FOREWORD

This manual, which is written for engineers who service the machine, describes procedures for disassembly and assembly, inspection and maintenance, and troubleshooting, as well as maintenance reference values and an outline of the specifications. Refer to this manual during daily work to improve your services. Note that the information is subject to change without notice due to design modifications made to the machine from time to time by the manufacturer.

Directional terms: front, rear, left, right

In this manual, the “front” refers to the end of the machine where the bucket is mounted, while the “rear” refers to the other end where the travel motor is mounted. The “right” or “left” refers to the side viewed by a person sitting in the operator’s seat.

Machine serial number

The machine serial number is stamped on the identification plate. Be sure to include this number when sending a report or inquiry or when ordering parts.

Control of manual

Appoint a person in charge of keeping the manuals up to date in your company and inform us of the person’s name for our records. Any revisions or additions to this manual will be sent to the person.

Symbols used in this manual

The symbols used in this manual have the following meanings.

S/N Indicates the machine serial number.
☞ Means “Refer to the section quoted.”
kg Indicates the mass of the equipment or machine.
Means “Tighten to the torque specified here.”
Indicates the use of thread-locking compound.
Indicates the use of grease.

Manual structure

This manual consists of the following parts.

1. Safety
2. Service data
3. Function
4. Disassembly and assembly
5. Troubleshooting
6. Engine

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SAFETY ALERT SYMBOL



This symbol represents the safety alert. The message that follows the symbol contains important information regarding human safety.
Read and understand the message to avoid personal injury or death.

Safety label

Safety labels are used to alert operators or other people exposed to the risks of injury or damage. There are the following three types of labels.
Read the labels carefully as they are important for your safety.

⚠ DANGER

The word "DANGER" indicates an imminently hazardous situation which, if not avoided, is likely to 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 operators and maintenance personnel about situations which could result in 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. It is also impossible to cover all hazards and risks which may be associated with the maintenance of the machine in every environment. For maintenance work, each person must take adequate safety precautions against possible hazards in the respective working environment.

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SPECIFICATIONS TABLES

Performance

Bucket type			Standard bucket
Bucket capacity		m^3	0.298
Tipping load		kg	1610
Rated loading mass		kg	565
Breakout force		kN	21.4
Raising time (load)		s	3.7
Lowering time		s	2.7
Bucket forward tilting time		s	2.6
Travel speed	Forward 1st	km/h	6.5
	Forward 2nd	km/h	9.3
	Reverse 1st	km/h	6.5
	Reverse 2nd	km/h	9.3
Maximum tractive force		kN	29.5
Gradeability		degree (°)	30
Minimum turning radius	Bucket outside	m	1.995

Dimensions

Overall length in transport condition	Without teeth		mm	3220
	With teeth		mm	–
Overall width (body)			mm	1470
Bucket width			mm	1600
Overall height	Bucket on ground	Canopy	mm	1970
		Cab	mm	1970
	Max. raised height of bucket		mm	3725
Crawler bearing length			mm	1240
Track gauge			mm	1170
Shoe width			mm	300
Crawler bearing area			m^2	0.745
Ground clearance of undercarriage			mm	250
Bucket hinge pin height			mm	2905
Dumping clearance (at 45-degree forward tipping)	Without teeth		mm	2275
	With teeth		mm	–
Dumping reach (at 45-degree forward tipping)	Without teeth		mm	590
	With teeth		mm	–
Bucket roll back angle	On ground		degree (°)	30.4
Bucket dumping angle	Maximum height position		degree (°)	38.5
Maximum digging depth			mm	0

Mass

Gross machine mass	Canopy	kg	3270
	Cab	kg	3330
Operating mass	Canopy	kg	2795
	Cab	kg	2855
Machine mass	Canopy	kg	2720
	Cab	kg	2780
Shipping mass	Canopy	kg	2675
	Cab	kg	2735

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LUBRICANT AND FUEL CHART

Select the appropriate fuel, lubricant and grease according to the temperature by referring to the table below.

- Regardless of the specified time, change the oil if it becomes too dirty or degraded.
- When refilling, never mix oils of different brands. If a brand is to be changed, replace the whole fuel/oil.

Part	Type	Type by air temperature -30 -20 -10 0 10 20 30 40°C	When to change/ replenish	Capacity
Engine oil pan	Diesel engine oil API: CD class	SAE 10W-30 SAE 15W-40	Every 250 hrs after the first 50 hrs	Upper limit 7.4 L Lower limit 4.0 L
Hydraulic oil tank	Diesel engine oil API: CD class	SAE 10W-30 SAE 10W-40	Every 1000 hrs	Total amount of oil: 45 L Tank capacity: 29 L
Engine cooling system	**Cooling water (water + coolant)	Mixture of 50% coolant Mixture of 30% coolant	Every 1000 hrs	11.0 L
Travel reduction gear	Gear oil API: GL-4	SAE 90	Every 500 hrs after the first 250* hrs	1.0 L
Track roller A	Diesel engine oil API: CD class	SAE 30	—	0.18 L
Track roller B	Mobilgear SHC680	—	—	0.14 L
Idler	Diesel engine oil API: CD class	SAE 30	—	0.07 L
Working equipment	Lithium grease EP-2 NLGI No.2	—	Daily or every 10 hrs	As required
Lever/pedal			When required	

* If the ratio of traveling time to total operating time is high, replace the gear oil earlier than the specified time.

** For water, use tap water (soft). Do not use well or river water.
When the ambient temperature drops below 0°C, add coolant (antifreeze). Follow the coolant manufacturer's instructions to determine the mixture ratio.

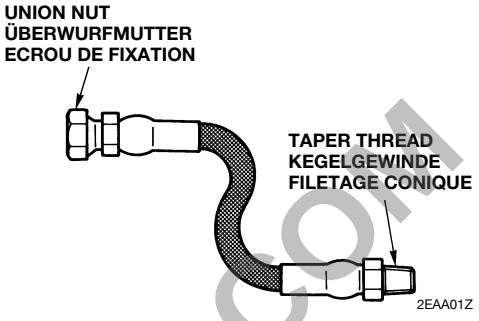
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TIGHTENING TORQUE

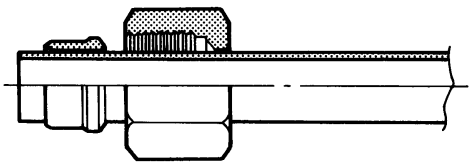
Hydraulic hose

Hose fitting size	Tightening torque	
	Union nut (G)	Taper thread (R)
	N·m	N·m
1/8	$9.8^{+4.9}_{0}$	11.8 ±1.2
1/4	$24.5^{+4.9}_{0}$	29.4 ±2.9
3/8	$49.0^{+4.9}_{0}$	53.9 ±5.4
1/2	$58.8^{+4.9}_{0}$	88.3 ±8.8
3/4	$117.7^{+4.9}_{0}$	147.1 ±14.7
1	$137.3^{+4.9}_{0}$	196.1 ±19.6



Bite-type pipe fitting for steel pipe

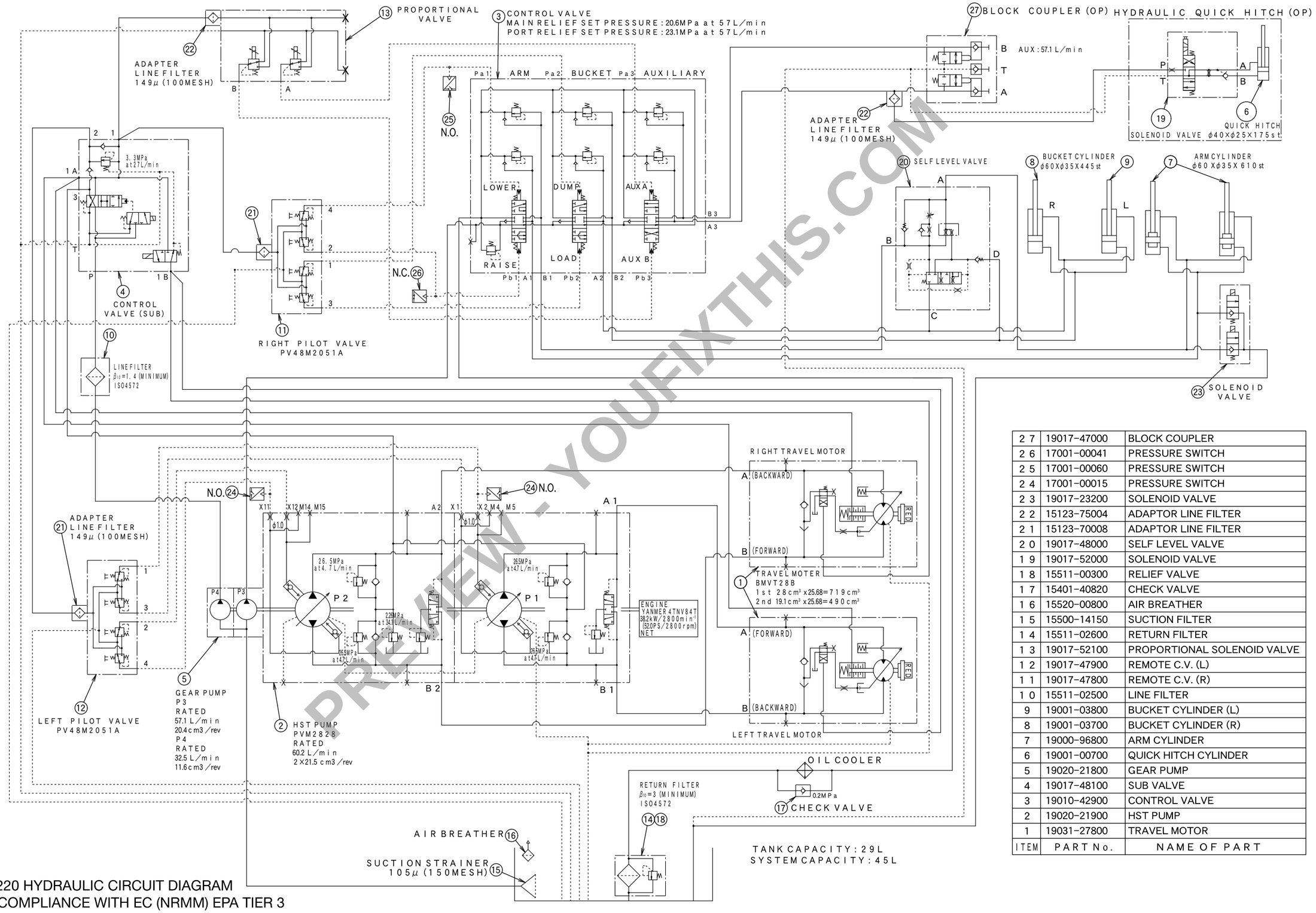
Pipe outer diameter (mm)	Tightening torque
	N·m
8	34.3 ±4.9
10	41.7 ±2.5
12	58.8 ±4.9
15	88.3 ±4.9
16	93.2 ±4.9
18	132.4 ±4.9
22	205.9 ±9.8
27.2	245.2 ±9.8
28	313.8 ±19.6
32	313.8 ±19.6
35	411.9 ±19.6



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HYDRAULIC CIRCUIT DIAGRAM



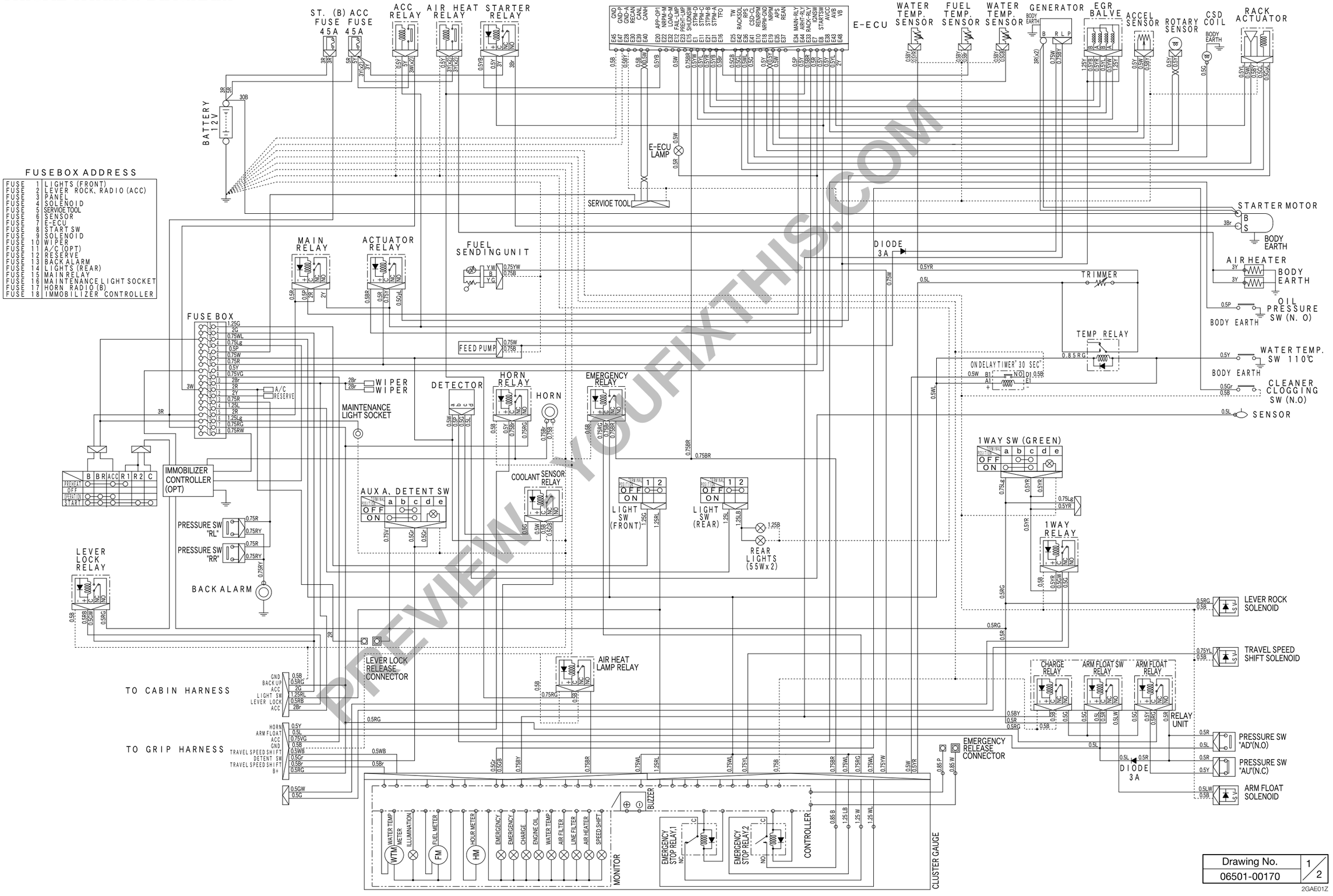
TL220 HYDRAULIC CIRCUIT DIAGRAM
IN COMPLIANCE WITH EC (NRMM) EPA TIER 3

ITEM	PART No.	NAME OF PART
27	19017-47000	BLOCK COUPLER
26	17001-00041	PRESSURE SWITCH
25	17001-00060	PRESSURE SWITCH
24	17001-00015	PRESSURE SWITCH
23	19017-23200	SOLENOID VALVE
22	15123-75004	ADAPTOR LINE FILTER
21	15123-70008	ADAPTOR LINE FILTER
20	19017-48000	SELF LEVEL VALVE
19	19017-52000	SOLENOID VALVE
18	15511-00300	RELIEF VALVE
17	15401-40820	CHECK VALVE
16	15520-00800	AIR BREATHER
15	15500-14150	SUCTION FILTER
14	15511-02600	RETURN FILTER
13	19017-52100	PROPORTIONAL SOLENOID VALVE
12	19017-47900	REMOTE C.V. (L)
11	19017-47800	REMOTE C.V. (R)
10	15511-02500	LINE FILTER
9	19001-03800	BUCKET CYLINDER (L)
8	19001-03700	BUCKET CYLINDER (R)
7	19000-96800	ARM CYLINDER
6	19001-00700	QUICK HITCH CYLINDER
5	19020-21800	GEAR PUMP
4	19017-48100	SUB VALVE
3	19010-42900	CONTROL VALVE
2	19020-21900	HST PUMP
1	19031-27800	TRAVEL MOTOR

2FAE01Z

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ELECTRICAL WIRING DIAGRAM



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Inspection and Maintenance-without gauges

Click on any of these subject headings to go directly to the page

- **Discussion of Inspection & Maintenance Survey Results**
- **Visual Inspection - System Off**
- **Electrical System Inspection**
- **Performance Inspection - Engine Running**
- **Heater System Inspection**
- **Preventive Maintenance Worksheet**
- **Chapter Review**

Discussion of Inspection & Maintenance Survey Results

There are three reasons for regular inspection and maintenance procedures:

1. They save money in the long run by reducing down time and often prevent more costly repairs.
2. They help to insure driver comfort and safety.
3. They add to your store of knowledge about these systems and maintain your level of efficiency.

About half of all heavy duty vehicles have air conditioners. Surveys of AC system owners find that over 30% of the systems are serviced every six months or less, and another 62% are serviced at least once a year.

The survey also covered how often the different components required maintenance. Figure 7.1 below shows survey finding percentages. Failure of any of the AC components listed in the survey could cause a system to malfunction or stop cooling.

Figure 7-1
This chart shows maintenance frequency, lists key parts and how often they require maintenance.

INSPECTION & MAINTENANCE SURVEY

How often are your air conditioners serviced?				
Average	1 to 6 months 30%	7 to 12 months 62%	More than 12 months 6%	Never 2%

Which AC components require frequent maintenance?					
Belts 32%	Compressor Clutch 26%	Condenser 12%	Add Refrigerant 12%	Refrigerant Lines 11%	Valves 7%

Note: The above survey results may not apply to your situation. Actual operating conditions for the vehicles you service will determine or influence maintenance frequency and requirements.

The following inspection procedures should take about 15 to 20 minutes, longer if corrective steps, part replacement or adding refrigerant is necessary. There is a "Preventive Maintenance Worksheet" you may use at the end of this chapter, Figure 7-9

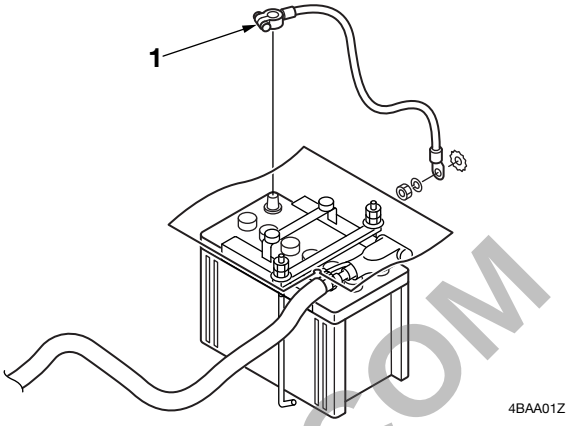
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DRIVE SYSTEM

Removing the engine

1. Disconnect the battery ground cable (1) from the battery terminal.



4BAA01Z

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

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

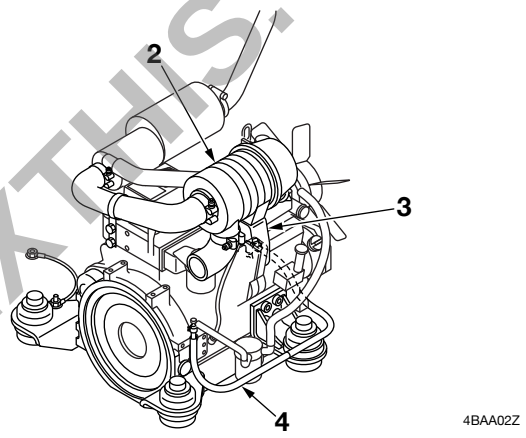
4. Disconnect the electrical wiring to the air cleaner (2).

5. Remove the bracket (3) together with the air cleaner (2).

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

7. Remove the drain hose (4).

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

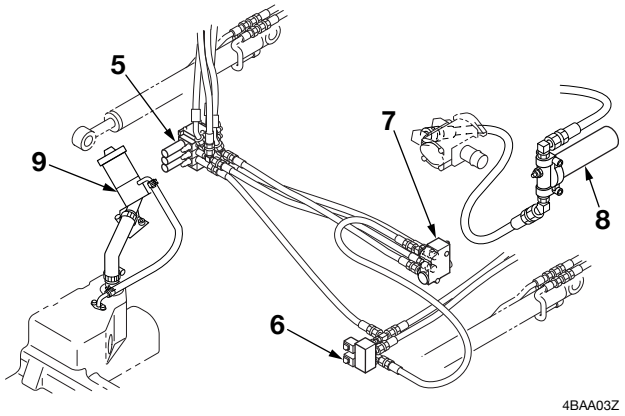


4BAA02Z

9. Remove the control valve (5), the solenoid valve (6) and the self-level valve (7).

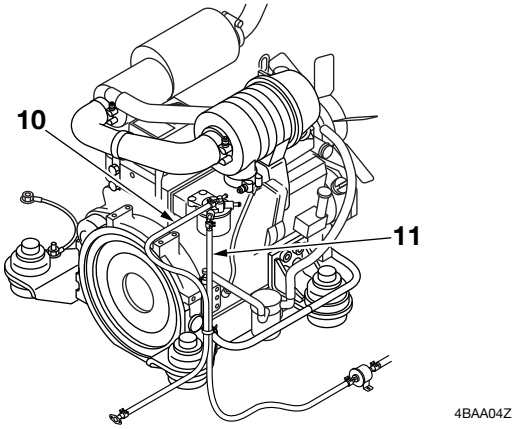
10. Remove the line filter (8).

11. Remove the filler opening (9).



4BAA03Z

12. Disconnect the fuel hoses (10) and (11).



4BAA04Z

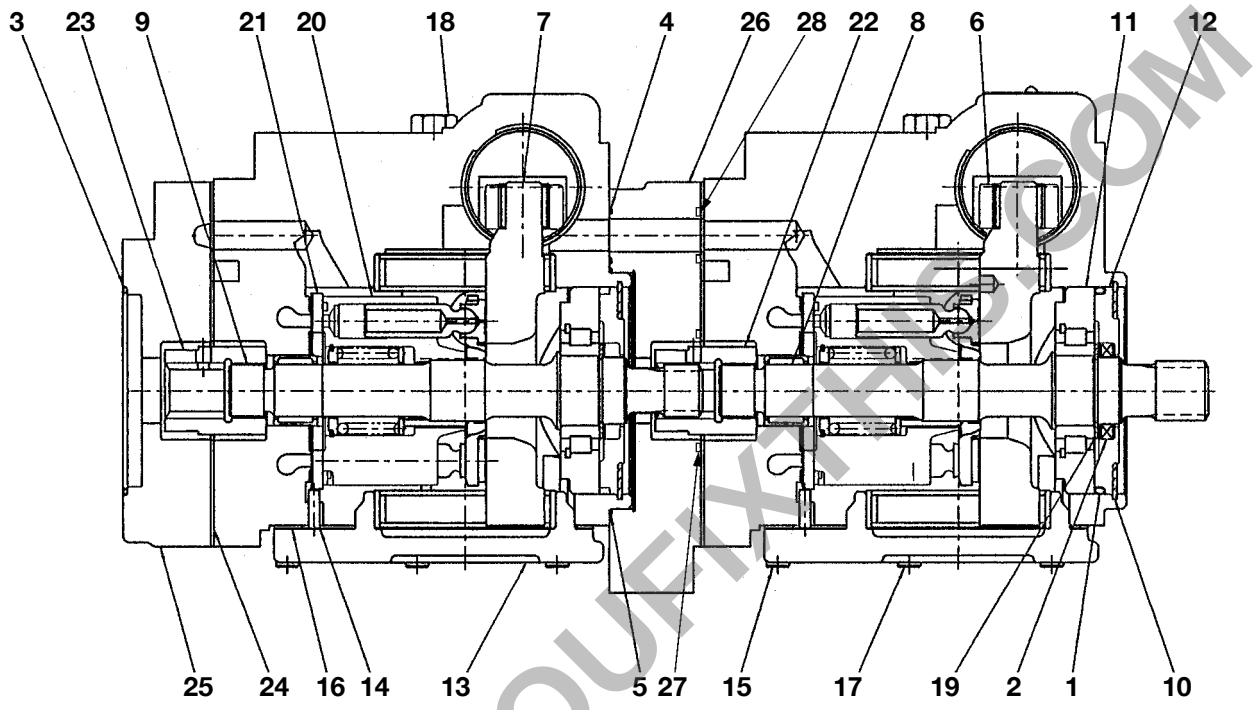
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HST PUMP

Construction

Pump assembly (1/4)



4IAA01Z

1. O-ring
2. Seal
3. O-ring
4. O-ring
5. O-ring
6. Bearing
7. Swash plate
8. Shaft
9. Shaft
10. Ring
11. Bearing
12. Seal carrier
13. Cover
14. Pin
15. Cap screw
16. Gasket
17. Cap screw
18. Plug
19. Ring
20. Cylinder block
21. Valve plate
22. Coupling
23. Coupling
24. Gasket
25. Pad “A” adaptor
26. Pad “B” adaptor
27. O-ring
28. O-ring

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TROUBLESHOOTING 5

Overall machine 5-3
No operation is possible. 5-3
All systems working, but insufficient power. 5-6
Lift arm and bucket fail to move or are too slow. 5-8
Traveling 5-9
Traveling fails. 5-9
Right or left travel speed decelerates and the machine veers to one side. 5-11
Operating temperature of the travel system is too high. 5-12
2nd speed travel is not possible. 5-14
Lift arm 5-16
Arm cylinder fails. 5-16
Arm cylinder is slow or the power is insufficient. 5-18
When the control lever is pulled slowly, the lift arm drops once. 5-20
Spontaneous drop of the lift arm is too large. 5-21
Bucket 5-22
Bucket cylinder fails to move. 5-22
Bucket cylinder is slow or the power is insufficient. 5-24
Spontaneous drop of the bucket is too large. 5-26
Auxiliary hydraulics 5-27
Proportional control is not possible 5-27
HST pump 5-28
Gear pump 5-30
Control valve 5-31
SUB valve 5-33
Self-level valve 5-34
Pilot valve 5-35
Proportional control solenoid valve 5-36
Cylinders 5-37
Travel motor 5-38
Air conditioner system 5-41

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