

WSM

WORKSHOP MANUAL
TRACTOR

MECHANISM

Kubota

NOTICE

This reedited manual includes additional data and information on Kubota tractors. This manual describes the functions and structures of existing tractors. From now on, the Workshop Manual for each model will mainly cover servicing information.

If deemed to be fit, however, data and information on new mechanisms and peculiar items to specified model will be added to newly issued Workshop Manuals. The above documents will also include those data and information and their revised editions will be issued.

We are expecting your kind understanding and approval.

IMPORTANT : Please do not use the parts number described in this manual to order spare parts.

TO THE READER

The main purpose of this manual is to train the servicing personnel so that he / she can understand and service Kubota machines with speed.

This manual is also an excellent reference for the trained mechanic who wants to refresh his memory on Kubota machines.

All information and illustrations contained in this manual are based on the latest product information available at the time of publication.

The right is reserved to make changes in all information at any time without notice.

NOTE: The chapter of the engine is not included in this manual. Refer to workshop manual of diesel engine mechanism (Code No. 9Y021-01873 or 97897-60812 CD-ROM Version).

The peculiar one to the specified model such as transmission cross section, schematic of hydraulic circuit and electrical circuit are not described in this manual. Please refer to each workshop manual according to the tractor model.

October 2001

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1 ENGINE

NOTICE

Regarding engine mechanism information, please refer to DIESEL ENGINE MECHANISM Workshop manual (Code No. 9Y021-01873 or 97897-60812(CD-ROM Version)).

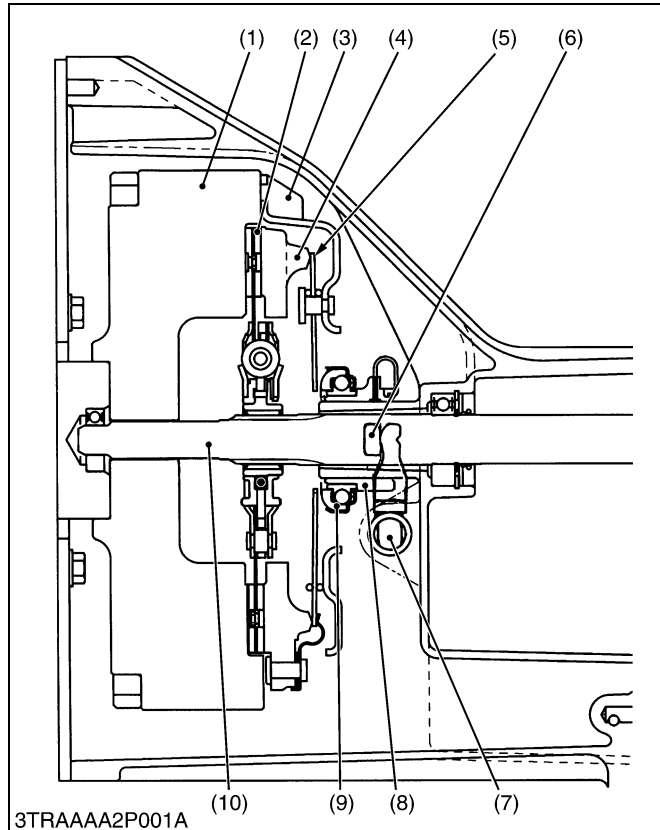
2 CLUTCH

MECHANISM

CONTENTS

1. DRY TYPE, SINGLE PLATE CLUTCH	2-M1
2. DRY TYPE, DUAL STAGE CLUTCH.....	2-M2
3. HYDRAULIC MULTIPLE DISC CLUTCH.....	2-M4
[1] TYPE 1 (For Travelling)	2-M4
[2] TYPE 2 (For PTO).....	2-M5

1. DRY TYPE, SINGLE PLATE CLUTCH



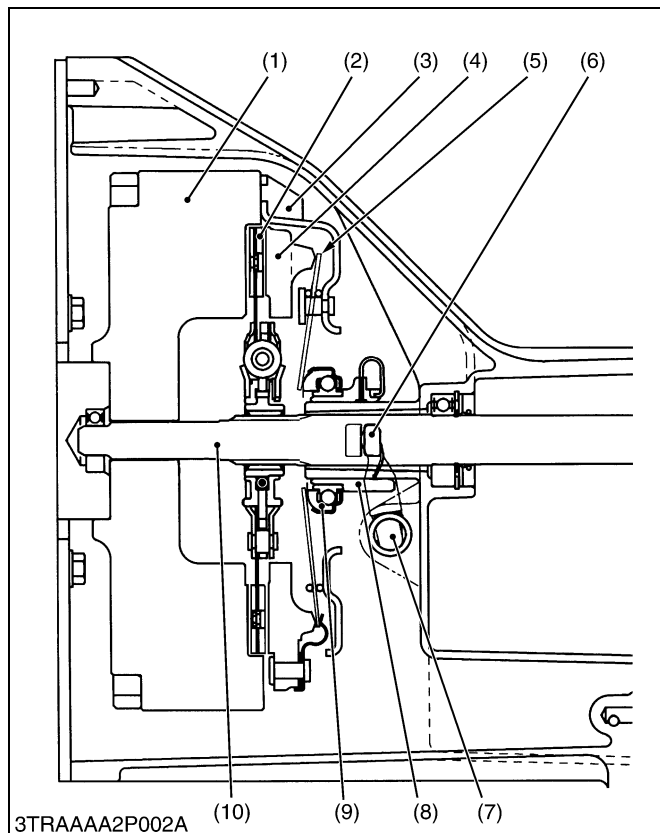
■ Clutch "Engaged"

When the clutch pedal is not depressed, the clutch release bearing (9) and the fingers of diaphragm spring (5) are not connected to each other.

Accordingly, the pressure plate (4) is tightly pressed against the flywheel (1) by the diaphragm spring (5). As a result, rotation of the flywheel (1) is transmitted to the transmission through the clutch shaft (10) due to the frictional force among the flywheel (1), clutch disc (2) and pressure plate (4).

- | | |
|----------------------|---------------------|
| (1) Flywheel | (6) Release Fork |
| (2) Clutch Disc | (7) Clutch Rod |
| (3) Clutch Cover | (8) Release Hub |
| (4) Pressure Plate | (9) Release Bearing |
| (5) Diaphragm Spring | (10) Clutch Shaft |

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■ Clutch "Disengaged"

When the clutch pedal is depressed, the clutch pedal rod is pulled to move the clutch rod (7). Then, the release fork (6) pushes the release hub (8) and release bearing (9) toward the flywheel. Simultaneously, the release bearing (9) pushes the diaphragm spring (5).

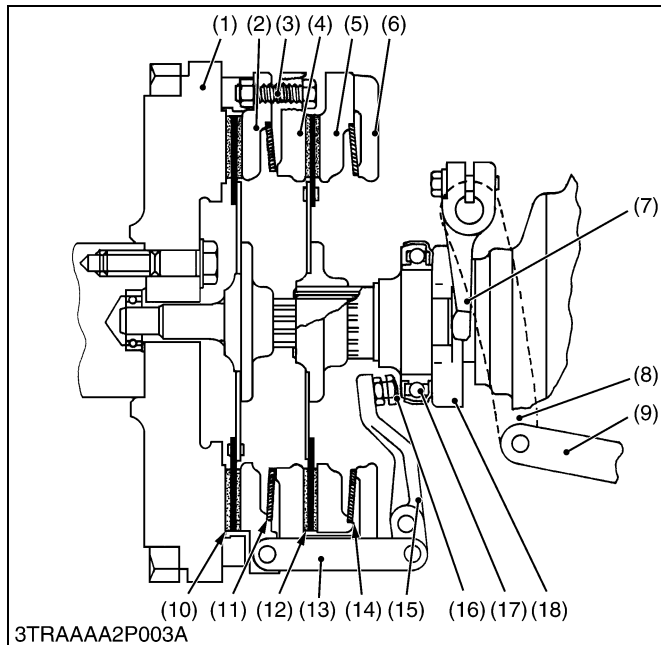
As the pressure plate (4) is pulled by the diaphragm spring (5), the frictional force among the flywheel (1), clutch disc (2) and pressure plate (4) disappears.

Therefore, rotation of the flywheel (1) is not transmitted to the clutch disc (2), and then the rotation of the clutch shaft (10) stops.

- | | |
|----------------------|---------------------|
| (1) Flywheel | (6) Release Fork |
| (2) Clutch Disc | (7) Clutch Rod |
| (3) Clutch Cover | (8) Release Hub |
| (4) Pressure Plate | (9) Release Bearing |
| (5) Diaphragm Spring | (10) Clutch Shaft |

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2. DRY TYPE, DUAL STAGE CLUTCH



A dual stage clutch is a combination of two single plate clutches. One clutch controls power transmitted to travelling, and the other to the PTO.

■ Travelling Clutch “Engaged”

■ PTO Clutch “Engaged”

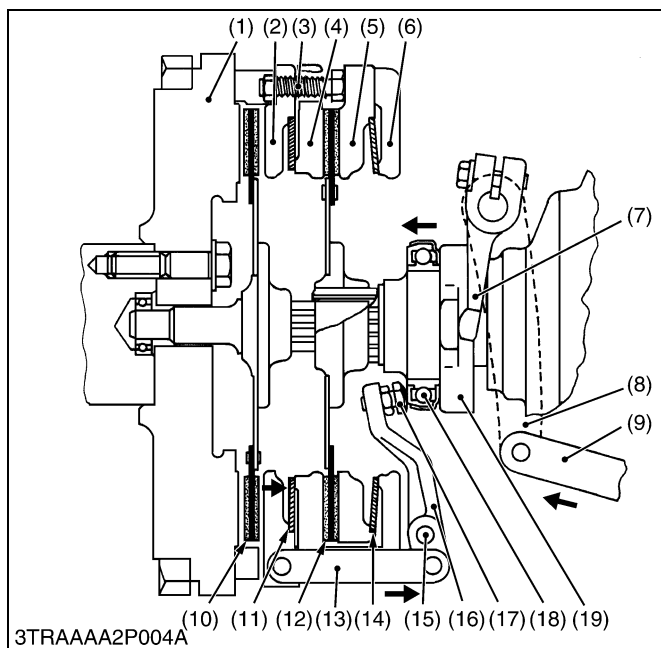
When the clutch pedal is not depressed, there is a certain amount of clearance between the release bearing (17) and the adjusting screw (16) mounted on the release lever (15). Under the conditions above;

- The travelling clutch disc (10) is pressed between the flywheel (1) and the pressure plate 1 (2) by the force of the belleville spring (11).
- The PTO clutch disc (12) is pressed between the clutch cover 1 (4) and the pressure plate 2 (5) by the force of the belleville spring (14).

Thus, the rotation of flywheel is transmitted to both the travelling and PTO systems.

(1) Flywheel	(10) Clutch Disc (Travelling)
(2) Pressure Plate 1 (Travelling)	(11) Belleville Spring
(3) Adjusting Screw	(12) Clutch Disc (PTO)
(4) Clutch Cover 1	(13) Release Rod
(5) Pressure Plate 2 (PTO)	(14) Belleville Spring
(6) Clutch Cover 2	(15) Release Lever
(7) Release Fork	(16) Adjusting Screw
(8) Clutch Lever	(17) Release Bearing
(9) Clutch Rod	(18) Release Hub

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■ Travelling Clutch “Disengaged”

■ PTO Clutch “Engaged”

When the clutch pedal is depressed to the middle of the stroke, the clutch rod (9) is pushed to move the clutch lever (8). Then, the release fork (7) pushes the release hub (19) and release bearing (18) toward the flywheel. Simultaneously, the release bearing (18) pushes the adjusting screw (17) attached to the release lever (16).

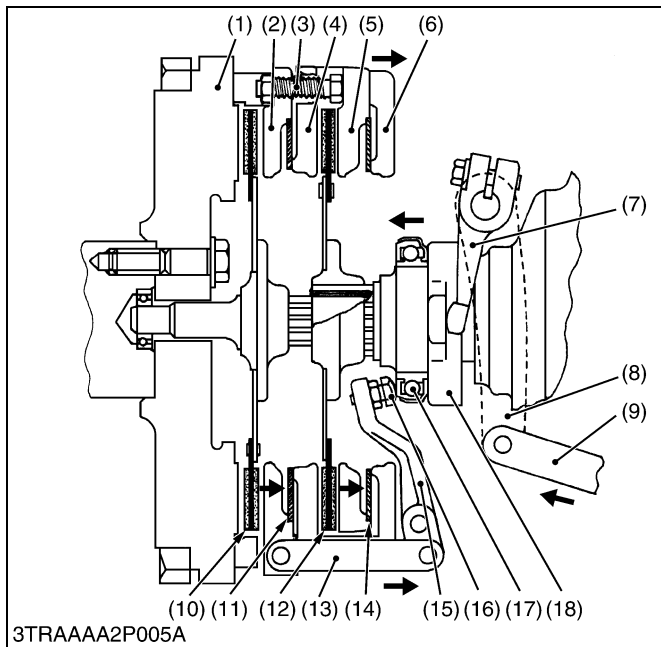
The release lever pulls the pressure plate 1 (2) by means of the release rod (13) as the lever turns at the clevis pin (15) as a fulcrum.

When the pressure plate 1 is pulled, friction force among the clutch cover 1 (4), clutch disc (10) and the pressure plate 1 (2) is lost. The rotation of flywheel is not transmitted to travelling system.

At this time, the pressure plate 2 (5) is in contact with the head of the adjusting screw (3) which serves as a stopper.

(1) Flywheel	(11) Belleville Spring
(2) Pressure Plate 1 (Travelling)	(12) Clutch Disc (PTO)
(3) Adjusting Screw	(13) Release Rod
(4) Clutch Cover 1	(14) Belleville Spring
(5) Pressure Plate 2 (PTO)	(15) Clevis Pin
(6) Clutch Cover 2	(16) Release Lever
(7) Release Fork	(17) Adjusting Screw
(8) Clutch Lever	(18) Release Bearing
(9) Clutch Rod	(19) Release Hub
(10) Clutch Disc (Travelling)	

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■ Travelling Clutch “Disengaged”

■ PTO Clutch “Disengaged”

When the clutch pedal is depressed to the full stroke, the pressure plate 2 (5) is pushed to the right by the adjusting screw (3).

This results in no friction among the flywheel (1), clutch disc (12) and pressure plate 2 (5).

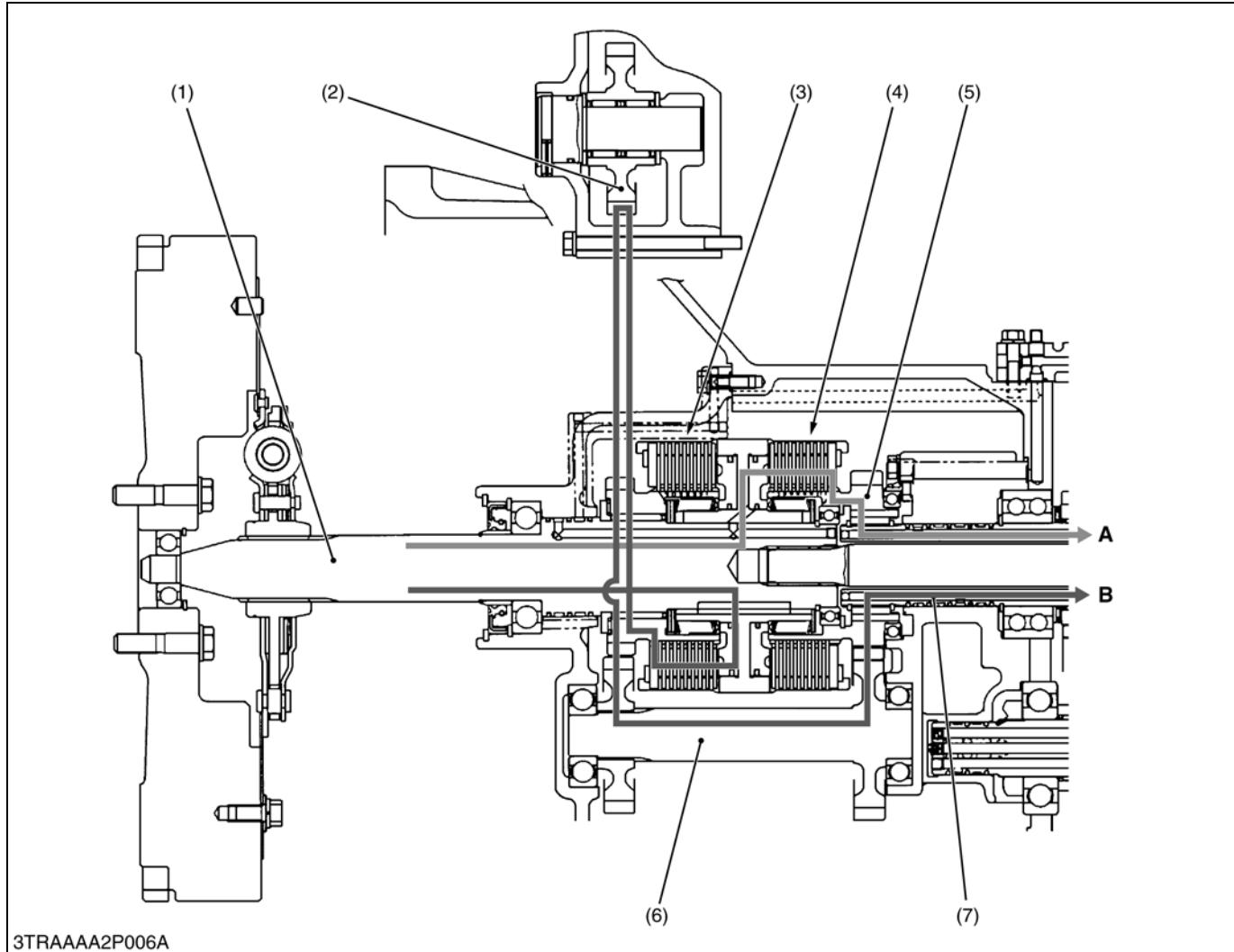
The rotation of flywheel is not transmitted to PTO system and travelling system.

- | | |
|-----------------------------------|-------------------------------|
| (1) Flywheel | (10) Clutch Disc (Travelling) |
| (2) Pressure Plate 1 (Travelling) | (11) Belleville Spring |
| (3) Adjusting Screw | (12) Clutch Disc (PTO) |
| (4) Clutch Cover 1 | (13) Release Rod |
| (5) Pressure Plate 2 (PTO) | (14) Belleville Spring |
| (6) Clutch Cover 2 | (15) Release Lever |
| (7) Release Fork | (16) Adjusting Screw |
| (8) Clutch Lever | (17) Release Bearing |
| (9) Clutch Rod | (18) Release Hub |

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3. HYDRAULIC MULTIPLE DISC CLUTCH

[1] TYPE 1 (For Travelling)



(1) Input Shaft
 (2) Idle Gear
 (3) Clutch Pack (Reverse)

(4) Clutch Pack (Forward)
 (5) Reverse Gear

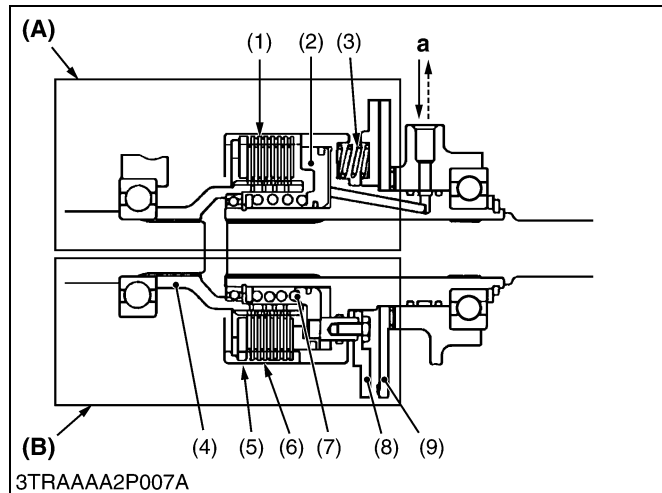
(6) Reverse Gear Shaft
 (7) Output Shaft

A : Forward
B : Reverse

When the clutch control valve is at “**Neutral**” position, the oil from hydraulic pump does not flow to clutch pack. Therefore the power from input shaft (1) is not transmitted to output shaft (7).

When the clutch control valve is set at “**Forward**” position, the oil from hydraulic pump flows to the forward side of the clutch pack (4). As a result, power is transmitted from input shaft (1) to output shaft (7) through clutch pack (4).

When the clutch control valve is set at “**Reverse**” position, the oil from hydraulic pump flows to the reverse side of the clutch pack (3). As a result, power is transmitted from input shaft (1) to output shaft (7).

[2] TYPE 2 (For PTO)

When the clutch control valve is set at the **“ENGAGED”** position, the oil from hydraulic pump flows to clutch valve. Oil entering the clutch pack pushes the piston (2) to engage the clutch pack.

When the clutch control valve is set at the **“DISENGAGED”** position, the oil from hydraulic pump stopped and the oil in the clutch pack is drained into the transmission case. Thus the piston (2) is pushed back by the return spring (7). When the piston (2) is pushed back, the brake plate (8) is also moved to contact the brake disc (9) so as to stop the rotation and drag of the PTO shaft.

- (1) Plate
- (2) Piston
- (3) Brake Spring
- (4) Clutch Hub
- (5) Back Plate
- (6) Clutch Disc
- (7) Return Spring
- (8) Brake Plate
- (9) Brake Disc

a : From or To Clutch Control Valve

(A) DISENGAGED
(B) ENGAGED

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3 TRANSMISSION

MECHANISM

CONTENTS

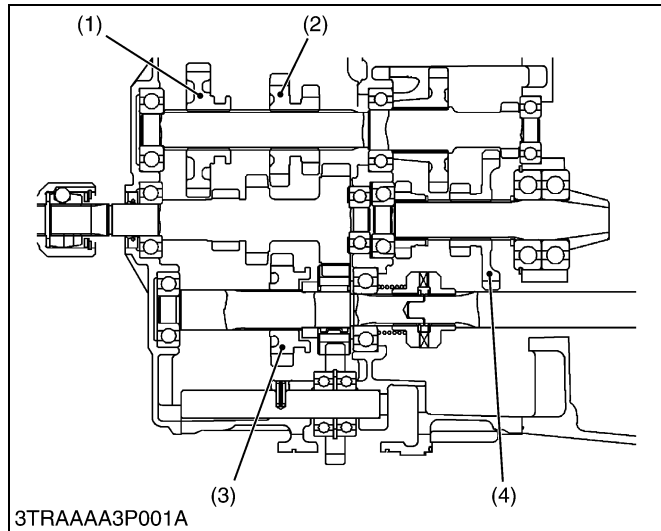
1. TRANSMISSION GEARS	3-M1
[1] SLIDING MESH TYPE	3-M1
[2] CONSTANT MESH TYPE	3-M2
[3] SYNCHRONOUS MESH TYPE	3-M3
2. HYDRAULIC SHUTTLE SHIFT	3-M4
[1] HYDRAULIC SHUTTLE SHIFT	3-M4
[2] HYDRAULIC SHUTTLE VALVE (TYPE 1) (Code No. 3A691-23800, 3A051-23803)	3-M5
(1) Operation	3-M6
[3] HYDRAULIC SHUTTLE VALVE (TYPE 2) (Code No. YW119-0103)	3-M16
(1) Structure	3-M16
(2) Operation	3-M18
3. SWING SHIFT	3-M28
4. DUAL SPEED	3-M31
[1] DUAL SPEED SECTION	3-M32
[2] DUAL SPEED VALVE (Code No. YW217-00100)	3-M33
5. HYDROSTATIC TRANSMISSION (TYPE 1) (Code No. 6C150-11603) ..	3-M34
[1] STRUCTURE	3-M34
[2] OIL FLOW AND VALVES	3-M36
[3] OPERATION	3-M40
[4] CONTROL LINKAGE	3-M43
6. HYDROSTATIC TRANSMISSION (TYPE 2) (Code No. TA240-58004) ..	3-M44
[1] STRUCTURE	3-M44
[2] FUNCTION OF EACH COMPONENTS	3-M46
[3] OIL FLOW	3-M49
[4] OPERATION	3-M50
[5] CONTROL LINKAGE	3-M56
7. HYDROSTATIC TRANSMISSION (TYPE 3) (Code No. 6C200-11604) ..	3-M57
[1] STRUCTURE	3-M57
[2] PUMP AND MOTOR	3-M59
[3] OIL FLOW AND VALVES	3-M60
[4] CONTROL LINKAGE	3-M68
[5] CRUISE CONTROL LINKAGE	3-M69
(1) Cruise Control	3-M69
(2) Cruise Control Release	3-M70
8. HYDROSTATIC TRANSMISSION (TYPE 4) (Code No. TD020-59992, TD060-59994)	3-M71
[1] STRUCTURE	3-M71
[2] OIL FLOW	3-M73
[3] FUNCTION OF COMPONENTS	3-M74
[4] OPERATION	3-M75
[5] CONTROL LINKAGE	3-M78
[6] CRUISE CONTROL	3-M79

9. HYDROSTATIC TRANSMISSION (TYPE 5) (Code No. TC220-59990) ..	3-M81
[1] STRUCTURE	3-M81
[2] OIL FLOW	3-M83
[3] OPERATION	3-M84
[4] CONTROL LINKAGE	3-M87
(1) HST Pedal Linkage	3-M87
(2) Cruise Control	3-M88
10. GLIDE SHIFT TRANSMISSION (TYPE 1)	
(GST Valve Code No. TA040-65015, TA040-99034)	3-M89
[1] CHARACTERISTIC AND OUTLINE	3-M89
[2] HYDRAULIC CIRCUIT	3-M90
[3] STRUCTURE	3-M91
[4] CONSTRUCTION PARTS	3-M92
(1) Regulator Valve	3-M92
(2) GST Valve Assembly	3-M93
(3) Rotary Valve	3-M94
(4) Shift Pistons	3-M95
(5) Shift Check Valves	3-M96
(6) Low-pass Valve	3-M97
(7) Modulating Valve	3-M98
(8) Modulating Check Valve	3-M99
(9) Accumulator	3-M100
(10)Clutch Valve	3-M101
(11)Clutch Pack	3-M102
11. GLIDE SHIFT TRANSMISSION (TYPE 2)	
(GST Valve Code No. T1063-65004)	3-M103
[1] CHARACTERISTIC AND SYSTEM OUTLINE	3-M103
[2] POWER TRAIN	3-M104
[3] ELECTRICAL CONTROL SYSTEM	3-M105
(1) Construction and Function of Components	3-M105
(2) Electrical Control	3-M108
[4] HYDRAULIC CONTROL SYSTEM	3-M109
(1) Hydraulic Circuit and System Outline	3-M109
(2) Construction and Function of Components	3-M111
12. POWER SHIFT SYSTEM	3-M118
[1] CONSTRUCTION AND FUNCTION OF COMPONENTS	3-M118
(1) Electric Components	3-M118
(2) Hydraulic Components	3-M122
[2] ELECTRIC CONTROL SYSTEM	3-M124
(1) Control System	3-M124
(2) Power Shift Control	3-M125
[3] AUTO SPEED CONTROL	3-M126
(1) Travel Mode	3-M126
(2) Field Mode	3-M128

[4] OTHER CONTROL.....	3-M130
(1) Down-hill Control.....	3-M130
(2) Clutch Pedal Control.....	3-M130
(3) Shuttle Control.....	3-M130
(4) Auxiliary Control.....	3-M131
[5] HYDRAULIC CONTROL SYSTEM.....	3-M132
(1) Hydraulic Circuit.....	3-M132
[6] POWER SHIFT VALVE.....	3-M133
13. DIFFERENTIAL GEAR SYSTEM.....	3-M136
[1] STRUCTURE.....	3-M136
[2] OPERATION.....	3-M136
[3] DIFFERENTIAL LOCK.....	3-M137
(1) Dog Clutch Type.....	3-M137
(2) Pin Type.....	3-M138
(3) Hydraulic Actuated Type.....	3-M139
14. FINAL REDUCTION SYSTEM.....	3-M140
15. PTO SYSTEM.....	3-M141
[1] REAR AND MID PTO SYSTEM.....	3-M141
[2] LIVE PTO AND GROUND PTO.....	3-M142
[3] INDEPENDENT PTO SYSTEM.....	3-M143
[4] REAR PTO SHAFT.....	3-M144
(1) Fixed PTO Shaft Type.....	3-M144
(2) Interchangeable PTO Shaft Type.....	3-M145
[5] ONE-WAY CLUTCH SYSTEM.....	3-M146

1. TRANSMISSION GEARS

[1] SLIDING MESH TYPE

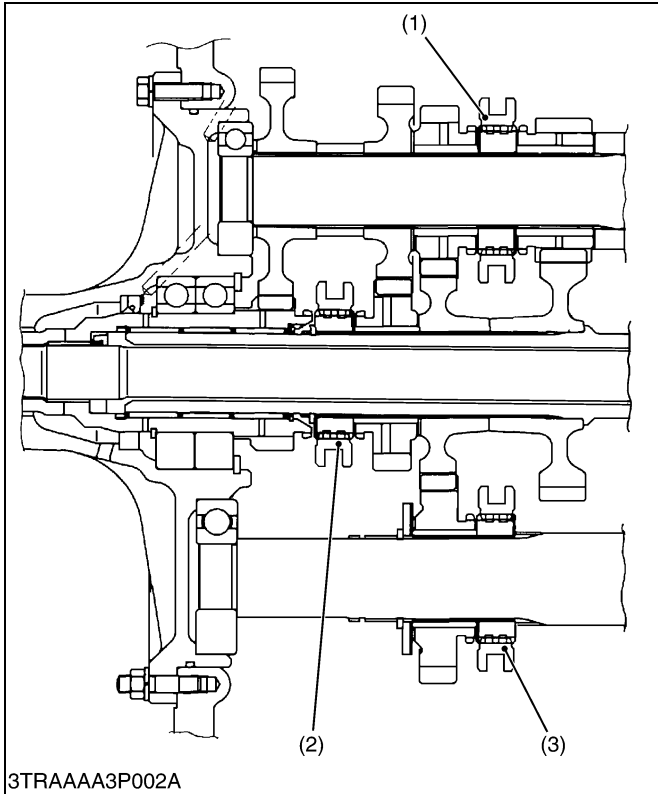


In sliding mesh type, when the speed is selected, the sliding gear is slide on the shaft and engaging gears to enable the transmission of power.

- (1) Shifter Gear 1
- (2) Shifter Gear 2
- (3) Shifter Gear 3
- (4) Shifter Gear 4

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[2] CONSTANT MESH TYPE



In constant mesh type, each gear always engaged with its opponent gear. When the speed is selected by this type, shifter on the shaft slides to engage the gear and shaft. As a result, the transmission of power becomes possible.

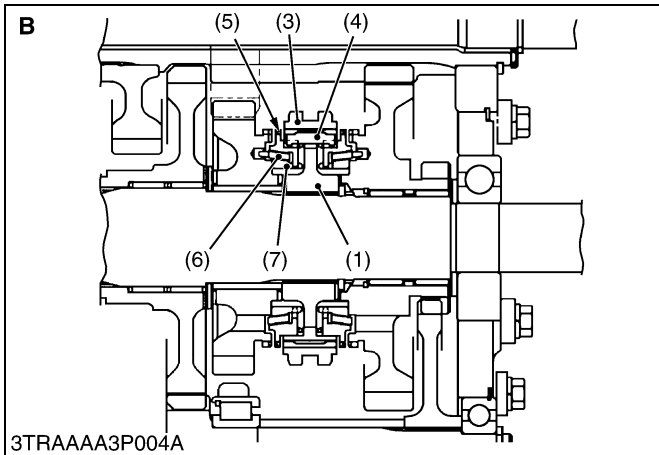
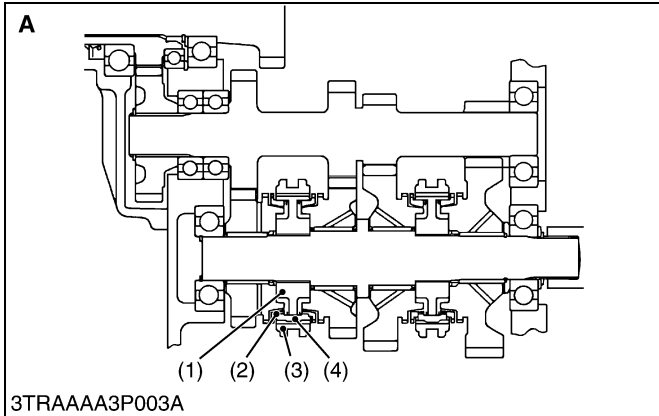
The constant mesh type have the advantage of much less frequency in gear breakage compared to sliding mesh type.

- (1) Shifter 1
- (2) Shifter 2

- (3) Shifter 3

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[3] SYNCHRONOUS MESH TYPE



Synchronous mesh type transmits power by sliding the shifter as well as constant mesh type.

However, the rotation of driving side parts and driven side parts is synchronized with synchronous mesh type, and to facilitate changing the speed, synchronizer is installed.

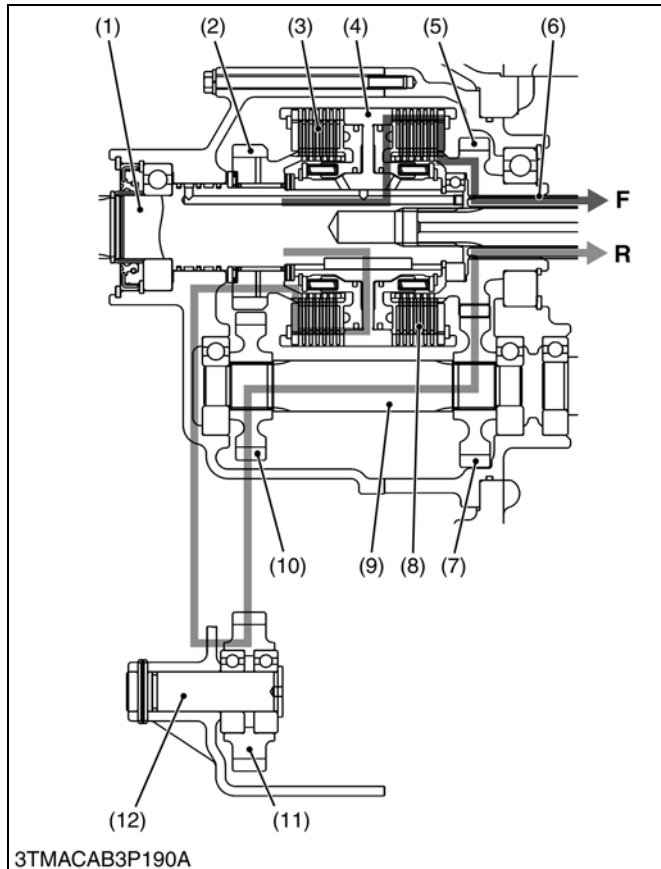
Therefore, it is possible to change the speed in this type while the tractor even is moving.

- | | |
|-----------------------------|--------------------------------------|
| (1) Hub | (6) Center Ring |
| (2) Synchronizer Ring | (7) Inner Synchronizer Ring |
| (3) Shifter | |
| (4) Synchronizer Key | A : Type 1 (Single Cone Type) |
| (5) Outer Synchronizer Ring | B : Type 2 (Double Cone Type) |

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2. HYDRAULIC SHUTTLE SHIFT

[1] HYDRAULIC SHUTTLE SHIFT



The hydraulic shuttle shift allows the operators to change forward and reverse with a shuttle lever.

When the shuttle lever is move to the “**Forward**” or “**Reverse**” position, each side of the hydraulic clutch is engaged. The power is transmitted as follows

■ Forward

Input Shaft (1) → Shuttle Clutch Body (4) → Clutch Disc and Plate (8) → 28T Gear (5) → 1st Shaft (6)

■ Reverse

Input Shaft (1) → Shuttle Clutch Body (4) → Clutch Disc and Plate (3) → 26T Gear (2) → 25T Idle Gear (11) → 23T Gear (10) → Shaft 1 (9) → 25T Gear (7) → 28T Gear (5) → 1st Shaft (6)

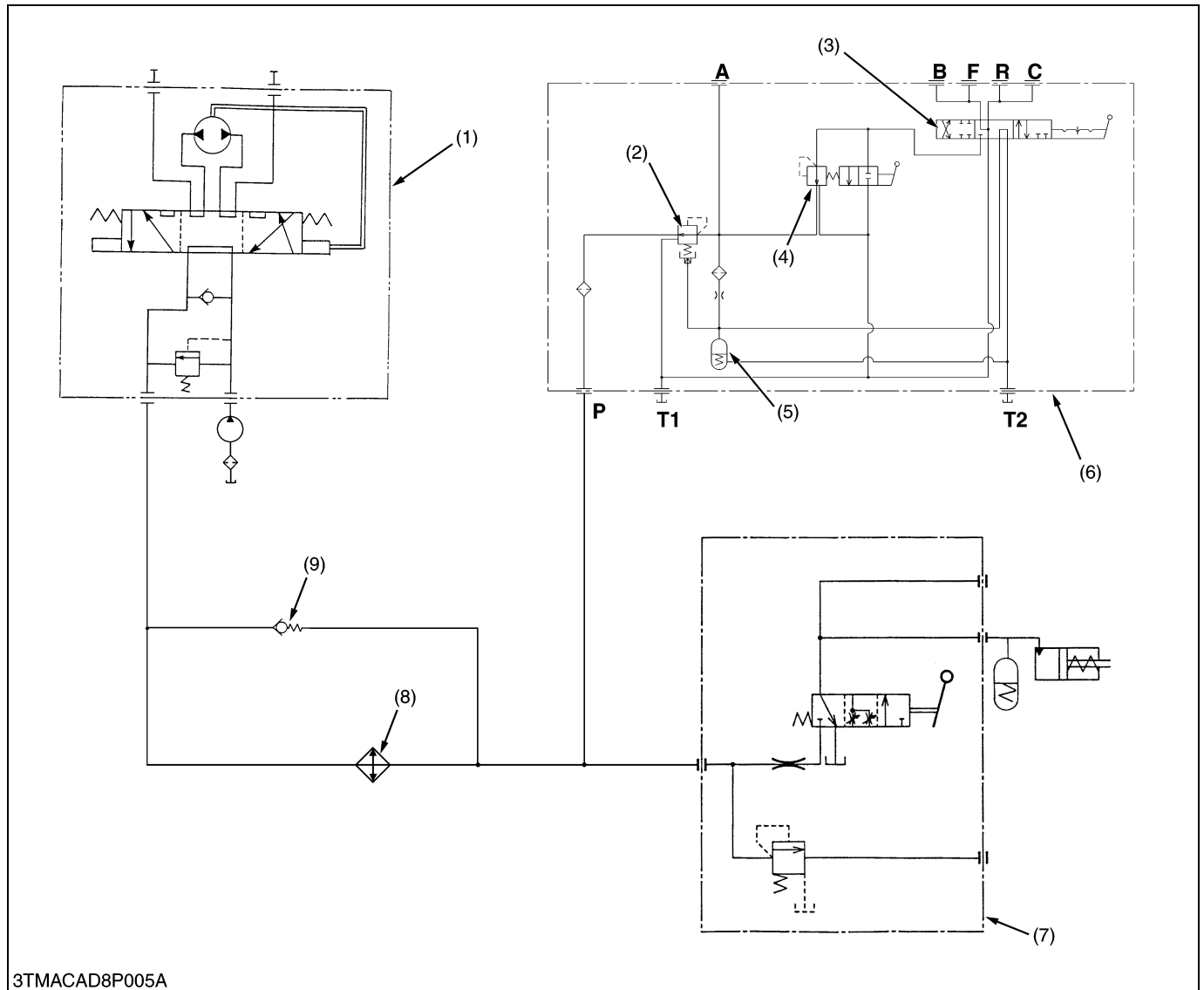
■ NOTE

- When the clutch pedal is depressed, neither “**Forward**” side or “**Reverse**” side is engaged and the power is not transmitted.

(1) Input Shaft	(7) 25T Gear
(2) 26T Gear	(8) Clutch Disc and Plate
(3) Clutch Disc and Plate	(9) Shaft 1
(4) Shuttle Clutch Body	(10) 23T Gear
(5) 28T Gear	(11) 25T Idle Gear
(6) 1st Shaft	(12) Idle Shaft

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[2] HYDRAULIC SHUTTLE VALVE (TYPE 1) (Code No. 3A691-23800, 3A051-23803)



- (1) Power Steering Controller
- (2) Modulating Valve
- (3) Shuttle Shift Spool (Forward, Reverse)
- (4) Proportionally Reducing Valve
- (5) Accumulate Valve
- (6) Shuttle Valve
- (7) PTO Control Valve
- (8) Oil Cooler
- (9) Oil Cooler Relief Valve

- P : From Power Steering Controller**
- A : Pressure Check Port (Modulation)**
- B : Pressure Check Port (Forward)**
- F : To Clutch Body (Forward)**
- R : To Clutch Body (Reverse)**
- C : Pressure Check Port (Reverse)**
- T1, T2 : Tank Port**

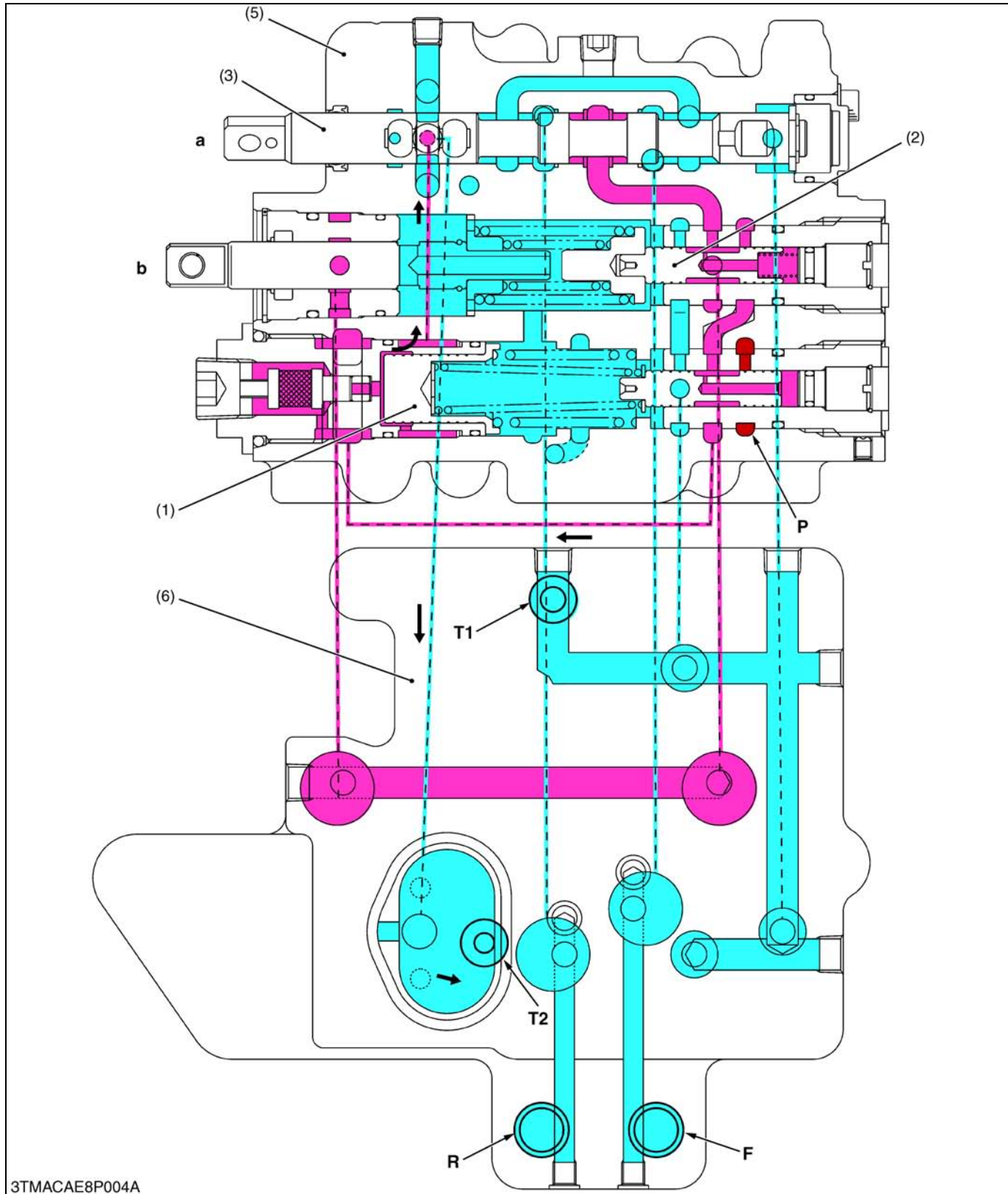


Hydraulic shuttle valve is composed of modulating valve (2), proportionally reducing valve (4), shuttle shift spool (3), accumulate valve (5) and other component parts.

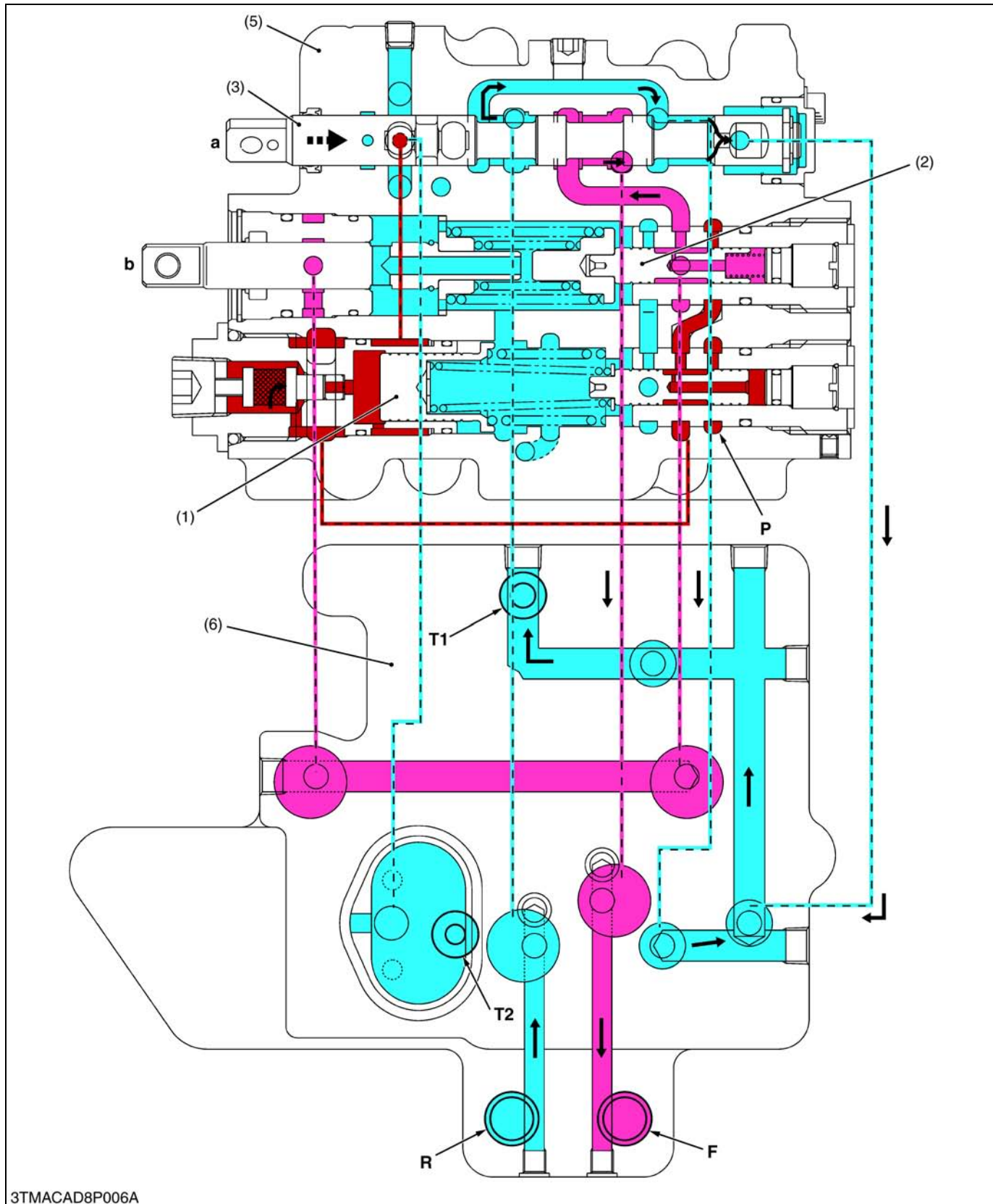
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(1) Operation

■ Shuttle Lever at Neutral Position

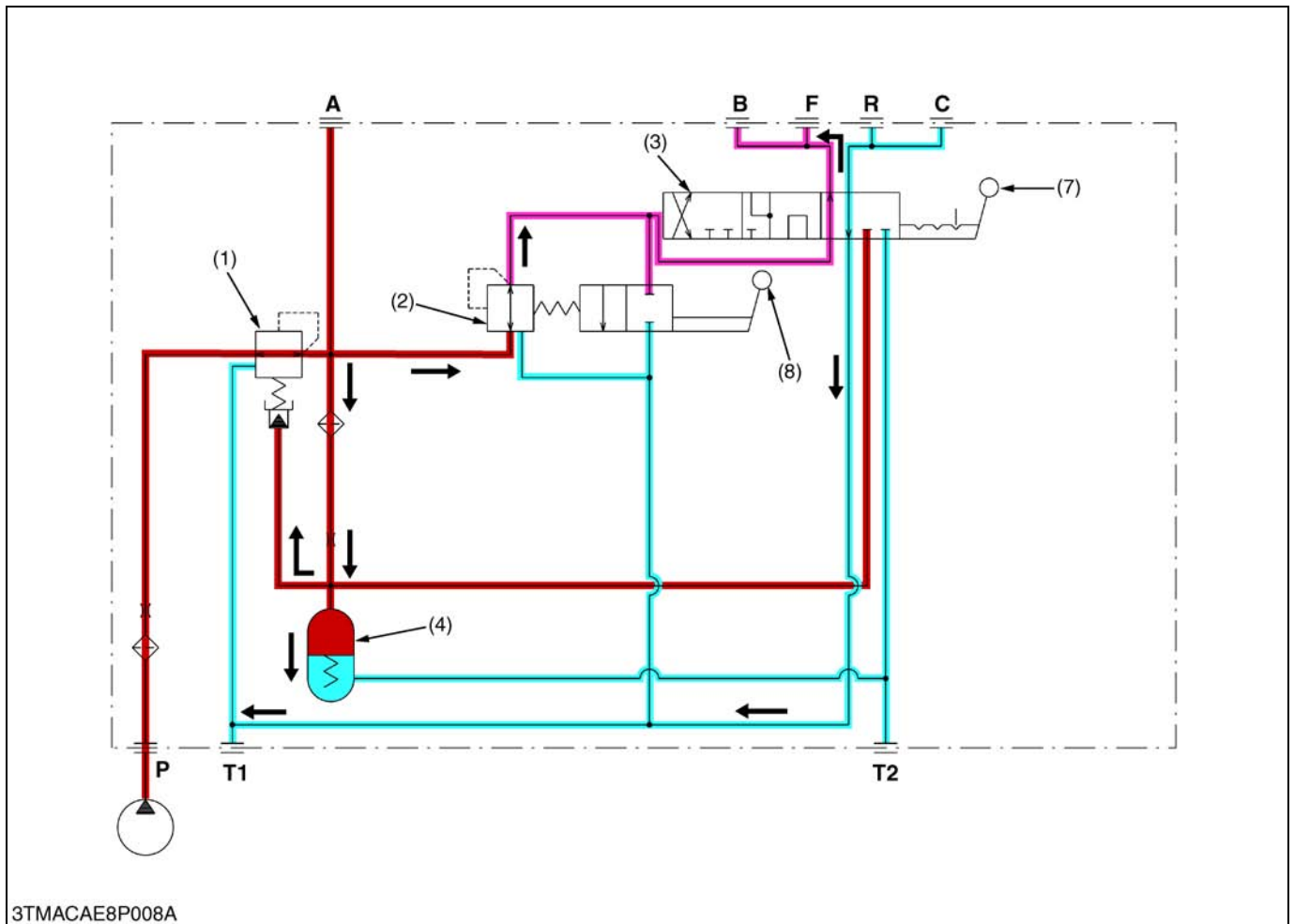


■ When Shuttle Lever is Shifting Neutral to Forward or Reverse Position (Clutch Pedal is Released)



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a : Connect to Shuttle Lever b : Connect to Clutch Pedal



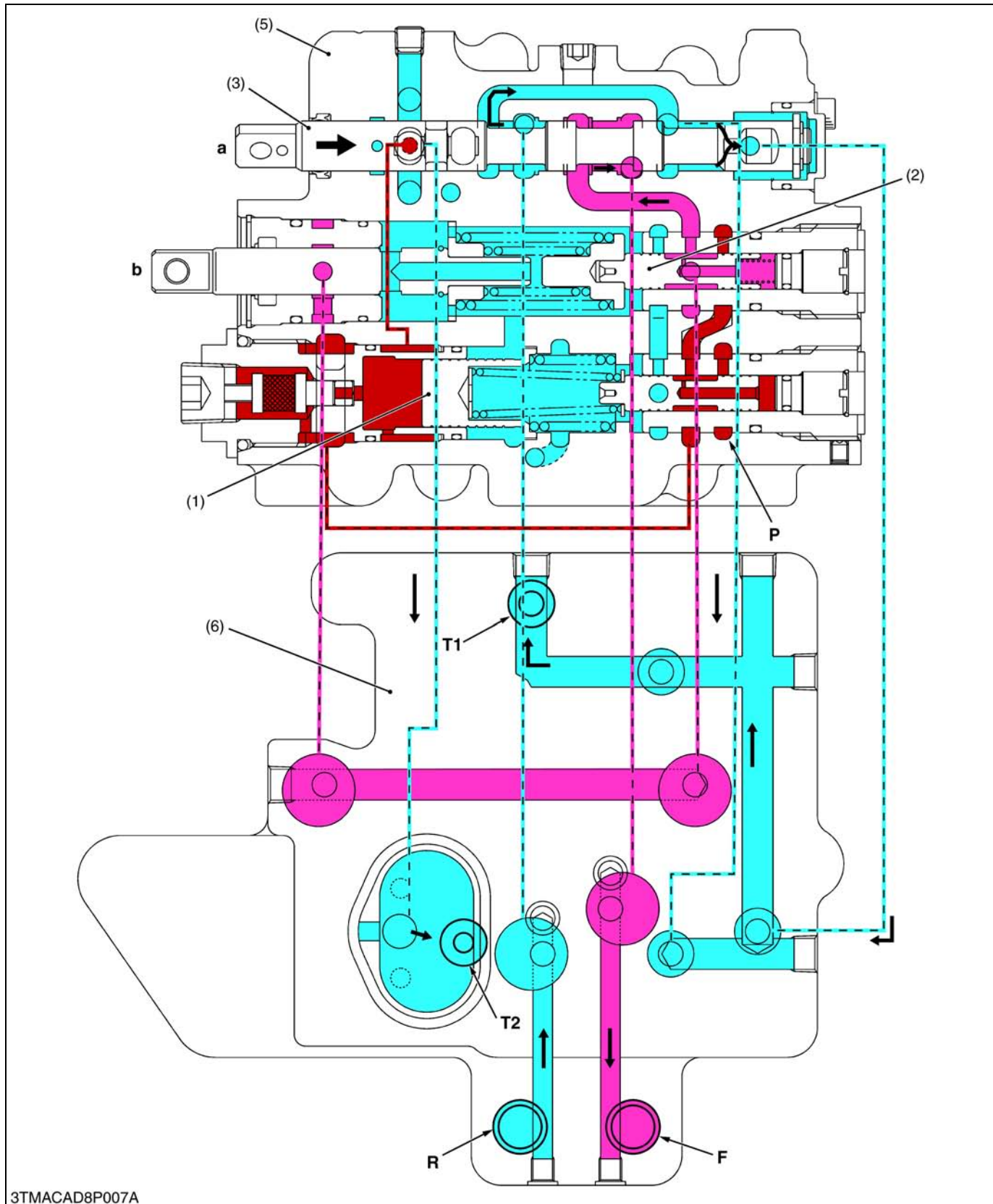
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- | | | | |
|-----------------------------------|--------------------------|------------------------------------|-------------------------------------|
| (1) Modulating Valve | (5) Shuttle Valve Case 1 | A : Check Port (Modulation) | F : To Clutch Body (Forward) |
| (2) Proportionally Reducing Valve | (6) Shuttle Valve Case 2 | B : Check Port (Forward) | R : To Clutch Body (Reverse) |
| (3) Spool (Forward, Reverse) | (7) Shuttle Lever | C : Check Port (Reverse) | T1 : To Transmission Case |
| (4) Accumulate Valve | (8) Clutch Pedal | P : From Pump | T2 : To Transmission Case |

When the shuttle lever is moved to “**FORWARD**” or “**REVERSE**”, pressure-fed oil from **P** port flows into shuttle clutch via **F** or **R** port. At this time, the pressure of **F** or **R** port is increased gradually by modulating valve (1).

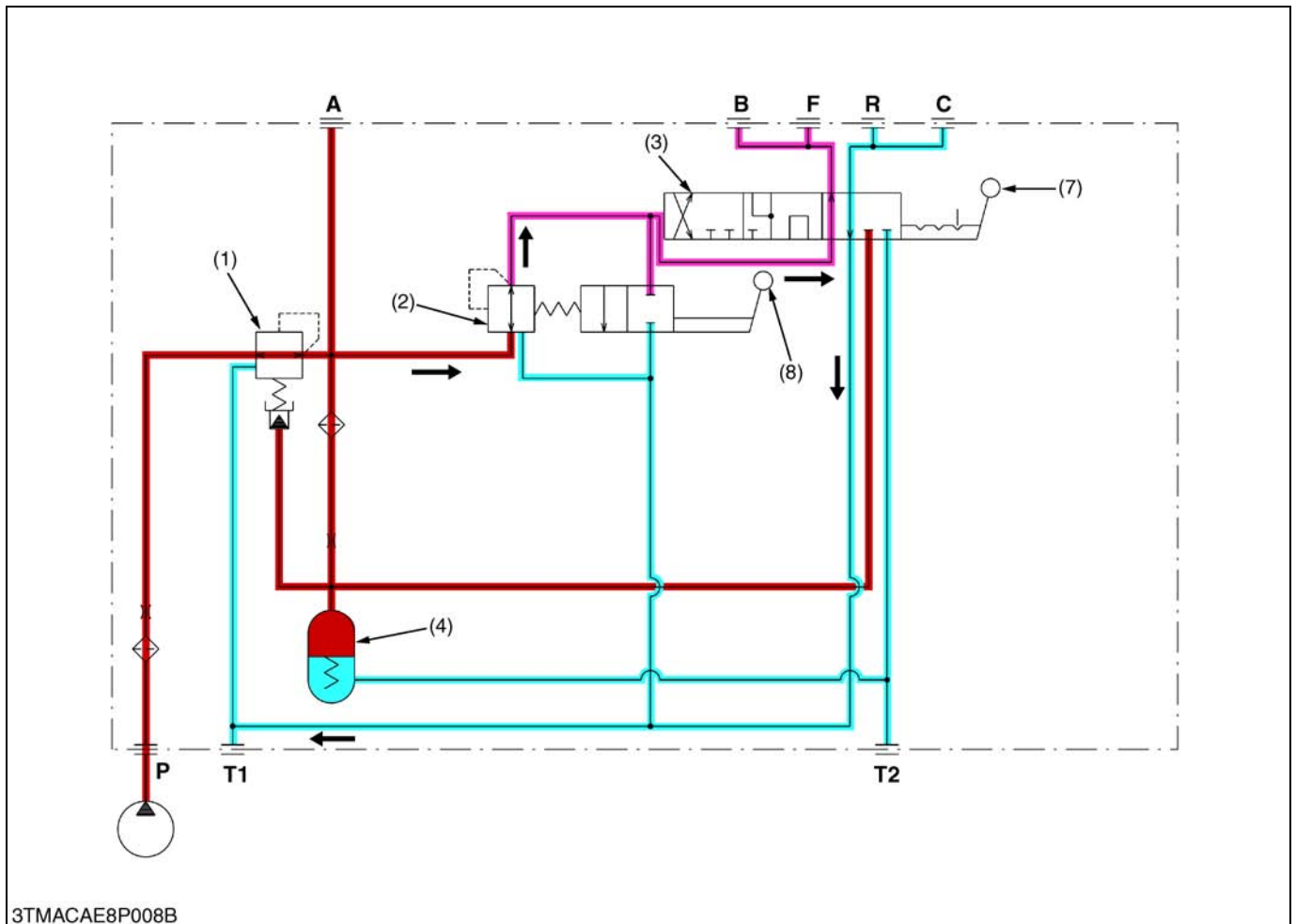
When the shuttle clutch is engaging, the accumulate valve (4) assists the operation of modulating valve (1) to reduce a shock.

■ Shuttle Lever at Forward Position (Clutch Pedal is Released)



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a : Connect to Shuttle Lever b : Connect to Clutch Pedal

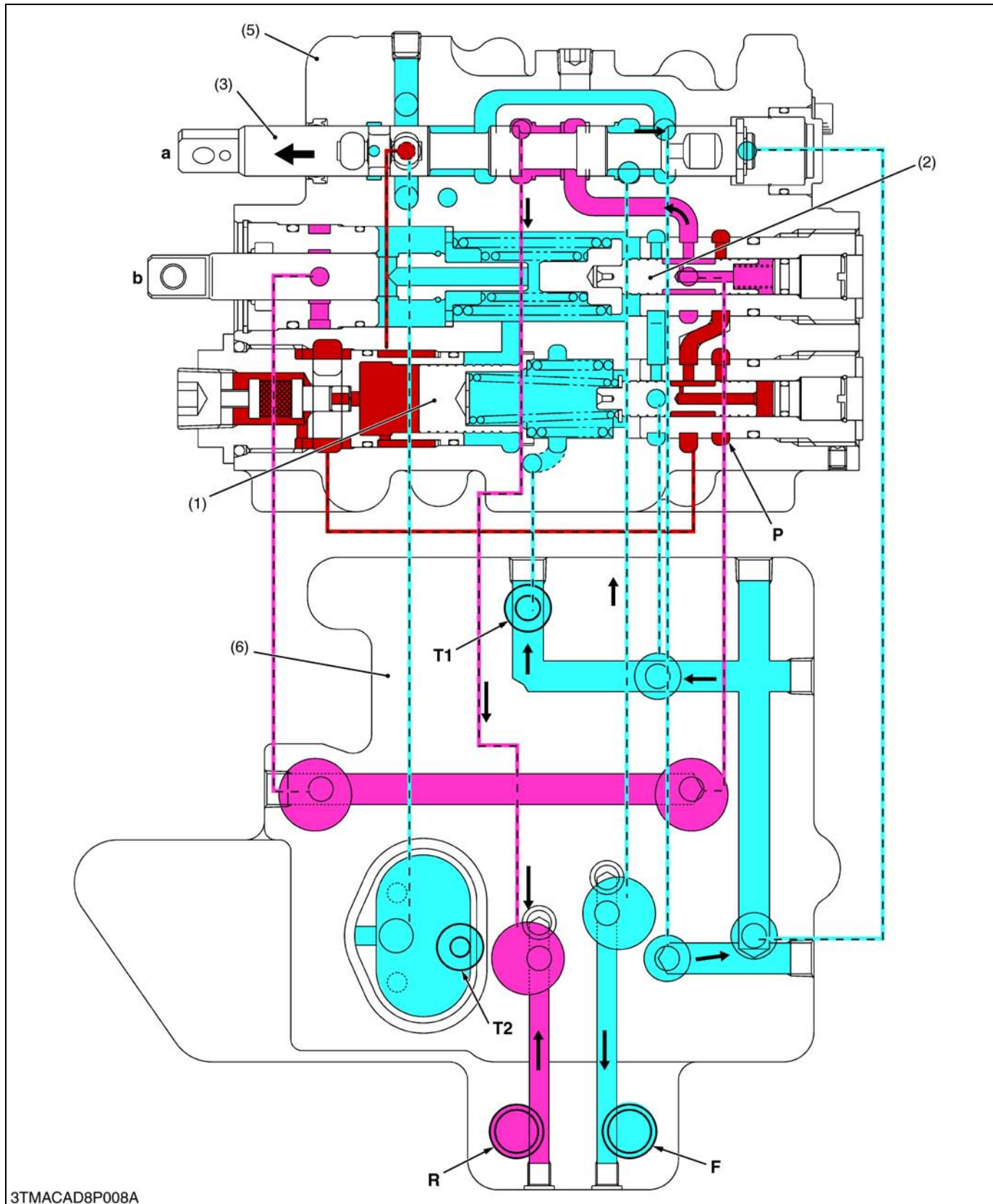


- | | | | |
|-----------------------------------|--------------------------|------------------------------------|-------------------------------------|
| (1) Modulating Valve | (5) Shuttle Valve Case 1 | A : Check Port (Modulation) | F : To Clutch Body (Forward) |
| (2) Proportionally Reducing Valve | (6) Shuttle Valve Case 2 | B : Check Port (Forward) | R : To Clutch Body (Reverse) |
| (3) Spool (Forward, Reverse) | (7) Shuttle Lever | C : Check Port (Reverse) | T1 : To Transmission Case |
| (4) Accumulate Valve | (8) Clutch Pedal | P : From Pump | T2 : To Transmission Case |

When the shuttle lever have been setting on the **F** side, the oil pressure on **F** port is constantly controlled by proportionally reducing valve (2).

On the other hand, the oil in the **R** side of shuttle clutch returns to **T1** port through **R** port and spool (3).

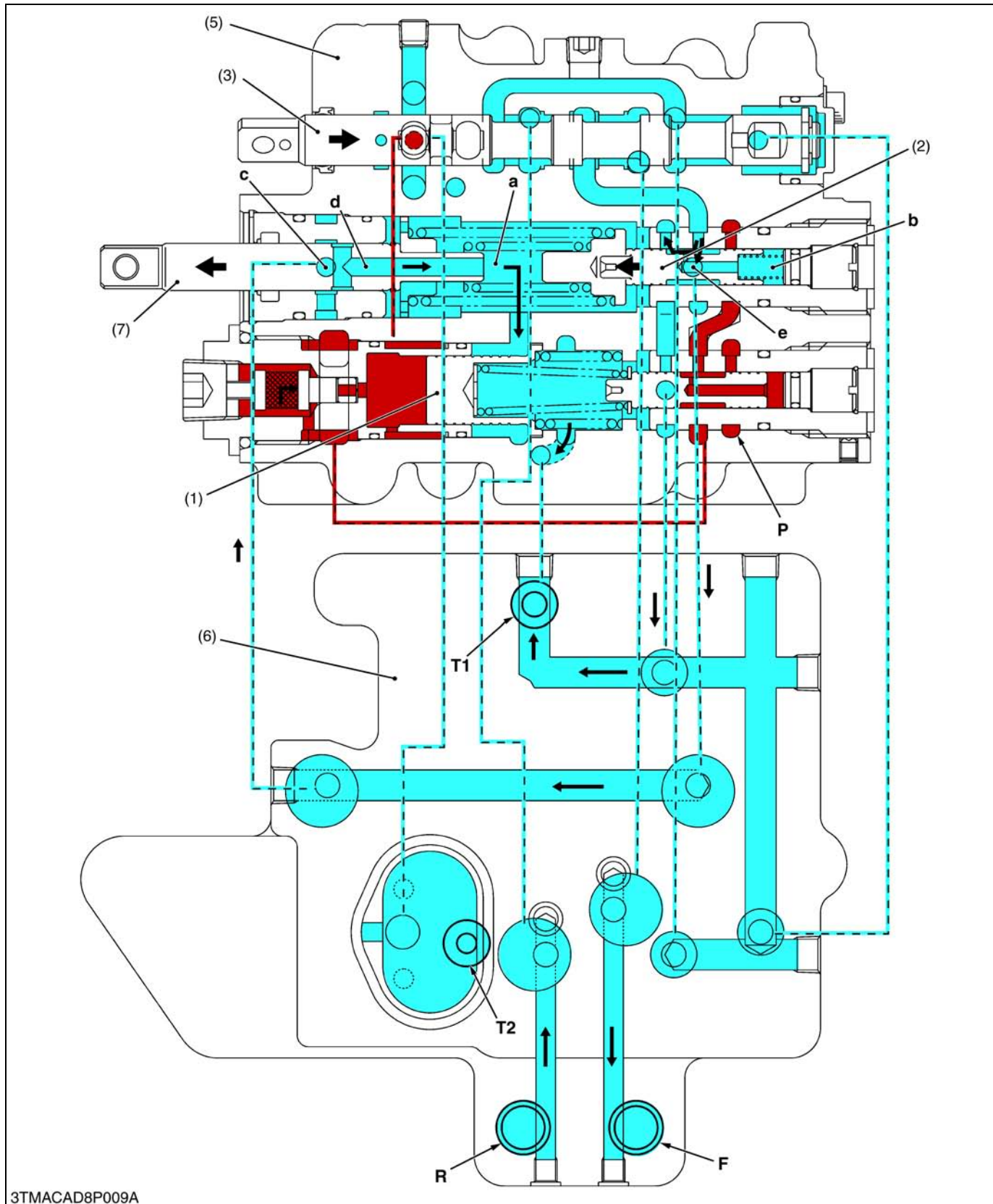
■ Shuttle Lever at Reverse Position (Clutch Pedal is Released)



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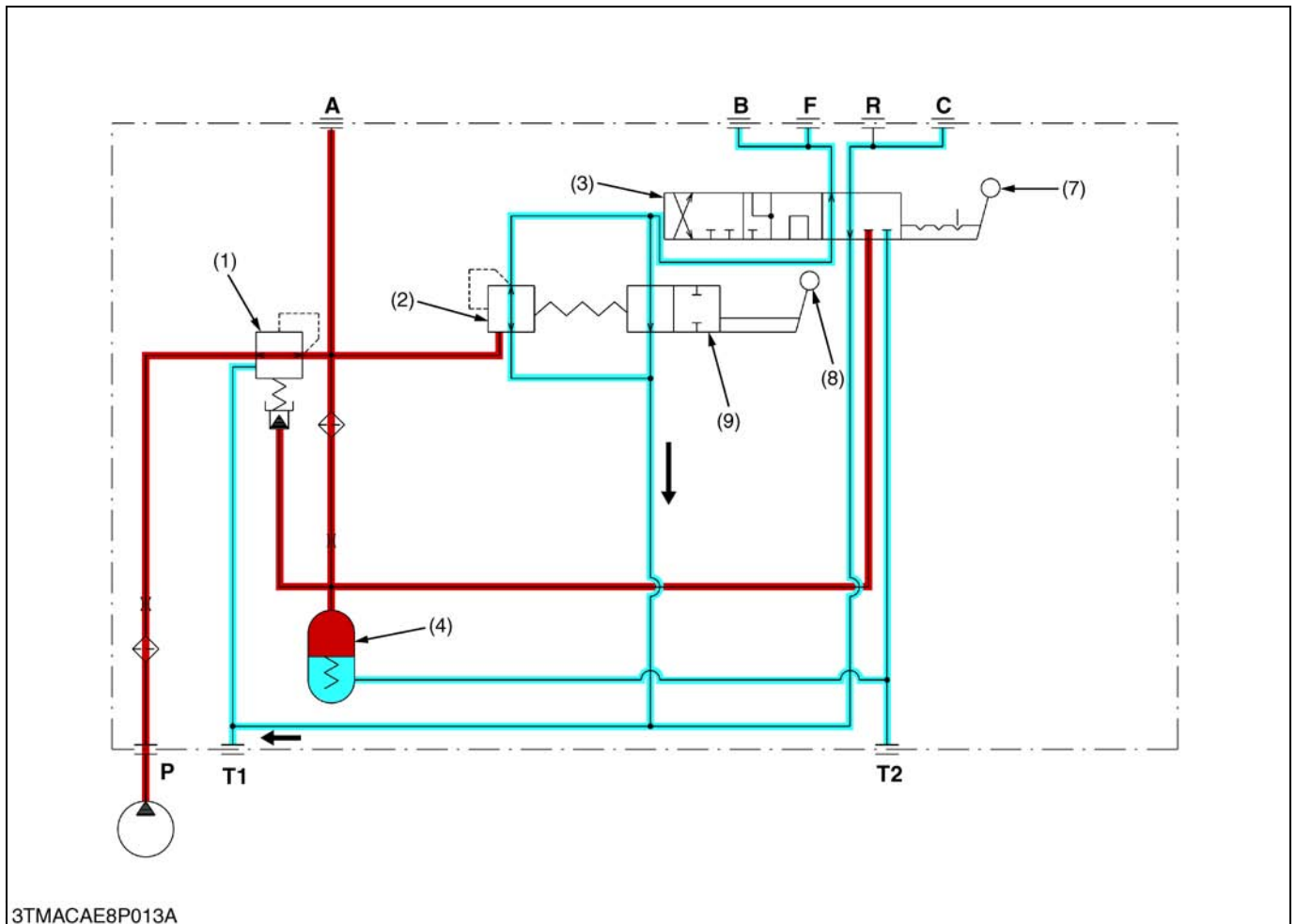
a : Connect to Shuttle Lever b : Connect to Clutch Pedal

■ When Clutch Pedal is Depressed (with Shuttle Lever at Forward or Reverse Position)



3TMACAD8P009A

a : Connect to Shuttle Lever b : Connect to Clutch Pedal



- | | | | |
|------------------------------|------------------------------------|-------------------------------------|----------------------|
| (1) Modulating Valve | A : Check Port (Modulation) | F : To Clutch Body (Forward) | a : Part a |
| (2) Spool 1 | B : Check Port (Forward) | R : To Clutch Body (Reverse) | b : Part b |
| (3) Spool (Forward, Reverse) | C : Check Port (Reverse) | T1 : To Transmission Case | c : Hole c |
| (4) Accumulate Valve | P : From Pump | T2 : To Transmission Case | d : Passage d |
| (5) Shuttle Valve Case 1 | | | e : Hole e |
| (6) Shuttle Valve Case 2 | | | |
| (7) Shuttle Lever | | | |
| (8) Clutch Pedal | | | |
| (9) Spool 2 | | | |

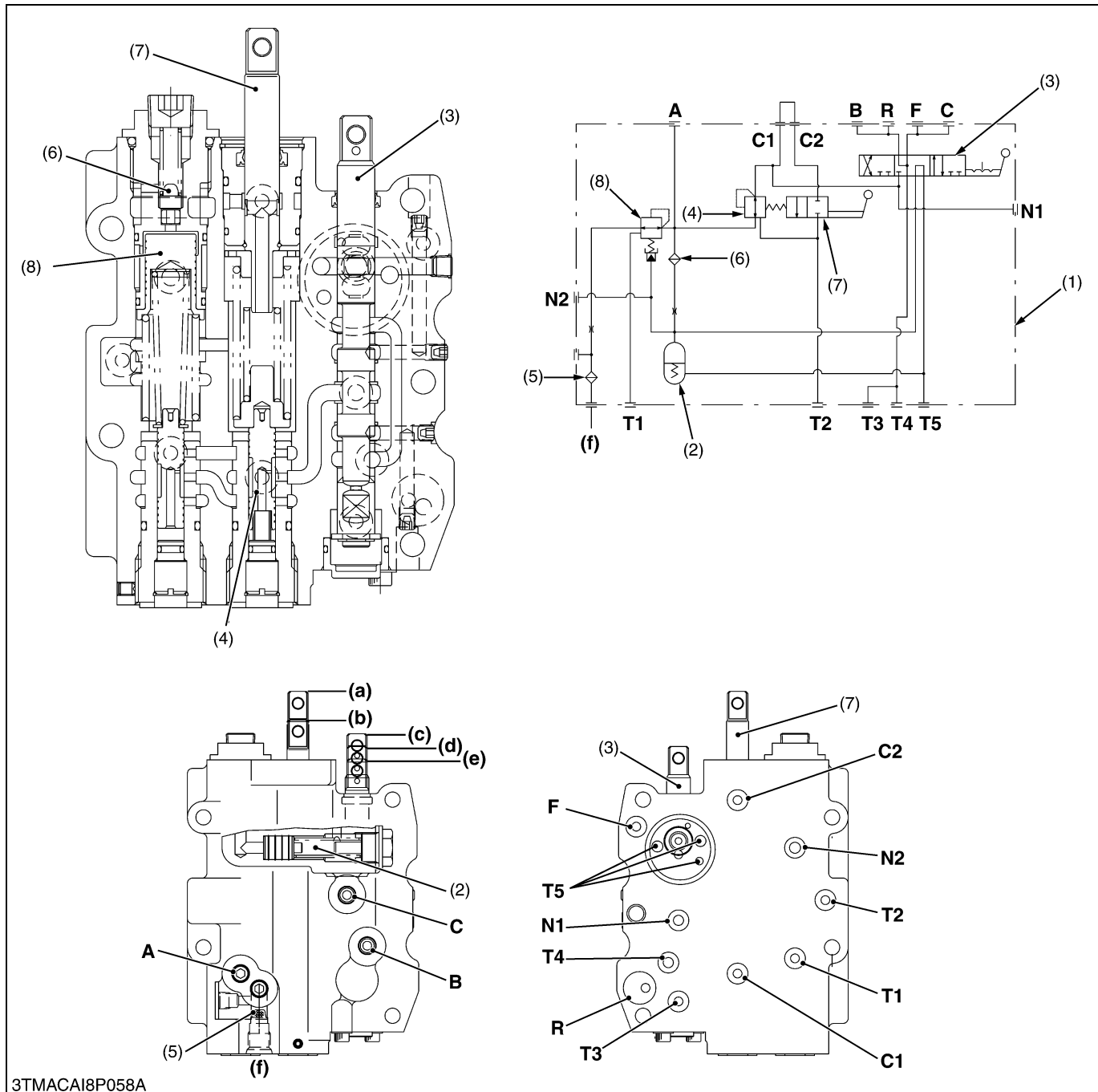
With the shuttle lever at **F** or **R** position, when the clutch pedal is depressed, the spool 2 (9) is moved to the left. And pressure difference between **a** part and **b** part is generated. As the spool 1 (2) is moved to the left by pressure difference, **F** port (or **R** port) and **T1** port are connected.

The oil in the shuttle clutch returns into the transmission case via **F** port (or **R** port), notched portion of spool 1 (2) and **T1** port. This cause the shuttle clutch to be set off.

At the same time, as the hole **c** and passage **d** are connected, oil passage among the hole **e**, hole **c** and **T1** port are connected. As a result, even when the spool 1 (2) does not move, the oil passage from **F** port (or **R** side) to **T1** port is secured.

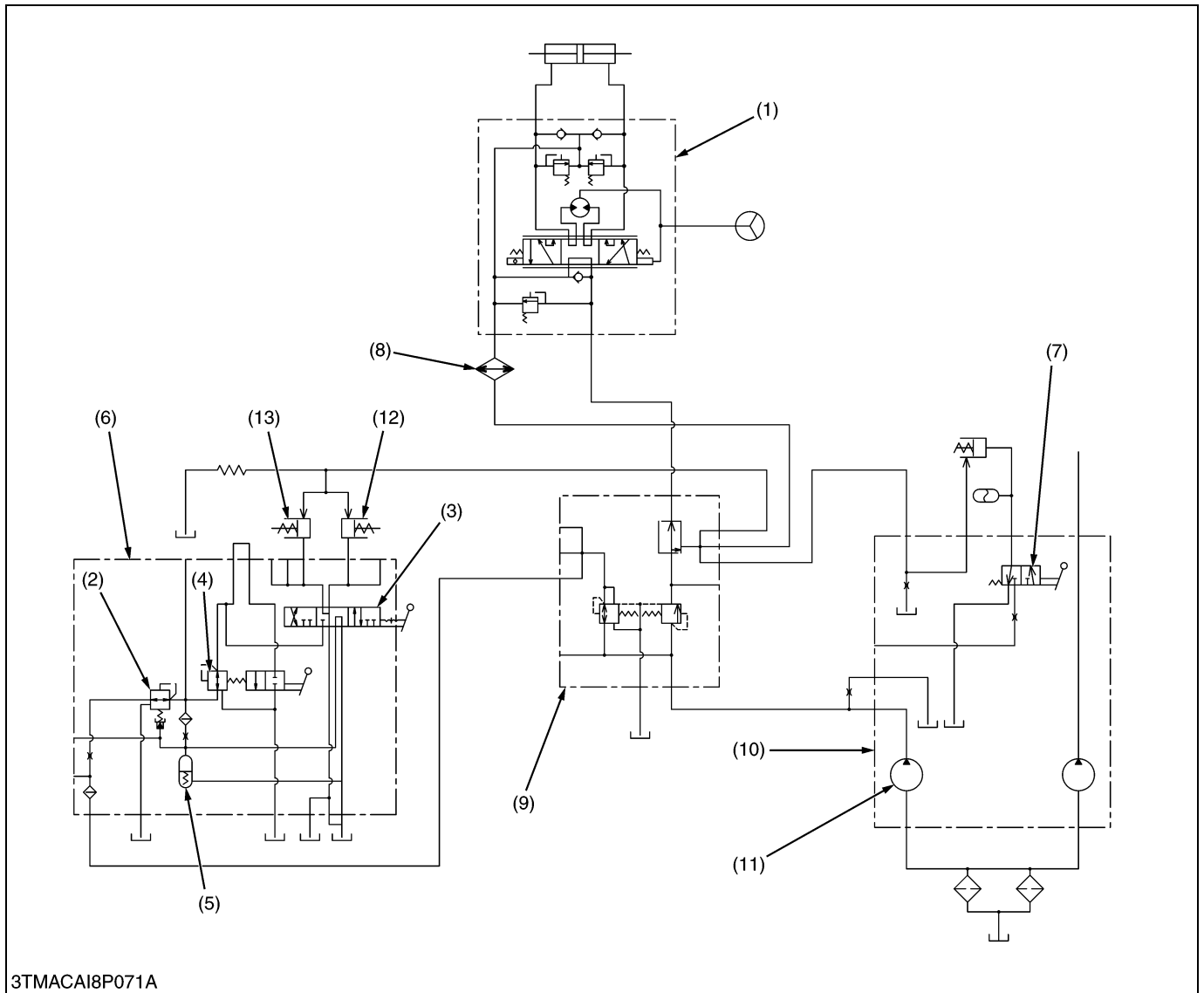
[3] HYDRAULIC SHUTTLE VALVE (TYPE 2) (Code No. YW119-0103)

(1) Structure



3TMACAI8P058A

- | | | | |
|--|-------------------------------------|--------------------------------------|-----------------------------------|
| (1) Shuttle Valve | (7) Inching Valve Spool | (c) Shuttle Forward Position | B : Pressure Check Port (Reverse) |
| (2) Accumulate Valve | (8) Modulating Valve | (d) Shuttle Neutral Position | C : Pressure Check Port (Forward) |
| (3) Shuttle Shift Spool (Forward, Reverse) | (a) Clutch Pedal Released Position | (e) Shuttle Reverse Position | F : To Clutch Body (Forward) |
| (4) Proportionally Reducing Valve | (b) Clutch Pedal Depressed Position | (f) Oil from Regulator Valve | R : To Clutch Body (Reverse) |
| (5) Line Filter | | A : Pressure Check Port (Modulation) | T1 a T5 : Tank Port |
| (6) Filter | | | |

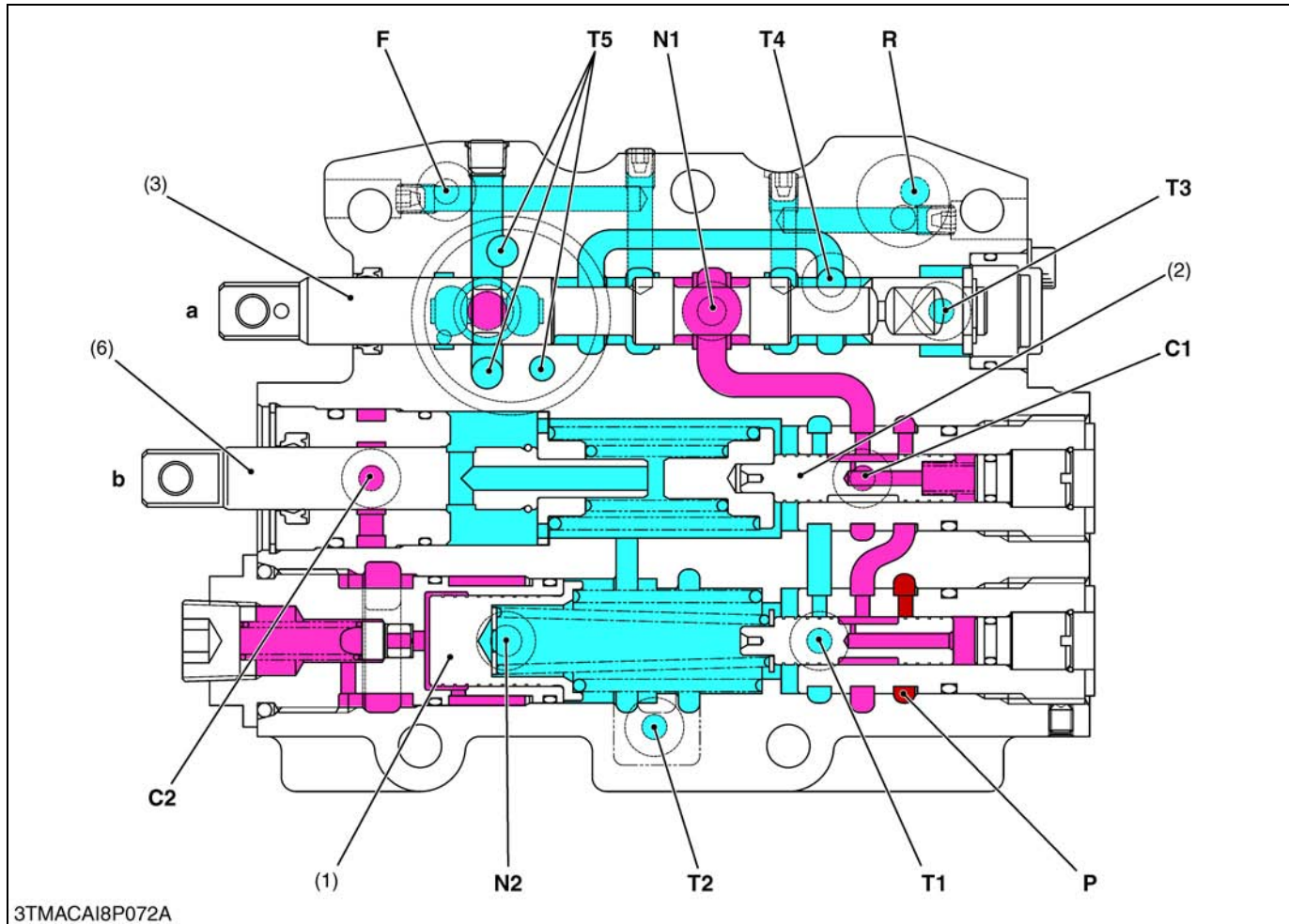


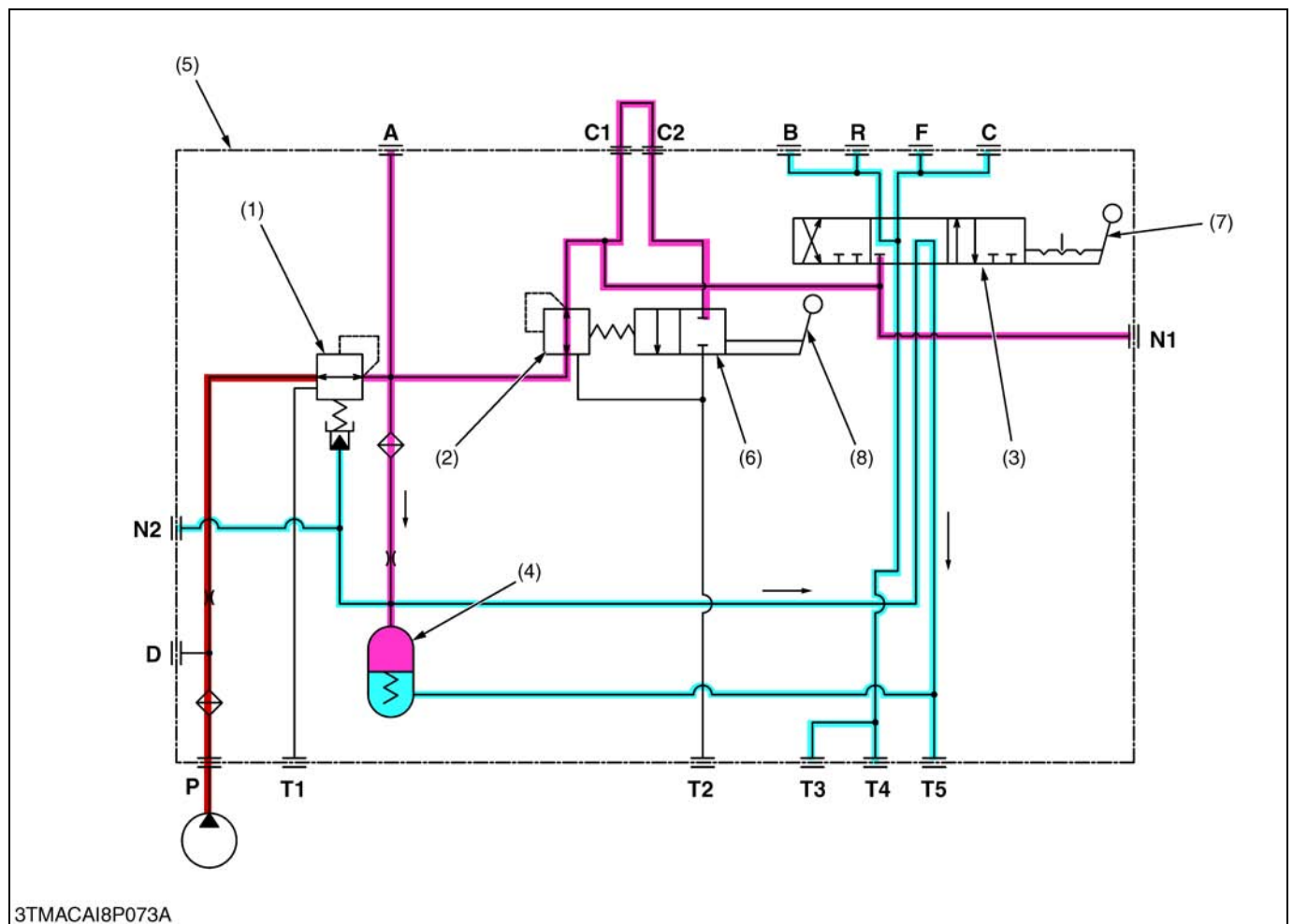
- | | | | |
|--|-----------------------------------|---|-----------------------|
| (1) Power Steering Controller | (4) Proportionally Reducing Valve | (9) Regulator Valve | (12) Shuttle Clutch R |
| (2) Modulation Valve | (5) Accumulate Valve | (10) Pump Base | (13) Shuttle Clutch F |
| (3) Shuttle Shift Spool (Forward, Reverse) | (6) Shuttle Valve | (11) Hydraulic Pump for PTO, Power Steering, Shuttle, Swing Shift, Dual Speed | |
| | (7) PTO Clutch Control Valve | | |
| | (8) Oil Cooler | | |

Hydraulic shuttle valve is composed of modulating valve (2), proportionally reducing valve (4), shuttle shift spool (3), accumulate valve (5) and other component parts.

(2) Operation

■ Shuttle Lever at Neutral Position





- (1) Modulating Valve
 (2) Proportionally Reducing Valve
 (3) Shuttle Shift Spool (Forward, Reverse)
 (4) Accumulate Valve

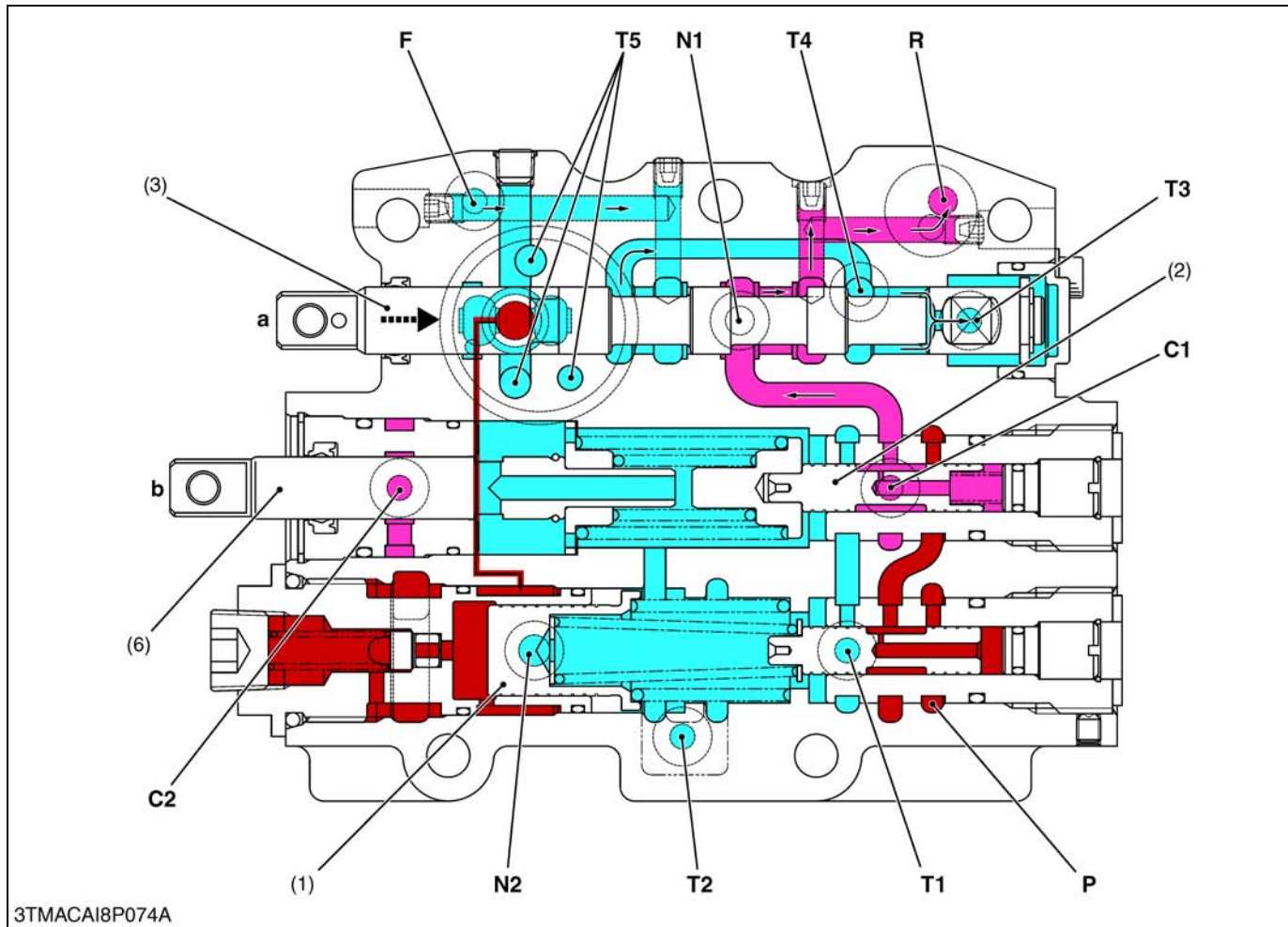
- (5) Shuttle Valve
 (6) Inching Valve
 (7) Shuttle Lever
 (8) Clutch Pedal

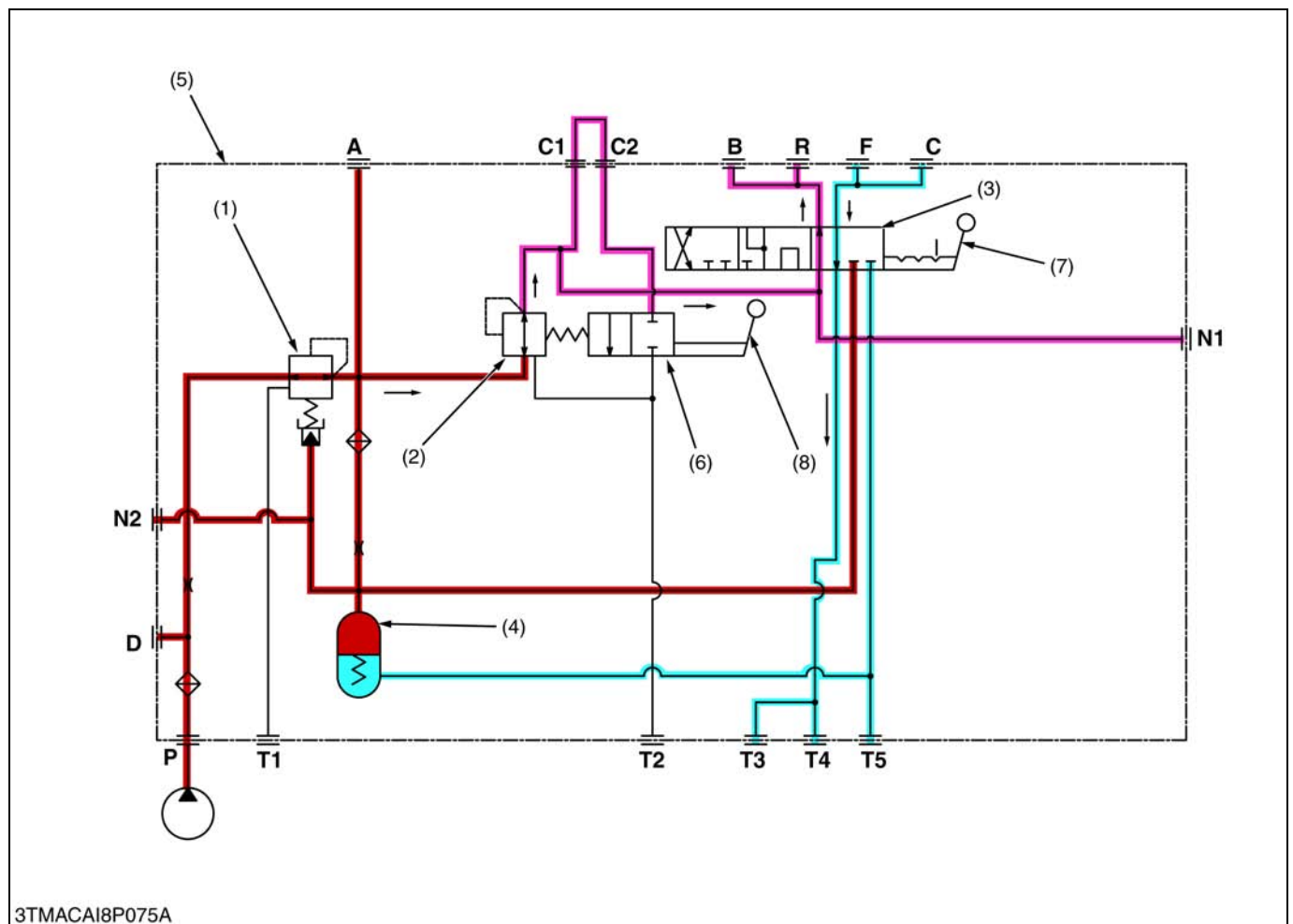
- A : Check Port (Modulation)**
B : Check Port (Reverse)
C : Check Port (Forward)
D : Check Port (Pump)
P : From Regulator Valve
C1, C2 : Connection Port

- T1 to T5: To Transmission Case**
N1 : Port N1
N2 : Port N2
a : Connect to Shuttle Lever
b : Connect to Clutch Pedal

When the shuttle lever at **Neutral** position, as the oil passage between **P** port to **F** or **R** port is closed by shuttle shift spool (3), pressure-fed oil from **P** port flows to the **T5** port. Thus the shuttle clutch is not engage.

■ When Shuttle Lever is Shifting Neutral to Reverse or Forward Position (Clutch Pedal is Released)



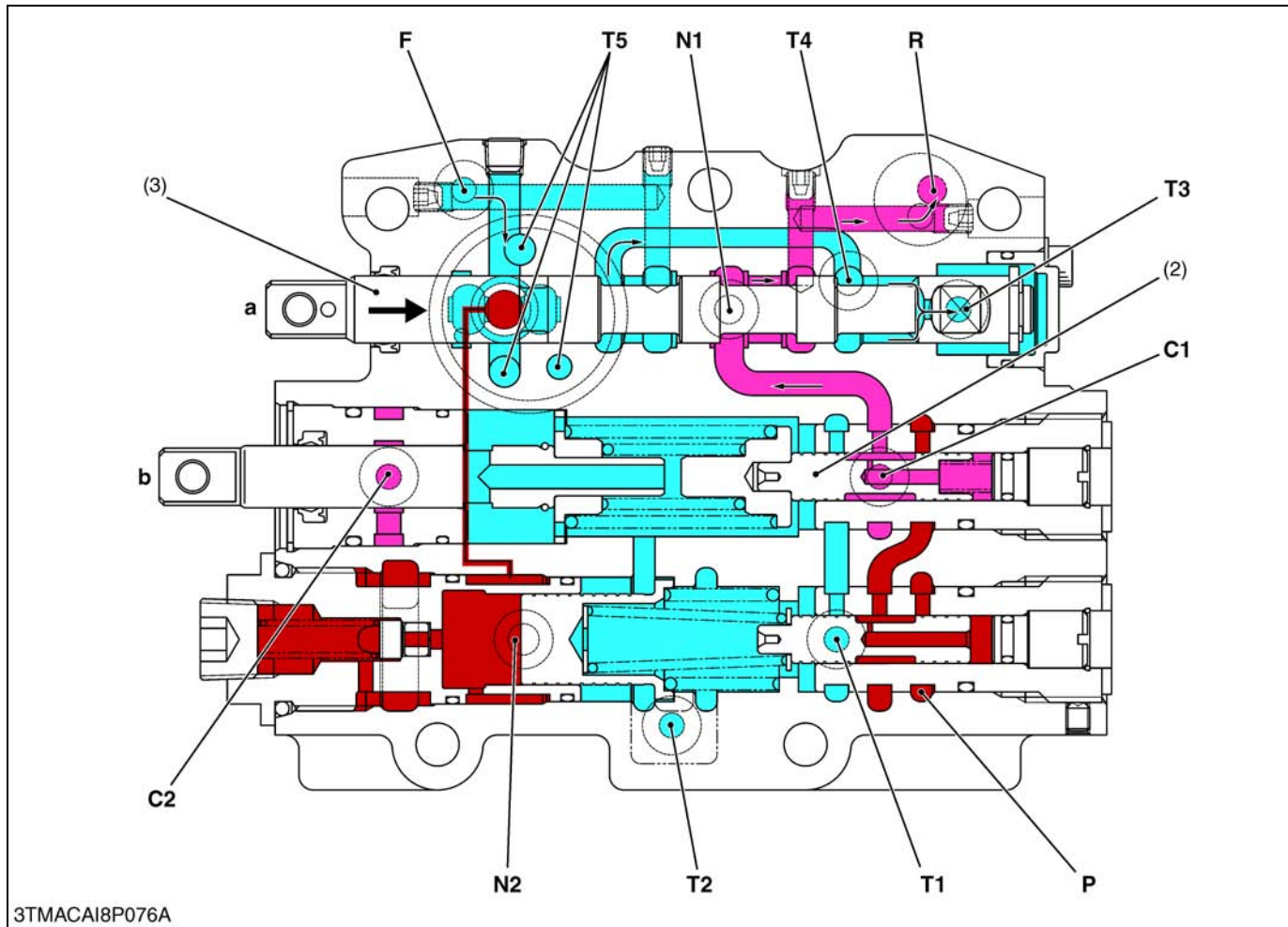


- | | | | |
|--|-------------------|------------------------------------|---------------------------------------|
| (1) Modulating Valve | (5) Shuttle Valve | A : Check Port (Modulation) | T1 to T5: To Transmission Case |
| (2) Proportionally Reducing Valve | (6) Inching Valve | B : Check Port (Reverse) | N1 : Port N1 |
| (3) Shuttle Shift Spool (Forward, Reverse) | (7) Shuttle Lever | C : Check Port (Forward) | N2 : Port N2 |
| (4) Accumulate Valve | (8) Clutch Pedal | D : Check Port (Pump) | a : Connect to Shuttle Lever |
| | | P : From Regulator Valve | b : Connect to Clutch Pedal |
| | | C1, C2 : Connection Port | |

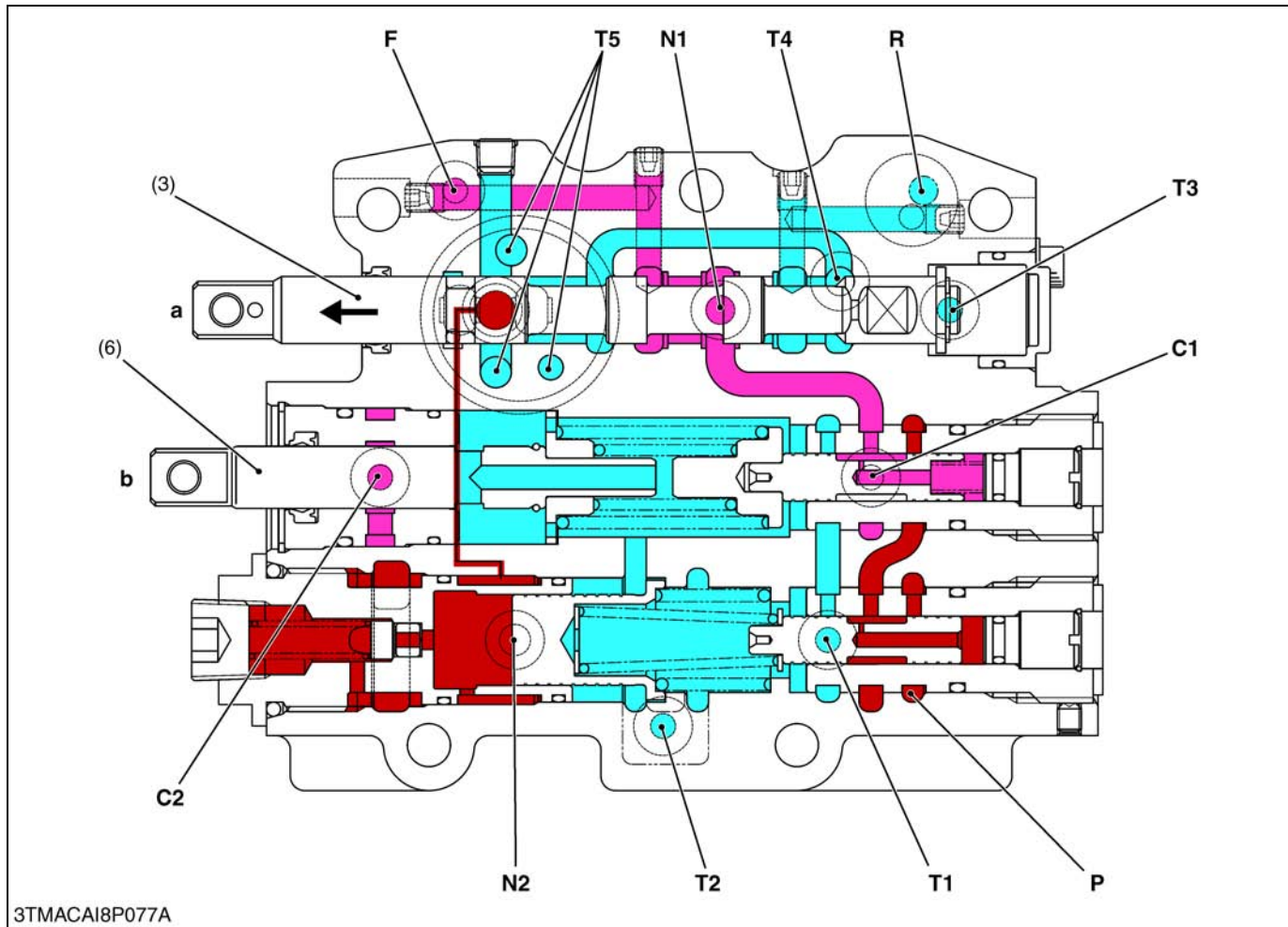
When the shuttle lever is moved to “**REVERSE**” or “**FORWARD**”, pressure-fed oil from **P** port flows into shuttle clutch via **R** or **F** port. At this time, the pressure of **R** or **F** port is increased gradually by modulating valve (1).

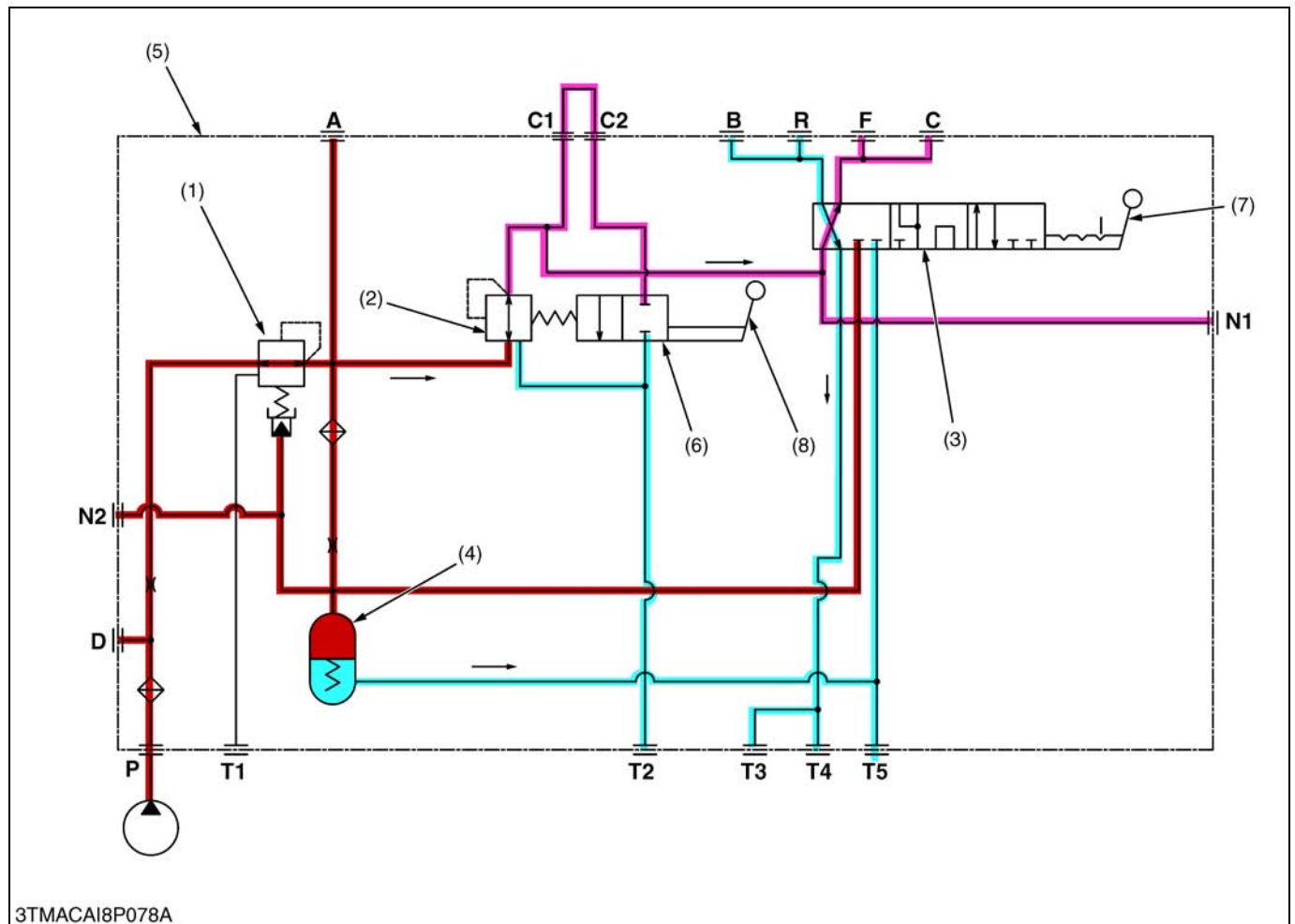
When the shuttle clutch is engaging, the accumulate valve (4) assists the operation of modulating valve (1) to reduce a shock.

■ Shuttle Lever at Reverse Position (Clutch Pedal is Released)



■ Shuttle Lever at Forward Position (Clutch Pedal is Released)



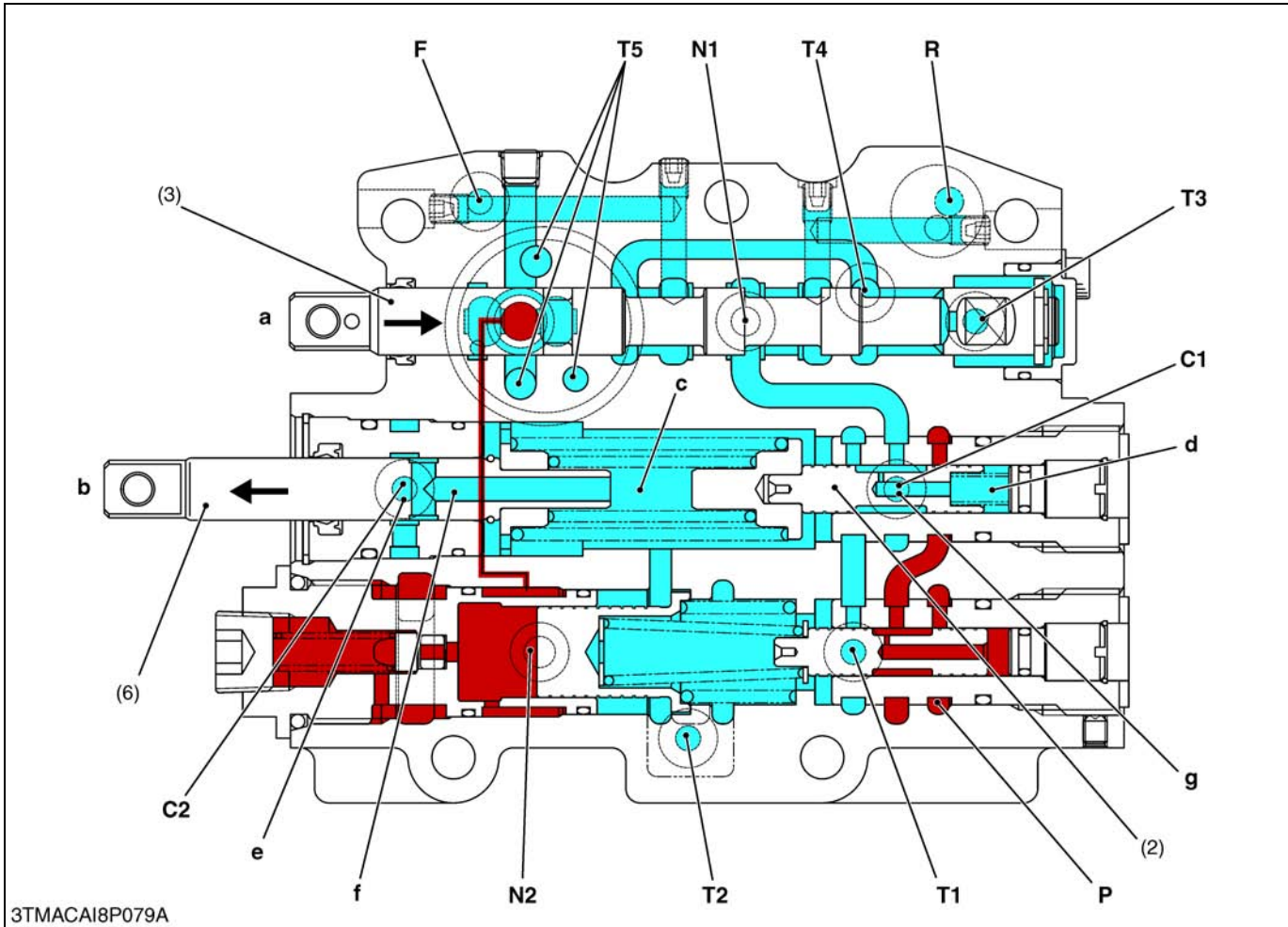


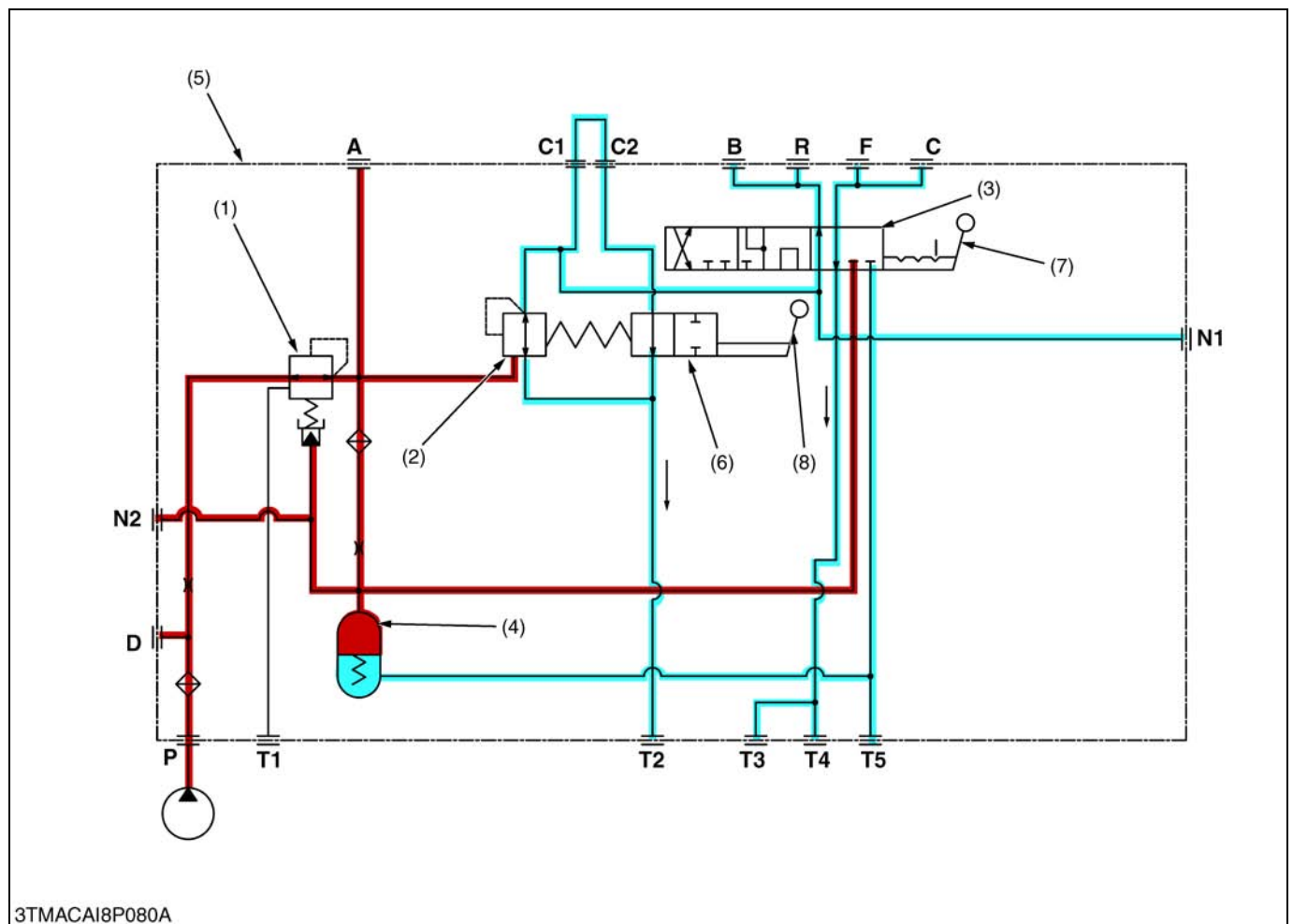
- | | | | |
|--|-------------------|------------------------------------|---------------------------------------|
| (1) Modulating Valve | (5) Shuttle Valve | A : Check Port (Modulation) | T1 to T5: To Transmission Case |
| (2) Proportionally Reducing Valve | (6) Inching Valve | B : Check Port (Reverse) | N1 : Port N1 |
| (3) Shuttle Shift Spool (Forward, Reverse) | (7) Shuttle Lever | C : Check Port (Forward) | N2 : Port N2 |
| (4) Accumulate Valve | (8) Clutch Pedal | D : Check Port (Pump) | a : Connect to Shuttle Lever |
| | | P : From Regulator Valve | b : Connect to Clutch Pedal |
| | | C1, C2 : Connection Port | |

When the shuttle lever have been setting on the **F** side, the oil pressure on **F** port is constantly controlled by proportionally reducing valve (2).

On the other hand, the oil in the **R** side of shuttle clutch returns to **T4** and **T3** port through **R** port and shuttle shift spool (3).

■ When Clutch Pedal is Depressed (with Shuttle Lever at Reverse or Forward Position)





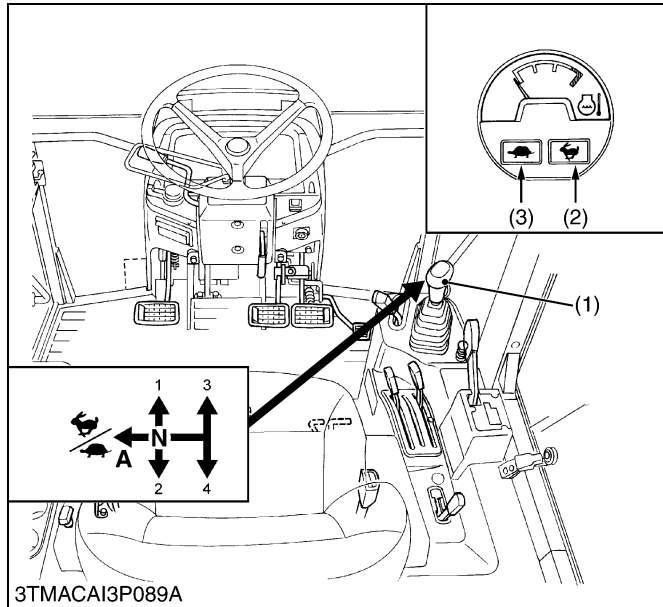
- | | | | |
|--|---------------------------------|--|-------------------------------------|
| (1) Modulating Valve | (6) Inching Valve | D : Check Port (Pump) | a : Connect to Shuttle Lever |
| (2) Proportionally Reducing Valve | (7) Shuttle Lever | P : From Regulator Valve | b : Connect to Clutch Pedal |
| (3) Shuttle Shift Spool (Forward, Reverse) | (8) Clutch Pedal | C1, C2 : Connection Port | c : Part c |
| (4) Accumulate Valve | A : Check Port | T1 to T5 : To Transmission Case | d : Part d |
| (5) Shuttle Valve | B : Check Port (Reverse) | N1 : Port N1 | e : Hole e |
| | C : Check Port | N2 : Port N2 | f : Passage f |
| | | | g : Hole g |

With the shuttle lever at **R** or **F** position, when the clutch pedal is depressed, the inching valve (6) is moved to the left. And pressure difference between **c** part and **d** part is generated. As the proportionally reducing valve (2) is moved to the left by pressure difference, **R** port (or **F** port) and **T2** port are connected.

The oil in the shuttle clutch returns into the transmission case via **R** port (or **F** port), notched portion of proportionally reducing valve (2) and **T2** port. This cause the shuttle clutch to be set off.

At the same time, as the hole **e** and passage **f** are connected, oil passage among the hole **g**, hole **e** and **T2** port are connected. As a result, even when the proportionally reducing valve (2) does not move, the oil passage from **R** port (or **F** side) to **T2** port is secured.

3. SWING SHIFT



■ Operation Method

1. The swing shift is a method which the **HI** and **LO** speed range is changing by using the electric and hydraulic device combination.

2. The main gear shift lever is in **Neutral** position during the engine is running.

Move the lever against the left side face, and the speed changes each time between the rabbit lamp-**HI** (2) and turtle lamp-**LO** (3).

Be sure to use the clutch while shifting.

3. The lamp (2), (3) indicate that the shift is change between **HI** speed range (2) and **LO** speed range (3).

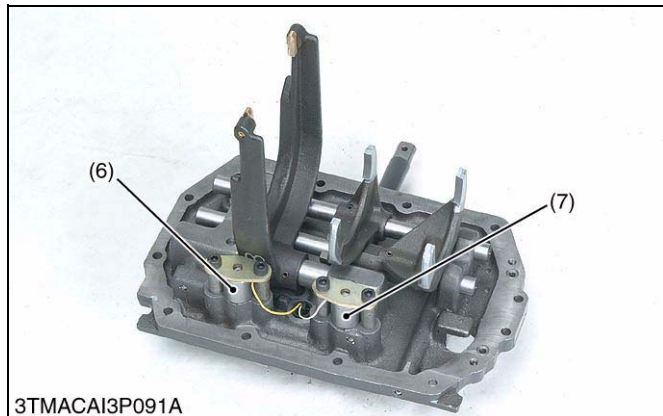
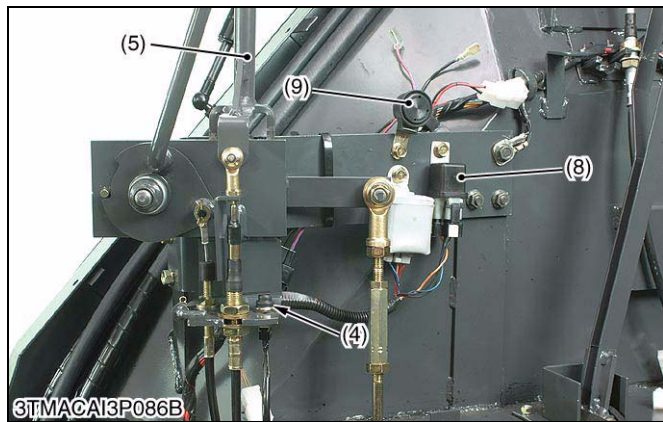
4. The buzzer sounds when the shifting has occurred with both the lamps (2), (3) off.

5. When moving the main gear shift lever (5) against the left side at "**Neutral**", the swing shift switch (4) is turned each time between rabbit (**HI**) and turtle (**LO**). Battery current flows from swing shift switch (4) to solenoid valve (6) or (7), then solenoid valve is actuated.

6. As for buzzer, the **HI** or **LO** monitor switch is turned **ON** according to the movement of the **HI-LO** shift rod, battery current flows from swing shift switch to buzzer relay through the monitor switch.

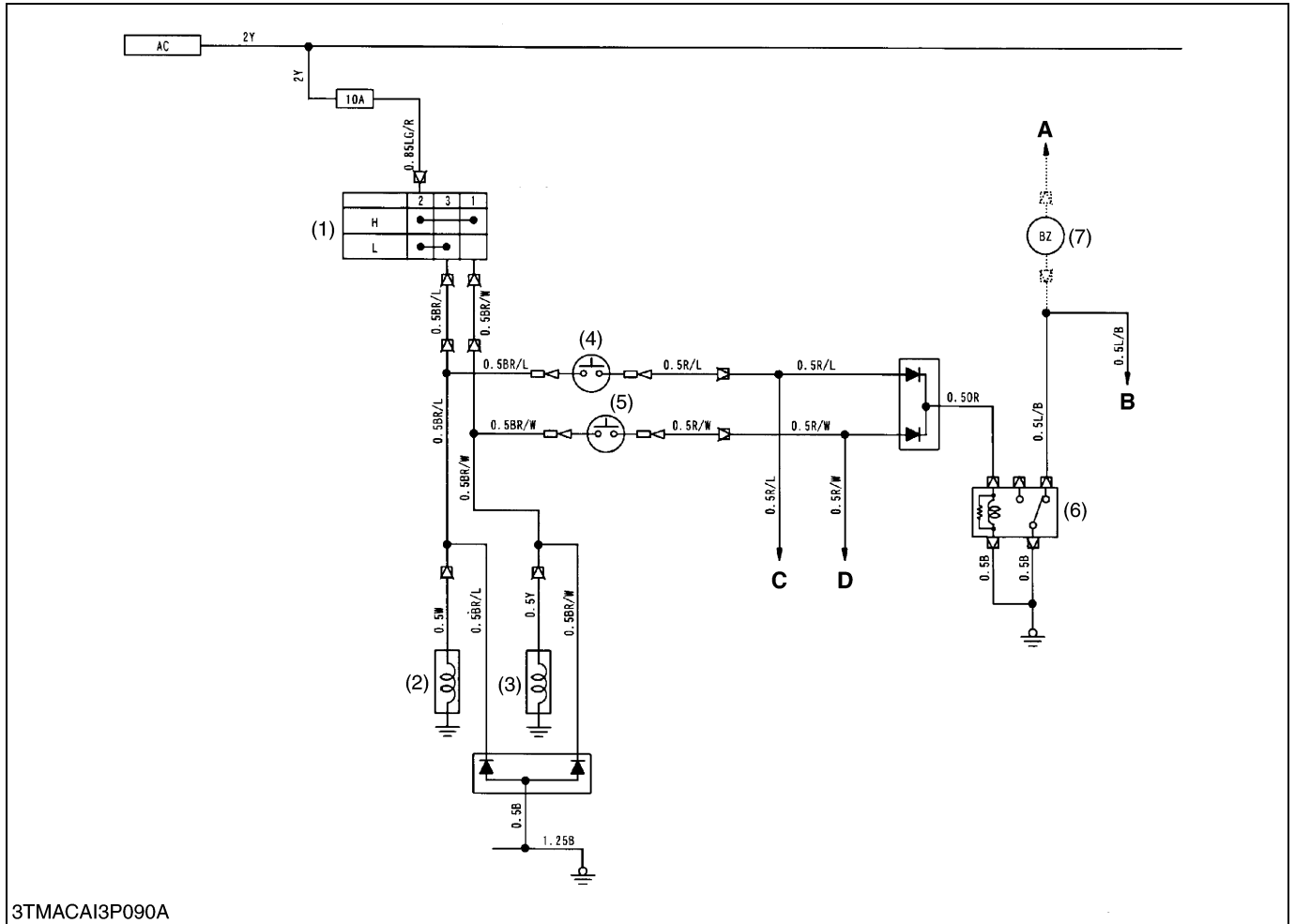
Buzzer relay is actuated, battery current flows to buzzer.

- | | |
|----------------------------|------------------------------|
| (1) Main Gear Shift Lever | (6) LO Solenoid Valve |
| (2) Rabbit Lamp- HI | (7) HI Solenoid Valve |
| (3) Turtle Lamp- LO | (8) Buzzer Relay |
| (4) Swing Shift Switch | (9) Buzzer |
| (5) Main Shift Lever | |



W1013666

■ Electrical Device



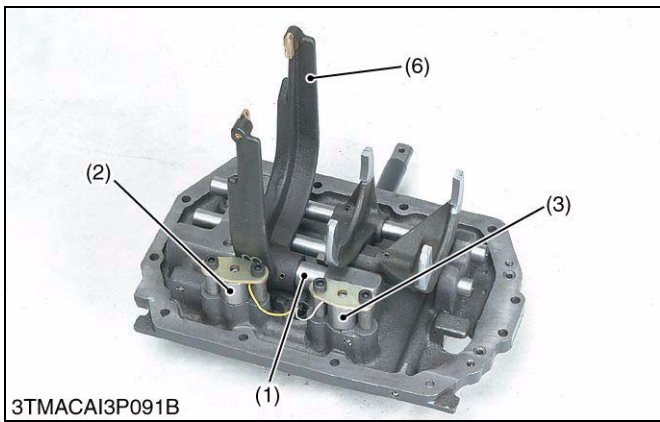
3TMACAI3P090A

- (1) Swing Shift Switch
- (2) LO Solenoid Valve
- (3) HI Solenoid Valve
- (4) LO Motion Switch

- (5) HI Motion Switch
- (6) Buzzer Relay
- (7) Buzzer

- A : To Meter Panel (10A Fuse)
- B : To OPC Unit

- C : To Meter Panel (Swing Shift HI)
- D : To Meter Panel (Swing Shift LO)

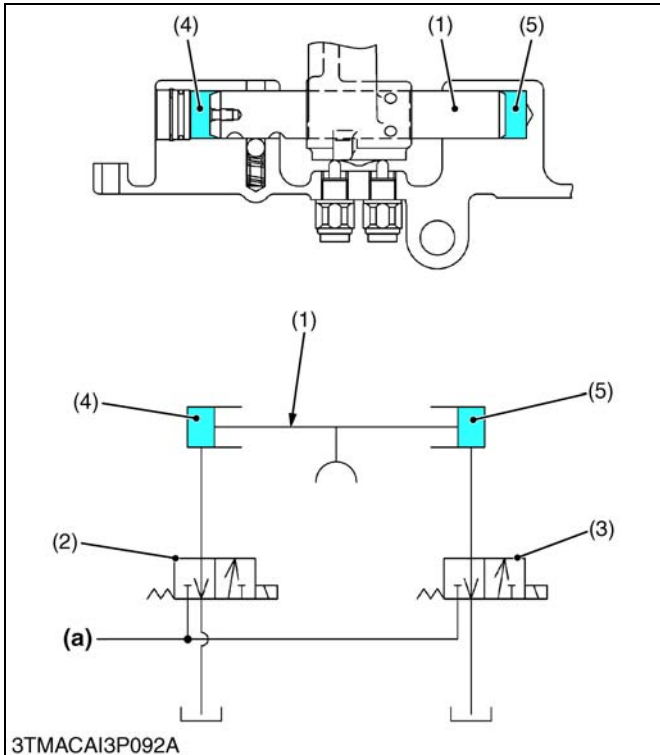


■ Hydraulic Device

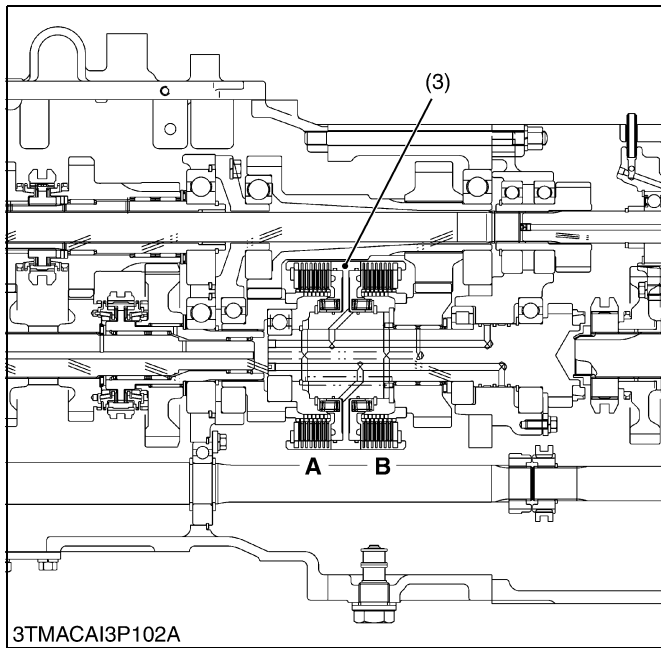
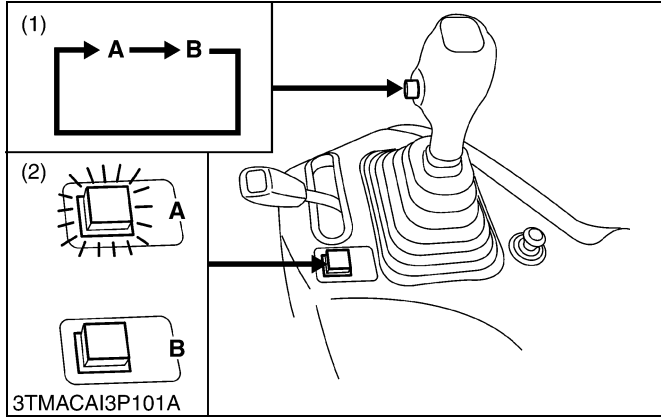
1. The shift fork rod (1) is used as a double acting piston.
2. The shift fork rod (1) is moved to the right or left by switching the solenoid valve (2), (3) and flowing oil into **A** chamber (4) or **B** chamber (5).
3. The **HI** or **LO** speed is charged by the shift fork (6) with the shift fork rod (1).

- | | |
|------------------------------|----------------------|
| (1) Shift Fork Rod | (5) B Chamber |
| (2) LO Solenoid Valve | (6) Shift Fork |
| (3) HI Solenoid Valve | |
| (4) A Chamber | |
- (a) Oil from the Regulator Valve

W1014355



4. DUAL SPEED



■ Dual Speed

Model M95S-DS and M105S-DS have dual speed device as a standard equipment.

The dual speed device consists of the **HI-LO** clutch, located in the mid case, and the clutch valve that controls the **HI-LO** clutch.

The dual speed shift switch (1) can be operated when the tractor is travelling without using the clutch (Tractor travel speed change by about 17 %). **LO** speed and **HI** speed change at each time by the switch is pushed.

■ Dual Speed Indicator

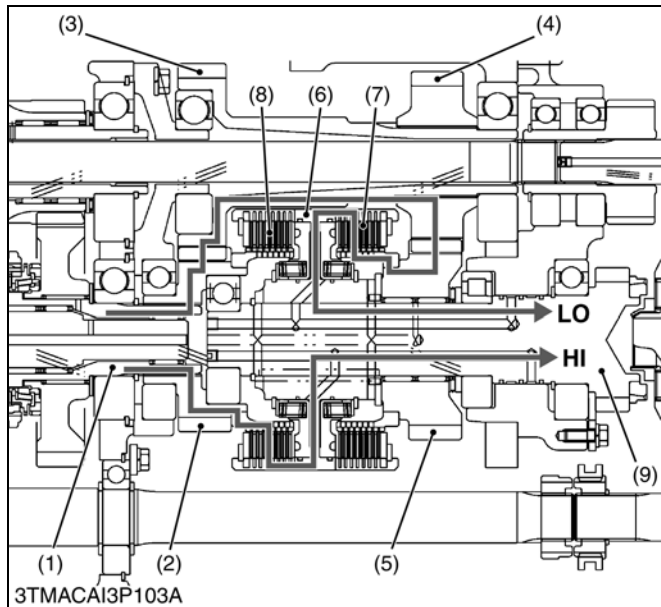
The indicator comes on when the dual speed switch is set to **LO**.

The indicator goes off, when the dual speed switch is set to **HI**.

- | | |
|-----------------------------|---------------------|
| (1) Dual Speed Shift Switch | A : LO Speed |
| (2) Dual Speed Indicator | B : HI Speed |
| (3) Dual Speed Clutch | |

W1014755

[1] DUAL SPEED SECTION



The dual speed clutch is controlled by the combination of the solenoid valve and the hydraulic flow.

When the dual speed shift switch is pushed and indicator comes on, **LO** speed clutch (7) is engaged.

When indicator goes off, **HI** speed clutch (8) is engaged.

Two ways of power train are available as follows.

■ LO Speed

Hub (1) → 25 T Gear (2) → 27T Gear (3) → 25T Gear (4) → 28T Gear (5) → **LO** Speed Clutch (7) → Clutch Body (6) → Range Shift Gear Shaft (9).

(Reference)

- Reduction ratio : Approx. 0.827 (cut by 17.3 %)
- Torque ratio : Approx. 1.209 (boost 20.9 %)

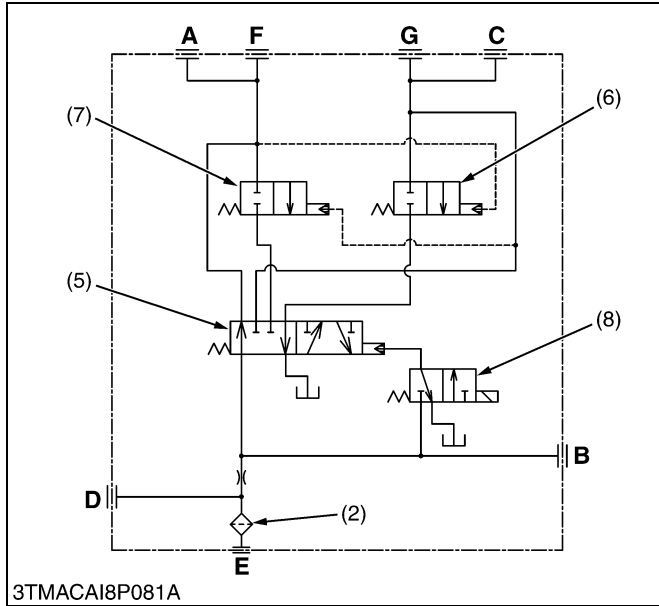
■ HI Speed

Hub (1) → 25 T Gear (2) → **HI** Speed Clutch (8) → Clutch Body (6) → Range Shift Gear Shaft

- | | |
|--------------|----------------------------|
| (1) Hub | (6) Clutch Body |
| (2) 25T Gear | (7) LO Speed Clutch |
| (3) 27T Gear | (8) HI Speed Clutch |
| (4) 25T Gear | (9) Range Shift Gear Shaft |
| (5) 28T Gear | |

W1017027

[2] DUAL SPEED VALVE (Code No. YW217-00100)



This valve change the oil flow to the dual speed **HI** clutch or **LO** clutch.

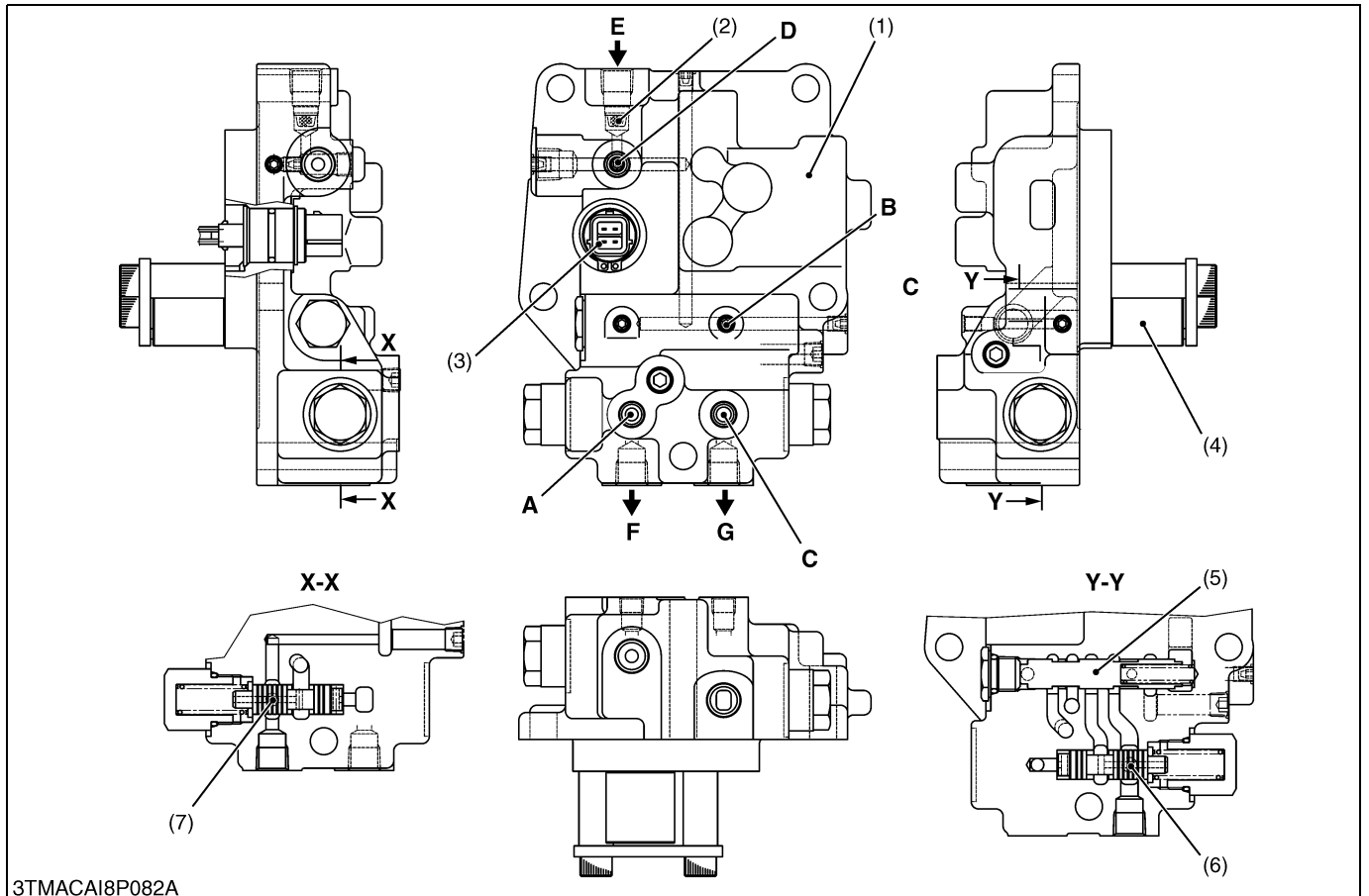
As the pilot valve DS (8) operates by energizing the solenoid valve (4), the flow of oil is switched to the **HI** side or **LO** side of dual speed clutch with DS spool (5).

When one of clutches are engaged, pilot valve **HI** and pilot valve **LO** are object in free which makes it do as for the other clutch.

- (1) Valve Body
- (2) Line Filter
- (3) Connector
- (4) Solenoid Valve
- (5) DS Spool
- (6) Pilot Valve **LO**
- (7) Pilot Valve **HI**
- (8) Pilot Valve **DS**

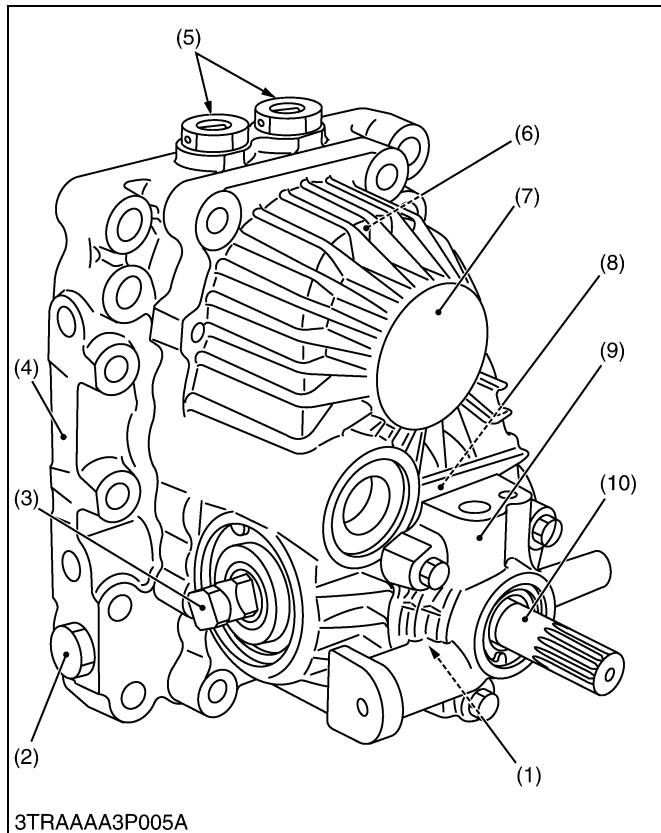
- A : Check Port HI**
- B : Check Port P**
- C : Check Port LO**
- D : Check Port System**
- E : From Regulator Valve**
- F : To Clutch Pack HI**
- G : To Clutch Pack LO**
- X-X : View X**
- Y-Y : View Y**

W1017062



5. HYDROSTATIC TRANSMISSION (TYPE 1) (Code No. 6C150-11603)

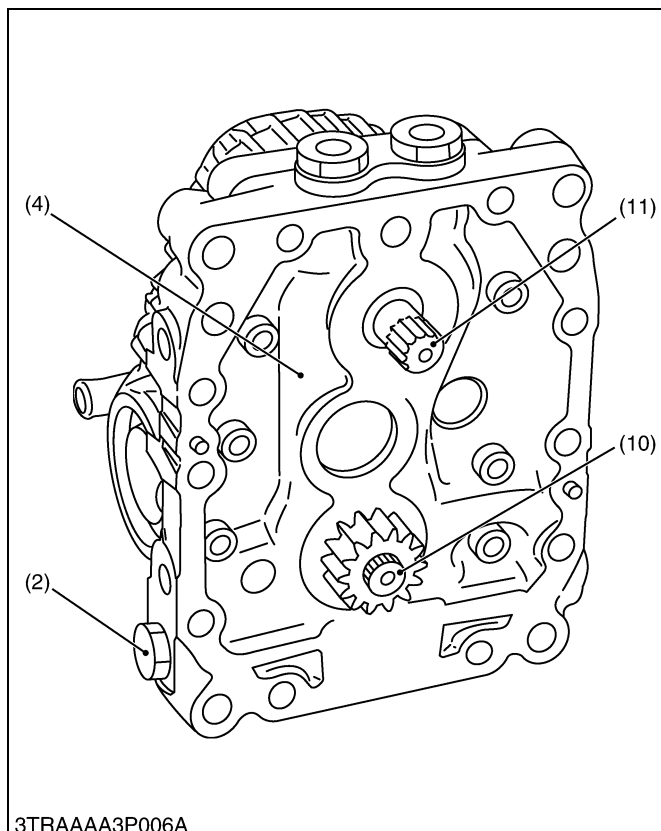
[1] STRUCTURE

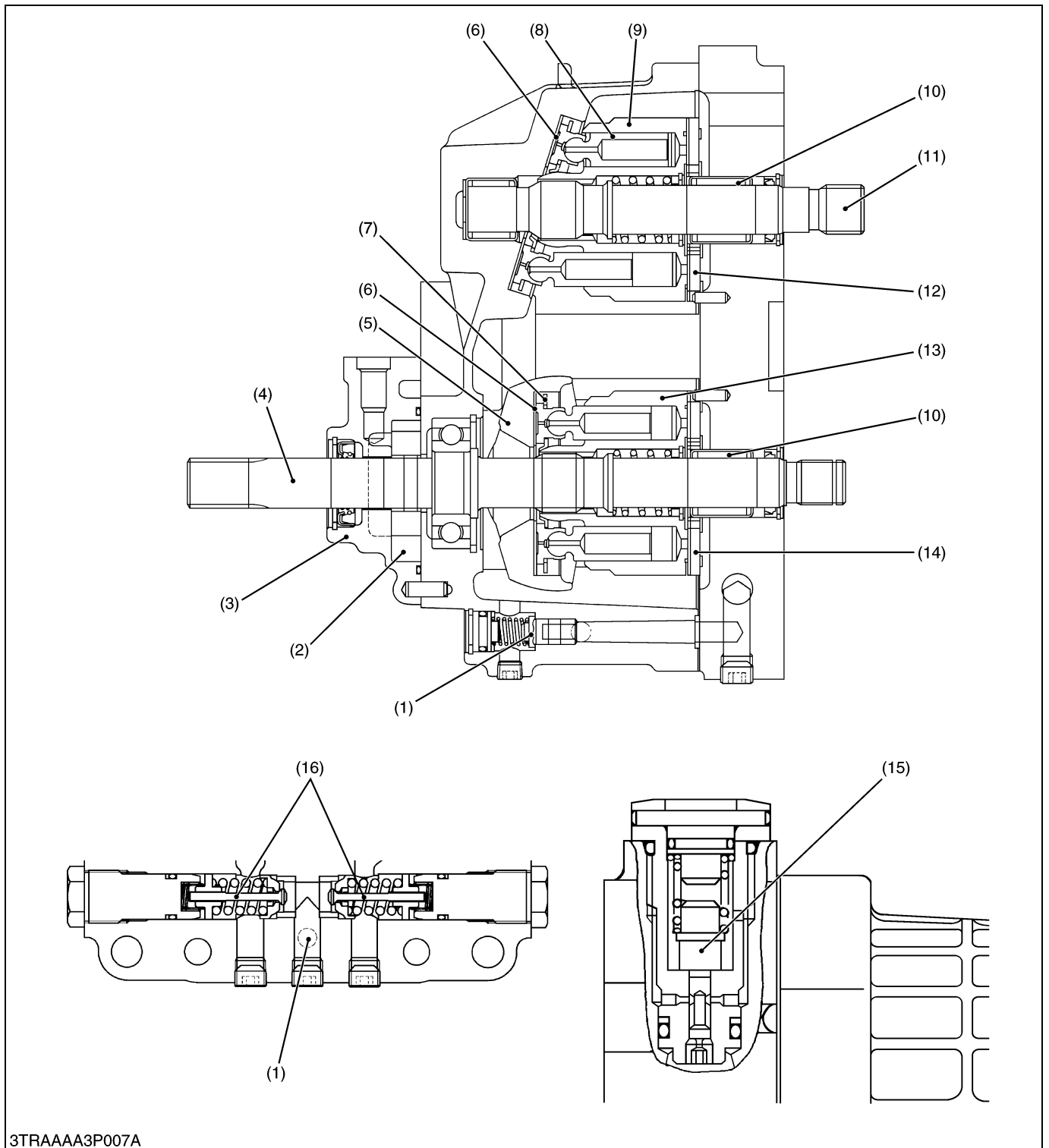


Hydrostatic transmission is composed of variable displacement piston pump, fixed displacement piston motor, charge pump and valve system.

- | | |
|--|---------------------------------------|
| (1) Charge Relief Valve | (7) Housing |
| (2) Check and High Pressure Relief Valve | (8) Variable Displacement Piston Pump |
| (3) Trunnion Shaft | (9) Charge Pump |
| (4) Center Section | (10) Input Shaft (Pump Shaft) |
| (5) Neutral Valve | (11) Output Shaft |
| (6) Fixed Displacement Piston Motor | |

W10132090

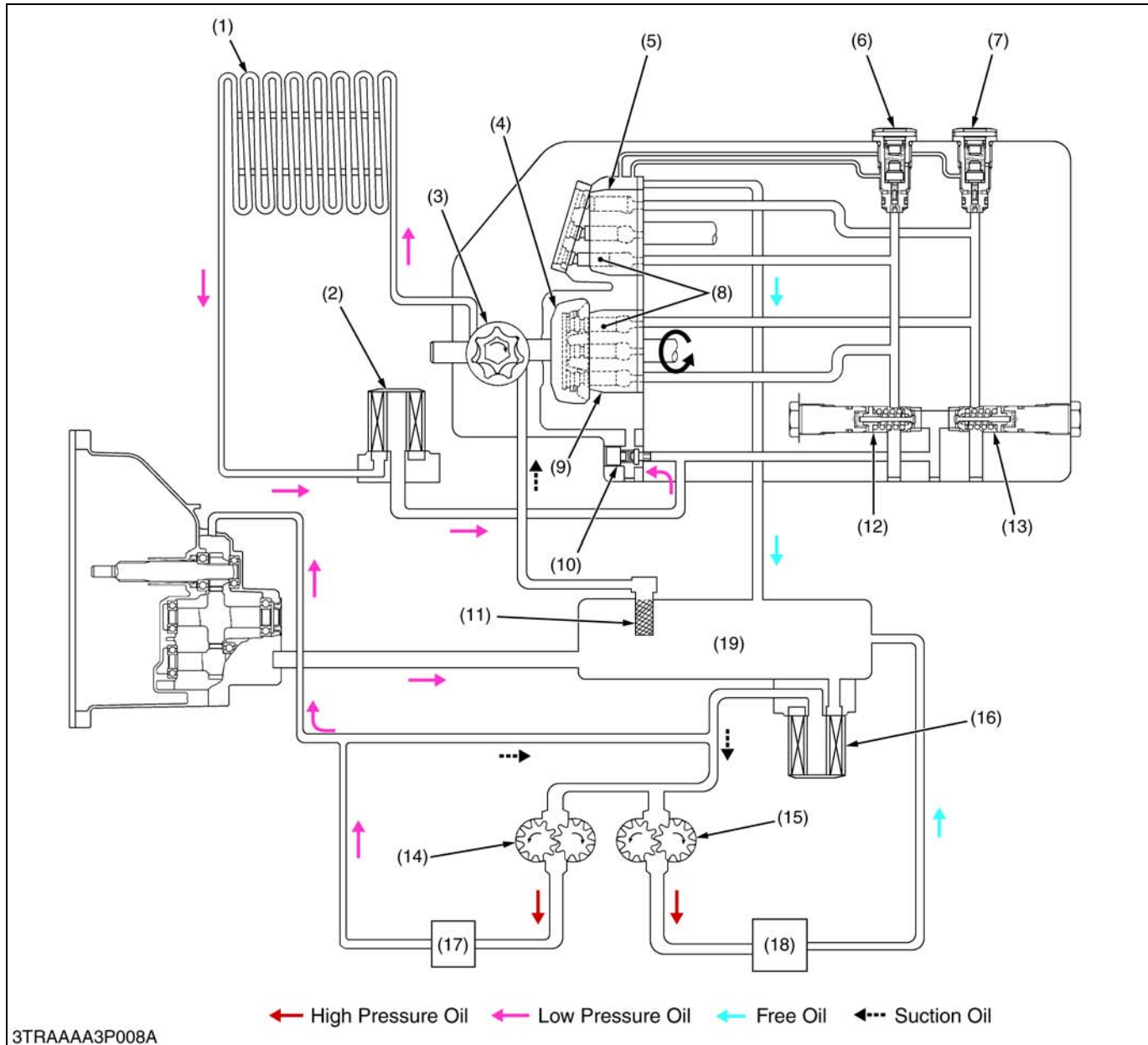




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- | | | | |
|-------------------------|----------------------------|----------------------------|---|
| (1) Charge Relief Valve | (6) Thrust Collar | (10) Needle Bearing | (14) Valve Plate (Pump) |
| (2) Charge Pump | (7) Retainer Plate | (11) Motor Shaft | (15) Neutral Valve |
| (3) Charge Pump Case | (8) Piston | (12) Valve Plate (Motor) | (16) Check and High Pressure Relief Valve |
| (4) Pump Shaft | (9) Cylinder Block (Motor) | (13) Cylinder Block (Pump) | |
| (5) Variable Swashplate | | | |

[2] OIL FLOW AND VALVES

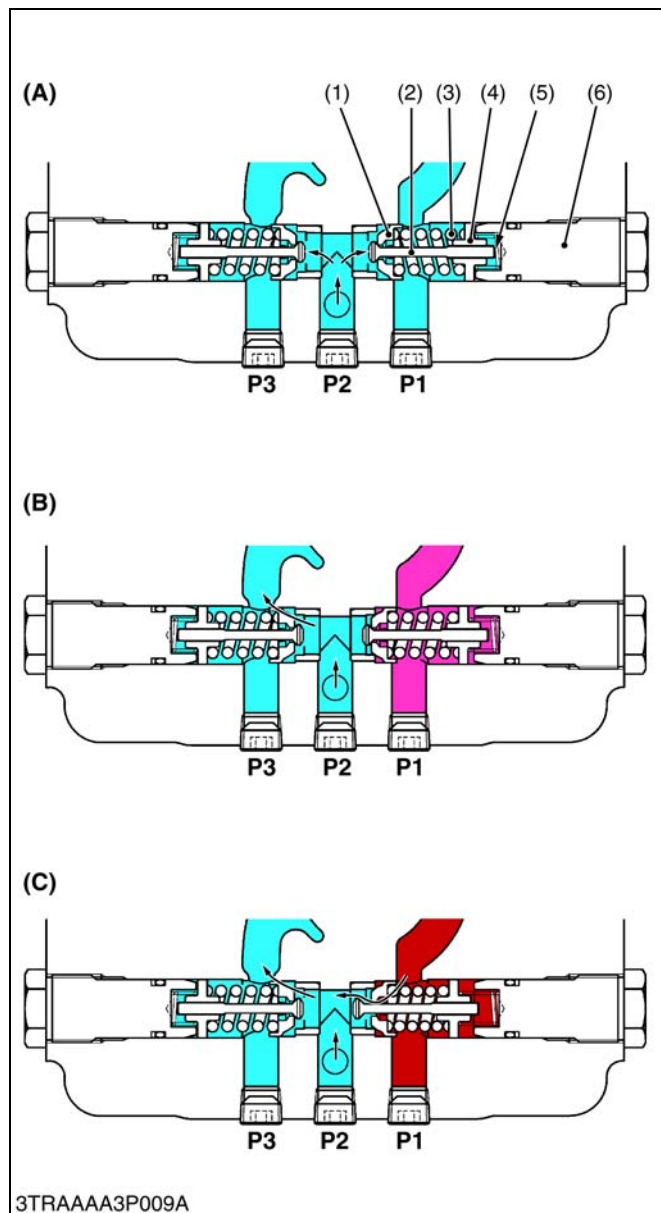


- | | | | |
|-----------------------------|-----------------------------|---|--|
| (1) Oil Cooler | (7) Neutral Valve (Reverse) | (12) Check and High Pressure Relief Valve (Forward) | (15) Hydraulic Pump (for Main Circuit) |
| (2) Oil Filter (for HST) | (8) Piston | (13) Check and High Pressure Relief Valve (Reverse) | (16) Oil Filter |
| (3) Charge Pump | (9) Pump Cylinder Block | (14) Hydraulic Pump (for Power Steering) | (17) Power Steering Controller |
| (4) Swashplate | (10) Charge Relief Valve | | (18) Hydraulic Control Valve |
| (5) Motor Cylinder Block | (11) Oil Strainer | | (19) Transmission Case |
| (6) Neutral Valve (Forward) | | | |

The pump and motor are joined in a closed hydraulic loop and most of oil circulates within the main oil circuit. A little oil lubricates and oozes out from the clearance between the moving parts of the case. Then oil in the main oil circuit of the HST needs to be supplied a want.

So all of oil fed from charge pump flow to hydrostatic transmission for charging and cooling.

The charge oil aids smooth operation of pistons for pump and motor. The charge oil passes through the oil cooler and oil filter cartridge to charge relief valve port. The rest of oil passes through the charge relief valve into the HST housing. And overflow oil from HST housing return to the transmission case.



■ Check and High Pressure Relief Valve

The check and high-pressure relief valve consists of pressure poppet (2), check valve seat (1), relief valve spring (3), spring guide (4) and check valve spring (5).

The valve is used to prevent an overload that would happen at a quick start, sudden stop or even during usual running. This valve doubles as a check valve.

The check and high-pressure relief valves are laid out facing each other as shown in the figure.

In neutral, both valves are open and charging oil enters into the main oil circuit through the valves. **(A)**

At normal operation, the check valve in the high-pressure side is closed and it pushes and opens the another one. An excessive charge flow goes through the charge relief valve into HST housing. **(B)**

The check and high-pressure relief valve along the high-pressure line serves as a high-pressure relief valve.

If the pressure exceeds a high-pressure limit level, the pressure poppet opens itself against the relief valve spring (3) force and opens the valve seat that is located between the check valve seat (1) and the pressure poppet (2). Now the flow goes from **P1** to **P2** and **P3**. **(C)**

If the **P1** pressure drops, the relief valve spring forces the valve seat closed against the pressure. The high-pressure oil at **P1** does not flow to **P2** any longer.

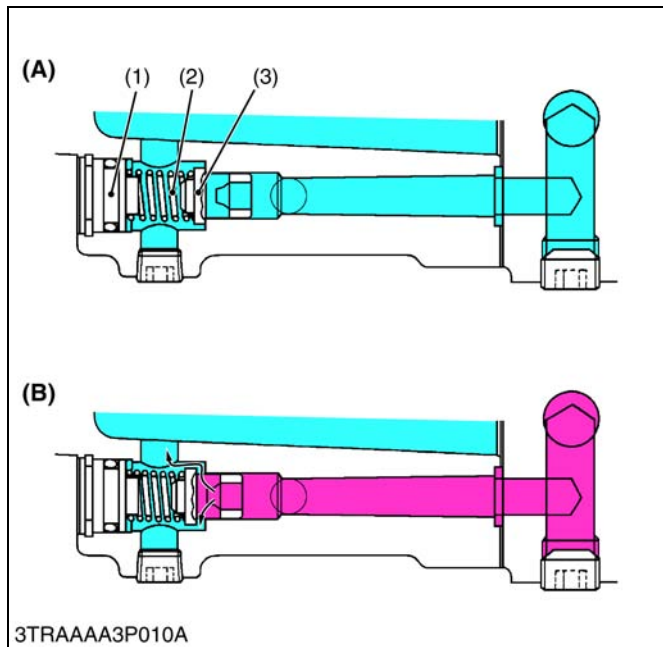
As discussed above, the check and high-pressure relief valve protects engines, pumps, motors, gears and even the machine itself from overload.

Oil temperature	Valve operating pressure
50 °C (122 °F)	30.9 to 31.9 MPa 315 to 325 kgf/cm ² 4480 to 4622 psi

- (1) Check Valve Seat
- (2) Pressure Poppet
- (3) Relief Valve Spring
- (4) Spring Guide
- (5) Check Valve Spring
- (6) Valve Plug

- (A) In Neutral (Stop)**
- (B) When Check Valve Activating (Normal Operation)**
- (C) When High Pressure Relief Valve Activating**

W10139670



■ **Charge Relief Valve**

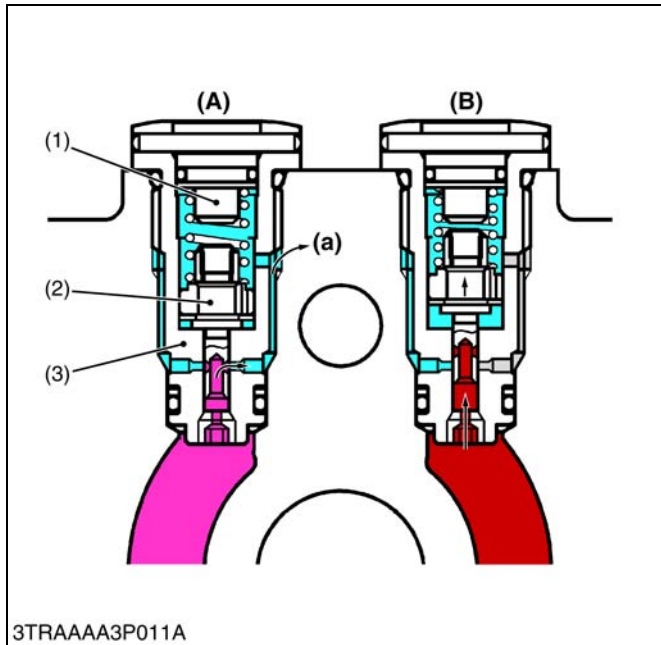
While pumped and filtered oil flows into the main oil circuit through the check and high pressure relief valves, and excessive oil passes to the housing through the charge relief valve.

Oil temperature	Valve operating pressure
50 °C (122 °F)	500 to 800 kPa 5.1 to 8.2 kgf/cm ² 73 to 116 psi

- (1) Plug
- (2) Spring
- (3) Charge Relief Valve

- (A) Charge Relief Valve Closed**
- (B) Charge Relief Valve Opened**
(When engine is started)

W10142580



■ Neutral Valve

The neutral valves in the main oil circuit lines are open and pass the oil to the case when in neutral, and the oil pressure in their lines becomes low. And when the oil pressure in the high pressure line increases to a specified pressure, the neutral valve closes.

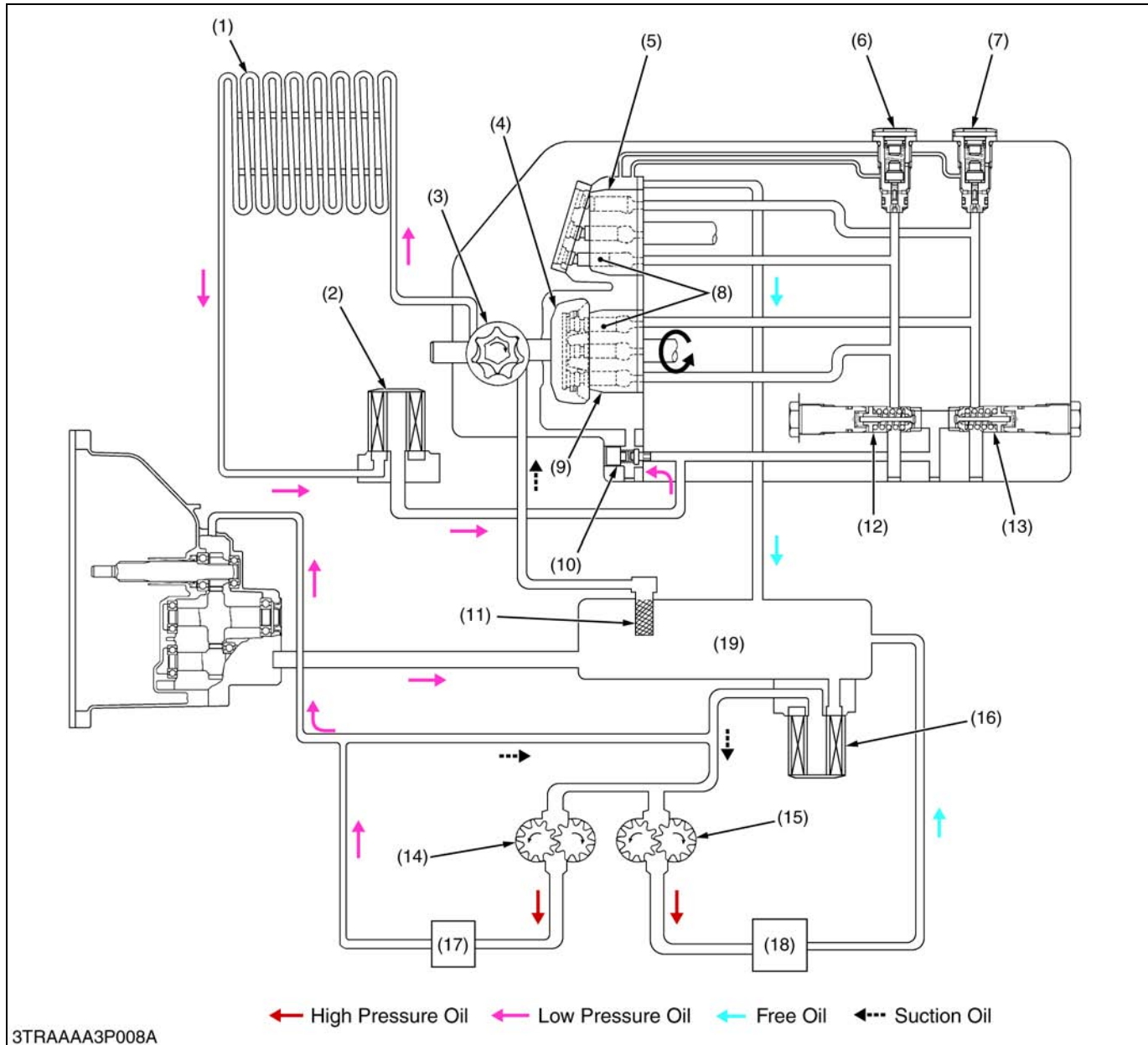
Oil temperature	Valve operating pressure	
50 °C (122 °F)	Close	7.36 to 9.81 MPa 75 to 100 kgf/cm ² 1067 to 1422 psi
	Open	1.47 to 2.45 MPa 15 to 25 kgf/cm ² 213 to 356 psi

- (1) Plug
- (2) Neutral Valve Poppet
- (3) Neutral Valve Body
- (A) Low Pressure Side (Open)**
- (B) High Pressure Side (Close)**
- (a) To HST Case**

W10144000

[3] OPERATION

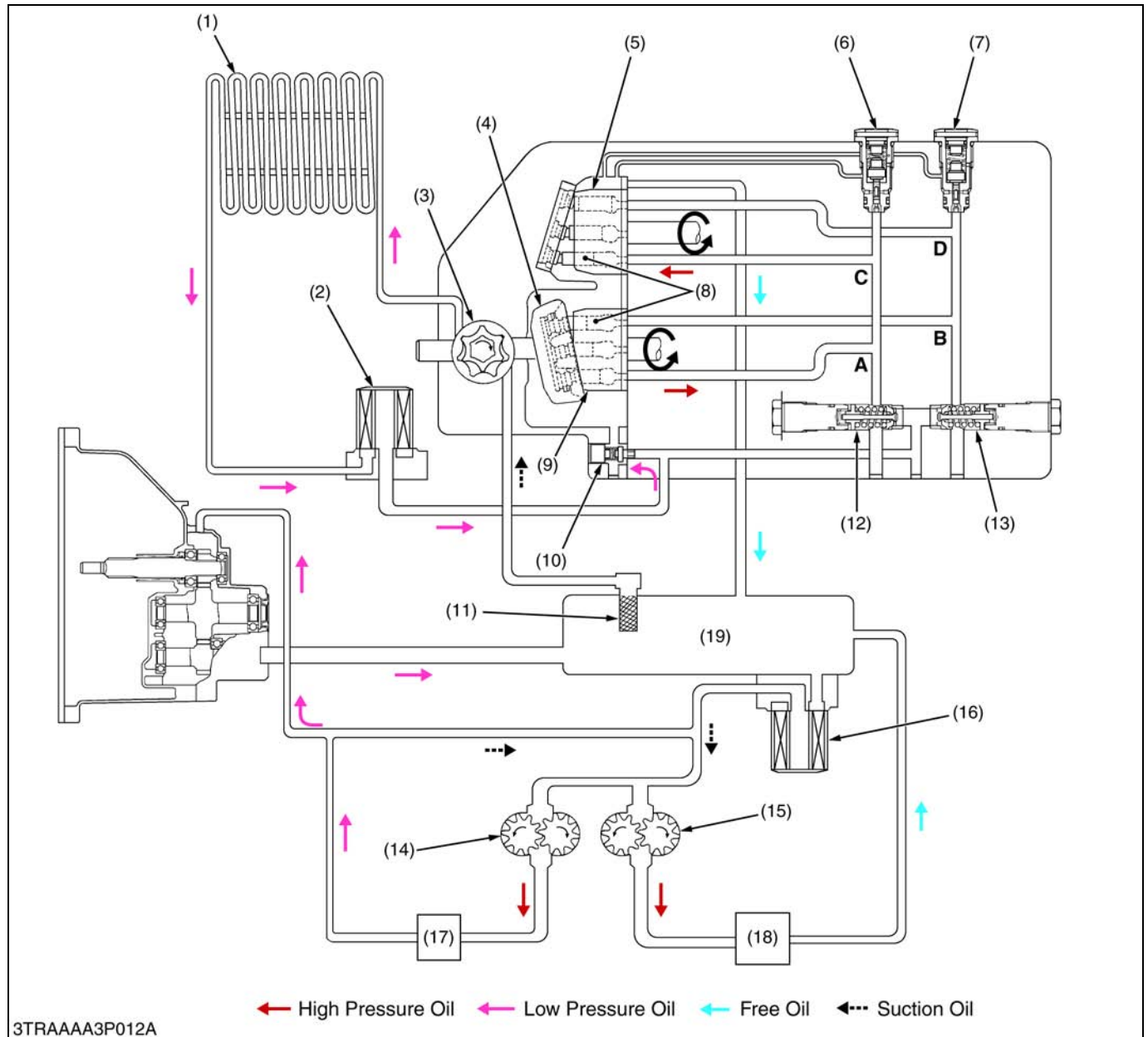
■ Neutral



- | | | | |
|-----------------------------|-----------------------------|---|--|
| (1) Oil Cooler | (7) Neutral Valve (Reverse) | (12) Check and High Pressure Relief Valve (Forward) | (15) Hydraulic Pump (for Main Circuit) |
| (2) Oil Filter (for HST) | (8) Piston | (13) Check and High Pressure Relief Valve (Reverse) | (16) Oil Filter |
| (3) Charge Pump | (9) Pump Cylinder Block | (14) Hydraulic Pump (for Power Steering) | (17) Power Steering Controller |
| (4) Swashplate | (10) Charge Relief Valve | | (18) Hydraulic Control Valve |
| (5) Motor Cylinder Block | (11) Oil Strainer | | (19) Transmission Case |
| (6) Neutral Valve (Forward) | | | |

When the speed control pedal is in neutral, the variable swashplate is at right angles to the pump pistons and they only rotate with cylinder block without reciprocating. Since the oil is not being pumped to the motor, the cylinder block in the motor is stationary and the output shaft does not move.

■ Forward



- | | | | |
|-----------------------------|-----------------------------|---|--|
| (1) Oil Cooler | (7) Neutral Valve (Reverse) | (12) Check and High Pressure Relief Valve (Forward) | (15) Hydraulic Pump (for Main Circuit) |
| (2) Oil Filter (for HST) | (8) Piston | (13) Check and High Pressure Relief Valve (Reverse) | (16) Oil Filter |
| (3) Charge Pump | (9) Pump Cylinder Block | (14) Hydraulic Pump (for Power Steering) | (17) Power Steering Controller |
| (4) Swashplate | (10) Charge Relief Valve | | (18) Hydraulic Control Valve |
| (5) Motor Cylinder Block | (11) Oil Strainer | | (19) Transmission Case |
| (6) Neutral Valve (Forward) | | | |

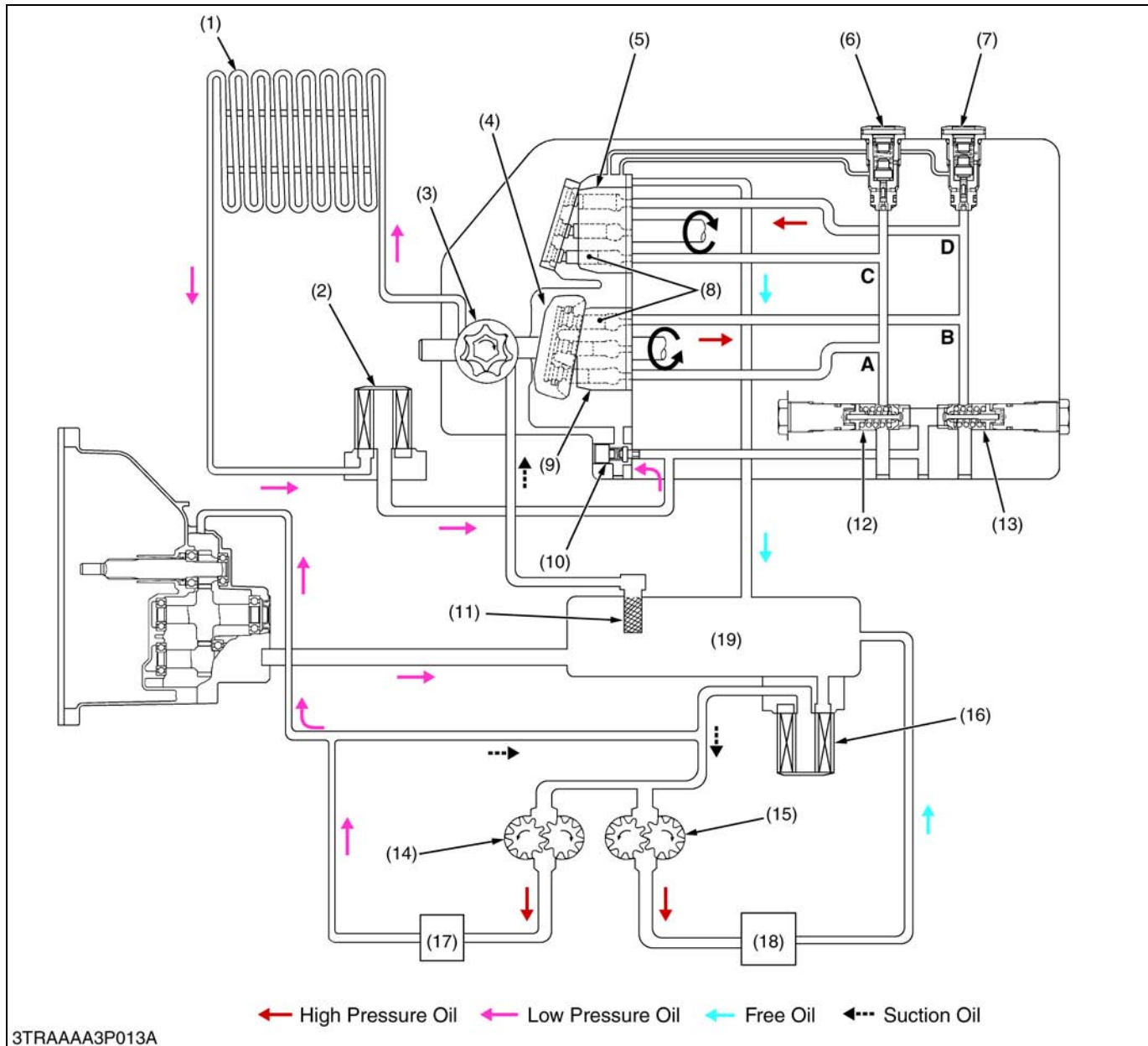
When the speed control pedal is stepped on and in forward, the variable swashplate is tilted as shown in figure above.

As the pump cylinder block rotates with the input shaft, oil is forced out of pump port **A** at high pressure. As pressure oil enters motor port **C**, the pistons, which align with port **C**, are pushed against the swashplate and slide down the inclined surface.

Then the output shaft rotates with the motor cylinder block. This drives the machine forward and the angle of pump swashplate determines the output shaft speed.

As the motor cylinder block continues to rotate, oil is forced out of motor port **D** at low pressure and returns to the pump port **B**.

Reverse



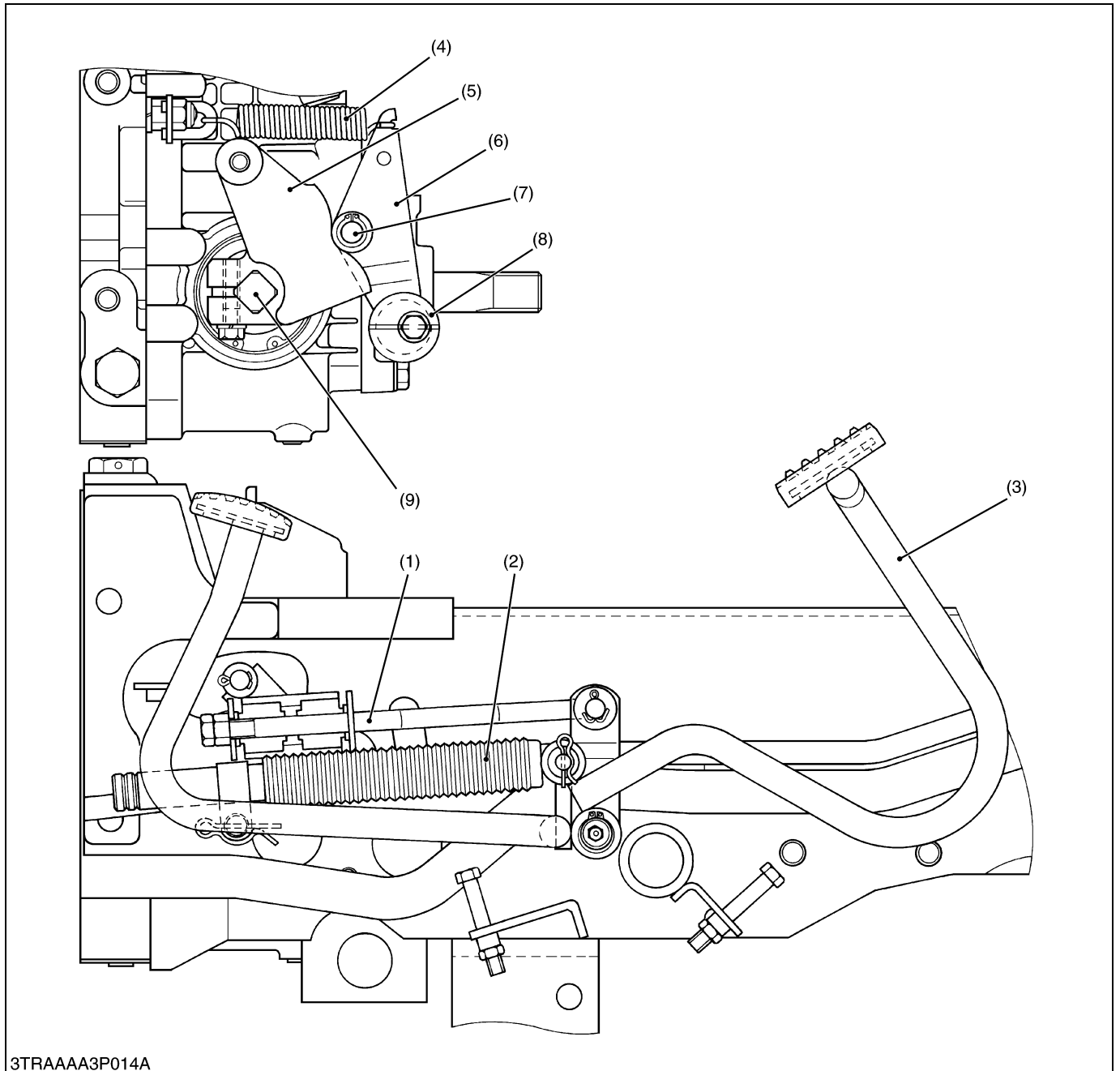
- | | | | |
|--------------------------|-----------------------------|---|--|
| (1) Oil Cooler | (7) Neutral Valve (Reverse) | (12) Check and High Pressure Relief Valve (Forward) | (15) Hydraulic Pump (for Main Circuit) |
| (2) Oil Filter (for HST) | (8) Piston | (13) Check and High Pressure Relief Valve (Reverse) | (16) Oil Filter |
| (3) Charge Pump | (9) Pump Cylinder Block | (14) Hydraulic Pump (for Power Steering) | (17) Power Steering Controller |
| (4) Swashplate | (10) Charge Relief Valve | | (18) Hydraulic Control Valve |
| (5) Motor Cylinder Block | (11) Oil Strainer | | (19) Transmission Case |

When the speed control pedal is stepped on and in reverse, the variable swashplate is tilted as shown in figure above.

As the pump cylinder block rotates with the input shaft, oil is forced out of pump port **B** at high pressure. As pressure oil enters motor port **D**, the pistons, which align with port **D**, are pushed against the swashplate and slide down the inclined surface.

Then the output shaft rotates with the motor cylinder block. This drives the machine rearward and the angle of pump swashplate determines the output shaft speed.

As the motor cylinder block continues to rotate, oil is forced out of motor port **C** at low pressure and returns to the pump port **A**.

[4] CONTROL LINKAGE

3TRAAAA3P014A

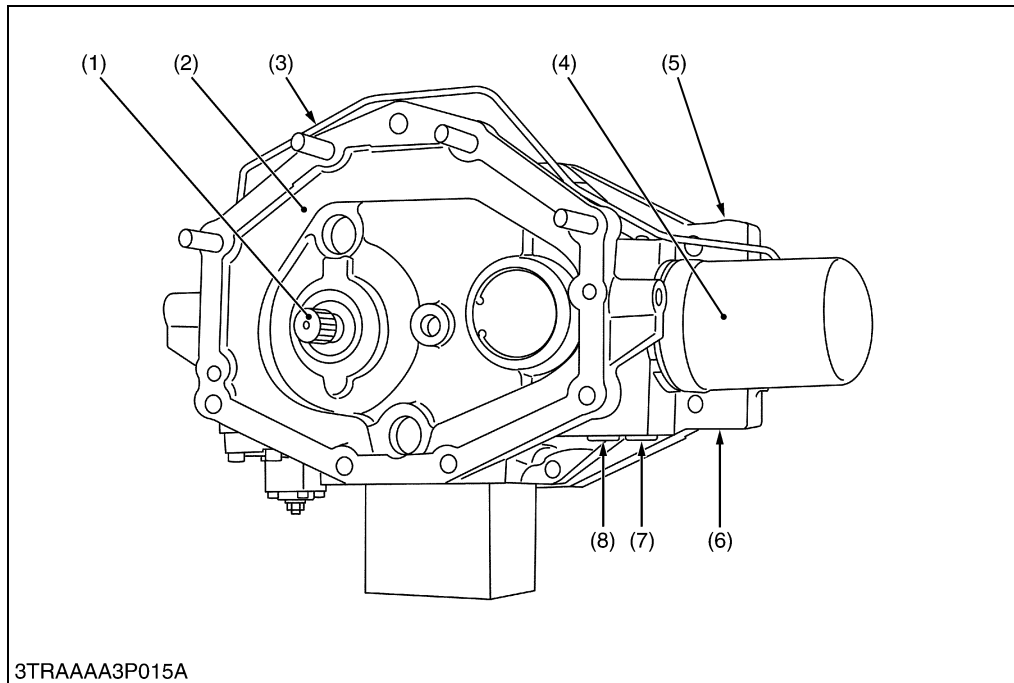
- | | | | |
|--------------------------------|--------------------|------------------------|----------------------|
| (1) Speed Control Rod Assembly | (4) Spring | (6) Neutral Holder Arm | (8) Neutral Adjuster |
| (2) Damper | (5) Neutral Holder | (7) Roller | (9) Trunnion Shaft |
| (3) Speed Control Pedal | | | |

The speed control pedal (3) and the trunnion shaft (9) of variable swashplate are linked with the speed control rod (1) and the neutral holder (5). As the front footrest of the pedal is depressed, the swashplate rotates and forward travelling speed increased. Depressing the rear footrest increases reverse speed.

The roller (7) on the neutral holder arm (6) is held with spring seats the detent of the neutral holder (5) so that the neutral holder returns to neutral. Then, the swashplate is returned to neutral with the neutral holder, when the pedal is released. The damper (2) connected to the speed control pedal restricts the movement of the linkage to prevent abrupt operation or reversing.

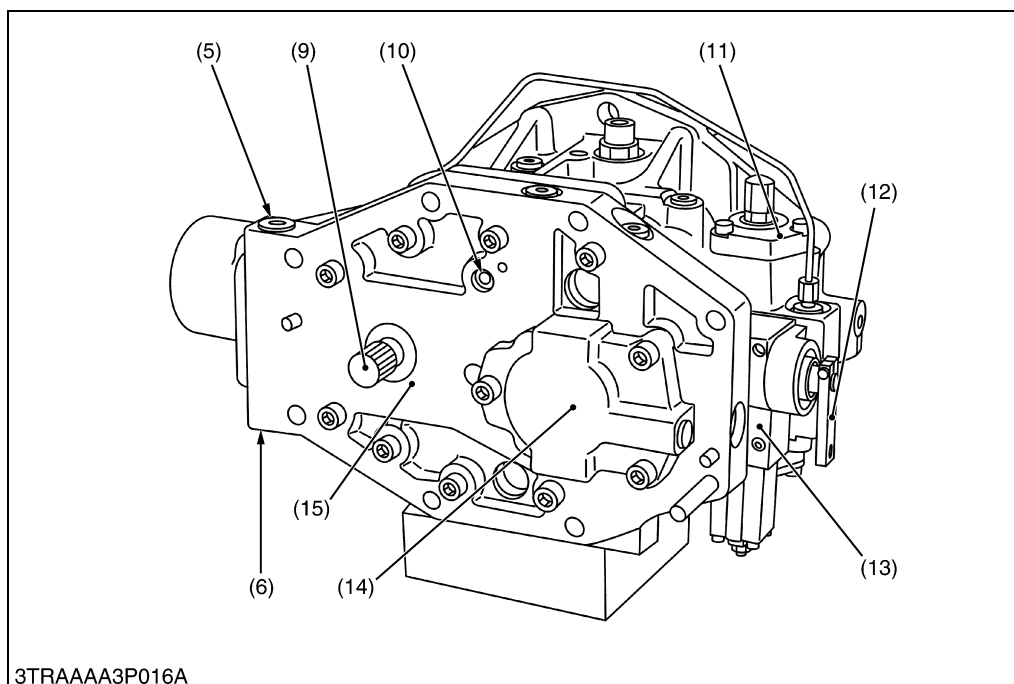
6. HYDROSTATIC TRANSMISSION (TYPE 2) (Code No. TA240-58004)

[1] STRUCTURE

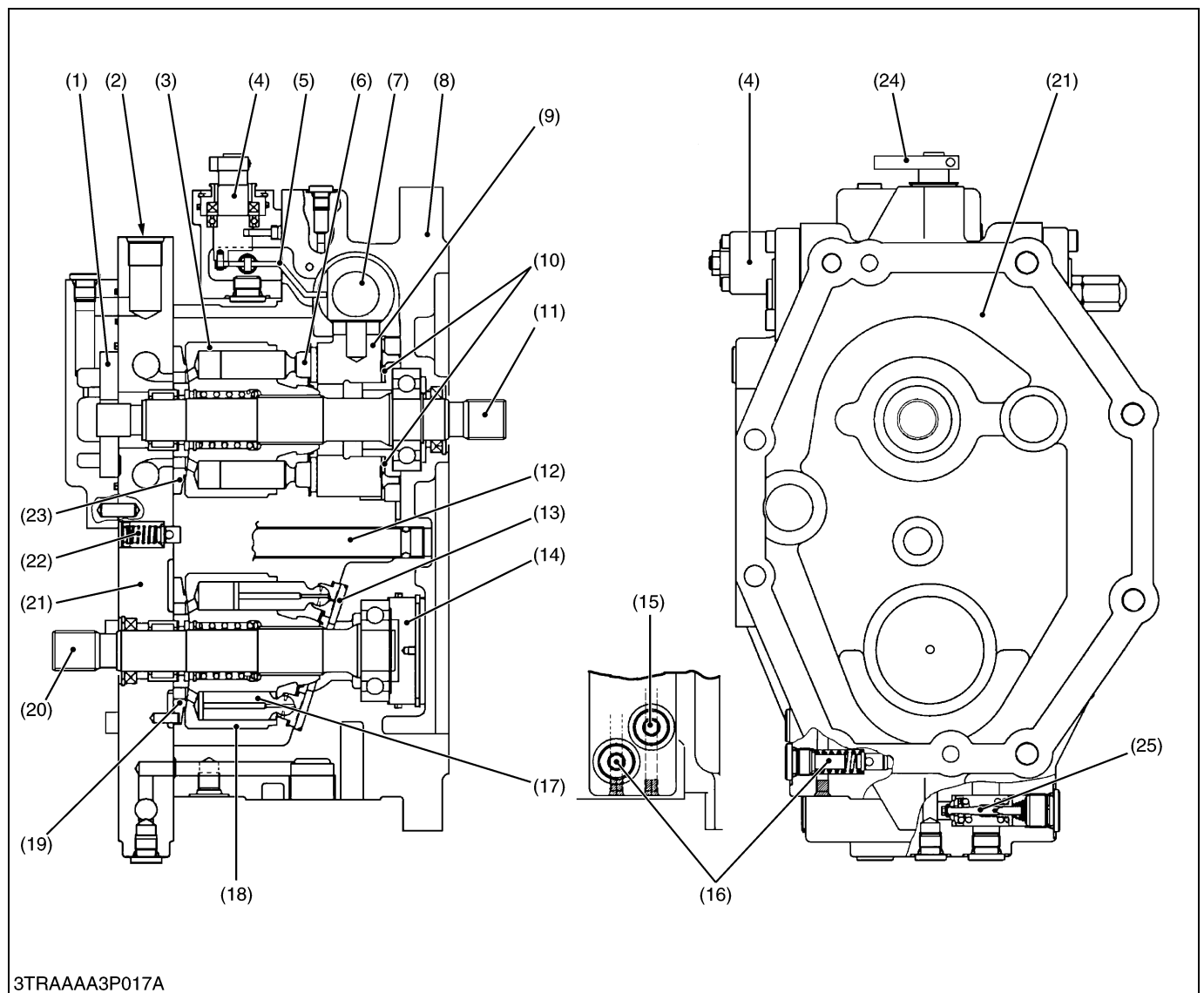


- (1) Input Shaft (Pump Shaft)
- (2) Housing
- (3) Bypass Pipe
- (4) Oil Filter Cartridge
- (5) Check and High Pressure Relief Valve (Reverse)
- (6) Check and High Pressure Relief Valve (Forward)
- (7) Charge Relief Valve
- (8) Filter Protective Relief Valve
- (9) Output Shaft (Motor Shaft)
- (10) Case Relief Valve
- (11) Servo Piston Assembly
- (12) Servo Control Lever
- (13) Servo Regulator Assembly
- (14) Charge Pump Assembly
- (15) Center Section (Port Block)

W10128170



This hydrostatic transmission is the HST unit which is composed of variable displacement piston pump, fixed displacement piston motor, charge pump, valves and servomechanism. The rotation of input shaft is transferred to that of output shaft, which is changeable steplessly that is variable speed device. The servomechanism, connected to HST foot pedal, permits simple operation of the tractor, starting, stopping, increasing or decreasing speeds, changing the travelling direction, and even going up or down hills.

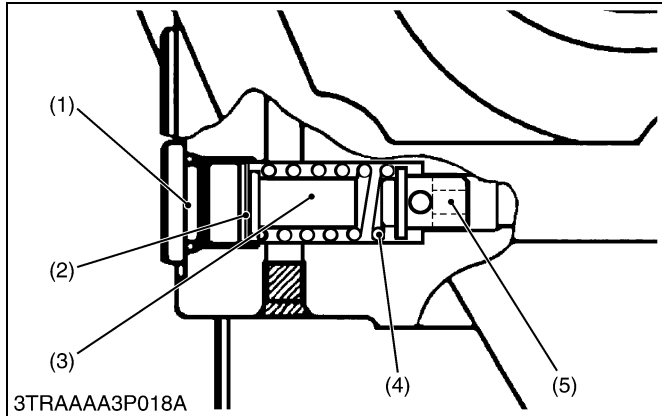


- | | | | |
|---------------------------|-------------------------------|-------------------------------------|---|
| (1) Charge Pump | (8) HST Housing | (15) Filter Protective Relief Valve | (21) Center Section (Port Block) |
| (2) Suction Port | (9) Variable Swashplate | (16) Charge Relief Valve | (22) Case Relief Valve |
| (3) Cylinder Block (Pump) | (10) Cradle Bearing | (17) Motor Piston | (23) Valve Plate |
| (4) Regulator | (11) Input Shaft (Pump Shaft) | (18) Cylinder Block (Motor) | (24) Control Lever |
| (5) Feedback Rod | (12) Connecting Pipe | (19) Valve Plate | (25) Check and High Pressure Relief Valve (Reverse) |
| (6) Pump Piston | (13) Thrust Plate | (20) Output Shaft (Motor Shaft) | |
| (7) Servo Piston | (14) Shaft Cover | | |

The hydrostatic transmission consists of a variable displacement piston pump (3), (6), fixed displacement piston motor (17), (18), charge pump (1), regulator (4), check and high pressure relief valve (25), charge relief valve (16) and filter protective relief valve (15).

HST pedal is connected to the regulator (4), (24) by the mechanical linkages. The servo piston (7) is operated by the regulator through hydraulic oil and operates variable swashplate (9).

[2] FUNCTION OF EACH COMPONENTS



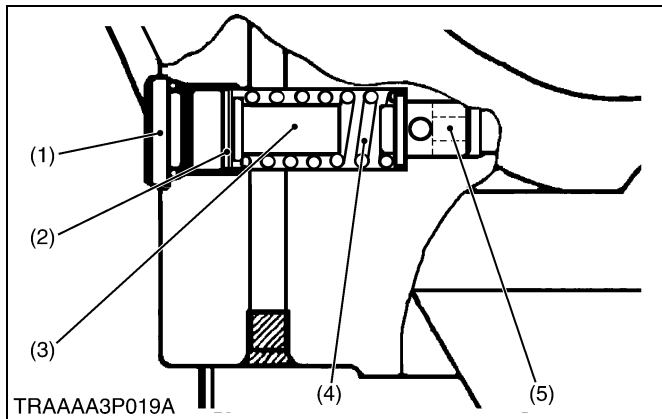
■ Charge Pump and Charge Relief Valve

The charge pump feeds oil to the HST main circuit (closed circuit) and the regulator. Oil may leak out of the HST main circuit (in the HST housing) depending on the pressure, oil temperature and other factors. With this in mind, oil must be constantly fed. The charge relief valve is located on the secondary side of the filter and serves to set the discharge pressure of the charge pump.

Oil temperature	Valve operating pressure
50 °C (122 °F)	2.35 to 2.55 MPa 24 to 26 kgf/cm ² 342 to 370 psi

- (1) Plug
- (2) Shim
- (3) Spring Guide
- (4) Spring
- (5) Valve Poppet

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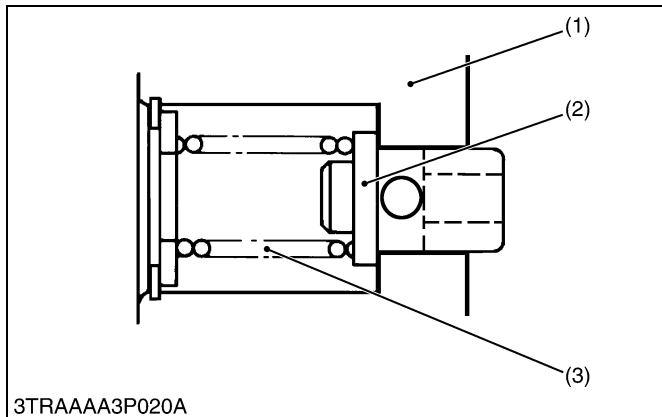


■ Filter Protective Relief Valve

Located on the primary side of the filter, this valve serves to prevent an overpressure that would occur due to a resistance through the filter at a low-temperature start. A setting pressure of this valve is set about 294 kPa (3 kgf/cm², 43 psi) more than charge relief valve setting pressure.

- (1) Plug
- (2) Shim
- (3) Spring Guide
- (4) Spring
- (5) Valve Poppet

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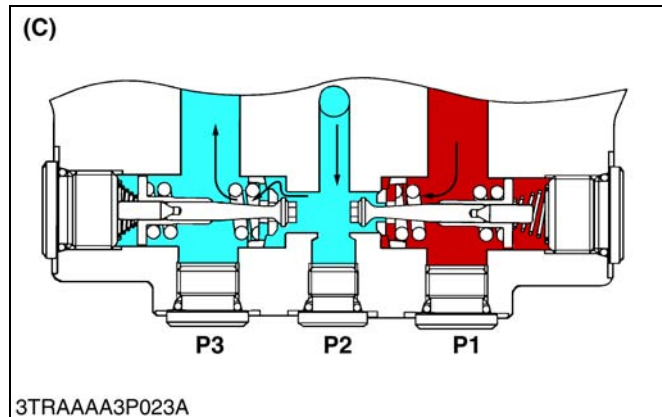
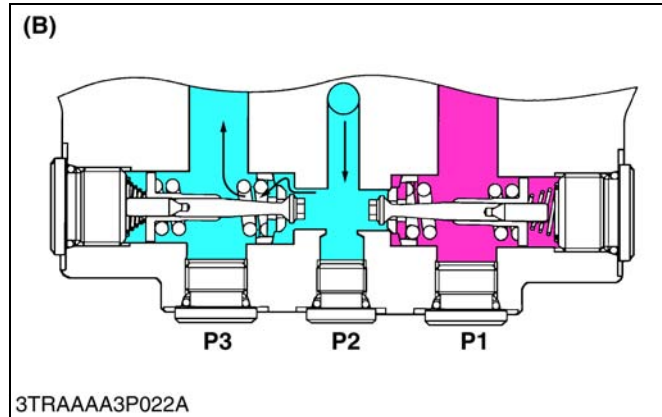
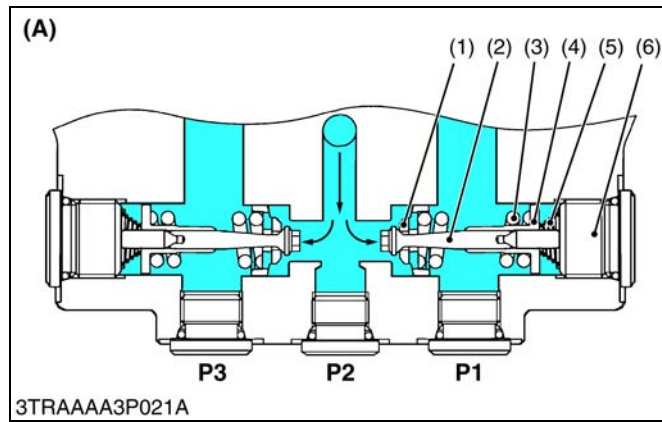


■ Case Relief Valve

The case relief valve monitors the oil pressure in the hydrostatic transmission case. When the oil pressure raised, it opens and flows the oil directly to the transmission case, so that the oil may not leak against the sealings.

- (1) Center Section (Port Block)
- (2) Valve Poppet
- (3) Spring

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■ Check and High Pressure Relief Valve

The cartridge-type check and high-pressure relief valve consists of pressure poppet (2), check valve seat (1), relief valve spring (3), spring guide (4) and check valve spring (5). The spring guide (4) is provided with an anti-rotation, which keeps the threads tight after a pressure has been set.

The valve is used to prevent an overload that would happen at a quick start, sudden stop or even during usual running. This valve doubles as a check valve.

The check and high-pressure relief valves are laid out facing each other as shown in the figure.

In neutral, both valves are open and charging oil enters into the main oil circuit through the valves.

At normal operation, the check valve in the high-pressure side is closed and it pushes and opens the another one. An excessive charge flow goes through the charge relief valve into HST housing.

The check and high-pressure relief valve along the high-pressure line serves as a high-pressure relief valve. If the pressure exceeds a high-pressure limit level, the pressure poppet opens itself against the relief valve spring (3) force and opens the valve seat that is located between the check valve seat (1) and the pressure poppet (2). Now the flow goes from **P1 to P2 and P3**.

If the **P1** pressure drops, the relief valve spring forces the valve seat closed against the pressure. The high-pressure oil at **P1** does not flow to **P2** any longer.

As discussed above, the check and high-pressure relief valve protects engines, pumps, motors, gears and even the machine itself from overload.

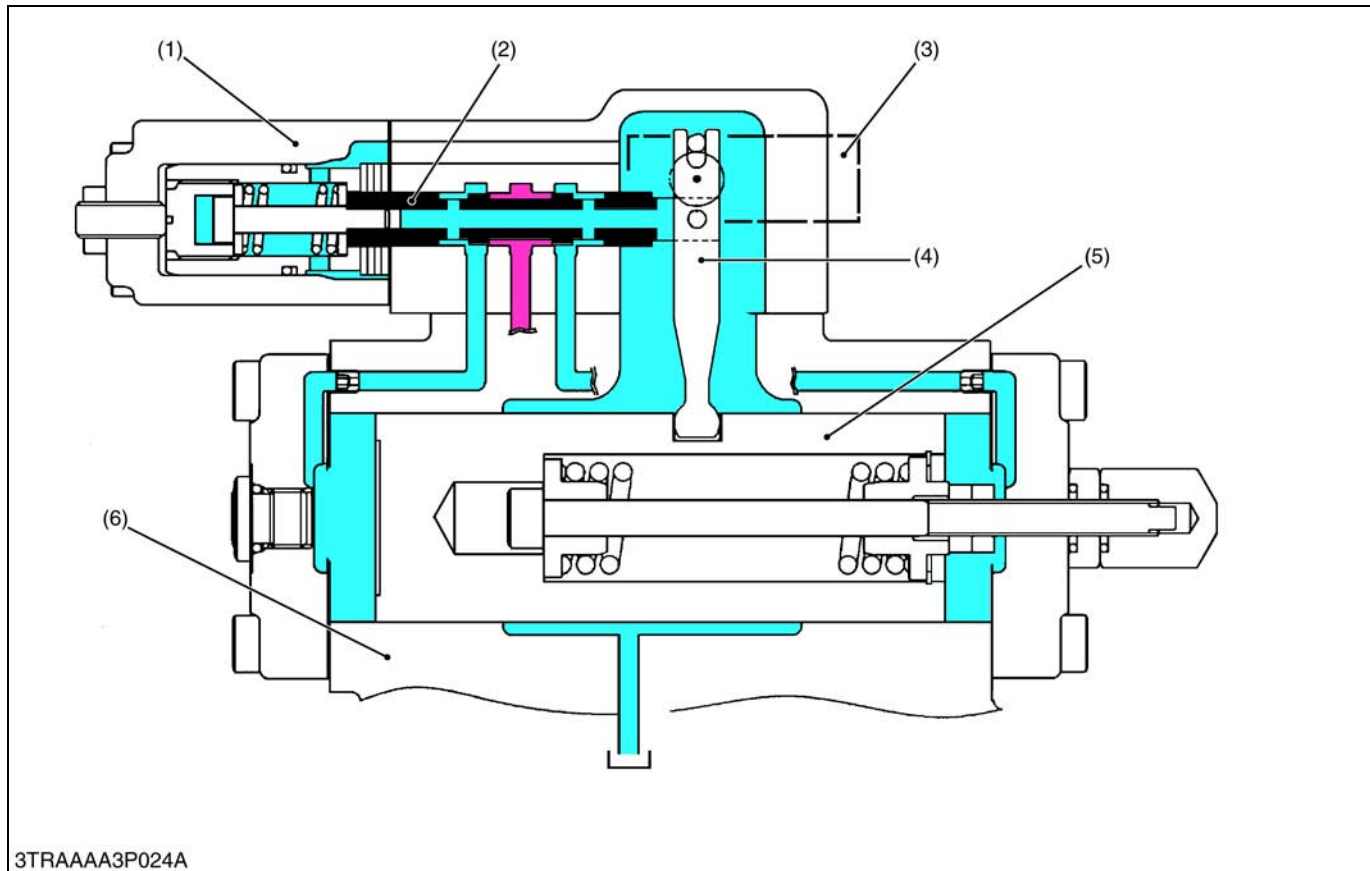
Oil temperature	Valve operating pressure
50 to 60 °C (122 to 140 °F)	33.3 to 35.3 MPa 340 to 360 kgf/cm ² 4836 to 5124 psi

- (1) Check Valve Seat
- (2) Pressure Poppet
- (3) Relief Valve Spring
- (4) Spring Guide
- (5) Check Valve Spring
- (6) Valve Plug

- (A) In Neutral (Stop)**
- (B) When Check Valve Activating (Normal Operation)**
- (C) When High Pressure Relief Valve Activating**

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■ Servomechanism



(1) Regulator Assembly
(2) Spool

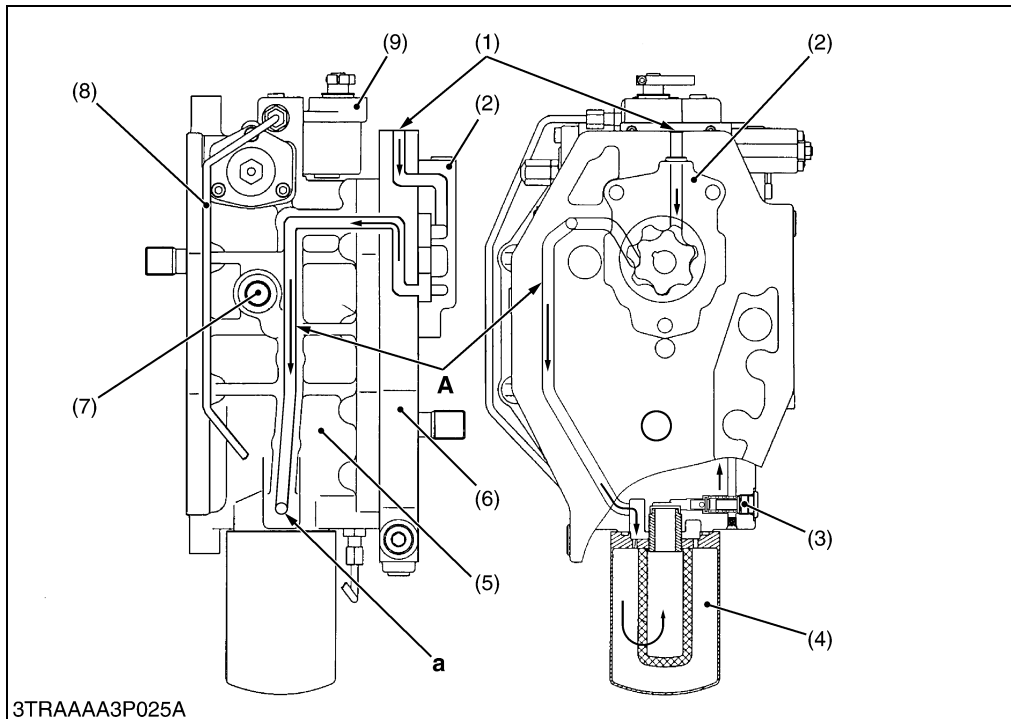
(3) Control Lever
(4) Feedback Lever

(5) Servo Piston

(6) HST Housing

The servomechanism is adapted in this HST, and a smooth pedal operation can be done. As for the servomechanism, the regulator (1) and servo piston (5) are chiefly composed. The regulator is connected to the HST pedal through linkages, and it controls the flow of oil in the servo piston by the pedal operation.

The servo piston moved by hydraulic force, is connected to the variable swashplate therefore a tilt angle of swashplate is varied by servo piston movement.

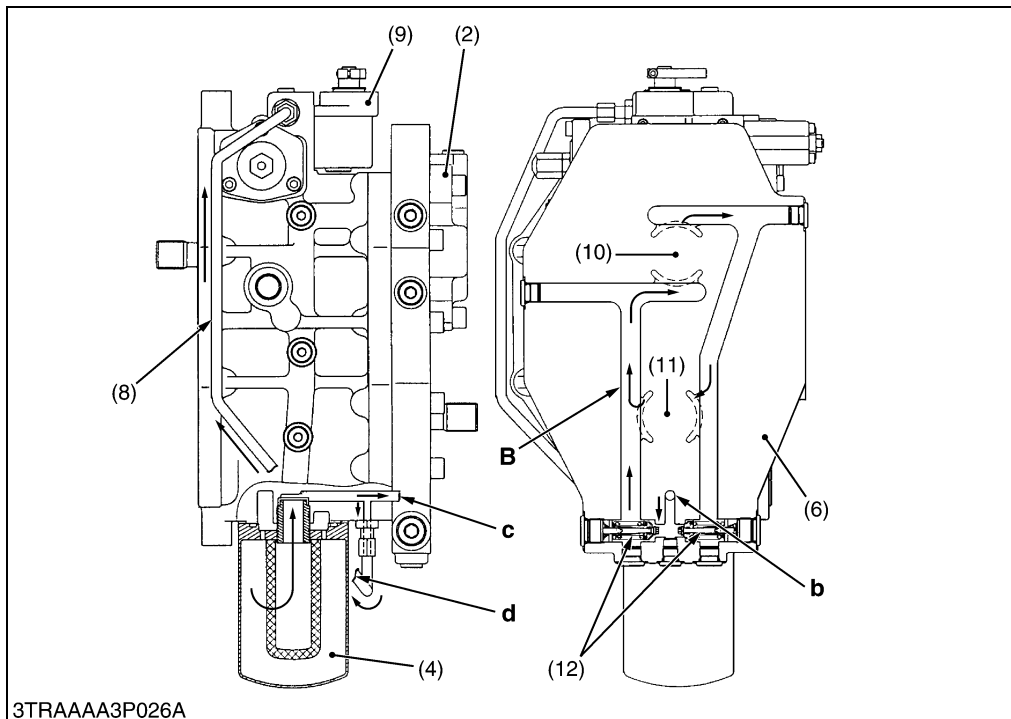
[3] OIL FLOW

- (1) Suction Port (From Transmission Case and Power Steering Return Line)
- (2) Charge Pump
- (3) Charge Relief Valve
- (4) Oil Filter
- (5) HST Housing
- (6) Port Block
- (7) Drain Port (To Oil Cooler)
- (8) Bypass Pipe
- (9) Servo Regulator
- (10) Pump Port (Variable Displacement Piston Pump)
- (11) Motor Port (Fixed Displacement Piston Motor)
- (12) Check and High Pressure Relief Valve

A : Oil Passage A
B : HST Main Circuit

a : To Oil Filter
b : From Oil Filter
c : To HST Main Circuit
d : To Regulator

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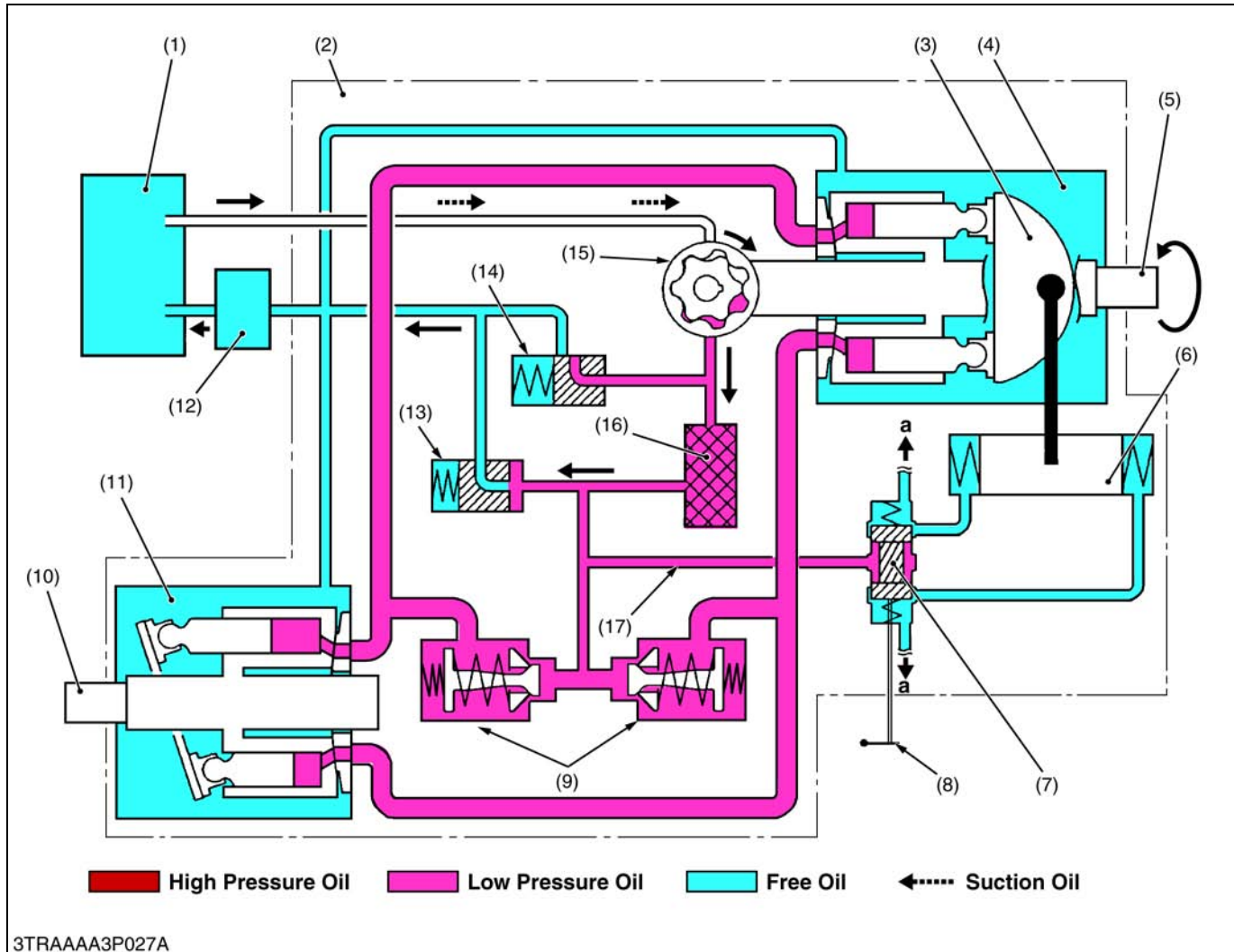


The oil comes in from the charge pump's suction port (1) and flows through the charge pump (2), oil passage "A", filter (4), and charge relief valve (3) into the housing (5). The oil, in the HST housing goes out of the drain port (7). The oil, in the HST housing coming into the filter (4) is balanced into the charge relief valve (3), HST main circuit (closed circuit), and regulator (9).

The oil in the HST main circuit gets circulated between the variable displacement piston pump (10) and the fixed displacement motor (11), which forms a closed circuit.

[4] OPERATION

■ Neutral

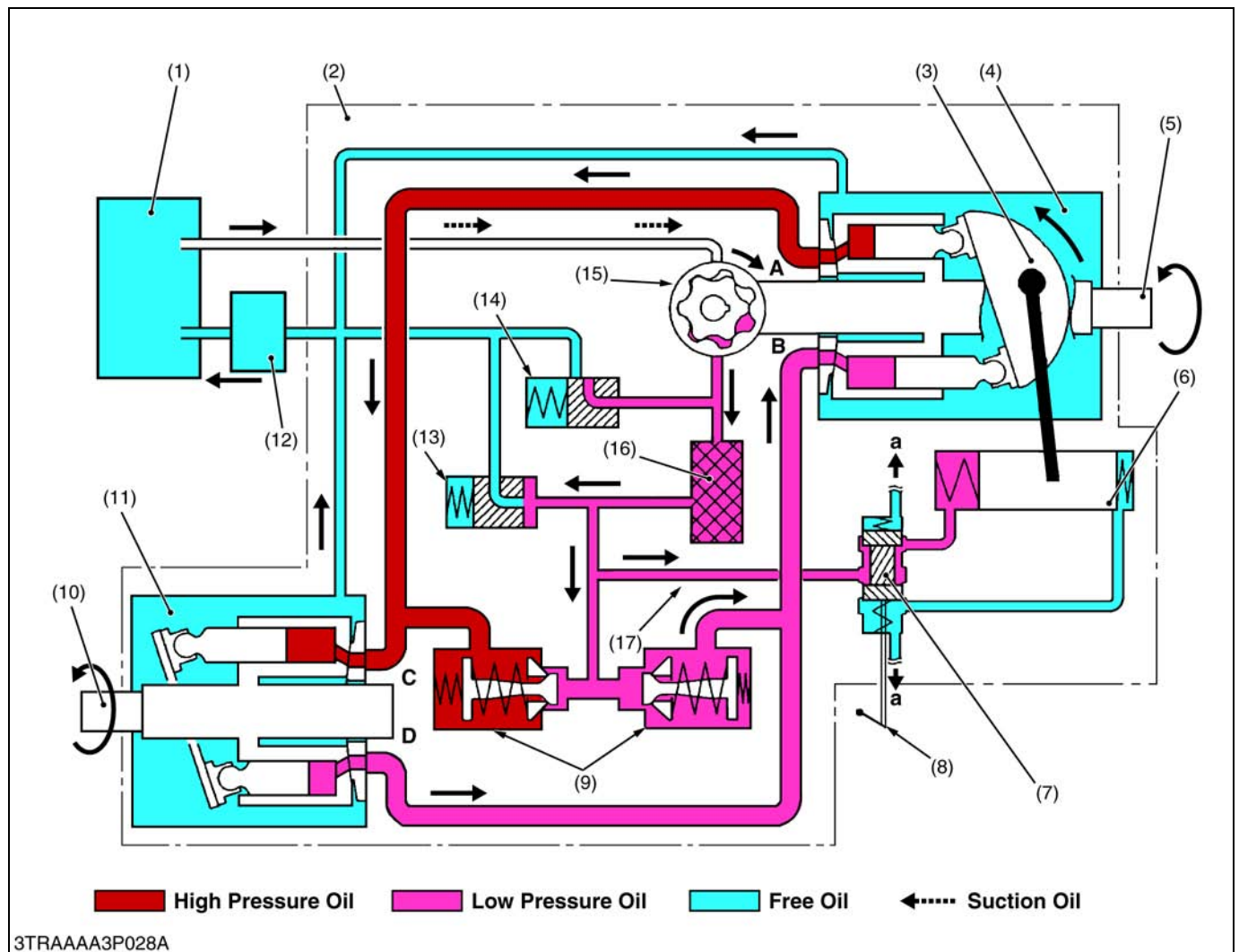


- | | | | |
|-------------------------|--|-------------------------------------|---------------------------|
| (1) Transmission Case | (7) Regulator | (11) Motor Cylinder | (16) Oil Filter |
| (2) HST Housing | (8) HST Pedal (Control Lever) | (12) Oil Cooler | (17) Bypass Pipe |
| (3) Variable Swashplate | (9) Check and High Pressure Relief Valve | (13) Charge Relief Valve | |
| (4) Pump Cylinder | (10) Output Shaft | (14) Filter Protective Relief Valve | a : To HST Housing |
| (5) Input Shaft | | (15) Charge Pump | |
| (6) Servo Piston | | | |

The sucked oil from the transmission case (1) by the charge pump (15) flows into the HST housing (2) and regulator (7) through the oil filter (16) and charge relief valve (13). Overflow oil from HST housing (2) returns to the transmission case (1) through the oil cooler (12).

When the HST pedal (8) is in neutral, regulator (7) is not activated, so the variable swashplate (3) is at right angles to the pump pistons and they only rotate with cylinder block (4) without reciprocation. Since the oil is not being pumped to motor, the cylinder block in the motor (11) is stationary and the output shaft (10) does not rotate.

■ Forward



- | | | | |
|-------------------------|--|-------------------------------------|---------------------------|
| (1) Transmission Case | (7) Regulator | (12) Oil Cooler | A : Pump Port A |
| (2) HST Housing | (8) HST Pedal (Control Lever) | (13) Charge Relief Valve | B : Pump Port B |
| (3) Variable Swashplate | (9) Check and High Pressure Relief Valve | (14) Filter Protective Relief Valve | C : Motor Port C |
| (4) Pump Cylinder | (10) Output Shaft | (15) Charge Pump | D : Motor Port D |
| (5) Input Shaft | (11) Motor Cylinder | (16) Oil Filter | a : To HST Housing |
| (6) Servo Piston | (17) Bypass Pipe | | |

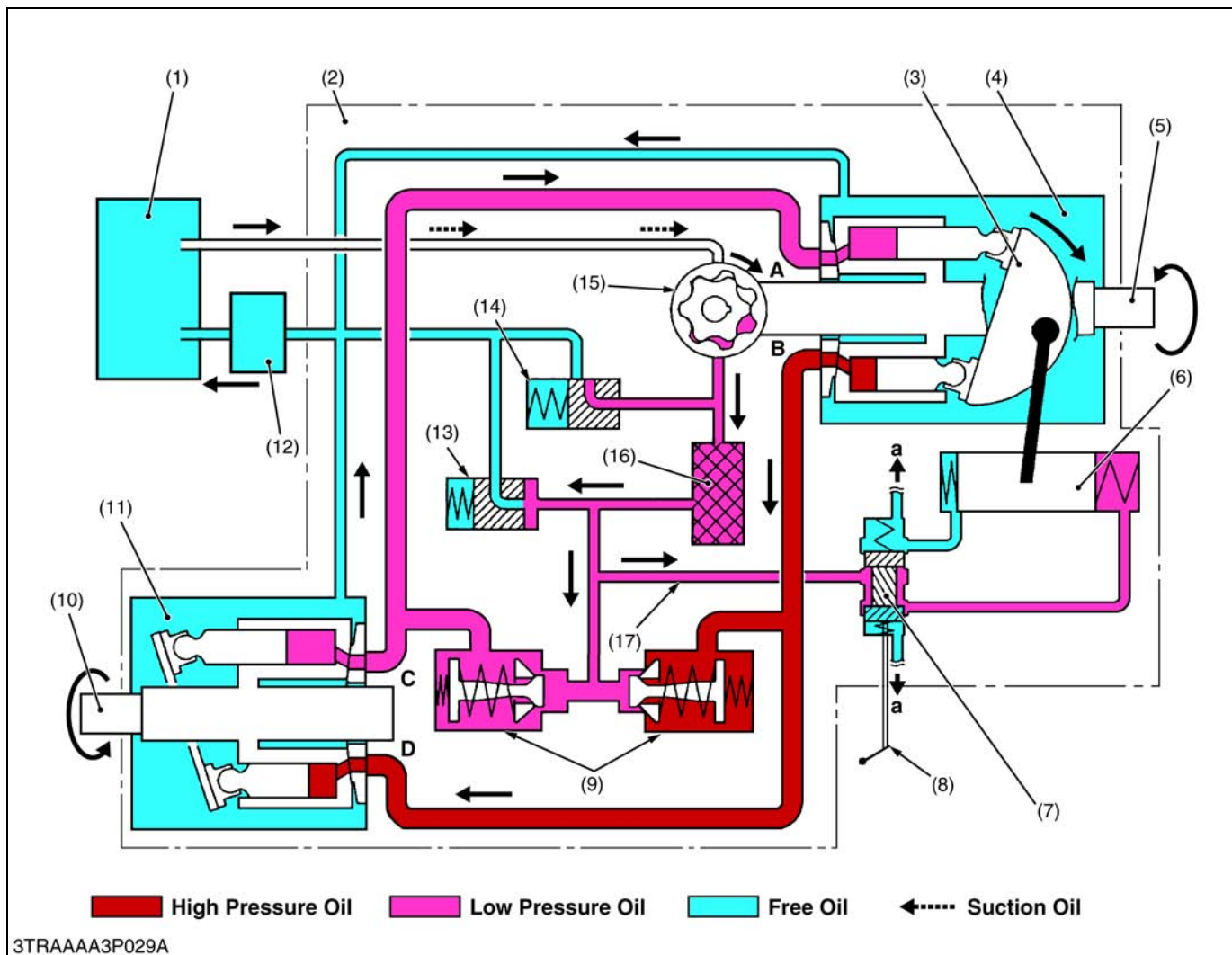
When the HST pedal (8) is stepped on and in forward, the regulator (7) is actuated, so the variable swashplate (3) is tilted as shown in figure above.

As the pump cylinder block (4) rotates with the input shaft (5), oil is forced out of pump port **A** at high pressure. As pressure oil enters motor port **C**, the pistons, which align with port **C**, are pushed against the thrust plate and slide down inclined surface.

Then the output shaft (10) rotates with the motor cylinder block (11). This drives the machine forward and the angle of pump swashplate determines the output shaft speed.

As the motor cylinder block continues to rotate, oil is forced out of motor port **D** at low pressure and returns to the pump.

Reverse



- | | | | |
|-------------------------|--|-------------------------------------|---------------------------|
| (1) Transmission Case | (7) Regulator | (12) Oil Cooler | A : Pump Port A |
| (2) HST Housing | (8) HST Pedal (Control Lever) | (13) Charge Relief Valve | B : Pump Port B |
| (3) Variable Swashplate | (9) Check and High Pressure Relief Valve | (14) Filter Protective Relief Valve | C : Motor Port C |
| (4) Pump Cylinder | (10) Output Shaft | (15) Charge Pump | D : Motor Port D |
| (5) Input Shaft | (11) Motor Cylinder | (16) Oil Filter | a : To HST Housing |
| (6) Servo Piston | | (17) Bypass Pipe | |

When the HST pedal (8) is stepped on and in reverse, the variable swashplate (3) is tilted as shown in figure above.

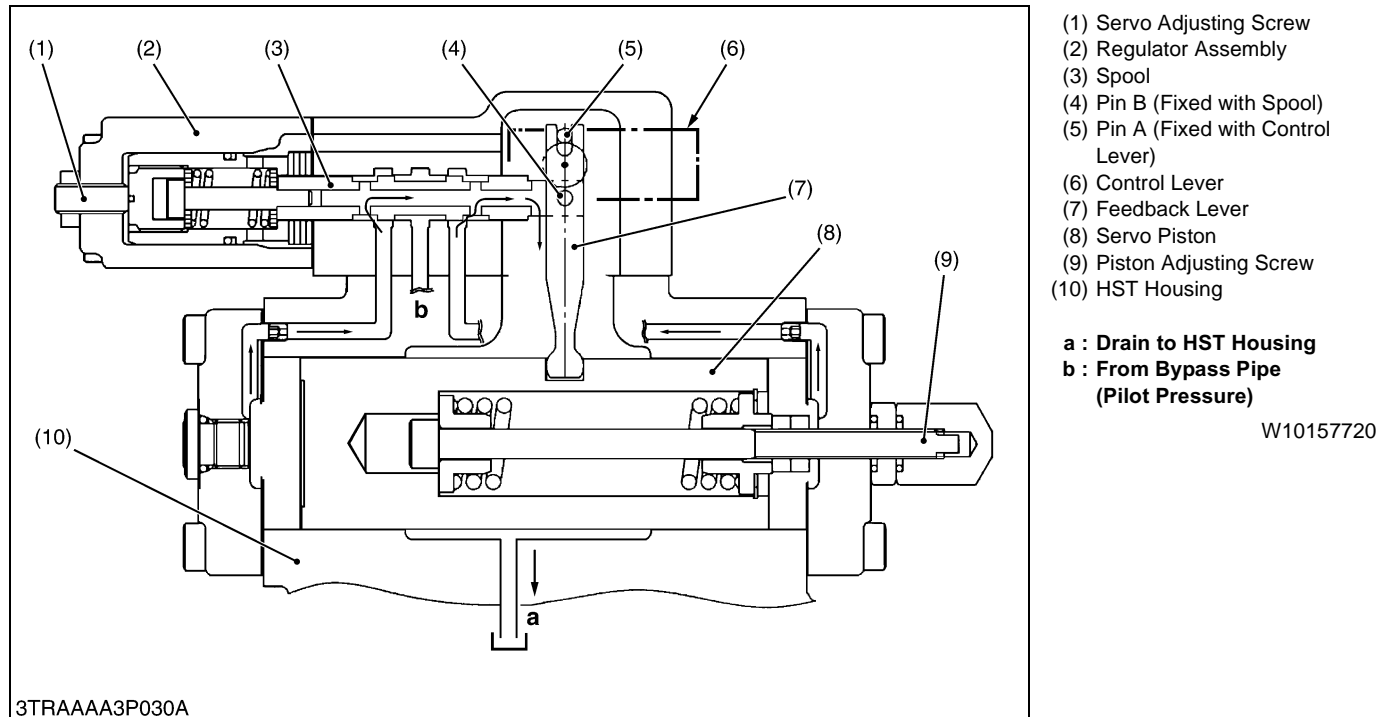
As the pump cylinder block (4) rotates with the input shaft (5), oil is forced out of pump port **B** at high pressure. As pressure oil enters motor port **D**, the pistons, which align with port **D**, are pushed against the thrust plate and slide down inclined surface.

Then the output shaft (10) rotates with the motor cylinder block (11). This drives the machine rearward and the angle of pump swashplate determines the output shaft speed.

As the motor cylinder block continues to rotate, oil is forced out of motor port **C** at low pressure and returns to the pump.

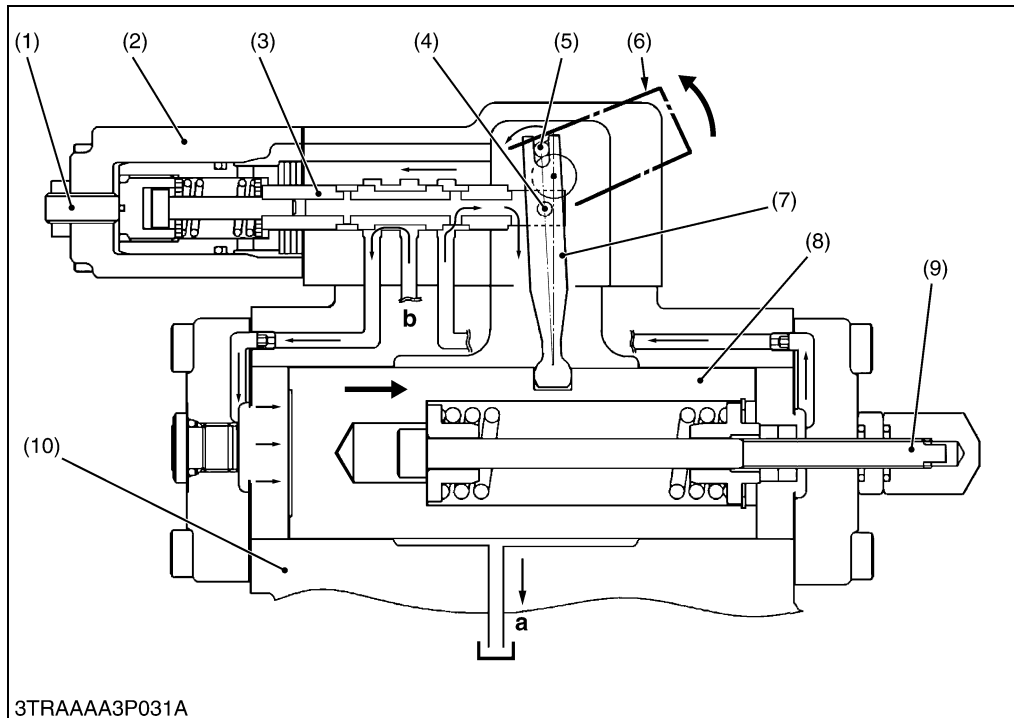
■ Regulator and Servo Piston Operation

i) Control Lever at Neutral



The spool (3) is situated at the neutral position that is preset with the servo adjusting screw (1). Both ends of the servo piston (8) get connected to the drain port and held at the neutral position that is preset with piston adjusting screw (9).

ii) Control Lever Activated (First Step)



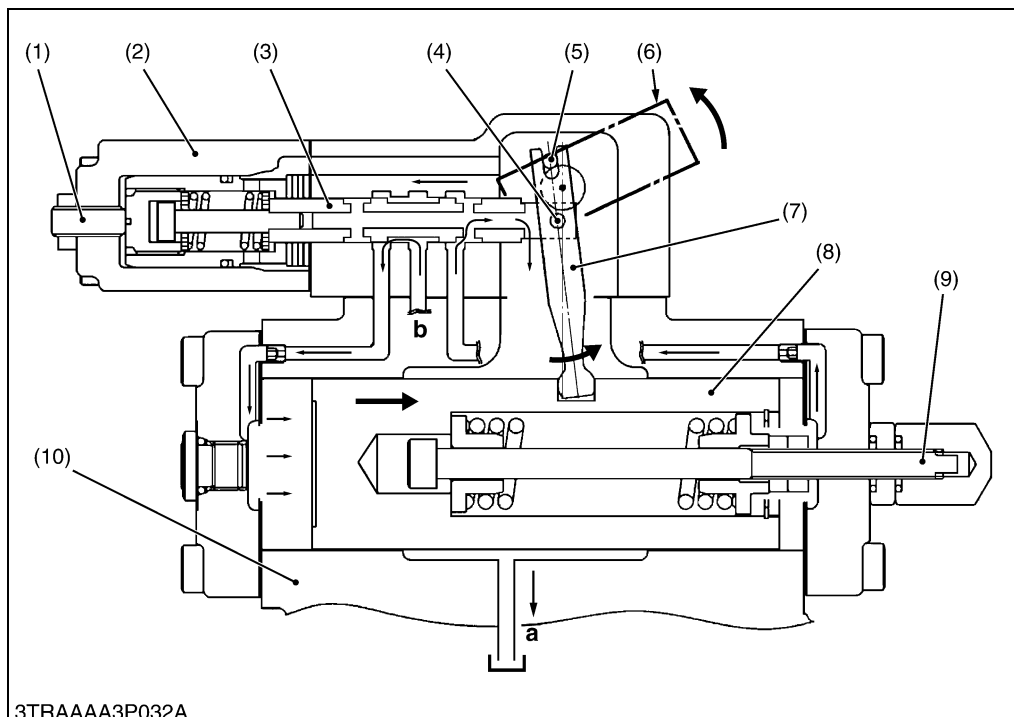
- (1) Servo Adjusting Screw
- (2) Regulator Assembly
- (3) Spool
- (4) Pin B (Fixed with Spool)
- (5) Pin A (Fixed with Control Lever)
- (6) Control Lever
- (7) Feedback Lever
- (8) Servo Piston
- (9) Piston Adjusting Screw
- (10) HST Housing

a : Drain to HST Housing
b : From Bypass Pipe (Pilot Pressure)

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When the control lever (6) is activated, the feedback lever (7) starts also moving to shift the spool (3). The servo piston (8), now under the pilot pressure at one end, is pushed in the direction of arrow as shown in figure.

(Second Step)



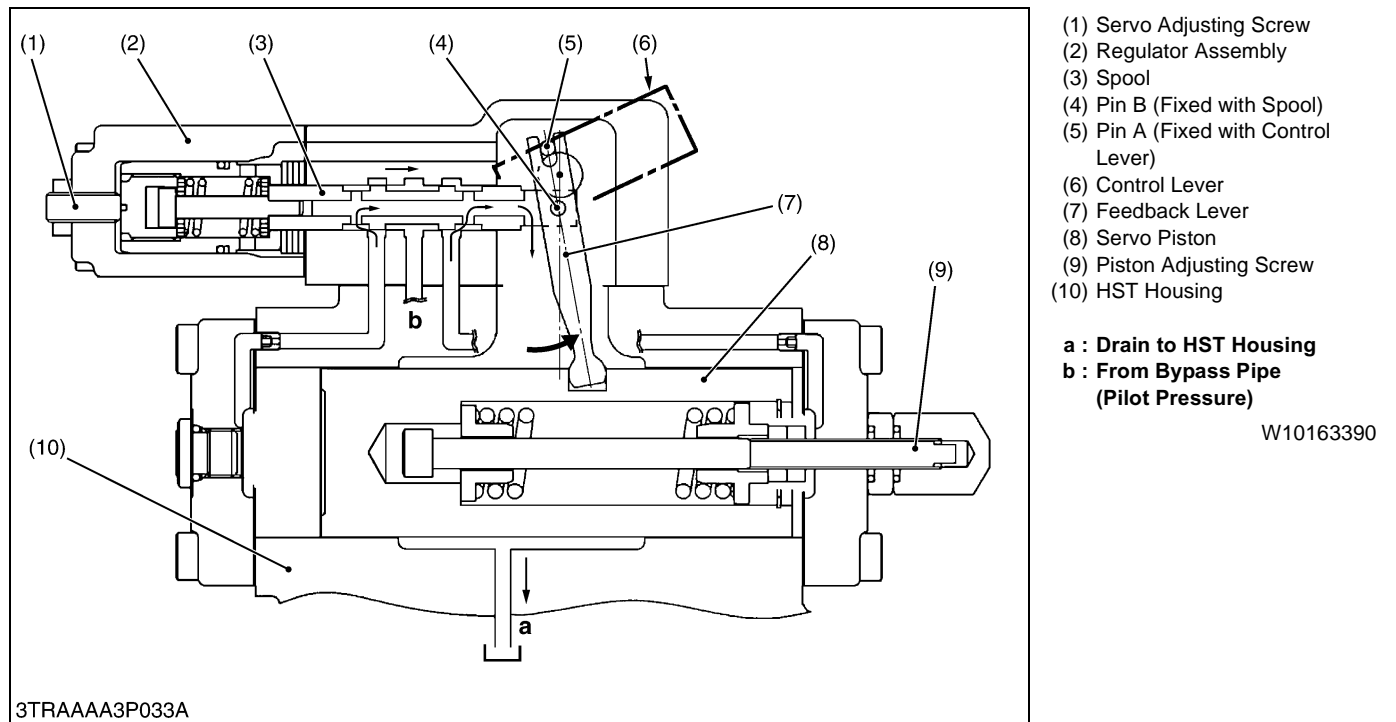
- (1) Servo Adjusting Screw
- (2) Regulator Assembly
- (3) Spool
- (4) Pin B (Fixed with Spool)
- (5) Pin A (Fixed with Control Lever)
- (6) Control Lever
- (7) Feedback Lever
- (8) Servo Piston
- (9) Piston Adjusting Screw
- (10) HST Housing

a : Drain to HST Housing
b : From Bypass Pipe (Pilot Pressure)

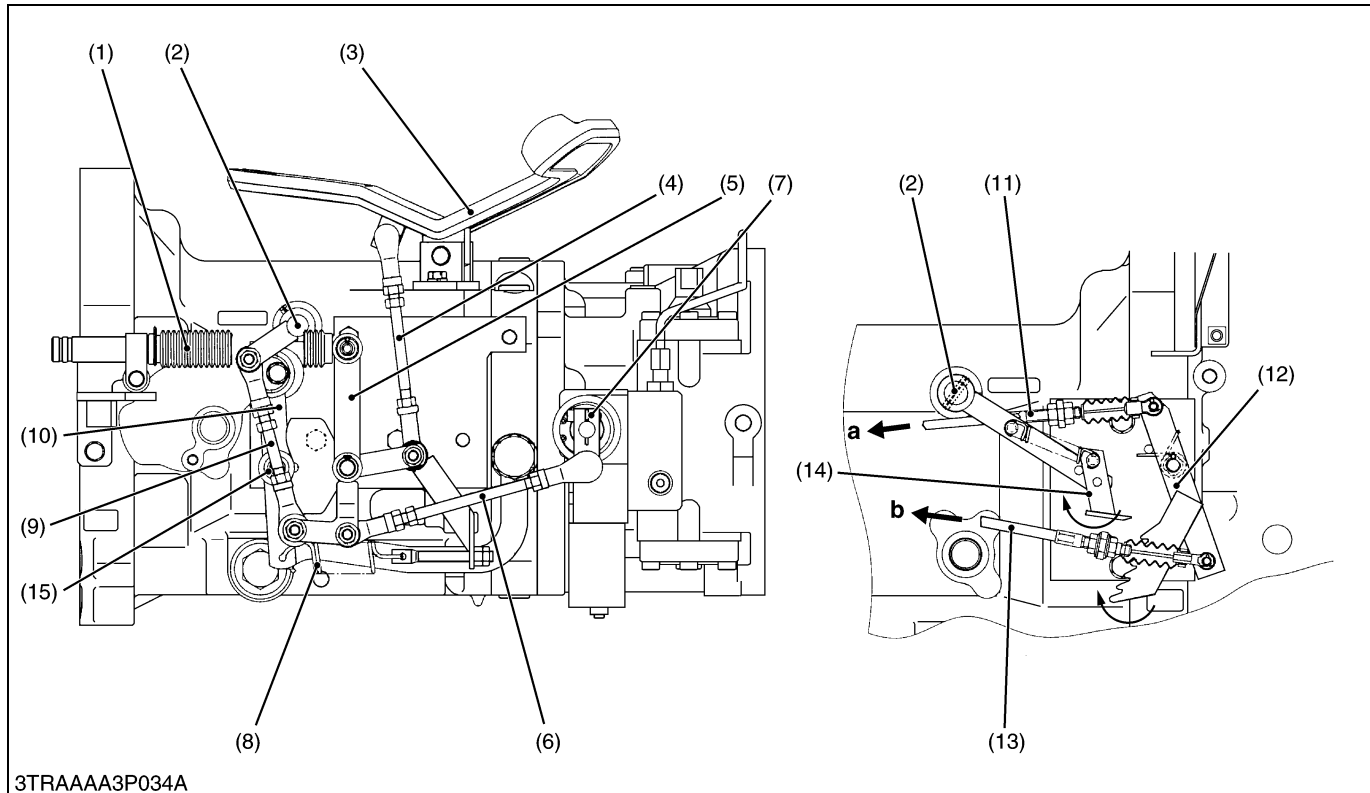
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By this motion of the servo piston (8), the feedback lever (7) causes the spool (3) to come back to its original position.

iii) Control Lever Deactivated



When the control lever (6) is deactivated, the spool (3) finally goes back to the position shown in the figure. The servo piston (8) gets well balanced according to the turning angle of the control lever (6).

[5] CONTROL LINKAGE

- | | | | |
|---------------------------|-----------------------------------|------------------------------|----------------------------|
| (1) Damper | (7) HST Control Lever | (12) Cruise Control Arm | a : To Brake Pedal |
| (2) Connecting Shaft | (8) Neutral Spring | (13) Cruise Control Cable | b : To Cruise Lever |
| (3) HST Pedal | (9) Cruise Control Rod | (Connected to Cruise Control | |
| (4) Speed Control Rod | (10) Neutral Holder | Lever) | |
| (5) Neutral Holder Arm | (11) Cruise Control Release Cable | (14) Cruise Control Hook | |
| (6) Neutral Adjusting Rod | (Connected to Brake Pedal) | (15) Ball Bearing | |

The speed control pedal (HST pedal) (3) and the HST control lever (7) are linked with the speed control rod (4), neutral holder arm (5) and neutral adjusting rod (6).

As the front footrest of the pedal is depressed, the HST control lever (7) is rotated, then the swashplate is tilted by servomechanism and forward travelling speed increases.

Then, the swashplate is returned to neutral with the neutral holder arm (5), when the pedal is released. The ball bearing (15) on the neutral holder (10) pulled with the neutral spring (8) seats the detent of the neutral holder arm (5) so that the neutral holder arm returns to neutral.

The damper (1) is connected to the HST pedal (3) through speed control rod (4) and neutral holder arm (5), restricts the movement of the linkage to prevent abrupt operation or reversing.

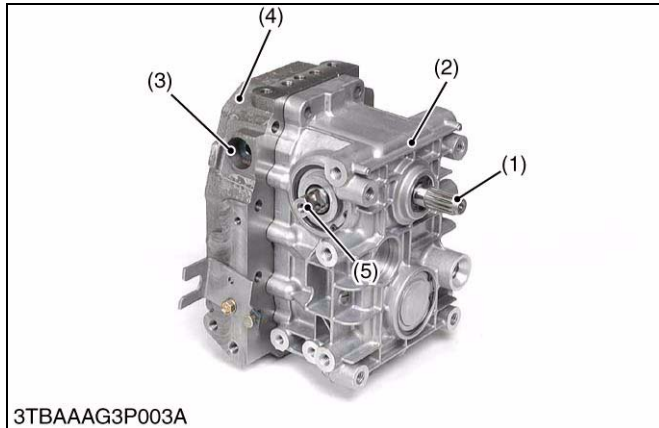
The cruise control lever (speed set lever) linked to the HST pedal enables the linkage not to return to neutral and keep a certain forward speed while the HST pedal is released.

The HST pedal (3) and the cruise control hook (14) are linked with the speed control rod (4), neutral holder arm (5), cruise control rod (9) and connecting shaft (2). The cruise control lever is connected to cruise control arm (12) through cruise control cable (13).

When the front footrest of the pedal is depressed and cruise control lever is pushed, the cruise control arm (12) and cruise control hook (14) are moved in the direction of arrow shown in figure above. The result was that speed is set. The cruise control arm (12) is also connected with brake pedal through cruise control release cable (13), so it can be released while depressed brake pedal.

7. HYDROSTATIC TRANSMISSION (TYPE 3) (Code No. 6C200-11604)

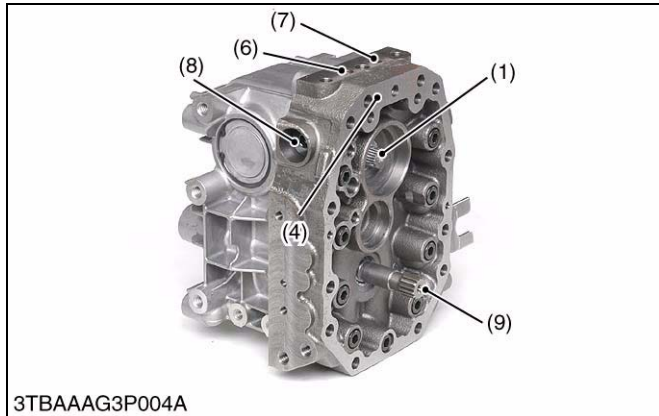
[1] STRUCTURE

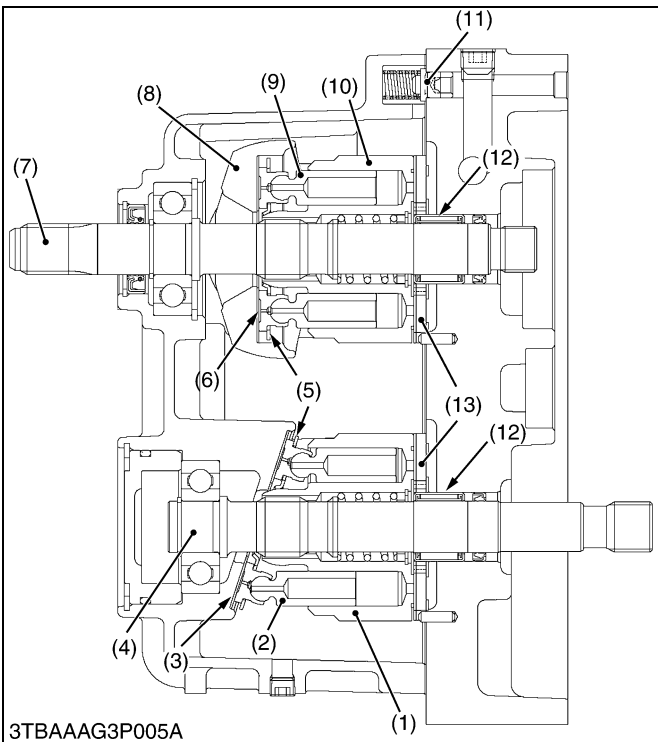


Hydrostatic transmission is composed of variable displacement piston pump, fixed displacement piston motor and valve system.

- | | |
|--|--|
| (1) Input Shaft (Pump Shaft) | (6) Check Port |
| (2) Housing | (7) Check Port |
| (3) Check and High Pressure Relief Valve (Reverse) | (8) Check and High Pressure Relief Valve (Forward) |
| (4) Center Section | (9) Output Shaft (Motor Shaft) |
| (5) Trunnion Shaft | |

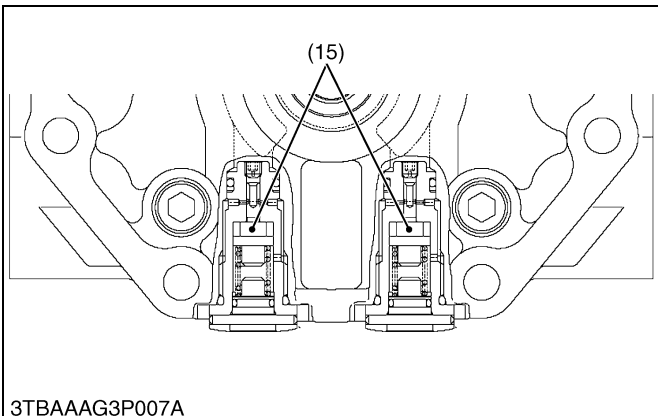
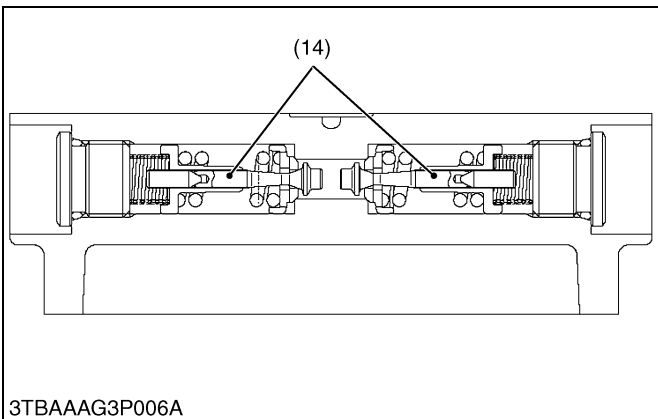
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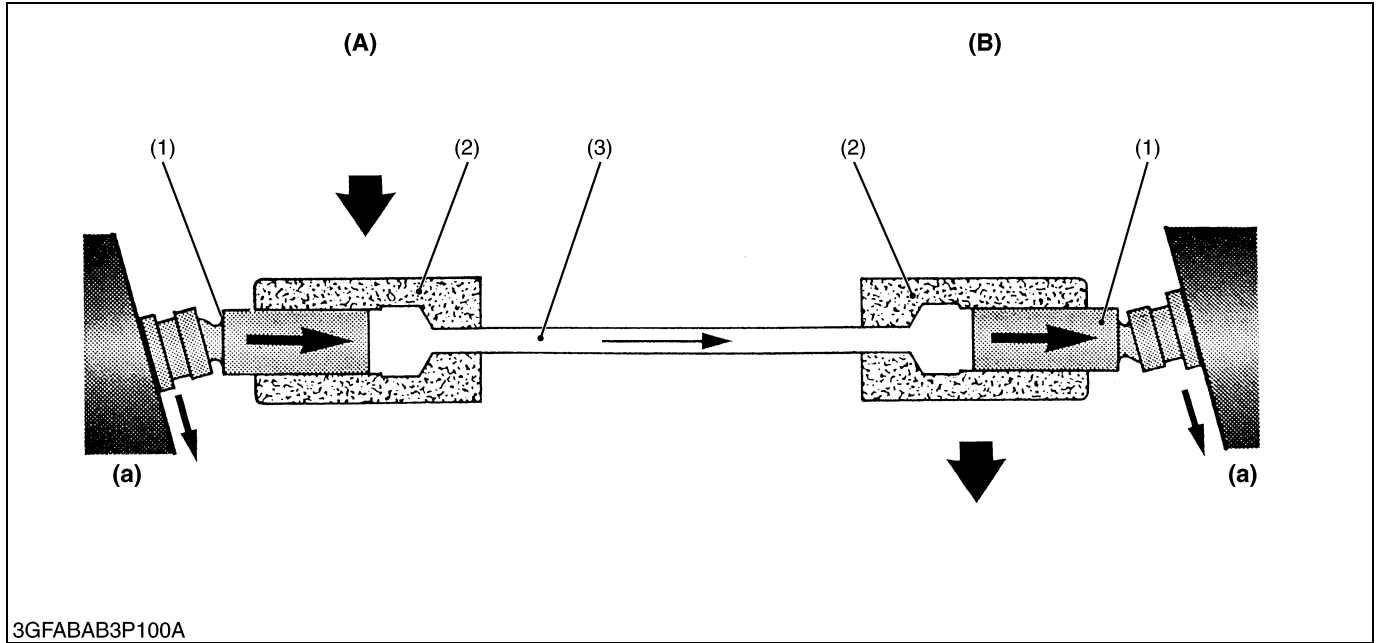


- (1) Cylinder Block (Motor)
- (2) Piston
- (3) Thrust Collar
- (4) Motor Shaft
- (5) Retainer Plate
- (6) Thrust Collar
- (7) Pump Shaft
- (8) Variable Swashplate
- (9) Piston
- (10) Cylinder Block (Pump)
- (11) Charge Relief Valve
- (12) Needle Bearing
- (13) Valve Plate
- (14) Check and High Pressure Relief Valve
- (15) Neutral Valve

W10285810



[2] PUMP AND MOTOR



3GFABAB3P100A

Pump and motor cylinder, each containing pistons, are connected by lines. Cylinders and lines are filled with oil. Piston ride against swashplates located in pump and motor.

In the pump, as the cylinder rotates, pistons move across the sloping face of swashplate and slide in or out of their cylinder bores. The oil forced out by the pump pistons, causes the motor pistons to slide out of their cylinder bores.

In the motor, sliding out of the cylinder and moving across the sloping face of swashplate, the pistons rotate the cylinder.

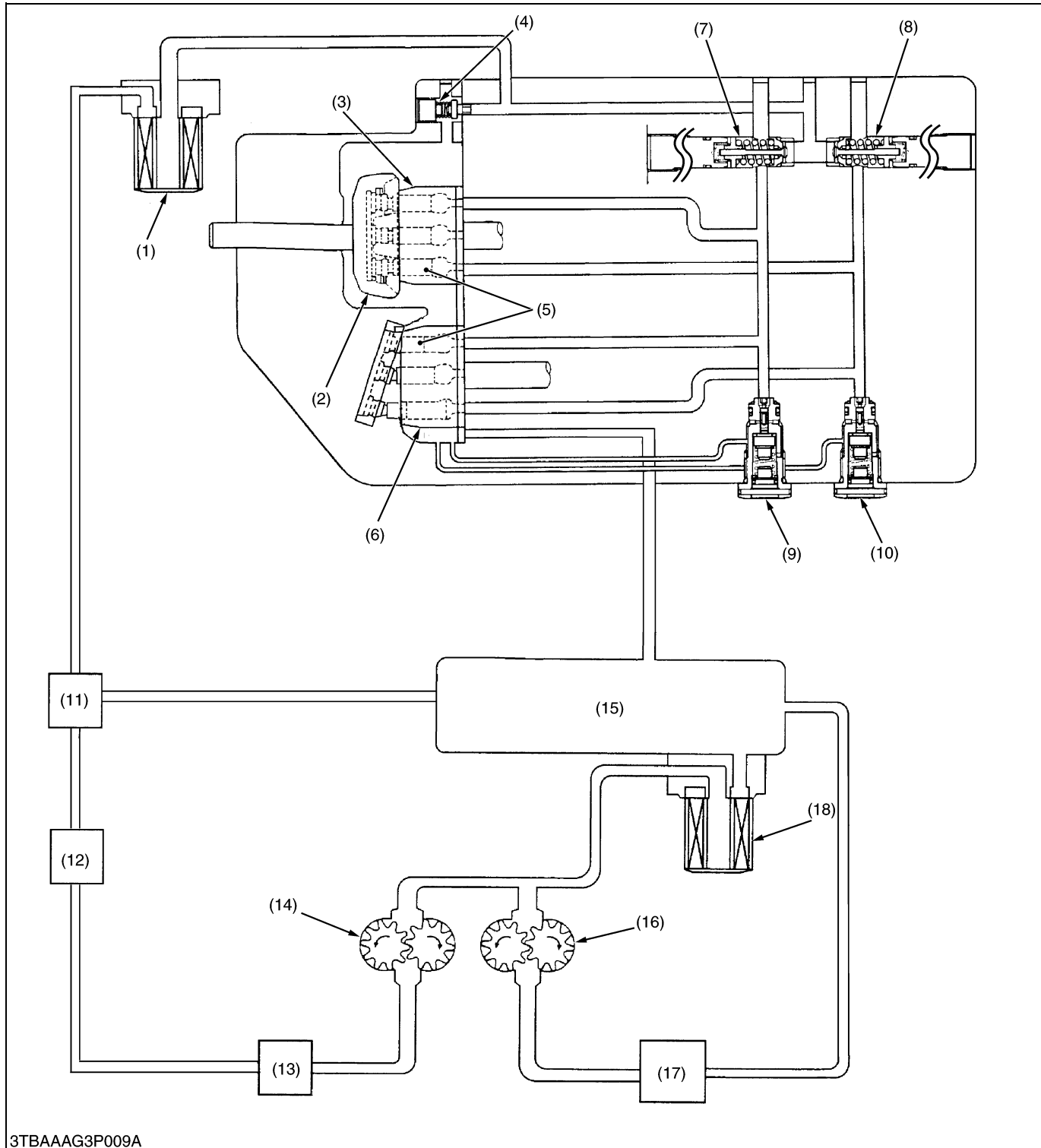
- (1) Piston
- (2) Cylinder

(3) Cylinder

A : Pump
B : Motor

(a) Swashplate

[3] OIL FLOW AND VALVES



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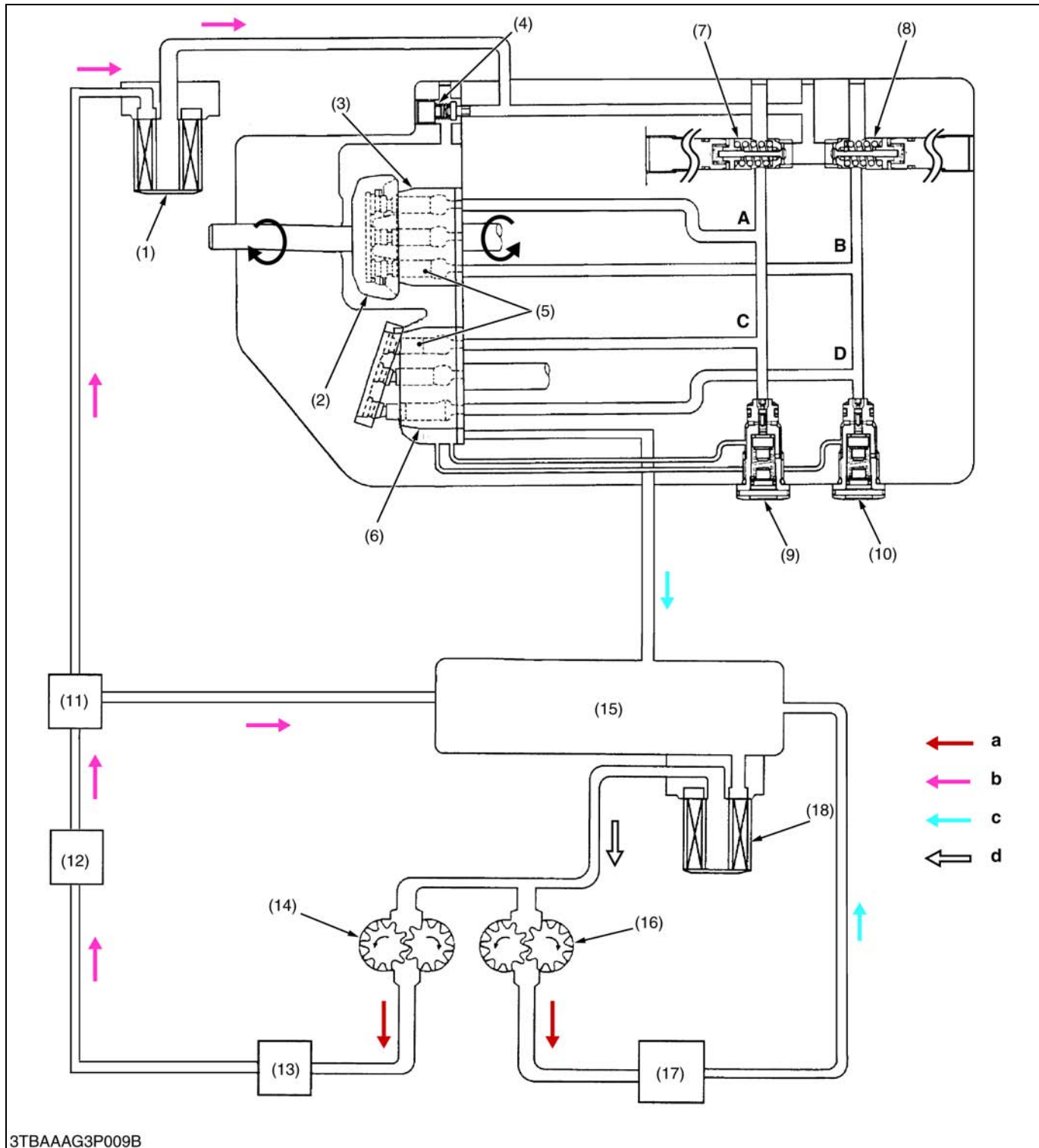
- | | | | |
|------------------------------------|--|--|---|
| (1) Oil Filter Cartridge (for HST) | (7) Check and High Pressure Relief Valve (for Forward) | (11) Independent PTO Control Valve | (15) Oil Tank |
| (2) Swashplate | (8) Check and High Pressure Relief Valve (for Reverse) | (12) Oil Cooler | (16) Hydraulic Pump (for 3-points Hitch) |
| (3) Cylinder Block (for Pump) | (9) Neutral Valve (for Forward) | (13) Power Steering | (17) Hydraulic Control Valve (for 3-points Hitch) |
| (4) Charge Relief Valve | (10) Neutral Valve (for Reverse) | (14) Hydraulic Pump (for Power Steering, Independent PTO, HST) | (18) Oil Filter Cartridge |
| (5) Piston | | | |
| (6) Cylinder Block (for Motor) | | | |

The pump and the motor are joined in a closed hydraulic circuit. Most of oil circulates with in the main oil circuit. A little oil lubricates and oozes out from the clearance between the moving parts in the case. Then oil in the main oil circuit of the HST needs to be supplied a want.

So all of oil fed from hydraulic pump flow to hydraulic transmission for charging and cooling.

The charge oil aids smooth operation of pistons for pump and motor. The charge oil passed to charge relief valve port. The rest of oil passed through the charge relief valve into the HST housing. And overflow oil from HST housing return to the transmission case.

■ Neutral



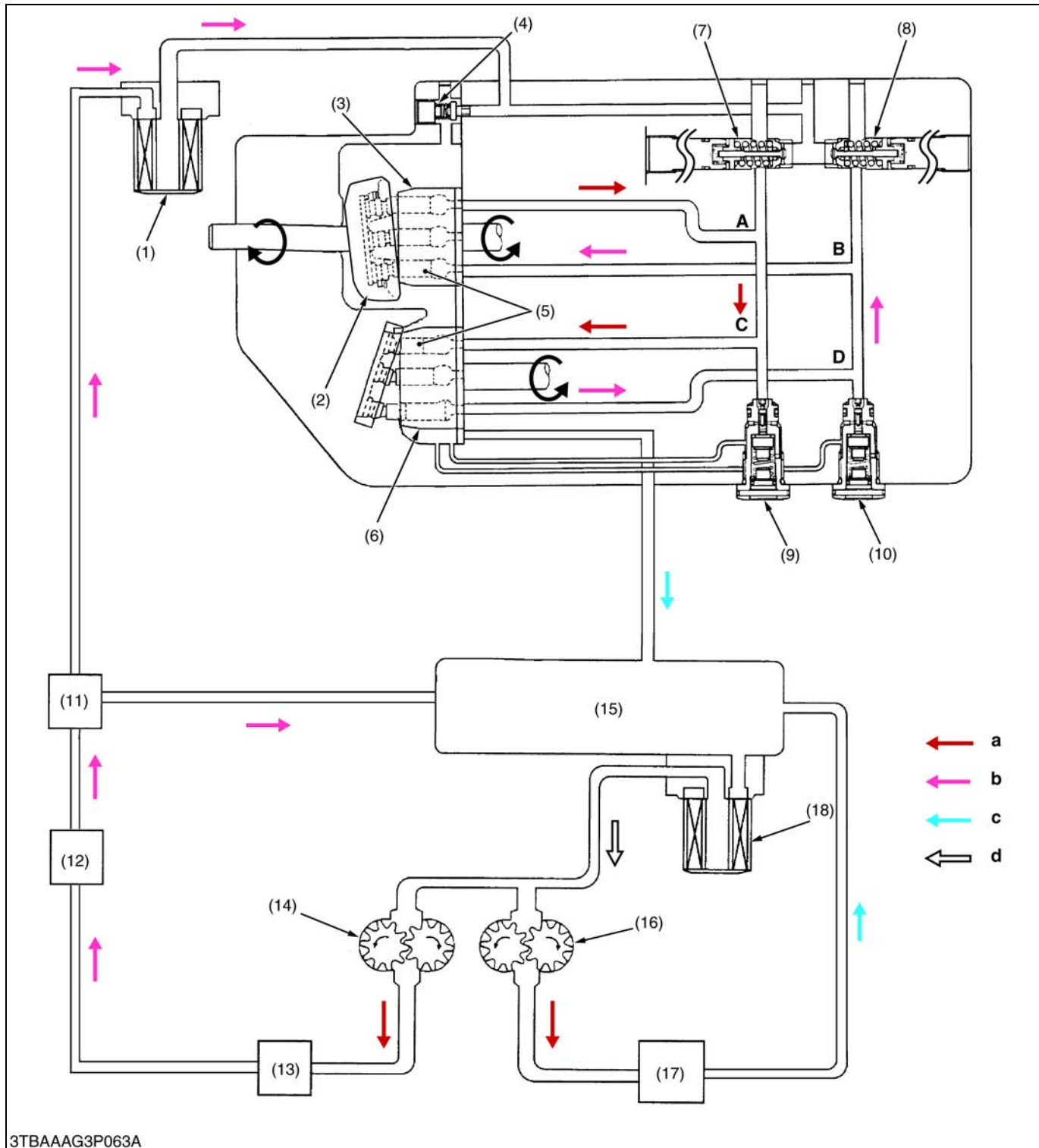
3TBAAAG3P009B

- | | | | |
|--|--|--|------------------------------|
| (1) Oil Filter Cartridge (for HST) | (8) Check and High Pressure Relief Valve (for Reverse) | (14) Hydraulic Pump (for Power Steering, Independent PTO, HST) | A : Pump A Port |
| (2) Swashplate | (9) Neutral Valve (for Forward) | (15) Oil Tank | B : Pump B Port |
| (3) Cylinder Block (for Pump) | (10) Neutral Valve (for Reverse) | (16) Hydraulic Pump (for 3-points Hitch) | C : Pump C Port |
| (4) Charge Relief Valve | (11) Independent PTO Control Valve | (17) Hydraulic Control Valve (for 3-points Hitch) | D : Pump D Port |
| (5) Piston | (12) Oil Cooler | (18) Oil Filter Cartridge | a : High Pressure Oil |
| (6) Cylinder Block (for Motor) | (13) Power Steering | | b : Low Pressure Oil |
| (7) Check and High Pressure Relief Valve (for Forward) | | | c : Free Oil |
| | | | d : Suction Oil |

When the speed control pedal is in "**NEUTRAL**", the variable swashplate is right-angles to the pump pistons. And the pump pistons only rotate with cylinder block (pump) without reciprocating.

Since the oil is not being pumped to the motor, the cylinder block (motor) is stationary. And the output shaft does not rotate.

■ Forward



- (1) Oil Filter Cartridge (for HST)
- (2) Swashplate
- (3) Cylinder Block (for Pump)
- (4) Charge Relief Valve
- (5) Piston
- (6) Cylinder Block (for Motor)
- (7) Check and High Pressure Relief Valve (for Forward)

- (8) Check and High Pressure Relief Valve (for Reverse)
- (9) Neutral Valve (for Forward)
- (10) Neutral Valve (for Reverse)
- (11) Independent PTO Control Valve
- (12) Oil Cooler
- (13) Power Steering

- (14) Hydraulic Pump (for Power Steering, Independent PTO, HST)
- (15) Oil Tank
- (16) Hydraulic Pump (for 3-points Hitch)
- (17) Hydraulic Control Valve (for 3-points Hitch)
- (18) Oil Filter Cartridge

- A : Pump A Port**
- B : Pump B Port**
- C : Pump C Port**
- D : Pump D Port**

- a : High Pressure Oil**
- b : Low Pressure Oil**
- c : Free Oil**
- d : Suction Oil**

When the speed control pedal is stepped on and set to "**FORWARD**", the variable swashplate is tilted as shown in figure above.

As the pump cylinder block rotates with the input shaft, oil is forced out of pump port **A** at high pressure. As pressure oil from the pump cylinder block enters to motor port **C**, the pistons, which align with port **C**, are pushed against the swashplate and slide down the inclined surface.

Then the output shaft rotates with the motor cylinder block. This drives the machine forward and the angle of pump swashplate determines the output speed.

As the motor cylinder block continues to rotate, oil is forced out of motor port **D** at low pressure and returns to the pump port **B**.

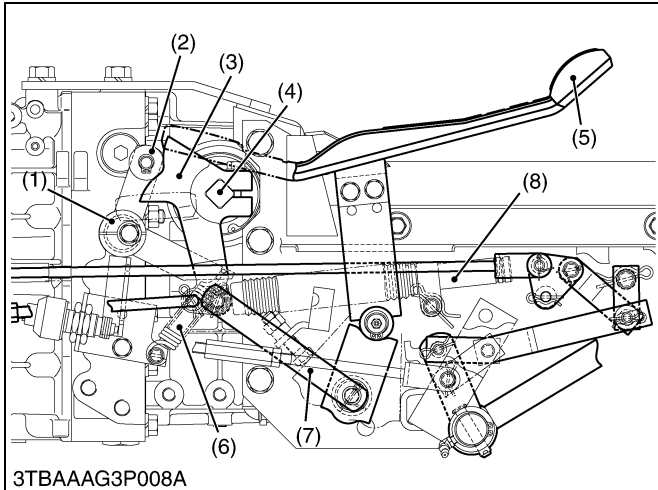
When the speed control pedal is stepped on and set to "**REVERSE**", the variable swashplate is tilted as shown in figure above.

As the pump cylinder block rotates with the input shaft, oil is forced out of pump port **B** at high pressure. AS pressure oil from the pump cylinder block enters to motor port **D**, the pistons, which align with port **D**, are pushed against the swashplate and slide down the inclined surface.

Then the output shaft rotates with the motor cylinder block. This drives the machine reward and the angle of pump swashplate determines the output speed.

As the motor cylinder block continues to rotate, oil is forced out of motor port **C** at low pressure and retunes to the pump port **A**.

[4] CONTROL LINKAGE



The HST pedal (5) and trunnion shaft (4) of variable swashplate are linked with the speed control rod (7) and the neutral holder (3). As the front footrest of the pedal is depressed, the swashplate rotates and forward travelling speed increases. Depressing the rear footrest increases reverse travelling speed.

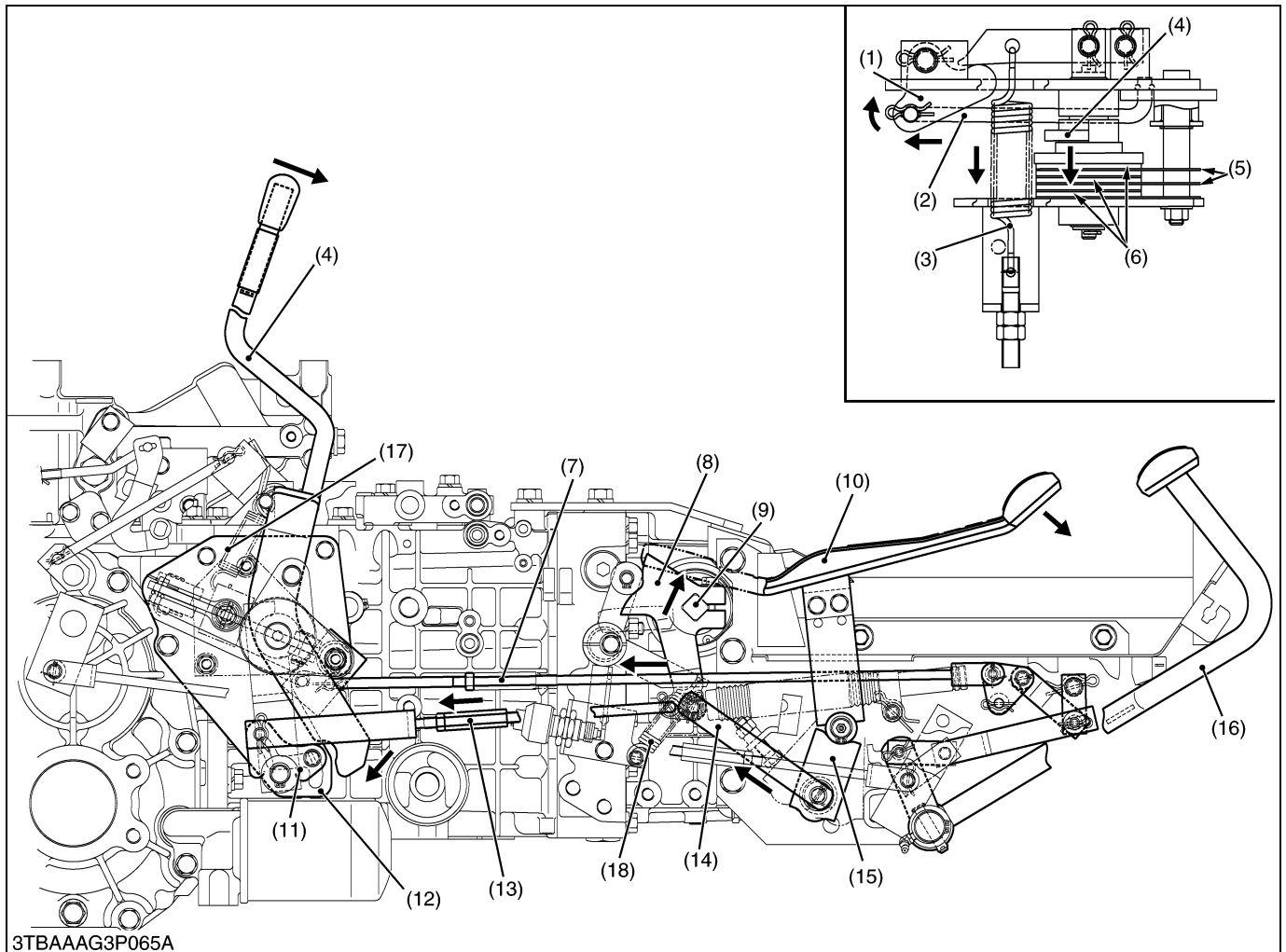
The roller (2) on the neutral holder arm (1) is held with spring seats and the detent of the neutral holder (3) so that the neutral holder (3) returns to neutral. When the pedal is released, the swashplate is returned to neutral with the neutral holder (3). The damper (8) connected to the HST pedal (5) restricts the movement of the linkage to prevent abrupt operation or reversing.

- | | |
|--------------------|-----------------------------|
| (1) Neutral Arm | (5) HST Pedal |
| (2) Roller | (6) Spring |
| (3) Neutral Holder | (7) Speed Control Rod (HST) |
| (4) Trunnion Shaft | (8) Damper |

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[5] CRUISE CONTROL LINKAGE

(1) Cruise Control



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- | | | | |
|---------------------------|--------------------|--------------------------|--------------------|
| (1) Release Lever 1 | (6) Friction Disk | (11) Control Lever Arm 2 | (16) Brake Pedal |
| (2) Cruise Release Rod | (7) Release Rod | (12) Cruise Control Base | (17) Return Spring |
| (3) Cruise holding Spring | (8) Neutral Holder | (13) Cruise Rod | (18) Return Spring |
| (4) Cruise Control Lever | (9) Trunnion Shaft | (14) HST Plate | |
| (5) Friction Plate | (10) HST Pedal | (15) HST Lever | |

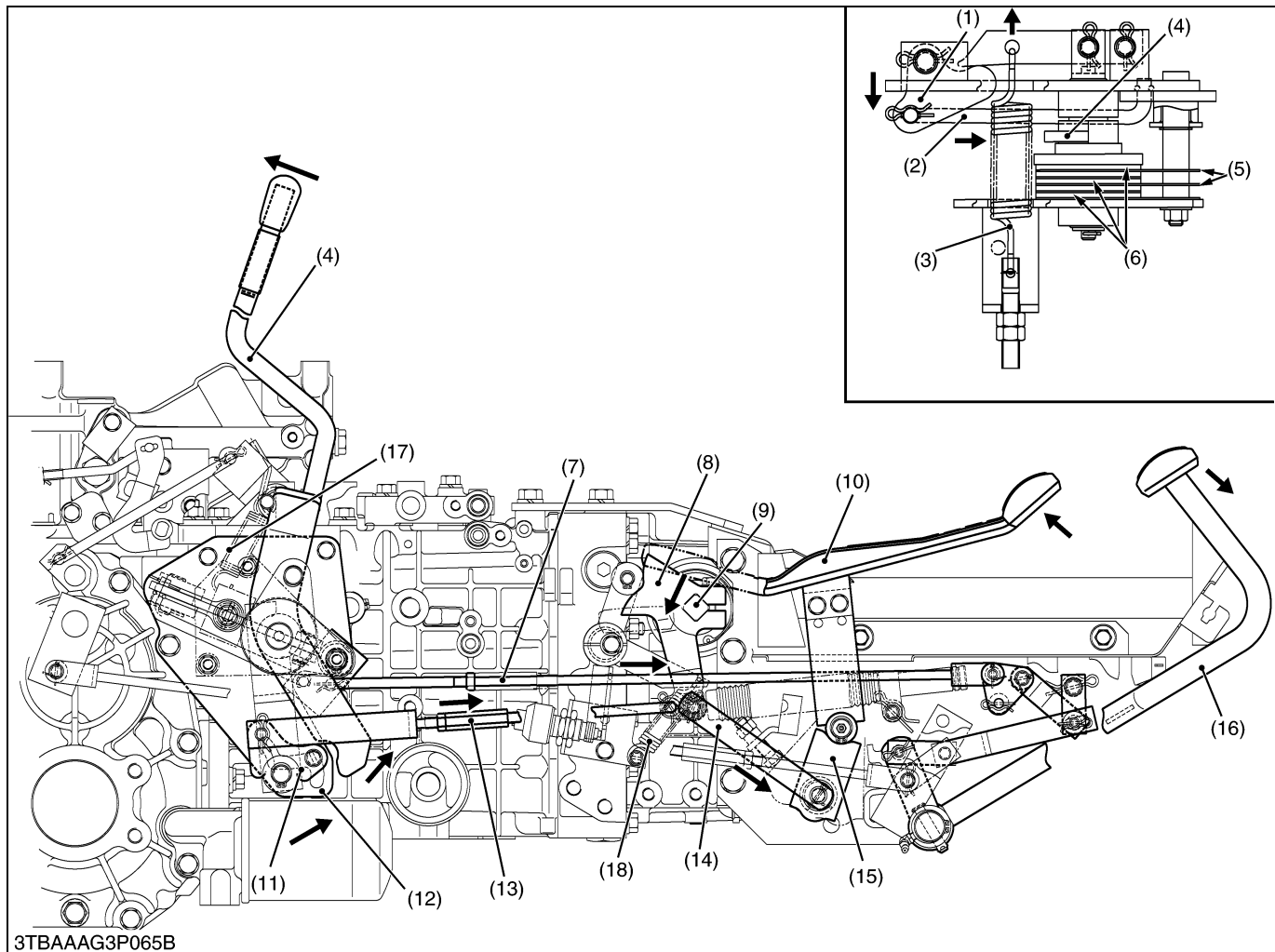
Cruise control system mainly consists of cruise control lever holding section and cruise control releasing section. When the cruise control lever (4) is set to the desired position, the bottom end of the cruise control lever turns clockwise.

The control lever (4) pushes the control lever arm 2 (11). The control lever arm 2 (11) pulls the cruise rod (13).

The cruise rod (13) pulls the neutral holder (8). The HST plate (14) is pulled by the cruise rod (13).

Since the neutral holder (8) turns clockwise, the trunnion shaft (9) directly attached to the neutral holder (8) turns clockwise. On the other hand, since the HST plate (14) pulls the HST lever (15) and the HST pedal (10). The HST pedal (10) is turned to the front side.

On the other hand, since there is friction force between the friction plates (5) and the friction disks (6), the cruise control lever (4) is held at the desired cruise position until the brake pedals will be depressed by an operator.

(2) Cruise Control Release

- | | | | |
|---------------------------|--------------------|--------------------------|--------------------|
| (1) Release Lever 1 | (6) Friction Disk | (11) Control Lever Arm 2 | (16) Brake Pedal |
| (2) Cruise Release Rod | (7) Release Rod | (12) Cruise Control Base | (17) Return Spring |
| (3) Cruise holding Spring | (8) Neutral Holder | (13) Cruise Rod | (18) Return Spring |
| (4) Cruise Control Lever | (9) Trunnion Shaft | (14) HST Plate | |
| (5) Friction Plate | (10) HST Pedal | (15) HST Lever | |

Cruise control release is done by depressing the brake pedals (16).

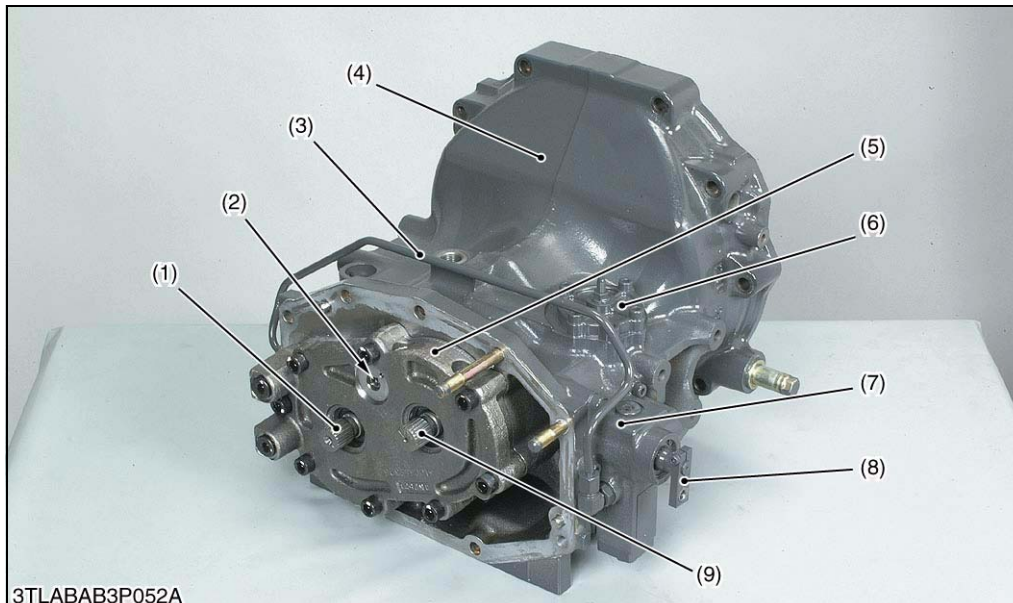
When an operator depresses the brake pedal (16), the release rod (7) is pulled by the brake pedals (16).

The release rod (7) pulls the cruise release rod (2) and the cruise release rod (2) pulls the release lever 1 (1). At the time, the release lever 1 (1) turns counterclockwise. Since the friction force between friction plates (5) and the friction disks (6) is reduced, the cruise control lever (4) is free. The cruise control lever (4) is returned to **"NEUTRAL"** position by the return spring (17).

On the other hand, the return spring (18) pulls the neutral holder (8). The neutral holder (8) and the trunnion shaft (9) turns counterclockwise. Since the neutral holder (8) is connected to the HST plate (14), the HST plate (14) is pushed to the front side. The HST plate (14) pushes the HST pedal to return to **"NEUTRAL"** position.

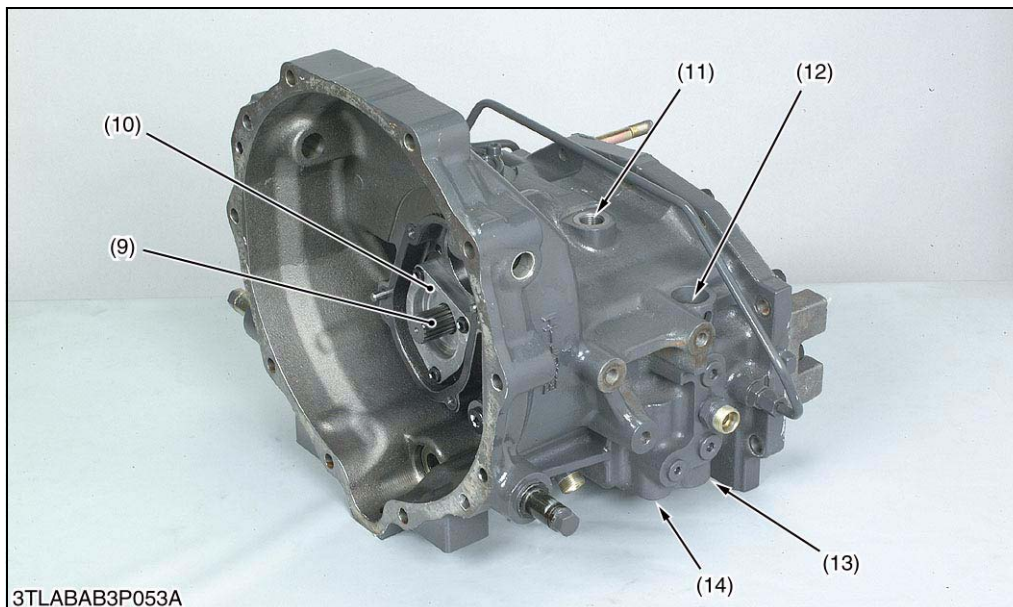
8. HYDROSTATIC TRANSMISSION (TYPE 4) (Code No. TD020-59992, TD060-59994)

[1] STRUCTURE



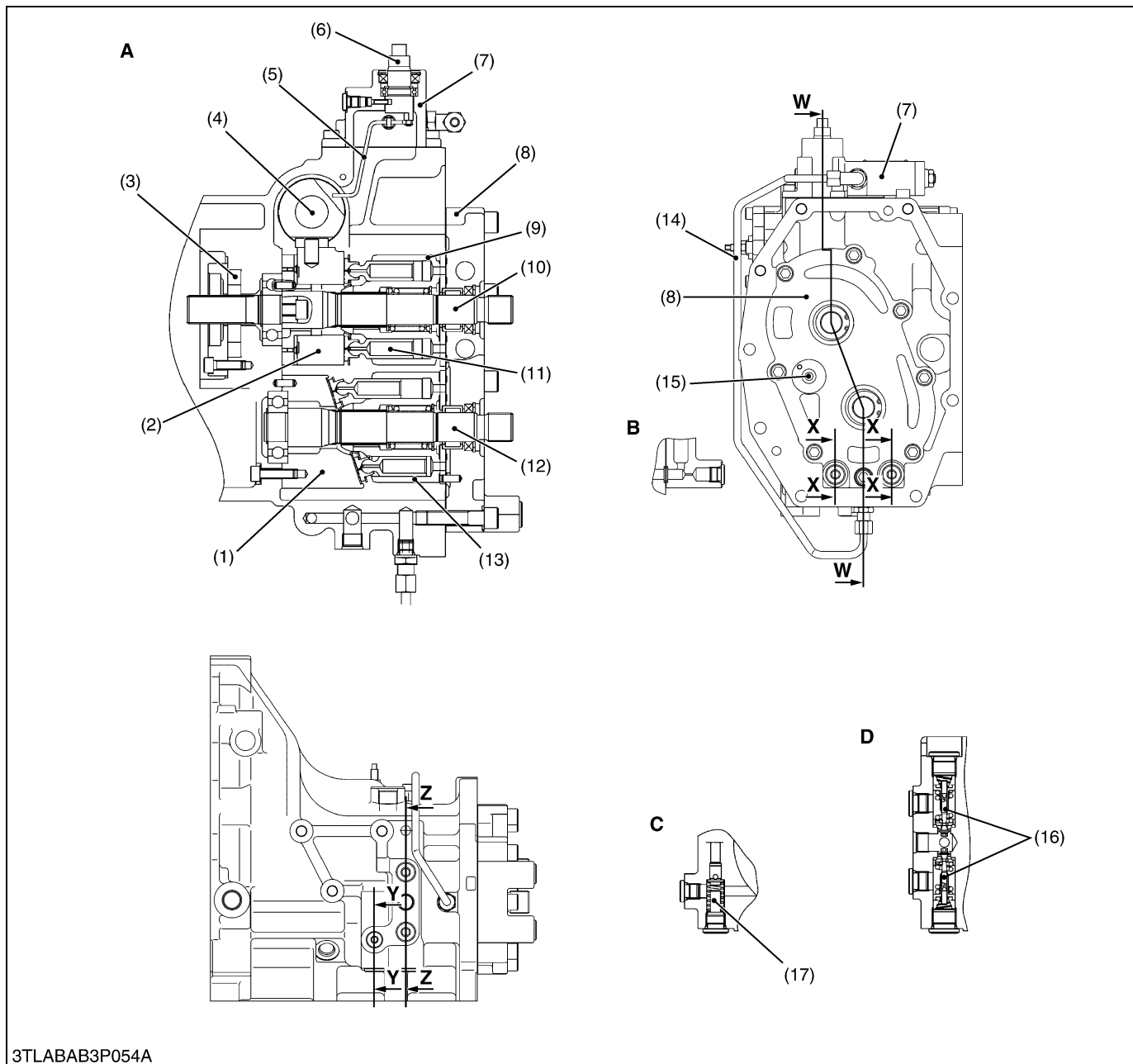
- (1) Output Shaft (Motor Shaft)
- (2) Case Relief Valve
- (3) Bypass Pipe (Servo Pipe)
- (4) HST Case (Clutch Housing)
- (5) Port Block Cover
- (6) Servo Piston
- (7) Servo Regulator
- (8) Control Lever (Connect to HST Pedal)
- (9) Input Shaft (Pump Shaft)
- (10) Charge Pump
- (11) Outlet Port (To Oil Cooler)
- (12) Check and High Pressure Relief Valve (Reverse)
- (13) Check and High Pressure Relief Valve (Forward)
- (14) Charge Relief Valve

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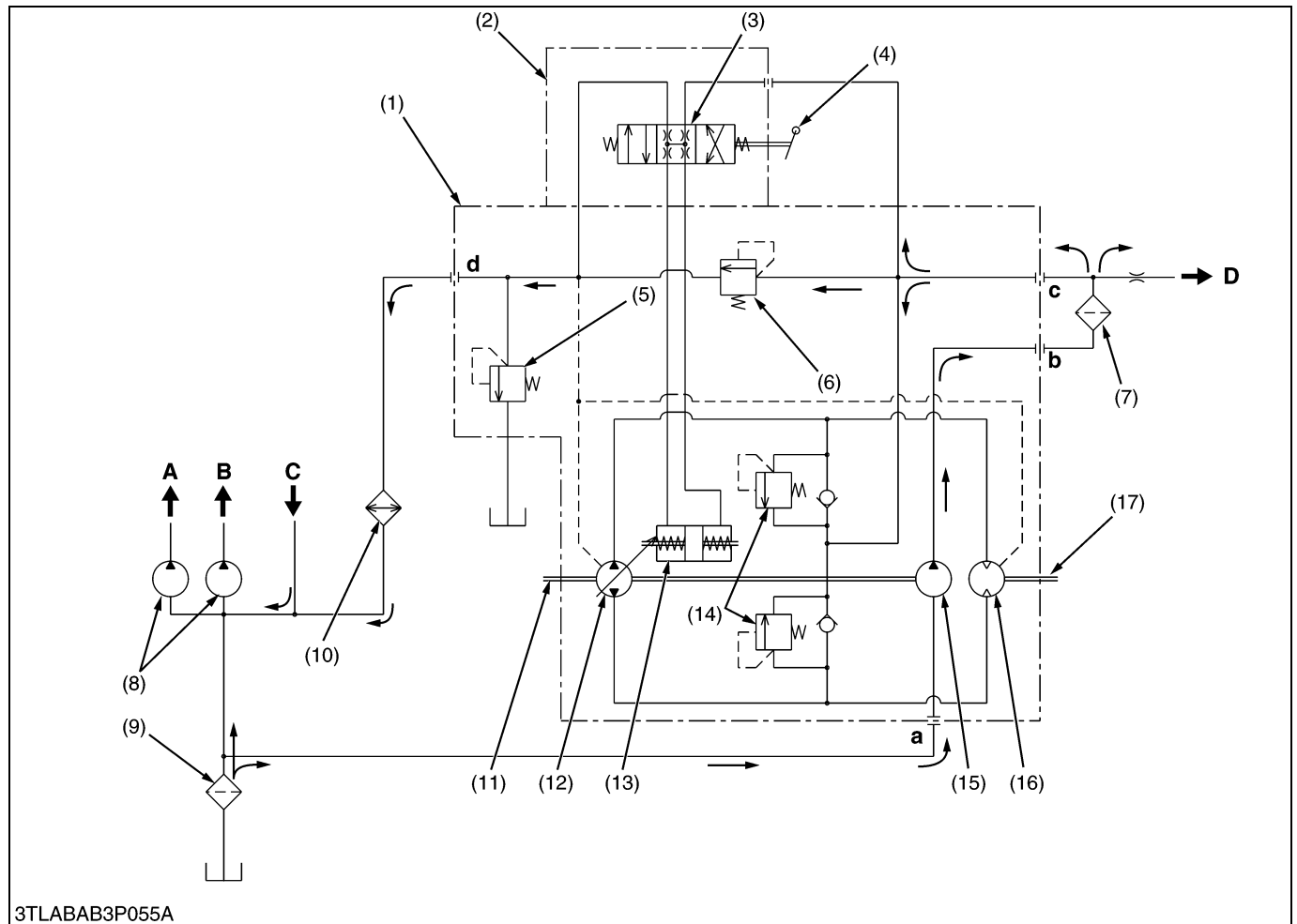
The HST of L30 series tractor is a built-in type to the clutch housing, and HST with the servomechanism is adapted. The servomechanism controls the pedal operation of HST hydraulically. As a result, the HST pedal feels extremely light and smoother pedal operation can be done.

HST assembly is chiefly composed of HST case (clutch housing), variable displacement piston pump, fixed displacement piston motor, charge pump, servo-regulator and various valves. Refer to the next page for detailed parts in the HST.



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- | | | | |
|-------------------------|---------------------------------|---|-------------------------------|
| (1) Fixed Swashplate | (7) Regulator Assembly | (13) Cylinder Block (Motor) | A : Sectional View W-W |
| (2) Variable Swashplate | (8) Port Block Cover | (14) Bypass Pipe (Servo Pipe) | B : Sectional View X-X |
| (3) Charge Pump | (9) Cylinder Block (Pump) | (15) Case Relief Valve | C : Sectional View Y-Y |
| (4) Servo Piston | (10) Input Shaft (Pump Shaft) | (16) Check and High Pressure Relief Valve | D : Sectional View Z-Z |
| (5) Feedback Rod | (11) Piston | (17) Charge Relief Valve | |
| (6) Control Shaft | (12) Output Shaft (Motor Shaft) | | |

[2] OIL FLOW

- | | | | |
|-------------------------------|-------------------------------|---|--|
| (1) HST Assembly | (8) Hydraulic Pump | (14) Check and High Pressure Relief Valve | C : From Steering Controller |
| (2) Servo Regulator Assembly | (9) Filter | (15) Charge Pump | D : To PTO Clutch Valve |
| (3) Regulator Valve | (10) Oil Cooler | (16) Motor Cylinder Block | a : a-port (In from suction line) |
| (4) Control Lever (HST Pedal) | (11) Input Shaft (Pump Shaft) | (17) Output Shaft (Motor Shaft) | b : b-port (Out by charge pump) |
| (5) Case Relief Valve | (12) Pump Cylinder Block | | c : c-port (In from charge pump) |
| (6) Charge Relief Valve | (13) Servo Piston | | d : d-port (Out from HST circuit) |
| (7) Filter | | | |
- A : To Hydraulic Block**
B : To Steering Controller

Oil flows in HST case from **a**-port, and is sent to **b**-port with the charge pump (15). Oil from **b**-port is sent to the HST circuit and the PTO clutch circuit through the filter (7). Moreover, the oil of the HST circuit sent to **c**-port is flowed into the servo regulator (2) and HST main circuit. At this time, the pressure in the regulator, HST main circuit (closed circuit) and PTO clutch circuit is controlled with the charge relief valve (6). The oil in regulator is used for the movement of servo piston (13) which is operated by the regulator valve (3) and HST pedal (4). And the oil in the HST main circuit gets circulated between the variable displacement piston pump (12) and the fixed displacement piston motor (16), which forms a closed circuit.

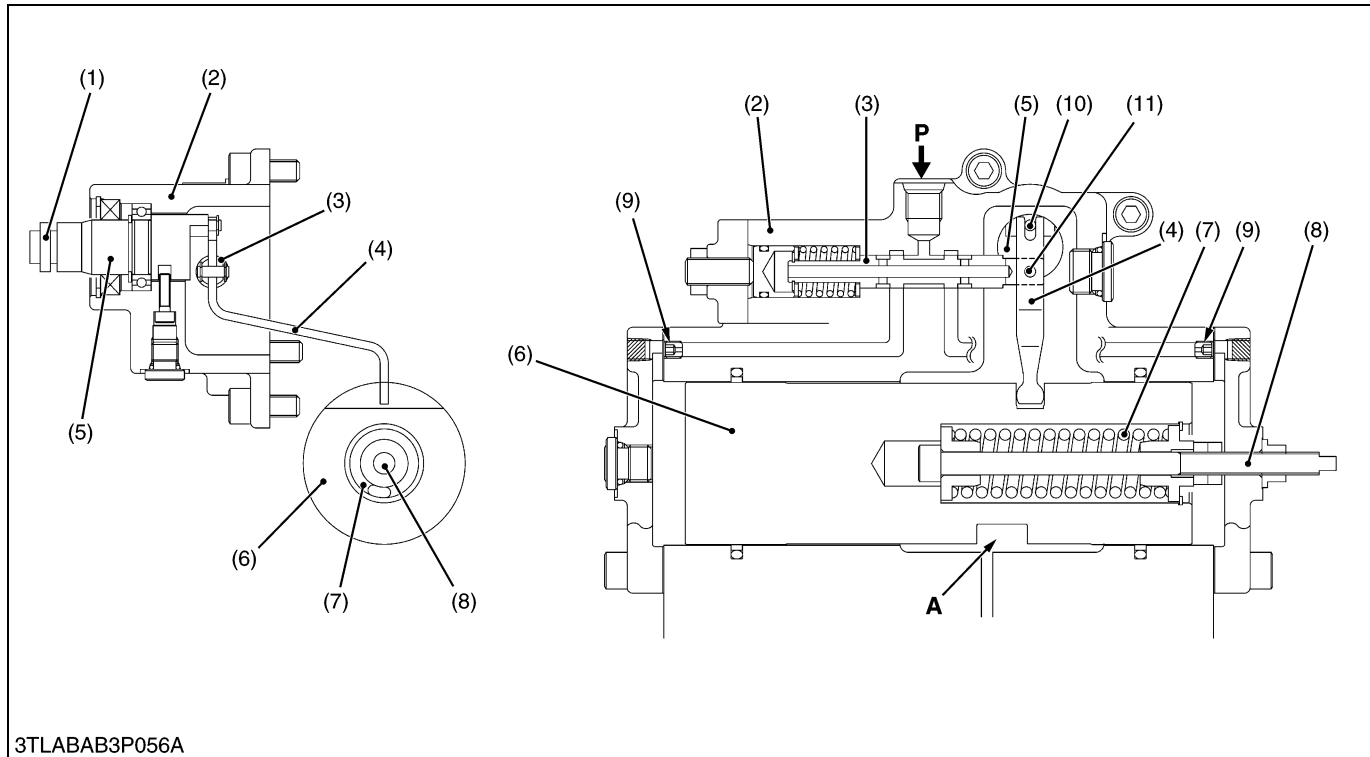
On the other hand, surplus oil with the charge relief valve (6) flows out from **d**-port, and is sent to the suction line through the oil cooler (10). And the case relief valve (5) controls pressure in the HST case.

(Reference)

- Valve Setting Pressure [Oil temperature : 40 to 60 °C (104 to 140 °F)]
 - Charge Relief Valve : 2.25 to 2.45 MPa (23 to 25 kgf/cm², 327 to 355 psi)
 - Check and High Pressure Relief Valve : 33.3 to 36.3 MPa (340 to 370 kgf/cm², 4836 to 5262 psi)
 - Case Relief Valve : 0.29 MPa (3.0 kgf/cm², 42.7 psi)

[3] FUNCTION OF COMPONENTS

■ Servomechanism



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- | | | | |
|--|--------------------|-------------------------------------|--|
| (1) Control Lever (Connected to HST Pedal) | (4) Feedback Lever | (8) Piston Adjusting Screw | A : Slit for Connection of Swashplate |
| (2) Regulator Valve Assembly | (5) Control Arm | (9) Orifice | P : IN Port (From Bypass Pipe) |
| (3) Spool | (6) Servo Piston | (10) Pin A (Fixed with Control Arm) | |
| | (7) Spring | (11) Pin B (Fixed with Spool) | |

As for the servomechanism, the regulator (2) and servo piston (6) are chiefly composed. The regulator is connected to the HST pedal through linkages, and controls the flow of oil to the servo piston by the pedal operation.

The servo piston moved by hydraulic force, is connected to the pump cylinder swashplate. Therefore, a tilt angle of swashplate is varied by servo piston movement.

As for the regulator and the servo piston, it is connected with feedback lever (4), and the movement of the piston is restricted according to the amount of depressing of the HST pedal.

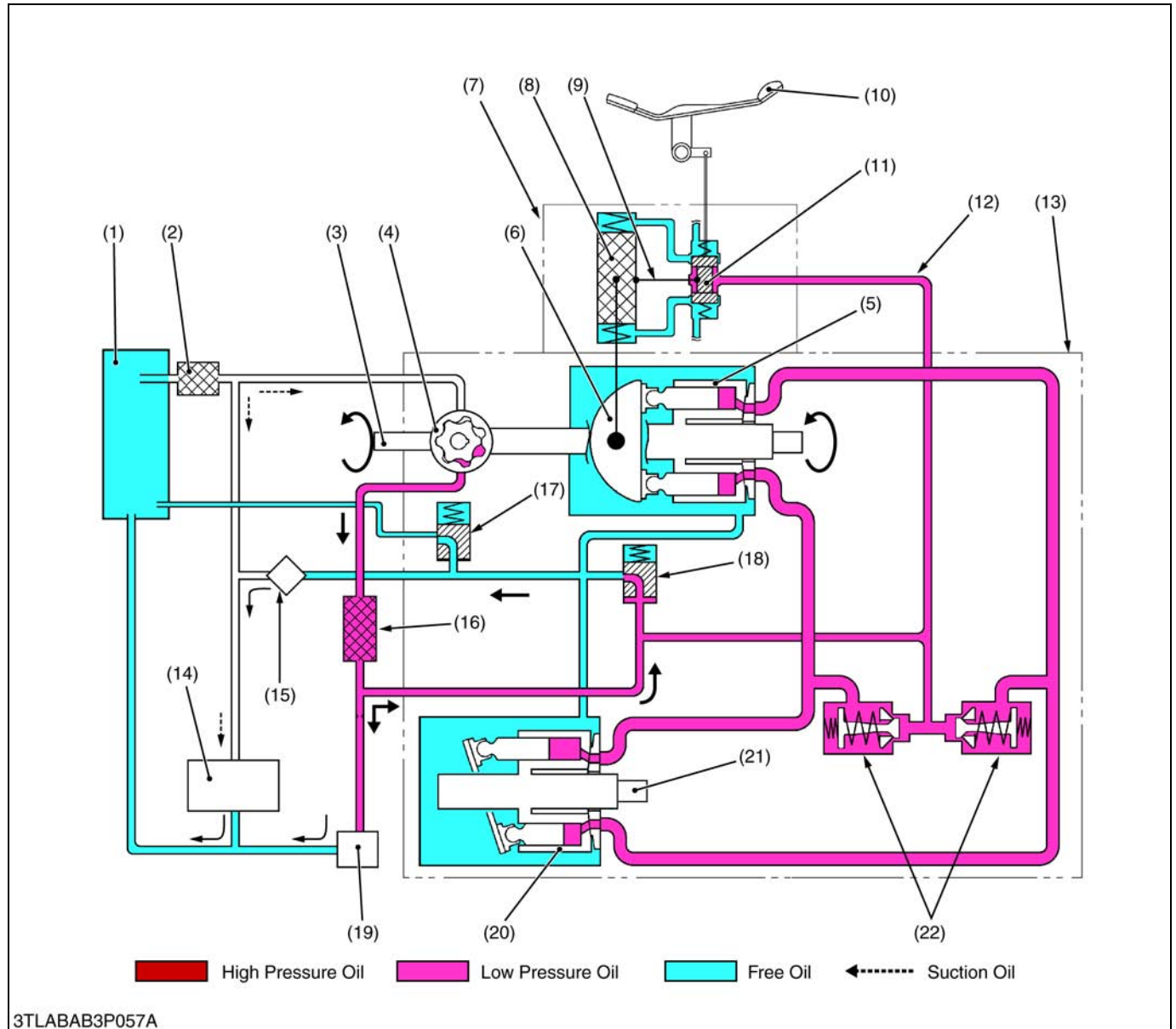
Refer to “**HYDROSTATIC TRANSMISSION (TYPE 2)**” for the operation of the servomechanism, that is, the operation of regulator and servo piston.

■ Valves

As for the mechanism and function of check and high pressure relief valve, charge relief valve and case relief valve, refer to “**HYDROSTATIC TRANSMISSION (TYPE 2)**”.

[4] OPERATION

■ Neutral

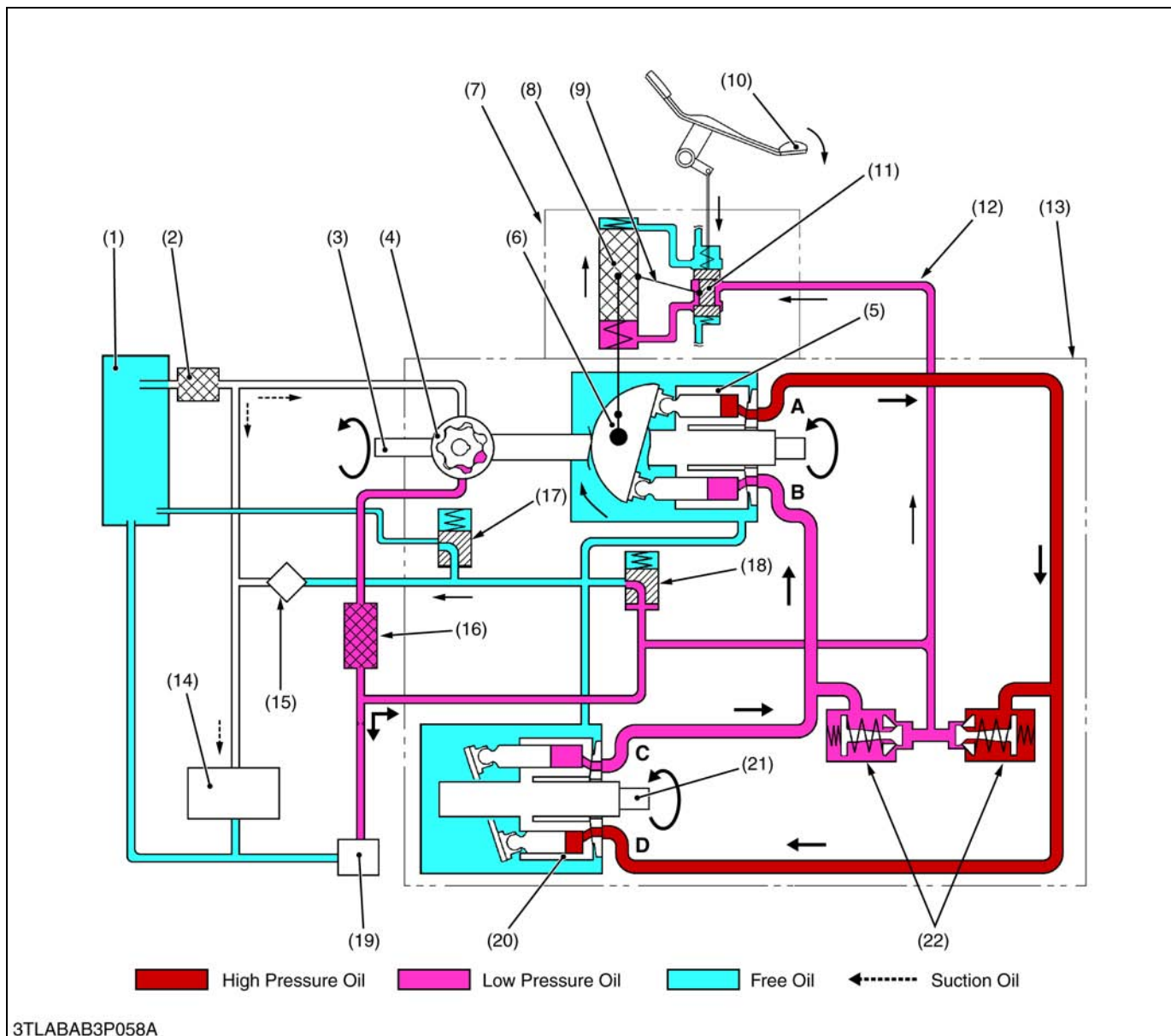


- | | | | |
|-------------------------|------------------------------|--|---|
| (1) Transmission Case | (7) Regulator Valve Assembly | (13) HST Assembly | (18) Charge Relief Valve |
| (2) Filter | (8) Servo Piston | (14) Main Circuit and Steering Circuit | (19) PTO Clutch Valve Circuit |
| (3) Input Shaft | (9) Feedback Lever | (15) Oil Cooler | (20) Motor Cylinder |
| (4) Charge Pump | (10) HST Pedal | (16) Filter | (21) Output Shaft |
| (5) Pump Cylinder | (11) Regulator Valve | (17) Case Relief Valve | (22) Check and High Pressure Relief Valve |
| (6) Variable Swashplate | (12) Bypass Pipe | | |

The sucked oil from the transmission case (1) by the charge pump (4) flows into the HST housing (13) and regulator valve (7) through the oil filter (16) and charge relief valve (18). Overflow oil from HST housing (13) flows to the suction line through the oil cooler (15).

When the HST pedal (10) is in neutral, regulator valve (7) is not activated, so the variable swashplate (6) is at right angle to the pump pistons and they only rotate with cylinder (5) without reciprocation. Since the oil is not being pumped to motor, the cylinder block in the motor (20) is stationary and the output shaft (21) does not rotate.

■ Forward



- | | | | |
|------------------------------|--|---|-------------------------|
| (1) Transmission Case | (9) Feedback Lever | (16) Filter | A : Pump Port A |
| (2) Filter | (10) HST Pedal | (17) Case Relief Valve | B : Pump Port B |
| (3) Input Shaft | (11) Regulator Valve | (18) Charge Relief Valve | C : Motor Port C |
| (4) Charge Pump | (12) Bypass Pipe | (19) PTO Clutch Valve Circuit | D : Motor Port D |
| (5) Pump Cylinder | (13) HST Assembly | (20) Motor Cylinder | |
| (6) Variable Swashplate | (14) Main Circuit and Steering Circuit | (21) Output Shaft | |
| (7) Regulator Valve Assembly | (15) Oil Cooler | (22) Check and High Pressure Relief Valve | |
| (8) Servo Piston | | | |

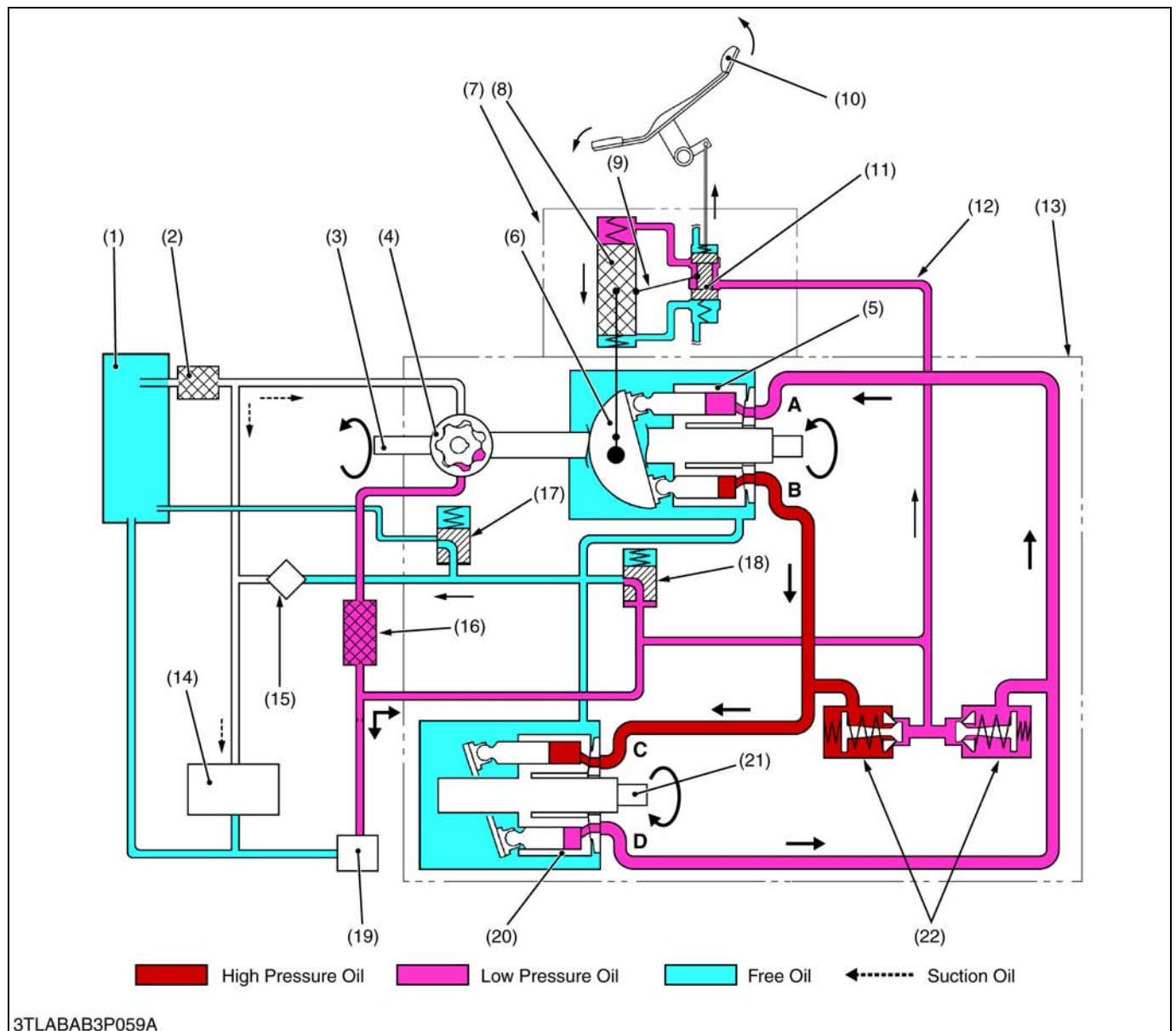
When the HST pedal (10) is stepped on and in forward, so the variable swashplate (6) is tilted by the servo piston (8) and regulator valve (11) as shown in figure above.

As the pump cylinder block (5) rotates with the input shaft (3), oil is forced out of pump port **A** at high pressure. As pressure oil enters motor port **D**, the pistons, which align with port **D**, are pushed against the thrust plate and slide down inclined surface.

Then the output shaft (21) rotates with the motor cylinder block (20). This drives the machine forward and the angle of pump swashplate determines the output shaft speed.

As the motor cylinder block continues to rotate, oil is forced out of motor port **C** at low pressure and returns to the pump port **B**.

■ Reverse



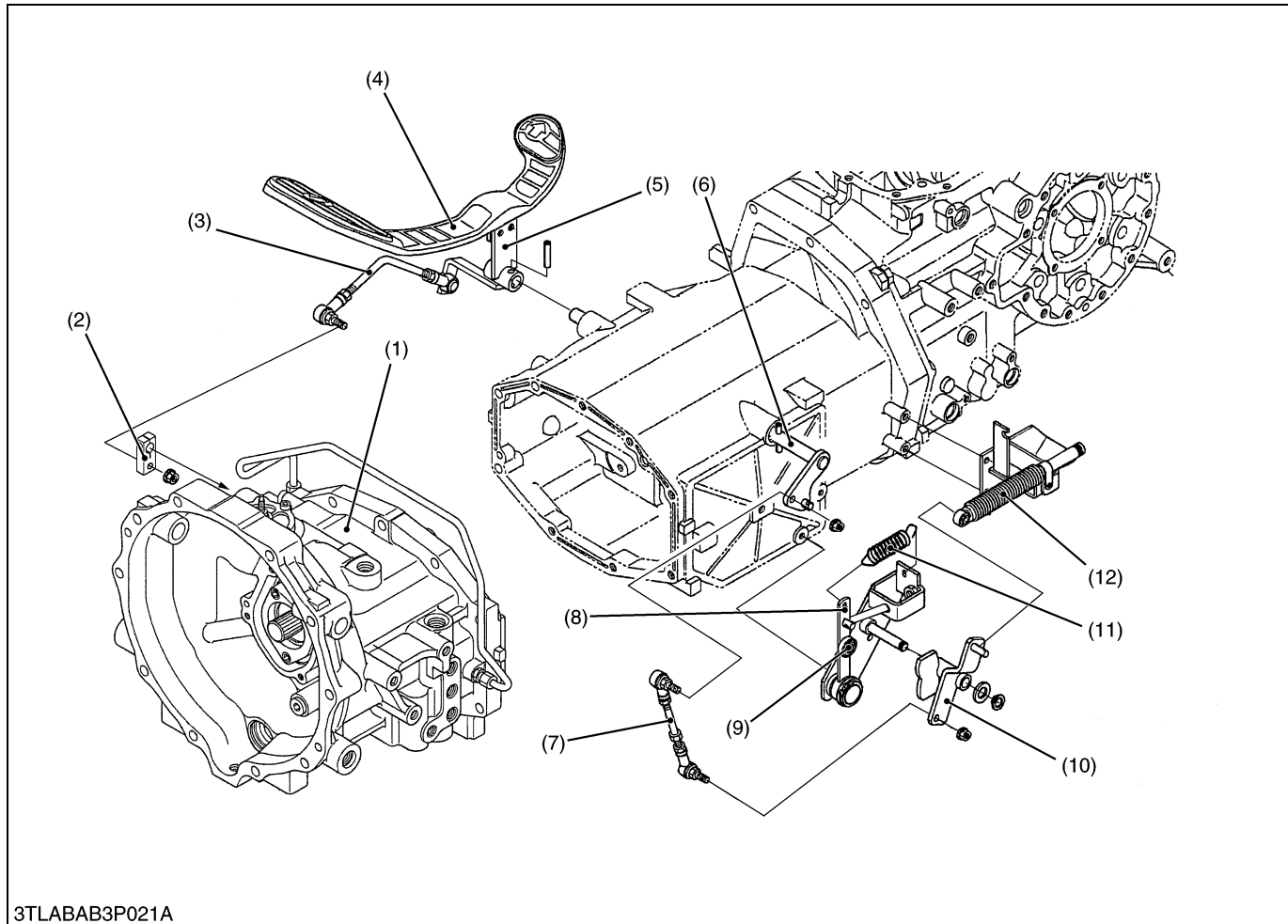
- | | | | |
|------------------------------|--|---|-------------------------|
| (1) Transmission Case | (9) Feedback Lever | (16) Filter | A : Pump Port A |
| (2) Filter | (10) HST Pedal | (17) Case Relief Valve | B : Pump Port B |
| (3) Input Shaft | (11) Regulator Valve | (18) Charge Relief Valve | C : Motor Port C |
| (4) Charge Pump | (12) Bypass Pipe | (19) PTO Clutch Valve Circuit | D : Motor Port D |
| (5) Pump Cylinder | (13) HST Assembly | (20) Motor Cylinder | |
| (6) Variable Swashplate | (14) Main Circuit and Steering Circuit | (21) Output Shaft | |
| (7) Regulator Valve Assembly | (15) Oil Cooler | (22) Check and High Pressure Relief Valve | |
| (8) Servo Piston | | | |

When the HST pedal (10) is stepped on and in reverse, the variable swashplate (6) is tilted by servo piston (8) and regulator valve (11) as shown in figure above.

As the pump cylinder block (5) rotates with the input shaft (3), oil is forced out of pump port **B** at high pressure. As pressure oil enters motor port **C**, the pistons, which align with port **C**, are pushed against the thrust plate and slide down inclined surface.

Then the output shaft (21) rotates with the motor cylinder block (20). This drives the machine rearward and the angle of pump swashplate determines the output shaft speed.

As the motor cylinder block continues to rotate, oil is forced out of motor port **D** at low pressure and returns to the pump port **A**.

[5] CONTROL LINKAGE

- | | | | |
|-----------------------|----------------------|--------------------|-------------------------|
| (1) HST Assembly | (4) HST Pedal | (7) Neutral Rod | (10) Neutral Holder Arm |
| (2) HST Control Lever | (5) Pedal Bracket | (8) Neutral Holder | (11) Neutral Spring |
| (3) HST Control Rod | (6) Connecting Shaft | (9) Ball Bearing | (12) Damper |

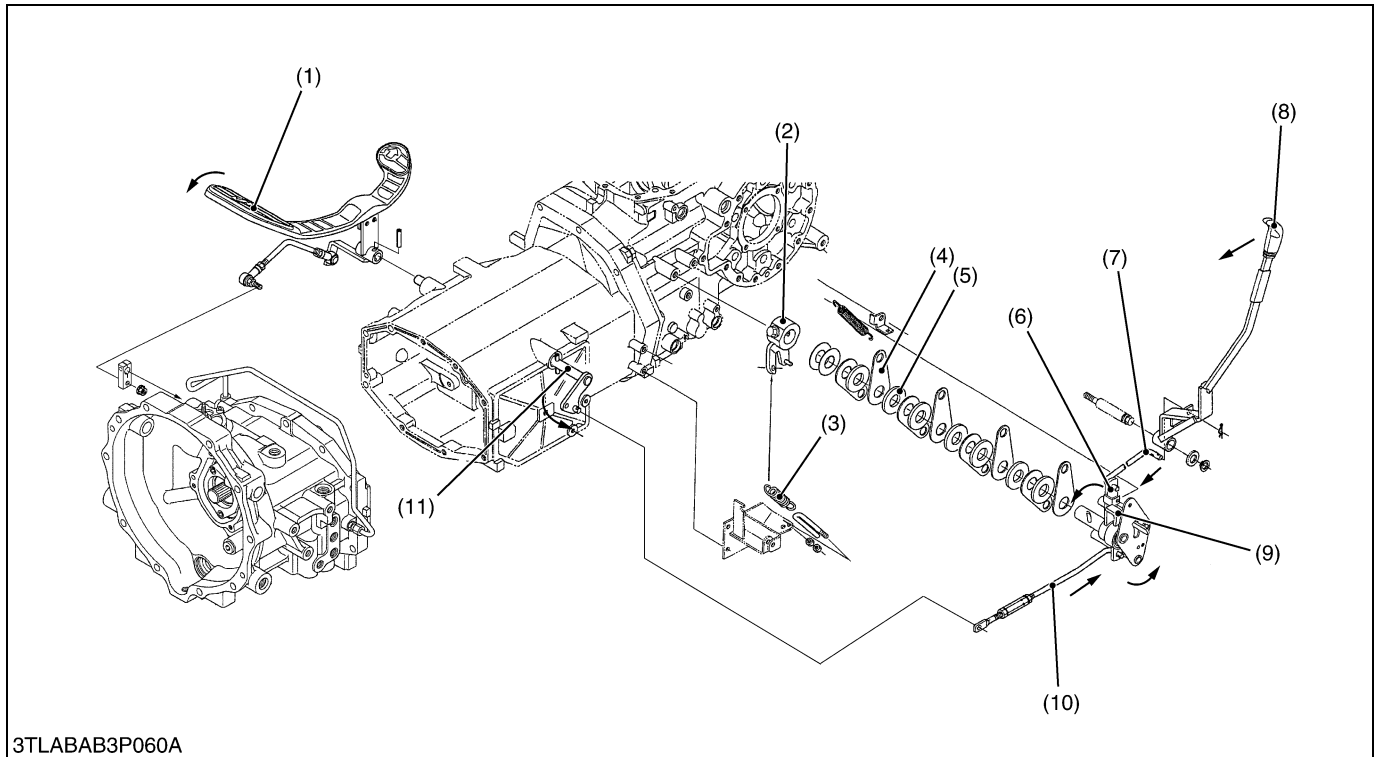
The speed control pedal (HST pedal) (4) and the HST control lever (servo control lever) (2) are linked with the pedal bracket (5) and HST control rod (3). And HST pedal (4) and the neutral holder arm (10) are linked with pedal bracket (5) and neutral rod (7) through connecting shaft (6).

As the HST pedal (4) is depressed to forward, the HST control lever (2) is rotated, then the swashplate is tilted by servomechanism and forward travelling speed increases. Then, the swashplate is returned to neutral with the neutral holder arm (10), when the pedal is released. The ball bearing (9) on the neutral holder (8) pulled with the neutral spring (11) seats the detent of the neutral holder arm (10) so that the neutral holder arm returns to neutral.

The damper (12) is connected to the HST pedal (4) through connecting shaft (6), neutral rod (7) and neutral holder arm (10), restricts the movement of the linkage to prevent abrupt operation or reversing.

[6] CRUISE CONTROL

■ Speed Set



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- | | | | |
|-------------------|--------------------|--------------------------|---------------------------|
| (1) HST Pedal | (4) Plate | (7) Lever Rod | (10) Cruise Adjusting Rod |
| (2) Release Lever | (5) Rubber | (8) Cruise Control Lever | (11) Connecting Shaft |
| (3) Cruise Spring | (6) Cruise Lever 2 | (9) Cruise Lever 1 | |

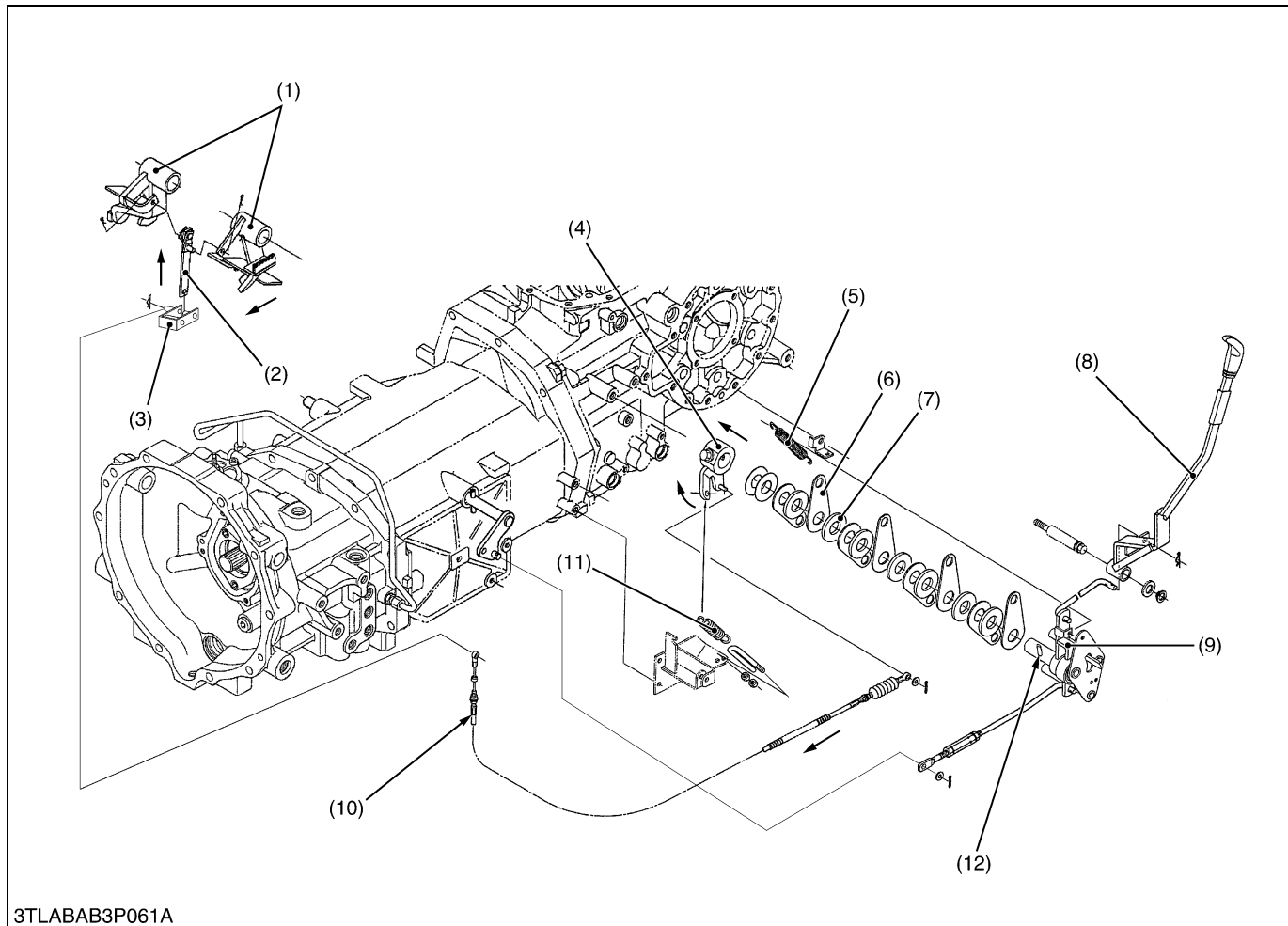
The cruise control lever (8) and HST pedal (1) are linked with the lever rod (7), cruise lever 1 (9), cruise lever 2 (6), cruise adjusting rod (10) and connecting shaft (11).

When the cruise control lever (8) is moved to forward direction, cruise lever 2 (6) is moved to arrow direction by the lever rod (7). The cruise lever 1 (9) is moved forward by being pushed to the cruise lever 2 (6), and cruise adjusting rod (10) is pulled backward. Because cruise adjusting rod (10) and the HST pedal (1) are connected by the connecting shaft (11), the HST pedal is moved and HST becomes forward position.

On the other hand, because the plate (4) and the rubber (5) are suppressed outside by the release lever (2) and the cruise spring (3), cruise lever 1 (9) and cruise lever 2 (6) are fixed at the position. As a result, cruise control lever position can be infinitely set.

In addition, because the movement of the cruise lever 1 (9) is restricted by the cruise lever 2 (6), the backward pedal operation cannot be done while the cruise control lever (8) is operating.

■ Release



- | | | | |
|-----------------|--------------------|--------------------------|--------------------|
| (1) Brake Pedal | (4) Release Lever | (7) Rubber | (10) Release Wire |
| (2) Brake Lever | (5) Release Spring | (8) Cruise Control Lever | (11) Cruise Spring |
| (3) Bracket | (6) Plate | (9) Cruise Lever 2 | (12) Groove |

The cruise control can be returned to neutral automatically when brake pedals (1) are depressed.

The cruise control lever (8) is set with plates (6) and rubbers (7) by the release lever (4) and cruise spring (11). When brake pedals (1) are depressed, brake lever (2) to pull the release lever (4) via release wire (10). The release lever (4) is moved along grooves (12).

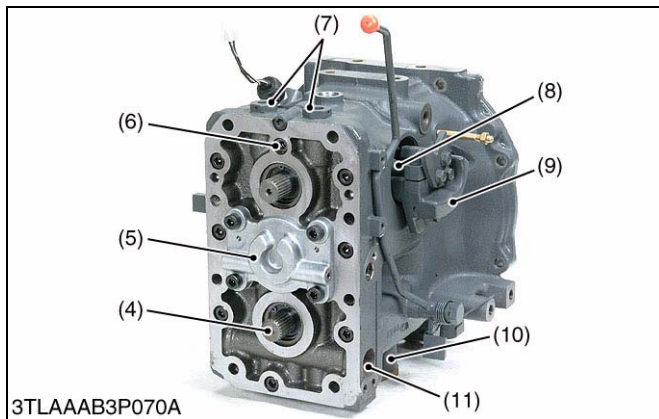
As a result, the holding force of cruise control lever (8) is lost and the cruise control lever (8) returns to neutrality by force of the release spring (5).

■ NOTE

- The cruise control will release when both brake pedals are depressed.
- The cruise control does not release when the individual right or left brake is applied.

9. HYDROSTATIC TRANSMISSION (TYPE 5) (Code No. TC220-59990)

[1] STRUCTURE



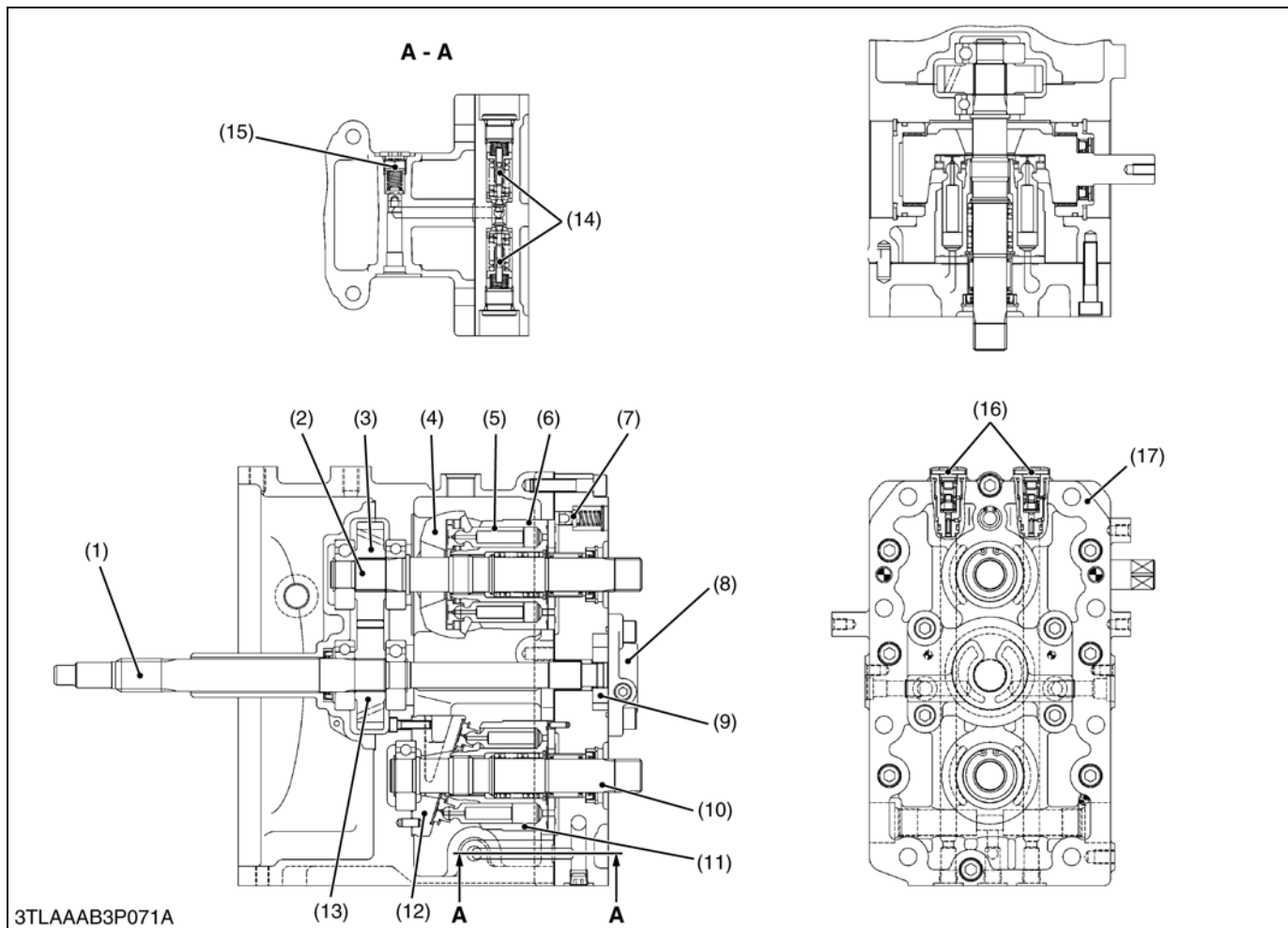
The HST of this tractor is a built-in type to the clutch housing.

HST assembly is chiefly composed of HST case (clutch housing), variable displacement piston pump, fixed displacement piston motor, charge pump and various valves.

Refer to the next page for detailed parts in HST.

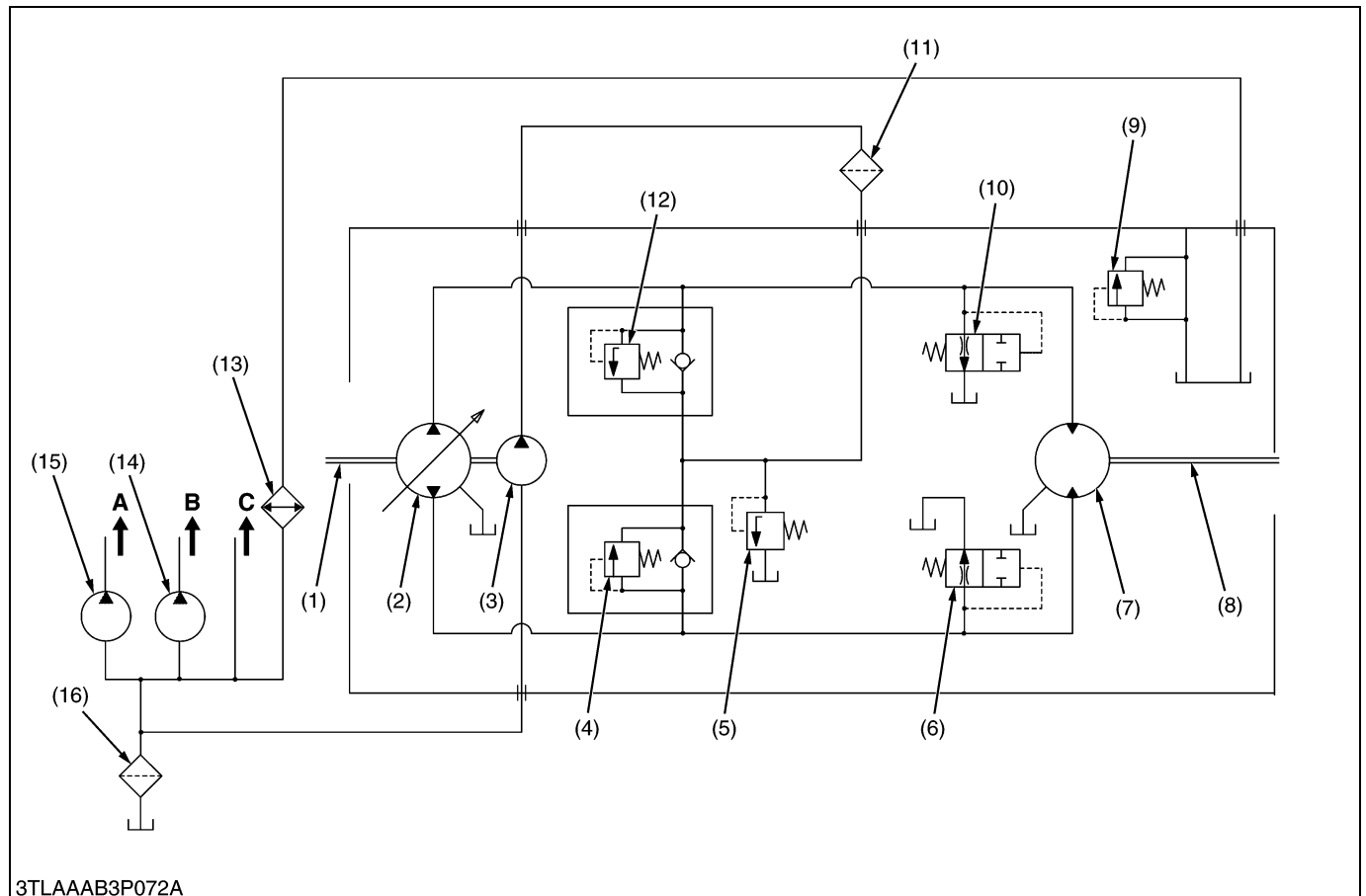
- | | |
|--|---|
| (1) Input Shaft | (6) Case Relief Valve |
| (2) HST Case (Clutch Housing) | (7) Neutral Valve |
| (3) Check and High Pressure Relief Valve | (8) Trunion Shaft |
| (4) Output Shaft (Motor Shaft) | (9) Neutral Holder |
| (5) Charge Pump | (10) Charge Relief Valve |
| | (11) Check and High Pressure Relief Valve |

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- | | | | |
|-------------------------|---------------------------|-----------------------------|---|
| (1) Input Shaft | (6) Cylinder Block (Pomp) | (10) Output Shaft (Motor) | (14) Check and High Pressure Relief Valve |
| (2) Pump Shaft | (7) Case Relief Valve | (11) Cylinder Block (Motor) | (15) Charge Relief Valve |
| (3) 27T Gear | (8) Charge Pump Cover | (12) Fixed Swashplate | (16) Neutral Valve |
| (4) Variable Swashplate | (9) Charge pump | (13) 28T Gear | (17) Port Block Cover |
| (5) Piston (Pmp) | | | |

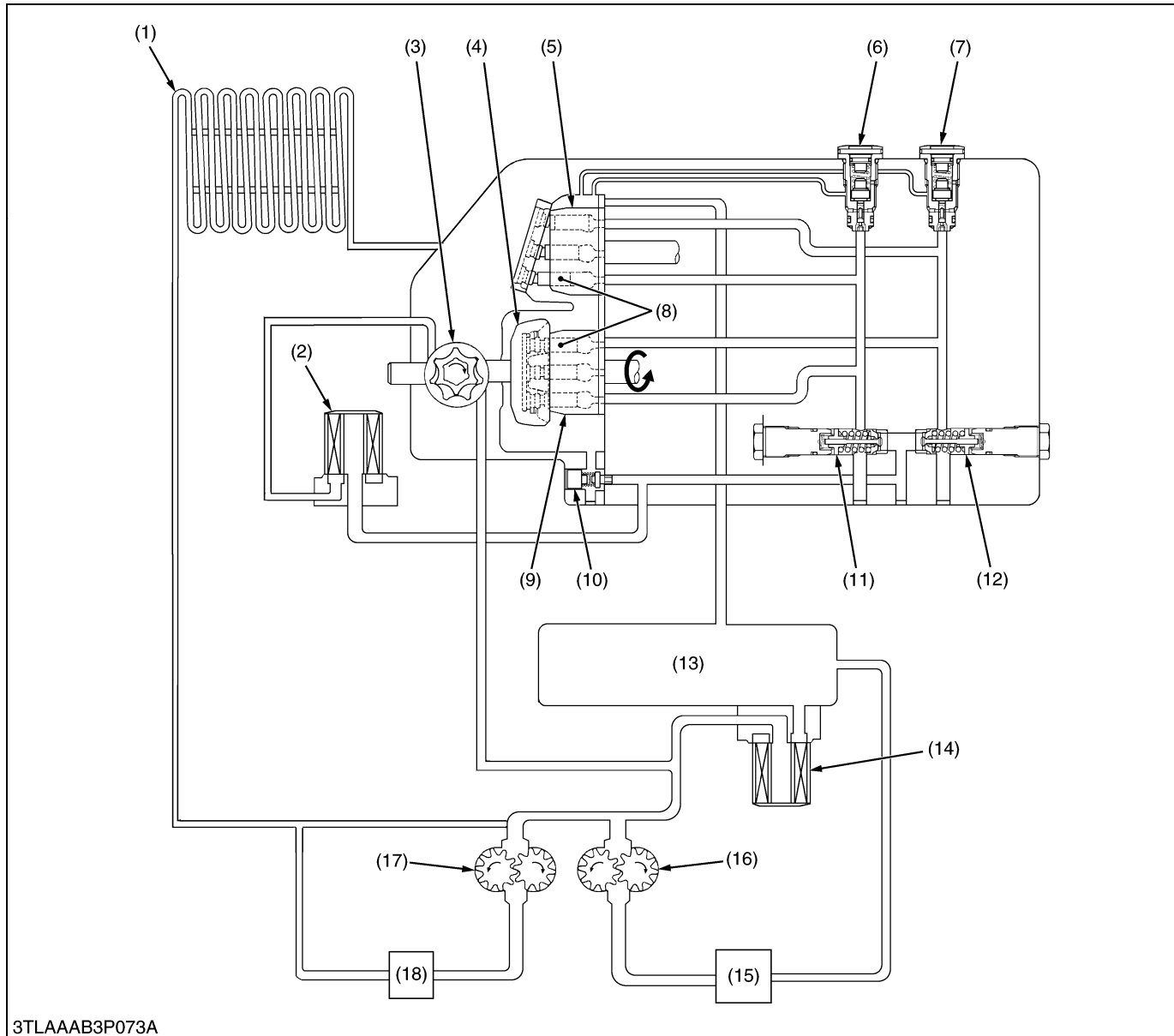
[2] OIL FLOW

- | | | | |
|--|------------------------------|---|-------------------------------------|
| (1) Input Shaft | (6) Neutral Valve | (12) Check and High Pressure Relief Valve | A : To Hydraulic Block |
| (2) Variable Displacement Pump | (7) Fixed Displacement Motor | (13) Oil Cooler | B : To Power Steering |
| (3) Charge Pump | (8) Output Shaft (Motor) | (14) Pump | C : From Steering Controller |
| (4) Check and High Pressure Relief Valve | (9) Case Relief Valve | (15) Pump | |
| (5) Charge Relief Valve | (10) Neutral Valve | (16) Oil Filter | |

The pump(2) and Motor(7) are joined in a closed hydraulic loop and most of oil circulates within the main oil circuit. When the variable swash-plate is at right angle to the pump piston, the oil is not send to the motor(7). When the variable swash-plate is tilted to forward or reverse, oil forced out of pump(2) at high pressure and send to the motor.

But the neutral valve(6), (10) in the main oil circuit lines are open and pass the oil to the case when in neutral, and oil pressure in their lines becomes low. And when the oil pressure in the high pressure line increase to a specified pressure, the neutral valve(6), (10) closes. Then the output shaft(8) rotates with the motor and oil is forced out of motor at low pressure and return to the pump(2). On the other hand, oil is send to the main circuit with the charge pump(3) through the filter(11) and check valve and excessive oil passes to the case through the charge relief valve(5). The case relief valve(9) controls pressure in the HST case.

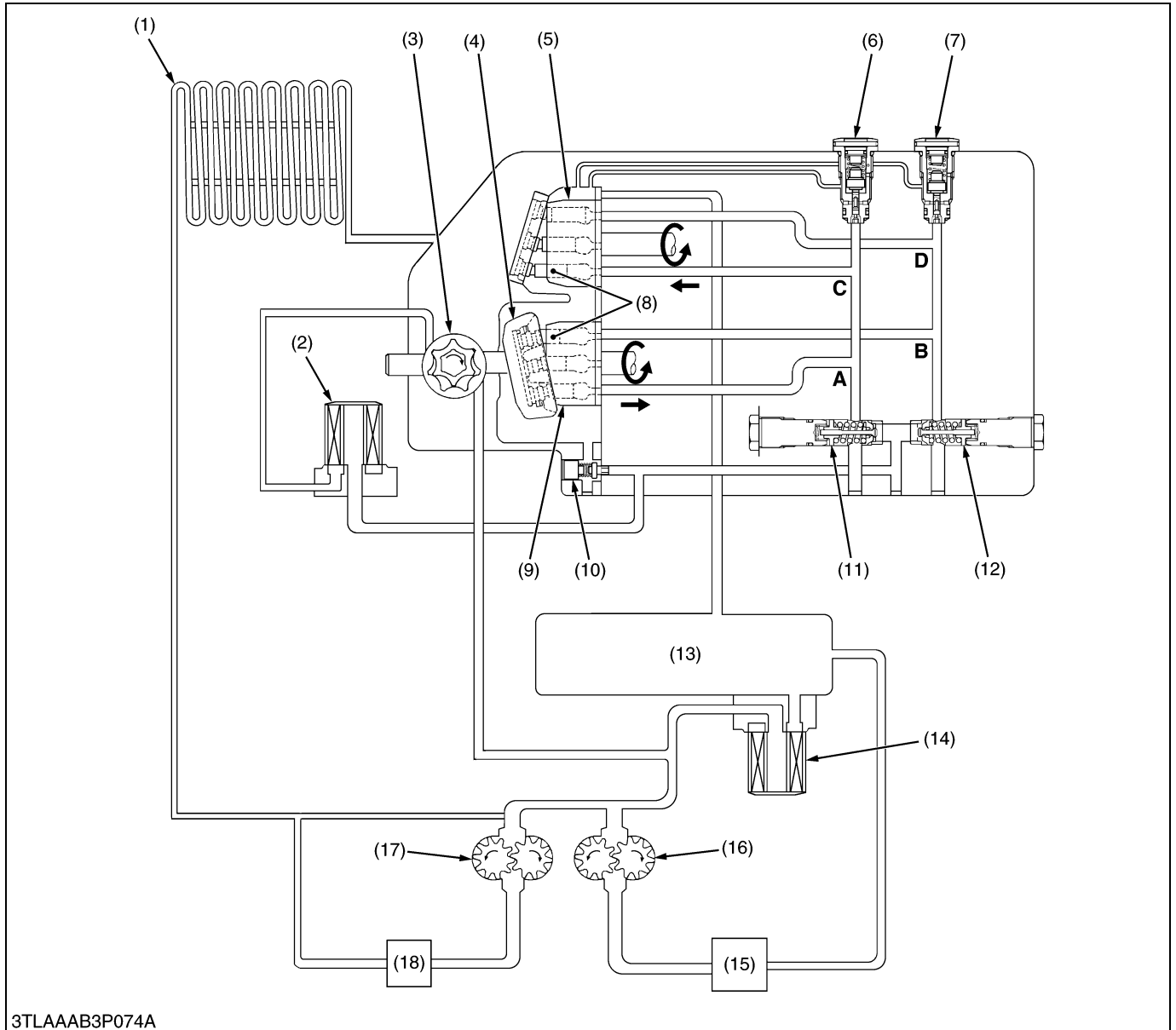
The high pressure relief valve(4), (12) between the two lines in the main oil circuit monitors the oil pressure in each line, it opens and close the oil into another line.

[3] OPERATION**■ Neutral**

- | | | | |
|----------------------------|-----------------------------|---|--|
| (1) Oil Cooler | (6) Neutral Valve (Forward) | (11) Check and High Pressure Relief Valve (Forward) | (15) Hydraulic Control Valve |
| (2) Oil Filter (For HST) | (7) Neutral Valve (Reverse) | (12) Check and High Pressure Relief Valve (Reverse) | (16) Hydraulic Pump (For Main Circuit) |
| (3) Charge Pump | (8) Piston | (13) Transmission Case | (17) Hydraulic Pump (For Power Steering) |
| (4) Swash plate | (9) Cylinder Block (Pump) | (14) Oil Filter | (18) Power Steering Controller |
| (5) Cylinder Block (Motor) | (10) Charge Relief Valve | | |

When the speed control pedal is in neutral, the variable swash-plate is at right angles to the pump piston and they only rotate with cylinder block without reciprocating. Since the oil is not being pumped to the motor, the cylinder block in the motor is stationary and the output shaft does not move.

■ Forward



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- | | | | |
|----------------------------|-----------------------------|---|--|
| (1) Oil Cooler | (6) Neutral Valve (Foward) | (11) Check and High Pressure Relief Valve (Forward) | (15) Hydraulic Control Valve |
| (2) Oil Filter (For HST) | (7) Neutral Valve (Reverse) | (12) Check and High Pressure Relief Valve (Reverse) | (16) Hydraulic Pump (For Main Circuit) |
| (3) Charge Pump | (8) Piston | (13) Transmission Case | (17) Hydraulic Pump (For Power Steering) |
| (4) Swash plate | (9) Cylinder Block (Pump) | (14) Oil Filter | (18) Power Steering Controller |
| (5) Cylinder Block (Motor) | (10) Charge Relief Valve | | |

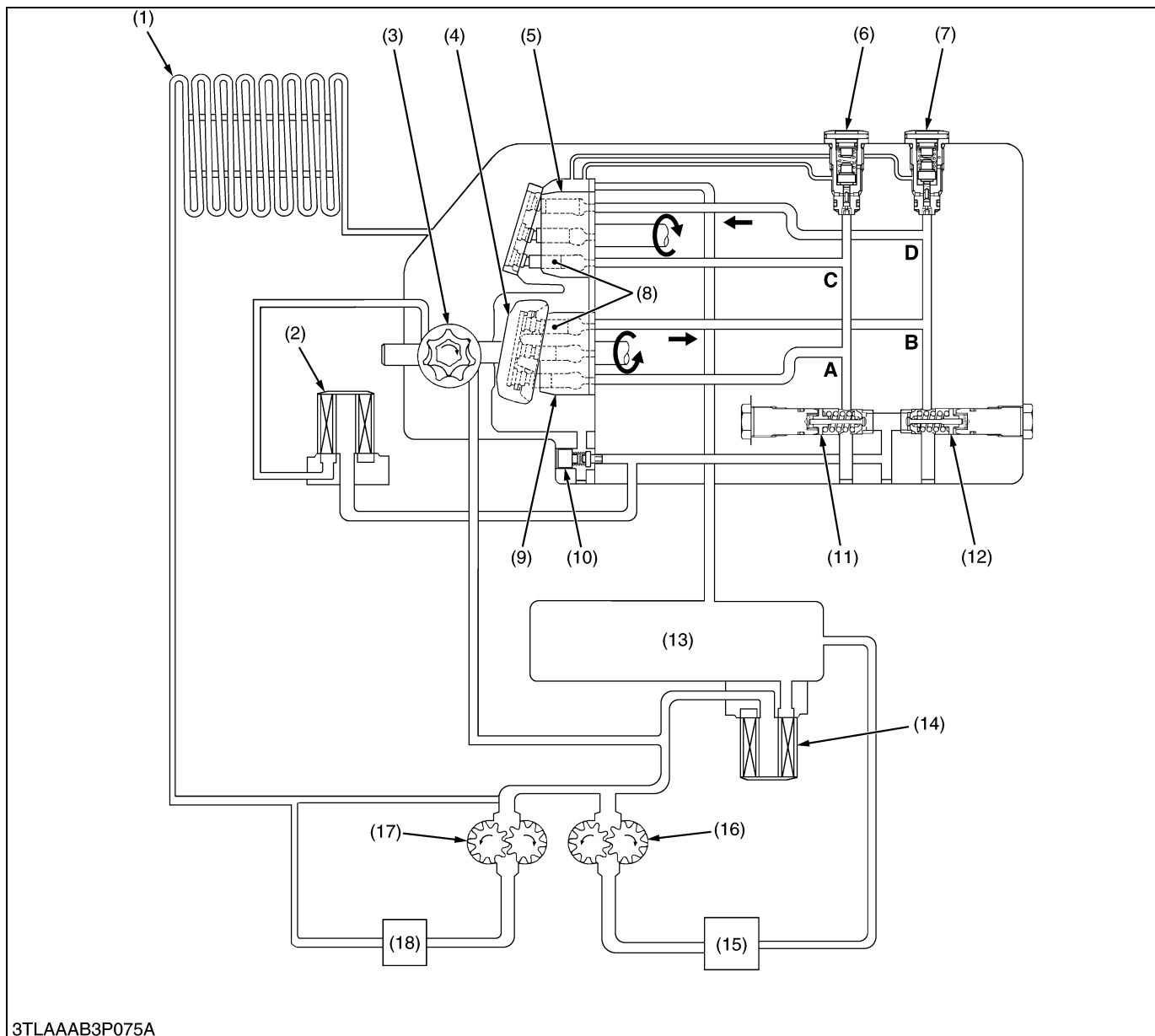
When the speed control pedal is stepped on and in forward, the variable swash-plate is tilted as shown in figure above.

As the pump cylinder block rotates with the input shaft, oil is forced out of pump port **A** at high pressure. As pressure oil enters motor port **C**, the pistons, which align with port **C**, are pushed against the swash-plate and slide down the inclined surface.

Then the output shaft rotates with the motor cylinder block. This drives the machine forward and the angle of pump swash-plate determines the output shaft speed.

As the motor cylinder block continues to rotate, oil is forced out of motor port **D** at low pressure and returns to the pump port **B**.

■ Reverse



- | | | | |
|----------------------------|-----------------------------|---|--|
| (1) Oil Cooler | (6) Neutral Valve (Forward) | (11) Check and High Pressure Relief Valve (Forward) | (15) Hydraulic Control Valve |
| (2) Oil Filter (For HST) | (7) Neutral Valve (Reverse) | (12) Check and High Pressure Relief Valve (Reverse) | (16) Hydraulic Pump (For Main Circuit) |
| (3) Charge Pump | (8) Piston | (13) Transmission Case | (17) Hydraulic Pump (For Power Steering) |
| (4) Swash plate | (9) Cylinder Block (Pump) | (14) Oil Filter | (18) Power Steering Controller |
| (5) Cylinder Block (Motor) | (10) Charge Relief Valve | | |

When the speed control pedal is stepped on and in reverse, the variable swash-plate is tilted as shown in figure above.

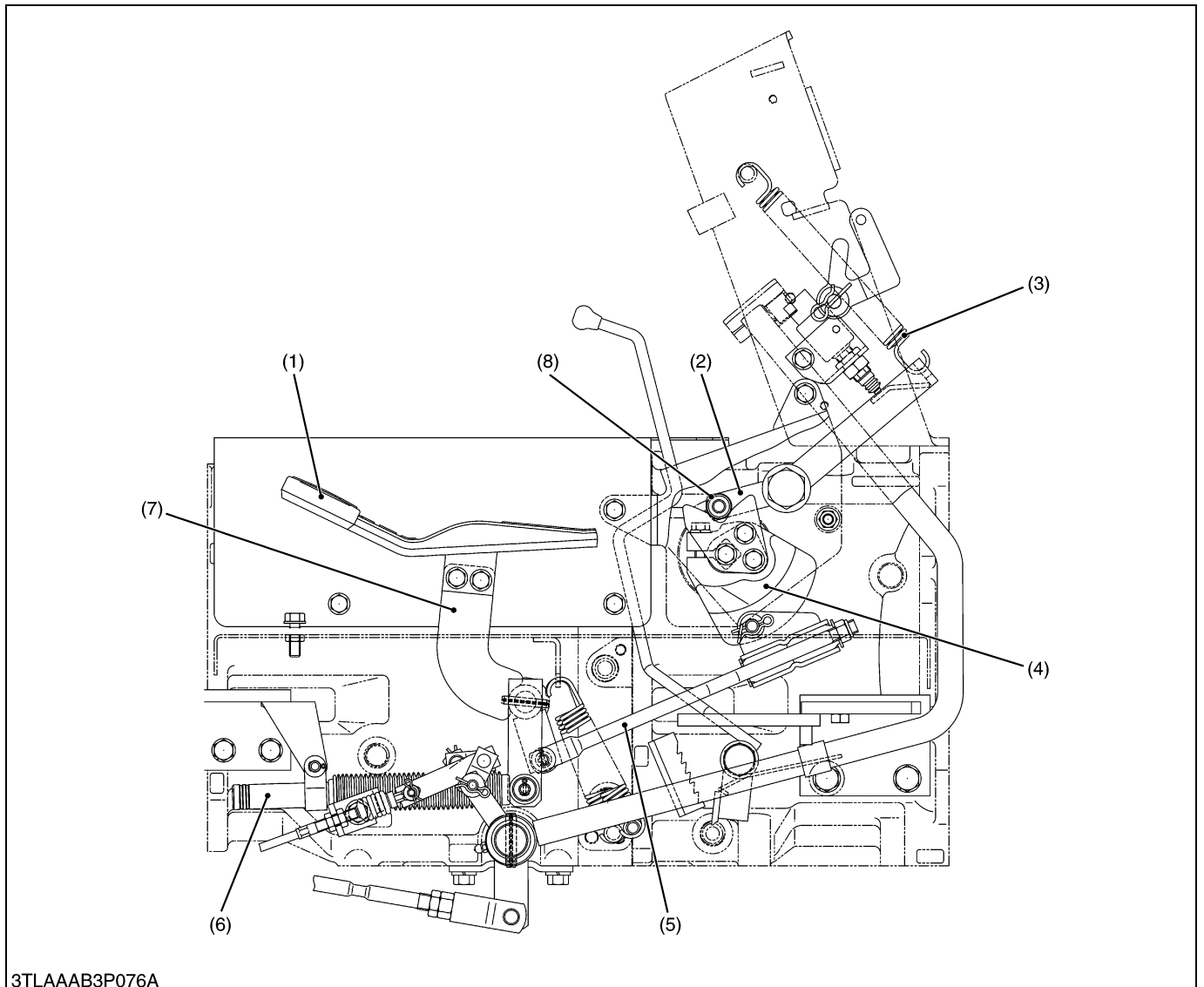
As the pump cylinder block rotates with the input shaft, oil is forced out of pump port **B** at high pressure. As pressure oil enters motor port **D**, the pistons, which align with port **D**, are pushed against the swash-plate and slide down the inclined surface.

Then the output shaft rotates with the motor cylinder block. This drives the machine rearward and the angle of pump swash-plate determines the output shaft speed.

As the motor cylinder block continues to rotate, oil is forced out of motor port **C** at low pressure and returns to the pump port **A**.

[4] CONTROL LINKAGE

(1) HST Pedal Linkage

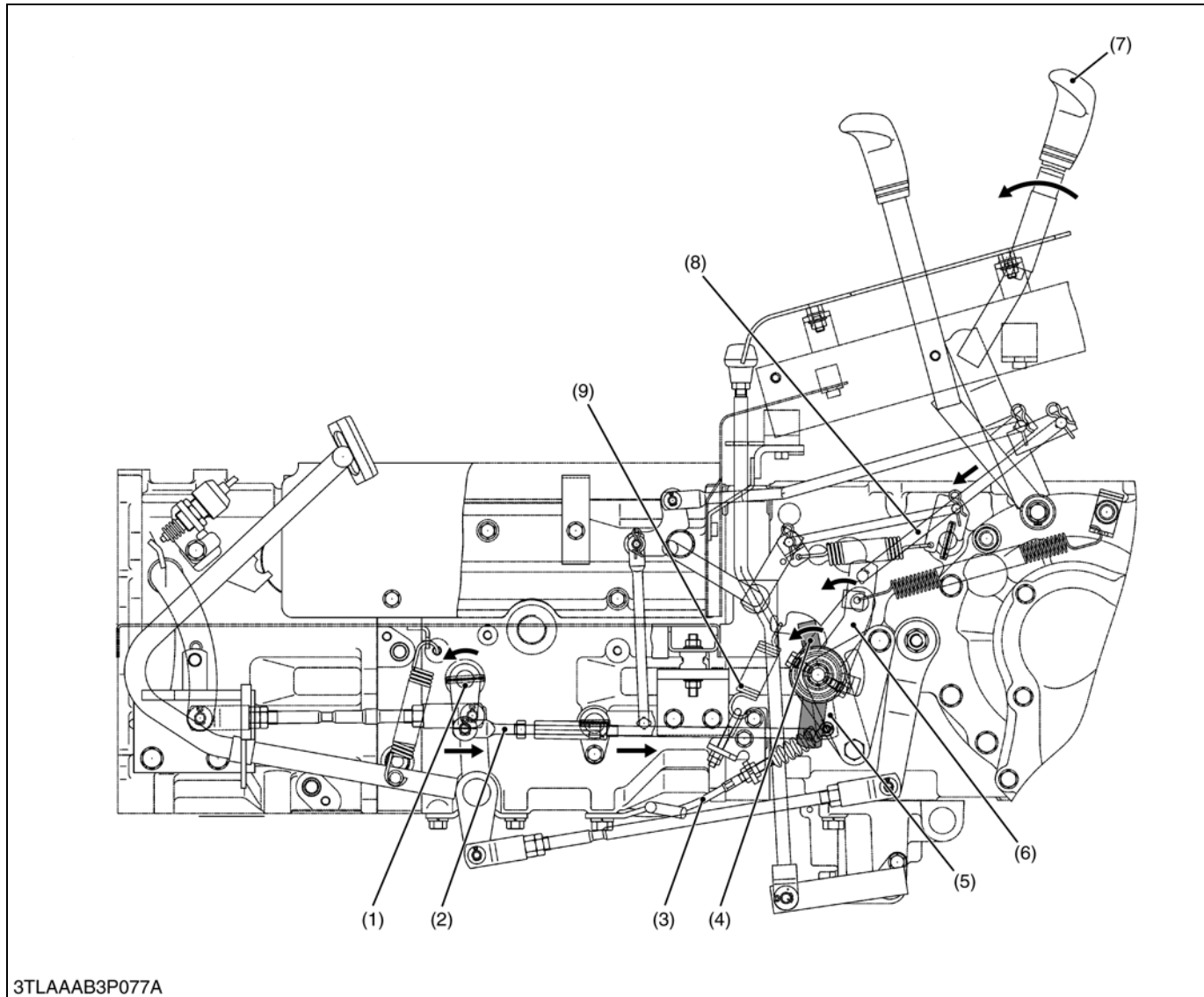


- | | | | |
|------------------------|--------------------|-----------------|-------------------|
| (1) HST Pedal | (3) Spring | (5) Neutral Rod | (7) Pedal Bracket |
| (2) Neutral Holder Arm | (4) Neutral Holder | (6) Damper | (8) Ball Bearing |

The speed control pedal (HST pedal) (1) and the holder (Trunion) are linked with the pedal bracket and HST neutral rod (5).

As the HST pedal (1) is depressed to forward, the HST holder (4) is rotated, then the swash-plate is tilted by trunion shaft and forward travelling speed increases. Then, the swash-plate is returned to neutral with the neutral holder arm (2), when the pedal is released. The ball bearing (8) on the neutral holder (2) pulled with the neutral spring (3) seats the detent of the neutral holder arm (4) so that the neutral holder arm returns to neutral.

The damper (6) is connected to the HST pedal (1) and restricts the movement of the linkage to prevent abrupt operation or reversing.

(2) Cruise Control

- | | | | |
|--------------------------|--------------------|--------------------------|--------------------|
| (1) Connecting Shaft | (4) Cruise Lever 1 | (6) Cruise Lever 2 | (8) Lever Rod |
| (2) Cruise Adjusting Rod | (5) Release Lever | (7) Cruise Control Lever | (9) Release Spring |
| (3) Release Wire | | | |

The cruise control lever (7) and HST pedal are linked with the lever rod (8), cruise lever 1 (4), cruise lever 2 (6), cruise adjusting rod (2) and connecting shaft (1).

When the cruise control lever (7) is moved to forward direction, cruise lever 2 (6) is moved to arrow direction by the lever rod (8). The cruise lever 1 (4) is moved forward by being pushed to the cruise lever 2 (6), and cruise adjusting rod (2) is pulled backward. Because cruise adjusting rod (2) and the HST pedal are connected by the connecting shaft (1), the HST pedal is moved and HST becomes forward position.

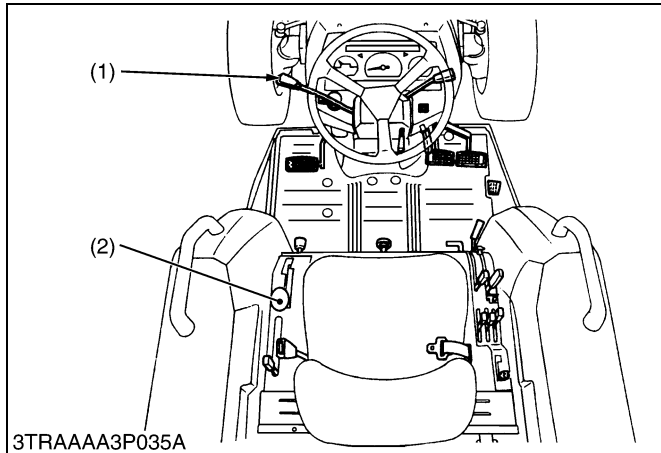
The cruise control can be returned to neutral automatically when brake pedals are depressed.

When brake pedals are depressed, release wire pull the release lever (5) to forward.

As result, the holding force of cruise control lever (7) is lost and the cruise control lever (7) return to neutrality by force of release spring (9).

10. GLIDE SHIFT TRANSMISSION (TYPE 1) (GST Valve Code No. TA040-65015, TA040-99034)

[1] CHARACTERISTIC AND OUTLINE



A series of mechanical operations are instantly performed hydraulically by the GST, without having to step on the clutch. Simply move either the main shift lever (2) or the shuttle shift lever (1), and the hydraulic clutch is automatically disengaged, shifting takes place to the appropriate synchronized gear, and the hydraulic clutch is once more engaged.

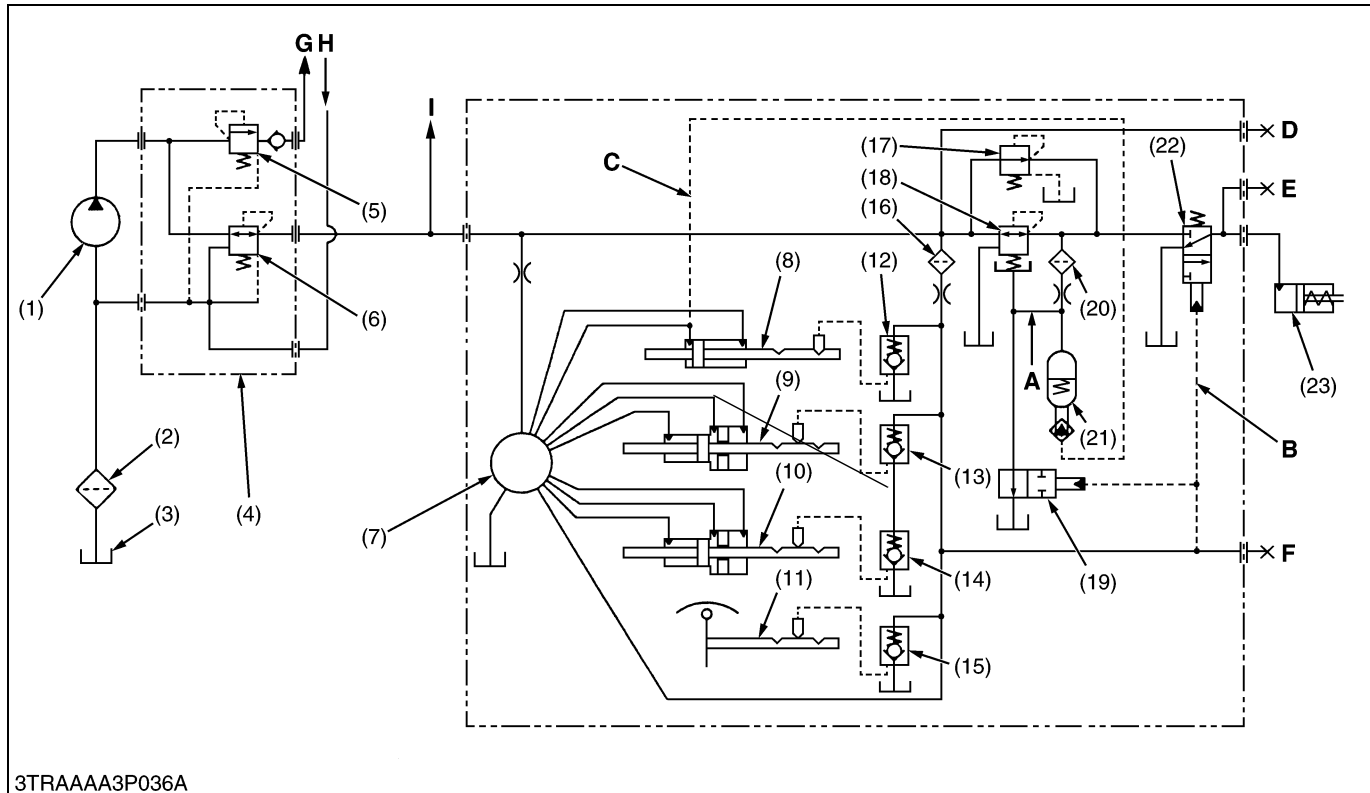
To make possible smooth, swift, and shock resistant gear shift operations and to ensure the best possible clutch engagement for each tractor speed, the hydraulic clutch pack exhibits separate “**Pressure rise control characteristics**” for “**Low-speed shifting**” (N → 1st → 2nd → 3rd → 4th) and “**High-speed shifting**” (4th → 5th → 6th → 7th → 8th).

Made possible by the incorporation of superior KUBOTA hydraulic technology, this exceptionally advanced transmission permits swift shifting with minimal power loss between 1st and 8th gears as well as between forward and reverse without using the clutch.

(1) Shuttle Shift Lever

(2) Main Shift Lever

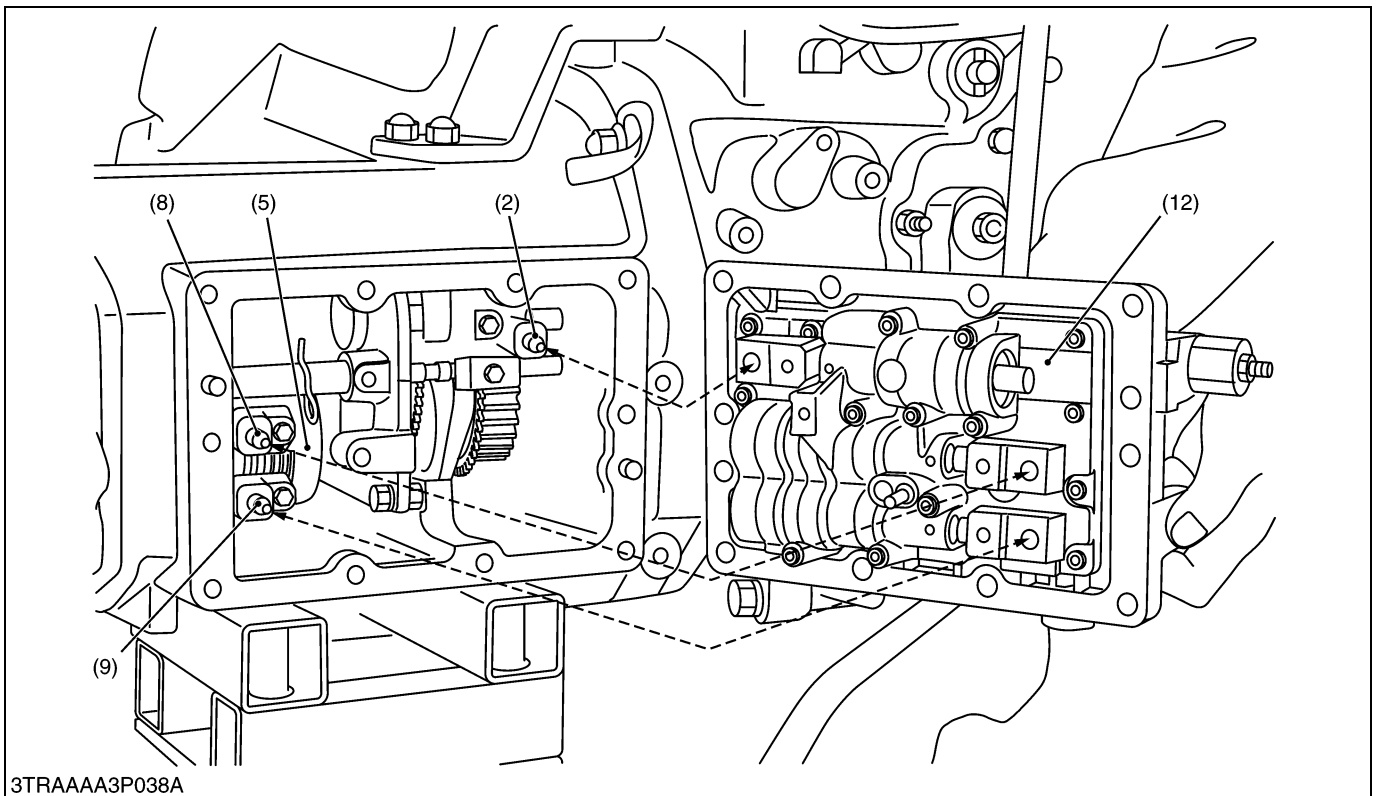
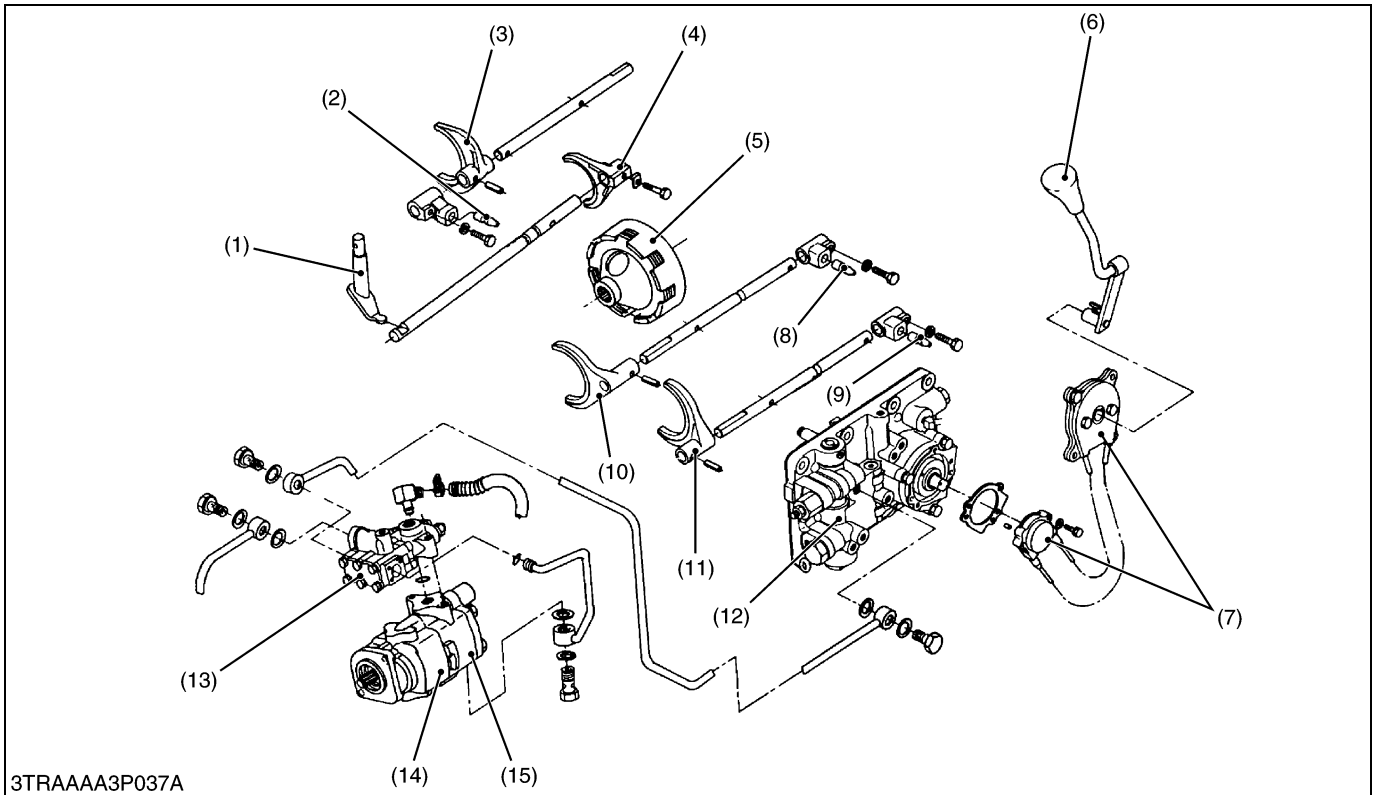
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[2] HYDRAULIC CIRCUIT

- | | | | |
|------------------------------|----------------------------------|--|--|
| (1) Hydraulic Pump | (10) Shift Piston (1, 2) | (19) Modulating Check Valve | C : Accumulator Pilot Circuit |
| (2) Oil Filter | (11) Shuttle Shift Rod | (20) Line Filter | D : Check Port (GST System Pressure) |
| (3) Oil Tank | (12) Shift Check Valve (H, L) | (21) Accumulator | E : Check Port (Clutch Pack Pressure) |
| (4) Regulator Valve Assembly | (13) Shift Check Valve (3, 4) | (22) Clutch Valve | F : Check Port (Pilot Pressure) |
| (5) Relief Valve | (14) Shift Check Valve (1, 2) | (23) Clutch Pack | G : To Power Steering Circuit |
| (6) Reducing Valve | (15) Shift Check Valve (Shuttle) | | H : From Power Steering Circuit |
| (7) Rotary Valve | (16) Line Filter | A : Modulating Feedback Circuit | I : To Independent PTO Clutch |
| (8) Shift Piston (H, L) | (17) Low-pass Valve | B : Pilot Circuit | |
| (9) Shift Piston (3, 4) | (18) Modulating Valve | | |

- When the engine is started, hydraulic pump (1) rotates and sucks in the oil from the oil tank (3). The oil is filtered through the oil filter (2).
- The oil entering the regulator valve (4) flows through the reducing valve (6) to the GST circuit. The oil pressure is maintained at a fixed level by the reducing valve (6). Other oil flows through the relief valve (5) to the power steering circuit.
- When the main shift lever is moved, the rotary valve (7) is activated to drain the oil in the pilot circuit (B), and the clutch pack (23) is disengaged.
- Then, the oil is supplied from the rotary valve (7) to the shift pistons (8), (9), (10) to shift the gear. When the gear is shifted, the shift check valves (12), (13), (14), (15) are closed, pressurizing the pilot circuit (B). When the gear is shifted to the Hi-speed side (5th, 6th, 7th, 8th speed) during the above oil flow, the accumulator pilot circuit (C) is pressurized.
- The clutch valve (22) is opened and the modulating check valve (19) is closed by the pressure of the pilot circuit (B).
- The clutch valve (22) is opened and the oil flows to the clutch pack (23) through the low-pass valve (17), the modulating valve (18). During this period, the pressure is built up gradually by the low-pass valve (17), modulating valve (18), and accumulator (21), causing the clutch to be engaged smoothly. When the speed is changed to the Hi-speed side (5th, 6th, 7th, 8th speed), the volume of the accumulator (21) is reduced and the pressurizing time is changed.

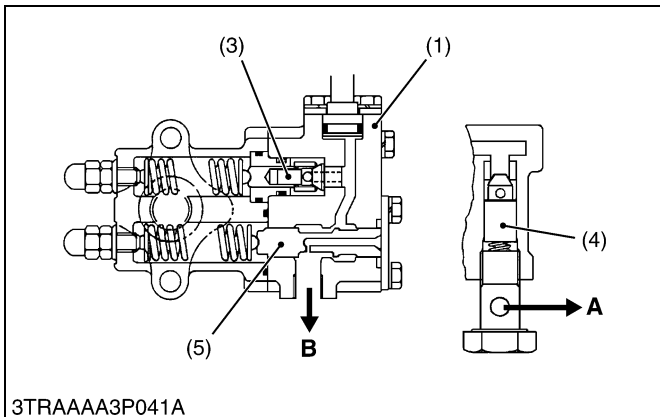
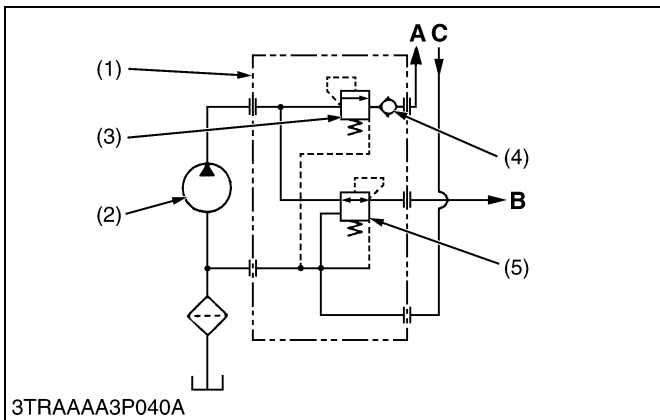
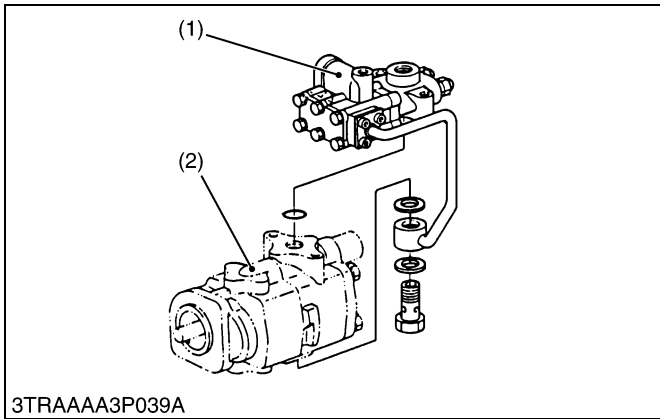
[3] STRUCTURE



- | | | | |
|-------------------------|----------------------|-------------------------------|--|
| (1) Shuttle Shift Lever | (6) Main Shift Lever | (10) Shift Fork 3-4 | (14) Hydraulic Pump for Three Points Linkage |
| (2) Shift Pin H-L | (7) Shift Cable | (11) Shift Fork 1-2 | (15) Hydraulic Pump for Power Steering |
| (3) Shift Fork H-L | (8) Shift Pin 3-4 | (12) GST Valve Assembly | |
| (4) Shuttle Shift Fork | (9) Shift Pin 1-2 | (13) Regulator Valve Assembly | |
| (5) Clutch Pack | | | |

[4] CONSTRUCTION PARTS

(1) Regulator Valve



The oil from the hydraulic pump for the power steering system flows to the GST circuit to set the pressure of the circuit. Other oils flow to the power steering circuit.

Oil Flow

The oil from the power steering hydraulic pump (2) flows through the reducing valve (5) to the GST circuit. When the oil is filled into the circuit, the reducing valve (5) is closed to maintain the pressure in the GST system circuit to 2.45 MPa (25.0 kgf/cm², 356 psi).

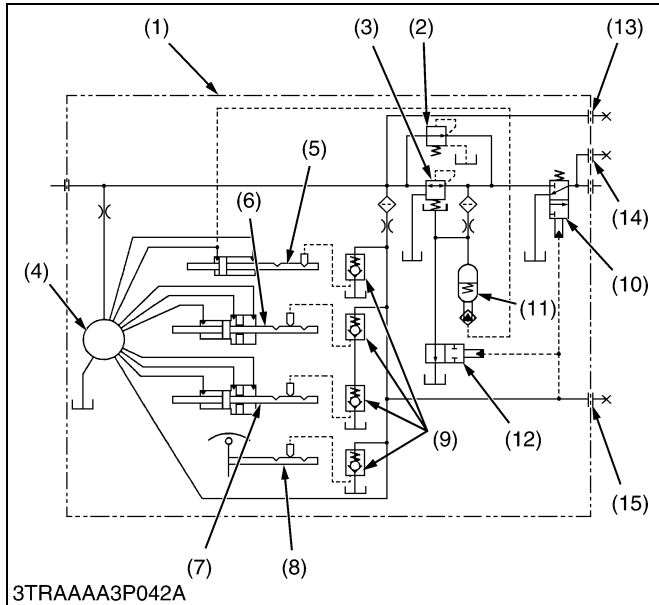
The oil from the power steering pump passes through the relief valve (3) and check valve (4), then it flows to power steering circuit. The relief valve (3) is provided to maintain 2.94 MPa (30.0 kgf/cm², 427 psi) at inlet pressure of the reducing valve (5) except when the power steering is operated. Thereby the GST circuit pressure is gotten to 2.45 MPa (25.0 kgf/cm², 356 psi).

- (1) Regulator Valve
- (2) Hydraulic Pump
- (3) Relief Valve
- (4) Check Valve
- (5) Reducing Valve

- A : To Power Steering Circuit**
- B : To GST Circuit**
- C : From Power Steering Circuit**

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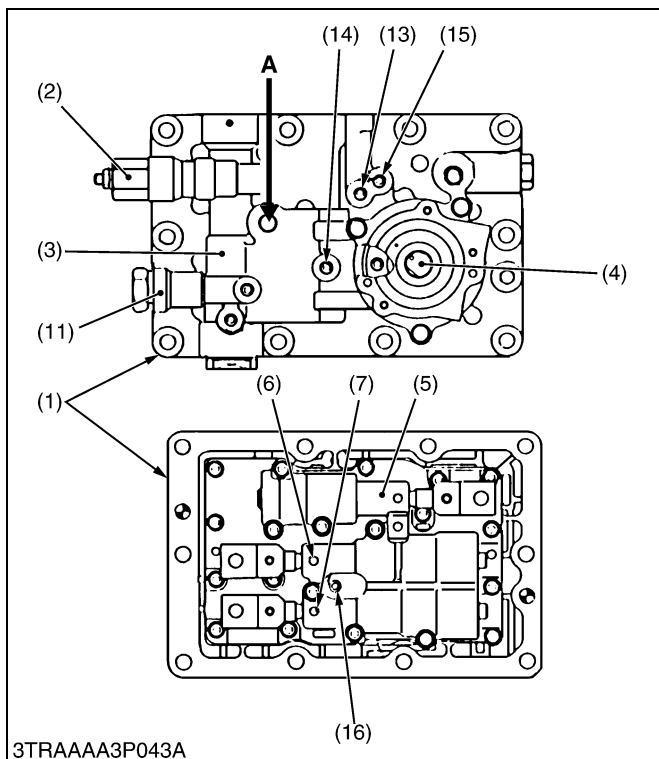
(2) GST Valve Assembly



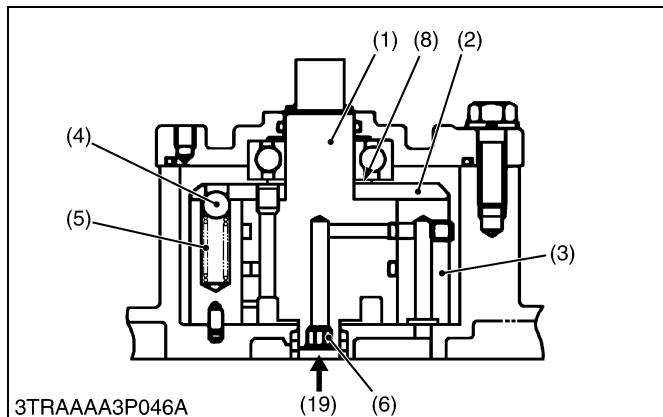
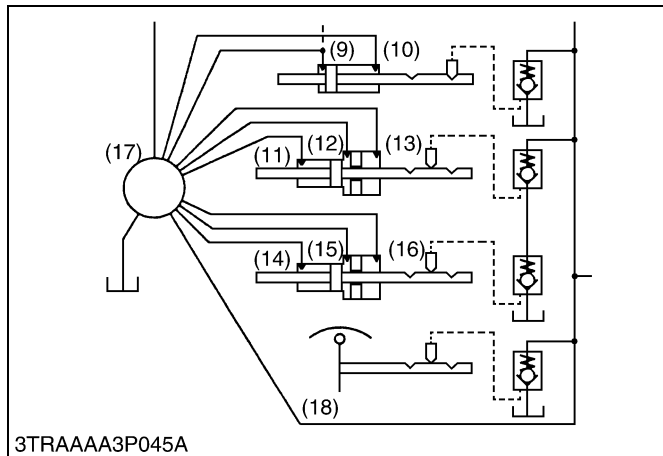
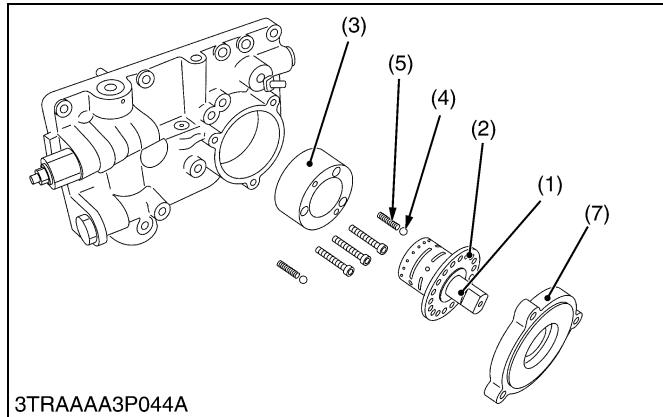
The GST valve assembly (1) is installed at the left side of the transmission. In the GST valve assembly, many parts comprising the system are installed, including the rotary valve (4), low-pass valve (2), modulating valve (3), clutch valve (10), accumulator (11), modulating check valve (12), shift pistons (5), (6), (7), and shift check valves (9). The GST valve assembly functions as the central unit of the GST system.

- | | |
|-------------------------|---|
| (1) GST Valve Assembly | (11) Accumulator |
| (2) Low-pass Valve | (12) Modulating Check Valve |
| (3) Modulating Valve | (13) Check Port
(GST System Pressure) |
| (4) Rotary Valve | (14) Check Port
(Clutch Pack Pressure) |
| (5) Shift Piston (H, L) | (15) Check Port (Pilot Pressure) |
| (6) Shift Piston (3, 4) | (16) Clutch Port |
| (7) Shift Piston (1, 2) | |
| (8) Shuttle Shift Rod | |
| (9) Shift Check Valve | |
| (10) Clutch Valve | |
- A : From Regulator Valve**

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(3) Rotary Valve



When the main shift lever is moved, the rotary valve (17) is actuated and oil is distributed to each shift piston. Also, the oil in the pilot circuit is drained and the clutch pack is disengaged, thereby shifting the gear.

Oil Flow

When the rotor (1) is rotated by the main shift lever, the oil is drained from the pilot circuit and the modulate feedback circuit. At the same time, the oil from the regulator valve is supplied to the shift pistons according to the gear shifting operation. Oil distribution of the rotary valve (17) is shown in the table below.

[Pressure Port Table]

Shift range	Ports							
	L (10)	H (9)	1st (14)	2nd (15)	n1-2 (16)	3rd (11)	4th (12)	n3-4 (13)
Neutral	-	-	☆	-	☆	☆	-	☆
1st	☆	-	☆	-	-	☆	-	☆
2nd	☆	-	-	☆	-	☆	-	☆
3rd	☆	-	☆	-	☆	☆	-	-
4th	☆	-	☆	-	☆	-	☆	-
5th	-	☆	☆	-	-	☆	-	☆
6th	-	☆	-	☆	-	☆	-	☆
7th	-	☆	☆	-	☆	☆	-	-
8th	-	☆	☆	-	☆	-	☆	-

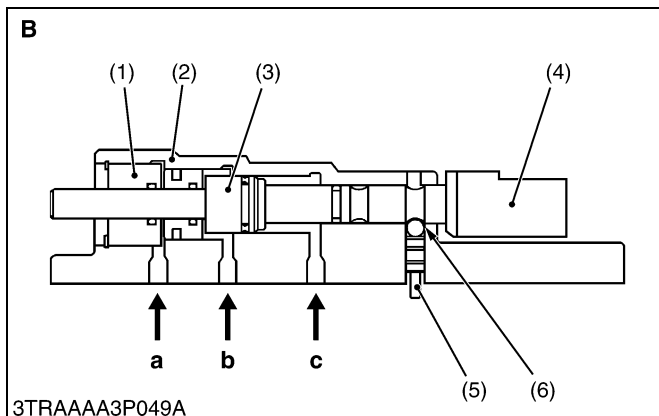
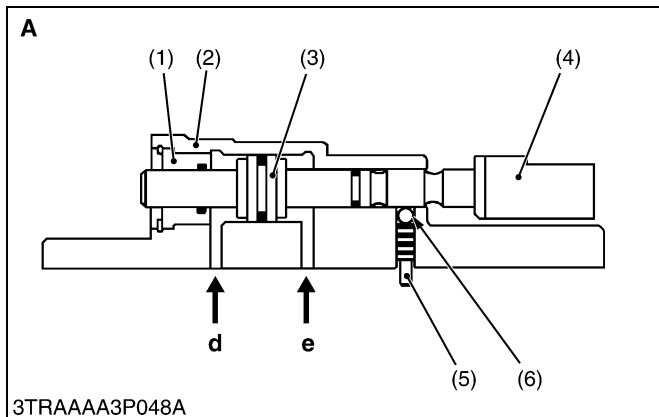
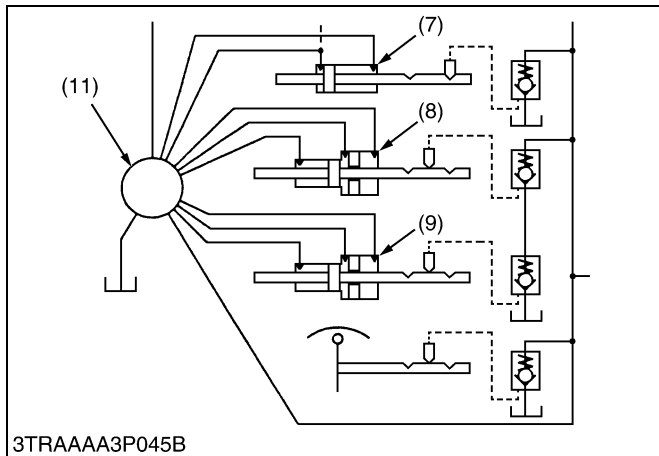
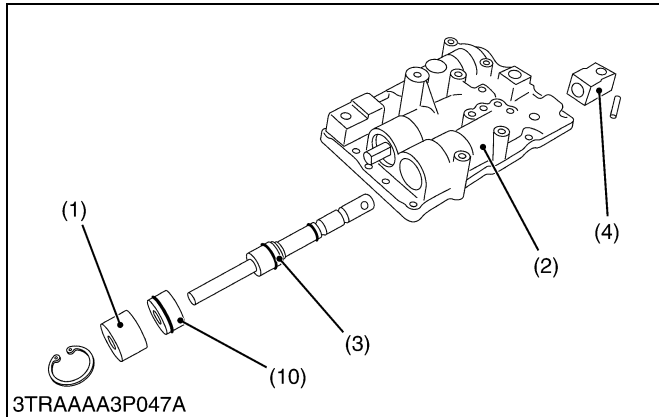
* ☆ marks represent the oil pressurized ports. Minus signs represent the drain port.

* During the gear shift, the pilot port (18) operates as the drain circuit in the rotary valve and is closed after the speed is changed.

- (1) Rotor
- (2) Detent Plate
- (3) Valve Case
- (4) Ball
- (5) Detent Spring
- (6) Orifice
- (7) Rotary Valve Case
- (8) 20 Thrust Collar
- (9) H Port
- (10) L Port
- (11) 3rd Port
- (12) 4th Port
- (13) n3-4 Port
- (14) 1st Port
- (15) 2nd Port
- (16) n1-2 Port
- (17) Rotary Valve
- (18) Pilot Port
- (19) Pump Port

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(4) Shift Pistons



The shift pistons (7), (8), (9) are actuated by the oil distributed by the rotary valve (11). At the tip of these shift pistons are installed the shifters (4), which are connected to each shift rod and shift the gear.

■ **Oil Flow**

The shift piston H-L (7) allows the oil to flow to the **L** port (**e**) for low shift (1st, 2nd, 3rd, 4th) and to the **H** port (**d**) for high shift (5th, 6th, 7th, 8th), thus changing the speed accordingly.

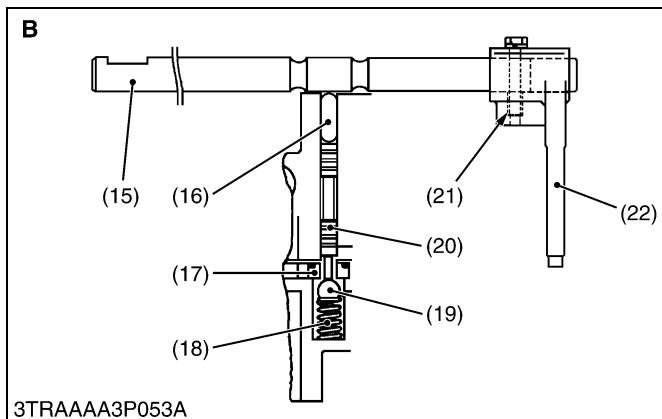
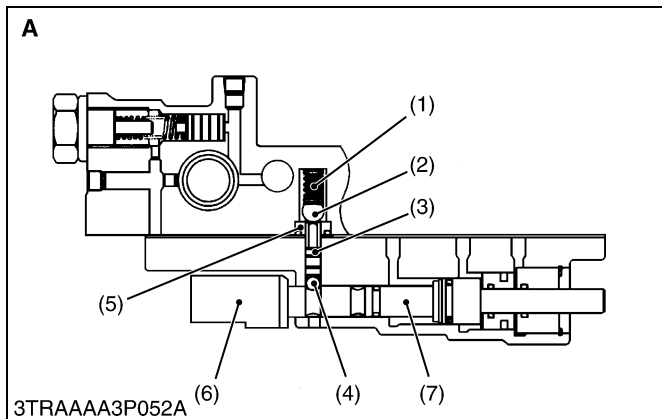
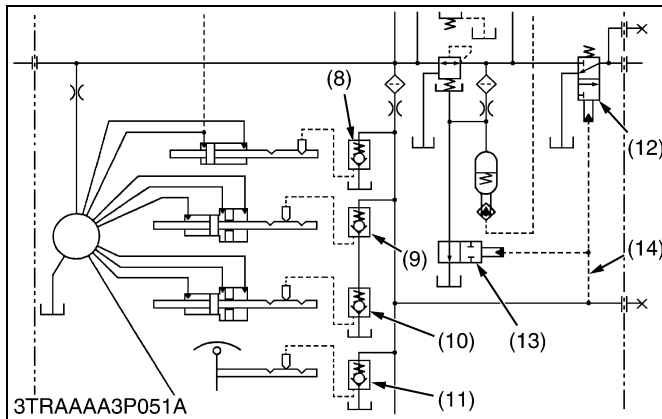
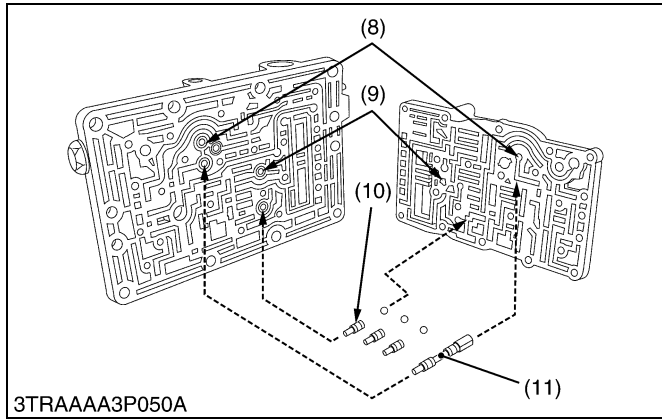
The shift piston 1-2 (9) and the shift piston 3-4 (8) allow the oil to flow to the 1st port (**c**) or the 3rd port (**c**) for the 1st or 3rd shift and to flow to the 2nd port (**b**) or 4th port (**b**) for the 2nd or 4th shift, causing the shift piston (3) to move to shift the gear. When set at the neutral position, the oil is flown to the n1-2 port (**a**) or the n3-4 port (**a**) and the 1st port (**c**) or the 3rd port (**c**), thereby maintaining the neutral position.

- | | |
|----------------------|---------------------|
| (1) Cover | (10) Neutral Piston |
| (2) Shift Valve Body | (11) Rotary Valve |
| (3) Shift Piston | |
| (4) Shifter | |
| (5) Check Pin | |
| (6) Ball | |
| (7) Shift Piston H-L | |
| (8) Shift Piston 3-4 | |
| (9) Shift Piston 1-2 | |

- A : Shift Piston H-L**
B : Shift Piston 1-2, 3-4
a : n1-2 Port or n3-4 Port
b : 2nd Port or 4th Port
c : 1st Port or 3rd Port
d : H Port
e : L Port

W10205040

(5) Shift Check Valves



The shift check valves (8), (9), (10), (11) are provided on the shift pistons (7) of the shift piston H-L, shift piston 1-2, shift piston 3-4 and the shuttle shift rod. These shift check valves detect the start and end of gear shifting.

Oil Flow

From the start to the end of gear shifting, the shift check valves (8), (9), (10) of the shift pistons are opened because the ball (4) of the check pin (3) is on the straight portion of the shift piston (7). Therefore, between this portion, the oil in the pilot circuit of the clutch valve (12) and modulate check valve (13) passes through the shift check valves (8), (9), (10), (11) to be drained into the tank, causing the clutch pack to be disengaged.

When the gear shifting is completed, the ball (4) of the check pin (3) enters the groove of the shift piston (7), the check valve is closed, causing the pilot circuit pressure to rise and the clutch valve (12) to open. Thus, the oil flows into the clutch pack to engage it.

The shift check valve (1-2) (10) and the shift check valve (3-4) (9) compose a serial circuit. When either valve is closed, the oil in the pilot circuit will not be drained into the tank.

In the case of the shuttle shift, the shift check valve (11) is opened and closed by the groove of the shuttle shift fork rod (15).

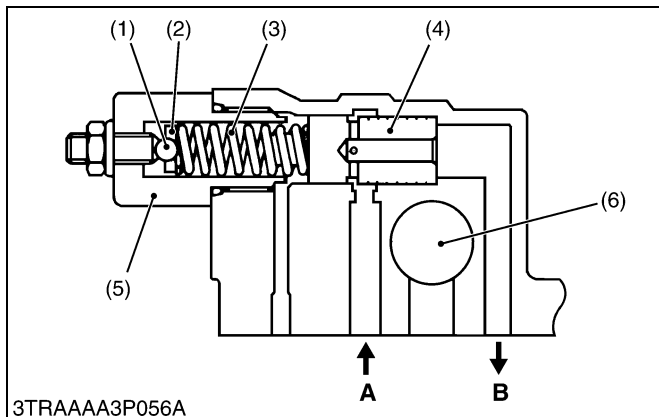
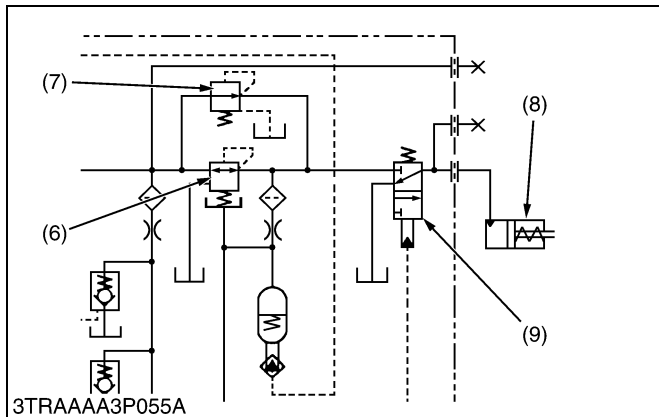
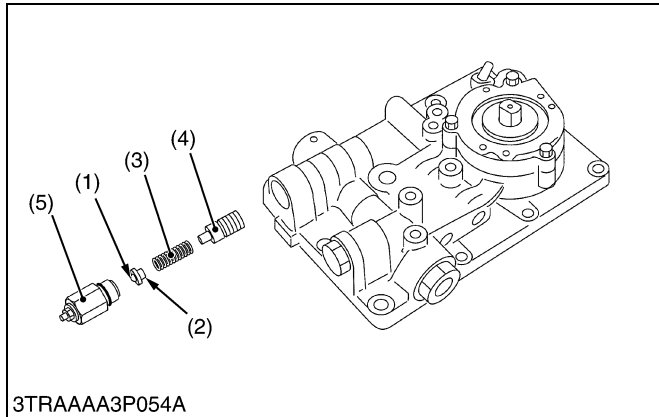
Note that the shuttle shift fork rod (15) has a slot into which the shift fork mounting bolt (21) is inserted. Therefore, when the shuttle shift lever is moved, the shuttle shift fork rod (15) is moved before the shuttle shift fork (22) is moved, disengaging the clutch pack and thus moving the shuttle shift fork (22).

- | | |
|----------------------------------|-----------------------------|
| (1) Check Spring | (15) Shuttle Shift Fork Rod |
| (2) Ball | (16) Pin |
| (3) Check Pin | (17) Check Valve Seat |
| (4) Ball | (18) Spring |
| (5) Check Valve Seat | (19) Ball |
| (6) Shifter | (20) Check Pin |
| (7) Shift Piston | (21) Bolt |
| (8) Shift Check Valve (H-L) | (22) Shuttle Shift Fork |
| (9) Shift Check Valve (3-4) | |
| (10) Shift Check Valve (1-2) | |
| (11) Shift Check Valve (Shuttle) | |
| (12) Clutch Valve | |
| (13) Modulate Check Valve | |
| (14) Pilot Circuit | |

A : Shift Check Valve of Shift Piston
B : Shift Check Valve of Shuttle Shift

W10211960

(6) Low-pass Valve



After completion of the gear shifting, the low-pass valve opens immediately to flow oil into the clutch pack (8), to promote the engagement of the clutch pack.

When the gear shifting starts, the oil in the clutch pack (8) passes the clutch valve (9) to be drained into the tank.

So prior to the beginning of the clutch pack engagement and after completion of shifting. It is necessary to flow oil quickly to the clutch pack (8). It is the low-pass valve that does this operation.

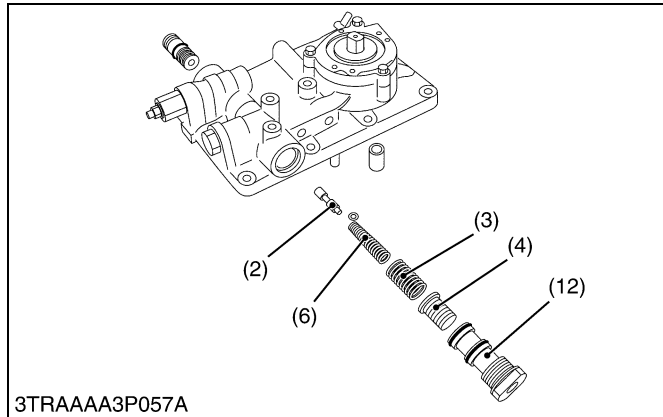
Oil Flow

The oil from the regulator valve flows in from the **IN** port (**A**), passes through the low-pass spool, flows out from the **OUT** port (**B**), and flows to the clutch pack (8). When the pressure on the side of the **OUT** port (**B**) reaches fixed pressure, the low-pass spool (4) pushes the spring (3) to close the circuit.

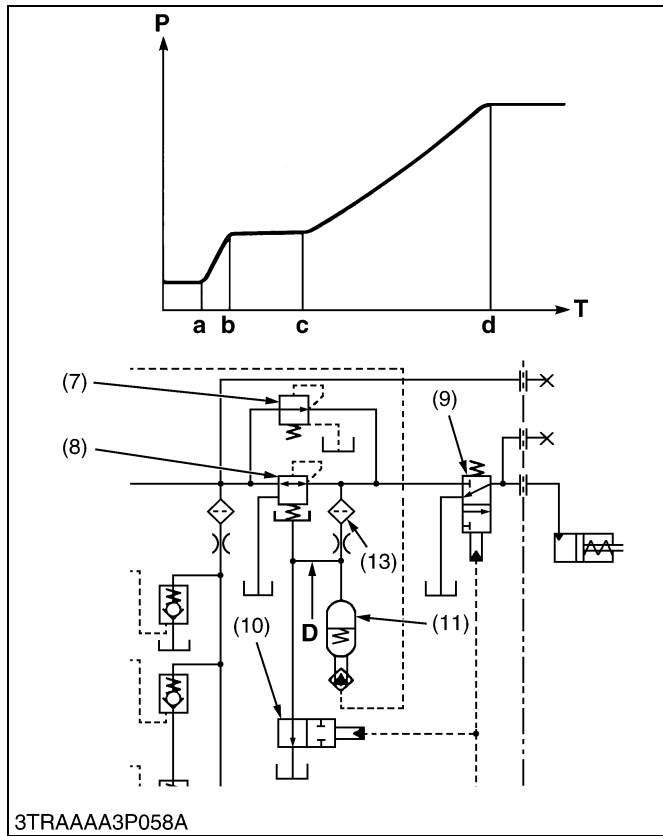
- | | |
|----------------------|---------------------|
| (1) Ball | (7) Low-pass Valve |
| (2) Spring Support | (8) Clutch Pack |
| (3) Spring | (9) Clutch Valve |
| (4) Low-pass Spool | |
| (5) Plug | A : IN Port |
| (6) Modulating Valve | B : OUT Port |

W10220340

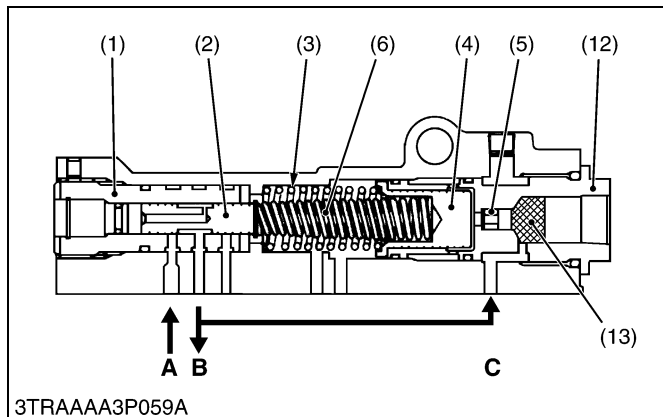
(7) Modulating Valve



3TRAAAA3P057A



3TRAAAA3P058A



3TRAAAA3P059A

After the gear shifting is completed, pressure of the clutch pack is gradually increased in order to engage the clutch pack smoothly with reduced shock.

■ **Oil Flow**

When the gear shifting is completed, the clutch valve (9) is opened and at the same time, the modulating check valve (10) is closed.

As stated above, the oil is filled into the clutch pack through the low-pass valve (7). (a to b, b to c)

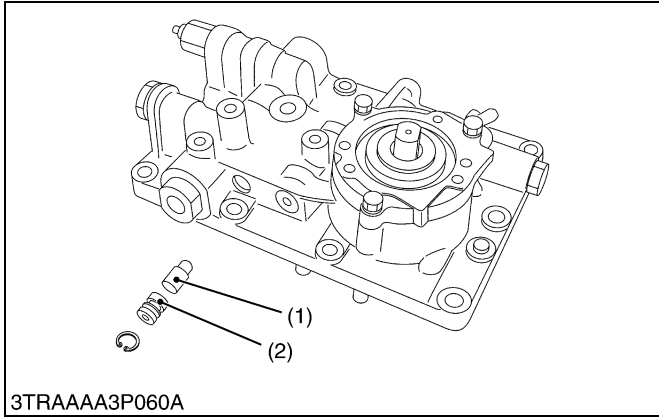
At the same time, the modulating valve (8) starts operation, too. The oil flowing to the clutch pack also flows to the modulate feedback circuit (D), enters the back of the modulating piston (4), increases the tensile force of the modulating spring (6), and the modulating spool (2) is moved to open position.

Therefore, the oil from the regulator valve flows to the clutch pack again. After that, the modulating spool (2) is closed again to repeat the same movement, so that the pressure to the clutch pack is gradually increased to the set pressure 2.45 MPa (25.0 kgf/cm², 356 psi) of the reducing valve. (c to d)

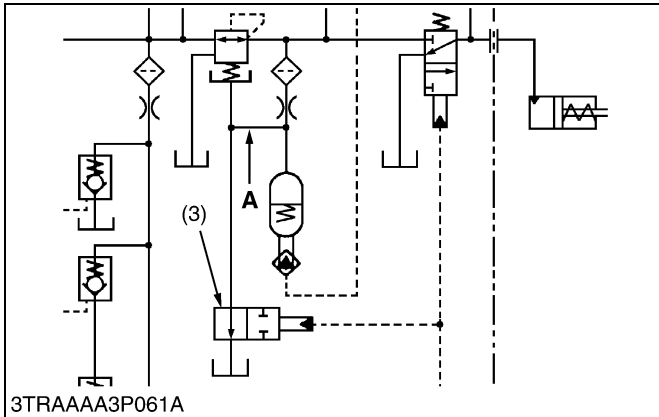
- | | |
|-----------------------------|--|
| (1) Valve Housing | (12) Sleeve |
| (2) Modulating Spool | (13) Line Filter |
| (3) Return Spring | |
| (4) Modulating Piston | |
| (5) Orifice | A : From Regulator Valve |
| (6) Modulating Spring | B : To Clutch Pack |
| (7) Low-pass Valve | C : To Modulating Valve |
| (8) Modulating Valve | D : Modulating Feedback Circuit |
| (9) Clutch Valve | P : Pressure (MPa, kgf/cm², psi) |
| (10) Modulating Check Valve | T : Time (sec.) |
| (11) Accumulator | |

W10225870

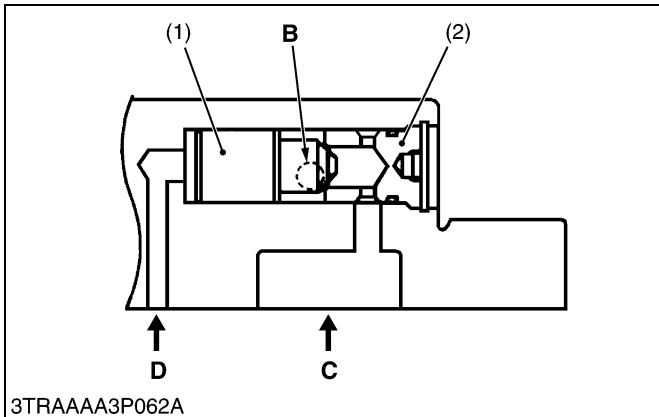
(8) Modulating Check Valve



3TRAAAA3P060A



3TRAAAA3P061A



3TRAAAA3P062A

From the start to the end of gear shifting, the modulating check valve (3) drains the oil of the modulating feedback circuit (A). By this action, the pressure rise pattern of the clutch pack is made the same regardless of the speed of operating the shift lever.

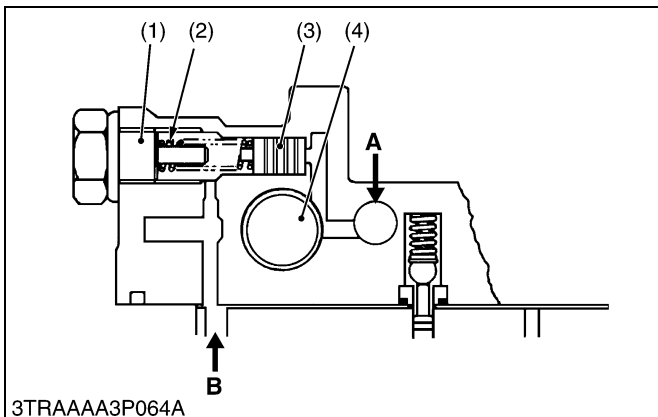
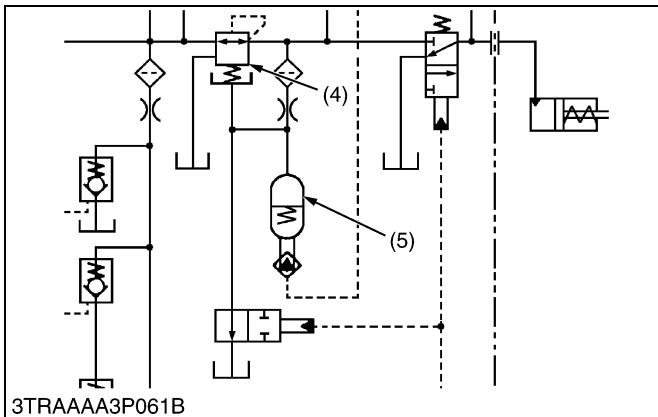
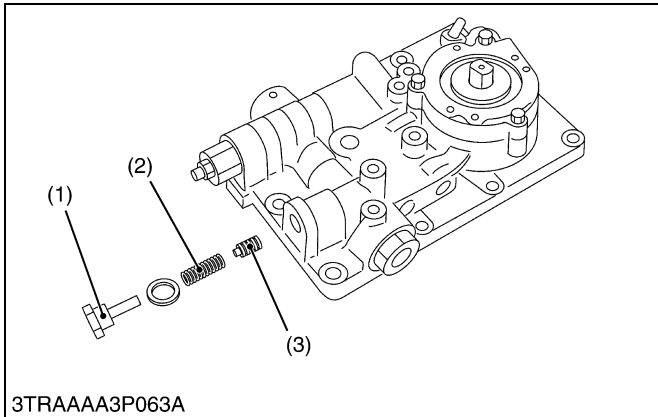
Oil Flow

The oil of the modulate feedback circuit (A) flows in from the C port. The oil of the pilot circuit flows in from the D port. Therefore, when the pressure is present in the pilot circuit, the poppet (1) is closed, and when the pressure is not present in the pilot circuit, the poppet (1) is pushed open.

- (1) Poppet
- (2) Valve Seat
- (3) Modulating Check Valve

- A : Modulating Feedback Circuit**
- B : Tank Port**
- C : C port (From Modulating Feedback Circuit)**
- D : D Port (From Pilot Circuit)**

W10241610

(9) Accumulator

The accumulator is provided to reduce the shock during the clutch pack engagement.

When the gear shifting is completed, the clutch valve is opened and the oil starts flowing to the clutch pack.

As the oil flows to the clutch pack, the high pressure generated temporarily during the clutch connection is absorbed to prevent the shock.

The accumulator is operated only by Lo shift. Because the accumulator is not necessary on the Hi side where the required driving torque is large, the oil is flown to the back of the accumulator piston (3) to prevent the accumulator operation.

Oil Flow

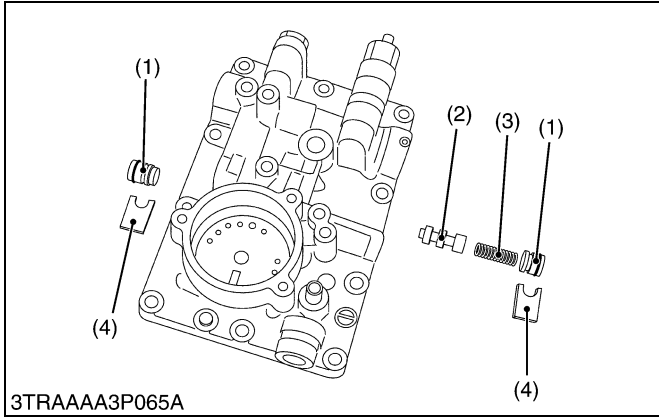
Oil flows in from the **A** port to push the accumulator piston (3). When the Hi-Lo shift is moved to the Hi-speed side, the oil flows in from the **B** port to push the accumulator piston (3) to prevent the accumulator from operating.

- (1) Plug
- (2) Spring
- (3) Accumulator Piston
- (4) Modulating Valve
- (5) Accumulator Assembly

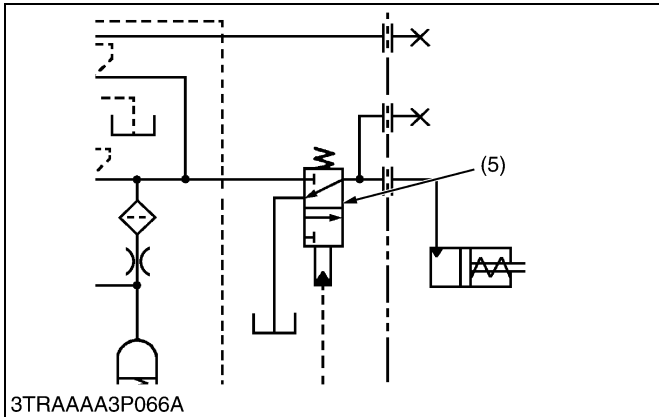
- A : A Port**
(From Modulating Valve)
- B : B Port**
(From Shift Piston H-L)

W10245430

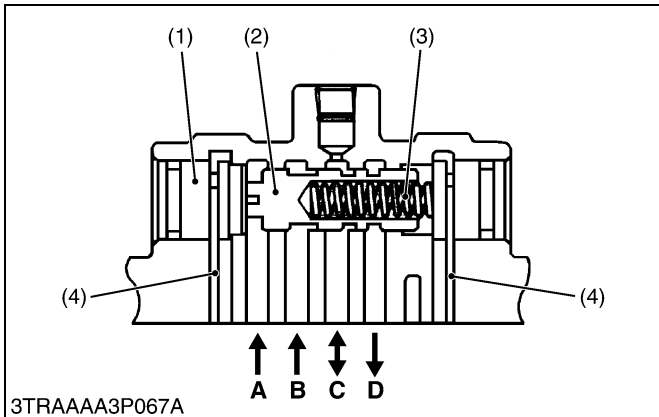
(10) Clutch Valve



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3TRAAAA3P066A



3TRAAAA3P067A

The clutch valve (5) changes the flow of the oil flowing to the clutch pack to carry out “**ENGAGED**” / “**DISENGAGED**” of the clutch pack.

■ **Oil Flow**

Except for the gear shifting, when the pilot circuit is pressurized, the oil of the pilot circuit flows in from the **A** port to push the spool (2) to the right. Therefore, the oil from the modulate valve flows in from the **B** port, flows out from the **C** port, and flows to the clutch pack.

When the pilot circuit pressure is not built from the start to the end of gear shifting, the spool (2) is pushed to the left by the spring (3) to cut the oil flow from the modulate valve of the **B** port, stopping the oil flow to the clutch pack.

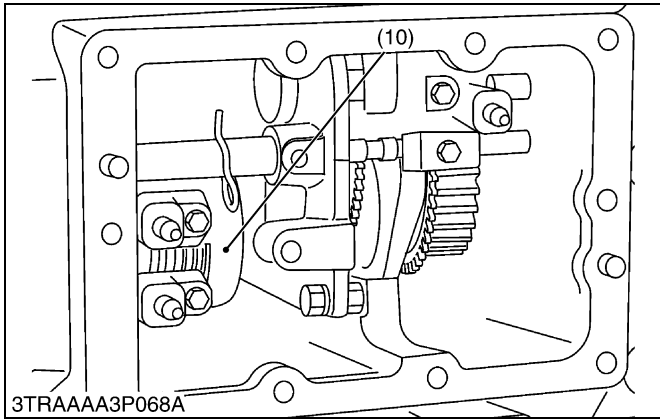
Furthermore, the oil of the clutch pack flows in from the **C** port, drained from the **D** port, and the clutch pack is disengaged.

- (1) Plug
- (2) Spool
- (3) Spring
- (4) Stop Plate
- (5) Clutch Valve

- A** : A Port (From Pilot Circuit)
- B** : B Port (From Shift Piston H-L)
- C** : C Port (To Clutch Pack or From Clutch Pack)
- D** : D Port (To Tank)

W10249800

(11) Clutch Pack

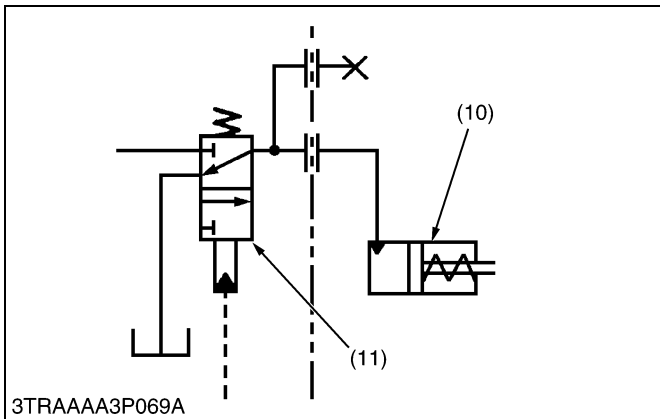


The clutch pack is a multiple disc clutch provided between the counter shaft (1) and the shuttle shaft (8) of the transmission and “engages” and “disengages” the power from the engine.

Oil Flow

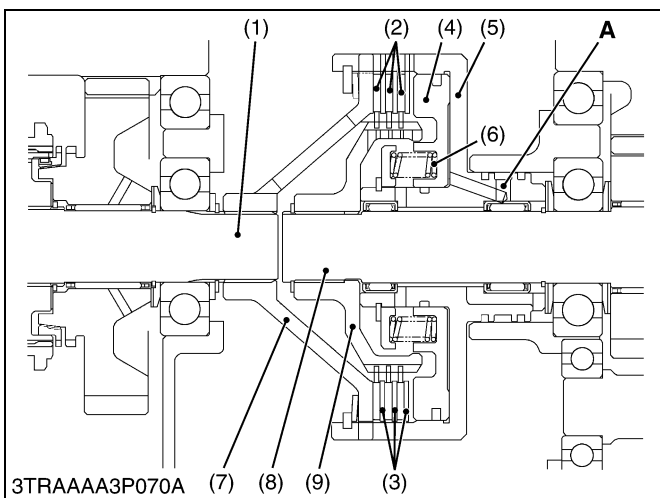
The oil from the clutch valve (11) flows in from the **A** port to push the return spring (6) and the piston (4). The piston (4) is pushed to the left by the oil, thereby pushing the clutch discs (2) and the plate (3) to transmit the power.

When the engine power is disengaged, the oil of the clutch pack (10) is pushed by the return spring (6) and flows out from the **A** port.



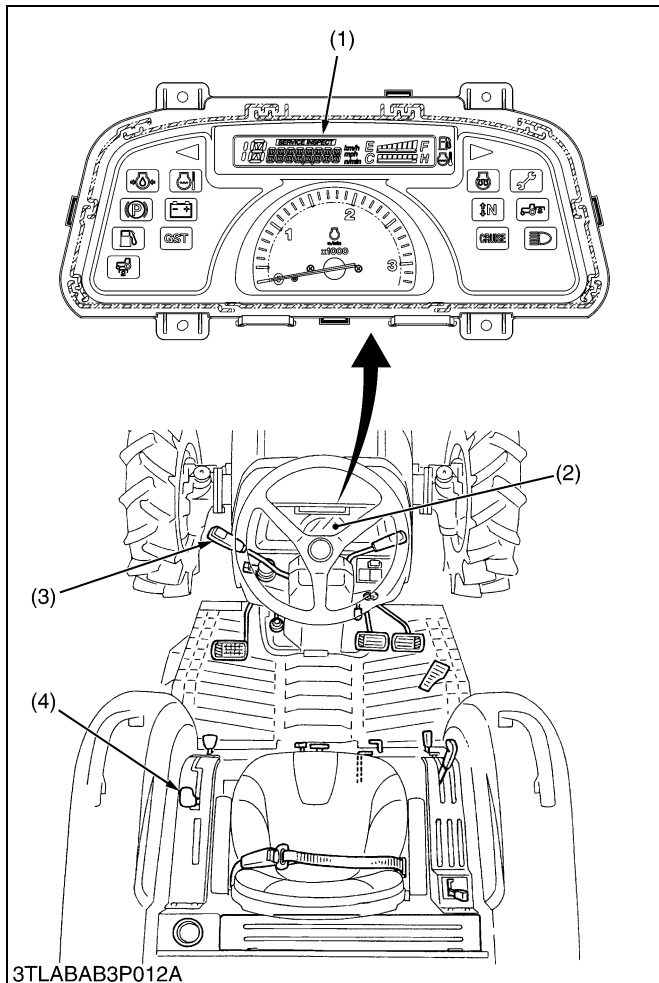
- (1) Counter Shaft
 - (2) Clutch Disc
 - (3) Plate
 - (4) Piston
 - (5) Clutch Case
 - (6) Return Spring
 - (7) Clutch Input Hub
 - (8) Shuttle Shaft
 - (9) Clutch Output Hub
 - (10) Clutch Pack
 - (11) Clutch Valve
- A : A Port (From Clutch Valve or To Clutch Valve)**

W10254490



11. GLIDE SHIFT TRANSMISSION (TYPE 2) (GST Valve Code No. T1063-65004)

[1] CHARACTERISTIC AND SYSTEM OUTLINE



The GST of a new version is adapted in the L30 series tractor. In addition to the former GST system that controls the gear shifting and clutch operation hydraulically, this new GST has the function to control these operations electrically.

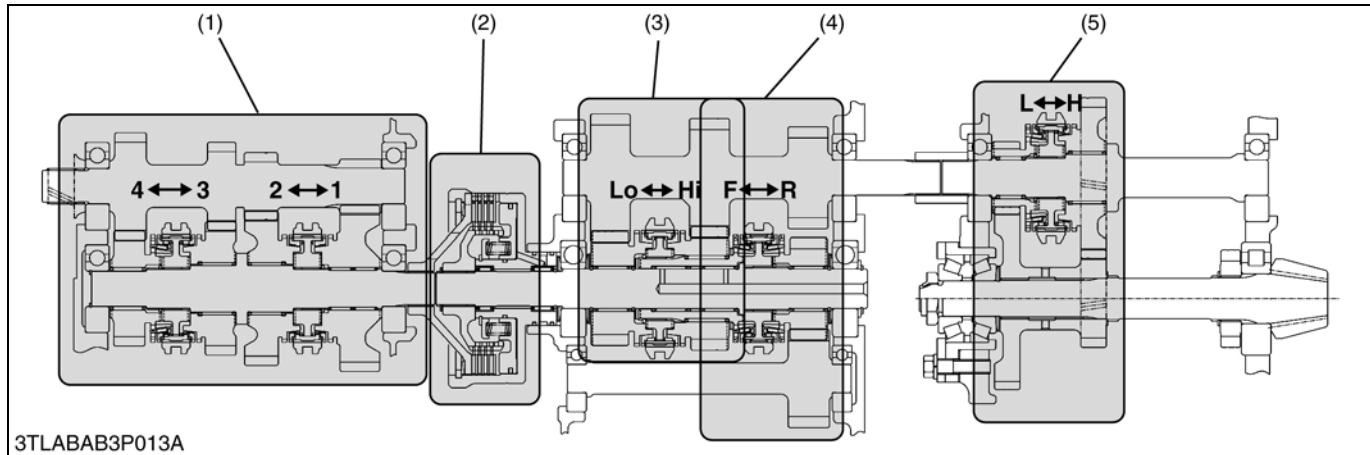
12 forward and 8 reverse speeds can shift only by operating the main shift lever (GST lever) (4) and shuttle shift lever (3) without the clutch operation as well as the former GST system. In addition, the movement and gear shifting according to the oil temperature and the traveling speed can be achieved by having electronically controlled the GST system, and a smoother operation can be done.

Moreover, because the selected speed and the traveling speed can be confirmed by the liquid crystal display (LCD) (1) of electronic instrument panel (IntelliPanel) (2), it can do a comfortable tractor operation. And it is excellent in service because it can confirm the error indication with an electronic instrument panel (2) when the electric wiring is disconnected or short-circuited.

- | | |
|--|----------------------------------|
| (1) Liquid Crystal Display (LCD) | (3) Shuttle Lever |
| (2) Electronic Instrument Panel (IntelliPanel) | (4) Main Shift Lever (GST Lever) |

W1014583

[2] POWER TRAIN



- (1) Main Shift Section
- (2) GST Clutch Pack
- (3) Sub-range Shift Section
- (4) Shuttle Shift Section
- (5) Main Range Shift Section

The transmission is composed of the fully synchronized gear shifting and the hydraulic clutch as shown above figure. And the double cone type synchromesh is adapted on the 4th speed side of main shift section (1), shuttle shift section (4) and L side of main range shift section (5).

As for the speed changing, only by operating the GST lever, the shifter of the gear changing is moved by hydraulic operation which is electrically controlled. And as for each gear changing, each shift is moved according to the shift pattern input to the electric control unit (ECU). The shift pattern is shown in the table below.

Regarding a double cone type synchromesh system and front wheel drive section, these are basically similar to manual transmission model and refer to page 3-M2 and 3-M3.

(Forward shift pattern)

Lever Location at Lever Guide	1	2	3	4	5	6	7	8	9	10	11	12
Display on LCD	1	2	3	4	5	6	7	8	9	10	11	12
(1) Main Shift	1	2	3		4		1		2		3	4
(3) Sub-range Shift	Hi		Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi		
(5) Main Range Shift	L						H					

(Reverse shift pattern)

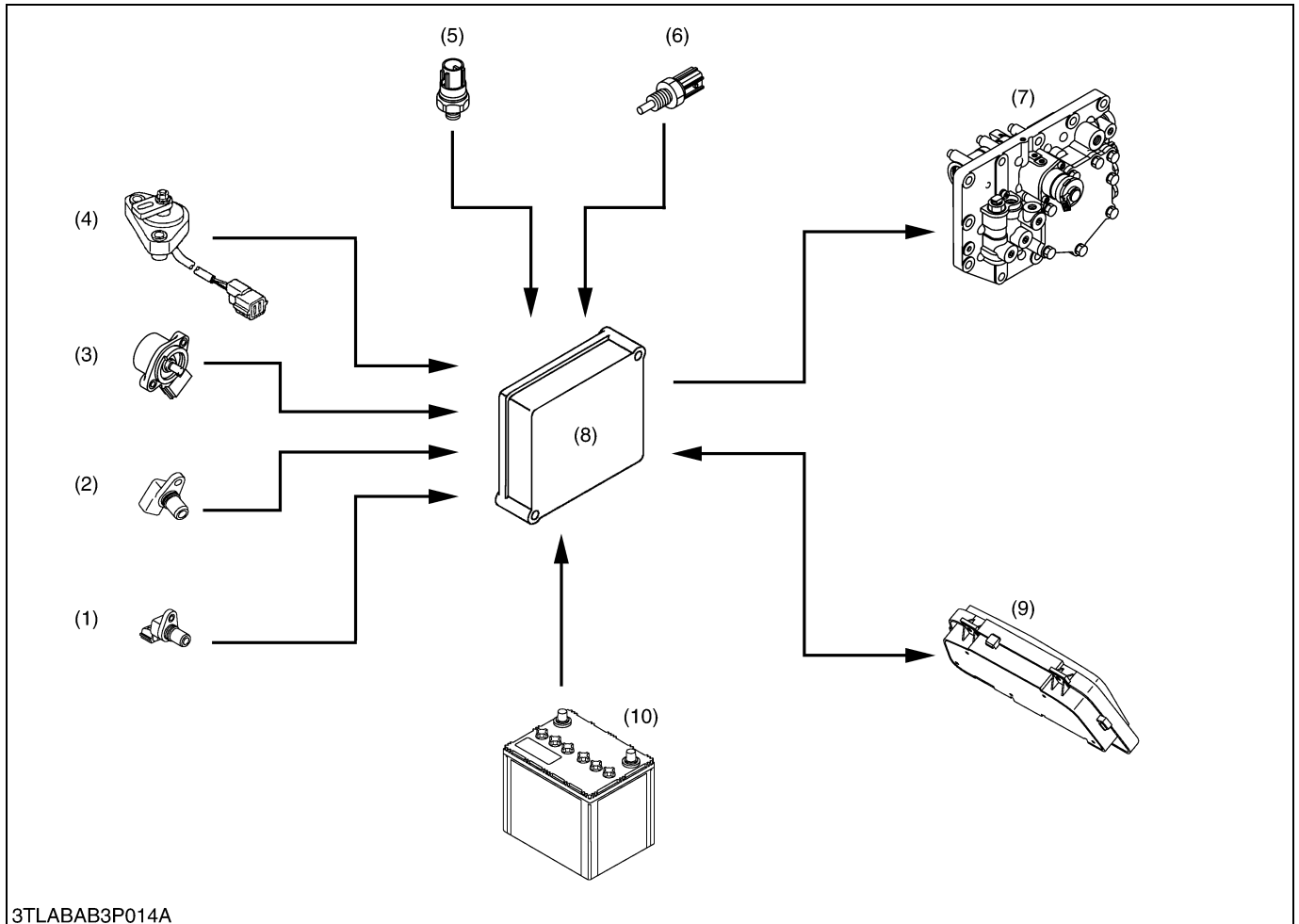
Lever Location at Lever Guide	1	2	3	4	5	6	7	8	9	10	11	12
Display on LCD	1	2	3		4		5		6		7	8
(1) Main Shift	1	2	3		4		1		2		3	4
(5) Main Range Shift	L						H					

[3] ELECTRICAL CONTROL SYSTEM

■ NOTE

- Only the electrical control system concerning the GST operation has been described in this section. Therefore, refer to “ELECTRICAL SYSTEM” section (Section 9) for a general electrical control system.

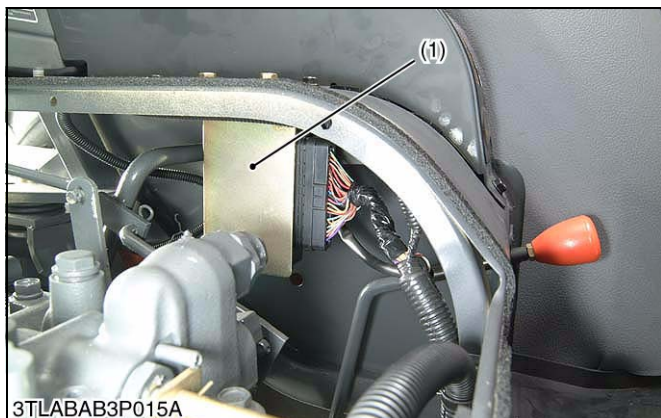
(1) Construction and Function of Components



3TLABAB3P014A

- | | | | |
|------------------------------|----------------------------|------------------------------|---------------------------------|
| (1) Traveling Speed Sensor | (4) Shuttle Switch | (7) GST Valve | (8) Electric Control Unit (ECU) |
| (2) Engine Tachometer Sensor | (5) Pressure Switch | (Solenoid Valve and | (9) Electronic Instrument Panel |
| (3) GST Lever Sensor | (6) Oil Temperature Sensor | Proportional Reducing Valve) | (10) Battery |

The electric control of the GST system is composed by parts shown in the above figure.



3TLABAB3P015A

■ Electric Control Unit (ECU)

This unit incorporates an electronic circuit for various control of GST system and it is equipped on the left under of the platform.

The ECU processes and judges the input data from various switches and sensors and send the signal to various solenoid valves (solenoid valves and proportional reducing valve). At the same time, it also sends the communication data to display the selected-speed and several messages in electronic instrument panel.

- (1) Electric Control Unit

W1015703



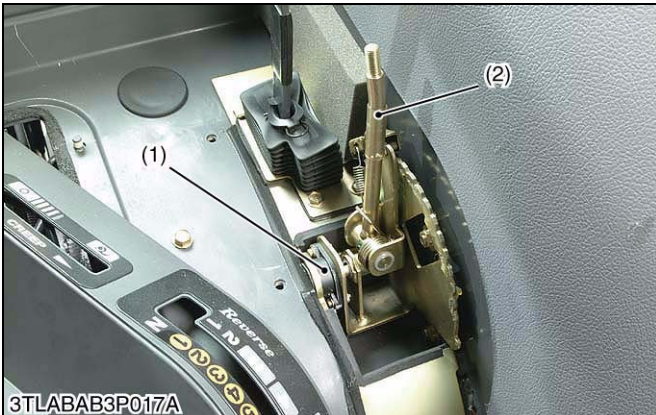
3TLABAB3P016A

■ Electronic Instrument Panel (IntelliPanel)

The 8 bits CPU is built into this panel.

The electronic instrument panel has functions to receive several data of GST control from the ECU, and output them to the liquid crystal display and the monitor lamps. Moreover, it transmits the model data and the sensor data, etc. also to the ECU.

W1015755



3TLABAB3P017A

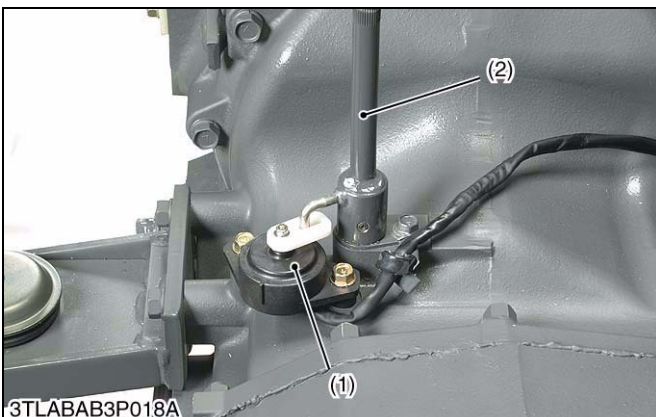
■ GST Lever Sensor

This sensor has function to detect the GST lever position, and it is equipped on the bottom of the GST lever (2).

This sensor is a variable resistor of the rotation displacement type, and all resistance is 2 k Ω , and electrically effective angle is 140 degrees. Then, the lever position from **N** to 12 speed is output within the range from about 0.7 to 4.2 voltages.

(1) GST Lever Sensor (2) GST Lever

W1015847



3TLABAB3P018A

■ Shuttle Switch

This switch has function to detect the shuttle lever position, and it is equipped on the bottom of the shuttle lever rod (2).

This switch has three contact points, which is **Forward**, **Neutral** and **Reverse**, and detects their position. As for GST control, it judges the shuttle start condition.

(1) Shuttle Switch (2) Shuttle Lever Rod

W1015891



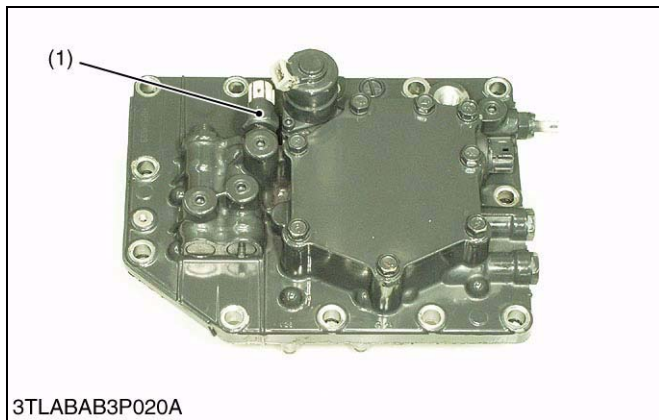
3TLABAB3P019A

■ Engine Tachometer Sensor

This sensor is to detect the engine rotating speed, and it is equipped on the left side of the engine gear case. This sensor perceives tooth of the fuel camshaft gear and emits the pulse. This pulse is sent to the electronic instrument panel, and converted at the engine speed. The data of engine speed is always sent to the ECU.

(1) Engine Tachometer Sensor

W1015946



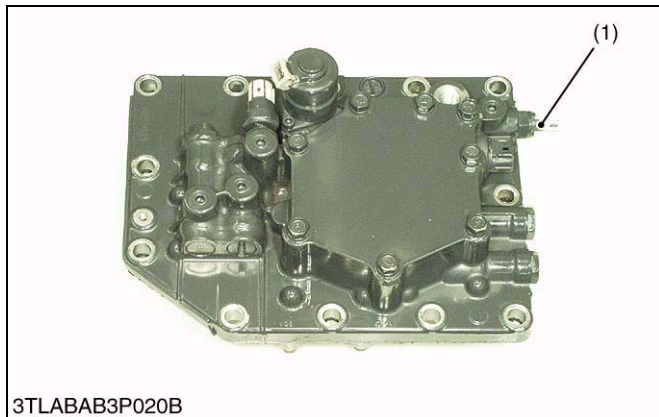
■ **Pressure Switch**

This switch is to detect the gear change completion and hydraulic clutch operation, and it is equipped on the GST valve.

This switch is turned **ON** when the pressure in the GST valve becomes higher than 0.49 MPa (5 kgf/cm², 71 psi) of the pilot pressure, and it is turned **OFF** at a pressure lower than 0.34 MPa (3.5 kgf/cm², 50 psi).

(1) Pressure Switch

W1015998



■ **Oil Temperature Sensor**

This sensor is to detect the temperature of transmission fluid, and it is equipped on the GST valve.

This is provided to make correction for driving time and current of proportional reducing valve in accordance with the oil temperature. This is used to thermistor, and it has such characteristics that its resistance decreases at high temperature and increases at low temperature.

(1) Oil Temperature Sensor

W1016064

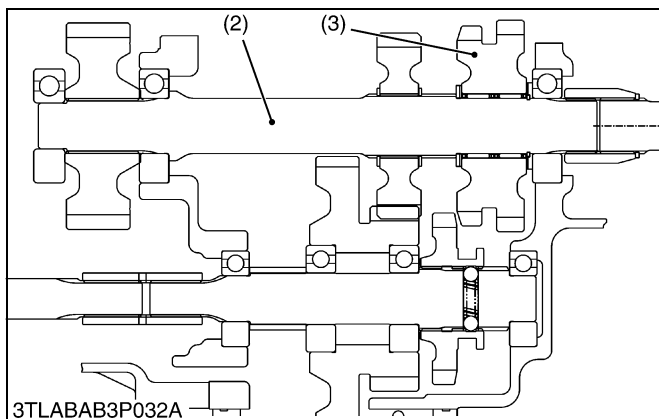


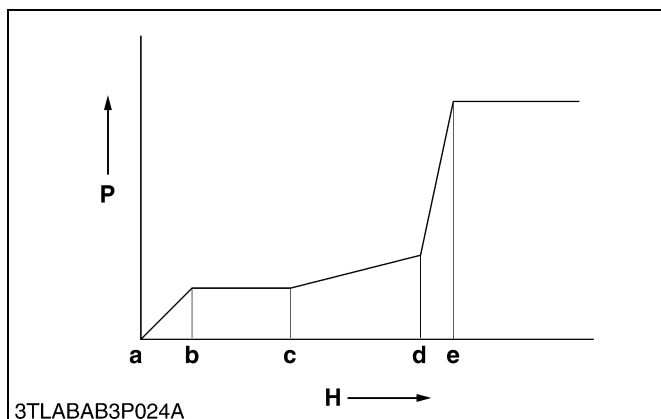
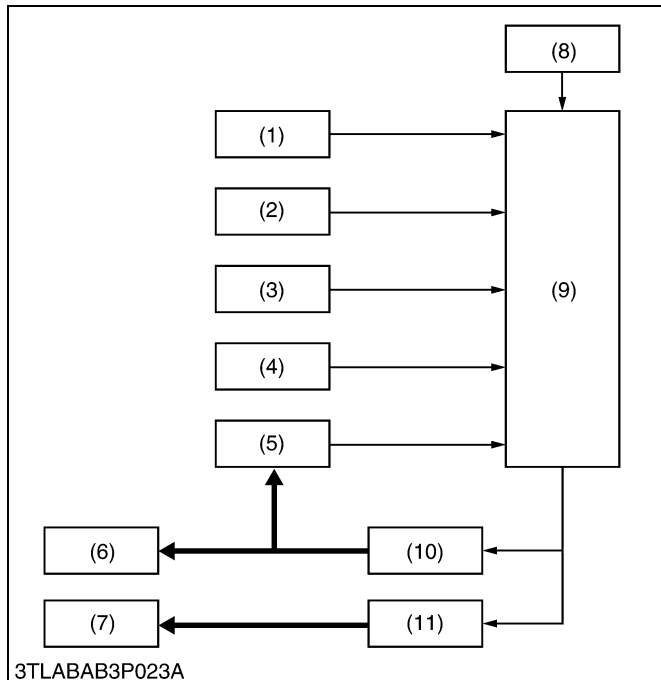
■ **Traveling Speed Sensor**

This sensor is to detect the traveling speed, and it is equipped on the right bottom side of the differential case. This sensor perceives tooth of the front wheel drive gear (3) on the PTO drive shaft (2) and emits pulse. This pulse is sent to the electronic instrument panel, and the traveling speed is calculated by the coefficient which is set according to the tire size. The data of traveling speed is always sent to the ECU.

(1) Traveling Speed Sensor (3) Front Wheel Drive Gear
(2) PTO Drive Shaft

W1015587



(2) Electrical Control

An electrical control of GST system is as follows.

1. Shift the GST lever and shuttle lever to desired position.
2. The output voltage of selected gear shift position is output to microcomputer of the ECU by lever sensor.
3. The ECU detects the gear shift position with GST lever sensor and shuttle switch, and excites various solenoid valves in accordance with selected position.
4. When the desired solenoid is excited, oil is sent to the desired shift piston.
5. A pressure in the circuit is raised because the movement of shift piston shuts the shift check pin. When the pressure in the circuit reaches 0.49 MPa (5 kgf/cm², 71 psi), the pressure switch becomes **ON**.
6. By means of the pressure switch's **ON**, the ECU detects the present condition (traveling speed, engine speed and oil temperature) from various sensors, and pressure in the hydraulic clutch is raised according to the respective condition.

■ **NOTE**

- **By means of speed increasing, speed decreasing, traveling speed, engine speed and oil temperature, the indicated pressure period from c to d is controlled at appropriate pressure respectively.**
7. A pressurizing to hydraulic clutch has been done until it reaches the system pressure, and pressure in the clutch is maintained at this state.

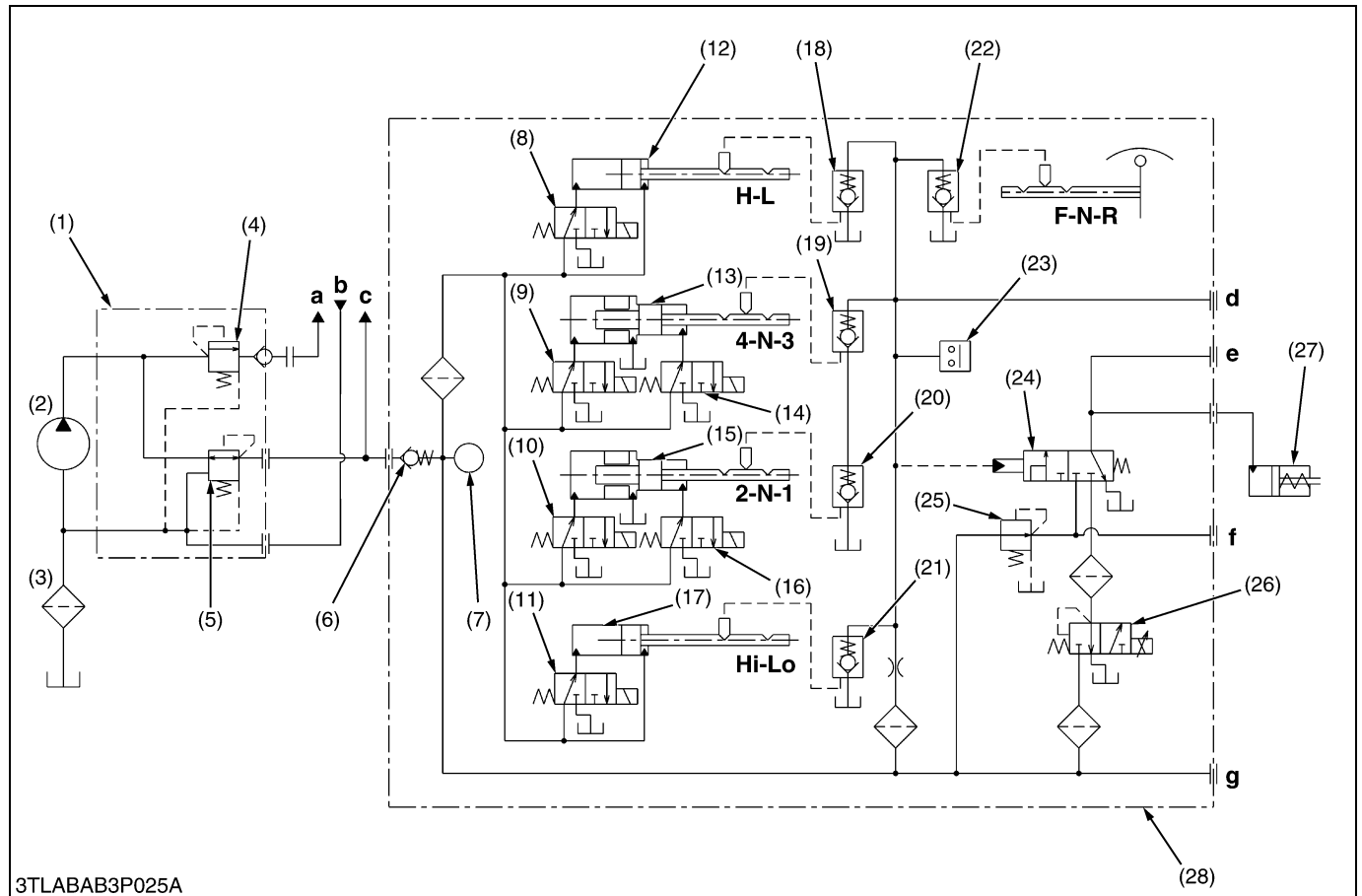
- (1) Oil Temperature Sensor
- (2) Engine Tachometer Sensor
- (3) Traveling Speed Sensor
- (4) Shuttle Switch
- (5) Pressure Switch
- (6) Shift Piston
- (7) Clutch Valve
- (8) GST Lever Sensor
- (9) ECU
- (10) Solenoid Valves
- (11) Proportional Reducing Valve

- P : Pressure**
H : Time
a : Starting of clutch engaging
b : Low-pas pressure
c : Starting of pressurized
c to d :Specified pressure from ECU
e : Gear shifting completion

W1016324

[4] HYDRAULIC CONTROL SYSTEM

(1) Hydraulic Circuit and System Outline



- (1) Regulating Valve Assembly
- (2) Hydraulic Pump
- (3) Hydraulic Oil Filter
- (4) Regulating Valve
- (5) Pressure Reducing Valve
- (6) Check Valve
- (7) Oil Temperature Sensor
- (8) Solenoid Valve 6
(Main Range Shift)
- (9) Solenoid Valve 3
- (10) Solenoid Valve 1

- (11) Solenoid Valve 5
(Sub-range Shift)
- (12) Shift Piston
(Main Range Shift)
- (13) 3-4 Shift Piston
- (14) Solenoid Valve 4
- (15) 1-2 Shift Piston
- (16) Solenoid Valve 2
- (17) Shift Piston (Sub-range Shift)
- (18) Shift Check Valve
(Main Range Shift)

- (19) 3-4 Shift Check Valve
- (20) 1-2 Shift Check Valve
- (21) Shift Check Valve
(Sub-range Shift)
- (22) Shift Check Valve, Shuttle
- (23) Pressure Switch
- (24) Clutch Valve
- (25) Low-pass Valve
- (26) Proportional Reducing Valve
- (27) GST Clutch
- (28) GST Valve Assembly

- a : To Steering Controller**
- b : From Steering Controller**
- c : To PTO Clutch Valve**
- d : Check port for pilot pressure**
- e : Check port for clutch pressure**
- f : Check port for Low-pass pressure**
- g : Check port for system pressure**

- Oil is supplied from the power steering hydraulic pump (2) while running the engine.
- The oil entering the regulating valve assembly (1) flows through the pressure reducing valve (5) to the GST circuit. This oil pressure is maintained at a fixed level by the pressure reducing valve (5).
- When the GST lever is operated, the desired shift solenoids (8), (9), (10), (11), (14) or (16) are excited according to the output voltage from the GST lever sensor.
- When the solenoid valve is operated, oil is supplied to corresponded shift pistons (12), (13), (15) or (17), and the shift piston is moved. The shift arm that is moved by the shift piston moves shifter of synchromesh to shift the gear. At this time, GST clutch (27) has been disengaging until gear shifting is completed. The GST clutch (27) is engaging except where the condition is neutral, is gear shifting and is engine stopping.
- Pressure in the pilot circuit rises because the shift check valves (18), (21) and (19) or (20) are shut by the movements of shift pistons at the same time as completing gear shifting.
- By means of pressure rising of the circuit, the clutch valve (24) is actuated. And, oil flows through the low-pass valve (25) and the proportional reducing valve (26) to the GST clutch (27). This oil flows until becoming the compound pressure which is both of setting pressure for closing of low-pass valve, and controlled indication pressure of the proportional reducing valve.

(Reference)

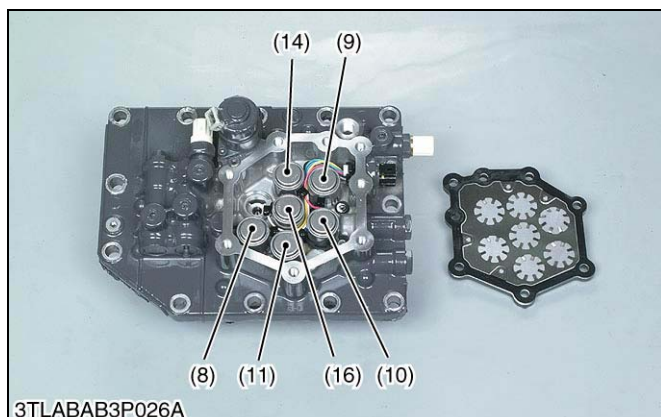
- Setting pressure for closing of low-pass valve : 0.24 MPa (2.5 kgf/cm², 34.1 psi)
- Because pressure in the GST clutch (27) is gradually pressurized by function of proportional reducing valve (26), clutch is able to engage without shock and smoothly.
 - When the pressure in the circuit rises to the system pressure, pressure is maintained. And the GST clutch is maintained at engaging condition until the next gear shifting.

State of energizing of solenoid**(Forward)**

	N	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
Solenoid 1(10)		ON						ON	ON				
Solenoid 2 (16)			ON							ON	ON		
Solenoid 3 (9)				ON	ON							ON	
Solenoid 4 (14)						ON	ON						ON
Solenoid 5 (11)				ON		ON		ON		ON			
Solenoid 6 (8)	(ON)	ON	ON	ON	ON	ON	ON						

(Reverse)

	N	1st	2nd	3rd	4th	5th	6th	7th	8th
Solenoid 1 (10)		ON				ON			
Solenoid 2 (16)			ON				ON		
Solenoid 3 (9)				ON				ON	
Solenoid 4 (14)					ON				ON
Solenoid 6 (8)	(ON)	ON	ON	ON	ON				



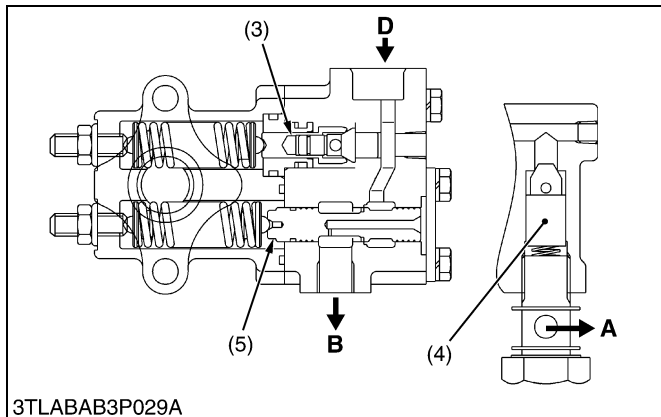
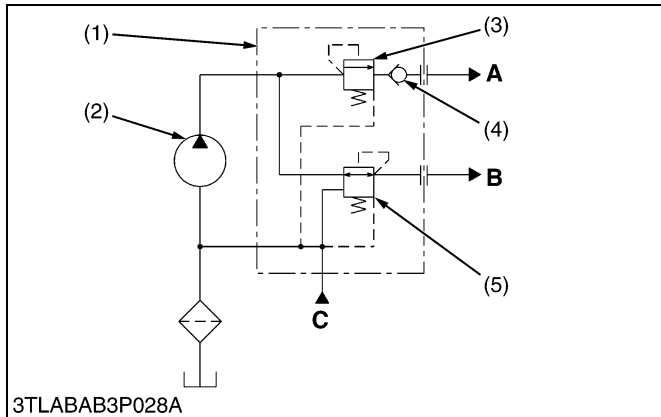
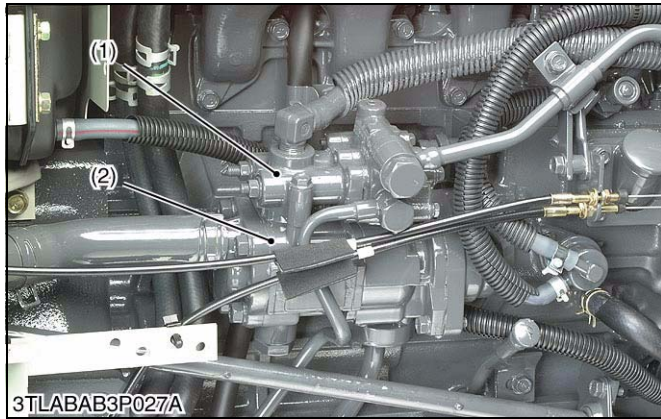
No.	Solenoid	Color of wiring
(10)	Solenoid 1	Black
(16)	Solenoid 2	White
(9)	Solenoid 3	Red
(14)	Solenoid 4	Green
(11)	Solenoid 5, Sub-range Lo-Hi	Blue
(8)	Solenoid 6, Main range L-H	Yellow

3TLBAB3P026A

W1019092

(2) Construction and Function of Components

(A) Regulating Valve



The oil from the hydraulic pump for the power steering system flows to the GST circuit to set the pressure of the circuit. Other oil flows to the power steering circuit.

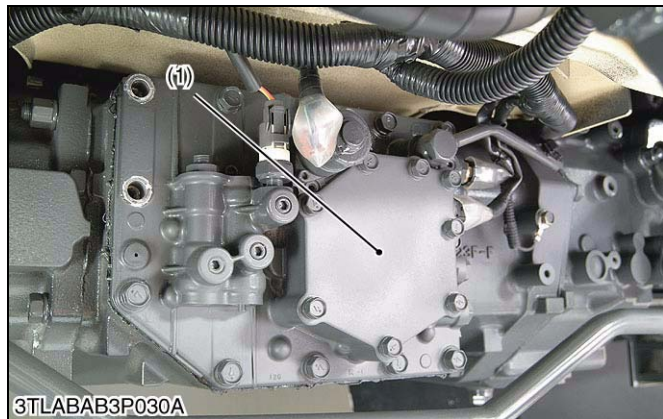
The oil from the power steering hydraulic pump (2) flows through the pressure reducing valve (5) to the GST circuit. When the oil is filled into the circuit, the pressure reducing valve (5) is closed to maintain the pressure in the GST system circuit to 2.45 MPa (25.0 kgf/cm², 356 psi).

The oil from the power steering pump passes through the regulating valve (3) and check valve (4), and then it flows to power steering circuit. The regulating valve (3) is provided to maintain 2.94 MPa (30.0 kgf/cm², 427 psi) at inlet pressure of the pressure reducing valve (5) except when the power steering is operated. Thereby getting 2.45 MPa (25.0 kgf/cm², 356 psi) of the GST circuit pressure.

- (1) Regulating Valve Assembly **A : To Power Steering Circuit**
- (2) Hydraulic Pump **B : To GST Circuit and PTO Clutch Valve**
- (3) Regulating Valve
- (4) Check Valve **C : From Power Steering Circuit**
- (5) Pressure Reducing Valve **D : From Hydraulic Pump**

W1019304

(B) GST Valve



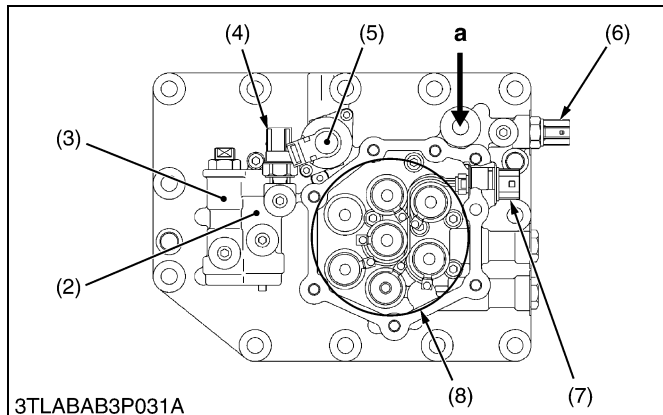
■ GST Valve Assembly

The GST valve assembly is installed at the left side of the transmission mid case. In the GST valve assembly, many parts comprising the system are installed, including the solenoid valves, shift pistons, shift check valves, low-pass valve, proportional reducing valve, clutch valve, check valves, sensor and switches. The GST valve assembly functions as the central unit of the GST system.

- | | |
|-----------------------------------|--|
| (1) GST Valve Assembly | (6) Connector for Oil Temperature Sensor |
| (2) Clutch Valve | (7) Connector for Solenoid Valve |
| (3) Low-pass Valve | (8) Solenoid Valves |
| (4) Connector for Pressure Switch | |
| (5) Proportional Reducing Valve | |

a : Oil From Regulating Valve

W1019626



■ Solenoid Valve

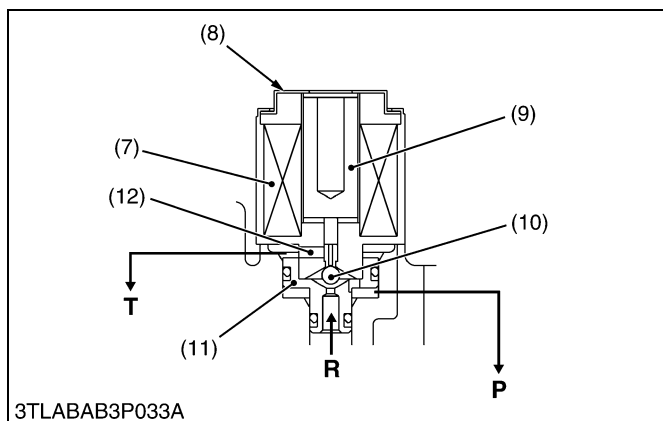
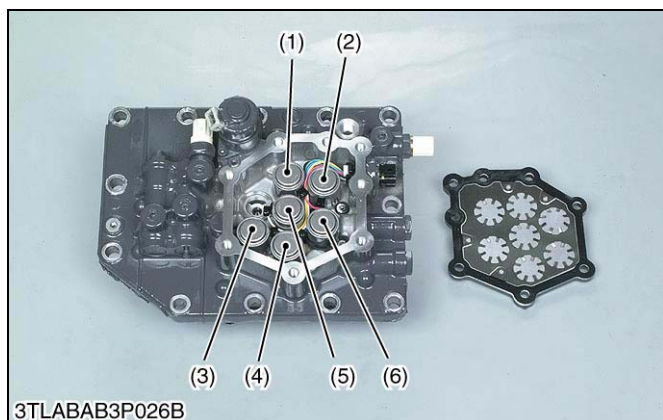
When the GST lever is operated, the solenoid valve controls the flow of oil according to the gear shifting operation.

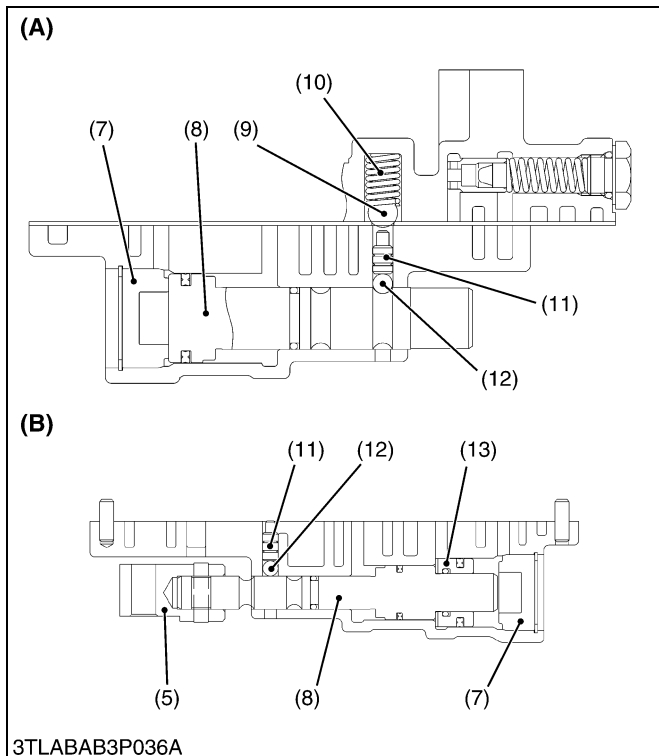
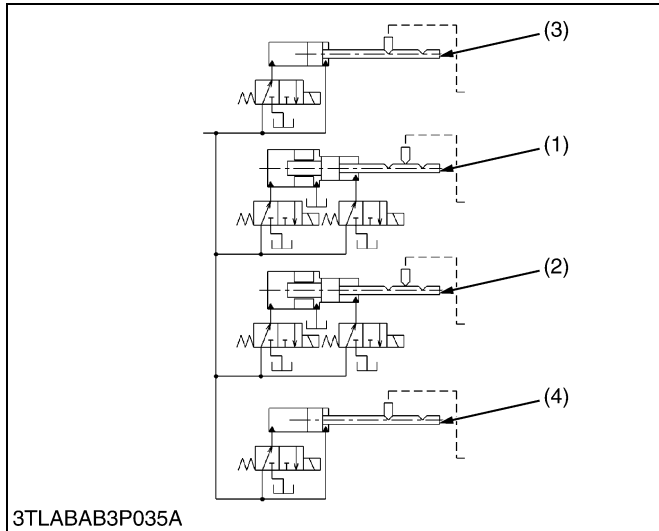
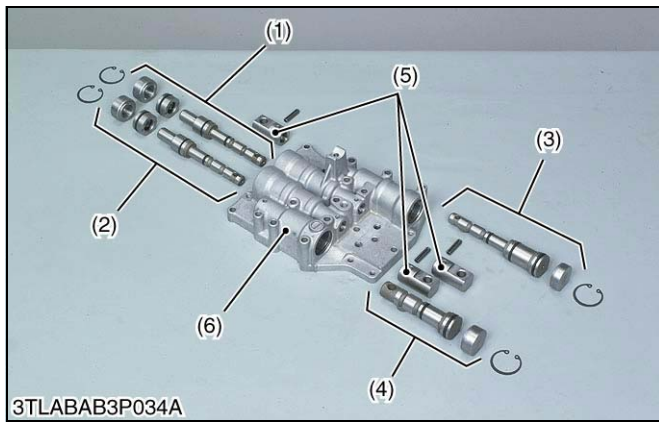
When the solenoid is not excited, oil from regulating valve flows to the shift piston through the surrounding of the ball (10) in the valve. When the solenoid is excited, plunger (9) presses the ball against the valve seat (11) to open the unload passage (12), and drain the oil.

- | | |
|---|---------------------|
| (1) Solenoid Valve 4 | (9) Plunger |
| (2) Solenoid Valve 3 | (10) Ball |
| (3) Solenoid Valve 6 (Main Range Shift) | (11) Valve Seat |
| (4) Solenoid Valve 5 (Sub-range Shift) | (12) Unload Passage |
| (5) Solenoid Valve 2 | |
| (6) Solenoid Valve 1 | |
| (7) Coil | |
| (8) Solenoid Valve | |

T : Drain Port
R : IN Port
P : To Shift Piston

W1019949





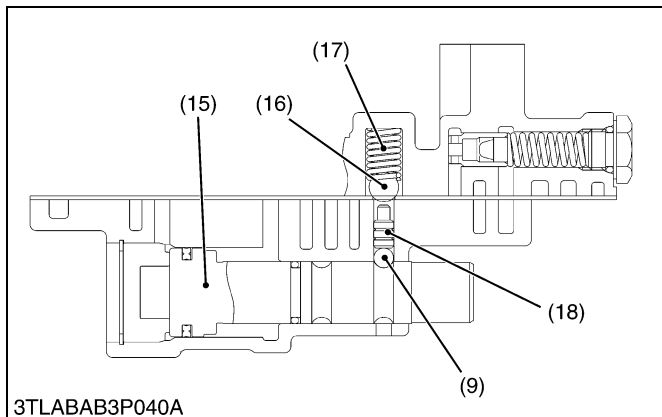
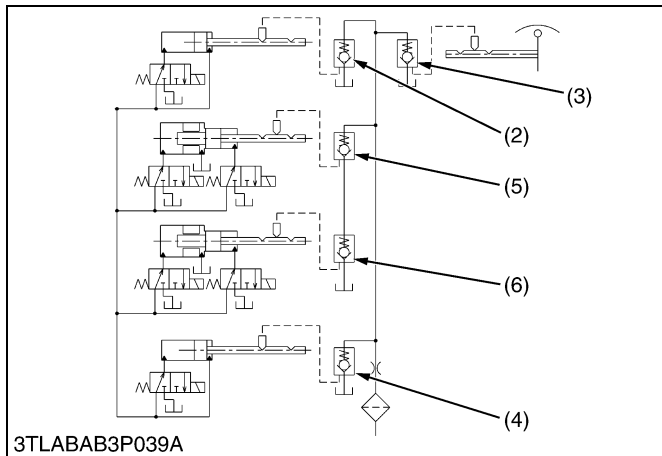
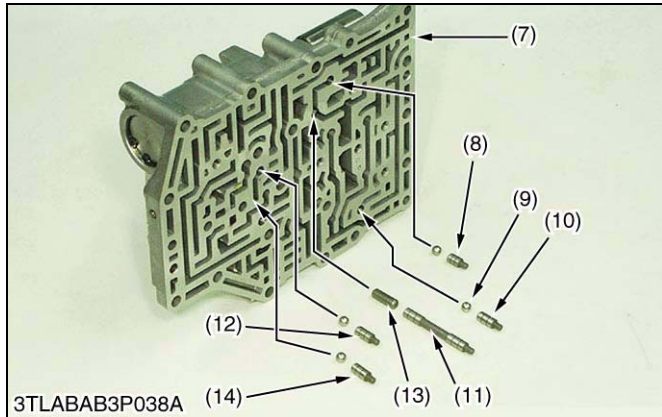
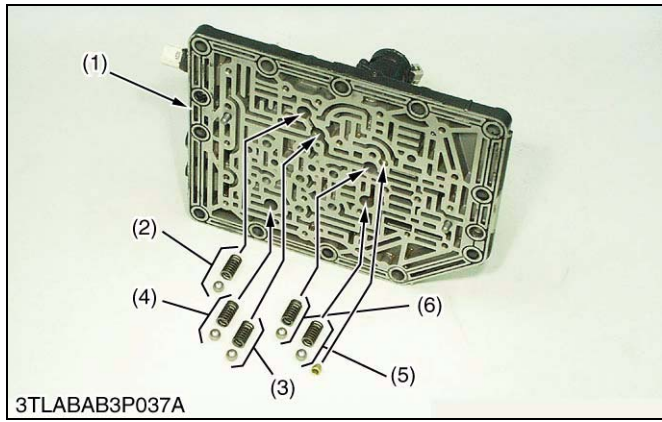
■ Shift Piston

The shift pistons (1), (2), (3), (4) are actuated by the oil distributed by the each solenoid valve. At the tip of these shift pistons (1), (2), (3) are installed the shifters (5), which are connected to each shift rod and shift the gear.

There are neutral positions in 1-2 shift piston (2) and 3-4 shift piston (1).

- (1) 3-4 Shift Piston
 - (2) 1-2 Shift Piston
 - (3) Main Range Shift Piston
 - (4) Sub-range Shift Piston
 - (5) Shifter
 - (6) Valve Body
 - (7) Cover
 - (8) Piston
 - (9) Ball for Check Valve
 - (10) Spring
 - (11) Check Pin
 - (12) Ball for Detent
 - (13) Neutral Piston
- A : Shift Piston for Main Range Shift**
B : 1-2 and 3-4 Shift Piston

W1020109



■ Shift Check Valve

The shift check valves (2), (3), (4), (5), (6) are provided on each shift piston and the shuttle shift rod.

From the start to the end of gear shifting, the shift check valves (2), (4), (5), (6) of the shift pistons are opened because the ball (9) of the check pin (18) is on the straight portion, the oil in the pilot circuit of the clutch valve passes through the shift check valves (2), (3), (4), (5), (6) to be drained into the tank, causing the GST clutch to be disengaged.

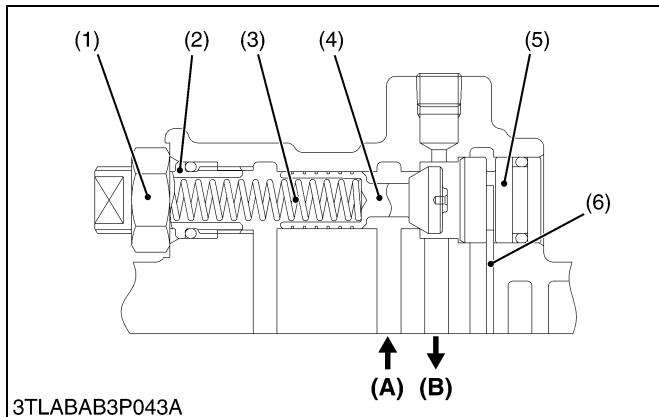
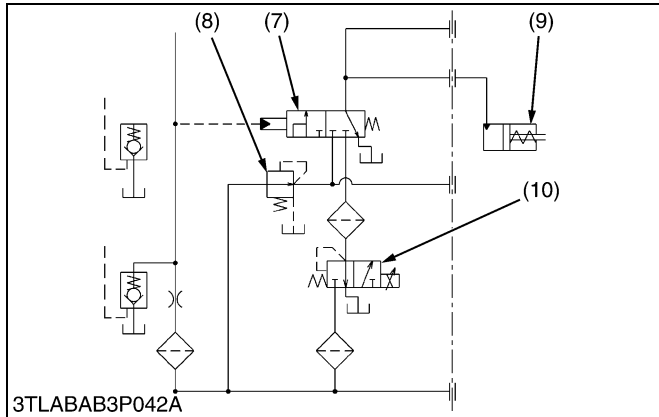
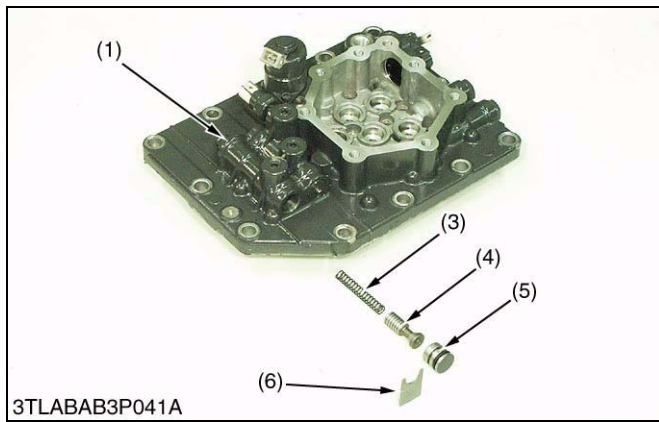
When the gear shifting is completed, the ball (9) of the check pin (18) enters the groove of the shift piston; the check valve is closed, causing the pilot circuit pressure to rise and the clutch valve to open. Thus, the oil flows into the GST clutch to engage it. The 1-2 shift check valve (6) and 3-4 shift check valve (5) compose a serial circuit. When either valve is closed, the oil in the pilot circuit will not be drained into the tank.

In case of the shuttle shifting, the shift check valve (3) is opened and closed by the groove of the shuttle shift rod.

Note that the shuttle shift fork rod has a slot into which the shift fork mounting bolt is inserted. Therefore, when the shuttle shift lever is moved, the shuttle shift fork rod is moved before the shuttle shift fork is moved, disengaging the clutch pack and thus moving the shuttle shift fork.

- | | |
|----------------------------------|-------------------------------------|
| (1) GST Valve Cover | (10) Main Range Check Pin |
| (2) Main Range Shift Check Valve | (11) Shuttle Check Pin |
| (3) Shuttle Shift Check Valve | (12) 3-4 Check Pin |
| (4) Sub-range Shift Check Valve | (13) Pin |
| (5) 3-4 Shift Check Valve | (14) 1-2 Check Pin |
| (6) 1-2 Shift Check Valve | (15) Shift Piston (Sub-range Shift) |
| (7) GST Valve Body | (16) Ball |
| (8) Sub-range Check Pin | (17) Spring |
| (9) Ball for Detent | (18) Check Pin |

W1020427



■ **Low-pass Valve**

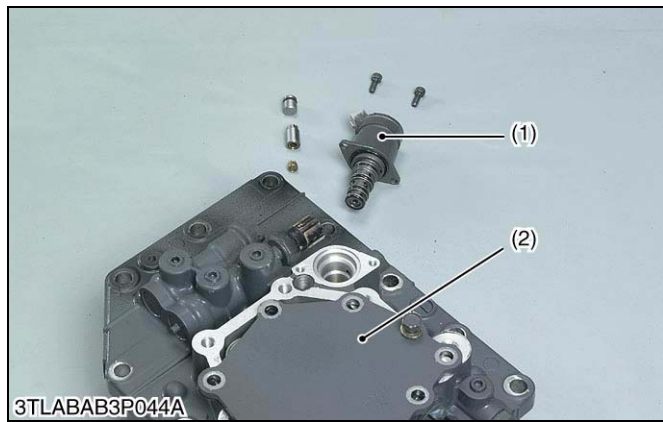
After completion of the gear shifting, the low-pass valve (8) opens immediately to flow oil into the GST clutch (9), to promote the engagement of the clutch.

When the gear shifting starts, the oil in the GST clutch (9) passes the clutch valve (7) to be drained into the tank. So prior to beginning of the GST clutch connection and after completion of gear shifting, it is necessary to flow oil to the GST clutch quickly. It is the low-pass valve that does this operation with the proportional reducing valve (10) simultaneously.

The oil from the regulating valve flows in from the **IN-port (A)**, passes through the low-pass valve poppet (4), flows out from **OUT-port (B)**, and flows to the clutch valve (7) and clutch (9). When the pressure on the side of the **OUT-port (B)** reaches setting pressure, the poppet (4) pushes the spring (3) to close the circuit.

- (1) Nut
 - (2) Adjuster
 - (3) Spring
 - (4) Poppet
 - (5) Plug
 - (6) Stopper Plate
 - (7) Clutch Valve
 - (8) Low-pass Valve
 - (9) GST Clutch
 - (10) Proportional Reducing Valve
- (A) IN-Port**
(B) OUT-Port

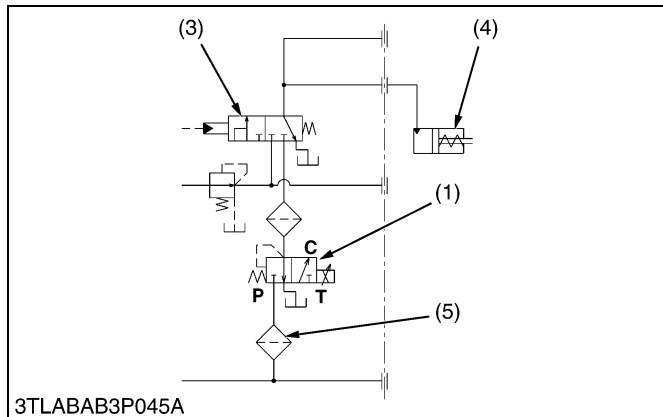
W1020861



■ Proportional Reducing Valve

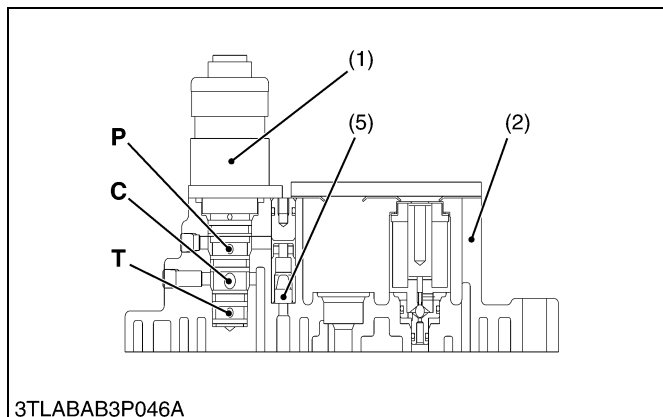
After the gear shifting is completed, this valve has function which gradually rises the pressure in the clutch (4) in order to make a clutch engaging for without shock and smoothly.

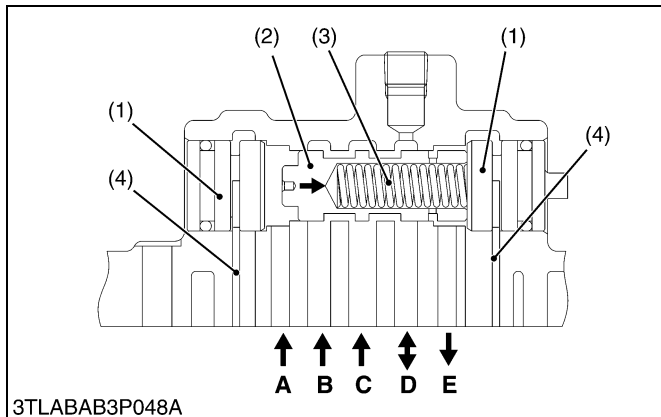
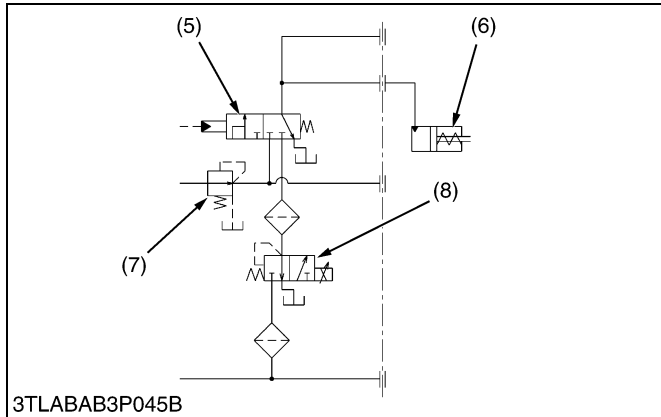
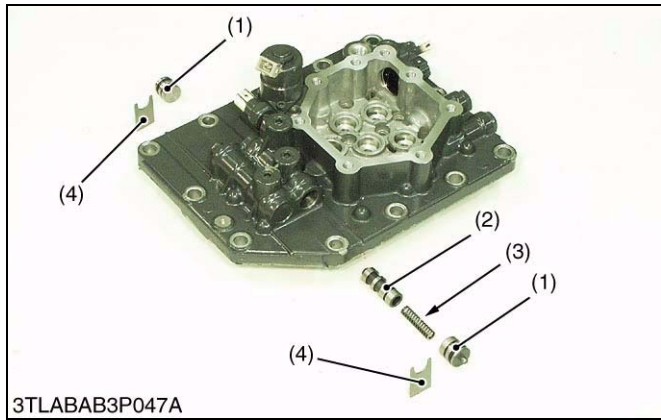
When the gear shifting is completed, the pressure switch is turned **ON**. By means of turning on the pressure switch, the microcomputer of ECU calculates and judges the charging of pressure and its time according to the oil temperature sensor and gear shifting period, and the traveling speed and speed acceleration according to the traveling speed sensor. By these instructions from microcomputer of ECU, the proportional reducing valve adjusts pressure in the clutch to become a appropriate acceleration.



- (1) Proportional Reducing Valve
 - (2) GST Valve Assembly
 - (3) Clutch Valve
 - (4) GST Clutch
 - (5) Filter
- P : IN Port (From Regulating Valve)**
C : OUT Port (To Clutch Valve)
T : DRAIN Port (To Tank)

W1021268





■ Clutch Valve

The clutch valve (5) changes the flow of the oil flowing to the GST clutch to carry out “ENGAGE” / “DISENGAGED” of the clutch.

Except for during gear shifting, the oil of the pilot circuit flows in from the **A**-port to push the spool to the right when the pilot circuit is pressurized. Therefore, the oil from the low-pass valve (7) and proportional reducing valve (8) flows in from **B** and **C**-port, flows out from the **D**-port, and flows to the GST clutch (6).

When the pilot circuit pressure is zero, that is, from the start to the left with the spring (3) to cut the oil flow of **B** and **C**-port, and stopping the oil flow to the GST clutch (6). Furthermore, the oil of the GST clutch flows in from **D**-port, and is drained from **E**-port, and then the GST clutch is disengaged.

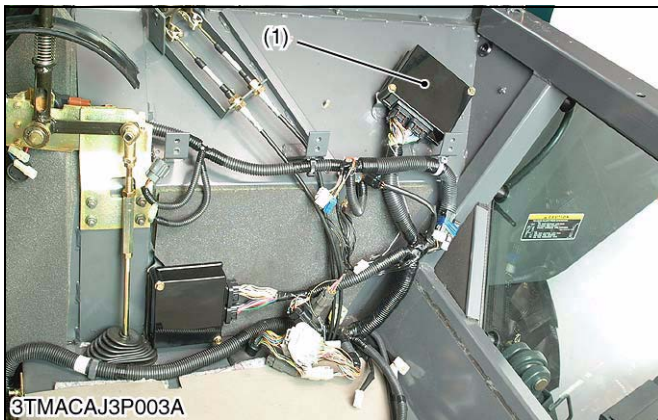
- | | |
|---------------------------------|--|
| (1) Plug | A : A-Port (From Pilot Circuit) |
| (2) Spool | B : B-Port (From Low-pass Valve) |
| (3) Spring | C : C-Port (From Proportional Reducing Valve) |
| (4) Stopper Plate | D : D-Port (To GST Clutch) |
| (5) Clutch Valve | E : E-Port (To Tank) |
| (6) GST Clutch | |
| (7) Low-pass Valve | |
| (8) Proportional Reducing Valve | |

W1021514

12. POWER SHIFT SYSTEM

[1] CONSTRUCTION AND FUNCTION OF COMPONENTS

(1) Electric Components



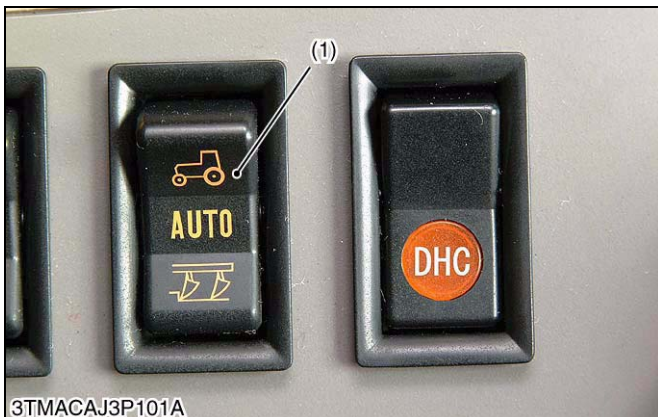
■ Power Shift Control Unit (ECU)

The power shift control unit includes the electronic circuits for power shift, 4WD and Bi-speed control functions.

The control unit processes and judges the input signals from the switches and sensors, and sends the signals to solenoid valves.

(1) Power Shift Control Unit

W1012772



■ Auto Mode Switch

This switch the automatic shifting mode between the field mode and travel mode and performs automatic shifting within an automatic shifting range.

- **Field Mode**
For plowing, subsoiling and other tilling operations.
- **Travel Mode**
For trailing and other hauling operations.

(1) Auto Mode Switch

W1012842



■ Power Shift / Range Shift Lever

The power shift lever is equipped with shift (**UP / DOWN**) switches, clutch switch and range shift lever sensor which detect L/H speed in range shift lever operation.

The construction of the lever, and the switches are mounted at the positions as shown in the picture. The speed change mode can be switched mechanically to the **Hi-Lo** speed change mode by moving this lever to the front or rear side.

- **Shift Up / Down Switch**
Shift up and down the travel speeds.
- **Clutch Switch**
Pressing the clutch switch disengage the master clutch.
- **Range Shift Lever Sensor**
The shift lever sensor detects position of range shift (**H-L**).

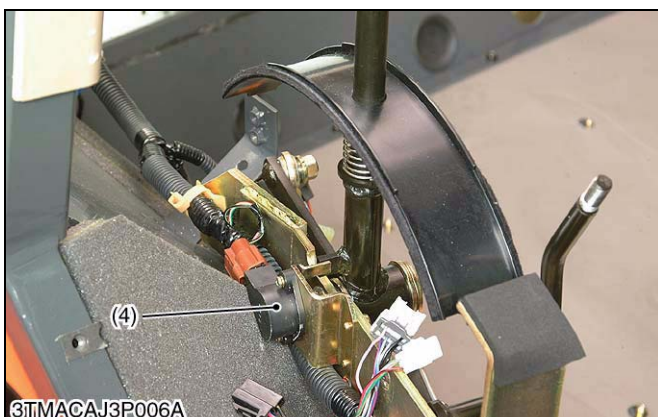
(1) Power Shift / Range Shift
Lever

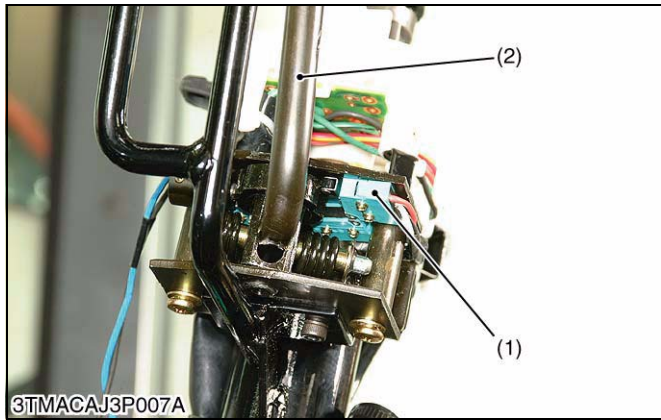
(3) Shift Up / Down Switch

(2) Clutch Switch

(4) Range Shift Lever Sensor

W1012930





■ Shuttle Switch

In the power shift, switching of **Forward / Reverse** operation is effected electrically. Therefore, three micro-switches are provided on the shuttle lever shaft so that the position (**Forward-N-Reverse**) of the shuttle lever should be detected.

- (1) Shuttle Switch (2) Shuttle Lever

W1013103



■ Clutch Pedal Sensor

The clutch pedal sensor detects a position of the clutch pedal to control pressures of the master clutch.

This system allows clutch operation similar to a mechanical clutch.

- (1) Clutch Pedal Sensor

W1013247



■ Throttle Sensor

The throttle sensor detects a position of engine throttle lever.

- (1) Throttle Sensor

W1013318



■ Engine Rotation Sensor

The engine rotation sensor detects rotation of the gear pump driver gear to calculate the number of engine rotations.

The sensor output a pulse signal according to engine rotations, and the signal is converted in the meter panel and sent to the microcomputer unit.

- (1) Engine Rotation Sensor

W1013375



■ Shuttle Rotation Sensor

The shuttle rotation sensor is to detect the rotating speed of the master clutch output shaft and it is provided to detect the connection of master clutch.

This sensor has a function to generate AC voltage in accordance with changes in the distance from metal. The ruggedness of the shuttle gear generate an AC voltage having frequency proportional to the rotating speed of the gear, and the rotating speed of the master clutch output is detected by the frequency.

(1) Shuttle Rotation Sensor

W1013713



■ Alternator (L Terminal)

The power system shift detects the rotation of an engine by both engine rotation sensor and alternator L terminal.

Even if the engine rotation sensor is faulty, the L terminal voltage of the alternator allows detecting rotations on the engine, making operation of power shift possible.

(1) Alternator

W1013784



■ Travelling Speed Sensor

This sensor is to detect the travelling speed and it is equipped on the left bottom side of differential case.

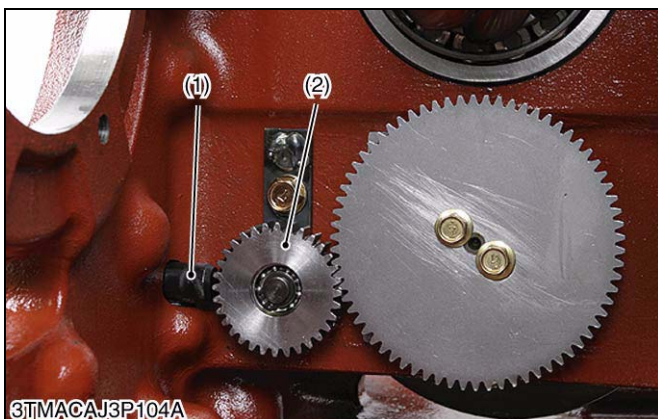
This sensor perceives tooth of the detection gear which is driven by drive gear on the 4WD shaft and emits pulse.

This pulse is sent to the electronic instrument panel and the travelling speed is calculated by the coefficient which is set according to the tire size.

The date of travelling speed is always sent to the ECU.

(1) Travelling Speed Sensor (2) Detaction Gear

W1013858





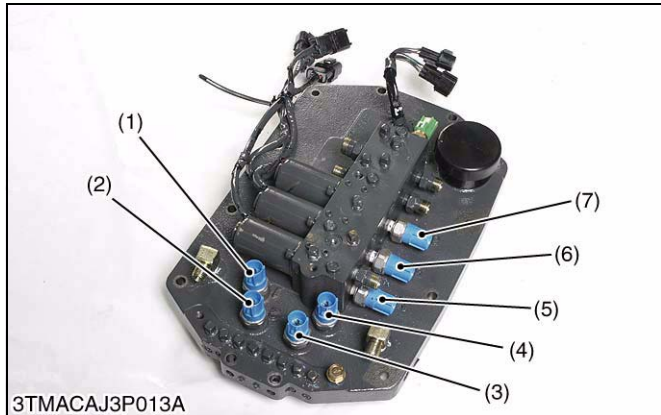
■ Hydraulic Oil Temperature Sensor

The oil temperature sensor detects a temperature of transmission fluid, and corrects operating time and current of the solenoid valve according to the temperature of transmission fluid.

This system makes engagement of master clutch smooth even if oil viscosity changes.

- (1) Hydraulic Oil Temperature Sensor

W1013563



■ Pressure Switch

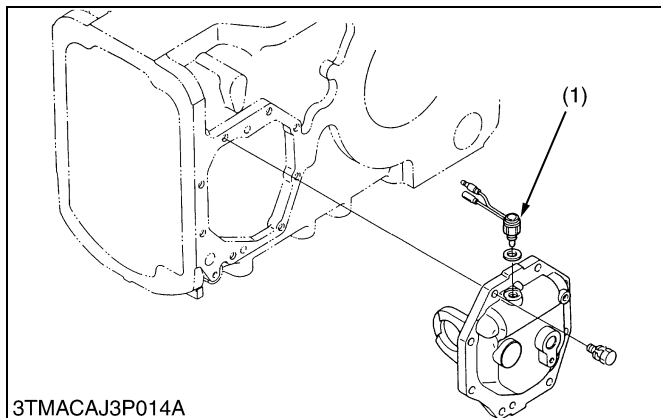
The pressure switch is to detect the operation of hydraulic clutches and is provide at the power shift valve. (7 pressure switch are provided.)

This switch is a **NO** (Normal Open) type switch which contact closes when the pressure is raised.

The contacts close at a pressure higher than 1.18 MPa (12 kgf/cm²) and open at a pressure lower than 0.74 MPa (7.5 kgf/cm²).

- (1) For Main Shift 1
- (2) For Main Shift 2
- (3) For Main Shift 3
- (4) For Main Shift 4
- (5) For Master (F-R)
- (6) For Main Shift L
- (7) For Main Shift H

W1013642



■ Creep Speed Change Switch (Option)

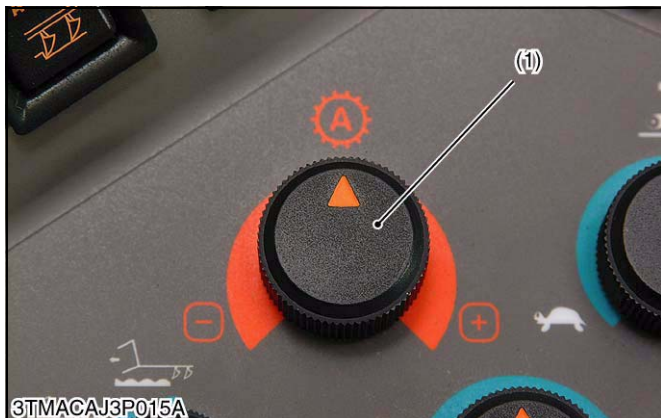
The creep speed change switch is to detect the **ON / OFF** status of the creep speed change operation and it is provided inside the creep speed change gear case.

When the creep speed change switch is turned **ON**, the operation changes to the creep speed change control mode which is different from the normal speed change control mode.

When this switch is turned **OFF**, the tractor is operated in the normal speed change control mode.

- (1) Creep Speed Change Switch

W1013438



■ Auto Mode Sensitivity Adjustment Dial

This is to change the shift conditions and timing of gear shift (up and down) for power shift auto control.

Turn the dial to the negative side	Higher sensitivity for shift-down and lower sensitivity for shift-up
Turn the dial to the positive side	Higher sensitivity for shift-up but the same sensitivity for shift-down

- (1) Auto Mode Sensitivity Adjustment Dial

W1014362



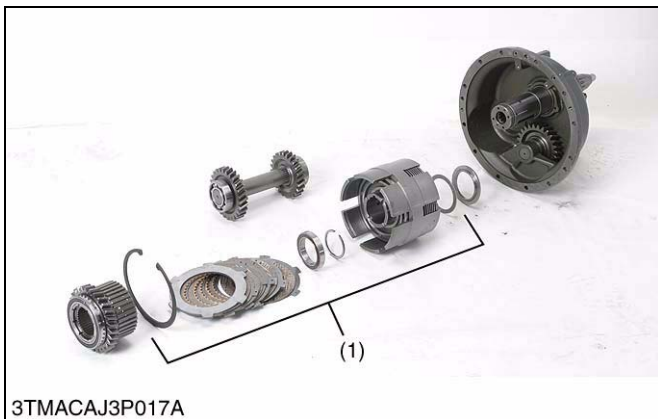
■ Instrument Panel

On the meter panel are provided the lamps to indicate the power shift system such as the step of main speed change, **Forward / Reverse** position of shuttle lever and the **Neutral** position of range shift lever.

Besides, this instrument panel has a function to convert the signals coming from the engine rotation sensor and send them to the power shift control unit.

W1014299

(2) Hydraulic Components



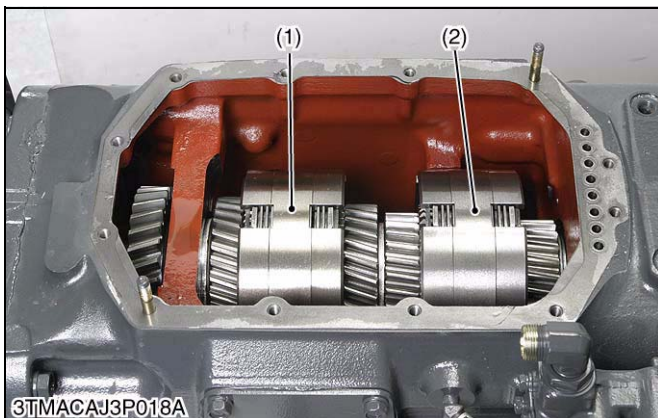
■ Master Clutch (Forward and Reverse)

The master clutch is composed of forward and reverse hydraulic clutches, and the hydraulic clutches are switched over by turning on and off the solenoid valve.

A pressure of oil into the clutch is controlled by the electromagnetic proportional pressure reducing valve, allowing smooth engagement of the clutch.

(1) Master Clutch

W1014660



■ Main Shift Clutch (1-4, L-H)

In power shift system, switching of 8 step seed shift for main speed change and **forward / reverse** operation is performed by 4 sets of 8 hydraulic clutches.

These hydraulic clutches are positioned at the points shown in the figure.

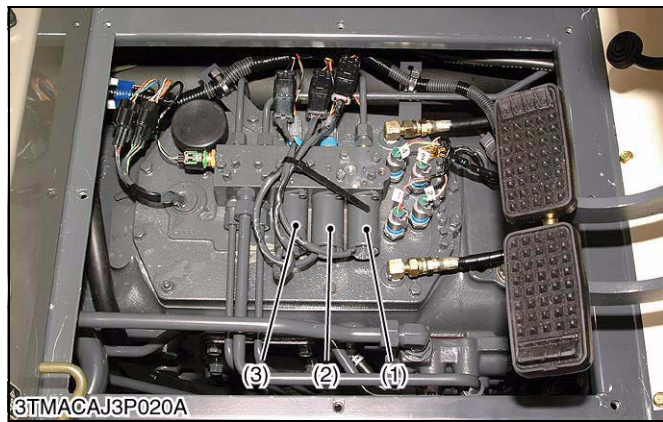
(1) Main Shift Clutch (1-2)

(3) Main Shift Clutch (L-H)

(2) Main Shift Clutch (3-4)

W1014739



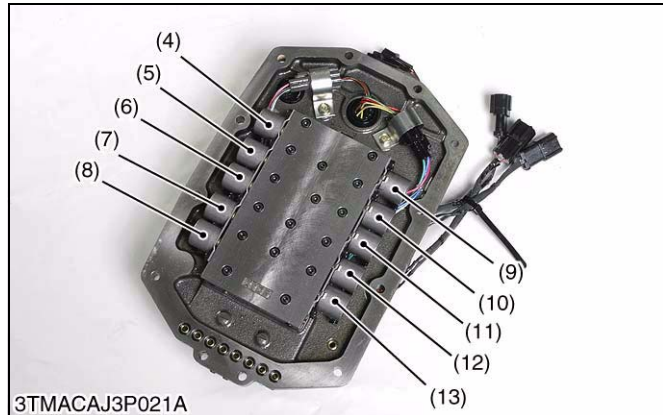


■ **Power Shift Valve Assembly**

The power shift valve comprises 10 sets of solenoid **ON / OFF** valve (4), (5), (6), (7), (8), (9), (10), (11), (12), (13) and 3 sets of solenoid proportional pressure reducing valve (1), (2), (3).

- | | |
|--|--------------------------------------|
| (1) Solenoid Proportional Pressure Reducing Valve for Master Clutch | (6) Main Shift 3 Solenoid Valve |
| (2) Solenoid Proportional Pressure Reducing Valve for Main Shift Clutch L | (7) Main Shift 4 Solenoid Valve |
| (3) Solenoid Proportional Pressure Reducing Valve for Main Shift Clutch H | (8) Master Solenoid Valve (Forward) |
| (4) Rear Differential Lock Solenoid Valve | (9) 4WD Solenoid Valve |
| (5) Front Differential Lock Solenoid Valve | (10) Bi-speed Solenoid Valve |
| | (11) Main Shift 2 Solenoid Valve |
| | (12) Main Shift 1 Solenoid Valve |
| | (13) Master Solenoid Valve (Reverse) |

W1014810



■ **Regulator Valve**

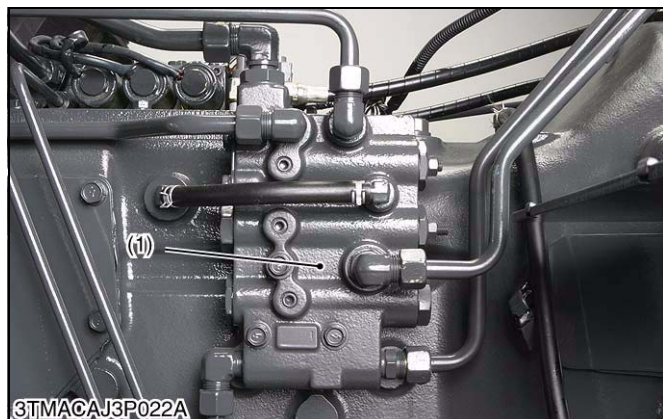
The regulator valve consist of flow priority valve, regulating valve and pressure reduction valve.

The oil from the hydraulic pump for power steering system flows to the power shift valve. Other oil flows to the power steering circuit.

The regulating valve controls the operating pressure of power shift valve to 2.06 to 2.25 MPa (21.0 to 23.0 kgf/cm², 298.7 to 327.1 psi)

- (1) Regulator Valve

W1014873



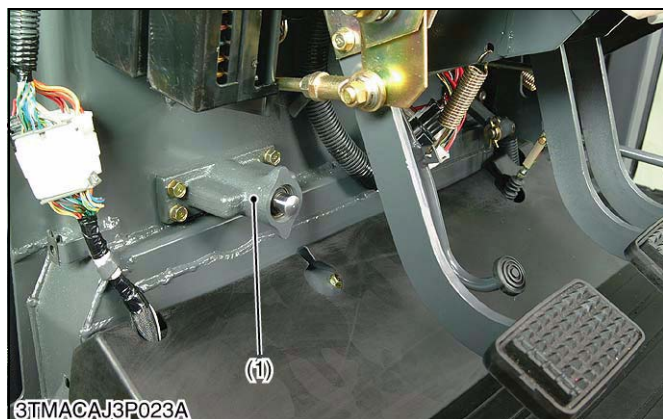
■ **Clutch Safety Valve**

This valve works to lower the master clutch (**F-R**) pressure surely when the clutch pedal is depressed.

The master clutch (**F-R**) pressure is lowered mechanically by thrusting the spool end by the clutch pedal to relieve the pilot pressure directly into the transmission case.

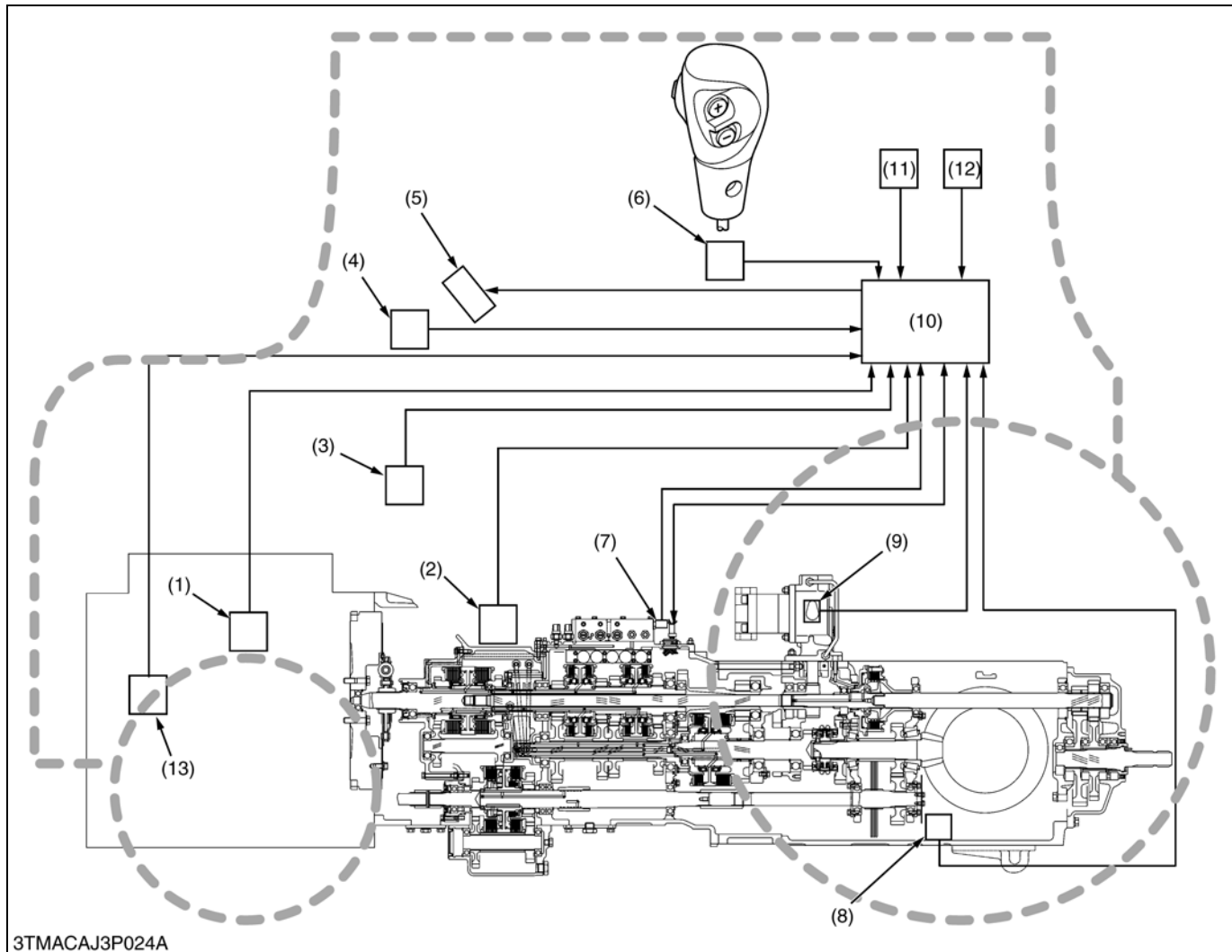
- (1) Clutch Safety Valve

W1014496



[2] ELECTRIC CONTROL SYSTEM

(1) Control System



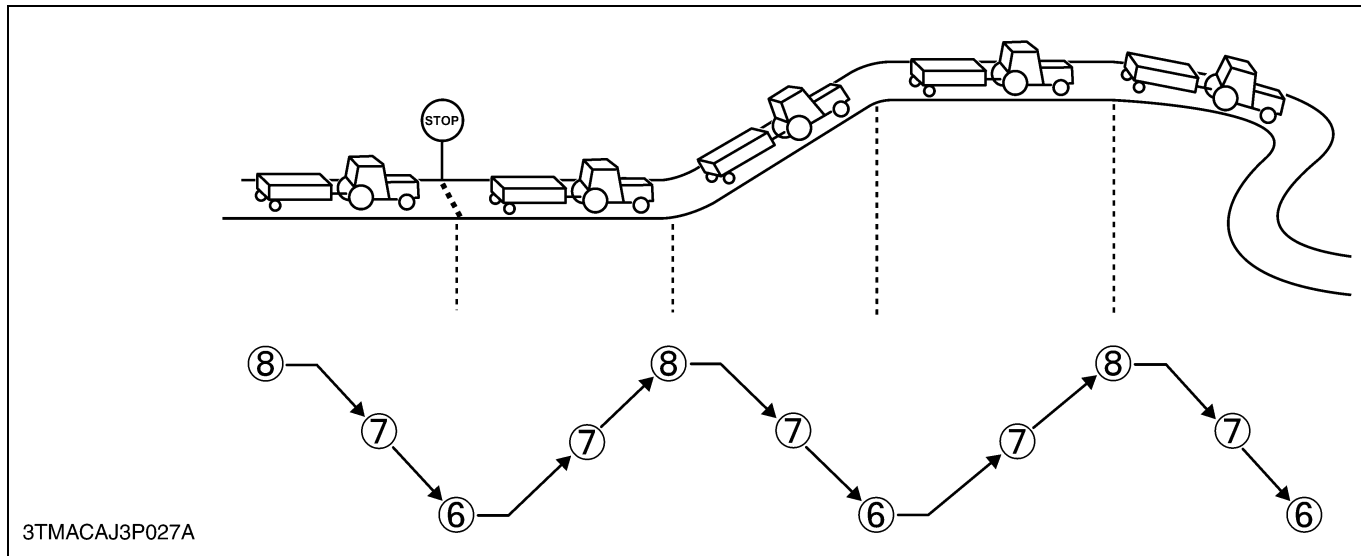
- | | | | |
|-----------------------------|--|-------------------------------|--|
| (1) Throttle Sensor | (5) Meter Panel | (8) Travelling Speed Sensor | (11) Auto Mode Switch |
| (2) Shuttle Rotation Sensor | (6) Power Shift/Range Shift Lever Sensor | (9) Engine Rotation Sensor | (12) Auto Mode Sensitivity Adjustment Dial |
| (3) Clutch Pedal Sensor | (7) Oil Temperature Sensor | (10) Power Shift Control Unit | (13) Turning Angle Switch |
| (4) Shuttle Switch | | | |

[3] AUTO SPEED CONTROL

The auto-mode is an automatic speed change function that is designed to shift up and down the travel speed in response to the load-dependent engine rpm fluctuations, attachment maneuvering, acceleration pedal movement and other factors. The auto-mode comes in two ways, "Travel Mode" and "Field Mode", according to the application.

(1) Travel Mode

In trailing operation, the automatic shift-up/down is carried out within a predetermined range (factory-set for 2 shifts), responding to the acceleration pedal movement and rpm changes from load. The helps you avoid troublesome gear shifting.



<p>[Example] Running at the automatic travel speeds (6), (7), (8)</p>	<p>Acceleration pedal released When the acceleration pedal is completely released, the hand throttle is in idle position, the automatic shift-down from speed (8) to speed (7) to (6) occurs.</p>	<p>Tractor stopped When the tractor pauses, the automatic shift-up from speed (6) occurs for smooth restarting.</p>	<p>Uphill travel On an uphill slope, an increase in load is sensed, prompting the automatic shift-down to speed (7) or (6) for more traction force.</p>	<p>Travelling Over the uphill slope, a decrease in load is sensed, prompting the automatic shift-up.</p>	<p>Acceleration adjusted On a downhill slope or along a curve, the automatic shift-down to speed (7) or (6) occurs, responding to the acceleration pedal movement.</p>
--	--	--	--	---	---

■ Execution Condition for Automatic Shifting

Auto shift up or down is conducted when the following condition matches.

1. Power shift lever is in **L** or **H** position, and the neutral switch is not depressed.
2. The acceleration control increase or decrease is not being conducted.
3. The clutch pedal is not depressed.
4. The steering wheel is not being operated (turning angle switch is not turned on).
5. The machine is running forward.

■ Auto Shift Down Function

Tractor will auto shift down when the following condition are achieved.

1. The acceleration opening of the engine set without load is above 1300 min^{-1} (rpm).
2. Engine drop is above the preset value.
3. Engine is not on recovering condition.

■ Auto Shift Up Function

Tractor will auto shift up when the following conditions are achieved.

1. Engine rpm is not increased by pushing outer load.
2. When the engine rpm is accelerated from low speed to high speed quickly, auto shift up is conducted according to the engine rpm increase condition.
3. Auto shift up is conducted according to the acceleration set rpm, if the acceleration set rpm is gradually increased from the low rpm range, with the engine drop is within a certain value.
4. After manual shift is conducted, auto shift cannot be conducted unless acceleration pedal is depressed.

■ Working Support Function

There is support function as described below to support the gear change (shift up and down) operation.

1. Acceleration release to shift down function

For cornering or deceleration, when the operator release the acceleration control, shift down is conducted automatically down to the lowest gear if match to the conditions described below.

- Acceleration set rpm needs to low idle (rpm is lower than 1000 min^{-1} (rpm)).
- Actual engine rpm is not high side (rpm is lower than 2300 min^{-1} (rpm)).

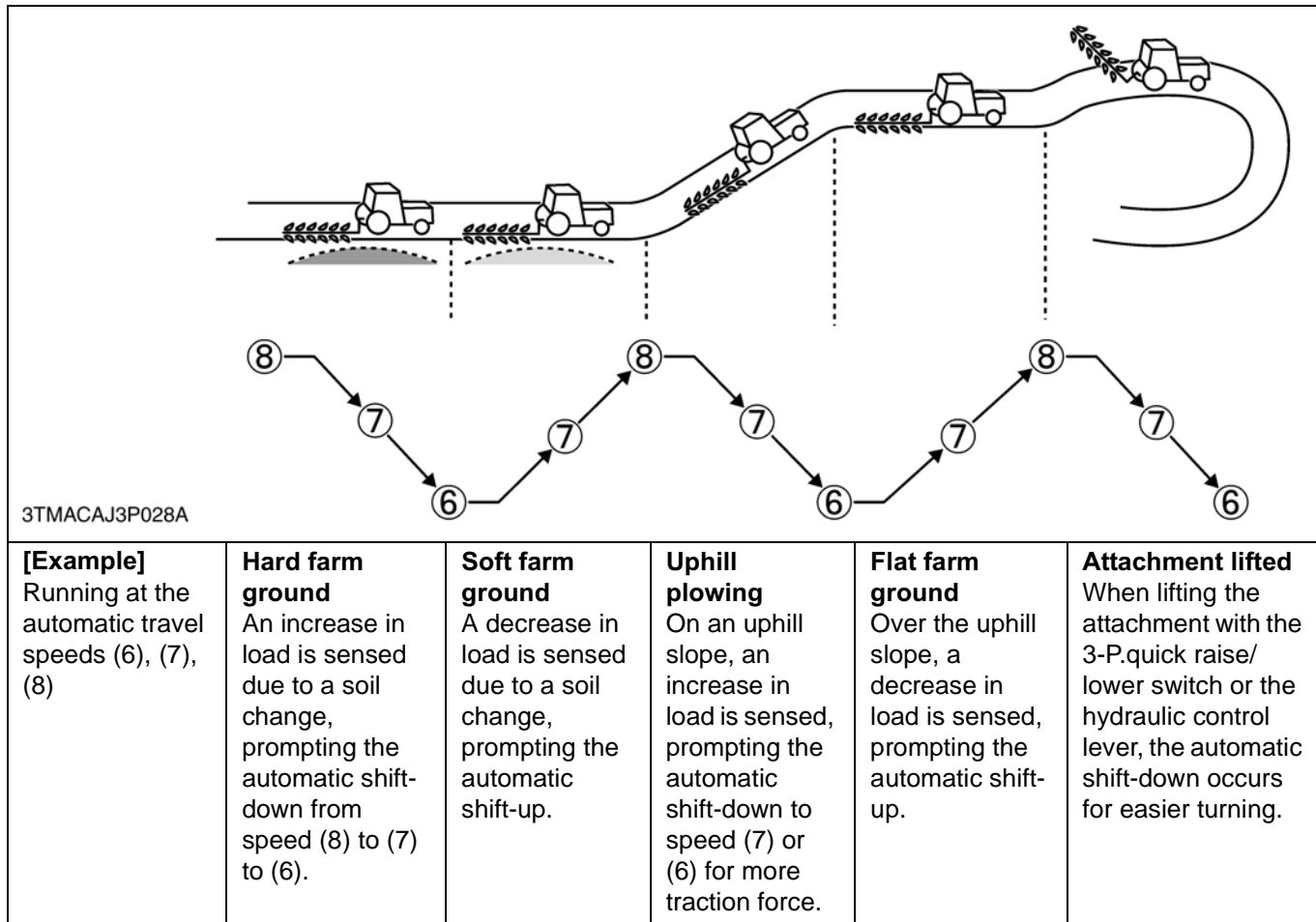
2. Start Function from Stop

This function forces the gear engagement to be the lowest gear while parking. This function works, when the following condition meets.

- Power shift lever is in **L** or **H** position, and the neutral switch is not depressed.
- Shuttle lever is not located on **R** position.
- Auto or manual gear shift is completed.
- Master clutch is not engaged.
- Tractor is not in motion (stopped).

(2) Field Mode

In plowing operation, the automatic shift-up/down is carried out within a predetermined range (factory-set for 2 shifts), responding to the field condition, soil condition and other factors. When lifting the attachment using 3-point hitch, the automatic shift-down is mode for easier turning.



■ Execution Condition for Automatic Shifting

The condition to shift automatically is as follows.

1. Power shift is in **L** or **H** position, and the neutral switch is not depressed.
2. The throttle control increase or decrease is not being conducted.
3. The clutch pedal is not depressed.
4. The steering wheel is not being operated (turning angle switch is not turned on).
5. The machine is running forward.

■ Auto Shift Down Function

Tractor will auto shift down when the following conditions are achieved.

1. The throttle opening of the engine set without load is above 1300 min^{-1} (rpm).
2. Engine drop is above the preset value.
3. Engine is not on recovering condition.

■ Auto Shift Up Function

Tractor will auto shift up when the following conditions are achieved.

1. Throttle set rpm is above 1600 min^{-1} (rpm).
2. Engine rpm is not increased by pushing outer load.
3. Engine drop speed and range is smaller than preset value.

■ Working Support Function

There is support function as described below. However, while the 3-point hitch safety lock is on, support function does not work.

1. No auto shift up according to the 3-point hitch height

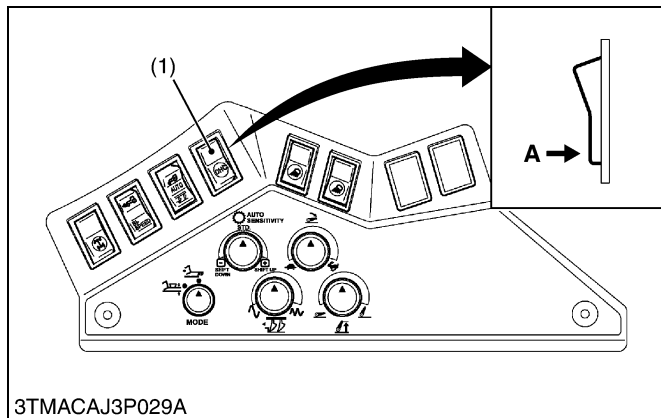
When the 3-point hitch is being raised, no auto up can be done. (assuming tillage work is not being conducted.)

2. Auto shift down function accordance with the 3-point hitch raising

Auto shift down to the lower limit is conducted when the 3-point hitch is raised.

[4] OTHER CONTROL

(1) Down-hill Control



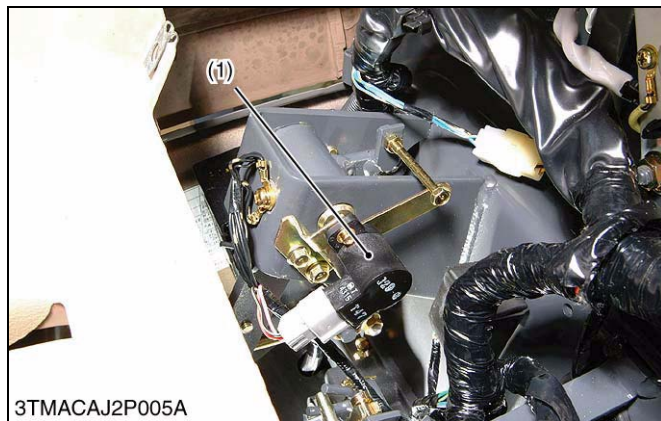
On this tractor, the engine load and other fluctuations are sensed and the speed is well controlled in response to the loads. Turn the DHC switch “ON” when using a traction PTO attachment (baler, etc.) on a slope. A well responsive speed control can be expected. In other applications, turn this switch “OFF”. Smooth speed change is available for comfortable ride.

(1) DHC Switch

(A) Push to ON

W1017203

(2) Clutch Pedal Control



The position of clutch pedal is detected by clutch pedal sensor and the master clutch pressure is controlled by solenoid proportional reducing valve according to the position of clutch pedal. Thus, it can be operated with a feeling similar to that of ordinary mechanical clutch. Moreover, since the master clutch pressure boosting pattern is set for each of the speed change steps, it can be operated with a same feeling at any step.

Besides the clutch can be shifted also by operation of the clutch button of the power shift lever. In this case, the pressure of master clutch is also controlled (modulated) in the effect for smooth clutch engagement.

(1) Clutch Pedal Sensor

W1017517

(3) Shuttle Control



The master (F-R) clutch is controlled to switch the forward / reverse operation by manipulating the shuttle lever. At this time, the forward / reverse operation can be switched smoothly by controlling (modulating) the pressure of the master clutch.

(1) Shuttle Lever

W1017380

(4) Auxiliary Control

■ Master Clutch Protection Control

To avoid damage on a clutch caused by a long-lasting half-clutch state by clutch pedal operation, this system disengages the clutch automatically and notifies it to a driver.

To return to a normal control state, step on the clutch pedal, place the shuttle lever at neutral, or press the clutch button on the power shift lever.

■ Machine Speed Check Control

Operating the shuttle lever at a speed higher than 11 km/h (7.6 m/h) results in disengaging the master clutch and sounding an warning buzzer.

Returning the shuttle lever to its original position engages the clutch again and stops the buzzer.

■ Protection against Hard Start

If the shuttle lever is at the forward or backward run position and the clutch pedal is not stepped on, placing the power shift lever at **L** or **H** position without pressing the shift button results in sounding a buzzer to warn an operator. By the safety control, the tractor does not start.

■ Fail-safe Control

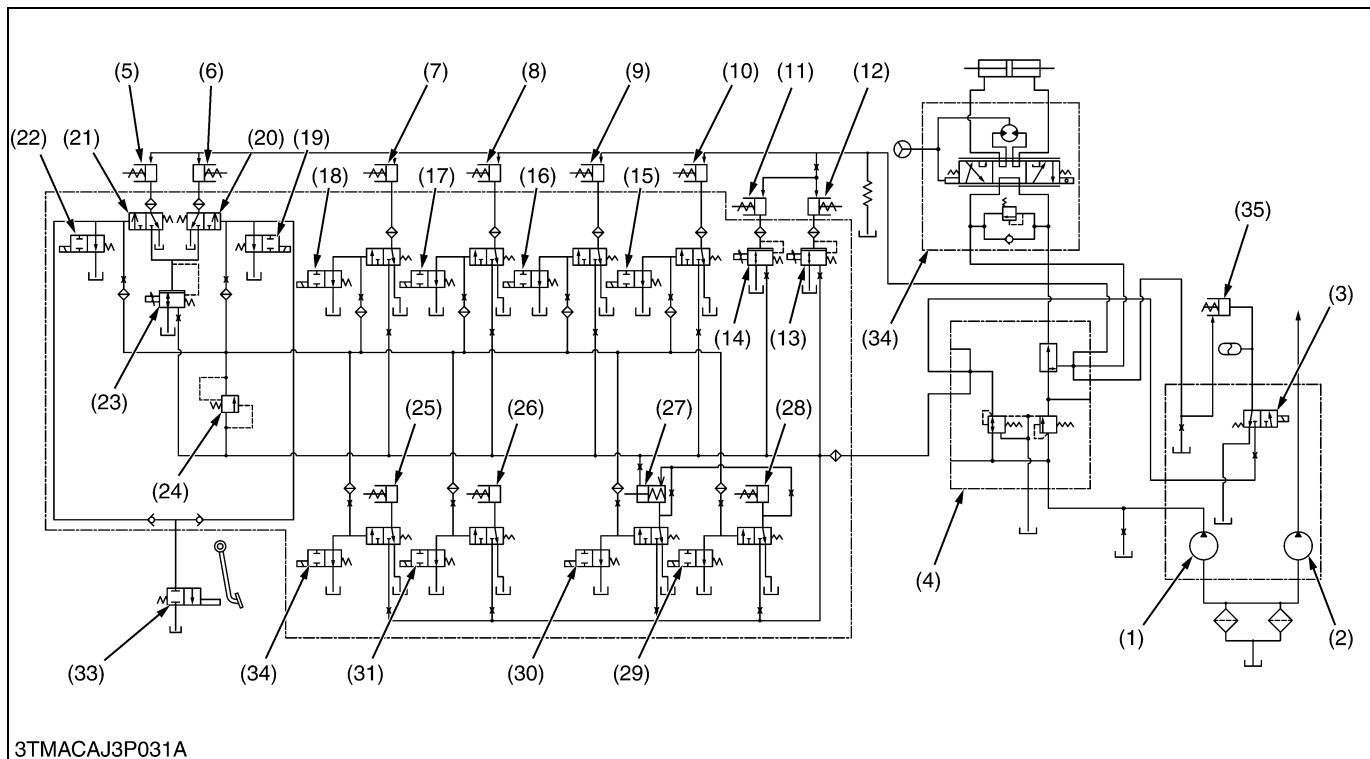
If a sensor or a solenoid valve becomes faulty, a related control is stopped to avoid abnormal operations. At the same time, the shifting display blinks or lights on and a buzzer sounds.

Returning the power shift lever to the neutral position releases the failsafe function temporarily.

Depending on a condition of a failure, the tractor can still move at a certain speed.

[5] HYDRAULIC CONTROL SYSTEM

(1) Hydraulic Circuit



- | | | | |
|-----------------------------|---|---|--|
| (1) Hydraulic Pump | (12) Main Shift Clutch H | (19) Solenoid ON/OFF Valve | (26) Hydraulic Clutch (Rear Differential Lock) |
| (2) Hydraulic Pump | (13) Solenoid Proportional Pressure Reducing Valve (Main Shift H) | (20) Main Spool | (27) Hydraulic Clutch (4WD) |
| (3) PTO Valve | (14) Solenoid Proportional Pressure Reducing Valve (Main Shift L) | (21) Main Spool | (28) Hydraulic Clutch (Bi-speed) |
| (4) Regulator Valve | (15) Solenoid ON/OFF Valve | (22) Solenoid ON/OFF Valve | (29) Solenoid ON/OFF Valve |
| (5) Master Clutch (Forward) | (16) Solenoid ON/OFF Valve | (23) Solenoid Proportional Pressure Reducing Valve (Master) | (30) Solenoid ON/OFF Valve |
| (6) Master Clutch (Reverse) | (17) Solenoid ON/OFF Valve | (24) Pressure Reducing Valve | (31) Solenoid ON/OFF Valve |
| (7) Main Shift Clutch 1 | (18) Solenoid ON/OFF Valve | (25) Hydraulic Clutch (Front Differential Lock) | (32) Solenoid ON/OFF Valve |
| (8) Main Shift Clutch 2 | | | (33) Safety Valve |
| (9) Main Shift Clutch 3 | | | (34) Power Steering Controller |
| (10) Main Shift Clutch 4 | | | (35) PTO Clutch |
| (11) Main Shift Clutch L | | | |

The figure above shows the oil pressure circuit diagram of power shift system.

The oil coming out of hydraulic pump (1) and enters the regulator valve (4).

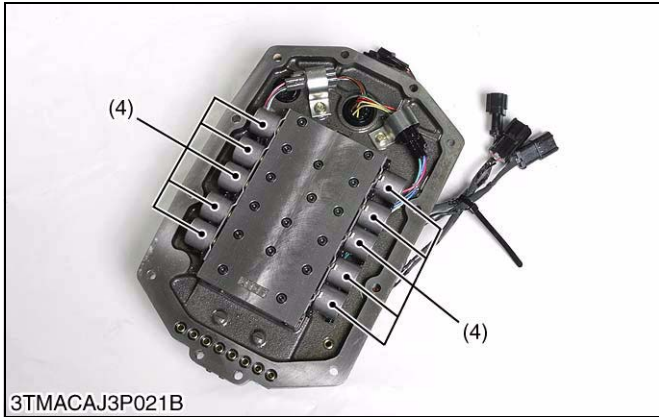
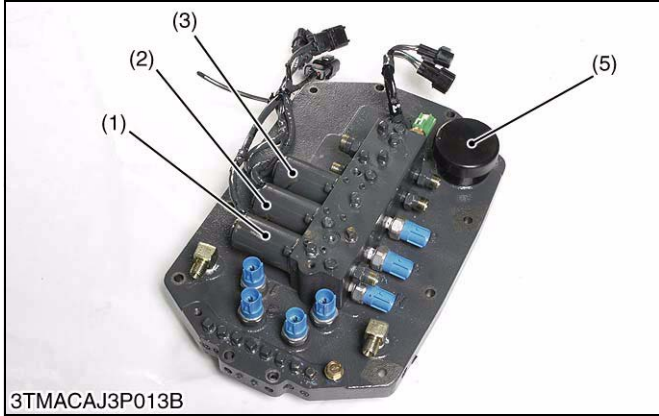
Oil pressure is regulated to 2.06 to 2.25 MPa (21.0 to 23.0 kgf/cm², 298.7 to 327.1 psi) by means of the pressure reducing valve and then it is sent to the power shift valve and PTO valve. Other oil flows to the power steering circuit.

In the power shift valve, the oil flow channel and oil pressure are controlled by the each solenoid ON/OFF valve, main spool and solenoid proportional pressure reducing valve (13), (14), (23) and sent to hydraulic clutches.

In the power shift valve, this value 2.06 to 2.25 MPa (21.0 to 23.0 kgf/cm², 298.7 to 327.1 psi) is used as hydraulic clutch operating pressure.

As the pilot pressure for operating main spools, this pressure is also used after having been reduced to 0.78 MPa (8 kgf/cm², 113.8 psi) by the pressure reducing valve (24).

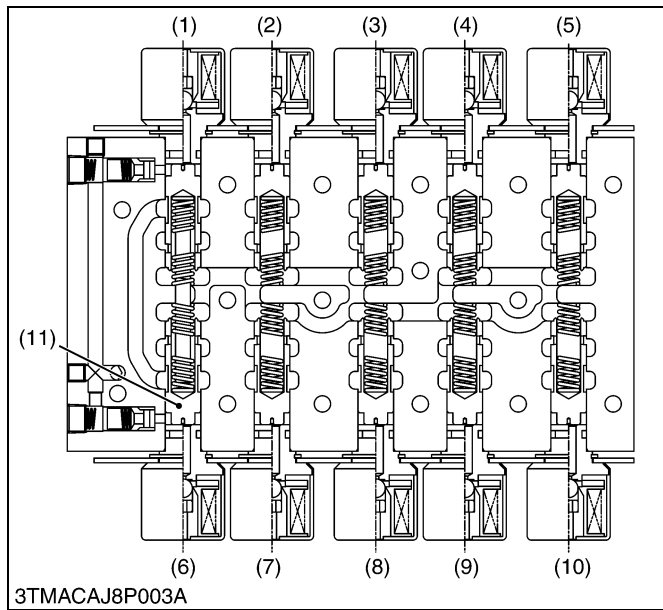
[6] POWER SHIFT VALVE



The power shift valve comprises 10 sets of solenoid ON/OFF valve (4) for main speed change (in 1-4 steps), forward/reverse operation switching, 4WD/bi-speed switching and ON/OFF switching of front and rear wheel hydraulic differential lock, a main spool, 3 sets of solenoid (1), (2), (3) which control the pressure of the clutches for master clutch (**F-R**) and main shift (**L-H**).

- | | |
|---|--|
| (1) Solenoid Proportional Reducing Valve (Master) | (3) Solenoid Proportional Reducing Valve (H) |
| (2) Solenoid Proportional Reducing Valve (L) | (4) Solenoid ON/OFF Valve |
| | (5) Breather |

W1013752



(1) Master (F-R)

The valves relating to the master clutch (F-R) includes the solenoid proportional reducing valve, 2 sets of solenoid ON/OFF valve and the main spool.

The hydraulic clutch for Forward/Reverse operation is switched by the solenoid ON/OFF valve (5), (10), and the pressure of oil to be supplied to the hydraulic clutch is controlled by the solenoid proportional reducing valve. The combination of these valves realizes clutch operation having quasi-mechanical feeling and non-clutch shuttle speed change.

(2) Main Shift (1-4)

The valves to operate the main shift (1-4) clutch are 4 sets of solenoid ON/OFF valve (3), (4), (8), (9) and the main spool. Electricity is supplied to solenoid valves to switch over to the hydraulic clutch to be operated, in accordance with the signal sent from the power shift control unit.

(3) Main Shift (L-H)

The valves to operate the main shift (L-H) clutch are 2 sets of solenoid proportional reducing valve.

This solenoid proportional reducing valve controls the pressure of oil to be supplied to the hydraulic clutch and reduced shock at the time of speed change.

(4) 4WD/Bi-speed Turn and Differential Lock

4 sets of solenoid proportional reducing valve and main spool are provided for 4WD/bi-speed switching and hydraulic differential locking of front and rear wheels.

Electricity is supplied to solenoid valves and they are switched according to the state of switches and sensors.

- | | |
|-----------------------------------|------------------------------------|
| (1) Rear Differential Lock | (7) Bi-speed Turn Solenoid Valve |
| (2) Front Differential Lock | (8) Main Shift 2 Solenoid Valve |
| (3) Main Shift 3 Solenoid Valve | (9) Main Shift 1 Solenoid Valve |
| (4) Main Shift 4 Solenoid Valve | (10) Master Reverse Solenoid Valve |
| (5) Master Forward Solenoid Valve | (11) Main Spool |
| (6) 4WD Solenoid Valve | |

W1013874

(5) Solenoid ON/OFF Valve

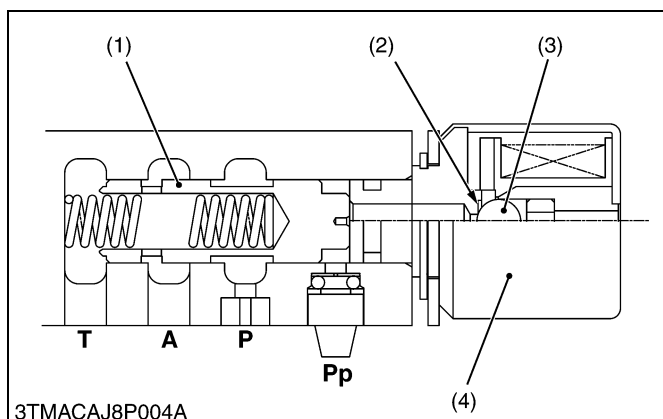
The figure shows the construction of this solenoid ON/OFF valve. When electricity is not supplied, hydraulic oil passes around the ball and the pilot pressure is unloaded. Thus the main spool is closed by spring force.

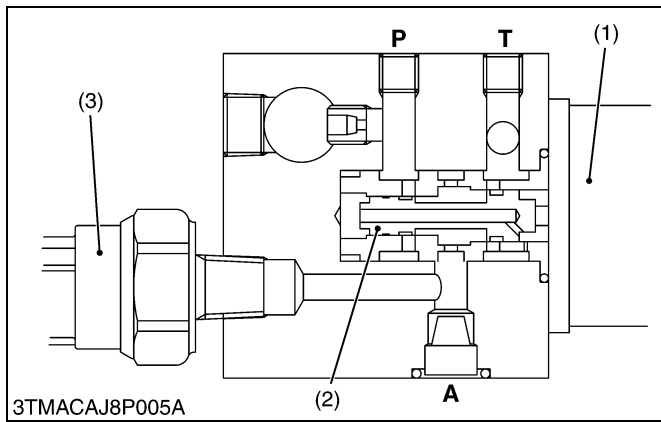
When electricity is supplied to the solenoid valve, the ball is pressed to the seat by which the unloading oil channel closes and the pilot pressure is applied to the main spool.

Thus, the main spool is pressed to make communication between P port and A port.

- | | |
|---------------------------|---------------------------------|
| (1) Main Spool | P : System Pressure |
| (2) Valve Seat | Pp : Pilot Pressure |
| (3) Steel Ball | A : To Hydraulic Clutch |
| (4) Solenoid ON/OFF Valve | T : To Transmission Case |

W1014110





(6) Solenoid Proportional Reducing Valve

The figure shows the construction of this solenoid proportional reducing valve.

Since the spool remains pressed when no electricity is supplied to the solenoid valve, the oil channel between the **P** port and the **A** port is closed.

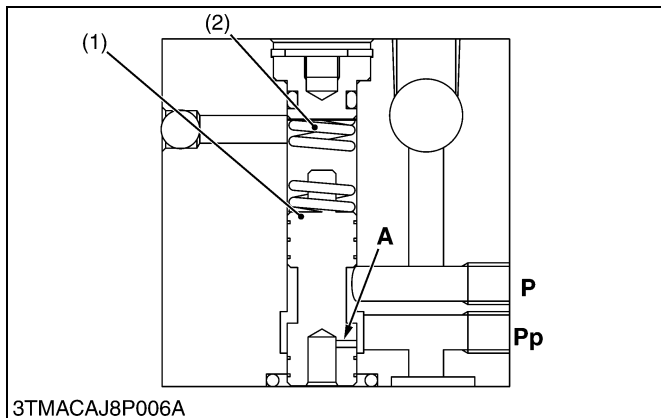
When electricity is supplied to the solenoid valve, the spool is pressed by a force generated by current, and the oil channel between the **P** port and **A** port opens and oil runs through this channel. On the other hand, since the sectional area of **P** port side of the spool is different from that of **A** port side, the spool is thrust back in closing direction by a force proportional to the pressure applied to the **A** port, and it stops at a position where both the forces are balanced.

Thus, a pressure proportional to the current running through the solenoid valve is generated.

- (1) Solenoid
- (2) Spool
- (3) Pressure Switch

- P** : System Pressure (from Regulator Valve)
- A** : To Hydraulic Clutch
- T** : To Transmission Case

W1014306



(7) Pressure Reducing Valve

The figure shows the construction of the pilot pressure reducing valve.

Since the spool remains pressed by spring force when no pressure is supplied to the **P** port, communication is established between the **P** port and the **Pp** port.

When the **P** port is pressurized, the pressure is transmitted to the spool backside through the path (**A**) and the spool is thrust back to the spring side. As the result, the oil channel formed between the **P** port and the **Pp** port narrows to lower the **Pp** port pressure, and the spool stops at the position where the spool thrusting force equalizes with the spring force.

Thus, the pilot pressure lower than the system pressure is obtained.

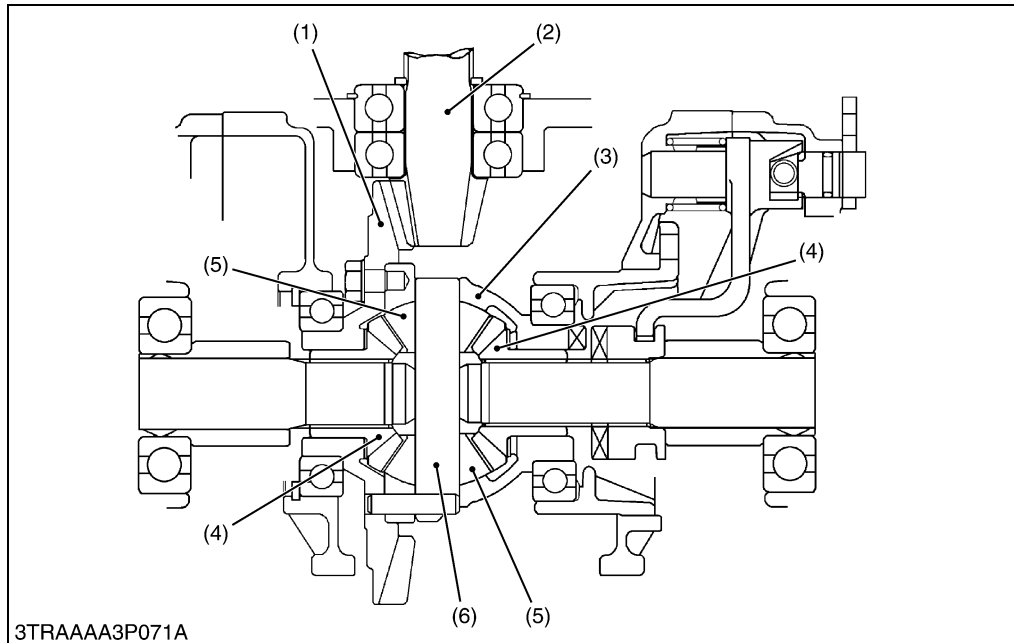
- (1) Spool
- (2) Spring

- P** : System Pressure (from Regulator Valve)
- Pp** : Pilot Pressure
- A** : Path

W1014607

13. DIFFERENTIAL GEAR SYSTEM

[1] STRUCTURE



- (1) Spiral Bevel Gear
- (2) Spiral Bevel Pinion
- (3) Differential Gear Case
- (4) Differential Side Gear
- (5) Differential Pinion
- (6) Differential Pinion Shaft

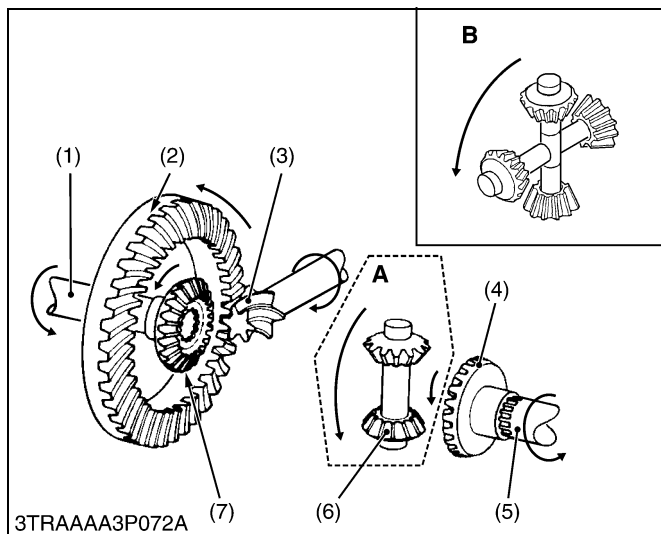
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3TRAAA3P071A

The differential gear assembly is a mechanism to provide smooth steering. It automatically provides different optimum torques to the right and left wheels according to road resistance and braking friction at the wheels.

The differential gear assembly is composed of the differential case, differential pinions, differential side gears, differential pinion shaft, spiral bevel gear, etc..

[2] OPERATION



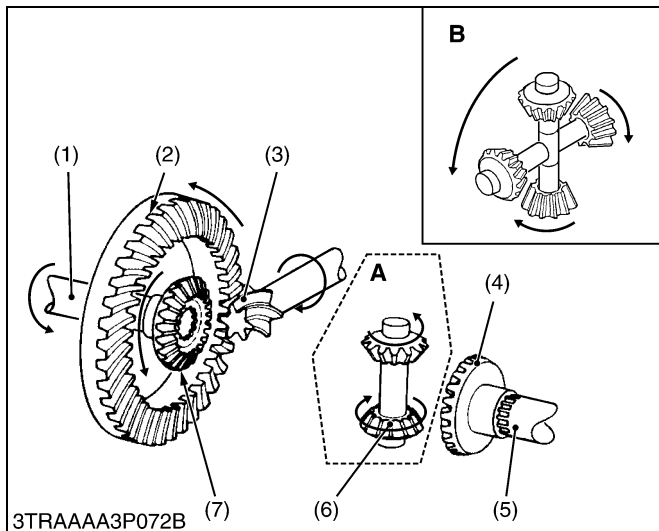
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■ During Straight Running

Rotation of the spiral bevel pinion (3) is transmitted to the spiral bevel gear (2) bolted to the differential case. When road resistance to the right and left wheels are equal, the differential pinions (6), and differential side gears (4), (7) are carried around by the spiral bevel gear (2), and differential case rotate as a unit. Differential gear shaft (1), (5) receive the same rotation and both wheels travel at the same speed.

- (1) Differential Gear Shaft
 - (2) Spiral Bevel Gear
 - (3) Spiral Bevel Pinion
 - (4) Differential Side Gear
 - (5) Differential Gear Shaft
 - (6) Differential Pinion
 - (7) Differential Side Gear
- A : 2 Pinion Type**
B : 4 Pinion Type

W10198320



■ During Turning

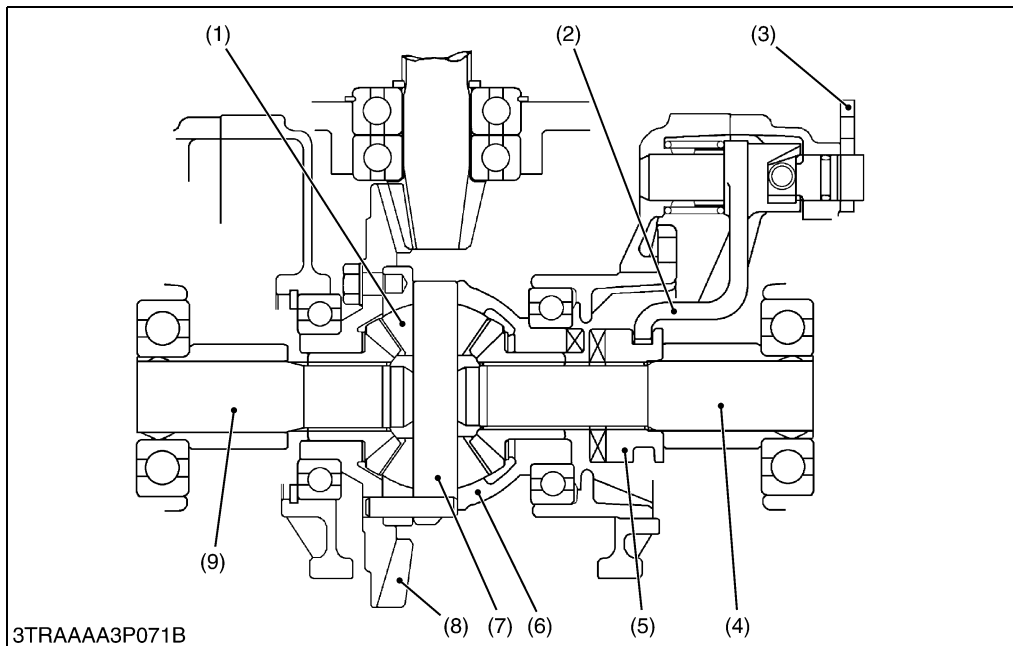
The power from the engine on spiral bevel pinion (3) rotates spiral bevel gear (2). When turning a corner, the outer wheel must travel farther than the inner one. While differential pinions (6) rotate with the differential case, they spin on differential pinion (6) to transmit more rotation to one differential side gear (4) or (7) than to the other. As one differential gear shaft rotates faster, the other rotates slower by the same amount.

- | | |
|-----------------------------|----------------------------|
| (1) Differential Gear Shaft | (6) Differential Pinion |
| (2) Spiral Bevel Gear | (7) Differential Side Gear |
| (3) Spiral Bevel Pinion | |
| (4) Differential Side Gear | A : 2 Pinion Type |
| (5) Differential Gear Shaft | B : 4 Pinion Type |

W10199510

[3] DIFFERENTIAL LOCK

(1) Dog Clutch Type



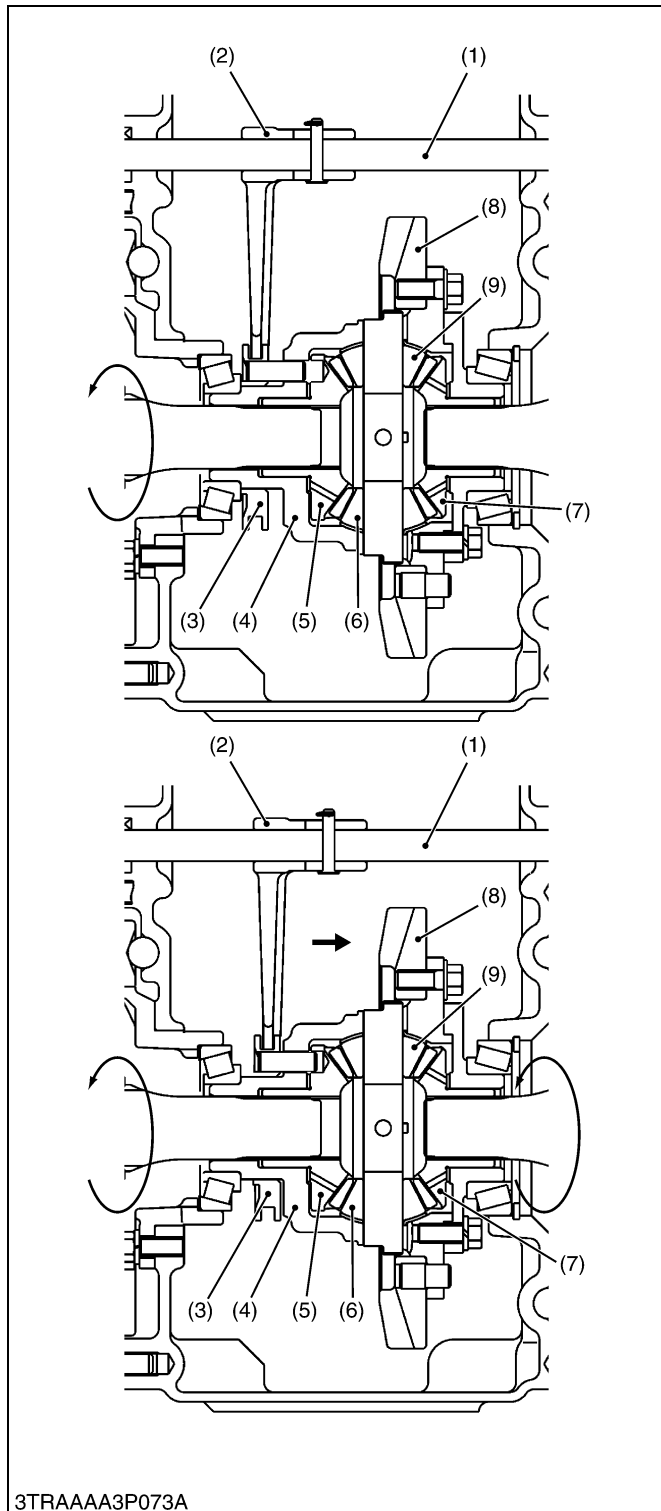
- | |
|-------------------------------|
| (1) Differential Pinion |
| (2) Shift Fork |
| (3) Differential Lock Lever |
| (4) Differential Gear Shaft |
| (5) Differential Lock Clutch |
| (6) Differential Case |
| (7) Differential Pinion Shaft |
| (8) Spiral Bevel Gear |
| (9) Differential Gear Shaft |

W10180970

When resistance to the right and left tires are greatly different due to ground conditions or type of work, the tire with less resistance slips and prevents the tractor from moving ahead. To compensate for this drawback, the differential lock restricts the differential action and causes both rear axles to rotate as a unit.

When the differential lock pedal is stepped on, it causes the differential lock lever (3) to rotate, which will move the shift fork (2) and the differential lock clutch (5) toward the spiral bevel gear (8). The differential lock clutch (5) engaged with the teeth of the differential case (6) to cause the differential case (6) and the differential lock clutch (5) to rotate as a unit.

Therefore, differential pinions (1) are unable to rotate around differential pinion shaft (7) and identical revolutions are transmitted to the right and left differential gear shaft (4), (9).

(2) Pin Type

When resistances to the right and left tires are different due to ground conditions or type of work, the wheel with less resistance slips and prevents the tractor from moving ahead. To compensate for this, the differential lock restricts the differential function and causes both rear axles to rotate as a unit.

When the differential lock pedal is stepped on, it causes the differential lock cam shaft (1), differential lock shift fork (2) and differential lock shifter (3) are moved toward the ring gear (8).

The pins on the differential lock shifter (3) go into the holes in the differential side gear (5) through the holes in the differential case (4) to cause the differential case, differential lock shifter and differential side gear to rotate as a unit. Therefore the differential pinions (6), (9), can not rotate on their axles, and the rotation of the spiral bevel pinion is transmitted to the both rear axles evenly. It means the tractor going straight ahead.

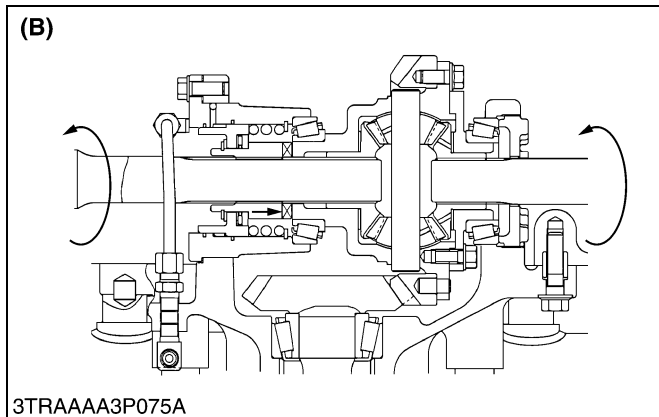
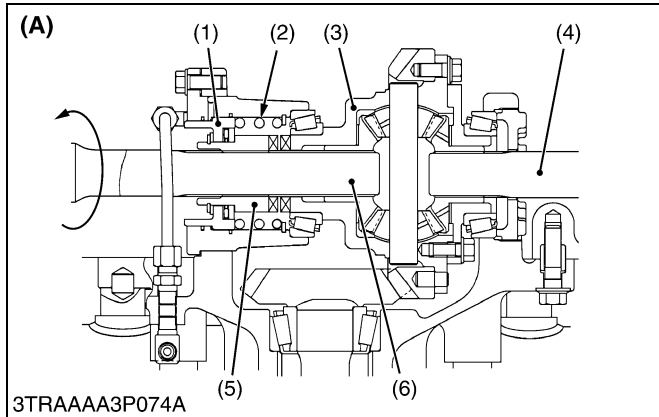
When the drive wheels regain equal traction, the lock will disengage automatically by the force of differential lock pedal return spring, while released differential lock pedal.

- | | |
|----------------------------------|----------------------------|
| (1) Differential Lock Cam Shaft | (6) Differential Pinion |
| (2) Differential Lock Shift Fork | (7) Differential Side Gear |
| (3) Differential Lock Shifter | (8) Ring Gear |
| (4) Differential Case | (9) Differential Pinion |
| (5) Differential Side Gear | |

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3TRAAA3P073A

(3) Hydraulic Actuated Type



The differential lock can be operated easily with an electric switch.

When the switch is turned **ON**, the solenoid valve operates and oil flows in the back of the piston (1). Clutch (5) engages, and as a result, right and left differential yoke shaft rotate as a unit through differential case (3).

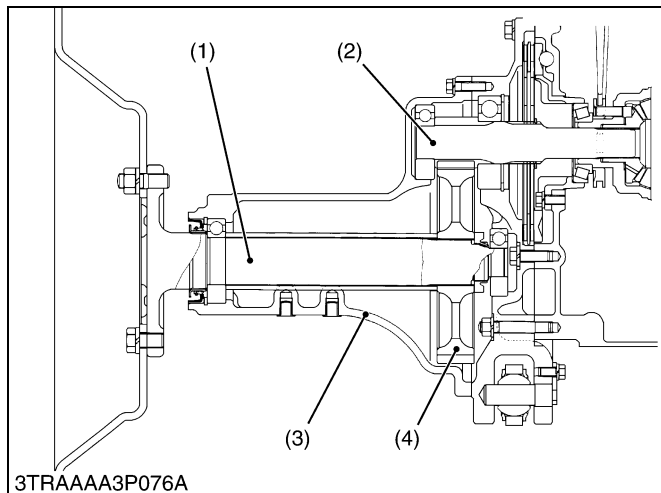
On the other hand, oil is not supplied when the switch is **OFF**, and clutch (5) is maintained at the disengaged position by force of spring (2).

- | | |
|--------------------------------|--------------------------------|
| (1) Piston | (5) Clutch |
| (2) Spring | (6) Differential Yoke Shaft LH |
| (3) Differential Case | (A) OFF |
| (4) Differential Yoke Shaft RH | (B) ON |

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14. FINAL REDUCTION SYSTEM

The tractor requires a large rate of speed reduction for the power from engine to the driving wheel for service of heavy duty. The final reduction system located between the differential gears and wheel axles.

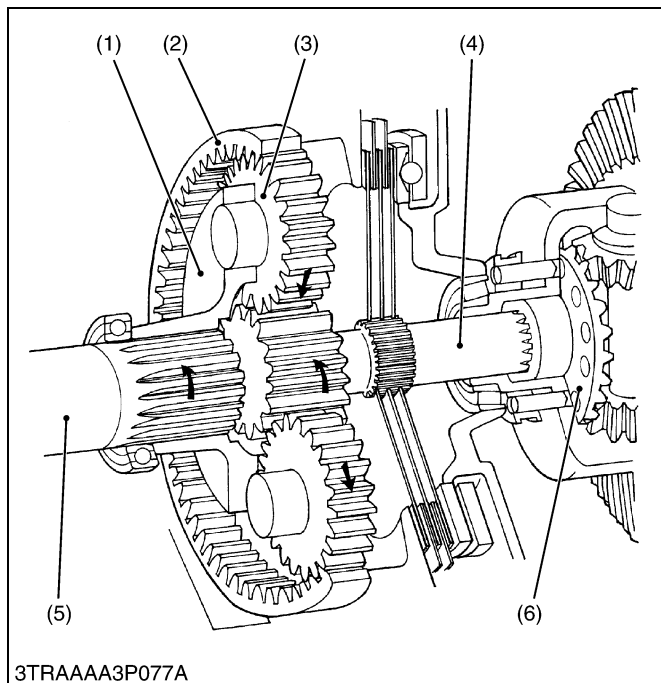


■ Spur Gear Type

The structure of spur gear type is simple. And, because power is transmitted from a small gear on differential gear shaft to a big gear on rear axle, a large speed reduction is obtained.

- | | |
|-----------------------------|--------------------|
| (1) Rear Axle | (3) Rear Axle Case |
| (2) Differential Gear Shaft | (4) Final Gear |

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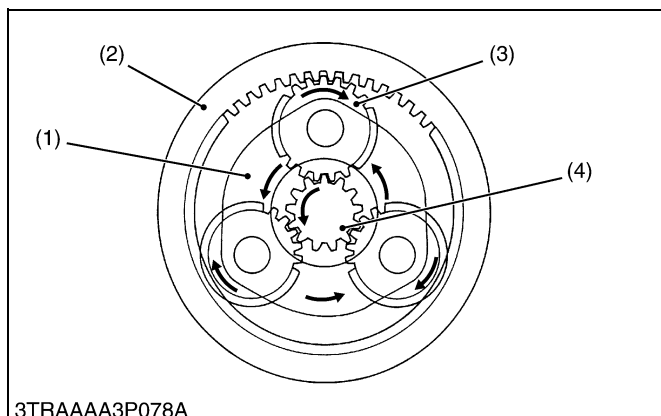
■ Planetary Gear Type

The final reduction system is compact, and is durable under heavy loads since torque loads are spread over three gears, decreasing the load on each tooth. And this system also spreads the load evenly around the circumference of the system, eliminating the sideways stress on the shafts.

Power, transmitted from the differential side gear (6) to the brake shaft (4), drives the three planetary gear (3). Since the internal gear (2) is fixed to the rear axle case, the planetary gears move around the teeth of the internal gear while rotating on their axes. The movement of the planetary gears around the internal gear is transmitted to the rear axle (5) through the planetary gear support (1). As a result, the planetary gear support (1) and rear axle (5) rotate in the same direction as the brake shaft (4), but at a reduced speed and increased torque.

- | | |
|----------------------------|----------------------------|
| (1) Planetary Gear Support | (4) Brake Shaft |
| (2) Internal Gear | (5) Rear Axle |
| (3) Planetary Gear | (6) Differential Side Gear |

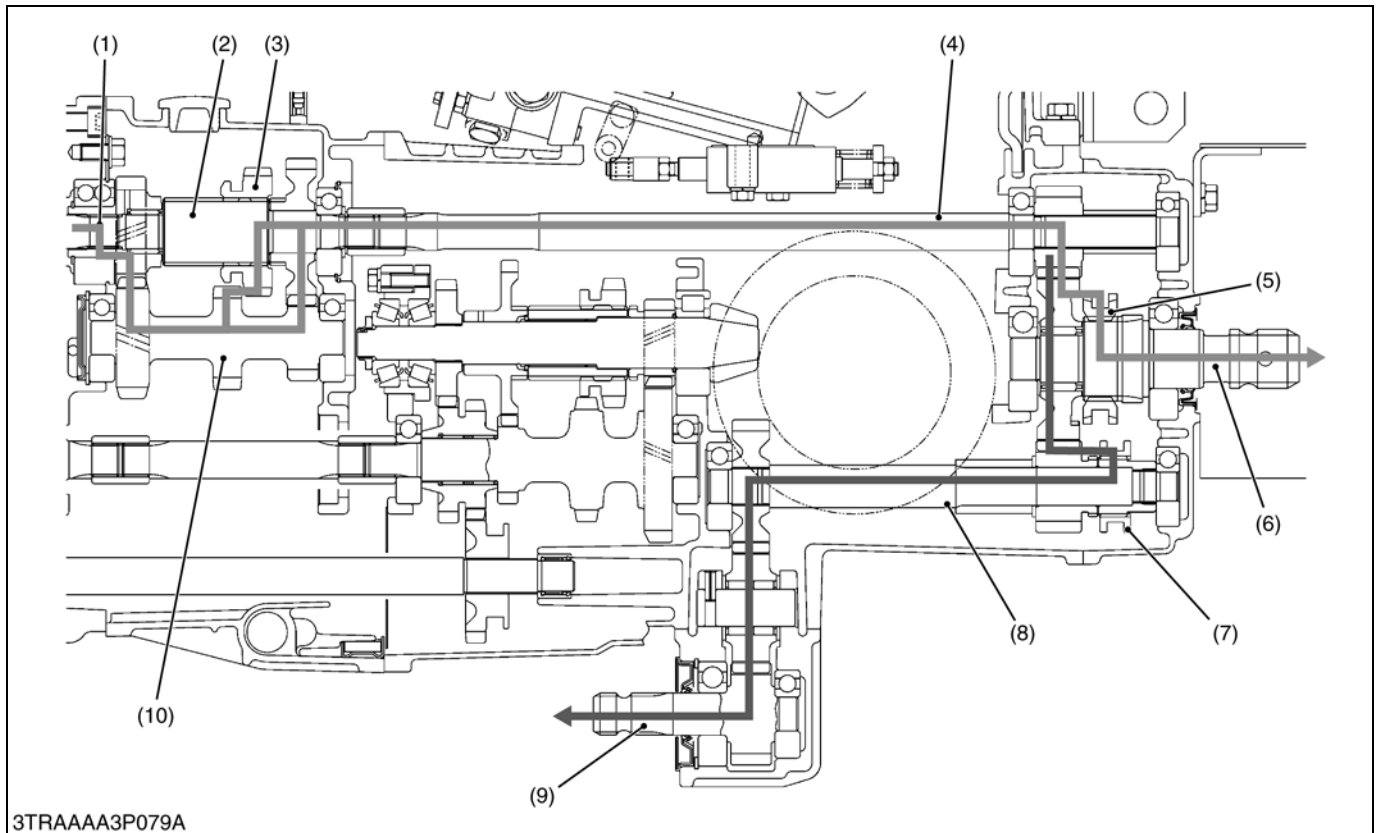
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15. PTO SYSTEM

[1] REAR AND MID PTO SYSTEM

The tractor is equipped with a PTO (Power Take Off) shaft for driving implement. It is usually located at the rear end of the tractor, but some tractors have auxiliary PTO shafts at the middle of the body.



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- | | | | |
|---------------------------------|------------------------|-------------------------|-------------------|
| (1) Input Shaft | (4) PTO Drive Shaft | (7) Shifter (Mid PTO) | (9) Mid PTO Shaft |
| (2) PTO Counter Shaft | (5) Shifter (Rear PTO) | (8) Mid PTO Drive Shaft | (10) Gear Shaft |
| (3) Shifter Gear (Speed Change) | (6) PTO Shaft | | |

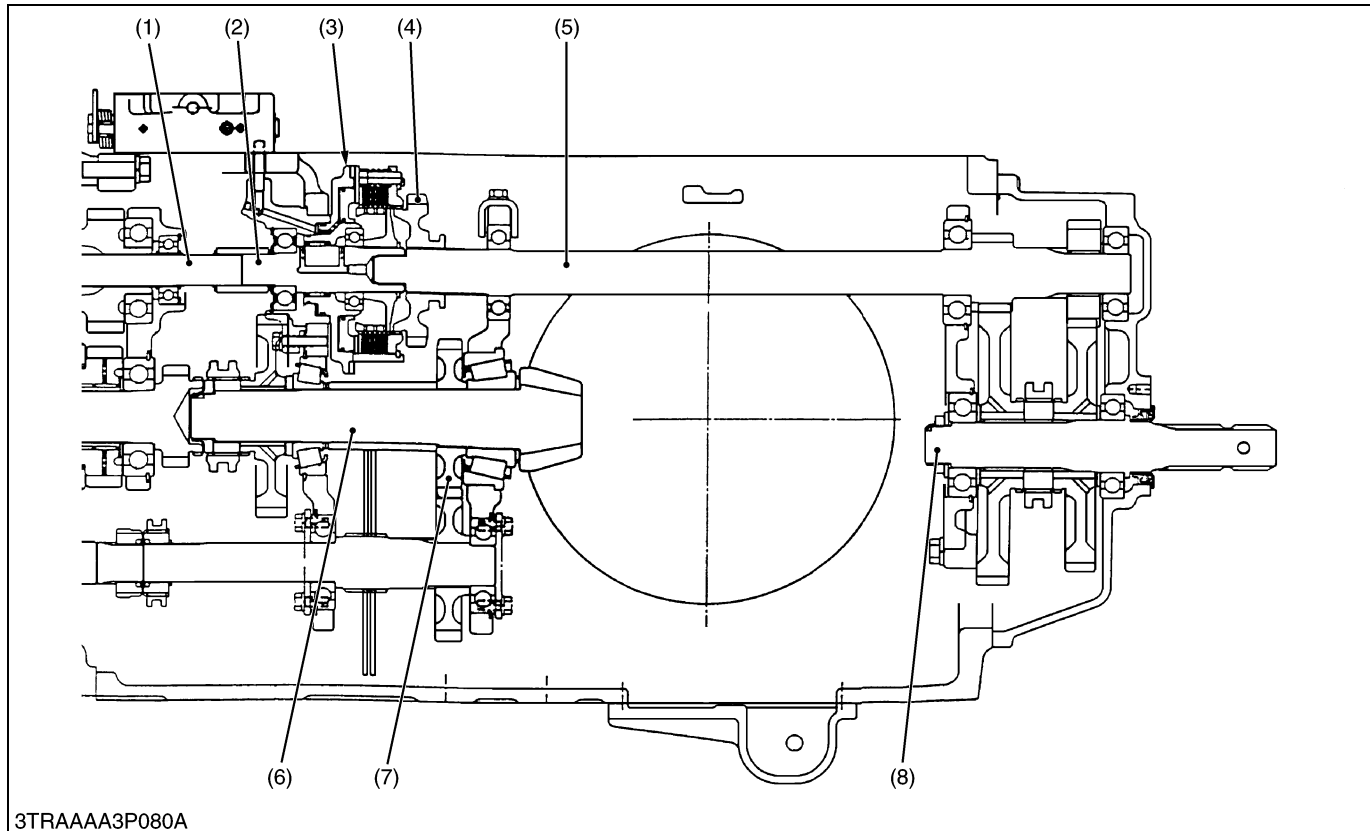
(1) Rear PTO

Input Shaft (1) → Gear Shaft (10) → Shifter Gear (3) → PTO Counter Shaft (2) → PTO Drive Shaft (4) → Shifter (5) → PTO Shaft (6)

(2) Mid PTO

Input Shaft (1) → Gear Shaft (10) → Shifter Gear (3) → PTO Counter Shaft (2) → PTO Drive Shaft (4) → Shifter (7) → Mid PTO Drive Shaft (8) → Mid PTO Shaft (9)

[2] LIVE PTO AND GROUND PTO



- | | | | |
|-------------------------|------------------|-------------------------------|---------------|
| (1) PTO Propeller Shaft | (3) PTO Clutch | (5) PTO Drive Shaft | (7) Gear |
| (2) PTO Clutch Shaft | (4) Shifter Gear | (6) Spiral Bevel Pinion Shaft | (8) PTO Shaft |

In PTO system in the above figure, there are two kinds of power train (Live PTO and Ground PTO).

(1) Live PTO

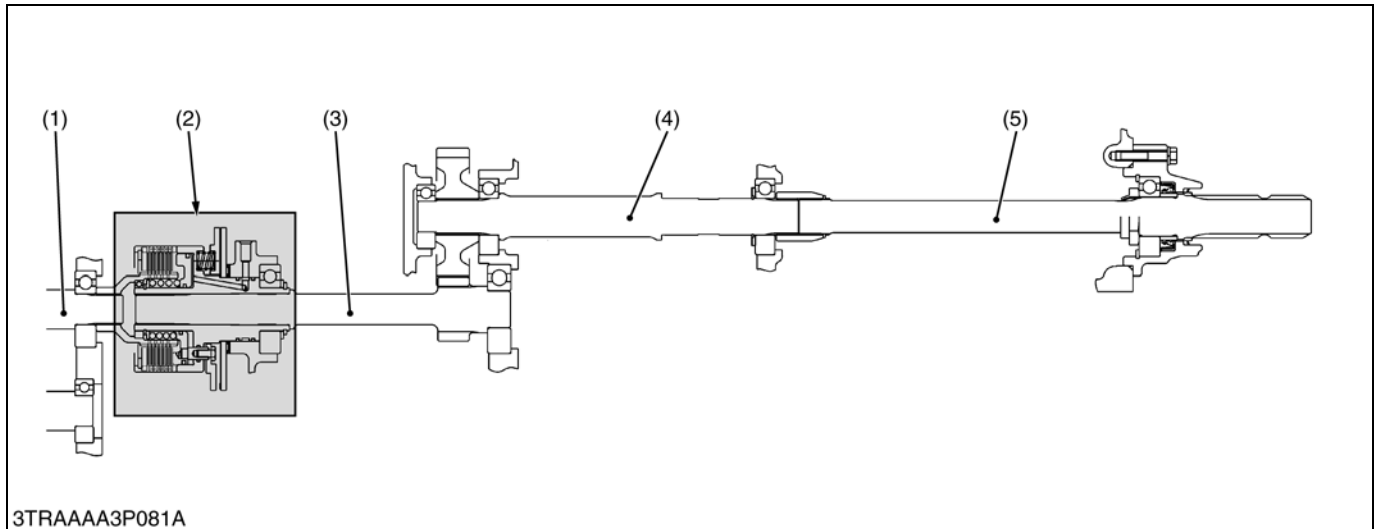
The gear (4) is connected the PTO clutch. When PTO clutch lever is turn to **ON** position, the rotation of PTO propeller shaft (1) is transmitted to the PTO drive shaft (5).

(2) Ground PTO

When the PTO gear shift lever is shifted to **GROUND PTO** setting, the shifter gear (4) is moved to the right and meshed with the gear (7) on the spiral bevel pinion shaft (6).

Then, the PTO shaft is turned an amount proportional to the tractor travelling speed.

[3] INDEPENDENT PTO SYSTEM



(1) PTO Counter Shaft
(2) PTO Clutch Pack

(3) Gear Shaft

(4) PTO Drive Shaft

(5) PTO Shaft

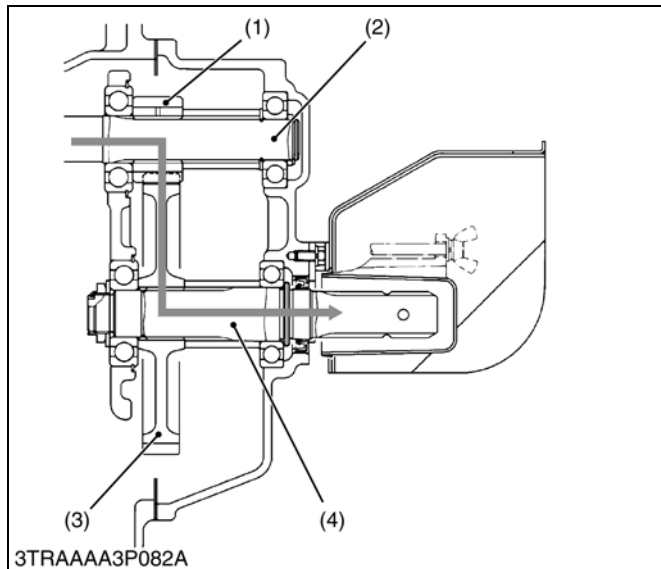
The hydraulic multiple disc clutch is used for tractor with independent PTO. This PTO is controlled by the clutch and is independent of the driving system. PTO is **“ENGAGED”** or **“DISENGAGED”** by operating the shift lever of the PTO clutch valve.

[4] REAR PTO SHAFT

There are two kinds of rear PTO shaft (fixed PTO shaft and interchangeable PTO shaft).

Moreover, in interchangeable PTO shaft, there is 6-spline type for 540 rpm and the 21-spline type for 1000 rpm.

(1) Fixed PTO Shaft Type

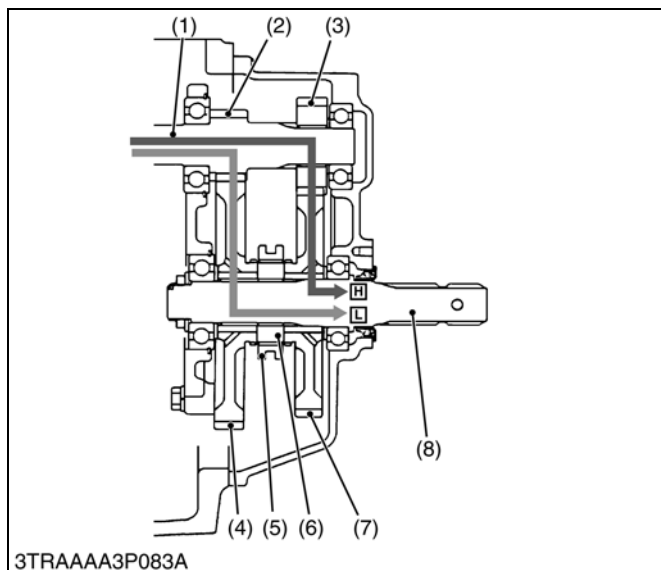


■ With Single Speed

PTO Drive Shaft (2) → Gear 1 (1) → Gear 2 (3) → PTO Shaft (4)

- | | |
|---------------------|---------------|
| (1) Gear 1 | (3) Gear 2 |
| (2) PTO Drive Shaft | (4) PTO Shaft |

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■ With Two Speeds

L : Low Position [540 min⁻¹ (rpm)]

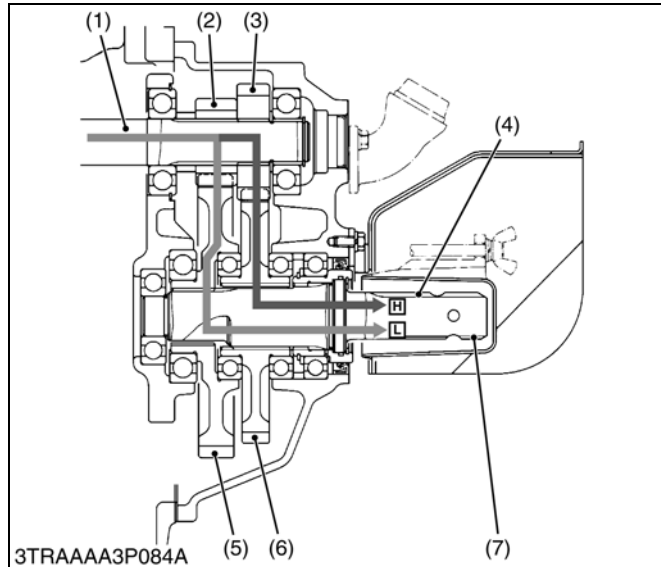
PTO Drive Shaft (1) → Gear 1 (2) → Gear 3 (4) → Shifter (5) → Coupling (6) → PTO Shaft (8)

H : High Position [1000 min⁻¹ (rpm)]

PTO Drive Shaft (1) → Gear 2 (3) → Gear 4 (7) → Shifter (5) → Coupling (6) → PTO Shaft (8)

- | | |
|---------------------|---------------|
| (1) PTO Drive Shaft | (5) Shifter |
| (2) Gear 1 | (6) Coupling |
| (3) Gear 2 | (7) Gear 4 |
| (4) Gear 3 | (8) PTO Shaft |

W10279150

(2) Interchangeable PTO Shaft Type**L : Low Position [540 min-1 (rpm)]**

PTO Drive Shaft (1) → Gear 1 (2) → Gear 3 (5) → 6-spline PTO Shaft (4)

H : High Position [1000 min-1 (rpm)]

PTO Drive Shaft (1) → Gear 2 (3) → Gear 4 (6) → 21-spline PTO Shaft (7)

(1) PTO Drive Shaft

(2) Gear 1

(3) Gear 2

(4) 6-spline PTO Shaft

(5) Gear 3

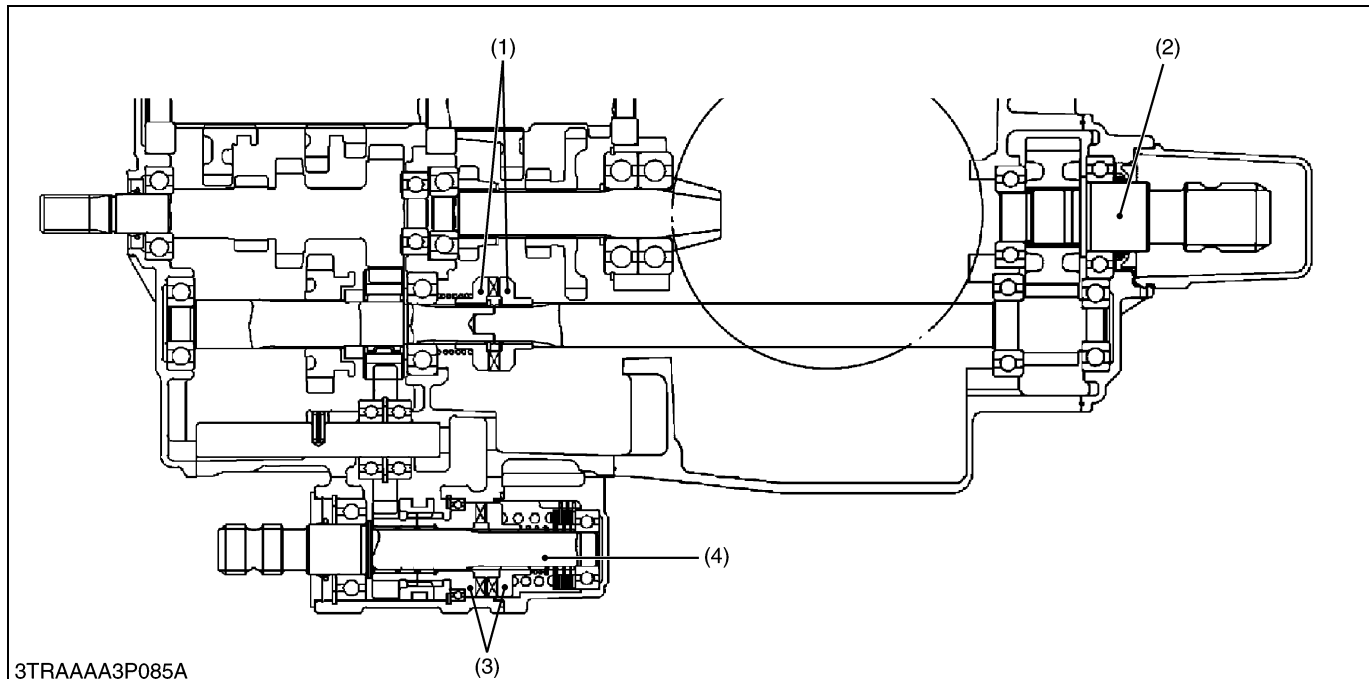
(6) Gear 4

(7) 21-spline PTO Shaft

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[5] ONE-WAY CLUTCH SYSTEM

The one-way clutch system is adapted in the PTO system of some tractors. There are two one-way clutch and they are located as shown figure below.

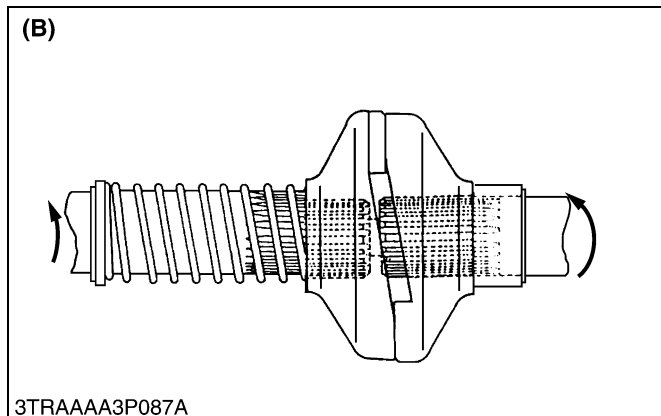
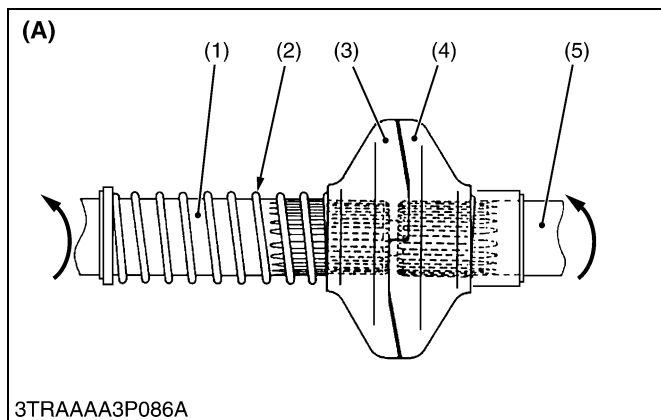


(1) One-way Clutch Cam for Rear PTO

(2) Rear PTO Shaft

(3) One-way Clutch Cam for Mid-PTO

(4) Mid-PTO Shaft



■ One-way Clutch for Rear PTO

The one-way clutch cam is also called an overrunning clutch. It is composed of a pair of clutch cams (3), (4) and a cam spring (2). One of the clutch cam is splined to the shaft (1), and the other is splined to the shaft (5).

These two clutch cam (3), (4) are engaged with each other by the force of the cam spring. As long as the shaft (1) is rotating faster than the shaft (5) these two clutch cams (3), (4) will remain engaged, and the shaft (5) is driven.

But, if the PTO shaft drives a rotary mower as an implement, for example, and the source of power is stopped by pressing the clutch pedal, or if the engine speed is lowered, the clutch cam (4) will overrun as shown in the figure. This overrunning is caused by the inertia of the mower blades. Then, engagement will not take place until the shaft (1) is running faster than the shaft (5).

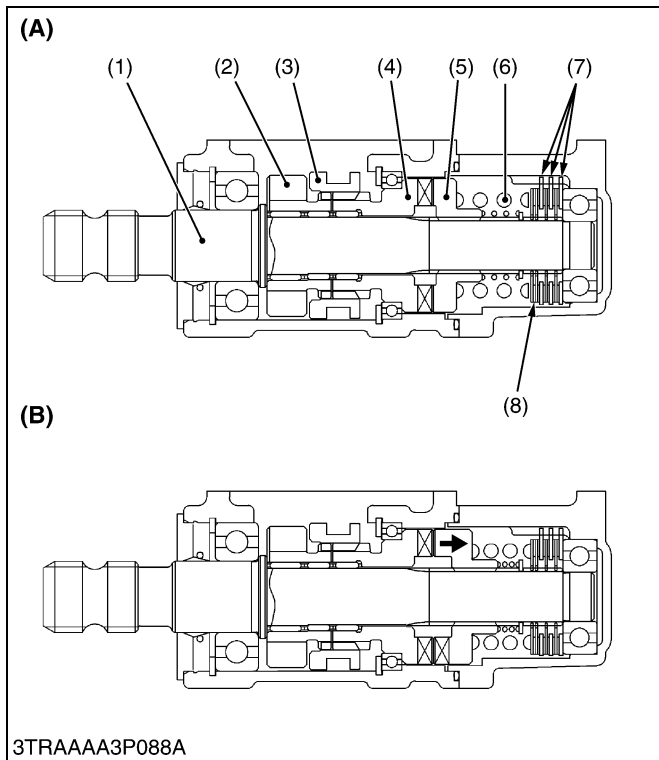
In this way, the one-way clutch cam protects the transmission and engine power train against damage, by allowing the PTO shaft and the shaft (5) to overrun if PTO shaft overspeeds.

- (1) 3rd Shaft
- (2) Clutch Cam Spring
- (3) Clutch Cam
- (4) Clutch Cam
- (5) 5th Gear Shaft

(A) Cam is engaging

(B) PTO shaft is overrunning

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■ **One-way Clutch for Mid-PTO**

It is composed of pair of clutch cams (4), (5) clutch springs, brake discs and pressure plate. When the mid-PTO shift lever is at **ON** position, one of the clutch cam (4) is connected to gear (2) by the shifter (3). The other clutch cam (5) is splined to the mid-PTO shaft (1).

This one-way clutch system also functions as same as rear PTO one-way clutch.

If the source of power is stopped by pressing the clutch pedal or disengaging the shifter (3), the clutch cam (5) will overrun and move to press the brake disc (8) by spring (6). As a result, rotation of mid-PTO shaft (1) is reduced or stopped.

- (1) Mid-PTO Shaft
- (2) Gear
- (3) Shifter
- (4) Clutch Cam
- (5) Clutch Cam
- (6) Spring
- (7) Pressure Plate
- (8) Brake Disc

- (A) Mid-PTO Engaged**
- (B) Mid-PTO Over running**

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4 REAR AXLE

MECHANISM

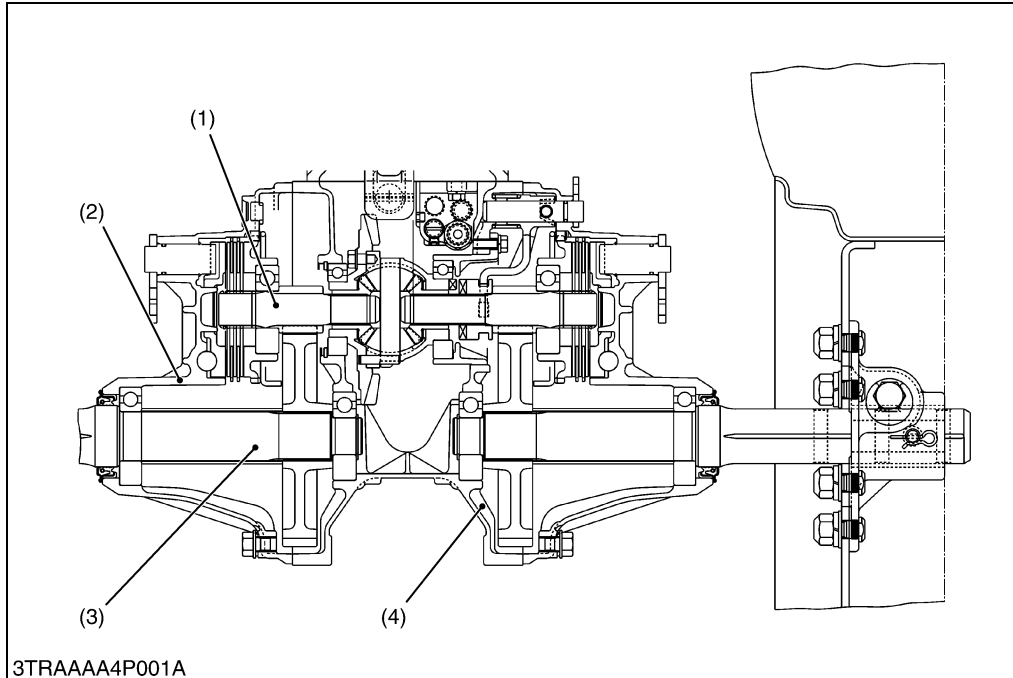
CONTENTS

1. STRUCTURE	4-M1
[1] HEXAGONAL SHAFT TYPE.....	4-M1
[2] FLANGE TYPE	4-M1
[3] FLANGE TYPE WITH DROPPED AXLE CASE	4-M2

1. STRUCTURE

The rear axles are semi-floating type with the ball bearing between the rear axle and rear axle case, which support the rear wheel load as well as transmitting power to the rear wheel. They withstand all the forces caused by tire rotation and side skidding.

[1] HEXAGONAL SHAFT TYPE

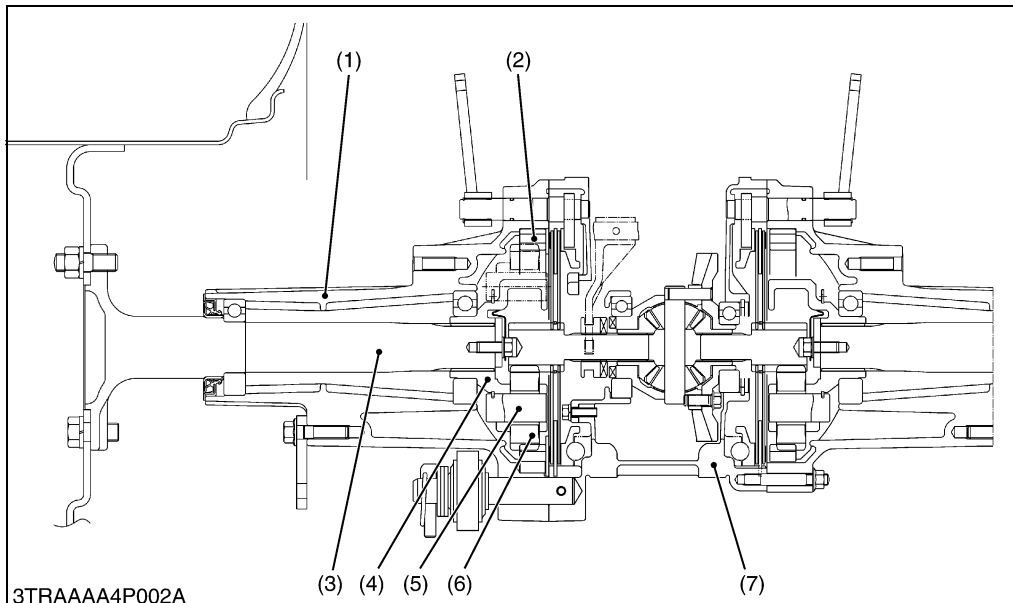


- (1) Differential Gear Shaft
- (2) Rear Axle Case
- (3) Rear Axle
- (4) Transmission Case

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As for hexagonal shaft type, it is adopted for a small tractor, and the tread adjustment is easy.

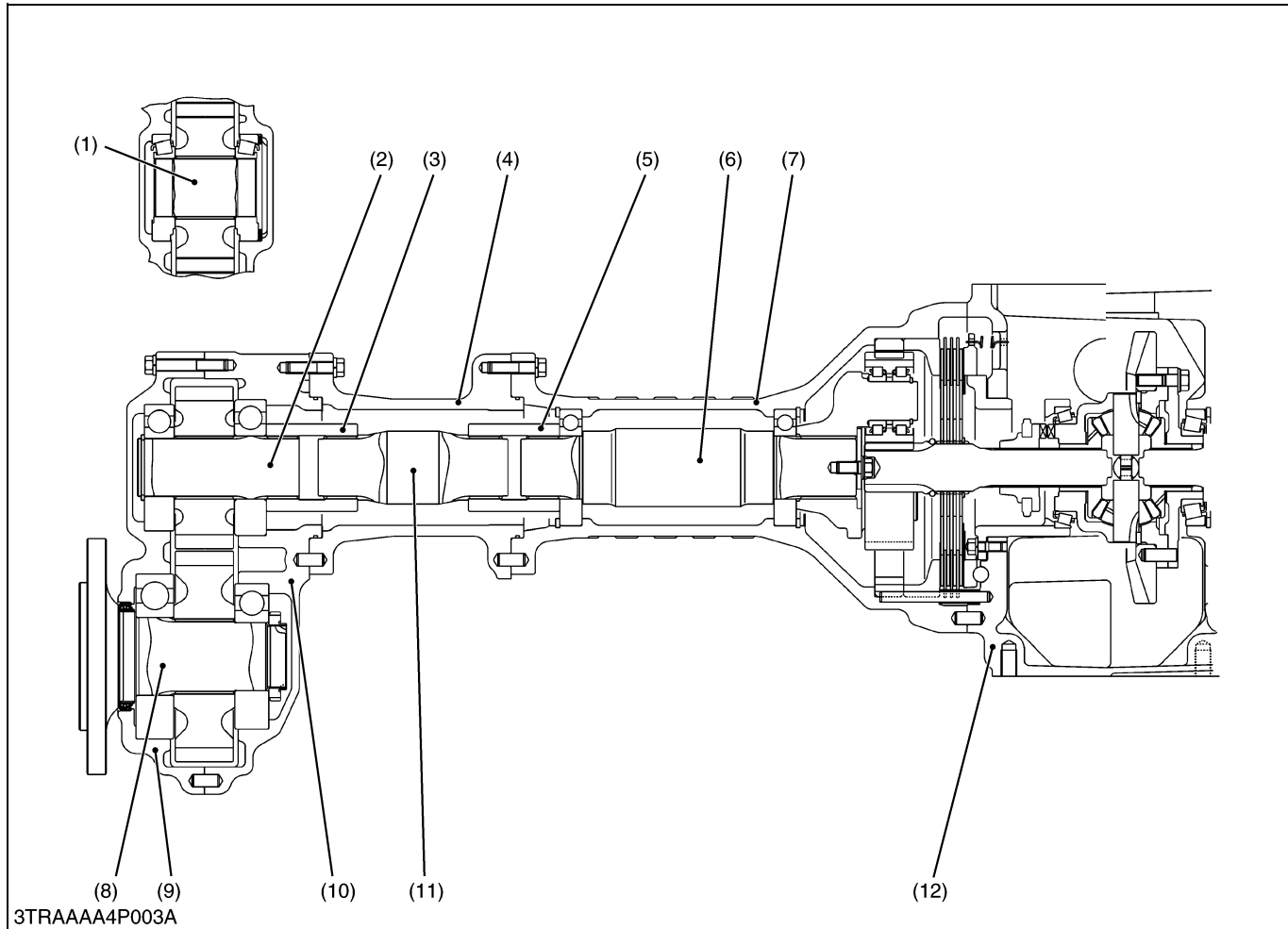
[2] FLANGE TYPE



- (1) Rear Axle Case
- (2) Internal Gear
- (3) Rear Axle Shaft
- (4) Planetary Carrier
- (5) Planetary Gear Pin
- (6) Planetary Gear
- (7) Transmission Case

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The flange type rear axle is generally adopted for the tractor.

[3] FLANGE TYPE WITH DROPPED AXLE CASE

- | | | | |
|--------------|--------------|-------------------------|--------------------------|
| (1) Shaft 1 | (4) Spacer | (7) Rear Axle Case | (10) Dropped Axle Case 2 |
| (2) Shaft 2 | (5) Coupling | (8) Rear Axle | (11) Shaft 4 |
| (3) Coupling | (6) Shaft 3 | (9) Dropped Axle Case 1 | (12) Transmission Case |

As for this type, spacer is adopted to extend the overall width, and the dropped axle case is adopted to raise the minimum ground clearance.

5 BRAKES

MECHANISM

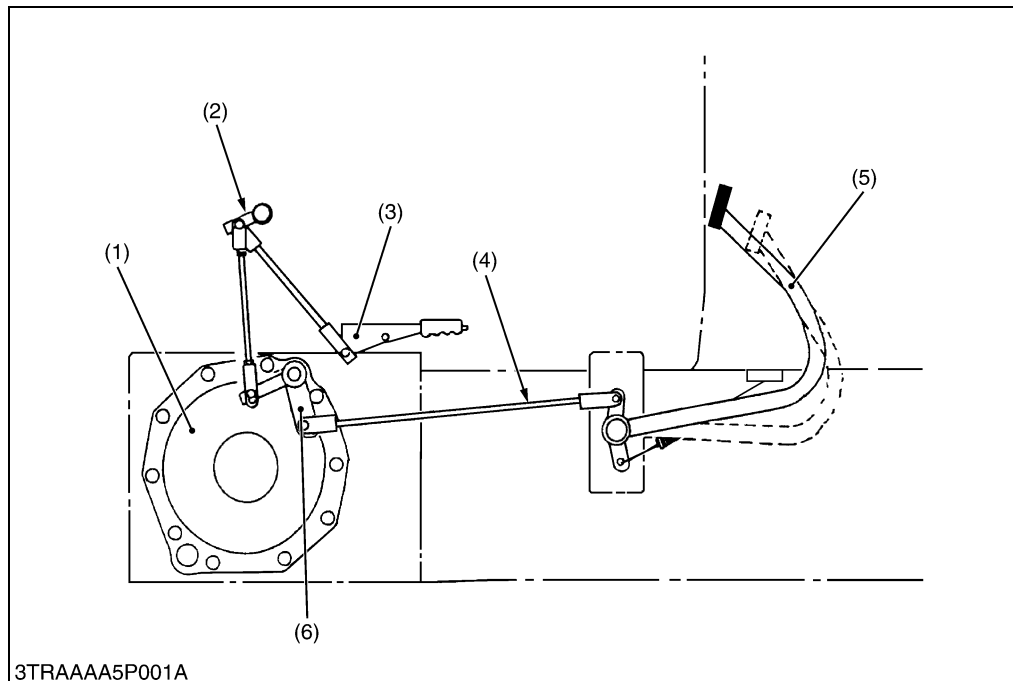
CONTENTS

1. TRAVELLING (FOOT) BRAKE	5-M1
[1] MECHANICAL TYPE	5-M1
(1) Linkage	5-M1
(2) Operation	5-M2
[2] HYDRAULIC TYPE	5-M3
(1) General Outline	5-M3
(2) Operation	5-M4
(3) Brake Body	5-M5
(4) Master Cylinder	5-M6
(5) Equalizer	5-M7
(6) Brake Oil	5-M7
2. PARKING BRAKE	5-M8
3. HYDRAULIC TRAILER BRAKE	5-M10
[1] HYDRAULIC TRAILER BRAKE VALVE (Code No. 33963-69113)....	5-M11
(1) Structure	5-M11
(2) Operation	5-M12

1. TRAVELLING (FOOT) BRAKE

[1] MECHANICAL TYPE

(1) Linkage

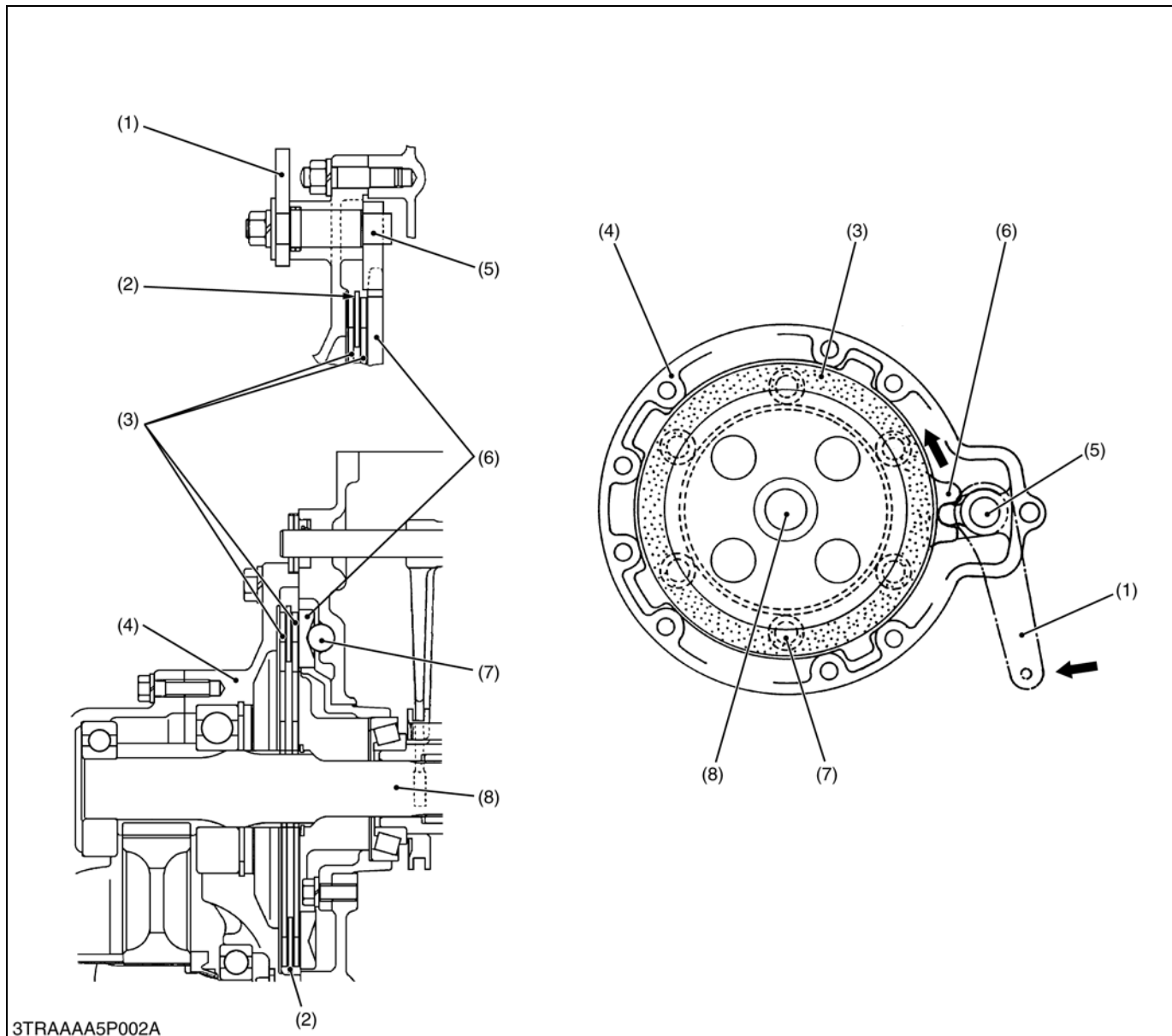


- (1) Rear Axle Case
- (2) Parking Brake Rod Linkage
- (3) Parking Brake Lever
- (4) Brake Rod
- (5) Brake Pedal
- (6) Brake Cam Lever

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Independent mechanical wet disc brakes are used for the right and left travelling brakes. They are operated by the brake pedals through the mechanical linkages and provide stable braking and require little adjustment.

(2) Operation

(1) Brake Cam Lever
(2) Steel Plate

(3) Brake Disc
(4) Brake Case

(5) Brake Cam
(6) Cam Plate

(7) Steel Ball
(8) Differential Gear Shaft

The brake body is incorporated in the brake case (4) filled with transmission oil and is designed to brake when the brake disc (3) splined with the differential gear shaft (8) is pressed against the cam plate (6) by means of the cam mechanism incorporating steel balls (7).

For greater braking force, two brake discs are provided at the right and left sides respectively, and the steel plate (2) fixed to the brake case is arranged between the brake discs.

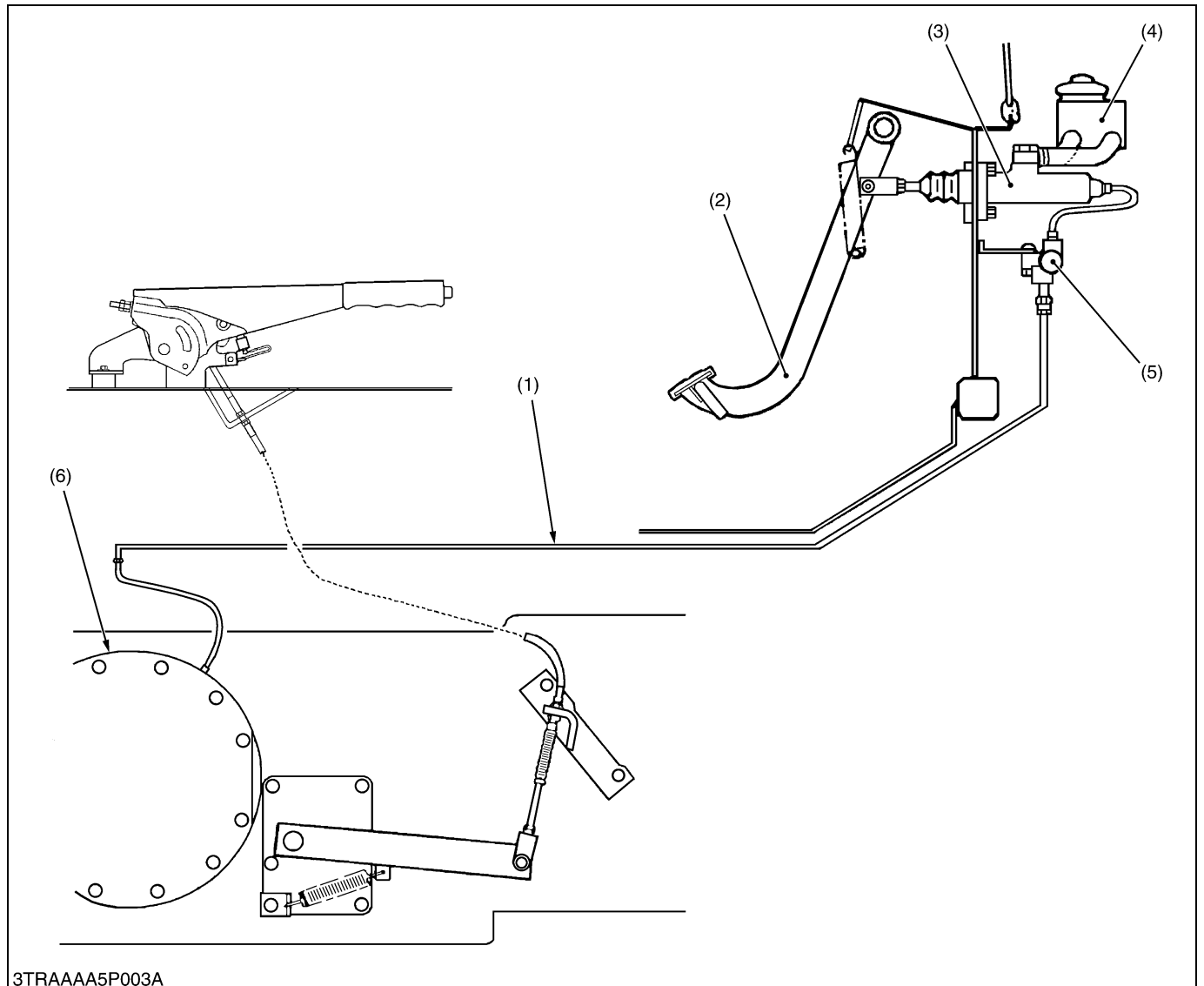
■ During Braking

When the brake pedal is pressed, the linkage causes the brake cam lever (1) and brake cam (5) to turn into the direction of arrow shown in the above figure.

Therefore, the cam plate (6) also moves the direction of arrow. At this time, since the cam plate (6) rides on the steel balls (7) set in the grooves of the transmission case to press the brake disc (3), the differential gear shaft (8) is braked by the frictional force generated by the cam plate (6) and brake disc (3).

[2] HYDRAULIC TYPE

(1) General Outline



(1) Brake Pipe
(2) Brake Pedal

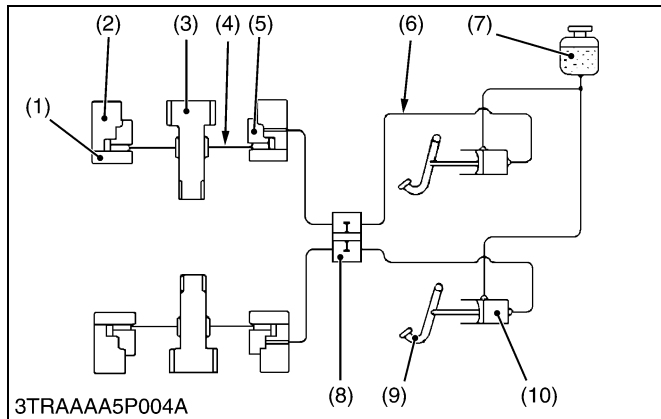
(3) Master Cylinder
(4) Brake Oil Reservoir

(5) Equalizer

(6) Brake Case

The hydraulic wet disc brake consists of the master cylinder (3), equalizer (5), brake pipe (1), brake oil reservoir (4) and others.

This type provides high and stable braking effect and requires almost no adjustment.

(2) Operation**■ Brake Oil Flow**

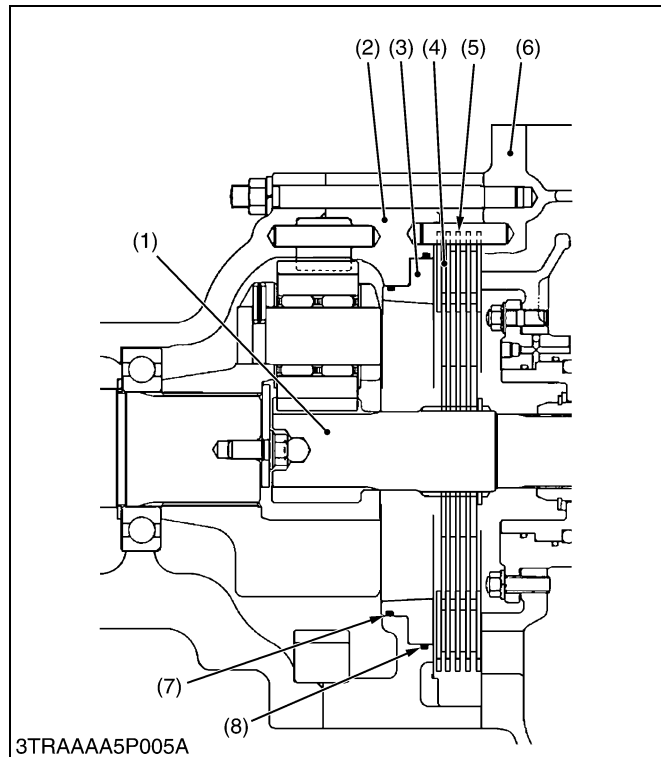
When the brake pedal is pressed, the piston in the master cylinder moves and the brake oil pressure increases.

This pressure is applied to the brake body through the equalizer (8) to force out the brake piston (5). As a result, the brake disc (4) rotating with the brake shaft (3) is pressed against the transmission case (1), causing braking.

- | | |
|-----------------------|-------------------------|
| (1) Transmission Case | (6) Brake Pipe |
| (2) Brake Case | (7) Brake Oil Reservoir |
| (3) Brake Shaft | (8) Equalizer |
| (4) Brake Disc | (9) Brake Pedal |
| (5) Brake Piston | (10) Master Cylinder |

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(3) Brake Body

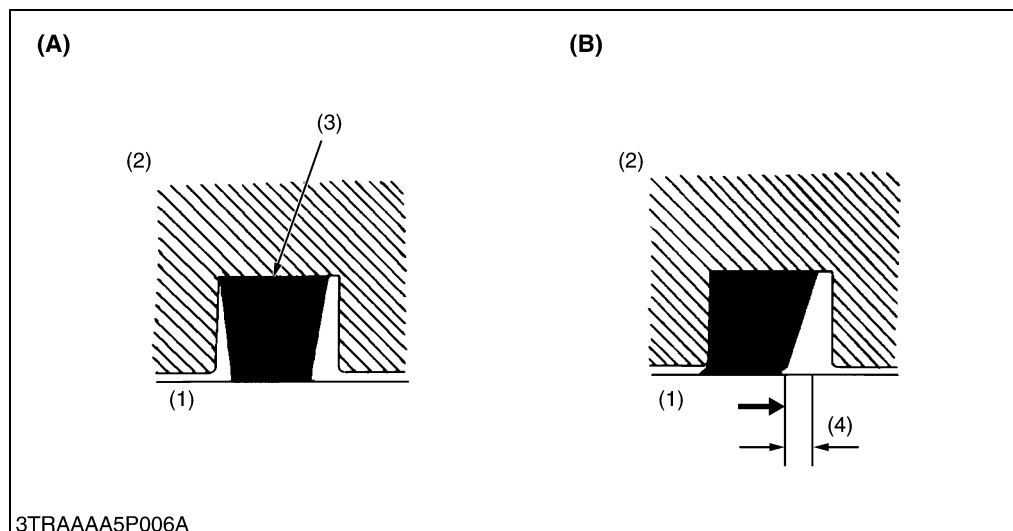


Basically, the brake body is similar to that of the mechanical wet disc brake. It is designed to brake when the brake disc (4) rotating together with the brake shaft (1) is pressed.

The brake case (2) of the hydraulic brake serves as a cylinder. When brake oil pressure increases, the brake piston (3) is forced out and presses the brake discs against the transmission case (6), thereby causing braking.

- | | |
|------------------|-----------------------|
| (1) Brake Shaft | (5) Plate |
| (2) Brake Case | (6) Transmission Case |
| (3) Brake Piston | (7) Brake Seal 1 |
| (4) Brake Disc | (8) Brake Seal 2 |

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- | |
|--------------------------|
| (1) Brake Case |
| (2) Brake Piston |
| (3) Brake Seal 1 |
| (4) Piston Return Stroke |

- (A) When Brake Pedal is Released
 (B) When Brake Pedal is Pressed

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■ Automatic Brake Adjustment

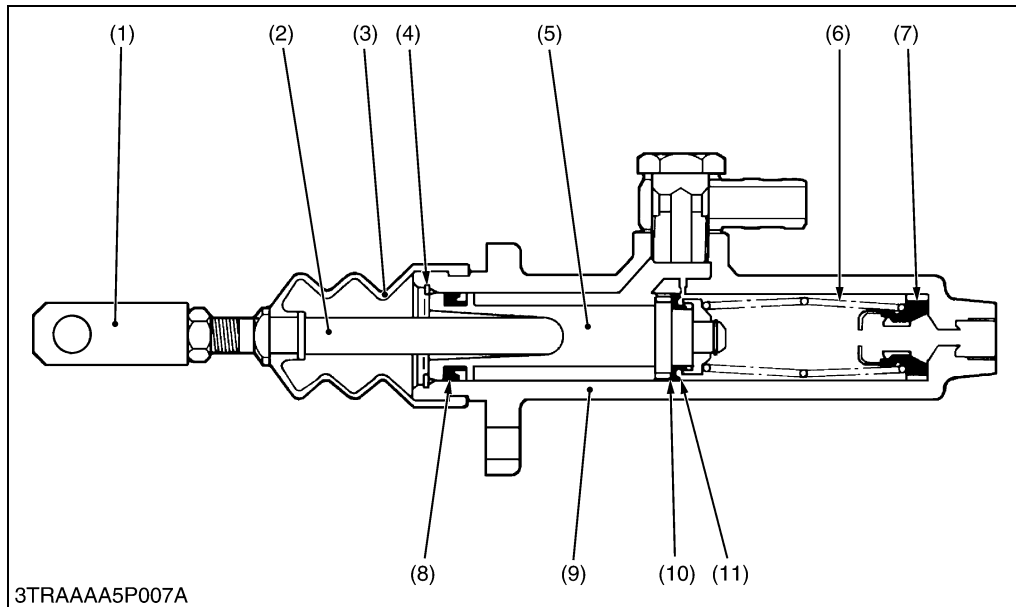
With a mechanical brake, the brake returns to its original position by spring tension and cam mechanism when the brake pedal is released.

With a hydraulic brake, brake seal 1 (3) serve to return the brake piston (2) to the original position (no braking force).

When the brake pedal is pressed, pressure in the brake case rises, and the brake piston moves in the direction of arrow to press the brake discs against the transmission case. At this time, brake seals 1, fitted to the brake case (1), are subjected to elastic deformation as shown in the figure above.

When the brake pedal is released, pressure in the brake case reduces, due to which the brake seals tend to restore their original form. This force returns the brake piston as much as the brake seals have been deformed, as a result of which it returns to its origin position. Accordingly, a clearance is formed between the brake disc and brake piston to prevent the brake dragging.

Worn brake discs require longer brake piston movement. When the brake piston movement exceeds the elastic limit of brake seal, sliding occurs between the seals and the brake piston, with the brake seals kept deformed, due to which the clearance is automatically kept constant.

(4) Master Cylinder

- (1) Turnbuckle
- (2) Push Rod
- (3) Boot
- (4) Internal Snap Ring
- (5) Piston
- (6) Return Spring
- (7) Outlet Valve
- (8) Primary Cylinder Cup
- (9) Master Cylinder Body
- (10) Spacer (Shim)
- (11) Secondary Cylinder Cup

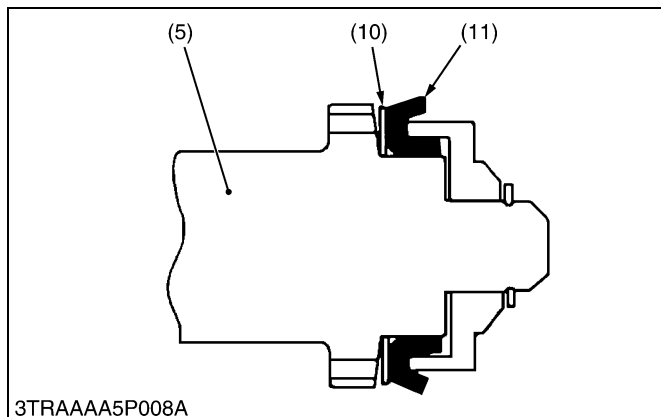
W10136720

The structure of the master cylinder is shown above. One end, the push rod (2) is inserted in the hole of the piston (5), and the other end is connected to the brake pedal via the turnbuckle (1).

At both ends of the piston, there are the rubber cylinder cups (8), (11) to obtain cylinder oil tightness and to prevent brake oil leakage.

Since mineral oil is used for the brake oil (specified brand), the cylinder cups are made of nitrile rubber (NBR) which are compatible to mineral oils.

Generally, brake oils for automobiles are vegetable oils based on glycol or castor oil, and accordingly, cylinder cups for automobiles are made of styrol rubber, etc.. Therefore, use of brake oil or cylinder cups for automobiles results in malfunction of the brake due to deterioration of rubber.

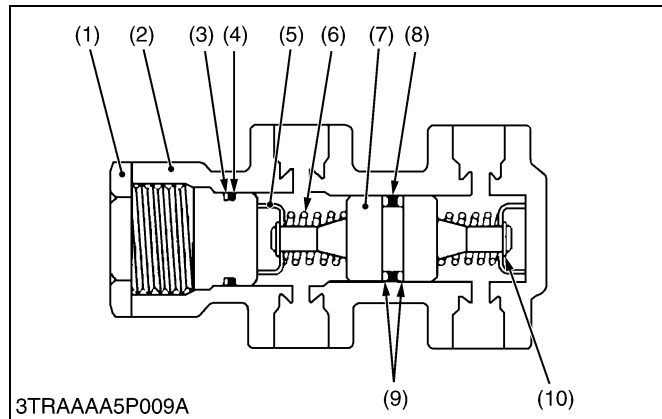


The piston (5) is made of aluminum, and the master-cylinder body is made of cast iron. The piston is further alumite-treated (hard anodizing) for greater wear resistance and corrosion resistance.

The piston is tapered to which the spacer (10) is fitted to provide the spacer with spring effect. The spring effect of the spacer ensures the brake oil passage when the brake pedal is released, and also improves air bleeding.

W10139290

(5) Equalizer



The equalizer is provided to equalize the braking force of the left and right brakes and to prevent uneven braking when the brake pedal is pressed with the left and right brake pedals connected with each other.

The equalizer equalizes the pressure transmitted from the left and right master cylinders so that even pressure is transmitted to the left and right brake cases.

(Reference)

Equalizer specification is as follows.

- Piston stroke : approx. 4 mm (0.16 in.)
- Oil displacement : approx. 1.2 to 1.3 cm³
(1.3 to 1.4 U.S.qts.)
- Difference in brake pedal depressing strokes :
Less than 5 mm (0.20 in.)

- | | |
|--------------------|------------------|
| (1) Plug | (6) Spring |
| (2) Equalizer Body | (7) Piston |
| (3) Backup Ring | (8) O-ring |
| (4) O-ring | (9) Backup Ring |
| (5) Retainer | (10) E Snap Ring |

W10139750

(6) Brake Oil

The brake oil must be the specified oil.

Generally, brake oils for automobile hydraulic brakes are vegetable oil based on glycol or castor oil. Glycol is apt to absorb moisture and its boiling point abruptly drops due to moisture entry.

Mineral oils are, therefore, selected for brakes on the tractors, with due considerations to working conditions.

The brake oil must transmit the brake pedal pressing force securely to the brake body, and it must be handled with care.

Kubota Super UDT oil also is available.

■ Precautions for Handling Brake Oil

1. Do not mix the brake oils of different brands

If brake oils of different brands are mixed, chemical reaction may occur, causing boiling point to drop remarkably. Boiling point may also drop even when chemical reaction does not occur, which results in possible vapor lock*.

Therefore, when disassembling, use the specified brake oil for cleaning.

* Vapor Lock

When brake oil temperature rises in the closed hydraulic brake system and the vapor pressure of the oil equals the internal pressure of the system, brake oil begins to gasify. In this state, the brake oil pressure does not increase even the pedal is pressed, and braking effect can not be achieved. This phenomenon is called vapor lock.

2. Prevent entry of moisture

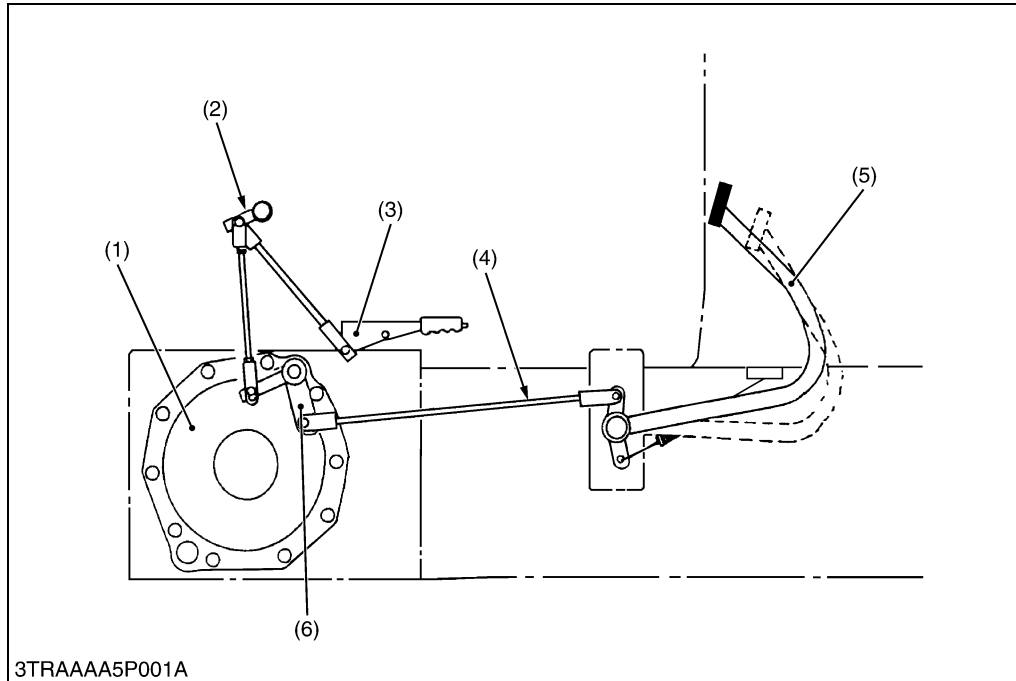
Entry of moisture results in lower boiling point.

3. Do not mix with brake fluid for automobiles

The cylinder cups and brake seals used are made of nitrile rubber (NBR) that resists mineral oils. Automobile brake fluid, which is vegetable oil, can deteriorate cylinder cup and brake seal rubber when mixed, and the brake may malfunction.

4. Be sure to cover brake oil containers to prevent dust, dirt and water from entering.

2. PARKING BRAKE



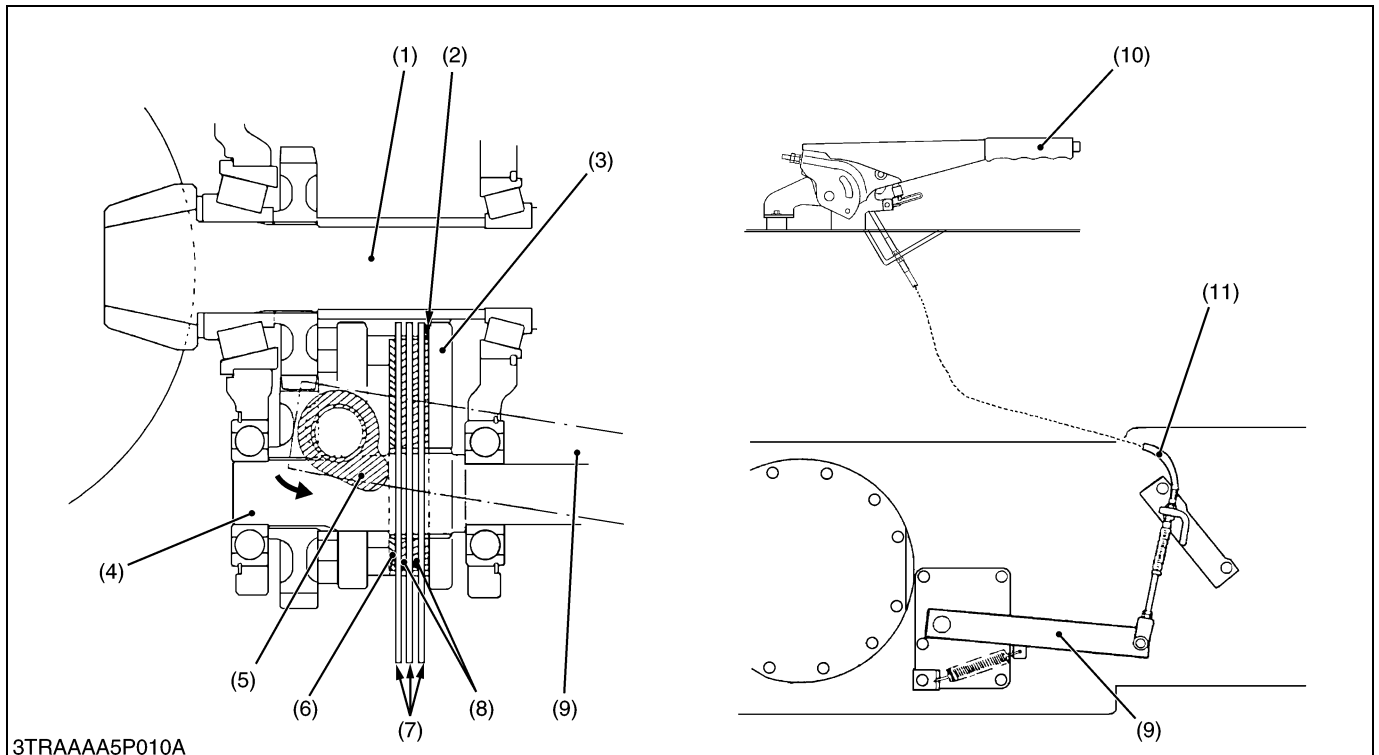
- (1) Rear Axle Case
- (2) Parking Brake Rod Linkage
- (3) Parking Brake Lever
- (4) Brake Rod
- (5) Brake Pedal
- (6) Brake Cam Lever

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The parking brake is mechanical type which is connected to the brake cam lever by the parking brake rod linkages. This parking brake is a mechanism that same brake discs as travelling brake is operated.

■ Independent Type



- | | | | |
|------------------------|------------------------------|-----------------------------|--------------------------|
| (1) Bevel Pinion Shaft | (4) Transmitting Shaft, Rear | (7) Plate | (10) Parking Brake Lever |
| (2) Brake Pad 1 | (5) Parking Brake Cam | (8) Brake Pad 2 | (11) Parking Brake Wire |
| (3) Parking Brake Case | (6) Brake Plate | (9) Parking Brake Cam Shaft | |

Parking brakes are a wet disc brake, which is independent of the travelling brakes and provided on the rear transmitting shaft (4). When the parking brake lever is pulled, the parking brake cam (5) is moved in the direction of arrow through the parking brake wire (11).

As the parking brake cam moves, the plates (7) (steel plate) are pressed by the brake pads (2), (8), causing frictional force. This frictional force provides braking effect.

3. HYDRAULIC TRAILER BRAKE

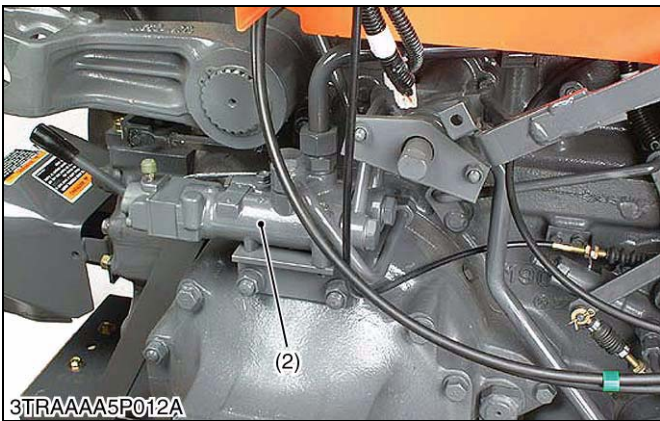


The trailer brake is worked using the tractor's brake pedals. It uses the pressure from the main hydraulic circuit.

The braking force while towing is proportional to the force applied on the tractor pedals. It is most useful when towing very heavy loads, this device considerably increases braking efficiency and safety.

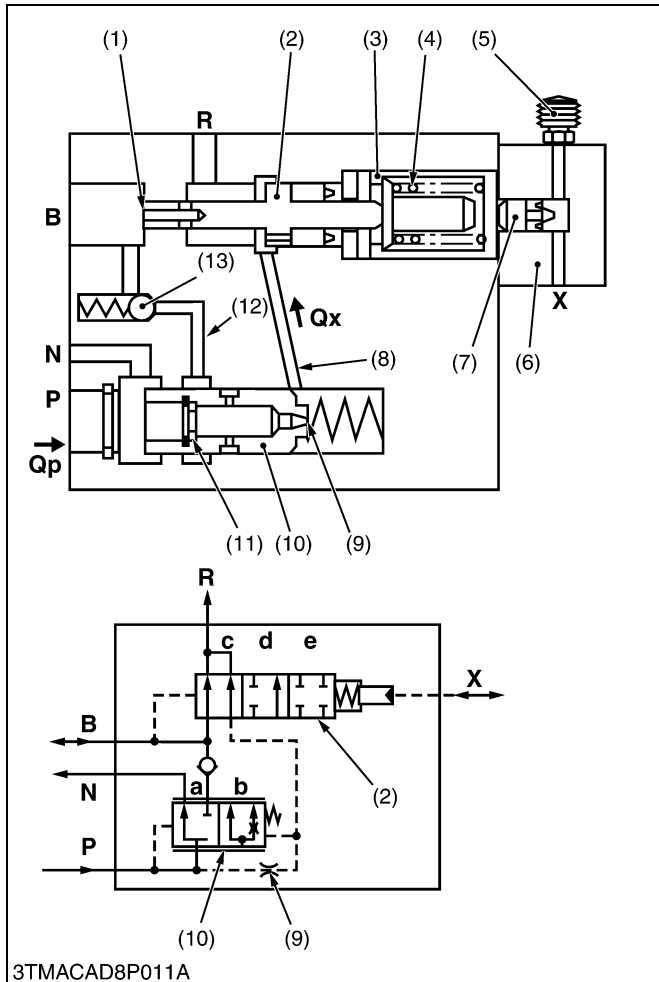
- (1) Hydraulic Port for Trailer Brake (2) Trailer Brake Valve

W1014023



[1] HYDRAULIC TRAILER BRAKE VALVE (Code No. 33963-69113)

(1) Structure



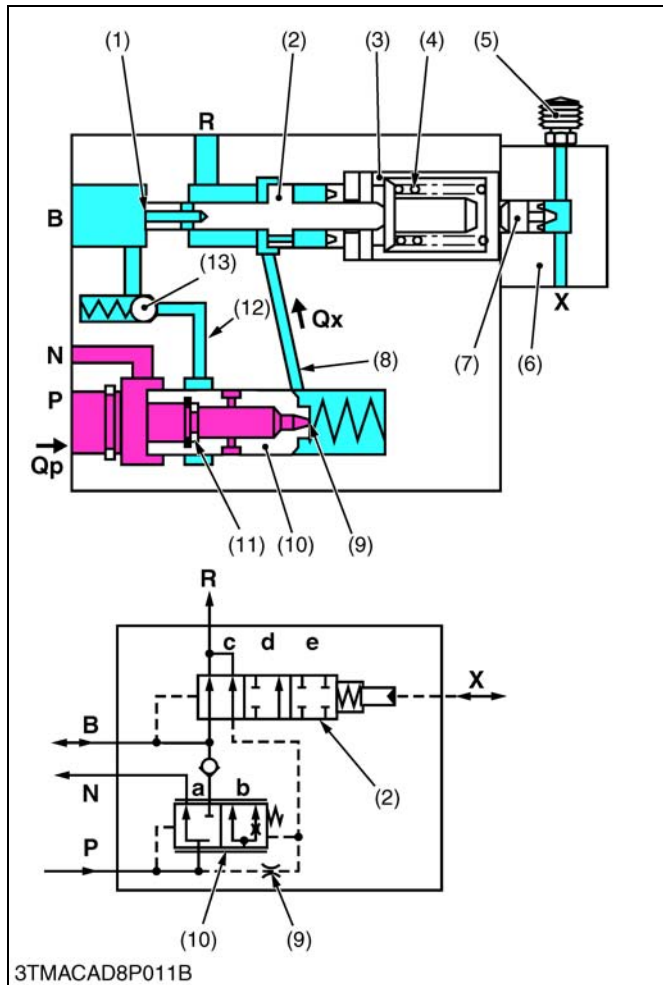
■ Main Elements

- Flow control valve (10) with throttle (9) and restrictor (11) : for controlling the delivery flow Q_p and for regulating the fluid flow for the trailer brake.
- Control spool (2) with piston surface (1) : for controlling the flow control valve (10) and regulating the trailer braking pressure.
- Check valve (13) : prevents oil from flowing back from the brake line **B** to port **N**.
- Pressure relief element (3) with pre-loaded spring (4) : for limiting the trailer braking pressure.
- Control head (6) with piston (7) and bleed valve (5) : for operating the trailer brake valve through the tractor brake line.

- | | |
|-----------------------------|---|
| (1) Piston Surface | P : Port for 3P Hydraulic Pump |
| (2) Control Spool | N : Port for 3P Control Valve |
| (3) Pressure Relief Element | B : Port for Trailer Brake
(Connected to Coupler) |
| (4) Spring | R : Port for Reservoir
(Transmission Case) |
| (5) Bleed Valve | X : Port for Tractor Service
Brake (Connected to Pilot
Pipe) |
| (6) Control Head | Q_p : Delivery Flow |
| (7) Piston | Q_x : Control Flow |
| (8) Bore | |
| (9) Throttle | |
| (10) Flow Control Valve | |
| (11) Restrictor | |
| (12) Bore | |
| (13) Check Valve | |

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(2) Operation



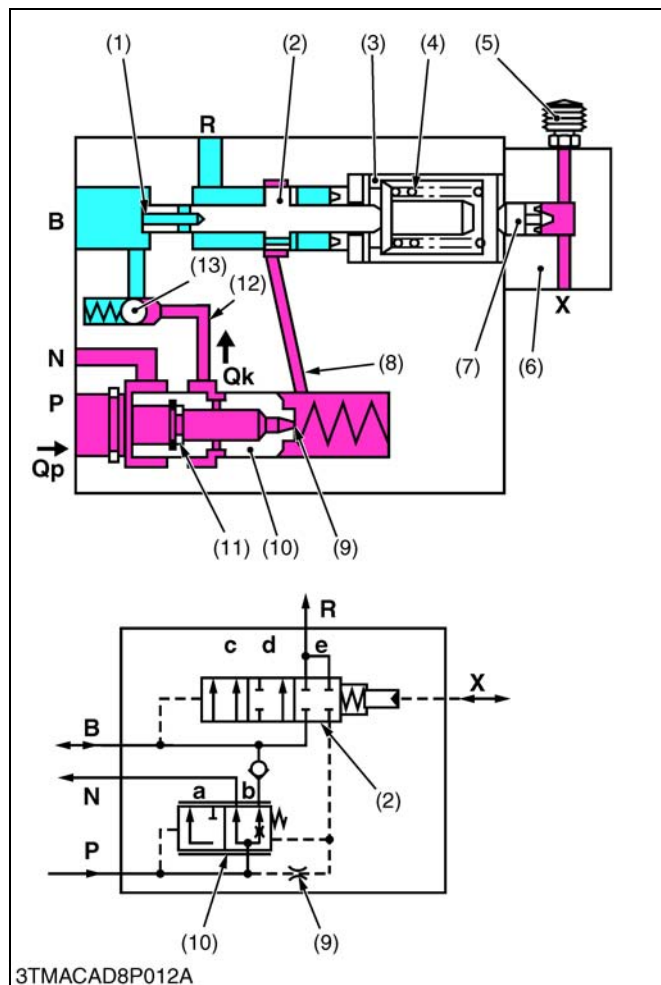
■ Tractor Brake Released

The tractor service brake line **X** is pressureless. The brake line **B** is relieved to the reservoir through the control spool (2) and port **R**.

The delivery flow **Q_p** of the pump flows from port **P** past flow control valve (10), the flow **Q_p - Q_x** continues through port **N** to the tractor hydraulics.

A small control oil flow **Q_x** of approx. 0.6 L/min. passes from port **P** to the reservoir through restrictor (11), throttle (9), bore (8), control spool (2), and port **R**. Thus the pressure drop at throttle (9) holds the flow control valve (10) in the open flow position **a**. The flow control valve (10) has no regulating function.

- | | |
|-----------------------------|--|
| (1) Piston Surface | P : Port for 3P Hydraulic Pump |
| (2) Control Spool | N : Port for 3P Control Valve |
| (3) Pressure Relief Element | B : Port for Trailer Brake |
| (4) Spring | R : Port for Reservoir
(Transmission Case) |
| (5) Bleed Valve | X : Port for Tractor Service
Brake |
| (6) Control Head | Q_p : Delivery Flow |
| (7) Piston | Q_x : Control Flow |
| (8) Bore | |
| (9) Throttle | |
| (10) Flow Control Valve | |
| (11) Restrictor | |
| (12) Bore | |
| (13) Check Valve | |



■ Partial Braking of Trailer Brake - Initiation

Piston (7) of control head (6) is pressurized through control line **X** from the tractor service brake. Control spool (2) is thus shifted to the left and separates from the reservoir first brake line **B** and then bore (8). The control spool (2) is shifted from position **c** to position **e**. The control oil flow is blocked and hence flow control valve (10) is switched into the regulating function in position **b**. A constant flow **Q_k** (approx. 30 L/min.) passes from port **P** to the trailer brake through restrictor (11), bore (12), check valve (13) and port **B**.

The restrictor (11) is designed for the constant flow **Q_k**. A residual flow **Q_p-Q_k** bypasses the flow control valve (10), and then passes to the tractor hydraulic through port **N**.

The pressure in the trailer brake line **B** is built up and it acts on surface (1) of control spool (2) in opposition to the pressure on piston (7).

- | | |
|-----------------------------|---|
| (1) Piston Surface | P : Port for 3P Hydraulic Pump |
| (2) Control Spool | N : Port for 3P Control Valve |
| (3) Pressure Relief Element | B : Port for Trailer Brake |
| (4) Spring | R : Port for Reservoir (Transmission Case) |
| (5) Bleed Valve | X : Port for Tractor Service Brake |
| (6) Control Head | |
| (7) Piston | Q_p : Delivery Flow |
| (8) Bore | Q_x : Control Flow |
| (9) Throttle | |
| (10) Flow Control Valve | |
| (11) Restrictor | |
| (12) Bore | |
| (13) Check Valve | |

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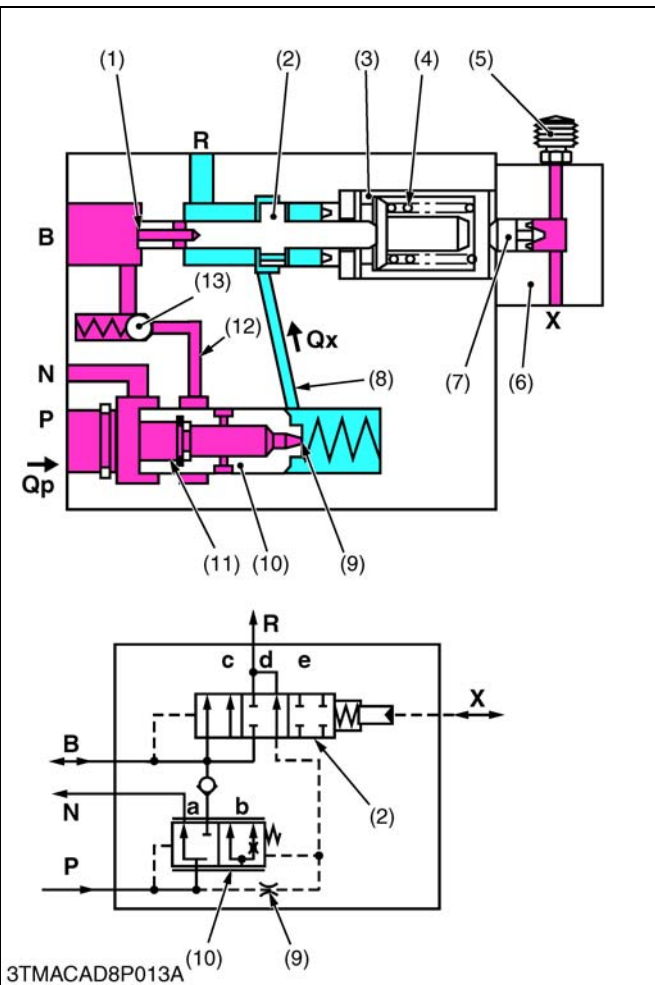
■ Partial Braking of Trailer Brake

The trailer braking pressure P_b (acting on surface (1) of control spool (2)) is in equilibrium with the tractor braking pressure P_x (acting on piston (7)).

The brake line **B** remains separated from the reservoir and the oil in the trailer brake is thus enclosed.

Control spool (2) is shifted to the right after the pressures have equalized and opens bore (8) to the reservoir through port **R**. Control spool (2) is in position **d**. Flow control valve (10) is thus switched into position **a** and has no regulating function.

As in the case of the released trailer brake, the delivery flow Q_p from the pump passes through port **N** and flows as $Q_p - Q_x$ to the tractor hydraulic system. A control flow Q_x passes to the reservoir through control spool (2).

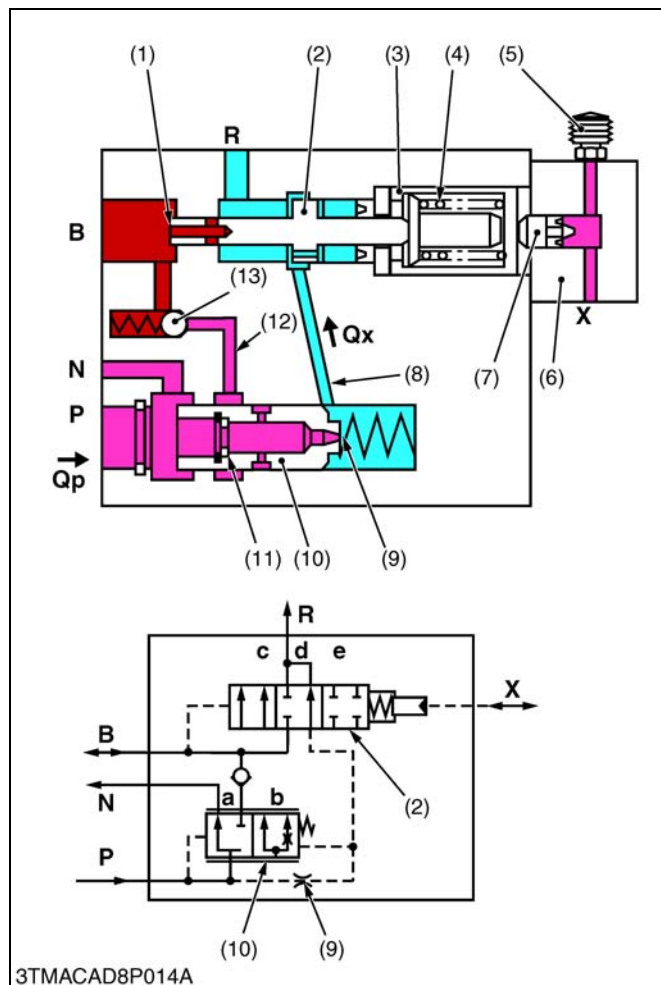


3TMACAD8P013A

- (1) Piston Surface
- (2) Control Spool
- (3) Pressure Relief Element
- (4) Spring
- (5) Bleed Valve
- (6) Control Head
- (7) Piston
- (8) Bore
- (9) Throttle
- (10) Flow Control Valve
- (11) Restrictor
- (12) Bore
- (13) Check Valve

- P** : Port for 3P Hydraulic Pump
- N** : Port for 3P Control Valve
- B** : Port for Trailer Brake
- R** : Port for Reservoir (Transmission Case)
- X** : Port for Tractor Service Brake
- Q_p : Delivery Flow
- Q_x : Control Flow

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■ **Maximum Braking of Trailer Brake - Braking Pressure Limited**

Flow control valve (10) and control spool (2) have the same spool positions (**a** and **d**) as in the case of partial braking.

The fluid flows **Qp** and **Qx** pass as with partial braking.

The maximum permissible trailer braking pressure **Pb** (e.g. 150 bar) has been reached. An even further increase of the trailer braking pressure is prevented, even if the tractor braking pressure rises further. The pressure relief element (3) is now shifted to the left. The springs (4), which are pre-loaded to the maximum permissible trailer braking pressure **Pb**, are compressed.

If the trailer braking pressure **Pb** also rises, e.g. owing to external factor, control spool (2) momentarily opens brake line **B** to the reservoir and avoids further increasing of the braking pressure.

In all control positions of the trailer brake valve, the tractor hydraulics can be used and pressurized as desired through port **N**. This does not have any important effect on the trailer brake. The trailer brake has precedence over the tractor hydraulics. The maximum pressure of the tractor hydraulics may be higher than the maximum trailer braking pressure

- | | |
|-----------------------------|---|
| (1) Piston Surface | P : Port for 3P Hydraulic Pump |
| (2) Control Spool | N : Port for 3P Control Valve |
| (3) Pressure Relief Element | B : Port for Trailer Brake |
| (4) Spring | R : Port for Reservoir (Transmission Case) |
| (5) Bleed Valve | X : Port for Tractor Service Brake |
| (6) Control Head | Qp : Delivery Flow |
| (7) Piston | Qx : Control Flow |
| (8) Bore | |
| (9) Throttle | |
| (10) Flow Control Valve | |
| (11) Restrictor | |
| (12) Bore | |
| (13) Check Valve | |

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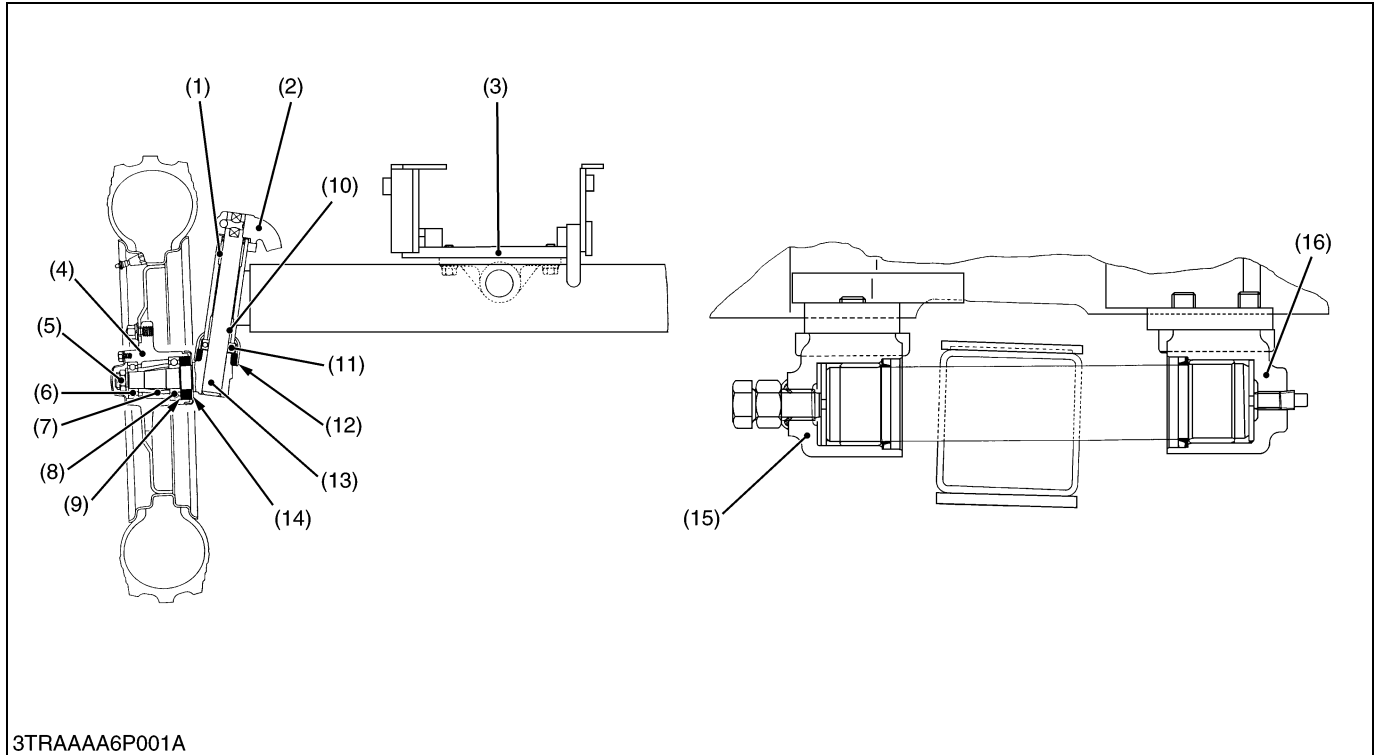
6 FRONT AXLE

MECHANISM

CONTENTS

1. TWO WHEEL DRIVE	6-M1
2. FOUR WHEEL DRIVE (STANDARD)	6-M2
3. FOUR WHEEL DRIVE (WITH BI-SPEED TURN SYSTEM)	6-M3
[1] FRONT AXLE TYPE	6-M3
(1) Structure	6-M3
(2) Power Train	6-M4
(3) Bi-speed Cam Operation	6-M5
[2] TRANSMISSION TYPE (TYPE 1)	6-M6
(1) Power Train	6-M6
(2) Turning Angle Inspection Switch	6-M7
(3) 4WD / Bi-Speed Valve (Code No. YW273-00100)	6-M8
[3] TRANSMISSION TYPE (TYPE 2)	6-M9
(1) Power Train	6-M9
(2) Bi-speed Valve (Code No. YW255-00102)	6-M10

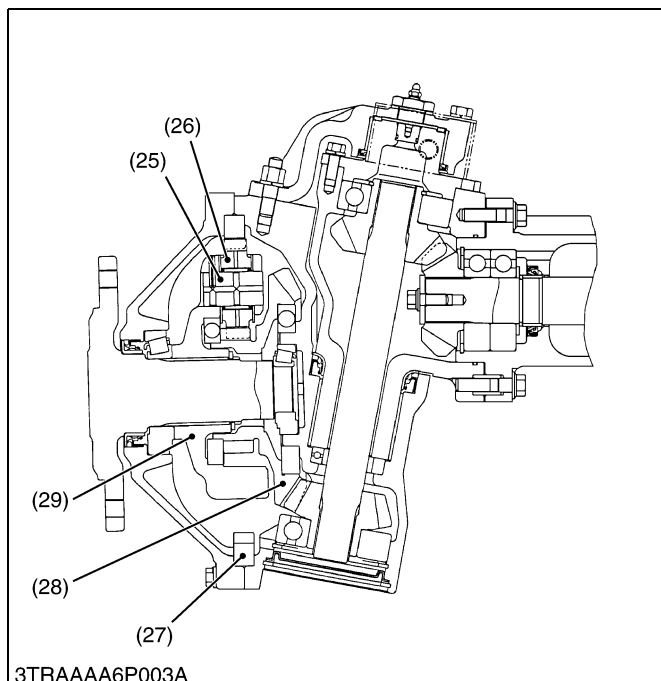
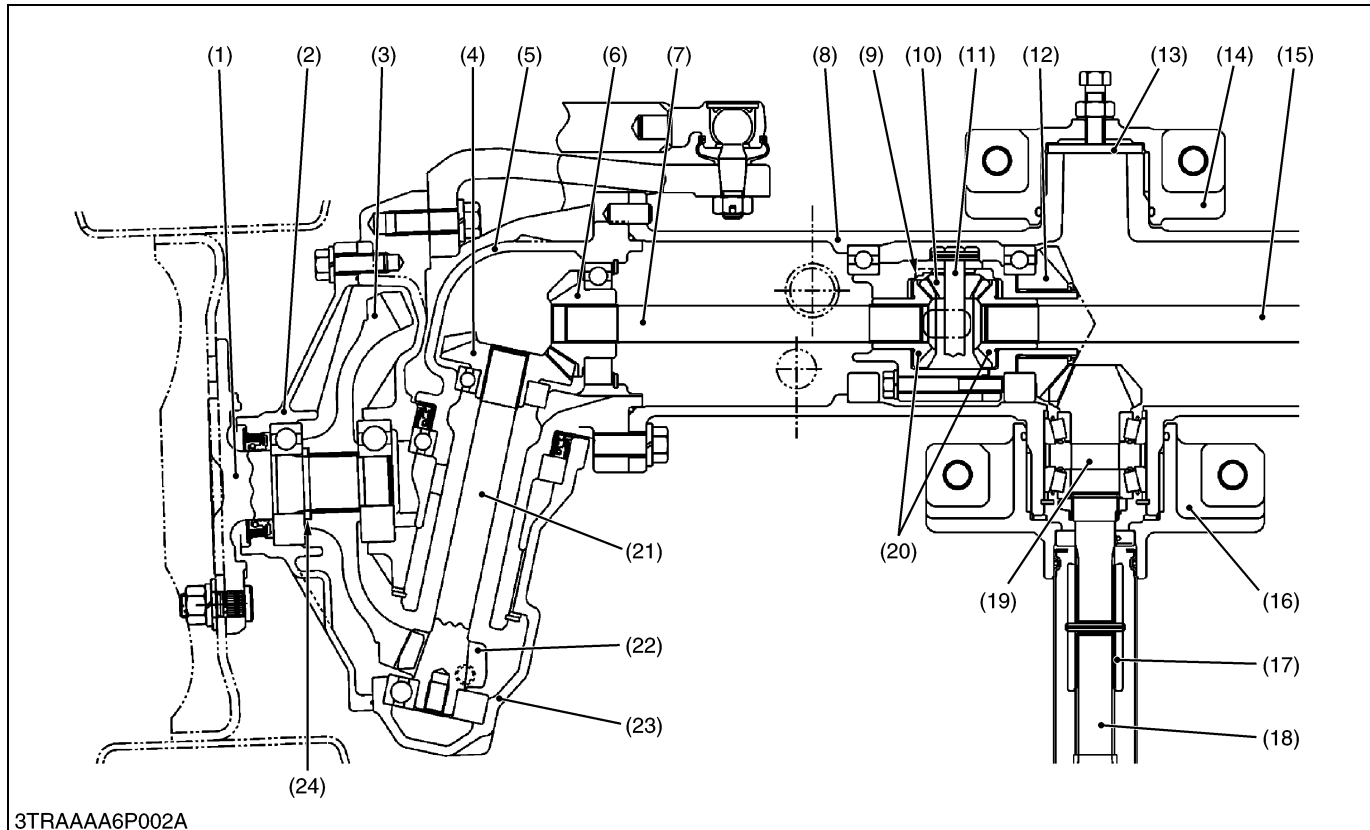
1. TWO WHEEL DRIVE



- | | | | |
|----------------------|------------------|--------------------------|--------------------------------|
| (1) Bushing | (5) Slotted Nut | (9) Oil Seal | (13) Knuckle Shaft |
| (2) Knuckle Arm | (6) Ball Bearing | (10) Bushing | (14) Dust Cover |
| (3) Front Axle Frame | (7) Spacer | (11) Thrust Ball Bearing | (15) Front Axle Bracket, Front |
| (4) Front Wheel Hub | (8) Ball Bearing | (12) Oil Seal | (16) Front Axle Bracket, Rear |

The front axle of the 2WD type is constructed as shown above. The shape of the front axle is relatively simple, and the front axle is supported at its center with the front axle brackets (15), (16) on the front axle frame (3), so that steering operation is stable even on an uneven grounds in a farm field.

2. FOUR WHEEL DRIVE (STANDARD)



- | | |
|----------------------------------|--------------------------------|
| (1) Axle | (16) Front Axle Bracket, Rear |
| (2) Axle Flange | (17) Coupling |
| (3) Bevel Gear | (18) Propeller Shaft |
| (4) Bevel Gear | (19) Spiral Bevel Pinion Shaft |
| (5) Bevel Gear Case | (20) Differential Side Gear |
| (6) Bevel Gear | (21) Bevel Gear Shaft |
| (7) Differential Yoke Shaft, LH | (22) Bevel Gear |
| (8) Front Axle Case | (23) Front Gear Case |
| (9) Differential Gear Assembly | (24) Collar |
| (10) Differential Pinion Gear | (25) Planetary Gear Pin |
| (11) Pinion Shaft | (26) Planetary Gear |
| (12) Spiral Bevel Gear | (27) Internal Gear |
| (13) Collar | (28) Bevel Gear |
| (14) Front Axle Bracket, Front | (29) Planetary Gear Support |
| (15) Differential Yoke Shaft, RH | |

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The front axle is constructed as shown above. Power is transmitted from the transmission through the propeller shaft (18) to the spiral bevel pinion shaft (19), then to the spiral bevel gear (12) and to the differential side gear (20).

The power through the differential side gear is transmitted to the differential yoke shaft (7), (15), and to the bevel gear shaft (21) through the bevel gears (4), (6) in the bevel gear case (5).

The revolution is greatly reduced by the bevel gears (22), (3) or planetary gear system (25), (26), (27), (28), (29), then the power is transmitted to the axle (1).

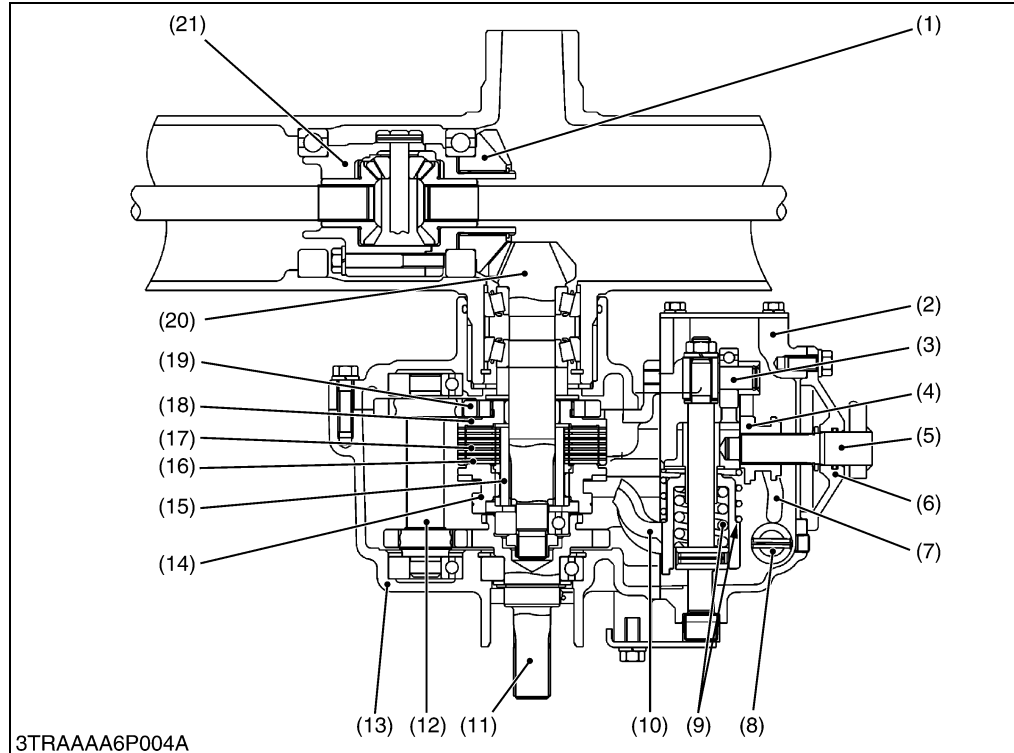
The differential system allows each wheel to rotate at a different speed to make turning easier.

3. FOUR WHEEL DRIVE (WITH BI-SPEED TURN SYSTEM)

There are two kinds of bi-speed turn system with the one installed in the front axle and the other one installed in transmission case.

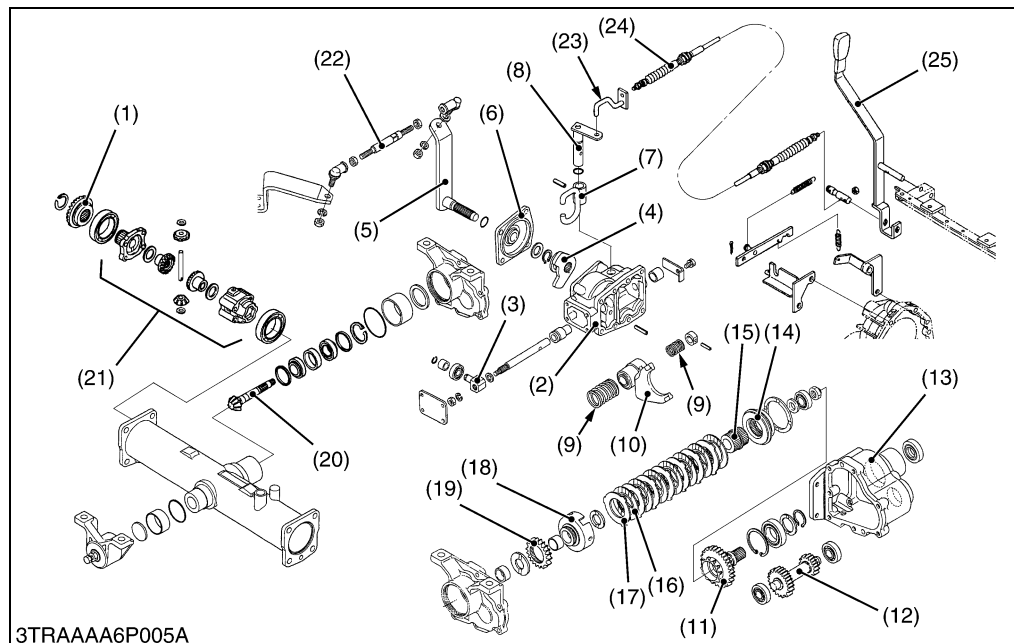
[1] FRONT AXLE TYPE

(1) Structure



- (1) Bevel Gear
- (2) Bi-speed Turn Case
- (3) Shift Roller Shaft
- (4) Shift Cam
- (5) Shift Lever
- (6) Shift Lever Fulcrum
- (7) Change Fork
- (8) Change Lever
- (9) Spring
- (10) Bi-speed Turn Shift Fork
- (11) Gear Shaft
- (12) Gear Shaft
- (13) Bi-speed Turn Gear Case
- (14) Shifter
- (15) Coupling
- (16) Clutch Disc
- (17) Friction Plate
- (18) Clutch Drum
- (19) 18T Gear
- (20) Spiral Bevel Pinion Shaft
- (21) Front Differential Assembly
- (22) Shift Rod
- (23) Bi-speed Turn Rod
- (24) Bi-speed Turn Change Cable
- (25) Bi-speed Turn Lever

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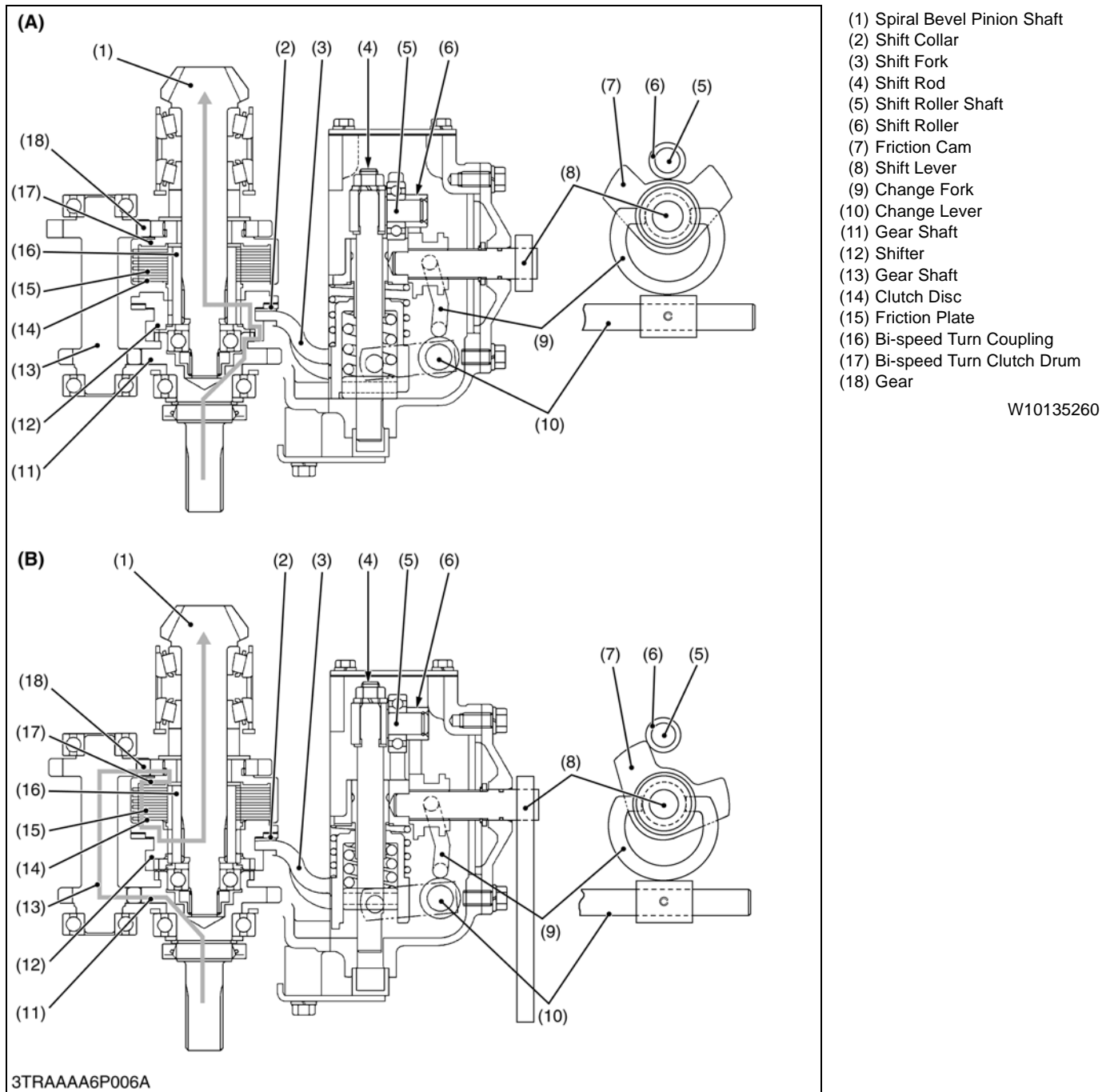


The front axle with bi-speed turn is constructed as shown above. Front wheel speed change mechanism, which is located in the bi-speed turn gear case (13) and bi-speed turn case (2), consists of the bi-speed turn lever (25), shift rod (22), shift cam (4), shift fork (10), bi-speed turn clutch assembly (14 to 18), gears (11), (12), (19) and so on.

(2) Power Train

Bi-speed clutch is mechanically engaged when front wheel reaches specified turning angle.

This bi-speed turn front wheel speed is 1.53 times higher than the standard front wheel speed.



(A) Standard 4WD

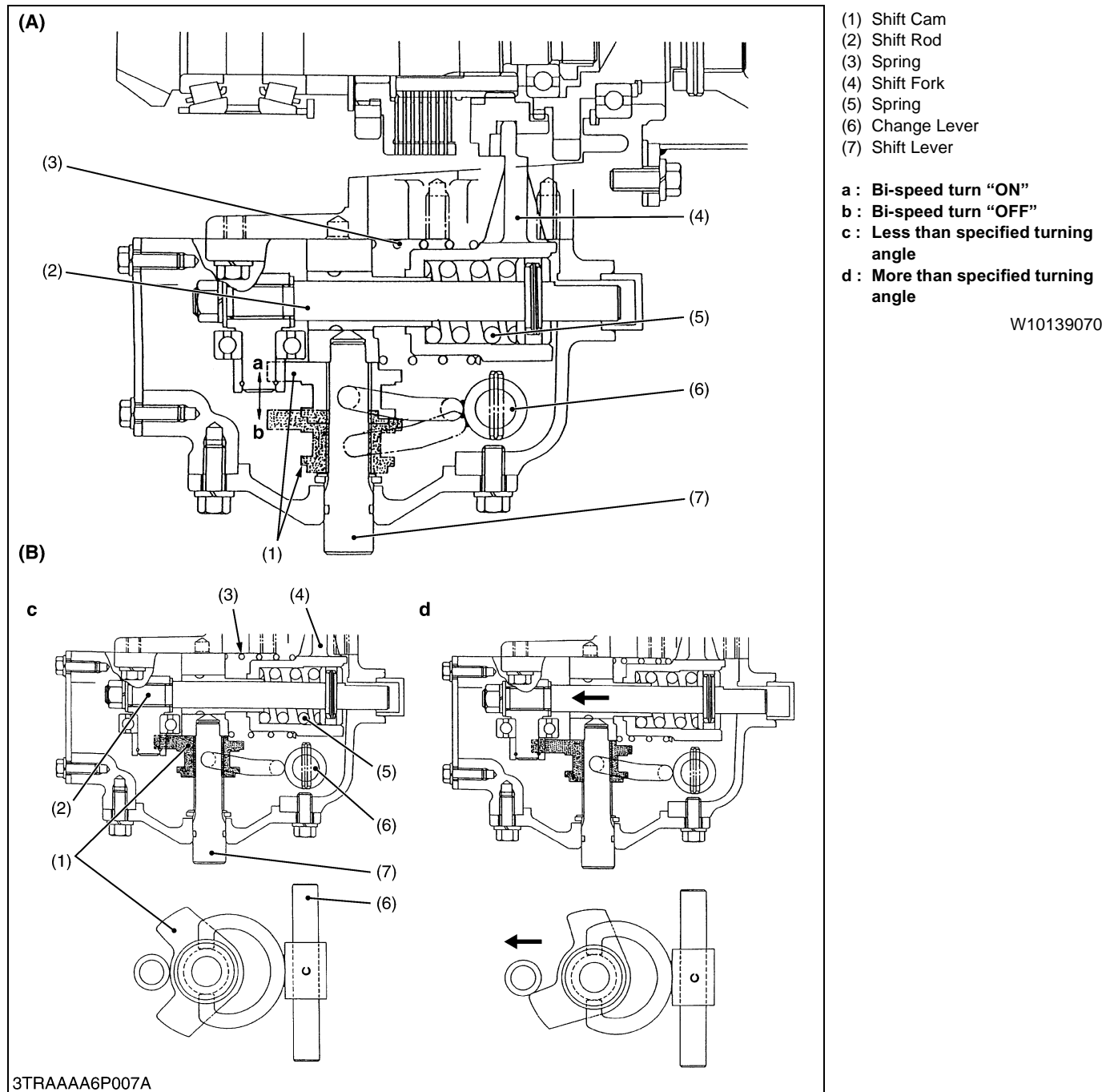
Gear Shaft (11) → Shifter (12) → Bi-speed Turn Coupling (16) → Spiral Bevel Pinion Shaft (1) → Front Axle.

(B) Bi-speed Turn 4WD

Gear Shaft (11) → Gear Shaft (13) → Gear (18) → Bi-speed Turn Clutch Drum (17) → Friction Plate (15) → Clutch Disc (14) → Bi-speed Turn Coupling (16) → Spiral Bevel Pinion Shaft (1) → Front Axle.

(3) Bi-speed Cam Operation

Bi-speed turn 4WD and standard 4WD positions are selected by change lever (6) to move the position of shift cam (1). This lever is operated by the bi-speed turn change lever.



(A) Standard 4WD

The bi-speed turn change lever is shifted to the "OFF" position.

The shift cam (1) is free to turn, so that the shift rod (2) and shift fork (4) are remained in standard 4WD position by springs (3), (5).

(B) Bi-speed Turn 4WD

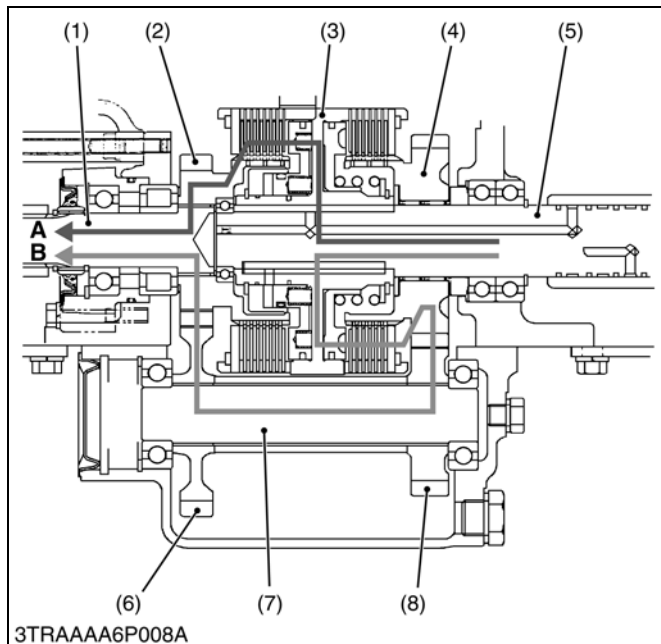
The bi-speed turn change lever is shifted to the "ON" position.

When the steering wheel is turned more than specified turning angle, the shift lever (7) and shift cam (1) are turned together. This cam make the shift rod (2) move the arrow direction so that the shifter is engaged with the bi-speed turn clutch.

When the steering wheel is turned less than specified turning angle, the shift rod doesn't move in spite of the cam rotation.

[2] TRANSMISSION TYPE (TYPE 1)

(1) Power Train



The bi-speed turn clutch is controlled by the combination of the solenoid valve and the hydraulic flow.

When the 4WD / Bi-speed turn switch is pushed once, the front wheel drive (4WD) is engaged. When it is pushed twice, the bi-speed turn system works. When it is pushed once more, the power is not transmitted to the front axle.

Three ways of power train are available as follows.

2-wheel Drive (4WD Switch is turned to "OFF")

Power is not transmitted from the middle transmitting shaft (5) to the front transmitting shaft (1), because both sides of clutch are disengaged.

Standard 4-wheel Drive (4WD Switch is turned to "ON")

Middle Transmitting Shaft (5) → Clutch Body (3) → Gear (2) → Front Transmitting Shaft (1).

Bi-speed Turn 4-wheel Drive (4WD Switch is turned to "Bi-speed Turn")

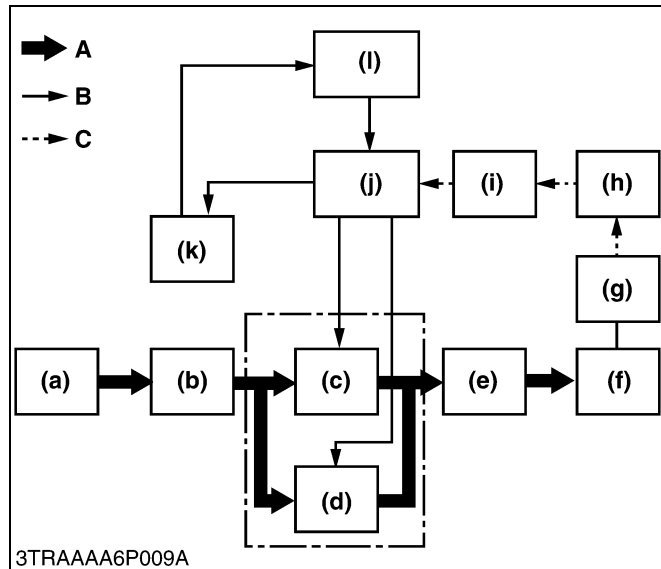
When front wheels reach to the specified turning angle, its angle inspection switch is pushed to **ON** position and solenoid valve is operated. As a result, the bi-speed turn is hydraulically engaged and the front wheel is revolved 1.6 times faster than standard 4-wheel drive mode.

Middle transmitting Shaft (5) → Clutch Body (3) → Gear (4) → Gear (8) → Bi-speed Turn Shaft (7) → Gear (6) → Gear (2) → Front Transmitting Shaft (1).

- | | |
|-------------------------------|--|
| (1) Front Transmitting Shaft | (7) Bi-speed Turn Shaft |
| (2) Gear | (8) Gear |
| (3) Clutch Body | |
| (4) Gear | A : Bi-speed Turn is Disengaged |
| (5) Middle Transmitting Shaft | B : Bi-speed Turn is Engaged |
| (6) Gear | |

W10137290

(2) Turning Angle Inspection Switch



The turning angle inspection switch is installed in front wheel case support. This switch controls the **ON** / **OFF** position of bi-speed turn system.

When turning angle is less than specified turning angle, this switch becomes **OFF** position in the place where 4WD / Bi-speed turn switch has been set in bi-speed turn position. And current flows from battery to the 4WD solenoid to engage the standard 4WD. On the other hand, when turning angle exceeds specified turning angle, this switch becomes **ON** position. As a result, the current flows to bi-speed turn relay's coil, and relay contact becomes bi-speed turn position by electromagnetic force. And current flows from battery to the bi-speed turn solenoid to engage the bi-speed turn 4WD.

- | | |
|-------------------------------------|---|
| A : Power | (h) 4WD / Bi-speed Turn Relay |
| B : Oil | (i) 4WD / Bi-speed Turn Changeable Switch |
| C : Electrical Signal | (j) 4WD / Bi-speed Turn Solenoid Valve |
| (a) Engine | (k) Oil Reservoir (Transmission Case) |
| (b) Transmission Case | (l) Hydraulic Pump and Relief Valve |
| (c) 4WD Clutch | |
| (d) Bi-speed Turn Clutch | |
| (e) Front Axle | |
| (f) Front Wheel | |
| (g) Turning Angle Inspection Switch | |

W10140020

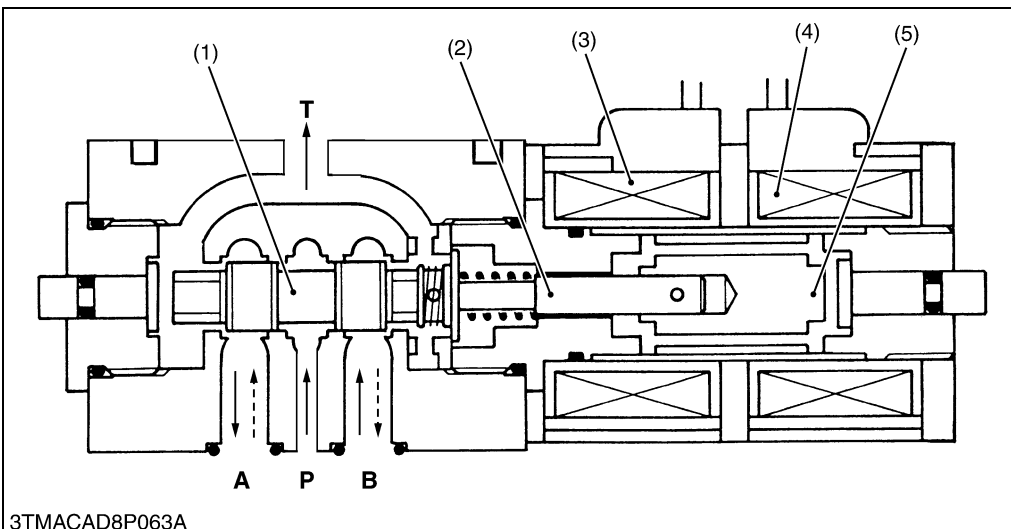
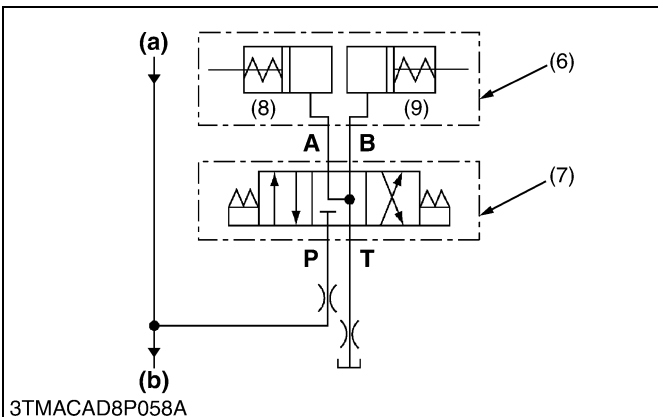
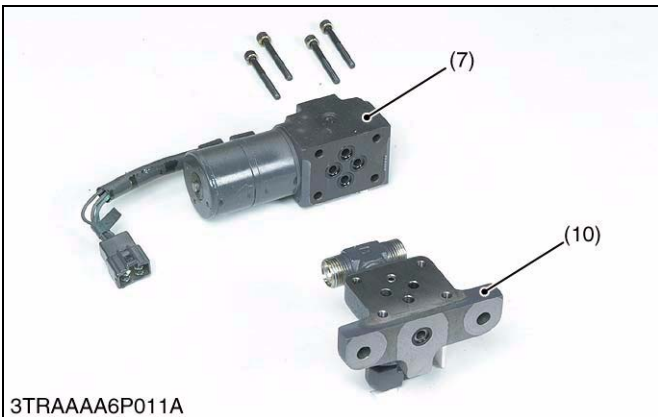
(3) 4WD / Bi-Speed Valve (Code No. YW273-00100)



This solenoid valve is a double acting solenoid type of 4-ports and 3-positions one. Being not electrified, it is kept in neutral position. Therefore, oil is flowed to neither Bi-speed clutch nor 4WD clutch when the 4WD / Bi-speed turn switch is switched to **OFF** position.

When the solenoid A (4) or solenoid B (3) is electrified, the plunger (5) is pulled by its electromagnetic force and its position is switched. Then, oil pressure-fed from the hydraulic pump to **P** port is flowed from **A** or **B** port to 4WD side (8) or Bi-speed turn side (9) of the clutch (6). The return oil from the other side is flowed to the transmission case through **T** port.

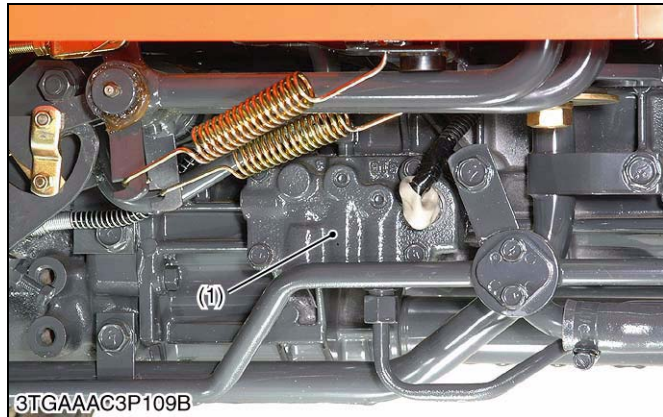
W1014425



- (1) Spool
 - (2) Push Rod
 - (3) Solenoid B
 - (4) Solenoid A
 - (5) Plunger
 - (6) 4WD / Bi-speed Clutch
 - (7) 4WD / Bi-speed Valve
 - (8) 4WD Side
 - (9) Bi-speed Turn Side
 - (10) Valve Base
- A : 4WD Port**
B : Bi-speed Turn Port
P : From Power Steering Pump
T : To Tank
(a) From Power Steering Controller
(b) To PTO Clutch Valve

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(2) Bi-speed Valve (Code No. YW255-00102)



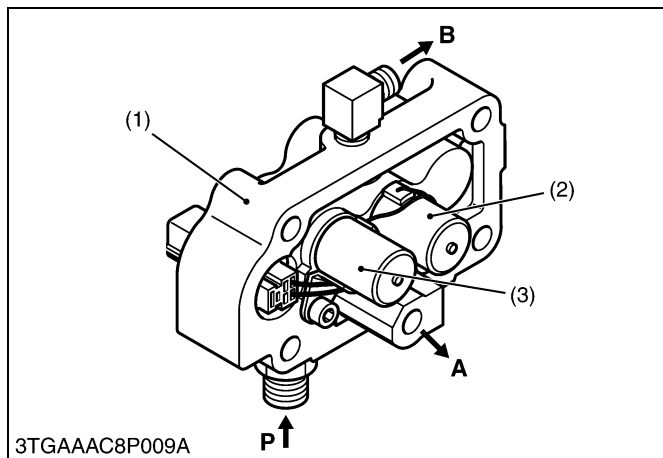
The bi-speed valve (1) is installed on a right side of the clutch housing into which the bi-speed clutch is built.

The solenoid valve (2) and (3) are built into the bi-speed valve (1), and they operate respectively according to the electrical signal from the PTO switch and the bi-speed controller.

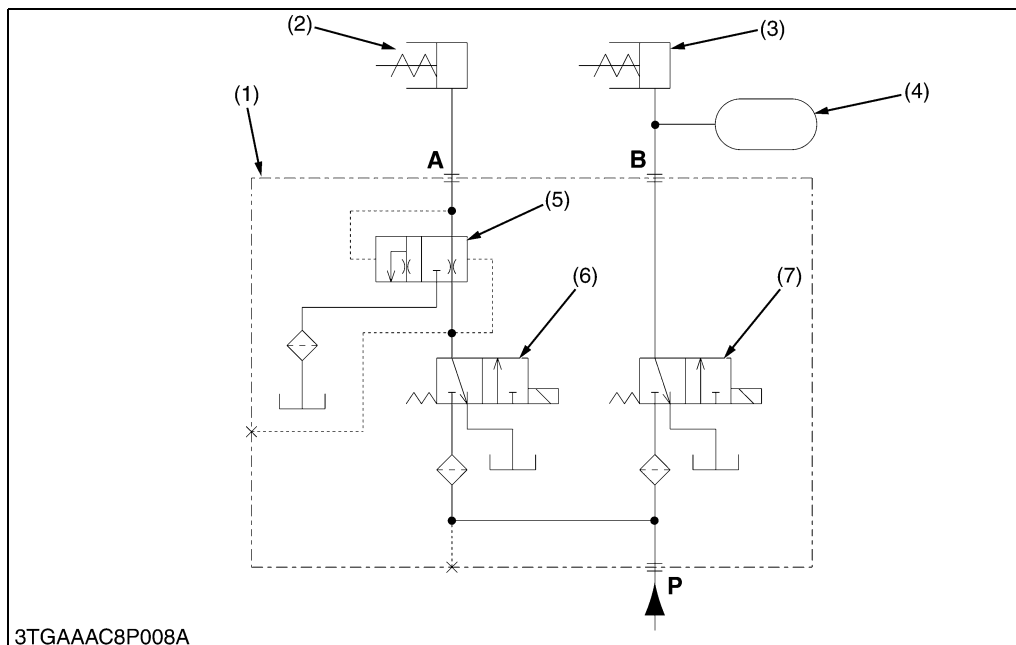
- (1) Bi-speed Valve
- (2) Solenoid Valve (PTO)
- (3) Solenoid Valve (Bi-speed)

- A : A Port (To Bi-speed Hydraulic Clutch)**
- B : B Port (To PTO Hydraulic Clutch)**
- P : P Port (From Regulator valve)**

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1) Hydraulic Circuit



- (1) Bi-speed Valve
- (2) Bi-speed Hydraulic Clutch
- (3) PTO Hydraulic Clutch
- (4) Accumulator
- (5) Orifice Valve
- (6) Solenoid Valve (Bi-speed)
- (7) Solenoid Valve (PTO)

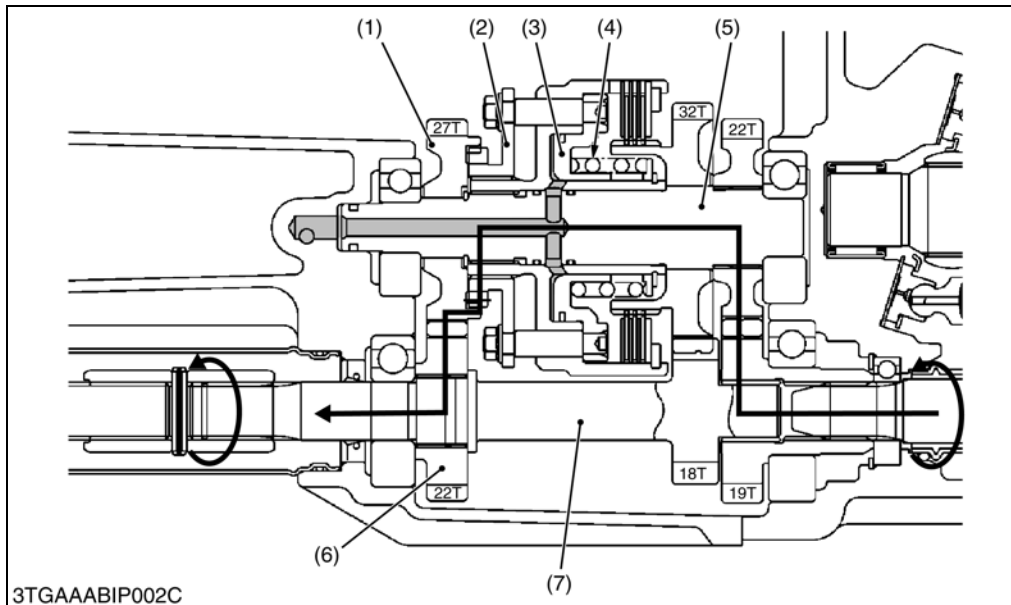
- A : A Port (To Bi-speed Hydraulic Clutch)**
- B : B Port (To PTO Hydraulic Clutch)**
- P : P Port (From Regulator Valve)**

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[3] TRANSMISSION TYPE (TYPE 2)

(1) Power Train

■ 4WD Position



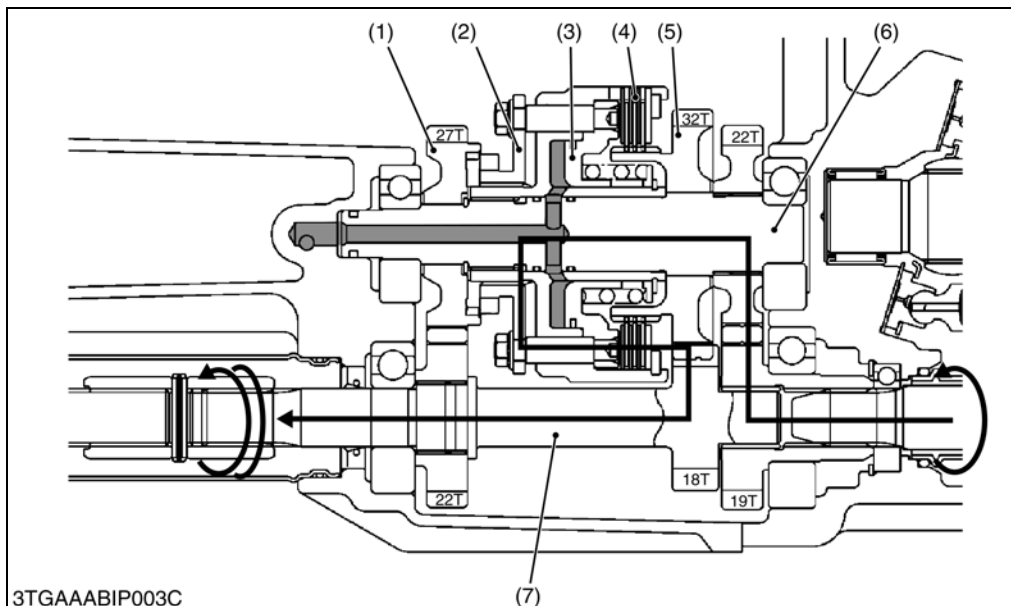
- (1) 27T Gear
- (2) Shifter
- (3) Piston
- (4) Spring
- (5) Counter Shaft
- (6) 22T Gear
- (7) 18T Gear Shaft

W10148930

When the hydraulic clutch is not operated, the piston (3) is pushed by the spring (4) and shifter (2) is engaged to the 27T gear (1) with spline. Power is transmitted as shown in the figure.

Counter Shaft (5) → Shifter (2) → 27T Gear (1) → 22T Gear (6) → 18T Gear Shaft (7).

■ Bi-speed Turn Position



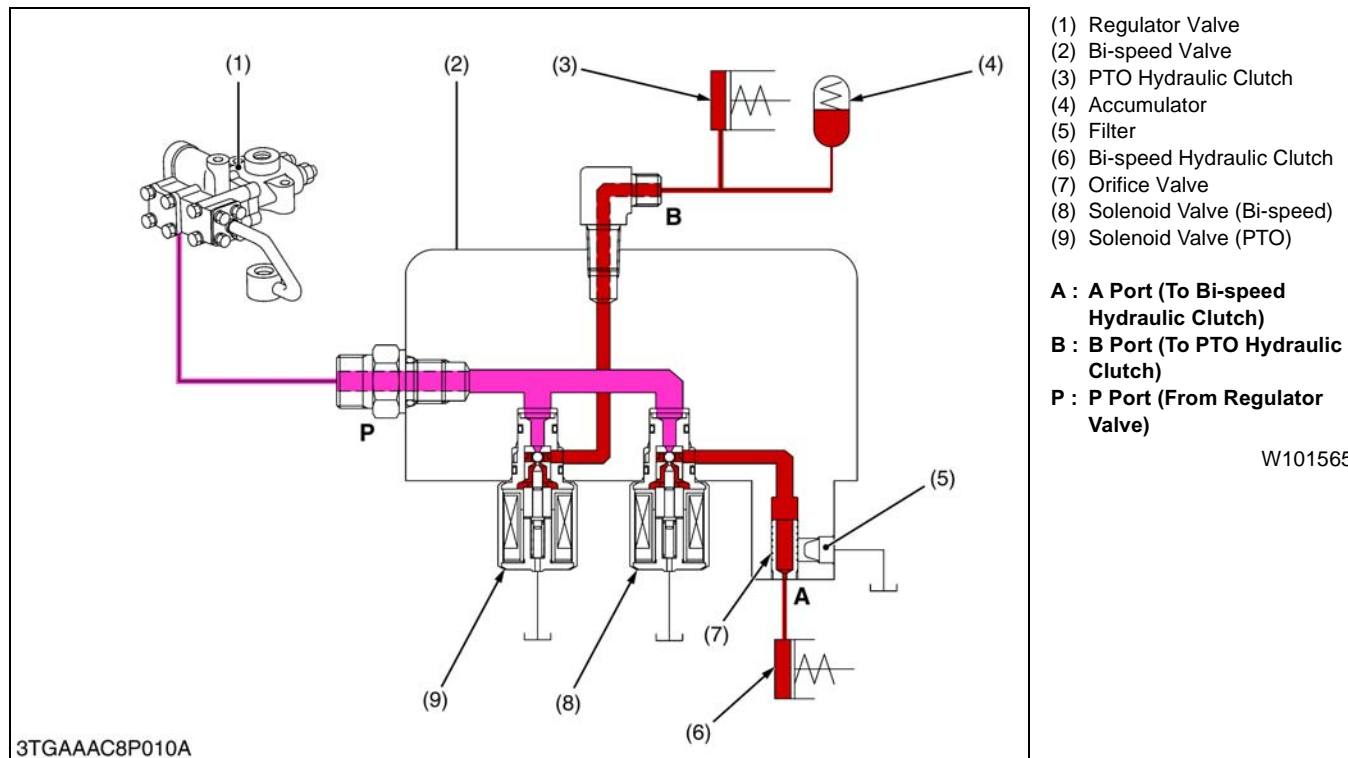
- (1) 27T Gear
- (2) Shifter
- (3) Piston
- (4) Clutch Disc and Plate
- (5) 32T Gear
- (6) Counter Shaft
- (7) 18T Gear Shaft

0

When the bi-speed solenoid valve is actuated, the piston (3) moves in the direction of arrow by hydraulic pressure. The clutch disc and plate (4) is pressed and the shifter (2) is disengaged from the 27T gear (1). Power is transmitted as shown in the figure. The front wheel rotates by 1.5 times the speed for smooth turning.

Counter Shaft (6) → Shifter (2) → Clutch Disc and Plate (4) → 32T Gear (5) → 18T Gear Shaft (7).

2) Oil Flow



- (1) Regulator Valve
- (2) Bi-speed Valve
- (3) PTO Hydraulic Clutch
- (4) Accumulator
- (5) Filter
- (6) Bi-speed Hydraulic Clutch
- (7) Orifice Valve
- (8) Solenoid Valve (Bi-speed)
- (9) Solenoid Valve (PTO)

A : A Port (To Bi-speed Hydraulic Clutch)
B : B Port (To PTO Hydraulic Clutch)
P : P Port (From Regulator Valve)

W10156520

■ When both solenoid valves are "OFF"

When both solenoid valves (8) (9) are "OFF", pressurized oil does not flow in bi-speed valve (2).

The piston in the hydraulic clutches (3) (6) are positioned at the left of figure by spring

■ When the solenoid valve (PTO) is turned ON

When the solenoid valve (9) is turned on, the pressurized oil flows to the PTO hydraulic clutch (3) through the solenoid valve (9). The clutch piston moves against the spring until the stroke end and power is transmitted to the PTO shaft. Oil in the PTO hydraulic clutch (3) is kept pressured of 18.5 kg fixed.

To make the movement of the clutch piston smooth, the accumulator (4) is prepared for. The accumulator (4) is built in HST case.

■ When the solenoid valve (PTO) is turned OFF

When the solenoid valve (9) is turned off, the oil passage in the solenoid valve (9) changes, and oil in the PTO hydraulic clutch (3) is drained to the transmission case through the solenoid valve (9).

The clutch piston returns to left in figure by spring. The power to the PTO shaft is cut off

■ When the solenoid valve (Bi-speed) is turned ON

When the solenoid valve (8) is turned on, the pressurized oil gradually flows to the bi-speed hydraulic clutch (6) through the solenoid valve (8) and orifice valve (7). The clutch piston moves against the spring at an appropriate speed until the stroke end, and power of bi-speed is transmitted to the front wheel.

Oil in the bi-speed hydraulic clutch (6) is kept pressured of 18.5 kg fixed.

■ When the solenoid valve (Bi-speed) is turned OFF

When the solenoid valve (8) is turned off, the oil passage in the solenoid (8) valve changes, and oil between the solenoid valve (8) and orifice valve (7) is drained to the transmission case through the solenoid valve (8). At this time, the orifice valve (7) moves up in figure by pressure difference. The oil in the bi-speed hydraulic clutch (6) is drained promptly to the transmission case through the filter (5).

The clutch piston returns to left in figure by spring.

7 STEERING

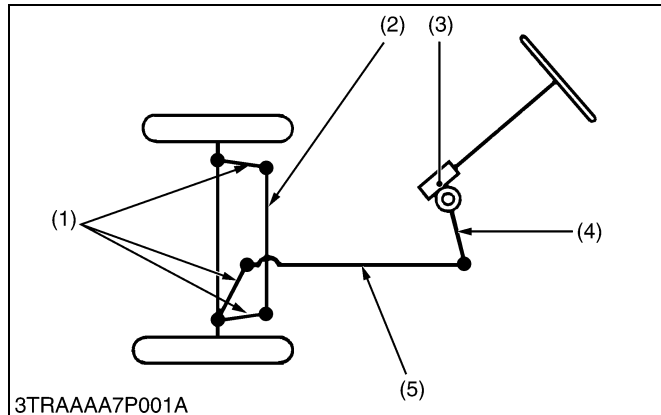
MECHANISM

CONTENTS

1. MANUAL STEERING.....	7-M1
[1] STEERING LINKAGE.....	7-M1
[2] STEERING GEAR BOX.....	7-M1
2. POWER STEERING.....	7-M2
[1] INTEGRAL TYPE (TYPE 1) (Code No. 6C070-41105).....	7-M2
(1) Hydraulic Circuit.....	7-M2
(2) Hydraulic Pump.....	7-M2
(3) Power Steering Body.....	7-M3
(4) Oil Flow.....	7-M4
[2] INTEGRAL TYPE (TYPE 2) (Code No. TC220-37000, TC230-37000).....	7-M8
(1) Structure.....	7-M8
(2) Operation.....	7-M9
[3] FULL HYDROSTATIC TYPE (TYPE 1) (Code No. TA470-37001, TA040-37102, TA040-37002, TA150-37004, TA530-37002, TC050-37100, TD030-37000, TD060-37000).....	7-M10
(1) Hydraulic Circuit.....	7-M10
(2) Hydraulic Pump.....	7-M10
(3) Steering Controller.....	7-M11
(4) Oil Flow.....	7-M13
[4] FULL HYDROSTATIC TYPE (TYPE 2) (Code No. 3A111-63072).....	7-M15
(1) Hydraulic Circuit.....	7-M15
(2) Hydraulic Pump.....	7-M15
(3) Steering Controller.....	7-M16
(4) Oil Flow.....	7-M18
[5] FULL HYDROSTATIC TYPE (TYPE 3) (Code No. 3F240-63071, 3F250-63072, 3F290-63071).....	7-M21
(1) Hydraulic Circuit.....	7-M21
(2) Hydraulic Pump.....	7-M21
(3) Steering Controller.....	7-M22
(4) Oil Flow.....	7-M23
(5) Flow Control Valve (Relief Valve).....	7-M26
[6] FULL HYDROSTATIC TYPE (TYPE 4) (Code No. 6C200-41100).....	7-M28
(1) Hydraulic Circuit.....	7-M28
(2) Steering Controller.....	7-M29
[7] STEERING CYLINDER.....	7-M30

1. MANUAL STEERING

[1] STEERING LINKAGE

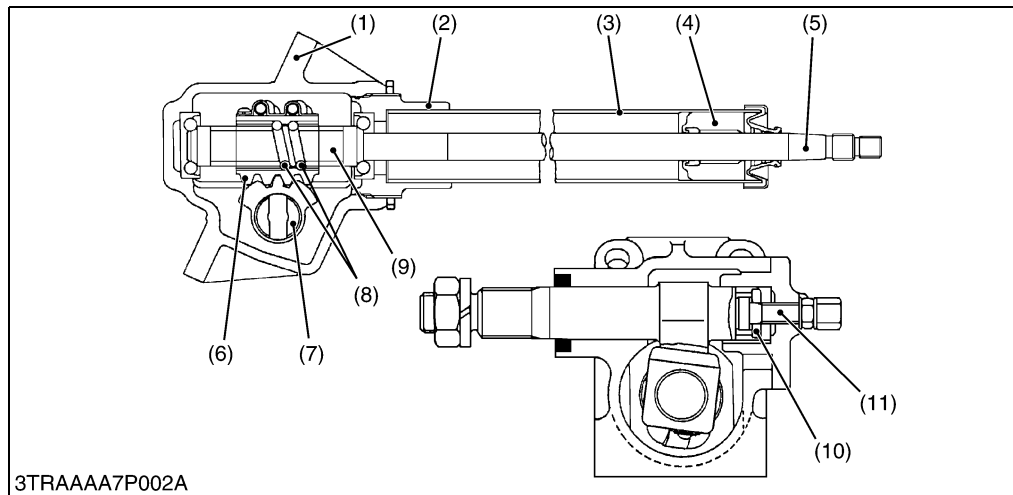


This type consists of five parts, a steering gear box (3), a pitman arm (4), a drag link (5), knuckle arms (1) and a tie-rod (2).

- | | |
|-----------------------|----------------|
| (1) Knuckle Arm | (4) Pitman Arm |
| (2) Tie-rod | (5) Drag Link |
| (3) Steering Gear Box | |

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[2] STEERING GEAR BOX



- | |
|-----------------------|
| (1) Gear Box |
| (2) Gear Box Cover |
| (3) Steering Post |
| (4) Column Bushing |
| (5) Steering Shaft |
| (6) Ball Nut |
| (7) Sector Gear Shaft |
| (8) Ball |
| (9) Worm Shaft |
| (10) Shim |
| (11) Adjusting Screw |

W10127360

The steering unit mainly consists of two parts, a ball nut (6) and a sector gear shaft (7). When the worm shaft (9) is rotated (by rotation of the steering wheel), the ball nut (6) is moved along the worm shaft, and this action causes the sector gear shaft (7) to rotate. The one end of the sector gear shaft carries the pitman arm. Rotation of the sector gear shaft causes the pitman arm to swing in one direction or the other.

The motion is then carried through the drag link to the knuckle arm at the wheel.

In this unit, friction is kept exceptionally low by interposing balls (8) between the worm teeth and grooves cut in the inner face of a ball nut (6).

As the worm shaft (9) rotates, the balls roll and cause the ball nut to move along the worm shaft.

This motion is carried to the sector gear by teeth on the side of the ball nut.

This forces the sector gear shaft (7) to rotate.

These balls are called "**recirculating balls**" because they continuously recirculate from one end of the ball nut to the other through a pair of ball return guides.

For example, suppose that the operator makes a right turn. The worm gear is rotated in a clockwise direction (viewed from the operator's seat), and this causes the ball nut to move upward. The balls roll between the worm shaft and ball nut and as they reach the upper end of the ball nut, they enter the return guide and then roll back to a lower point, where they reenter the groove between the worm and ball nut.

Steering wheel play can be adjusted by turning an adjusting screw (11) at the end of the sector gear shaft, and with shims (10). As the sector gear shaft is shifted axially by the adjusting screw, the backlash between the sector gear and the ball nut teeth increases or decreases.

When the adjusting screw is turned clockwise, the steering wheel play reduces in proportion to the backlash. Counterclockwise increases the play.

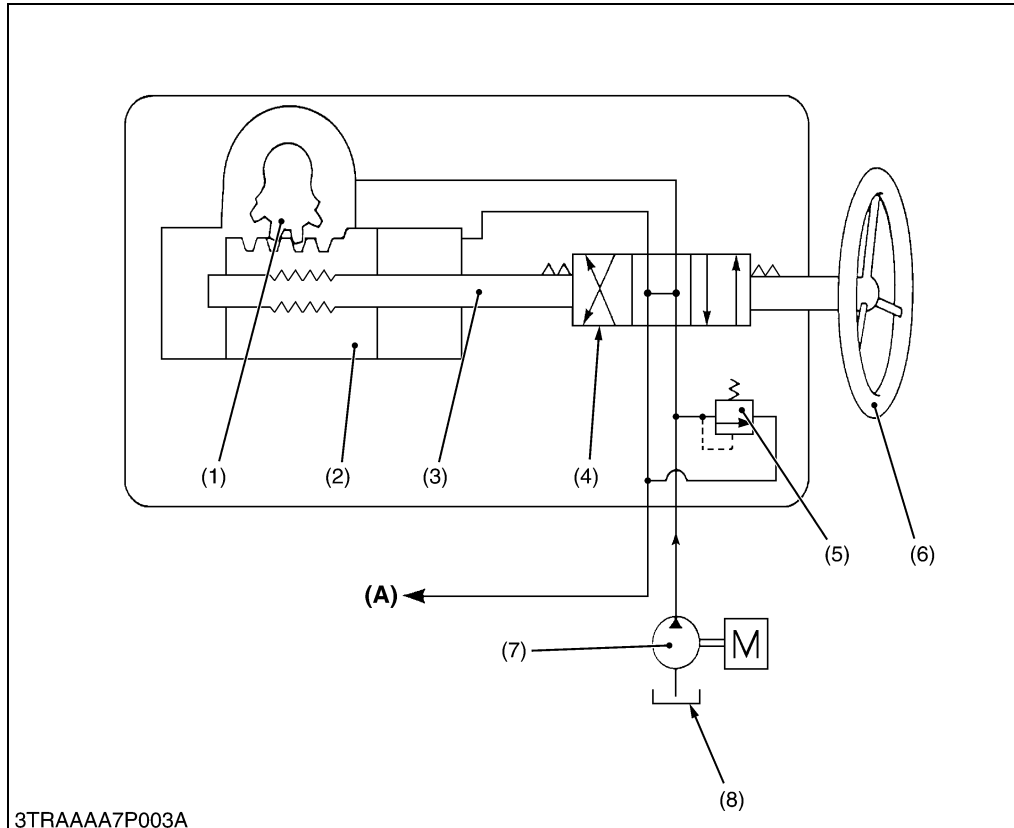
2. POWER STEERING

[1] INTEGRAL TYPE (TYPE 1) (Code No. 6C070-41105)

(1) Hydraulic Circuit

■ NOTE

- Please refer to hydraulic section for circuit symbol.



- (1) Sector Gear Shaft
- (2) Rack (Piston)
- (3) Worm Shaft
- (4) Control Valve
- (5) Relief Valve
- (6) Steering Wheel
- (7) Hydraulic Pump
- (8) Transmission Case

(A) Return to Transmission Case

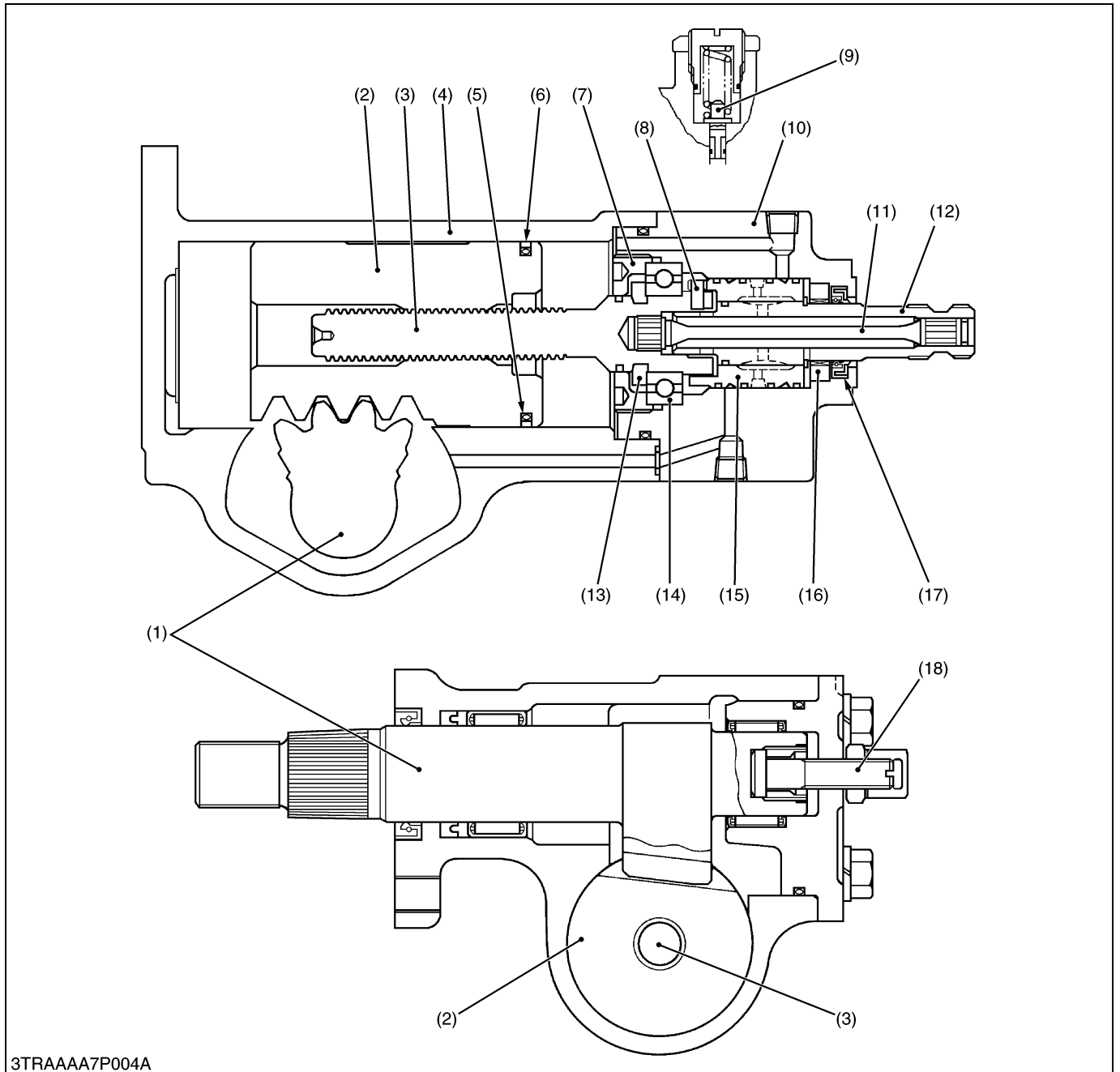
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Some models are equipped with integral type power steering that of rotary type control valve with torsion bar. The oil sent from hydraulic pump (7) flows in gear case through control valve (4) and moves rack (2). And at the same time, oil from gear case returns to transmission case through control valve (4).

(2) Hydraulic Pump

Please refer to hydraulic system section for hydraulic pump.

(3) Power Steering Body

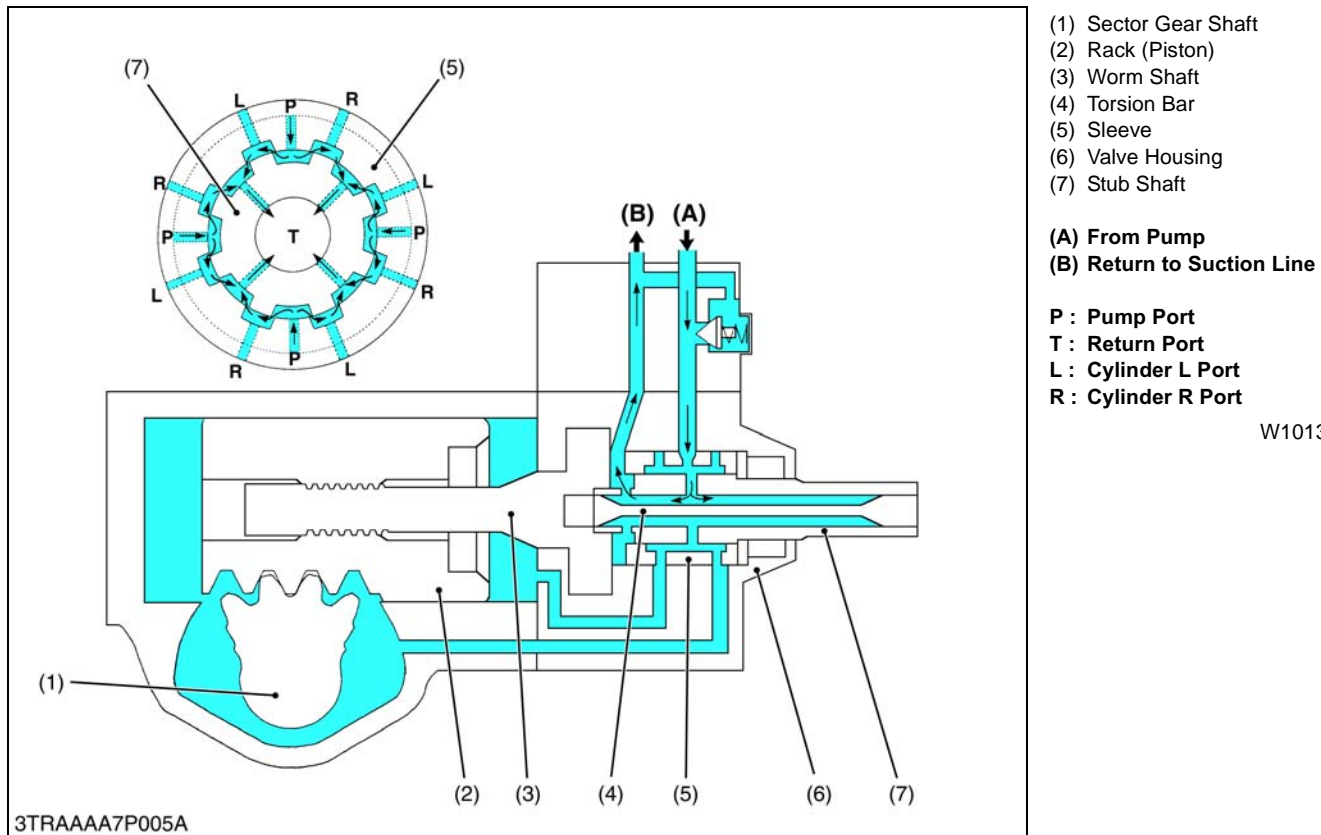
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- | | | | |
|-----------------------|--------------------|-------------------------|-------------------------------|
| (1) Sector Gear Shaft | (6) Seal Ring | (11) Torsion Bar | (15) Sleeve |
| (2) Rack (Piston) | (7) Plug | (12) Stub Shaft (Spool) | (16) Bearing |
| (3) Worm Shaft | (8) Pin | (13) Staking Ring | (17) Oil Seal |
| (4) Gear Case | (9) Relief Valve | (14) Ball Bearing | (18) Adjusting Screw for Play |
| (5) O-ring | (10) Valve Housing | | |

The input shaft (stub shaft) (12) and the worm shaft (3), which can separate from each other, are jointed together via a torsion bar (11). One end of the torsion bar is fixed by a pin with the stub shaft (12), whereas the other end is press fitted to the end of the worm shaft (3).

The control valve consists of a sleeve (15) and a spool (12). The sleeve is coupled by a pin to the worm shaft (3), and the spool is provided on the stub shaft (12).

When a turning torque in either direction is given to the stub shaft (12), the counterforce of the tires is produced from the sector gear shaft (1) through the drag link, pitman arm and other parts. The torsion bar (11) then gets under torsional force. In this way, the positional relation between the sleeve (15) and spool (12) changes, thereby switching the direction of the oil flowing into the right and left cylinders.

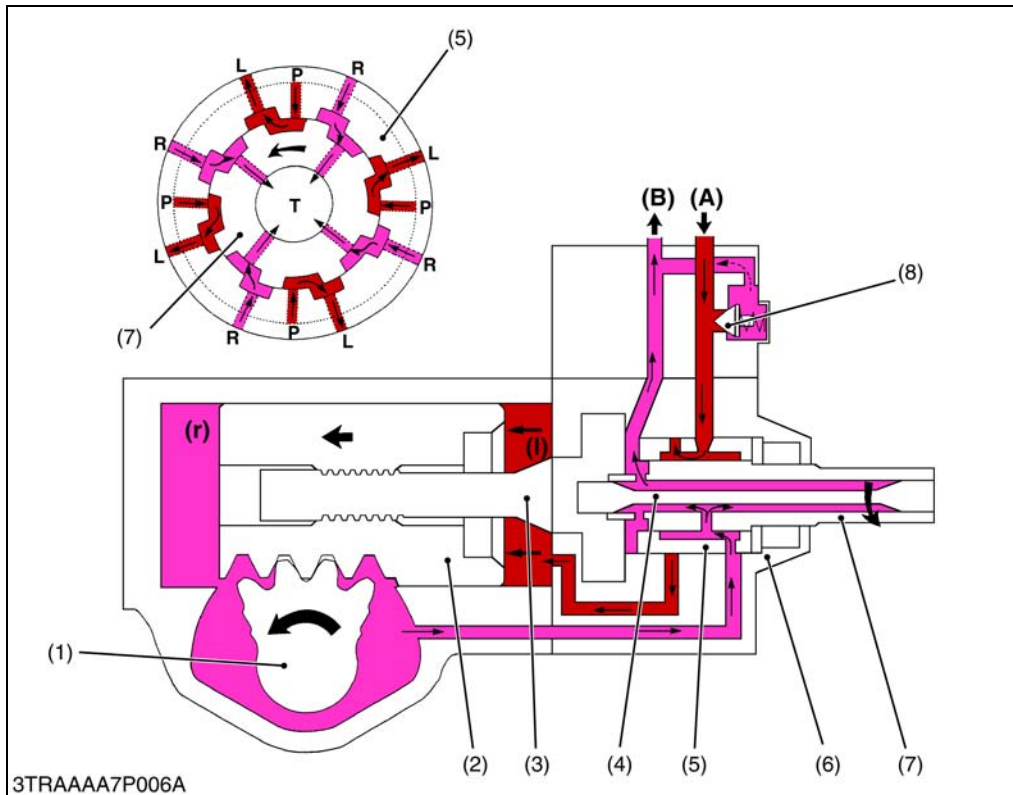
(4) Oil Flow**■ Neutral Position**

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When the steering wheel is not turned, there is no relative displacement between stub shaft (7) and worm shaft (3). And spool part of the stub shaft (7) and sleeve (5) are placed in the neutral position.

Therefore, pressure-fed oil from pump flows to return line through the clearance between spool and sleeve. As a result pressure in the cylinder does not rise, so the front wheels keep the direction.

■ Left Turning

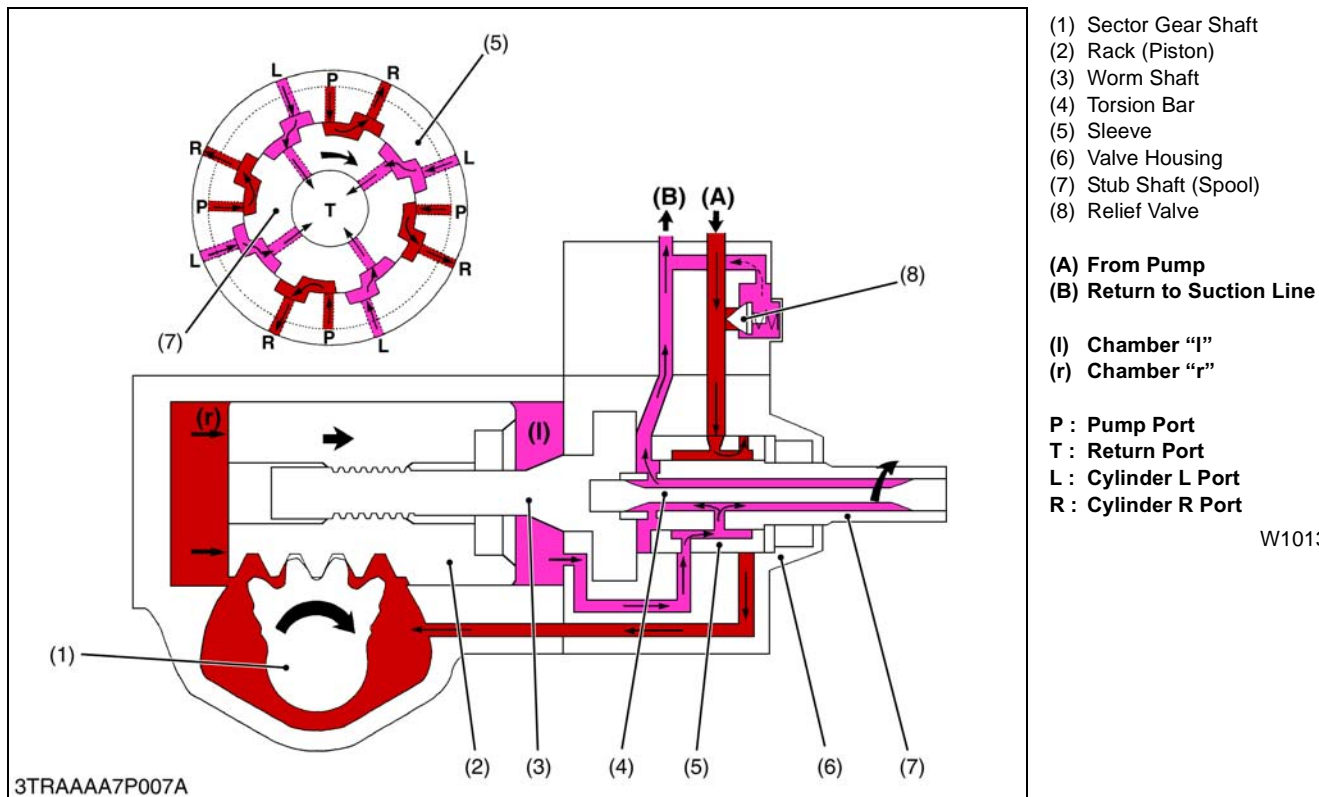


- (1) Sector Gear Shaft
 - (2) Rack (Piston)
 - (3) Worm Shaft
 - (4) Torsion Bar
 - (5) Sleeve
 - (6) Valve Housing
 - (7) Stub Shaft (Spool)
 - (8) Relief Valve
- (A) From Pump
(B) Return to Suction Line
- (I) Chamber "I"
(r) Chamber "r"
- P : Pump Port
T : Return Port
L : Cylinder L Port
R : Cylinder R Port

W10135480

1. When the steering wheel is turned counterclockwise, the stub shaft (7) starts turning, but the sector gear shaft (1), rack (piston) (2) and worm shaft (3) remain motionless under the load of the tires. This means that the torsion bar (4) gets under torsional force and that stub shaft (7) and the worm shaft (3) start turning in a relative displacement, the spool part of the stub shaft (7) turns counterclockwise with respect to the sleeve (5).
2. At this time, the oil passage from pump port P to cylinder port R and return port T are closed. At the same time, the oil passage from pump port P to cylinder port L is opened. Therefore, the pressure-fed oil from pump flows to the chamber "I" through cylinder port L. Thus, the rack (piston) (2) is pushed, and the sector gear shaft (1) is rotated in the direction of the arrow.
3. On the other hand, oil in the chamber "r" flows to return line through the cylinder port R and return port T.

■ Right Turning



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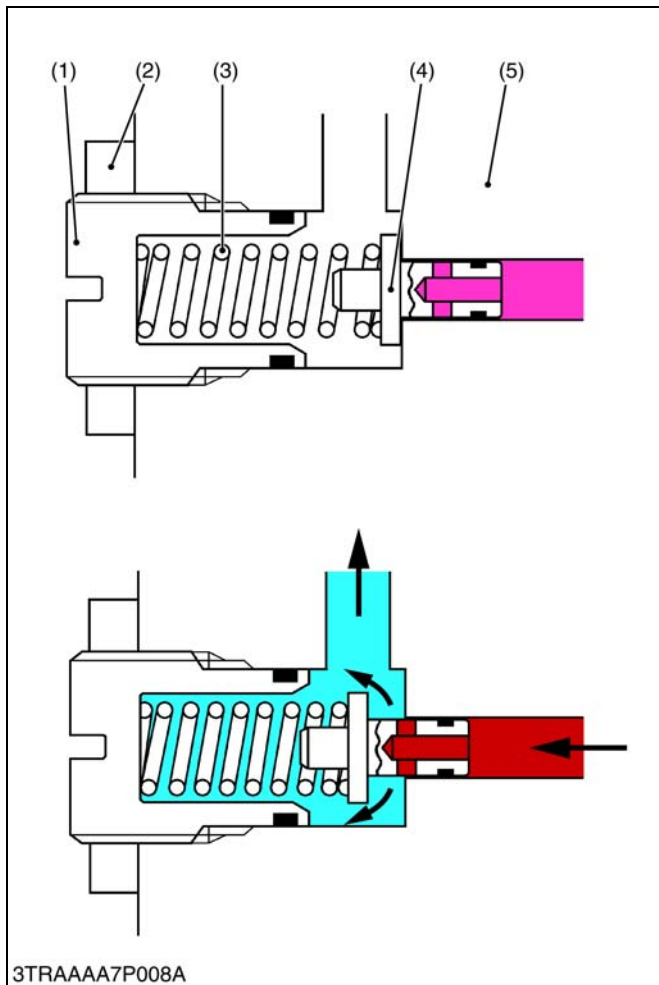
Operation mechanism for left turning is the same as that for right turning, except for directions of oil flow from and to the cylinder ports.

■ Manual Operation

(When Engine Stops or Hydraulic Circuit Troubles)

Even when the engine stops or hydraulic circuit malfunctions thus leading to hydraulic operation stop, manual operation is possible. However, naturally, steering wheel requires a larger operating power.

If the steering wheel is turned when hydraulic circuit ceases to operate, the worm shaft (3) which is connected with stub shaft (7) moves slightly by steering force, then the worm shaft (3) and rack (piston) (2) have same relationship with the manual steering gear.



■ Operation of Relief Valve

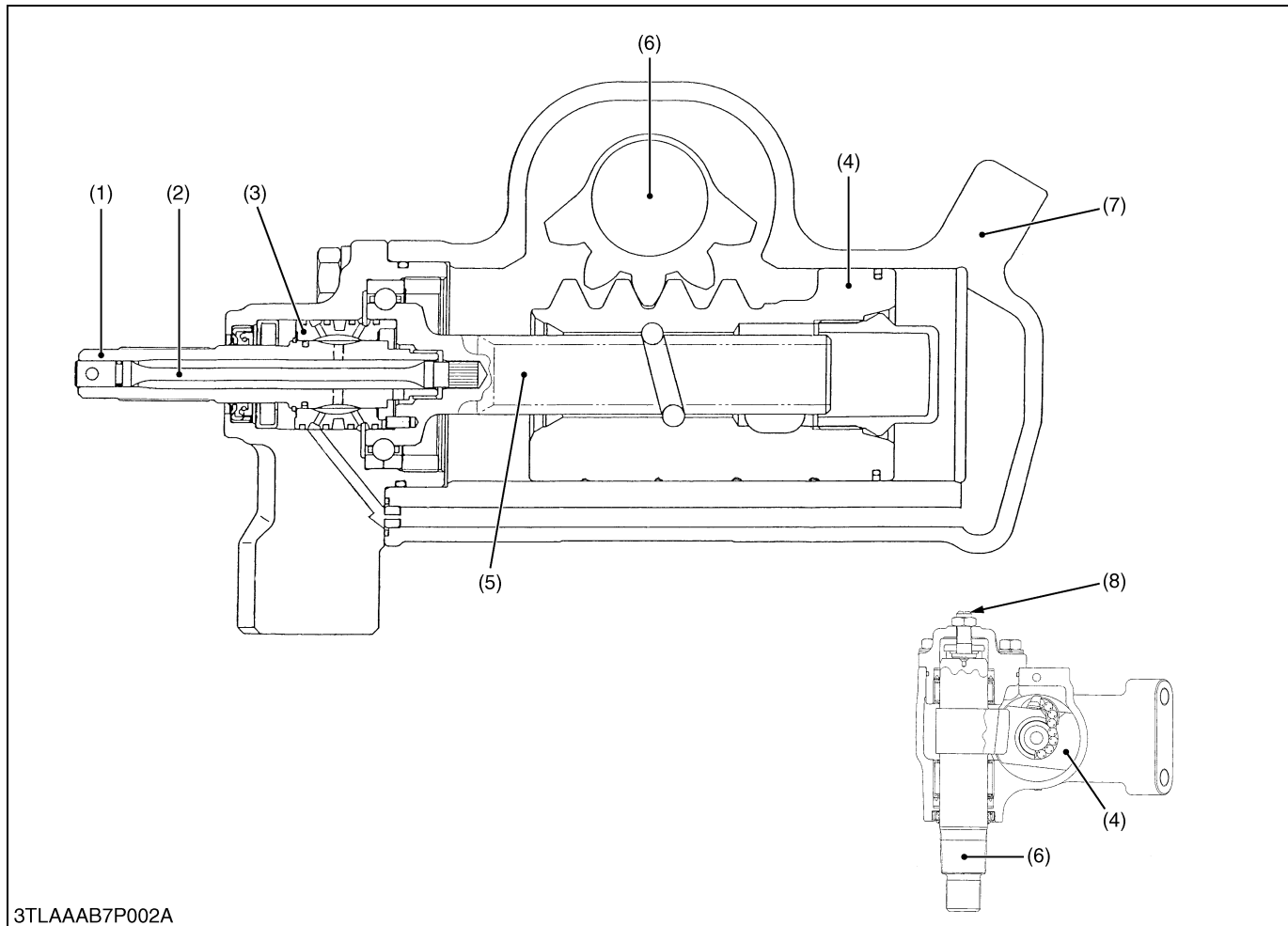
This power steering is equipped with a direct-acting relief valve to restrict the maximum pressure in the hydraulic circuit and to prevent breakage of the hydraulic equipment.

When the pressure in the hydraulic circuit exceeds the relief valve setting pressure in such a case that the maximum steering angle of the front wheels is reached or road resistance to the front tires is too great, the spring (3) is compressed to generate a gap between the poppet (4) and the valve housing (5). The pressure-fed oil flows to tank port through the gap so that pressure rise is restricted.

The relief valve setting pressure can be adjusted by turning the adjusting screw (1).

- | | |
|---------------------|-------------------|
| (1) Adjusting Screw | (4) Poppet |
| (2) Lock Nut | (5) Valve Housing |
| (3) Spring | |

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[2] INTEGRAL TYPE (TYPE 2) (Code No. TC220-37000, TC230-37000)**(1) Structure**

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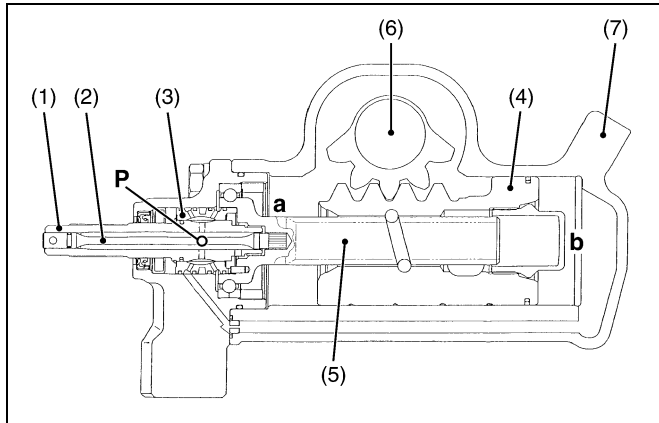
- | | | | |
|-----------------|--------------|------------------|------------------|
| (1) Input Shaft | (3) Sleeve | (5) Main Shaft | (7) Gear Box |
| (2) Torsion Bar | (4) Ball Nut | (6) Sector Shaft | (8) Adjust Screw |

This integral power steering mechanism consists of the following two major components as shown above:

hydraulic control valve and steering force assist hydraulic cylinder. The control valve is housed in the casing and composed of sleeve (3), input shaft (1) and other parts. The hydraulic cylinder, on the other hand, is composed of gear box (7) (cylinder tube), ball nut (4) (piston) and other parts. When the steering wheel is turned, the reaction force from the tires is exerted through the sector shaft (6) onto the main shaft (5). The torsion bar (2) is then twisted to make a gap between the input shaft (1) and sleeve (3). Such gap activates the valve to switch the oil flow direction. The sector shaft's pinion, which comes in mesh with the ball nut's rack, is tapered along the teeth.

In this way, the sector shaft (6) that turns by the adjust screw (8) changes the clearance between the rack and pinion, adjusting the play of the steering wheel. (Tighten the adjust screw and the play becomes smaller, and vice versa.)

(2) Operation



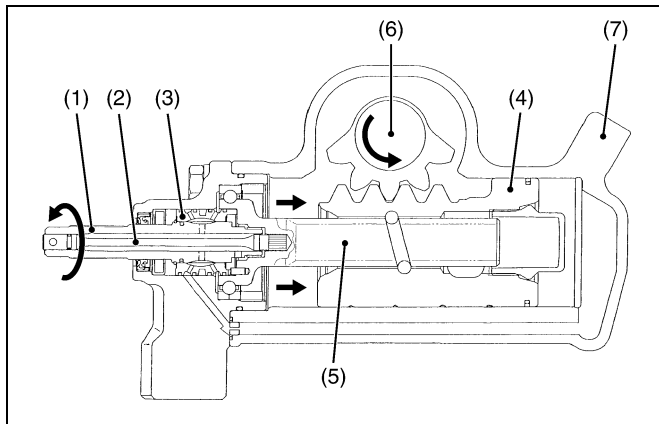
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■ Neutral Position

While the steering wheel is not moved, the torsion bar (2) is not twisted. There is no gap between the input shaft (1) and sleeve (3). This makes no pressure difference between the chambers "a" and "b" of the cylinder, which keeps the ball nut (4) and sector shaft (6) in their positions.

- | | |
|-----------------|----------------------|
| (1) Input Shaft | (6) Sector Shaft |
| (2) Torsion Bar | (7) Gear Box |
| (3) Sleeve | |
| (4) Ball Nut | a : Chamber |
| (5) Main Shaft | b : Chamber |
| | c : Pump Port |

W10179730



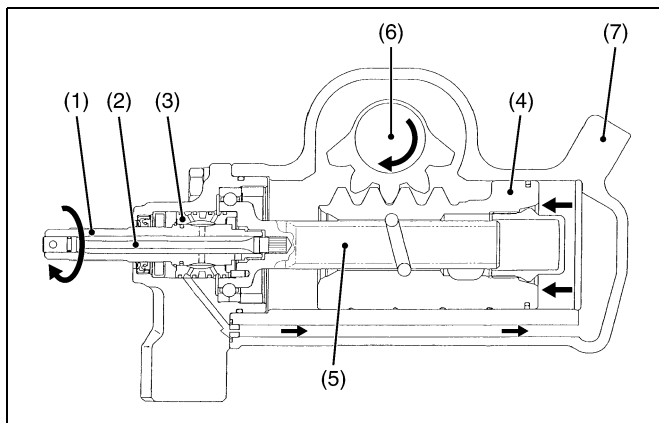
3TLAAB7P003B

■ Left Turn

When the steering wheel is turned left, the initial friction between the tires and the road surface keeps the ball nut (4) and sector shaft (6) in their positions. The torsion bar (2) alone is twisted to produce a gap between the input shaft (1) and sleeve (3) and to activate the valve. By so doing, the cylinder's chamber "a" comes under high pressure and the ball nut (4) is moved to the right. Finally the sector shaft (6) gets turned to turn the machine to the left.

- | | |
|-----------------|------------------|
| (1) Input Shaft | (5) Main Shaft |
| (2) Torsion Bar | (6) Sector Shaft |
| (3) Sleeve | (7) Gear Box |
| (4) Ball Nut | |

W10182800



3TLAAB7P003C

■ Right Turn

The operating principle is the same as with the left turn. For the right turn, however, the gap between the input shaft (1) and sleeve (3) is in the direction opposite to that of left turn. By so doing, the cylinder's chamber "b" comes under high pressure and the ball nut (4) is moved to the left. Finally the sector shaft (6) gets turned to turn the machine to the right.

- | | |
|-----------------|------------------|
| (1) Input Shaft | (5) Main Shaft |
| (2) Torsion Bar | (6) Sector Shaft |
| (3) Sleeve | (7) Gear Box |
| (4) Ball Nut | |

W10184400

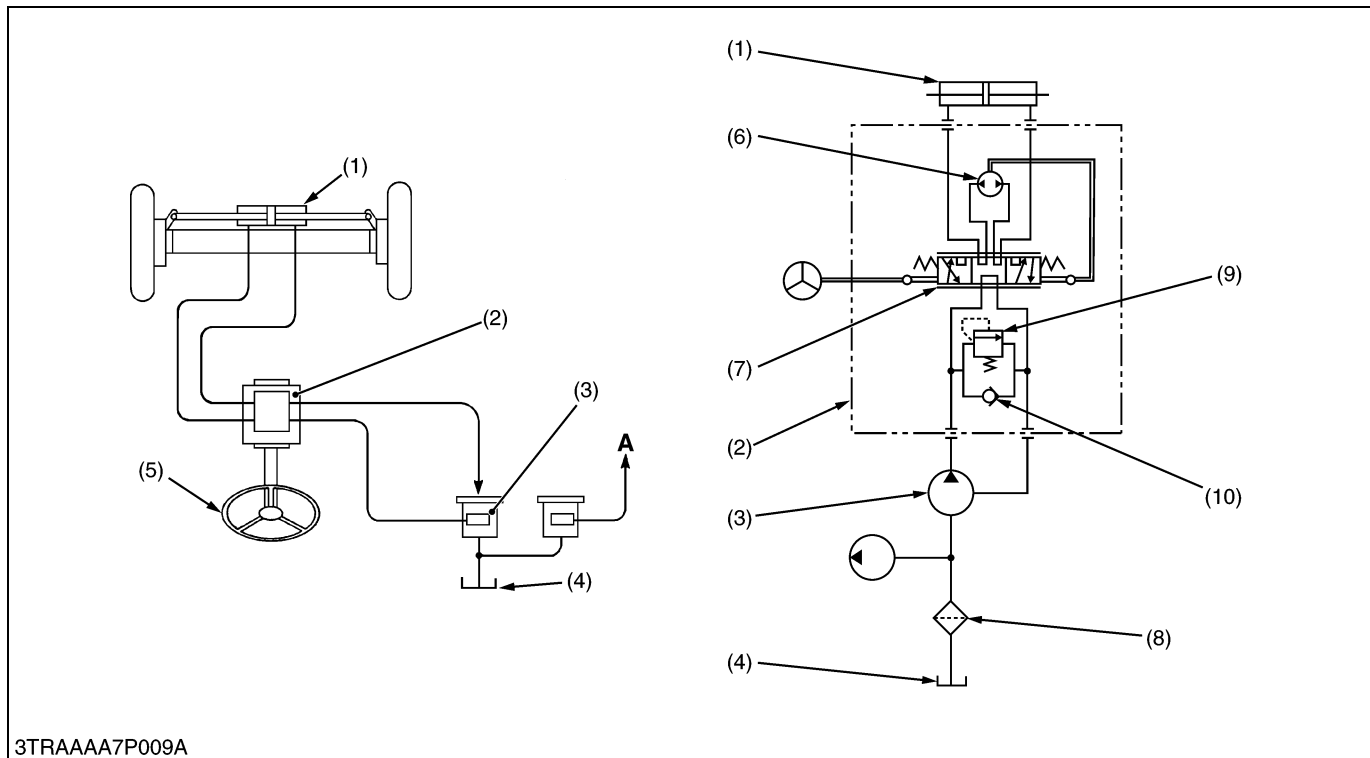
■ Manual Operation in Case of Hydraulic System Failure

Let's suppose that the hydraulic system gets in trouble due to a defective pump, damaged pipe or the like and that the steering resistance is too high to use the power steering system. In such case, the steering wheel can be in the manual mode. When the steering wheel is turned, the torsion bar is twisted for the valve's stroke and from now on the steering wheel functions in the manual mode. It should be noted that the steering wheel's play becomes larger than that in the power steering mode.

W10185610

[3] FULL HYDROSTATIC TYPE (TYPE 1) (Code No. TA470-37001, TA040-37102, TA040-37002, TA150-37004, TA530-37002, TC050-37100, TD030-37000, TD060-37000)

(1) Hydraulic Circuit



3TRAAAA7P009A

- | | | | |
|-------------------------|-----------------------|-------------------|-------------------------------------|
| (1) Steering Cylinder | (4) Transmission Case | (7) Control Valve | (10) Check Valve |
| (2) Steering Controller | (5) Steering Wheel | (8) Oil Filter | |
| (3) Hydraulic Pump | (6) Gerotor | (9) Relief Valve | A : To 3P Hydraulic Cylinder |

In the full hydrostatic power steering, the steering controller is connected to the steering cylinder with only the hydraulic piping. This steering is actuated by oil pressure. Accordingly, it does not have mechanical transmitting parts such as steering gear, pitman arm, drag link, etc.. Therefore, it is simple in construction.

■ Hydraulic Oil Flow

1. Power steering hydraulic pump (3), driven by the engine, sucks oil from transmission case (4), and it to steering controller (2).
2. The oil which has entered steering controller (2) is directed to control valve (7). As the steering wheel is turned, control valve (7) operates, and the oil passes through gerotor (6) and into steering cylinder (1). The cylinder rod then moves to control the directional movement of the front wheels.
3. Return oil from steering cylinder (1) passes through control valve (7) and back into power steering hydraulic pump (3).
4. When the engine is not operating, and the steering wheel is turned, gerotor (6) rotates to supply oil in the pipe to steering cylinder (1). Thus the machine can be steered manually. Under this condition, check valve (10) opens, and oil returning from the steering cylinder, which would otherwise return to power steering hydraulic pump (3).

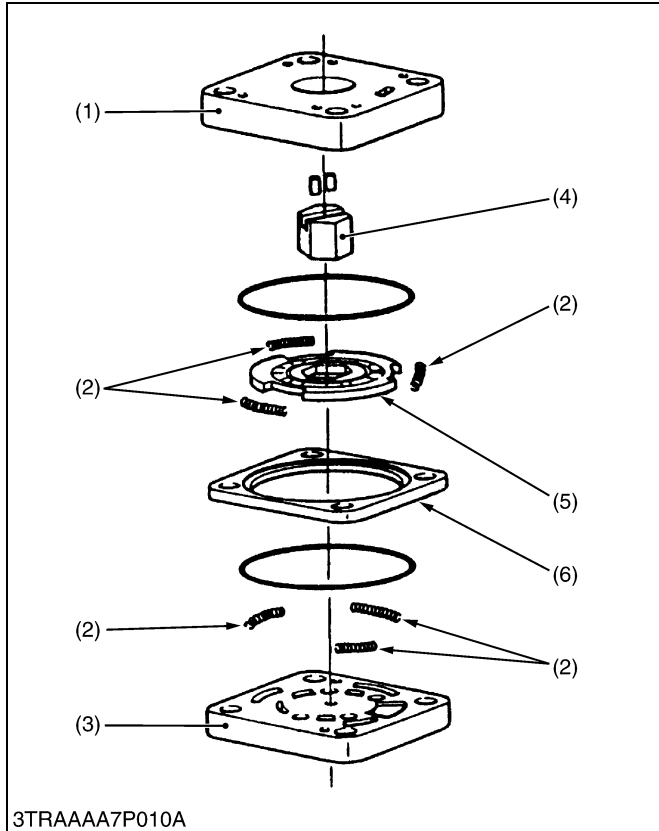
(2) Hydraulic Pump

Please refer to hydraulic system section for hydraulic pump.

(3) Steering Controller

The steering controller mainly consists of a control valve, a metering device and a relief valve with check valve. The metering device comprises a set of special gear called “Gerotor”.

(A) Control Valve



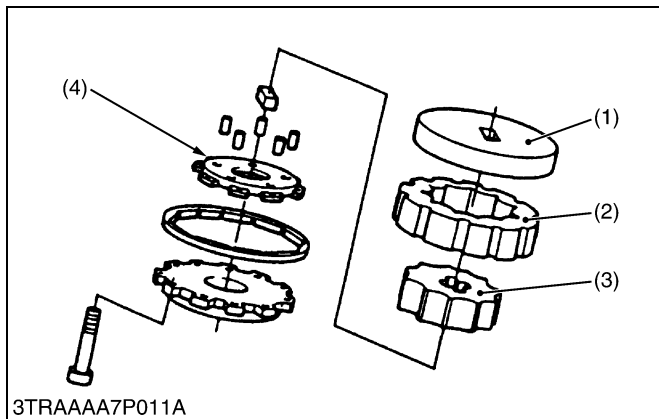
The control valve is a rotary plate type valve. When the steering wheel is not turned, the position of the valve plate (5) and the manifolds (1), (3) is kept neutral by the centering springs (2). This causes the forming of a “Neutral” oil circuit.

When the steering wheel is turned either clockwise or counterclockwise, the position of the valve plate (5) and manifolds (1), (3) changes against the centering spring. This allows the forming of a “Right Turning” or “Left Turning” oil circuit. At the same time, the gerotor rotates with the valve plate and sends the oil to the cylinder corresponding to the rotation of the steering wheel.

- | | |
|------------------------|-------------------------|
| (1) Isolation Manifold | (4) Hex. Drive Assembly |
| (2) Centering Spring | (5) Valve Plate |
| (3) Port Manifold | (6) Valve Ring |

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(B) Metering Device (Gerotor)



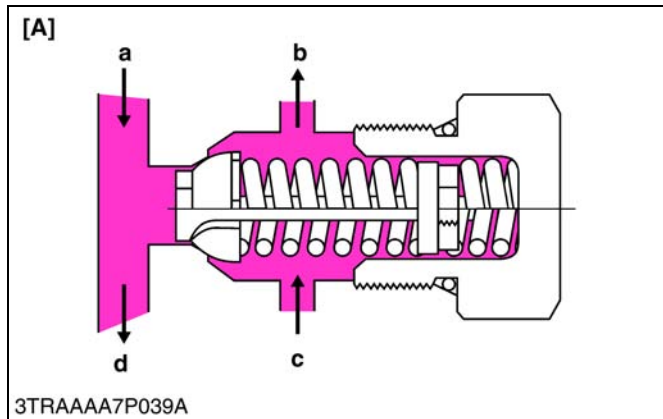
All oil directed from the hydraulic pump to the steering cylinder passes through the metering device (gerotor) on its way. This metering device is a trochoid pump. As the steering wheel is turned, the action is transmitted directly to stator (2) through drive plate (1). Thus, the gerotor sends the amount of oil corresponding to the turn of the steering wheel to the hydraulic cylinder, and the front wheels are moved through the angle corresponding to the turn of the steering wheel.

When the engine is not operating or the hydraulic pump fails. The gerotor serves as a manual pump, and thus the machine can be steered manually.

- | | |
|-----------------|----------------|
| (1) Drive Plate | (3) Rotor |
| (2) Stator | (4) Commutator |

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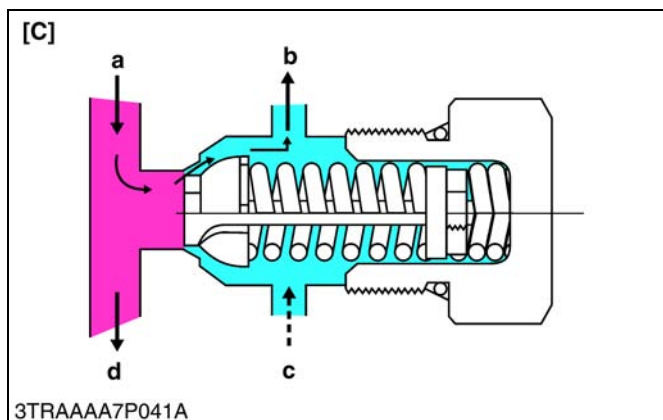
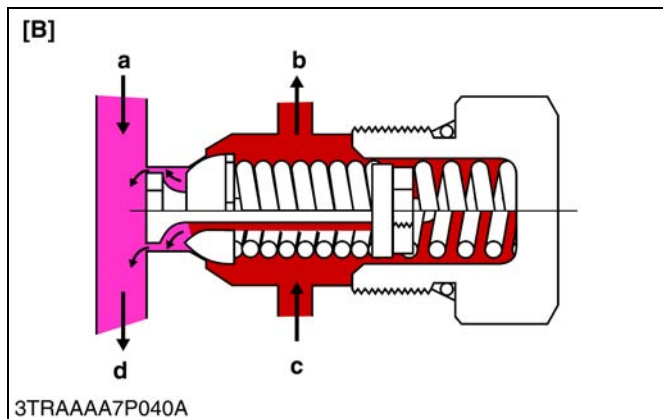
(C) Relief Valve (with Check Valve)

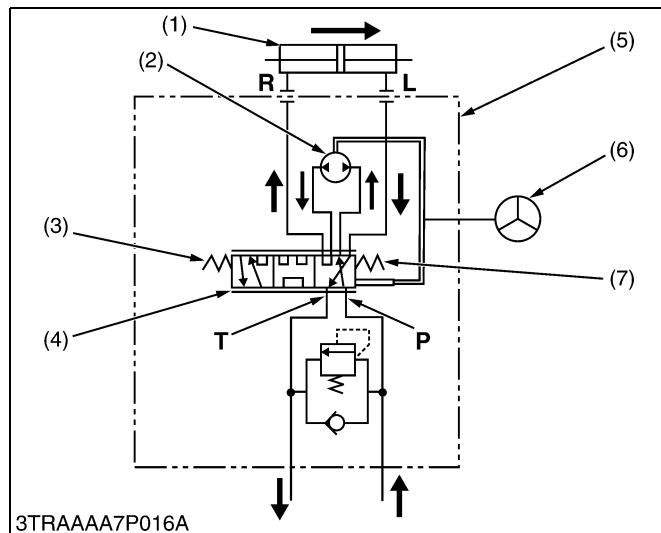
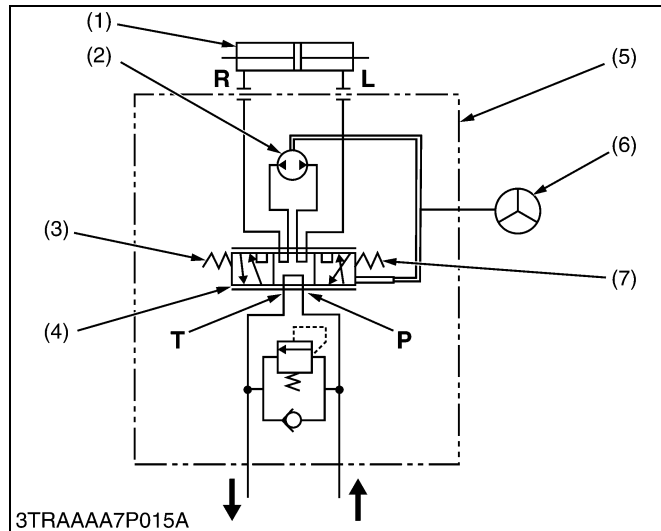


If the pressure in the hydraulic circuit rises above the set pressure of the relief valve, the relief valve will actuate to prevent the pressure from rising further and protect the hydraulic system. Also, if no oil is supplied from the hydraulic pump, the relief valve will act as a check valve and help draw oil from the return oil line to the drain hose, thus making it possible to steer the machine manually.

- | | |
|-------------------------------|------------------------|
| [A] Relief Valve | a : From Control Valve |
| [B] Relief Valve in Operation | b : To Control Valve |
| [C] Check Valve in Operation | c : From Pump |
| | d : To Drain Hose |

W10136960



(4) Oil Flow**■ Neutral Position**

When the steering wheel (6) is not being turned, valve plate (4) is held in the neutral position by centering springs (3), (7). Under this condition, an oil passage is formed between **P** port (from pump) and **T** port (to transmission case) in the control valve, and all oil from the hydraulic pump flows to **T port**.

- | | |
|-------------------------|----------------------------|
| (1) Steering Cylinder | P : Pump Port |
| (2) Gerotor | T : Tank Port |
| (3) Centering Spring | R : Cylinder Port R |
| (4) Valve Plate | L : Cylinder Port L |
| (5) Steering Controller | |
| (6) Steering Wheel | |
| (7) Centering Spring | |

W10137760

■ Right Turn

When the steering wheel is turned to the right, the action is transmitted through the drive plate, gerotor, and drive link to the control valve. Valve plate (4) then rotates to the right on manifolds, located on the opposite faces of the valve plate (4). Thus, the **P** port passage in the control valve is connected with gerotor (2).

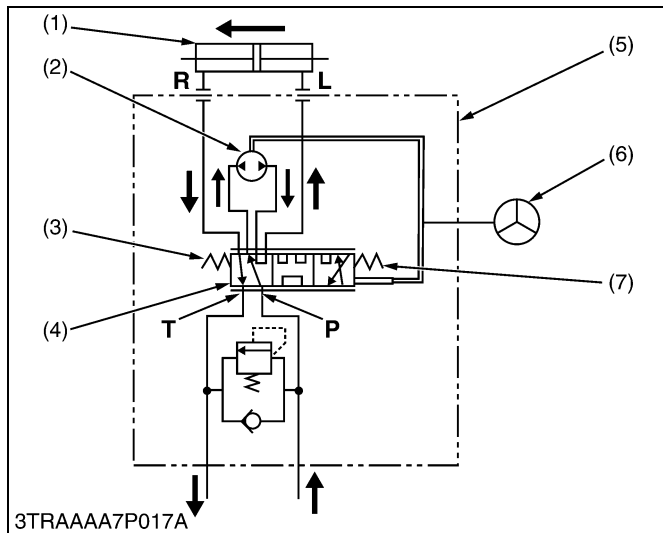
The stator of gerotor (2) turns by the amount corresponding to the turn of the steering wheel (6), and the gerotor performs the metering function and lets oil through it, the amount of which corresponds to the turn of the steering wheel (6).

The oil which has passed through gerotor (2) flows back to the control valve, in which it is directed to cylinder port **R** to operate steering cylinder (1). Consequently, the front wheels are moved to the right through the angle corresponding to the amount of the oil.

When steering cylinder (1) operates, oil returning to cylinder port **L** flows back to the transmission case through the passage connected to **T** port in the control valve.

- | | |
|-------------------------|----------------------------|
| (1) Steering Cylinder | P : Pump Port |
| (2) Gerotor | T : Tank Port |
| (3) Centering Spring | R : Cylinder Port R |
| (4) Valve Plate | L : Cylinder Port L |
| (5) Steering Controller | |
| (6) Steering Wheel | |
| (7) Centering Spring | |

W10139140



■ **Left Turn**

The steering system operates in the same way at a left-turn as well, except that oil flows into and out of steering cylinder in the directions opposite to those at a right-turn.

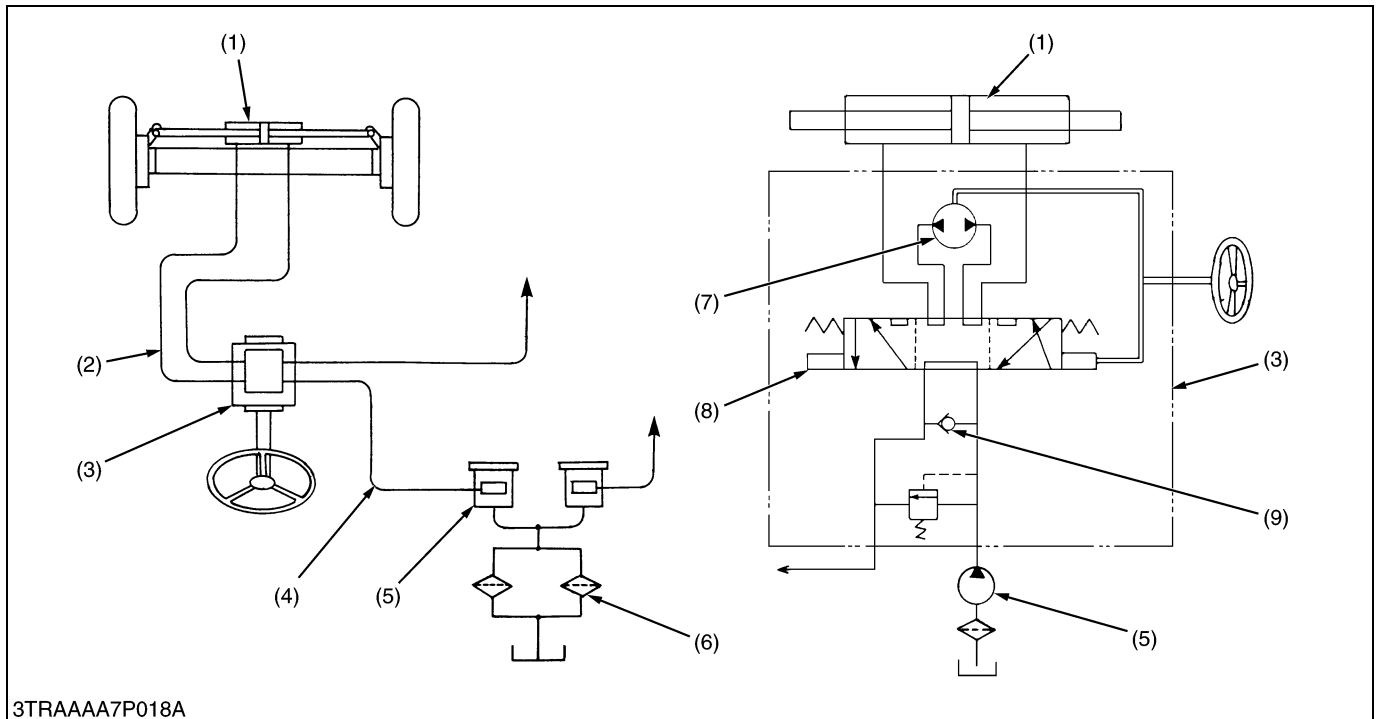
- (1) Steering Cylinder
- (2) Gerotor
- (3) Centering Spring
- (4) Valve Plate
- (5) Steering Controller
- (6) Steering Wheel
- (7) Centering Spring

- P : Pump Port**
- T : Tank Port**
- R : Cylinder Port R**
- L : Cylinder Port L**

W10140410

[4] FULL HYDROSTATIC TYPE (TYPE 2) (Code No. 3A111-63072)

(1) Hydraulic Circuit



(1) Steering Cylinder
 (2) Power Steering Hose
 (3) Steering Controller

(4) Power Steering Pipe
 (5) Hydraulic Pump

(6) Oil Filter (Magnet)
 (7) Gerotor

(8) Control Valve
 (9) Check Valve

■ Hydraulic Oil Flow

When the engine starts, the hydraulic pump (5) of the power steering system pressure-feeds the oil drawn from the transmission case through the suction pipe.

The oil which has entered steering controller (3) is directed to control valve (8).

As the steering wheel is turned, control valve (8) operates and the oil passes through gerotor (7) and into steering cylinder (1). The cylinder rod then moves to control the directional movement of the front wheels.

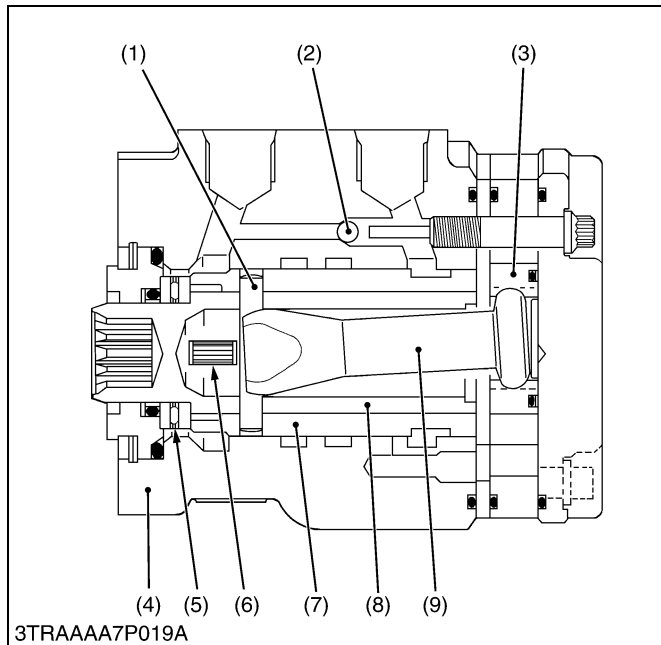
Return oil from steering cylinder (1) passes through control valve (8) is sent to the PTO clutch valve.

When the engine is not operating, and the steering wheel is turned, gerotor (7) rotates to supply oil to steering cylinder (1). Thus the machine can be steered manually.

(2) Hydraulic Pump

Please refer to hydraulic system section for hydraulic pump.

(3) Steering Controller



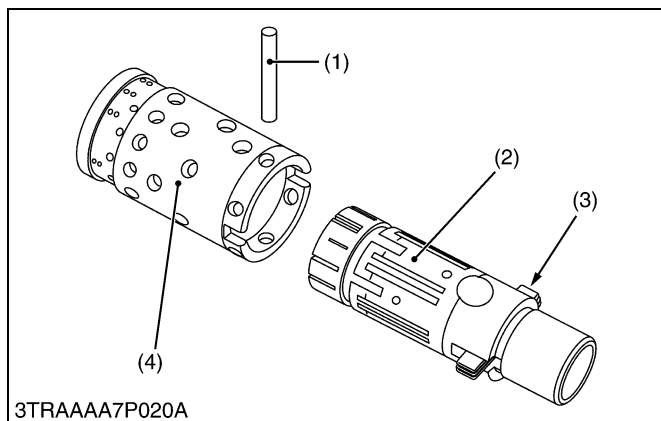
The steering controller mainly consists of a control valve, a metering device and a relief valve.

The metering device comprises a set of special gear called "**Gerotor**".

- | | |
|----------------------|----------------------|
| (1) Dowel Pin | (6) Centering Spring |
| (2) Check Valve | (7) Sleeve |
| (3) Gerotor | (8) Spool |
| (4) Housing | (9) Drive Shaft |
| (5) Bearing Assembly | |

W10133560

(A) Control Valve



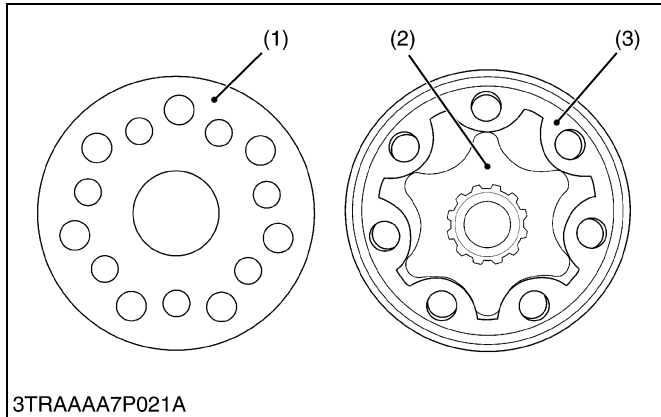
The control valve is a rotating spool type. When the steering wheel is not turned, the valve is kept in the neutral position by the centering spring (3).

Then, the oil flow from the hydraulic pump to the steering cylinder and from the steering cylinder to the transmission case is shut off. Oil from the hydraulic pump is sent to the transmission case through the control valve.

When the steering wheel is turned clockwise or counterclockwise, the control valve, together with the gerotor, changes the direction of oil flow to the steering cylinder according to the direction, the steering wheel was turned.

- | | |
|---------------|----------------------|
| (1) Dowel Pin | (3) Centering Spring |
| (2) Spool | (4) Sleeve |

W10134810

(B) Metering Device (Gerotor)

All oil sent from the hydraulic pump to the steering cylinder, passes through the metering device (Gerotor).

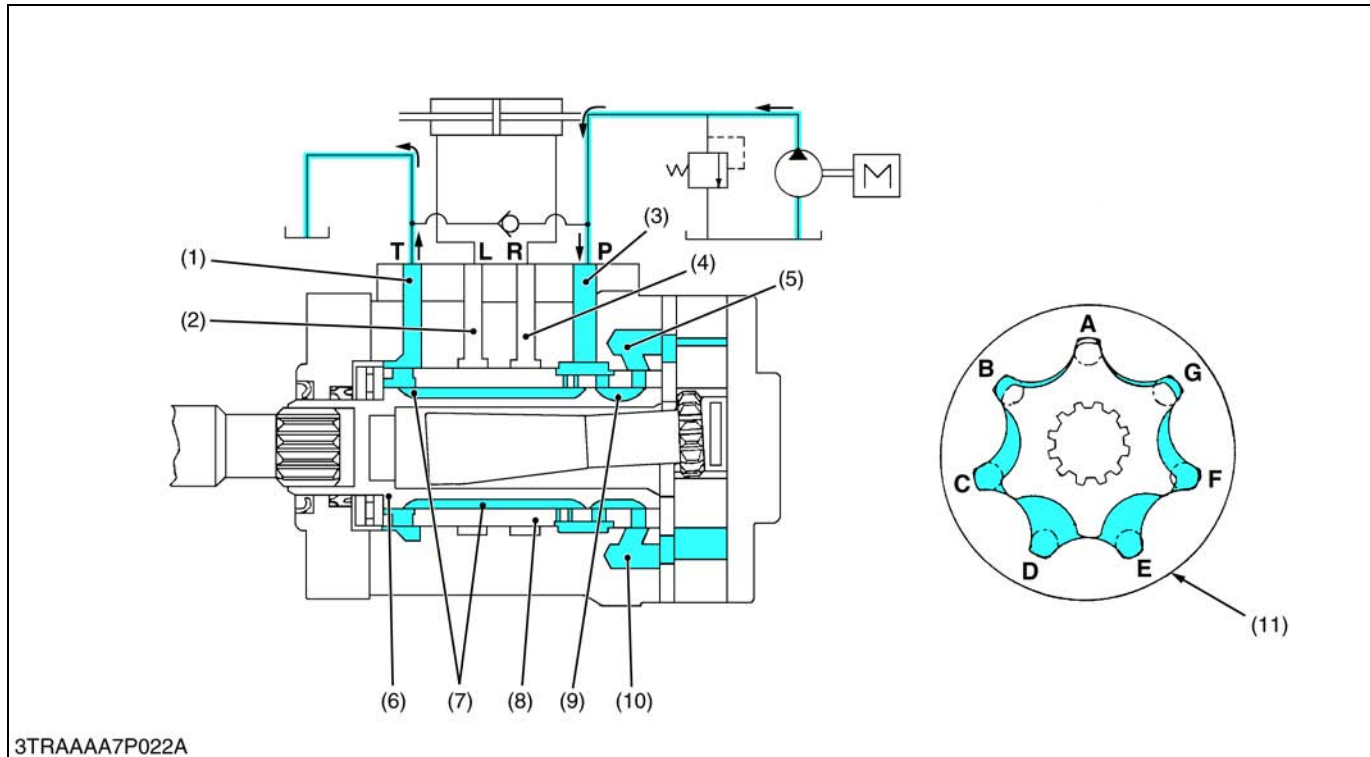
Namely, when the rotor is drive, three chambers suck in oil due to volumetric change in the pump chambers formed between the rotor (2) and the stator (3), while oil is discharged from other three chambers. On the other hand, rotation of the steering wheel is directly transmitted to the rotor through the steering shaft, spool, drive shaft, etc..

Accordingly, the gerotor serves to supply the steering cylinder with oil, amount of which corresponds to the rotation of the steering wheel. The wheels are thus turned by the angle corresponding to the rotation of the steering wheel.

When the engine stops or the hydraulic pump malfunctions, the gerotor functions as a manual trochoid pump, which makes manual steering possible.

- (1) Distributor Plate (3) Stator
(2) Rotor

W10135720

(4) Oil Flow**■ Neutral Position**

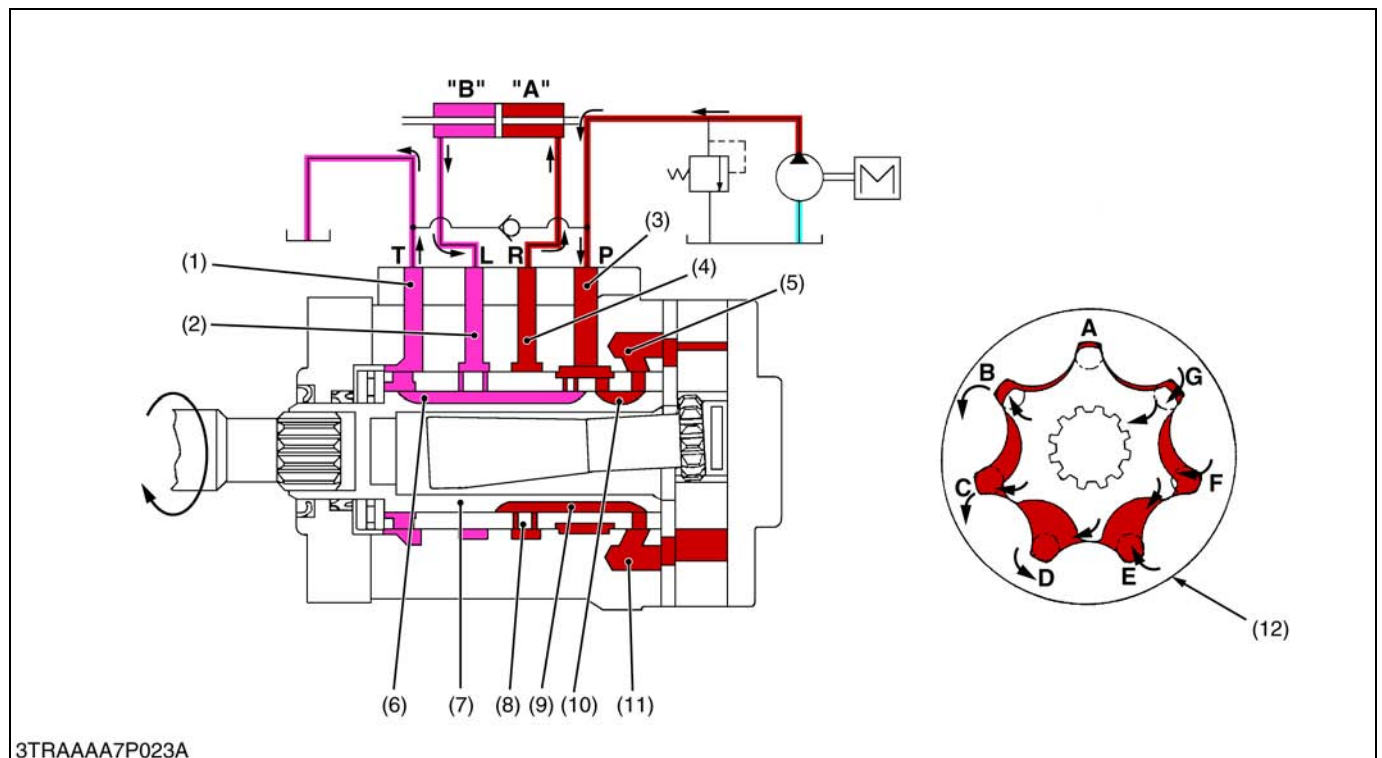
- | | | | |
|-------------|-------------|------------------|--------------|
| (1) Passage | (4) Passage | (7) Spool Groove | (10) Passage |
| (2) Passage | (5) Passage | (8) Sleeve | (11) Gerotor |
| (3) Passage | (6) Spool | (9) Spool Groove | |

When the steering wheel is not turned, the control valve is kept in neutral position by the centering spring.

Oil, sent from the hydraulic pump to pump port **P**, returns to the transmission case from tank port **T**, passing through the passage (3), spool groove (7), and passage (1).

The cylinder ports **L** and **R** are blocked by the sleeve. So the piston does not act, when affected by an external force, due to which the wheels are held running straight forward or turning at a given angle.

■ Right Turning

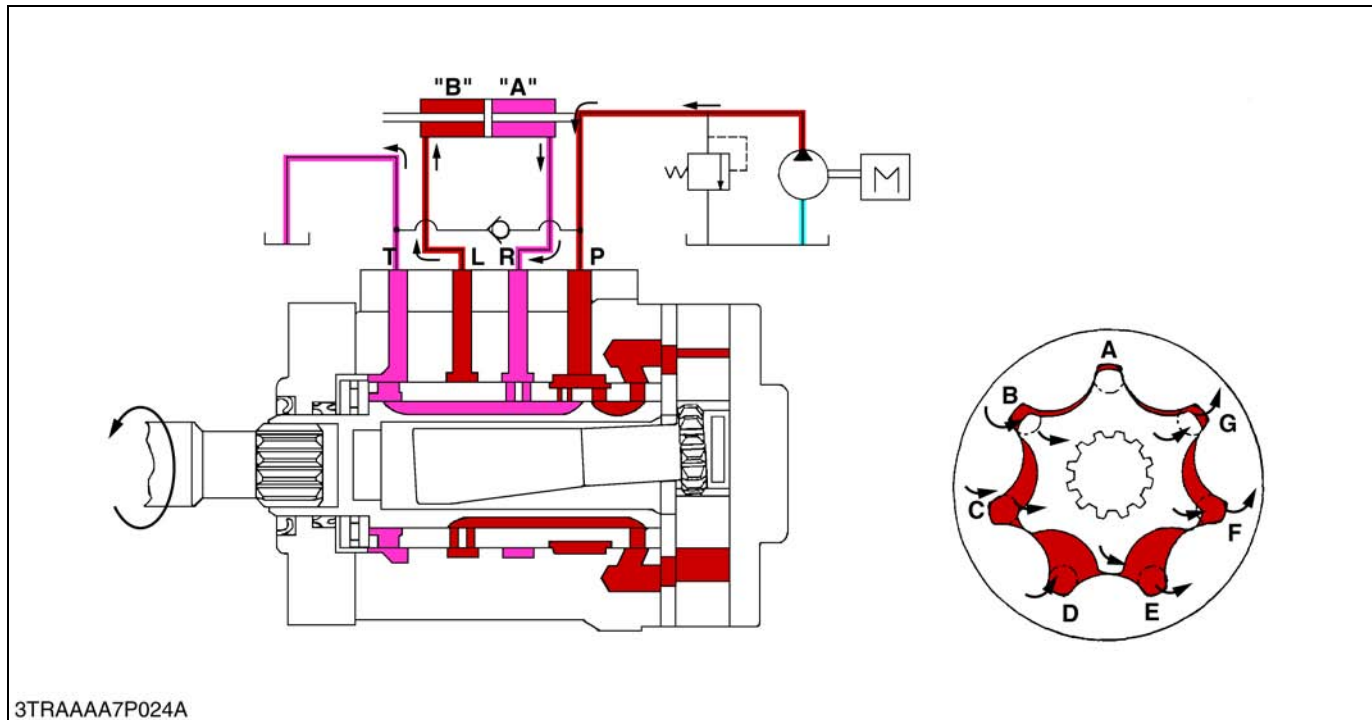


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(1) Passage	(4) Passage	(7) Spool	(10) Spool Groove
(2) Passage	(5) Passage	(8) Sleeve	(11) Passage
(3) Passage	(6) Spool Groove	(9) Passage	(12) Gerotor

1. When the operator attempts to turn the steering wheel clockwise, only the spool (7) is rotated a small amount overcoming the force of the centering spring, thereby causing a relative displacement between the spool (7) and the sleeve (8). As a result, while the passage from the passage (3) to the spool groove (6) is throttled, the passage from (3) to (1) and (5) is opened, forming a passage to the three pump chambers **E**, **F** and **G** (in sucking-in state) of the gerotor. At the same time, a passage is formed from the three chambers **B**, **C** and **D** (in oil discharging state) of the gerotor to the cylinder port **R** through the passages (11), (9) and (4).
2. Oil pressure generated at this time in the three chambers **E**, **F** and **G** of the gerotor, that is oil pressure generated in the spool groove (10), is set depending on the extent of throttling from (3) to (6). The extent of throttling increases as the relative displacement between the spool (7) and the sleeve (8) increases. Accordingly, at small relative displacements, oil pressure generated in the three chambers **E**, **F** and **G** of the gerotor is too low to move the piston overcoming road resistance. When the relative displacement increases to such an extent that oil pressure generated in the three chambers **E**, **F** and **G** rises up to the operating pressure, the rotor rotates and oil in the three chambers **B**, **C** and **D** of the gerotor which are in the discharging state is pressure-fed to the cylinder chamber "**A**" to steer. On the other hand, oil discharged from the cylinder chamber "**B**" returns to the oil tank from tank port **T**, after following through the passages (2), (6) and (1) from the cylinder port **L**.
3. When the steering wheel is turned, a relative displacement develops and generates operating pressure corresponding to the road resistance, and the spool (7) and sleeve (8) rotate as the steering wheel is turned. As already described, the gerotor serves as a metering device so that the wheels are turned to the angle corresponding to the turn of the steering wheel.
4. When the steering wheel is stopped, a relative displacement between the spool (7) and the sleeve (8) becomes zero due to the function of the centering spring, and the neutral state is restored.

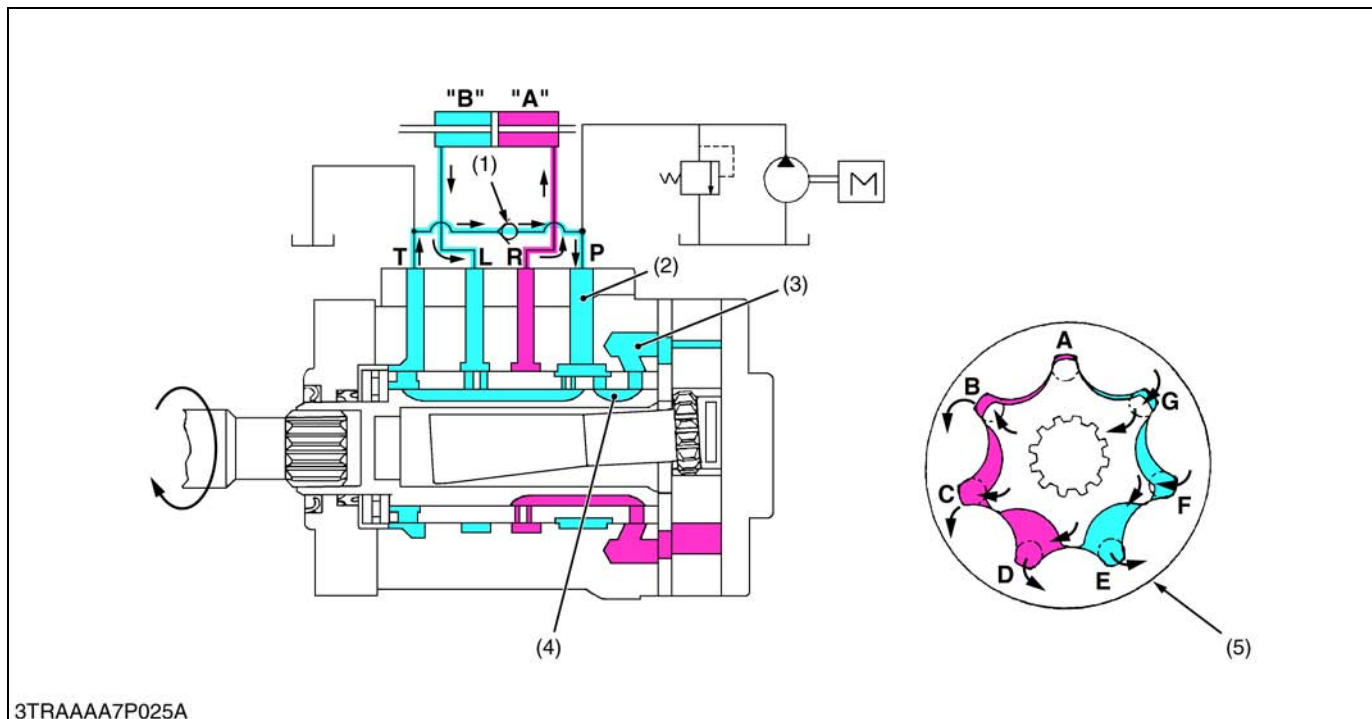
■ Left Turning



3TRAAAA7P024A

Operation mechanism for left turning is the same as that for right turning, except for directions of oil flow from and to the steering cylinder.

■ Manual Operation



3TRAAAA7P025A

(1) Check Valve
(2) Passage

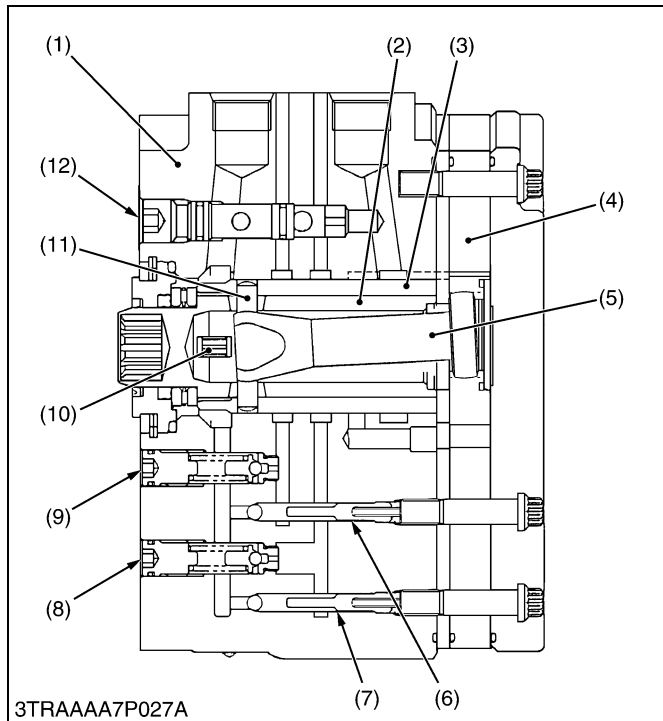
(3) Passage

(4) Spool Groove

(5) Gerotor

As already described, in the case of manual operation the gerotor functions as a hand-operated trochoid pump. Accordingly, when the rotor in the gerotor is driven by steering force, oil is sucked from the oil tank through the check valve provided in the housing, passage (2), spool groove (4) and passage (3). And oil is pressure-fed to the cylinder, and flows through the same route as in power steering operation. (The illustration shows right turning.)

(3) Steering Controller

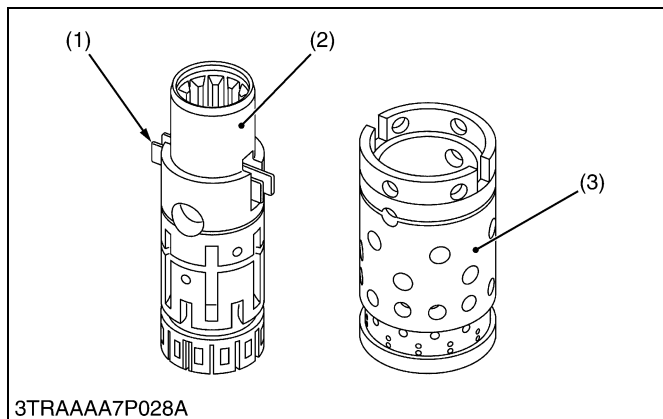


The steering controller is separated into a control valve and a metering device. The control valve consists of the housing (1), spool (2), sleeve (3), etc.. The metering device is composed of a special gear set called "Gerotor" (4).

- (1) Housing
- (2) Spool
- (3) Sleeve
- (4) Gerotor
- (5) Drive Shaft
- (6) Check Valve (Except Code No. 3F240-63071)
- (7) Check Valve (Except Code No. 3F240-63071)
- (8) Overload Relief Valve (Except Code No. 3F240-63071)
- (9) Overload Relief Valve (Except Code No. 3F240-63071)
- (10) Centering Spring
- (11) Dowel Pin
- (12) Check Valve

W10172020

(A) Control Valve



The control valve is a rotating spool type. When the steering wheel is not turned, the valve is kept in the neutral position by the centering spring (1).

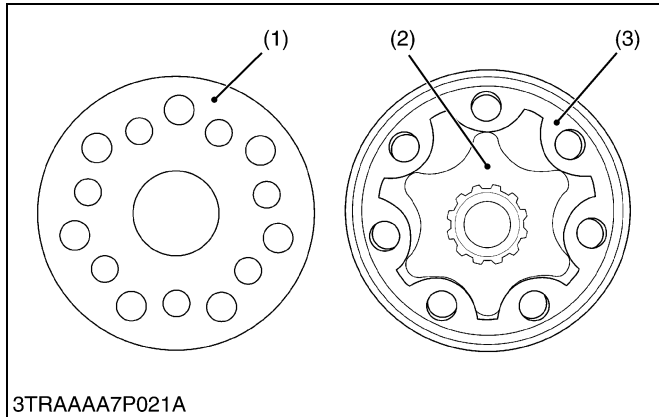
Then, the oil flow from the hydraulic pump to the steering cylinder and from the steering cylinder to the transmission case is shut off. Oil from the hydraulic pump is sent to the transmission case through the control valve.

When the steering wheel is turned clockwise or counterclockwise, the control valve, together with the gerotor, changes the direction of oil flow to the steering cylinder according to the direction, the steering wheel was turned.

- (1) Centering Spring
- (2) Spool
- (3) Sleeve

W10174880

(B) Metering Device (Gerotor)



3TRAAAA7P021A

All oil sent from the hydraulic pump to the steering cylinder, passes through the metering device (Gerotor).

Namely, when the rotor is drive, three chambers suck in oil due to volumetric change in the pump chambers formed between the rotor (2) and the stator (3), while oil is discharged from other three chambers. On the other hand, rotation of the steering wheel is directly transmitted to the rotor through the steering shaft, spool, drive shaft, etc..

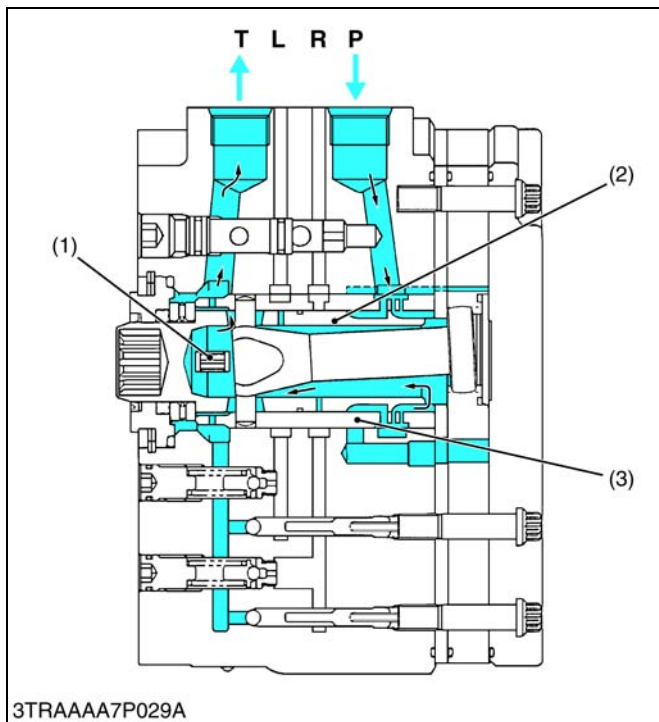
Accordingly, the gerotor serves to supply the steering cylinder with oil, amount of which corresponds to the rotation of the steering wheel. The wheels are thus turned by the angle corresponding to the rotation of the steering wheel.

When the engine stops or the hydraulic pump malfunctions, the gerotor functions as a manual trochoid pump, which makes manual steering possible.

- (1) Distributor Plate
- (2) Rotor
- (3) Stator

W1234567

(4) Oil Flow



3TRAAAA7P029A

■ Neutral Position

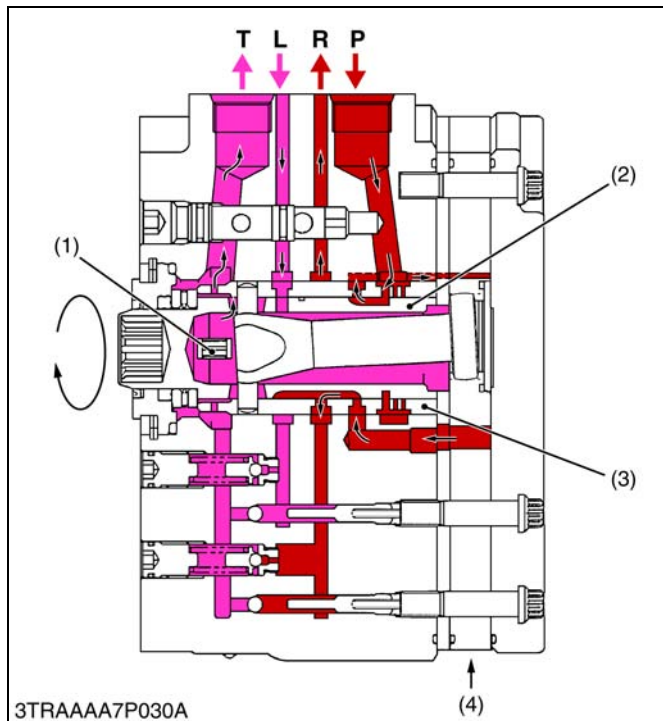
When the steering wheel is not turned, the control valve is kept in neutral position by the centering spring (1).

Oil, sent from the hydraulic pump to **P** port returns to the transmission case from **T** port.

The cylinder ports **L** and **R** are blocked by the sleeve (3). So the piston does not act, when affected by an external force, due to which the wheels are held running straight forward or turning at a given angle.

- (1) Centering Spring
- (2) Spool
- (3) Sleeve
- P : P Port**
- T : T Port**
- R : R Port**
- L : L Port**

W10177260



■ **Right Turning**

When the steering wheel is turned clockwise, the spool (2) and sleeve (3) rotate, but due to friction, there occurs slight lag in angle during rotation.

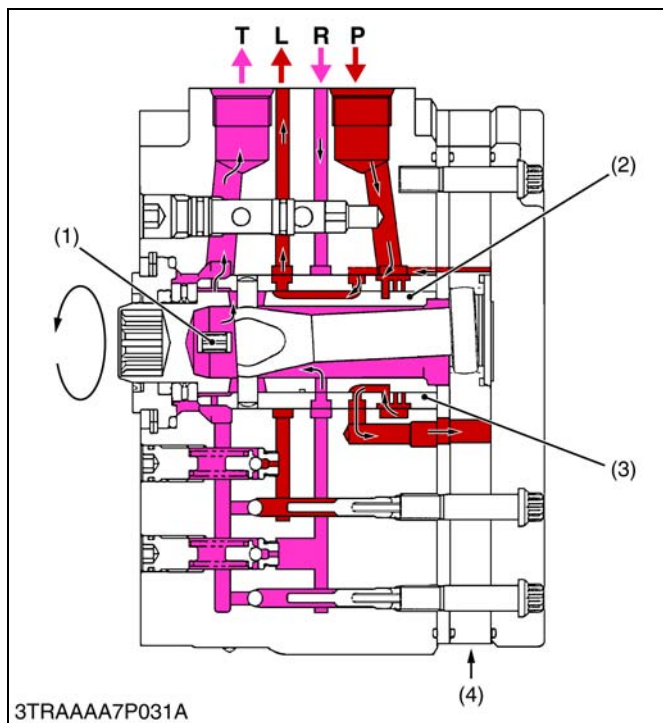
Thereby, a relative displacement develops and generates operating pressure corresponding to the road resistance, and the spool (2) and sleeve (3) rotate as the steering wheel is turned. The oil sent from hydraulic pump to **P** port flows to power steering cylinder through **R** port.

On the other hand, oil discharged from power steering (**L** port) cylinder returns to the transmission case from **T** port. As already described, the gerotor (4) serves as a metering device so that the wheels are turned to the angle corresponding to the turn of the steering wheel.

When the steering wheel is stopped, a relative displacement between the spool (2) and the sleeve (3) becomes zero due to the function of the centering spring (1), and the neutral state is restored.

- | | |
|----------------------|-------------------|
| (1) Centering Spring | P : P Port |
| (2) Spool | T : T Port |
| (3) Sleeve | R : R Port |
| (4) Gerotor | L : L Port |

W10178530

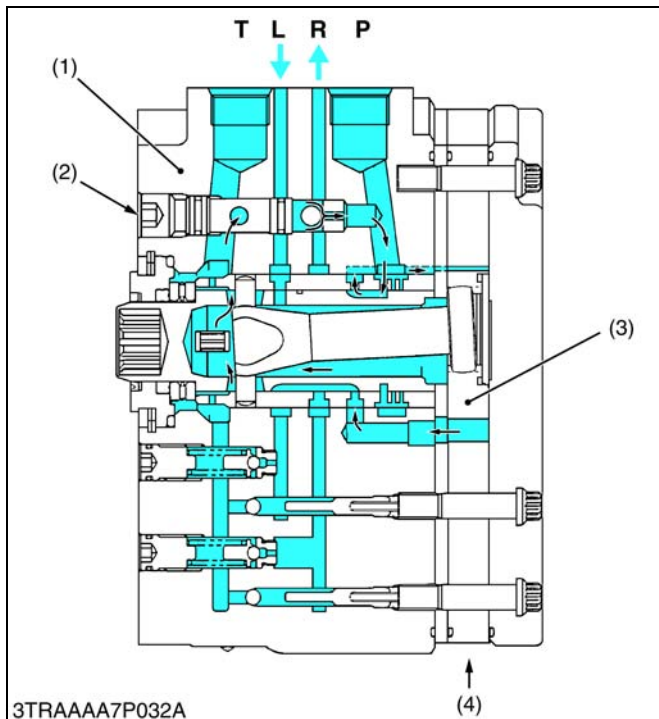


■ **Left Turning**

Operation mechanism for left turning is the same as that for right turning, except for directions of oil flow from and to the steering cylinder.

- | | |
|----------------------|-------------------|
| (1) Centering Spring | P : P Port |
| (2) Spool | T : T Port |
| (3) Sleeve | R : R Port |
| (4) Gerotor | L : L Port |

W10179760

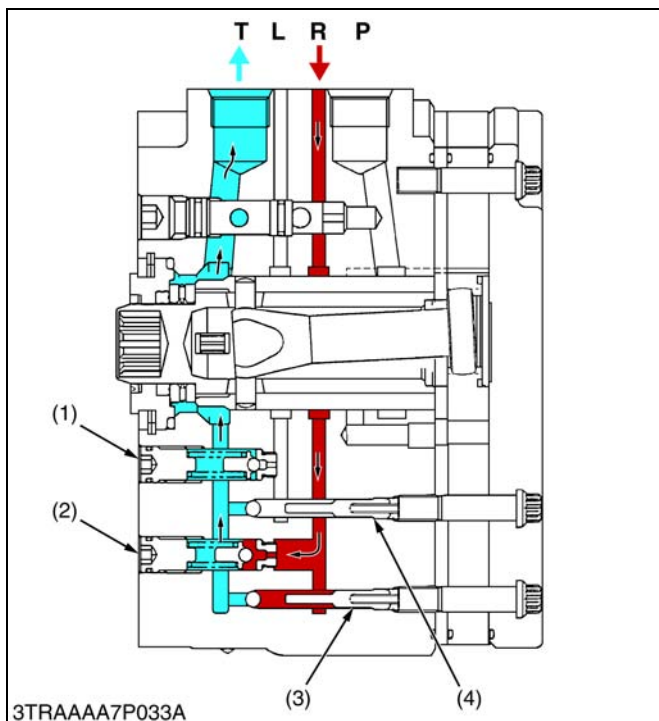


■ Manual Operation

In the case of manual operation, the gerotor functions as a hand-operated trochoid pump. Accordingly, when the rotor (3) in the gerotor (4) is driven by steering force, oil is sucked from the oil tank through the check valve (2) provided in the housing (1). And oil is pressure-fed to the cylinder, and flows through the same route as in power steering operation. (The illustration shows right turning.)

- | | |
|-----------------|-------------------|
| (1) Housing | P : P Port |
| (2) Check Valve | T : T Port |
| (3) Rotor | R : R Port |
| (4) Gerotor | L : L Port |

W10181960



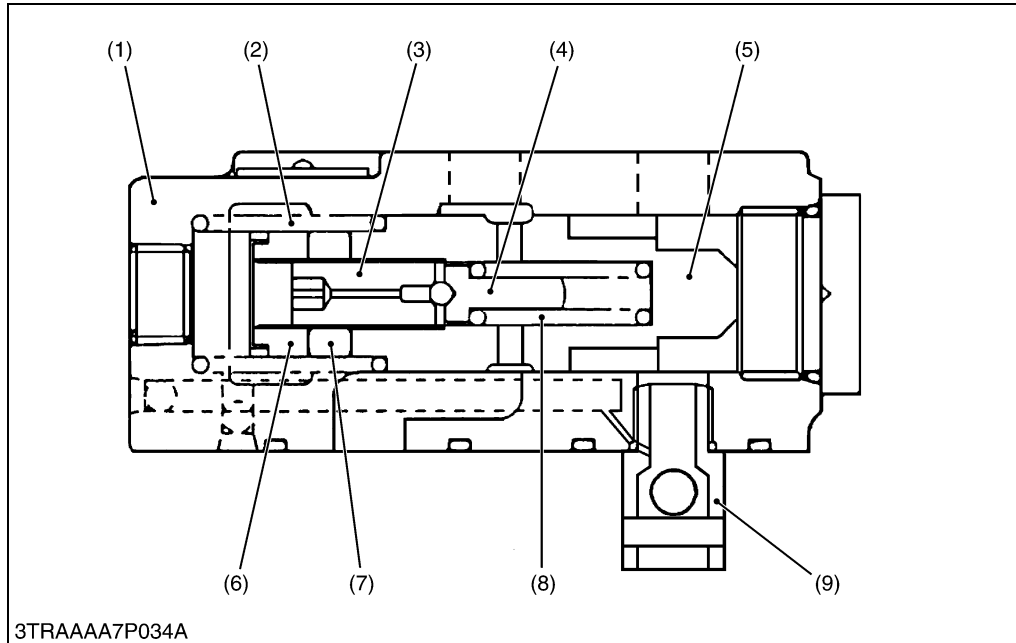
■ Overload Relief Valve and Check Valve (Except Code No. 3F240-63071)

Two overload relief valves (1), (2) are located in the steering valve. When a front wheel strikes a solid object. The position in power steering cylinder is forced to one side by the piston rod and oil pressure increases greatly in the hydraulic lines. The ball of the check valve (3) is closed and overload relief valve (2) is opened immediately. The overload relief valve permits oil to flow into the return oil passage. This return oil opens another check valve (4) and is flowed to the unloaded side of the cylinder and to the T port.

Thereby, the cylinder is prevented any interruption of the oil column.

- | | |
|---------------------------|-------------------|
| (1) Overload Relief Valve | P : P Port |
| (2) Overload Relief Valve | T : T Port |
| (3) Check Valve | R : R Port |
| (4) Check Valve | L : L Port |

W10183090

(5) Flow Control Valve (Relief Valve)

- (1) Valve Housing
- (2) Spring
- (3) Valve Seat
- (4) Pilot Valve
- (5) Spool
- (6) Filter
- (7) Lock Nut
- (8) Spring
- (9) Check Valve

W10187310

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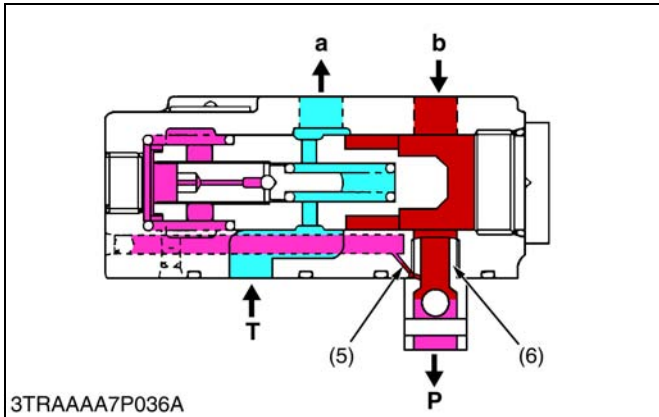
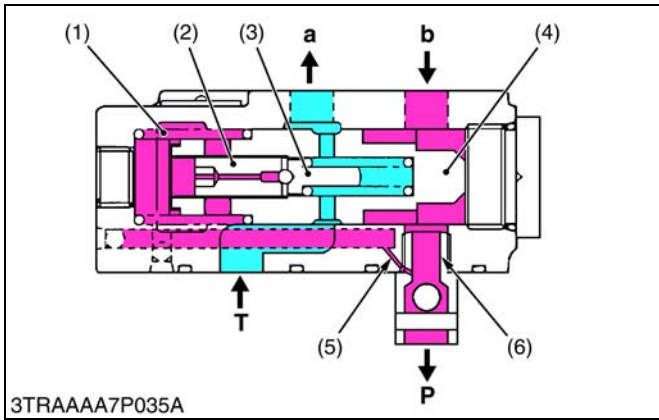
This full hydrostatic power steering system has a flow control valve which is directly connected to the control valve. It restricts amount of oil to be supplied to the control valve as well as maximum working pressure in the hydraulic circuit.

Thereby, even when the discharge of hydraulic pump increases proportionally to the engine speed, excessive oil is released to the tank (Flow control).

In the case when the piston reaches its stroke end or resistance to the wheels to be turned is too large, this valve serves as a relief valve, thereby maintaining safety of the hydraulic circuit (Pressure control).

As a constant volume type hydraulic pump is used, pump discharge increases proportionally to the engine speed. However, the flow control valve controls constant amount of oil supplied to the control valve.

As a result, steering wheel operating force is stabilized and excessive flow is released to the oil tank, which result in decreased piping resistance and engine load.



■ **Flow Control**

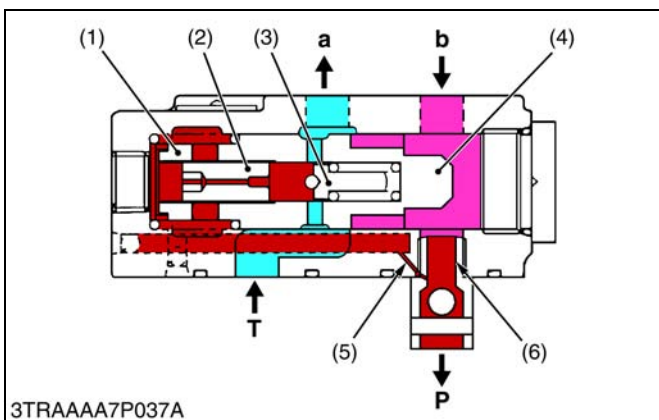
1. In this valve, **P** port side pressure is led to the left side of the spool (4) through orifice **B** (5) and gives a force pushing the spool (4) to the right together with the spring (1). Oil pressure fed from the pump is delivered from the **P** port to the controller through orifice **A** (6).
If pump discharge is small, pressure difference generated between the ends of orifice **A** (6) is low and setting load of the spring (1) overcomes the force to move the spool (4) to the left owing to the pressure difference at left and right sides of the spool (4). Therefore, the spool does not move and all amount of oil flowing from pump is led to the controller through **P** port.
2. As the pump discharge increases as the engine speed increases, pressure difference generated between the ends of the orifice **A** (6) rises. When oil flow exceeds setting flow, pressure difference at left and right sides of the spool (4) (it generates between the ends of the orifice **A**), overcomes to spring force. Therefore, the spool (4) is moved to the left and release excessive flow to the oil tank.
3. In this case, the spool (4) moves to the place where the pressure difference is balanced with the spring force. Even when the pump discharge fluctuates and exceeds the setting flow, the spool maintains constant pressure difference (approx. 3.0 kgf/cm², 42,7 psi) between the ends of the orifice **A** (6). Thereby, setting amount of oil is delivered to the control valve through the orifice **A** (6).

- | | |
|-----------------|------------------------|
| (1) Spring | a : To Oil Tank |
| (2) Valve Seat | b : From Pump |
| (3) Pilot Valve | P : P Port |
| (4) Spool | T : T Port |
| (5) Orifice B | |
| (6) Orifice A | |

W10188460

■ **Pressure Control (Relief Operation)**

Pressure at the controller side (**P** port side) is led to the left side of the spool (4) through orifice **B** (5). When the controller side pressure rises up to the relief setting pressure, the pilot valve (3) opens and the pressure at the left side of the spool reduces abruptly. At this time, the force affecting the spool is unbalanced, causing the spool to move to the left. Accordingly, oil in the main circuit is released to the tank through the **T** port, and pressure in the main circuit is prevented from rising.

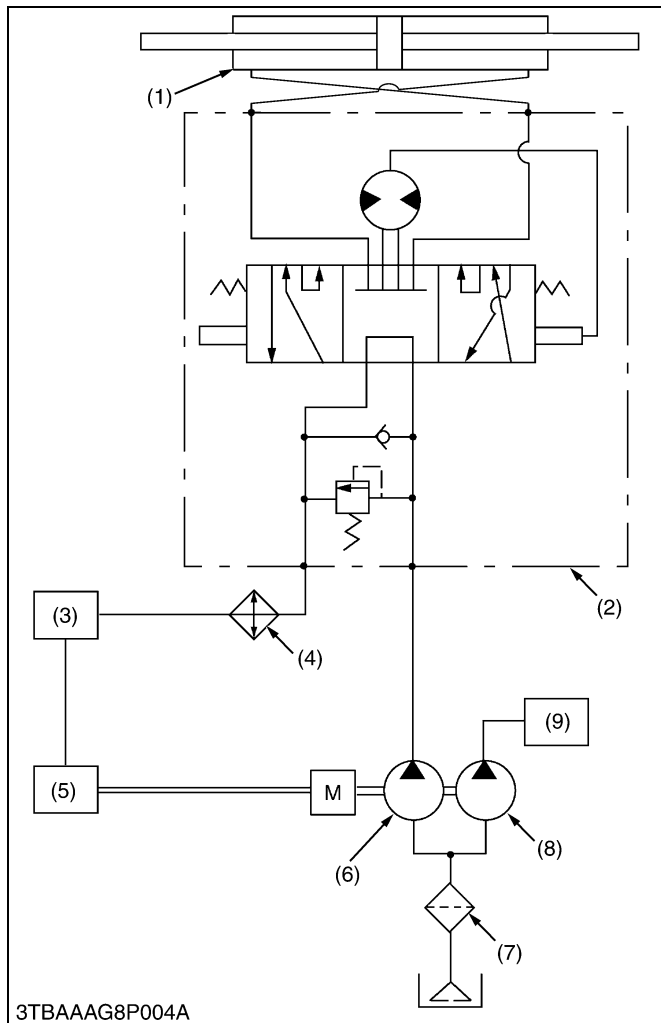


- | | |
|-----------------|------------------------|
| (1) Filter | a : To Oil Tank |
| (2) Valve Seat | b : From Pump |
| (3) Pilot Valve | P : P Port |
| (4) Spool | T : T Port |
| (5) Orifice B | |
| (6) Orifice A | |

W10193210

[6] FULL HYDROSTATIC TYPE (TYPE 4) (Code No. 6C200-41100)

(1) Hydraulic Circuit



Hydraulic oil for power steering is forced by the hydraulic pump (6).

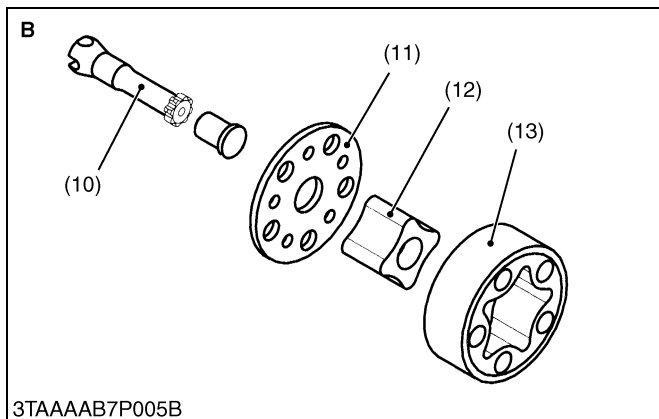
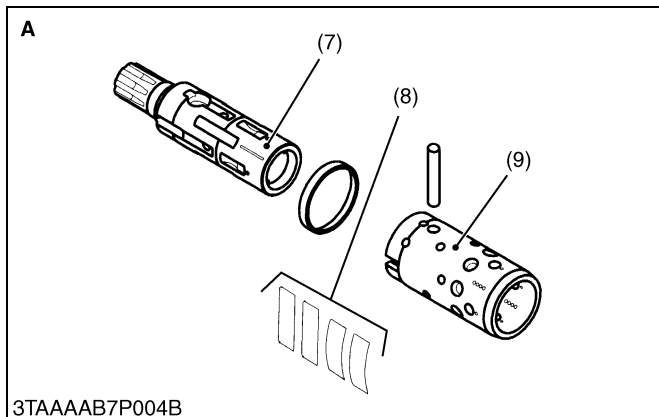
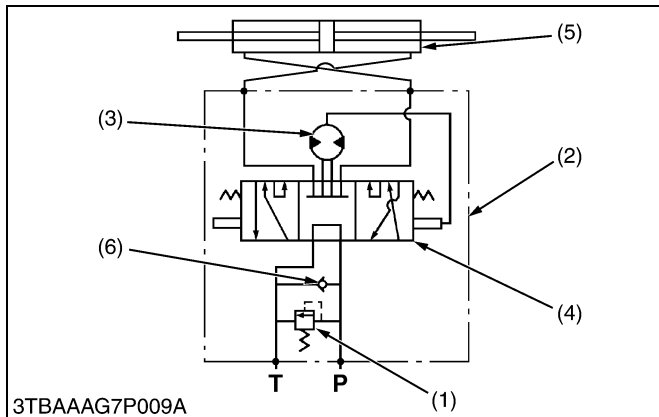
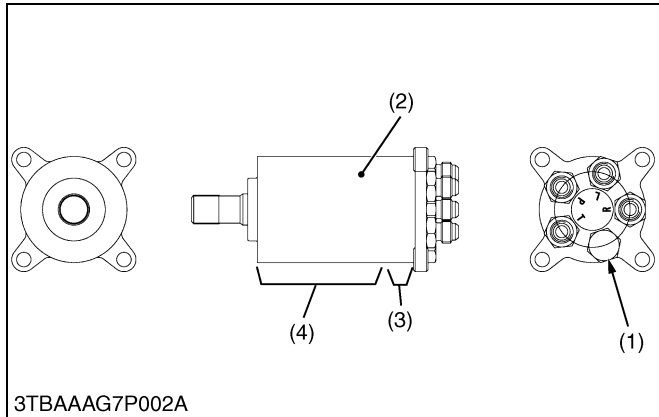
Hydraulic oil in the power steering controller is controlled by the steering wheel.

The controlled oil is forced to the power steering cylinder. The oil to the controller is forced return through oil cooler (4) to independent PTO (3) and HST (5).

- | | |
|-------------------------------|--|
| (1) Power Steering Cylinder | (6) Hydraulic Pump (for Power Steering, Independent PTO and HST) |
| (2) Power Steering Controller | (7) Oil Filter Cartridge |
| (3) Independent PTO | (8) Hydraulic Pump (for 3-Points Hitch) |
| (4) Oil Cooler | (9) 3-Points Hitch |
| (5) HST | |

W10327540

(2) Steering Controller



The steering controller consists of a control valve (4) and a metering device (3)

■ Control Valve

The control valve is a rotating spool type. When the steering wheel is not turned, the position of the spool (7) and sleeve (9) is kept neutral by the centering spring (8). This causes the forming of a "Neutral" oil circuit. When the steering wheel is turned either clockwise or counterclockwise, the position of the spool and sleeve changes in relation to the centering spring. This allows the forming of a "Right Turning" or "Left Turning" oil circuit. At the same time, the gear pump (Metering device) rotates with the spool and sends the oil to the cylinder corresponding to the rotation of the steering wheel.

■ Metering Device

An oil, sent from the hydraulic pump to the steering cylinder, passes through the metering device (3). Namely, when the rotor is driven, two chambers suck in oil due to volumetric change in the pump chambers formed between the rotor (12) and the stator (13), while oil is discharged from other two chambers. On the other hand, rotation of the steering wheel is directly transmitted to the rotor through the spool (7), drive shaft (10), etc.

Accordingly, the metering device serves to supply the steering cylinder with oil, amount of which corresponds to the rotation of the steering wheel. The wheels are thus turned by the angle corresponding to the rotation of the steering wheel. When the engine stops or the hydraulic pump malfunctions, the metering device functions as a manual trochoid pump, which makes manual steering possible

■ Relief Valve

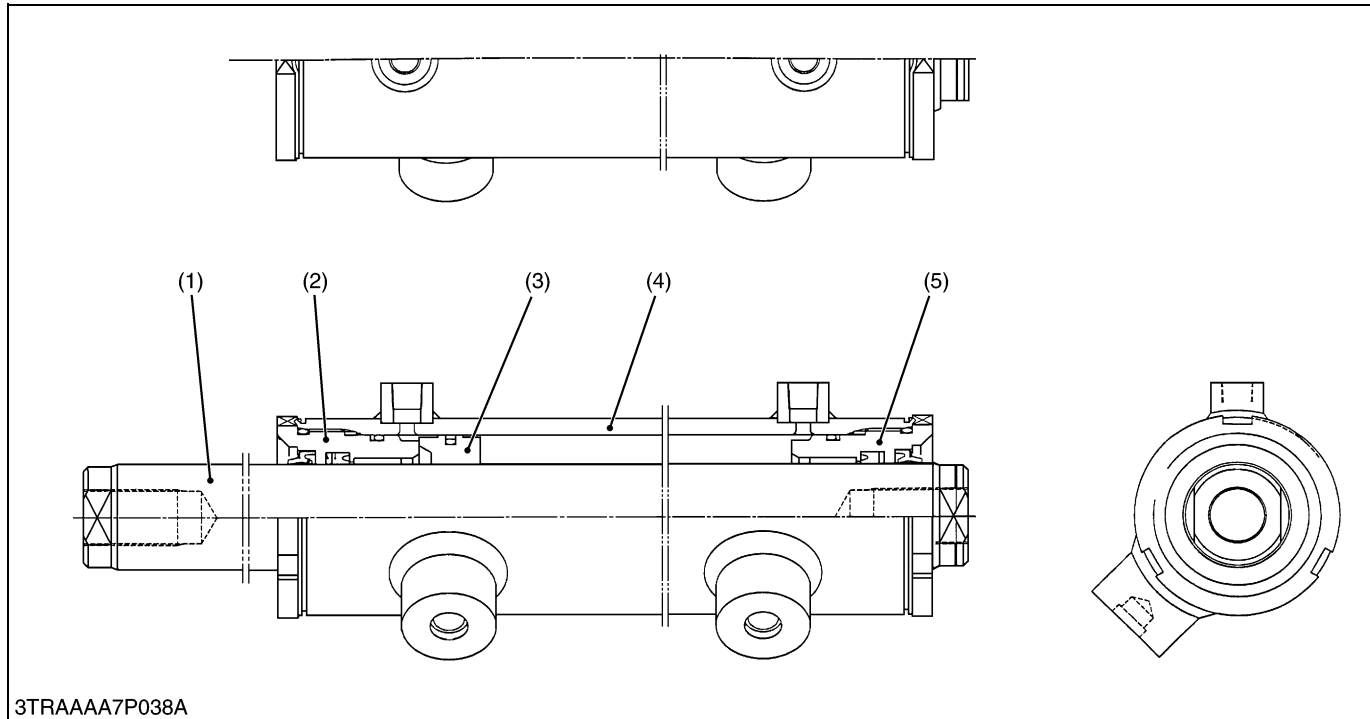
The relief valve (1) is located in the steering controller. It controls the maximum pressure of the power steering system.

Its setting pressure is as follows.

- 11.9 to 12.8 MPa
- 121 to 131 kgf/cm²
- 1726 to 1856 psi

- (1) Relief Valve
 - (2) Steering Controller
 - (3) Metering Device
 - (4) Control Valve
 - (5) Steering Cylinder
 - (6) Check Valve
 - (7) Spool
 - (8) Centering Spring
 - (9) Sleeve
 - (10) Drive Shaft
 - (11) Distributor Plate
 - (12) Rotor
 - (13) Stator
- A : Control Valve**
 - B : Metering Device**
 - P : P Port (From Hydraulic Pump)**
 - T : T Port (To Independent PTO Clutch Valve and HST Circuit)**

W10329680

[7] STEERING CYLINDER

(1) Cylinder Rod
(2) Guide

(3) Piston

(4) Cylinder Tube

(5) Guide

The steering cylinder is single piston both rod double-acting type. This steering cylinder is installed parallel to the front axle and connected to tie-rods.

The tie-rods connected to both knuckle arm guarantees equal steering movement to both front wheels.

The steering cylinder provide force in both directions. Depending upon direction the steering wheel is turned pressure oil enters at one end of the cylinder to extend, or the other end to retract it, thereby turning front wheel of the tractor.

8 HYDRAULIC SYSTEM



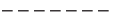

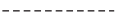






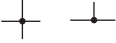
















MECHANISM

CONTENTS










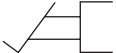

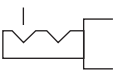








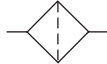

1. HYDRAULIC CIRCUIT SYMBOLS.....	8-M1
2. HYDRAULIC PUMP	8-M3
3. OIL STRAINER AND FILTER	8-M5
[1] OIL STRAINER	8-M5
[2] OIL FILTER	8-M5
4. FLOW PRIORITY VALVE	8-M6
[1] TYPE 1	8-M6
[2] TYPE 2	8-M7
5. REGULATOR VALVE	8-M8
[1] TYPE 1 (TA530-19050, T1060-19053, T1170-19050).....	8-M8
[2] TYPE 2 (YW177-00100, YW250-00100)	8-M10
6. RELIEF VALVE	8-M12
[1] DIRECT ACTING TYPE.....	8-M12
[2] PILOT OPERATED TYPE.....	8-M13
7. THREE POINT HITCH SYSTEM	8-M14
[1] MANUAL CONTROL VALVE	8-M14
[2] POSITION CONTROL VALVE.....	8-M15
(1) Position Control Valve – Type 1 (Code No. 6C070-36202)	8-M15
(2) Position Control Valve – Type 2 (Code No. 31391-39002)	8-M17
(3) Position Control Valve – Type 3 (Code No. 31351-39604)	8-M18
(4) Position Control Valve – Type 4 (Code No. T0430-37500).....	8-M20
(5) Position Control Valve – Type 5 (Code No. 38240-39143)	8-M22
(6) Position Control Valve – Type 6 (Code No. 32530-39150)	8-M23
(7) Position Control Valve – Type 7 (Code No. 3A151-82301)	8-M26
(8) Position Control Valve – Type 8 (Code No. YR906-00106)	8-M28
(9) Position Control Valve – Type 9 (Code No. YW276-00100)	8-M31
(10) Position Control Valve – Type 10 (Code No. YW158-00100).....	8-M33
[3] DRAFT CONTROL VALVE	8-M35
[4] SOLENOID PROPORTIONAL CONTROL VALVE.....	8-M36
[5] FEEDBACK LINKAGE FOR POSITION CONTROL.....	8-M39
(1) Type 1	8-M39
(2) Type 2	8-M40
(3) Type 3	8-M41
(4) Type 4	8-M43
(5) Type 5	8-M45
[6] LOAD SENSING SYSTEM FOR DRAFT CONTROL	8-M46
(1) Top Link Sensing System (Type 1).....	8-M46
(2) Top Link Sensing System (Type 2).....	8-M47
(3) Lower Link Sensing System.....	8-M48
[7] HYDRAULIC CYLINDER	8-M49
[8] CYLINDER SAFETY VALVE (SURGE RELIEF VALVE).....	8-M50
[9] LOWERING SPEED ADJUSTING VALVE	8-M51

8. AUXILIARY (REMOTE) CONTROL VALVE.....	8-M52
[1] DOUBLE ACTING TYPE.....	8-M52
(1) Type 1 (with Mechanical Check Valve, Code No. 6C142-38400)	8-M52
(2) Type 2 (Code No. 35340-99420).....	8-M53
(3) Type 3 (Code No. TA040-96112, YW313-00101, YW089-00103)..	8-M54
(4) Type 4 (Floating with Detent-1, Code No. 3A031-82800, 3G710-82812, 3F740-82810).....	8-M55
(5) Type 5 (Floating with Detent-2, Code No. YW077-00103, YW312-00101)	8-M59
(6) Type 6 (Self Cancelling with Detent-1, Code No. 3A111-82540, 3A751-82540,3A151-82540).....	8-M61
(7) Type 7 (Self Cancelling with Detent-2, Code No. 3A751-82560, 3A151-82560).....	8-M66
[2] SINGLE / DOUBLE ACTING TYPE (Code No. 3A031-82350, 3G700-82350,3F740-82350).....	8-M71
[3] OTHERS (TA470-38000, YW277-00102)	8-M76
[4] FLOW CONTROL VALVE.....	8-M81

1. HYDRAULIC CIRCUIT SYMBOLS

Passages and Connections		Cylinders	
	Main line (Passage)		Single acting
	Pilot line		Double acting, single rod
	Drain line		Double acting, double rod
	Flow direction (Liquid)	Valves	
	Flow direction (Gas)		Check valve
	Crossing of lines		Stop valve or cock
	Connection of lines		Fixed orifice
	Deflected line		Variable orifice
Pumps and Motors			Relief valve
	Fixed displacement hydraulic pump		Unload valve
	Variable displacement hydraulic pump		Fixed volume flow control valve
	Fixed displacement hydraulic motor		Variable volume flow control valve
	Variable displacement hydraulic motor		2 port 2 position change-over valve
Oil Tank (Reservoir)			4 port 3 position change-over valve
	Line connected to oil tank Line whose end does not enter into oil		4 port throttle change-over valve
	Line whose end enters into oil		

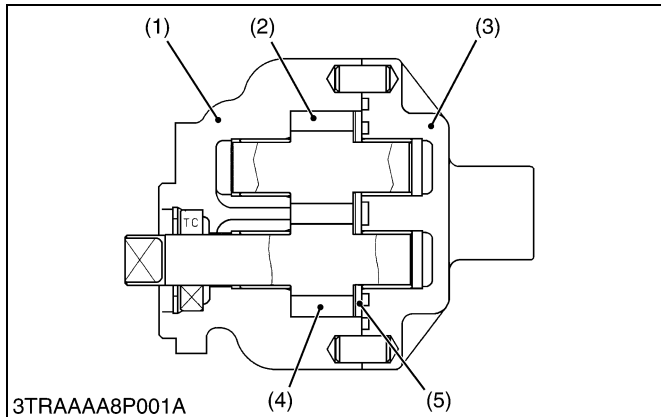
W10126420

Valve Operators			Temperature controller
	Spring		Electric motor
	Manual		Accumulator
	Push button		Temperature indicator
	Lever		Pressure gauge
	Pedal		Variable component (Symbol thru component)
	Detents		Plug, test port, pressure supply test
	Pilot pressure (External)		Shaft, lever, rod
	Single coil solenoid		Rotation direction
	Double coil solenoid		Flow direction
Others			Assembled unit
	Filter, strainer		
	Cooler		

W10316090

2. HYDRAULIC PUMP

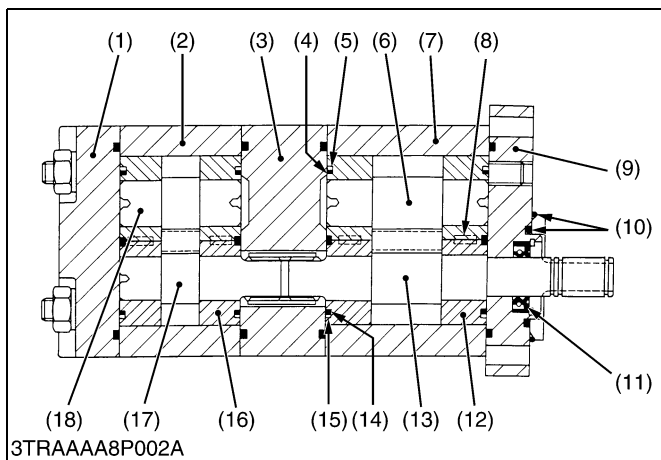
The gear type hydraulic pump is adopted for tractor. The location and capacity of installed hydraulic pump are different according to each tractor.



■ Single Pump

- | | |
|-----------------|----------------|
| (1) Casing | (4) Drive Gear |
| (2) Driven Gear | (5) Side Plate |
| (3) Cover | |

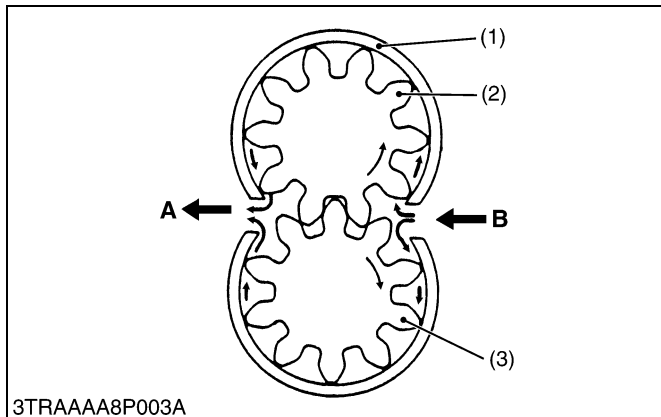
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■ Tandem Pump

- | | |
|--------------------|---------------------|
| (1) Cover | (10) Backup Element |
| (2) Housing 2 | (11) Oil Seal |
| (3) Flange 2 | (12) Bushing 1 |
| (4) Seal Element | (13) Drive Gear 1 |
| (5) Backup Element | (14) Seal Element |
| (6) Driven Gear 1 | (15) Backup Element |
| (7) Housing 1 | (16) Bushing 2 |
| (8) Key | (17) Drive Gear 2 |
| (9) Flange 1 | (18) Driven Gear 2 |

W10131220



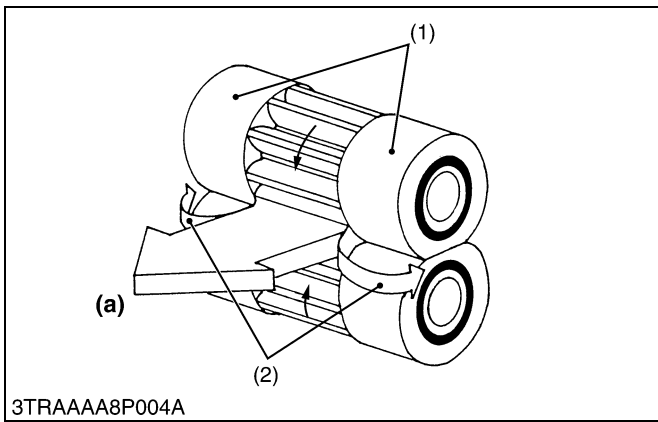
■ Operation of Hydraulic Pump

The hydraulic pump has two meshing gears (2), (3) whose teeth run close to the casing (1). One gear is a drive gear (2) which drives the driven gear (3).

When the drive gear is driven in the direction of the arrow the gears trap oil between the gear teeth and the casing. The trapped oil is carried around to the outlet. The higher the engine speed, the more the pump discharge.

- | | |
|-----------------|-------------------|
| (1) Casing | A : Outlet |
| (2) Drive Gear | B : Inlet |
| (3) Driven Gear | |

W10130980



■ Pressure Loading System (Pressure Loading Type Only)

The pressure loading system automatically decreases the clearance between the gear and the bushing (1). A small amount of pressure oil is fed behind the bushings, pressing them against the gears and forming a tighter seal against leakage.

Therefore, leakage from the delivery side (high pressure) to the inlet side (low pressure) does not increase even if the pressure on the delivery side increases.

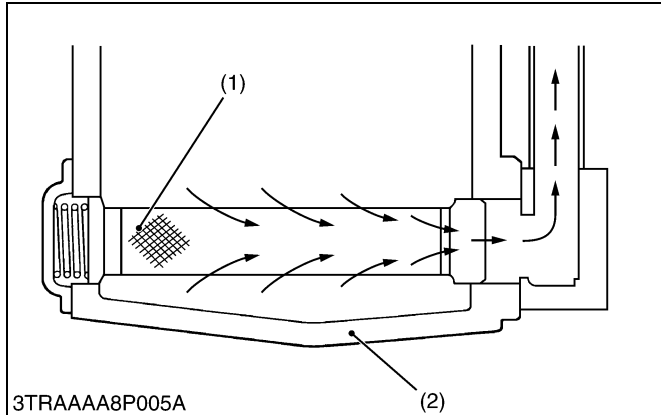
- (1) Bushing
- (2) Loading Pressure

(a) Outlet

W10131830

3. OIL STRAINER AND FILTER

[1] OIL STRAINER



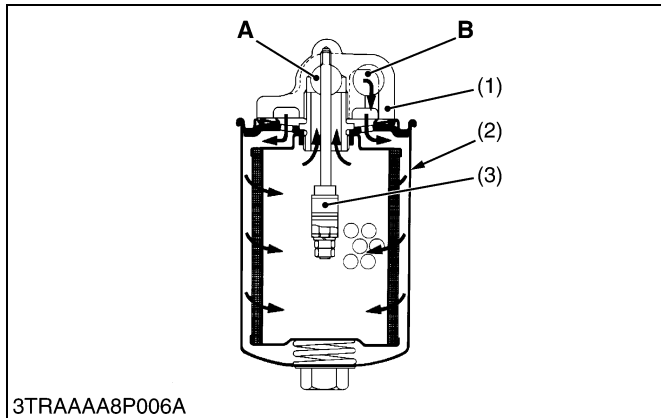
This oil strainer (1) is located in the transmission case (2).

(1) Oil Strainer

(2) Transmission Case

W10134940

[2] OIL FILTER



The oil filter is located at the pump suction line. A permanent magnet (3), serving as a magnet filter, is inserted in the cartridge.

(1) Filter Bracket

(2) Cartridge

(3) Magnet (If equipped)

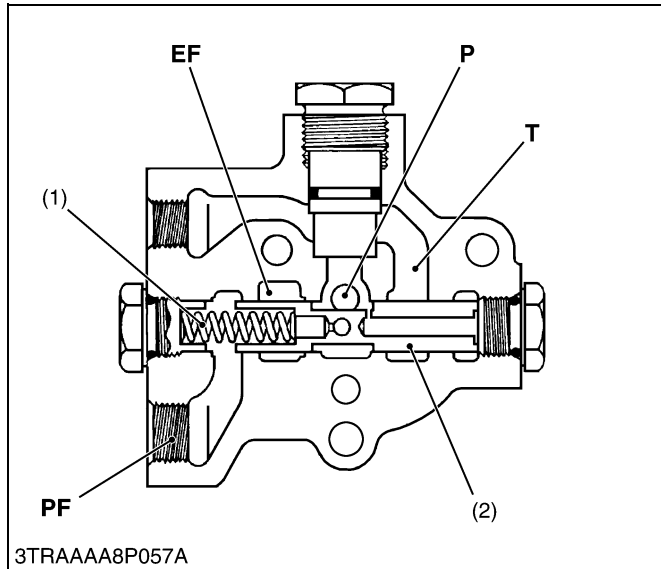
A : To Hydraulic Pump

B : From Transmission Case

W10135680

4. FLOW PRIORITY VALVE

[1] TYPE 1

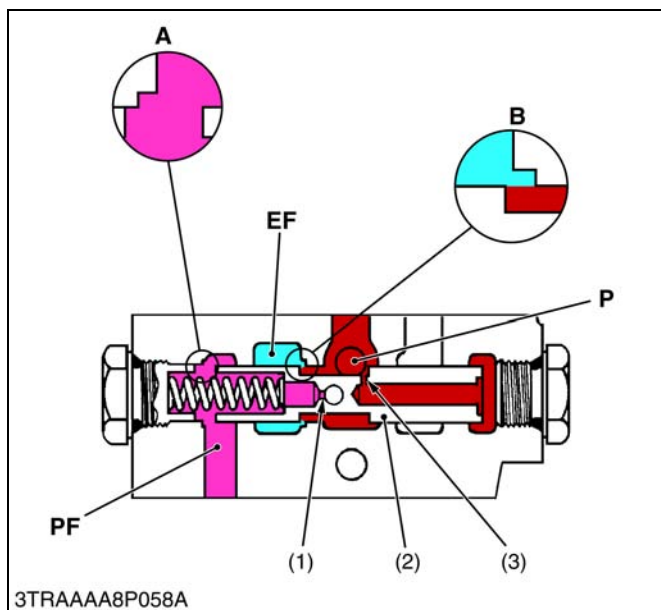


The flow priority valve is a flow divider that divides the flow from single hydraulic source (hydraulic pump) and actuates two circuits simultaneously. This valve feeds fixedly controlled flow to the **PF** port side with priority and remainder to the **EF** port side.

- (1) Spring
- (2) Plunger

P : P Port (From Pump)
T : T Port (To Transmission Case)
PF :PF Port
EF :EF Port

W10236450



■ Oil Flow

1. When the engine starts, oil flows into the valve through **P** port.
2. A pressure difference is created between the ends of the orifice (1) as the flow passes the orifice. This causes the plunger (2) to move to the left, deflecting the spring.
3. Then the oil passage is formed in portion **B** shown left figure, and the remainder flows to the **EF** side.
4. The plunger automatically balances itself to maintain the pressure difference between the ends of the orifice (1). Thus the fixedly controlled flow is fed to the **PF** side at all times even if the oil flow from the **P** port is changes.

(Reference)

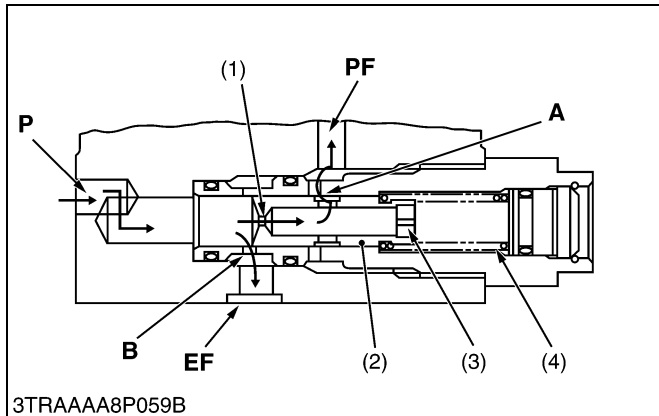
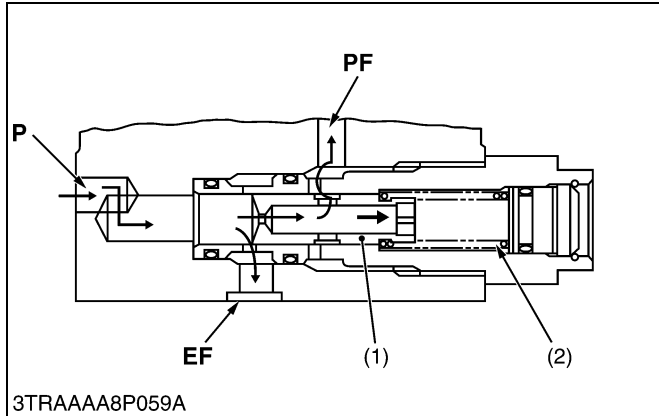
- Fixedly controlled flow is determined by the diameter of orifice (1).
- The damper orifice (3) prevents plunger (2) vibration causes by a sudden change in engine rpm (change in the oil flow rate).

- (1) Orifice
- (2) Plunger
- (3) Damper Orifice

A : Portion A
B : Portion B
P : P Port (From Pump)
PF :PF Port
EF :EF Port

W10237340

[2] TYPE 2



The flow priority valve is a flow divider that divides the flow from single hydraulic source (hydraulic pump) and actuates two circuits simultaneously. This valve feeds fixedly controlled flow to the **PF** port side with priority and remainder to the **EF** port side.

- (1) Plunger
- (2) Spring

P : P Port (From Pump)
PF :PF Port
EF :EF Port

W10149390

Oil Flow

1. When the engine starts, oil flows into the valve through **P** port.
2. A pressure difference is created between the ends of the orifice (1) as the flow passes the orifice (1). This causes the plunger (2) to move to the right, deflecting the spring (4).
3. Then the oil passage is formed in portion **B** shown left figure, and the remainder flows to the **EF** port.
4. The plunger automatically balances itself to maintain the pressure difference between the ends of the orifice (1). Thus the fixedly controlled flow is fed to the **PF** port side at all times even if the oil flow from the **P** port is changes.

(Reference)

- Fixedly controlled flow is determined by the diameter of orifice (1).
- The damper orifice (3) prevents plunger vibration caused by a sudden change in engine rpm (change in the oil flow rate).

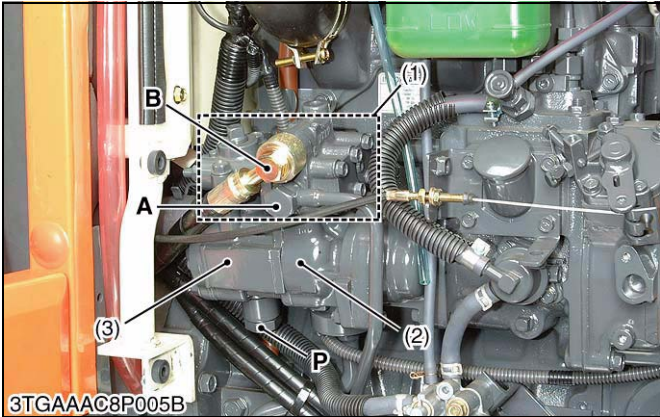
- (1) Orifice
- (2) Plunger
- (3) Damper Orifice
- (4) Spring

A : Portion A
B : Portion B
P : P Port (From Pump)
PF :PF Port
EF :EF Port

W10150710

5. REGULATOR VALVE

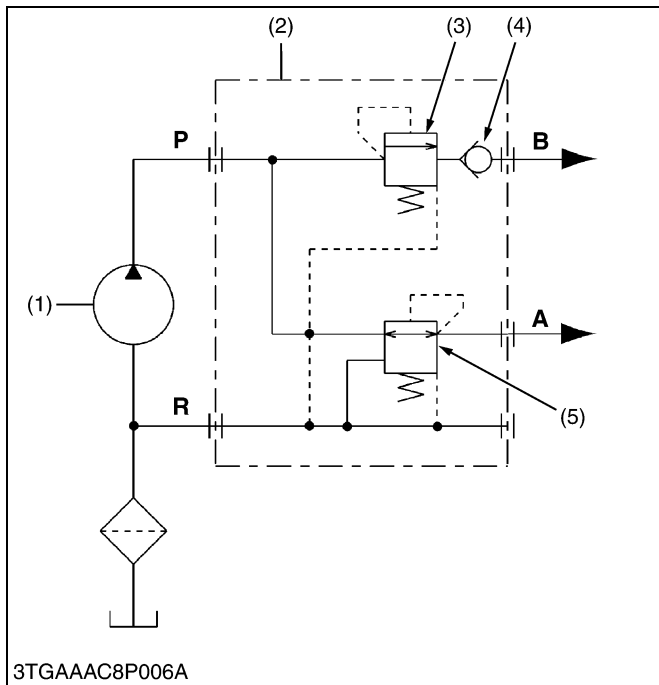
[1] TYPE 1 (TA530-19050, T1060-19053, T1170-19050)



The regulator valve (1) is installed on the power steering pump, regulating the oil pressure of the hydraulic PTO clutch and bi-speed clutch circuit.

- | | |
|-------------------------|-------------------|
| (1) Regulator Valve | A : A Port |
| (2) 3P Hydraulic Pump | B : B Port |
| (3) Power Steering Pump | P : P Port |

W10283140



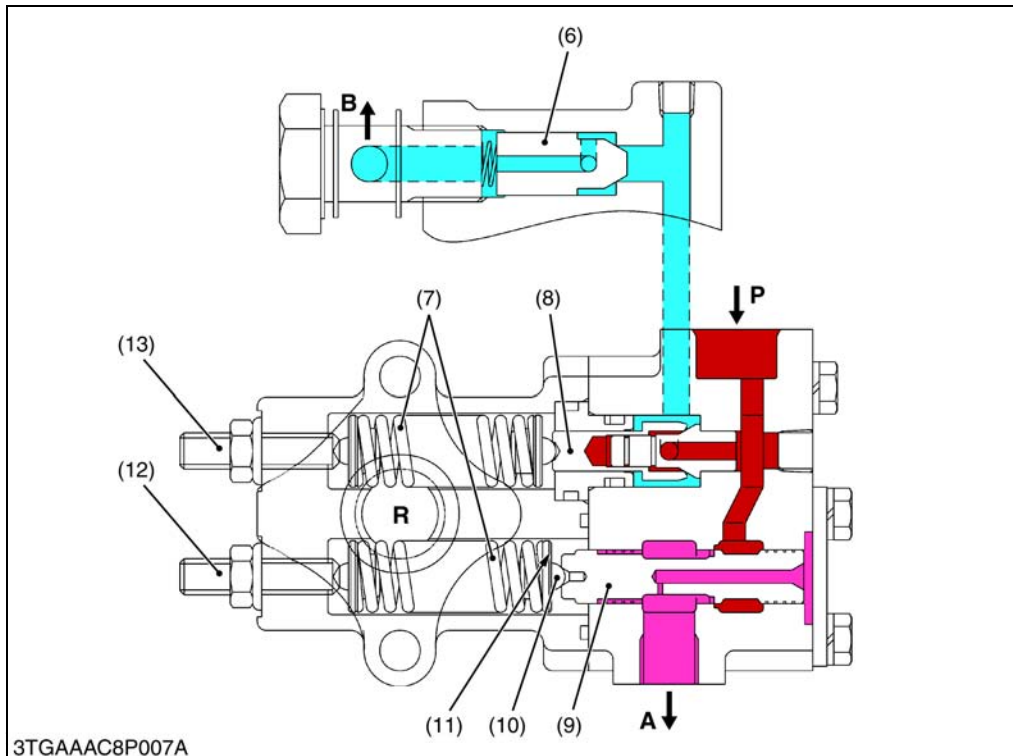
■ Oil Flow

The oil from the power steering pump passes through the regulating valve (3) and check valve (4), and then flows to the power steering circuit.

The regulating valve (3) is provided to maintain the inlet pressure of the pressure reducing valve (5) to 30 kgf/cm² except when the power steering is operated.

When the bi-speed valve operates, the oil adjusted with the reducing valve (5) to 18.5 kgf/cm² flows to the bi-speed valve through A port

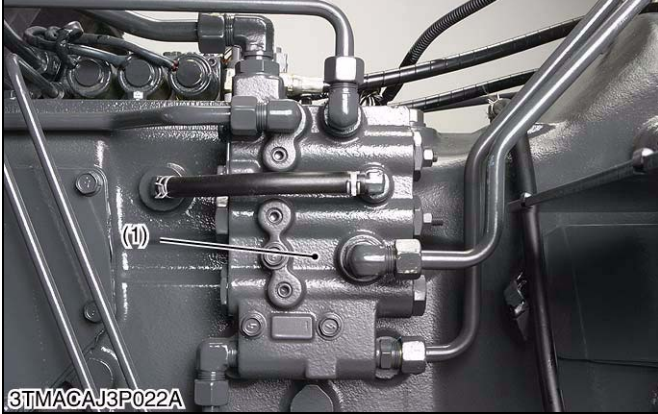
W10284430



- (1) Power Steering Pump
- (2) Regulator Valve Assembly
- (3) Regulating Valve
- (4) Check Valve
- (5) Pressure Reducing Valve
- (6) Poppet (Check Valve)
- (7) Spring
- (8) Relief Poppet
- (9) Reducing Spool
- (10) Ball
- (11) Spring Receiver
- (12) Adjusting Screw
- (13) Adjusting Screw

- A : A Port (To Bi-Speed Valve)**
- B : B Port (To Steering Controller)**
- P : P Port (From Pump)**
- R : R Port (To Pump)**

W10286050

[2] TYPE 2 (YW177-00100, YW250-00100)

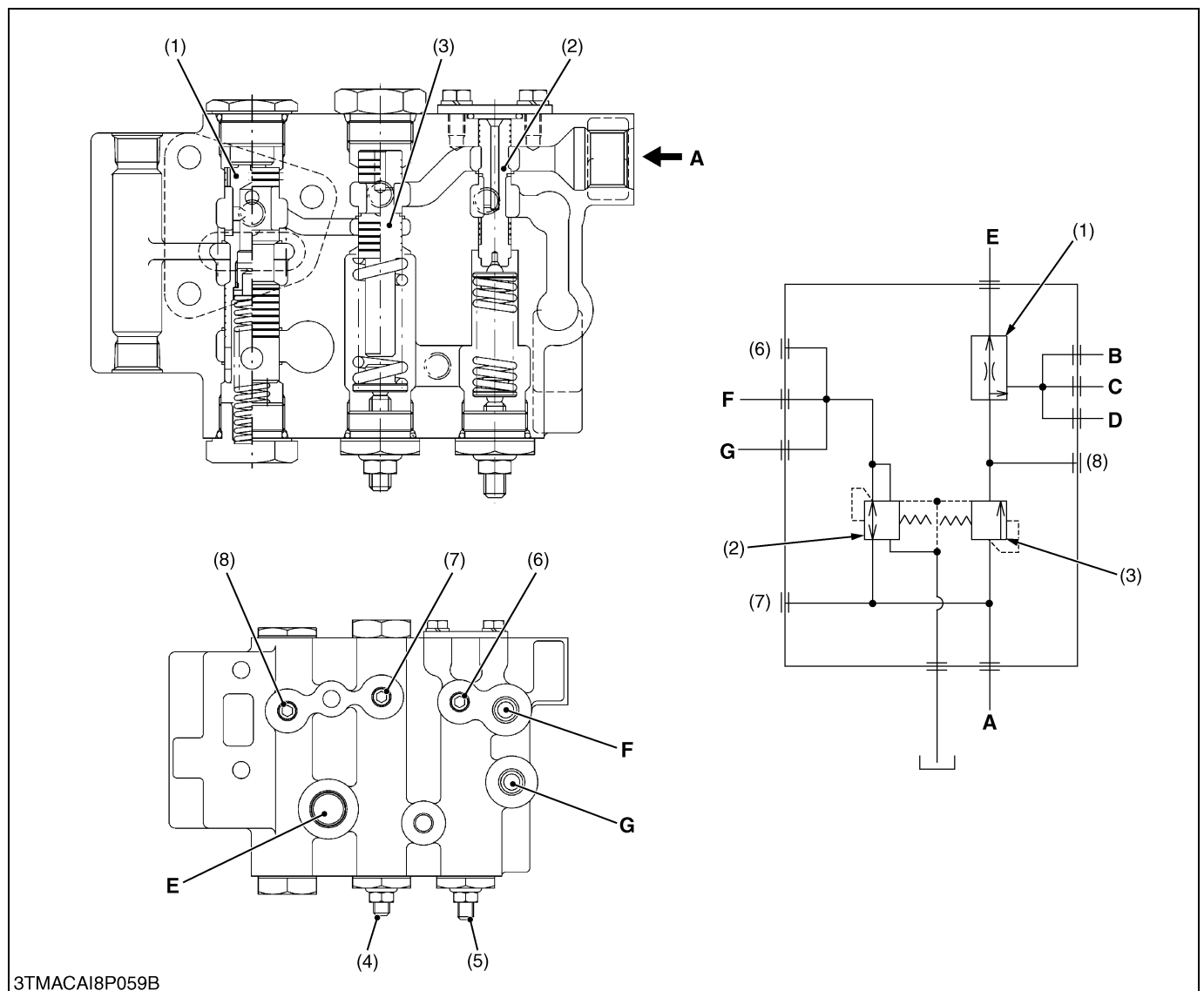
This regulator valve consist of flow priority valve, regulating valve and pressure reducing valve.

Flow priority valve feeds fixedly controled flow to the power steering circuit with priority.

The pressure reducing valve controls the operating pressure of power shift valve to 2.06 to 2.25 MPa (21.0 to 23.0 kgf/cm², 298.7 to 327.1 psi)

(1) Regulator Valve

W1014873



- | | |
|-----------------------------|---------------------|
| (1) Flow Priority Valve | (5) Adjusting Screw |
| (2) Pressure Reducing Valve | (6) Check Port 1 |
| (3) Regulating Valve | (7) Check Port 2 |
| (4) Adjusting Screw | (8) Check Port 3 |

- | | |
|--|---|
| A : From Hydraulic Pump | D : To PTO Clutch Pack for Lubrication |
| B : To Main Shift Clutch Pack for Lubrication | E : To Power Steering Controller |
| C : From Power Steering Controller | F : To PTO Clutch Valve |
| | G : To Power Shift Valve |

Section view of the regulator valve and its hydraulic circuit are shown in the figure above.

The regulator valve is composed of the flow priority valve, regulating valve and pressure reducing valve. Oil from the hydraulic pump for the power steering system flows through the pressure reducing valve (2) to the power shift circuit / PTO circuit / 4WD, bi-speed circuit and differential lock circuit. When oil filled into the circuit the pressure reducing valve (2) is closed to maintain the pressure in power shift system circuit to 2.16 MPa (22 kgf/cm², 313 psi). The oil from the power steering pump passes through the regulating valve (3) and flow priority valve (1) and then it flow to the power steering circuit.

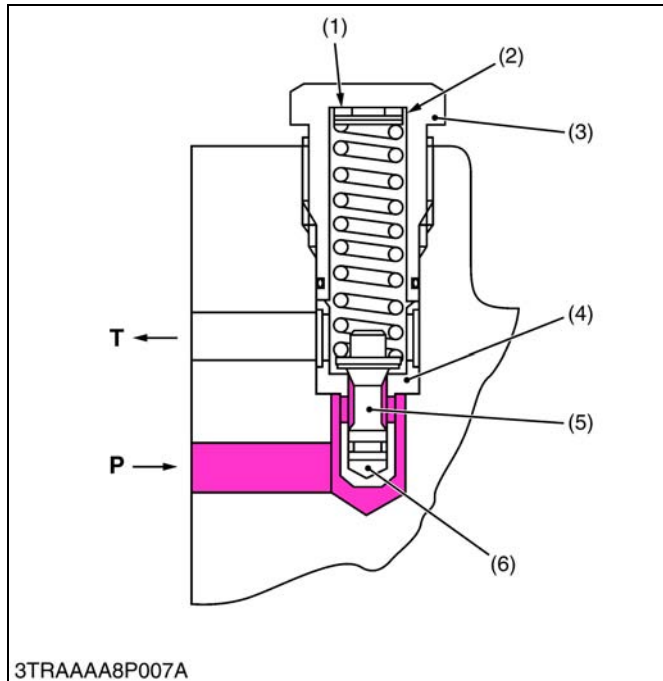
The regulating valve (3) is provided to maintain 2.94 MPa (30 kgf/cm², 427 psi) at inlet pressure of the pressure reducing valve (2) except when the power steering is operated.

Thereby getting 2.16MPa (22 kgf/cm², 313 psi) of the power shift circuit / PTO circuit / 4WD, bi-speed circuit and differential lock circuit.

The flow priority valve is a flow divider that dives the flow from single hydraulic source (hydraulic pump). This valve feeds fixedly controlled flow to the **E** port side with priority and remainder to the **B** and **D** port side.

6. RELIEF VALVE

[1] DIRECT ACTING TYPE



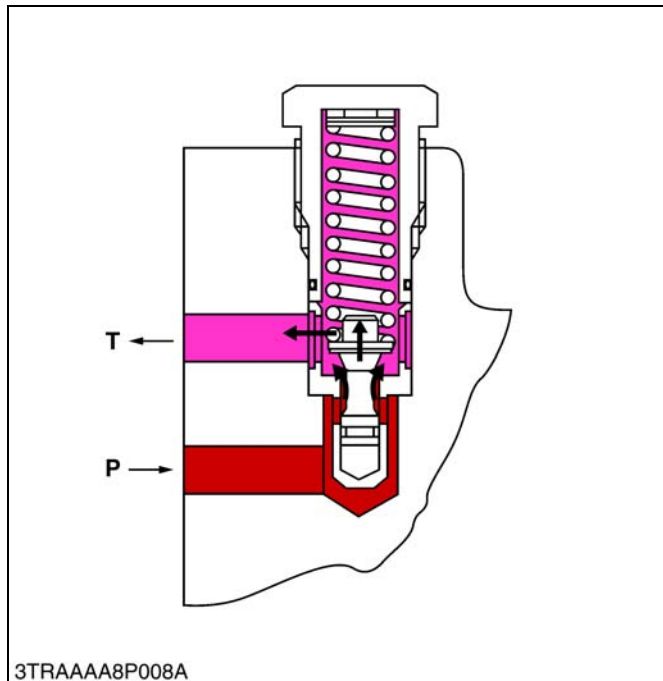
The 3-point hydraulic circuit has a relief valve to restrict the maximum pressure in its circuit.

This is a guide piston relief valve with damper, a direct acting relief valve suitable for relatively high pressure and capacity, and constructed so as to prevent chattering and other unstableness associated with direct acting relief valves. As shown in the diagram, poppet (5) has a guide, and there is a valve chamber called a damping chamber (6) in the base of this guide piston. The valve inlet is connected to this chamber through the clearance between the guide surface and the seat so that the chamber provides a damping effect, controlling valve vibration.

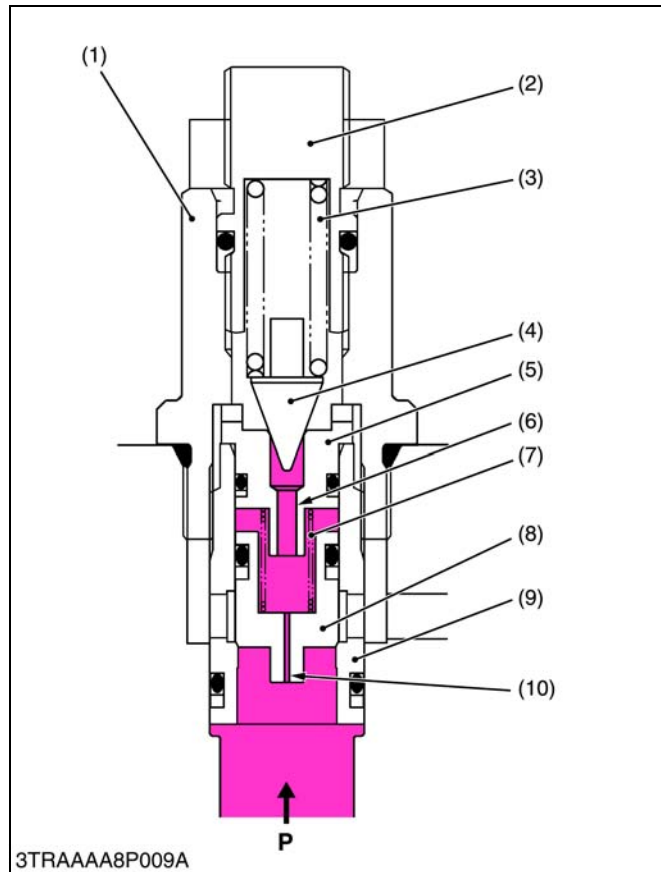
When the pressure in the circuit rises, the pressure in the damping chamber also rises, and when it exceeds the relief pressure setting the spring is compressed, making a clearance between the poppet and the seat. The hydraulic oil can escape to the transmission case through this clearance, controlling the pressure rise.

- (1) Washer
 - (2) Shim
 - (3) Plug
 - (4) Seat
 - (5) Poppet
 - (6) Damping Chamber
- P : Pump Port**
T : Tank Port

W10160700



[2] PILOT OPERATED TYPE



■ Relief Valve Closed

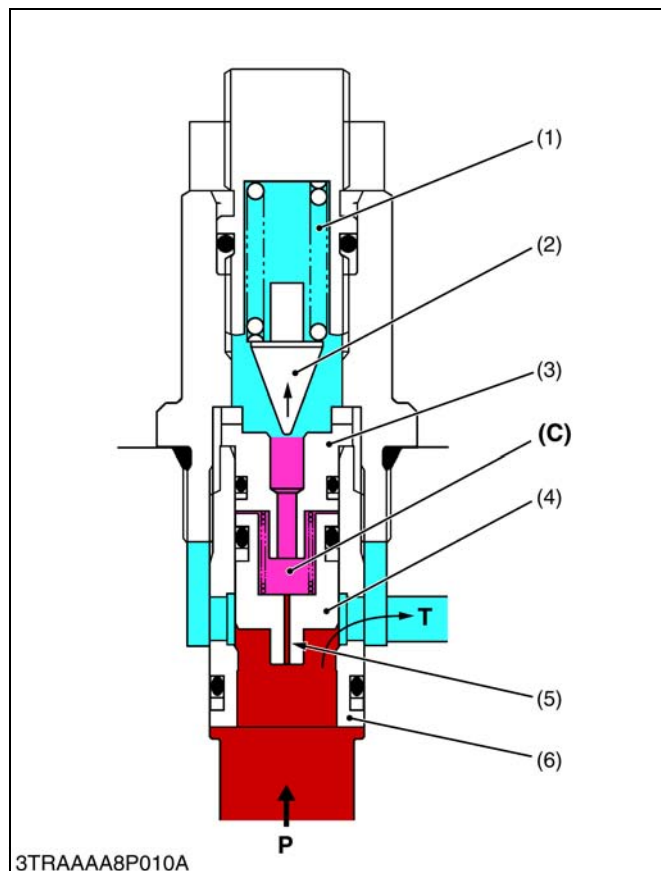
This relief valve is suitable for a high pressure and large volumetric flow, and has better pressure override performance than direct acting relief valves.

This relief valve consists of a pilot valve (4) and main valve (8). The pilot valve (4) is a trigger which controls the main valve (8).

When the oil pressure in the circuit is lower than the setting pressure, the pilot valve (4) and main valve (8) are closed by the spring (3) and (7).

- | | |
|-----------------------|-------------------|
| (1) Relief Valve Body | (7) Spring |
| (2) Adjuster | (8) Main Valve |
| (3) Spring | (9) Valve Seat |
| (4) Pilot Valve | (10) Passage |
| (5) Valve Seat | |
| (6) Sensing Passage | P : P Port |

W10153050



■ Relief Valve in Operation

As the oil pressure in the circuit rises, so does the pressure in the chamber "C". When it reaches the pilot valve setting pressure, the pilot valve (2) opens. This releases oil in the chamber "C" to the transmission case. Accordingly the oil in the circuit flows to the chamber "C" through the passage (5).

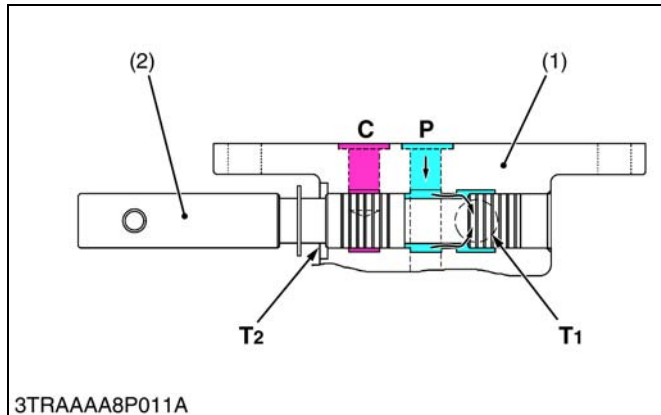
The resulting pressure drop in the chamber "C" causes the main valve (4) open. The oil in the circuit then flows out to the transmission case, preventing any further rise in pressure. The relief valve close again when the oil pressure in the circuit drops below the setting pressure.

- | | |
|-----------------|------------------------|
| (1) Spring | (C) Chamber "C" |
| (2) Pilot Valve | P : P Port |
| (3) Valve Seat | T : T Port |
| (4) Main Valve | |
| (5) Passage | |
| (6) Valve Seat | |

W10154530

7. THREE POINT HITCH SYSTEM

[1] MANUAL CONTROL VALVE



■ Neutral

Oil forced into the control valve (1) through **P** port and returns to the transmission case through **T1** port.

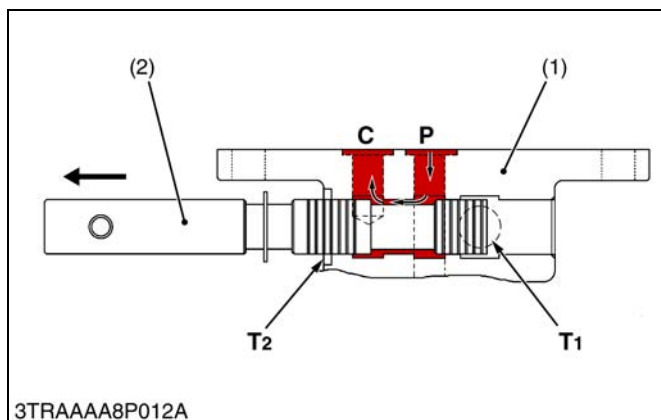
Also, **C** port is closed by spool (2), oil in the hydraulic cylinder does not flow to the transmission case.

Thus, the implement remains at its fixed position.

- (1) Control Valve
(2) Spool

P : Pump Port
C : Cylinder Port
T1 : Tank Port 1
T2 : Tank Port 2

W10143670



■ Lift

When the control lever is set to the “**LIFT**” position, the spool (2) is moved to the left.

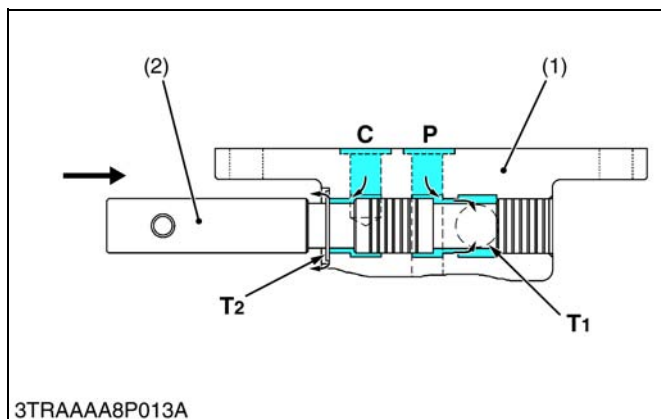
The oil forced into the control valve (1) through **P** port flows to **C** port.

The oil pushes and flow into the hydraulic cylinder through the **C** port to lift the implement.

- (1) Control Valve
(2) Spool

P : Pump Port
C : Cylinder Port
T1 : Tank Port 1
T2 : Tank Port 2

W10145690



■ Down

When the control lever is moved to “**DOWN**” position, the spool (2) is moved to the right.

Oil in the hydraulic cylinder is forced out to the transmission case through the **T2** port by the weight of the implement, causing the implement to lower.

Oil forced into the control valve (1) through the **P** port and returns to the transmission case through the **T1** port.

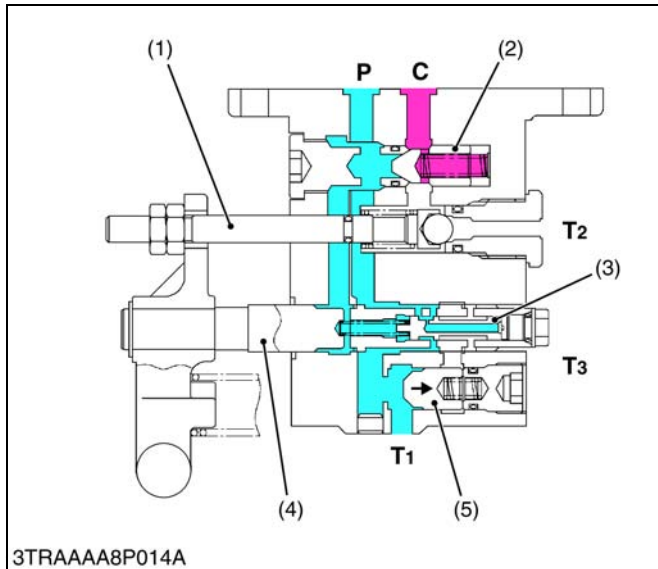
- (1) Control Valve
(2) Spool

P : Pump Port
C : Cylinder Port
T1 : Tank Port 1
T2 : Tank Port 2

W10144820

[2] POSITION CONTROL VALVE

(1) Position Control Valve – Type 1 (Code No. 6C070-36202)



■ Neutral

Oil forced into the control valve through the **P** port pushes open the unload poppet (5) and then returns to the transmission case through the **T1** port.

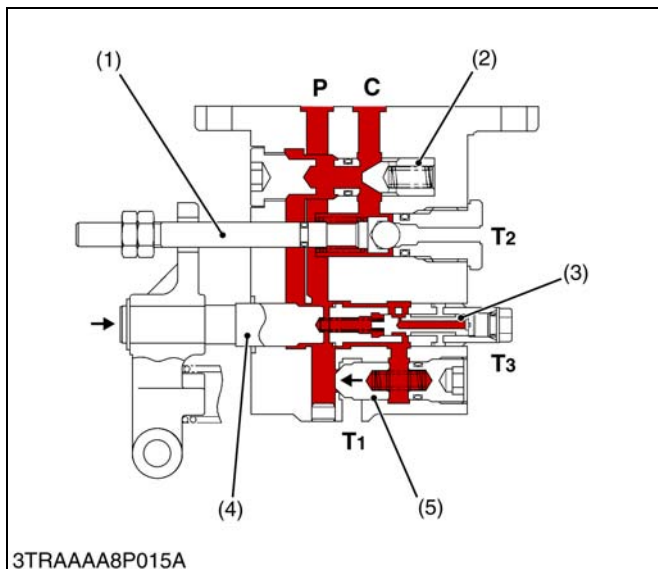
Oil behind the unload poppet (5) returns to the transmission case through the spool (4) and the **T3** port.

Since the poppet 2 (1) and poppet 1 (2) are closed, oil in the hydraulic cylinder does not flow to the transmission case. Thus, the implement remains at its fixed position.

- (1) Poppet 2
- (2) Poppet 1
- (3) Plunger
- (4) Spool
- (5) Unload Poppet

P : Pump Port
C : Cylinder Port
T1, T2, T3 : Tank Port

W10136350



■ Lift

When the control lever is set to the **LIFT** position, the spool (4) is move to the right.

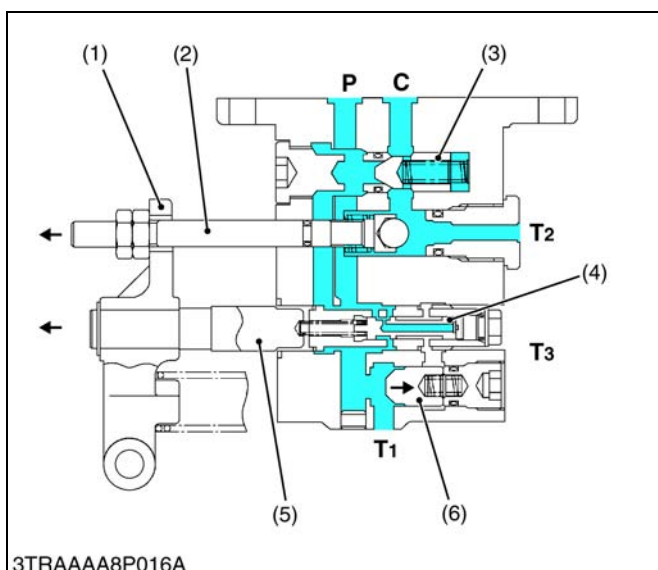
The oil forced into the control valve through the **P** port flows to the back of the unload poppet (5) to close it.

The oil pushes open the poppet 1 (2), and flows into the hydraulic cylinder through the **C** port to lift the implement.

- (1) Poppet 2
- (2) Poppet 1
- (3) Plunger
- (4) Spool
- (5) Unload Poppet

P : Pump Port
C : Cylinder Port
T1, T2, T3 : Tank Port

W10137360



■ Down

When the control lever is moved to **DOWN** position, the spool (5) is move to the left, and the poppet 2 (2) is also move to the left by the lever (1).

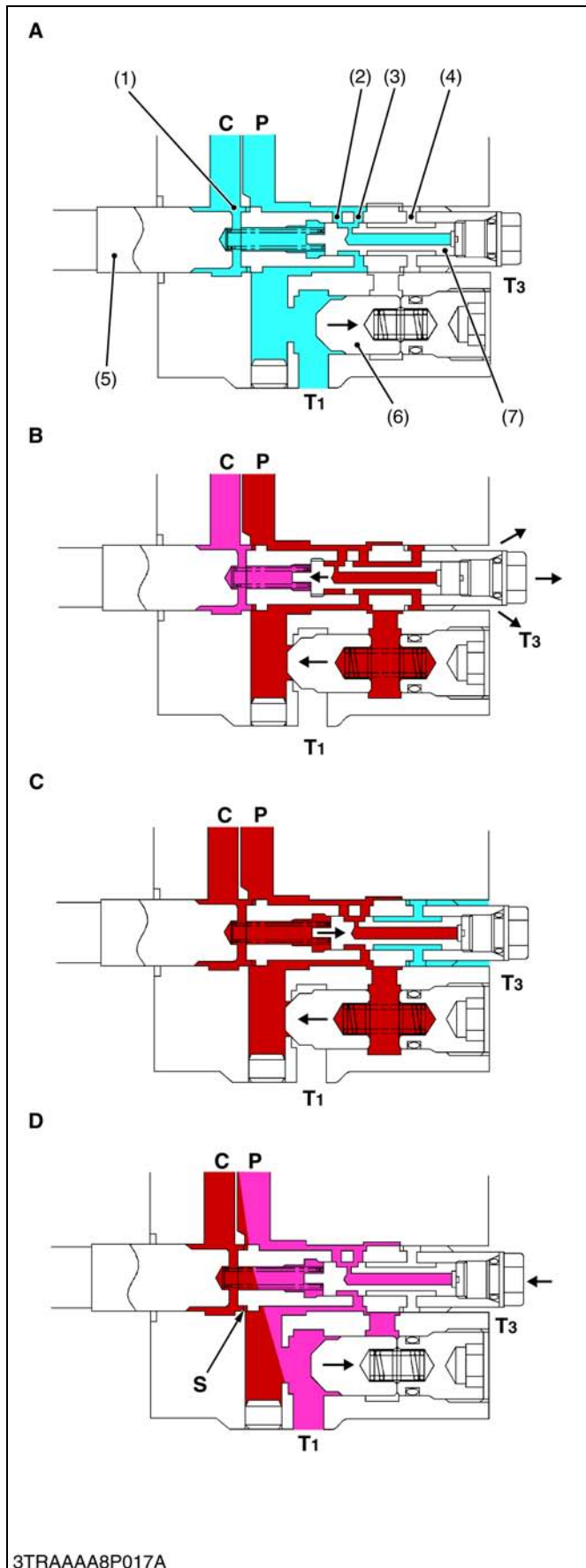
Oil in the hydraulic cylinder is forced out to the transmission case through the **T2** port by the weight of the implement, causing the implement to lower.

Oil forced into the control valve through the **P** port pushes open the unload poppet (6) and returns to the transmission case through the **T1** port.

- (1) Lever
- (2) Poppet 2
- (3) Poppet 1
- (4) Plunger
- (5) Spool
- (6) Unload Poppet

P : Pump Port
C : Cylinder Port
T1, T2, T3 : Tank Port

W10138410



■ Shockless Mechanism

The control valve is provided with a shockless mechanism. This is intended to reduce a sudden change of the oil pressure and flow when the three point linkage system begins to going up or stop going up. As a result, operator does not feel the unpleasant shock.

1. When the three point linkage system starts going up, the spool (5) is located slightly at the right from the neutral position. (Fig. B)

A small amount of oil is kept constantly flowing from the pump through the slit into the cylinder port. (A fixed flow rate is guaranteed.)

2. The oil fed from hydraulic pump flows in passages 2 (2) and 3 (3) by the difference of the hole diameter, and pushes the plunger (7) to the left. Then the passages 3 (3) and 4 (4) connect to each other, and the oil between them return to the transmission case through the clearance between the valve body and the spool (5) and through the T3 port. In this way, the plunger (7) returns to the rightmost position. (Fig. B and C)

Some of the oil coming from the pump is drained into the T3 port, which controls the flow rate of the oil going into the cylinder.

3. As a result, the oil pressure is controlled not to rise suddenly. The shock at the start of lifting is thus reduced.

4. When the spool (5) comes close to the neutral position by the motions of feedback linkage, the oil pressure gradually drops by the slit provided in the spool (5). Therefore the shock at the stop of lifting is reduced. (Fig. D)

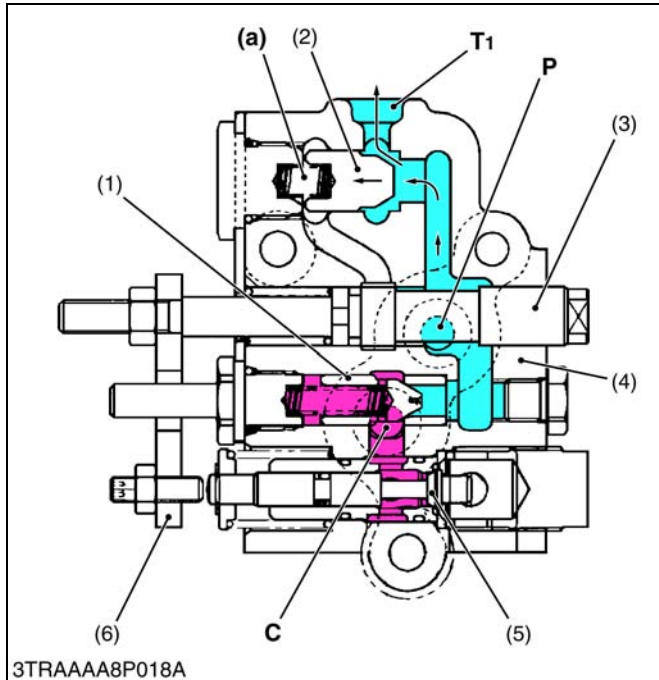
- (1) Passage 1
- (2) Passage 2
- (3) Passage 3
- (4) Passage 4
- (5) Spool
- (6) Unload Poppet
- (7) Plunger

- P : Pump Port
- C : Cylinder Port
- S : Slit
- T1, T3 : Tank Port

W10140620

3TRAAAA8P017A

(2) Position Control Valve – Type 2 (Code No. 31391-39002)



■ Neutral

Pressurized oil flows at the **P** port, pushes open unload poppet (2) and returns to the transmission case from **T1** port.

The oil in the **A** chamber (a) behind the unload poppet (2) returns to the transmission case through the clearance between spool (3) and valve body (4). The oil in the hydraulic cylinder does not flow out because the circuit is cut off by the actions of poppet 1 (1) and poppet 2 (5).

This allows the implement to be kept at a steady height.

- (1) Poppet 1
- (2) Unload Poppet
- (3) Spool
- (4) Valve Body
- (5) Poppet 2
- (6) Plate

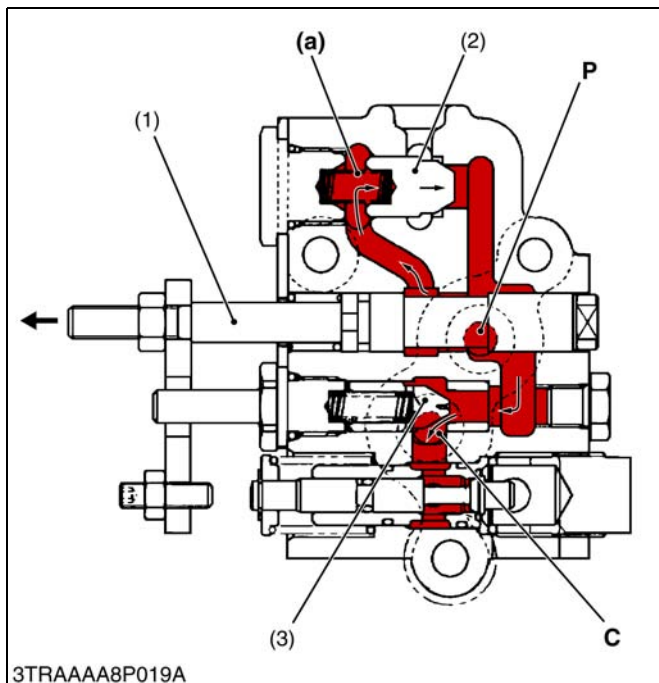
(a) **A Chamber**

C : C (Cylinder) Port

P : P (Pump) Port

**T1 : T1 Port
(To Transmission Case)**

W10153290



■ Lifting

When the control lever is moved to **UP** position, spool (1) is pulled by the spool operating lever, forming a circuit with the **P** port and **A** chamber (a).

The pressurized oil thus flows into the **A** chamber (a) and closes unload poppet (2).

The pressure in the circuit slowly rises, pushing open poppet 1 (3), and the hydraulic oil flows into the hydraulic cylinder from the **C** port, lifting the implement.

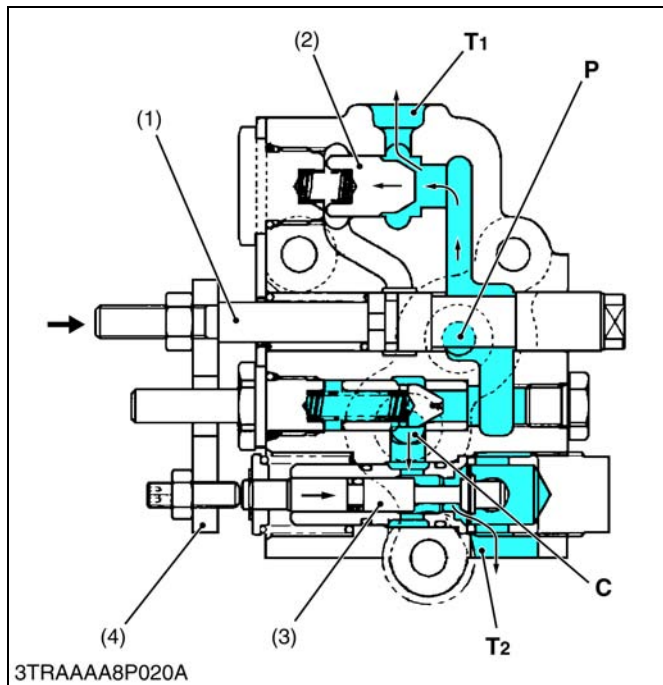
- (1) Spool
- (2) Unload Poppet
- (3) Poppet 1

(a) **A Chamber**

C : C (Cylinder) Port

P : P (Pump) Port

W10157920



■ **Lowering**

When the control lever is moved to **DOWN** position, spool (1) and plate (4) are pushed by the spool operating lever.

The plate (4) pushes open poppet 2 (3), forming a circuit with the **C** port and **T2** port.

The oil in the hydraulic cylinder is forced out by the weight of the implement, and returns to the transmission case through the **C** port and **T2** port, lowering the implement. The pressurized oil pushes open unload poppet (2) and returns to the transmission case from **T1** port.

■ **Floating**

When the control lever is moved all the way to the bottom, spool (1) and poppet 2 (3) remain in the positions described for “**Lowering**”. The oil flows freely between the hydraulic pump, hydraulic cylinder and transmission case.

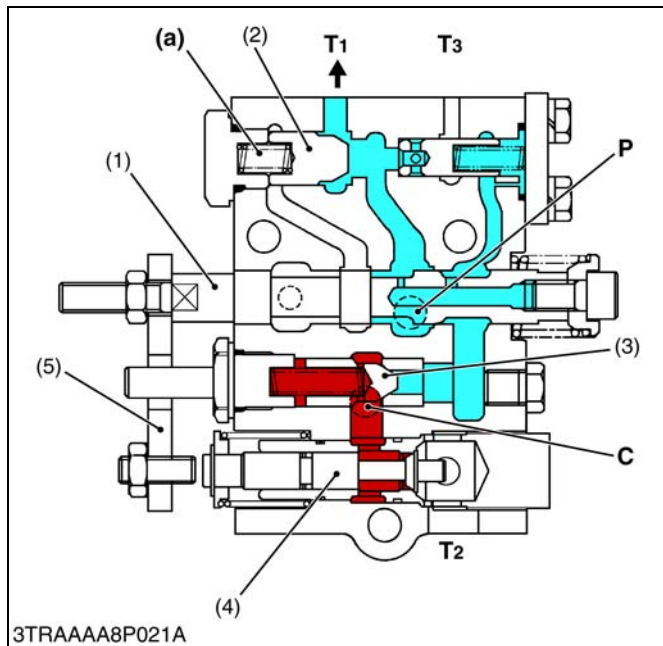
- (1) Spool
- (2) Unload Poppet
- (3) Poppet 2
- (4) Plate

- C : C (Cylinder) Port**
- P : P (Pump) Port**
- T1 : T1 Port**
(To Transmission Case)
- T2 : T2 Port**
(To Transmission Case)

(a) A Chamber

W10157190

(3) Position Control Valve – Type 3 (Code No. 31351-39604)



■ **Neutral**

Pressurized oil flows at the **P** port, pushes open unload poppet (2) and returns to the transmission case from **T1** port.

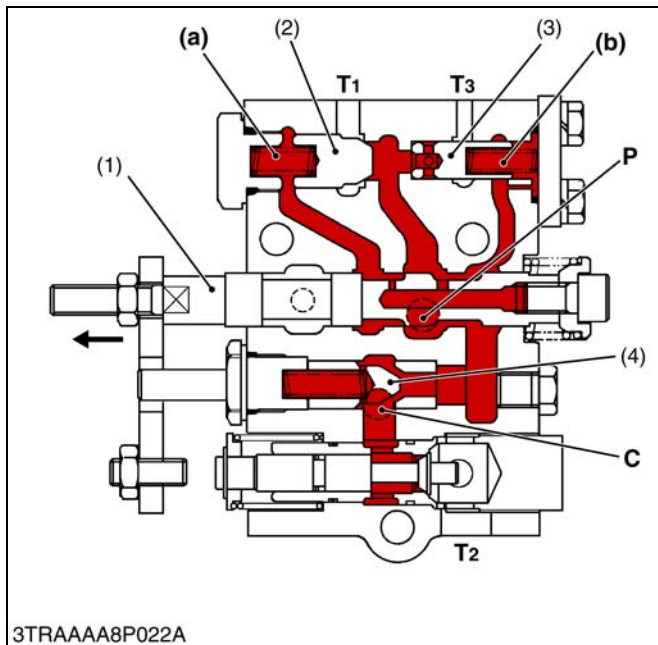
The oil in the **A** chamber (a) behind the unload poppet (2) returns to the transmission case through the clearance between spool (1) and valve body. The oil in the hydraulic cylinder does not flow out because the circuit is cut off by the actions of poppet 1 (3) and poppet 2 (4).

- (1) Spool
- (2) Unload Poppet
- (3) Poppet 1
- (4) Poppet 2
- (5) Plate

- P : P (Pump) Port**
- T1 : T1 Port**
(To Transmission Case)
- T2 : T2 Port**
(To Transmission Case)
- T3 : T3 Port**
(To Transmission Case)

(a) A Chamber
C : C (Cylinder) Port

W10161940



■ Lifting

When the control lever is moved to **UP** position, spool (1) moves to arrow-mark direction. The oil entered **P** port flows into the **A** chamber (a), **B** chamber (b) and closes unload poppet (2), poppet 3 (3).

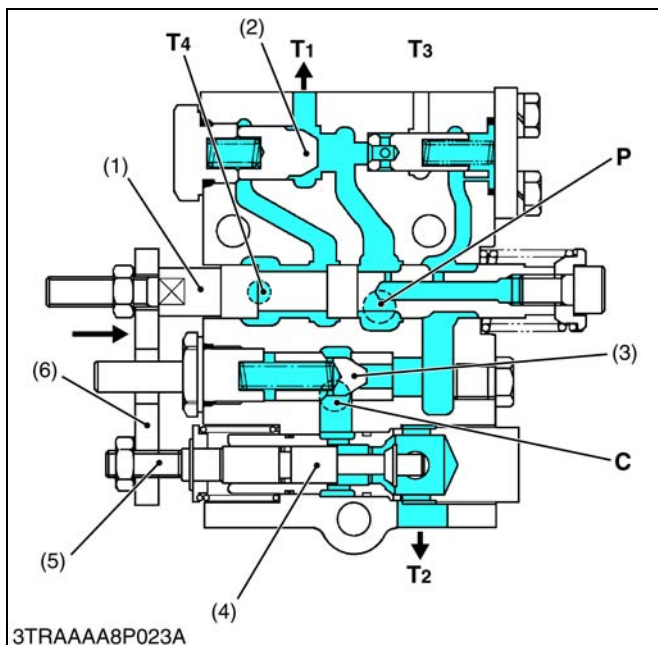
The pressure in the circuit slowly rises, pushing open poppet 1 (4), and the hydraulic oil flows into the hydraulic cylinder from the **C** port, lifting the implement.

- (1) Spool
- (2) Unload Poppet
- (3) Poppet 3
- (4) Poppet 1

- (a) A Chamber
- (b) B Chamber

- C** : C (Cylinder) Port
- P** : P (Pump) Port
- T1** : T1 Port
(To Transmission Case)
- T2** : T2 Port
(To Transmission Case)
- T3** : T3 Port
(To Transmission Case)

W10163440



■ Lowering

When the control lever is moved to **DOWN** position, spool (1) moves to arrow-mark direction, and poppet 2 (4) is pushed by set screw (5). As the poppet 2 (4) is pushed, an oil circuit of **C** port to **T2** port is formed.

The oil in the hydraulic cylinder is forced out by the weight of the implement, and returns to the transmission case through the **C** port and **T2** port, lowering the implement. The pressurized oil at the **P** port pushes open unload poppet (2) and returns to the transmission case from **T1** port.

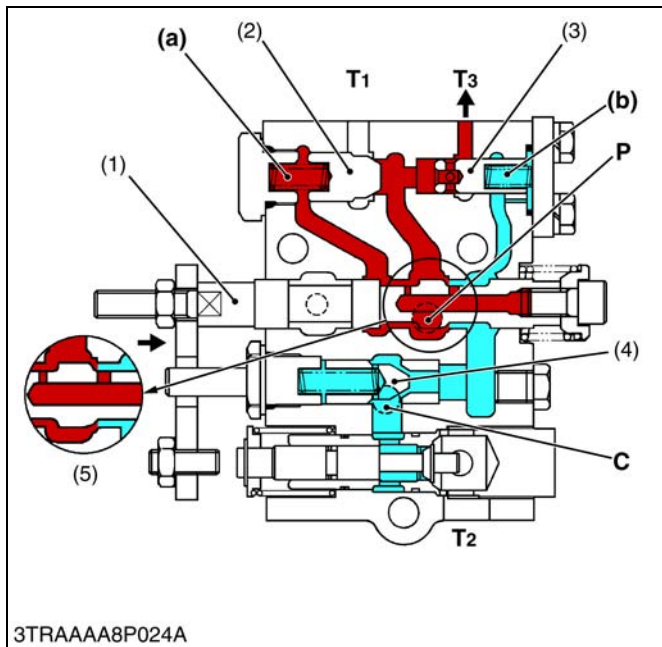
■ Floating

When the control lever is moved all the way to the bottom, spool (1) and poppet 2 (4) remain in the positions described for "**Lowering**". The oil flows freely between the hydraulic pump, hydraulic cylinder and transmission case.

- (1) Spool
- (2) Unload Poppet
- (3) Poppet 1
- (4) Poppet 2
- (5) Set Screw
- (6) Plate
- C** : C (Cylinder) Port
- P** : P (Pump) Port

- T1** : T1 Port
(To Transmission Case)
- T2** : T2 Port
(To Transmission Case)
- T3** : T3 Port
(To Transmission Case)
- T4** : T4 Port
(To Transmission Case)

W10165370



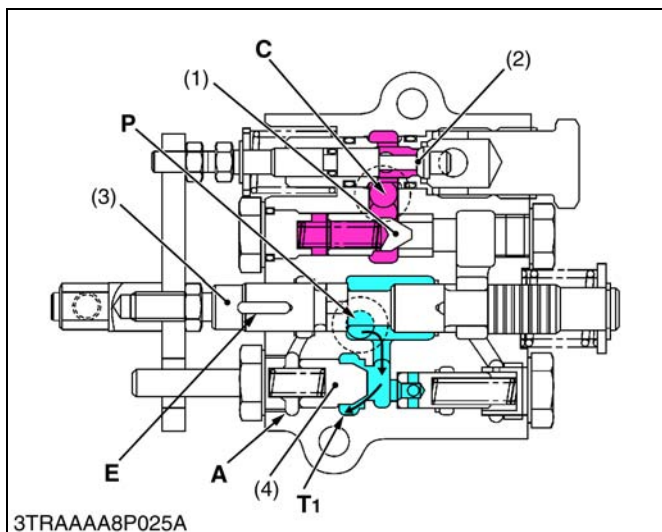
■ Lifting to Neutral

In returning from **Lifting** to **Neutral**, to spool (1) is pushed back to the arrow-mark direction. When the neutral position comes near, the tapered part (5) of the spool (1) makes the pressure difference at the **P** port and **C** port. Therefore, the poppet 1 (4) gradually closes, and absorbs any shock at lifting stop. In that case, since oil is remained in the **A** chamber (a) behind the unload poppet (2), the unload poppet (2) does not open. However, the poppet 3 (3) opens because of low pressure in **B** chamber (b), and then the oil from the pump returns to the transmission case through **T3** port.

- | | |
|----------------------|------------------------------|
| (1) Spool | C : C (Cylinder) Port |
| (2) Unload Poppet | P : P (Pump) Port |
| (3) Poppet 3 | T1 : T1 Port |
| (4) Poppet 1 | (To Transmission Case) |
| (5) Tapered Part | T2 : T2 Port |
| | (To Transmission Case) |
| (a) A Chamber | T3 : T3 Port |
| (b) B Chamber | (To Transmission Case) |

W10166580

(4) Position Control Valve – Type 4 (Code No. T0430-37500)



■ Neutral

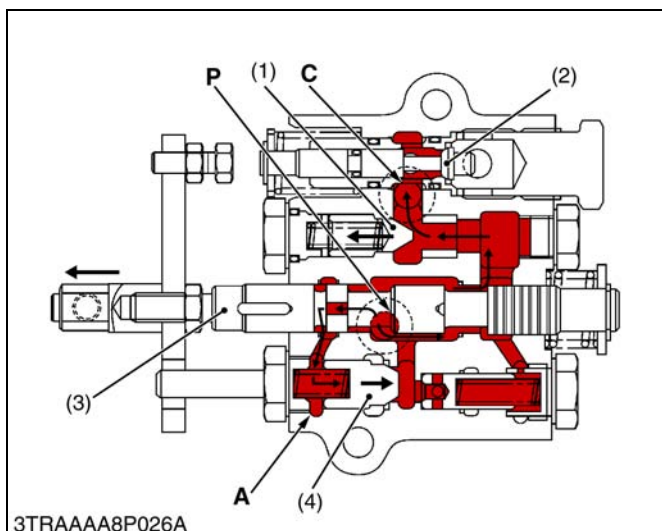
Pressurized oil flows at the **P** port, pushes open unload poppet 1 (4) and returns to tank from **T1** port.

The oil in the chamber **A** behind the unload poppet 1 (4) returns to the tank through the **E** of spool (3) and control valve body. The oil in the hydraulic cylinder does not flow out because the circuit is cut off by the actions of poppet 1 (1), poppet 2 (2).

This allows the implement to be kept at a steady height.

- | | |
|---------------------|--------------------------|
| (1) Poppet 1 | P : Pump Port |
| (2) Poppet 2 | C : Cylinder Port |
| (3) Spool | T1 : Tank Port 1 |
| (4) Unload Poppet 1 | E : Groove 2 |
| | A : Chamber A |

W10173470



■ Lifting

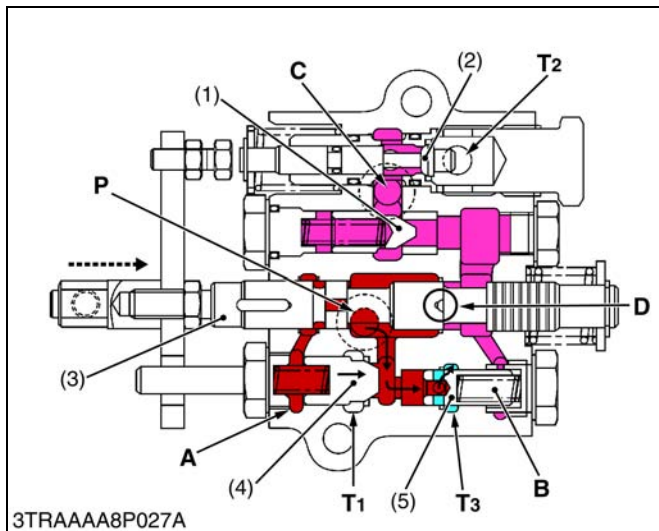
When the control lever is moved to “**UP**” position, spool (3) is pulled by the spool operating lever, forming a circuit with the **P** port and chamber **A**.

The pressurized oil thus flows into the chamber **A** and closes unload poppet 1 (4).

The pressure in the circuit slowly rises, pushing open poppet 1 (1), and the hydraulic oil flows into the hydraulic cylinder from the **C** port, lifting the implement.

- | | |
|---------------------|--------------------------|
| (1) Poppet 1 | P : Pump Port |
| (2) Poppet 2 | C : Cylinder Port |
| (3) Spool | A : Chamber A |
| (4) Unload Poppet 1 | |

W10137420



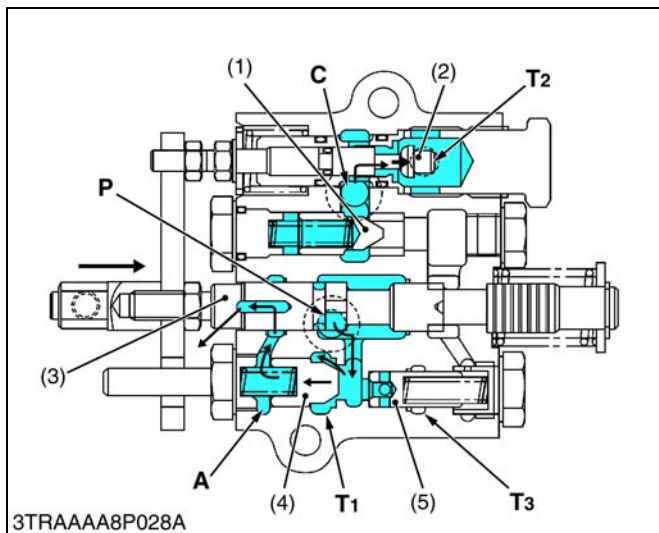
■ **Lifting to Neutral (Acting the shockless mechanism)**

In returning from **Lifting to Neutral**, the spool (3) is pushed back to the arrow-mark direction. When the Neutral position comes near, the groove part **D** of the spool (3) makes the pressure difference at the **P** port and **C** port. Therefore, the poppet 1 (1) gradually closes, and absorbs any shock at lifting stop. In that case, since oil is remained in the chamber **A** of the unload poppet (4) and closes. However, the unload poppet 2 (5) opens because of low pressure in chamber **B**, and then the oil from the pump returns to the transmission case through **T3** port until unload poppet 1 (4) opens.

- (1) Poppet 1
- (2) Poppet 2
- (3) Spool
- (4) Unload Poppet 1
- (5) Unload Poppet 2

- P : Pump Port**
- C : Cylinder Port**
- A : Chamber A**
- B : Chamber B**
- D : Groove 1**
- T1 : Tank Port 1**
- T2 : Tank Port 2**
- T3 : Tank Port 3**

W10139000



■ **Lowering**

When the control lever is moved to “**DOWN**” position, spool (3) moves to arrow-mark direction, and pushes the poppet 2 (2). It forms a circuit with the **C** port and **T2** port.

The oil in the hydraulic cylinder is forced out by the weight of the implement, and returns to the tank through the **C** port and **T2** port, lowering the implement. The pressurized oil pushes open unload poppet (4) and returns to the tank from **T1** port.

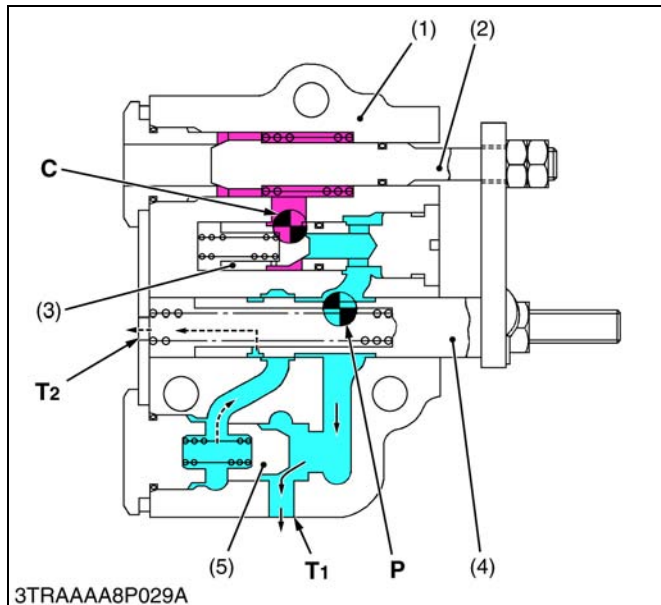
■ **Floating**

When the control lever is lowest position, spool (3) and poppet 2 (2) keeps same as lowering position. The hydraulic cylinder is unloading condition. Therefore pressurized oil pushes open unload poppet (4) and returns to tank.

- (1) Poppet 1
- (2) Poppet 2
- (3) Spool
- (4) Unload Poppet 1
- (5) Unload Poppet 2

- P : Pump Port**
- C : Cylinder Port**
- T1 : Tank Port 1**
- T2 : Tank Port 2**
- T3 : Tank Port 3**

W10140750

(5) Position Control Valve – Type 5 (Code No. 38240-39143)**Neutral**

Oil forced into the control valve through the **P** port pushes open the unload valve (5) and then returns to the transmission case through the **T1** port.

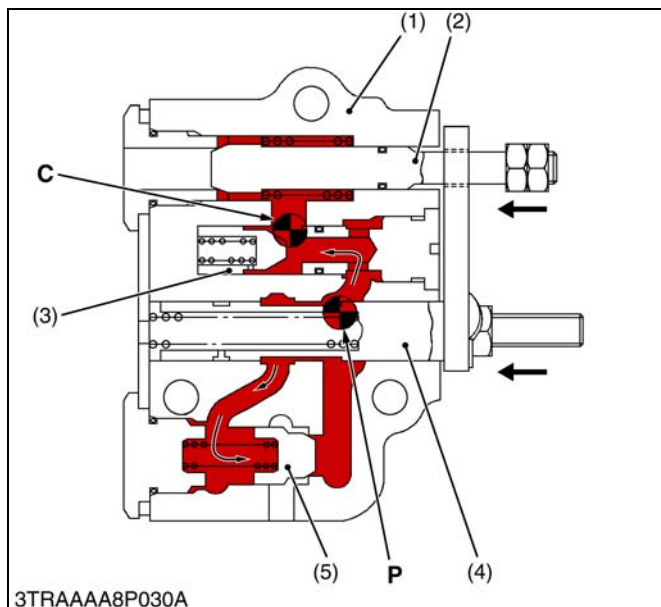
Oil behind the unload valve (5) returns to the transmission case through the spool (4) and the **T2** port.

Since the check valve (3) and poppet valve (2) are closed, oil in the hydraulic cylinder does not flow to the transmission case. Thus, the implement remains at its fixed position.

- (1) Valve Body
- (2) Poppet Valve
- (3) Check Valve
- (4) Spool
- (5) Unload Valve

C : C (Cylinder) Port
P : P (Pump) Port
T1 : T1 Port
(To Transmission Case)
T2 : T2 Port
(To Transmission Case)

W10136450

**Lift**

When the control lever is set to the “**LIFT**” position, the spool (4) is pushed to the left.

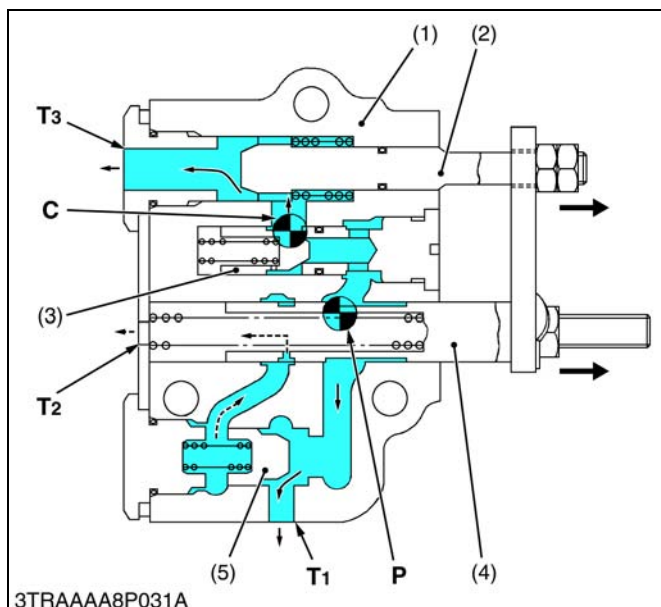
The oil forced into the control valve through the **P** port is directed to the back of the unload valve (5) to close it.

The oil pushes open the check valve (3), and flows into the hydraulic cylinder through the **C** port to lift the implement.

- (1) Valve Body
- (2) Poppet Valve
- (3) Check Valve
- (4) Spool
- (5) Unload Valve

C : C (Cylinder) Port
P : P (Pump) Port

W10137900

**Down**

When the control lever is moved to the “**DOWN**” position, the spool (4) is pulled out to the right, and the poppet valve (2) is also pulled out.

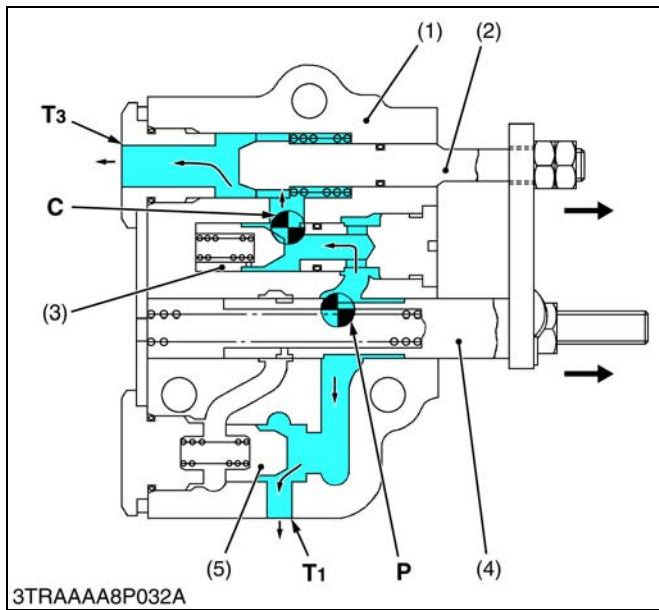
Oil in the hydraulic cylinder is forced out to the transmission case through the **T3** port by the weight of the implement, causing the implement to lower.

Oil forced into the control valve through the **P** port pushes open the unload valve (5) as in neutral and returns to the transmission case through the **T1** port.

- (1) Valve Body
- (2) Poppet Valve
- (3) Check Valve
- (4) Spool
- (5) Unload Valve

C : C (Cylinder) Port
P : P (Pump) Port
T1 : T1 Port
(To Transmission Case)
T2 : T2 Port
(To Transmission Case)
T3 : T3 Port
(To Transmission Case)

W10139310



■ **Floating**

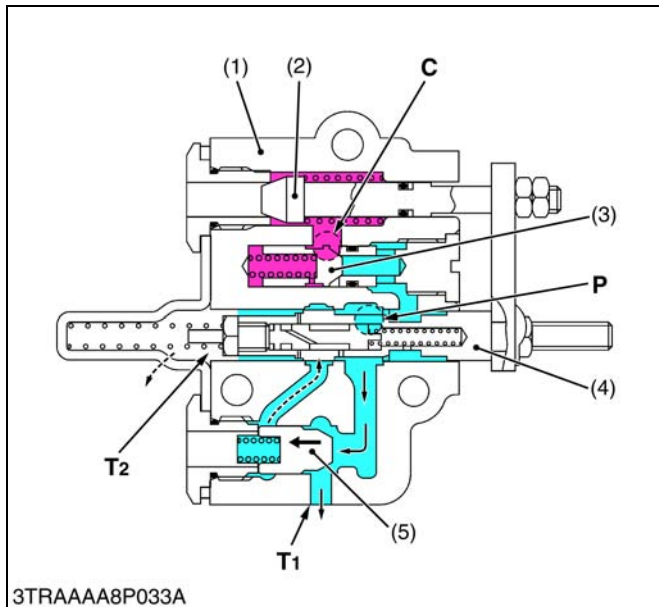
When the position control lever is moved to its lowest position, the spool (4) is maintained at the “DOWN” position. When the implement is at its lowest position, the hydraulic cylinder is in no-load condition, and oil forced out by the hydraulic pump pushes open both the unload valve (5) and check valve (3). Thus, oil flows freely in the valves.

- (1) Valve Body
- (2) Poppet Valve
- (3) Check Valve
- (4) Spool
- (5) Unload Valve

- C : C (Cylinder) Port**
- P : P (Pump) Port**
- T1 : T1 Port**
(To Transmission Case)
- T3 : T3 Port**
(To Transmission Case)

W10140970

(6) Position Control Valve – Type 6 (Code No. 32530-39150)



■ **Neutral**

Oil forced into the control valve through the **P** port pushes open the unload valve (5) and then returns to the transmission case through the **T1** port.

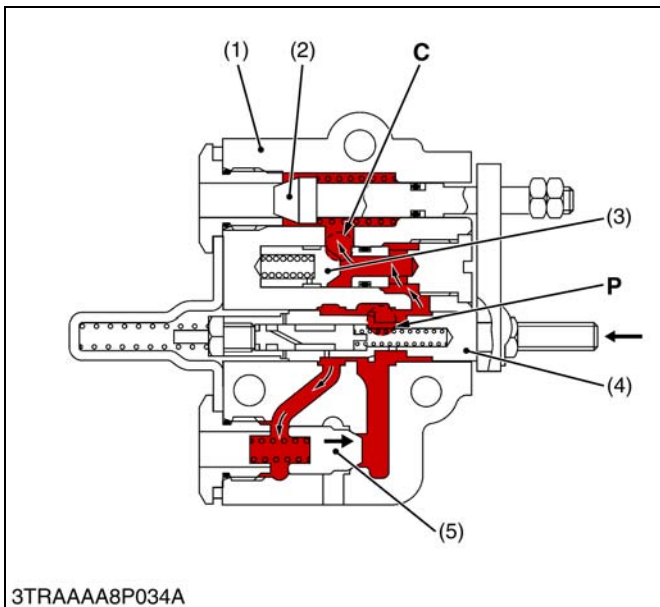
Oil behind the unload valve (5) returns to the transmission case through the spool (4) and the **T2** port.

Since the check valve (3) and poppet valve (2) are closed, oil in the hydraulic cylinder does not flow to the transmission case. Thus, the implement remains at its fixed position.

- (1) Valve Body
- (2) Poppet Valve
- (3) Check Valve
- (4) Spool
- (5) Unload Valve

- C : C (Cylinder) Port**
- P : P (Pump) Port**
- T1, T2 : T1, T2 Port**
(To Transmission Case)

W10135490



■ **Lift**

When the control lever is moved to the **LIFT** position, the spool (4) is pulled to the left.

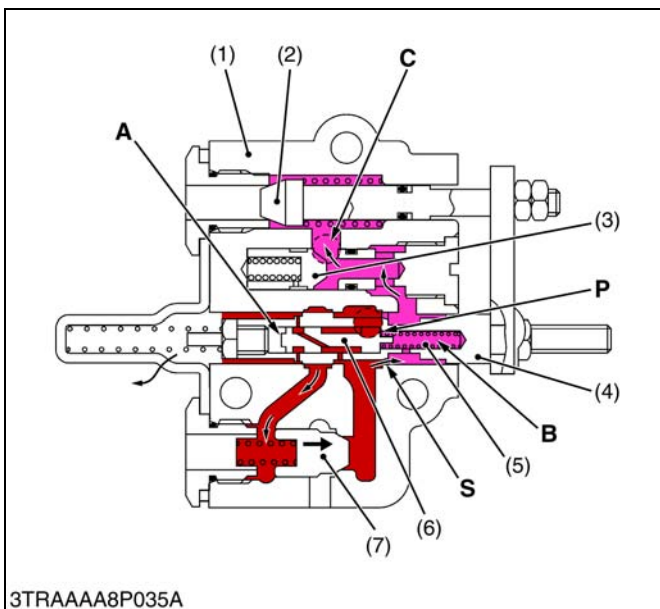
The oil forced into the control valve through the **P** port is directed to the back of the unload valve (5) to close it.

The oil pushed open the check valve (3), and flows into the hydraulic cylinder through the **C** port to lift the implement.

- (1) Valve Body
- (2) Poppet Valve
- (3) Check Valve
- (4) Spool
- (5) Unload Valve

C : C (Cylinder) Port
P : P (Pump) Port

W10137750



■ **Bypass Valve Operation**

This control valve has a bypass valve (6) inside the spool (4) to prevent the tractor from getting a shock when the implement begins to going up or stop going up.

When the implement begins to going up or stop going up, the spool (4) is locked at the position slightly slid from the neutral position. Then, the pressure difference is generated between both ends of the slit **S** of the spool.

The **P** port side pressure is led to the chamber **A** through the passage of bypass valve (6), while the **C** port side pressure is led to the chamber **B**.

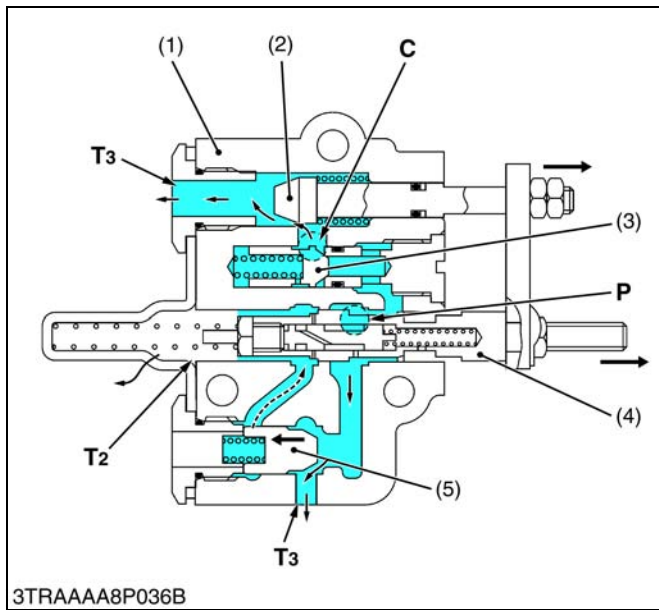
When the pressure difference at the left and right sides of the bypass valve (6) overcomes the force of spring (5), the bypass valve (6) is moved to the right to release part of oil pressure-fed from pump to the transmission case through the passages of bypass valve (6) and spool (4).

As the amount of oil pressure-fed to the hydraulic cylinder is reduced, the implement goes up slowly preventing the tractor from getting a shock.

- (1) Valve Body
- (2) Poppet Valve
- (3) Check Valve
- (4) Spool
- (5) Spring
- (6) Bypass Valve
- (7) Unload Valve

A : Chamber A
B : Chamber B
C : C (Cylinder) Port
P : P (Pump) Port
S : Slit

W10139620



■ **Down**

When the control lever is moved to the **DOWN** position, the spool (4) is pulled out to the right, and the poppet valve (2) is also pulled out.

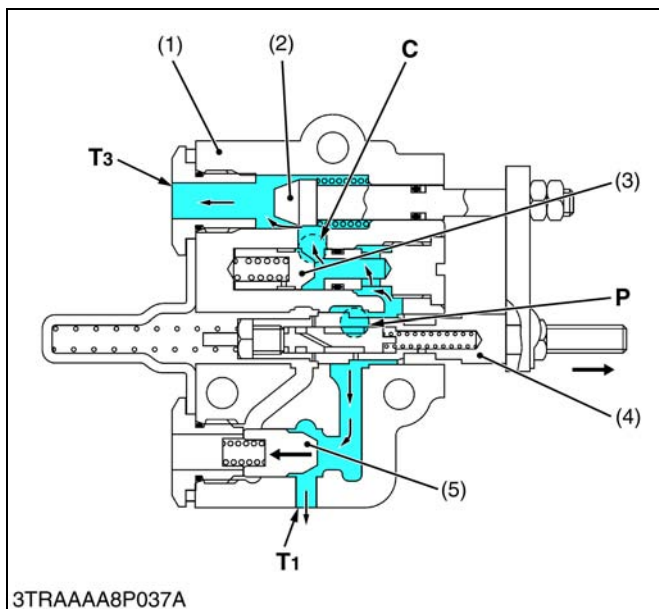
Oil in the hydraulic cylinder is forced out to the transmission case through the **T3** port by the weight of the implement, causing the implement to lower.

Oil forced into the control valve through the **P** port pushes to open the unload valve (5) as in neutral and returns to the transmission case through the **T1** port.

- (1) Valve Body
- (2) Poppet Valve
- (3) Check Valve
- (4) Spool
- (5) Unload Valve

C : C (Cylinder) Port
P : P (Pump) Port
T1, T2, T3 : T1, T2, T3 Port
(To Transmission Case)

W10141330



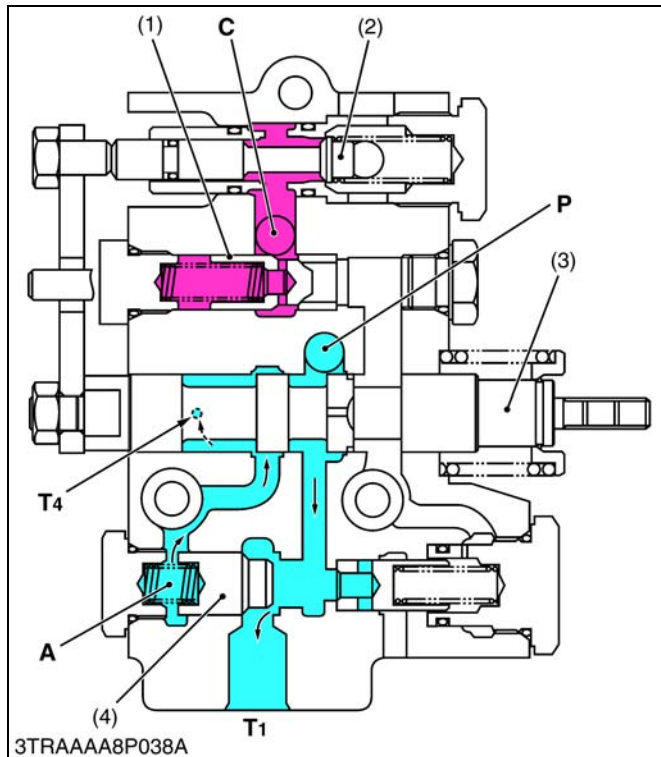
■ **Floating**

When the position control lever is moved to its lowest position, the spool (4) is maintained at the **DOWN** position. When the implement is at its lowest position, the hydraulic cylinder is in no-load condition, and oil forced out by the hydraulic pump pushes to open both the unload valve (5) and check valve (3). Thus, oil flows freely in the position control valve.

- (1) Valve Body
- (2) Poppet Valve
- (3) Check Valve
- (4) Spool
- (5) Unload Valve

C : C (Cylinder) Port
P : P (Pump) Port
T1, T3 : T1, T3 Port
(To Transmission Case)

W10142880

(7) Position Control Valve – Type 7 (Code No. 3A151-82301)**■ Neutral**

Pressurize oil flows at the **P** port, pushes open unload poppet 1 (4) and returns to tank from **T1** port.

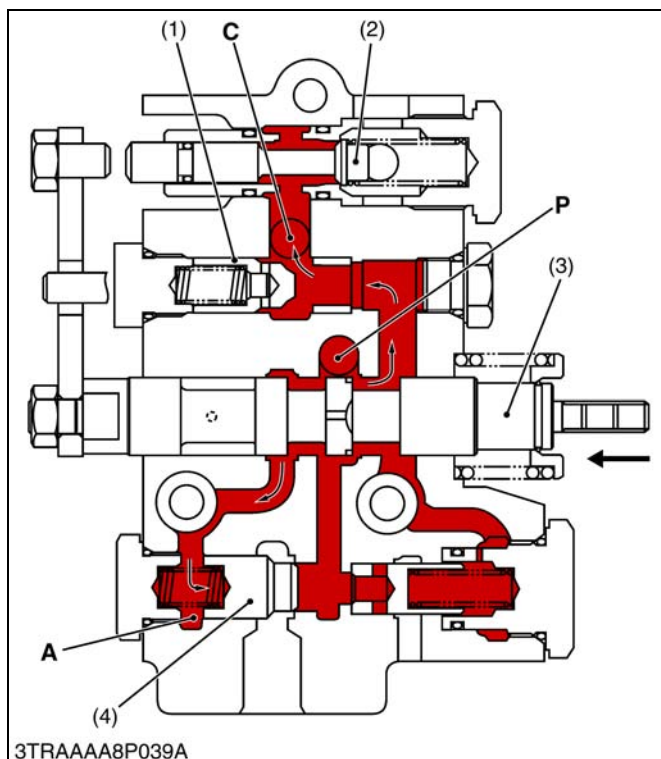
The oil in the chamber **A** behind the unload poppet 1 (4) returns to the tank through the clearance between spool (3) and **T4** port at the valve body. The oil in the hydraulic cylinder does not flow out because the circuit is cut off by the actions of poppet 1 (1), poppet 3 (2).

This allows the implement to be kept at a steady height.

- (1) Poppet 1
- (2) Poppet 3
- (3) Spool
- (4) Unload Poppet 1

P : Pump Port
C : Cylinder Port
T1 : Tank Port 1
T4 : Tank Port 4
A : Chamber A

W10144780

**■ Lift**

When the control lever is moved to “UP”, spool (3) is pushed by the spool operating lever, forming a circuit with the **P** port and chamber **A**.

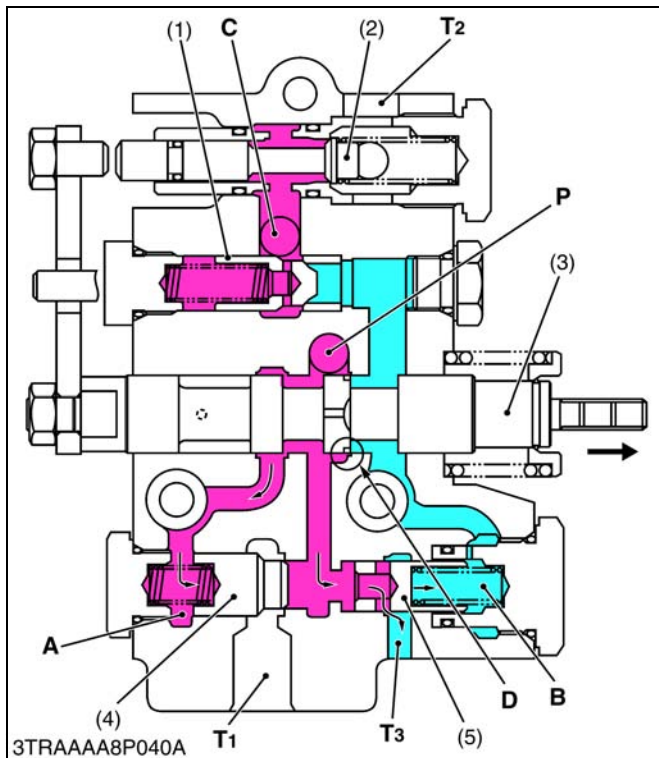
The pressurized oil thus flows into the chamber **A** and closes unload poppet 1 (4).

The pressure in the circuit slowly rises, pushing open poppet 1 (1), and the hydraulic oil flows into the hydraulic cylinder from the **C** port, lifting the implement.

- (1) Poppet 1
- (2) Poppet 3
- (3) Spool
- (4) Unload Poppet 1

P : Pump Port
C : Cylinder Port
A : Chamber A

W10146200



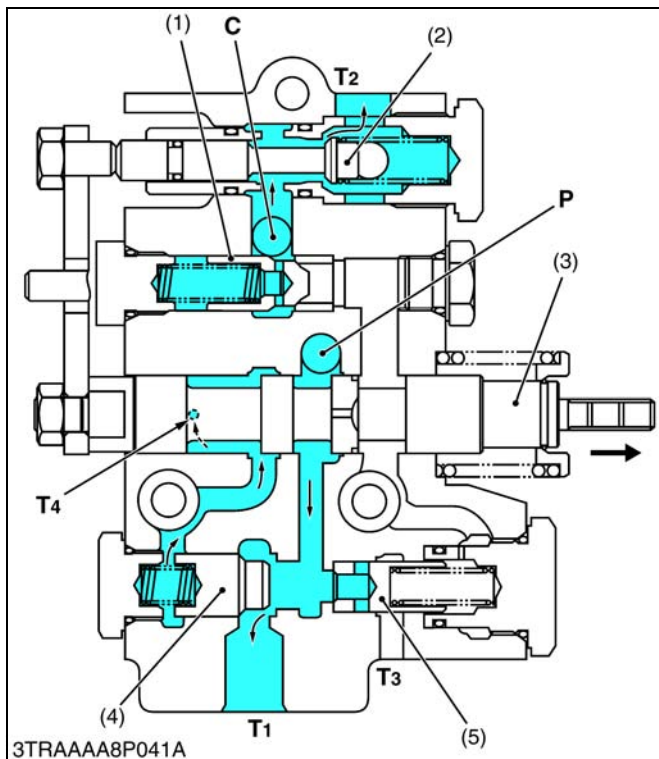
■ **Lift to Neutral (Acting the Shockless Mechanism)**

In returning from **Lifting** to **Neutral**, the spool (3) is pulled back to the arrow-mark direction. When the **Neutral** position comes near, the tapered part **D** of the spool (3) makes the pressure difference at the **P** port and **C** port. Therefore, the poppet 1 (1) gradually closes, and absorbs any shock at lifting stop. In that case, since oil is remained in the chamber **A** of the unload poppet 1 (4), the unload poppet 1 (4) does not open. However, the unload poppet 2 (5) opens because of low pressure in chamber **B**, and then the oil from the pump returns to the transmission case through **T3** port.

- (1) Poppet 1
- (2) Poppet 3
- (3) Spool
- (4) Unload Poppet 1
- (5) Unload Poppet 2

- P** : Pump Port
- A** : Chamber A
- B** : Chamber B
- C** : Cylinder Port
- D** : Tapered Part
- T1** : Tank Port 1
- T2** : Tank Port 2
- T3** : Tank Port 3

W10148450



■ **Down**

When the control lever is moved to **Down**, spool (3) moves to arrow-mark direction, and push the poppet 3 (2). It forms a circuit with the **C** port and **T2** port.

The oil in the hydraulic cylinder is forced out by the weight of the implement, and returns to the tank through the **C** port and **T2** port, lowering the implement. The pressurized oil pushes open unload poppet 1 (4) and returns to the tank from **T1** port.

■ **Floating**

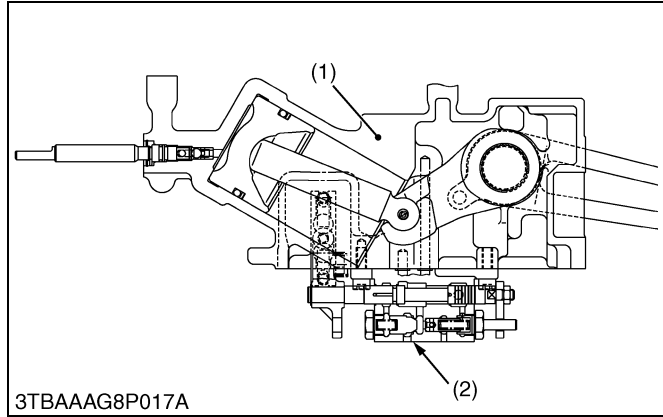
When the control lever is lowest position, spool (3) and poppet 3 (2) keeps same as lowering position. The hydraulic cylinder is unloading condition. Therefore pressurized oil pushes open unload poppet 1 (4), poppet 1 (1) and returns to transmission case.

- (1) Poppet 1
- (2) Poppet 3
- (3) Spool
- (4) Unload Poppet 1
- (5) Unload Poppet 2

- P** : Pump Port
- C** : Cylinder Port
- T1** : Tank Port 1
- T2** : Tank Port 2
- T3** : Tank Port 3
- T4** : Tank Port 4

W10150850

(8) Position Control Valve – Type 8 (Code No. YR906-00106)



This position control (2) valve is located under the hydraulic cylinder block (1).

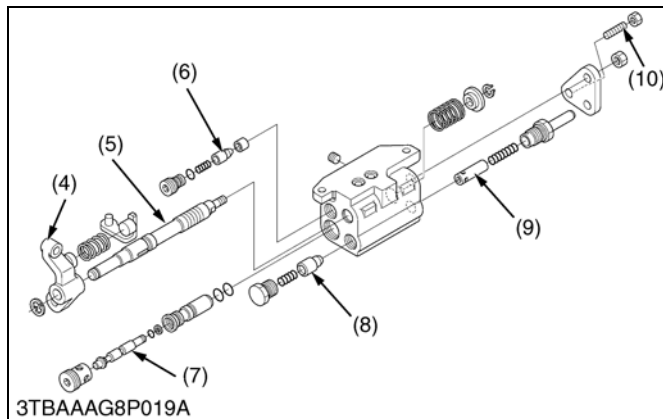
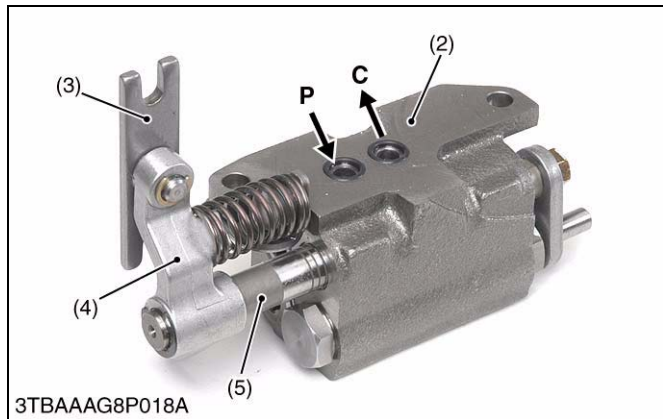
This control valve is mechanically connected to the position control lever with linkage.

This control valve is also mechanically connected to the lift arm with a feed back rod.

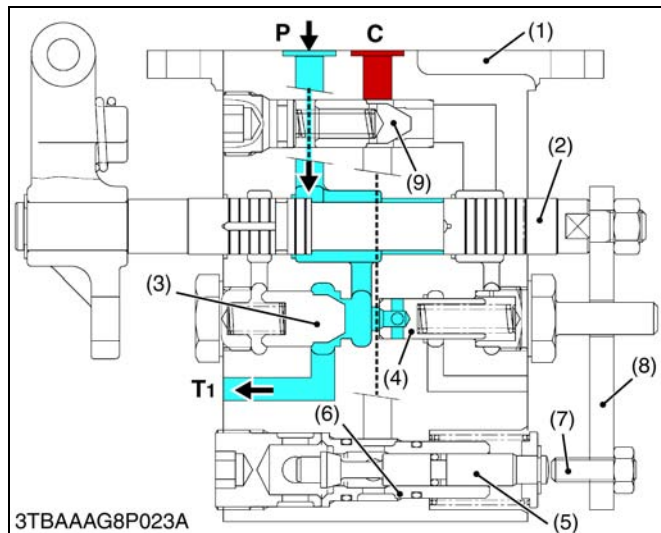
This control valve controls the oil flow forced from hydraulic pump and the oil returned back from the hydraulic cylinder.

- (1) Hydraulic Cylinder Block
- (2) Position Control Valve
- (3) Link
- (4) Lever
- (5) Spool
- (6) Poppet
- (7) Poppet
- (8) Poppet
- (9) Poppet
- (10) Set Screw

P : Pump Port
C : Cylinder Port



W10296420



■ Neutral

Oil forced into the control valve through **P** port pushes and opens the unload valve (3), and opens the unload valve (3), and then returns to the transmission case through **T1** port.

Oil behind the unload valve (3) returns to the transmission case through the groove of the spool (2).

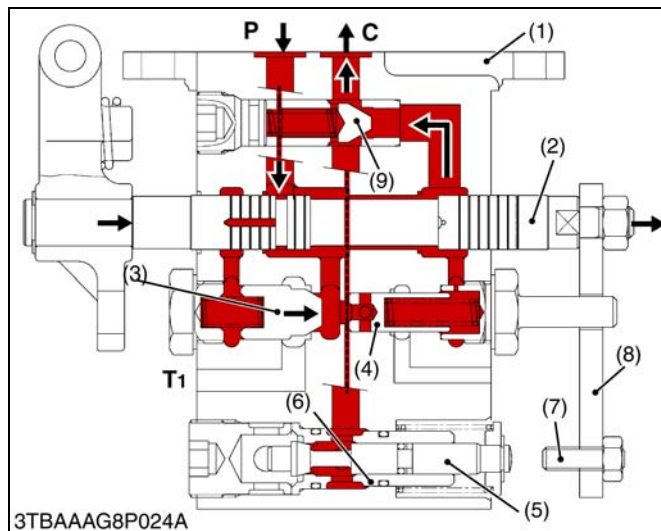
Since the check valve (9) and the poppet 2 (5) are closed, oil in the hydraulic cylinder does not flow to the transmission case. Thus, the implement remains at its fixed position.

- (1) Valve Body
- (2) Spool
- (3) Unload Valve
- (4) Unload Poppet
- (5) Poppet 2
- (6) Sleeve
- (7) Adjusting Bolt

- (8) Connecting Plate
- (9) Check Valve

A : Pump Port
C : Cylinder Port
T1 :Tank Port

W10305440



■ Lift

When the position control lever is set to "**LIFT**" position, the spool (2) is pushed into the valve body (1).

The oil forced into the control valve body (1) through **P** port flows to two oil circuits.

The first circuit is oil flowing to the back of the unload valve (3) to close it.

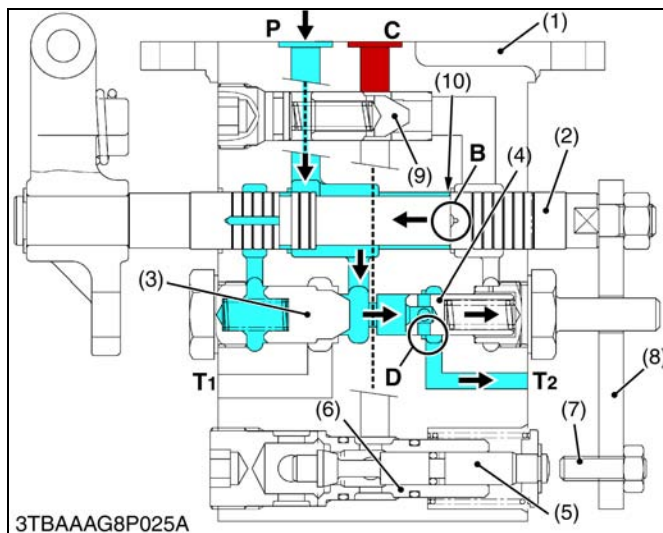
The second oil circuit is oil flowing to the check valve (9) and the hydraulic cylinder through **C** port to lift the implement.

- (1) Valve Body
- (2) Spool
- (3) Unload Valve
- (4) Unload Poppet
- (5) Poppet 2
- (6) Sleeve
- (7) Adjusting Bolt

- (8) Connecting Plate
- (9) Check Valve

A : Pump Port
C : Cylinder Port
T1 :Tank Port

W10316200



Shockless Mechanism Operating (Lift to Neutral)

When the implement begins to lift up, the feedback rod connected to the lift arm pushes back the spool (2) to near "NEUTRAL" position.

When the implement lifts up near the "NEUTRAL" position, quantity of oil passing through the orifice (10) is reduced.

It causes oil pressure difference between portion B and unload poppet (4).

Since oil pressure at unload poppet (4) is higher than oil pressure at portion D, oil forced from P port pushes and opens unload poppet (4), and oil drains through T2 port to transmission case.

Quantity of oil flowing through portion B is less.

Quantity of oil flowing to unload poppet (4) is greater.

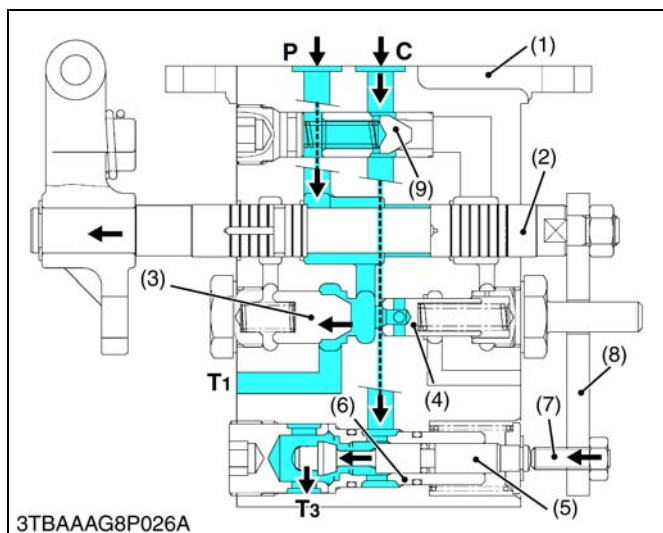
It causes oil pressure increase at portion D of the unload poppet (4).

While the implement is coming to "NEUTRAL" position, quantity of oil flowing to spool (2) is reduced at portion B. And then, oil drains through unload poppet (4) to transmission case.

It causes implement's smooth stopping at "NEUTRAL" position without shock.

- | | |
|--------------------|--------------------------|
| (1) Valve Body | (8) Connecting Plate |
| (2) Spool | (9) Check Valve |
| (3) Unload Valve | (10) Orifice |
| (4) Unload Poppet | |
| (5) Poppet 2 | A : Pump Port |
| (6) Sleeve | C : Cylinder Port |
| (7) Adjusting Bolt | T1 :Tank Port |

W10319020



Down

When the position control lever is set to "DOWN" position, the spool (2) is pulled out from the control valve body (1).

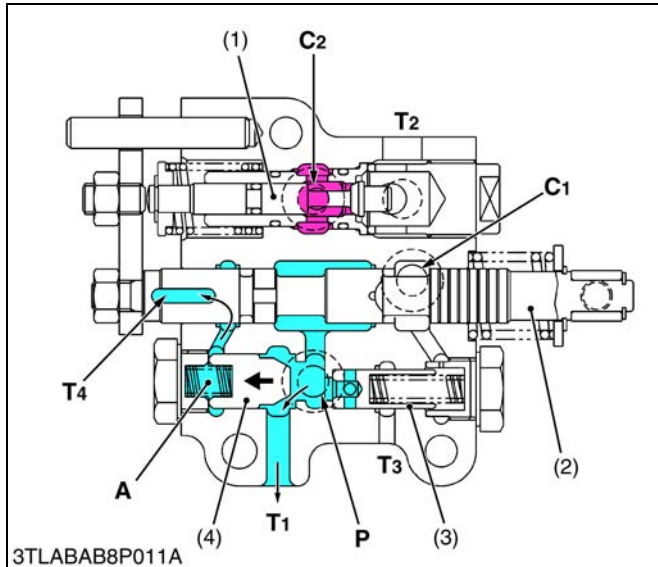
At the same time, the adjust bolt (7) connected to the connecting plate (8) pushes the poppet (5) into the control valve body (1). And then the poppet (5) is opened.

Oil in the hydraulic cylinder is forced out through T3 port and T4 port to transmission case by the weight of the implement, causing the implement to lower.

Oil forced into the control valve through P port pushes and opens the unload valve (3) and returns to the transmission case through T1 port.

- | | |
|--------------------|--------------------------|
| (1) Valve Body | (8) Connecting Plate |
| (2) Spool | (9) Check Valve |
| (3) Unload Valve | |
| (4) Unload Poppet | A : Pump Port |
| (5) Poppet 2 | C : Cylinder Port |
| (6) Sleeve | T1 :Tank Port |
| (7) Adjusting Bolt | |

W10325040

(9) Position Control Valve – Type 9 (Code No. YW276-00100)**■ Neutral**

Pressurized oil flows at the **P** port, pushes open unload poppet 1 (4) and returns to tank from **T1** port.

The oil in the chamber **A** behind the unload poppet 1 (4) returns to the tank from **T4** port. The oil in the hydraulic cylinder does not flow out because the circuit is cut off by the actions of poppet 2 (1) and check valve in the rear hydraulic block.

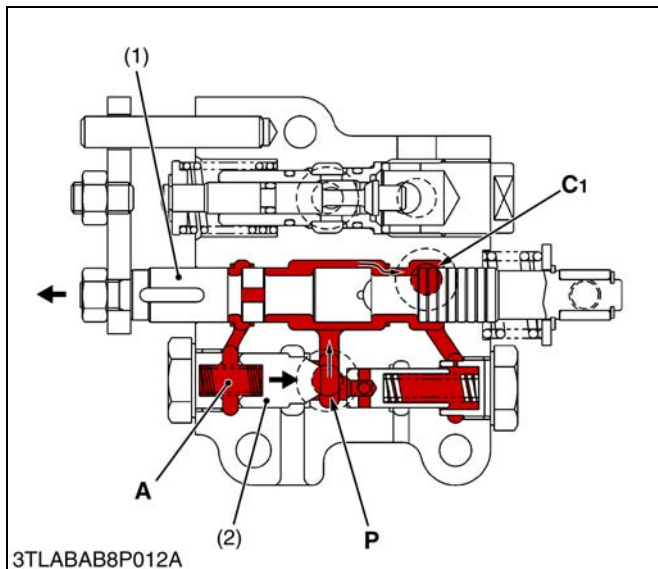
This allows the implement to be kept at a steady height.

- (1) Poppet 2
- (2) Spool
- (3) Unload Poppet 2
- (4) Unload Poppet 1

P : Pump Port
C1 : Cylinder Port 1
C2 : Cylinder Port 2
T1 : Tank Port 1
T2 : Tank Port 2
T3 : Tank Port 3
T4 : Tank Port 4

A : Chamber A

W1013891

**■ Lifting**

When the control lever is moved to “**LIFT**” position, spool (1) is pushed by the spool operating lever, forming a circuit with the **P** port and chamber **A**.

The pressurized oil thus flows into the chamber **A** and closes unload poppet 1 (2).

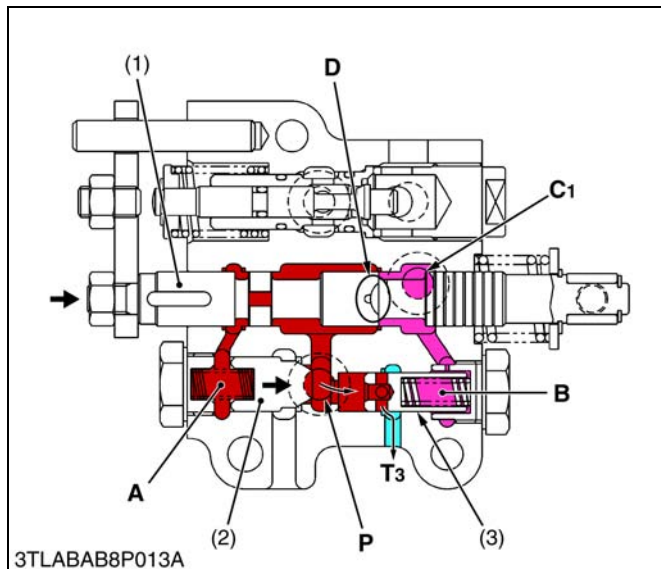
The oil from **C1** port flows into hydraulic cylinder through check valve in the rear hydraulic block to lift the implement.

- (1) Spool
- (2) Unload Poppet 1

P : Pump Port
C1 : Cylinder Port 1

A : Chamber A

W1014132



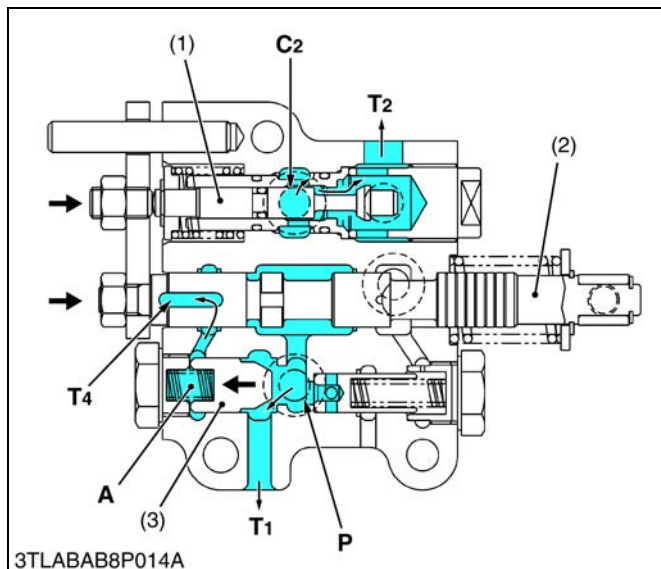
■ Lifting to Neutral (Acting the shockless mechanism)

In returning from **Lifting** to **Neutral**, the spool (1) is pushed back to the arrow-mark direction. When the **Neutral** position comes near, the groove part **D** of the spool (1) makes the pressure difference at the **P** port and **C1** port. Therefore, the check valve in the rear hydraulic block gradually closes, and absorbs any shock at lifting stop. In that case, since oil is remained in the chamber **A** of the unload poppet 1 (2) and closes. However, the unload poppet 2 (3) opens because of low pressure in chamber **B**, and then the oil from the pump returns to the transmission case through **T3** port until unload poppet 1 (2) opens.

- (1) Spool
- (2) Unload Poppet 1
- (3) Unload Poppet 2
- A** : Chamber A
- B** : Chamber B
- D** : Groove

- P** : Pump Port
- C1** : Cylinder Port 1
- T3** : Tank Port 3

W1014273



■ Lowering

When the control lever is moved to “**DOWN**” position, spool (2) moves to arrow-mark direction, and pushes the poppet 2 (1). It forms a circuit with the **C2** port and **T2** port.

The oil in the hydraulic cylinder is forced out by the weight of the implement, and returns to the tank through the **C2** port and **T2** port, lowering the implement.

The pressurized oil at the **P** port pushes open unload poppet 1 (3) and returns to tank from **T1** port.

■ Floating

When the control lever is moved all the way to the bottom, spool (2) and poppet 2 (1) remain in the position described for “**Lowering**”. The oil flows freely between the hydraulic pump, hydraulic cylinder and tank.

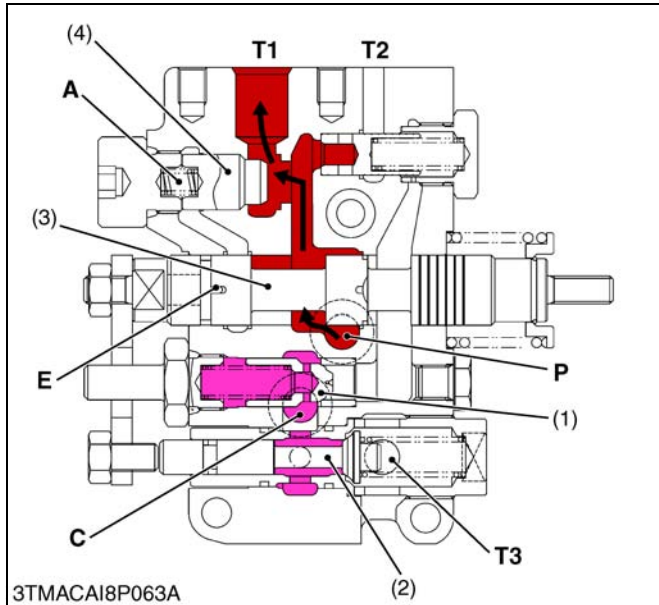
- (1) Poppet 2
- (2) Spool
- (3) Unload Poppet 1

A : Chamber A

- P** : Pump Port
- C2** : Cylinder Port 2
- T1** : Tank Port 1
- T2** : Tank Port 2
- T4** : Tank Port 4

W1014640

(10) Position Control Valve – Type 10 (Code No. YW158-00100)



■ **Neutral**

Pressurized oil flows at the **P** port, pushes open unload poppet 1 (4) and returns to tank from **T1** port.

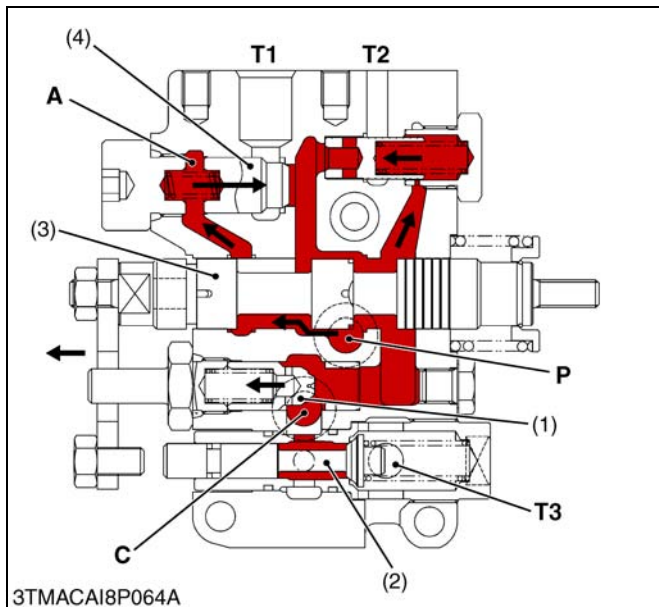
The oil in the chamber **A** behind the unload poppet 1 (4) returns to the tank through the **E** of spool (3) and control valve body. The oil in the hydraulic cylinder does not flow out because the circuit is cut off by the actions of poppet 1 (1), poppet 2.

This allows the implement to be kept at a steady height.

- (1) Poppet 1
- (2) Poppet 2
- (3) Spool
- (4) Unload Poppet 1

- P : Pump Port**
- C : Cylinder Port**
- T1 : Tank Port 1**
- T2 : Tank Port 2**
- T3 : Tank Port 3**
- E : Groove**
- A : Chamber A**

W1020421



■ **Lifting**

When the control lever is moved to “**UP**” position, spool (3) is pulled by the spool operating lever, forming a circuit with the **P** port and chamber **A**.

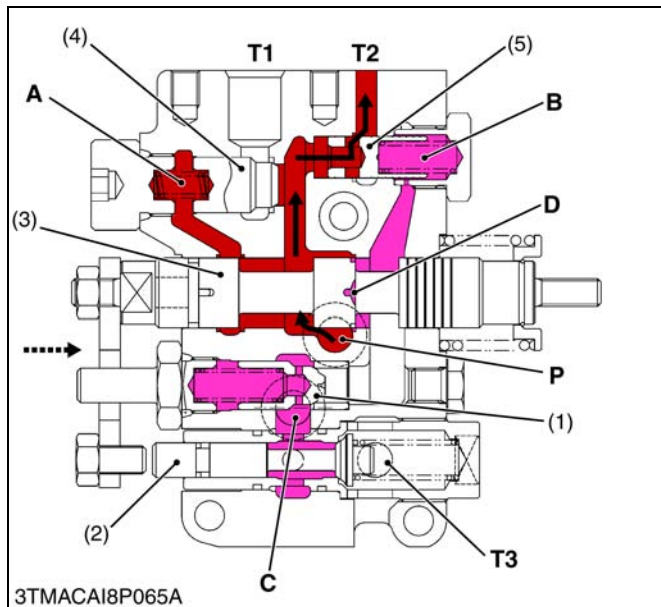
The pressurized oil thus flows into the chamber **A** and closes unload poppet 1 (4).

The pressure in the circuit slowly rises, pushing open poppet 1 (1), and the hydraulic oil flows into the hydraulic cylinder from the **C** port, lifting the implement.

- (1) Poppet 1
- (2) Poppet 2
- (3) Spool
- (4) Unload Poppet 1

- P : Pump Port**
- C : Cylinder Port**
- T1 : Tank Port 1**
- T2 : Tank Port 2**
- T3 : Tank Port 3**
- A : Chamber A**

W1020747



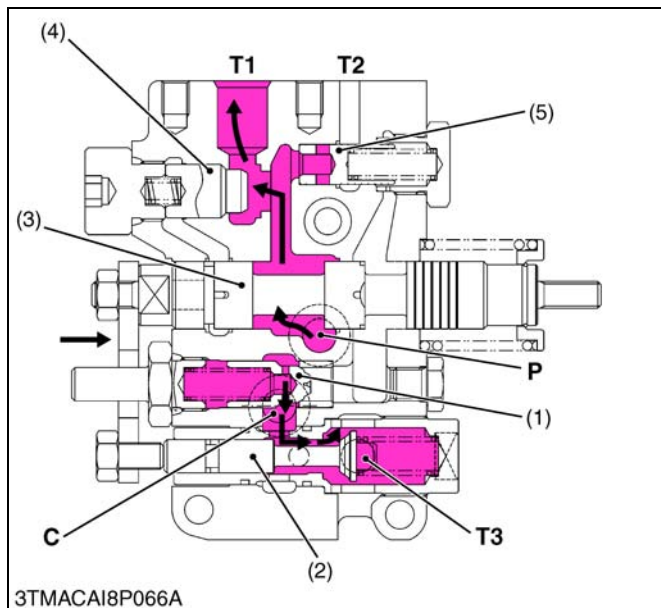
■ Lifting to Neutral (Acting the shockless mechanism)

In returning from **Lifting** to **Neutral**, the spool (3) is pushed back to the arrow-mark direction. When the **Neutral** position comes near, the groove part **D** of the spool (3) makes the pressure difference at the **P** port and **C** port. Therefore, the poppet 1 (1) gradually closes, and absorbs any shock at lifting stop. In that case, since oil is remained in the chamber **A** of the unload poppet (4) and closes. However, the unload poppet 2 (5) opens because of low pressure in chamber **B**, and then the oil from the pump returns to the transmission case through **T2** port until unload poppet 1 (4) opens.

- (1) Poppet 1
- (2) Poppet 2
- (3) Spool
- (4) Unload Poppet 1
- (5) Unload Poppet 2

- P** : Pump Port
- C** : Cylinder Port
- A** : Chamber A
- B** : Chamber B
- D** : Groove
- T1** : Tank Port 1
- T2** : Tank Port 2
- T3** : Tank Port 3

W1020929



■ Lowering

When the control lever is moved to “**DOWN**” position, spool (3) moves to arrow-mark direction, and pushes the poppet 2 (2). It forms a circuit with the **C** port and **T3** port.

The oil in the hydraulic cylinder is forced out by the weight of the implement, and returns to the tank through the **C** port and **T3** port, lowering the implement. The pressurized oil pushes open unload poppet (4) and returns to the tank from **T1** port.

■ Floating

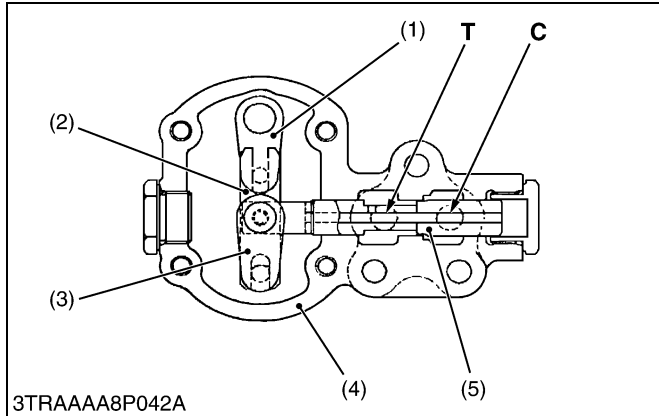
When the control lever is lowest position, spool (3) and poppet 2 (2) keeps same as lowering position. The hydraulic cylinder is unloading condition. Therefore pressurized oil pushes open unload poppet (4) and returns to tank.

- (1) Poppet 1
- (2) Poppet 2
- (3) Spool
- (4) Unload Poppet 1
- (5) Unload Poppet 2

- P** : Pump Port
- C** : Cylinder Port
- T1** : Tank Port 1
- T2** : Tank Port 2
- T3** : Tank Port 3

W1021318

[3] DRAFT CONTROL VALVE

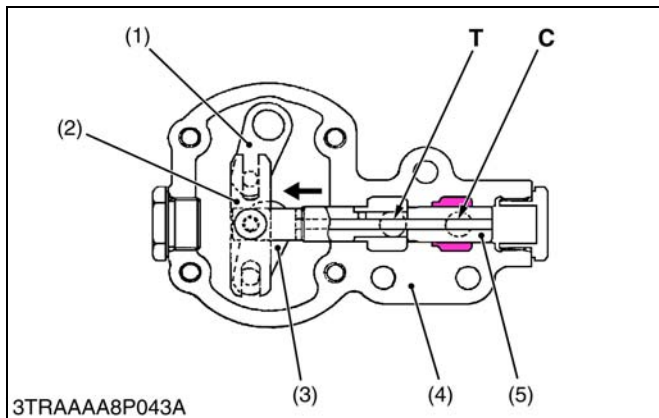


When the traction load nearly equals the setting traction load determined by the position of draft control lever, the oil passage to the transmission case is throttled to generate the constant oil pressure in the hydraulic cylinder. (Neutral)

Therefore the position of the implement is maintains.

- (1) Control Lever Shaft
 - (2) Spool Drive Lever
 - (3) Feedback Lever Shaft
 - (4) Valve Body
 - (5) Spool
- C : Cylinder Port**
T : Tank Port

W10204890

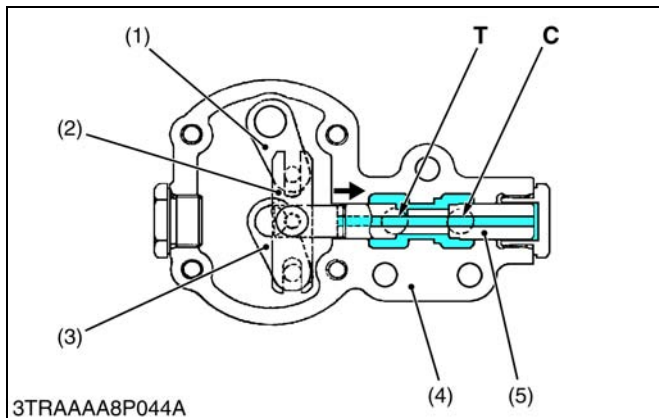


When the traction load increases, the spool (5) in the draft control valve is pushed in closing the oil passage to the transmission case, so oil flows into the hydraulic cylinder to raise the implement.

As the implement is raised and the traction load decrease, the spool (5) is restored to form a neutral circuit in the draft control valve.

- (1) Control Lever Shaft
 - (2) Spool Drive Lever
 - (3) Feedback Lever Shaft
 - (4) Valve Body
 - (5) Spool
- C : Cylinder Port**
T : Tank Port

W10205730



When the traction load decreases, the spool (5) in the draft control valve is pulled out, opening the oil passage to the transmission case. Therefore, the oil in the hydraulic cylinder returns to the transmission case together with the oil from the hydraulic pump, and the implement lowers.

As the implement lowers and the traction load increases, the spool (5) is twisted to form a neutral circuit in the draft control valve.

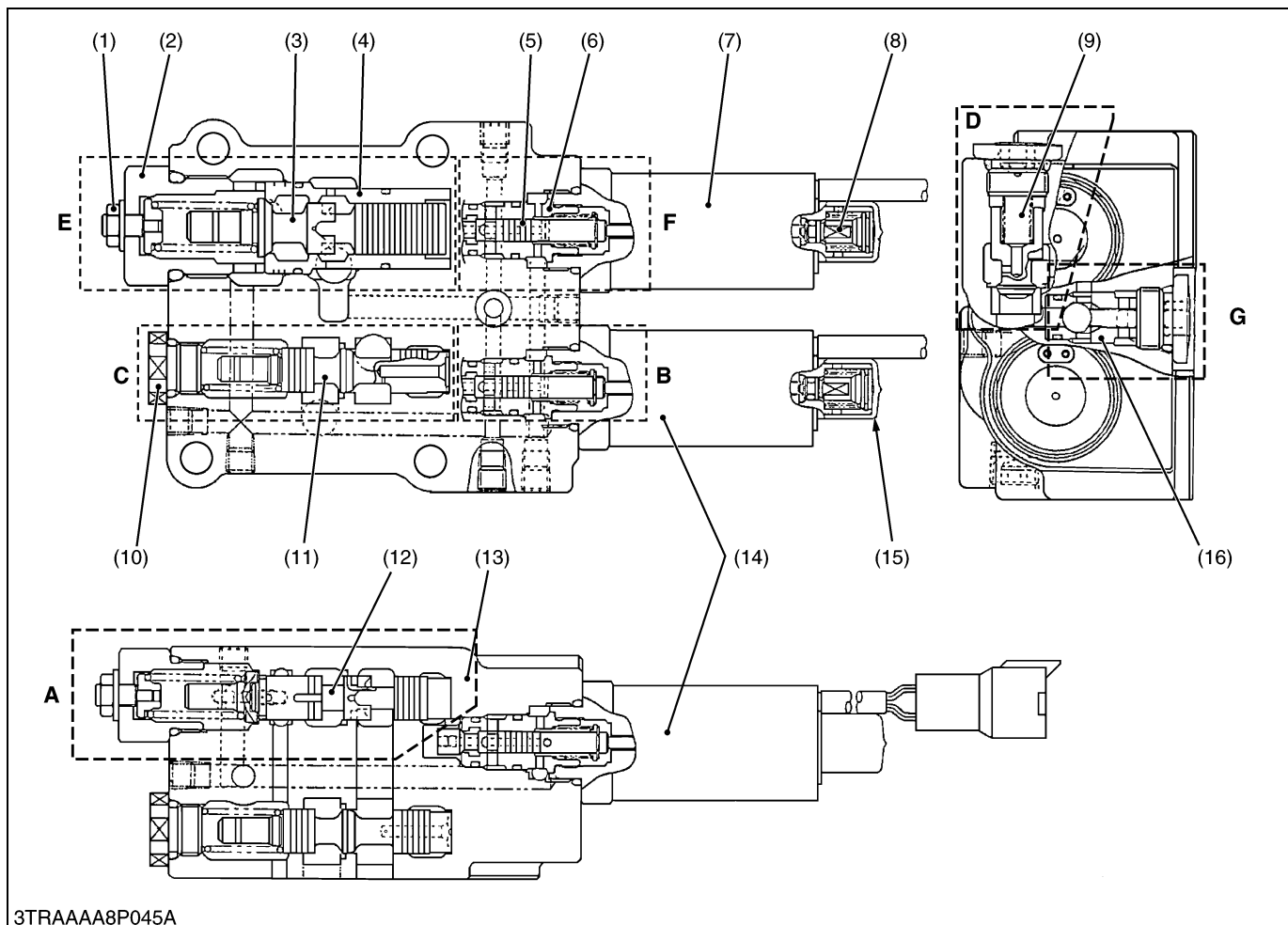
- (1) Control Lever Shaft
 - (2) Spool Drive Lever
 - (3) Feedback Lever Shaft
 - (4) Valve Body
 - (5) Spool
- C : Cylinder Port**
T : Tank Port

W10204060

[4] SOLENOID PROPORTIONAL CONTROL VALVE

The solenoid proportional control valve is used to regulate the oil flowrate in proportion to the electric current. When the solenoid is energized, its current activates the main spool proportionally, which controls the oil flowing into the hydraulic cylinder.

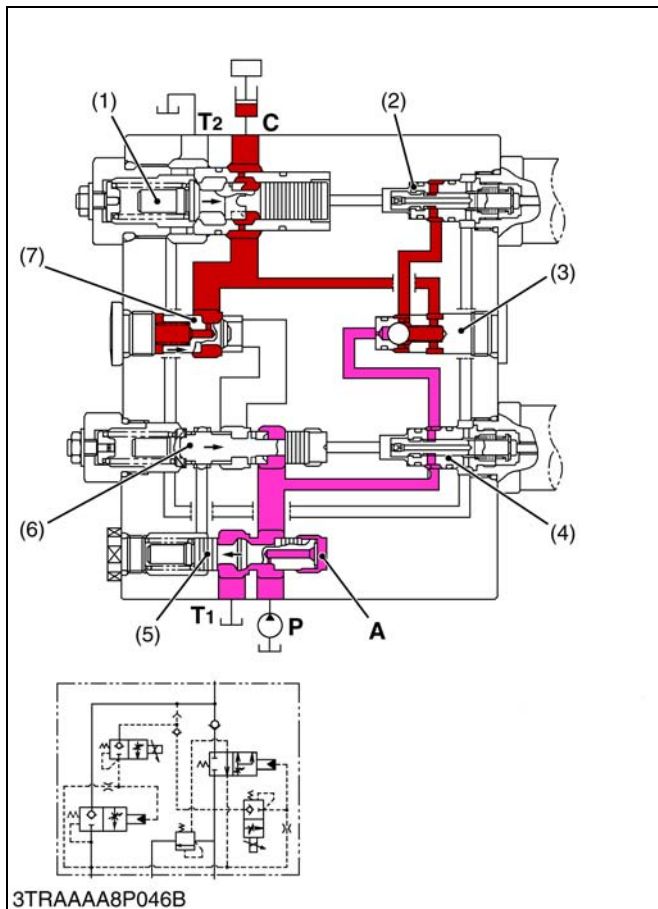
■ Component and the Function



- | | | | |
|-----------------------------|---------------------------------|-----------------------------|---------------------------------|
| (1) Adjusting Screw | (5) Pilot Spool | (9) Check Valve | (13) Valve Body |
| (2) Plug | (6) Sleeve | (10) Plug | (14) Solenoid Valve for Lifting |
| (3) Main Spool for Lowering | (7) Solenoid Valve for Lowering | (11) Spool (Unload Valve) | (15) Cap |
| (4) Bush | (8) Manual Push Button | (12) Main Spool for Lifting | (16) Shuttle Valve |

	Name	Function
A	Main spool for lifting	Flow control on lifting side
B	Pilot valve for lifting	Pilot pressure control of main spool for lifting
C	Compensator (Unload valve)	The part has the following functions : compensating the pressure at lifting flow control; regulating the hydraulic pressure for the high pressure selector valve when lowering the attachment (the hydraulic cylinder in under light load); serving as an unload valve at neutral.
D	Check valve	Backflow protection of oil from cylinder port to pump port
E	Main spool for lowering	Flow control on lowering side
F	Pilot valve for lowering	Pilot pressure control of main spool lowering
G	High pressure selecting valve	Selection of pilot valve primary passage for lowering

W10208470



■ Neutral

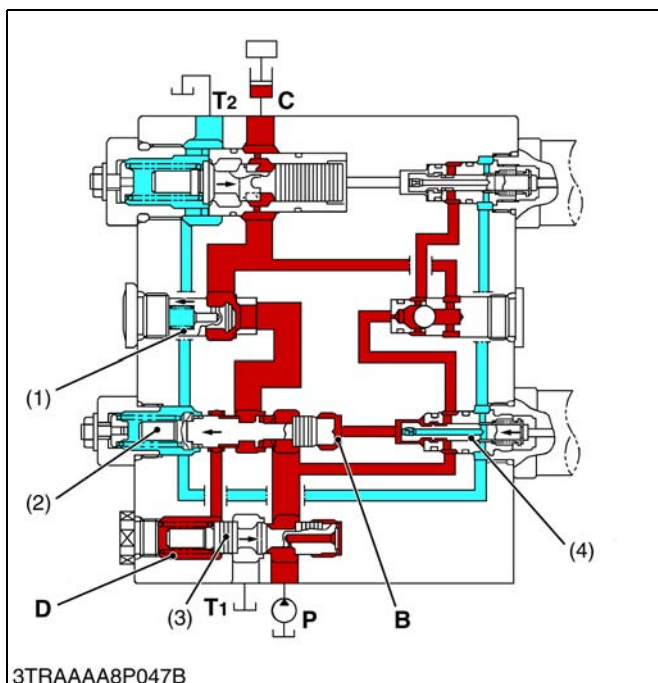
While the both solenoid are not energized, the pilot spools (2), (4), main spools (1), (6) and check valve (7) are closed by the springs.

The oil from hydraulic pump flows into chamber **A** to move the compensation spool (5) to the left.

As a result, the oil from hydraulic pump returns to transmission case through **T1** port.

- | | |
|-----------------------------------|--------------------------|
| (1) Main Spool for Lowering | A : Chamber A |
| (2) Pilot Spool for Lowering | C : Cylinder Port |
| (3) High Pressure Selecting Valve | P : Pump Port |
| (4) Pilot Spool for Lifting | T1 : Tank Port 1 |
| (5) Compensation Spool | T2 : Tank Port 2 |
| (6) Main Spool for Lifting | |
| (7) Check Valve | |

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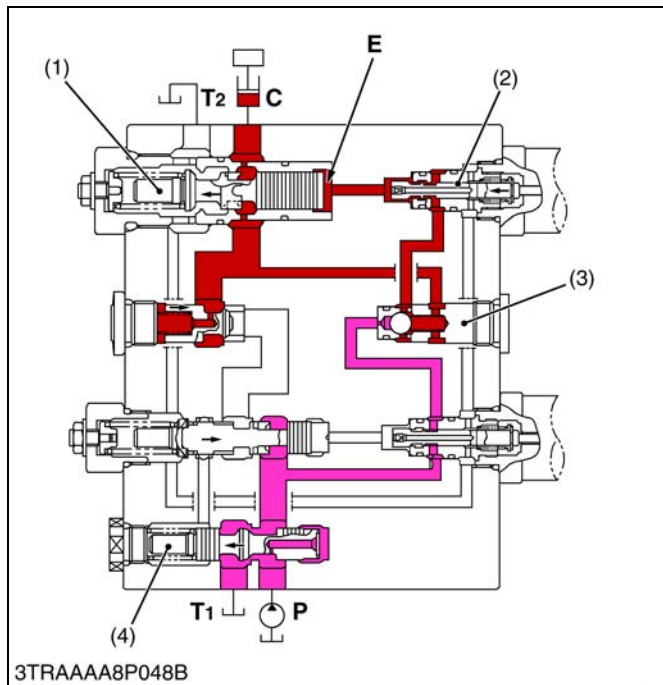


■ Lifting

When the lifting solenoid is energized, the pilot spool (4) move to the left. The oil sent from hydraulic pump flows to chamber **B** and move the main spool (2) to the left. Then, the oil flows to chamber **D** to close the compensation spool (3). Finally, the oil from hydraulic pump opens the check valve (1) and flows to hydraulic cylinder through **C** port.

- | | |
|-----------------------------|--------------------------|
| (1) Check Valve | B : Chamber B |
| (2) Main Spool for Lifting | D : Chamber D |
| (3) Compensation Spool | C : Cylinder Port |
| (4) Pilot Spool for Lifting | P : Pump Port |
| | T1 : Tank Port 1 |
| | T2 : Tank Port 2 |

W10214690



Lowering

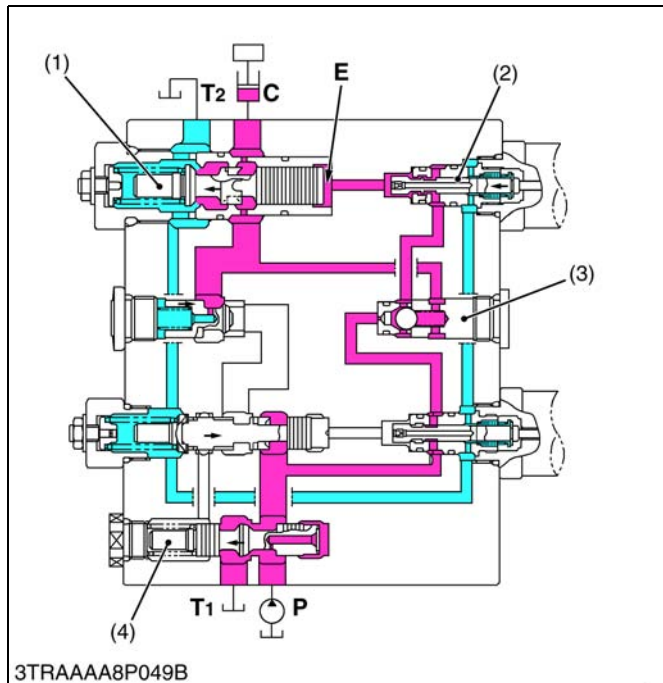
[When the C port pressure is higher than the unload pressure]

When the lowering solenoid is energized, the pilot spool (2) move to the left.

The oil from C port flows to chamber E through high pressure selecting valve (3) and move the main spool (1) to the left. Then the oil from C port flows out to transmission case through T2 port.

- | | |
|-----------------------------------|--------------------------|
| (1) Main Spool for Lowering | E : Chamber E |
| (2) Pilot Spool for Lowering | C : Cylinder Port |
| (3) High Pressure Selecting Valve | P : Pump Port |
| (4) Compensation Spool | T1 : Tank Port 1 |
| | T2 : Tank Port 2 |

W10217090



[When the C port pressure is lower than the unload pressure]

When the lowering solenoid is energized, the pilot spool (2) move to the left. The oil from P port flows to chamber E through high pressure selecting valve (3) and move the main spool (1) to the left. Therefore, the oil from C port flows out to transmission case through T2 port.

- | | |
|-----------------------------------|--------------------------|
| (1) Main Spool for Lowering | E : Chamber E |
| (2) Pilot Spool for Lowering | C : Cylinder Port |
| (3) High Pressure Selecting Valve | P : Pump Port |
| (4) Compensation Spool | T1 : Tank Port 1 |
| | T2 : Tank Port 2 |

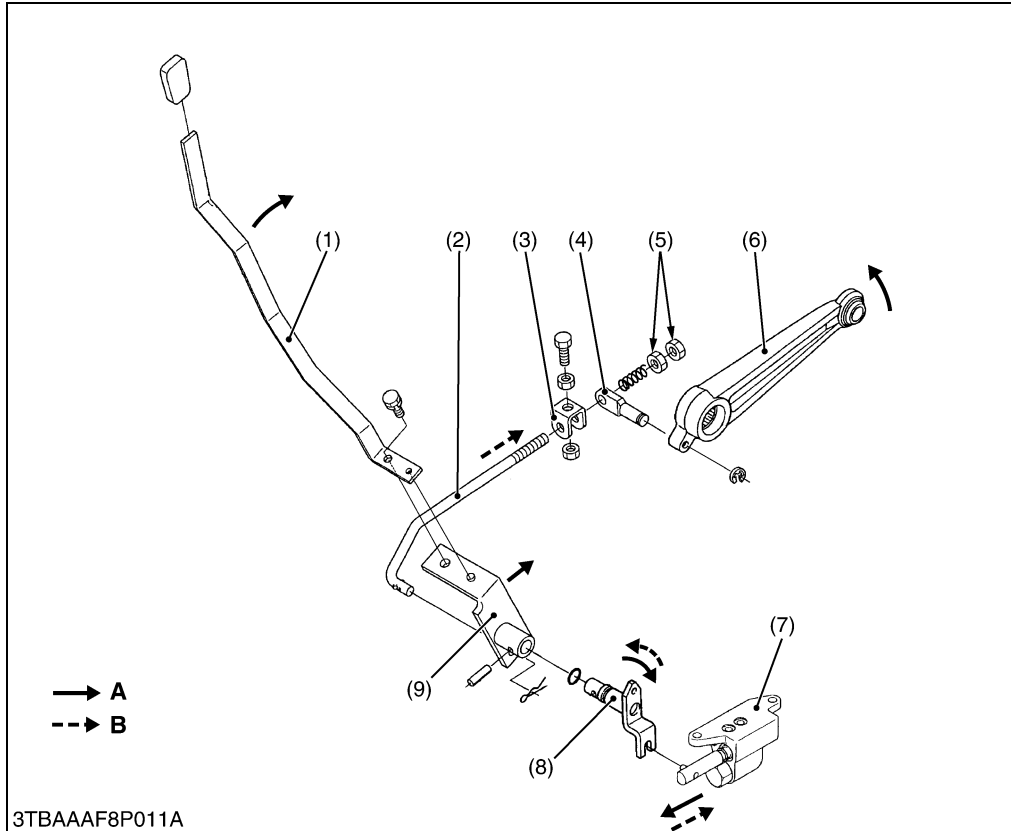
W10215840

[5] FEEDBACK LINKAGE FOR POSITION CONTROL

(1) Type 1

When the hydraulic control lever (1) is moved to rearward to lift the implement, the spool of the control valve (7) is pulled out to form a raising circuit. Then the lift arm begins to rise.

And after the lift arm (6) gets to the uppermost position, the spool is pushed in and returned to form a neutral circuit by the motions of feedback pin (4), lock nut (5), feedback rod (2), control lever arm (9) and control lever shaft (8)



- (1) Hydraulic Control Lever
- (2) Feedback Rod
- (3) Interlocker
- (4) Feedback Pin
- (5) Lock Nut
- (6) Lift Arm
- (7) Control Valve
- (8) Control Lever Shaft
- (9) Control Lever Arm

A : When the hydraulic control lever is moved to rearward
B : When the lift arm gets to the uppermost position

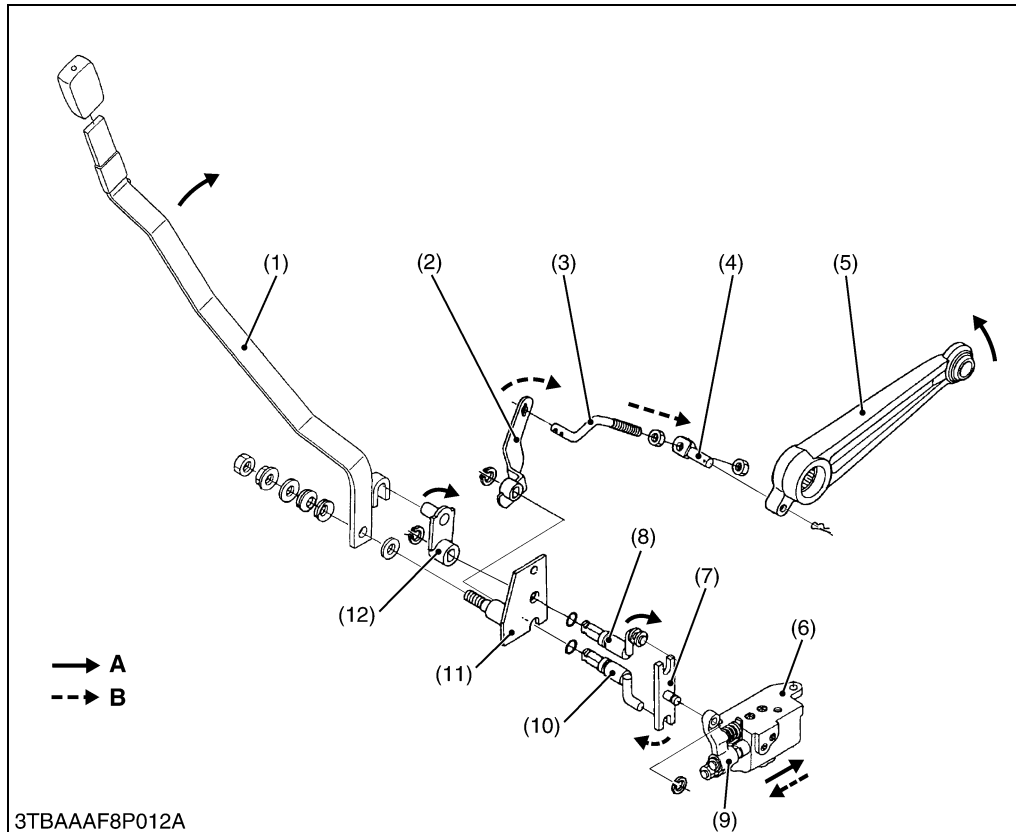
W10346830

(2) Type 2

When the position control lever (1) is moved to rearward to lift the implement, the spool of the control valve (6) is pushed in to form a raising circuit by the motions of control lever arm (12), control lever shaft (8), connecting link (7) and the lever (9).

And after the lift arm (5) moves upward, the spool is pulled out and returned to form a neutral circuit by the motions of feedback pin (4), feedback rod (3), feedback arm (2), feedback arm shaft (10), connecting link (7) and the lever (9).

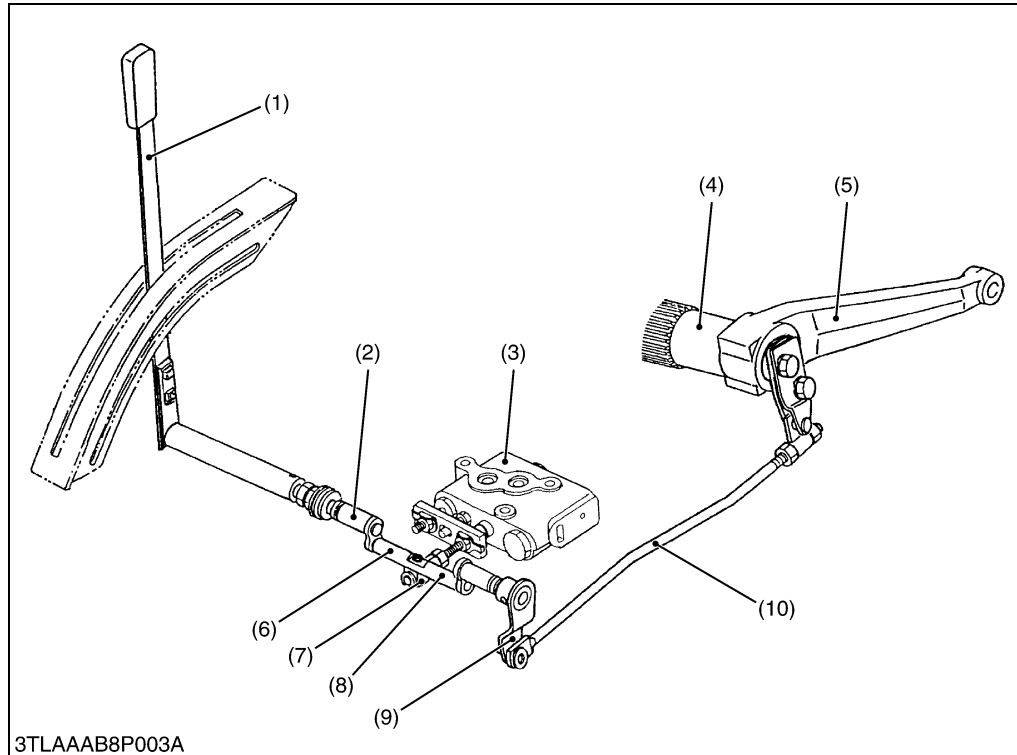
As a result, the implement height can be easily determined in proportion to the set position of the position control lever (1).



- (1) Position Control Lever
- (2) Feedback Arm
- (3) Feedback Rod
- (4) Feedback Pin
- (5) Lift Arm
- (6) Control Valve
- (7) Connecting Link
- (8) Control Lever Shaft
- (9) Lever
- (10) Feedback Arm Shaft
- (11) Plate
- (12) Control Lever Arm

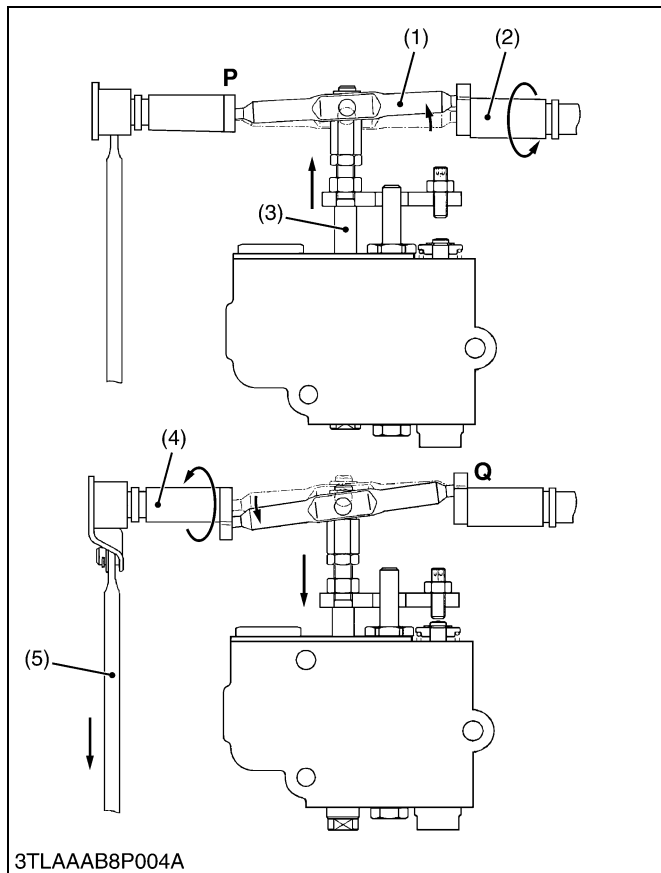
A : When the hydraulic control lever is moved to rearward
B : When the lift arm moves upward

W10350070

(3) Type 3

- (1) Position Control Lever
- (2) Control Arm
- (3) Control Valve
- (4) Hydraulic Arm Shaft
- (5) Lift Arm
- (6) Spool Drive Lever
- (7) Spool Joint
- (8) Feedback Lever Shaft
- (9) Feedback Lever
- (10) Position Control Rod

W10352990

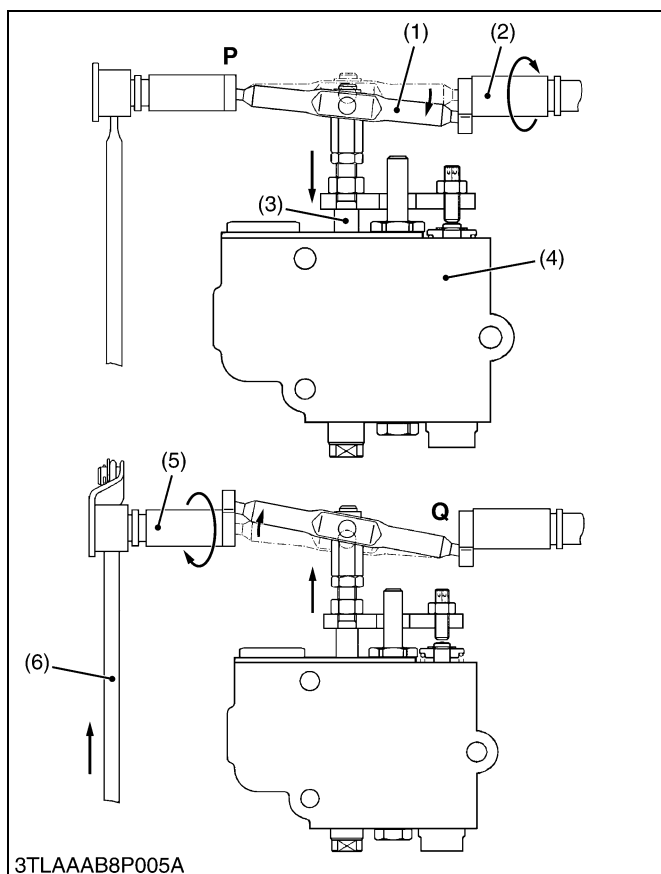


■ Lifting

1. When the position control lever is moved to the **LIFT** position, the control arm (2) rotates to the arrow. Therefore, the spool drive lever (1) moves around the fulcrum **P** and pull the spool (3) opening the **LIFT** circuit.
2. When the lift arm moves upward, the feedback lever shaft (4) is rotated to the arrow, since the position control rod (5) is actuated. Therefore, the spool drive lever (1) moves around the fulcrum **Q** and pushes the spool (3).
3. The lift arm stops when the spool (3) returns to the neutral position.

- | | |
|-----------------------|--------------------------|
| (1) Spool Drive Lever | (4) Feedback Lever Shaft |
| (2) Control Arm | (5) Position Control Rod |
| (3) Spool | |

W10354350



■ Lowering

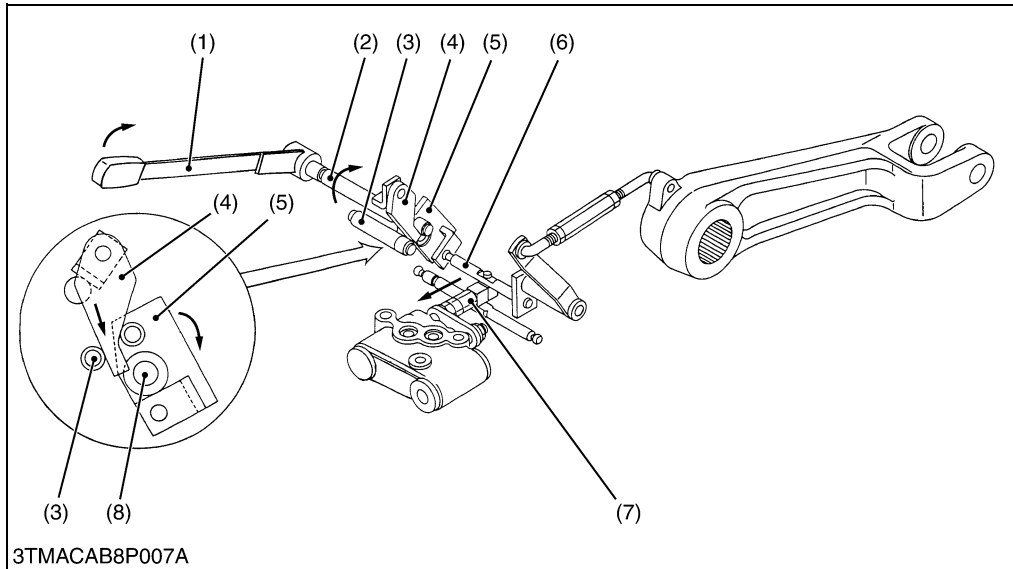
4. When the position control lever is moved to the **DOWN** position, the control arm (2) rotates to the arrow. Therefore, the spool drive lever (1) moves around the fulcrum **P** and pushes the spool (3) opening the **DOWN** circuit.
5. When the lift arm moves downward, the feedback lever shaft (5) is rotated to the arrow, since the position control rod (6) is actuated. Therefore, the spool drive lever (1) moves around the fulcrum **Q** and pull the spool (3).
6. The lift arm stops when the spool (3) returns to the neutral position.

- | | |
|-----------------------|--------------------------|
| (1) Spool Drive Lever | (4) Valve Body |
| (2) Control Arm | (5) Feedback Lever Shaft |
| (3) Spool | (6) Position Control Rod |

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(4) Type 4

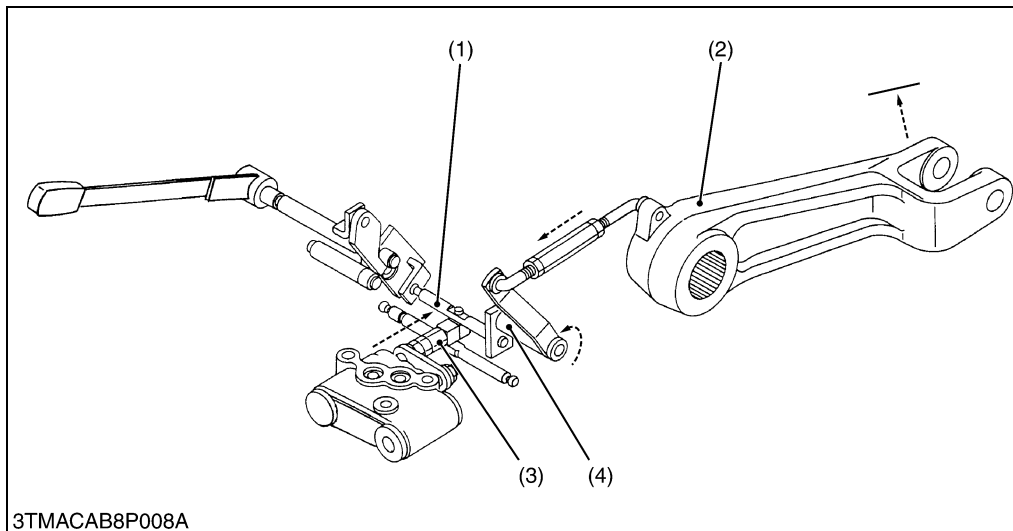
■ **Lift**



- (1) Position Control Lever
- (2) Lever Shaft
- (3) Fulcrum 1
- (4) Cam Link
- (5) Link
- (6) Spool Drive Lever
- (7) Spool
- (8) Fulcrum 2

W1015984

1. When the position control lever (1) is moved to the “**LIFT**” position, the lever shaft (2) rotates and press down the cam link (4) between the fulcrum 1 (3) and link (5).
The link (5) rotates around the fulcrum 2 (8) and pushes the spool (7) by the spool drive lever (6), opening the “**LIFT**” circuit.

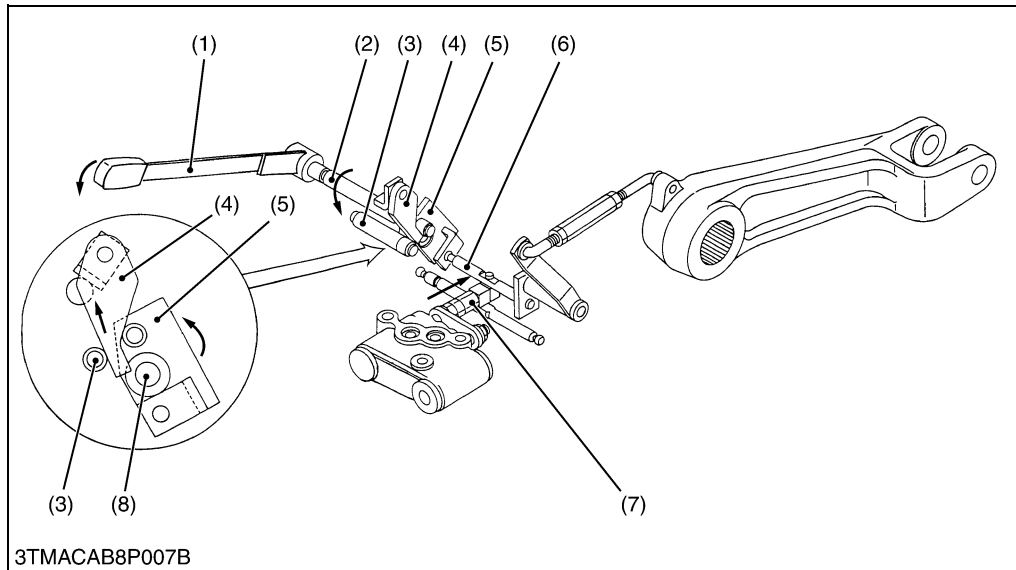


- (1) Spool Drive Lever
- (2) Lift Arm
- (3) Spool
- (4) Feedback Shaft

W1016089

2. When the lift arm (2) moves upward, feedback shaft (4) rotates and pulls the spool (3) by the spool drive lever (1).
The lift arm stops when the spool returns to the neutral position.

Down

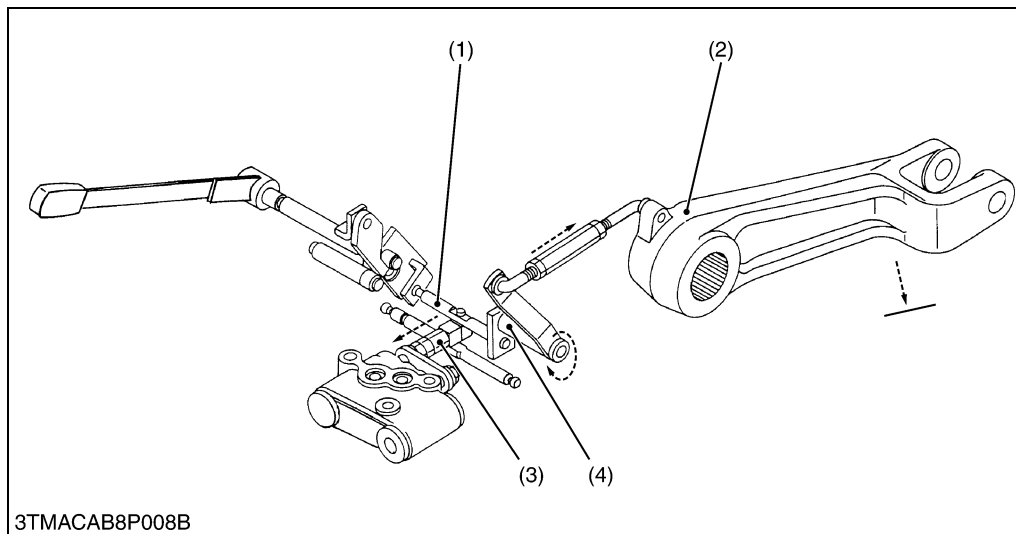


- (1) Position Control Lever
- (2) Lever Shaft
- (3) Fulcrum 1
- (4) Cam Link
- (5) Link
- (6) Spool Drive Lever
- (7) Spool
- (8) Fulcrum 2

3TMACAB8P007B

1. When the position control lever (1) is moved to the “**DOWN**” position, the lever shaft (2) rotates and pull up the cam link (4) between the fulcrum 1 (3) and link (5).

The link (5) rotates around the fulcrum 2 (8) and pull the spool (7) out by the spool drive lever (6), opening the “**DOWN**” circuit.

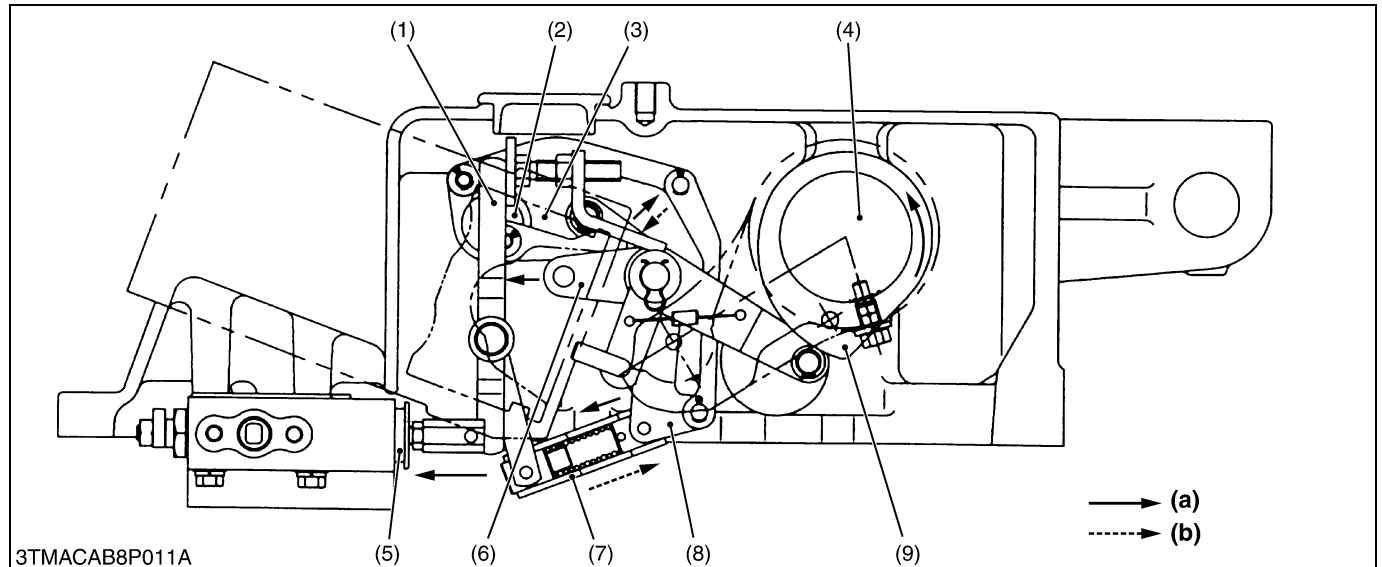


- (1) Spool Drive Lever
- (2) Lift Arm
- (3) Spool
- (4) Feedback Shaft

3TMACAB8P008B

2. When the lift arm (2) moves downward, feedback shaft (4) rotates and push the spool (3) by the spool drive lever (1).

The lift arm stops when the spool returns to the neutral position.

(5) Type 5

(1) Spool Retainer
 (2) Position Control Shaft
 (3) Position Connector

(4) Hydraulic Arm Shaft
 (5) Spool
 (6) Position Balancer

(7) Holder
 (8) Connector
 (9) Position Cam

(a) Motion for Raising
 (b) Motion for Feed-back

■ Raising

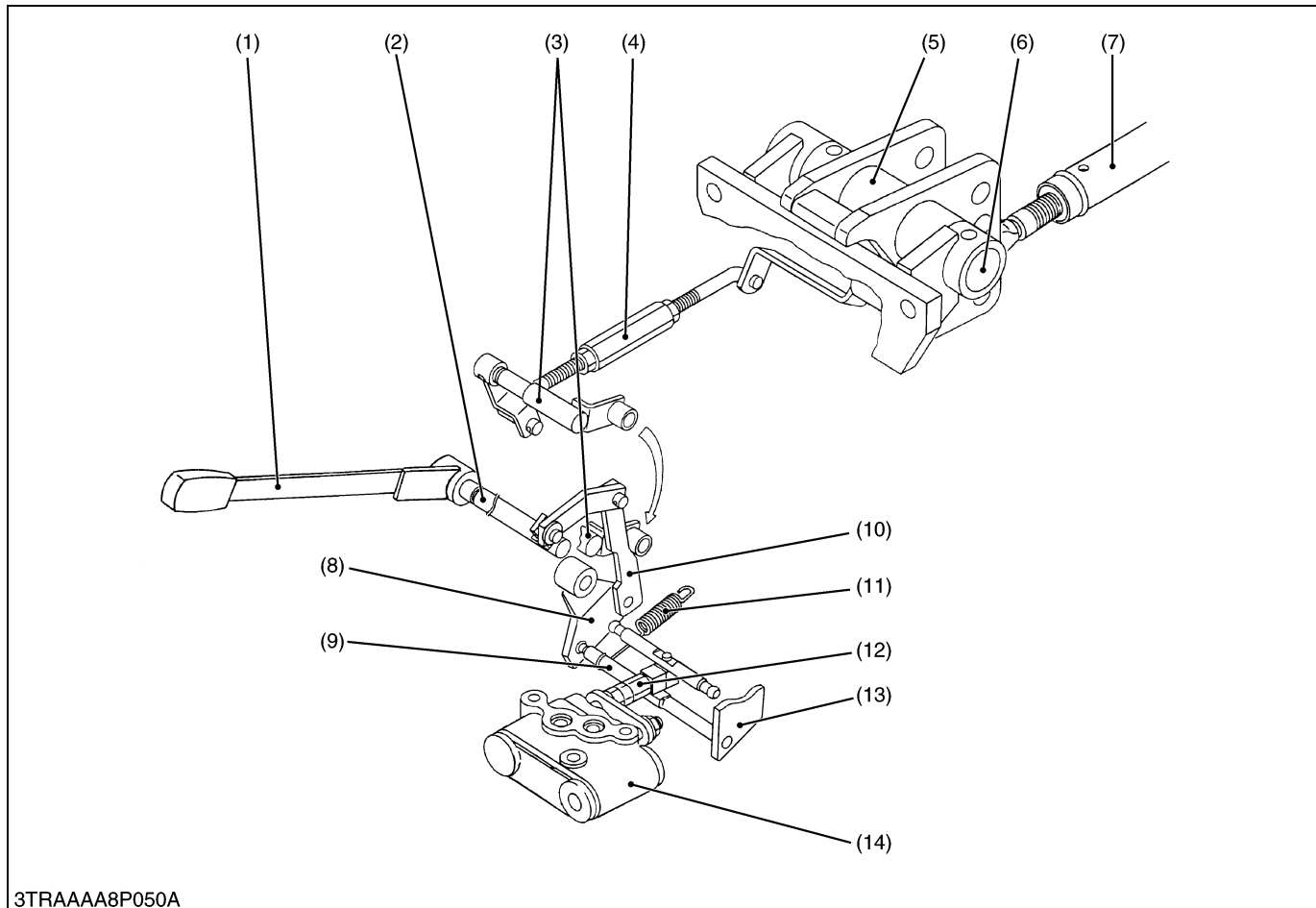
1. When the position control lever is moved to the **Raising** direction, the position control shaft (2) rotates clockwise to move the position connector (3) to the left.
2. Since the position balancer (6) is prevented by the position cam (9) from moving, the connector (8) rotates clockwise as the position connector (3) moves. Thereby the holder (7) and spool retainer (1) are pushed against the spool (5), and the spool (5) is forced in the control valve. As a result, a **Raising** circuit is formed.
3. When the lift arm moves upward, the hydraulic arm shaft (4) and position cam (9) rotate counterclockwise. As a result, the position balancer (6) is also rotated counterclockwise. Accordingly, as the connector (8) does not press the spool retainer (1), the spool (5) is forced out by the return spring in the control valve (feedback mechanism).
4. When the spool (5) returns to the neutral position, the lift arms stop rising. This results in raising of the lift arm in proportion to the movement of the position control lever.

■ Lowering

1. When the control lever is moved to the **Lowering** direction, the position control shaft (2) rotates counterclockwise to move the position connector (3) to the right.
2. As the position connector (3) moves, the connector (8) does not press the spool retainer (1) and the spool (5) is forced out by the return spring in the control valve. As a result, a **Lowering** circuit is formed.
3. When the lift arms move downward, the hydraulic arm shaft (4) and position cam (9) rotate clockwise, causing the position balancer (6) and connector (8) to press the holder (7) and spool retainer (1). Thereby, the spool (5) is forced in (feedback mechanism).
4. When the spool (5) returns to the neutral position, the lift arms stop rising. This results in lowering of the lift arms in proportion to the movement of the position control lever.

[6] LOAD SENSING SYSTEM FOR DRAFT CONTROL

(1) Top Link Sensing System (Type 1)



- | | | | |
|-------------------------|---------------------|-----------------------|--------------------|
| (1) Draft Control Lever | (5) Top Link Holder | (9) Spool Drive Lever | (12) Spool |
| (2) Lever Shaft | (6) Torsion Bar | (10) Link 1 | (13) Fixed Arm |
| (3) Feedback Shaft | (7) Top Link | (11) Spring | (14) Control Valve |
| (4) Feedback Rod | (8) Link 2 | | |

The traction load applied to the tractor from the implement act as a torsional force to the torsion bar (6) via the top link (7) and top link holder (5). When the torsion bar (6) is twisted, its displacement is transmitted to the feedback shaft (3) to rotate via the feedback rod (4). The feedback shaft rotates and push the link 1 (10) to rotate the link 2 (8). The end of the spool drive lever (9) is connected to the link 2 (8) and the other end is hold by the fixed arm (13), pulling out or pushing in the spool (12) by the rotation of the link 2 (8).

The spring (11) is pulling the spool drive lever (9) to keep the link 1 (10) coming in contact with the feedback shaft (3). The angle of the link 1 (10) is controlled by the draft control lever (1) via the lever shaft (2).

■ NOTE

- The linkage mechanism is different according to the tractor model.

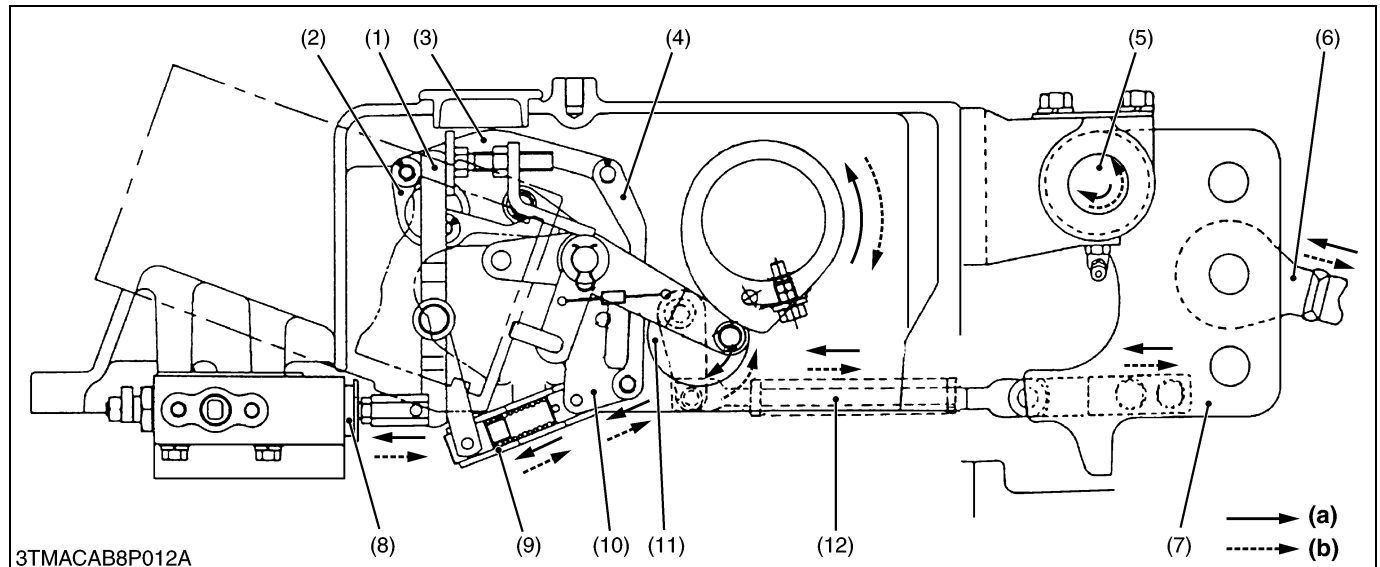
(2) Top Link Sensing System (Type 2)

Draft control is a system in which the lift arms (implement) automatically rise when the implement's traction load is increased and lower when the traction load is decreased. By maintaining a constant traction load, it prevents the tractor from slipping and over-load.

There are two types of traction load sensing system: top link sensing system and lower link sensing system. These tractor are equipped with the top link sensing type.

When using the draft control, the draft control lever should be set in the draft range, and the position control lever should be set at the lowest position.

■ Draft Control System



- (1) Spool Retainer
- (2) Draft Control Shaft
- (3) Draft Link
- (4) Draft Link 2

- (5) Torsion Bar
- (6) Top Link
- (7) Top Link Bracket
- (8) Spool

- (9) Holder
- (10) Connector
- (11) Draft Cam
- (12) Draft Control Rod

- (a) Motion when traction load increases
- (b) Motion when traction load decreases

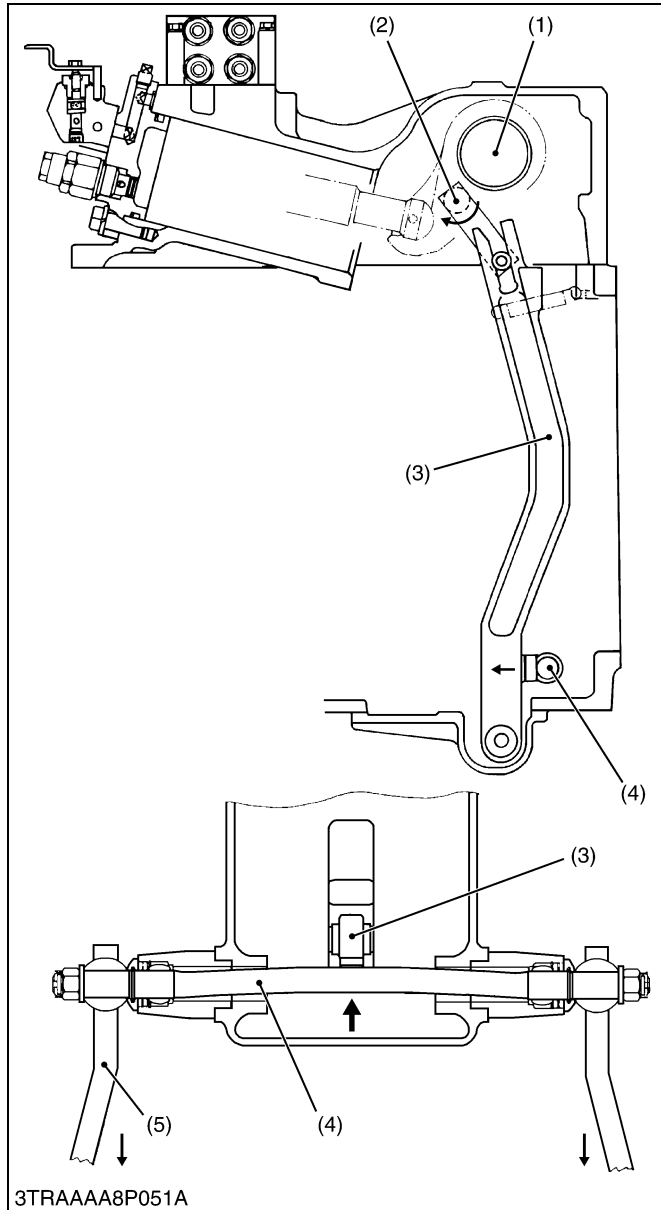
1. When the draft control lever is moved to the draft range, the draft control shaft (2) rotates clockwise and draft link 2 (4) approaches to the draft cam (11).

(Reference)

- Draft control sensitivity can be regulated by changing the distance between draft link 2 (4) and the draft cam (11) using the draft control lever.
2. Traction load of the implement acts as torsion force to the torsion bar (5) via the top link bracket (7). When traction load increases, the torsion bar is twisted depending on the load, and this twist is transmitted to the draft control rod (12), draft cam (11), draft link 2 (4), connector (10), holder (9), and spool holder (1), thereby causing the spool (8) to be forced in. As a result, a **Raising** circuit is formed.
 3. As the lift arms (implement) are raised, traction load reduces. Therefore, the draft control rod (12) returns. As a result of this, the spool (8) is forced out by the return spring which allows a **Lowering** circuit to be formed again, thereby causing the lift arm to move downward.

(Reference)

- The spring installed inside the holder (9) is a safety device which functions when the draft control rod (12) is pushed in excess of the specified spool stroke.

(3) Lower Link Sensing System

The traction load of the implement acts as deflection force to the sensing bar (4) via the lower link (5).

When traction load increases, the sensing bar (4) is deflected depending on the load, and this deflection is transmitted to draft cam (2), causing it to rotate clockwise by link 1 (3).

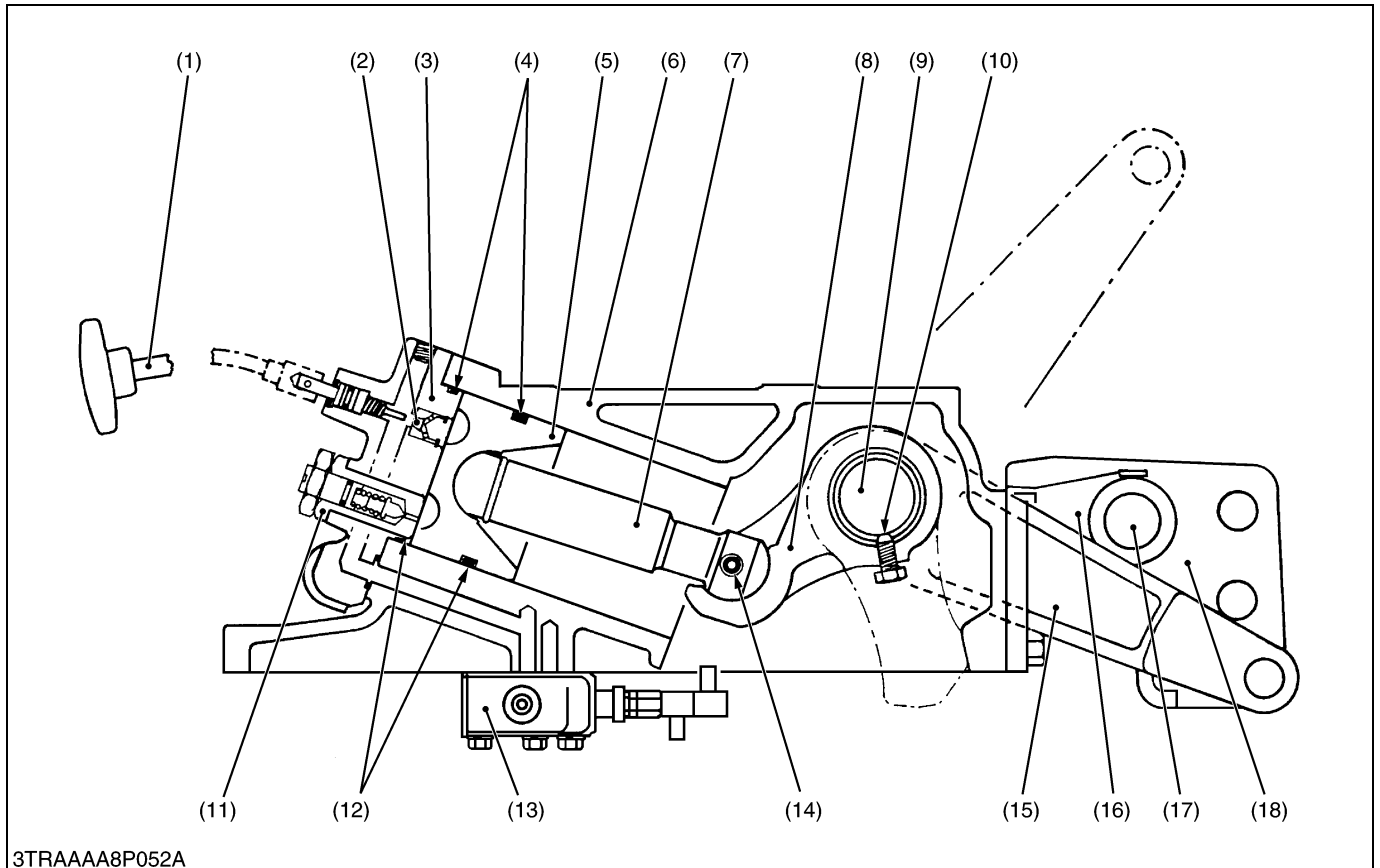
The draft cam is provided with a draft sensor, which senses the draft load for highly responsive control.

In Fig. → Motion when traction load increases.

- | | |
|-------------------------|-----------------|
| (1) Hydraulic Arm Shaft | (4) Sensing Bar |
| (2) Draft Cam | (5) Lower Link |
| (3) Link 1 | |

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[7] HYDRAULIC CYLINDER

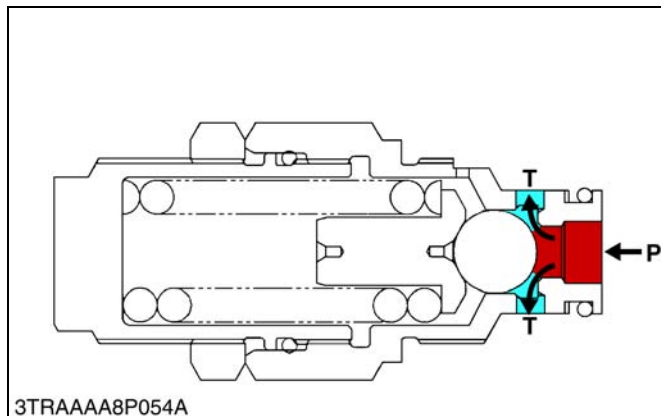
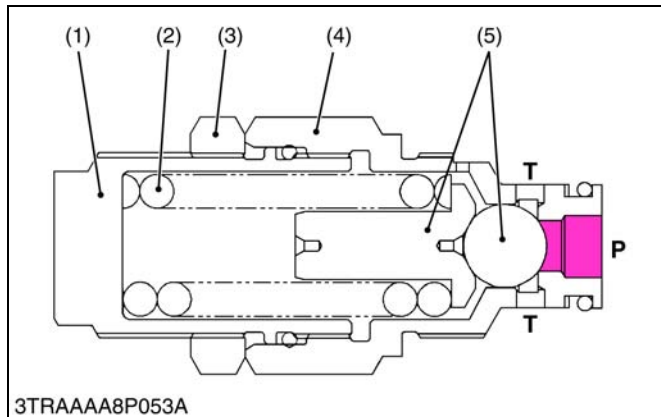


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- | | | | |
|------------------------------------|------------------------|-----------------------------|-----------------------|
| (1) Lowering Speed Adjusting Knob | (4) O-ring | (9) Hydraulic Arm Shaft | (14) Spring Pin |
| (2) Lowering Speed Adjusting Valve | (5) Hydraulic Piston | (10) Setting Screw | (15) Lift Arm |
| (3) Hydraulic Cylinder Cover | (6) Hydraulic Cylinder | (11) Cylinder Safety Valve | (16) Top Link Bracket |
| | (7) Hydraulic Rod | (12) Backup Ring | (17) Torsion Bar |
| | (8) Hydraulic Arm | (13) Position Control Valve | (18) Top Link Holder |

The main components of the hydraulic cylinder are shown in the figure above. However, the design, size and installed parts are different according to the tractor specification.

[8] CYLINDER SAFETY VALVE (SURGE RELIEF VALVE)



The cylinder safety valve is located on the hydraulic cylinder of the three point hydraulic system. These tractors use a direct acting relief valve, which is suitable for low volume and less frequent operations.

This valve has a fast response, makes it ideal for relieving shock pressure caused by heavy implement bounce and thereby reducing the possibility of damage to three point hydraulic system components.

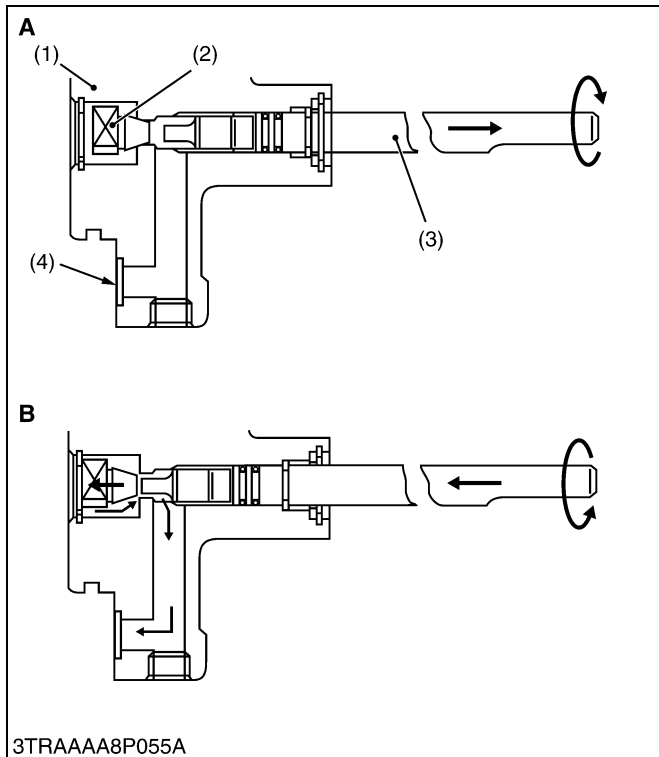
If pressure in the cylinder becomes too great, oil pressure forces the valve (5) off the seat of valve body (4), compressing the springs (2) and allows oil to flow to the transmission case through the T port.

- (1) Adjusting Plug
- (2) Spring
- (3) Lock Nut
- (4) Valve Body
- (5) Valve

P : P Port (From Hydraulic Cylinder)
T : T Port (To Transmission Case)

W10178410

[9] LOWERING SPEED ADJUSTING VALVE

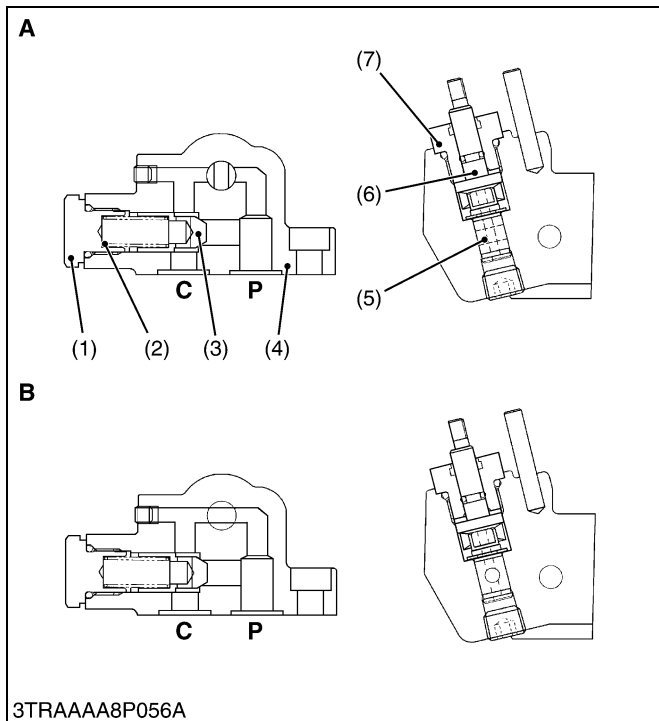


■ Type 1

Turning the lowering speed adjusting knob (3) clockwise decreases the lowering speed, and counterclockwise increases lowering speed. When the lowering speed adjusting valve (2) is completely closed, the 3-point linkage is held at its position since oil in the hydraulic cylinder is sealed between the piston and lowering speed adjusting valve (2).

- (1) Hydraulic Cylinder Cover
 - (2) Lowering Speed Adjusting Valve
 - (3) Lowering Speed Adjusting Shaft (Knob)
 - (4) Tank Port
- A : Closed Position**
B : Open Position

W10228850



■ Type 2

This valve is switchable between **LOCK** and **RELEASE (SLOW ↔ FAST)** position of the 3-point linkage lowering speed adjustment.

Turning the rotor shaft (6) clockwise decreases the lowering speed, and counterclockwise increases lowering speed. When the rotor shaft (6) is completely closed, the 3-point linkage is held at its position since oil in the hydraulic cylinder is sealed between the piston and rotor (5).

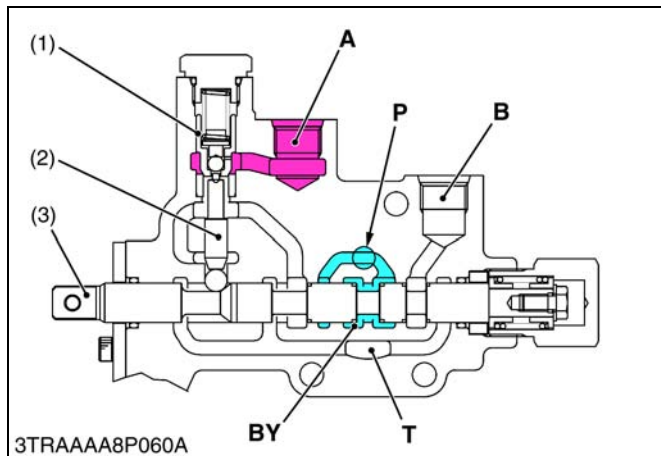
- (1) Plug
 - (2) Spring
 - (3) Poppet (For Lifting)
 - (4) Valve Body
 - (5) Rotor
 - (6) Rotor Shaft
 - (7) Holder
- A : Closed Position**
B : Open Position
C : Cylinder Port
P : Pump Port

W10229970

8. AUXILIARY (REMOTE) CONTROL VALVE

[1] DOUBLE ACTING TYPE

(1) Type 1 (with Mechanical Check Valve, Code No. 6C142-38400)



■ Neutral

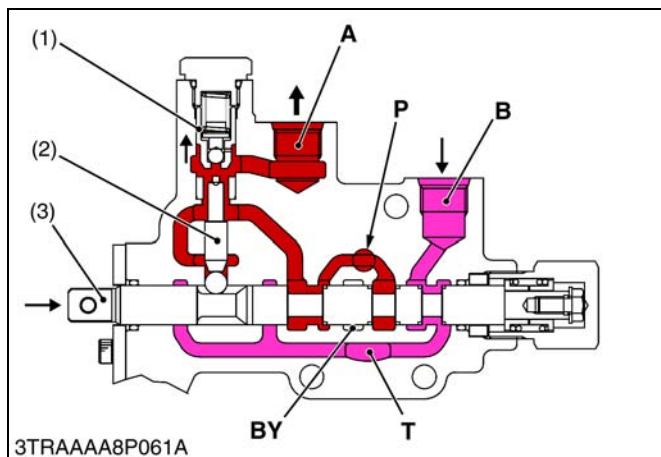
Pressure-fed oil from the hydraulic pump is delivered into the **P** port, and flows to the rear hydraulic outlet through **BY** port.

At this time, oil from **A** port to the **T** port is blocked by the mechanical check valve (Poppet (1)). Therefore the position of implement is maintained at the set position.

- (1) Poppet
- (2) Piston
- (3) Spool

P : Pump Port
T : Tank Port
BY : BY Port (To Position Control Valve)
A : A Port
B : B Port

W10147800



■ Lift

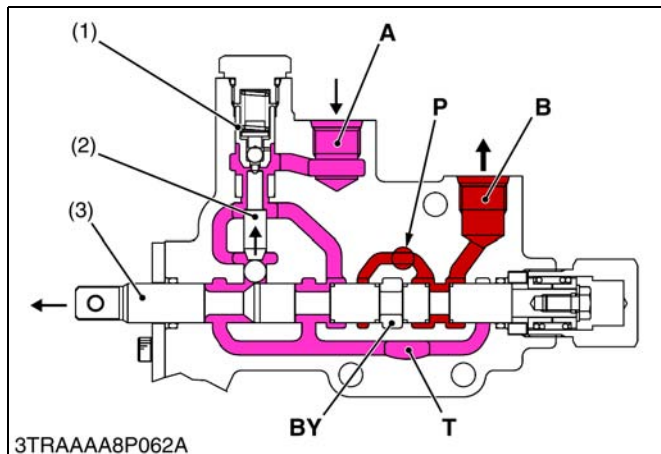
When the remote control valve operating lever is set to **LIFT** position, the spool (3) moves to the right and the passage from **P** port to the **BY** port is blocked by the spool (3).

Then the pressure-fed oil open the poppet (1) and flow through the **A** port to the hydraulic cylinder to lift the implement.

- (1) Poppet
- (2) Piston
- (3) Spool

P : Pump Port
T : Tank Port
 (To Transmission Case)
BY : BY Port
A : A Port
B : B Port

W10148930



■ Down

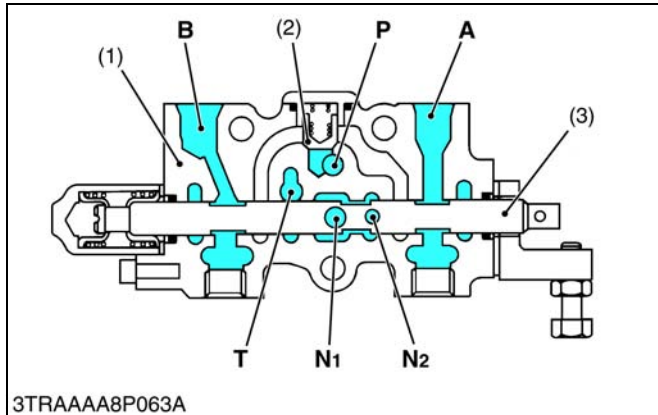
When the remote control valve operating lever is set to **DOWN** position, the spool (3) moves to the left and the passage from **P** port to the **BY** port is blocked by the spool (3). At the same time, the piston (2) and poppet (1) moves upward, and open the passage from **A** port to **T** port.

Then the pressure-fed oil flow through the **B** port to the hydraulic cylinder to lower the implement. Return oil from hydraulic cylinder flows from **A** port to the transmission case.

- (1) Poppet
- (2) Piston
- (3) Spool

P : Pump Port
T : Tank Port
 (To Transmission Case)
BY : BY Port
A : A Port
B : B Port

W10149920

(2) Type 2 (Code No. 35340-99420)**■ Neutral**

Pressure-fed oil from the hydraulic pump is delivered into the **P** port, and flows to the position control valve via **N2** port.

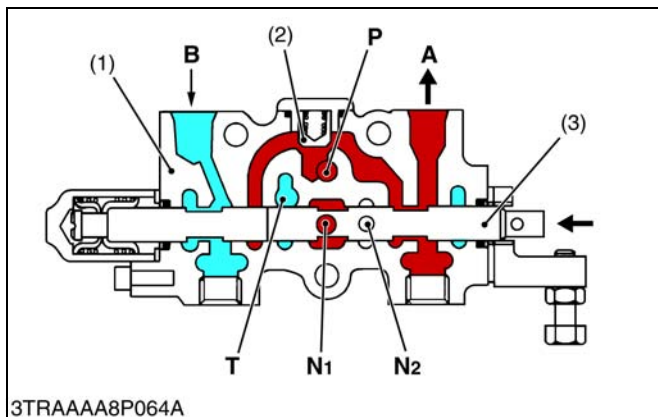
- (1) Valve Body
(2) Poppet
(3) Spool

P : P Port (From Hydraulic Pump)
T : T Port (To Transmission Case)

A : A Port (To or From Implement Cylinder)
B : B Port (To or From Implement Cylinder)

N1 :N1 Port (From P Port)
N2 :N2 Port (To Position Control Valve)

W10250550

**■ Lift**

When the spool (3) is moved in the direction of the arrow, the pressure-fed oil in the **P** port opens the poppet (2) and flows to the implement cylinder via **A** port.

Return oil from the implement cylinder flows from the **B** port through the **T** port to the transmission case.

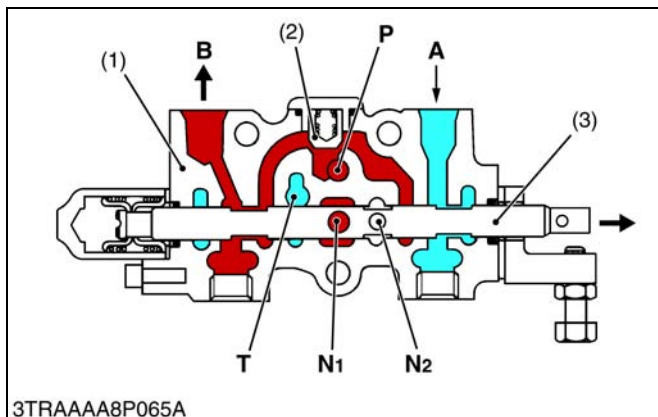
- (1) Valve Body
(2) Poppet
(3) Spool

P : P Port (From Hydraulic Pump)
T : T Port (To Transmission Case)

A : A Port (To Implement Cylinder)
B : B Port (From Implement Cylinder)

N1 :N1 Port (From P Port)
N2 :N2 Port (To Position Control Valve)

W10251780

**■ Down**

When the spool (3) is moved in the direction of the arrow, the pressure-fed oil in the **P** port opens the poppet (2) and flows to the implement cylinder via **B** port.

Return oil from the implement cylinder flows from the **A** port through the **T** port to the transmission case.

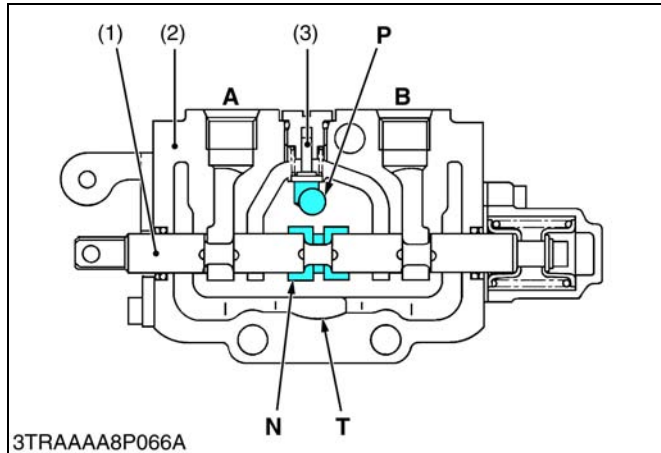
- (1) Valve Body
(2) Poppet
(3) Spool

P : P Port (From Hydraulic Pump)
T : T Port (To Transmission Case)

A : A Port (From Implement Cylinder)
B : B Port (To Implement Cylinder)

N1 :N1 Port (From P Port)
N2 :N2 Port (To Position Control Valve)

W10247780

(3) Type 3 (Code No. TA040-96112, YW313-00101, YW089-00103))**Neutral**

Pressure-fed oil from the hydraulic pump is delivered into the **P** port, and flows to the position control valve via **N** port.

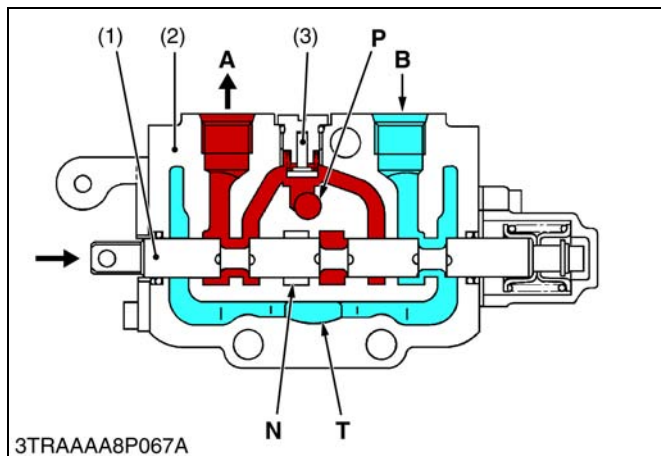
- (1) Spool
- (2) Valve Body
- (3) Check Valve

P : P Port (From Hydraulic Pump)

N : N Port (To Position Control Valve)

A : A Port (Implement Cylinder) **T** : T Port (To Transmission Case)
B : B Port (Implement Cylinder)

W10253990

**Lift**

When the spool (1) is moved in the direction of the arrow, the pressure-fed oil in the **P** port opens the check valve (3) and flows to the implement cylinder via **A** port.

Return oil from the implement cylinder flows from the **B** port through the **T** port to the transmission case.

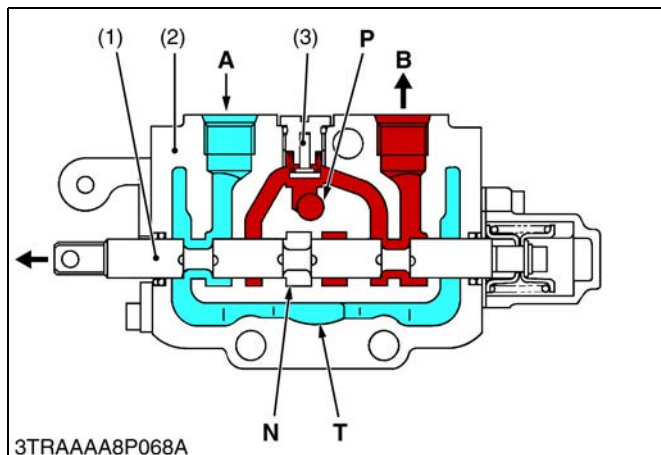
- (1) Spool
- (2) Valve Body
- (3) Check Valve

P : P Port (From Hydraulic Pump)

N : N Port (To Position Control Valve)

A : A Port (Implement Cylinder) **T** : T Port (To Transmission Case)
B : B Port (Implement Cylinder)

W10255810

**Down**

When the spool (1) is moved in the direction of the arrow, the pressure-fed oil in the **P** port opens the check valve (3) and flows to the implement cylinder via **B** port.

Return oil from the implement cylinder flows from the **A** port through the **T** port to the transmission case.

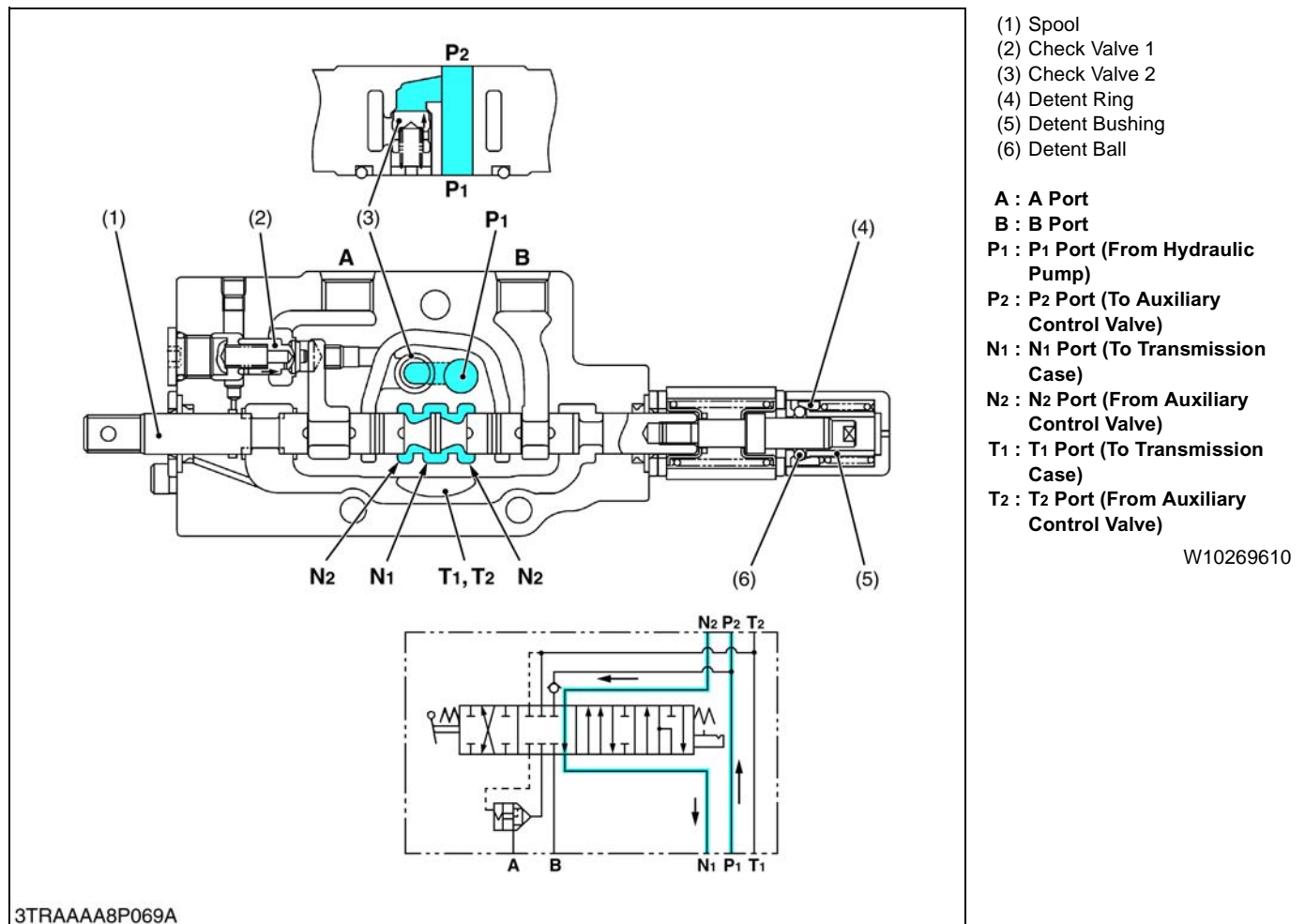
- (1) Spool
- (2) Valve Body
- (3) Check Valve

P : P Port (From Hydraulic Pump)

N : N Port (To Position Control Valve)

A : A Port (Implement Cylinder) **T** : T Port (To Transmission Case)
B : B Port (Implement Cylinder)

W10256940

(4) Type 4 (Floating with Detent-1, Code No. 3A031-82800, 3G710-82812, 3F740-82810)**■ Neutral**

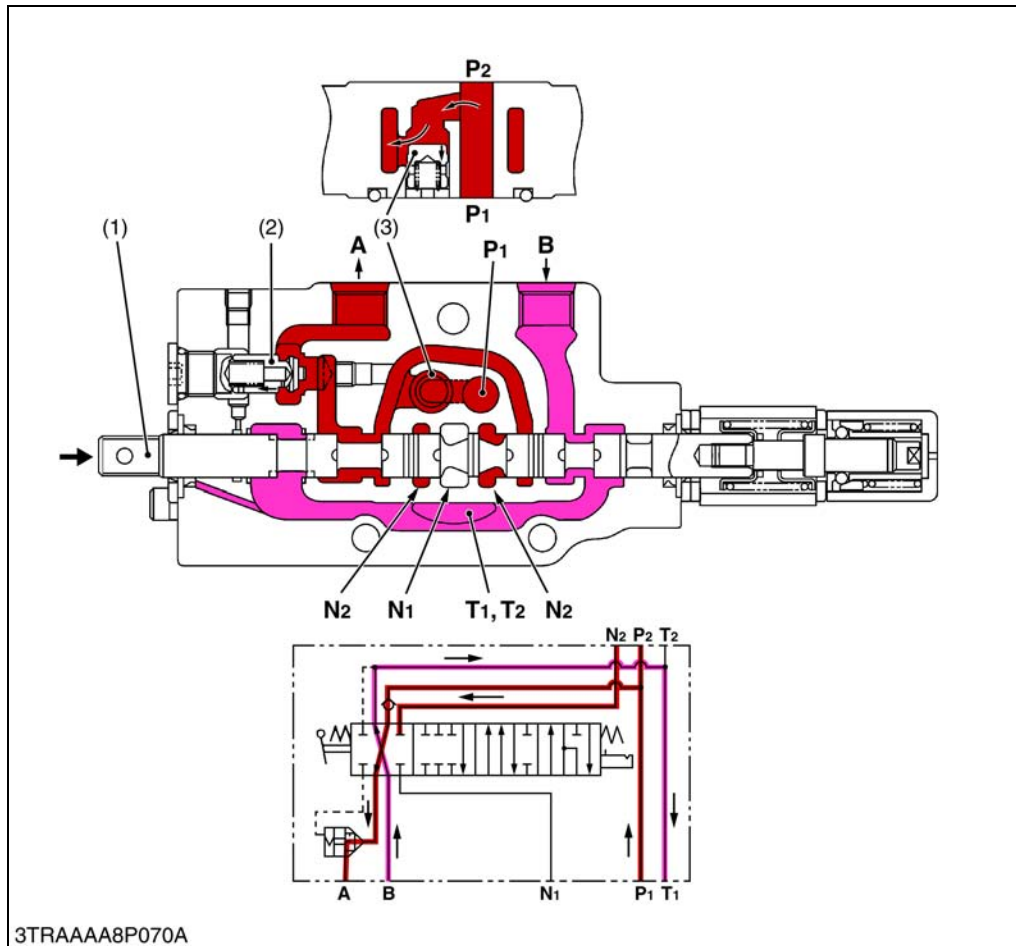
Pressure-fed oil from the hydraulic pump is delivered into the **P1** port.

As the passage from the **P1** port to the **A** port or **B** port is blocked by the spool (1), the oil in the **P1** port flows to **P2** port across the valve body.

When the auxiliary control valve is in neutral, the oil flows from **P2** port through the auxiliary control valve and cover.

Then, the oil in the **N2** port flows along the notched section of the spool (1) to the **N1** port which leads to the transmission case.

■ Lift



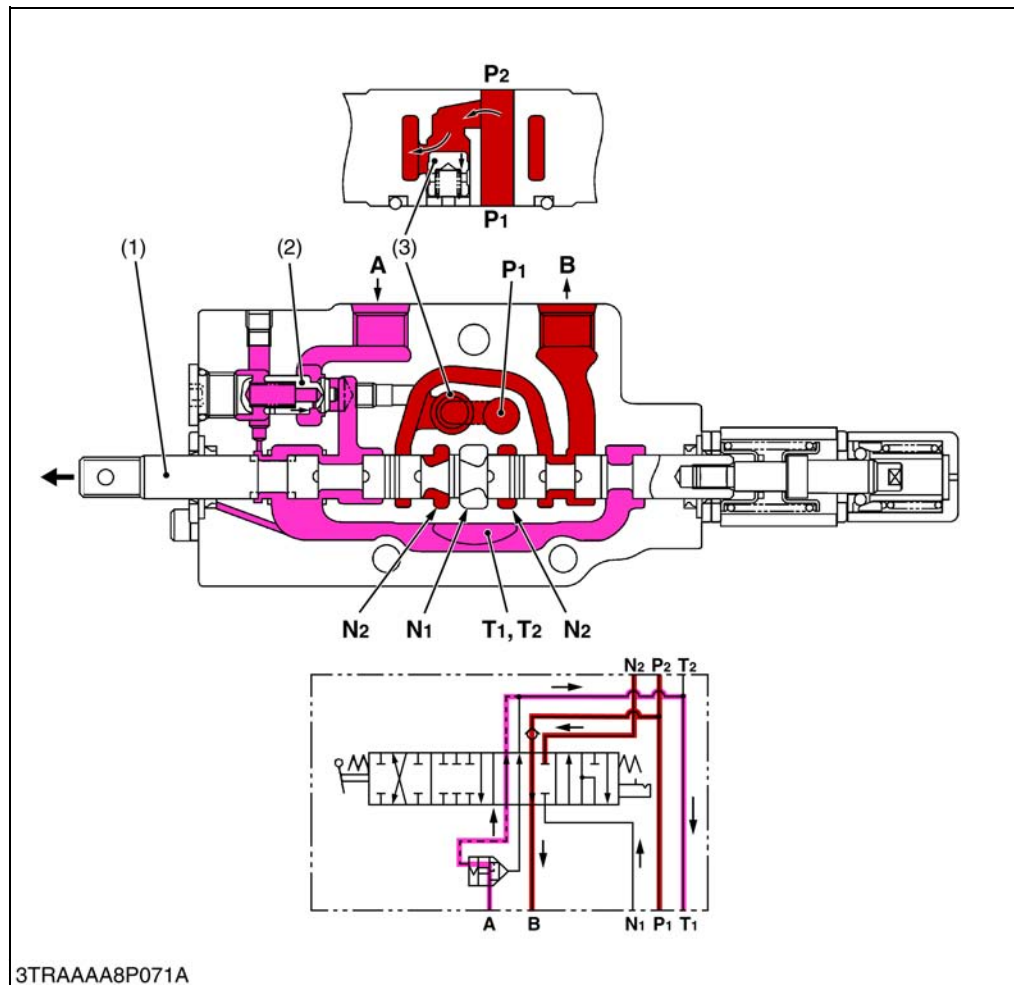
- (1) Spool
- (2) Check Valve 1
- (3) Check Valve 2

- A : A Port
- B : B Port
- P1 : P1 Port (From Hydraulic Pump)
- P2 : P2 Port (To Auxiliary Control Valve)
- N1 : N1 Port (To Transmission Case)
- N2 : N2 Port (From Auxiliary Control Valve)
- T1 : T1 Port (To Transmission Case)
- T2 : T2 Port (From Auxiliary Control Valve)

W10274500

When the spool (1) moves to the right, the oil passage from **N2** port to **N1** port is blocked by the spool (1). Therefore, the pressure-fed oil in the **P1** port opens the check valves (2), (3) and flows to implement cylinder via **A** port. The return oil from implement cylinder flows from **B** port through the **T1** port to the transmission case.

■ Down



- (1) Spool
- (2) Check Valve 1
- (3) Check Valve 2

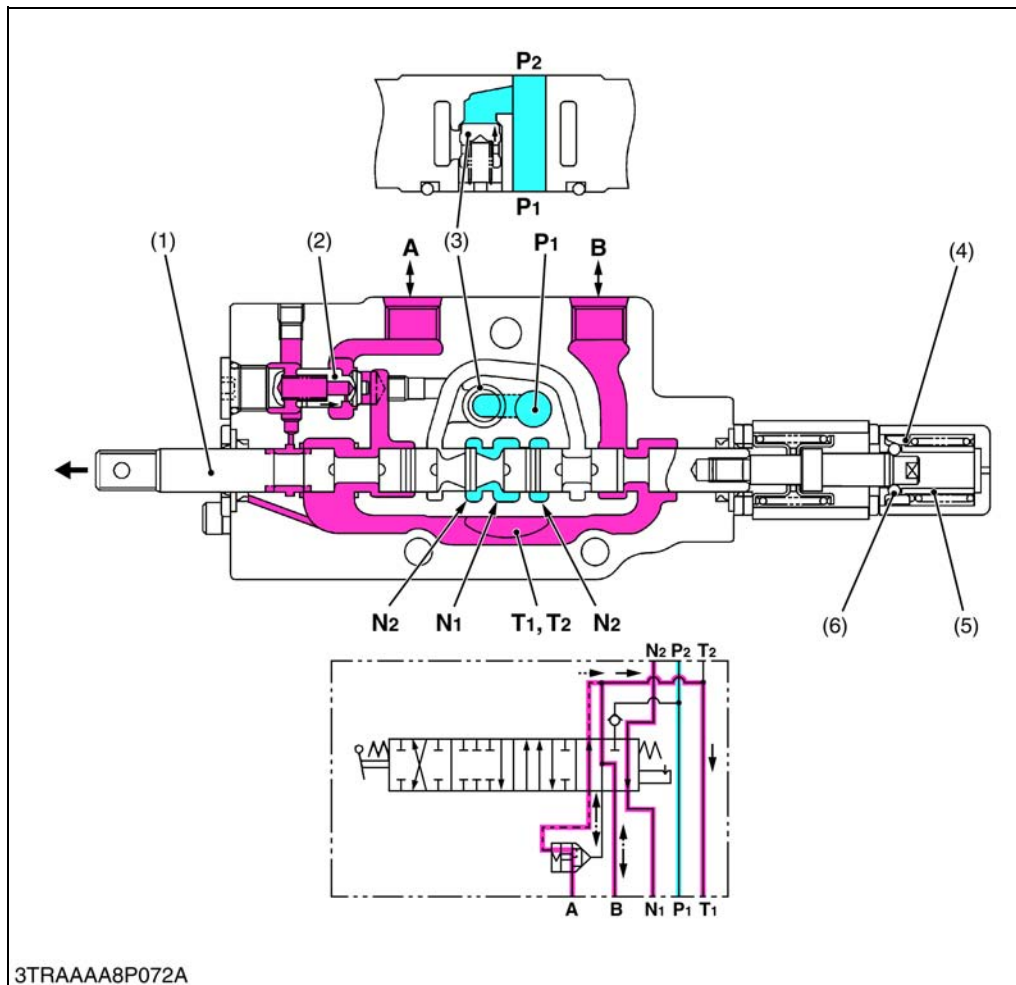
- A** : A Port
- B** : B Port
- P1** : P1 Port (From Hydraulic Pump)
- P2** : P2 Port (To Auxiliary Control Valve)
- N1** : N1 Port (To Transmission Case)
- N2** : N2 Port (From Auxiliary Control Valve)
- T1** : T1 Port (To Transmission Case)
- T2** : T2 Port (From Auxiliary Control Valve)

W10276070

3TRAAAA8P071A

When the spool (1) moves to the left, the oil passage from **N2** port to **N1** port is blocked by the spool (1). Then, the pressure-fed oil in the **P1** port opens the check valve 2 (3) and flows to implement cylinder via **B** port. The return oil from implement cylinder flows from **A** port through the **T1** port to the transmission case.

■ Floating



- (1) Spool
- (2) Check Valve 1
- (3) Check Valve 2
- (4) Detent Ring
- (5) Detent Bushing
- (6) Detent Ball

- A** : A Port
- B** : B Port
- P1** : P1 Port (From Hydraulic Pump)
- P2** : P2 Port (To Auxiliary Control Valve)
- N1** : N1 Port (To Transmission Case)
- N2** : N2 Port (From Auxiliary Control Valve)
- T1** : T1 Port (To Transmission Case)
- T2** : T2 Port (From Auxiliary Control Valve)

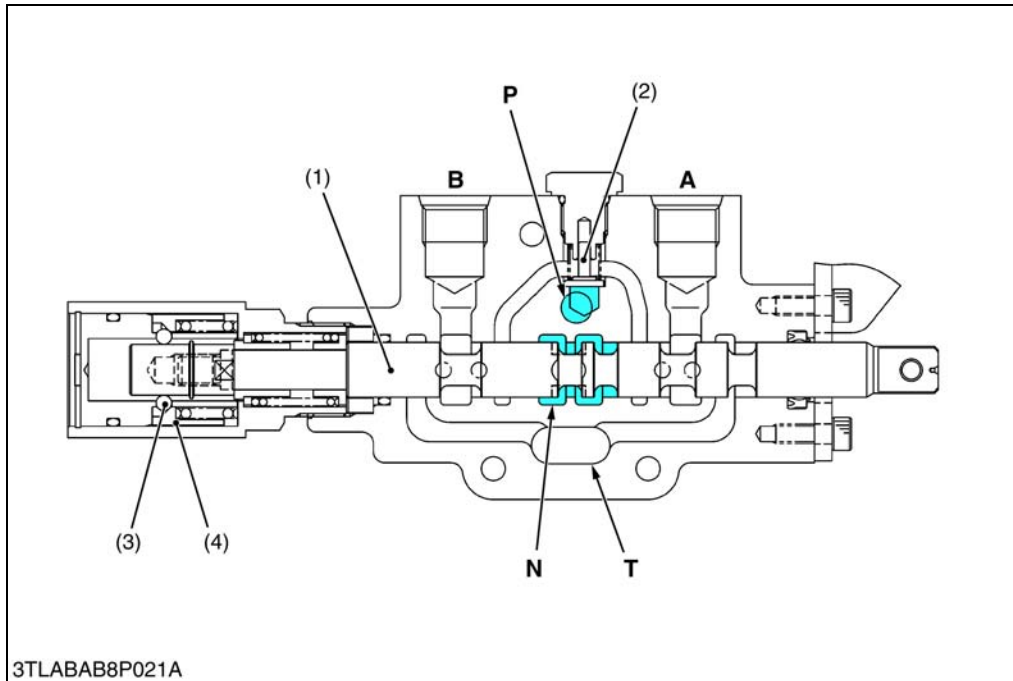
W10277930

3TRAAA8P072A

When the spool (1) moves to extreme left, the detent ring (4) and detent ball (6) hold the spool (1) at the float position as shown in the figure. The pressure-fed oil from the hydraulic pump flows to transmission case through **N2** port and **N1** port. And, the **A** port and **B** port lead to the **T1** port along the notched sections of the spool (1). This result in the attached implement to follow the contour of the terrain.

(5) Type 5 (Floating with Detent-2, Code No. YW077-00103, YW312-00101)

■ **Neutral**



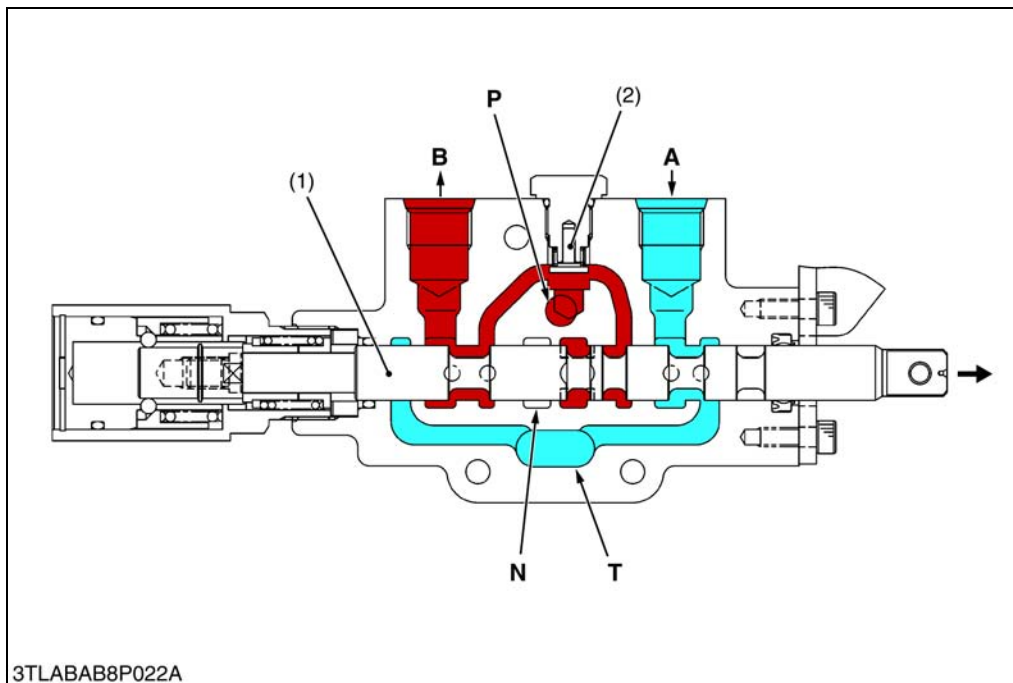
- (1) Spool
- (2) Check Valve
- (3) Detent Ball
- (4) Detent Sleeve

- A : A Port**
(Implement Cylinder)
- B : B Port**
(Implement Cylinder)
- P : Pump Port**
- N : Neutral Port**
- T : Tank Port**

W1015904

Pressure-fed oil from the hydraulic pump is delivered into the **P** port, and flows to the position control valve via **N** port.

■ **Lift**



- (1) Spool
- (2) Check Valve

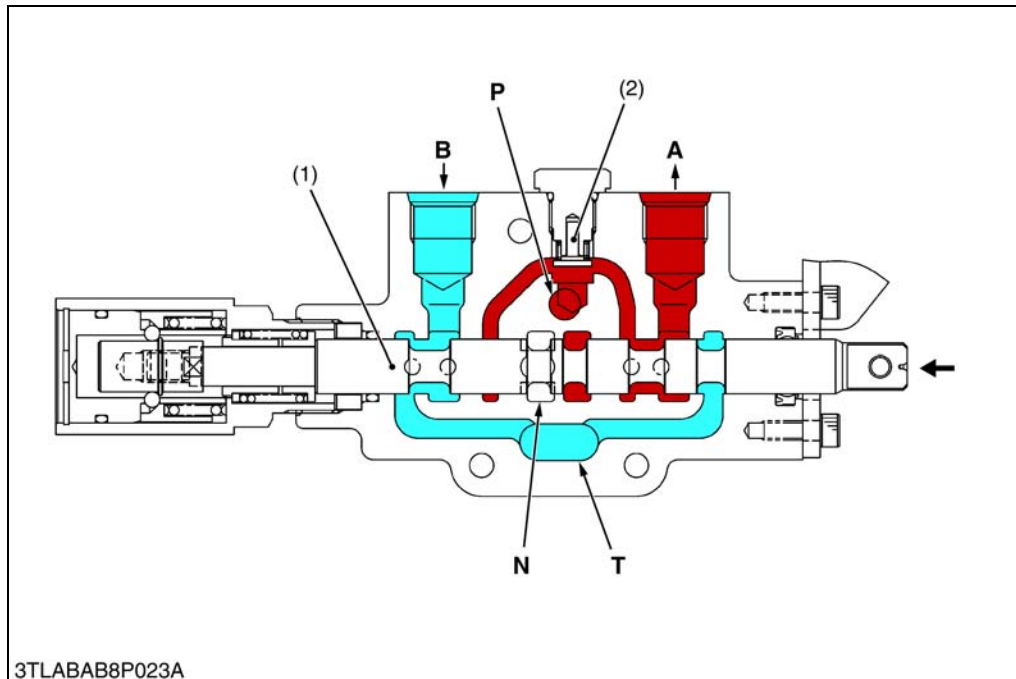
- A : A Port**
(Implement Cylinder)
- B : B Port**
(Implement Cylinder)
- P : Pump Port**
- N : Neutral Port**
- T : Tank Port**

W1016058

When the spool (1) is moved in the direction of the arrow, the pressure-fed oil in the **P** port opens the check valve (2) and flows to the implement cylinder via **B** port.

Return oil from the implement cylinder flows from the **A** port to the transmission case through **T** port.

Down



- (1) Spool
- (2) Check Valve

**A : A Port
(Implement Cylinder)**
**B : B Port
(Implement Cylinder)**
P : Pump Port
N : Neutral Port
T : Tank Port

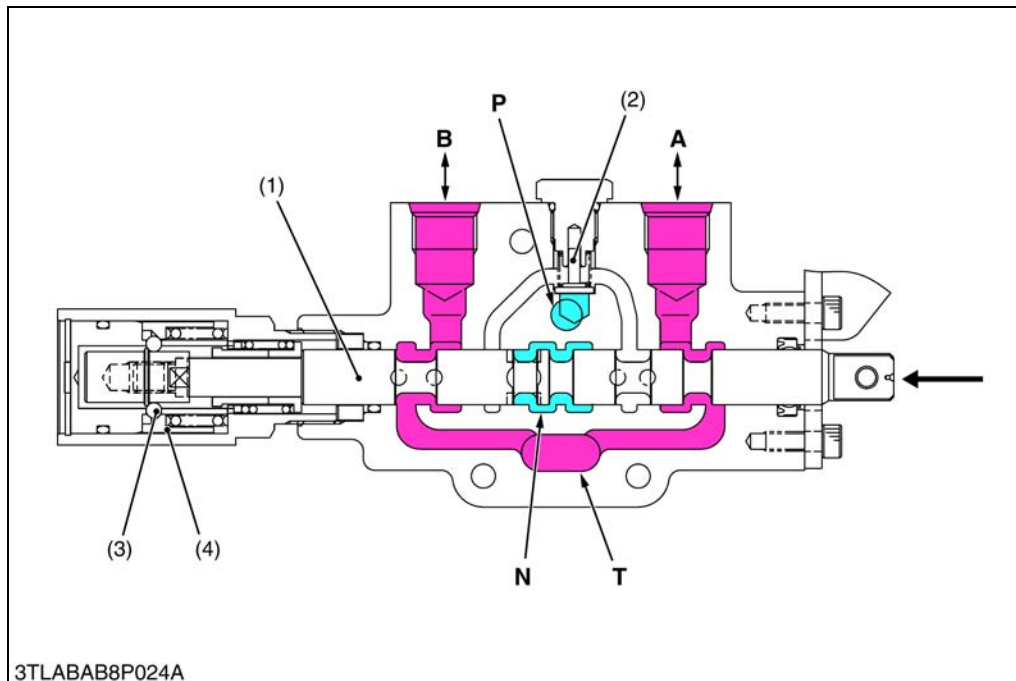
W1016237

3TLABAB8P023A

When the spool (1) is moved in the direction of the arrow, the pressure-fed oil in the **P** port opens the check valve (2) and flows to the implement cylinder via **A** port.

Return oil from the implement cylinder flows from the **B** port to the transmission case through **T** port.

Floating



- (1) Spool
- (2) Check Valve
- (3) Detent Ball
- (4) Detent Sleeve

**A : A Port
(Implement Cylinder)**
**B : B Port
(Implement Cylinder)**
P : Pump Port
N : Neutral Port
T : Tank Port

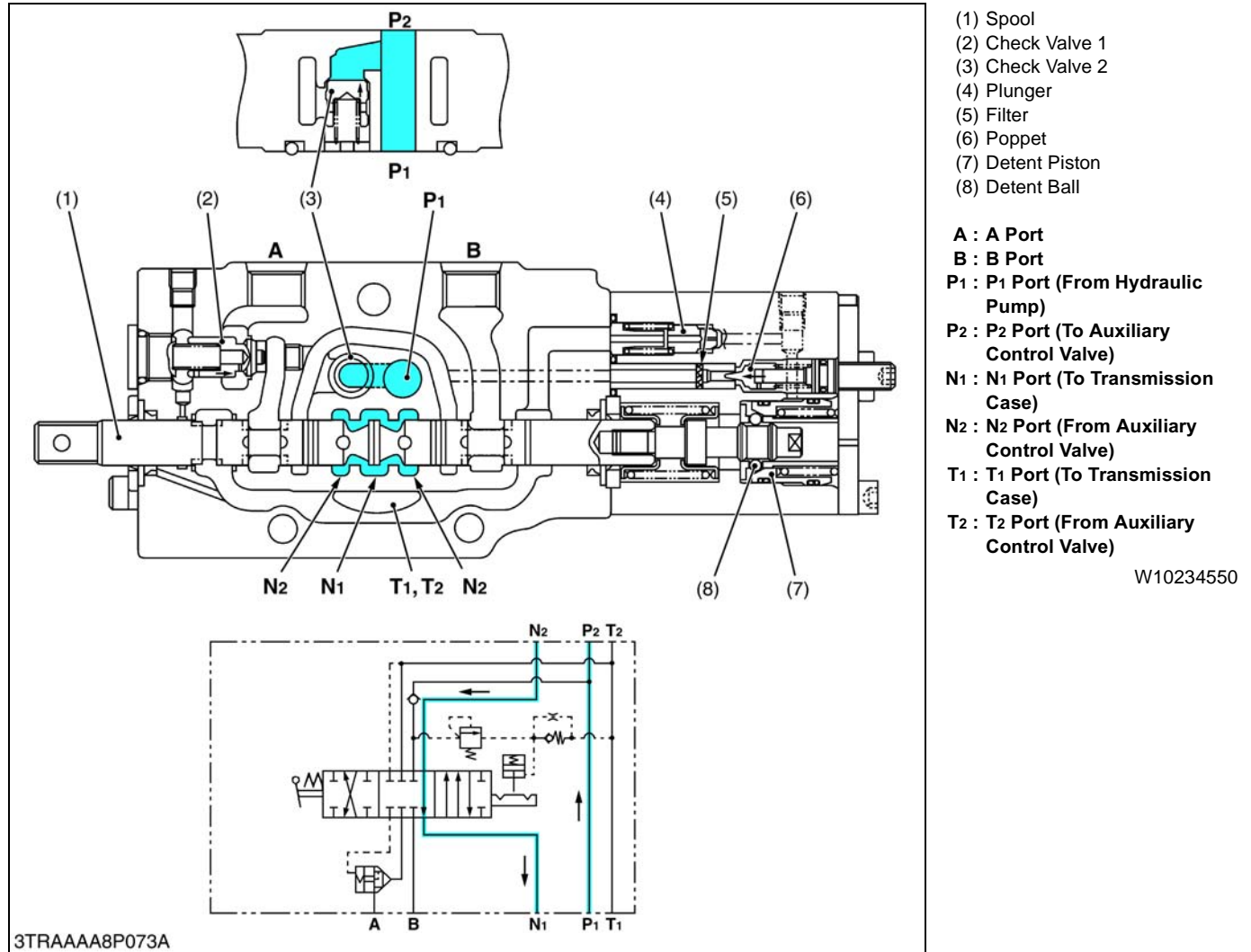
W1016319

3TLABAB8P024A

When the spool (1) moves to extreme left, the detent ball (3) and detent sleeve (4) hold the spool (1) at the floating position as shown in the figure. The pressure-fed oil from the hydraulic pump flows to position control valve via **N** port. And, the **A** port and **B** port lead to the **T** port along the notched sections of the spool (1). This result in the attached implement to follow the contour of the terrain.

(6) Type 6 (Self Cancelling with Detent-1, Code No. 3A111-82540, 3A751-82540, 3A151-82540)

■ Neutral



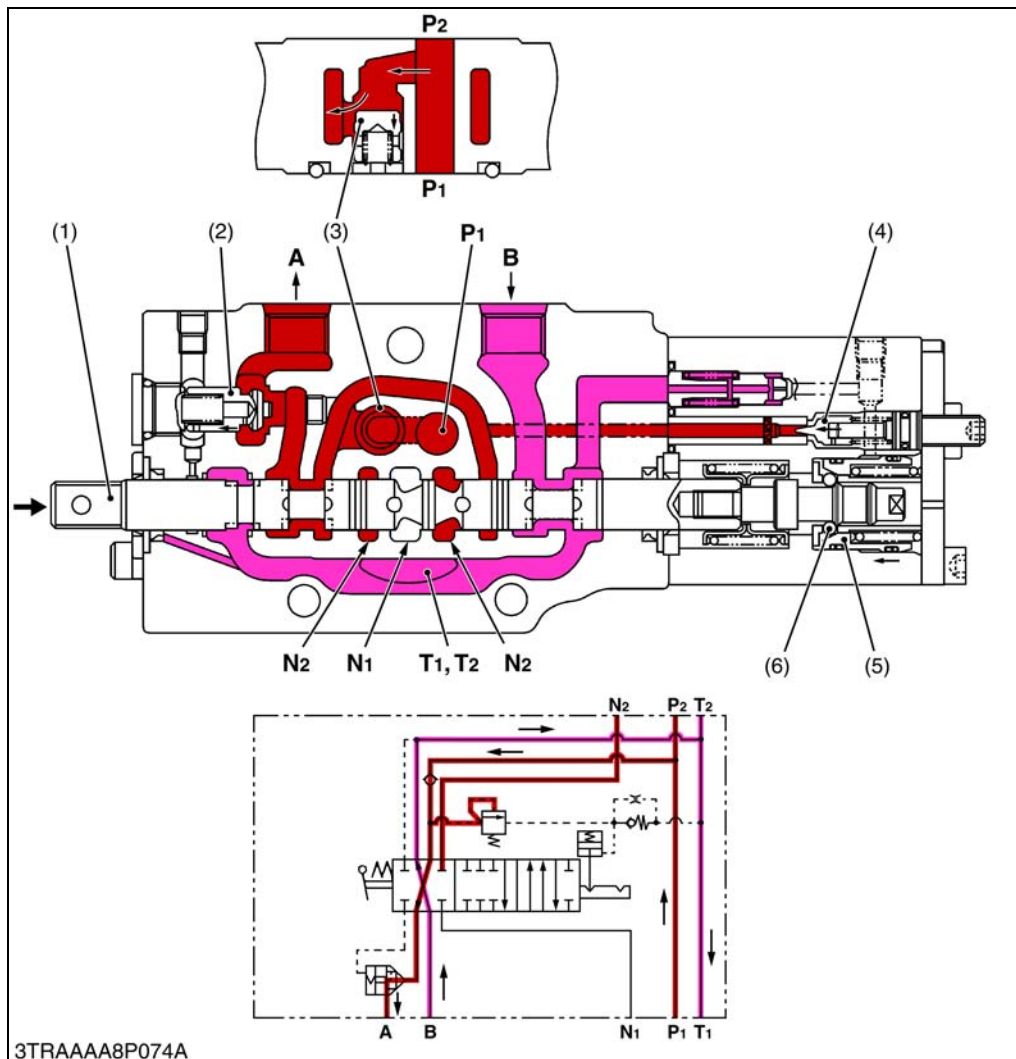
Pressure-fed oil from the hydraulic pump is delivered into the **P1** port.

As the passage from the **P1** port to the **A** port or **B** port is blocked by the spool (1), the oil in the **P1** port flows across the valve body to **P2** port.

When the auxiliary control valve is in neutral, the oil flows from **P2** port to **N2** port via the another auxiliary control valve and its cover.

Then, the oil in the **N2** port flows along the notched section of the spool (1) to the **N1** port to the transmission case.

■ Lift-1 (When Spool is Held at "Lift" Position by Detent)



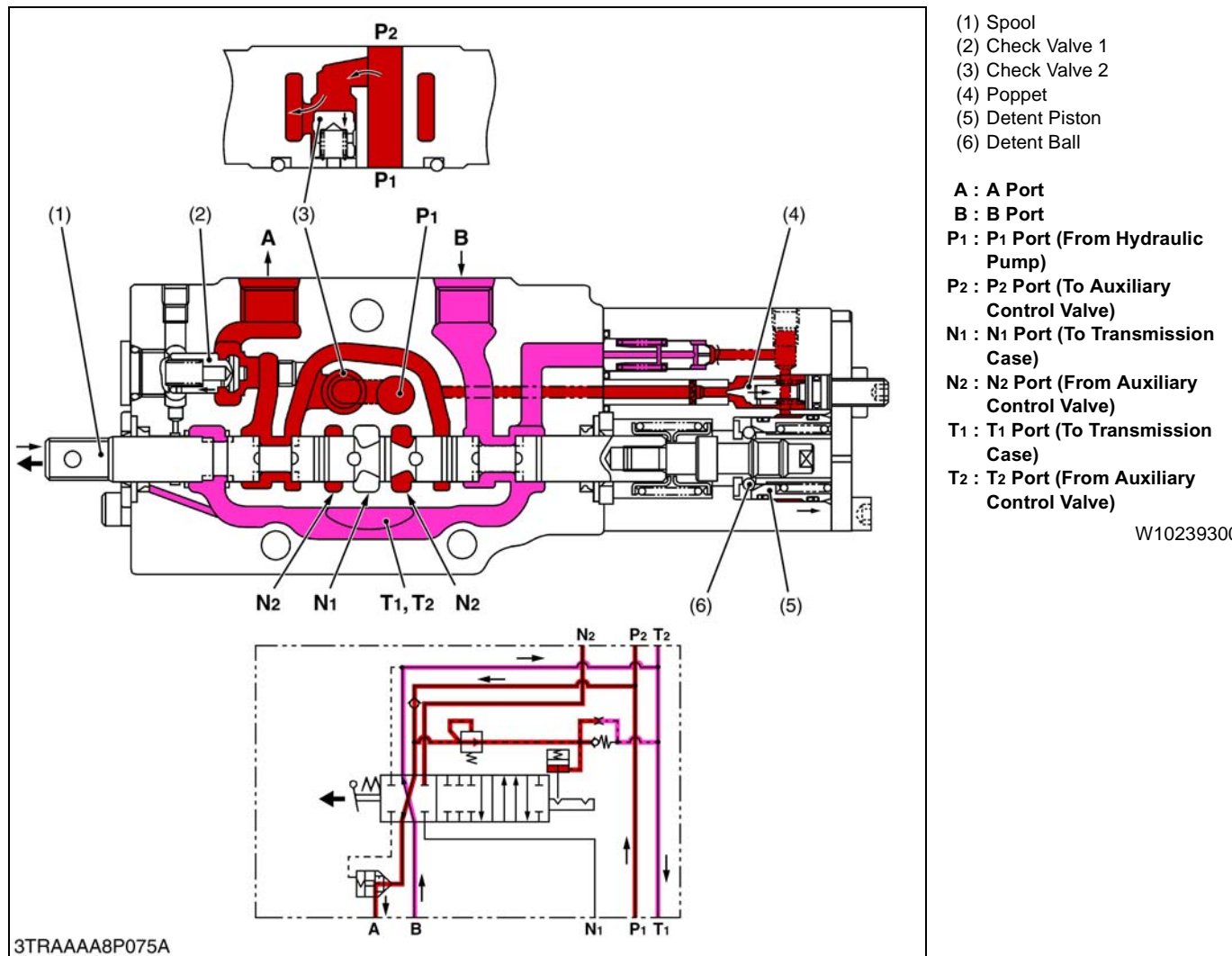
- (1) Spool
- (2) Check Valve 1
- (3) Check Valve 2
- (4) Poppet
- (5) Detent Piston
- (6) Detent Ball

- A** : A Port
- B** : B Port
- P1** : P1 Port (From Hydraulic Pump)
- P2** : P2 Port (To Auxiliary Control Valve)
- N1** : N1 Port (To Transmission Case)
- N2** : N2 Port (From Auxiliary Control Valve)
- T1** : T1 Port (To Transmission Case)
- T2** : T2 Port (From Auxiliary Control Valve)

W10237370

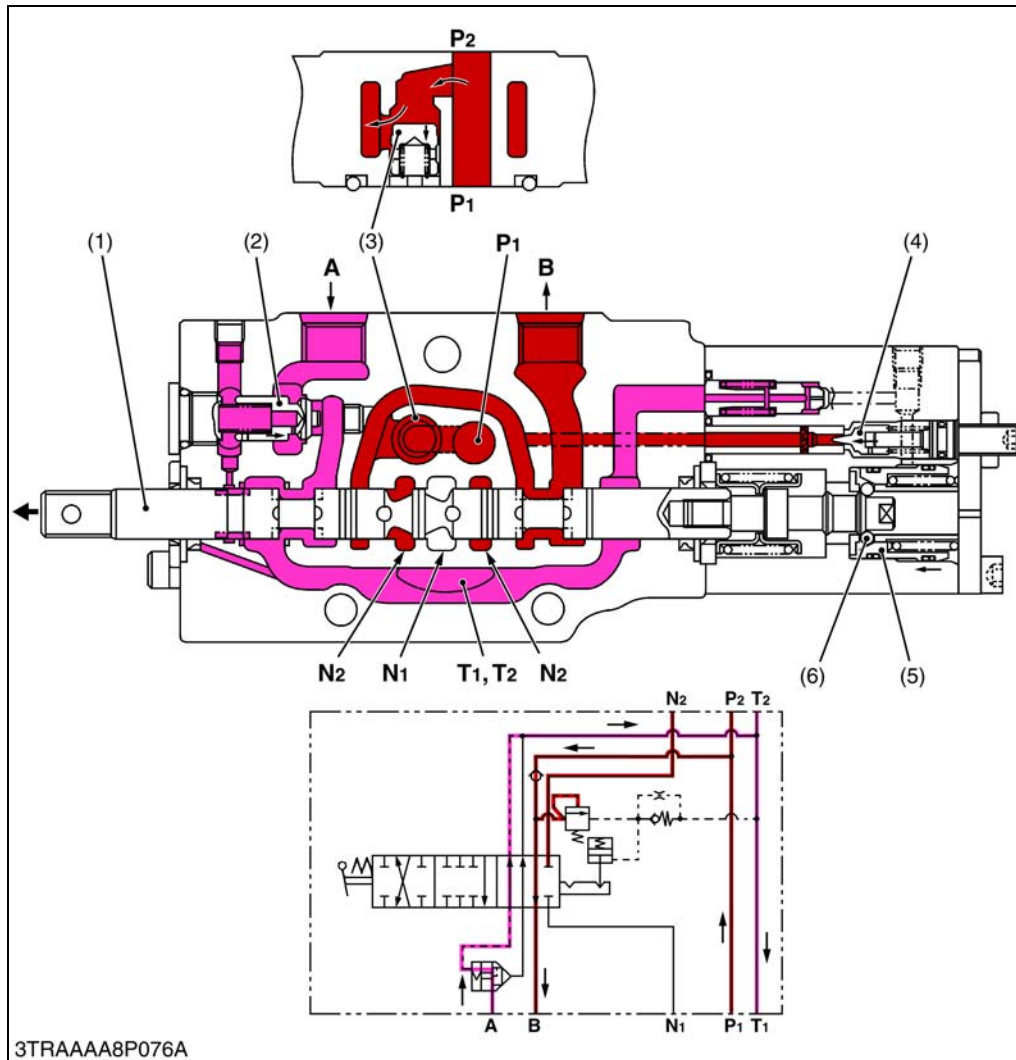
When the spool (1) moves to right, the detent piston (5) and detent ball (6) hold the spool (1) at the **LIFT** position as shown in the figure. The pressure-fed oil in the **P1** port opens the check valves (2), (3) and flows to implement cylinder via **A** port. The return oil from implement cylinder flows from **B** port to the transmission case through **T1** port.

■ Lift-2 (When "Lift" Position is Self-Cancelled)



As the implement cylinder rises to its uppermost position, pressure at **P1** port increases. When this pressure exceeds the poppet setting pressure, the pressure-fed oil opens the poppet (4) and moves the detent piston (5) to right. As a result, the spool (1) is returned to **NEUTRAL** position by the tension of spring while the detent balls (6) are moved outside.

■ Down-1 (When Spool is Held at “Down” Position by Detent)



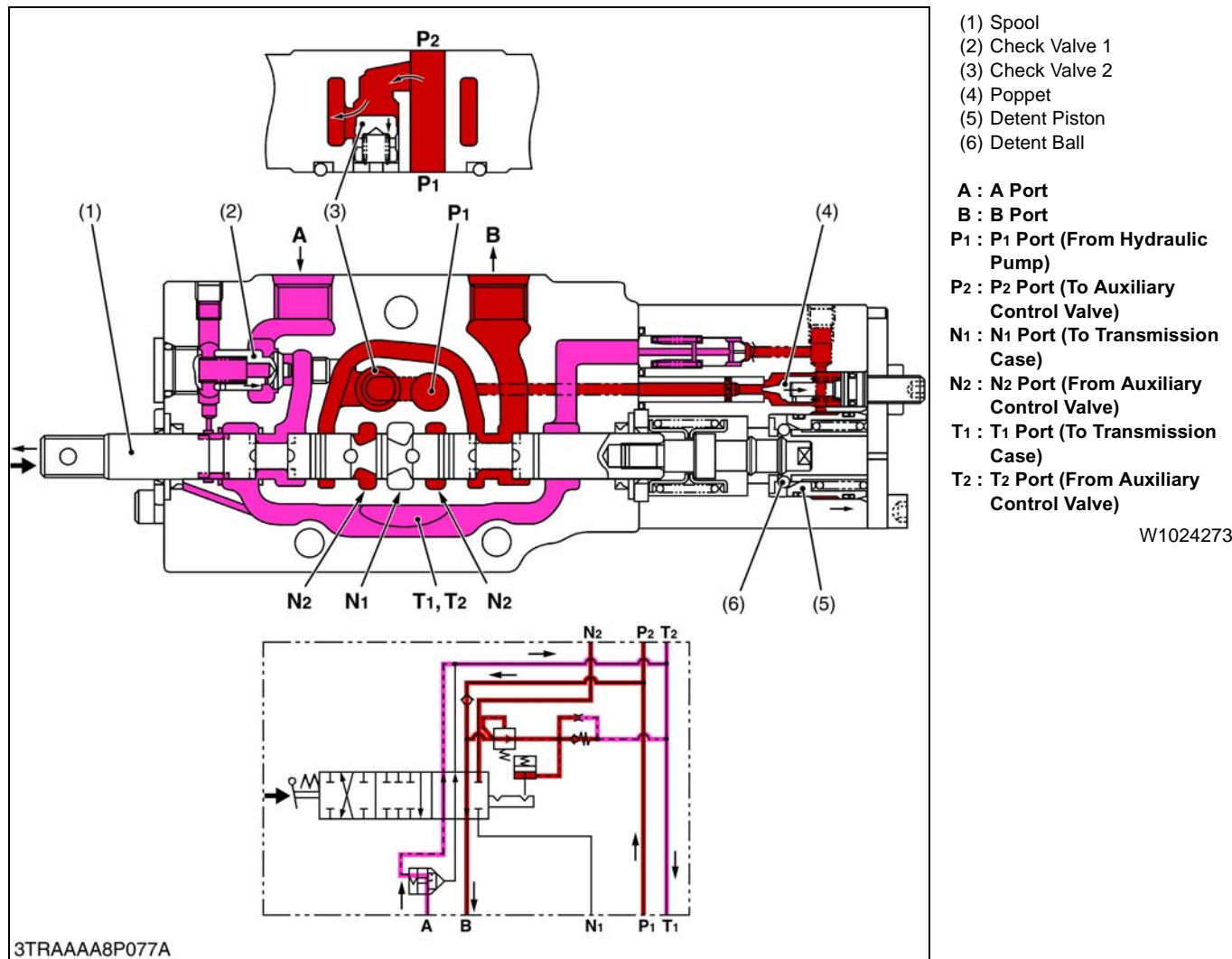
- (1) Spool
 - (2) Check Valve 1
 - (3) Check Valve 2
 - (4) Poppet
 - (5) Detent Piston
 - (6) Detent Ball
- A : A Port
 - B : B Port
 - P1 : P1 Port (From Hydraulic Pump)
 - P2 : P2 Port (To Auxiliary Control Valve)
 - N1 : N1 Port (To Transmission Case)
 - N2 : N2 Port (From Auxiliary Control Valve)
 - T1 : T1 Port (To Transmission Case)
 - T2 : T2 Port (From Auxiliary Control Valve)

W10241070

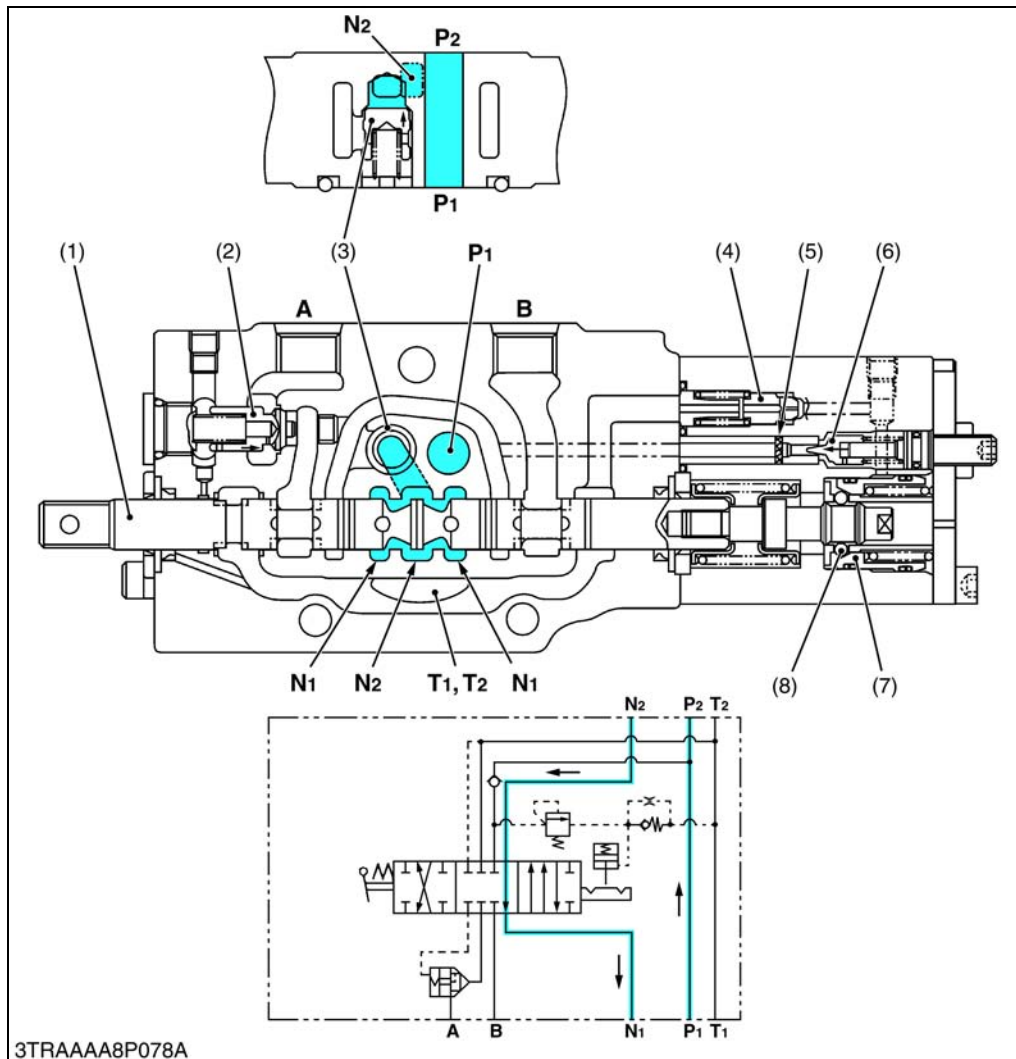
3TRAAA8P076A

When the spool (1) moves to left, the detent piston (5) and detent ball (6) hold the spool (1) at the **DOWN** position as shown in the figure. The pressure-fed oil in the **P1** port opens the check valve 2 (3) and flows to implement cylinder via **B** port. The return oil from implement cylinder flows from **A** port to the transmission case through **T1** port.

■ Down-2 (When “Down” Position is Self-Cancelled)



As the implement cylinder lowers to its downmost position, pressure at **P1** port increases. When this pressure exceeds the poppet setting pressure, the pressure-fed oil opens the poppet (4) and moves the detent piston (5) to right. As a result, the spool (1) is returned to **NEUTRAL** position by the tension of spring while the detent balls (6) are moved outside.

(7) Type 7 (Self Cancelling with Detent-2, Code No. 3A751-82560, 3A151-82560)**■ Neutral**

- (1) Spool
- (2) Check Valve 1
- (3) Check Valve 2
- (4) Plunger
- (5) Filter
- (6) Poppet
- (7) Detent Piston
- (8) Detent Ball

A : A Port

B : B Port

P1 : P1 Port (From Hydraulic Pump)

P2 : P2 Port (To Auxiliary Control Valve)

N1 : N1 Port (To Transmission Case)

N2 : N2 Port (From Auxiliary Control Valve)

T1 : T1 Port (To Transmission Case)

T2 : T2 Port (From Auxiliary Control Valve)

W10257300

3TRAAAA8P078A

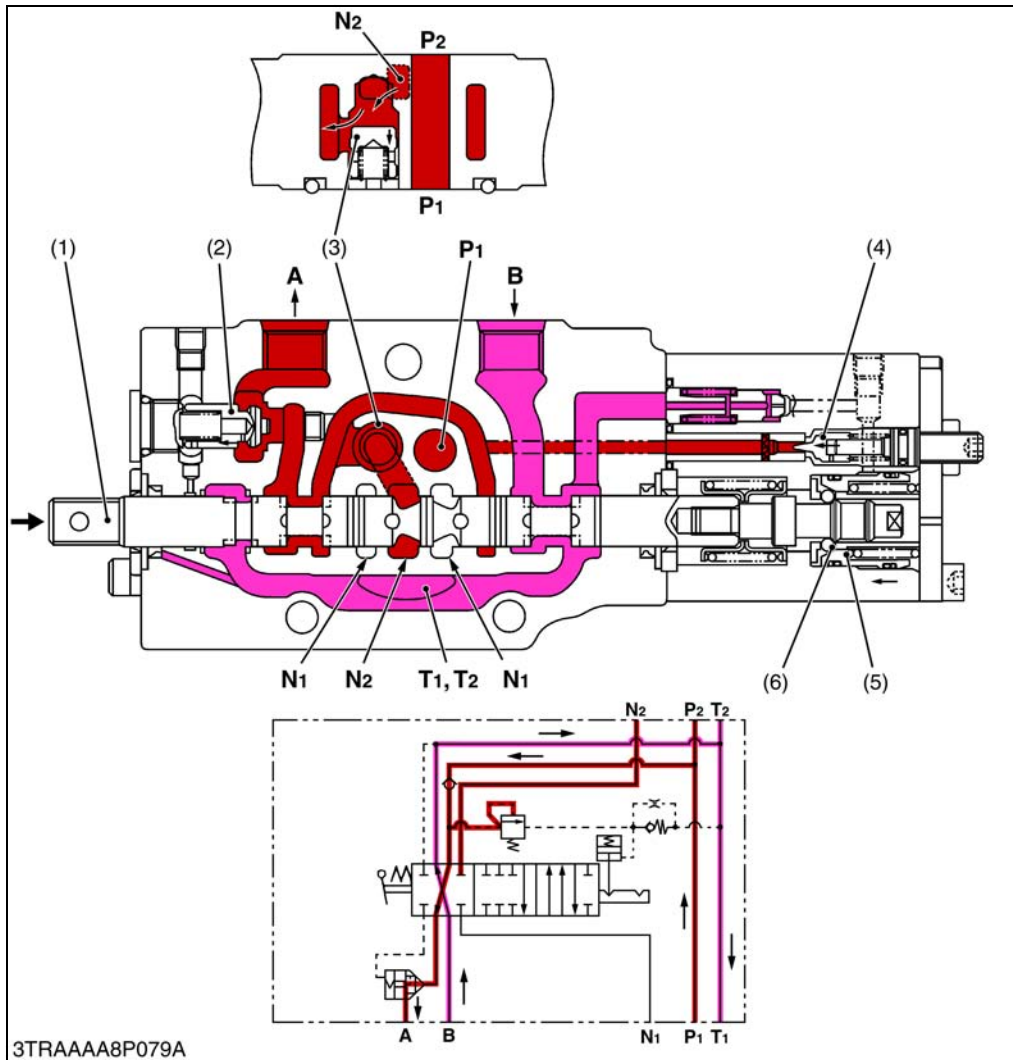
Pressure-fed oil from the hydraulic pump is delivered into the **P1** port.

As the passage from the **P1** port to the **A** port or **B** port is blocked by the spool (1), the oil in the **P1** port flows across the valve body to **P2** port.

When the auxiliary control valve is in neutral, the oil flows from **P2** port to **N2** port via the another auxiliary control valve and its cover.

Then, the oil in the **N2** port flows along the notched section of the spool (1) to the **N1** port to the transmission case.

■ Lift-1 (When Spool is Held at “Lift” Position by Detent)

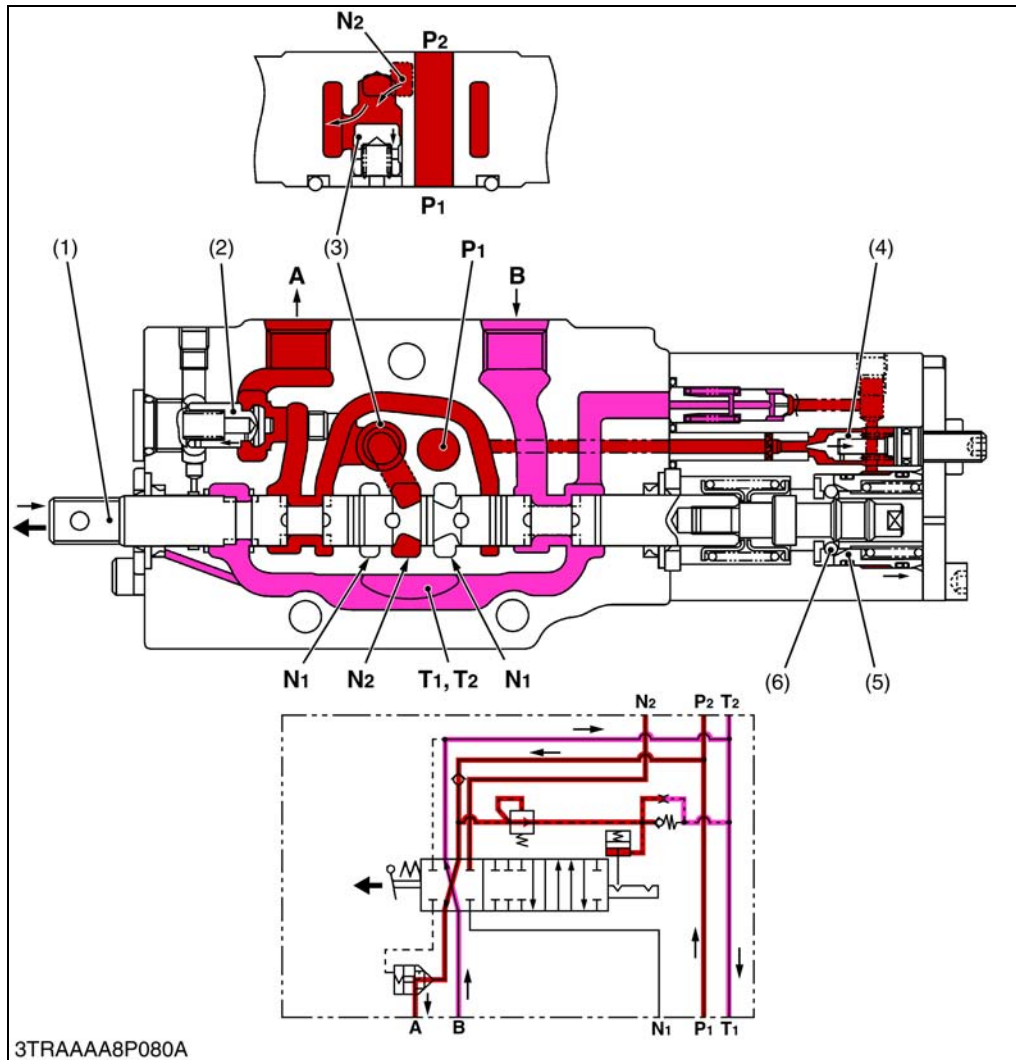


- (1) Spool
 - (2) Check Valve 1
 - (3) Check Valve 2
 - (4) Poppet
 - (5) Detent Piston
 - (6) Detent Ball
- A : A Port
 - B : B Port
 - P1 : P1 Port (From Hydraulic Pump)
 - P2 : P2 Port (To Auxiliary Control Valve)
 - N1 : N1 Port (To Transmission Case)
 - N2 : N2 Port (From Auxiliary Control Valve)
 - T1 : T1 Port (To Transmission Case)
 - T2 : T2 Port (From Auxiliary Control Valve)

W10262840

When the spool (1) moves to right, the detent piston (5) and detent ball (6) hold the spool (1) at the **LIFT** position as shown in the figure. The pressure-fed oil in the **P1** port opens the check valves (2), (3) and flows to implement cylinder via **A** port. The return oil from implement cylinder flows from **B** port to the transmission case through **T1** port.

■ Lift-2 (When "Lift" Position is Self-Cancelled)



- (1) Spool
- (2) Check Valve 1
- (3) Check Valve 2
- (4) Poppet
- (5) Detent Piston
- (6) Detent Ball

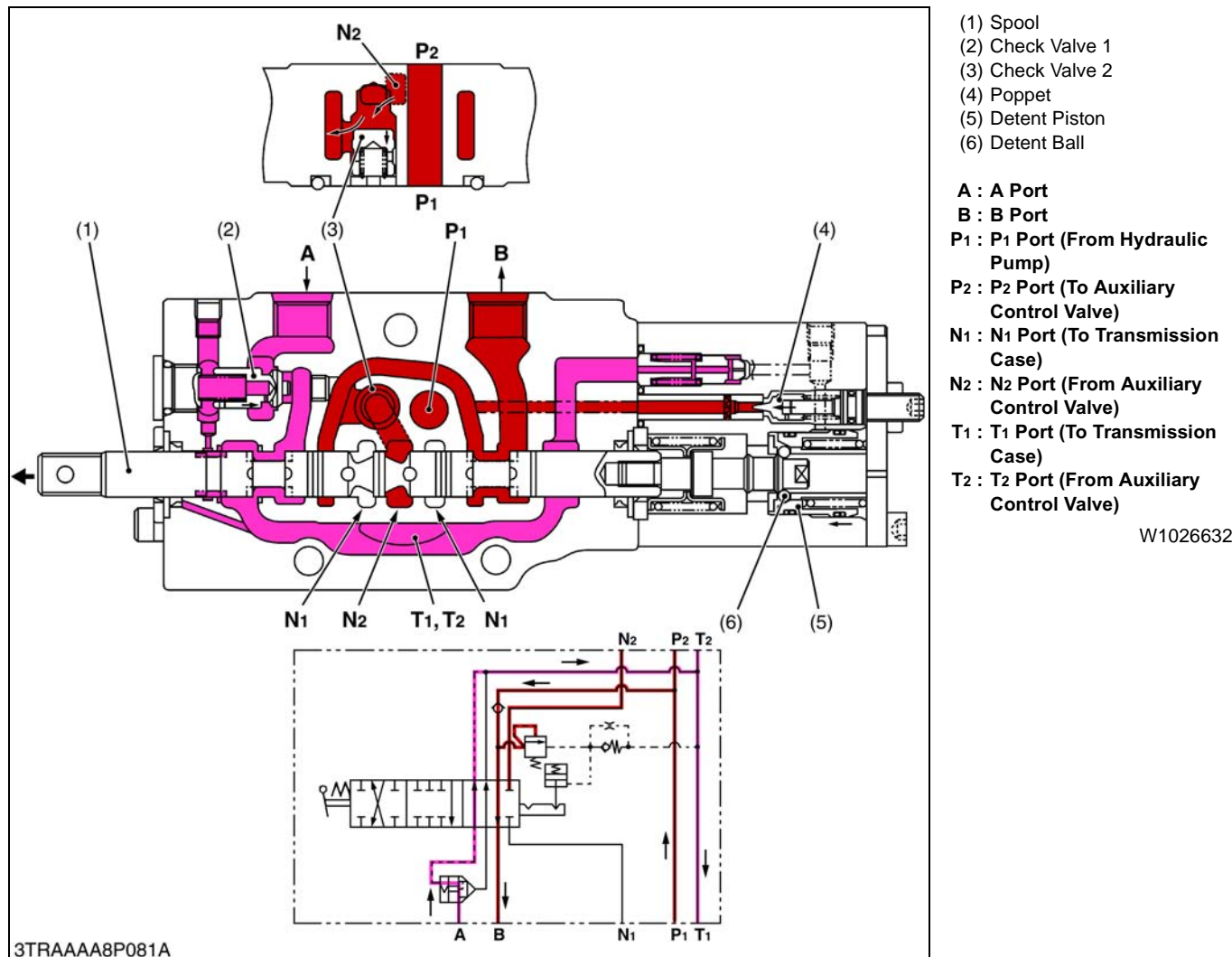
- A** : A Port
- B** : B Port
- P1** : P1 Port (From Hydraulic Pump)
- P2** : P2 Port (To Auxiliary Control Valve)
- N1** : N1 Port (To Transmission Case)
- N2** : N2 Port (From Auxiliary Control Valve)
- T1** : T1 Port (To Transmission Case)
- T2** : T2 Port (From Auxiliary Control Valve)

W10264790

3TRAAA8P080A

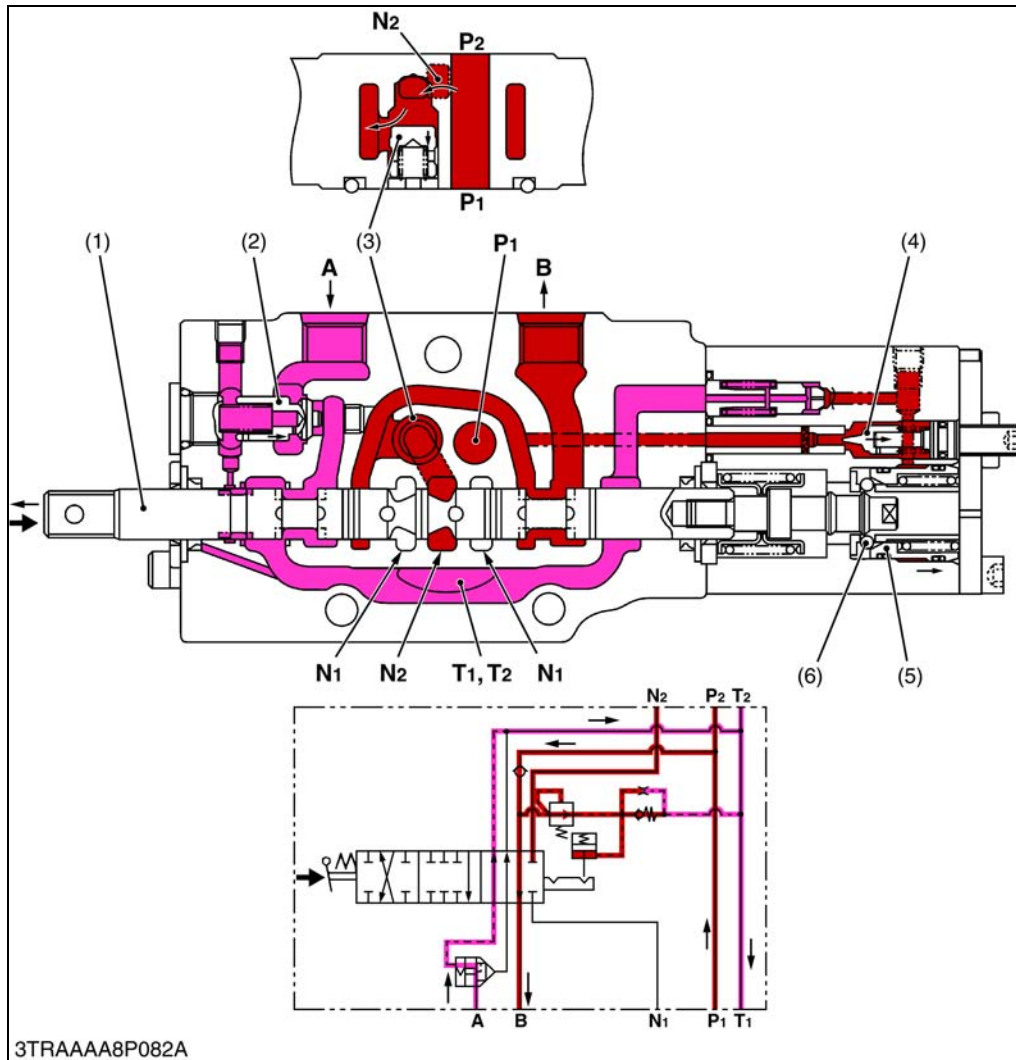
As the implement cylinder rises to its uppermost position, pressure at **P1** port increases. When this pressure exceeds the poppet setting pressure, the pressure-fed oil opens the poppet (4) and moves the detent piston (5) to right. As a result, the spool (1) is returned to **NEUTRAL** position by the tension of spring while the detent balls (6) are moved outside.

■ Down-1 (When Spool is Held at “Down” Position by Detent)



When the spool (1) moves to left, the detent piston (5) and detent ball (6) hold the spool (1) at the **DOWN** position as shown in the figure. The pressure-fed oil in the **P1** port opens the check valve 2 (3) and flows to implement cylinder via **B** port. The return oil from implement cylinder flows from **A** port to the transmission case through **T1** port.

Down-2 (When "Down" Position is Self-Cancelled)



- (1) Spool
- (2) Check Valve 1
- (3) Check Valve 2
- (4) Poppet
- (5) Detent Piston
- (6) Detent Ball

- A** : A Port
B : B Port
P1 : P1 Port (From Hydraulic Pump)
P2 : P2 Port (To Auxiliary Control Valve)
N1 : N1 Port (To Transmission Case)
N2 : N2 Port (From Auxiliary Control Valve)
T1 : T1 Port (To Transmission Case)
T2 : T2 Port (From Auxiliary Control Valve)

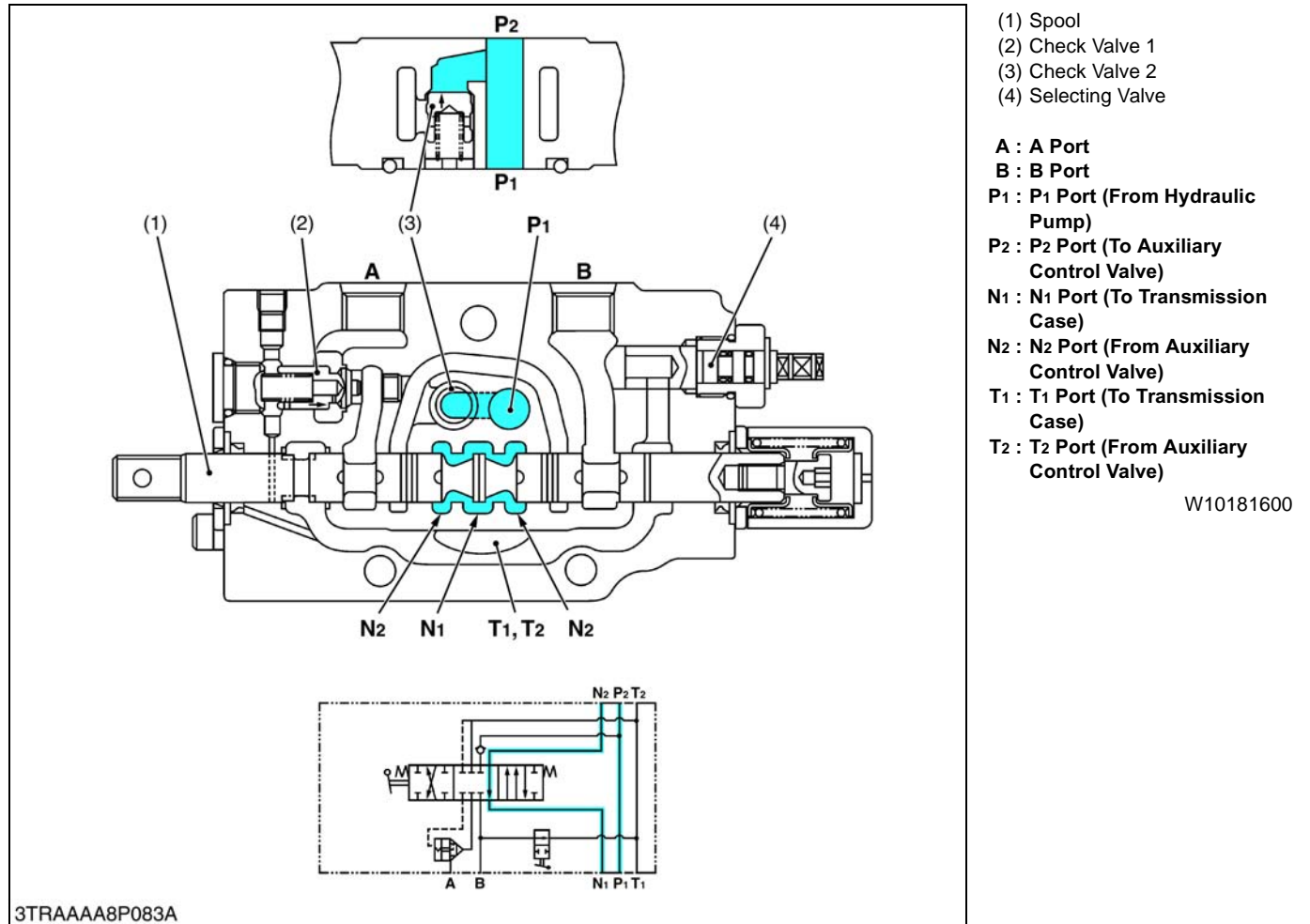
W10268050

3TRAAA8P082A

As the implement cylinder lowers to its downmost position, pressure at **P1** port increases. When this pressure exceeds the poppet setting pressure, the pressure-fed oil opens the poppet (4) and moves the detent piston (5) to right. As a result, the spool (1) is returned to **NEUTRAL** position by the tension of spring while the detent balls (6) are moved outside.

[2] SINGLE / DOUBLE ACTING TYPE (Code No. 3A031-82350, 3G700-82350, 3F740-82350)

■ Neutral



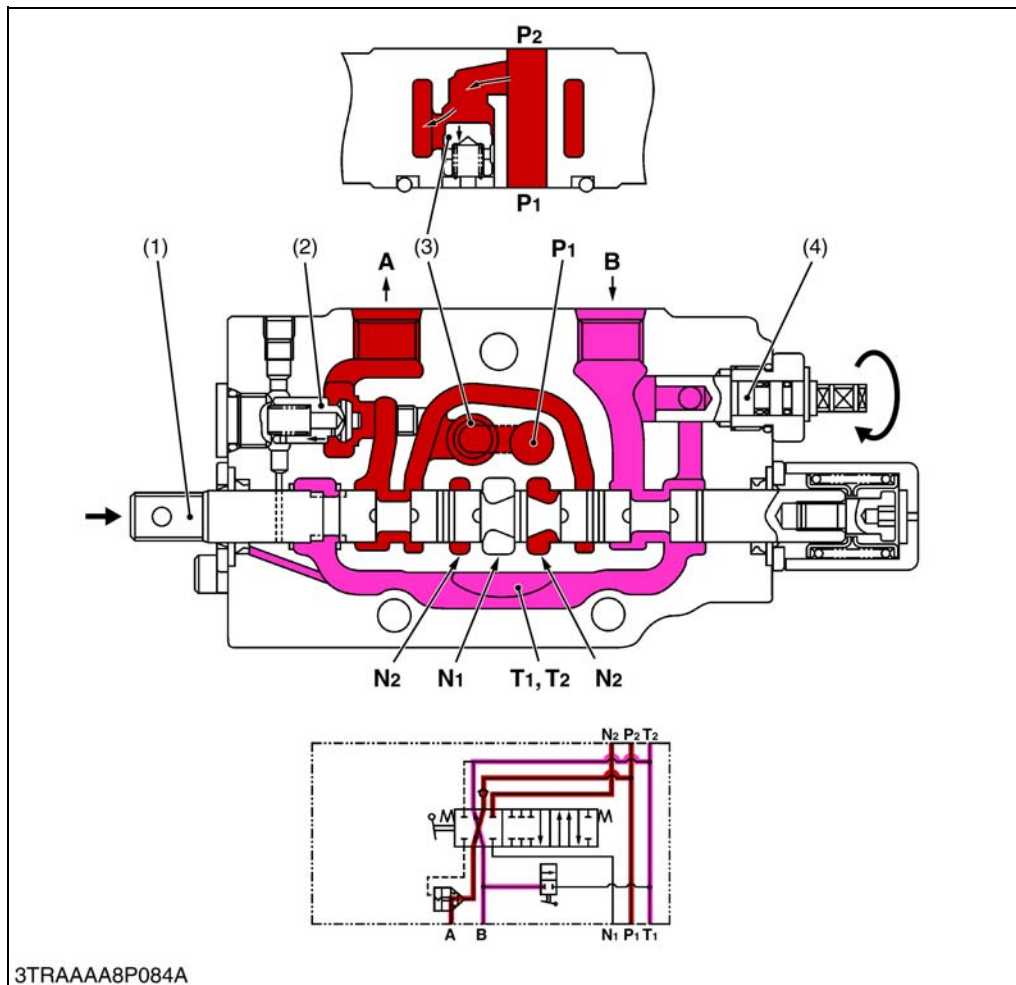
Pressure-fed oil from the hydraulic pump is delivered into the **P1** port.

As the passage from the **P1** port to the **A** port or **B** port is blocked by the spool (1), the oil in the **P1** port flows across the valve body to **P2** port.

When the auxiliary control valve is in neutral, the oil flows from **P2** port to **N2** port via the another auxiliary control valve and its cover.

Then, the oil in the **N2** port flows along the notched section of the spool (1) to the **N1** port to the transmission case.

■ Lift (Double Acting)



- (1) Spool
- (2) Check Valve 1
- (3) Check Valve 2
- (4) Selecting Valve

- A : A Port
- B : B Port
- P1 : P1 Port (From Hydraulic Pump)
- P2 : P2 Port (To Auxiliary Control Valve)
- N1 : N1 Port (To Transmission Case)
- N2 : N2 Port (From Auxiliary Control Valve)
- T1 : T1 Port (To Transmission Case)
- T2 : T2 Port (From Auxiliary Control Valve)

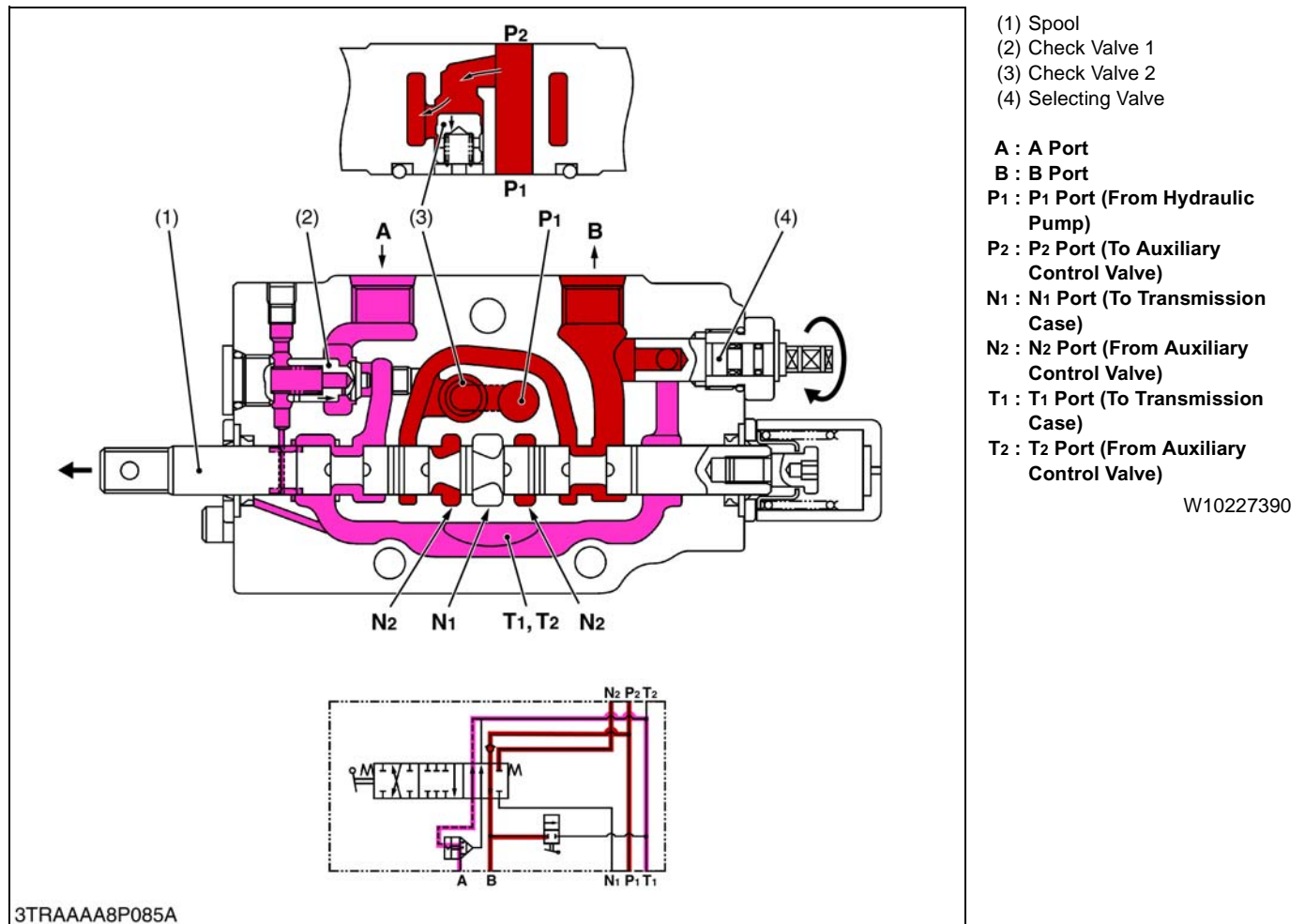
W10224960

3TRAAA8P084A

When the auxiliary control valve is used in double acting mode, the selecting valve (4) is turned clockwise to close the passage from selecting valve (4) to T1 port.

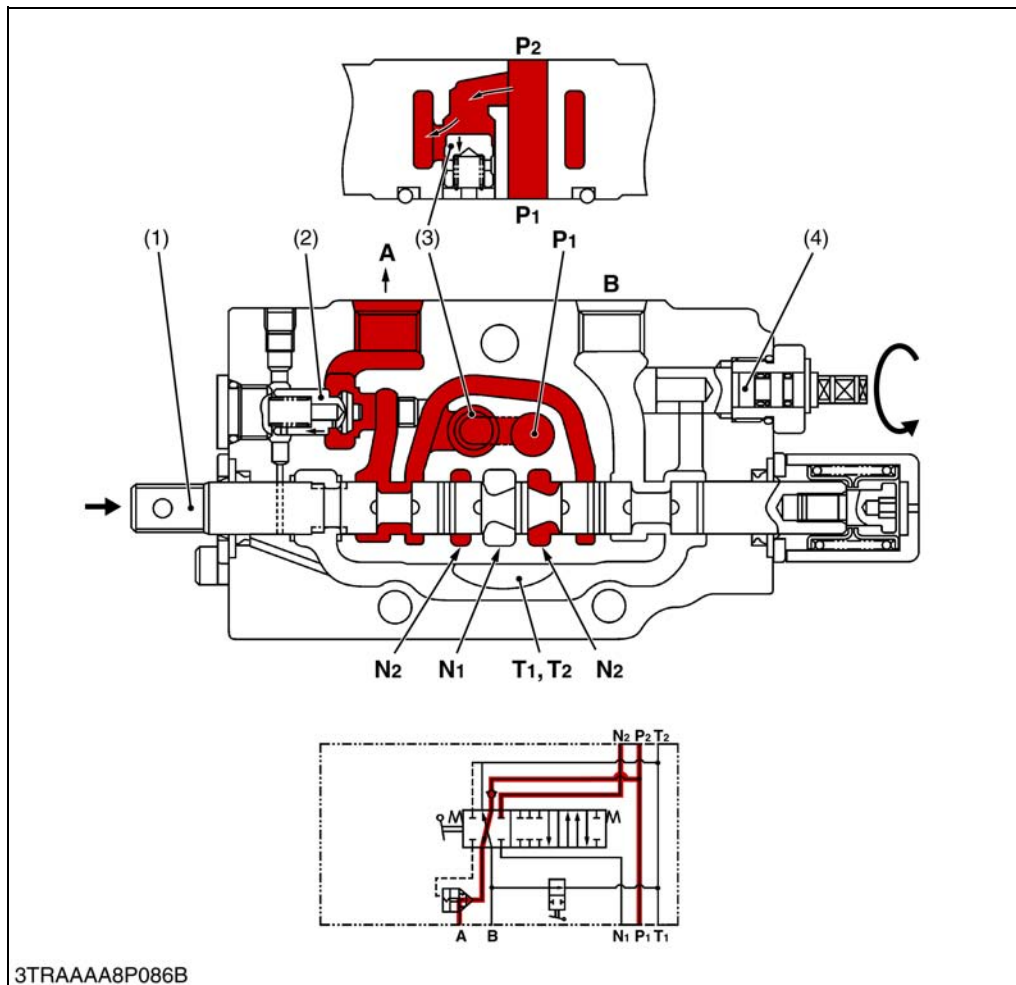
When the spool (1) moves to right, the oil passage from N2 port to N1 port is blocked by the spool (1). Then, the pressure-fed oil in the P1 port opens the check valves (2), (3) and flows to implement cylinder via A port. The return oil from implement cylinder flows from B port to the transmission case through T1 port.

■ Down (Double Acting)



When the spool (1) moves to left, the oil passage from **N2** port to **N1** port is blocked by the spool (1). Then, the pressure-fed oil in the **P1** port opens the check valve 2 (3) and flows to implement cylinder via **B** port. The return oil from implement cylinder flows from **A** port to the transmission case through **T1** port.

■ Lift (Single Acting)

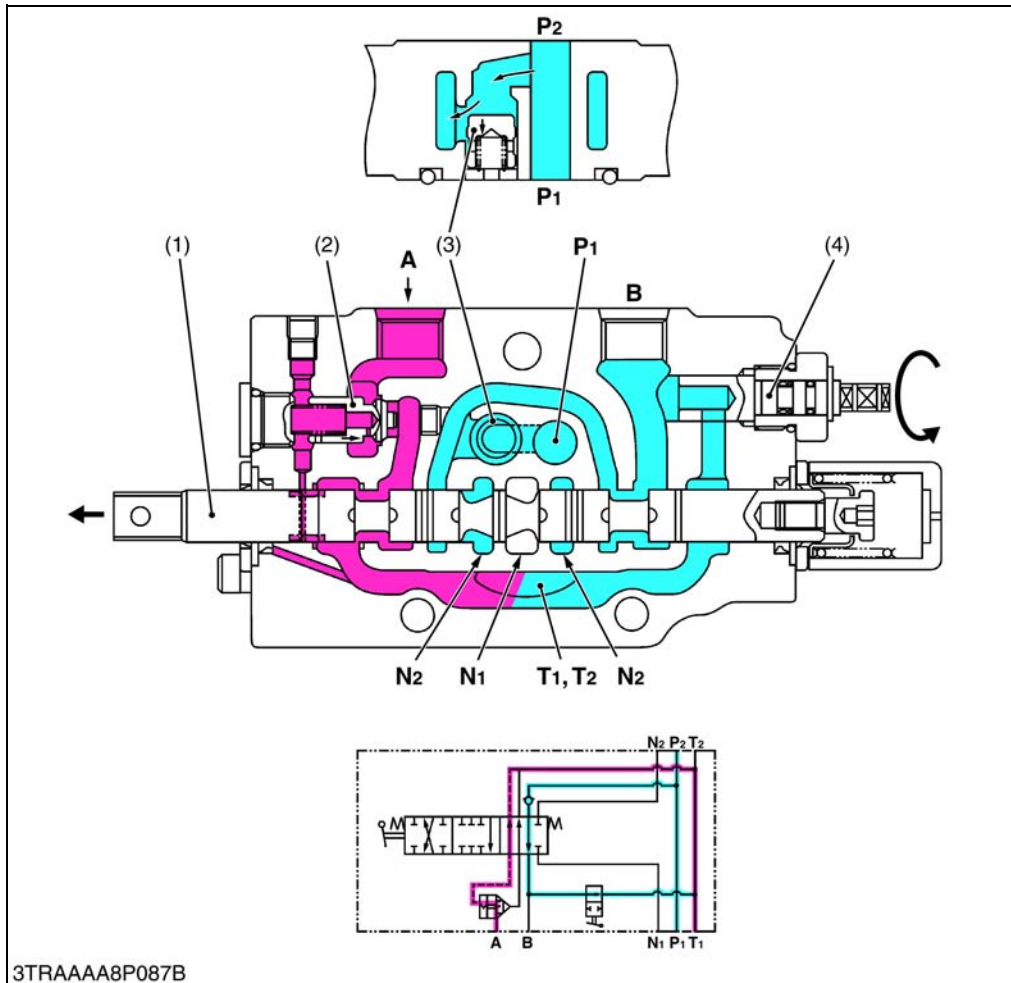


W10229450

When the auxiliary control valve is used in single acting mode, the selecting valve (4) is turned counterclockwise to open the passage from selecting valve (4) to T1 port.

When the spool (1) moves to right, the oil passage from N2 port to N1 port is blocked by the spool (1). Then, the pressure-fed oil in the P1 port opens the check valves (2), (3) and flows to implement cylinder via A port.

■ Down (Single Acting)



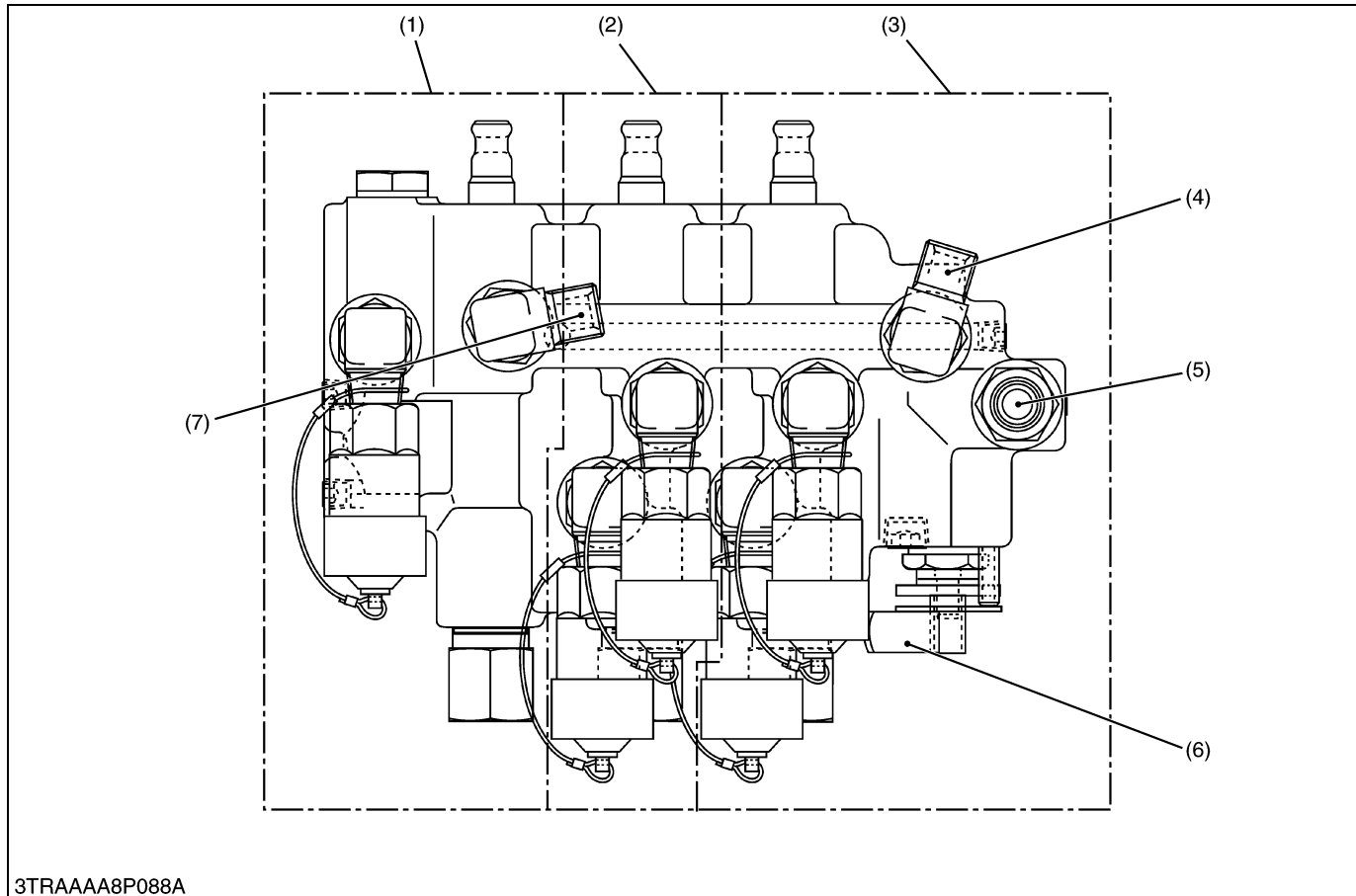
- (1) Spool
- (2) Check Valve 1
- (3) Check Valve 2
- (4) Selecting Valve

- A** : A Port
- B** : B Port
- P1** : P1 Port (From Hydraulic Pump)
- P2** : P2 Port (To Auxiliary Control Valve)
- N1** : N1 Port (To Transmission Case)
- N2** : N2 Port (From Auxiliary Control Valve)
- T1** : T1 Port (To Transmission Case)
- T2** : T2 Port (From Auxiliary Control Valve)

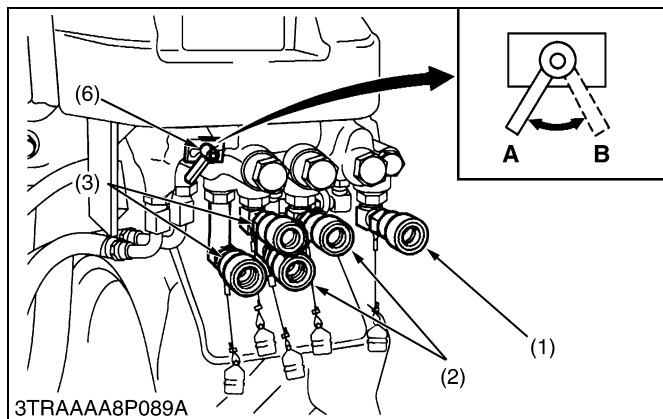
W10230970

When the spool (1) moves to left, the oil passage from **N2** port to **N1** port is blocked by the spool (1). Then, the pressure-fed oil in the **P1** port opens the check valve 2 (3) and flows to transmission case through selecting valve (4) and **T1** port. And the return oil from implement cylinder flows from **A** port to the transmission case through **T1** port.

[3] OTHERS (TA470-38000, YW277-00102)



3TRAAA8P088A



3TRAAA8P089A

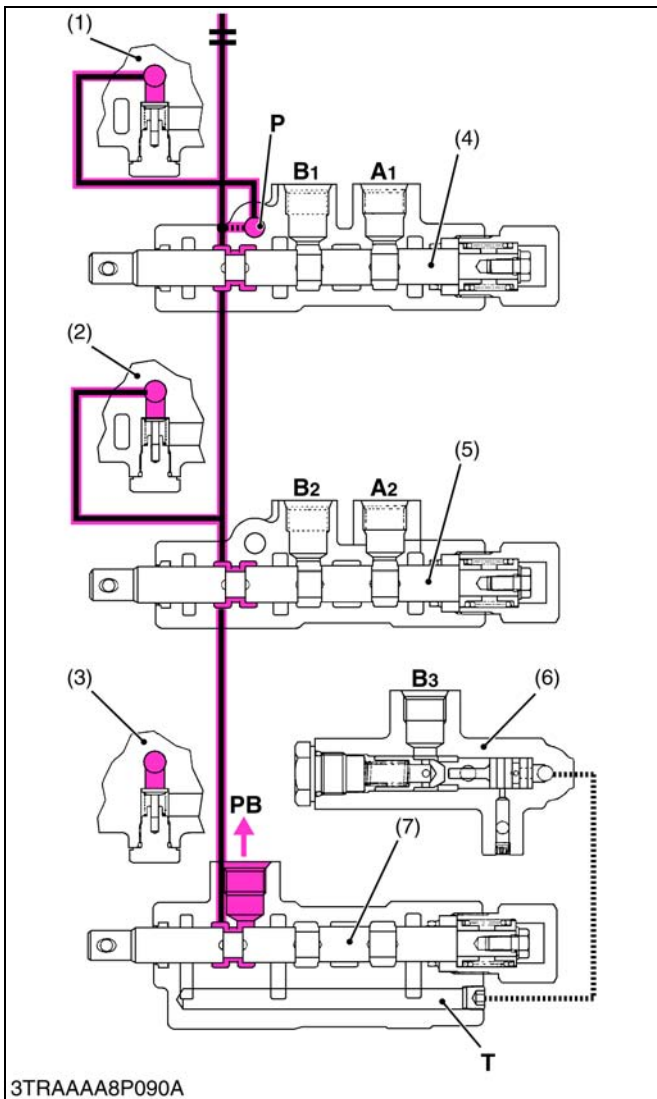
This auxiliary control valve is a unit for three valves as single / double acting selectable valve, double acting valve and single acting valve.

The pressured oil into the three each control valve with parallel connection through the **P** port (4).

The single / double acting valve (3) is changeable for single or double acting with select lever (6).

- (1) Single Acting Valve
 - (2) Double Acting Valve
 - (3) Single / Double Acting Valve
 - (4) **P** Port
 - (5) **T** Port
 - (6) Auxiliary Control Valve Select Lever
 - (7) **PB** Port
- (A) Single Acting**
 - (B) Double Acting**

W10291210



■ Neutral

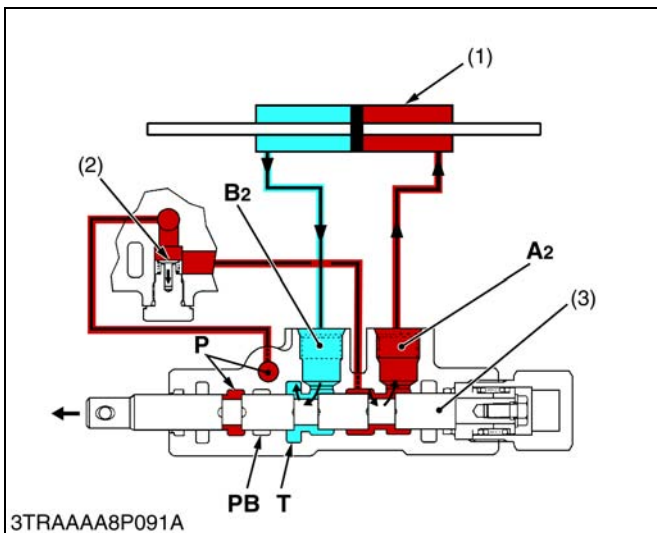
While the spools (4), (5), (7) are in neutral position, the pressure-fed oil from the hydraulic pump is delivered into the **P** port and flows to 3-point linkage control valve through **PB** port.

- (1) Check Valve
- (2) Check Valve
- (3) Check Valve
- (4) Spool
- (5) Spool
- (6) Unload Valve
- (7) Spool

- A1** :A1 Port (To or From Implement Cylinder)
- A2** :A2 Port (To or From Implement Cylinder)
- B1** :B1 Port (To or From Implement Cylinder)
- B2** :B2 Port (To or From Implement Cylinder)
- B3** :B3 Port (To or From Implement Cylinder)

- P** : P Port (From Hydraulic Pump)
- PB** :PB Port (To Control Valve)
- T** : T Port (To Transmission Case)

W10293540



■ Double Acting Valve – Lift

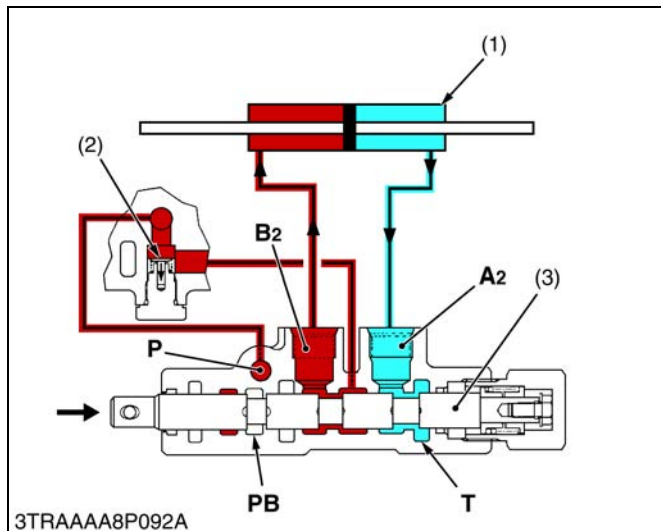
When the spool (3) moves to left, the passage from **P** port to **PB** port is closed. The pressure-fed oil opens the check valve (2) and flows to implement cylinder via **A2** port. The return oil from implement cylinder flows from **B2** port to transmission case through **T** port.

- (1) Double Acting Cylinder
- (2) Check Valve
- (3) Spool

- T** : T Port (To Transmission Case)
- A2** :A2 Port (To Implement Cylinder)
- B2** :B2 Port (From Implement Cylinder)

- P** : P Port (From Hydraulic Pump)
- PB** :PB Port (To Control Valve)

W10296100



■ Double Acting Valve – Down

When the spool (3) moves to right, the passage from **P** port to **PB** port is closed. The pressure-fed oil opens the check valve (2) and flows to implement cylinder via **B2** port. The return oil from implement cylinder flows from **A2** port to transmission case through **T** port.

- (1) Double Acting Cylinder
- (2) Check Valve
- (3) Spool

T : T Port (To Transmission Case)

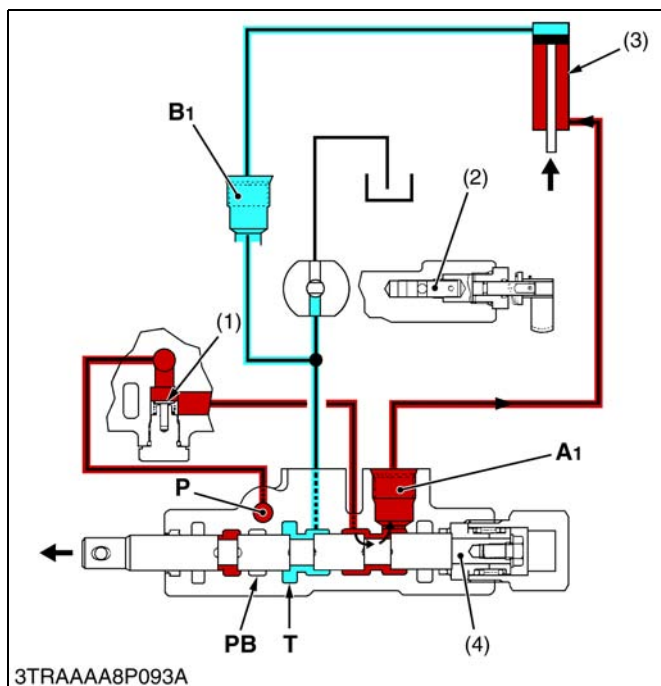
A2 :A2 Port (From Implement Cylinder)

P : P Port (From Hydraulic Pump)

B2 :B2 Port (To Implement Cylinder)

PB :PB Port (To Control Valve)

W10298070



■ Single / Double Acting Valve – Lift (Double Acting)

When this valve is used in double acting mode, the selecting valve (2) is turned counterclockwise to close the passage from selecting valve (2) to transmission case.

When the spool (4) moves to left, the oil passage from **P** port to **PB** port is blocked by the spool (4). The pressure-fed oil in the **P** port opens the check valve (1) and flows to implement cylinder via **A1** port. The return oil from implement cylinder flows from **B1** port to the transmission case through **T** port.

- (1) Check Valve
- (2) Selecting Valve
- (3) Double Acting Cylinder
- (4) Spool

P : P Port (From Hydraulic Pump)

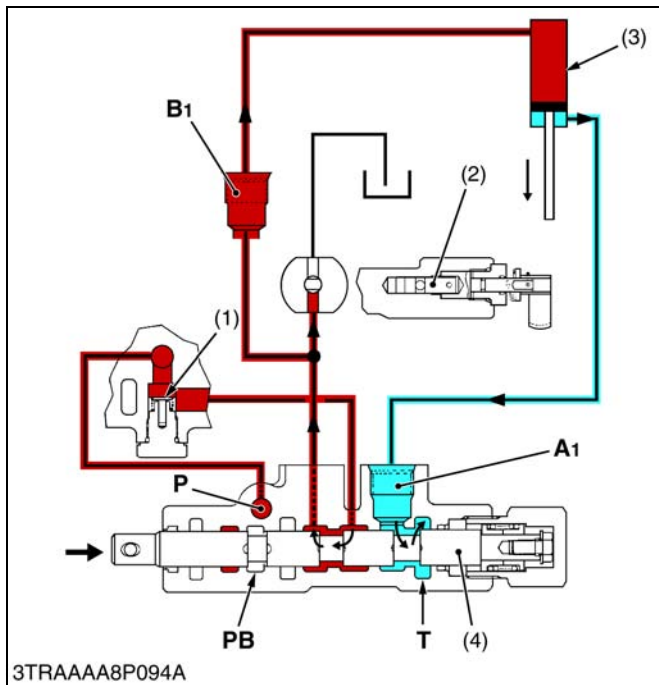
PB :PB Port (To Control Valve)

T : T Port (To Transmission Case)

A1 :A1 Port (To Implement Cylinder)

B1 :B1 Port (From Implement Cylinder)

W10302600



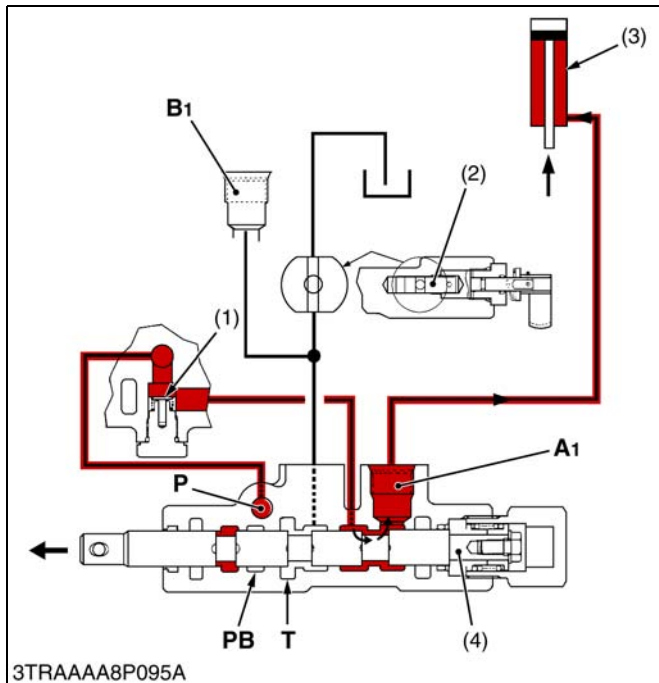
■ **Single / Double Acting Valve – Down (Double Acting)**

When the spool (4) moves to right, the oil passage from **P** port to **PB** port is blocked by the spool (4). The pressure-fed oil in the **P** port opens the check valve (1) and flows to implement cylinder via **B1** port. The return oil from implement cylinder flows from **A1** port to the transmission case through **T** port.

- (1) Check Valve
- (2) Selecting Valve
- (3) Double Acting Cylinder
- (4) Spool

- P** : **P** Port (From Hydraulic Pump)
- PB** : **PB** Port (To Control Valve)
- T** : **T** Port (To Transmission Case)
- A1** : **A1** Port (From Implement Cylinder)
- B1** : **B1** Port (To Implement Cylinder)

W10301160



■ **Single / Double Acting Valve – Lift (Single Acting)**

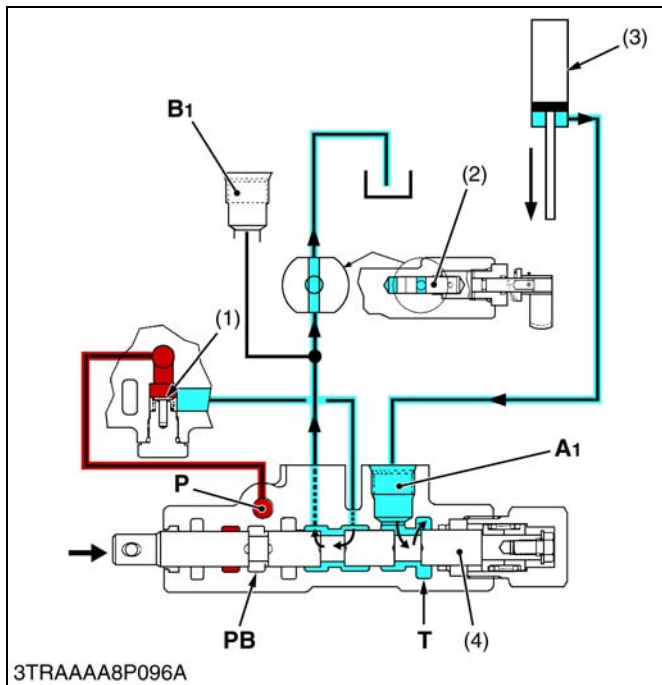
When this valve is used in single acting mode, the selecting valve (2) is turned clockwise to open the passage from selecting valve (2) to transmission case.

When the spool (4) moves to left, the oil passage from **P** port to **PB** port is blocked by the spool (4). The pressure-fed oil in the **P** port opens the check valve (1) and flows to implement cylinder via **A1** port.

- (1) Check Valve
- (2) Selecting Valve
- (3) Single Acting Cylinder
- (4) Spool

- P** : **P** Port (From Hydraulic Pump)
- T** : **T** Port (To Transmission Case)
- A1** : **A1** Port (To Implement Cylinder)
- B1** : **B1** Port (Plugged)

W10306980



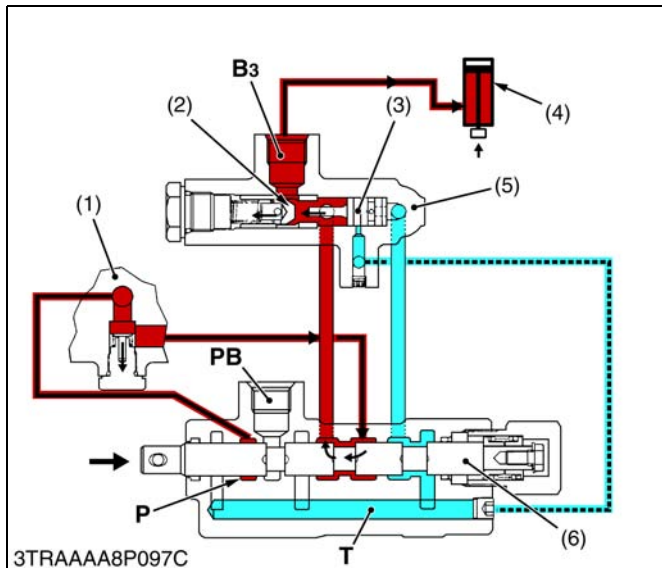
■ **Single / Double Acting Valve – Down (Single Acting)**

When the spool (4) moves to right, the oil passage from **P** port to **PB** port is blocked by the spool (4). The pressure-fed oil in the **P** port opens the check valve (1) and flows to transmission case through selecting valve (2). The return oil from implement cylinder flows from **A1** port to the transmission case through **T** port.

- (1) Check Valve
- (2) Selecting Valve
- (3) Single Acting Cylinder
- (4) Spool

- P** : **P Port (From Hydraulic Pump)**
- PB** : **PB Port (To Control Valve)**
- T** : **T Port (To Transmission Case)**
- A1** : **A1 Port (From Implement Cylinder)**
- B1** : **B1 Port (Plugged)**

W10304610



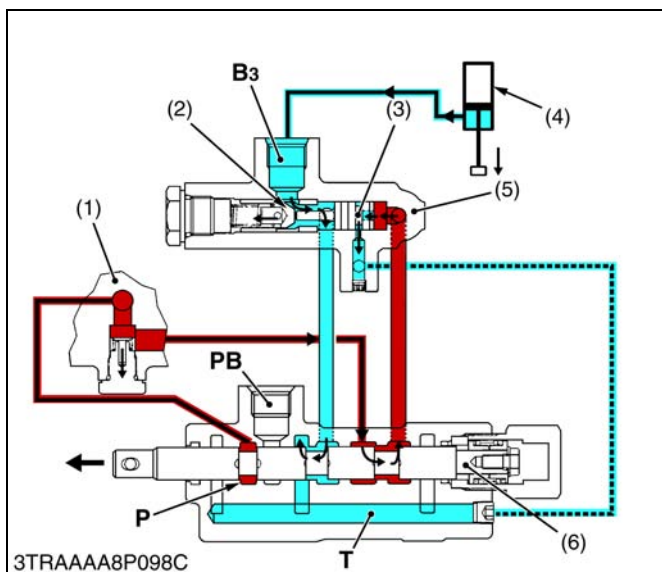
■ **Single Acting Valve – Lift**

When the spool (6) moves to right, the oil passage from **P** port to **PB** port is blocked by the spool (6). The pressure-fed oil opens the check valve (1) and flows to implement cylinder via unload valve (5) and **B3** port. The return oil from unload valve (5) flows to the transmission case through **T** port.

- (1) Check Valve
- (2) Poppet
- (3) Pilot Valve
- (4) Single Acting Cylinder
- (5) Unload Valve
- (6) Spool

- P** : **P Port (From Hydraulic Pump)**
- PB** : **PB Port (To Control Valve)**
- T** : **T Port (To Transmission Case)**
- B3** : **B3 Port (To Implement Cylinder)**

W10310180



■ **Single Acting Valve – Down**

When the spool (6) moves to left, the oil passage from **P** port to **PB** port is blocked by the spool (6). The pressure-fed oil in the **P** port opens the check valve (1) and flows to transmission case through pilot valve (3) and **T** port. The return oil from implement cylinder flows from **B3** port to transmission case through unload valve and **T** port.

- (1) Check Valve
- (2) Poppet
- (3) Pilot Valve
- (4) Single Acting Cylinder
- (5) Unload Valve
- (6) Spool

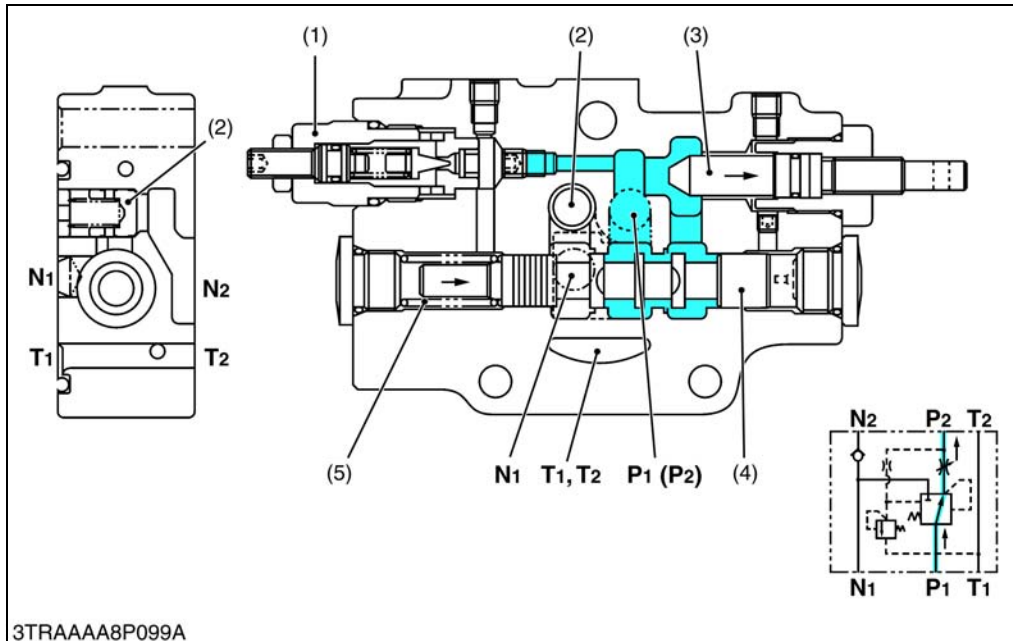
- P** : **P Port (From Hydraulic Pump)**
- PB** : **PB Port (To Control Valve)**
- T** : **T Port (To Transmission Case)**
- B3** : **B3 Port (From Implement Cylinder)**

W10309090

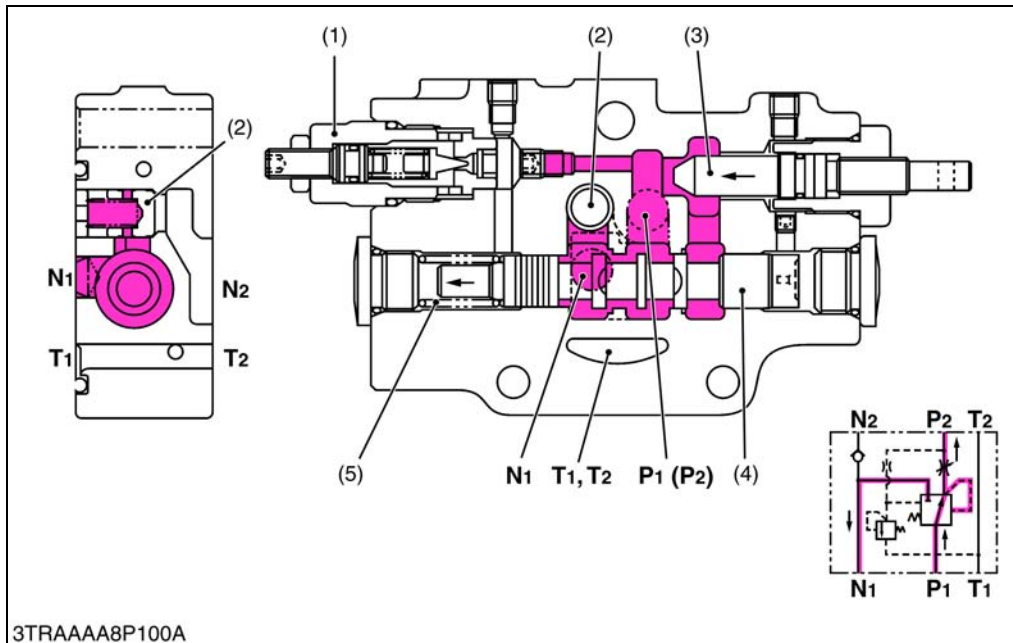
[4] FLOW CONTROL VALVE

Flow control valve is installed in hydraulic systems to control the quantity of fluid flowing to auxiliary control valves by needle valve.

The needle valve may be used to regulate the speed of a hydraulic cylinder.



When the needle valve (3) is wide opened, oil from pump is sent to the **P2** port only.



When the needle valve (3) is partly closed, pressure in a **P1** port increases and spool (4) moves to the left. Therefore, oil flowed from the pump is sent to the **N1** port and **P2** port.

9 ELECTRICAL SYSTEM

MECHANISM

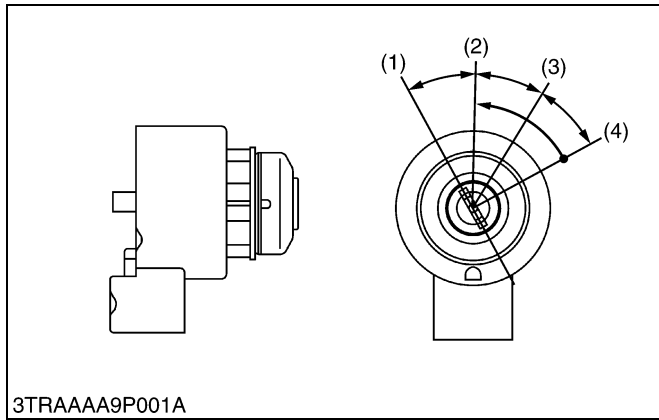
CONTENTS

1. STARTING SYSTEM	9-M1
[1] MAIN SWITCH.....	9-M1
(1) Type 1 (Code No. 6C040-55452, 37410-59113)	9-M1
(2) Type 2 (Code No. TC020-31821)	9-M1
(3) Type 3 (Code No. 34670-31822)	9-M2
(4) Type 4 (Code No. T0270-81811)	9-M2
(5) Type 5 (Code No. 52200-41212)	9-M2
(6) Type 6 (Code No. 36919-75162)	9-M3
[2] STARTER	9-M4
[3] STARTER RELAY.....	9-M4
[4] GLOW CONTROL SYSTEM.....	9-M4
[5] SAFETY SWITCH.....	9-M5
[6] ENGINE STOP SOLENOID.....	9-M5
[7] OPERATOR PRESENCE CONTROL.....	9-M6
(1) Type 1 (OPC Buzzer Timer ; Code No. 3A272-75251).....	9-M6
(2) Type 2 (OPC Timer ; Code No. TD060-30502)	9-M8
(3) Type 3 (OPC Controller ; Code No. 6C190-55510)	9-M9
2. CHARGING SYSTEM	9-M13
[1] AC DYNAMO	9-M13
[2] ALTERNATOR WITH IC REGULATOR – TYPE 1	9-M13
[3] ALTERNATOR WITH IC REGULATOR – TYPE 2	9-M13
[4] REGULATOR.....	9-M14
3. LIGHTING SYSTEM	9-M15
[1] COMBINATION SWITCH.....	9-M15
[2] HAZARD SWITCH	9-M16
[3] POSITION (PARKING) SWITCH	9-M16
[4] BRAKE SWITCH.....	9-M17
[5] EASY CHECKER.....	9-M18
(1) Charge Lamp	9-M18
(2) Pre-heat Indicator Lamp	9-M18
(3) Engine Oil Pressure Lamp	9-M18
(4) Transmission Oil Pressure Lamp	9-M18
(5) Hydraulic Oil Filter Clogged Lamp	9-M19
(6) Air Cleaner Clogged Lamp.....	9-M19
(7) Fuel Level Sensor	9-M20
(8) Brake Oil Level Lamp.....	9-M20
(9) PTO Operation Lamp.....	9-M21
(10) Parking Brake Lamp	9-M21
[6] TRAILER SOCKET	9-M22
[7] ROOM LAMP (CABIN TYPE)	9-M23
4. GAUGES.....	9-M24
[1] FUEL QUANTITY.....	9-M24
[2] COOLANT TEMPERATURE.....	9-M25

1. STARTING SYSTEM

[1] MAIN SWITCH

(1) Type 1 (Code No. 6C040-55452, 37410-59113)



The main switch has four positions; **OFF**, **ON**, **PRE-HEAT** and **START**. To pre-heat or start the engine, turn the main switch clockwise to required position.

After pre-heated or started, the main switch return to **ON** position by return spring provided in the switch.

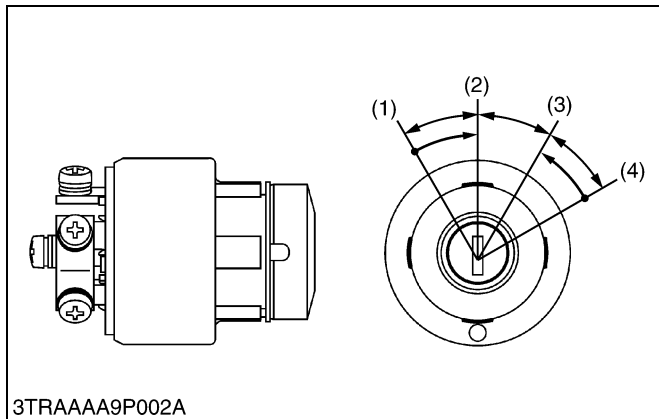
	Terminal			
	19	30	50	AC
OFF				
ON		●		●
PRE-HEAT	●	●		●
START	●	●	●	●

- (1) **OFF** Position
- (2) **ON** Position

- (3) **PRE-HEAT** Position
- (4) **START** Position

W10126600

(2) Type 2 (Code No. TC020-31821)



This main switch has four positions; **OFF**, **ON**, **START** and **PRE-HEAT**.

Turn the main switch clockwise to start the engine. After started, the main switch return to **ON** position by return spring provided in the switch.

When preheating is required, turn the main switch counterclockwise. After the preheating is completed, the switch returns to **OFF** position automatically by the spring.

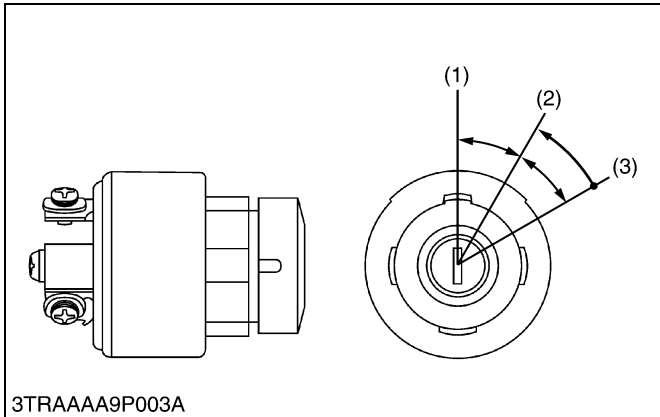
	Terminal				
	BAT	G1	G2	ST	AC
PRE-HEAT	●	●	●		●
OFF					
ON	●				●
START	●	●	●	●	●

- (1) **PRE-HEAT** Position
- (2) **OFF** Position

- (3) **ON** Position
- (4) **START** Position

W10127710

(3) Type 3 (Code No. 34670-31822)



This main switch has three positions; **OFF**, **ON** and **START**.

Turn the main switch clockwise to start the engine. After started the engine, the main switch return to **ON** position by return spring provided in the switch.

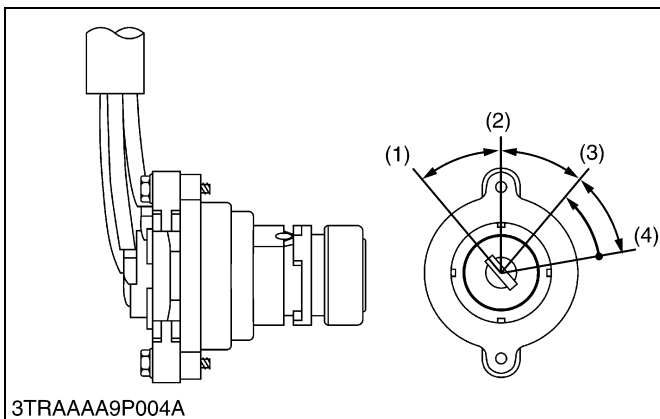
	Terminal				
	BAT		G2	ST	AC
OFF					
ON	●				●
START	●		●	●	●

(1) **OFF** Position
(2) **ON** Position

(3) **START** Position

W10129240

(4) Type 4 (Code No. T0270-81811)



This main switch has four position; **OFF**, **ACC**, **ON** and **START**.

To start the engine, turn the main switch clockwise. After started, the main switch return to **ON** position by return spring provided in the switch.

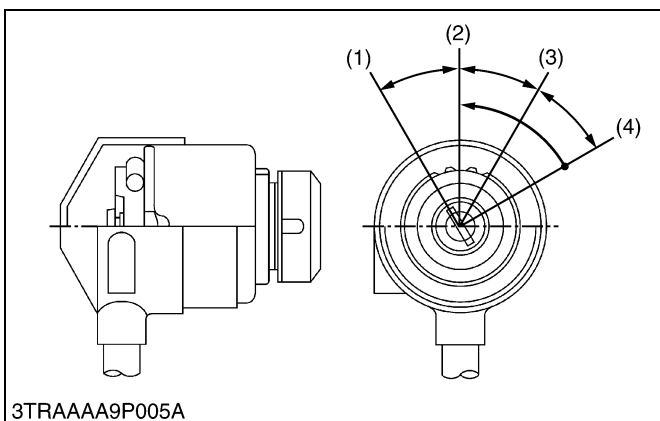
	Terminal				
	ACC	BAT	IG1	IG2	ST
OFF					
ACC	●	●			
ON	●	●	●	●	
START		●	●		●

(1) **OFF** Position
(2) **ACC** Position

(3) **ON** Position
(4) **START** Position

W10130390

(5) Type 5 (Code No. 52200-41212)



This main switch has four positions; **OFF**, **ON**, **PRE-HEAT** and **START**.

To pre-heat or start the engine, turn the main switch clockwise to required position. After pre-heated or started, the main switch return to **ON** position by return spring provided in the switch.

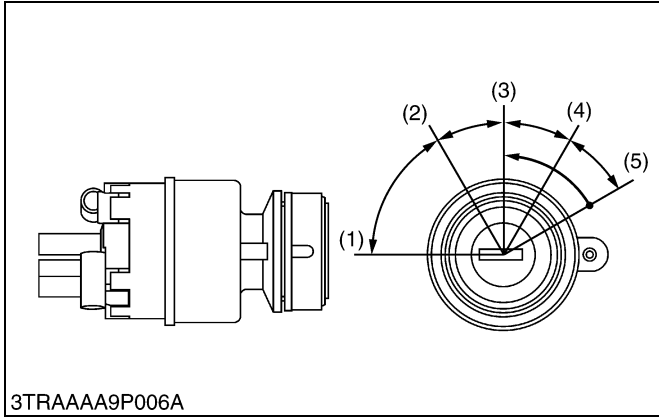
	Terminal				
	B	L	M	G	ST
OFF	●	●			
ON	●		●		
PRE-HEAT	●		●	●	
START	●		●	●	●

(1) **OFF** Position
(2) **ON** Position

(3) **PRE-HEAT** Position
(4) **START** Position

W10133010

(6) Type 6 (Code No. 36919-75162)



3TRAAAA9P006A

This main switch has five positions; **OFF**, **ACC**, **ON**, **PRE-HEAT** and **START**.

To pre-heat or start the engine, turn the main switch clockwise to required position. After pre-heated or started, the main switch return to **ON** position by return spring provided in the switch.

	Terminal				
	AM	ACC	M	G	ST
OFF					
ACC	●	●			
ON	●	●	●		
PRE-HEAT	●		●	●	
START	●		●		●

- (1) **OFF** Position
- (2) **ACC** Position
- (3) **ON** Position

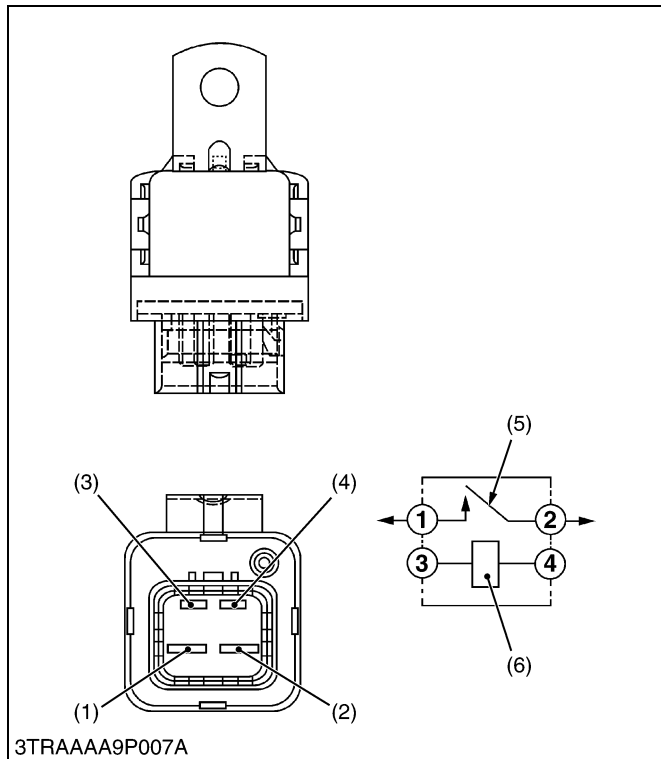
- (4) **PRE-HEAT** Position
- (5) **START** Position

W10134180

[2] STARTER

Refer to Workshop Manual for Diesel Engine Mechanism (Code No. 97897-01872).

[3] STARTER RELAY



In some cases, the starter relay is mounting on starting system to prevent the contact of the main switch burning out when the main switch is switched.

Current from the main switch flows only the starter relay coil (6), and the relay contact (5) is pulled to **ON** position by electromagnetic force.

Therefore, current from the battery flows directly to the pull-in coil and holding coil of the starter.

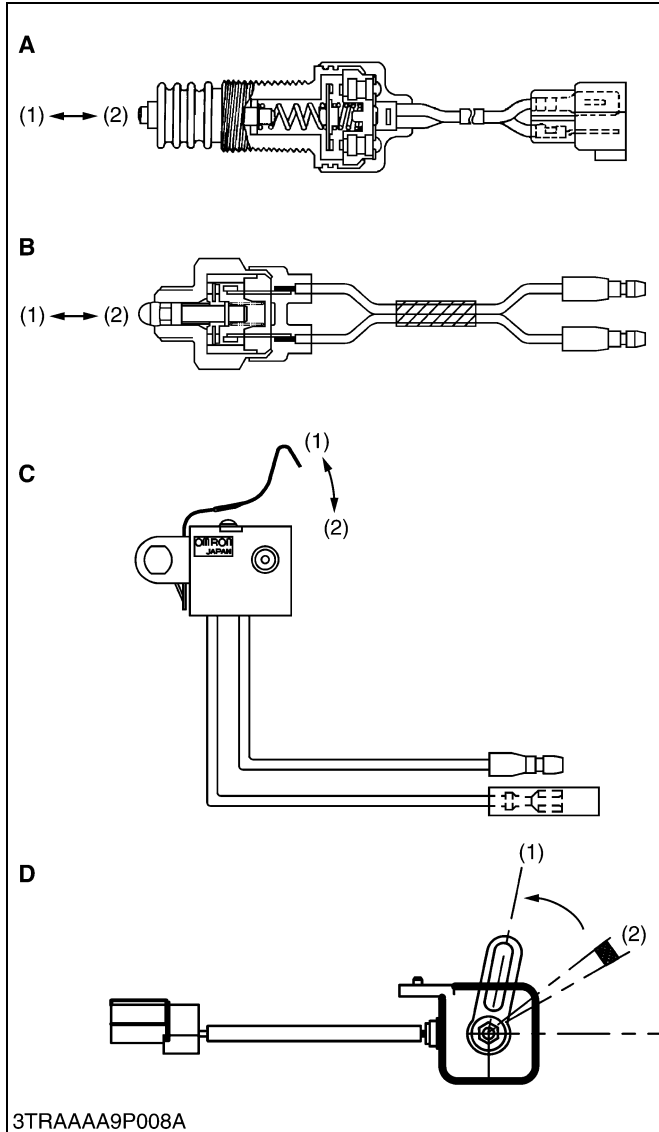
- | | |
|------------------|----------------------|
| (1) From Battery | (4) From Main Switch |
| (2) To Starter | (5) Relay Contact |
| (3) To Ground | (6) Relay Coil |

W10135850

[4] GLOW CONTROL SYSTEM

Refer to Workshop Manual for Diesel Engine Mechanism (Code No. 97897-01872).

[5] SAFETY SWITCH



The safety switch prevents current from flowing to the starter when the safety switches are not engaged. This is to ensure safe starting.

The examples of safety switches are shown left.

- (1) OFF Position
- (2) ON Position

- A : Push Type 1**
(Code No. 52320-42902,
6A100-30860, TD060-57500,
TA530-30860, T2050-33780,
6C040-55852,
6A320-42770)
- B : Push Type 2**
(Code No. 3A011-75101,
6A320-42770, 3A051-75101)
- C : Lever Type 1**
(Code No. TA040-43902,
T1060-43900, TD060-42780,
TC220-43900)
- D : Lever Type 2**
(Code No. T1060-42785,
TD060-42772)

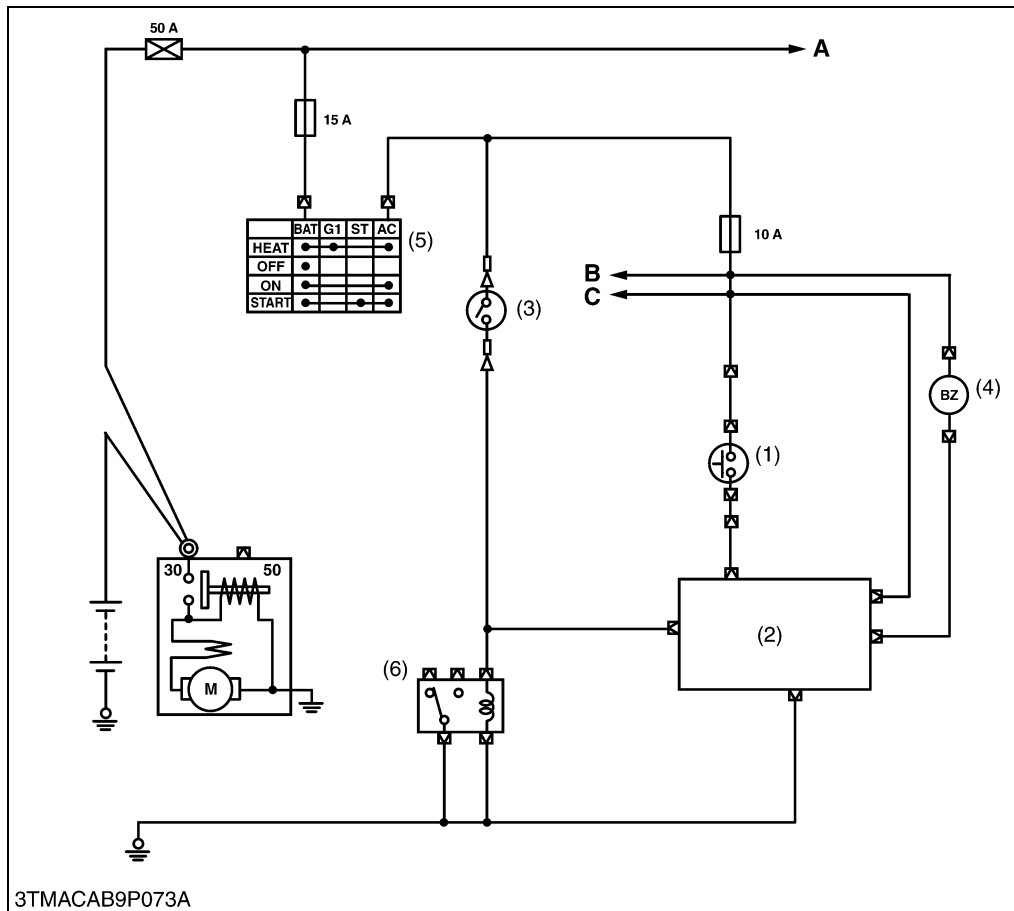
W10137100

[6] ENGINE STOP SOLENOID

Refer to Workshop Manual for Diesel Engine Mechanism (Code No. 97897-01872).

[7] OPERATOR PRESENCE CONTROL

(1) Type 1 (OPC Buzzer Timer ; Code No. 3A272-75251)



- (1) Seat Switch
- (2) OPC Buzzer Timer
- (3) PTO Switch
- (4) Buzzer
- (5) Main Switch
- (6) PTO Relay

A : To Alternator B Terminal
 B : To Meter
 C : To Easy Checker

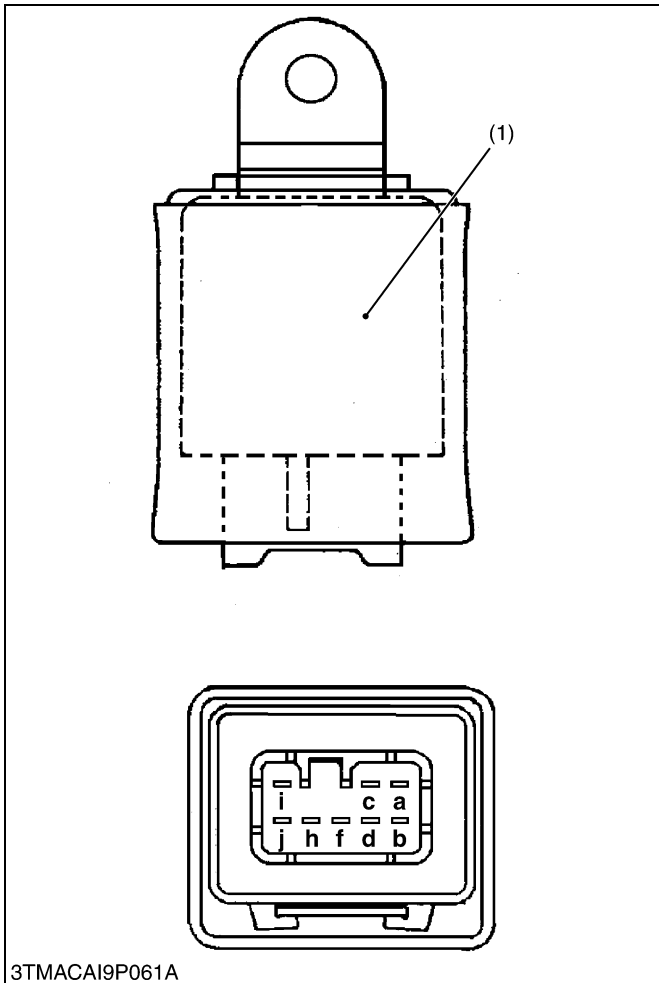
W1032141

The operator presence control (OPC) system which automatically whistling when operator stands from the seat while engaging PTO clutch.

This system is controlled by the seat switch (1), OPC buzzer timer (2), PTO switch (3) and buzzer (4).

■ Electric Circuit

1. When sitting on the seat in the state of the main switch **ON**, the battery voltage passes the seat switch (1) and the OPC buzzer timer (2).
2. When standing from the operator's seat, the circuit from the seat switch (1) to the OPC buzzer timer is cut. However, if the PTO clutch lever is set at **ON** position, the circuit from the battery to the OPC buzzer timer (2) is formed with the PTO switch (3).
3. When standing from the seat while shifting the PTO clutch lever at **ON** position, the circuit from battery to the buzzer (4) is flowed, and the buzzer is whistled.



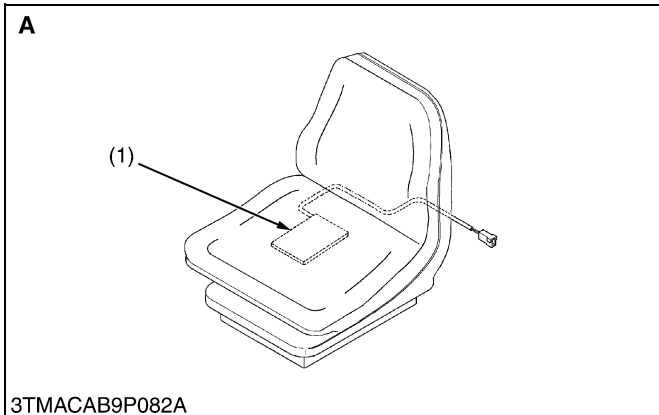
3TMACAI9P061A

■ **OPC Buzzer Timer**

After the current supply cuts from seat switch, the OPC buzzer timer (1) adopted for this system has maintained the state of **ON** position for whistling the buzzer about 10 seconds.

(1) OPC Buzzer Timer

W1032783



3TMACAB9P082A

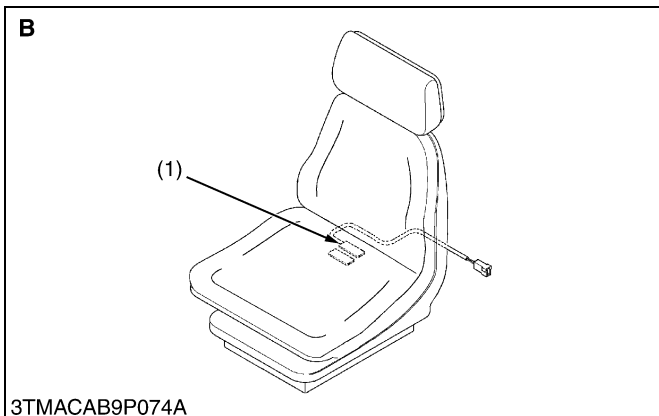
■ **Seat Switch**

The seat switch (1) has **ON** and **OFF** positions. When operator sits the seat, the seat switch is **ON** state.

(1) Seat Switch

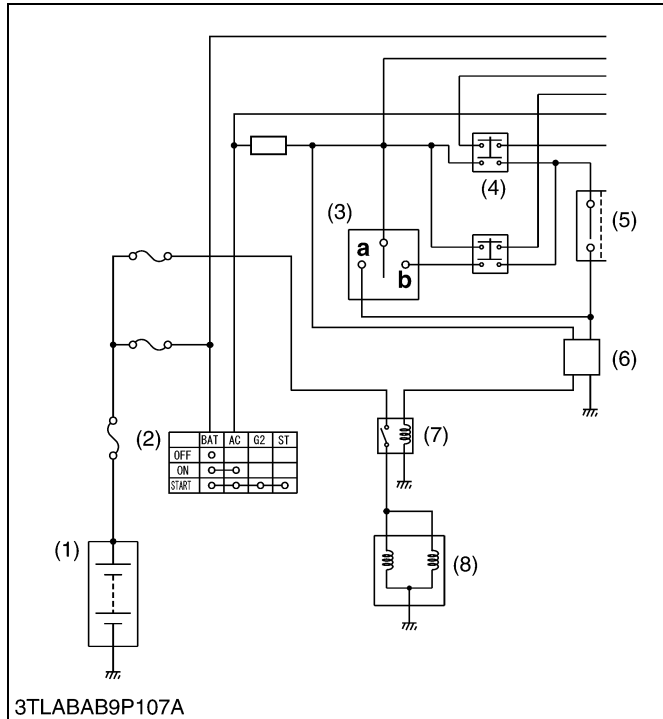
A : ROPS Model
B : CABIN Model

W1032240



3TMACAB9P074A

(2) Type 2 (OPC Timer ; Code No. TD060-30502)



The L30 series tractor equips operator presence control (OPC) system which automatically stops the engine when operator stands from the seat while shifting the PTO lever, shuttle lever or HST pedal.

This system is controlled by the seat switch (3), OPC timer (6), key stop solenoid relay (7), key stop solenoid (8), PTO switch (4) and shuttle switch or HST pedal switch (5).

■ Electric Circuit

1. When sitting on the seat in the state of main switch **ON**, the battery voltage passes the seat switch (3) and the OPC timer (6), and maintain the key stop solenoid relay (7).
2. When standing from the operators seat, the circuit from the seat switch (3) to the OPC timer is cut. However, if the levers (or pedal) are set at a **neutral** position, the circuit from the battery to the key stop solenoid relay (7) is formed with the lever (or pedal) switches (4), (5).
3. When standing from the seat while shifting the levers, the circuit from the battery to the key stop solenoid relay is cut, and the engine is stopped by function of key stop solenoid (8).

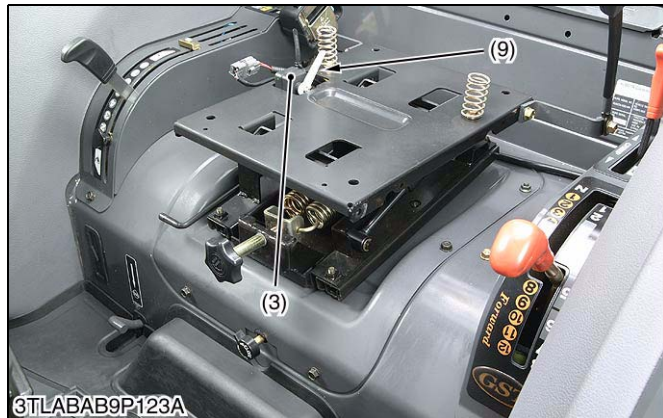
■ OPC Timer

After the current supply cuts, the OPC timer (6) adopted for this system has maintained the state of **ON** position for about one second.

■ Seat Switch

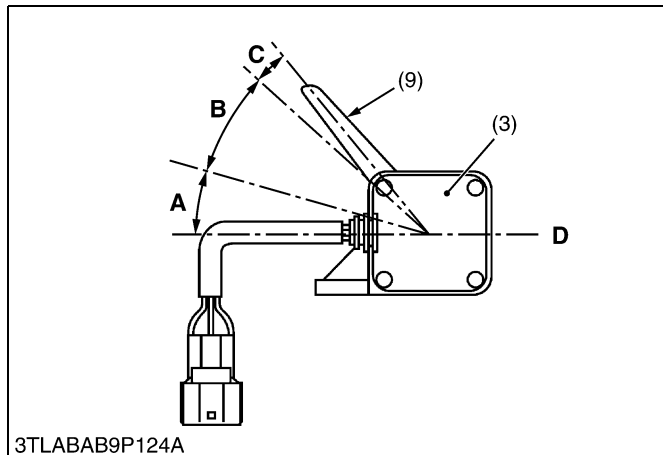
The seat switch (3) has two **ON** positions. One is sitting condition, and another is condition of seat lifting.

Therefore, if the engine is started, levers (or pedal) are shifted to neutral, it gets off from the tractor, and the seat is tilted forward, the PTO operation etc. become possible.



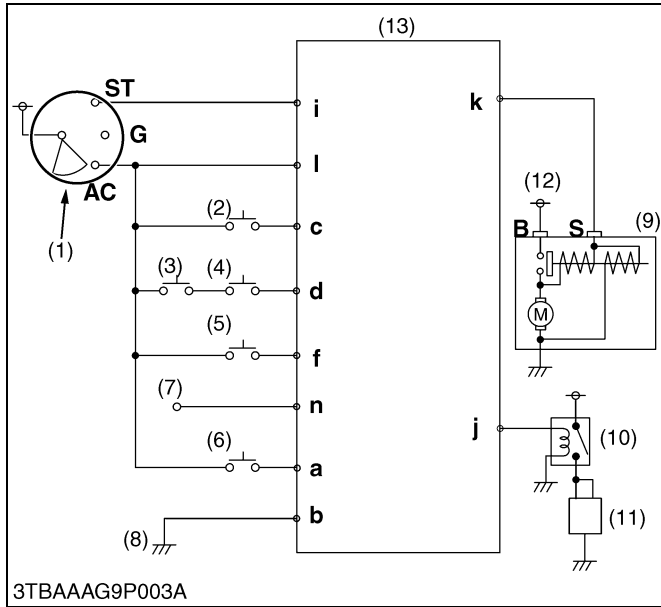
- (1) Battery
- (2) Main Switch
- (3) Seat Switch
- (4) PTO Switch
- (5) Shuttle Switch (for Manual and GST Model)
HST Pedal Switch (HST Model)
- (6) OPC Timer
- (7) Key Stop Solenoid Relay
- (8) Key Stop Solenoid
- (9) Sensor Bar

- a : Sitting on the seat**
- b : Lifting the seat**
- A : Seat Switch is ON**
- B : Seat Switch is OFF**
- C : Seat Switch is ON**
- D : Seat Suspension Plate Line**



W1029338

(3) Type 3 (OPC Controller ; Code No. 6C190-55510)



B2630 and B3030 are configured with an "Operator Presence Control (OPC)" system to control engine starting and engine automatically stopping.

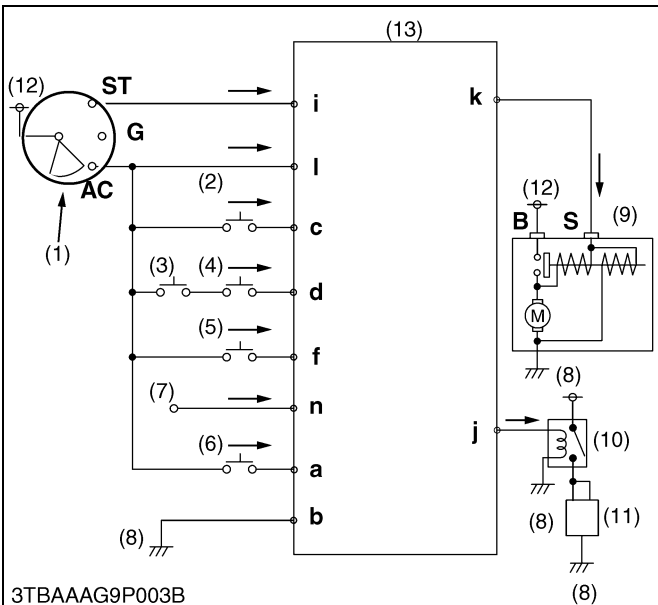
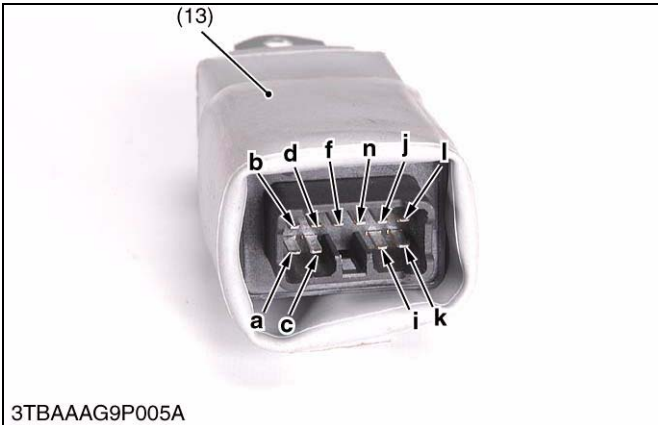
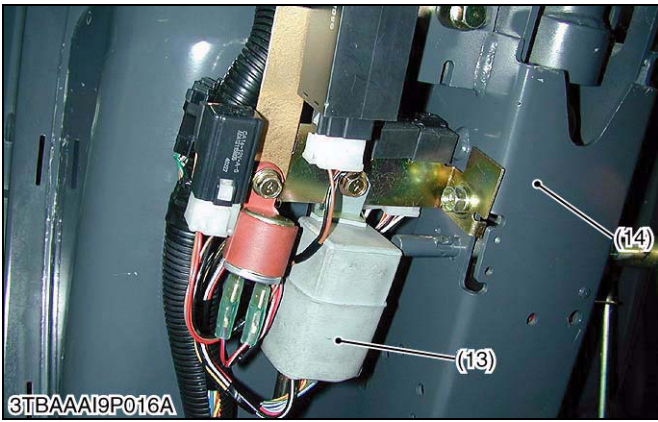
This OPC system mainly consists of controller and engine starting / stopping control switches such as HST pedal switch, independent PTO lever switch, seat switch, seat tilt switch and PTO lever switch.

Main parts regarding OPC system are laid out as shown in the electrical circuit.

- | | |
|----------------------------------|------------------------|
| (1) Main Switch | (11) Key Stop Solenoid |
| (2) Independent PTO Lever Switch | (12) Battery |
| (3) Seat Tilt Switch | (13) OPC Controller |
| (4) PTO Lever Switch | |
| (5) Seat Switch | |
| (7) Regulator L Terminal | |
| (8) Body Earth | |
| (9) Starter Motor | |
| (10) Key Stop Solenoid Relay | |

a to l :Controller Terminal
ST :Main Switch ST Terminal
G : Main Switch G Terminal
AC :Main Switch AC Terminal
B : Starter Motor B Terminal
S : Starter Motor S Terminal

W1018634



■ **Controller**

Controller is located inside the panel board.

Current from the main switch, safety switches and regulator L terminal flows to controller.

Controller receives current as data, processes the data, and sends out current computing results to starter motor, key stop solenoid relay, and key stop solenoid.

OPC controller (13) controls engine starting and engine stopping.

Current flows from battery to controller.

Current from switches such as independent PTO lever switch (2), seat tilt switch (3), PTO lever switch (4), seat switch (5) and HST pedal switch (6), flows to the controller.

Current from regulator L terminal (7) flows to the controller.

After starting the engine, the controller (13) supplies current to starter motor S terminal or key stop solenoid relay (10).

Controller (13) receives data, processes the data, and sends out the computing results.

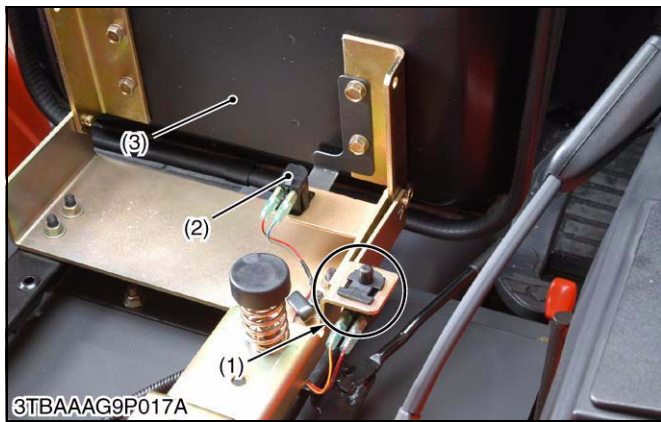
Controller (13) receives data from safety switches, processes the data inside the controller itself, and sends out the computing results to starter motor (9) for engine starting, and key stop solenoid relay (10) for engine stopping.

Controller (13) is configured with a delay timer in the controller unit to hold fuel cut signal from the controller unit to key stop solenoid (11) for about 1 second.

- (1) Main Switch
- (2) Independent PTO Lever Switch
- (3) Seat Tilt Switch
- (4) PTO Lever Switch
- (5) Seat Switch
- (6) HST Pedal Switch
- (7) Regulator L Terminal
- (8) Body Earth
- (9) Starter Motor
- (10) Key Stop Solenoid Relay
- (11) Key Stop Solenoid
- (12) Battery
- (13) OPC Controller
- (13) Steering Post

- a to l :Controller Terminal**
- ST :Main Switch ST Terminal**
- G : Main Switch G Terminal**
- AC :Main Switch AC Terminal**
- B : Starter Motor B Terminal**
- S : Starter Motor S Terminal**
- : Curernt Flow**

W1019184



■ Seat Switch

This switch locates under the seat (3).

This switch is a push type.

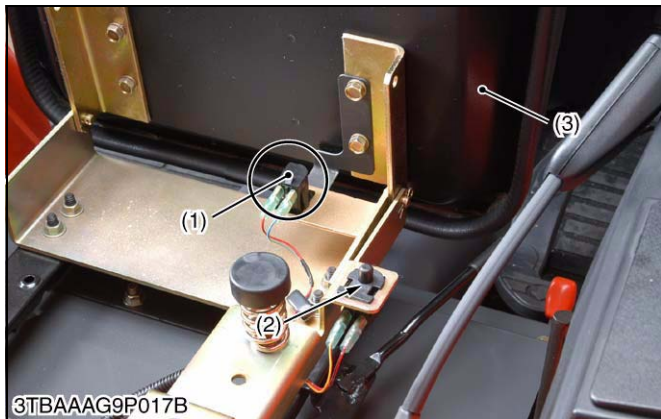
This switch detects the operator's sitting on the seat or not.

When the operator sits on the seat, this switch is turned to **"ON"**.

When the operator stand up from the seat, this switch is turned to **"OFF"**.

- (1) Seat Switch (3) Seat
(2) Seat Tilt Switch

W1019684



■ Seat Tilt Switch

This switch locates under the seat (3).

This switch is a push type.

This switch detects the tilted position of the seat.

When the tractor is used stationary PTO works such as blowers or pumps, tilting the seat makes tractor PTO works possible at HST pedal **"NEUTRAL"** position.

When the seat is tilted this switch is turned to **"ON"**.

But when HST pedal is set at **"FORWARD"** or **"REVERSE"** position, engine is normally stopped in one second delay.

When the seat is returned to **"NORMAL"** position, this switch is turned to **"OFF"** position.

- (1) Seat Tilt Switch (3) Seat
(2) Seat Switch

W1020263

■ Safety Switch Position and Engine Condition

No.	Independent PTO Lever	Seat Tilt Switch	PTO Select Lever	Seat Switch	HST Pedal Switch	Engine Condition	
						Engine Starting	Engine Stopping
	Disengaged : ON Engaged : OFF	Tilting seat : ON Original position : OFF	Rear PTO : ON Rear / Mid PTO : OFF Mid PTO : OFF	Occupied : ON Vacant : OFF	Neutral : ON Forward and Reverse : OFF	Current to Starter : ON, Can start No current to starter : OFF, Can not start	No current to key stop solenoid relay : ON, engine running Current to key stop solenoid : OFF, one second delay engine shut off
1	ON	OFF	ON / OFF	ON	ON	Can start	Running
2	OFF	OFF	ON	ON	ON	Can not start	Running
3	OFF	OFF	OFF	ON	ON	Can not start	Running
4	ON	OFF	ON / OFF	ON	OFF	Can not start	Running
5	OFF	OFF	ON	ON	ON	Can not start	Running
6	OFF	OFF	OFF	ON	ON	Can not start	Running
7	ON	OFF	ON / OFF	OFF	ON	Can start	Running
8	OFF	OFF	ON	OFF	ON	Can not start	Engine shut off
9	OFF	OFF	OFF	OFF	ON	Can not start	Engine shut off
10	ON	OFF	ON / OFF	OFF	OFF	Can not start	Engine shut off
11	OFF	OFF	ON	OFF	OFF	Can not start	Engine shut off
12	OFF	OFF	OFF	OFF	OFF	Can not start	Engine shut off
13	ON	ON	ON / OFF	OFF	ON	Can start	Running
14	OFF	ON	ON	OFF	ON	Can not start	Running
15	OFF	ON	OFF	OFF	ON	Can not start	Engine shut off
16	ON	ON	ON / OFF	OFF	OFF	Can not start	Engine shut off
17	OFF	ON	ON	OFF	OFF	Can not start	Engine shut off
18	OFF	ON	OFF	OFF	OFF	Can not start	Engine shut off
19	ON	OFF	ON / OFF	OFF	ON	Can start	Engine shut off
20	OFF	OFF	ON	ON	ON	Can not start	Engine shut off
21	OFF	OFF	OFF	ON	ON	Can not start	Engine shut off
22	ON	OFF	ON / OFF	ON	OFF	Can not start	Engine shut off
23	OFF	OFF	ON	ON	OFF	Can not start	Running
24	OFF	OFF	OFF	ON	OFF	Can not start	Running
25	ON	OFF	ON / OFF	OFF	ON	Can not start	Running
26	OFF	OFF	ON	OFF	ON	Can not start	Engine shut off
27	OFF	OFF	OFF	OFF	ON	Can not start	Engine shut off
28	ON	OFF	ON / OFF	OFF	OFF	Can not start	Engine shut off
29	OFF	OFF	ON	OFF	OFF	Can not start	Engine shut off
30	OFF	OFF	OFF	OFF	OFF	Can not start	Engine shut off
31	ON	ON	ON / OFF	OFF	ON	Can not start	Running
32	OFF	ON	ON	OFF	ON	Can not start	Running
33	OFF	ON	OFF	OFF	ON	Can not start	Engine shut off
34	ON	ON	ON / OFF	OFF	OFF	Can not start	Engine shut off
35	OFF	ON	ON	OFF	OFF	Can not start	Engine shut off
36	OFF	ON	OFF	OFF	OFF	Can not start	Engine shut off

W1020618

2. CHARGING SYSTEM

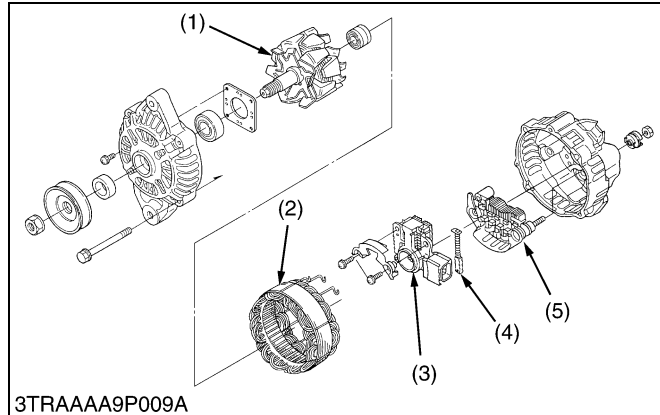
[1] AC DYNAMO

Refer to Workshop Manual for Diesel Engine Mechanism (Code No. 97897-01872).

[2] ALTERNATOR WITH IC REGULATOR – TYPE 1

Refer to Workshop Manual for Diesel Engine Mechanism (Code No. 97897-01872).

[3] ALTERNATOR WITH IC REGULATOR – TYPE 2



A compact alternator with an IC regulator is used, having the following characteristics :

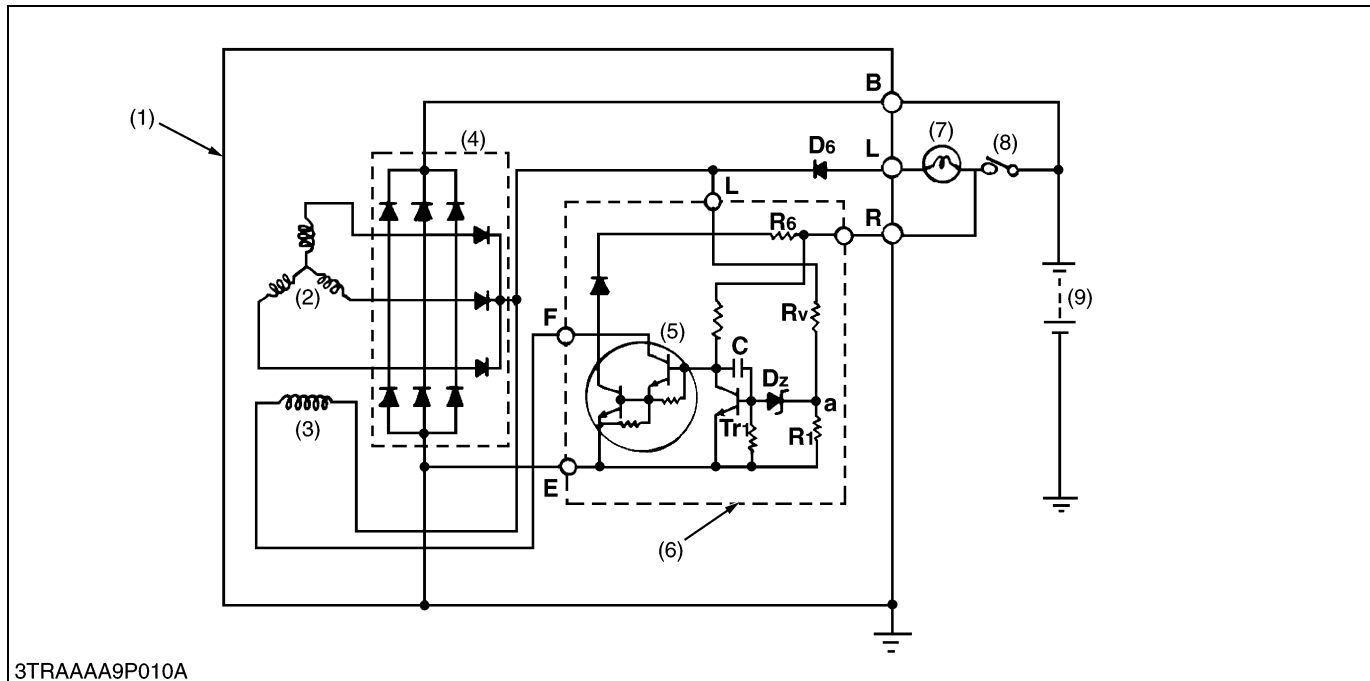
- Cooling performance and safety have been improved by combining the cooling fan with the rotor and incorporating the fan / rotor unit inside the alternator.
- IC regulator is fitted inside the alternator.
- The rectifier, IC regulator and similar components are easy to remove, making it easier to service the alternator.

(1) Rotor
(2) Stator
(3) IC Regulator

(4) Brush
(5) Rectifier

W10139020

■ Operation of Charging System



3TRAAAA9P010A

- | | | | |
|-----------------|----------------------|------------------|-----------------|
| (1) Alternator | (4) Trio Diode | (6) IC Regulator | (8) Main Switch |
| (2) Stator Coil | (5) Power Transistor | (7) Charge Lamp | (9) Battery |
| (3) Field Coil | | | |

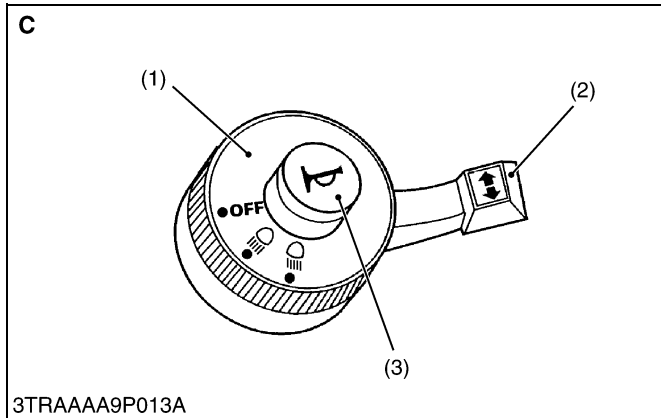
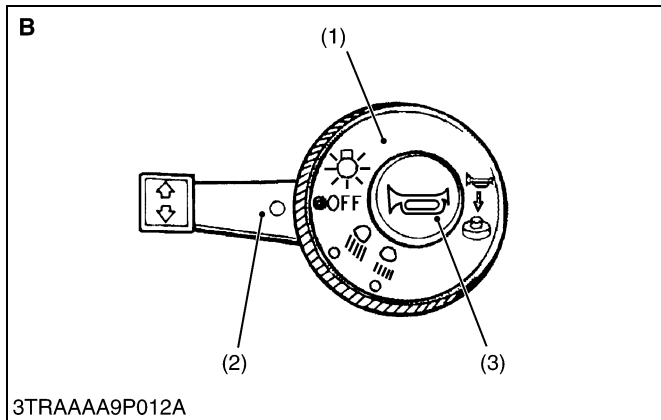
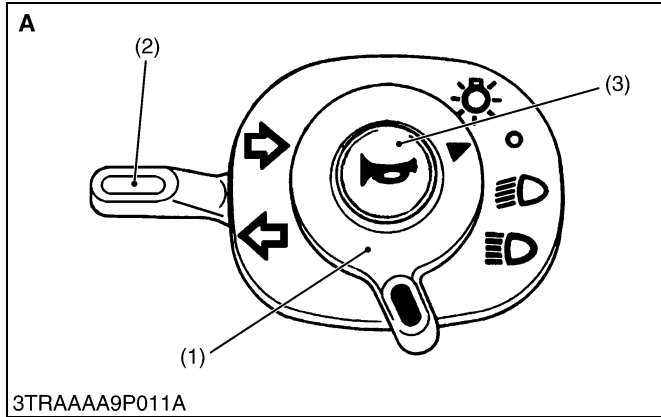
- When the key switch is turned on, the base current of the power transistor starts flowing.
Battery → Key Switch → Terminal (R) → Power Transistor's Base → Power Transistor's Emitter → Ground.
- Now the power transistor (5) is energized, causing the field current to flow.
Battery → Main Switch (8) → Charge Lamp (7) – Terminal (L) · Resistance R_6 → Field Coil (3) → Power Transistor (5) → Ground.
- The engine gets started and the alternator starts generating electricity. The base current and field current, mentioned above, are both supplied by the alternator. The field current flows as follows.
Trio Diode (4) → Field Coil (3) → Power Transistor (5) → Ground.
- If the alternator-generated voltage is too low, the terminal voltage (divided by resistors R_v and R_1 , electric potential at point "a") of the Zener diode D_z is lower than the Zener voltage. This means that no current flows into the diode D_z and that the transistor Tr_1 is shut off.
- In this state, the generated voltage gets higher. When the voltage applied to the Zener diode D_z exceeds the Zener voltage, current starts flowing into the diode D_z . This current is the base current of transistor Tr_1 .
Terminal (L) → Resistor R_v → Point "a" → Diode D_z → Base of Transistor Tr_1 → Emitter of Transistor Tr_1 → Ground.
- Now the transistor Tr_1 is energized. In this state, the collector and emitter of transistor Tr_1 makes a sort of short-circuit between the base and emitter of the power transistor (5). The base current of the power transistor stops flowing, causing the power transistor (5) to turn off. The field current is therefore cut off, reducing the generated voltage.
- In this way, the voltage begin applied to the Zener diode D_z drops below the Zener voltage. The diode D_z first and then the transistor Tr_1 are therefore turned off again. This causes the base current to flow in the power transistor (5) again. This transistor is energized to make the field current and raise the generated voltage. The above steps 5., 6., 7. are repeated to turn on and off the field current and control the alternator voltage.
- The capacitor C is intended to keep the transistor Tr_1 functioning stably. To do this, ripples of the alternator output and surges at ignition are suppressed. The reverse-current preventive diode D_6 serves to block the current that would flow from the trio diode through terminal L to the machine's cabling.

[4] REGULATOR

Refer to Workshop Manual for Diesel Engine Mechanism (Code No. 97897-01872).

3. LIGHTING SYSTEM

[1] COMBINATION SWITCH



Combination switch consist of head light switch, turn signal light switch and horn switch.

• **Head Light Switch**

	B1	T	1	2
OFF	●			
Low	●	●	●	
High (If available)	●	●		●

• **Turn Signal Light Switch**

	B2	R	L
R	●	●	
OFF	●		
L	●		●

• **Horn Switch**

	B1	H
OFF	●	
ON	●	●

- (1) Head Light Switch
- (2) Turn Signal Light Switch
- (3) Horn Switch

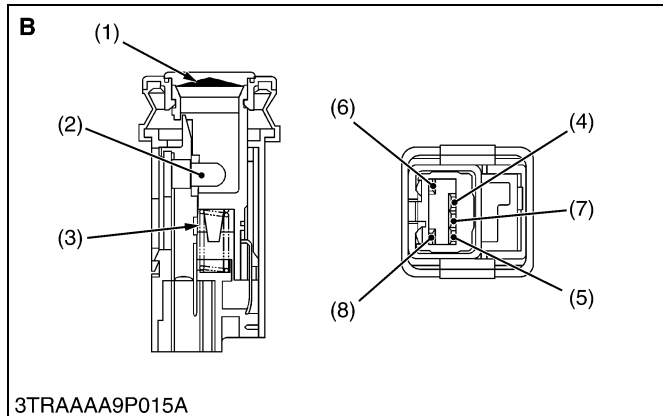
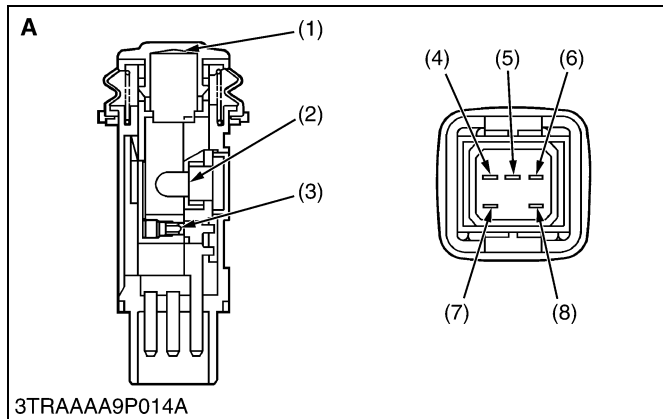
B : Type 2 (Code No. 37410-55121, TA040-76631, 3A751-75011, 67156-55211)

C : Type 3 (Code No. 36760-75011, 36330-75013)

A : Type 1 (Code No. 6C042-55422, 6C070-55421)

W10155870

[2] HAZARD SWITCH



This is a pushing type switch to turn on the hazard lights. The lamp (2) in the switch is lighted up by the current from outside of the switch. The circuit in the switch is shown below.

Terminal	a	(b)	c	Lamp	
				d	e
OFF		●	●	●	●
ON	●		●	●	●

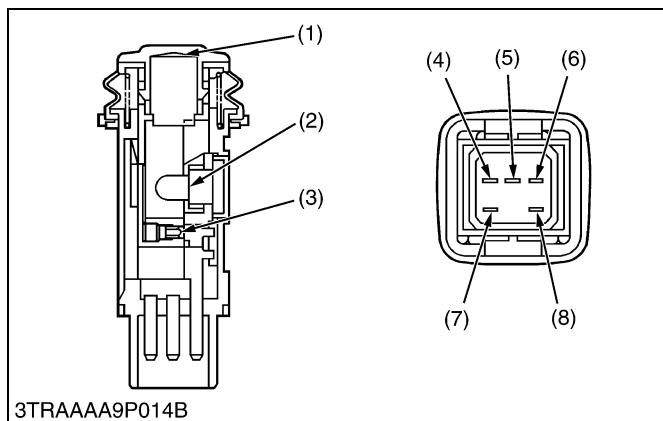
- (1) Lens
- (2) Lamp
- (3) Contact Portion
- (4) Terminal a
- (5) Terminal b
- (6) Terminal d
- (7) Terminal c

(8) Terminal e

A : Type 1 (Code No. 6C070-55431, 37500-55212, TA140-30911)
B : Type 2 (Code No. 3A751-75041)

W10150170

[3] POSITION (PARKING) SWITCH



This is a pushing type switch to turn on the position lamps. The lamp (2) in the switch is lighted up when the switch is "ON". The circuit in the switch is shown below.

Terminal	a	(b)	c	Lamp	
				d	e
OFF		●	●	●	●
ON	●		●	●	●

- (1) Lens
- (2) Lamp
- (3) Contact Portion
- (4) Terminal a

(5) Terminal b
 (6) Terminal d
 (7) Terminal c
 (8) Terminal e

W10177080

[4] BRAKE SWITCH

Brake switch is turned on by pushing a brake pedal and turned off by releasing it.

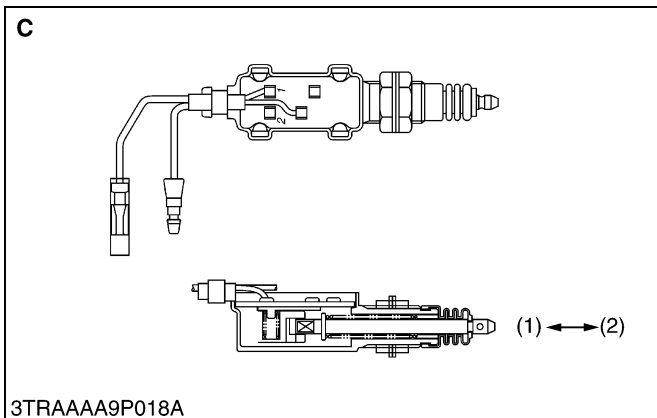
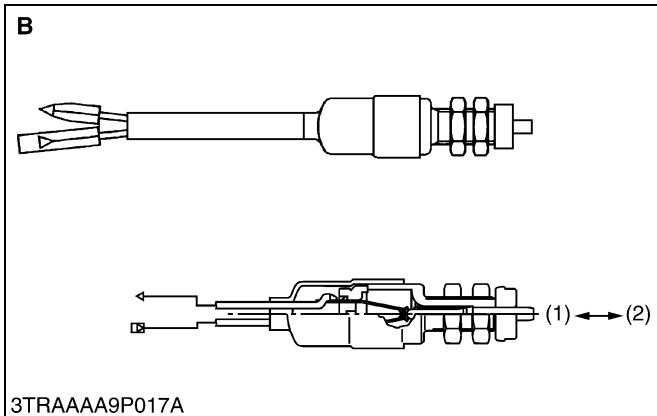
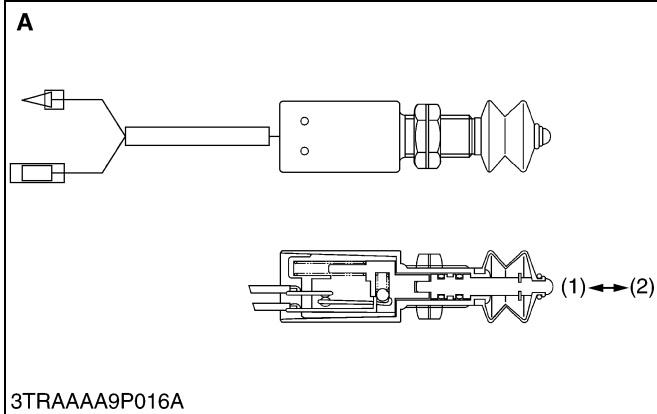
- (1) OFF Position
- (2) ON Position

B : Type 2 (Code No. TA470-31201, 33740-75482, TA530-31201)

A : Type 1 (Code No. 6C080-31011)

C : Type 3 (Code No. 36330-75481)

W10182350



[5] EASY CHECKER

To check the conditions of tractor easily before and during operation, the Easy Checker-combination of lamps on the panel board is provided.

The indication items are as follows. However, indication items are different depending on the model.

(1) Charge Lamp

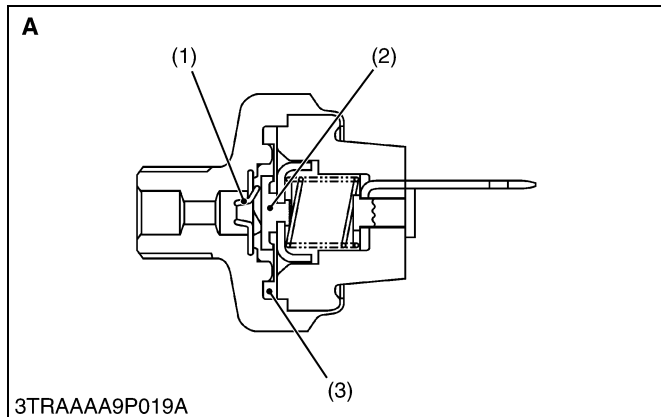
When the charging system is not functioning properly, the lamp illuminates.

(2) Pre-heat Indicator Lamp

When the key switch is in "Pre-heat" condition, the lamp illuminates.

(3) Engine Oil Pressure Lamp

When the engine oil pressure is low, the lamp illuminates.



■ Oil Pressure Switch

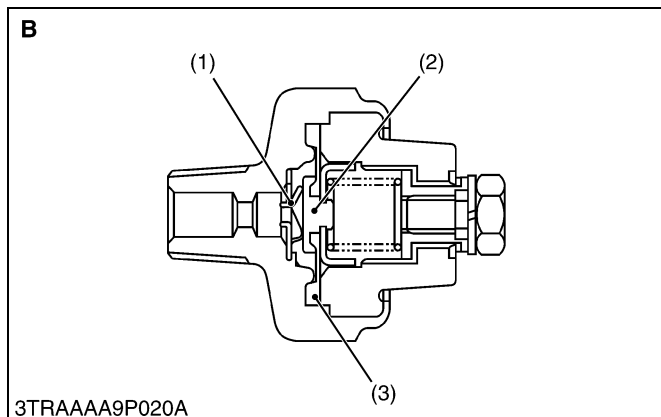
While oil pressure is high and the force applied to the diaphragm (3) is larger than the spring tension, the terminal contact (2) is open separated from the body contact (1). If the pressure drops below approx. 49 kPa (0.5 kgf/cm², 7.1 psi), the contact closes.

- (1) Body Contact
- (2) Terminal Contact
- (3) Diaphragm

A : Type 1
(Code No. 15531-39010,
1A024-39010)

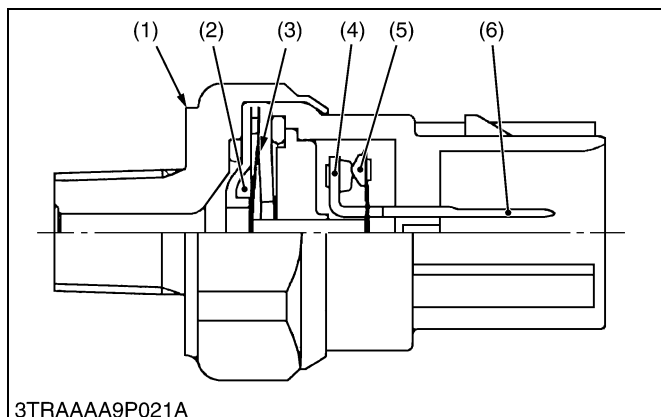
**B : Type 2 (Code No. 15841-
39010, 15451-39012)**

W10184140



(4) Transmission Oil Pressure Lamp

When the transmission oil pressure or hydraulic clutch pressure is low, the lamp illuminates.



■ Oil Pressure Switch

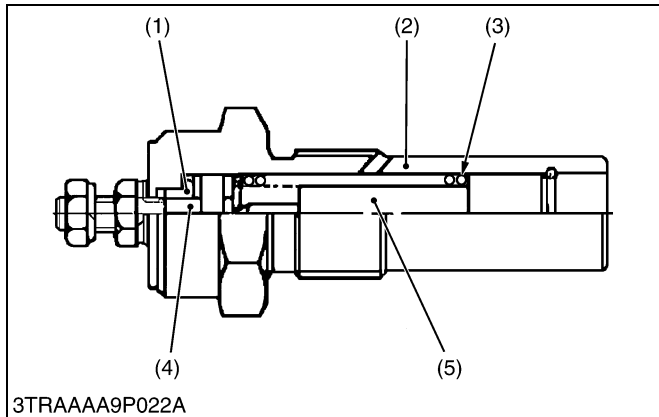
While oil pressure is high and the force applied to the diaphragm (3), the contact point (5) of the body is separated from the contact point (4) of the terminal (6). If the pressure drops below approx. 540 kPa (5.5 kgf/cm², 78 psi), the contact closes.

- (1) Body
- (2) Cap
- (3) Diaphragm
- (4) Fixed Contact
- (5) Movable Contact
- (6) Terminal

W10189650

(5) Hydraulic Oil Filter Clogged Lamp

When the hydraulic suction line or hydraulic return line pressure exceeds the specified level, the lamp illuminates.



■ Oil Pressure Switch 1 (Suction Line)

When the pressure is less than approx. 34 kPa (0.35 kgf/cm², 5.0 psi), the needle 1 (5) is separated from the needle 2 (4).

When the pressure is more than approx. 34 kPa (0.35 kgf/cm², 5.0 psi), the needle 1 is pushed against the spring (3) and it contacts with the needle 2 (4).

■ Oil Pressure Switch 2 (Return Line)

When the pressure is less than approx. 98 kPa (1.0 kgf/cm², 14.2 psi), the needle 1 (5) is separated from the needle 2 (4).

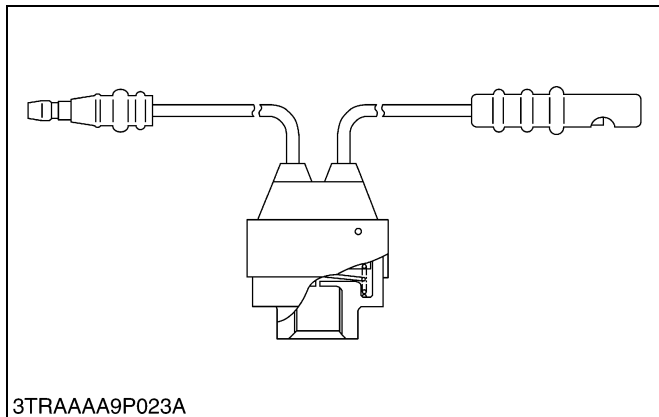
When the pressure is more than approx. 98 kPa (1.0 kgf/cm², 14.2 psi), the needle 1 is pushed against the spring (3) and it contacts with the needle 2 (4).

- | | |
|---------------|--------------|
| (1) Insulator | (4) Needle 2 |
| (2) Body | (5) Needle 1 |
| (3) Spring | |

W10190760

(6) Air Cleaner Clogged Lamp

When the air cleaner is clogged and the negative pressure of the suction air increases, the air cleaner sensor is turned **ON** and the lamps illuminate.



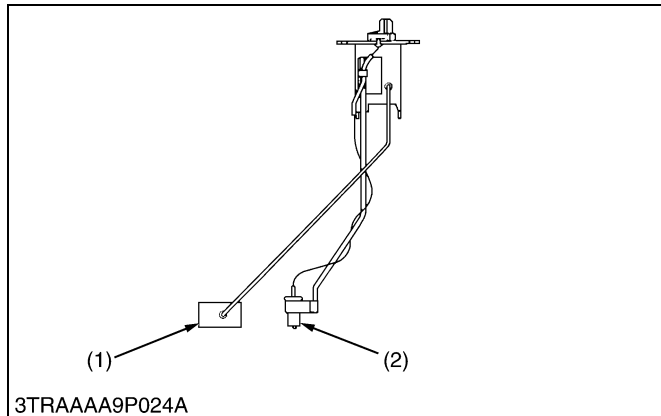
■ Air Cleaner Sensor

The switch is normally opened. When the air cleaner is clogged, the negative pressure is created in the outlet port of air cleaner and the diaphragm is attracted. And the switch is turned on when the negative pressure exceeds approx. 6.22 kPa (635 mmAq).

W10192380

(7) Fuel Level Sensor

Insufficient fuel is detected by the fuel limit sensor (thermistor) installed in the fuel tank. When the remaining fuel quantity is less than specified level, the lamp illuminates.



■ Fuel Limit Sensor (Thermistor)

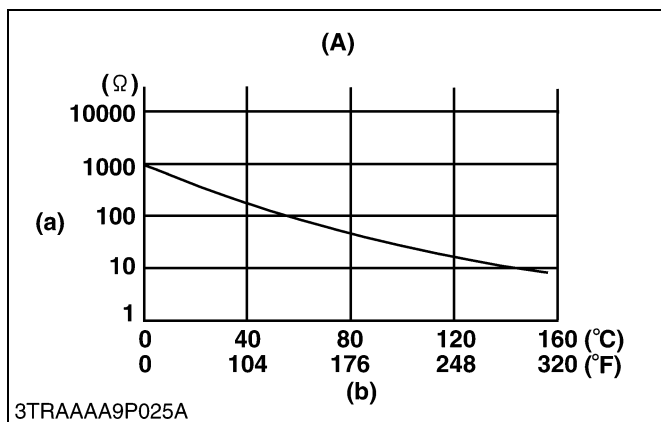
Thermistor is a kind of resistor whose resistance varies with the temperature.

It has a large resistance in fuel as it is cooled. But in the air, it is heated by flowing current, and as the temperature rises, the resistance decreases, which in turn further increases the current and decreases the resistance. After a certain period of time, calorific values (temperature) of heat radiation and heat generation are balanced. (Testing must be done under this equilibrium.)

- (1) Float
(2) Thermistor

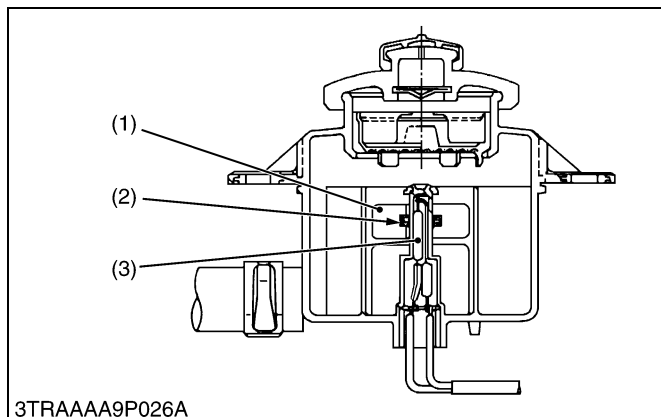
- (A) Characteristics of Thermistor
(a) Resistance
(b) Temperature

W10164710



(8) Brake Oil Level Lamp

Lack of brake oil is detected by the brake oil level switch installed in the brake oil tank. When the amount of brake oil is insufficient, the lamp illuminates.



■ Brake Oil Level Switch

When the amount of brake oil is sufficient, the float incorporating the magnet is held above the lead switch, keeping the contacts open. When the amount of brake oil decreases to approx. 106 cc (0.11 U.S.qts, 0.093 Imp.qts), the float falls to the lead switch level and the contacts are closed by magnetic attraction.

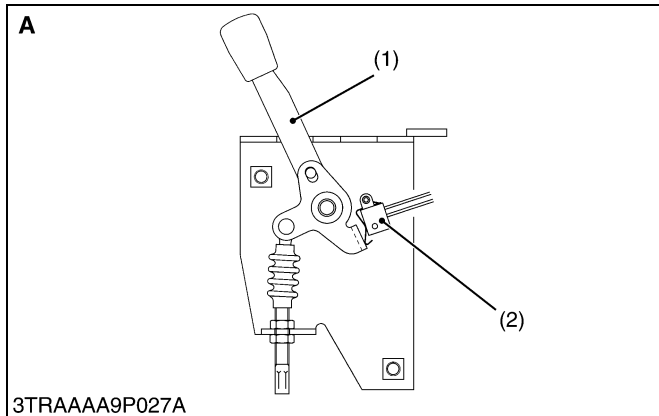
- (1) Float
(2) Magnet

- (3) Lead Switch

W10194160

(9) PTO Operation Lamp

PTO clutch lamp inform an operator that PTO clutch lever is engaged. When the PTO clutch lever is in engaged position, the lamp illuminates.

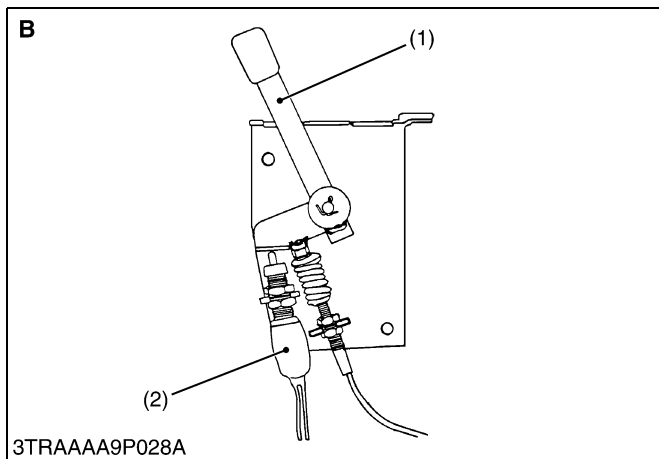


PTO clutch lamp inform an operator that PTO clutch lever is engaged. This system consists of a PTO clutch lamp on the panel board and a switch operated by a PTO clutch lever.

- (1) PTO Clutch Lever
- (2) PTO Switch

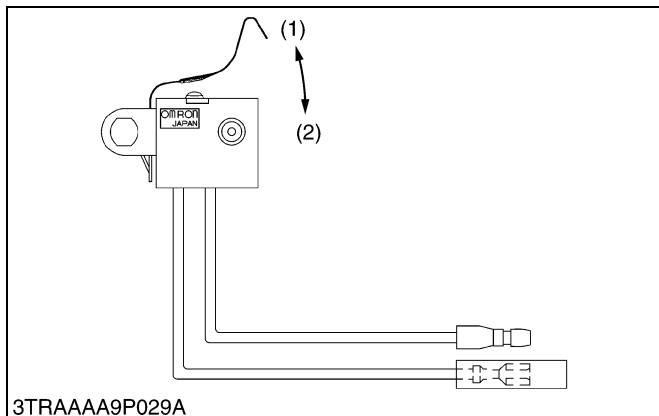
- A : Type 1**
- B : Type 2**

W10195010



(10) Parking Brake Lamp

The parking brake lamp comes on while parking brake is applied and goes off when it is released.



■ Parking Brake Switch

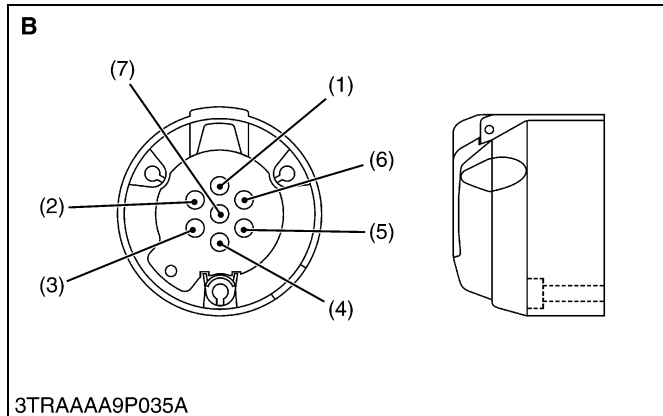
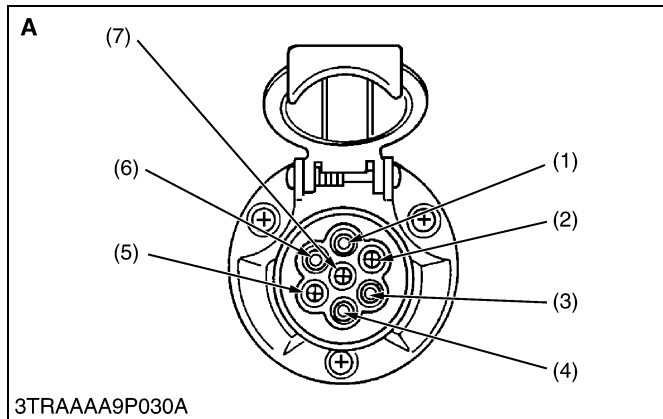
While the parking brake is released, the contacts are separated. When parking brake is applied, the contacts are closed by parking brake lever and the warning lamp illuminates.

- (1) **OFF** Position

- (2) **ON** Position

W10195990

[6] TRAILER SOCKET



■ Type A (Code No. 6C080-30350, 6C709-55861))

The trailer socket is provided to take out the electrical power from tractor to trailer or implement.

The function of each terminal is shown below.

Terminal	Function	Color of wire harness
(1)	Turn signal (LH)	Green / White
(2)	-	-
(3)	Ground	Black
(4)	Turn signal (RH)	Red / White
(5)	Tail (RH)	Yellow / Red
(6)	Brake	Yellow
(7)	Tail (LH)	Yellow / White

■ Type B (Code No. 3F263-77922, 3G715-77151)

Terminal	Function	Color of wire harness
(1)	Turn signal (LH)	Green / Black
(2)	Reverse (Back-up)	Green
(3)	Ground	Black
(4)	Turn signal (RH)	Green / Yellow
(5)	Tail	Green / Blue
(6)	Brake	Green / White
(7)	Number (Licence) Plate	Green / Red

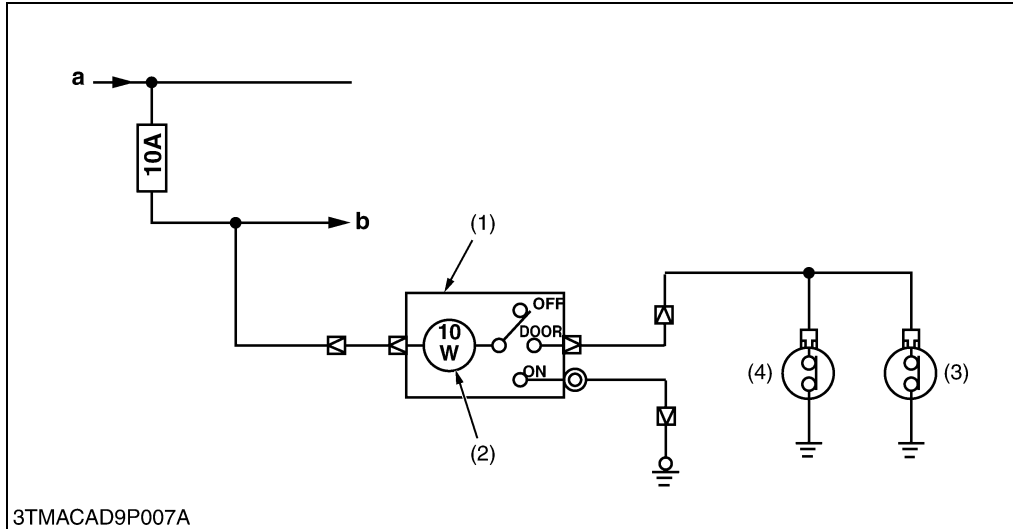
- (1) Terminal 1
- (2) Terminal 2
- (3) Terminal 3
- (4) Terminal 4
- (5) Terminal 5

- (6) Terminal 6
- (7) Terminal 7

A : Type A
B : Type B

W10161720

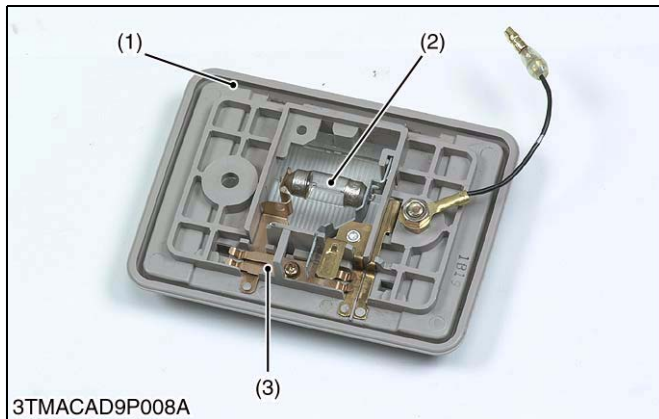
[7] ROOM LAMP (CABIN TYPE)



- (1) Room Lamp Switch
- (2) Room Lamp
- (3) Door Switch RH
- (4) Door Switch LH

(a) From Battery
(b) To Radio

W1013497



■ Room Lamp Switch

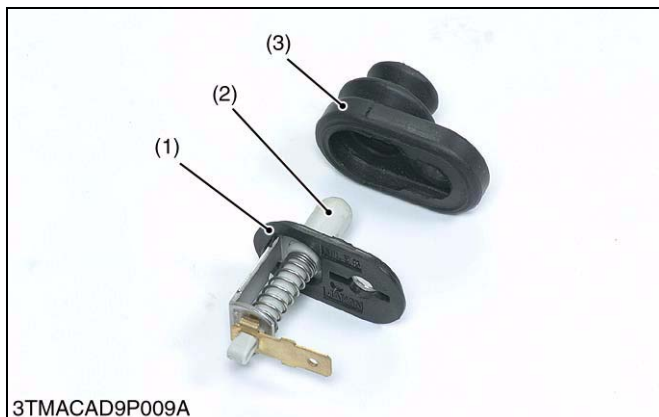
This switch is slide type switch.

When switch (3) slide to the **ON** position, room lamp (2) lights on without any relation to **DOOR** position.

When switch (3) slide to the **DOOR** position, room lamp (2) lights on, at the door switch comes close position.

- (1) Room Lamp Switch Assembly
- (3) Switch
- (2) Room Lamp

W1013629



■ Door Switch

When the door is closed, the push rod (2) is pushed by door frame, so that the door switch comes open position.

Both R.H. and L.H. door should close to lights off the room lamp.

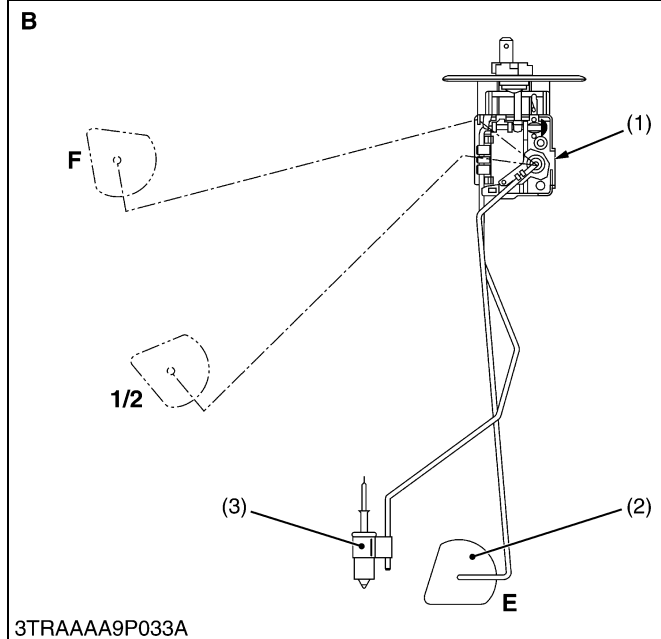
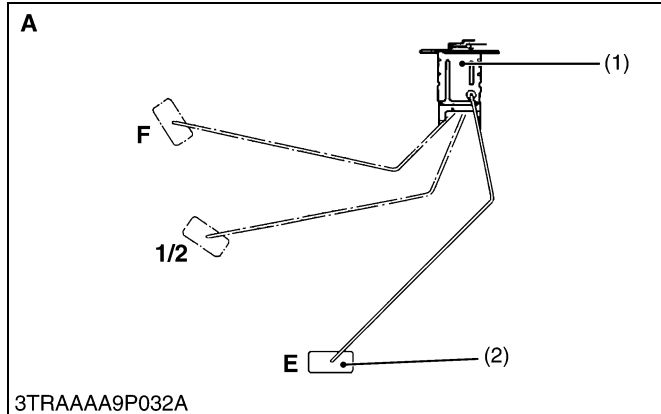
- (1) Door Switch
- (2) Push Rod
- (3) Cover

W1013781

4. GAUGES

The fuel quantity and coolant temperature are indicated by the ammeters. The ammeters indicate each amperage flowing through the fuel level sensor for the fuel quantity detection and through the coolant temperature sensor for the coolant temperature detection.

[1] FUEL QUANTITY



■ Fuel Level Sensor

The remaining fuel quantity is detected by the fuel level sensor installed in the fuel tank and indicated on the fuel gauge. For detection, a float and a resistor are used.

As the float (2) lowers, the resistance of the variable resistor (1) varies. The relation between the amount of fuel and the resistance is as follows.

Fuel Level Sensor 1

F	1/2	E
1 to 5 Ω	Approx. 32.5 Ω	103 to 117 Ω

Fuel Level Sensor 2 (with Thermistor)

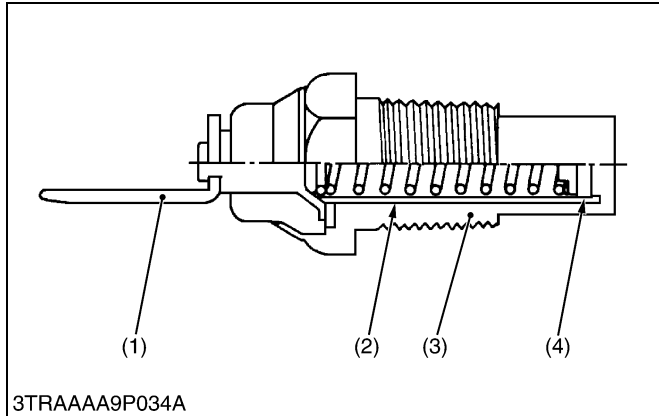
F	1/2	E
1 to 5 Ω	Approx. 32.5 Ω	108 to 112 Ω (or 103 to 117 Ω)

- (1) Variable Resistor
- (2) Float
- (3) Thermistor

A : Fuel Level Sensor 1
B : Fuel Level Sensor 2
(with Thermistor)

W10165250

[2] COOLANT TEMPERATURE



■ Coolant Temperature Sensor

The coolant temperature sensor is installed to the cylinder head of engine, and its tip is in touch with the coolant. It contains a thermistor (4) whose electrical resistance decreases as the temperature increases.

Current varies with changes in the coolant temperature, and the increases or decreases in the current move the pointer of gauge.

Type 1 (Code No. 31351-32831, 38240-32831)

Characteristics of Thermistor	
Temperature	Resistance
50 °C (122 °F)	153.9 Ω
80 °C (176 °F)	51.9 Ω
100 °C (212 °F)	27.4 Ω
120 °C (248 °F)	16.1 Ω

Type 2 (Code No. 32330-32831)

Characteristics of Thermistor	
Temperature	Resistance
35 °C (95 °F)	670 Ω
80 °C (176 °F)	118 Ω
105 °C (221 °F)	54.5 Ω
115 °C (239 °F)	42.5 Ω

Type 3 (Code No. T1063-65661)

Characteristics of Thermistor	
Temperature	Resistance
-20 °C (-4 °F)	18.8 kΩ
40 °C (104 °F)	1.14 kΩ
100 °C (212 °F)	0.16 kΩ

- (1) Terminal
- (2) Insulator
- (3) Body
- (4) Thermistor
- (5) O-ring

W10167200

10 CABIN

MECHANISM

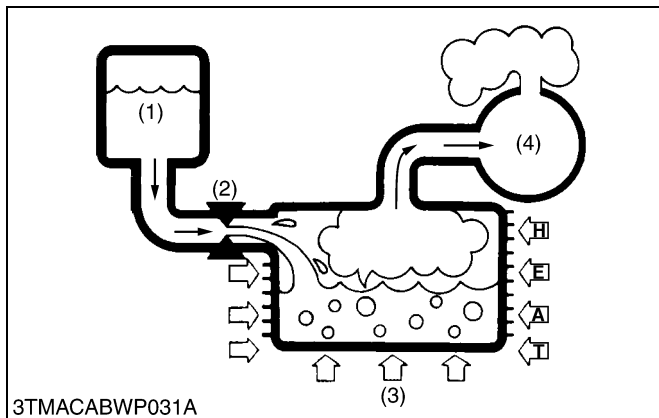
CONTENTS

1. AIR CONDITIONING SYSTEM.....	10-M1
[1] PRINCIPLES OF REFRIGERATION CYCLE	10-M1
(1) Expansion and Evaporation	10-M1
(2) How to Condense Gaseous Refrigerant into Liquid.....	10-M1
(3) Condensing Gaseous	10-M1
(4) Refrigeration Cycle	10-M2
[2] OUTLINE OF AIR CONDITIONING SYSTEM.....	10-M3
[3] SYSTEM LAYOUT AND COMPONENT PART	10-M4
(1) Compressor	10-M5
(2) Condenser	10-M9
(3) Receiver.....	10-M10
(4) Air Conditioner Unit.....	10-M11
[4] SYSTEM CONTROL.....	10-M18
(1) Type 1	10-M18
(2) Type 2.....	10-M19
(3) Type3.....	10-M20
2. WINDSHIELD WIPER.....	10-M21
[1] FRONT WINDSHIELD WIPER	10-M21
(1) Front Wiper Motor	10-M21
(2) Front Wiper / Washer Switch	10-M22
[2] REAR WINDSHIELD WIPER.....	10-M23
(1) Rear Wiper Motor.....	10-M23
(2) Rear Wiper / Washer Switch.....	10-M24
[3] WINDOW WASHER.....	10-M25
(1) Washer Tank.....	10-M25
(2) Washer Nozzle.....	10-M25

1. AIR CONDITIONING SYSTEM

[1] PRINCIPLES OF REFRIGERATION CYCLE

(1) Expansion and Evaporation



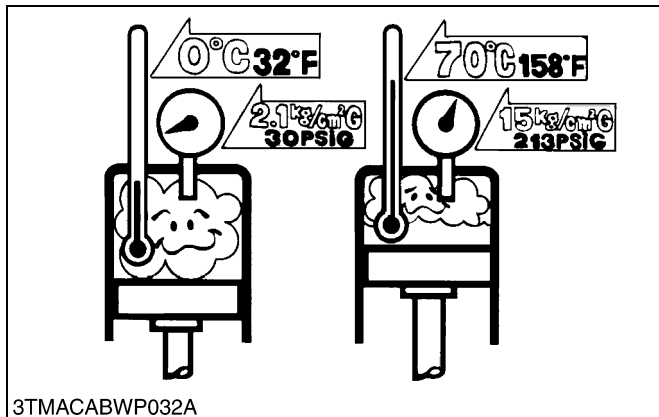
In the mechanical refrigeration system, the cool air is made by the following methods.

1. The high temperature and high pressure liquid refrigerant is stored in the container which is called receiver (1).
2. Then, the liquid refrigerant is released to evaporator (3) through a small hole, called expansion valve (2). At this time, temperature and pressure of the liquid refrigerant are lowered too, and some of the liquid refrigerant is changed to vapor.
3. The low temperature and low pressure refrigerant flows into the container, called evaporator. In the evaporator, the liquid refrigerant evaporates and removes heat from the surrounding air.

- | | |
|---------------------|----------------|
| (1) Receiver | (3) Evaporator |
| (2) Expansion Valve | (4) Pump |

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(2) How to Condense Gaseous Refrigerant into Liquid

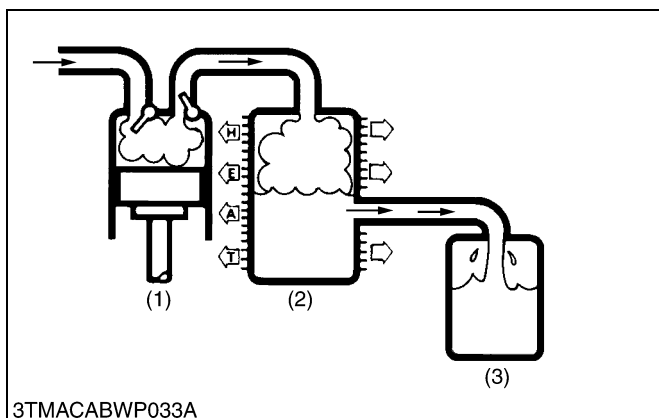


The mechanical refrigerant system changes the refrigerant from the gaseous state to the liquid state while it is passing through the evaporator.

When gas is compressed, both temperature and pressure increase. For example, when gaseous refrigerant is compressed from 0.21 MPa (2.1 kgf/cm², 30 psi) to 1.47 MPa (15 kgf/cm², 213 psi), temperature of the gaseous refrigerant rises from 0 °C (32 °F) to 70 °C (158 °F). The boiling point of refrigerant at 1.47 MPa (15 kgf/cm², 213 psi) is 62 °C (144 °F). So the temperature (70 °C, 158 °F) of compressed gaseous refrigerant is higher than the surrounding air. Therefore, the gaseous refrigerant can be converted into liquid state, releasing heat until its temperature drops to the boiling point. For example, 1.47 MPa (15 kgf/cm², 213 psi), 70 °C (158 °F) gaseous refrigerant can be liquefied by lowering the temperature by approx. 8 °C (46 °F).

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(3) Condensing Gaseous

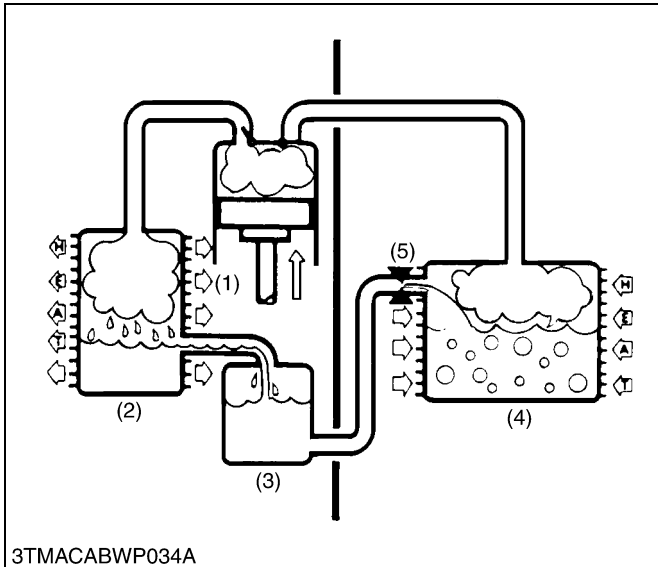


In the mechanical refrigeration system, the liquefaction of refrigerant is achieved by raising the pressure and then by lowering the temperature. The gaseous refrigerant which leaves the evaporator is compressed by the compressor (1). In the condenser (2) the compressed gaseous refrigerant releases heat to the surrounding air and it condenses back into liquid. And then the liquid refrigerant returns to the receiver (3).

- | | |
|----------------|--------------|
| (1) Compressor | (3) Receiver |
| (2) Condenser | |

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(4) Refrigeration Cycle

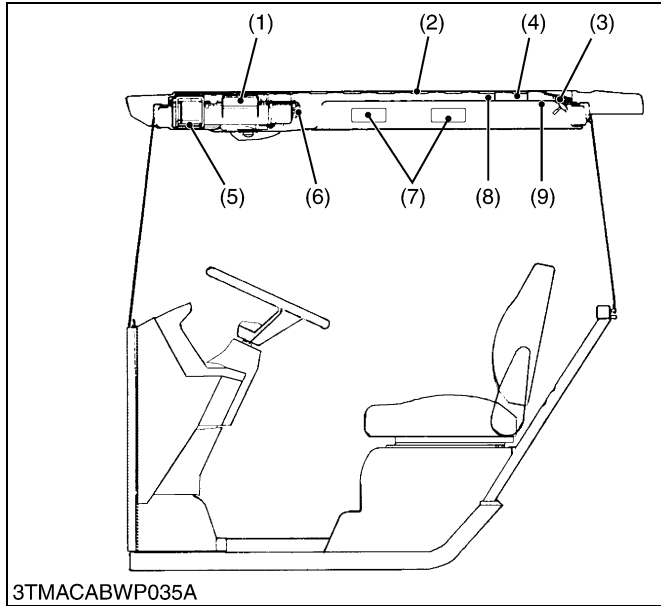


1. The compressor (1) discharges high temperature and high pressure refrigerant that contains the heat absorbed from the evaporator (4) plus the heat created by the compressor in a discharge stroke.
2. This gaseous refrigerant flows into the condenser (2). In the condenser, the gaseous refrigerant condenses into liquid refrigerant.
3. This liquid refrigerant flows into the receiver (3) which stores and filters the liquid refrigerant till the evaporator requires the refrigerant.
4. By the expansion valve (5), the liquid refrigerant changes into low temperature, low pressure liquid and gaseous mixture.
5. This cold and foggy refrigerant flows to evaporator. Vaporizing the liquid in the evaporator, the heat from the warm air steam passing through the evaporator core is transferred to the refrigerant. All the liquid will change into gaseous refrigerant in the evaporator and only heat-laden gaseous refrigerant is drawn into the compressor. Then the process is repeated again.

- | | |
|----------------|---------------------|
| (1) Compressor | (4) Evaporator |
| (2) Condenser | (5) Expansion Valve |
| (3) Receiver | |

W1032397

[2] OUTLINE OF AIR CONDITIONING SYSTEM



The machine is equipped with a thin large-capacity air conditioner with outside air intake. Through the inside air filter (9) as well as the outside air filter (4), the roof (8) and reaches the air conditioner unit (1). The air is cooled and dehumidified by this unit.

The resulting air is heated to a comfortable level. In this way, the air being blown via the blow port can be kept at comfortable temperature and humidity.

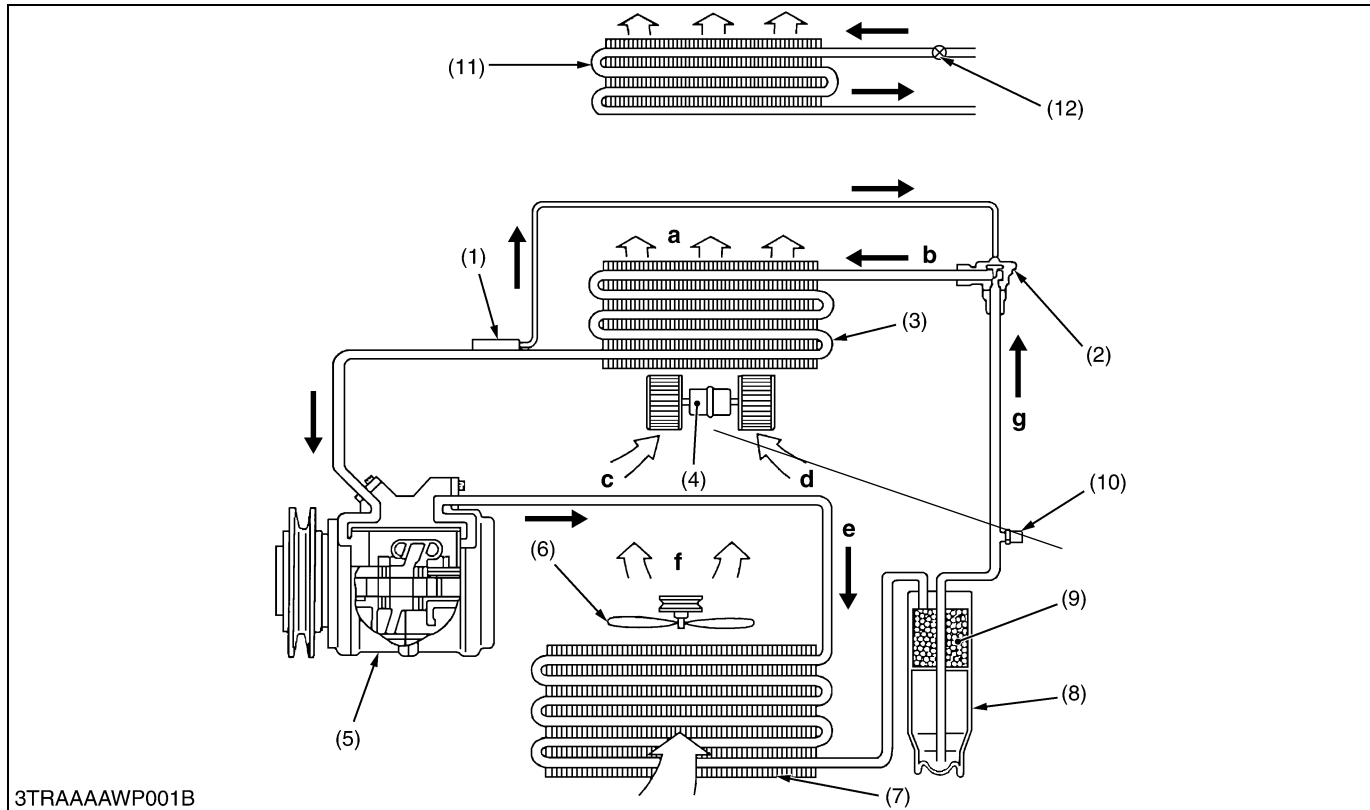
The front blow ports (5) can be opened and closed using the center knob of each port. The side blow ports (7) are opened and closed using the mode lever on the control panel (6). With these ports open or closed, you can feel your head cool and your feet warm.

		Type 1 (Swash plate type compressor)	Type 2 and 3 (Scroll type compressor)
Kinds of refrigerant (Charge amount)	Factory spec.	R134a 900 to 1000 g 1.98 to 2.21 lbs	
Pressure sensor (Low)	Factory spec.	0.196 MPa 2.0 kgf/cm ² 28.4 psi	
Pressure sensor (High)	Factory spec.	3.14 MPa 32.0 kgf/cm ² 455 psi	

- | | |
|--|-----------------------|
| (1) Air Conditioner Unit | (5) Front Blow Port |
| (2) Outer Roof | (6) Control Panel |
| (3) Inside / Outside Air Selection
Damper | (7) Side Blow Port |
| (4) Outside Air Filter | (8) Inner Roof |
| | (9) Inside Air Filter |

W1032524

[3] SYSTEM LAYOUT AND COMPONENT PART



3TRAAAAP001B

- | | | | |
|---------------------------|----------------------|--|---|
| (1) Heat Sensitizing Tube | (7) Condenser | (a) Cold Air | (e) High Pressure, High Temperature Gas |
| (2) Expansion Valve | (8) Receiver | (b) Low Pressure, Low Temperature Mist | (f) Hot Air |
| (3) Evaporator | (9) Desiccant | (c) Cabin Interior Air | (g) Liquid |
| (4) Blower Motor | (10) Pressure Switch | (d) Cabin Interior Air | |
| (5) Compressor | (11) Heater Core | | |
| (6) Engine Cooling Fan | (12) Water Valve | | |

The refrigerant cycle of air conditioning system is as follows.

- The gaseous refrigerant evaporated through the evaporator (3) is compressed in the compressor (5) to approx. 1.47 MPa (15 kgf/cm², 213 psi) and is also raised in temperature to approx. 70 °C (158 °F) and delivered to the condenser (7).
- The gaseous refrigerant is cooled down through the condenser (7) to approx. 50 °C (122 °F) and delivered to the receiver (8) in the liquid state.
At this time, heat removed from the cabin interior is extracted by means of the condenser (7).
- The liquid refrigerant is collected in the receiver (8) for a certain period. At this time moisture are removed from the refrigerant by desiccant (9).
- The liquid refrigerant after removing moisture and dust is jetted out of the small hole of the expansion valve (2) into the evaporator (3) as if it were distributed by an atomizer. Thus, the refrigerant is reduced in both pressure and temperature, and becomes easy to evaporate.
- The refrigerant evaporates at 0 °C (32 °F) vigorously, taking heat from the surface of the pipes in the evaporator (3).
- At this time, warm air in a cabin is drawn into the evaporator (3) by the blower motor and is passed over those pipes, transferring its heat to the refrigerant for evaporation. The air thus cooled is distributed to the cabin. (That is heat in a cabin is taken by the evaporator.)

(Reference)

- Since warm air in a cabin is cooled suddenly, water in the air is liquefied and removed, which means dehumidification is also performed.
- The gaseous refrigerant from the evaporator (3) after having performed the cooling action is returned to the compressor (5), and is compressed to liquefy it (high pressure and high temperature). This cycle is repeated.
 - The air coming from the evaporator is fed to the air mixing doors, by which part of the air is introduced into the heater core (11). In doing so, the air temperature can be adjusted to a comfortable level. The air mixing doors are controlled through the cable connected with the control panel.

(1) Compressor

The compressor is installed to on the engine and is driven by crank pulley through a belt.

The compressor is a pump designed to raise the pressure of refrigerant. Raising the pressure means raising the temperature. High temperature refrigerant vapor will condense rapidly in the condenser by releasing heat to the surrounding.

(Reference)

■ Compressor Oil

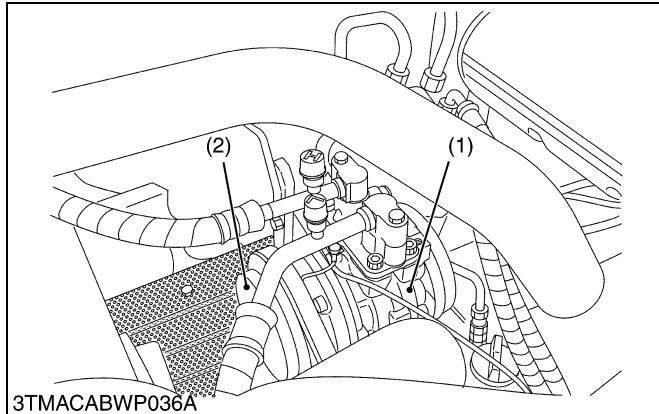
The compressor oil dissolves in the refrigerant, circulates through the air-conditioning cycle, and functions to lubricate the compressor. But the conventional compressor oil for R12 doesn't dissolve in R134a, so it doesn't circulate through the cycle, and the lifespan of the compressor is considerably shortened.

It is still essential to ensure that the correct refrigerant oil is used. R12 systems were lubricated with mineral oil, which is totally unsuitable for R134a systems. The letter require PAG oil, which mixes very well with the refrigerant and provides ideal lubrication throughout the system.

Compressor	Quantity (Total)	Brand Name
Swash plate type compressor (Type 1)	120 to 135 cc 0.127 to 0.143 U.S.qts. 0.106 to 0.119 Imp.qts.	DENSO CO. ND-OIL 8 <PAG* oil>
Scroll type compressor (Type 2)	60 to 100 cc 0.063 to 0.106 U.S.qts. 0.053 to 0.088 Imp.qts.	
Scroll type compressor (Type 3)	50 to 70 cc 0.053 to 0.074 U.S.qts. 0.044 to 0.062 Imp.qts.	

*PAG : Polyalkyleneglycol (Synthetic oil)

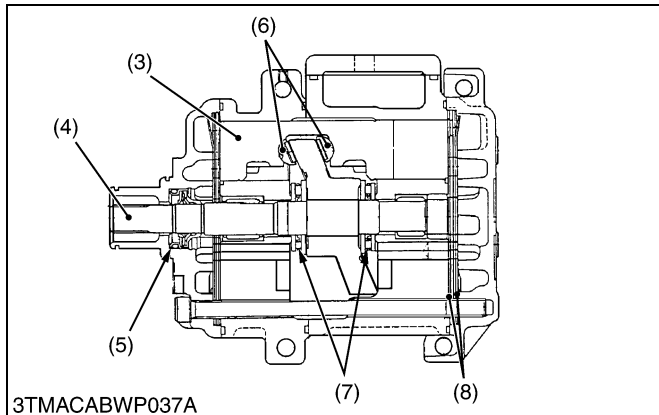
(A) Swash Plate Type Compressor (Type 1)

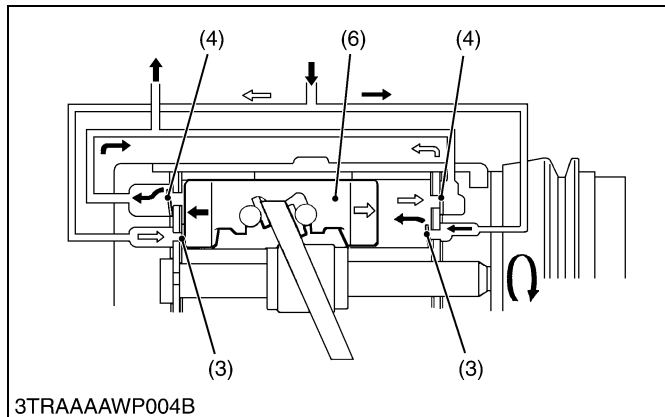
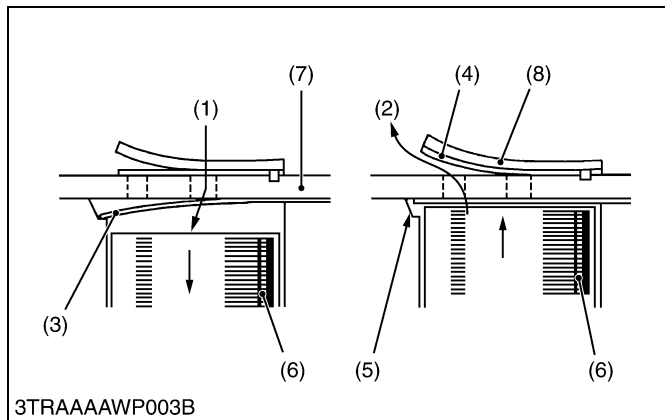


A number of paired piston at set on the swash plate in an interval of 1.26 rad (72 degrees) for 10 cylinders compressor. When one side of a piston is in a compression stroke, the other is in a suction stroke.

- (1) Magnetic Clutch
- (2) Shaft Seal
- (3) Pressure Relief Valve
- (4) Rear Housing
- (5) Piston
- (6) Cylinder
- (7) Swash Plate
- (8) Front Housing

W1052821





When the pressure inside piston becomes negative as the piston is lowered, the low pressure gas flows through the suction hole of the valve plate (7) to force down the suction valve (3), thereby sending refrigerant into each cylinder. The deflecting width of the suction valve (3) is determined by the notch in the cylinder (suction valve stopper) (5). When the piston goes into the compression stroke and the pressure exceeds that of high pressure side, the discharge valve (4) is pushed up to send out the high pressure gas from the compressor.

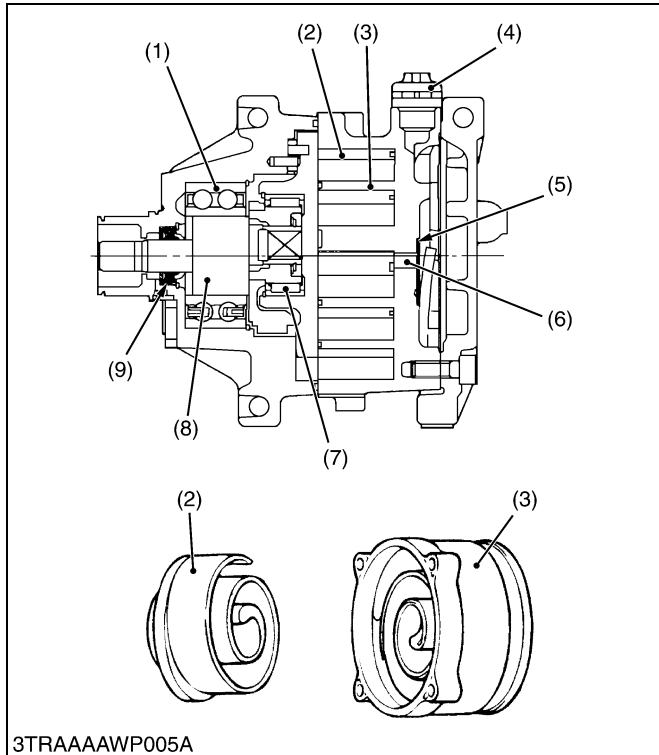
After the compression stroke is completed and the piston goes into the suction stroke, the high pressure gas on the discharge side holds the discharge valve to prevent the back flow of the gas from the high pressure side. In this way, the difference of high and low pressure can be maintained inside of the compressor.

The **R** type compressor has 5 pairs (10 cylinders) of pistons secured to the swash plate which is secured diagonally on the shaft. As the shaft rotates, the piston (6) reciprocates in the same direction as the shaft. Cylinders are arranged respectively on both sides of a pair of pistons and when the cylinder on one side is in compression stroke, the cylinder on the other side goes into suction stroke.

- | | |
|---------------------|-----------------|
| (1) Suction | (5) Notch |
| (2) Discharge | (6) Piston |
| (3) Suction Valve | (7) Valve Plate |
| (4) Discharge Valve | (8) Retainer |

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(B) Scroll Type Compressor (Type 2 and Type 3)

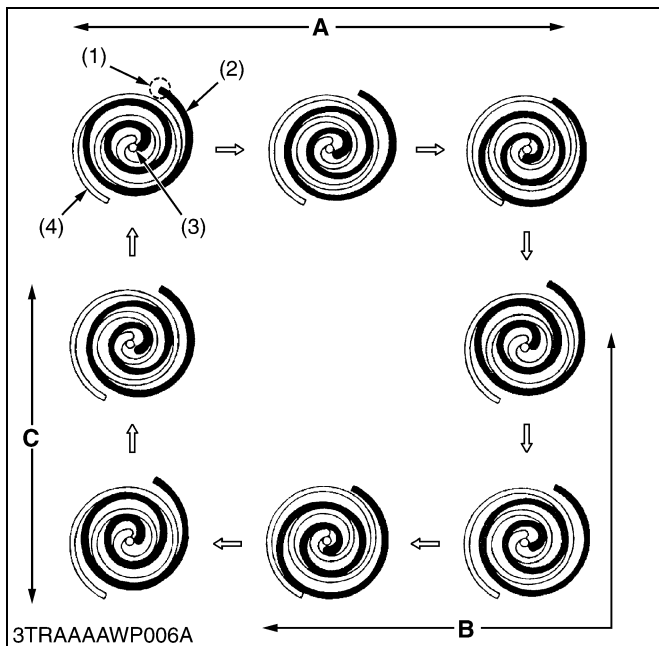


The scroll type compressor is composed of a pair of swirl shaped fixed scroll (3) and movable scroll (2).

The fixed scroll (3) combines with housing, and movable scroll (2) rotates with the shaft (8). Therefore, the capacity of the space partitioned with both scroll changes. As a result, the refrigerant is inhaled and compressed.

- | | |
|-------------------------------------|---------------------|
| (1) Bearing | (5) Discharge Valve |
| (2) Movable Scroll | (6) Discharge Port |
| (3) Fixed Scroll | (7) Bearing |
| (4) Service Valve for High Pressure | (8) Shaft |
| | (9) Shaft Seal |

W10338760



■ Operation

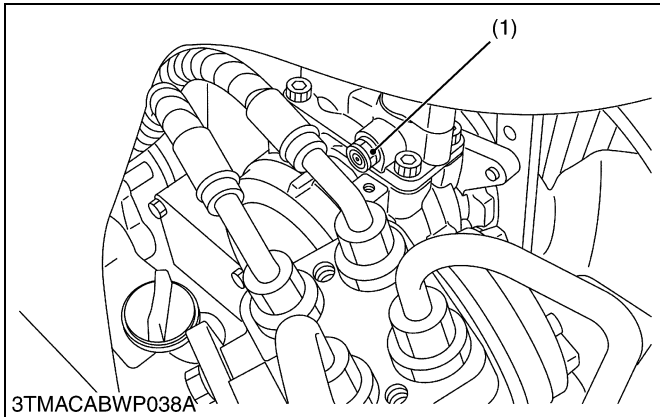
When the capacity between fixed scroll (4) increases along with rotational movement of movable scroll (2), the refrigerant is inhaled from the suction port (1). In addition, the refrigerant is compressed by rotational movement of movable scroll (2).

When the refrigerant pressure rises, the discharge valve is pushed open and the refrigerant gas is discharged. In this type, the refrigerant gas is discharged once in each rotation of the compressor shaft.

- | | |
|--------------------|-------------------------------|
| (1) Suction Port | A : Suction Stroke |
| (2) Movable Scroll | B : Compression Stroke |
| (3) Discharge Port | C : Discharge Stroke |
| (4) Fixed Scroll | |

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(C) Pressure Relief Valve



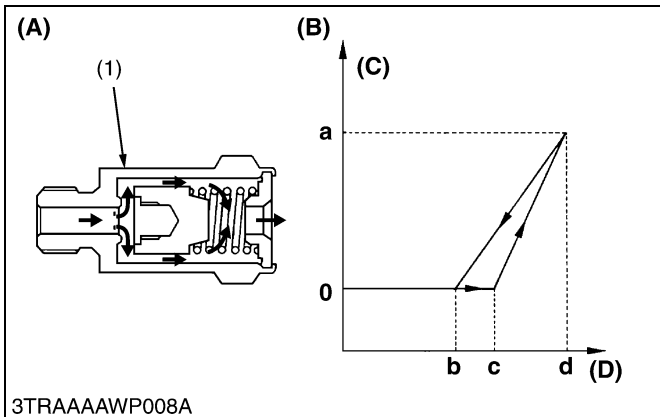
If the high pressure is abnormally high, the pressure relief valve open, and the refrigerant is released into the atmosphere, and the system is maintained. At the time, all of the refrigerant in the system is released into the atmosphere.

Even in the worst case, the outflow of refrigerant is stopped at the minimum limit.

(Reference)

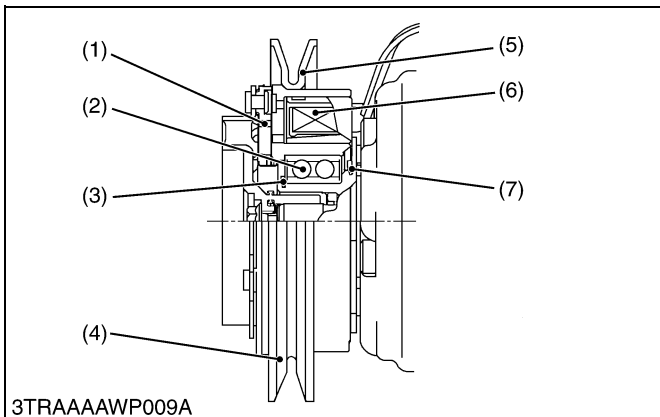
- In normal operation, the high pressure switch is triggered first and the compressor stops, so the pressure relief valve is not triggered so easily.

- | | |
|---|---------------------------------------|
| (1) Pressure Relief Valve | (A) Gas Ejection Route When Operating |
| (a) 113 L/min., 27.2 U.S.gals./min., 24.86 Imp.gals./min. | (B) Operation Characteristic |
| (b) 2.76 MPa, 28.1 kgf/cm ² , 399.7 psi | (C) Leakage Quantity |
| (c) 3.43 MPa, 35.0 kgf/cm ² , 497.8 psi | (D) Pressure |
| (d) 4.14 MPa, 42.4 kgf/cm ² , 603.1 psi | |



W1021726

(D) Magnetic Clutch



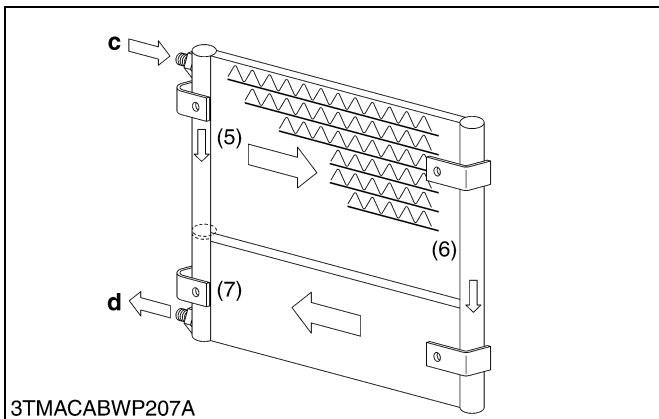
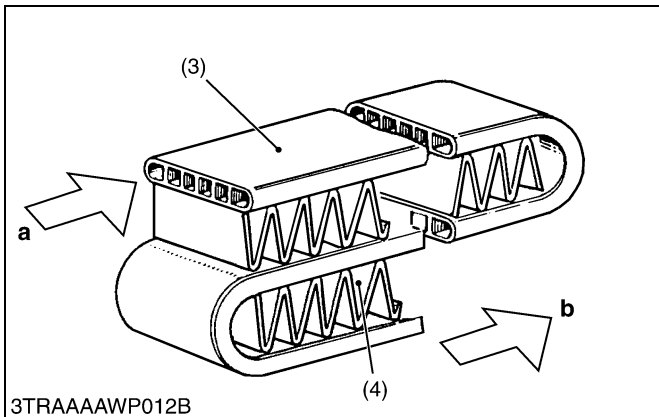
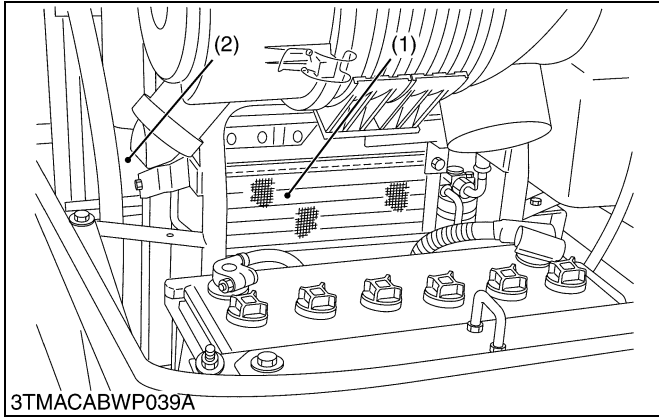
A magnetic clutch is used to engage and disengage the compressor from the engine. Main components are stator (6) and rotor with pulley (5), and pressure plate (1) to engage the drive pulley (4) and compressor magnetically.

The stator is fixed on the compressor housing, and the pressure plate is attached to the compressor shaft. Two ball bearings are used between the inner surface of the rotor and the front housing of the compressor.

- | | |
|--------------------|-----------------------|
| (1) Pressure Plate | (5) Rotor with Pulley |
| (2) Ball Bearing | (6) Stator |
| (3) Snap Ring | (7) Snap Ring |
| (4) Pulley | |

W1053520

(2) Condenser



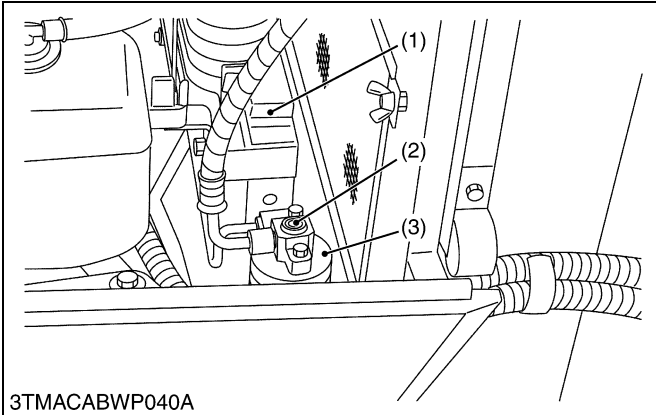
The condenser (1) is installed to the front of radiator (2) to enable forcible cooling by the air drawn in by the engine radiator fan.

The condenser is used for the purpose of cooling and robbing the heat from the refrigerant gas, which has been compressed by the compressor into high temperature, high pressure gas, so as to change this gas into liquid refrigerant.

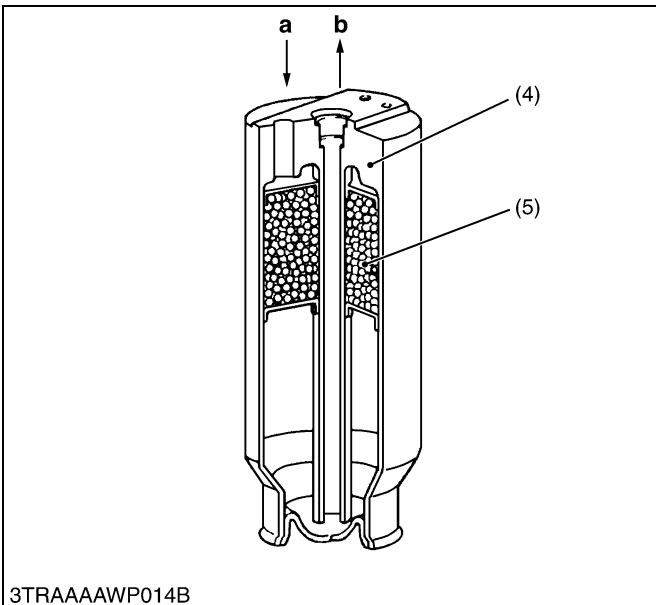
The heat given off by the gaseous refrigerant in the condenser is the sum of the heat absorbed at the evaporator and the heat of work required by the compressor to compress the refrigerant. The greater the amount of heat give off in the condenser, the greater will be the cooling effect attainable by the evaporator.

- | | |
|----------------|--------------------------------------|
| (1) Condenser | a : Gaseous Refrigerant |
| (2) Radiator | b : Liquid Refrigerant |
| (3) Tube | c : Heated Vapor from |
| (4) Fin | Compressor (70 °C, 158 °F) |
| (5) Vapor | d : Cooled Liquid to Receiver |
| (6) Liquefying | (50 °C, 122 °F) |
| (7) Liquefied | |

W1054237

(3) Receiver

3TMACABWP040A



3TRAAAAP014B

The receiver (3) serves the purpose of storing the liquid refrigerant. The amount of the liquid refrigerant flowing through the system varies with the operating condition of the air conditioner. To be accurate, the receiver stores excess amount of refrigerant when the heat load is lowered. It also releases stored refrigerant when additional cooling is needed, thus, maintaining the optimum flow of refrigerant within the system.

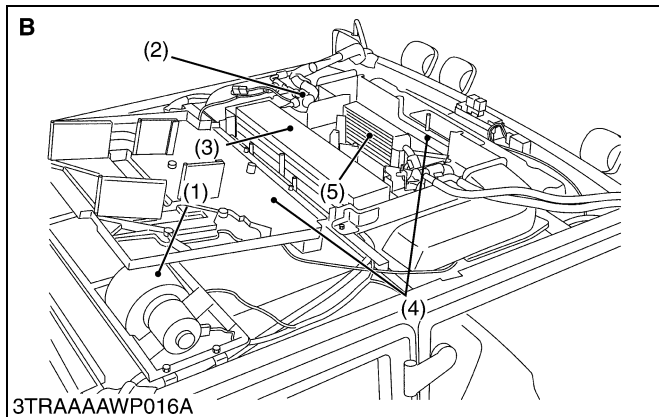
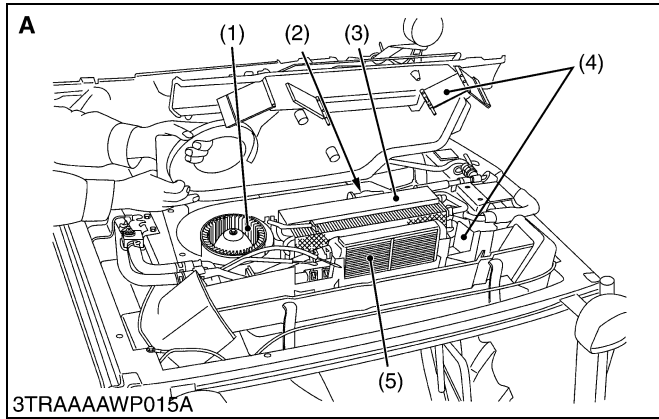
The receiver includes a desiccant (5). It has the job of removing moisture as the refrigerant circulates within the system.

The sight glass (2) is installed on the top of receiver. Amount of refrigerant to be charged is very important for the efficiency of air conditioner. The sight glass is used to check the amount of refrigerant. If large flow of bubbles can be seen in the sight glass, there is insufficient refrigerant charged. If so, replenish the refrigerant to the proper level.

- | | |
|-------------------|----------------|
| (1) Condenser | a : IN |
| (2) Sight Glass | b : OUT |
| (3) Receiver | |
| (4) Receiver Body | |
| (5) Desiccant | |

W1033129

(4) Air Conditioner Unit



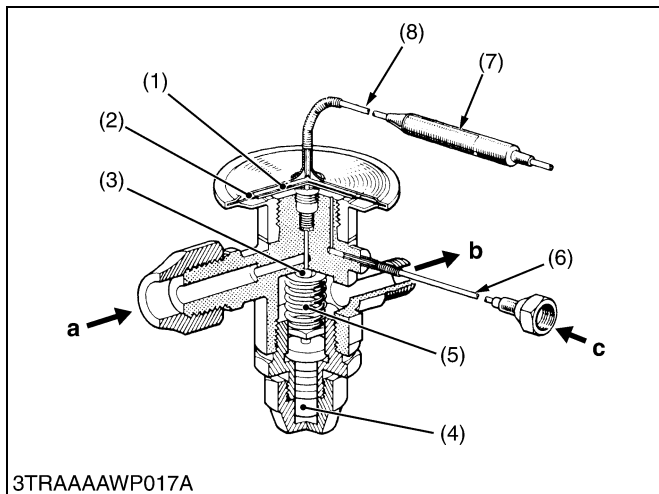
Air conditioner unit (4) consists of evaporator (3), expansion valve (2), heater core (5), blower (1), etc..

- (1) Blower
- (2) Expansion Valve
- (3) Evaporator
- (4) Air Conditioner Unit
- (5) Heater Core

- A : Type 1 (Except Code No. 3F761-50032)**
- B : Type 2 (Code No. 3F761-50032)**

W10336200

(A) Expansion Valve



■ Type 1 (Except Code No. 33770-96120)

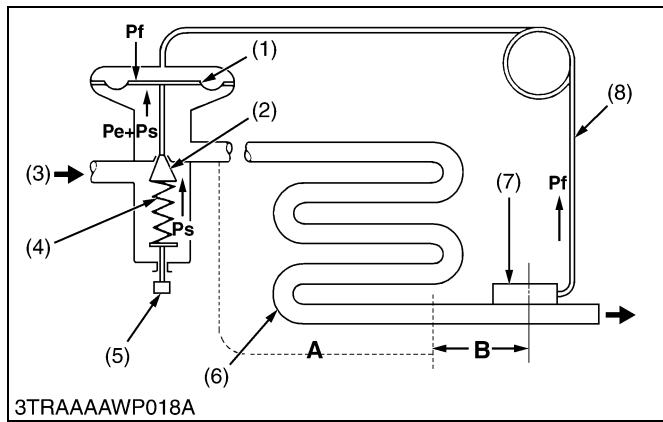
The expansion valve restricts the flow of liquid refrigerant as it passes through the expansion valve and delivers sprayed refrigerant to the evaporator for facilitating refrigerant evaporation.

The cabin interior will not be cooled sufficiently if the expansion valve outlet is too small. If it is too wide, frost will be produced on the evaporator, decreasing cooling efficiency. Thus the size of this small spray hole has to be controlled according to various conditions.

- (1) Diaphragm Chamber
- (2) Diaphragm
- (3) Needle Valve
- (4) Adjusting Screw
- (5) Pressure Spring
- (6) Tube
- (7) Heat Sensitizing Tube
- (8) Capillary Tube

- a : From Receiver**
- b : To Evaporator**
- c : From Evaporator**

W10343640



When the vapor pressure of the operating system is stable, $P_f = P_e + P_s$ condition will prevail. The needle valve opening at this time will be stationary and constant refrigerant flow will be maintained.

If the evaporator installing expansion valve, the refrigerant in the outlet is always in superheated vapor form for certain length (part **B** in the figure). If the cooling load increases (inlet air temperature of evaporator becomes high), the refrigerant will vaporize faster and cause the length of the superheated vapor part **B** to become longer. Thus, the pressure in the heat sensitizing tube (7) rises and increases the needle valve opening, resulting in larger flow of the refrigerant into evaporator. Conversely, if the amount of refrigerant in the evaporator becomes greater, the length of the superheated vapor part **B** will become shorter. The pressure in the heat sensitizing tube will drop and decrease the needle valve (2) opening.

- (1) Diaphragm
- (2) Needle Valve
- (3) Refrigerant Inlet
- (4) Spring
- (5) Adjusting Screw
- (6) Evaporator Tube
- (7) Heat Sensitizing Tube
- (8) Capillary Tube

A : Saturated Vapor Part
B : Superheated Vapor Part

Pf : Gas pressure in sensitizing tube

Ps : Spring pressure

Pe : Vapor pressure in evaporator

W10346170

■ **Type 2 (Code No. 33770-96120)**

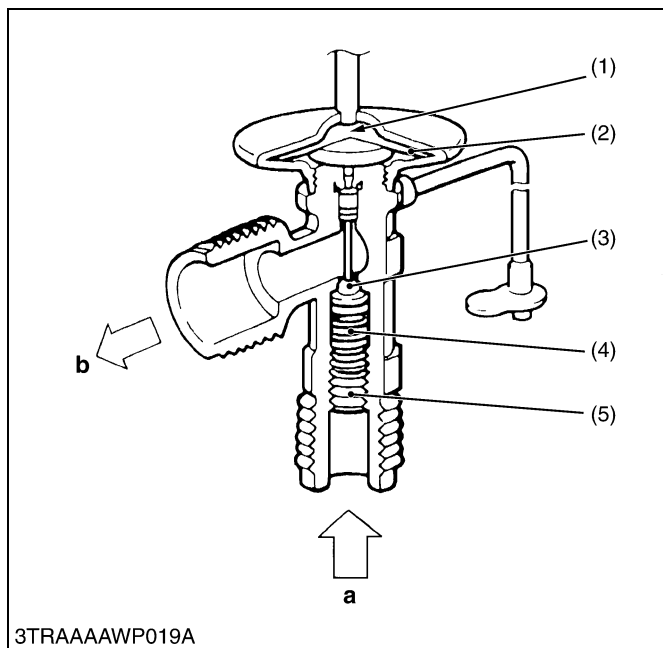
The expansion valve restricts the flow of liquid refrigerant as it passes through the expansion valve and delivers sprayed refrigerant to the evaporator for facilitating refrigerant evaporation.

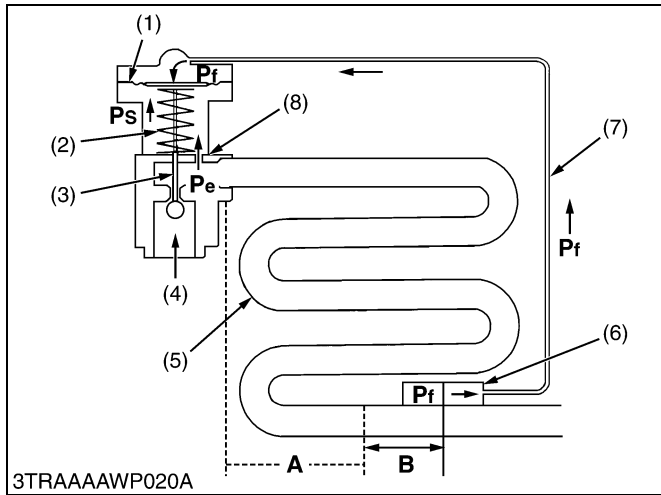
The cabin interior will not be cooled sufficiently if the expansion valve outlet is too small. If it is too wide, frost will be produced on the evaporator, decreasing cooling efficiency. Thus the size of this small spray hole has to be controlled according to various conditions.

- (1) Diaphragm Chamber
- (2) Diaphragm
- (3) Needle Valve
- (4) Pressure Spring
- (5) Adjusting Screw

a : From Receiver
b : To Evaporator

W10348870





3TRAAAAP020A

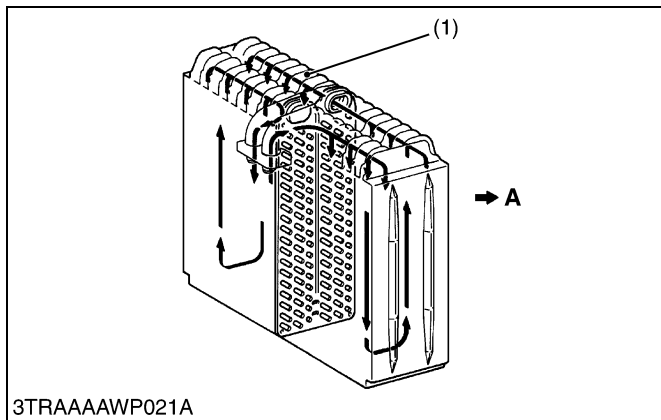
When the vapor pressure of the operating system is stable, $P_f = P_e + P_s$ condition will prevail. The needle valve (3) opening at this time will be stationary and constant refrigerant flow will be maintained.

If the evaporator installing expansion valve, the refrigerant in the outlet is always in superheated vapor form for certain length (part B in the figure). If the cooling load increases (inlet air temperature of evaporator becomes high), the refrigerant will vaporize faster and cause the length of the superheated vapor part B to become longer. Thus, the pressure in the heat sensitizing tube (6) rises and increases the needle valve opening, resulting in larger flow of the refrigerant into evaporator. Conversely, if the amount of refrigerant in the evaporator becomes greater, the length of the superheated vapor part B will become shorter. The pressure in the heat sensitizing tube will drop and decrease the needle valve (3) opening.

- | | |
|---------------------------|--|
| (1) Diaphragm | A : Saturated Vapor Part |
| (2) Spring | B : Superheated Vapor Part |
| (3) Needle Valve | |
| (4) Refrigerant Inlet | Pf : Gas pressure in sensitizing tube |
| (5) Evaporator Tube | Ps : Spring pressure |
| (6) Heat Sensitizing Tube | Pe : Vapor pressure in evaporator |
| (7) Capillary Tube | |
| (8) Equalizer Circuit | |

W10350980

(B) Evaporator



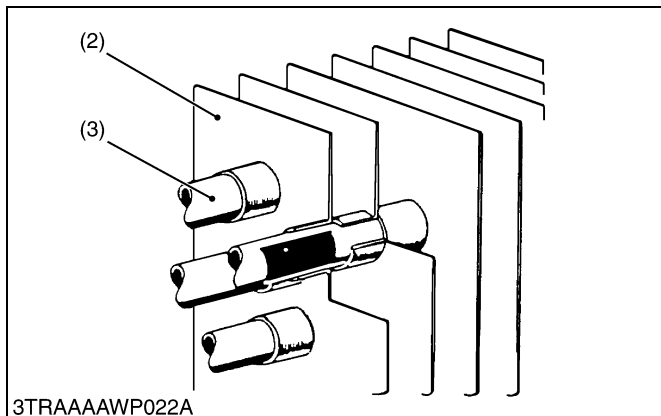
3TRAAAAP021A

The purpose of evaporator (1) is just opposite to that of the condenser. The state of refrigerant immediately after the expansion valve is 100 % liquid. As soon as the liquid pressure drops, it starts to boil, and in doing so, absorbs heat. This heat is removed from the air passing over the cooling fins of the evaporator and causes the air to cool.

If too much refrigerant is sent into the evaporator, it will not boil away so easily. Also, the evaporator filled with liquid refrigerant eliminates a place for the refrigerant to properly vaporize, which is necessary in order to take on heat. A flooding condition of the evaporator will allow an excess of liquid refrigerant to leave the evaporator and may cause serious damage to the compressor.

If too little refrigerant is sent into the evaporator, again the evaporator will not cool because the refrigerant will vaporize, or boil off, long before it passes through the evaporator.

Refrigerant properly metered into the evaporator should allow for 100 % liquid just after the expansion valve, and 100 % gas at the outlet.

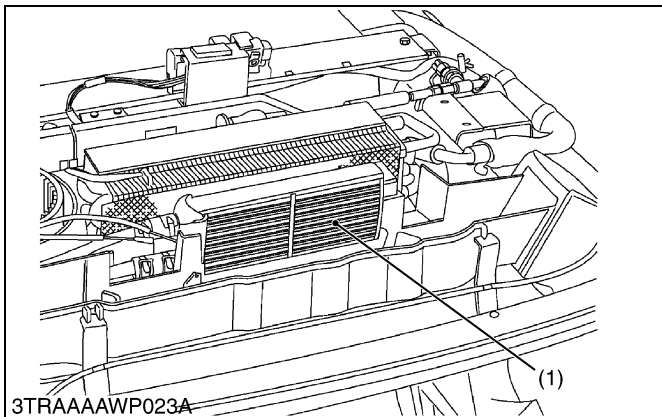


3TRAAAAP022A

- | | |
|----------------|--------------------------------|
| (1) Evaporator | A : Flow of Refrigerant |
| (2) Fin | |
| (3) Tube | |

W10353560

(C) Heater Core



The heater-core of heater utilizes coolant which becomes high temperature by heat of engine.

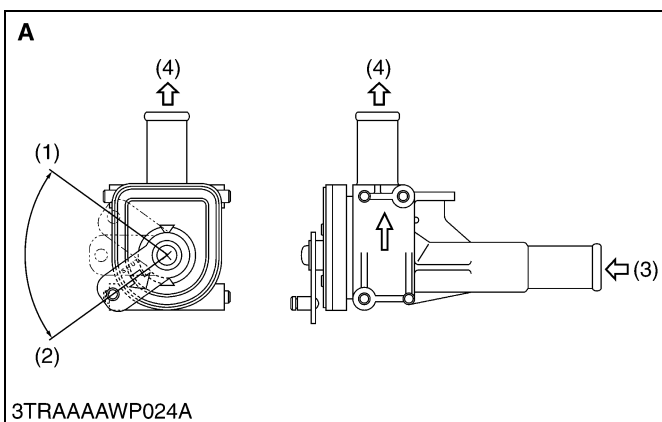
The inlet port of heater core is connected to the delivery side of engine water pump by a rubber hose, and the water valve is installed on the inlet port of heater core. Also, the outlet port of heater core is connected to the engine cylinder block.

The heater core is one of the heat exchangers like evaporator or condenser, and heat is exchanged between heated coolant passing through the core and air in the cabin or fresh outdoor air. Thus, air is heated.

(1) Heater Core

W10355410

(D) Water Valve



The water valve serves the purpose of opening and shutting off the hot water to heater core, and is installed on the inlet side of heater core.

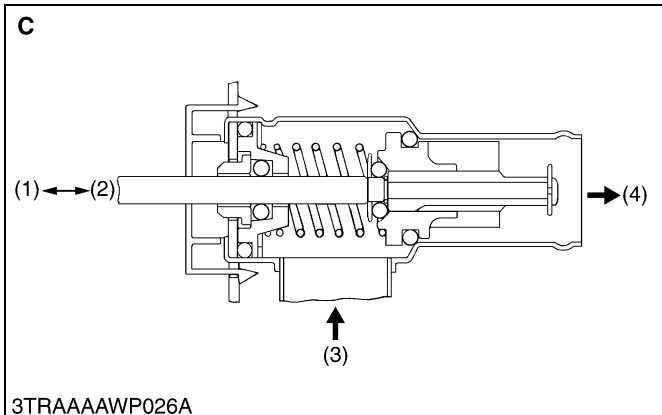
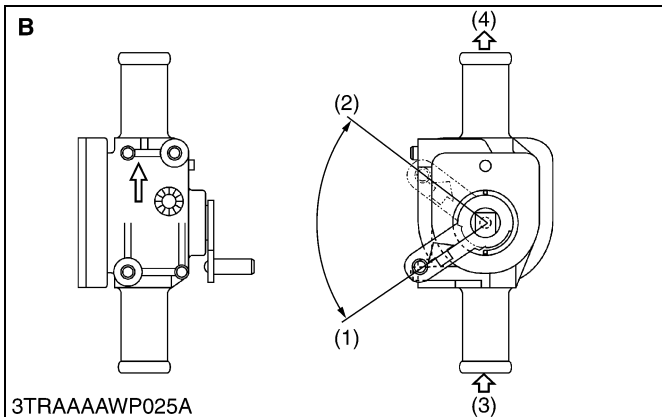
- (1) OPEN
- (2) CLOSE
- (3) INLET
- (4) OUTLET

A : Type 1
(Code No. T0270-72521,
T1065-72520)

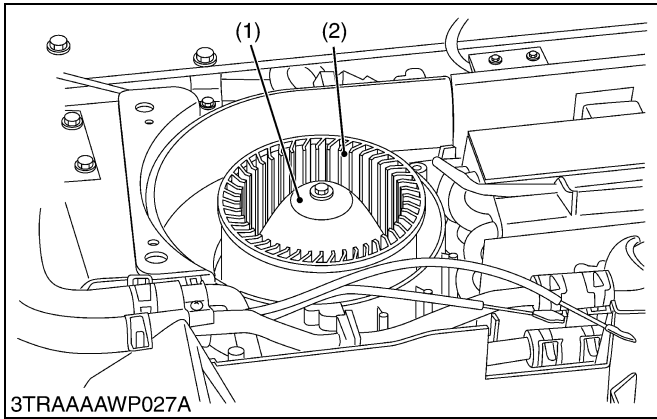
B : Type 2
(Code No. 3G710-72501)

C : Type 3
(Code No. 36919-96230)

W10357070



(E) A/C Blower



■ **Type 1 (Except Code No. 3F760-57021, 57031, 3M760-57020, 57030)**

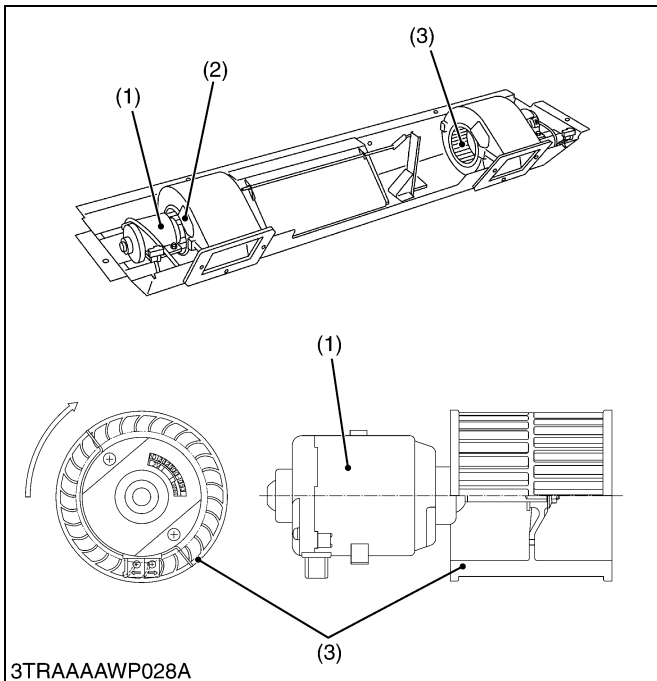
The blower is incorporated in the right-hand space of the air conditioner unit. It blows cool, warm or fresh air via the front and side blow ports into the cabin.

The speed of the blower motor (1) can be adjusted in 3 steps by the resistor.

The blower fan (2) is centrifugal type. The air being sucked in parallel with the rotary shaft is blown in the centrifugal direction; in other words, perpendicular to the rotary shaft.

- (1) Blower Motor
- (2) Blower Fan

W10359010



■ **Type 2 (Code No. 3F760-57021, 57031, 3M760-57020, 57030)**

The blower unit is installed on the rear of air conditioner unit, and forcibly sends cooling air, heating air or fresh outside air to cabin inside.

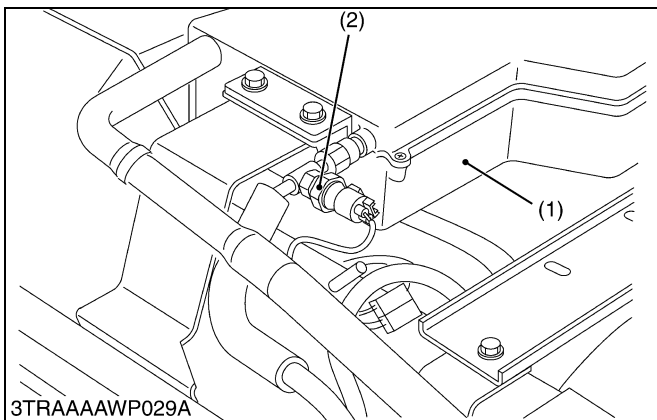
The speed of blower motor (1) can be adjusted in 3 steps by the resistor (2).

The blower fan (3) used is centrifugal type. In this type, the air drawn in parallel to the rotating axis is blown out perpendicular to rotating axis, that is, in the direction of centrifugal force.

- (1) Blower Motor
- (2) Resistor
- (3) Blower Fan

W10360370

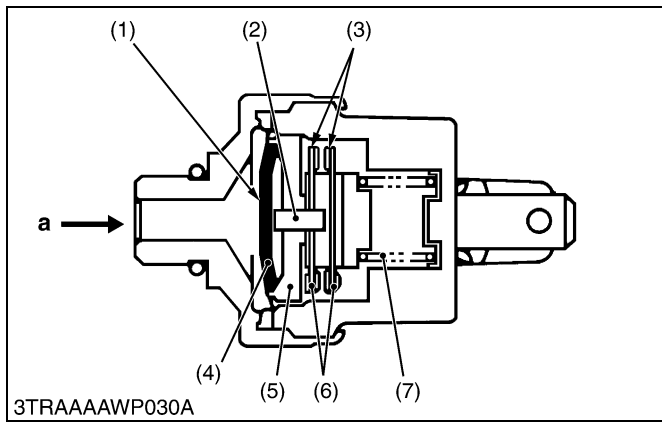
(F) Pressure Switch



The pressure switch detects the pressure in the refrigerant cycle, and when something is wrong, turns off the magnetic clutch to prevent the component from troubling. This system has dual type pressure switch (2), and this switch controls low pressure cut and high pressure cut.

- (1) A/C Unit
- (2) Pressure Switch

W10361670



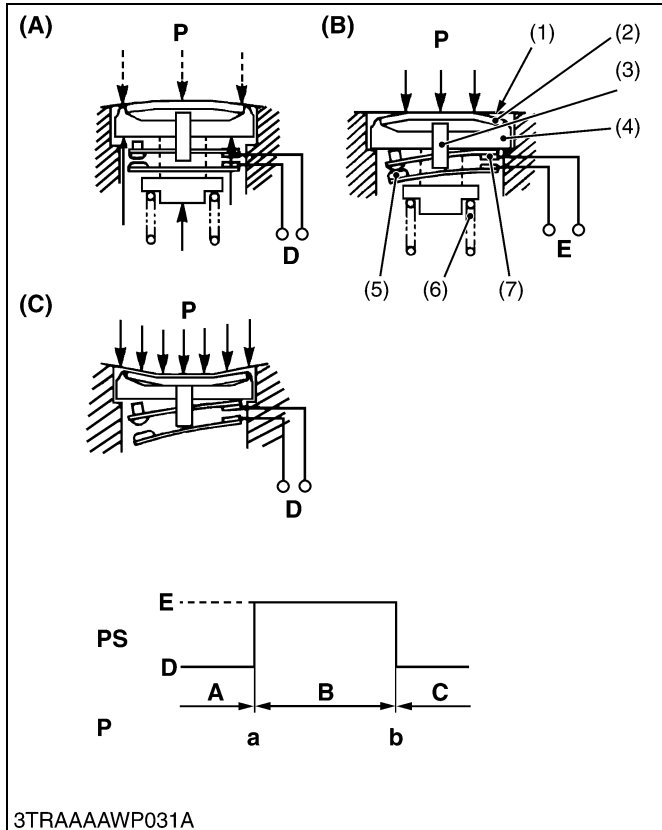
1) Pressure Switch (Dual Type)

The pressure switch is installed in inlet line (liquid line) between receiver and expansion valve.

The contact of pressure switch is normally open type.

- (1) Diaphragm
 - (2) Pin
 - (3) Terminal
 - (4) Belleville Spring
 - (5) Plate
 - (6) Movable Contact
 - (7) Spring
- a : Pressure**

W10362510



■ OFF Position : A (When the Refrigerant Pressure is Low)

The pressure switch detects the pressure drop when the refrigerant leaks from the system causing compressor seizure. When pressure of refrigerant is less than specified pressure, the switch is turned **OFF** and disengages magnetic clutch.

■ ON Position : B (When the Refrigerant Pressure is Normal)

When the pressure in the inlet line is between 0.196 MPa (2.0 kgf/cm², 28.4 psi) and 3.14 MPa (32 kgf/cm², 455 psi), the switch is turned **ON**, and engages magnetic clutch.

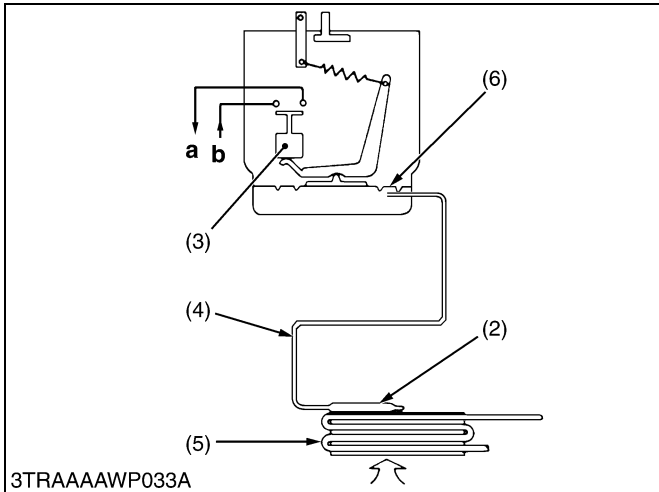
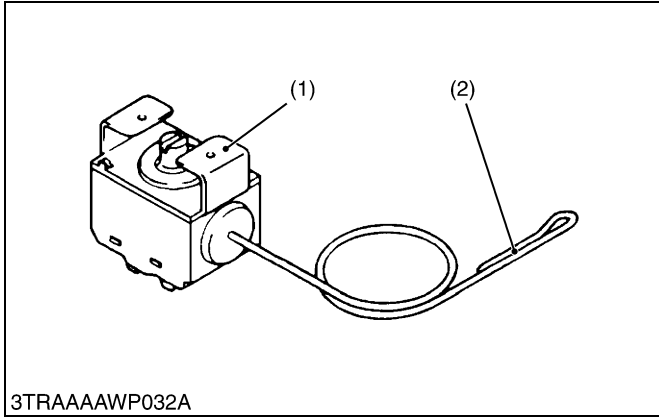
■ OFF Position : C (When the Refrigerant Pressure is High)

When the pressure in the inlet line is higher than specified pressure, the switch is turned **OFF**, and disengages magnetic clutch.

- (1) Diaphragm
 - (2) Belleville Spring
 - (3) Pin
 - (4) Plate
 - (5) Contact
 - (6) Spring
 - (7) Terminal
- D : OFF**
E : ON
P : Pressure
PS : Pressure Switch
a : 0.196 MPa
(2.0 kgf/cm², 28.4 psi)
b : 3.14 MPa
(32 kgf/cm², 455 psi)

W10363870

(G) Thermostat



If the evaporator fin temperature, that is, refrigerant vaporizing temperature, drops below 0 °C (32 °F), frost or ice will form on the fins, causing a decrease in air flow and lowering cooling capacity. To prevent such frosting, and also to allow setting cabin interior to desired temperature, a thermostat has been installed.

In this system, gas type thermostat is used.

The gas type thermostat has a capillary tube which is filled with special gas. The capillary tube is connected to the diaphragm chamber. The tip of the capillary tube is positioned on the evaporator fins.

When the evaporator fins temperature is higher than setting temperature of the thermostat, the micro switch in the thermostat is turned **ON** by increasing the pressure in the diaphragm chamber. When the evaporator fins temperature is low, such as in winter season, the micro switch is turned **OFF** because of the pressure in the diaphragm chamber and spring tension drops, thus turning **OFF** the magnetic clutch to prevent the evaporator from frosting.

(Reference)

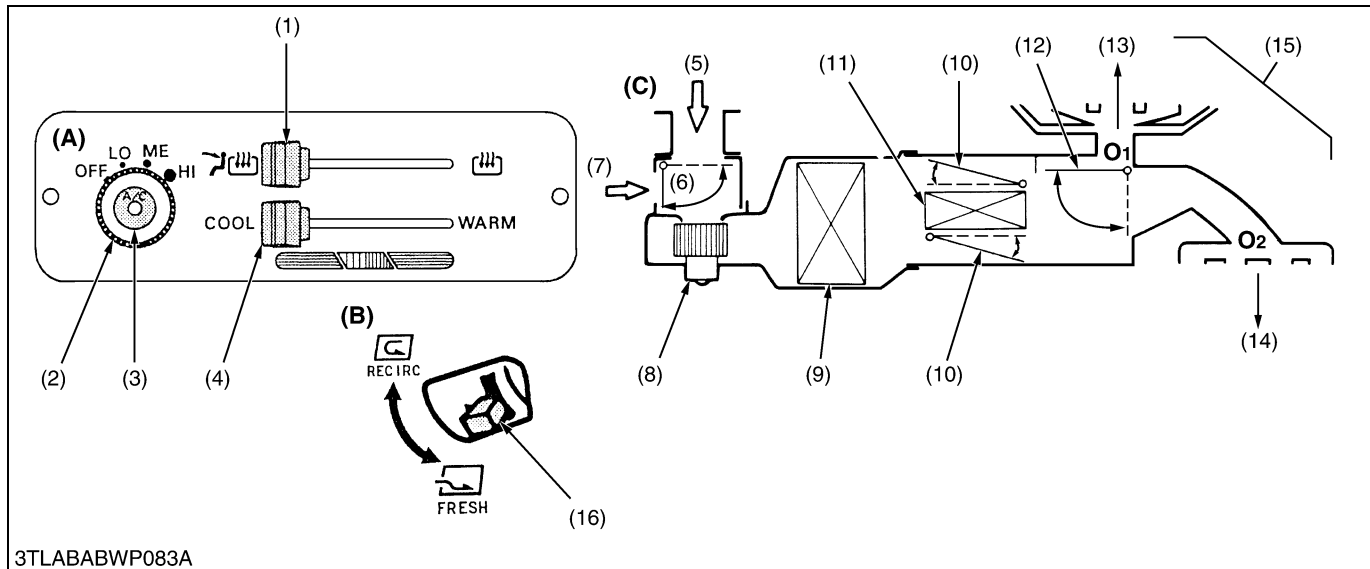
- Thermostat setting temperature
- OFF** Approx. 1 °C (34 °F)
- ON** Approx. 4.5 °C (40.1 °F)

- | | |
|--------------------------|-------------------------------|
| (1) Thermo Switch | (5) Evaporator |
| (2) Heat Sensitizer Tube | (6) Diaphragm |
| (3) Micro Switch | a : To Magnetic Clutch |
| (4) Capillary Tube | b : From A/C Switch |

W10366520

[4] SYSTEM CONTROL

(1) Type 1



- | | | | |
|-------------------------------|--|--|--|
| (1) Air Mode Lever | (7) Recirculated Air | (12) Air Outlet Door D3
(Mode Door) | (A) Control Plate |
| (2) Blow Switch | (8) Blower | (13) DEFOGGER | (B) Air Selection Lever |
| (3) Air Conditioner Switch | (9) Evaporator | (14) FACE | (C) Block Diagram of Air Flow
Passage |
| (4) Temperature Control Lever | (10) Temperature Door D2
(Air Mixed Door) | (15) DEF and FACE | O1 :Front air outlet |
| (5) Fresh Air | (11) Heater | (16) Air Selection Lever | O2 :Side air outlet |

1) Selection of recirculated air (7) or fresh air (5) is done with door D1.

■ RECIRC

By setting the air selection lever (16) in rear control panel to **RECIRC** position, door **D1** (6) shuts the fresh air inlet port. Air inside the cabin is recirculated.

■ FRESH

By moving the air selection lever (16) to **FRESH** position, door **D1** opens the fresh air inlet port. Outside air comes into cabin.

2) Temperature control of outlet air is done with door D2.

■ COOL

By setting the temperature control lever (4) in control panel to **COOL** position, door **D2** (10) is moved to close water valve. The air flows to door **D3** (12) side without passing the heater core.

■ WARM

By moving the temperature lever to **WARM** position door **D2** is moved to open water valve. The air flows to door **D3** (12) side passing through the heater core.

3) Outlet air flow is controlled by door D3.

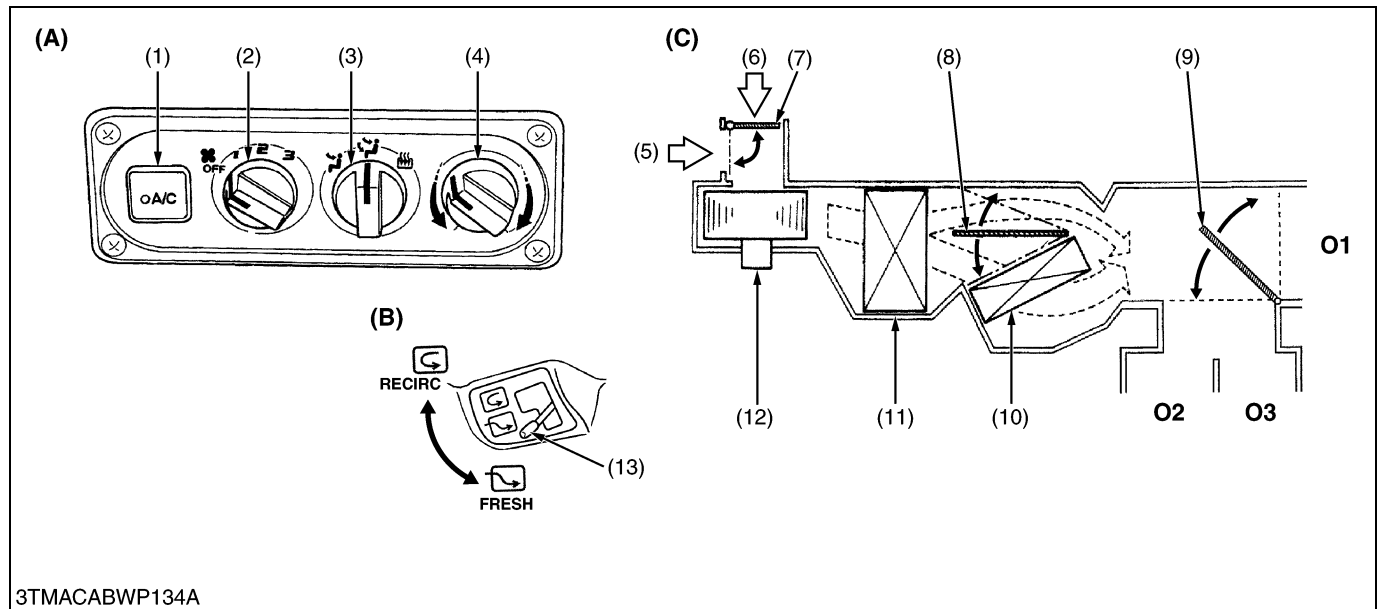
Moving the air mode lever (1) opens and shuts door **D3** and establishes the air passage according to the lever position.

■ DEF + FACE

By moving the mode lever to **DEF + FACE** position, the door **D3** is moved to establish the air passages to outlets **O1** and **O2**. Air comes out from both outlets.

■ DEF

Moving the mode lever to **DEF** position, door **D3** is moved to set up the air passage to outlet **O1**. Air comes out from outlet **O1**.

(2) Type 2

3TMACABWP134A

- (1) Air Condition Switch
- (2) Blow Switch
- (3) Mode Switch
- (4) Temperature Control Dial
- (5) Recirculated Air
- (6) Fresh Air

- (7) Air Intake Door 1
- (8) Temperature Door 2
(Air Mixed Door)
- (9) Air Outlet Door 3
(Mode Door)
- (10) Heater Core
- (11) Evaporator

- (12) Blower
- (13) Air Selection Lever

- (A) Control Panel**
- (B) Air Selection Lever**
- (C) Block Diagram of Air Flow Passage**
- O1 :FACE**
- O2 :DEFOGGER**
- O3 :SIDE**

1) Selection of recirculated air (5) or fresh air (6) is done with door 1.**■ RECIRCULATION**

By setting the air selection lever (13) in rear control panel to **RECIRC** position, door 1 (7) shuts the fresh air inlet port. Air inside the cabin is recirculated.

■ FRESH

By moving the air selection lever (13) to **FRESH** position, door 1 (7) opens the fresh air inlet port (6). Outside air comes into cabin.

2) Temperature control of outlet air is done with door 2 (8).

The opening and shutting of the door 2 (8) and the water valve has been linked.

■ COOL

By setting the temperature control dial in control panel to **COOL** position, door 2 (8) is moved to close water valve. The air flows to door 3 (9) side without passing the heater core (10).

■ WARM

By moving the temperature control dial to **WARM** position door 2 (8) is moved to open water valve. The air flows to door 3 (9) side passing through the heater core (10).

3) Outlet air flow is controlled by door 3.

Moving the mode switch (3) opens and shuts door 3 (9) and establishes the air passage according to the switch position.

■ FACE

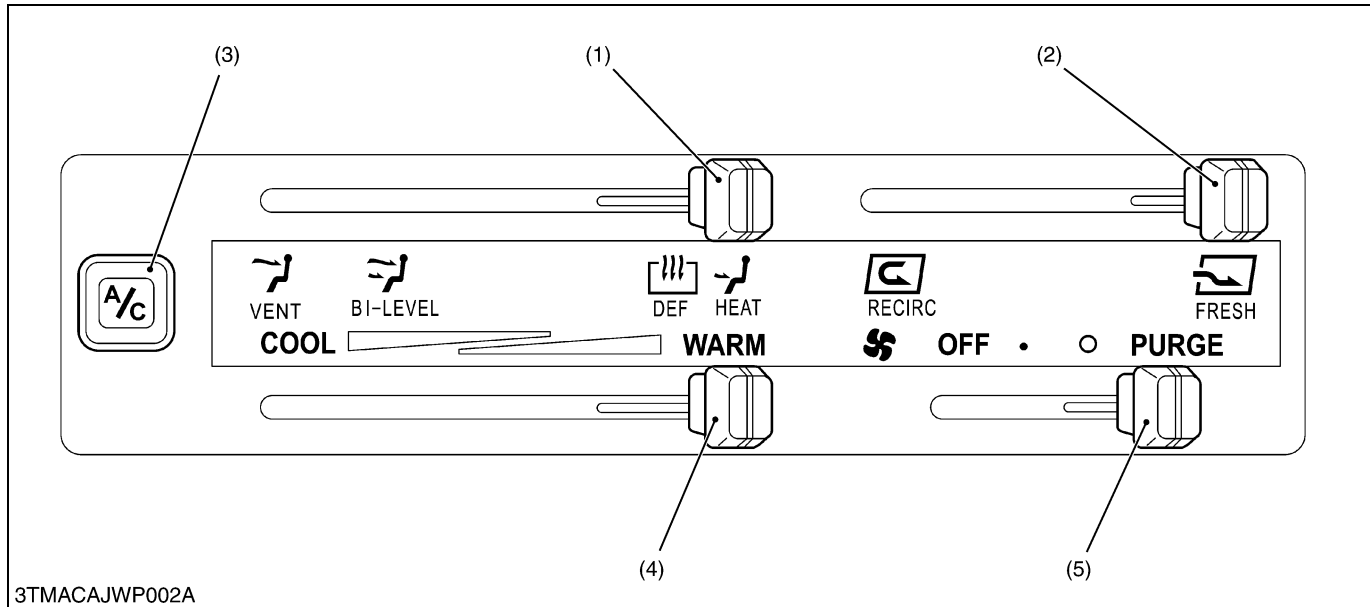
By setting the mode switch (3) to **FACE** position, the door 3 (9) is moved to position **A** the air passages to outlets **O1**.

■ FULL

By setting the mode switch (3) to **FULL** position, door 3 (9) is moved to position **B** the air passage to outlet **O1**, **O2** and **O3**.

■ DEF

By setting the mode switch (3) to **DEF** position, door 3 (9) is moved to position **C** the air passage to outlet **O2** and **O3**.

(3) Type3

(1) Mode Lever

(2) Recirculation / Fresh Air Selection Lever

(3) Air Conditioner Switch With Indicator Light

(4) Temperature Control lever
(5) Blower Switch**■ Mode Lever**

Set the mode lever to the desired position.

● Vent (Face and chest areas)

Air blowing or air conditioning

● Bi-level (Chest and foot areas)

Comfortable air conditioning by keeping the head cool and the feet warm

● DEF (Windshield)

Defrosting the windshield

● Heat (Foot area)

Normal heating

■ Recirculation / Fresh Air Selection lever**● RECIRCULATION**

Set the lever to “RECIRC” position, and the in-cabin air will be recirculated. This is useful for cooling or heating the cabin quickly or keeping it extra cool or warm.

● FRESH AIR

Set the lever to the “FRESH” position, and fresh air will flow into the cabin. This is helpful when you work in a dusty conditions or if the glass windows get foggy.

■ NOTE

- When heating, do not keep the lever at the “RECIRCULATION” position for a long time. The windshield easily gets foggy.
- While working in a dusty conditions, keep the lever at the “FRESH AIR” position. This increases the pressure in the cabin, while helps prevent dust from coming into the cabin.

■ Temperature Control Lever

Set this lever at the desired position to obtain the optimum air temperature. Move the lever to the right to obtain warmer air. Move it to the left to obtain cooler air.

■ Blower Switch

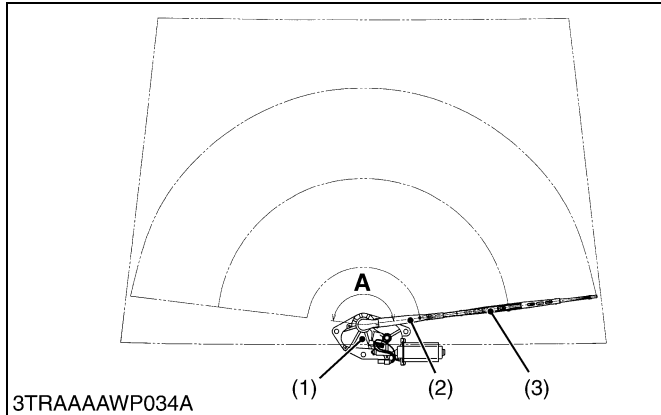
Air volume can be changed in three steps. At the “PURGE” position, the largest air volume is obtained.

■ Air Conditioner Switch

Push this switch to activate the air conditioner. An indicator light will light up when the switch is set to “ON”. Push switch again to turn air conditioner off, in which case the indicator light will be off.

2. WINDSHIELD WIPER

[1] FRONT WINDSHIELD WIPER



Front wiper motor is of the ferrite magnet type and possesses the function to stop the wiper arm (2) at a designed position.

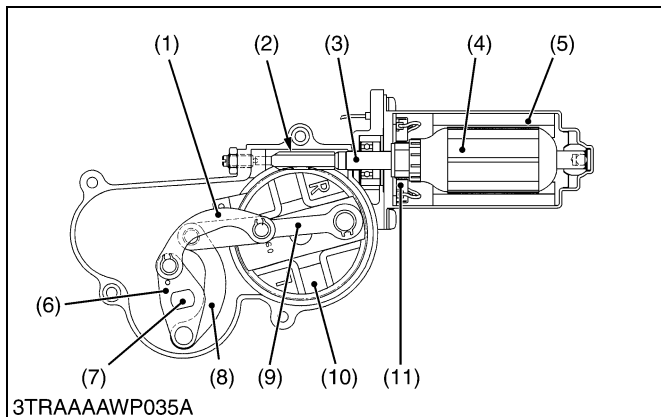
The wiper linkage changes rotating motion of the output shaft of the motor into reciprocating movement, which moves the wiper arm (2). The wiper arm (2) uses a pantograph system, so the wiper blade keeps a certain angle (perpendicular) continuously although the wiper arm (2) moves.

Wiping angle of the wiper arm (2) is 2.90 rad. (166 °).

- | | |
|-----------------------|------------------|
| (1) Front Wiper Motor | (A) Wiping Angle |
| (2) Wiper Arm | |
| (3) Wiper Blade | |

W10217710

(1) Front Wiper Motor

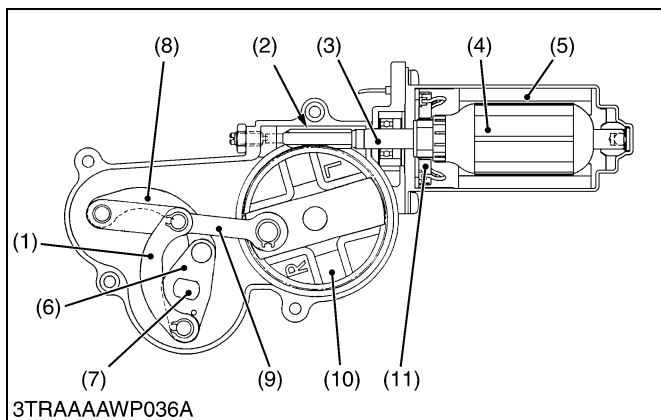


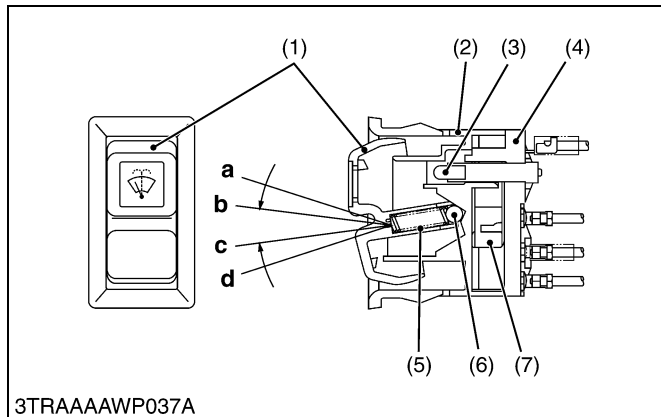
The front wiper motor is so designed as a field that cylindrical barium ferrite magnet (5) is fixed in the motor housing, in which armature (4) is mounted. Worm gear (2) is machined around armature shaft (3), and rotating speed of the armature is reduced by means of helical gear (10) and is transferred to motor shaft.

As the helical gear is turning, lever (6) which is attached to arm shaft (7) is oscillated by the function of rod (9), crank A (8) and crank B (1).

- | | |
|--------------------|-------------------|
| (1) Crank B | (7) Arm Shaft |
| (2) Worm Gear | (8) Crank A |
| (3) Armature Shaft | (9) Rod |
| (4) Armature | (10) Helical Gear |
| (5) Magnet | (11) Brush |
| (6) Lever | |

W10173270



(2) Front Wiper / Washer Switch**■ Type 1 (Code No. T0270-71141, T1065-75380)**

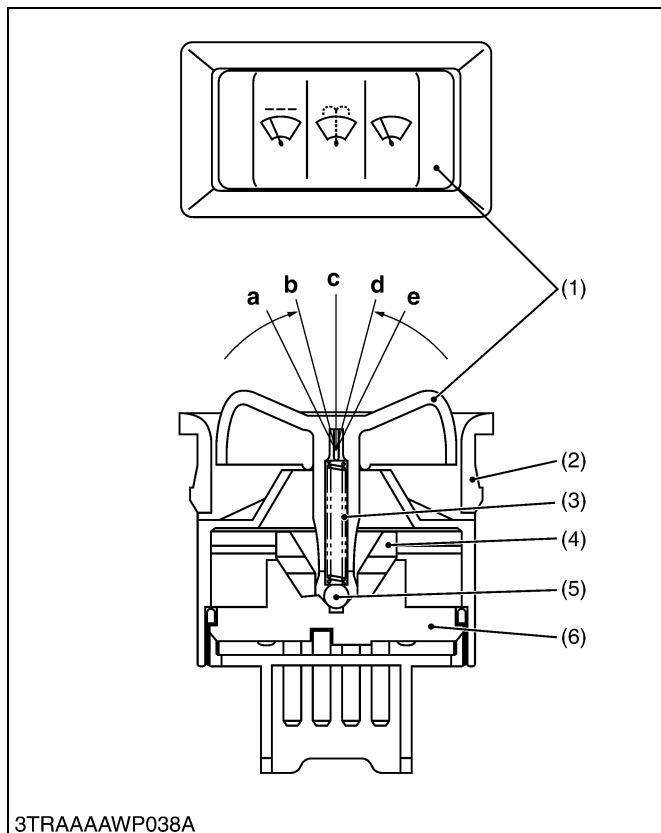
This switch has four positions; **WASH II**, **ON**, **OFF** and **WASH I**.

When the knob (1) pressed to **ON** position, the wiper is activated continuously. The washer fluid jets out while keeping the knob (1) at **WASH I** or **WASH II** position.

- (1) Knob
- (2) Body
- (3) Lamp
- (4) Insulator
- (5) Spring
- (6) Ball
- (7) Contact Holder

- a : **WASH II Position (Wiper with Washer Fluid)**
- b : **ON Position (Wiper Only)**
- c : **OFF Position**
- d : **WASH I Position (Washer Fluid Only)**

W10179460

**■ Type 2 (Code No. 3F260-75331)**

This switch has five positions; **WASH II**, **INT**, **OFF**, **ON** and **WASH I**.

When the knob (1) pressed to **ON** position, the wiper is activated continuously. And when the knob (1) pressed to **INT** position, the wiper is activated intermittently.

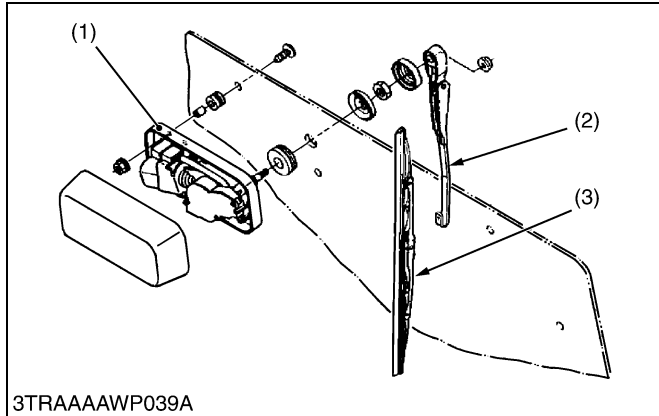
The washer fluid jets out while keeping the knob (1) at **WASH I** or **WASH II** position.

- (1) Knob
- (2) Body
- (3) Spring
- (4) Contact Holder
- (5) Ball
- (6) Insulator
- (7) Terminal Housing

- a : **WASH II Position (Wiper with Washer Fluid)**
- b : **INT Position (Wiper Only-Intermittent)**
- c : **OFF Position**
- d : **ON Position (Wiper Only-Continuous)**
- e : **WASH I Position (Wiper with Washer Fluid)**

W10177860

[2] REAR WINDSHIELD WIPER

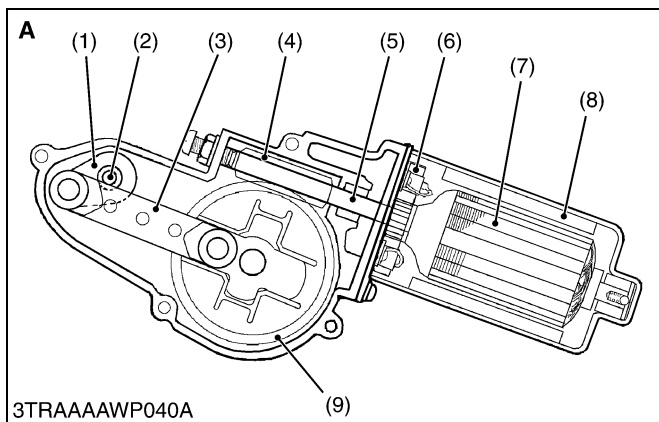


Rear wiper motor is of the ferrite magnet type and possesses the function to stop the wiper arm (2) at a desired position as same as the front wiper motor. Rotating speed is constant. The linkage mechanism which changes rotating movement of the crankshaft to oscillating movement of the wiper arm is provided in the motor, and the wiper arm is directly connected to the motor-output shaft. Wiping angle of the wiper arm is 1.57 rad. (90 °) or 1.92 rad. (110 °).

- (1) Rear Wiper Motor
- (2) Wiper Arm
- (3) Wiper Blade

W10220230

(1) Rear Wiper Motor

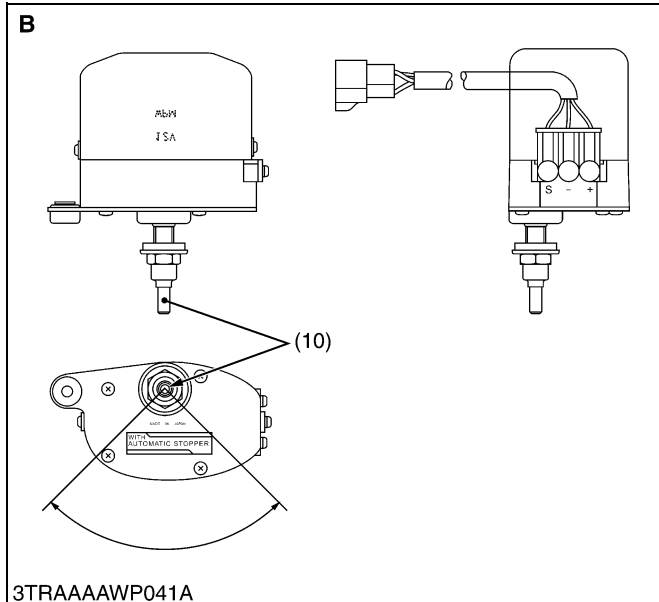


The rear wiper motor has basically the same structure with that of the front wiper motor, but it has two brushes only, so there is no such mechanism to change the rotating speed.

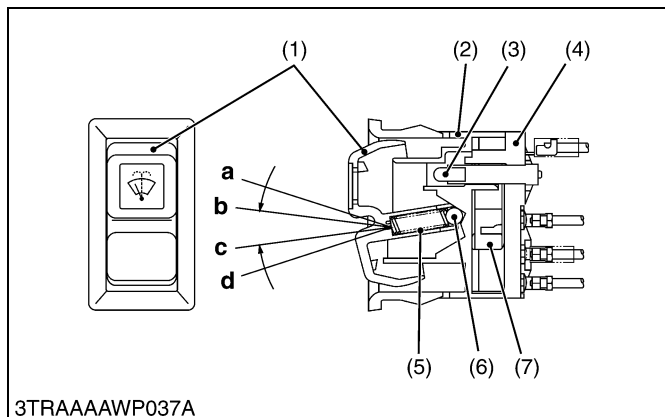
As the helical gear is turning, segment arm (1) which is attached to the arm shaft (2) is oscillated by the function of rod (3).

- (1) Segment Arm
 - (2) Arm Shaft
 - (3) Rod
 - (4) Worm Gear
 - (5) Armature Shaft
 - (6) Brush
 - (7) Armature
 - (8) Barium Ferrite Magnet
 - (9) Helical Gear
 - (10) Drive Shaft
- A : Type 1**
(Code No. 3F760-55781)
- B : Type 2**
(Code No. T0070-72671)

W10220760



(2) Rear Wiper / Washer Switch



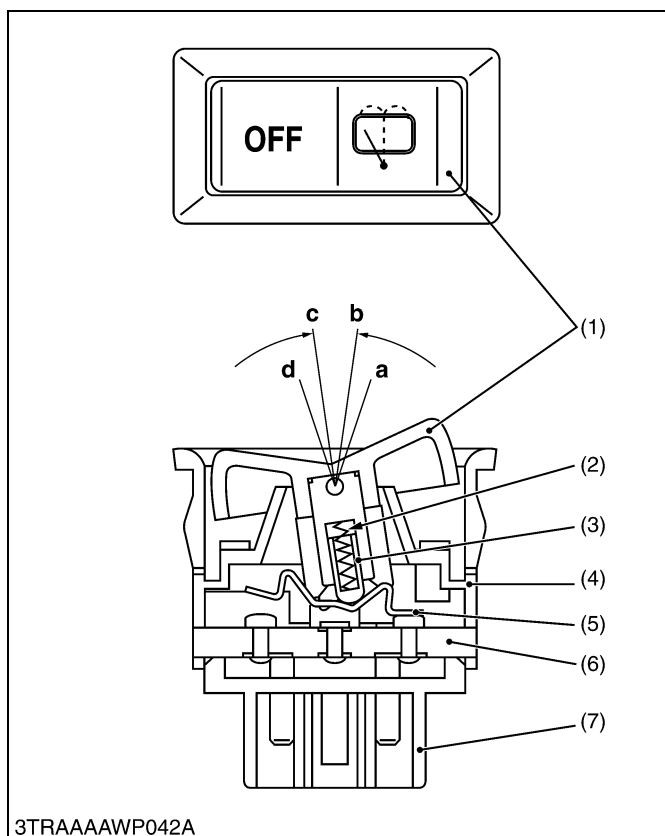
■ **Type 1 (Code No. T0070-71141, T1065-75393)**

This switch has four positions; **WASH II, ON, OFF** and **WASH I**.

When the knob (1) pressed to **ON** position, the wiper is activated continuously. The washer fluid jets out while keeping the knob (1) at **WASH I** or **WASH II** position.

- | | |
|--------------------|---|
| (1) Knob | a : WASH II Position (Wiper with Washer Fluid) |
| (2) Body | b : ON Position (Wiper Only) |
| (3) Lamp | c : OFF Position |
| (4) Insulator | d : WASH I Position (Washer Fluid Only) |
| (5) Spring | |
| (6) Ball | |
| (7) Contact Holder | |

W10189930



■ **Type 2 (Code No. 3F760-75341)**

This switch has four positions; **WASH I, OFF, ON** and **WASH II**.

When the knob (1) pressed to **ON** position, the wiper is activated continuously. The washer fluid jets out while keeping the knob (1) at **WASH I** or **WASH II** position.

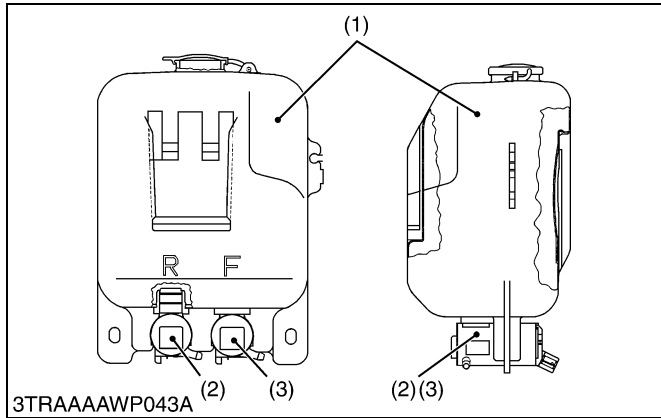
- | | |
|----------------------|---|
| (1) Knob | a : WASH I Position (Washer Fluid Only) |
| (2) Spring | b : OFF Position |
| (3) Contact | c : ON Position (Wiper Only) |
| (4) Body | d : WASH II Position (Wiper with Washer Fluid) |
| (5) Movable Contact | |
| (6) Insulator | |
| (7) Terminal Housing | |

W10188370

[3] WINDOW WASHER

The window washer is of the electric washer using a small size high speed motor and consists of tank, pump, nozzle, etc..

(1) Washer Tank



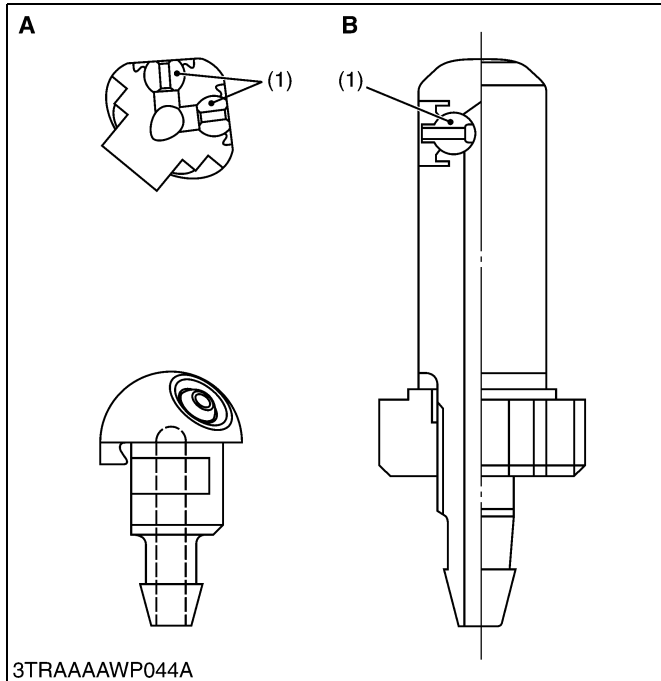
The washer tank capacity is 2.0 L (2.1 U.S.qts., 1.8 Imp.qts.).

Washer pump is mounted under the tank, and is driven by a motor. When the motor starts running, washer is drawn through the suction inlet and discharged through the discharge outlet to the washer nozzle.

- (1) Tank
- (2) Pump (Rear)
- (3) Pump (Front)

W10192550

(2) Washer Nozzle



The washer nozzle has single jetting hole or two jetting holes, and jetting angle can be adjusted by turning the jet (1).

- (1) Jet

- A : Type 1 (Code No. TA140-71171, 36919-54181)**
- B : Type 2 (Code No. 3F760-54181)**

W10193450

11 OTHERS

CONTENTS

1.	TABLE 1 -----	O-1
	[1] HYDRAULIC RELATED PARTS -----	O-1
	[2] ELECTRICAL RELATED PARTS -----	O-3
	[3] CABIN COMPONENT -----	O-7
2.	TABLE 2 -----	O-11
	[1] HYDRAULIC RELATED PARTS -----	O-11
	[2] ELECTRICAL RELATED PARTS -----	O-14
	[3] CABIN COMPONENT -----	O-18

NOTE: This chapter has described the above-mentioned parts of each model used by parts name and code number. Use it as a quick reference chart when you use Tractor Mechanism Workshop Manual.

Table 1 includes following models.

B	B1410, B1610, B1710, B2110, B2410, B2710, B2910, B7400, B7500,
L	ST α -30, ST α -35, L2600, L2500, L3000, L4300, L3010(L2900), L3410(L3300), L3300CAB, L3710(L3600), L3710CAB, L4310(L4200), L4310CAB, L4610, L4610CAB
M	M4900, M4900CAB, M5700, M5700CAB, M6800, M6800CAB, M8200, M8200CAB, M9000, M9000CAB, M110, M120

Table 2 includes following models.

B	B7410, B7510, B7610, B7800, B2630, B3030, B3030CAB,
L	L2800, L3400, L4400, L3130, L3430, L3430CAB, L3830, L4330, L4330CAB, L4630, L4630CAB, L5030, L5030CAB, STV32, STV36, STV40
M	MX5000, M4800, M5700HD, M5700HDCAB, M6800HD, M6800HDCAB, M8200HD, M8200HDCAB, M9000HD, M9000HDCAB, ME5700, ME5700CAB, ME8200, ME8200CAB, ME9000, ME9000CAB, M95S, M105S, M95X, M105X, M125X

1. TABLE1
[1] HYDRAULIC RELATED PARTS

	HST Assy	Steering Controller-1	Steering Controller-2	Flow Priority Valve	Regulator Valve	Bi-speed Valve	PTO Clutch Valve	3P Hydraulic system												
								Relief Valve	Manual Control Valve	Position Control Valve-1	Position Control Valve-2									
B	B1410	6C150-11603								6C080-36200 ↑ 6C120-36200										
	B1610																			
	B7400																			
	B1710												6C070-41104							6C070-36202
	B7500												6C140-41213							
	B2110												6C070-41104							
	B2410												↑							
	B2710												↑							
B2910	↑																			
L	Sta-30	TA470-39000	TA470-37000		T0430-36700		T0411-99310				T0430-37500									
	Sta-35	↑	↑		↑		↑				↑									
	L2600		6C070-41104		35270-16710						31351-39604	31391-39002								
	L2500		↑		↑						↑	↑								
	L3000		↑		↑						↑	↑								
	L4300		TA040-37002			T1060-19050		TA040-69300			↑									
	L3010(L2900)	TA240-58004	↑			TA040-66010		↑			↑									
	L3410(L3300)	↑	↑			↑		↑			↑									
	L3300CAB	↑	↑			↑		↑			↑									
	L3710(L3600)	↑	↑			↑		↑			↑									
	L3710CAB	↑	↑			↑		↑			↑									
	L4310(L4200)	↑	↑			↑		↑			↑									
	L4310CAB	↑	↑			↑		↑			↑									
	L4610	↑	TA150-37000			TA040-66050		↑			↑									
L4610CAB	↑	↑					↑			↑										
M	M4900		3A111-63070					3A111-27400	3A121-82360		38240-39143									
	M4900CAB		↑					↑	↑		↑									
	M5700		↑	3A011-63072				↑	↑		↑									
	M5700CAB		↑					↑	↑		↑									
	M6800		↑					↑	↑		↑									
	M6800CAB		↑					↑	↑		↑									
	M8200		↑	3A011-63072			YW273-00100	↑	3F740-82360		3A151-82300	38240-39143								
	M8200CAB		↑					↑	↑		↑	↑								
	M9000		↑					↑	↑		↑									
	M9000CAB		↑					↑	↑		↑									
	M-110		3F240-63071	3F250-63072			3F250-23110	3F240-27402	↑											
M-120		↑	↑			↑	↑	↑												

	3P Hydraulic system				Auxiliary Control Valve						
	Draft Control Valve	Solenoid Proportional Control Valve	Cylinder Safety Valve	Lowering Speed Adjusting Valve	Double Acting	Double Acting (*FD)	Double Acting (*SCD)	Double Acting (*SCD-FC)	Single / Double Acting	Combination Type	Flow Control Valve
B	B1410										
	B1610										
	B7400										
	B1710					6C142-38400					
	B7500										
	B2110					6C142-38400					
	B2410					↑					
	B2710					↑					
B2910											
L	Sta-30									TA470-38000	
	Sta-35									↑	
	L2600	35080-41100			TC020-37200						
	L2500	↑			↑	35340-99420					
	L3000	↑			↑	↑					
	L4300			YW125-00102							
	L3010(L2900)			↑	TA040-34500						
	L3410(L3300)			↑	↑						
	L3300CAB				↑						
	L3710(L3600)			YW125-00102	↑						
	L3710CAB			↑	↑						
	L4310(L4200)			↑	↑						
	L4310CAB			↑	↑						
	L4610			↑	↑						
L4610CAB			↑	↑							
M	M4900			3G700-82402			3A031-82800	3A111-82540		3A031-82350	
	M4900CAB			↑			3G710-82812	3A751-82540	3A751-82560	3G700-82350	3A151-82610
	M5700			↑			3A031-82800	3A111-82540		3A031-82350	
	M5700CAB			↑			3G710-82812	3A751-82540	3A751-82560	3G700-82350	3A151-82610
	M6800			↑			3A031-82800	3A111-82540		3A031-82350	
	M6800CAB			↑			3G710-82812	3A751-82540	3A751-82560	3G700-82350	3A151-82610
	M8200			3F740-82400			3F740-82810	3A151-82540	3A151-82560	3F740-82350	↑
	M8200CAB			↑			3G710-82812	3A751-82540	3A751-82560	3G700-82350	↑
	M9000			↑			3F740-82810	3A151-82540	3A151-82560	3F740-82350	↑
	M9000CAB			↑			3G710-82812	3A751-82540	3A751-82560	3G700-82350	↑
	M-110		3F740-82300	↑	3F740-82270		3F740-82810	3A151-82540	3A151-82560		↑
	M-120		↑	↑	↑		↑	↑	↑		↑

*FD :Floating with Detent

*SCD: Self Cancelling with Detent

*SCD-FC: Self Cancelling with Detent for Flow Control Valve

[2] ELECTRICAL RELATED PARTS

		Starting System										
		Main Switch	Starter-1	Starter-2	Glow Plug 1	Glow Plug 2	Glow Relay	Glow Controller	Glow Lamp Timer	Engine Stop Solenoid 1	Engine Stop Solenoid 2	Key Stop Timer
B	B1410	6C040-55452	6C090-59210		16851-65510							
	B1610	↑	↑		↑							
	B7400	↑	6C090-59300		↑							
	B1710	↑	6C140-59210		↑					6A320-31150		
	B7500	↑	↑		↑							
	B2110	↑	↑		↑					6A320-31150		
	B2410	↑	↑		↑					↑	32721-60010	
	B2710	↑	6C070-59210		↑					↑	↑	
B2910	↑	↑		↑					↑	↑		
L	Sta-30	37410-59110	T1150-16800		19077-65510	16415-65510			15694-65990	1A021-60013		
	Sta-35	↑	↑		↑				↑	↑		
	L2600	TC020-31820	T1060-16800		↑	16415-65510						
	L2500	↑	34070-16800		16415-65510							
	L3000	↑	T1060-16800		19077-65510	16415-65510						
	L4300	↑	17341-63010		↑		T1060-33710					
	L3010(L2900)	34670-31822	34070-16800		↑	16415-65510	16415-65600	16415-65660		15471-60010		T0070-31410
	L3410(L3300)	↑	↑		↑		↑	↑		↑		↑
	L3300CAB	T0270-81810	↑		↑		↑	↑		↑		↑
	L3710(L3600)	34670-31822	17341-63010		↑	16415-65510	↑	↑		↑		↑
	L3710CAB	T0270-81810	↑		↑	↑	↑	↑		↑		↑
	L4310(L4200)	34670-31822	↑		↑	↑	↑	↑		↑		↑
	L4310CAB	T0270-81810	↑		↑		↑	↑		↑		↑
L4610	34670-31822	↑		↑		↑	↑		↑		↑	
L4610CAB	T0270-81810	↑		↑		↑	↑		↑		↑	
M	M4900	52200-41212	15621-63012		19077-65510		35593-75210			15471-60010		T0070-31410
	M4900CAB	36919-75162	↑	1G835-63010	↑		↑			↑		↑
	M5700	52200-41212	↑		↑		↑			↑		↑
	M5700CAB	36919-75162	↑	1G835-63010	↑		↑			↑		↑
	M6800	52200-41212	1C010-63010				↑			1C010-60014		↑
	M6800CAB	36919-75162	↑				↑			↑		↑
	M8200	52200-41212	↑				↑			↑		↑
	M8200CAB	36919-75162	↑				↑			↑		↑
	M9000	52200-41212	↑				↑			↑		↑
	M9000CAB	36919-75162	↑				↑			↑		↑
	M-110	↑	16551-63010									
M-120	↑	↑										

		Starting System							Charging System		
		Key Stop Relay	Starter Relay	Safety Switch 1 (Clutch Pedal)	Safety Switch 2 (HST Pedal)	Safety Switch 3 (PTO)	Safety Switch 4 (Shift Lever, Shuttle Lever)	Seat Switch	Operator Presence Controller	Alternator-1	Alternator-2
B	B1410					6A320-42770	6A320-42770			16241-64010	
	B1610					↑	↑			↑	
	B7400			6C040-55852	52320-42900	52320-42900					
	B1710			↑		↑	6A320-42770			16241-64010	
	B7500			↑	52320-42900	↑	↑			↑	
	B2110			↑		↑	↑			66436-64010	16241-64010
	B2410			↑	52320-42900	↑	↑	K1122-62280	6C190-55510	↑	↑
	B2710			↑	↑	↑		↑	↑	↑	↑
B2910			↑	↑	↑		↑	↑	↑		
L	Sta-30		T1060-33720	52320-42900	52320-42900	T0430-32370				T1060-15600	
	Sta-35		↑	↑	↑	↑				↑	
	L2600					37150-32240	T1060-42786			↑	T1060-15680
	L2500					↑	37150-32240			16427-164012	
	L3000					TC020-32242	T1060-42786			T1060-15600	T1060-15680
	L4300					TA040-43900	↑	TD060-47902	TD060-30500	↑	↑
	L3010(L2900)		35800-75070		52320-42900	↑	TA040-43900			34070-75600	
	L3410(L3300)		↑		↑	↑	↑			↑	
	L3300CAB		↑		↑	↑	↑			TA040-74010	
	L3710(L3600)		↑		52320-42900	↑	↑			34070-75600	
	L3710CAB		↑		↑	↑	↑			TA043-74010	
	L4310(L4200)		↑		↑	↑	TA040-43900			34070-75600	
	L4310CAB		↑		↑	↑	↑			TA043-74010	
	L4610		↑		TA240-53900	↑	↑			34070-75600	
L4610CAB		↑		↑	↑				TA043-74010		
M	M4900		35800-75070			TA040-43900	3A011-75100		3A272-75250	3A011-74010	
	M4900CAB	3A111-75080	3G700-75080			↑	↑		↑	3A611-74010	3A612-74010
	M5700		35800-75070			↑	↑		↑	3A011-74010	
	M5700CAB	3A111-75080	3G700-75080			↑	↑		↑	3A611-74010	3A612-74010
	M6800	↑	↑			↑	↑		↑	1C010-64010	3A251-74010
	M6800CAB	↑	↑			↑	↑		↑	1C011-64010	3A651-74010
	M8200	↑	↑			↑	3A151-75100		↑	1C010-64010	3A251-74010
	M8200CAB	↑	↑			↑	↑		↑	1C011-64010	3A651-74010
	M9000	↑	↑			↑	↑		↑	1C010-64010	3A251-74010
	M9000CAB	↑	↑			↑	↑		↑	1C011-64010	3A651-74010
	M-110					↑		3F460-85210	↑	3F261-64010	3M760-64010
	M-120					↑		↑	↑	↑	↑

		Charging System		Lighting System										
		Dynamo	Regulator	Flasher Unit-1	Flasher Unit-2	Hazard Unit	Combination Switch-1	Combination Switch-2	Hazard Switch-1	Hazard Switch-2	Position Switch	Brake Switch		
B	B1410	6C040-59250	RP201-53710	6C080-30500			6C042-55422		6C070-55430		R2401-53272	6C080-31010		
	B1610			↑			↑		↑		↑		↑	
	B7400					3F240-75430			6C070-55420		6C070-55430			
	B1710	6C040-59250	RP201-53710	6C080-30500			6C042-55422		↑		R2401-53272	6C080-31010		
	B7500			3F240-75430			6C070-55420		↑					
	B2110			↑	↑	↑	6C080-30500		6C042-55422		↑	R2401-53272	6C080-31010	
	B2410			↑	↑	↑	↑		6C070-55420	6C042-55422	↑		↑	↑
	B2710			↑	↑	↑	↑		↑	↑	↑		↑	↑
B2910	↑	↑	↑			↑		↑						
L	Sta-30			6C080-30500			37410-55120		TA140-30910		37500-55312	TA470-31200		
	Sta-35			↑			↑		↑		↑	↑		
	L2600			3F240-75430			31351-32100		↑					
	L2500			↑	66706-55810	32400-33700	↑		37500-55212			36330-75480		
	L3000			↑	↑	↑	↑		TA140-30910			↑		
	L4300			↑			↑		↑					
	L3010(L2900)			↑		32400-33700	3A751-75010	37410-55120	37500-55212	TA140-30910	37500-55312	33740-75480		
	L3410(L3300)			↑	66466-55822	↑	↑	↑	↑	↑	↑	↑		
	L3300CAB			↑	↑		↑	↑	↑	↑	↑	↑		
	L3710(L3600)			↑	↑	32400-33700	↑	↑	↑	↑	↑	↑		
	L3710CAB			↑	↑	↑	↑	↑	↑	↑	↑	↑		
	L4310(L4200)			↑	↑	↑	↑	↑	↑	↑	↑	↑		
	L4310CAB			↑	↑	↑	↑	↑	↑	↑	↑	↑		
L4610			↑			↑			↑					
L4610CAB			↑			↑	37410-55120		↑					
M	M4900			3F240-75430	32400-33700		36330-75010	36760-75010	37500-55212			33740-75480		
	M4900CAB			↑	↑		3A751-75010	37410-55120	3A751-75040			↑		
	M5700			↑	↑		36330-75010	36760-75010	37500-55212			↑		
	M5700CAB			↑	↑		3A751-75010	37410-55120	3A751-75040			↑		
	M6800			↑	↑		36330-75010	36760-75010	37500-55212			↑		
	M6800CAB			↑	↑		3A751-75010	37410-55120	3A751-75040			↑		
	M8200			↑	↑		36330-75010	36760-75010	37500-55212			↑		
	M8200CAB			↑	↑		3A751-75010	37410-55120	3A751-75040			↑		
	M9000			↑	↑		36330-75010	36760-75010	37500-55212			↑		
	M9000CAB			↑	↑		3A751-75010	37410-55120	3A751-75040			↑		
	M-110			↑	33740-75430							↑		
M-120			↑	↑							↑			

		Easy Checker								Others	
		Instrument Panel-1	Instrument Panel-2	Fuel Level Sensor-1	Fuel Level Sensor-2	Coolant Temperature Sensor	Coolant Temperature Switch	Hand Brake Switch	Oil Pressure Switch	Air Cleaner Sensor	Trailer Socket
B	B1410	6C080-30200		6C090-54750		31351-32830			15531-39010		6C080-30350
	B1610	↑		↑		↑			↑		↑
	B7400	6C110-55100		6C090-54750		↑			↑		
	B1710	6C080-30200		6C040-54752		↑			↑		6C080-30350
	B7500	6C140-55100		6C120-54750		↑			↑		
	B2110	↑	6C080-30200	6C040-54752		↑			↑		6C080-30350
	B2410	↑	↑	↑		↑			↑		↑
	B2710	↑	↑	↑		↑			↑		↑
B2910	↑		↑		↑			↑			
L	Sta-30	TA470-30210		T0430-53620		31351-32830			15531-39010		66709-55854
	Sta-35	↑		↑		↑			↑		↑
	L2600	TC020-30210		TC020-31202		32330-32830			↑		
	L2500	↑		↑		↑			↑		66709-55854
	L3000	↑		↑		↑			↑		↑
	L4300	↑		↑		↑			↑		
	L3010(L2900)	TA120-30210	TA149-30210	TA040-31202		31351-32830	16415-83040	TA040-43900	↑	15831-11090	66709-55854
	L3410(L3300)	↑	↑	↑		↑	↑	↑	↑	↑	↑
	L3300CAB	TA140-30210		↑		↑	↑		↑	↑	
	L3710(L3600)	↑	TA149-30210	↑		↑	↑	TA040-43900	↑	↑	66709-55854
	L3710CAB	↑		↑		↑	↑		↑	↑	
	L4310(L4200)	↑	TA149-30210	↑		↑	↑	TA040-43900	↑	↑	66709-55854
	L4310CAB	↑		↑		↑	↑		↑	↑	
L4610	↑		↑		↑	↑		↑	↑		
L4610CAB	↑		↑		↑	↑		↑	↑		
M	M4900	3A211-75600	3A214-75600	3A011-75302		31351-32830			15531-39010	15831-11090	99884-48110
	M4900CAB	3A751-77500	3A754-77500	3A751-75300		↑			↑	↑	↑
	M5700	3A211-75600	3A214-75600	3A011-75302		↑			↑	↑	↑
	M5700CAB	3A751-77500	3A754-77500	3A751-75300		↑			↑	↑	↑
	M6800	3A152-75600		3A111-75300		↑			15841-39010	↑	↑
	M6800CAB	3A751-77500		3A751-75300		↑			↑	↑	↑
	M8200	3A151-75600		3A151-75300	3A481-75300	↑			↑	↑	↑
	M8200CAB	3A751-77500	3A754-77500	3A751-75300		↑			↑	↑	↑
	M9000	3A151-75600		3A151-75300		↑			↑	↑	↑
	M9000CAB	3A751-77500	3A754-77500	3A751-75300		↑			↑	↑	↑
	M-110	3F260-75602		3H760-75300		38240-32830	15668-83040	TA049-43900	15451-39012	↑	3F263-77920
M-120	↑		↑		↑	↑	↑	↑	↑	↑	

[3] CABIN COMPONENT

		Air Conditioner										
		Air Conditioner Unit-1	Air Conditioner Unit-2	Air Conditioner Unit-3	Compressor-1	Compressor-2	Compressor-3	Magnet Clutch-1	Magnet Clutch-2	Magnet Clutch-3	Magnet Clutch-4	Condensor
B	B1410											
	B1610											
	B7400											
	B1710											
	B7500											
	B2110											
	B2410											
	B2710											
B2910												
L	Sta-30											
	Sta-35											
	L2600											
	L2500											
	L3000											
	L4300											
	L3010(L2900)											
	L3410(L3300)											
	L3300CAB	T0270-72410										
	L3710(L3600)											
	L3710CAB	T0270-87200	T1065-72100		T0070-87290			T0070-87310				TA240-87280
	L4310(L4200)											
L4310CAB	T0270-87200	T1065-72100		T0070-87290			T0070-87310				TA240-87280	
L4610												
L4610CAB	T0270-87200	T1065-72100		T0070-87290			T0070-87310				TA240-87280	
M	M4900											
	M4900CAB	3G710-50030	3G910-50032	3A851-50033	T0070-87290	T1065-72213	6A671-97110	T0070-87310	T1065-89310	6A671-97210	6A671-97310	3G710-50040
	M5700											
	M5700CAB	3G710-50030	3G910-50032	3A851-50033	T0070-87290	T1065-72213	6A671-97110	T0070-87310	T1065-89310	6A671-97210	6A671-97310	3G710-50040
	M6800											
	M6800CAB	3G710-50030	3G910-50032	3A851-50033	T0070-87290	T1065-72213	6A671-97110	T0070-87310	T1065-89310	6A671-97210	6A671-97310	3G710-50040
	M8200											
	M8200CAB	3G710-50030	3G910-50032	3A851-50033	T0070-87290	T1065-72213	6A671-97110	T0070-87310	T1065-89310	6A671-97210	6A671-97310	3G710-50040
	M9000											
M9000CAB	3G710-50030	3G910-50032	3A851-50033	T0070-87290	T1065-72213	6A671-97110	T0070-87310	T1065-89310	6A671-97210	6A671-97310	3G710-50040	
M-110	3F761-50033			33770-50050	↑	↑	33770-96110	↑	6A671-97310		33770-50042	
M-120	↑			↑	↑	↑	↑	↑	↑		↑	

		Air Conditioner									
		Receiver	Expansion Valve-1	Expansion Valve-2	Evaporator-1	Evaporator-2	Water Valve-1	Water Valve-2	Blower Motor-1	Blower Motor-2	Blower Switch
B	B1410										
	B1610										
	B7400										
	B1710										
	B7500										
	B2110										
	B2410										
	B2710										
B2910											
L	Sta-30										
	Sta-35										
	L2600										
	L2500										
	L3000										
	L4300										
	L3010(L2900)										
	L3410(L3300)										
	L3300CAB						T0270-72520				
	L3710(L3600)										
	L3710CAB	T0070-79270	T1065-72170		T0270-87340		T0270-72520		T1065-72150		
	L4310(L4200)										
L4310CAB	T0070-79270	T1065-72170		T0270-87340		T0270-72520		T1065-72150			
L4610											
L4610CAB	T0070-79270	T1065-72170		T0270-87340		T0270-72520		T1065-72150			
M	M4900										
	M4900CAB	T0070-79270	T1065-72170	3A851-72170	T0270-87340	3A851-72100	3G710-72500		3A851-72150		3A851-72040
	M5700										
	M5700CAB	T0070-79270	T1065-72170	3A851-72170	T0270-87340	3A851-72100	3G710-72500		3A851-72150		3A851-72040
	M6800										
	M6800CAB	T0070-79270	T1065-72170	3A851-72170	T0270-87340	3A851-72100	3G710-72500		3A851-72150		3A851-72040
	M8200										
	M8200CAB	T0070-79270	T1065-72170	3A851-72170	T0270-87340	3A851-72100	3G710-72500		3A851-72150		3A851-72040
	M9000										
	M9000CAB	T0070-79270	T1065-72170	3A851-72170	T0270-87340	3A851-72100	3G710-72500		3A851-72150		3A851-72040
M-110	33770-56810	33770-96120		3F760-96190		36919-96230	3F260-96230	3F760-57020(R), 3F760-57030(L)	3M760-57020(R), 3M760-57030(L)	36919-96140	
M-120	↑	↑		↑		↑	↑	↑	↑	↑	

		Air Conditioner					Wiper				
		Air Conditioner Switch or Panel Switch 1	Air Conditioner Switch or Panel Switch 2	Pressure Switch 1	Pressure Switch 2	Thermo Switch	Front Wiper Motor	Rear Wiper Motor 1	Rear Wiper Motor 2	Front Washer Switch	Rear Washer Switch
B	B1410										
	B1610										
	B7400										
	B1710										
	B7500										
	B2110										
	B2410										
	B2710										
B2910											
L	Sta-30										
	Sta-35										
	L2600										
	L2500										
	L3000										
	L4300										
	L3010(L2900)										
	L3410(L3300)										
	L3300CAB	T0270-72420					T0270-71110	T0070-72670		T0270-71140	T0070-71140
	L3710(L3600)										
	L3710CAB	T0270-87232				T1065-72160	T0270-71110	T0070-72670		T0270-71140	T0070-71140
	L4310(L4200)										
L4310CAB	T0270-87232				T1065-72160	T0270-71110	T0070-72670		T0270-71140	T0070-71140	
L4610											
L4610CAB	T0270-87232				T1065-72160	T0270-71110	T0070-72670		T0270-71140	T0070-71140	
M	M4900										
	M4900CAB	3G710-50082	3A851-72010	33770-96290	3A761-96290	T1065-72160	T0270-71110	3F760-55780	3M760-55782	3F260-75330	3F760-75340
	M5700										
	M5700CAB	3G710-50082	3A851-72010	33770-96290	3A761-96290	T1065-72160	T0270-71110	3F760-55780	3M760-55782	3F260-75330	3F760-75340
	M6800										
	M6800CAB	3G710-50082	3A851-72010	33770-96290	3A761-96290	T1065-72160	T0270-71110	3F760-55780	3M760-55782	3F260-75330	3F760-75340
	M8200										
	M8200CAB	3G710-50082	3A851-72010	33770-96290	3A761-96290	T1065-72160	T0270-71110	3F760-55780	3M760-55782	3F260-75330	3F760-75340
	M9000										
M9000CAB	3G710-50082	3A851-72010	33770-96290	3A761-96290	T1065-72160	T0270-71110	3F760-55780	3M760-55782	3F260-75330	3F760-75340	
M-110	36919-96130	T0180-81850	↑	↑	33770-96240	3F760-53980	↑	↑	↑	↑	
M-120	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	

		Wind Washer		
		Window Washer	Front Wiper Nozzle	Rear Wiper Nozzle
B	B1410			
	B1610			
	B7400			
	B1710			
	B7500			
	B2110			
	B2410			
	B2710			
B2910				
L	Sta-30			
	Sta-35			
	L2600			
	L2500			
	L3000			
	L4300			
	L3010(L2900)			
	L3410(L3300)			
	L3300CAB	3F760-55760	TA140-71170	3F760-54180
	L3710(L3600)			
	L3710CAB	3F760-55760	TA140-71170	3F760-54180
	L4310(L4200)			
	L4310CAB	3F760-55760	TA140-71170	3F760-54180
L4610				
L4610CAB	3F760-55760	TA140-71170	3F760-54180	
M	M4900			
	M4900CAB	3G710-55760	3F760-54180	3F760-54180
	M5700			
	M5700CAB	3G710-55760	3F760-54180	3F760-54180
	M6800			
	M6800CAB	3G710-55760	3F760-54180	3F760-54180
	M8200			
	M8200CAB	3G710-55760	3F760-54180	3F760-54180
	M9000			
	M9000CAB	3G710-55760	3F760-54180	3F760-54180
M-110	3F760-55760	36919-54180	↑	
M-120	↑	↑	↑	

2.TABLE 2
[1] HYDRAULIC RELATED PARTS

	HST Assy	GST Valve Assy	Dual Speed Valve	Power Shift Valve	Shuttle Valve	Steering Controller-1	Steering Controller-2	Regulator Valve	Bi-speed Valve	Trailer Brake Valve
B	B7410					6C110-41100				
	B7510	6C150-11603				6C070-41105				
	B7610	↑				↑				
	B7800	↑				↑				
	B2630	6C200-11604				6C200-41100				
	B3030	↑				↑				
	B3030CAB	↑				↑				
L	L2800	TC220-59990				TC220-37000				
	L3400	↑				↑				
	L4400					↑		T1060-19050		
	L3130	TD020-59992	T1063-65004			TD030-37000		T1170-19050		
	L3430	↑	↑			↑		↑		
	L3430CAB	↑	↑			↑				
	L3830	↑	↑			↑		T1170-19050		
	L4330	TD060-59994	↑			TD060-37000		↑		
	L4330CAB	↑	↑			↑				
	L4630	↑	↑			↑		T1170-19050		
	L4630CAB	↑	↑			↑		↑		
	L5030	↑	↑			↑		↑		
	L5030CAB	↑	↑			↑				
	STV32	TA530-39000				TA530-37002		TA530-19050	YW255-00102	
STV36	↑				↑		↑	↑		
STV40	↑				↑		↑	↑		
M	MX5000					TA150-37004	TC050-37100	T1060-19050		
	M4800					3A111-63070				
	M5700HD				3A051-23803	↑				
	M5700HDCAB				3A691-23800	↑				
	M6800HD				3A051-23803	↑				
	M6800HDCAB				3A691-23800	↑				
	M8200HD				↑	↑				
	M8200HDCAB				↑	↑				
	M9000HD				↑	↑				
	M9000HDCAB				↑	↑				
	ME5700				3A051-23803	↑	3A011-63072			
	ME5700CAB				↑	↑				
	ME8200				3A691-23800	↑	3A471-63071		YW273-00100	33963-69113
	ME8200CAB				↑	↑				↑
	ME9000				↑	↑			YW273-00100	↑
	ME9000CAB				↑	↑				↑
	M95S			YW217-00100		YW119-00103	3N300-63070		YW177-00100	
	M105S			↑		↑	↑		↑	
M95X				3P300-23100	3P300-23100	↑		YW250-00100	3P300-23100	
M105X				↑	↑	↑		↑	↑	
M125X				↑	↑	↑		↑	↑	

	PTO Clutch Valve 1	PTO Clutch Valve 2	3P Hydraulic system							
			Relief Valve	Manual Control Valve	Position Control Valve-1	Position Control Valve-2	Draft Control Valve	Cylinder Safety Valve	Lowering speed Adjusting Valve	
B	B7410			YW176-00100						
	B7510			↑	6C070-36202					
	B7610			↑						
	B7800			↑						
	B2630	6C200-11200				YR906-00106				
	B3030	↑				↑				
	B3030CAB	↑				↑				
L	L2800					31391-39002		35080-41100	YW125-00102	31351-37200
	L3400					↑		↑	↑	↑
	L4400	TD060-69300				↑			↑	↑
	L3130	↑	TD060-51450			YW276-00100			↑	T1060-35300
	L3430	↑	↑			↑			↑	↑
	L3430CAB	TD060-51450				↑			↑	↑
	L3830	TD060-69300	TD060-51450						↑	↑
	L4330	↑	↑						↑	↑
	L4330CAB	TD060-51450							↑	↑
	L4630	TD060-69300	TD060-51450						↑	↑
	L4630CAB	↑							↑	↑
	L5030	↑	TD060-51450						↑	↑
	L5030CAB	TD060-51450							↑	↑
	STV32	YW255-00102					T0430-37500			
STV36	↑					↑				
STV40	↑					↑				
M	MX5000	TA040-69300				31351-39604			YW125-00102	
	M4800	3A111-27400		3A121-82360		38240-39143			YR827-00100	
	M5700HD	↑		↑		32530-39150			↑	
	M5700HDCAB	↑		↑		↑			↑	
	M6800HD	↑		↑		↑			↑	
	M6800HDCAB	↑		↑		↑			↑	
	M8200HD	↑		3F740-82360		3A151-82300			YR516-55100	
	M8200HDCAB	↑		↑		↑			↑	
	M9000HD	↑		↑		↑			↑	
	M9000HDCAB	↑		↑		↑			↑	
	ME5700	↑	3A011-27400	3A121-82360		32530-39150	38240-39143		YR827-00100	
	ME5700CAB	↑		↑		↑			↑	
	ME8200	↑	↑	3F740-82360		3A151-82300	38240-39143		YR516-55100	
	ME8200CAB	↑		↑		↑			↑	
	ME9000	↑		↑		↑			↑	
	ME9000CAB	↑		↑		↑			↑	
	M95S	3N300-82294		↑		YW158-00100			↑	
	M105S	↑		↑		↑			↑	
M95X	3P300-82292		↑		3F740-82300			↑	3P300-82272	
M105X	↑		↑		↑			↑	↑	
M125X	↑		↑		↑			↑	↑	

		Auxiliary Control Valve						
		Double Acting	Double Acting (*FD)	Double Acting (*SCD)	Double Acting (*SCD-FC)	Single/Double Acting	Combination Type	Flow Contrl Valve (FC)
B	B7410							
	B7510							
	B7610							
	B7800							
	B2630	YW313-00101	YW312-00101					
	B3030	↑	↑					
	B3030CAB							
L	L2800							
	L3400							
	L4400	TA040-96112						
	L3130	YW089-00103	YW077-00103					
	L3430	↑	↑					
	L3430CAB	↑	↑					
	L3830	↑	↑					
	L4330	↑	↑					
	L4330CAB	↑	↑					
	L4630	↑	↑					
	L4630CAB	↑	↑					
	L5030	↑	↑					
	L5030CAB	↑	↑					
	STV32						YW277-00102	
STV36						↑		
STV40						↑		
M	MX5000	TA040-96112						
	M4800		3A031-82803	3A111-82540				
	M5700HD		↑	↑				
	M5700HDCAB		3G710-82813	3A751-82540	3A751-82560			3A151-82610
	M6800HD		3A031-82803	3A111-82540				
	M6800HDCAB		3G710-82813	3A751-82540	3A751-82560			3A151-82610
	M8200HD		3F740-82813	3A151-82540	3A151-82560			↑
	M8200HDCAB		3G710-82813	3A751-82540	3A751-82560			↑
	M9000HD		3F740-82813	3A151-82540	3A151-82560			↑
	M9000HDCAB		3G710-82813	3A751-82540	3A751-82560			↑
	ME5700		3A031-82803	3A111-82540	↑	3A031-82350		
	ME5700CAB		3G710-82813	3A751-82540	↑	3G700-82352		3A151-82610
	ME8200		3F740-82813	3A151-82540	3A151-82560	3F740-82352		↑
	ME8200CAB		3G710-82813	↑	↑	3G700-82352		↑
	ME9000		3F740-82813	↑	↑	3F740-82352		↑
	ME9000CAB		3G710-82813	↑	↑	3G700-82352		↑
	M95S		3G710-82813	3A751-82540	3A751-82560			↑
	M105S		↑	↑	↑			↑
M95X		3F740-82813	3A151-82540	3A151-82560			↑	
M105X		↑	↑	↑			↑	
M125X		↑	↑	↑			↑	

*FD :Floating with Detent

*SCD: Self Cancelling with Detent

*SCD-FC: Self Cancelling with Detent for Flow Control Valve

[2] ELECTRICAL RELATED PARTS

		Starting System										
		Main Switch	Starter	Glow Plug	Glow Relay	Glow Lamp Timer	Intake Air Heater	Heater Relay	Heater Timer	Engine Stop Solenoid	Key Stop Timer	
B	B7410	6C040-55452	6C090-59210 (0.85kw)	16851-65510						16851-60012	T0070-31410	
	B7510	↑	6C140-59210 (0.95kw)	↑						32721-60010		
	B7610	↑	↑	↑						↑		
	B7800	↑	6C070-59210 (1.4kw)	↑						↑		
	B2630	↑	↑	↑						↑		
	B3030	↑	↑	↑						↑		
	B3030CAB	↑	↑	↑						↑		
L	L2800	TC020-31820	34070-16800 (1.2kw)	19077-65510						1A021-60013		
	L3400	↑	↑	↑						↑		
	L4400	↑	T1150-16800 (1.4kw)	↑						↑		
	L3130	34670-31823	↑	↑	T1060-33710					↑		
	L3430	↑	↑	↑	↑					↑		
	L3430CAB	T0270-81810	↑	↑	↑					↑		
	L3830	34670-31823	↑	↑	↑					↑		
	L4330	↑	↑	↑	↑					↑		
	L4330CAB	T0270-81810	↑	↑	↑					↑		
	L4630	34670-31823	↑	↑	↑					↑		
	L4630CAB	T0270-81810	↑	↑	↑					↑		
	L5030	34670-31823	↑	↑	↑					↑		
	L5030CAB	T0270-81810	↑	↑	↑					↑		
	STV32	37410-59110	↑	↑	↑	15694-65990				↑		
STV36	↑	↑	↑	↑	↑				↑			
STV40	↑	↑	↑	↑	↑				↑			
M	MX5000	TC020-31820	17123-63016 (2.0kw)	19077-65510	T1060-33710					1A021-60013		
	M4800	66021-55140	15621-63012 (1.4kw)	↑	35593-75210							
	M5700HD	52200-41212,	↑	↑	↑					15471-60010	T0070-31410	
	M5700HDCAB	36919-75162	↑	↑	↑					↑	↑	
	M6800HD	52200-41212	1C010-63010 (2.5kw)	16415-65510	↑					1C010-60014	↑	
	M6800HDCAB	36919-75162	↑	↑	↑					↑	↑	
	M8200HD	52200-41212	↑	↑	↑					↑	↑	
	M8200HDCAB	36919-75162	↑	↑	↑					↑	↑	
	M9000HD	52200-41212	↑	↑	↑					↑	↑	
	M9000HDCAB	36919-75162	↑	↑	↑					↑	↑	
	ME5700	52200-41212	15621-63012 (1.4kw)	19077-65510	↑					15471-60010	↑	
	ME5700CAB	36919-75162	↑	↑	↑					↑	↑	
	ME8200	52200-41212	1C010-63010 (2.5kw)	16415-65510	↑					1C010-60014	↑	
	ME8200CAB	36919-75162	↑	↑	↑					↑	↑	
	ME9000	52200-41212	↑	↑	↑					↑	↑	
	ME9000CAB	36919-75162	↑	↑	↑					↑	↑	
	M95S	36919-75162	↑					1C020-65450	3N300-75210	3N300-75290	↑	
	M105S	↑	↑					1G574-65450	↑	↑	↑	
	M95X	↑	↑					1C020-65450	↑	↑	↑	
M105X	↑	↑					1G574-65450	↑	↑	↑		
M125X	↑	16551-63010 (3.0kw)					1G411-65450	3F240-75210		1G411-60030		

		Starting System										Charging System
		Key Stop Relay	Starter Relay	Safety Switch 1 (Clutch Pedal)	Safety Switch 2 (HST Pedal)	Safety Switch 3 (PTO-1)	Safety Switch 4 (PTO-2)	Safety Switch 5 (Shift Lever, shuttle lever)	Seat Switch	Seat Tilt Switch	Operator Presence Controller	Alternator
B	B7410		T1060-33720	6C040-55852		52320-42900		6A320-42770	K1122-62280	K1122-62280		
	B7510	T1060-33710		↑	52320-42900	↑	T2050-33780	↑	↑	↑	6C190-55510	16241-64012
	B7610	↑		↑	↑	↑	↑	↑	↑	↑	↑	↑
	B7800	↑		↑	↑	↑			↑	↑	↑	↑
	B2630	↑			↑	6A700-18810			↑	↑	↑	↑
	B3030	↑			↑	↑			↑	↑	↑	↑
	B3030CAB	↑			↑	↑			↑	↑	↑	16210-64012
L	L2800	T1060-33710	T1060-33720	6A100-30860	TD060-53900	T0430-32370		TC220-43900	TD060-47902		TD060-30500	T1060-15682
	L3400	↑	↑	↑	↑	↑		↑	↑		↑	↑
	L4400	↑	↑			T1060-43900		↑	↑		↑	↑
	L3130	↑	↑	TD060-57500	TD060-53900	TD060-42780		TD060-42772	↑		↑	↑
	L3430	↑	↑	↑	↑	↑		↑	↑		↑	↑
	L3430CAB	↑	↑	↑	↑	↑			↑		↑	3A611-74012
	L3830	↑	↑	↑	↑	↑		TD060-42772	↑		↑	T1060-15682
	L4330	↑	↑	↑	↑	↑		↑	↑		↑	↑
	L4330CAB	↑	↑	↑	↑	↑			↑		↑	3A611-74012
	L4630	↑	↑	↑	↑	↑		TD060-42772	↑		↑	T1060-15682
	L4630CAB	↑	↑	↑	↑	↑		↑	↑		↑	3A611-74012
	L5030	↑	↑	TD060-57500	TD060-53900	↑		↑	↑		↑	T1065-15682
	L5030CAB	↑	↑	↑	↑	↑			↑		↑	3A611-74012
	STV32	↑	↑	TA530-30860	TA530-30860	TA530-32233						↑
STV36	↑	↑	↑	↑	↑						↑	
STV40	↑	↑	↑	↑	↑						↑	
M	MX5000	T1060-33710	T1060-33720			T1060-43900		TC220-43900	TD060-47902		TD060-30500	T1060-15682
	M4800		35800-75070			TA040-43900		3A011-75100	↑		3A272-75250	3A011-74013
	M5700HD		↑			↑		3A051-75100			↑	↑
	M5700HDCAB	3A111-75080	3G700-75080			↑		↑			↑	3A611-74012
	M6800HD	↑	↑			↑		↑			↑	3A251-74010
	M6800HDCAB	↑	↑			↑		↑			↑	3A651-74010
	M8200HD	↑	↑			↑		↑			↑	3A251-74010
	M8200HDCAB	↑	↑			↑		↑			↑	3A651-74010
	M9000HD	↑	↑			↑		↑			↑	3A251-74010
	M9000HDCAB	↑	35800-75070			↑		↑			↑	3A651-74010
	ME5700		↑			↑		↑				3A011-74012
	ME5700CAB		↑			↑		↑				3A611-74010
	ME8200	3A111-75080	3G700-75080			↑		↑				3A251-74010
	ME8200CAB	↑	↑			↑		↑				3A651-74010
	ME9000	↑	↑			↑		↑				3A251-74010
	ME9000CAB	↑	↑			↑		↑				3A651-74010
	M95S	3F740-75030	↑			↑		36602-29500	3N300-85070		3A272-75250	↑
	M105S	↑	↑			↑		↑	↑		↑	↑
	M95X	↑	↑			3P300-55412		3M750-34620	3F460-85210		3P300-78502	3P201-64010
M105X	↑	↑			↑		↑	↑		↑	3P200-64010	
M125X	↑	16541-60181			↑		↑	↑		↑	3M760-64010	

	Charging System		Lighting System					Easy Checker				
	Dynamo	Regulator	Flasher Unit	Combination Switch-1	Combination Switch-2	Hazard Switch	Position Switch	Brake Light Switch	Hand Brake Switch	Oil Pressure Switch	Air Cleaner Sensor	
B	B7410	15531-64016	5H215-41955	3F240-75430	6C070-55420		6C070-53430				15531-39010	
	B7510	6C040-59250	↑	↑	↑		↑			↑		
	B7610	↑	↑	↑	↑		↑			↑		
	B7800	↑	↑	↑	↑		↑			↑		
	B2630	↑	↑	↑	↑		↑			↑		
	B3030	↑	↑	↑	↑		↑			↑		
	B3030CAB			↑	6C070-55420		↑			↑		
L	L2800			3F240-75430	67156-55210		TA140-30910				15531-39010	
	L3400			↑	↑		↑			↑		
	L4400			↑	↑		↑			↑		
	L3130			↑	3A751-75010		↑		T1060-43900	↑		
	L3430			↑	↑		↑		↑	↑		
	L3430CAB			↑	↑		↑		↑	↑		
	L3830			↑	↑		↑		↑	↑		
	L4330			↑	↑		↑		↑	↑		
	L4330CAB			↑	↑	37410-55120	↑		↑	↑		
	L4630			↑	↑		↑		↑	↑		
	L4630CAB			↑	↑	37410-55120	↑		↑	↑		
	L5030			↑	↑		↑		↑	1A024-39010		
	L5030CAB			↑	↑	37410-55120	↑		↑	↑		
STV32			TD069-33700	37410-55120		↑	37500-55312	TA530-31200		15531-39010		
STV36			↑	↑		↑	↑	↑		↑		
STV40			↑	↑		↑	↑	↑		↑		
M	MX5000			3F240-75430	67156-55210		TA140-30910				15531-39010	
	M4800			↑	31351-32100		↑			↑		
	M5700HD			↑	36330-75010		37500-55212			↑		
	M5700HDCAB			↑	3A751-75010		3A751-75040			↑		
	M6800HD			↑	36330-75010		37500-55212			15841-39010		
	M6800HDCAB			↑	3A751-75010		3A751-75040			↑		
	M8200HD			↑	36300-75010		37500-55212			↑		
	M8200HDCAB			↑	3A751-75010		3A751-75040			↑		
	M9000HD			↑	36330-75010		37500-55212			↑		
	M9000HDCAB			↑	3A751-75010		3A751-75040			↑		
	ME5700			6C080-30500	36760-75010		37500-55212		33740-75480	TA049-43900	15531-39010	15831-11090
	ME5700CAB			↑	37410-55120		3A751-75040		↑	3F999-01190	↑	↑
	ME8200			↑	36760-75010		37500-55212		↑	TA049-43900	15841-39010	↑
	ME8200CAB			↑	37410-55120		3A751-75040		↑	3F999-01190	↑	↑
	ME9000			↑	36760-75010		37500-55212		↑	TA049-43900	↑	↑
	ME9000CAB			↑	37410-55120		3A751-75040		↑	3F999-01190	↑	↑
	M95S			TD069-33700	↑		↑		↑		15531-39010	
M105S			TD069-33700	3A751-75010		↑		↑		↑		
M95X			3F240-75430	3F260-23960		3F260-23960		33740-75480	↑	15451-39012	15831-11090	
M105X			3F240-75430	↑		↑		↑	↑	↑	↑	
M125X			3F240-75430	↑		↑		↑	↑	↑	↑	

	Easy Checker					Others					
	PTO Lamp Switch	Mid PTO Lamp Switch	PTO Lamp Relay	Fuel Level Sensor	Coolant Temp. Sensor	Trailer Socket	PTO Clutch Control Switch	Bi-speed Controller	Front wheel turning angle sensor	Speed sensor (Eng, Rev, Sensor)	Speed sensor (TM Rev. sensor)
B	B7410			6C090-54753	31351-32830						
	B7510			6C120-54750	↑						
	B7610			↑	↑						
	B7800			6C040-54752	↑						
	B2630			6C200-54750	↑						
	B3030			↑	↑						
	B3030CAB			↑	↑						
L	L2800			TC220-31200	32330-32830						
	L3400			↑	↑						
	L4400			TC230-31200	↑						
	L3130	TD060-42780		T1060-31204	T1063-65660					T1060-32270	T1060-18660
	L3430	↑		↑	↑					↑	↑
	L3430CAB	↑		↑	↑					↑	↑
	L3830	↑		↑	↑					↑	↑
	L4330	↑		↑	↑					↑	↑
	L4330CAB	↑		↑	↑					↑	↑
	L4630	↑		↑	↑					↑	↑
	L4630CAB	↑		↑	↑					↑	↑
	L5030	↑		TD060-31200	T1173-65660					↑	↑
	L5030CAB	↑		↑	↑					↑	↑
	STV32	TA530-32200	TD060-43902	T1060-33720	T0430-53620	31351-32830	66709-55861	TA530-32233	TA470-32807	T1060-32310	
STV36	↑	↑	↑	↑		↑	↑	↑	↑		↑
STV40	↑	↑	↑	↑		↑	↑	↑	↑		↑
M	MX5000			TC050-31202	32330-32830						
	M4800	TA040-43900		3A011-75302	31351-32830	99884-48110					
	M5700HD	↑		↑	↑	↑					
	M5700HDCAB	↑		3A751-75300	↑	↑					
	M6800HD	↑		3A111-75300	↑	↑					
	M6800HDCAB	↑		3A751-75300	↑	↑					
	M8200HD	↑		3A151-75300	↑	↑					
	M8200HDCAB	↑		3A751-75300	↑	↑					
	M9000HD	↑		3A151-75300	↑	↑					
	M9000HDCAB	↑		3A751-75300	↑	↑					
	ME5700	↑		3A011-75302	↑	66709-55861					
	ME5700CAB	↑		3A751-75300	↑	↑					
	ME8200	↑		3A151-75300	↑	↑					
	ME8200CAB	↑		3A751-75300	↑	↑					
	ME9000	↑		3A151-75300	↑	↑					
	ME9000CAB	↑		3A751-75300	↑	↑					
	M95S	↑		3N300-75300	↑	3G715-77150					
	M105S	↑		↑	↑	↑					
	M95X	3P300-55412		3N300-75300	↑	3N300-77150	3P300-55412	3P300-78502	3M860-40390	T1060-32270	T0430-32380
M105X	↑		↑	↑	↑	↑	↑	↑	↑	↑	
M125X	↑		↑	38240-32830	↑	↑	↑	↑	↑	↑	

[3] CABIN COMPONENT

	Air Conditionner Unit 1	Air Conditionner Unit 2	Compressor 1	Compressor 2	Magnet Clutch 1	Magnet Clutch 2	Magnet Clutch 3	Condensor 1	Condensor 2	Receiver	Evaporator	
B	B7410											
	B7510											
	B7610											
	B7800											
	B2630											
	B3030											
	B3030CAB	6C230-75020		6A671-97110		6A671-97310			T2055-72220		T2055-72230	6A741-75080
L	L2800											
	L3400											
	L4400											
	L3130											
	L3430											
	L3430CAB	T1065-72100		6A671-97110		6A671-97310	6A671-97210		T2055-72220		T0070-79270	T0270-87340
	L3830											
	L4330											
	L4330CAB	T1065-72100		6A671-97110		6A671-97310	6A671-97210		T2055-72220		T0070-79270	T0270-87340
	L4630											
	L4630CAB	T1065-72100		6A671-97110		6A671-97310	6A671-97210		T2055-72220		T0070-79270	T0270-87340
	L5030											
	L5030CAB	T1065-72100		6A671-97110		6A671-97310	6A671-97210		T2055-72220		T0070-79270	T0270-87340
STV32												
STV36												
STV40												
M	MX5000											
	M4800											
	M5700HD											
	M5700HDCAB	3G910-50032	3A851-50033	6A671-97110	T1065-72213	6A671-97310	6A671-97210	T1065-87310	3G710-50040	3A851-50040	T0070-79270	3A851-72100
	M6800HD											
	M6800HDCAB	3G910-50032	3A851-50033	6A671-97110	T1065-72213	6A671-97310	6A671-97210	T1065-87310	3G710-50040	3A851-50040	T0070-79270	3A851-72100
	M8200HD											
	M8200HDCAB	3G910-50032	3A851-50033	6A671-97110	T1065-72213	6A671-97310	6A671-97210	T1065-87310	3G710-50040	3A851-50040	T0070-79270	3A851-72100
	M9000HD											
	M9000HDCAB	3G910-50032	3A851-50033	6A671-97110	T1065-72213	6A671-97310	6A671-97210	T1065-87310	3G710-50040	3A851-50040	T0070-79270	3A851-72100
	ME5700											
	ME5700CAB	3G910-50032		6A671-97110	T1065-72213	6A671-97310	T1065-87310		3G710-50040		T0070-79270	T0270-87340
	ME8200											
	ME8200CAB	3G910-50032		6A671-97110	T1065-72213	6A671-97310	T1065-87310		3G710-50040		T0070-79270	T0270-87340
	ME9000											
	ME9000CAB	3G910-50032		6A671-97110	T1065-72213	6A671-97310	T1065-87310		3G710-50040		T0070-79270	T0270-87340
	M95S	3A851-50033		↑		↑			3A851-50040		↑	3A851-72100
M105S	↑		↑		↑			↑		↑	↑	
M95X	3F761-50033		↑		↑			3P200-50040		3P999-00220	3F760-96190	
M105X	↑		↑		↑			↑		↑	↑	
M125X	↑		↑		↑			↑		↑	↑	

		Wiper				Wind Washer		
		Front Wiper Motor	Rear Wiper Motor	Front Wiper Switch	Rear Wiper Switch	Washer Tank	Front Washer Nozzle	Rear Washer Nozzle
B	B7410							
	B7510							
	B7610							
	B7800							
	B2630							
	B3030							
	B3030CAB	5H736-39530	T1275-72750	T1065-75380	T1065-75393	6A741-74230	3F760-54180	3F760-54180
L	L2800							
	L3400							
	L4400							
	L3130							
	L3430							
	L3430CAB	T1275-71110	T0070-72670	T1065-75380	T1065-75393	3F760-55760	TA140-71170	3F760-54180
	L3830							
	L4330							
	L4330CAB	T1275-71110	T0070-72670	T1065-75380	T1065-75393	3F760-55760	TA140-71170	3F760-54180
	L4630							
	L4630CAB	T1275-71110	T0070-72670	T1065-75380	T1065-75393	3F760-55760	TA140-71170	3F760-54180
	L5030							
	L5030CAB	T1275-71110	T0070-72670	T1065-75380	T1065-75393	3F760-55760	TA140-71170	3F760-54180
	STV32							
STV36								
STV40								
M	MX5000							
	M4800							
	M5700HD							
	M5700HDCAB	T0270-71110	3M760-55782	3F260-75330	3F760-75340	3G710-55760	3F760-54180	3F760-54180
	M6800HD							
	M6800HDCAB	T0270-71110	3M760-55782	3F260-75330	3F760-75340	3G710-55760	3F760-54180	3F760-54180
	M8200HD							
	M8200HDCAB	T0270-71110	3M760-55782	3F260-75330	3F760-75340	3G710-55760	3F760-54180	3F760-54180
	M9000HD							
	M9000HDCAB	T0270-71110	3M760-55782	3F260-75330	3F760-75340	3G710-55760	3F760-54180	3F760-54180
	ME5700							
	ME5700CAB	T0270-71110	3M760-55782	3F260-75330	3F760-75340	3G710-55760	3F760-54180	3F760-54180
	ME8200							
	ME8200CAB	T0270-71110	3M760-55782	3F260-75330	3F760-75340	3G710-55760	3F760-54180	3F760-54180
	ME9000							
	ME9000CAB	T0270-71110	3M760-55782	3F260-75330	3F760-75340	3G710-55760	3F760-54180	3F760-54180
	M95S	↑	↑	↑	↑	↑	↑	↑
M105S	↑	↑	↑	↑	↑	↑	↑	
M95X	T1275-71110	3P300-55782	↑	↑	↑	↑	↑	
M105X	↑	↑	↑	↑	↑	↑	↑	
M125X	↑	↑	↑	↑	↑	↑	↑	

		Air Conditionner									
		Expansion Valve 1	Expansion Valve 2	Water Valve	Air Conditioner Blower Motor	Blower Switch	Air Conditionner Switch or Panel Switch 1	Air Conditionner Switch or Panel Switch 2	Thermo Switch	Pressure Switch 1	Pressure Switch 2
B	B7410										
	B7510										
	B7610										
	B7800										
	B2630										
	B3030										
	B3030CAB			T2055-72520	3G910-72150	T1065-72120	T0270-87232		T1065-72160	3A761-96290	
L	L2800										
	L3400										
	L4400										
	L3130										
	L3430										
	L3430CAB	T1065-72170		T1065-72520	T1065-72150	T1065-72120	T0270-87232		T1065-72160	33770-96290	
	L3830										
	L4330										
	L4330CAB	T1065-72170		T1065-72520	T1065-72150	T1065-72120	T0270-87232		T1065-72160	33770-96290	
	L4630										
	L4630CAB	T1065-72170		T1065-72520	T1065-72150	T1065-72120	T0270-87232		T1065-72160	33770-96290	
	L5030										
	L5030CAB	T1065-72170		T1065-72520	T1065-72150	T1065-72120	T0270-87232		T1065-72160	33770-96290	
	STV32										
STV36											
STV40											
M	MX5000										
	M4800										
	M5700HD										
	M5700HDCAB	T1065-72170	3A851-72170		3A851-72150	3A851-72040	3G710-50082	3A851-72010	T1065-72160	33770-96290	3A761-96290
	M6800HD										
	M6800HDCAB	T1065-72170	3A851-72170		3A851-72150	3A851-72040	3G710-50082	3A851-72010	T1065-72160	33770-96290	3A761-96290
	M8200HD										
	M8200HDCAB	T1065-72170	3A851-72170		3A851-72150	3A851-72040	3G710-50082	3A851-72010	T1065-72160	33770-96290	3A761-96290
	M9000HD										
	M9000HDCAB	T1065-72170	3A851-72170		3A851-72150	3A851-72040	3G710-50082	3A851-72010	T1065-72160	33770-96290	3A761-96290
	ME5700										
	ME5700CAB	T1065-72170		3G710-72500	3G910-72150	T1065-72120	3G710-50082		T1065-72160	33770-96290	
	ME8200										
	ME8200CAB	T1065-72170		3G710-72500	3G910-72150	T1065-72120	3G710-50082		T1065-72160	33770-96290	
	ME9000										
	ME9000CAB	T1065-72170		3G710-72500	3G910-72150	T1065-72120	3G710-50082		T1065-72160	33770-96290	
	M95S	3A851-72170			3A851-72150	3A851-72040	3A851-72010		↑	↑	3A761-96290
M105S	↑			↑	↑	↑		↑	↑	↑	
M95X	33770-96120		3F260-96230	3M760-57020 (R), 3M760-57030 (L)	36919-96140	T0180-81850		33770-96240	3A761-96290		
M105X	↑		↑	↑	↑	↑		↑	↑		
M125X	↑		↑	↑	↑	↑		↑	↑		

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