

Technical Manual

Operational Principle

ZW

220-5B

Wheel Loader

ZW220-5B WHEEL LOADER TECHNICAL MANUAL OPERATIONAL PRINCIPLE

 **Hitachi Construction Machinery Co., Ltd.**

URL:<http://www.hitachi-c-m.com>

Service Manual consists of the following separate Part No.
Technical Manual (Operational Principle) : Vol. No.TONEE-EN
Technical Manual (Troubleshooting) : Vol. No.TTNEE-EN
Workshop Manual : Vol. No.WNEE-EN

INTRODUCTION

To The Reader

This manual is written for an experienced technician to provide technical information needed to maintain and repair this machine.

- Be sure to thoroughly read this manual for correct product information and service procedures.

- If you have any questions or comments, at if you found any errors regarding the contents of this manual, please contact using "Service Manual Revision Request Form" at the end of this manual. (Note: Do not tear off the form. Copy it for usage.):
 - Publications Marketing & Product Support Hitachi Construction Machinery Co. Ltd.
 - TEL: 81-29-832-7084
 - FAX: 81-29-831-1162
 - E-mail: dc@hitachi-kenki.com

Additional References

Please refer to the other materials (operator's manual, parts catalog, engine technical material and Hitachi training material etc.) in addition to this manual.

Manual Composition

This manual consists the Technical Manual, the Workshop Manual and the Engine Manual.

- Information included in the Technical Manual: Technical information needed for redelivery and delivery, operation and activation of all devices and systems, operational performance tests, and troubleshooting procedures.

- Information included in the Workshop Manual: Technical information needed for maintenance and repair of the machine, tools and devices needed for maintenance and repair, maintenance standards, and removal / installation and assemble / disassemble procedures.

- Information included in the Engine Manual: Technical information needed for redelivery and delivery and maintenance and repair of the machine, operation and activation of all devices and systems, troubleshooting and assemble / disassemble procedures.

Page Number

Each page has a number, located on the center lower part of the page, and each number contains the following information:

Example:

- Technical Manual: T 1-3-5

| | |
|---|--|
| T | Technical Manual |
| 1 | Section Number |
| 3 | Group Number |
| 5 | Consecutive Page Number for Each Group |


- Workshop Manual: W 1-3-2-5


| | |
|---|--|
| W | Workshop Manual |
| 1 | Section Number |
| 3 | Group Number |
| 2 | Sub Group Number |
| 5 | Consecutive Page Number for Each Group |

INTRODUCTION


Safety Alert Symbol and Headline Notations

In this manual, the following safety alert symbol and signal words are used to alert the reader to the potential for personal injury of machine damage.

 This is the safety alert symbol. When you see this symbol, be alert to the potential for personal injury. Never fail to follow the safety instructions prescribed along with the safety alert symbol. The safety alert symbol is also used to draw attention to component/part weights. To avoid injury and damage, be sure to use appropriate lifting techniques and equipment when lifting heavy parts.

 **CAUTION:**
Indicates potentially hazardous situation which could, if not avoided, result in personal injury or death.

IMPORTANT:
Indicates a situation which, if not conformed to the instructions, could result in damage to the machine.

 **NOTE:**
Indicates supplementary technical information or know-how.


Units Used

SI Units (International System of Units) are used in this manual. MKSA system units and English units are also indicated in parentheses just behind SI units.

Example: 24.5 MPa (250 kgf/cm², 3560 psi)

A table for conversion from SI units to other system units is shown below for reference purposes.

| Quantity | To Convert From | Into | Multiply By |
|-------------|-------------------|---------------------|-------------|
| Length | mm | in | 0.03937 |
| | mm | ft | 0.003281 |
| Volume | L | US gal | 0.2642 |
| | L | US qt | 1.057 |
| | m ³ | yd ³ | 1.308 |
| Weight | kg | lb | 2.205 |
| Force | N | kgf | 0.10197 |
| | N | lbf | 0.2248 |
| Torque | N·m | kgf·m | 0.10197 |
| Pressure | MPa | kgf/cm ² | 10.197 |
| | MPa | psi | 145.0 |
| Power | kW | PS | 1.360 |
| | kW | HP | 1.341 |
| Temperature | °C | °F | °C×1.8+32 |
| Velocity | km/h | mph | 0.6214 |
| | min ⁻¹ | rpm | 1.0 |
| Flow rate | L/min | US gpm | 0.2642 |
| | mL/rev | cc/rev | 1.0 |

 **NOTE:** The numerical value in this manual might be different from the above-mentioned table.

SYMBOL AND ABBREVIATION

Symbol and Abbreviation

| Symbol / Abbreviation | Name | Explanation |
|-----------------------|--|--|
| TO | Technical manual (Operational principle) | Technical manual (Operational Principle). |
| TT | Technical manual (Troubleshooting) | Technical manual (Troubleshooting). |
| T/M | Technical manual | Technical manual. |
| W, W/M | Workshop manual | Workshop manual (Removal and Installation, Disassembly and Assembly). |
| MC | Main Controller | Main controller. MC controls the engine, pump, and valve according to the machine operating condition. |
| ECM | Engine Control Module | Engine controller. ECM controls fuel injection amount according to the machine operating condition. |
| VGS | Variable Geometry System controller | Variable turbo controller. VGS is an exhaust turbo charged system to supercharge the exhaust energy while running the engine at slow idle speed. VGS optimizes the turbine rotation, improves the performance at slow-speed torque and the acceleration, reduces fuel consumption, and reduces particulate matter (PM) by adjusting the nozzle opening of turbine housing. |
| TCU | Transmission Control Unit | Transmission control unit. TCU control transmission according to the machine operating condition. |
| GSM | Global System for Mobile communications controller | Communication controller. GSM is a type of wireless communication system, is used in more than on 100 countries around Europe and Asia, and becomes the factual global standards of the mobile telephone. |
| GPS | Global Positioning System | Global positioning system. |
| CAN | Controller Area Network | CAN communication. CAN is a serial communications protocol internationally-standardized by ISO (International Organization for Standardization). |
| A/C | Air Conditioner | Air conditioner. |
| OP, OPT | Option | Optional component. |
| MPDr. | Maintenance Pro Dr. | MPDr. is software that troubleshooting, monitoring, and adjustment. |
| A/I | Auto-Idle | Auto-idle. |
| WU | Warming-Up | Warming-up. |
| Li | Low (Slow) Idle | Slow idle engine speed. |
| ATT | Attachment | Attachment. |

SYMBOL AND ABBREVIATION

| Symbol / Abbreviation | Name | Explanation |
|-----------------------|-----------------------------|--|
| DPF | Diesel Particulate Filter | DPF is a filter which removes particulate matter (PM) including the toxic substance of exhaust gas of the diesel engine. Exhaust particulate removal equipment. |
| DPD | Diesel Particulate Diffuser | DPD is an exhaust emission control system, a type of DPF, which cleans up particulate matter (PM) of diesel engine exhaust gas. DPD is a ceramic filter which traps and filters PM of exhaust gas. DPD burns up accumulated PM when PM increases and regenerates the filter. |
| DOC | Diesel Oxidation Catalyst | Oxidation catalyst for the diesel engine. Diesel oxidation catalyst oxidizes unburnt fuel and raises exhaust temperature. |
| CSF | Catalyzed Soot Filter | Filter. The filter traps, burns, and remove particulate matter (PM) by using high-temperature-exhaust gas with diesel oxidation catalyst. Catalyst is applied onto the filter. This advances PM burning. |
| PM | Particulate Matter | Particulate matter. |
| EGR | Exhaust Gas Recirculation | The EGR control re-circulates a part of exhaust gas in the intake manifold and combines it with intake-air. Therefore, combustion temperature is lowered and generation of oxide of nitrogen (NO _x) is controlled. |

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| Group 3 Cooling Fan System |
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| Group 4 Steering Pilot Valve |
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| Group 5 Steering Valve |
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|---------------------|
| Group 6 Pilot Valve |
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| Group 7 Charging Circuit |
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| Group 8 Drive Unit |
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| Group 9 Axle |
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| Group 10 Brake Valve |
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| Group 11 Others |
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All information, illustrations and specifications in this manual are based on the latest product information available at the time of publication. The right is reserved to make changes at any time without notice.

| TECHNICAL MANUAL (Troubleshooting) | WORKSHOP MANUAL |
|--|---|
| <p>SECTION 4 OPERATIONAL PERFORMANCE TEST</p> <ul style="list-style-type: none">Group 1 IntroductionGroup 2 StandardGroup 3 Engine TestGroup 4 Machine Performance TestGroup 5 Component Test <p>SECTION 5 TROUBLESHOOTING</p> <ul style="list-style-type: none">Group 1 Diagnosing ProcedureGroup 2 MonitorGroup 3 e-ServiceGroup 4 Component LayoutGroup 5 Troubleshooting AGroup 6 Troubleshooting BGroup 7 Air Conditioner | <p>SECTION 1 GENERAL INFORMATION</p> <p>SECTION 2 MAINTENANCE STANDARD</p> <p>SECTION 3 BODY</p> <p>SECTION 4 TRAVEL SYSTEM</p> <p>SECTION 5 ATTACHMENT</p> |

SECTION 1

GENERAL

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| Emergency Steering Pump (Optional) | T1-2-21 |
| Flow Regulator Valve | T1-2-21 |

Group 3 Component Specifications

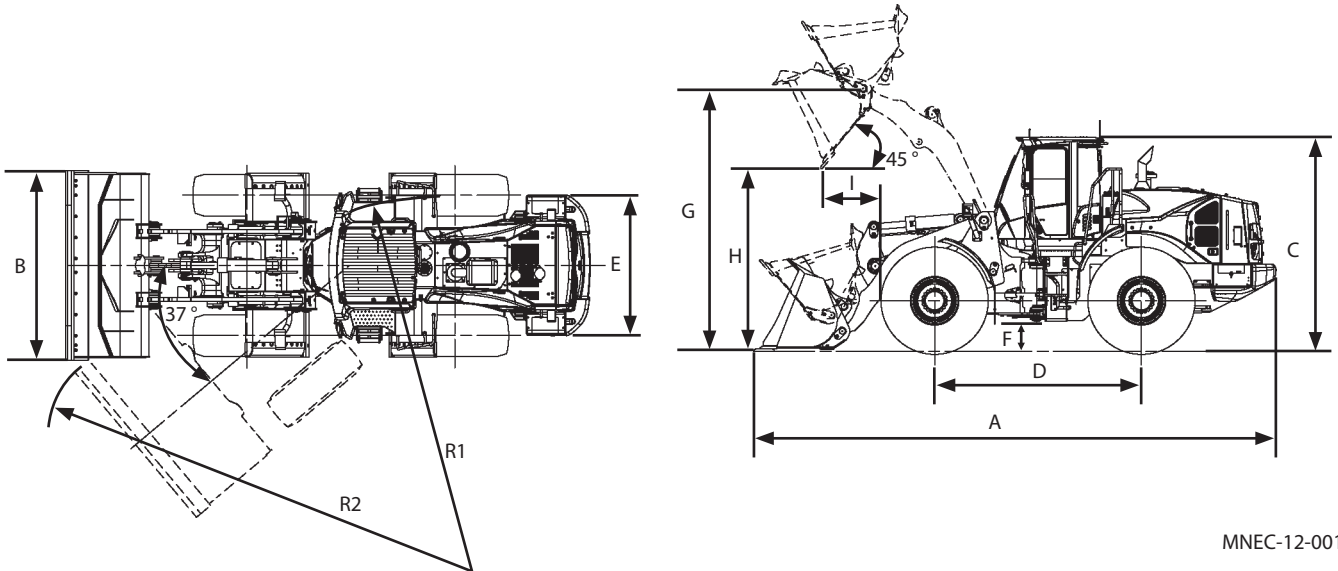
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SECTION 1 GENERAL


Group 1 Specifications

Specifications



MNEC-12-001

| | | |
|--|----------------|-------------------------|
| Model | - | ZW220-5B |
| Bucket Capacity: heaped | m ³ | 3.3 |
| Operating Weight | kg | 17830 |
| Static Tipping Load (Straight) | kg | 13010 |
| Engine | - | CUMMINS QSB6.7 |
| A: Overall Length | mm | 8220 |
| B: Overall Width (Bucket) | mm | 2910 |
| C: Overall Height | mm | 3370 |
| D: Wheel Base | mm | 3300 |
| E: Tread (front and rear tires) | mm | 2160 |
| F: Ground Clearance | mm | 450 |
| G: Bucket Hinge Height | mm | 4080 |
| H: Dumping Clearance (45 °) | mm | 2900 |
| I: Dumping Reach (45 °) | mm | 1110 |
| R1: Minimum Rotation Radius | mm | 6010 |
| R2: Minimum Rotation Radius | mm | 6940 |
| Travel Speed Forward/Reverse (at Power mode) | km/h | 36.0 (36.0)/24.9 (26.2) |
| Transmission Speeds (F/R) | - | 5/3 |
| Articulation Angle (Left/Right) deg | (°) | 37 |
| Tire Size | - | 23.5 R25 (L3) |

 NOTE: These specifications are subject to change without notice.

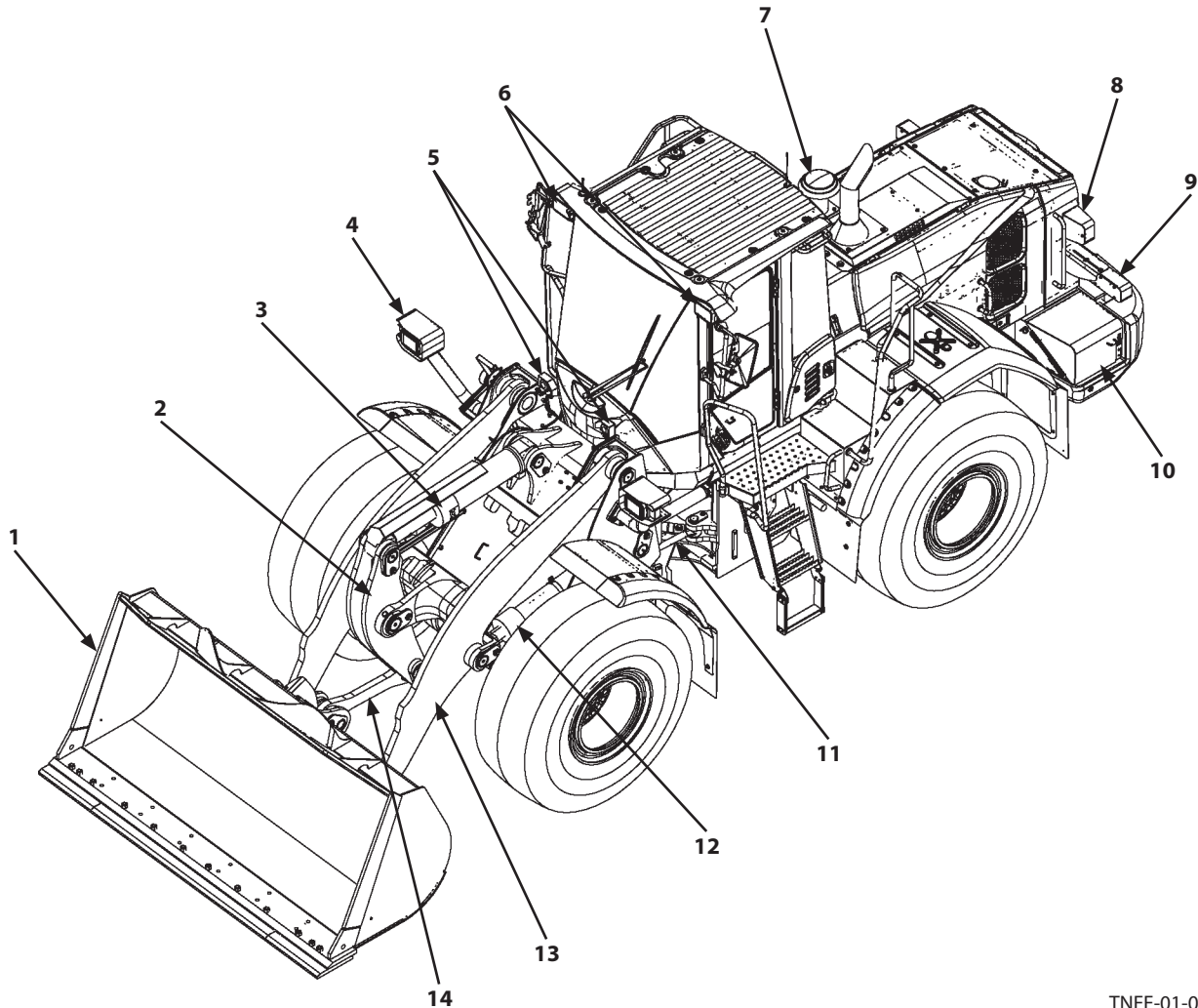
SECTION 1 GENERAL
Group 1 Specifications

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SECTION 1 GENERAL


Group 2 Component Layout

Main Component (Overview)



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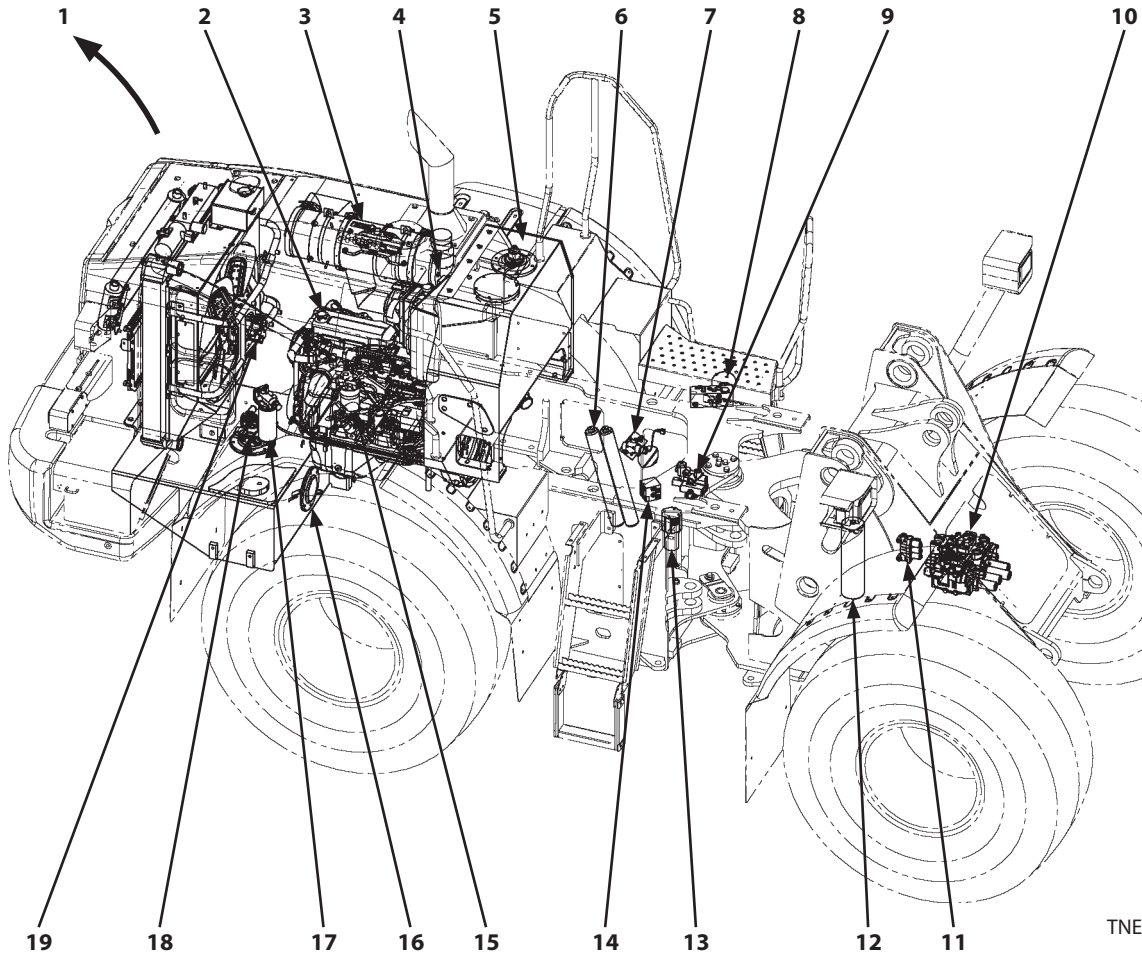
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|--|------------------------------------|--|-----------------------|
| 1- Bucket | 5- Horn | 9- Rear Combination Light (Turn Signal Light, Hazard Light, Tail Light, Brake Light, Backup Light) | 12- Lift Arm Cylinder |
| 2- Bell Crank | 6- Front Work Light | 10- Battery Box | 13- Lift Arm |
| 3- Bucket Cylinder | 7- Rain Cap/Pre-Cleaner (Optional) | 11- Steering Cylinder | 14- Bucket Link |
| 4- Front Combination Light (Headlight, Turn Signal Light, Clearance Light, Hazard Light) | 8- Rear Work Light | | |

 **NOTE:** Backup Lights are not equipped for European spec. units.

SECTION 1 GENERAL

Group 2 Component Layout

Main Component



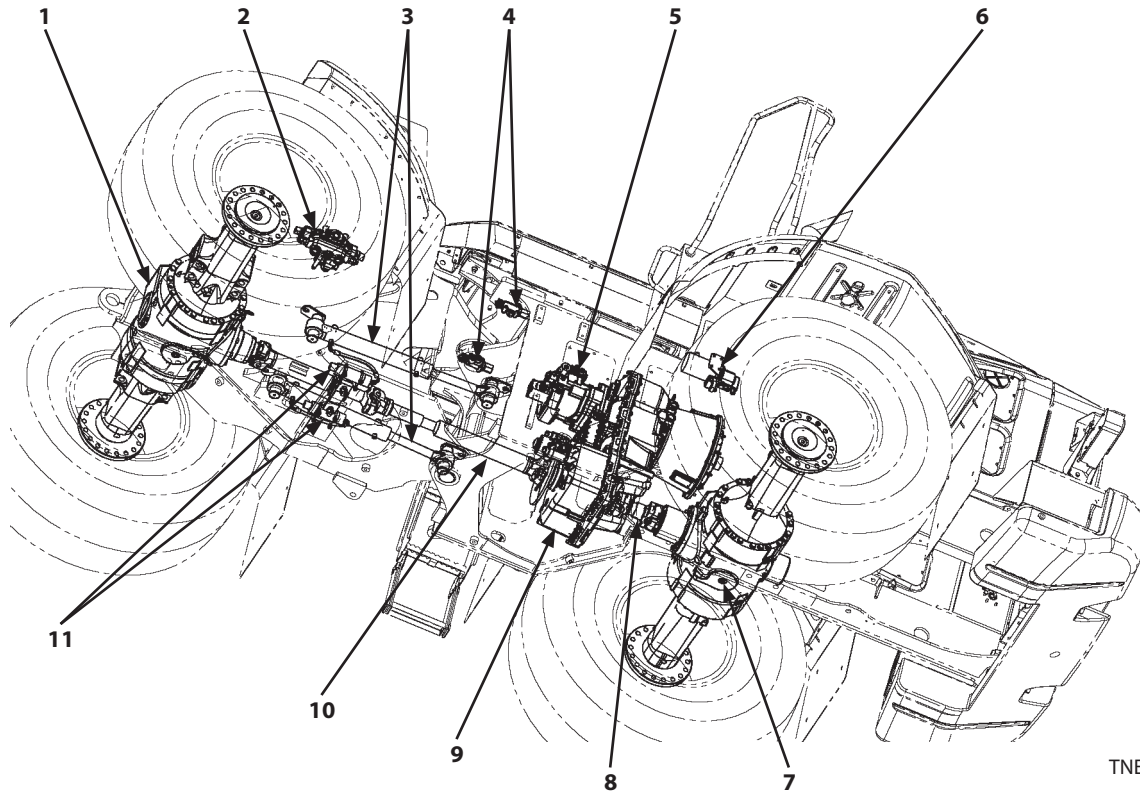
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- | | | | |
|--|--|--|---|
| 1- Radiator Assembly (Refer to T1-2-4) | 6- Service Brake Accumulator (2 Used) | 9- Brake Charge Valve (Refer to T1-2-20) | 14- Flow Regulator Valve (Refer to T1-2-21) |
| 2- Engin and Fan Pump (Refer to T1-2-15) | 7- Parking Brake Solenoid Valve (Refer to T1-2-20) | 10- Control Valve (Refer to T1-2-17) | 15- Fuel Main Filter |
| 3- Muffler Filter (Refer to T1-2-16) | 8- Manifold Valve (Refer to T1-2-20) | 11- 3-Spool Solenoid Valve Unit (Refer to T1-2-20) | 16- Fuel Tank |
| 4- Air Cleaner | | 12- Ride Control Accumulator | 17- Fuel Pre-Filter |
| 5- Hydraulic Oil Tank | | 13- Pilot Filter | 18- Fan Valve |
| | | | 19- Fan Motor |

SECTION 1 GENERAL

Group 2 Component Layout

Main Component



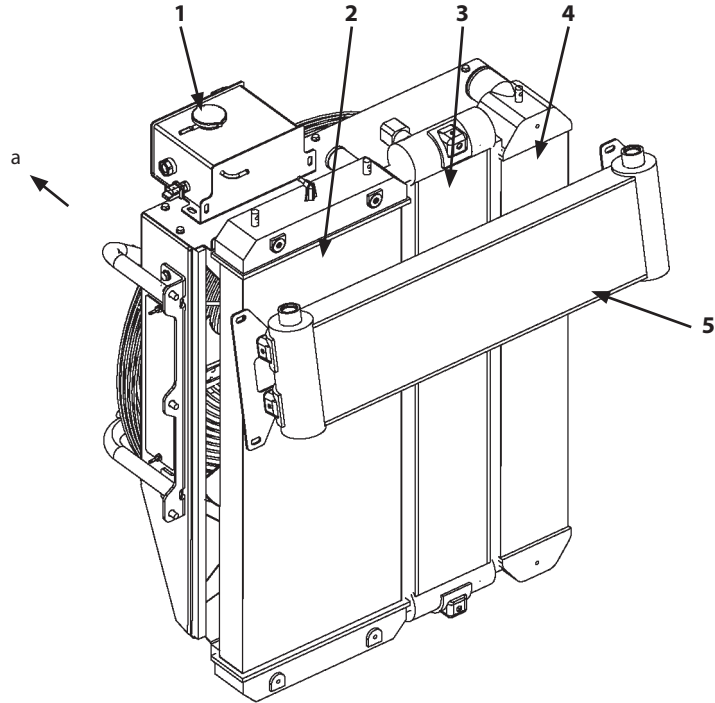
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| 1- Front Axle (Refer to T1-2-19) | 3- Steering Cylinder | 6- Emergency Steering Pump (Optional) (Refer to T1-2-21) | 9- Drive Unit (Refer to T1-2-19) |
| 2- Steering Valve/Emergency Steering Valve (Optional)(Refer to T1-2-21) | 4- Stop Valve | 7- Rear Axle | 10- Propeller Shaft (Front) |
| | 5- Pump Device (Refer to R1-2-17) | 8- Propeller Shaft (Rear) | 11- Steering Accumulator |

SECTION 1 GENERAL

Group 2 Component Layout

Radiator Assembly



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a- Front Side of Machine

1- Reserve Tank
2- Radiator

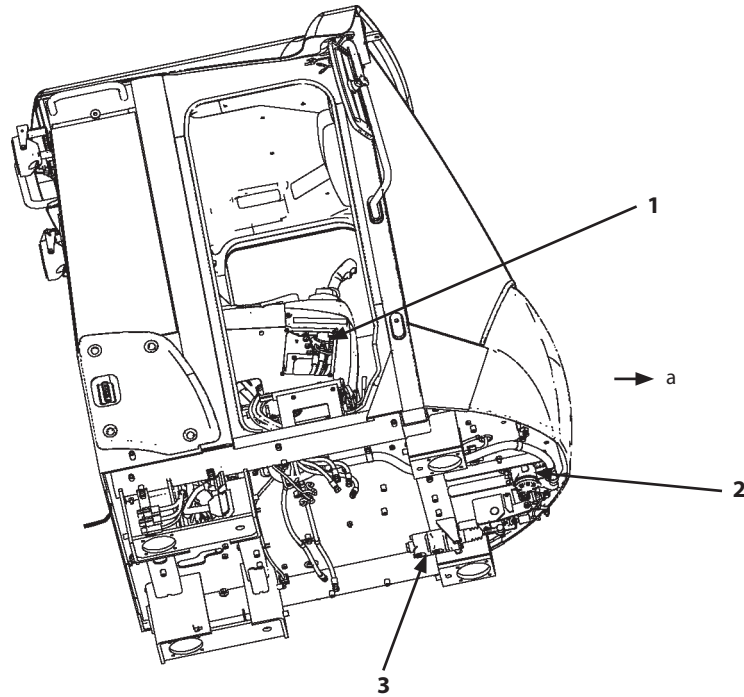
3- Oil Cooler
4- Inter Cooler

5- Torque Converter Cooler

SECTION 1 GENERAL

Group 2 Component Layout

Cab



TNEE-01-02-016

a- Front Side of Machine

1- Pilot Valve

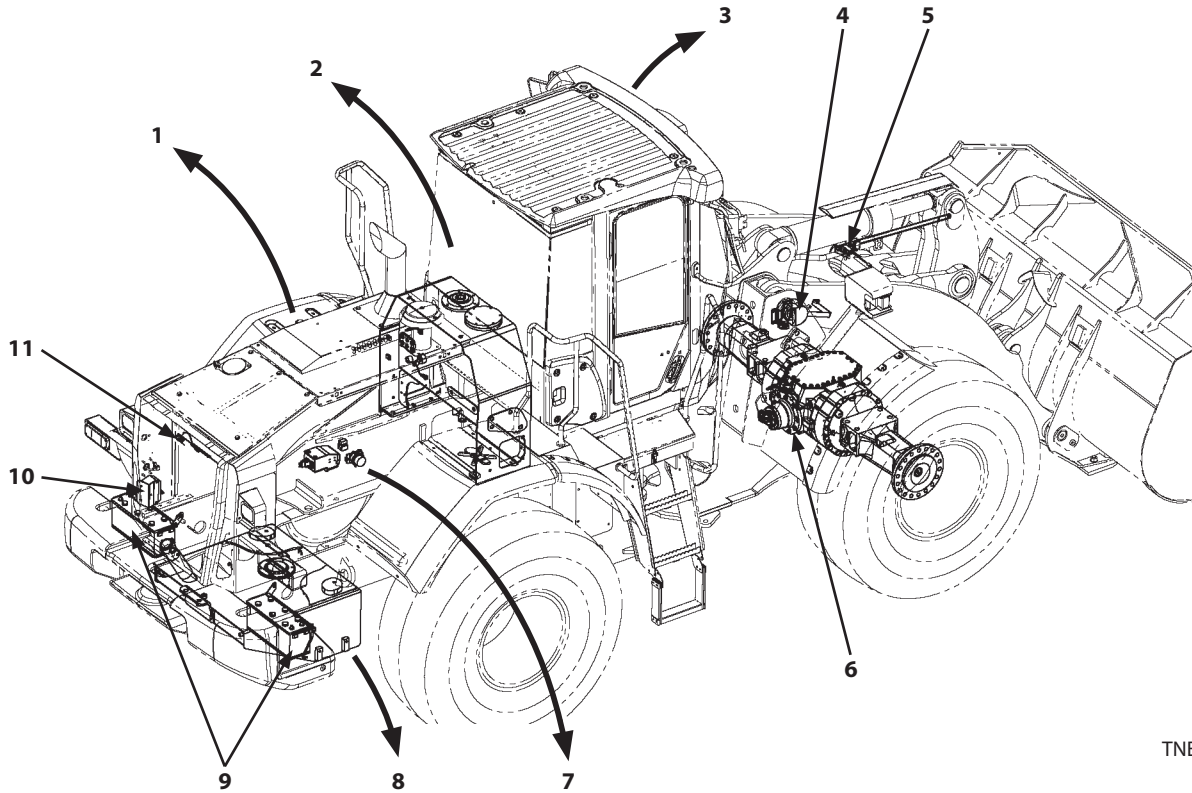
2- Steering Pilot Valve

3- Brake Valve

SECTION 1 GENERAL

Group 2 Component Layout

Electric Component Layout (Overview)



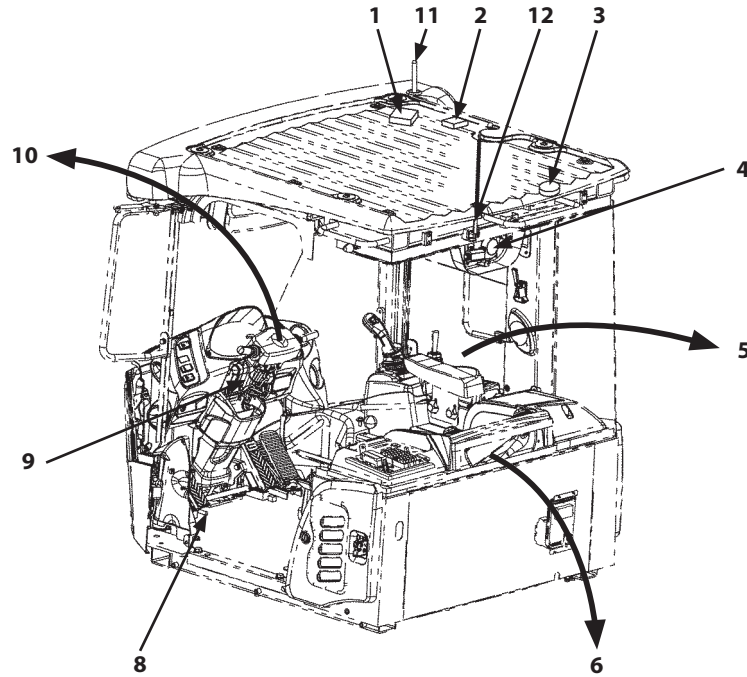
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| <p>1- Components Related with Engine and Fan Pump (Refer to T1-2-15)/Muffler Filter (Refer to T1-2-16)</p> <p>2- Components Related with Hydraulic Oil Tank (Refer to T1-2-13)</p> | <p>3- Components Related with Cab (Refer to T1-2-5)</p> <p>4- Lift Arm Angle Sensor (Optional)</p> <p>5- Bucket Proximity Switch</p> <p>6- Components Related with Front Axle (Refer to T1-2-19)</p> | <p>7- Electrical System (Relays) (Refer to T1-2-12)</p> <p>8- Electrical System (Fuel Tank and Radiator Assembly) (Refer to T1-2-14)</p> <p>9- Battery</p> <p>10- Back Buzzer</p> | <p>11- Rear Camera</p> |
|--|--|---|------------------------|

SECTION 1 GENERAL

Group 2 Component Layout

Electrical System (Cab)



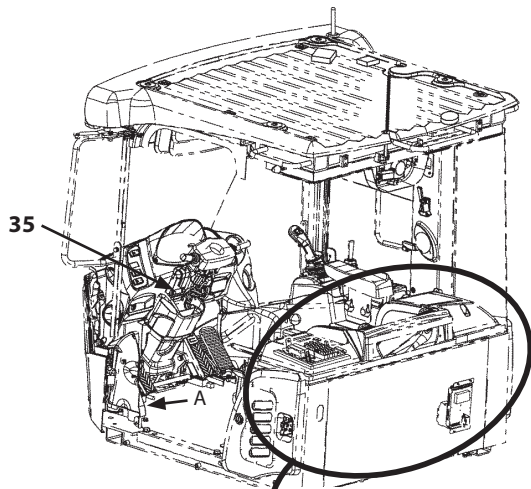
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| 1- Radio | 6- Components Related with Controllers and Relays (Refer to T1-2-6) | 10- Components Related with Monitor and Switches (Refer to T1-2-8) |
| 2- Upper Switch Panel (Optional) | 7- Outside Temperature Sensor | 11- GPS Antenna (Optional) |
| 3- Speaker | 8- Brake Lamp Switch | 12- Communication Antenna (Optional) |
| 4- Rear Wiper Motor | 9- Front Wiper Motor | |
| 5- Components Related with Right Console (Refer to T1-2-7) | | |

SECTION 1 GENERAL

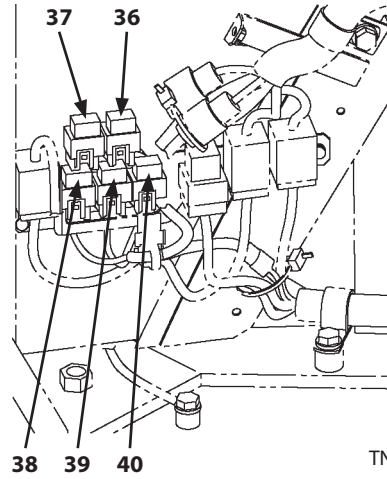
Group 2 Component Layout

Controller and Relays

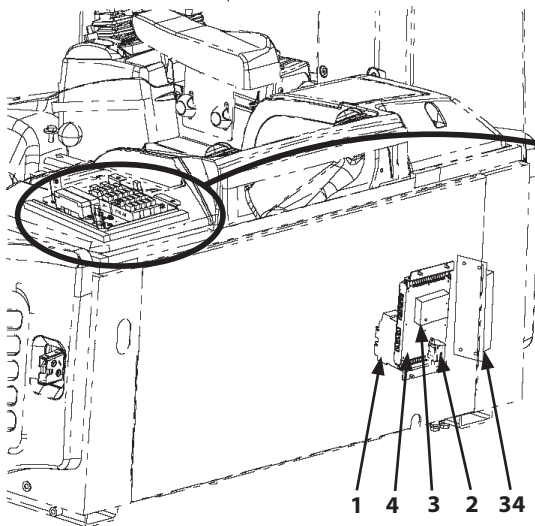


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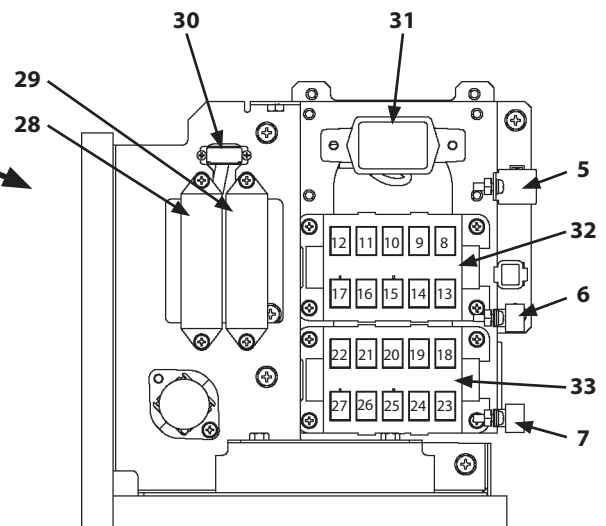
View A



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TNED-01-02-032



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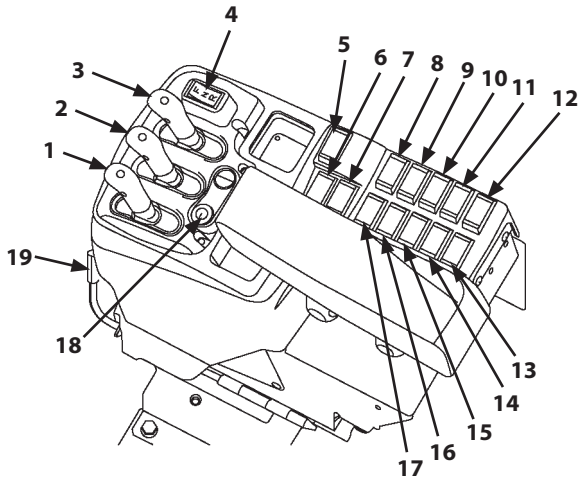
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|-----------------------------------|---|--|--|
| 1- TCU | 13- Work Light (Front) Relay (AR6) | 23- Neutral Relay (BR6) | 34- GSM (OP)/GPS (OP) |
| 2- Flasher Relay | 14- Work Light (Rear) Relay (AR7) | 24- Left Turn Signal Light Relay (BR7) | 35- ICF (Information Controller) |
| 3- Air Conditioner Controller | 15- Right Turn Signal Light Relay (AR8) | 25- Front Washer Relay (BR8) | 36- Front Wiper (1) Relay (WR1) |
| 4- MC (Main Controller) | 16- Horn Relay (AR9) | 26- Rear Wiper Relay (BR9) | 37- Front Wiper (2) Relay (WR2) |
| 5- ECM Main Relay | 17- Emergency Steering Relay (AR10) | 27- Rear Washer Relay (BR10) | 38- ACC Cut Relay (ACR) (OP) |
| 6- Fuel Pump Relay | 18- Parking Brake Relay 1 (BR1) | 28- Fuse Box B | 39- Auto Shut-Down Relay (ISR) (OP) |
| 7- Starter Cut Relay | 19- Parking Brake Relay 2 (BR2) | 29- Fuse Box A | 40- Key Switch ON Cut Relay (PCR) (OP) |
| 8- Head Light Relay (Left) (AR1) | 20- Pilot Shut-Off Relay (BR3) | 30- MPDr. Connector | |
| 9- Head Light Relay (Right) (AR2) | 21- Brake Light Relay (BR4) | 31- Timer | |
| 10- High-Beam Relay (AR3) | 22- Load Dump Relay (BR5) | 32- Relay Box A (RBA) | |
| 11- Bucket Leveler Relay (AR4) | | 33- Relay Box B (RBB) | |
| 12- Back Buzzer Relay (AR5) | | | |

SECTION 1 GENERAL

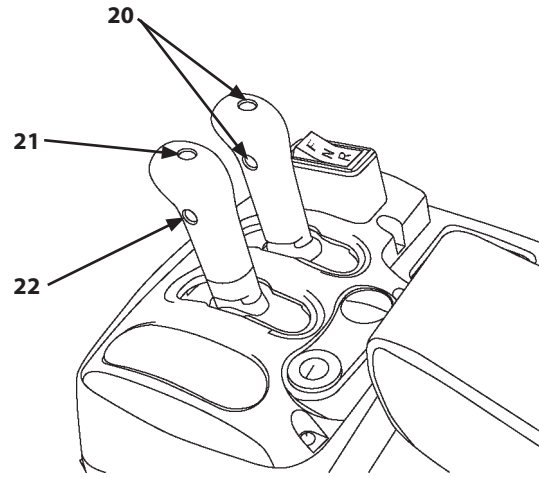
Group 2 Component Layout

Right Console

Fingertip Control Lever Type

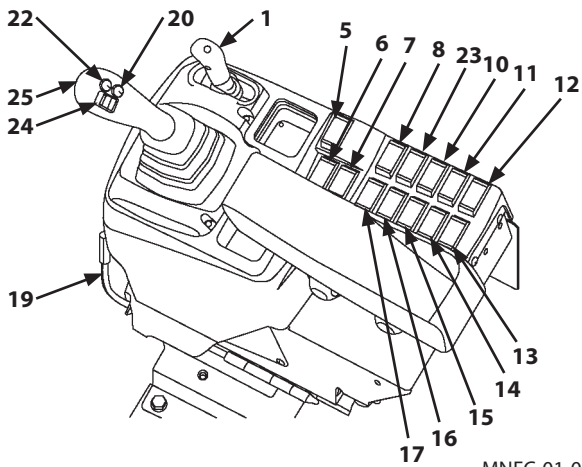


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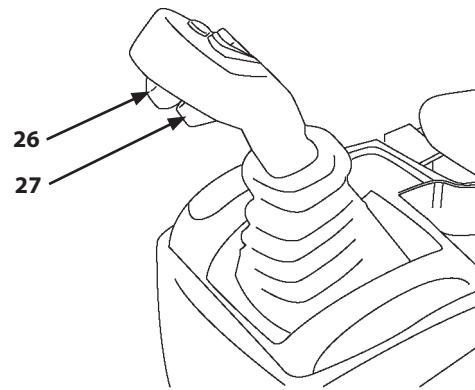


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Multi-Function Joystick Lever Type



MNEC-01-043



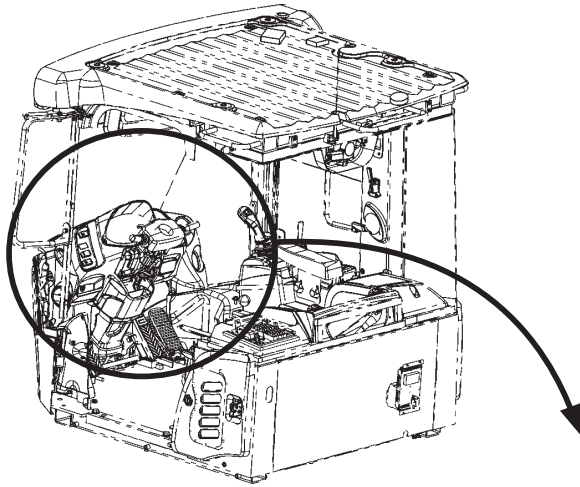
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|---------------------------------------|---|--|-------------------------------------|
| 1- Auxiliary Control Lever (Optional) | 7- Travel Mode Selector Switch | 13- Emergency Steering Operation Check Switch (Optional) | 21- Horn Switch |
| 2- Bucket Control Lever | 8- Power Mode Switch | 14- Muffler Filter Switch | 22- Quick Power Switch |
| 3- Lift Arm Control Lever | 9- Forward/Reverse Selector Switch (Optional) | 15- Auxiliary | 23- Forward/Reverse Selector Switch |
| 4- Forward/Reverse Switch (Optional) | 10- Fan Reverse Rotation Switch | 16- 1st Speed Fixed Switch | 24- Forward/Reverse Switch |
| 5- Front Control Lever Lock Switch | 11- Auxiliary | 17- Ride Control Switch (Optional) | 25- Multi-Function Joystick Lever |
| 6- Clutch Cut Position Switch | 12- Hydraulic Coupler Switch (Optional) | 18- Hold Switch | 26- Hold Switch (Under the Lever) |
| | | 19- Right Console Slide Lever | 27- Horn Button (Under the Lever) |
| | | 20- DSS (Down Shift Switch) | |

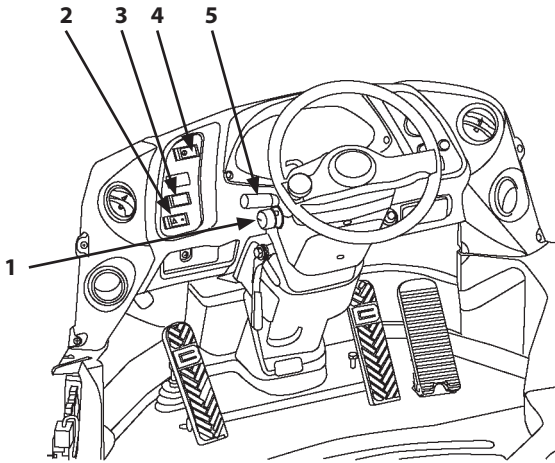
SECTION 1 GENERAL

Group 2 Component Layout

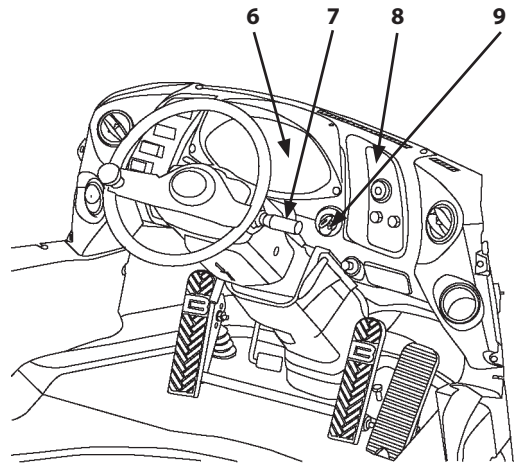
Monitor and Switches



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MNEC-01-037



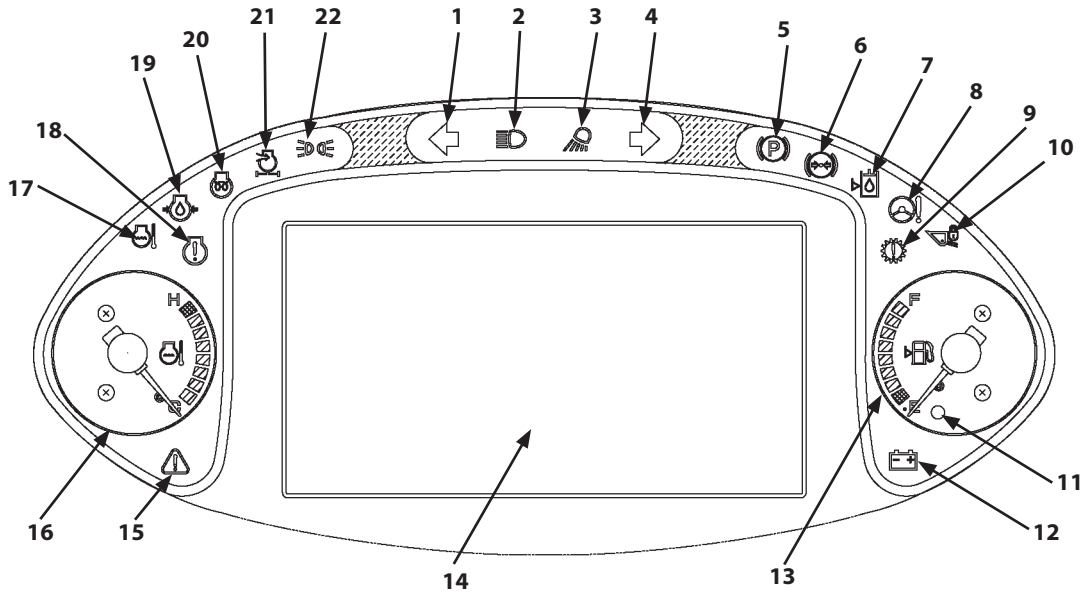
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|---|--|---|---|
| <ul style="list-style-type: none"> 1- Front/Rear Wiper Switch 2- Hazard Light Switch 3- Work Light Switch 4- Parking Brake Switch | <ul style="list-style-type: none"> 5- Forward/Reverse Lever/Shift Switch 6- Monitor Panel (Refer to T1-2-11) | <ul style="list-style-type: none"> 7- Turn Signal Lever/Light Switch/Dimmer Switch 8- Multi-Function Monitor/Air Conditioner Switch Panel | <ul style="list-style-type: none"> 9- Key Switch |
|---|--|---|---|

SECTION 1 GENERAL

Group 2 Component Layout

Monitor Panel



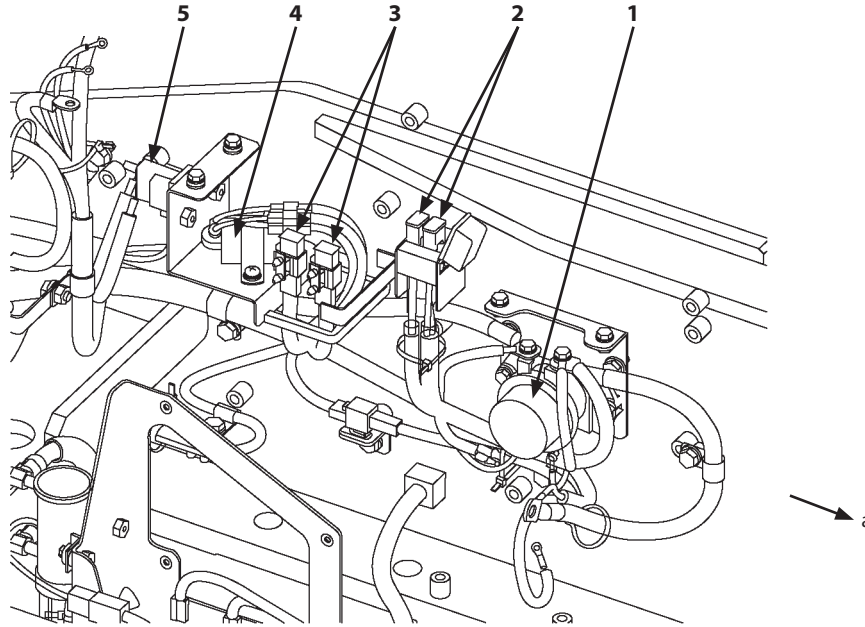
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|-------------------------------------|--|--|---------------------------------------|
| 1- Left Turn Signal Indicator | 7- Hydraulic Oil Level Indicator | 12- Discharge Warning Indicator | 18- Engine Warning Indicator |
| 2- High Beam Indicator | 8- Low Steering Oil Pressure Indicator | 13- Fuel Gauge | 19- Engine Oil Low Pressure Indicator |
| 3- Work Light Indicator | 9- Transmission Warning Indicator | 14- Multi Function Monitor | 20- Preheat Indicator |
| 4- Right Turn Signal Indicator | 10- Control Lever Lock Indicator | 15- Communication System Error Indicator | 21- Air Filter Restriction Indicator |
| 5- Parking Brake Indicator | 11- Fuel Level Indicator | 16- Coolant Temperature Gauge | 22- Clearance Light Indicator |
| 6- Brake Oil Low Pressure Indicator | | 17- Overheat Indicator | |

SECTION 1 GENERAL

Group 2 Component Layout

Electrical System (Relays)



TNEE-01-02-006

a- Front Side of Machine

1- Battery Relay

2- Fusible Link (140A)

3- Fusible Link (65A)

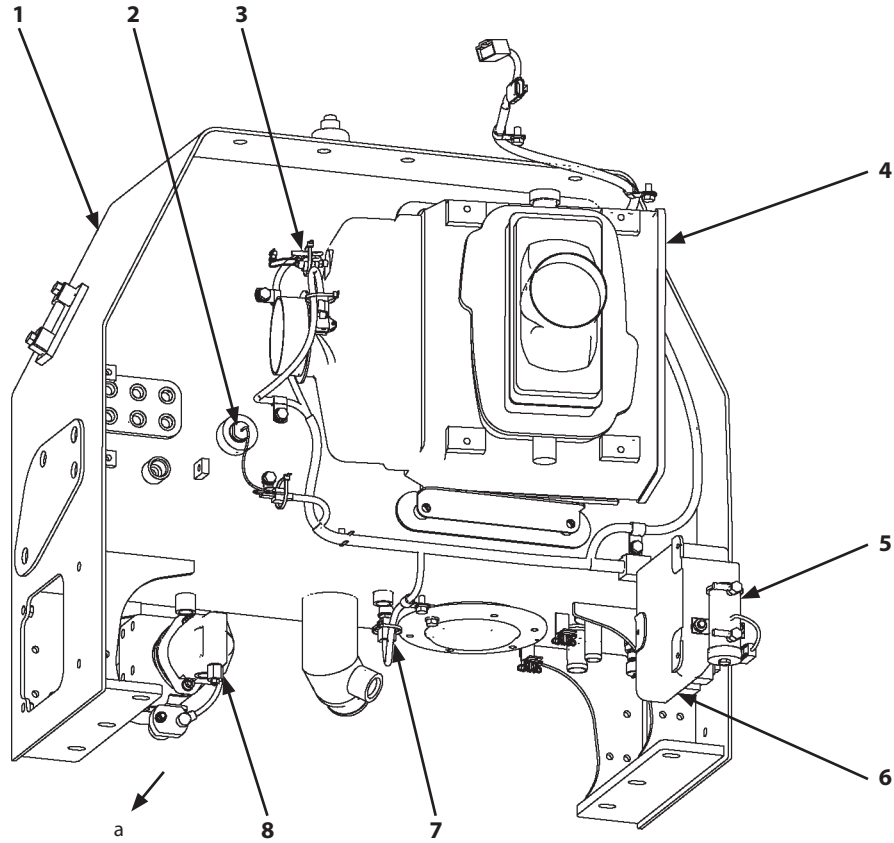
4- Starter Relay

5- Intake Air Heater Relay

SECTION 1 GENERAL

Group 2 Component Layout

Electrical System (Around Hydraulic Oil Tank)



TNEE-01-02-007

a- Front Side of Machine

- 1- Hydraulic Oil Tank
- 2- Hydraulic Oil Level Sensor
- 3- Air Filter Restriction Switch

- 4- Air Cleaner
- 5- Fuel Pump
- 6- Washer Tank

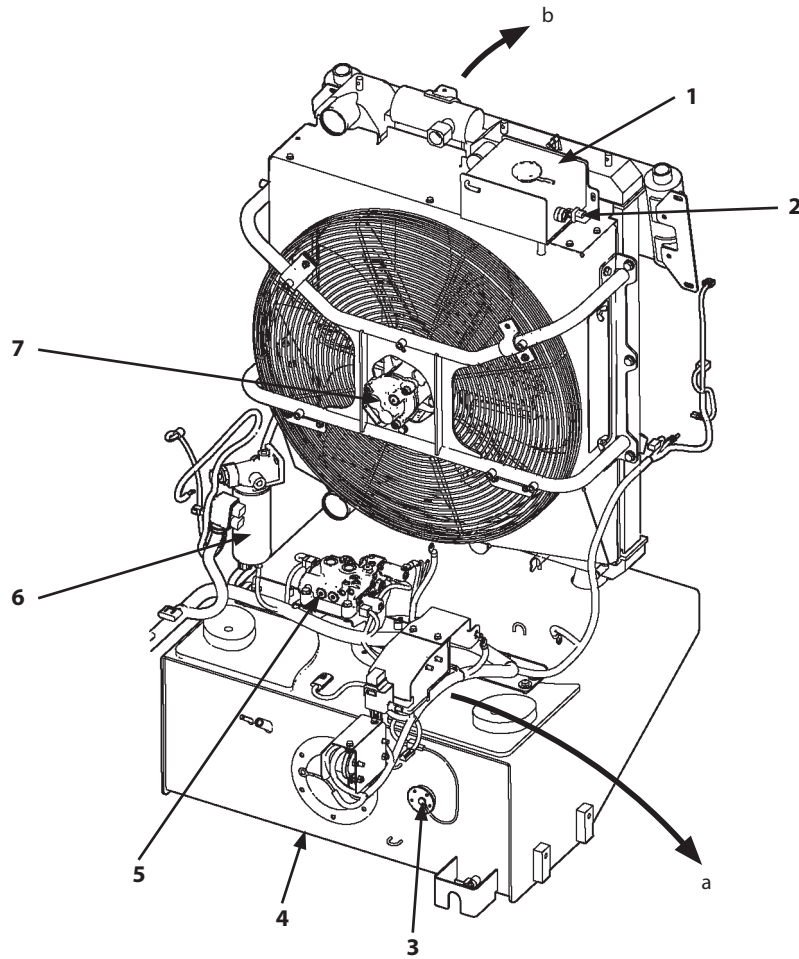
- 7- Hydraulic Oil Temperature Sensor

- 8- Emergency Steering Pump (Optional) (Refer to T1-2-21)

SECTION 1 GENERAL

Group 2 Component Layout

Electrical System (Around Fuel Tank and Radiator Assembly)



TNEE-01-02-008

a- Components Related with Relays (Refer to T1-2-12)

b- Radiator Assembly (Refer to T1-2-4)

1- Reserve Tank

4- Fuel Tank

6- Filter Restriction Switch (Fuel Pre-Filter)

2- Coolant Level Sensor

5- Fan Valve (Refer to T1-2-18)

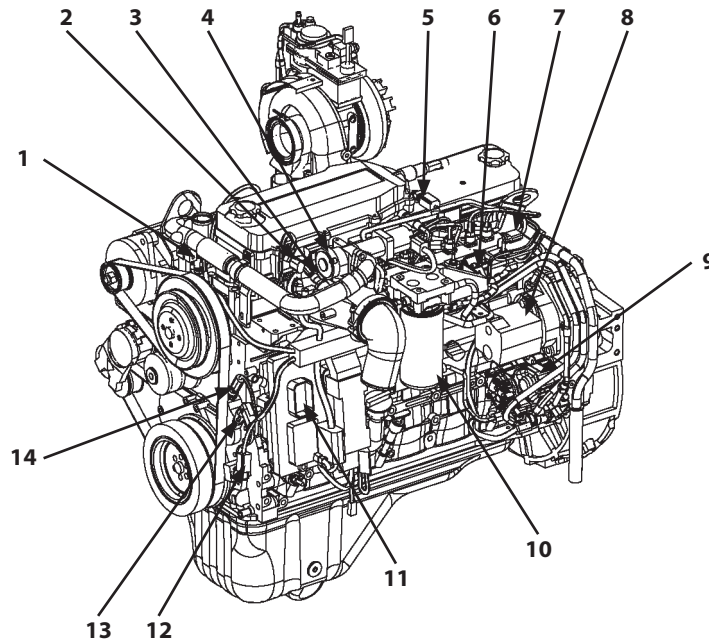
7- Fan Motor

3- Fuel Level Sensor

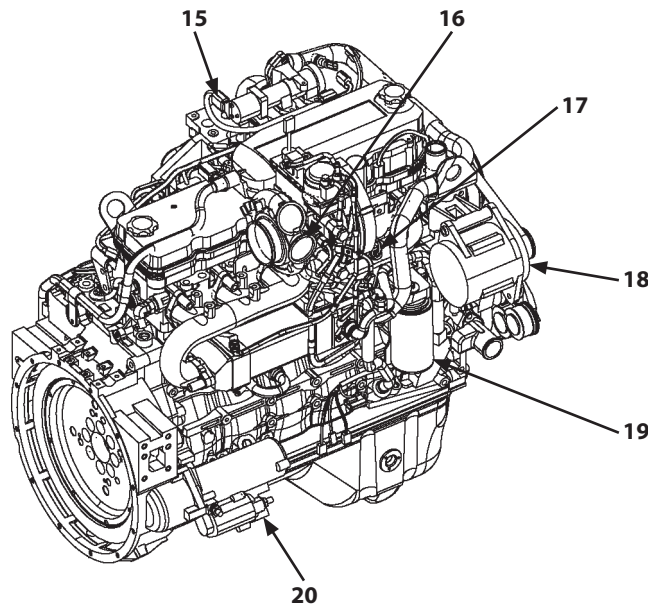
SECTION 1 GENERAL

Group 2 Component Layout

Engine and Fan Pump



TNEE-01-02-010



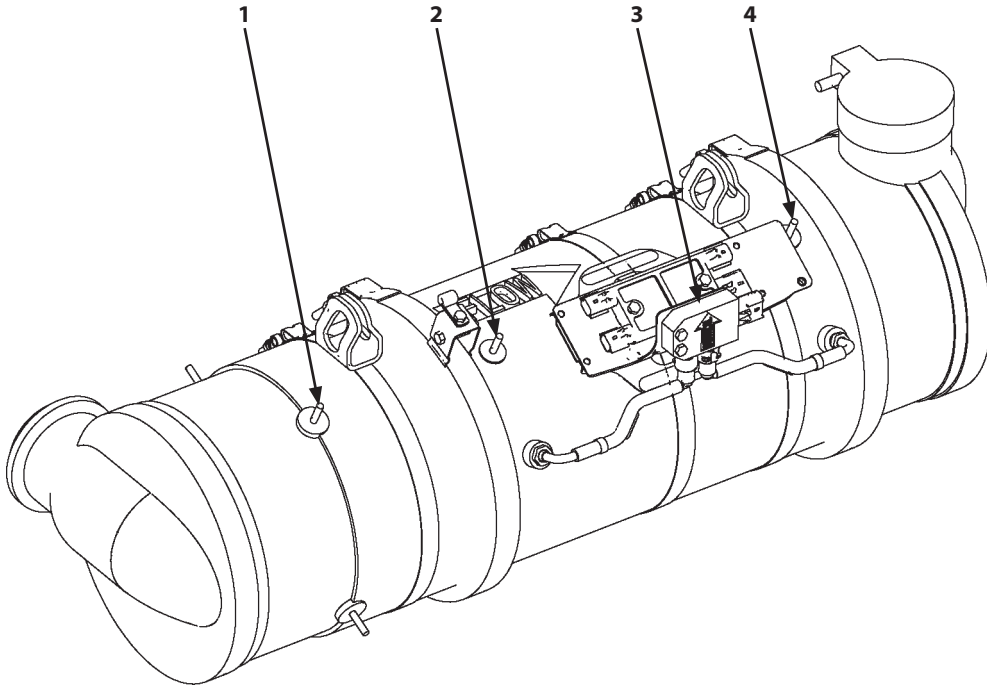
TNEE-01-02-011

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|---|--|--------------------------------|-----------------------------|
| 1- Coolant Temperature Sensor | 6- Boost Pressure/Boost Temperature Sensor | 11- ECM | 17- Exhaust Pressure Sensor |
| 2- EGR Gas Differential Pressure Sensor | 7- Common Rail Pressure Sensor | 12- Crank Speed Sensor | 18- Alternator |
| 3- EGR Gas Temperature Sensor | 8- Fan Pump | 13- Cam Angle Sensor | 19- Engine Oil Filter |
| 4- EGR Valve | 9- Supply Pump | 14- Engine Oil Pressure Switch | 20- Starter Motor |
| 5- Crankcase Pressure Sensor | 10- Fuel Main Filter | 15- EGR Motor Position Sensor | |
| | | 16- Turbocharger Speed Sensor | |

SECTION 1 GENERAL

Group 2 Component Layout

Muffler Filter



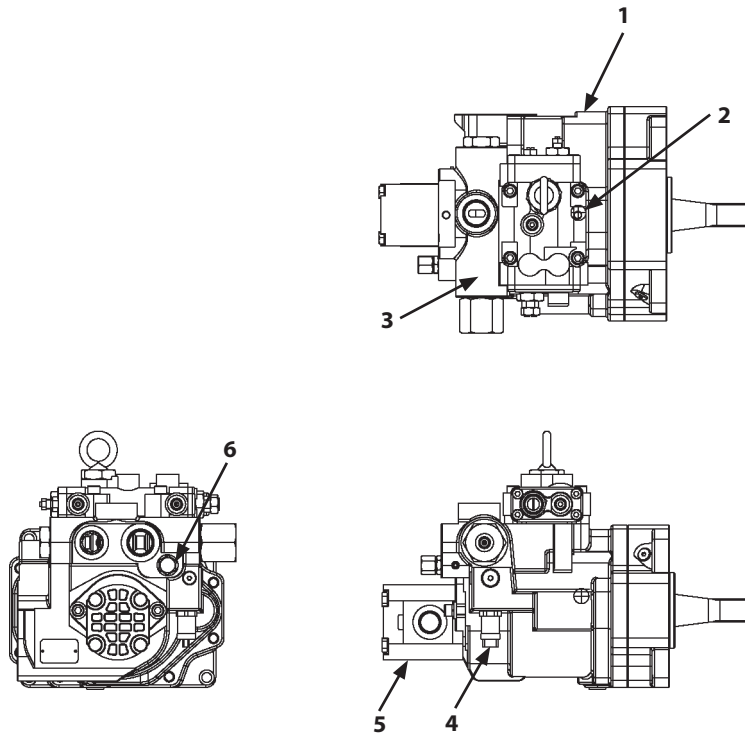
TNEE-01-02-012

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|-----------------------------------|---|---------------------------------|---|
| 1- DOC Exhaust Temperature Sensor | 2- Filter Intake Gas Temperature Sensor | 3- Differential Pressure Sensor | 4- Filter Outlet Gas Temperature Sensor |
|-----------------------------------|---|---------------------------------|---|

SECTION 1 GENERAL

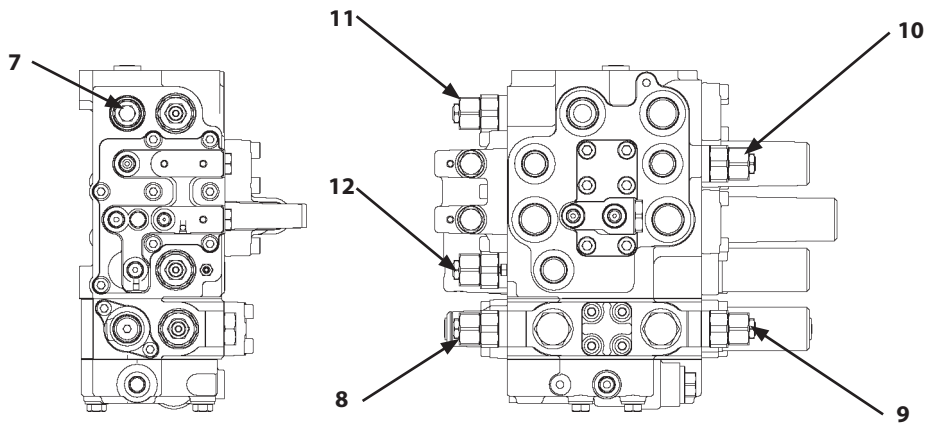
Group 2 Component Layout

Pump Device



T4GB-01-02-009

Control Valve



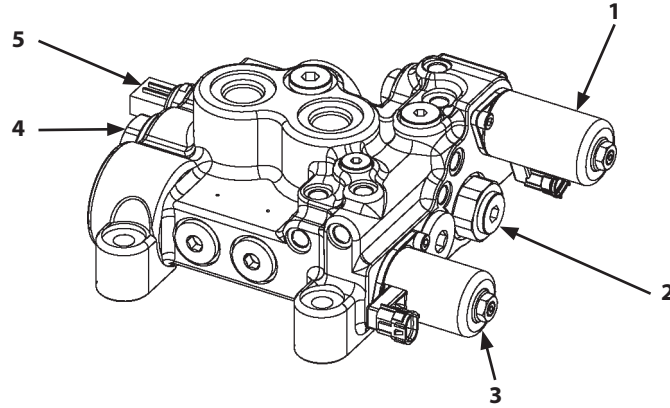
TNED-03-02-002

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|----------------------------------|---|------------------------------------|---|
| 1- Main Pump | 5- Pilot Pump | 8- Auxiliary Overload Relief Valve | 11- Overload Relief Valve (Bucket: Bottom Side) |
| 2- Regulator | 6- Main Relief Valve (Steering) | 9- Auxiliary Overload Relief Valve | 10- Overload Relief Valve (Bucket: Rod Side) |
| 3- Priority Valve | 7- Main Relief Valve (Front Attachment) | | 12- Overload Relief Valve (Lift Arm: Bottom Side) |
| 4- Pump Delivery Pressure Sensor | | | |

SECTION 1 GENERAL

Group 2 Component Layout

Fan Valve



TNEE-01-02-031

- | | | | |
|-------------------------------------|--|----------------------|--------------------------------------|
| 1- Fan Speed Control Solenoid Valve | 2- Fan Reverse Rotation Control Solenoid Valve | 3- Fan Control Valve | 5- Fan Pump Delivery Pressure Sensor |
| | 4- Fan Reverse Rotation Spool | | |

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