I . GENERAL
II . SPECIFICATIONS
III. MACHINE CONFIGURATION
IV. HYDRAULIC UNITS
V . TROUBLESHOOTING
VI. ENGINE

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## SAFETY PRECAUTIONS

### SAFETY ALERT SYMBOL

This symbol means Attention! Be Alert! Your Safety Is Involved.
The message that follows the symbol contains important information about safety.
Read and understand the message to avoid personal injury or death.

### ■ SIGNAL WORDS

Safety messages appearing in this manual and on machine decals are identified by the words "DANGER", "WARNING" and "CAUTION". These signal words mean the following:

**⚠ DANGER**

The word "DANGER" indicates an imminently hazardous situation which, if not avoided, can result in serious injury or death.

**⚠ WARNING**

The word "WARNING" indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death.

**⚠ CAUTION**

The word "CAUTION" indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

**IMPORTANT:** The word "IMPORTANT" is used to alert against operators and maintenance personnel about situations which can result in possible damage to the machine and its components.

This manual is intended for trained and qualified personnel only. Warnings or cautions described in this manual do not necessarily cover all safety measures. For maintenance work, each person must take adequate safety precautions against possible hazards present in the respective working environment.

### Observe all safety rules

- Operation, inspection and maintenance of this machine must be performed only by a trained and qualified person.
- All rules, regulations, precautions and safety procedures must be understood and followed when performing operation, inspection and maintenance of this machine.
- Do not perform any operation, inspection and maintenance of this machine when under the adverse influence of alcohol, drugs, medication, fatigue, or insufficient sleep.



E3A040

### Wear appropriate clothing and personal protective equipment

- Do not wear loose clothing or any accessory that can catch on controls or in moving parts.
- Do not wear oily or fuel stained clothing that can catch fire.
- Wear a hard hat, safety shoes, safety glasses, filter mask, heavy gloves, ear protection and other protective equipment as required by job conditions. Wear required appropriate equipment such as safety glasses and filter mask when using grinders, hammers or compressed air, as metal fragments or other objects can fly and cause serious personal injury.
- Use hearing protection when operating the machine. Loud prolonged noise can cause hearing impairments, even the total loss of hearing.

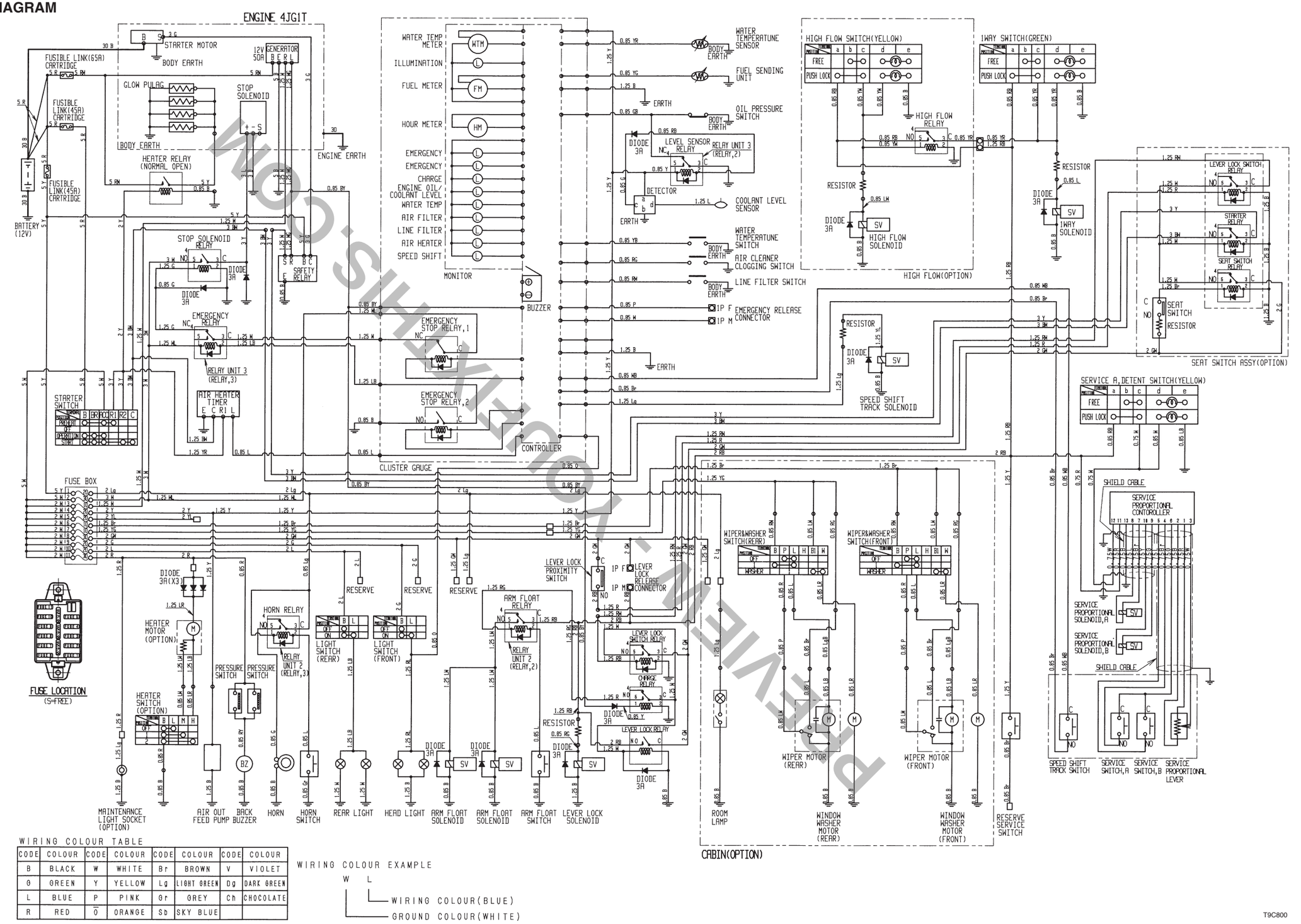
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# ELECTRICAL SYSTEM

## ELECTRICAL WIRING DIAGRAM




WIRING COLOUR TABLE

| CODE | COLOUR | CODE | COLOUR | CODE | COLOUR | CODE | COLOUR |
|---|---|---|---|---|---|---|---|
| B | BLACK | W | WHITE | Br | BROWN | V | VIOLET |
| G | GREEN | Y | YELLOW | Lg | LIGHT GREEN | Dg | DARK GREEN |
| L | BLUE | P | PINK | Gr | GREY | Ch | CHOCOLATE |
| R | RED | O | ORANGE | Sb | SKY BLUE | | |

WIRING COLOUR EXAMPLE

W L

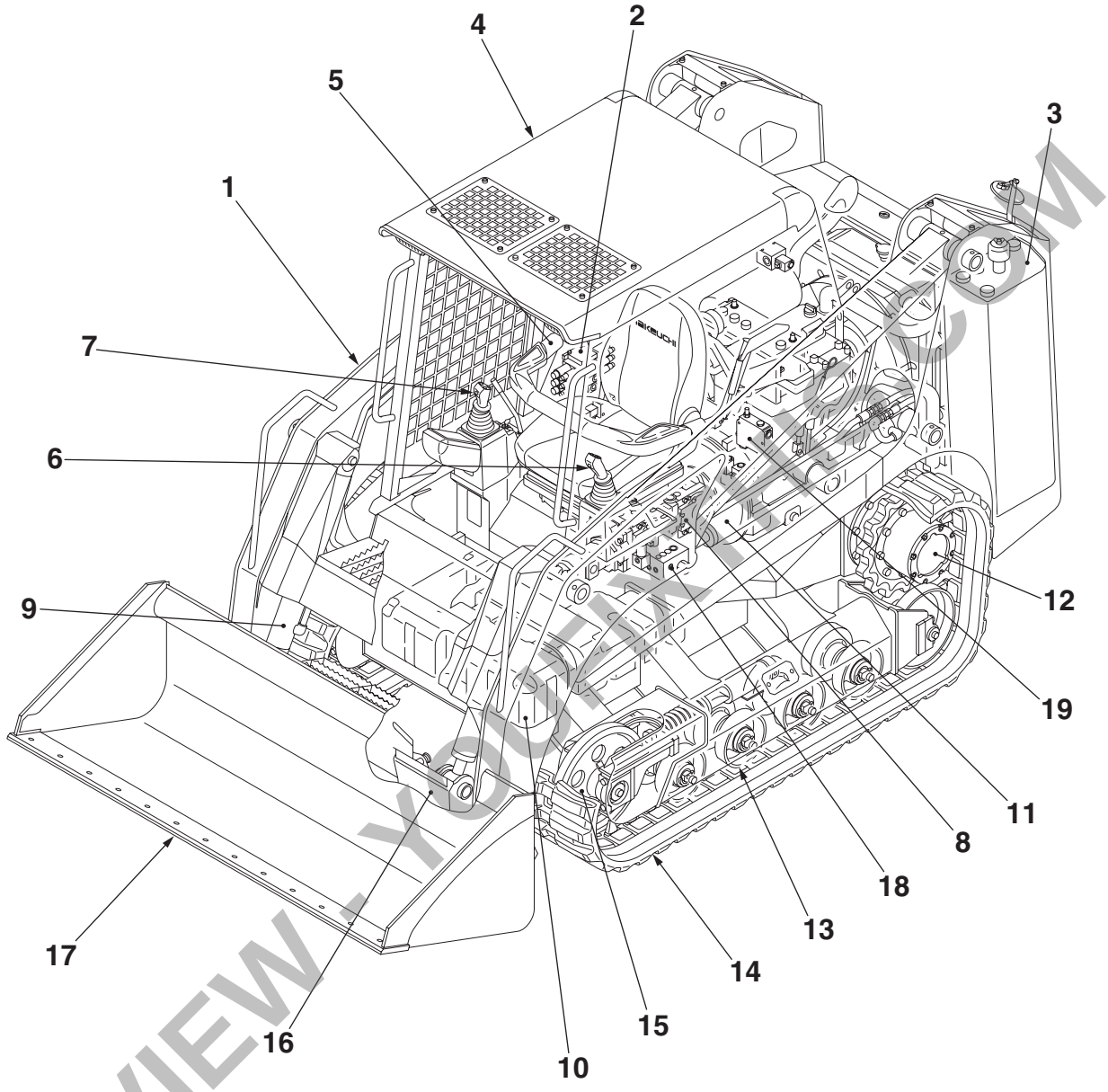
WIRING COLOUR(BLUE)

GROUND COLOUR(WHITE)

WOOSHIN HYDRAULIC SYSTEM REVIEW

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## NAMES OF COMPONENTS




1. Lift Arm
2. Control Valve
3. Hydraulic Tank
4. Canopy
5. Safety Bar
6. Pilot Valve (L. H.)
7. Pilot Valve (R. H.)
8. HST Pump
9. Bucket Cylinder
10. Fuel Tank
11. Arm Cylinder
12. Travel Motor
13. Track Roller
14. Crawler Belt
15. Idler
16. Quick Attachment
17. Bucket
18. Control Valve (Sub)
19. Self -Level Valve

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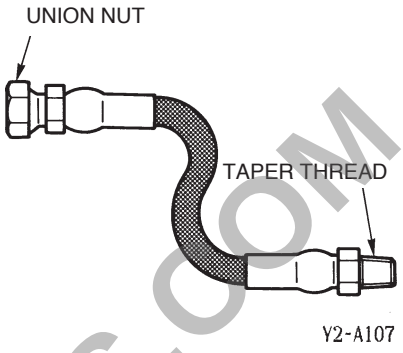


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## TIGHTENING TORQUES

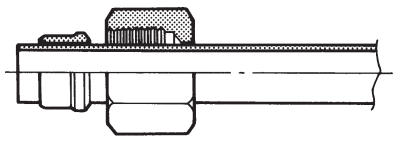
### Hydraulic Hoses

| Hose Fitting Size | Torque | | | |
|---|---|---|---|---|
| | Union Nut (G) | | Taper Thread (R) | |
| | N·m | ft-lb | N·m | ft-lb |
| 1/8 | 9.8 $^{+4.9}_{0}$ | 7.3 $^{+3.5}_{0}$ | 11.8 ±1.2 | 8.7 ±0.8 |
| 1/4 | 24.5 $^{+4.9}_{0}$ | 18.1 $^{+3.5}_{0}$ | 29.4 ±2.9 | 21.7 ±2.1 |
| 3/8 | 49 $^{+4.9}_{0}$ | 36.2 $^{+3.5}_{0}$ | 53.9 ±5.4 | 39.8 ±3.9 |
| 1/2 | 58.8 $^{+4.9}_{0}$ | 43.4 $^{+3.5}_{0}$ | 88.3 ±8.8 | 65.1 ±6.4 |
| 3/4 | 117.7 $^{+4.9}_{0}$ | 86.8 $^{+3.5}_{0}$ | 147.1 ±14.7 | 108.5 ±10.7 |
| 1 | 137.3 $^{+4.9}_{0}$ | 101.3 $^{+3.5}_{0}$ | 196.1 ±19.6 | 144.7 ±14.3 |




### Bite Type Pipe Fitting for Steel Pipe

| Pipe Outer Diameter (mm) | Torque | |
|---|---|---|
| | N·m | ft-lb |
| 8 | 34.3 ±4.9 | 25.3 ±3.5 |
| 10 | 41.7 ±2.5 | 30.7 ±1.7 |
| 12 | 58.8 ±4.9 | 43.4 ±3.5 |
| 15 | 88.3 ±4.9 | 65.1 ±3.5 |
| 16 | 93.2 ±4.9 | 68.7 ±3.5 |
| 18 | 132.4 ±4.9 | 97.6 ±3.5 |
| 22 | 205.9 ±9.8 | 151.8 ±7.2 |
| 27.2 | 245.2 ±9.8 | 181.0 ±7.2 |
| 28 | 313.8 ±19.6 | 231.4 ±14.3 |
| 32 | 313.8 ±19.6 | 231.4 ±14.3 |
| 35 | 411.9 ±19.6 | 303.7 ±14.3 |




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## DISASSEMBLY AND ASSEMBLY

### Removing the Engine

1. Disconnect the negative battery cable (1) from the battery.

2. Remove the canopy.
   ☞ "Removing the Canopy"

3. Remove the floor frame.
   ☞ "Removing the Floor Frame"

4. Disconnect the electrical wiring from the air cleaner (2). Next, remove the bracket (3) together with the air cleaner.

5. Remove the silencer (4) from the bracket.

6. Remove the radiator.
   ☞ "Removing the Radiator"

7. Disconnect the coolant drain hoses (5).

8. Remove the hydraulic pump.
   ☞ "Removing the Hydraulic Pump"

9. Remove the valves (6) and the filter (7).

10. Remove the fuel inlet pipe (8).

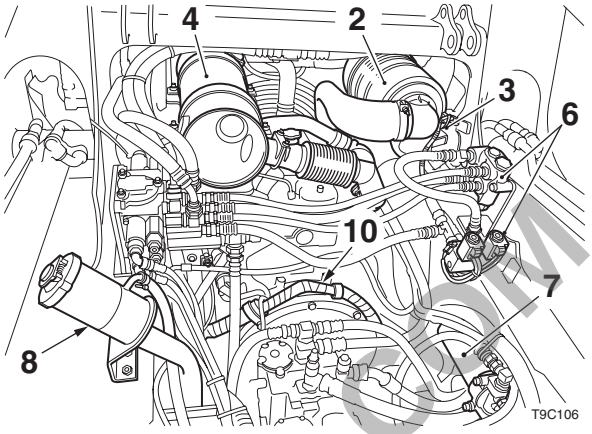
11. Disconnect the fuel hoses (9).

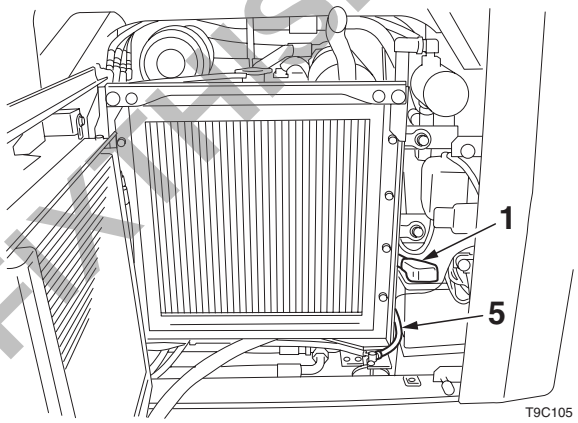
12. Disconnect the battery cable (1) and all the connections on the engine side of the electric wirings (10).
    - Attach identification labels to individual wirings.
    - Disconnect the wirings from the clamp and the band.

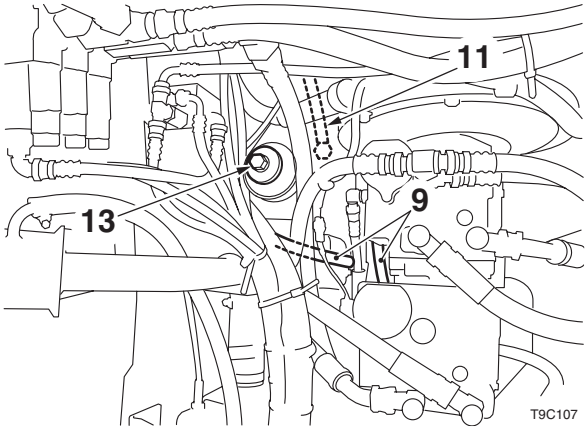
13. Disconnect the engine ground cable (11) and accelerator wire (12).

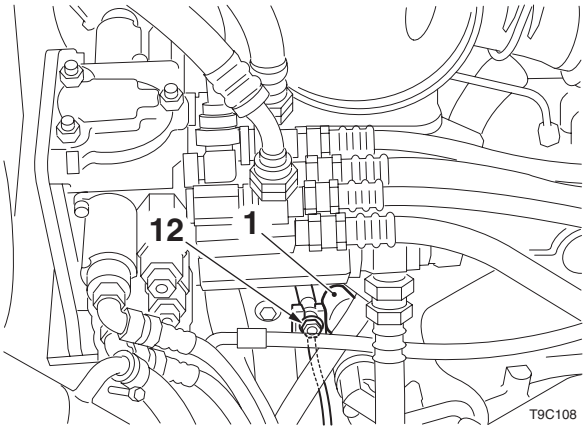
14. Remove the bolts (13) and then the cushion rubbers.
    ⊂ Bolt: 256 N·m; Apply thread-locking compound.

15. Suspend the engine temporarily, and remove the engine.
    ⏢ Engine: 260 kg



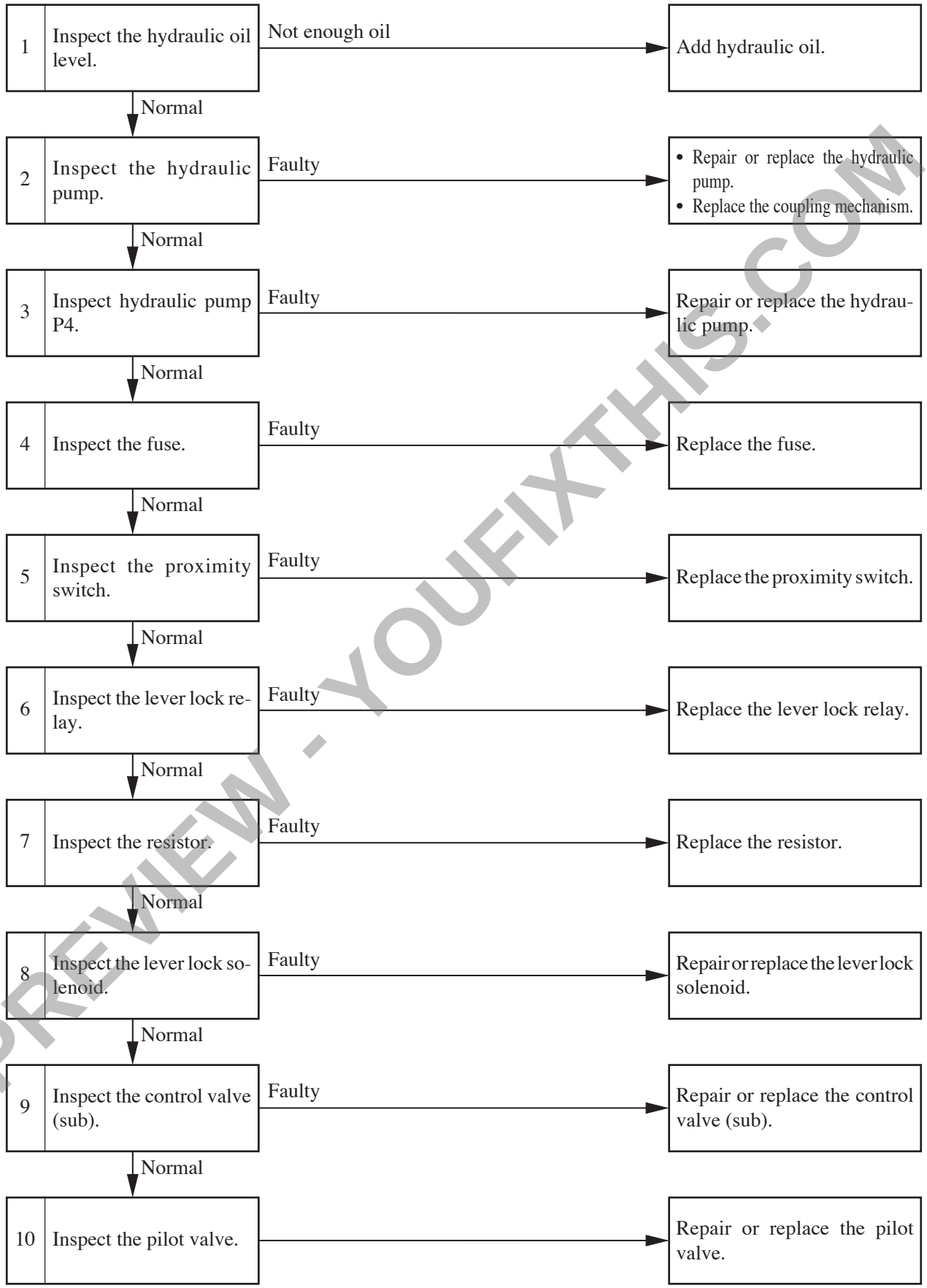

### Installing the Engine

Follow the same procedure as for removal in the reverse order.

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**COMPLETE FAILURE OF ALL SYSTEMS.**




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# SPECIFICATION TABLES

## SPECIFICATIONS

| | | |
|---|---|---|
| Serial Number | | 21400011~ |
| Machine Type | | Canopy |
| Standard Bucket Capacity | | |
| Rated Capacity | $m^3$ | 0.458 |
| Struck Capacity | $m^3$ | 0.335 |
| Machine Mass (not including operator) | kg | 4275 |
| Dimensions | | |
| Overall Lenght: with bucket/without bucket | mm | 3710/2950 |
| Overall Width: with bucket/without bucket | mm | 1880/1770 |
| Overall Height | mm | 2270 |
| Minimum Ground Clearance | mm | 325 |
| Front Clearance Radius: with bucket/without bucket | mm | 2295/1500 |
| Rear Clearance Radius | mm | 1670 |
| Overall Width of Crawler | mm | 1770 |
| Bucket Width | mm | 1880 |
| Angle of Departure | degree | 30 |
| Working Range | | |
| Maximum Lift Height to Bucket Pin | mm | 3120 |
| Maximum Dumping Height | mm | 2405 |
| Maximum Dump Angle Fully Raised | degree | 39 |
| Maximum Bucket Rollback at Ground Level | degree | 31 |
| Reach Fully Raised | mm | 875 |
| Performance | | |
| Breakout Force | kN | 32.9 |
| Travel Speed 1 st/2 nd | km/h | 7.3/10.4 |
| Gradeability | degree | 30 |
| Ground Pressure | kPa | 28.2 |
| Tipping Load | kg | 2700 |
| Cycle Time | | |
| Raise-Full Load (Lift Arm) | Sec. | 4.3 |
| Lower-No Load (Lift Arm) | Sec. | 2.9 |
| Dump-Full Load (Bucket) | Sec. | 3.2 |
| Curl-Full Load (Bucket) | Sec. | 2.2 |

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# STANDARDS FOR JUDGING PERFORMANCE

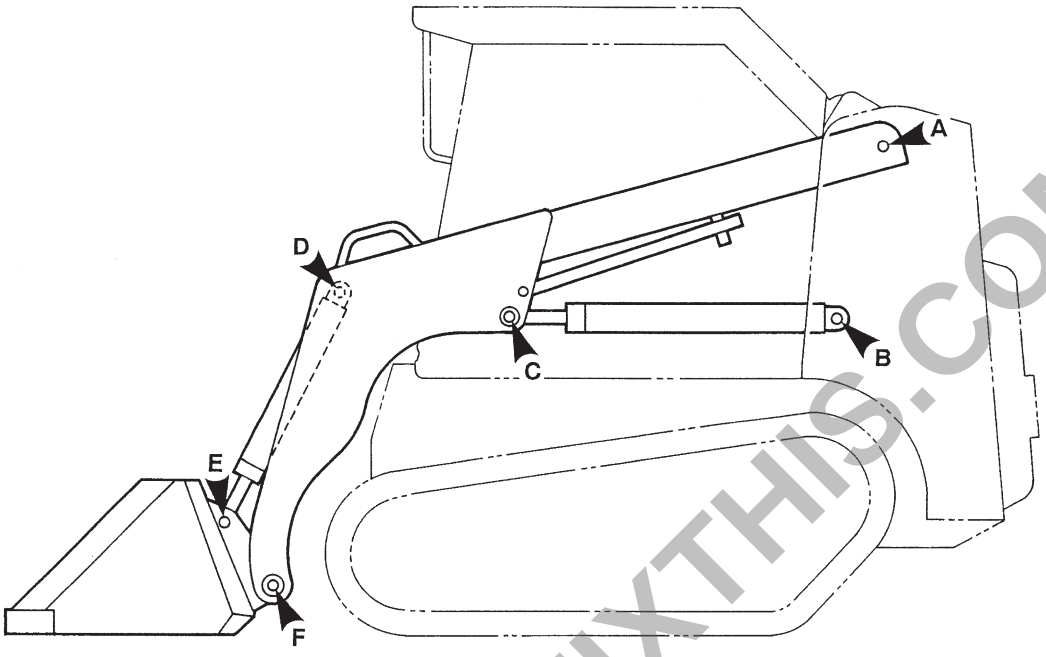
## REFERENCE VALUE TABLE

| Serial Number | | | 21400011~ | |
|---|---|---|---|---|
| Item | | Unit | Standard Values | Allowable Values |
| Hydraulic Oil Pressure | | | | |
| Travel | | MPa | $34.3^{+4.9}_{-1.0}$ | — |
| Lift Arm | | MPa | — | — |
| Bucket | | MPa | $20.6^{+0.5}_{-1.0}$ | — |
| Charge Pressure | | | | |
| Low | | MPa | 1.3 ±0.3 | — |
| Hight | | MPa | 1.8 ±0.3 | — |
| Pilot Pressure | | MPa | 3.0 ±0.4 | — |
| Travel | | | | |
| Travel Speed (5 rev.) | | | | |
| Low Speed | | s | 11.1 ±0.8 | 13.0 |
| Hight Speed | | s | 7.8 ±0.7 | 9.6 |
| Travel Speed (10 m) | | | | |
| Low Speed | | s | 4.7 ±0.6 | 5.8 |
| Hight Speed | | s | 3.3 ±0.5 | 4.3 |
| Travel Curve | | mm | $125^{0}_{-125}$ | 500 |
| Natural Travel Drop | Engages Parking Brake | mm | 0 | — |
| | Releases Parking Brake | mm | — | — |
| Cylinders | | | | |
| Cylinder Speed | | | | |
| Arm | Extended | s | 4.3 ±0.5 | 5.2 |
| | Retracted | s | 2.9 ±0.5 | 3.7 |
| Bucket | Extended | s | 2.2 ±0.5 | 2.9 |
| | Retracted | s | 3.2 ±0.5 | 4.0 |
| Natural Cylinder Drop | | | | |
| Arm | | mm | $8^{0}_{-8}$ | 16 |
| Bucket | | mm | $7^{0}_{-7}$ | 14 |
| Bucket Tip | | mm | $70^{0}_{-70}$ | 200 |
| Levers | | | | |
| Lever Operating Force | | | | |
| Arm | | N | 10 ±4 | |
| Bucket | | N | 10 ±4 | |
| Travel | | N | 10 ±4 | |
| Lever Play | | | | |
| Arm | | mm | $4^{0}_{-4}$ | |
| Bucket | | mm | $4^{0}_{-4}$ | |
| Travel | | mm | $4^{0}_{-4}$ | |
| Crawler | | | | |
| Crawler Tension | | mm | 15~25 | — |
| Level of Front Edge of Bucket | | mm | $10.0^{0}_{-10}$ | — |

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**Pin and Bushing Clearance**




T5-B206

Unit: mm

| Code | Item | Designated Standard | | | | | Servicing Procedure |
|---|---|---|---|---|---|---|---|
| | | Basic Dimensions | Allowable Tolerance | | Standard Clearance | Allowable Clearance | |
| | | | Shaft | Hole | | | |
| A | Lift Arm & Frame | 45 | -0.02<br>-0.05 | +0.17<br>+0.12 | 0.14~0.22 | 1.0 | Replace |
| B | Arm Cylinder & Frame | 40 | -0.06<br>-0.09 | +0.15<br>+0.05 | 0.11~0.24 | 1.0 | |
| C | Arm Cylinder & Lift Arm | 40 | -0.02<br>-0.05 | +0.15<br>+0.05 | 0.07~0.20 | 1.0 | |
| D | Bucket Cylinder & Lift Arm | 40 | -0.02<br>-0.05 | +0.15<br>+0.05 | 0.07~0.20 | 1.0 | |
| E | Bucket Cylinder & Quick Attachment | 40 | -0.02<br>-0.05 | +0.15<br>+0.05 | 0.07~0.20 | 1.0 | |
| F | Lift Arm & Quick Attachment | 40 | -0.02<br>-0.05 | +0.15<br>+0.10 | 0.12~0.20 | 1.0 | |

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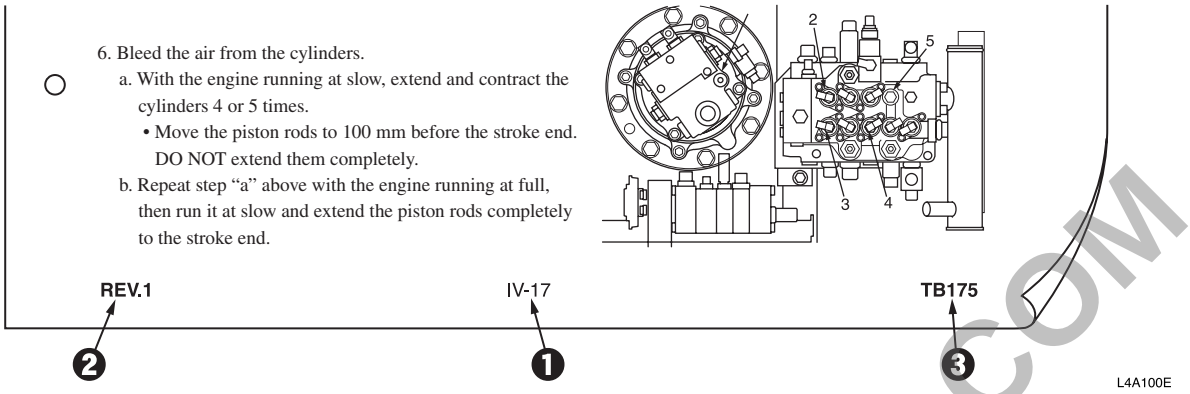


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## FOOT OF THE PAGE




1. Page number

The following page numbers are assigned to each respective page. And if there are additional pages, the addition codes are supplied. Please file the sheets in the order of the page numbers.

Page No.

X–XX

→ Page number within chapter

→ Chapter Number

Page Addition

X–XX–X

→ Addition Code

Example: II-8
II-9
II-9-1 ..... A page is added between page 9 and page 10.
II-10

2. Revision number

Indicates the number of revisions made to this manual. This number is printed on the page that reflects this revision.
If a page has been revised, it is to be used in place of the page used before revision and it is not necessary to keep the old page.

3. Model(s)

## SYMBOLS

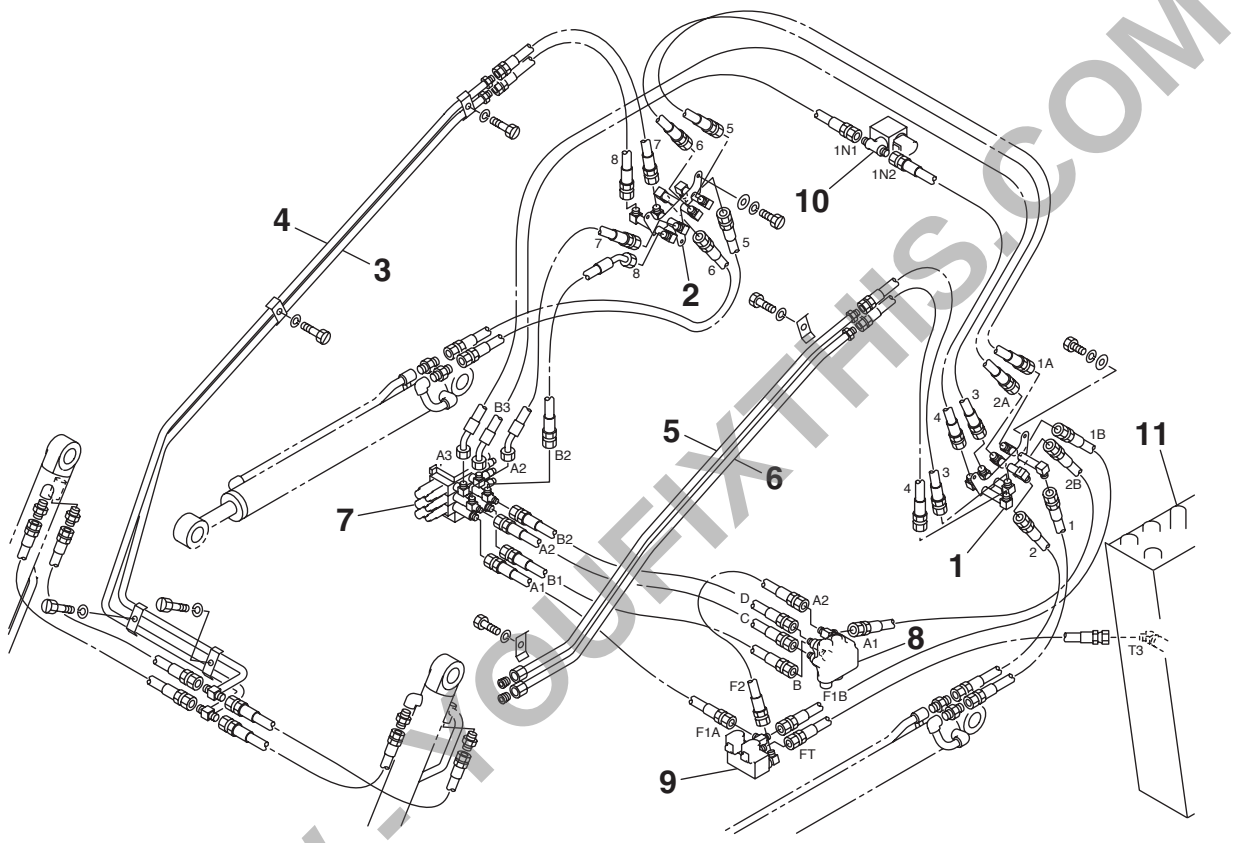
☞ means "Please refer to the section quoted."

Indicates the tightening torque at the specific section that requires special attention in designing.

Indicates the mass of a part or device.

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**Piping**




T9C601

1. Bracket
2. Bracket
3. Pipe [Bucket]
4. Pipe [Bucket]
5. Pipe [Auxiliary]
6. Pipe [Auxiliary]
7. Control Valve
8. Self-Level Valve
9. Solenoid Valve
10. Stop Valve
11. Hydraulic Tank

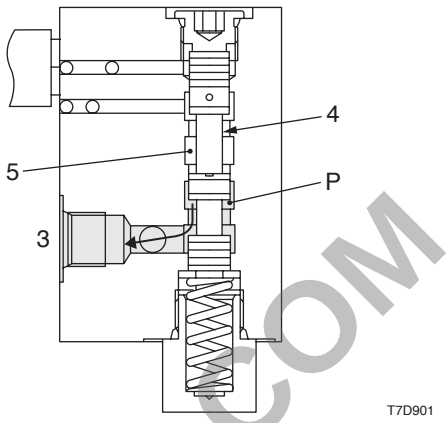
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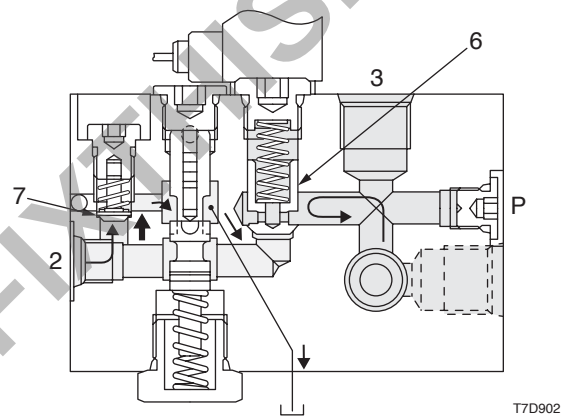
## OPERATION

### When the Solenoid A is not Electrified

The port P and the circuit of the port 3 are connected through the spool (4).
The hydraulic oil from the port P flows into the port 3, while the port P and the circuit (5) of the port 1 are shut off.

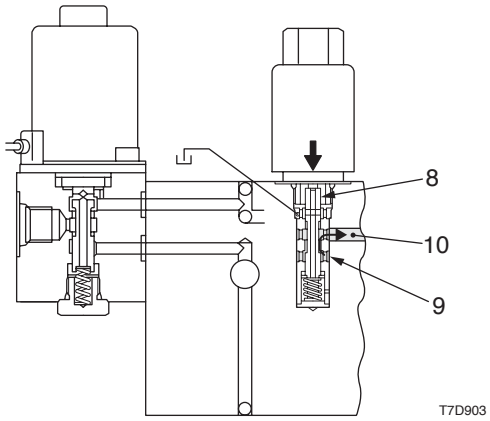



The port P and the circuit of the port 2 are shut off by the poppet (6).
The hydraulic oil from the port 2 pushes up the plunger (7), flows into the circuit of the port 1, and enters together with the oil from the port 1 into port T.

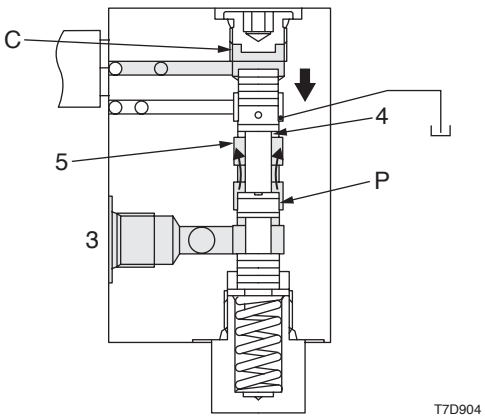



### When the Solenoid A is Electrified

A magnetic field is generated around the coil that causes the push rod to be pulled downward, pushing the spool (8) downward. Then the hydraulic oil from the port P flows through the passages (9) and (10) and enters the chamber C.



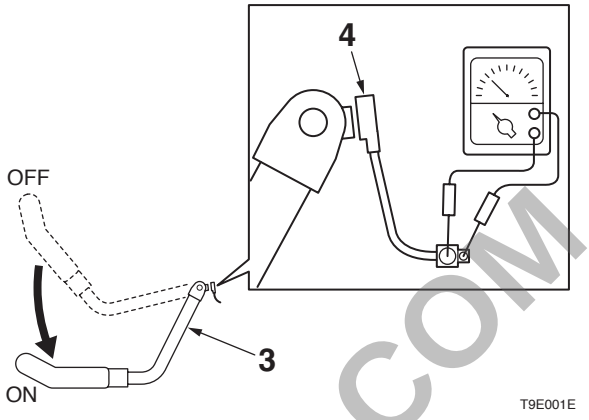

The hydraulic oil entering into the chamber C moves the spool (4) downward to shut off the ports P and 3. This connects the port P and the passage (5), allowing the oil flow from the port P to port 1.



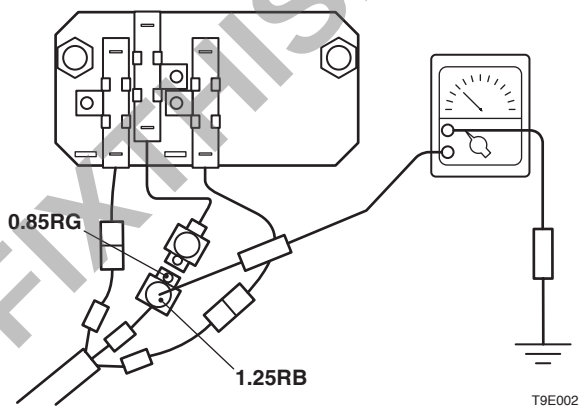

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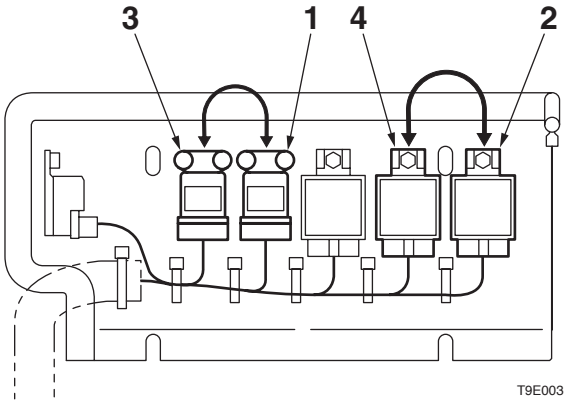

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5. Inspect the proximity switch.
   a. The proximity switch (4) should be switched on by moving the safety bar (3) into the driving position.
   b. Disconnect the wiring from the proximity switch to check for continuity with a tester.

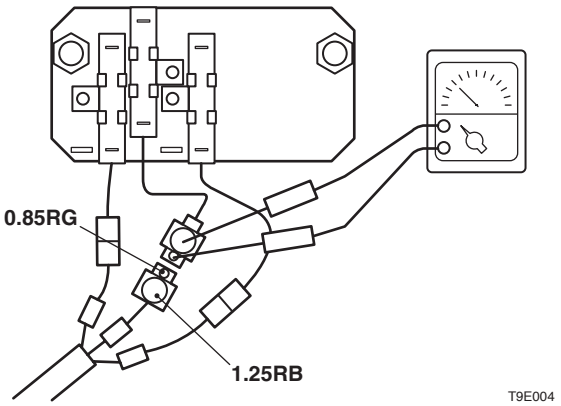



6. Inspect the lever lock relay.
   Disconnect the wirings (1.25RB, 0.85RG) from the resistor for the lever lock while the proximity switch and the starter switch are turned "ON", and check the voltage with a tester.
   • If the voltage level is +12 V, it is normal. If not, change the lever lock relay (1) with the stop solenoid relay (3) and the lever lock switch relay (2) with the charge relay (4), and check the voltage again.



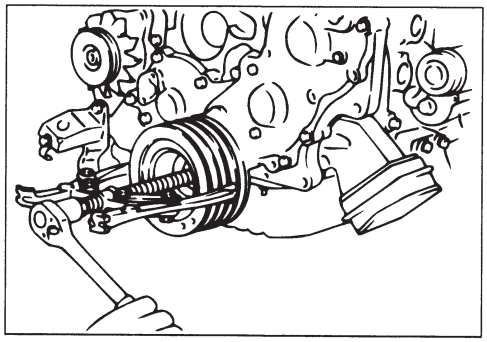




7. Inspect the resistor.
   While the wirings are still disconnected from the resistor as described above, check for continuity with a tester.




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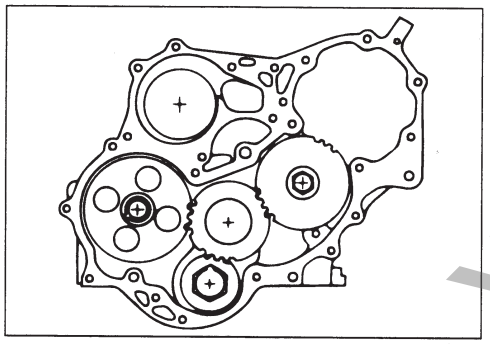
**11. Crankshaft Damper Pulley with Dust Seal**

1) Block the flywheel with a piece of wood to prevent it from turning.
2) Use the damper pulley remover to remove the damper pulley.

   Damper Pulley Remover

**16. Idler Gear "A"**

Measure the camshaft timing gear backlash, the crankshaft timing gear backlash, and the idler gear "A" end play before removing the idler gear "A" and shaft.



**Timing Gear Backlash Measurement**

1) Set a dial indicator to the timing gear to be measured.

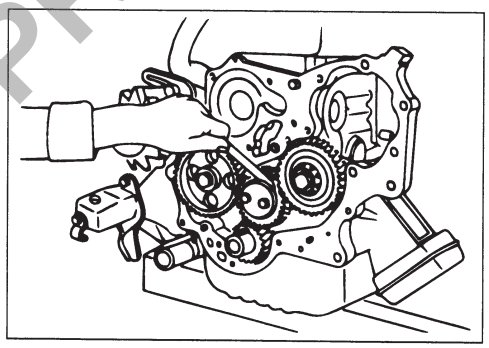
   Hold both the gear to be checked and the adjoining gear stationary.
2) Move the gear to be checked as far as possible to both the right and the left.

   Take the dial indicator reading.

   If the measured value exceeds the specified limit, the timing gear must be replaced.

Timing Gear Backlash mm(in.)

| GEAR | Standard |
|---|---|
| CAM ~ IDLE (A) | 0.10 – 0.17 |
| CRANK ~ IDLE (A) | 0.10 – 0.17 |
| IDLE (A) ~ IDLE (B) | 0.10 – 0.17 |
| IDLE (B) ~ INJ. PUMP | 0.10 – 0.17 |



**Idler Gear "A" End Play Measurement**

Insert a feeler gauge between the idler gear and the thrust collar to measure the gap and determine the idler gear end play.

If the measured value exceeds the specified limit, the thrust collar must be replaced.

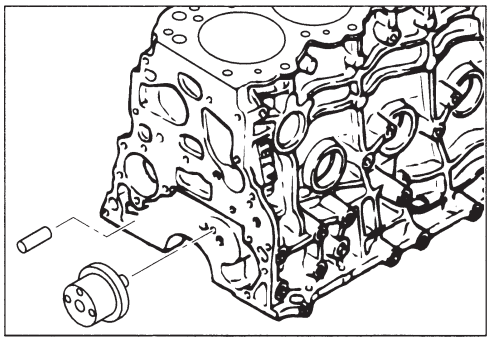
Idler Gear End Play mm(in.)

| Standard | Limit |
|---|---|
| 0.08 ~ 0.18 (0.003–0.007) | 0.30 (0.012) |

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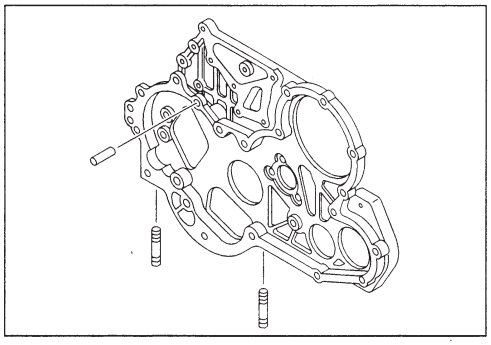
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**Idler gear shaft**

1. Install the idler gear shaft A with facing up oil hole to the cylinder block.
2. Install the locating pin to the cylinder block.

**Note:**
The gearcase is positioned by the locating pin and idler gear shaft A.



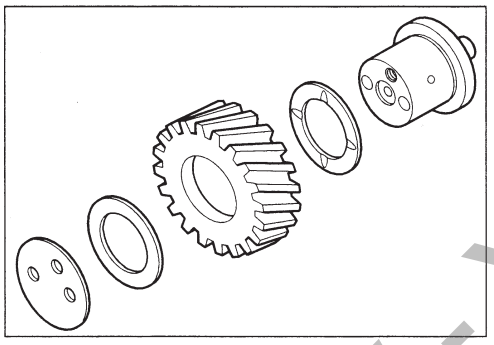
**Gearcase**

1. Install the gearcase with new gasket to the cylinder block. Tighten the bolts to the specified torque.

N·m (kgf·m/lb.ft)

| | |
|---|---|
| Gearcase Bolt Torque | 14 – 24 (1.4 – 2.4/10 – 17) |

2. Install the locating pin to the gearcase.
3. Install the stud bolts to the gearcase.
   - Apply Loctite 262 or equivalent to the thread portion of stud bolt.



**Idler gear A**

1. Install the camshaft with cam gear.
2. Install the idler gear and thrust washer to the idler gear shaft.
   - Apply engine oil to the idler gear shaft.
   - Install the thrust washers with the dimple of thrust washer facing to gear side.
   - Tighten the bolts to the specified torque.

N·m (kgf·m/lb.ft)

| | |
|---|---|
| Bolt Torque | 21 – 30 (2.1 – 3.1/15 – 22) |

3. Install the oil pipe (gearcase to idler gear shaft).
   Tighten the bolts to the specified torque.

N·m (kgf·m/lb.ft)

| | |
|---|---|
| Bolt Torque | 10 – 15 (1.0 – 1.5/7.2 – 11) |

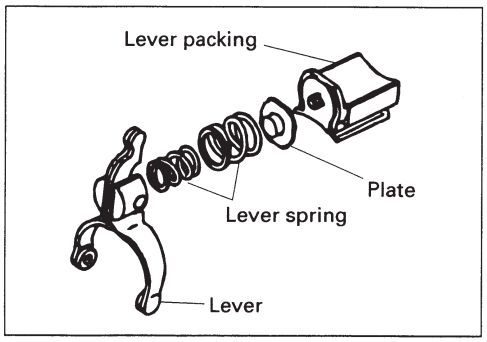
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**13. Ball**

Be careful not to lose the ball.

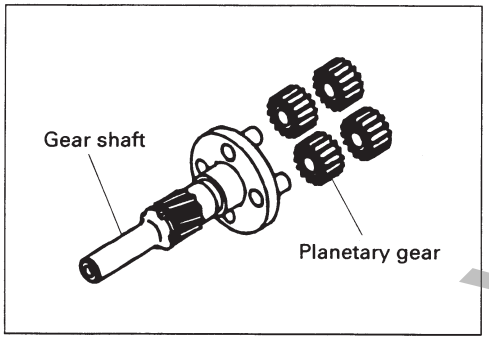



**14. Plate**

Remove the plate and the packing.

**15. Lever ASM**

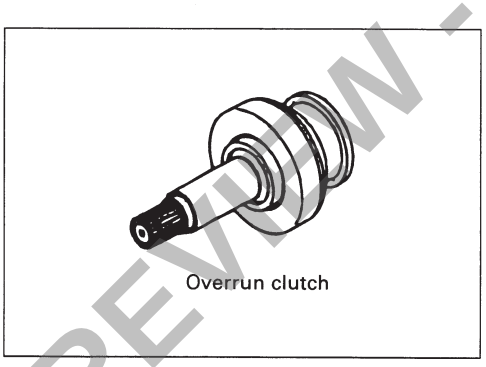
Remove the lever packing, the plate and the two lever springs.




**16. Planetary gear**

Remove the four packing, the plate and the two lever springs.

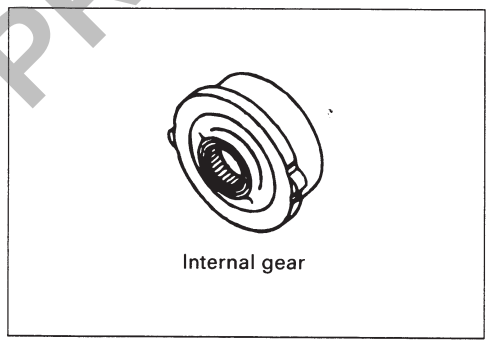
**17. Gear shaft**




**18. Clutch; Overrun**

**19. Bracket; Front**

Put the gear shaft, the overrunning clutch and the lever together, then remove them from the front bracket.




**20. Internal gear**

**21. Washer**

When the two E type washers are removed, it divides into the overrunning clutch, the internal gear, the washer and the gear shafts.

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