PART NO. TONFA-EN-00

HITACHI

Reliable solutions

Technical Manual
Operational Principle

ZW

310-5B
330-5B
Wheel Loader

Service Manual consists of the following separate Part No.

Technical Manual (Operational Principle)	: Vol. No.TONFA-EN
Technical Manual (Troubleshooting)	: Vol. No.TTNFA-EN
Workshop Manual	: Vol. No.WNFA-EN
Engine Manual	: Vol. No.ENFA-EN

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GENERAL

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Engine Accessories

RADIATOR ASSEMBLY	Type	Radiator and Torque Converter Cooler Parallel Type Assembly, Intercooler and Oil Cooler Tandem Type Assembly
	Weight	Radiator: 185 kg (408 lbs), Cooling Unit: 50 kg (110 lbs)

	Radiator	Oil Cooler
Air-Tight Test Pressure	100 kPa (1.02 kgf/cm^2, 14.5 PSI)	1500 kPa (15.3 kgf/cm^2, 217.6 PSI)
Cap Opening Pressure	50 kPa (0.5 kgf/cm^2, 7 PSI)	–

	Intercooler	Torque Converter Cooler
Air-Tight Test Pressure	200 kPa (2.04 kgf/cm^2, 29 PSI)	1500 kPa (15.3 kgf/cm^2, 217.6 PSI)
Cap Opening Pressure	–	–

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Torque Decrease Control While Dumping Bucket

Purpose:
The torque decrease control while dumping bucket (hydraulic load reduction) feature reduces pump oil flow and load so that the power from the engine can be applied to forward movement of the machine.

Operation:

1. When all of the items under the topic below of "Conditions" exist, Main Controller (MC) (3) judges that machine is digging and sets the target torque 315 N·m (32 kgf·m)(232 lbf·ft).
2. MC (3) receives a signal from lift arm angle sensor (48), and increases the target torque to obtain the optimum torque for the lift arm angle.
3. MC (3) sends a signal to torque control solenoid valve (30) depending on the target torque.
4. Torque control solenoid valve (30) adjusts the hydraulic oil flow delivery rate at the regulator relative to the electrical signal it receives from the MC (3).

Conditions:

- Torque Converter Rotation Speed Ratio: Below specified value (Reference: 15 % or less)
- Forward/Reverse Lever (23) or Switch (27): Forward Position (24)
- Pump Delivery Pressure: High Pressure (Reference: 20 MPa (204 kgf/cm^2, 2900 psi) or more)

5. When any of the following "Deactivation Conditions" exists, the Torque Decrease Control While Dumping Bucket is deactivated.

Deactivation Conditions:

- Torque Converter Rotation Speed Ratio: Above specified value (Reference: 40 % or more)
- Forward/Reverse Lever (23) or Switch (27): Neutral Position (25) or Reverse Position (26)
- Pump Delivery Pressure: Low Pressure (Reference: 9.8 MPa (100 kgf/cm^2, 1421 psi) or less)

NOTE: Torque Decrease Control While Dumping Bucket is activated by the signal from forward/reverse switch (27) when it is in use on the machine.

NOTE: When the power mode selector switch (35) is ON, the engine speed is controlled according to the lift arm angle, and there is a case where the Torque Decrease Control While Dumping Bucket is deactivated.

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Hydraulic Circuit

Main Circuit

Pressurized oil from pump (8) flows to the hydraulic oil tank through neutral circuit (11).
Parallel circuit (10) is provided in the hydraulic loading valve main circuit and makes possible the simultaneous combining of lift arm and bucket operation.
Pump control valve (1) is provided in the farthest downstream side of neutral circuit (11). Pump control valve (1) delivers pump control pressure to the hydraulic piston pump regulator in response to operation of the loading main control valve, and controls pump delivery flow rate.

Main relief valve (9) is provided in the main circuit (between the pump and the actuator (cylinder) spools within the valve). Main relief valve (9) prevents the pressure in the main circuit from exceeding the set pressure when the spool is operated (or when the control lever is operated).

Overload relief valve (2) is provided in the actuator (cylinder) circuit (between the control valve and the actuator (cylinder)) of the lift arm cylinder base end, bucket, and auxiliary. Overload relief valve (2) prevents pressure spikes caused by external forces in the actuator circuit from exceeding the set pressure when the spool is in neutral (with the control lever set in neutral).

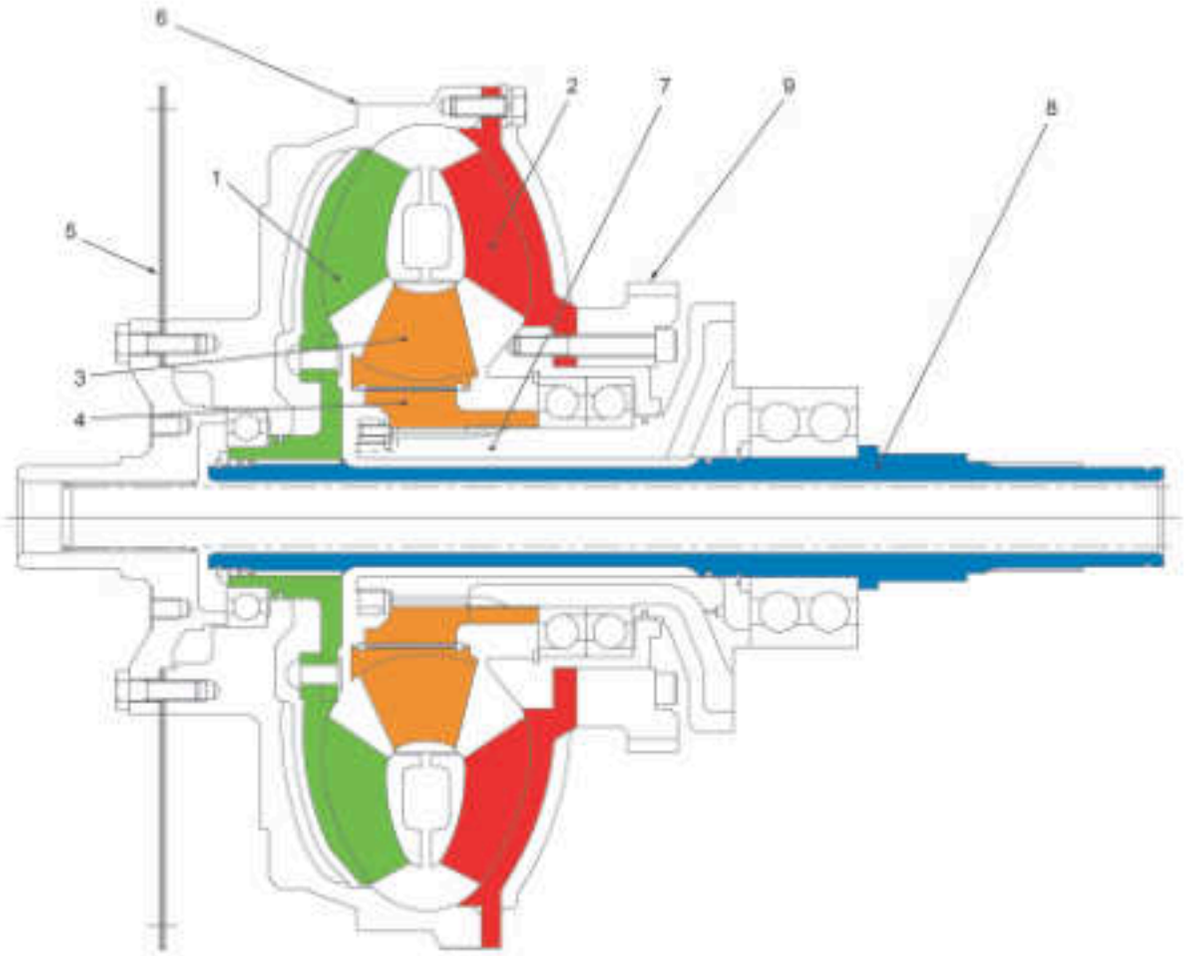
Make-up valves (4, 6, 7) are provided in overload relief valves (2), which are located in the bucket cylinder circuit on both the rod and bottom sides, and in the lift arm cylinder circuit on rod side. Make-up valves (4, 6, 7) draw in pressurized oil from the hydraulic tank and prevent cavitation from occurring when the pressure in the actuator circuit decreases due to fast lowering of the lift arms or quick dumping of the bucket. It can also prevent cavitation when there is an external force causing oil to be relieved over the overload relief valves, which results in the opposing end of the cylinder drawing in oil to fill that end of the cylinder with.

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Torque Converter

A wet type torque converter with a flexible input plate is between the engine and transmission.
The torque converter consists of pump impeller (2), turbine impeller (1), and stator (3), all in the casing filled with oil.
The pump is connected to the engine flywheel, and rotates together with the engine. The turbine is connected to the torque converter output shaft to transmit the power to the transmission.

1. Hydraulic oil is supplied from the transmission control valve to torque converter drive cover (6).
2. The area of the impellers is filled with oil. When the engine is started, pump impeller (2) rotates, therefore the oil will circulate to rotate turbine impeller (1) (circulation order: pump --> turbine --> stator --> pump).
3. Oil is redirected by fixed stator impeller (3) back to pump impeller (2).
4. When turbine impeller (1) rotates, the power will be transmitted to the output shaft (8).
5. If the engine speed/pump impeller speed stays the same, but the turbine impeller speed is reduced due to the transmission load, output torque is increased. This is "torque multiplication".



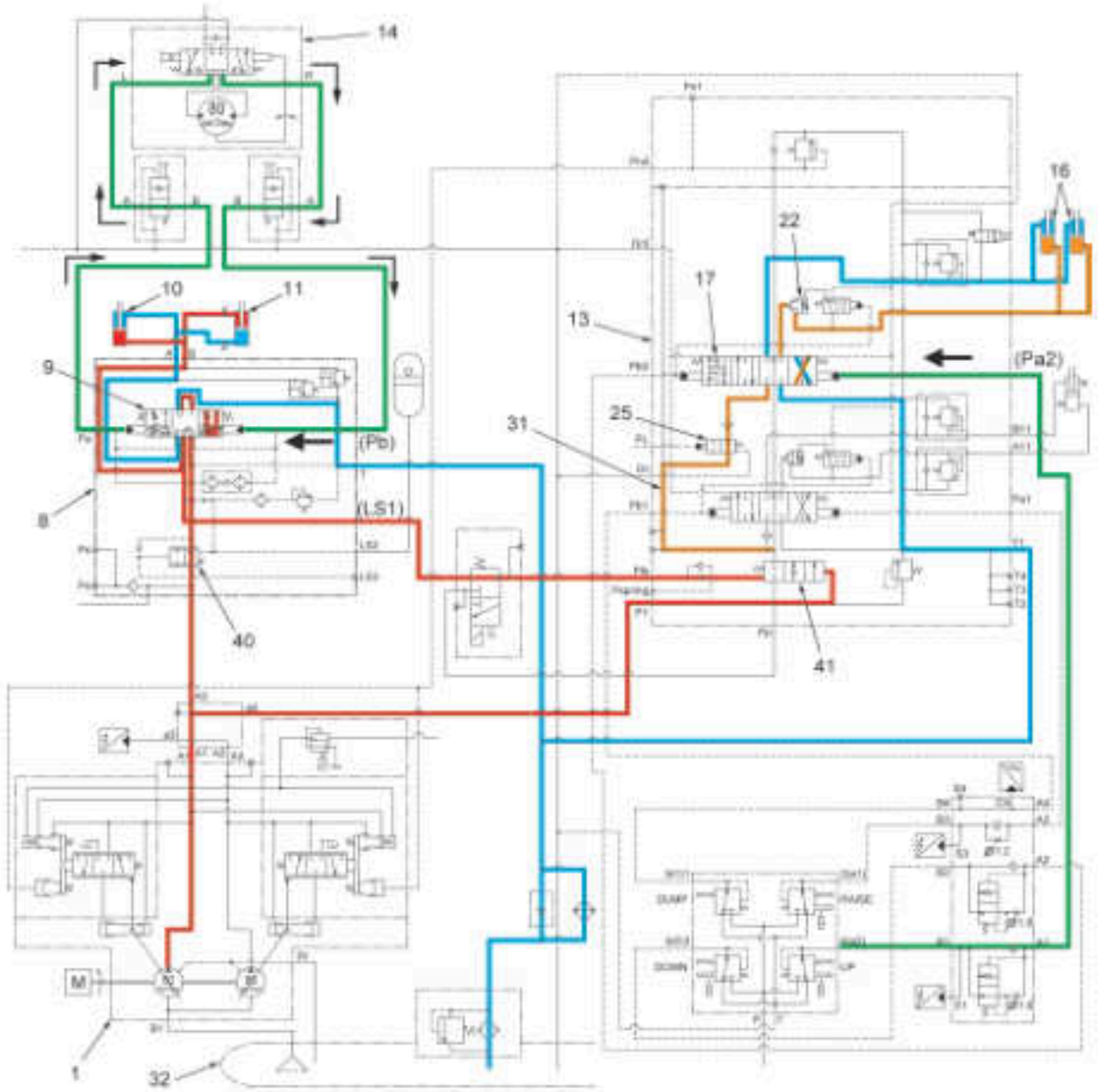
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a- Engine Side
b- Main Pump Drive Side

1- Turbine impeller Assy
2- Pump Impeller
3- Stator
4- Stator Hub
5- Flexible Plate
6- Drive Cover
7- Stator Shaft
8- Turbine Shaft
9- Charging Pump Drive Gear

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- Combined operation of steering right / lift arm raise



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Pb- Steering (Right) (Pilot Pressurized Oil)
Pa2- Lift Arm Raise (Pilot Pressurized Oil)

1- Main Pump
8- Steering Valve
9- Steering Spool
10- Steering Cylinder (Left)
11- Steering Cylinder (Right)
13- Control Valve
14- Steering Pilot Valve
16- Lift Arm Cylinder
17- Lift Arm Spool
22- Anti-Drift Valve
25- Lift Arm Flow Rate Control Valve
31- Parallel Circuit
32- Hydraulic Tank
40- Meter-in Compensation Valve
41- Bleed-off Compensation Valve

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