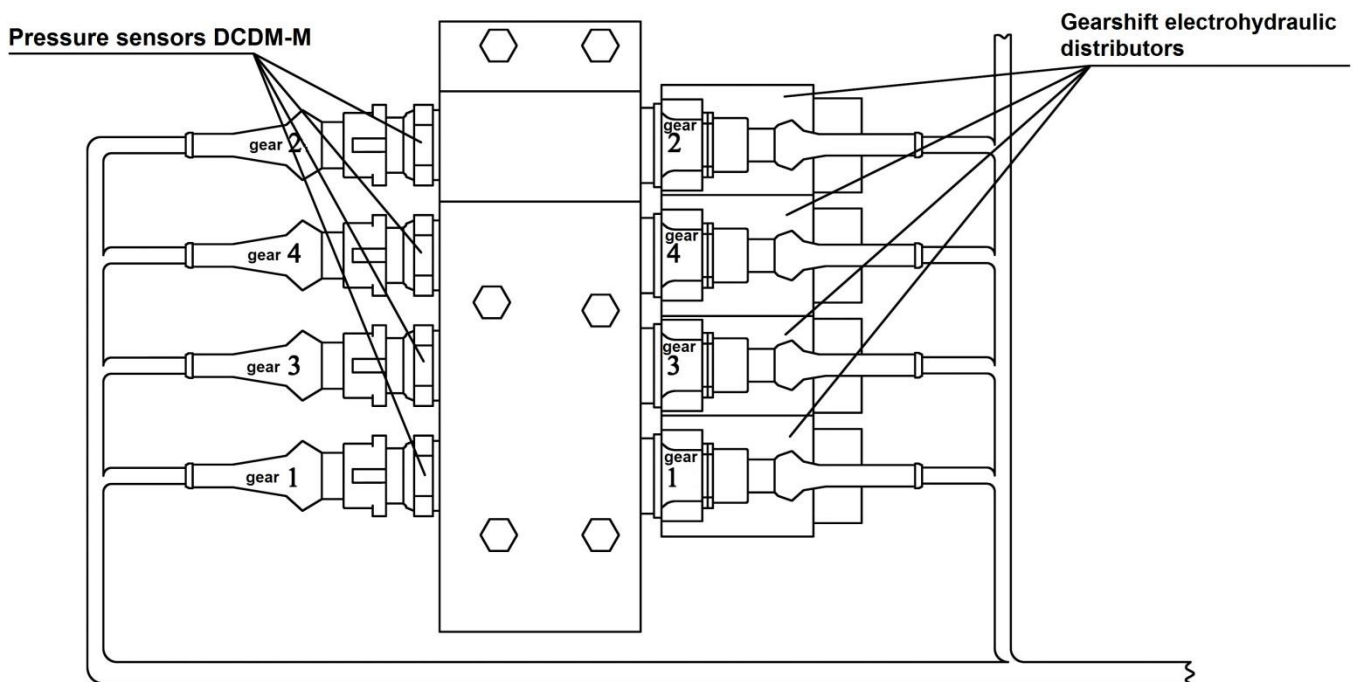
Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

3.9 Emergency second gear engagement. Diagram of gearshift control system electric connections

Possibility of emergency second gear engagement is provided in the system in case of microprocessor controller of control board failure – see paragraph 5.7

Harnesses connection to electro hydraulic distributors and discrete pressure sensors, installed on plate of transmission hydraulic distributor is shown on picture below.



Picture 3.10 Harnesses connection to plate with electro hydraulic gearshift distributors and pressure sensors

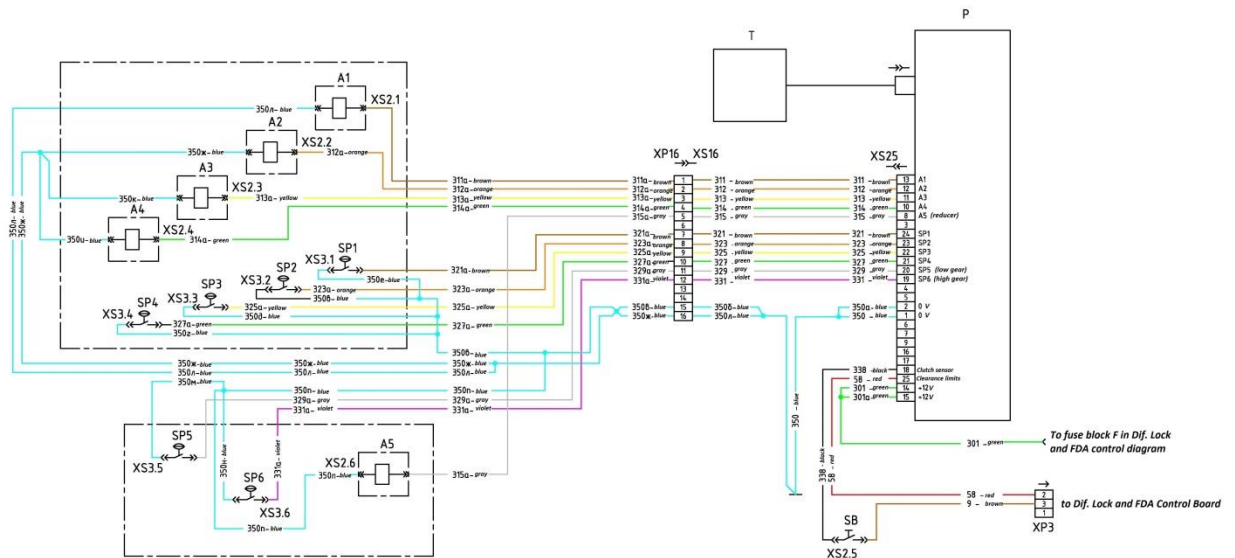
MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

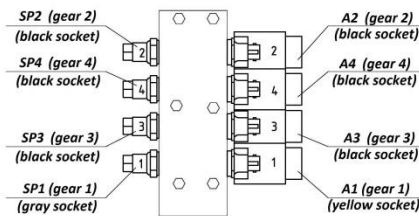
Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

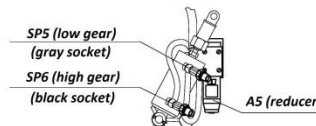
3.10 Diagram of gearshift and reducer control system electric connections



Layout chart of electromagnet A1...A4 and SP1...SP4 pressure sensors on plate with electrohydraulic distributors of gearshift control



Layout chart of electromagnet A5 and SP5 and SP6 pressure sensors in rangeshift control



Picture - Diagram of Electrical Connections of Gear and reducer step shift of MTZ.4 Partial Powershift transmission

ATTENTION:

Switchover to position "0" from 2-nd and 1-st gears can only be carry out by shift of pressed down hand knob!

Set gearshift hand knob to position "0" at diesel engine stopped to avoid batteries discharge.

At range control lever in neutral position and clutch pedal depressed, when control button of "slow down" mode set up is pressed, two gears (1-st and 4-th) are simultaneously engaged, slowing down gearbox in order to facilitate ranges change over.

Use of tractor with lack of starter interlock at engaged range (maladjusted or defective sensor of range neutral position) is strictly prohibited!

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

Watch for correct adjustment of clutch disengagement sensor – it's actuation (contact closure) at the end of clutch pedal stroke.

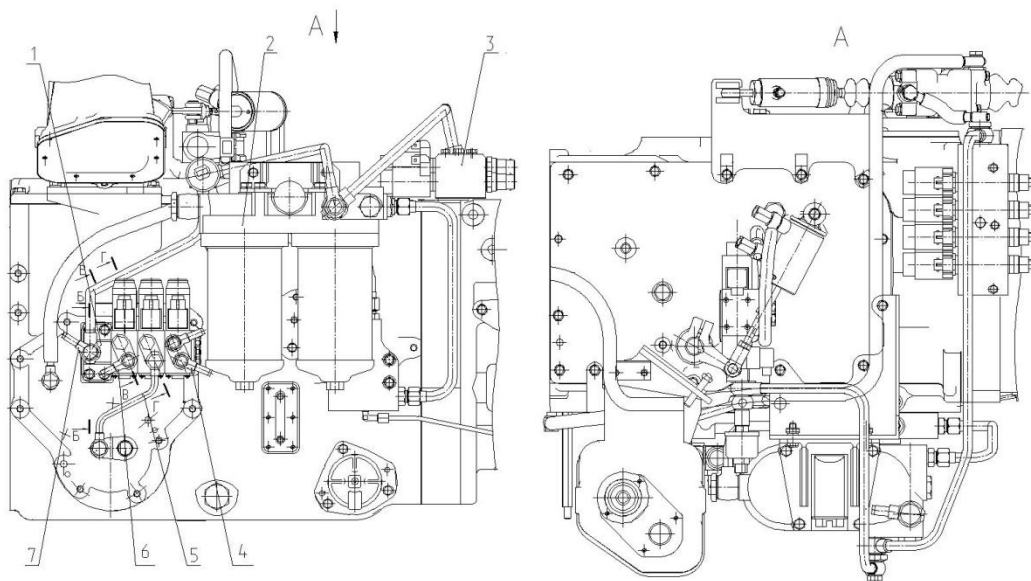
Symbol "U" is displayed on panel in red blinking color and system cuts off at tractor network voltage rise above 18 V.

If control board failed, use emergency engagement of second gear by turning on emergency board switch only as exception, in order to return from operation place or for driving to repair facility. Emergency engagement of second gear blocks operation of control board.

4. Transmission Hydraulic System

4.1 Major elements of Transmission Hydraulic System.

Disposition of Major elements of Transmission Hydraulic System is set out at picture 4.1



Picture 4.1 - Disposition of Major elements of Transmission Hydraulic System

1 - sectional distributor of Differential Lock, Front Drive Axle, Front PTO control; 2 - duplex filter; 3 - electro-hydraulic distributor; 4 - control line to Front PTO; 5 - control line to Front Drive Axle (FDA); 6 - control line to Differential Lock (Dif. Lock); 7 - line to Rear PTO control valve.

Besides Powershift gear selection, Transmission Hydraulic System provides oil filtration, pressure lubrication of heavy loaded gears and bearings, control of Rear and Front PTOs, Front Drive Axle (FDA) drive, rear axle Differential Lock.

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

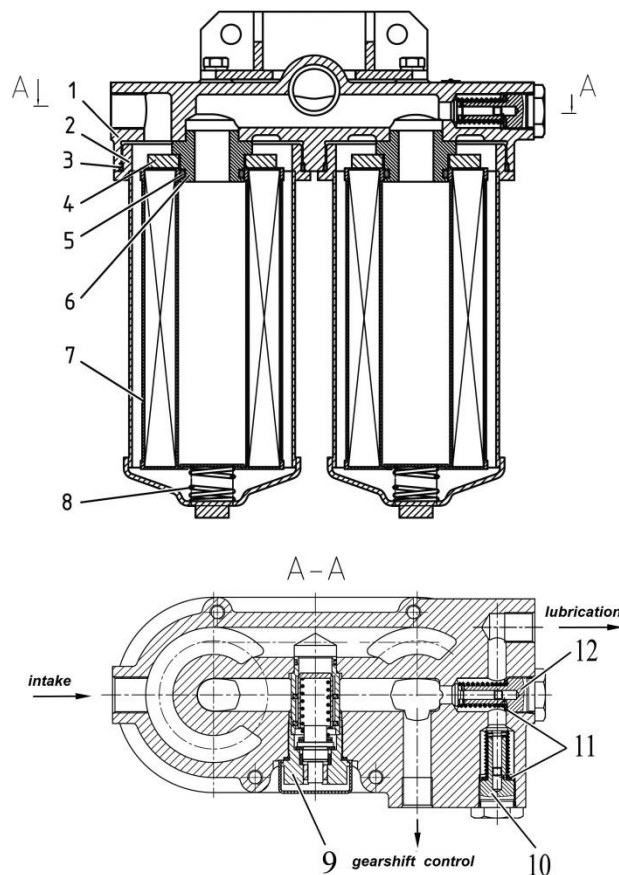
Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

4.2 Duplex filter.

Installed on the right side of transmission Duplex filter serves to clean with filtering degree of 0,025 mm oil, delivered by transmission pump to electro hydraulic distributors of transmission control, as well as to maintain pressure in transmission hydraulic system.

Filter consists of two cases 2 (picture 2), screwed into housing 1 with input and output openings. Filter elements 7 and permanent magnets 4 pressed by spring 8 to bushing 6, are located inside the cases. Sealing of connection "filter element - bushing" is provided by O-ring 5, installed into ring groove in bushing 6. Signaling valve 9 which signals the board (the light ignites when filter elements 7 are polluted) is installed in housing. Control valve 12 of transmission hydraulic system (maintains pressure $1.2_{-0,1}$ MPa) and valve 10 of oil lubrication system (maintains pressure of $0.2_{-0,1}$ MPa) are installed in housing 1. Valve's adjustment is accomplished by spacer shims 11.

ATTENTION: THE TOTAL THICKNESS OF SPACER SHIMS SHOULDN'T EXCEED 7 MM FOR ONE VALVE!



Picture 4.2 - Duplex filter

1 - housing; 2 - case; 3 - O-ring; 4 - permanent magnet; 5 - O-ring; 6 - bushing; 7 - filter element; 8 - spring; 9 - signaling valve; 10 - valve of oil lubricating system; 11 - spacer shims; 12 - control valve of transmission hydraulic system.

MTZ Equipment Ltd.

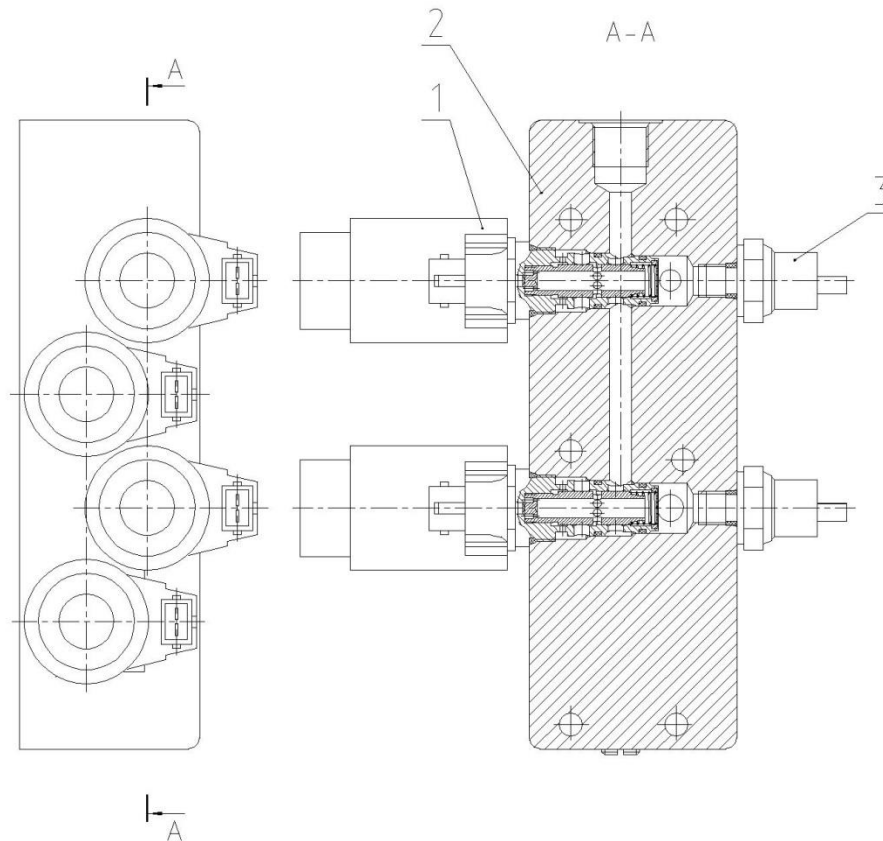
Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

4.3 Electro-hydraulic distributor of transmission hydraulic system

Electro-hydraulic distributor of transmission hydraulic system is provided to control frictional clutches in gearbox. The distributor is installed on upper plain surface of clutch housing. Four proportional valves 1 and four pressure sensors 3 are screwed into distributor housing (picture 4.3).



Picture 4.3 – Electro-hydraulic distributor of transmission hydraulic system

1 - proportional valve; 2 - housing; 3 - pressure sensor.

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

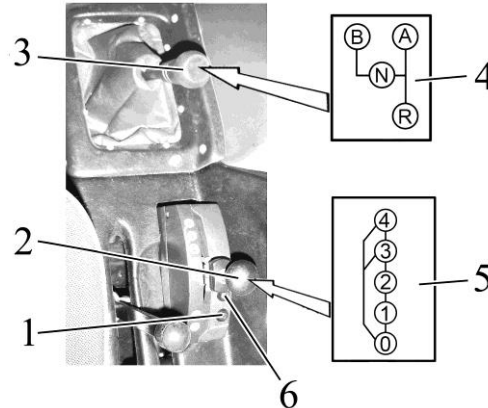
Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

5. Selection of Gearbox reducer steps, ranges, and gears (detailed description)

5.1 General information

Gearshift operation, in Gearbox, is carried out by means of a gearshift hand knob, range selector lever and reducer gears engagement button. Hand knob and button are incorporated into gear and reducer step shift block.



Picture 5.1 - Ranges, gears and reducer steps change over

1 - gearbox reducer gears engagement button; 2 - gearshift hand knob; 3 - range selector lever; 4 - gearbox ranges engagement diagram; 5 - gearshift layout; 6 – “slow down” mode button.

Engaged gear Indicator panel - 29 (picture 1.1) is designed to indicate gear number, setting and displaying selected gear-shift mode, and for displaying information on malfunctions in gear-shift control electric and hydraulic circuits.

Velocity diagram for tractor "MTZ-1523.4" with basic tires installed is located on right hand cab window and is presented on picture 2.1.

5.2 Gearbox reducer steps changeover

When the starter and instruments switch is shifted from position OFF into position "Instruments are ON", gearbox reducer lower gear (L) are engaged automatically.

ATTENTION: INDICATORS 4 AND 5 (PICTURE 5.4) ILLUMINATE ONLY AT RUNNING ENGINE!

In order to engage higher (H) gear in gearbox reducer it is required to switch on “slow down” mode, as described in paragraph 5.3.1 having set hand knob 1 (picture 5.4) in position "gear "0". Then button 3 located on block 8 is to be pushed. At that, button 3 will illuminate and indicator 5 will light up, indicator 4 will go out.

In order to switchover gearbox reducer from high (H) gear to low (L) gear, it is required to push button 3 at engaged “slow down” mode and gear "0". At that, button 3 illumination will go out and indicator 4 will light up, indicator 5 will go out.

ATTENTION: GEARBOX REDUCER STEPS SHIFTOVER SHOULD BE CARRIED OUT ONLY AT SWITCHED ON “SLOW DOWN” MODE AFTER GEAR "0" IS SET ON STOPPED TRACTOR!

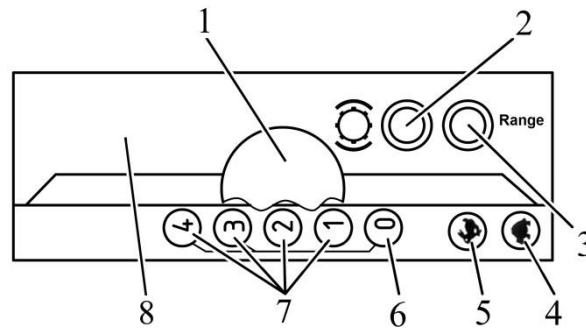
TO ENGAGE “SLOW DOWN” MODE, BUTTON 2 (PICTURE 5.4) IS TO BE PUSHED AT DISENGAGED CLUTCH PEDAL AND NEUTRAL POSITION OF RANGE SELECTOR LEVER!

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com



Picture 5.4 - gearbox gear and reducer step shift block

1 - gearshift hand knob; 2 – “slow down” mode setup button; 3 - gearbox reducer step engagement button; 4 - reducer low gear (L) engagement indicator; 5 - reducer high gear (H) engagement indicator; 6 - indicator of zero gear (gear "0"); 7 - indicators of gears engagement (from 1-st to 4-th); 8 - gearbox gear and reducer step shift block.

5.3 Selection of gearbox ranges

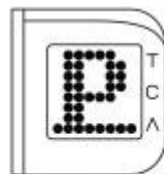
Select required range (see pictures 5.1(diagram 4), 5.2). Before start to move engage it with range selector lever 3 (picture 5.1), at previously engaged “slow down” mode.

5.3.1 Engagement of “slow down” mode

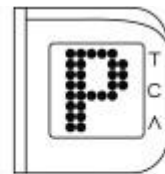
It is possible when the following conditions are met:

- Range selector lever is in neutral (signal from sensor of range neutral position should enter the gear and reducer step shift block);
- Clutch is disengaged (when pedal is in depressed position, signal from sensor of disengaged clutch condition should enter the gear and reducer step shift block);
- The operator depresses button 2 (picture 5.4) on gear and reducer step shift block.

When this happens the letter "P" (view "b" on picture 5.3) on panel 29 (picture 1.1) will highlight and signal devices of 1-st and 4-th gears (7, picture 5.4) will illuminate. If after short depression of “slow down” mode button 6 (picture 5.1), even one of above listed conditions fails to be fulfilled, symbol "P" (view "a" on picture 5.3) will highlight on display panel.



a) Indication of set up gearbox “slow down” mode



b) indication of gearbox operation at “slow down” mode (gears 1 and 4 are engaged simultaneously)

Picture 5.3 - Indication of set up and actuation of gearbox “slow down” mode on display panel

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

If after short depression of “slow down” mode setting button at clutch pedal depressed and range selector lever in neutral position, “slow down” mode is not engaged (symbol **"P"** highlights on display panel), contact your dealer to repair malfunction.

Gearbox “slow down” mode functions approx. 5 seconds. If range wasn't engaged within that time, it's necessary to depress button 6 again at clutch pedal depressed and range lever in neutral, and engage required range.

ATTENTION: ENGAGE RANGE ONLY AFTER ENGAGEMENT OF GEARBOX “SLOW DOWN” MODE! CARRY OUT SELECTION OF RANGES ONLY THROUGH RANGE LEVER NEUTRAL POSITION AND ENGAGEMENT OF GEARBOX “SLOW DOWN” MODE!

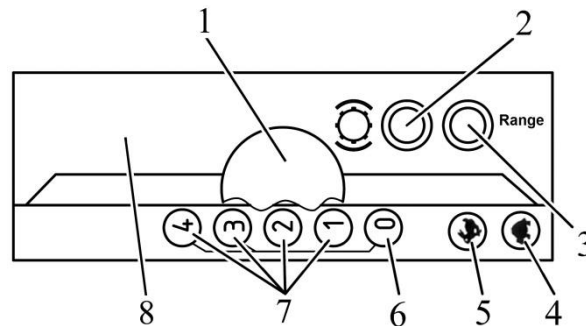
ATTENTION: ENGAGE THE RANGE ONLY ON BROUGHT TO A STOP TRACTOR AND WITH FULLY DEPRESSED CLUTCH PEDAL!

IT IS FORBIDDEN TO SHIFT RANGES ON MOVING TRACTOR!

ATTENTION: DISENGAGE GEARBOX RANGE LEVER INTO NEUTRAL POSITION ONLY AFTER SETTING GEARBOX TO "0" GEAR AT DISENGAGED CLUTCH ON STOPPED TRACTOR!

5.4 Gearshifting

Gearshift hand knob 1 (picture 5.4), provided with 5 fixed positions: 0-1-2-3-4 - is installed on gearbox gear and reducer step shift block.



Picture 5.4 - gearbox gear and reducer step shift block

1 - gearshift hand knob; 2 – “slow down” mode setup button; 3 - reducer step engagement button; 4 - reducer low gear (L) engagement indicator; 5 - reducer high gear (H) engagement indicator; 6 - indicator of zero gear (gear "0"); 7 - indicators of gears engagement (from 1-st to 4-th); 8 - gearbox gear and reducer step shift block.

When the starter and instruments switch is shifted from position OFF into position "Instruments are ON", gear "0" and mode of gearshift are displayed on panel 29 (picture 1.1) in constant yellow color. If any of gears is engaged, it's number and mode of gearshift are displayed in green flashing color.

At engine running gear "0" or number of engaged gear and mode of gearshift are displayed in constant yellow color on indicator panel. Indicators 4 or 5, 6 or 7 illuminates on block 8 (picture 5.4). Examples of number of engaged gear and mode of gearshift displaying on indicator panel are presented on picture 5.5.

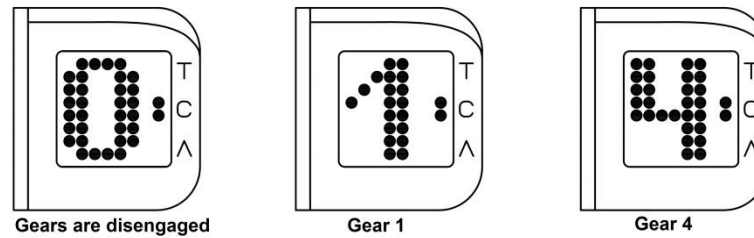
Note - Detailed information on rules of setting and displaying of chosen mode of gearshift is presented in paragraph 5.6.

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com



Picture 5.5 - Examples of number of engaged gear and mode of gearshift displaying

Initial position of gearbox gearshift hand knob 1 (picture 5.4) - "0" (gears are not engaged). In order to engage 1-st gear from gear "0" it's required to depress clutch pedal, lift hand knob, move it into position "1" and release. Clutch pedal must be depressed at beginning to move in 1st gear. It is not recommended to start moving in the 2-nd, 3-rd and 4-th gears.

Gears change-over within the range from 1-st to 2-nd and following gears and back is carried out by depression hand knob down with it's simultaneous shift forward (in higher gear) or backward (in lower gear) without depressing the clutch pedal. At that number of engaged gear and chosen *gearshift* mode are displayed in yellow color on indicator panel, as presented on picture 5.5; number of engaged gear illuminates in green color (signaling device 7, picture 5.4) on gear and reducer step shift block, operating from pressure sensor of the engaged gear. If gearbox gears are disengaged, signaling device 6 of gear "0" illuminates.

Block 8 is designed in such a way that gear shifting is possible only in series on the nearby gear. If it is required to shift from the 1-st to 4-th gear it is necessary to do the following actions:

- Depress down hand knob 1 and move it to 2-nd gear position, release the hand knob;
- Depress down hand knob and move it to 3-d gear position, release the hand knob;
- Depress down hand knob and move it to 4-th gear position, release the hand knob;

In order to shift hand knob 1 from 4-th to 1-st gear it is necessary to carry out similar actions in reverse order.

In order to speed up switchover to position "0" from 3d or 4th gear it is required to lift gearshift hand knob 1 and move it to position "0". Switchover to position "0" from 2nd and 1st gears can only be carried out by pressed down hand knob shift.

SET GEARSHIFT HAND KNOB TO POSITION "0" BEFORE ENGINE STOP TO AVOID BATTERIES DISCHARGE!

ATTENTION: INDICATORS 6 AND 7 (PICTURE 5.4) ILLUMINATE ONLY AT RUNNING ENGINE!

ATTENTION: GEARSHIFT FROM POSITION "GEARS DISENGAGED" (GEAR "0") IS ONLY PERMITTED AT FULLY DEPRESSED CLUTCH PEDAL!

ATTENTION: CARRY OUT GEARSHIFT OPERATIONS WITHIN ONE RANGE ON MOVING TRACTOR WITHOUT CLUTCH PEDAL DEPRESSION!

5.5 Engaged gear indicator panel

Engaged gear indicator panel 29 (picture 1.1) is designed for the following:

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

- Indication of setting up and switching on “slow down” mode;
- indication of of engaged gear Number;
- Setting up and indication of chosen gearshift mode;
- Reports of malfunctions in gearshift electric and hydraulic circuits displaying.

Engaged gear indicator panel represents color LED indicator. Dehighlighting of indication panel 29 at clearance lights switched on is provided.

Information on indication on panel setting up and switching on “slow down” mode is presented in paragraph 5.3.1.

Information on indication on panel number of engaged gear is presented in paragraph 5.4.

5.6 Setting and displaying of gearshift mode

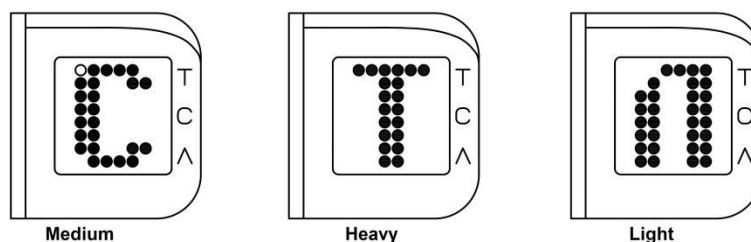
Three gearshift modes are implemented on tractors: «Л», «С», and «Т». It is recommended to set gearshift modes, depending on engine load, for example:

- Л (Light) - at hauling operations with empty trailer;
- С (Medium) – at sowing, grass harvesting operations;
- Т (Heavy) – at tillage, complete cultivation operations.

When the starter and instruments switch is shifted from position OFF into position "Instruments are ON", light gearshift mode ("Л") will be set up automatically.

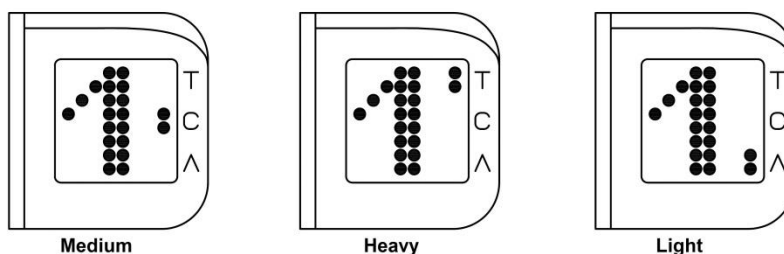
There is gearshift mode selector key on rear side of panel 29 (picture 1.1).

By pushing down gearshift mode selector key operator may set up another gearshift mode (C - medium, T - heavy, or get back to light mode). Set up gearshift mode will be displaying on panel, as demonstrated on picture 5.6.



Picture 5.6- Indication of gear-shift mode setting up

Additionally, during tractor operation set up, gearshift mode along with chosen gear will be displaying on panel, as shown on picture 5.7.



Picture 5.7- Indication of gear-shift mode set up along with selected gear during tractor operation.

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

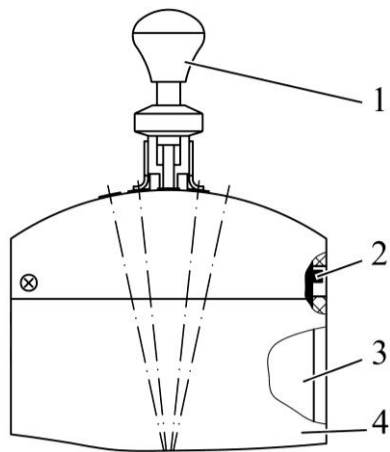
Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

After starter and instruments switch is shifted from position "Instruments are ON» into position OFF, chosen gearshift mode will not be stored. With every new instrument switching on light gearshift mode is installed.

5.7 Emergency 2-nd gear engagement switch

Emergency 2-nd gear engagement switch is provided in gear and reducer step shift block 4 (picture 5.8) if microprocessor's 3 failure results in inability to engage gears.

To do this it's required to unscrew 2 screws, take off cover on block 4 rear wall and move emergency 2-nd gear engagement switch to lower position. "0" gear and 2-nd gear engagement indicators start illuminate on block, electronic part of block and engaged gear indication panel are de-energized, power voltage is supplied straight through said switch to electromagnet of second gear. The further tractor movement is only possible in second gear of any gearbox range at low gearbox reducer step.



Picture 5.8 - Installation of second gear emergency engagement switch.

1 - gearbox gearshift hand knob; 2 - second gear emergency engagement switch; 3 - microprocessor;
4 - gearbox gear and reducer step shift block;

Note: Switch 2 (picture 5.7) is demonstrated at normal (nonemergency) state

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

6. Routine Maintenance operations

Only specific Routine Maintenance operations performed on MTZ-1523.4 with Partial Powershift transmission model tractor (additional or different compare to regular operations and procedure), are listed below.

6.1 Specific Maintenance operations after tractor break-in period (30 hrs. of operation)

- Drain transmission oil.
- Change both changeable filter elements in transmission hydraulic system and wash off gearbox screen filter (See picture 6.5 and description below).
- Fill fresh oil into transmission.

6.2 Specific Routine Maintenance operations

Operation No	Operation designation	Intervals, h					
		8-10	125	250	500	1000	2000
2	Check oil level in transmission	X					
33	Wash off transmission hydraulic screen filter			X			
62 ⁹⁾	Change oil in transmission					X	

⁹⁾ **Simultaneously with transmission oil change it's necessary to change double filter elements, independently of their previous change date.**

82	Adjust operational pressure valve in transmission hydraulic system	In proportion to oil pressure deviation from norm
83	Change filtering elements in transmission hydraulic filter	According to dirtiness, after indicator 6 (picture 6.3) operation

6.3 Description of Specific Routine Maintenance operations (General instructions)

6.3.1 Operation 2. Check transmission oil level

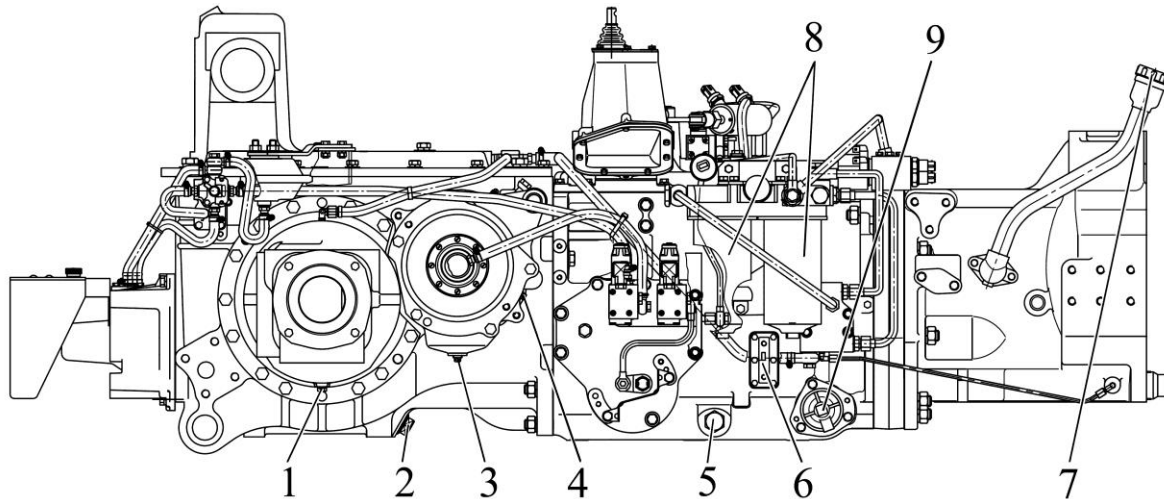
Check oil level by sight on indicating mark 6 (picture 6.1), located on transmission right side. Oil level should not be lower than 5 mm (0,2") from mark "П". If required take off cover 7 of oil filler and add oil to mark "П". **Normal oil level is within ± 5 mm ($\pm 0,2$ ") of mark «П».**

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com



Picture 6.1 Oil level check and oil replacement in transmission and brake housings

1*, 2, 5 – transmission drain plugs; 3* – brake housing drain plug; 4 – oil check/filler brake housing plug; 6 – oil level indicating mark; 7 - transmission oil filler cover; 8 – double filter; 9 – screen filter.

* - 2 places (on left and right side of transmission).

6.3.2 Operation 33. Wash off transmission hydraulic screen filter

See picture 6.5 and description in paragraph 6.3.4

6.3.3 Operation 82. Adjustment of operational pressure valve in transmission hydraulic system

Pressure valve 3 (picture 6.2) is located in double filter 8 (picture 6.1).

Valve 3 (picture 6.2) of transmission hydraulic system maintains operational oil pressure from 1.2 to 1.1 MPa at rated engine speed. If transmission oil pressure is constantly stays below 1.1 MPa or above 1.2 MPa on warmed-up tractor at rated engine speed, adjust the valve 3 by changing quantity of gaskets 4 between spring 2 and pressure valve 3. To do this it's required to unscrew valve 3 out of housing 1.

In order to increase pressure it's required to increase number of washers, for pressure decrease - lessen number of washers.

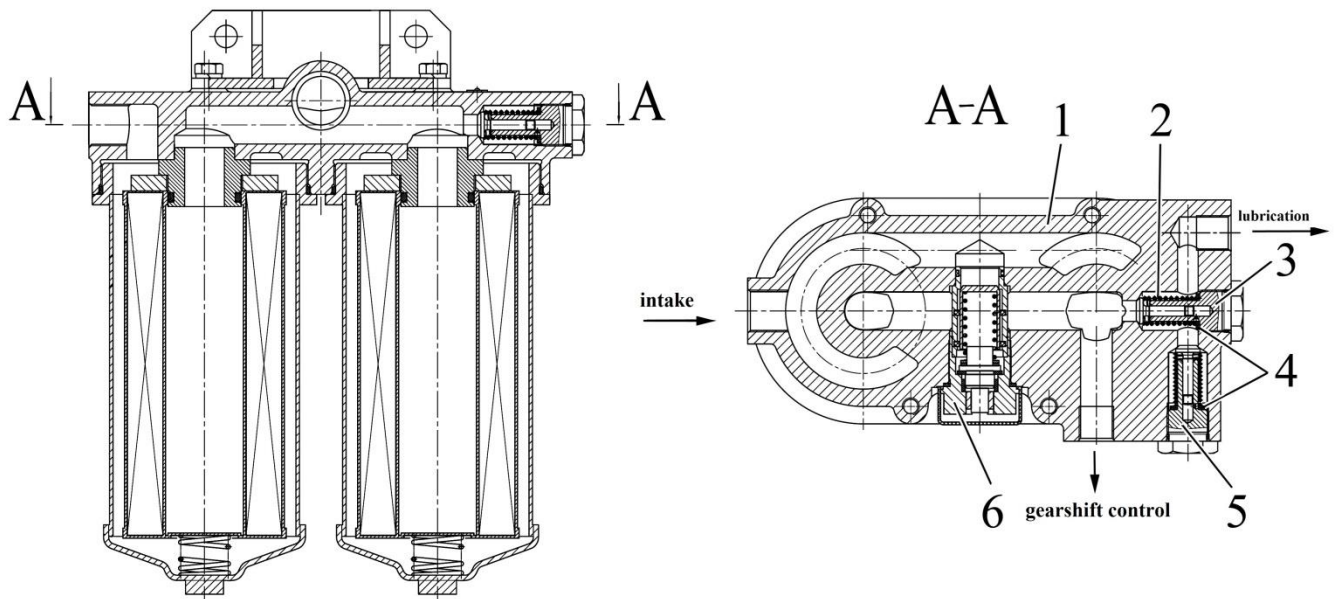
ATTENTION: THE TOTAL THICKNESS OF SPACER SHIMS SHOULD NOT EXCEED 7 MM!

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com



Picture 6.2 Operational pressure valve adjustment in transmission hydraulic

1 - double filter housing; 2 - spring; 3 - transmission hydraulic system operational pressure valve; 4 - spacer shims; 5 - oil lubricating valve; 6 - signaling valve.

ATTENTION: IF PRESSURE DROPS BELOW 0.7 МПа, STOP THE TRACTOR AND REPAIR FAILURE IN TRANSMISSION HYDRALIC SYSTEM!

6.3.4 Operation 83. Replacement of filtering elements in transmission hydraulic filter

Filtering elements of filter 8 (picture 6.1) should be replaced if valve indicator 6 located on control board illuminates (picture 6.3)

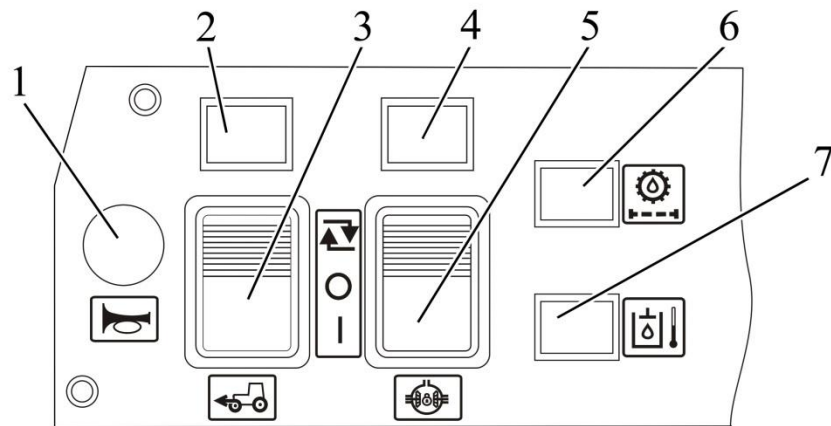
ATTENTION: TWO FILTERRING ELEMENTS SHOULD BE CHANGED SIMULTENIOUSLY!

MTZ Equipment Ltd.

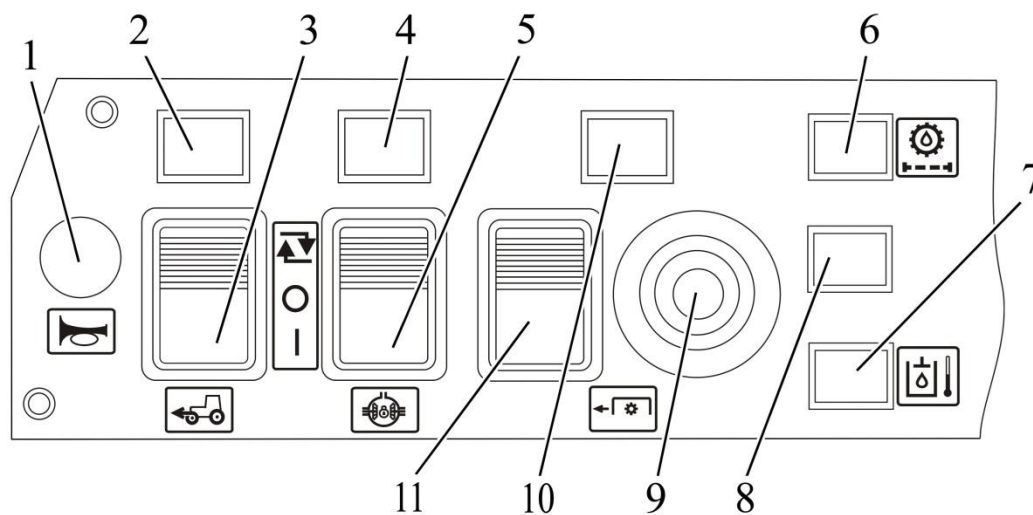
Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com



a) Control board without front PTO installed



b) Control board with front PTO installed

Picture 6.3 Rear axle Dif. Lock, front drive and front PTO control board

1 – button of audio warning signal engagement; 2 – indicator of front axle drive engagement; 3 – switch of front axle drive engagement; 4 – indicator of rear axle Dif. Lock engagement; 5 – switch of rear axle Dif. Lock engagement; 6 – signaling device of double filter pollution in transmission hydraulic system; 7 – signaling device of emergency temperature in hydraulic tank; 8 – plug; 9 – button of front PTO engagement; 10 – indicator of front PTO engagement; 11 – switch key of front PTO engagement.

Carry out replacement as follows:

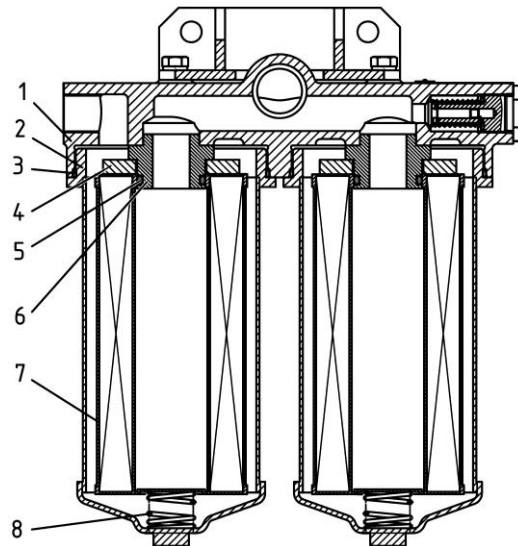
- after indicator 6 (picture 6.3) operation stop the engine, apply parking brake;
- unscrew double filter cup 2 (picture 6.4);
- remove dirty filtering element 7;
- clean permanent magnet 4 off metal particles;
- place cleaned permanent magnet 4 on bushing 6;
- install seal rings 3, 5 and new filtering element 7;
- place spring 8 into cup 2 and screw cup into housing 1;
- replace second filtering element in the same way.

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com



Picture 6.4 - Replacement of exchangeable elements in transmission hydraulic filter

1 – double filter housing; 2 – cup; 3, 5 – seal ring; 4 – permanent magnet; 6 – bushing; 7 – filtering element; 8 – spring.

ATTENTION: SCREEN FILTER SHOULD BE WASHED OFF SIMULTENIOUSLY WITH REPLACEMENT OF DOUBLE FILTER ELEMENTS !

IN ORDER TO WASH TRANSMISSION HYDRAULIC SYSTEM SCREEN FILTER 9 (PICTURE 6.5) PROCEED AS FOLLOWS:

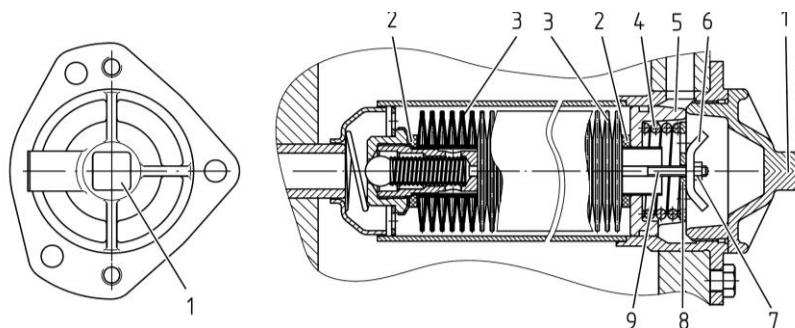
- unscrew cup 1 (picture 6.5) of screen filter and remove filter assembly (pull it by cramp 6);

disassemble the filter: unscrew locknut 7 and cramp 6 off stud 9. Take off washer 8, spring 4, piston 5, seal ring 2, filtering elements 3, seal ring 2;

- wash out filtering elements in diesel fuel until dirtinesses removed completely;

- assemble the filter in reverse order paying attention to obligatory seal rings 2 installation from both sides of filtering elements set.

ATTENTION: SCREW CRAMP 6 (PICTURE 6.5) ON STUD 9 UNTIL WASHER 8 SITS FLUSH TO THE PISTON 5 END FACE!



Picture 6.5 – Transmission hydraulic system screen filter washing-out

1 - cover; 2 - seal ring; 3 - filtering elements; 4 - spring; 5 - piston; 6 - cramp; 7 - locknut; 8 - washer; 9 - stud.

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

7 Troubleshooting

7.1 Troubleshooting of gearbox

List of possible malfunctions of gearbox and probable remedies are specified in table 7.1

Table 7.1

<i>Failure features, possible cause</i>	<i>Probable remedy</i>
Tractor doesn't drive in any gear at normal pressure in transmission hydraulic control system	
Wear of splined connection of clutch drive shaft, gearbox input shaft or connecting bushing.	Disconnect tractor units, remove gearbox and if required clutch housings, replace worn out parts.
Tractor doesn't drive in any gear, there is no pressure in transmission hydraulic control system	
Oil gear pump failure in transmission hydraulic control system	Replace the pump
Tractor wouldn't drive in one of gears, at normal pressure in transmission hydraulic control system (in other gears tractor operates normally)	
If electronic gearshift control operates normally then most probable reason is failure of frictional clutch of non-operated gear	Disconnect tractor units, remove gearbox housing, remove gear unit out of gearbox and disassemble, replace failed parts in frictional clutch
One of the ranges can not be engaged or is self-disengaged	
Wear of selector fork face or collar	Disconnect tractor units, remove gearbox and change broken down parts
Pressure drop in one of gears	
Oil leaks in line to frictional clutch (due to faulty gaskets, plugs, collars, seal rings, etc.)	Locate and repair place of leakage.
Gearbox reducer "L-H" step couldn't be engaged	
"Hangs" or failed reducer step shift cylinder distributor	Wash out valve's spool. Replace failed valve.
Cylinder of gearbox reducer step shift is out of adjustment	Adjust gearbox reducer step shift cylinder

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

<i>Failure features, possible cause</i>	<i>Probable remedy</i>
Completion of table 7.1	
Synchronizer of gearbox reducer step shift is destroyed or selector fork is worn out.	Replace the synchronizer and broken down parts
Increased noise	
Low oil level in transmission	Add oil to required level mark
Wear or destruction of bearings and other transmission parts	Replace damaged bearings and other transmission parts
Partial clutch disengagement (clutch "drags")	Adjust clutch according to directions in Operational Manual.
Tractor engine wouldn't start with range shift lever at neutral position or starts at engaged range	
Starter interlock (at engaged range) switch isn't adjusted properly	Adjust installation of starter interlock switch (on gearbox left side)
Starter interlock switch doesn't function properly	Replace starter interlock (at engaged range) switch
Oil leak into dry part of clutch housing	
Oil leak on connection of: sleeve— cover — housing or on connection of: clutch release bracket — shaft— housing	Disconnect tractor units in plane engine - clutch housing and repair leak
Oil leak trough the collars	Disconnect tractor units in plane engine - clutch housing and replace the collars
Increased noise, revealing products of bearings distraction	
Wear or distraction of bearings and other parts	Define destroyed transmission parts and repair assembly unit
Tractor starts to move at ranges engaged and gears disengaged, but at some gears engaged engine stops running	
If electro-hydraulic gearshift control operates normally then most possible reason is failure of frictional clutch (piston is jammed, disks are sintered or deformed)	Disconnect tractor units, remove gearbox housing, remove out of gearbox and disassemble gear unit, replace broken down parts in frictional clutch
There is essential pressure drop with engagement of every gear	
Bearing on input shaft was destroyed	Disconnect tractor units, remove gearbox housing, remove out of gearbox and disassemble gear unit, replace broken down parts

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

7.2 Troubleshooting of gearbox electronic control system

List of possible malfunctions in Gearbox Electronic Control System and probable remedies are specified in table 7.2

Table 7.2

<i>Failure features, possible cause</i>	<i>Probable remedy</i>
There's no High step engagement in gearbox reducer or front PTO drive, or there's no engagement in positive mode of front drive axle or rear axle Dif. Lock	
There's no power supply voltage on corresponding distributor electromagnet	Check power supply voltage advancing on corresponding distributor electromagnet (see electric connection diagram)
Corresponding distributor spool is jammed	Cleanse the distributor
There's no any drive engagement (front drive axle, rear axle Dif. Lock, front PTO) and there's no engagement of High step in gearbox reducer	
There's no pressure in transmission hydraulic system	Repair malfunction in transmission hydraulic system
When hand knob is lifted into upper position at gearshift (short term neutral position) there's engagement of gear, or instead of set up gear in accordance with hand knob position at gearshift happens engagement of adjacent gear, or when hand knob is pushed down there's disengagement of engaged gear or engagement of two gears	
Gearbox gear and reducer step shift block is out of order	Replace gearbox gear and reducer step shift block
Simultaneous symbols indication in several colors on panel, or symbols, which are not designated in manual indication on panel, or illumination of all dot marks on panel in different colors	
Engaged gear indicator panel is out of order	Replace Engaged gear indicator panel
Gearbox gear and reducer step shift block is out of order	Replace gearbox gear and reducer step shift block
Upon engagement of gearbox "slow down" mode engine stops running	
Sensor of clutch disengagement isn't adjusted	Adjust sensor of clutch disengagement
Clutch doesn't disengage	Adjust clutch actuating linkages
When the starter and instruments switch is shifted from position OFF into position "Instruments are ON", there's no indication on gear and reducer step shift block and on panel	

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

<i>Failure features, possible cause</i>	<i>Probable remedy</i>
Completion of table 7.2	
There's no power supply voltage in gearbox gearshift control system	Check electric circuits on electric equipment connections diagram or on Gearshift Electronic Control System diagram
At the time of gearshift from one gear to another there's symbol "!" indication in green blinking color	
"Hang-up" of the disengaging gear spool in the open condition, resulting in attempt to engage two gears	Return to disengaging gear. Indication of disengaging gear number on panel in constant yellow color means "hang-up" of the disengaging gear spool. Repair malfunction in the electro hydraulic distributor of the corresponding gear
Number of engaging gear illuminates on panel in blinking yellow color Gear cannot be engaged	
Rupture in the circuit to electric magnet of engaging gear distributor	Check electric circuits on Gearshift Electronic Control System diagram
Number of engaging gear on panel illuminates in blinking red color Gear can not be engaged	
Electrical short in circuit to electromagnet of given gear	Check electric circuits on Gearshift Electronic Control System diagram, repair malfunction
Number of engaging gear illuminates on panel in blinking green color Indicators of gear engagement on gearbox gear and reducer step shift block do not illuminate	
Low pressure in transmission hydraulic system	Repair malfunction in transmission hydraulic system
Pressure sensor ДСДМ-М of engaged gear is out of order. Movement in this gear is possible.	Check pressure sensor ДСДМ-М for normal operation, replace if sensor is out of order
Rupture in harness to pressure sensor ДСДМ-М of engaged gear. Movement in this gear is possible.	Check electric circuits (see Gearshift Electronic Control System diagram), repair malfunction
"Hang-up" of engaged gear distributor spool in closed position. Movement in this gear is impossible.	Repair malfunction in the electro hydraulic distributor of that gear
Symbol "U" is displayed on panel in red blinking color. Operation of gearbox gear and reducer step shift block is blocked.	
This implies that voltage applied in tractor electric circuits is above 18 V.	Generator regulator is out of order Check voltage on terminal "Д" of the generator, replace defective regulator

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

7.3 Troubleshooting of transmission hydraulic system

List of possible transmission hydraulic system failures and remedies is specified in table 7.3

Table 7.3

<i>Failure feature, possible cause</i>	<i>Probable remedy</i>
Low pressure in hydraulic system	
Low oil level in transmission	Check oil level in transmission as specified in section "Service Maintenance" Add the oil to required level if necessary
Spring 2 (picture 6.2) of operational pressure valve set up lost it's properties	Replace the spring or adjust with washers 4 (picture 6.2) - increase their's quantity
Dirtiness of screen filter	Rinse screen filter as stated in section "Service maintenance"
Contamination of double filter. Indicator of filter dirtiness illuminates on panel of rear axle Dif. lock and front drive axle control)	Replace both filtering elements of double filter, as stated in section "Service maintenance"
Transmission hydraulic system pump failure	Replace or repair pump in transmission hydraulic system
Oil leakage in frictional clutch boosters	Repair defects in specialized repair shop
Lack of pressure in transmission hydraulic system	
Oil gear pump in transmission hydraulic system failure	Replace transmission hydraulic system pump
Transmission hydraulic system pump drive is disengaged	Engage transmission hydraulic system pump drive
Parts in transmission hydraulic system pump drive broke down	Replace damaged parts in transmission hydraulic system pump drive
High oil pressure in hydraulic system	
Filled into transmission oil doesn't corresponds to season (air temperature)	Fill in corresponding seasonal oil
Adjustment of double filter operational pressure adjustment valve 3 (picture 6.2) isn't correct	Diminish adjustment washers 4 (picture 5.4.28) quantity
Noisy range collars shift-over	
Incomplete disengagement of the clutch (clutch "drags")	Carry out clutch checks and adjustments
Increased noise	

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

<i>Failure feature, possible cause</i>	<i>Probable remedy</i>
Completion of table 7.3	
Low oil level in transmission	Check oil level in transmission as specified in section "Service Maintenance". Add oil to required level if necessary
Wear or destruction of bearings, other transmission parts	Replace the damaged parts

8 Towing the tractor

Towing the tractor with non-operating steering pump is allowed at speed up to 10 km/hr on distance up to 5 km. Proceed as follows before towing the tractor:

- set range lever into neutral position, gearbox gearshift hand knob install in position "0".
- set the handle for Rear PTO engagement from independent or synchronous drive to a "Neutral" position.

In order to connect a towing rope on tractors with Front Hitch (additional configuration), there is a towing shackle located on the Front Hitch bracket!

In case the tractor without Front Hitch is towed, the towing rope shall be fastened to the towing shackle located on the spacer plate with weights.

THE TOWING SHACKLE SHALL NOT BE USED TO LIFT THE TRACTOR!
ATTENTION: DURING TRACTOR TOWING, IT IS REQUIRED TO OBSERVE TRAFFIC REGULATIONS!

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

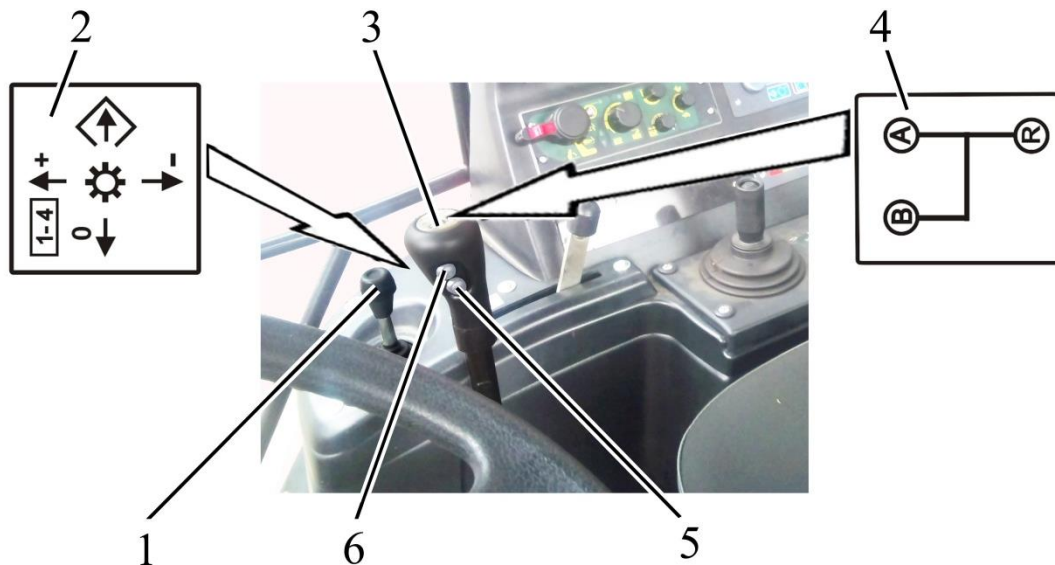
Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

9 Selection of ranges, gears and gearbox reducer steps (version with joystick gearshift control)

9.1 General information

Gear-shift operation in Gearbox is carried out by range selector lever 3 (picture 9.1), gearshift joystick 1 with range step shift button 5.



Picture 9.1 - Selection of ranges, gearbox gears and reducer steps

1 - gearshift joystick; 2 - gearbox gearshift selection diagram; 3 - gearbox ranges shift lever; 4 - gearbox range selection diagram; 5 - gearbox reducer step shift button; 6 - "slow down" mode engagement button.

First before to set up designated gear it is necessary to shift gearbox reducer step if required. Engage range and set up number of gear next.

9.2 Selection of gearbox ranges

First before start to move engage required gearbox range (see diagram 4, (picture 9.1) by range selector lever 3, with previously engaged gearbox "slow down" mode.) Engagement of "slow down" mode is possible when the following conditions are fulfilled:

- operator pushed down and retains button 6 on range selector lever;
- gearbox range selector lever 3 is in neutral position;
- clutch is disengaged.

Gearbox "slow down" mode is engaged only provided that symbol "P" (gearbox "slow down" mode is engaged) is displayed by digital indicator 7 (picture 10.1), located on IECS*, and corresponding segments of 1-st and 4-th gears engagement are illuminating continually on signaling device 6.
 * **IECS - integrated electronic control system.**

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

Every illuminating segment of "P" symbol represents implementation one or another of the above listed gearbox "slow down" mode conditions. If with button 6 depressed (picture 9.1) , one of symbol "P" segments doesn't illuminate, then there is no signal from one of sensors in accordance with the diagram on picture 9.2. If button 6 isn't depressed, there will not be illumination of any symbol "P" segments, even at range selector lever in neutral and clutch disengaged. Lower vertical segment of "P" symbol illuminates only under condition of all tree "slow down" mode conditions execution.

If in electronic circuits of 1-st and 4-th gears faults are detected, corresponding segments of indicator 6 will display appropriate code as indicated in paragraph 10.8.

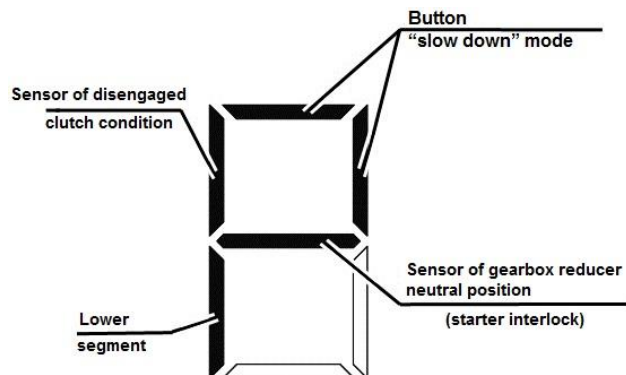
Malfunctions revealed in process of "slow down" mode engagement are to be repaired.

ATTENTION: ENGAGE RANGE ONLY AFTER ENGAGEMENT OF GEARBOX "SLOW DOWN" MODE! CARRY OUT SELECTION OF RANGES ONLY WITH DESENGAGED INTO NEUTRAL RANGE LEVER AND ENGAGEMENT OF GEARBOX "SLOW DOWN" MODE!

ATTENTION: ENGAGE THE RANGE ONLY ON BROUGHT TO A STOP TRACTOR AND WITH FULLY DEPRESSED CLUTCH PEDAL!

IT IS FORBIDDEN TO SWITCH RANGES ON MOVING TRACTOR!

ATTENTION: DESENGAGE GEARBOX RANGE LEVER INTO NEUTRAL POSITION ONLY AFTER SETTING GEARBOX TO "0" GEAR AT DESENGAGED CLUTCH ON STOPPED TRACTOR!



Picture 9.2 - Sensors and button operation diagram on digital panel at "slow down" mode engagement.

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

9.3 Gearbox gears changeover

Gearbox gears changeover is carried out by joystick 1 (picture 9.1). Indication of engaged gear is effected by signaling device 33 of gear "0" (picture 10.1) and by corresponding indicator 6 segments, as well as by digital indicator 7, installed on IECS.

At initial position when operator shifts starter and instrument switch in position "I" - instruments are on" - all gears are disengaged. On IECS face panel illuminates signaling device 33 of gear "0", and "0" number illuminates on digital indicator 7. It informs about availability of power supply to gearshift system, but system doesn't issue control signal to any electric magnet of gearshift distributor. After engine starts running transmission hydraulic system pump begins to operate. Indexation of "0" gear maintains.

In order to start moving, before engagement of gear gearbox range should be engaged by range shift lever 3 (picture 9.1) with previously "slow down" mode switched on, as said in paragraph 9.2 "Selection of gearbox ranges".

After required range engagement, gear shift is performed with joystick 1 (picture 9.1) without power flow interruption, except for gear engagement from "Gear disengaged" (gear "0") state. Gear engagement from "Gear disengaged" state is allowed at depressed against stop clutch pedal (operation of clutch disengaged position sensor). Successive joystick handle move forward against stop will ensure successive gear shifting on the higher gear (every movement forward against stop means plus one gear). Successive joystick handle move backward against stop will ensure successive gear shifting on the lower gear (every movement backward against stop means minus one gear).

Fast exit (disengagement) from any gear to state "Gear disengaged" (gear "0") is carried out by joystick 1 handle movement to the left against stop. If joystick 1 handle is pushed to the right side against stop and maintained for over 2 seconds in that state, "remembering" of engaged gear occurs. Repeated quick (less than 1 second) of joystick 1 handle movement to the right against stop at fully depressed clutch pedal will recall "memorized" gear (for example it's possible engage memorized gear at once from state "0"). Description of mode of engaged gear indication functioning is presented in section 2.15 "IECS" (Integrated Electronic Control System).

ATTENTION: IT IS PERMITTED TO CARRY OUT GEARSHIFT OPERATIONS WITHIN ONE RANGE ON MOVING TRACTOR WITHOUT CLUTCH PEDAL DEPRESSION!

Possibility to shift reducer steps automatically in motion (without tractor stoppage) is provided in range "B".

In order to accelerate tractor it's required, moving in 4-th gear at step "L" to depress and retain clutch pedal and to push joystick handle forward against stop. Automatic gearshift to second gear and change over from "L" to "H" step occurs. In the end of gearshift IECS will shortly switch on integrated buzzer, then it's necessary to release clutch pedal smoothly.

In order to decelerate tractor it's required, moving in the first gear at step "H" depress and retain clutch pedal and to push joystick handle backward against stop. Automatic gearshift to 4-th gear and change over from "H" to "L" step occurs. In the end of gearshift IECS will shortly switch on integrated buzzer, then it's necessary to release clutch pedal smoothly.

9.4 Gearbox reducer steps changeover

When operator shifts starter and instrument engagement switch into position "I" - instruments are on" indicator 17 of gearbox reducer engagement state (picture 10.1) illuminates on IECS panel. Engaged before engine stop step stays in engaged position, gearbox reducer and corresponding step engagement indicator 15 or 26 illuminates.

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

"L" (low) and "H" (High) gearbox reducer steps changeover is possible only after engine starts running, when transmission hydraulic system pump begins to operate.

ATTENTION: ENGAGE GEARBOX REDUCER STEPS ONLY ON STOPPED TRACTOR, GEARBOX RANGE SHIFT LEVER SHOULD BE SET IN NEUTRAL POSITION!

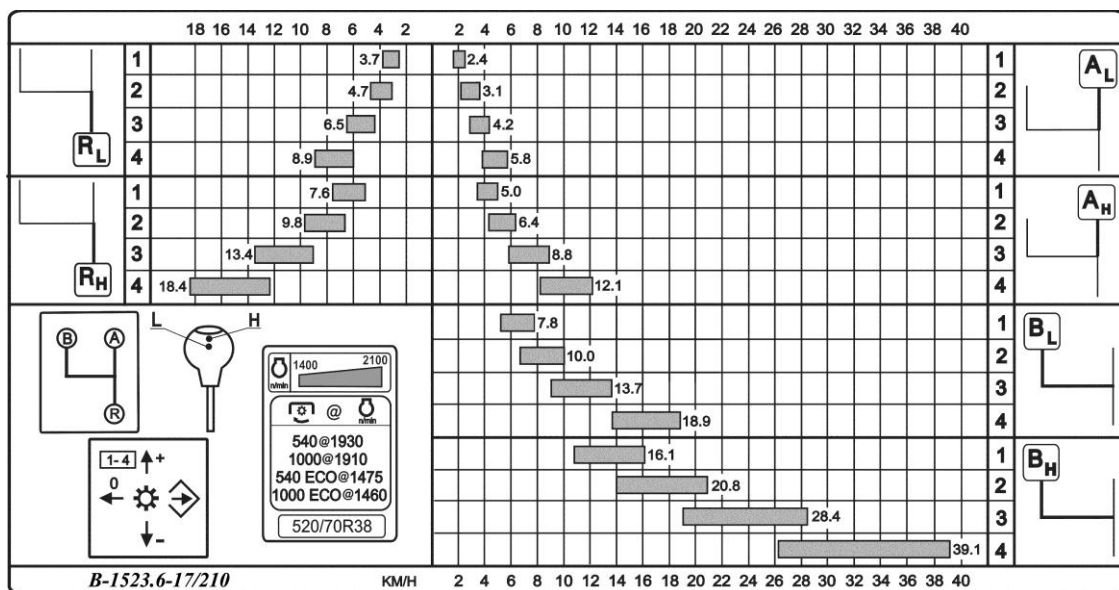
Engagement of low gearbox reducer step "L" is realized by button 25 (picture 10.1) on IECS. At that indicator 17 illuminates on IECS and reducer low step engagement indicator 26 is being turned on. Indicator 15 will go out.

Engagement of high reducer step "H" is effected by button 16 (picture 10.1) on IECS. At that indicator 17 illuminates and indicator 15 of gearbox reducer high step engagement is being turned on. Indicator 26 will go out.

Reducer steps change over ("L"/"H") is also possible by depressing button 5 (picture 9.1), located on range shift lever 3.

9.5 Velocity diagram for tractor "MTZ-1523.4"

Velocity diagram for tractor "MTZ-1523.4" on basic tires with joystick gearshift control is placed on cab right hand window glass and is presented on picture 9.3.



Picture 9.3 - Tractor "MTZ-1523.4" with Partial Powershift transmission velocity diagram

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

10 Integrated Electronic Control System (IECS; version available only with gearshift joystick control)

10.1 General information about Integrated Electronic Control System (IECS)

Integrated Electronic Control System (IECS) on tractor "MTZ-1523.4" with Partial Powershift transmission is designated for the following:

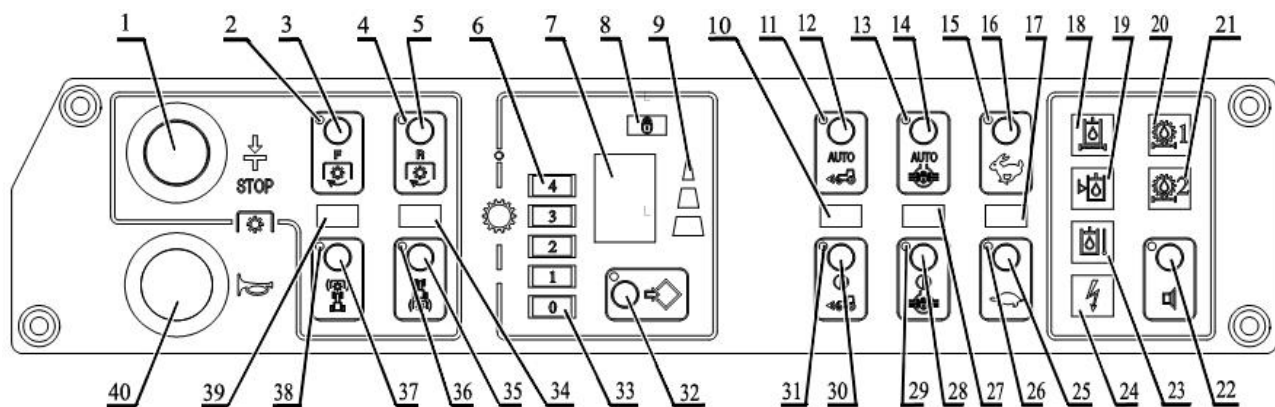
- indication of gearbox engaged gear and gearbox gearshift mode control;
- rear and front PTO control;
- front axle drive control;
- rear axle differential lock control;
- gearbox reducer steps change over control, indication of gearbox reducer operation;
- emergency state of transmission hydraulic system and tractor hydraulic system signaling, emergency power supply voltage in tractor circuits diagnostics;
- troubleshooting of electronic control systems of rear PTO, front PTO, front axle drive, rear axle Dif. Lock, gearbox gear and reducer step shift.

Disposition of control elements, indicators and signaling devices of IECS is presented on picture 10.1.

Short audio signal confirms set up with buttons modes of drive's operation.

When clearance lights are turned on, IECS indicators and signaling devices brightness dehighlighting takes place.

ATTENTION: CONTROL SIGNALING LIGHTS ARE SWITCHED ON AND OFF IN STEP WITH SYSTEMS SENSOR'S STATE CHANGE!



Picture 10.1 Integrated electronic control system

1 - Button of front and rear PTO disengagement in emergency; 2 - signaling device of front PTO engagement; 3 - engagement button of front PTO; 4 - signaling device of rear PTO engagement; 5 - engagement button of rear PTO; 6 - signaling devices of gear (from 1-st to 4-th) engagement; 7 - digital indicator; 8 - signaling device of gearbox operation at emergency state; 9 - gearshift mode indicator; 10 - signaling device of front axle engaged state; 11 - signaling device of front drive axle set up at automatic mode; 12 - engagement button of front drive axle automatic mode; 13 - signaling device of rear axle Dif. Lock set up at automatic mode; 14 - engagement button of rear axle Dif. Lock at automatic mode; 15 - signaling device of high step set up for gearbox reducer; 16 - engagement button of gearbox reducer high step; 17 - signaling device of gearbox reducer engaged state; 18 - signaling device of hydraulic pump filter pollution and emergency pump oil temperature (or depending on sensor type, signaling device of hydraulic pump filter pollution only); 19 - signaling device of emergency oil level in hydraulic tank (or depending on sensor type, signaling device of emergency oil temperature in hydraulic tank); 20 - signaling device of transmission double filter dirtiness; 21 - reserve signaling device; 22 - audible signal (buzzer) switch off button; 23 - signaling device of emergency oil temperature in hydraulic tank; 24 - signaling device of emergency IECS power supply voltage; 25 - engagement button of gearbox reducer low step; 26 - signaling device of gearbox reducer low step set up; 27 - signaling device of rear axle Dif. Lock

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

engaged state; 28 - engagement button of rear axle Dif. Lock positive mode; 29 - signaling device of rear axle Dif. Lock set up at positive mode; 30 - engagement button of positive mode for front drive axle; 31 – signaling device of positive mode set up for front drive axle; 32 - button of gearshift mode selection; 33 - signaling device of zero gear (gear "0") state; 34 - signaling device of rear PTO engaged state; 35 - disengagement button of rear PTO; 36 - signaling device of rear PTO disengagement; 37 - disengagement button of front PTO; 38 - signaling device of front PTO disengagement; 39 - signaling device of front PTO engaged state; 40 - button of audible signal switching on.

10.2 Indication of gearbox engaged gear and gearshift mode control

At initial position when operator shifts starter and instrument switch into position "I" - instruments are on", medium gearshift mode is installed by default - two upper segments illuminate on indicator 9 (picture 10.1).

Pushing button 32 of gearshift mode selection repeatedly it's possible to set light, heavy or return to medium gearshift mode, depending on kind of operations performed. Light mode could be used at operations with minimum loading, for example on transport operations with empty trailer, and heavy mode could be engaged for power-consuming operations with maximum loading. If upper (smaller) segment illuminates on indicator 9 - light mode was set, if two upper segments illuminate - medium mode was set, if all three segments illuminate - heavy gearshift mode was set.

Also when operator shifts starter and instrument switch into position "I" - instruments are on", all gears are disengaged. On IECS face panel illuminates indicator 33 of gear "0" (picture 10.1) and number "0" illuminates on digital indicator 7.

Then at gear shifting during operations number of set up with joystick gear is displayed on digital indicator 7, and signaling device 6 displays currently engaged gear.

Thus if during tractor movement in 1-st gear 4-th gear is set up successively with joystick, number "4" will be displayed on digital indicator at once, but signaling devices 6 of engaged gear will illuminate successively (at first lower one, then the others, the upper device will illuminate last), in accordance with operation of corresponding pressure sensors.

At stable operation mode indicator 7 indicate number of set up gear, and corresponding signaling device 6 illuminates steadily confirming pressure response.

Digital indicator 7 also displays set up of gearbox "slow-down" mode, as described in section 9.2 "Selection of gearbox ranges".

10.3 Rear Power Take Off (PTO) control

Rear PTO control is realized by pushbuttons 5 and 35 (picture 10.1). Indication of rear PTO operation is effected by signaling devices 4, 34, 36 and combined indicator.

At initial position when operator shifts starter and instrument switch into position "I" - instruments are on", disengaged rear PTO condition is installed by default - indicator 36 (picture 10.1) illuminates, confirming disengaged PTO condition.

In order to engage rear PTO button 5 is to be pushed. Signaling device 4 will operate immediately after button 5 has been pushed informing that rear PTO starts rotation. Then in short time when rear PTO

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

begins operation at normal operational mode, rear PTO engaged condition indicator 34 will illuminate additionally.

In order to disengage rear PTO button 30 is to be pushed. At that signaling devices 4 и 34 goes out and signaling device 36 of rear PTO starts illuminate confirming disengaged rear PTO condition.

IECS lets repeated rear PTO engagement only in 30 seconds after it was disengaged.

ATTENTION: IN ORDER TO DISENGAGE REAR PTO IN EMERGENCY PRESS DOWN BUTTON 1 (PICTURE 10.1)!

NOTE: ADDITIONAL INFORMATION ON REAR PTO CONTROL IS DESCRIBED IN SECTIONS 11"Additional information concerning to rear PTO control".

10.4 Front PTO control

Tractor MTZ-1523.4 can be equipped with Front PTO on request.

Front PTO control is similar to rear PTO control.

Front PTO control is realized by pushbuttons 3 and 37 (picture 10.1) Indication of front PTO operation is effected by signaling devices 2, 38, 39.

At initial position when operator shifts starter and instrument switch into position "I" - instruments are on", disengaged front PTO state is installed by default - indicator 38 illuminates, confirming disengaged front PTO state.

In order to engage front PTO button 3 is to be pushed. Signaling device 2 will operate immediately after button 3 has been pushed, informing that front PTO starts rotation. Then in short time when front PTO begins operation at normal operational mode, indicator 39 of front PTO engaged condition will illuminate additionally.

In order to disengage front PTO button 37 is to be pushed. At that signaling devices 2 and 39 goes out and signaling device 38 starts to illuminate confirming disengaged condition of front PTO.

ATTENTION: IN ORDER TO DISENGAGE FRONT PTO IN EMERGENCY PRESS DOWN BUTTON 1 (PICTURE 10.1)!

10.5 Front drive axle (FDA) control

Front drive axle (FDA) control is realized by pushbuttons 12 and 30 (picture 10.1). Indication of FDA operation is effected by signaling devices 10, 11, 31.

At initial position when operator shifts starter and instrument switch into position "I" - instruments are on" - disengaged FDA drive state is set by default.

Use mode "FDA drive disengaged" at transport operations on hard-surfaced roads at travel speed over 13 km/hr in order to avoid increased front tires wear.

If button 12 "AUTO" is pushed down at forward running with steering wheels position of direct motion and when slippage threshold of rear wheels is exceeded, FDA drive is engaged in automatic mode. Signaling devices 10, 11 will respond.

Disengagement of FDA drive occurs automatically at travel speed over 16 km/hr or at rear wheel slippage reduction below admissible limit, or at reverse movement. At speed drop below 13 km/hr or at rear

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

wheel slippage exceeding admissible limit FDA drive should be engaged automatically. Signaling device 11 of automatic FDA drive mode set up will illuminate continuously up to disengagement of that mode, but signaling device 10 of engaged FDA drive state will illuminate only during FDA operation.

Use "Automatic FDA drive control" when operating on different field works. **Use positive FDA drive engagement mode at reverse movement.**

Disengagement of "Automatic FDA drive control" mode is executed by repeated overstrike on button 12 "AUTO". Signaling devices 10 and 11 will go out at that.

If positive engagement of FDA drive unrelated to any conditions is needed, it is necessary to push down button 30. Signaling devices 10 and 31 will respond almost simultaneously. At repeated overstrike on button 30 positive FDA drive mode shuts off and signaling devices 10 and 31 go out.

In order to shift from automatic to positive mode of FDA drive it is enough to push button 30.

ATTENTION: AT TRACTOR OPERATION IN POOR TRACTION CONDITIONS AND REAR WHEEL SLIPPAGE INCLUDING WHEN TURNING, IN ORDER TO SECURE SMOOTH FDA ENGAGEMENT USE ONLY POSITIVE PTO DRIVE ENGAGEMENT MODE FOR WHICH PURPOSE DO THE FOLLOWING:

- STOP THE TRACTOR HAVING CLUTCH PEDAL DEPRESSED;
- ENGAGE FDA MODE "POSITIVE FDA DRIVE ENGAGEMENT", HAVING PRESSED BUTTON 30;
- RELEASE THE CLUTCH PEDAL SMOOTHLY.

ATTENTION: AUTOMATIC FDA DRIVE ENGAGEMENT INDEPENDENTLY OF FDA DRIVE MODE SET UP (INCLUDING "FDA DRIVE "DISENGAGED" MODE) TAKES PLACE WHEN INTERLOCKED BRAKE PEDALS ARE DEPRESSED!

ATTENTION: AT TRACTOR OPERATION ON HARD-SURFACED ROADS IT IS NECESSARY TO DISENGAGE FDA DRIVE IN ORDER TO AVOID INCREASED FRONT TYRES WEAR!

ATTENTION: FAILURE TO FOLLOW REGULATIONS OF FDA CONTROL MODES USAGE CAN RESULT IN BREAKDOWN OF FRONT DRIVE AXLE DOUBLE JOINTS AND OTHER DRIVE TRAIN PARTS!

IT IS FORBIDDEN OPERATION OF TRACTOR WITH ENGAGED FDA DRIVE AT TRAVEL SPEED OVER 13 KM/HR!

10.6 Rear axle differential lock control

Rear axle differential lock (Dif. Lock) control is realized by pushbuttons 14 and 28 (picture 10.1). Indication of Dif. Lock operation is effected by signaling devices 13, 27, 29.

At initial position when operator shifts starter and instrument switch into position "I" - instruments are on" - disengaged Dif. Lock state is set by default.

In order to avoid increased rear tires and rear axle differential wear, do not use mode: "Rear axle Dif. Lock engaged" on transport operations on hard-surface roads at speeds over 10 km/hr.

If button 14 "AUTO" is pushed down at steering wheels position of direct motion rear axle Dif. Lock is engaged in automatic mode. Signaling devices 13 and 27 will respond simultaneously.

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

Disengagement of rear axle Dif. Lock takes place automatically at front steering wheels turn on 13° or at travel speed over 16 km/hr and also when any of, or both brake pedals are depressed. At speed drop below 13 km/hr rear axle differential lock should be engaged automatically.

Signaling device 13 of automatic rear axle Dif. Lock set up mode will illuminate continuously up to disengagement of that mode, but signaling device 27 of engaged rear axle Dif. lock state will illuminate only during rear axle Dif. lock operation.

Disengagement of "Automatic Rear Axle Dif. Lock Control" mode is carried out by repeated pressing on button 14 "AUTO", or by pressing and releasing the button 28 of positive "Rear Axle Dif. Lock Control" engagement. Signaling devices 13 and 27 will go out at that.

If short term positive engagement of Rear Axle Dif. Lock Control, independent of tractor travel speed and steering angle is required, it is necessary to press and retain in that state button 28. Rear Axle Dif. Lock Control stays engaged for time of button 28 depressed position. Signaling devices 27 and 29 will respond simultaneously. At button 28 releasing rear Axle Dif. Lock Control resets (in disengaged state) and signaling devices 27 and 29 go out.

In order to shift from automatic to positive mode of Rear Axle Dif. Lock Control, it's enough to press and retain button 28.

ATTENTION: AUTOMATIC DISENGAGEMENT OF REAR AXLE DIF. LOCK CONTROL TAKES PLACE AT DEPRESSING OF BOTH OR ANY OF BRAKE PEDALS!

OPERATION OF TRACTOR WITH ENGAGED REAR AXLE DIF. LOCK CONTROL AT TRAVEL SPEED OVER 13 KM/HR IS FORBIDDEN!

OPERATION OF TRACTOR ON HARD-SURFACED ROADS WITH PERMANENTLY ENGAGED REAR AXLE DIF. LOCK CONTROL IS FORBIDDEN!

10.7 Signaling of transmission and tractor hydraulic systems emergency state, diagnostics of emergency power supply voltage

Signaling device 20 of transmission double filter pollution (picture 10.1) illuminates at heavy rate of pollution. It is required to change the both filter elements of transmission double filter and wash off gearbox screen filter.

Signaling device 18 of tractor hydraulic pump filter illuminates (and further illuminate steadily) at heavy pollution of hydraulic pump filter. It is necessary to replace filter of hydraulic pump.

ATTENTION: IT IS ALLOWED SHORT TERM OPERATION OF SIGNALING DEVICES 18 AND 20 AT COLD OIL IN HYDRAULIC SYSTEMS; IT SHOULD NOT BE CONSIDERED AS MULFUNCTION!

Signaling device 19 of emergency oil level in hydraulic tank illuminates at oil level lowering below permissible rates.

Signaling device 23 of emergency oil temperature in tractor hydraulic tank illuminates at oil temperature rise above permissible rates. Besides signaling device 18 illuminates in blinking mode at hydraulic oil temperature rise above permissible.

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

In case of hydraulic system emergency devices 19 or 23 operation it is necessary to stop work, find out and repair reasons of emergency state origins in order to prevent failures and breakdowns of hydraulic system units.

Note: Signaling devices 18, 19 и 23 operate as described above, if combined sensors are installed:

- of level/temperature in hydraulic tank;
- of pollution/temperature on hydraulic pump.

If emergency temperature sensor is installed in hydraulic tank, signaling device 19 (picture 10.1) operates at permissible temperature rise. Signaling device 23 will not operate at that.

If sensor of pump filter pollution is installed on hydraulic pump, then signaling device 19 illuminates at its operation. Checkup of emergency oil temperature in pump is not applicable at that.

ATTENTION: SIGNALING DEVICE OF EMERGENCY VOLTAGE SUPPLY ILLUMINATES AT POWER SUPPLY VOLTAGE RISE ABOVE 18 V, IECS (INTEGRATED ELECTRONIC CONTROL SYSTEM) IS FULLY DISCONNECTED (CONTROL OF ALL DRIVES AND GEARBOX IS CUT OFF); OPERABILITY IS RESTORED AT VOLTAGE LOWERING BELOW 17V!

AT POWER SUPPLY VOLTAGE LOWERING BELOW 9 V, IECS IS FULLY DISCONNECTED (CONTROL OF ALL DRIVES AND GEARBOX IS CUT OFF); OPERABILITY IS RESTORED AT VOLTAGE RISE OVER 9V!

Audio warning device (buzzer) turns on at operation of any of signaling devices 18, 19, 20, 23 or 24. Warning device could be temporally switched off if button 22 is shortly depressed; signaling device of buzzer disconnection, located to the left from button 22 will be switched on and off at that. Should be remembered that with following IECS turnings on and operation of emergency state sensors, audio warning device will be switched on up to illumination of corresponding malfunction or replacement of corresponding filtering element..

10.8 Diagnostics of Electronic control systems of rear and front PTO, FDA, rear axle Dif. Lock and gearshift

Besides indication of drive or gear engaged condition, signaling devices 6, 10, 27, 34, 39 (picture 10.1) of IECS performs diagnostics of the following malfunctions of drive or gear electronic control systems:

- signaling device of drive or gear engaged state indicates with **single blinking** shorts in electro magnet circuits of distributor;
- signaling device of drive or gear engaged state indicates with **double blinking** rupture in circuits to distributor electric magnet;
- signaling device of drive or gear engaged state indicates with **triple blinking** failure to operate of pressure sensor's;

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

- signaling device of drive or gear engaged state indicates with **quadruple blinking** distributor's valve "hang-up"; besides signaling device 8 of gearbox emergency mode operation turns on at gearbox distributor's valve "hang-up".

Triple blinking of signaling device 17 means lack of signal from gearbox reducer low step engagement sensor;

- quadruple blinking means absence of signal from gearbox reducer high step engagement sensor.

Note: Signaling device of gearbox emergency operational mode is also turned on with switch 3 "Breakdown" (paragraph 3.3) turning on.

Signaling of drive and gearshift operation malfunctions is accompanied by signal of audio warning device. Warning device could be temporally switched off if button 22 is shortly depressed; at that buzzer disconnection signal, located to the left from button 22 will be switched on and off. Should be remembered that with IECS turnings on and operation of corresponding pressure sensors, audio warning device will be switched on up to repair of corresponding malfunction.

If several malfunctions are revealed, then corresponding signaling devices display error codes in the following sequence:

- a) short failure in the circuit to electric magnet of proportional valve;
- b) rupture in the circuit to electric magnet of proportional valve;
- c) malfunctions of pressure gauges;
- d) "hang-up" of electro hydraulic valve.

Time pause between malfunction codes is three times longer compare to signaling device blinking intervals inside the code.

Revealed faults are to be repaired in accordance with instructions in section 7 "Troubleshooting of electronic control system of gearbox, rear axle dif. lock, front drive axle, front and rear PTO and remedies"

10.9 IECS functioning check

Test of signaling devices and indicators IECS unit carries out at every connection to power supply. All LED signaling devices and indicators are switched on within 2 seconds at that, digital indicator 7 (picture 10.1) illuminates number "8", audio warning signal operates. Then LED signaling devices and indicators, digital indicator and audio warning signal change over to operating mode - signaling devices 33, 36, 38 illuminate, gearshift mode indicator displays medium mode and digital indicator 7 illuminates number "0", the rest of LED signaling devices and audio warning signal are disconnected.

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com

11 Additional information concerning to rear PTO control

Note: Instruction of Rear PTO engagement and disengagement control are given in section 10.3 "Rear PTO control".

Handle 23 of rear PTO drive engagement (picture 2.1.1) has three positions:

- upper position - "independent PTO drive is engaged";
- mid-position - "PTO drive is disengaged";
- down position - "synchronous PTO drive is engaged"

ATTENTION: ENGAGE PTO SYNCHRONOUS DRIVE ONLY FROM NEUTRAL POSITION AT ENGINE OPERATING AND TRACTOR MOVING AT LOWER GEARS OF 1-ST OR 2-ND RANGE. OTHERWISE DAMAGES IN DRIVE TRAIN ARE POSSIBLE. CARRY OUT PTO SYNCHRONOUS DRIVE SHIFT TO NEUTRAL IN A SIMILAR WAY!

ATTENTION: ENGAGE PTO INDEPENDENT DRIVE ONLY AT ENGINE STOPPED OR RUNNING AT MINIMUM IDLE SPEED! DISENGAGE PTO IEPENDENT DRIVE IN A SIMILAR WAY!

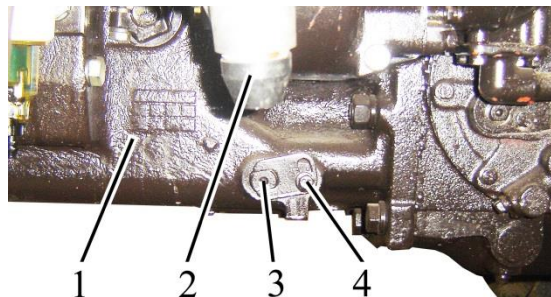
Rear PTO 540 1/min⁻¹ and 1000 min⁻¹ steps shift is carried out only by mounting of corresponding PTO ends, which have corresponding marking «540» и «1000». There's no special rear PTO step 540 мин⁻¹ and 1000 мин⁻¹ selector on «MTZ-1523.6» tractors.

There are two rear PTO modes of operation on «MTZ-1523.6» tractors:

- standard – 540 and 1000 min⁻¹;
- economical – 770 и 1460 min⁻¹ at engine rated speed.

Axle 3 (picture 11.1) located on the clutch housing left side under the hydraulic pump, is designed to shift rear PTO drive modes.

Rear PTO modes of operation shift is to be carried out only at engine stopped or running at minimum idle speed. To accomplish this it is required to loose fix bolt 4 (picture 11.1) and turn axle 3 up to engagement of collar, tighten the fix bolt after that. In order to engage standard mode of operation it is required to turn axle 3 counterclockwise against the stop.



Picture 11.1 - Switching rear PTO standard and economical mode of operation

1 - clutch housing; 2 - air pressure regulator; 3 axle; 4 - fixing bolt.

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) Fax: 1-647 933-9066 E-mail: info@mtzequipment.com Web: www.mtzequipment.com

Note: Picture 11.1 depicts position " standard mode of PTO operation is engaged".

Note: Rear PTO operation is controlled on the combined indicator, as described in section 2.8.2 "Purpose and operation principle of combine indicator indexes".

If tractor operates without rear PTO usage it is required to set handle of rear PTO drive engagement in position «disengaged PTO drive». Signaling device 36 (picture 10.1) should illuminate on IECS, signifying rear PTO disengaged state. Rear PTO guard hood is to be installed.

Note: Additional information on operating instructions for rear PTO are described in section 3.2.7 "PTO usage" in Operator's Manual.

MTZ Equipment Ltd.

Head Office: 3-1136 Centre St, Ste. 124, Thornhill, ON, L4J 3M8, Canada

Warehouse: 2682 Highway 34, Hawkesbury, Ontario, K6A 2R2, Canada

Tel: 1-855-2GO-4MTZ (1-855-246-4689) **Fax:** 1-647 933-9066 **E-mail:** info@mtzequipment.com **Web:** www.mtzequipment.com