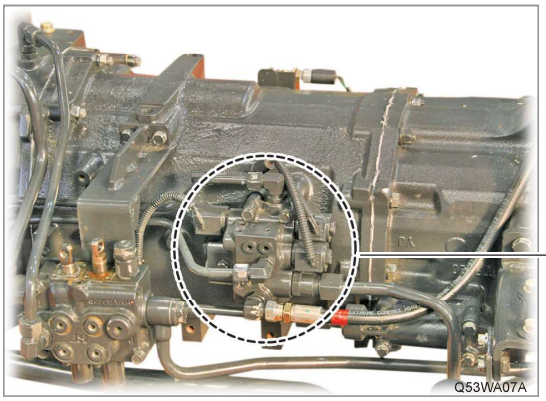
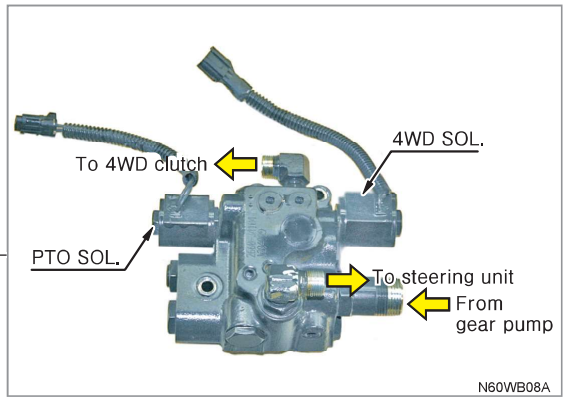
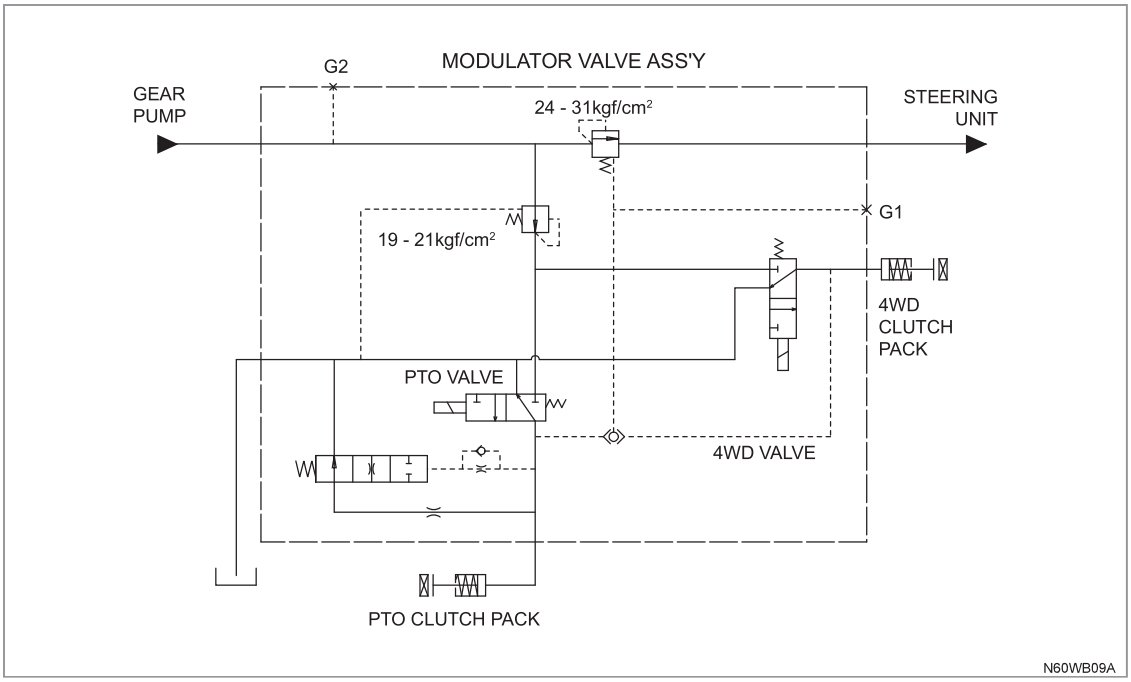
2.4.3 MODULATOR VALVE (PTO, 4WD)





Hydraulic oil from the secondary gear pump is directly delivered to the modulator valve. Then, the modulator valve controls the operation of the PTO clutch and 4WD before it sends the oil to the steering unit.



1) SEQUENCE, REDUCING VALVE

When the hydraulic fluid is supplied to the modulator valve, it passes the sequence valve initially. While hydraulic oil passes through the sequence valve, this valve increases pressure on its front up to 24 - 31 kgf/cm^2 in order to compress the PTO clutch and 4WD clutch sufficiently. Its pressure can be increased by 2 - 3 kgf/cm^2 only by its spring.

However, when any of the two solenoids (PTO, 4WD) in the modulator valve is operated, the hydraulic fluid is supplied to it through the pilot passage as shown in the dotted line in the circuit diagram to increase the differential pressure passing the sequence valve up to 24 - 31 kgf/cm^2. The reducing valve is a safety device to protect the modulator system from excessively high hydraulic pressure increased by the sequence valve.

The reducing valve opens and closes repeatedly at around 19 - 21 kgf/cm^2 to maintain proper pressure in the modulator system in order to protect the system. Therefore, the actual operating pressure of the PTO/4WD clutch is same to the pressure of the reducing valve and this pressure is measured during tests for troubleshooting.

2) SOLENOID AND PTO TIME DELAY VALVE

The solenoids for the PTO clutch and 4WD clutch are all equipped with electrical ON-OFF solenoid valves which are operated by electromagnets and return springs in the same structure. Each solenoid's spool has an orifice structure to reduce operating shock when opening the spool. On the other hand, the solenoid for PTO operation is equipped with a time delay valve for smooth operation.

The spool of the time delay valve is normally open by its return spring. Therefore, when the PTO solenoid starts to open, hydraulic fluid is drained through the time delay valve before it is supplied to the clutch piston. This is why the clutch is not engaged firmly in the initial operation of the solenoid. However, as time passes, pressure is built in the pilot line of the time delay valve which is then closed only halfway. Then, a small amount of oil is discharged through the orifice spool in the middle section and the remainder is supplied to the PTO clutch piston which then makes the PTO start to rotate. As more time passes, the amount of oil supplied through the pilot line of the time delay spool is maximized, so the time delay spool is completely closed. Then, all the oil is supplied to the PTO piston to compress the PTO clutch firmly, and this completes the PTO operation process for approx. 1.5 seconds.