KOBELCO

SERVICE MANUAL

HYDRAULIC EXCAVATOR

SK15MSR

SK16MSR

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SPECIFICATIONS

TABLE OF CONTENTS

1. COMPONENTS NAME 1-1
2. MACHINE DIMENSIONS 1-2
3. SPECIFICATIONS AND PERFORMANCE 1-4
4. MACHINE & COMPONENTS WEIGHT (DRY) 1-5
5. TRANSPORTATION DIMENSIONS AND WEIGHT 1-6
6. CRAWLER SHOES 1-8
7. BUCKETS (Not specified) 1-8
8. THE MACHINE LIFTING PROCEDURES 1- 9
9. ATTACHMENT WORKING RANGES 1-10
10. LIFTING CAPACITIES 1-12
11. ENGINE SPECIFICATIONS 1-16

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Book Code No. S5PF03 02E ①

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SK15MSR
SK16MSR

PF03

ATTACHMENT DIMENSIONS

TABLE OF CONTENTS

1. BOOM
   - 1.1 Boom dimensional drawings 1-1
   - 1.2 Boom maintenance standards 1-2
2. ARM
   - 2.1 Arm dimensional drawings 1-4
   - 2.2 Arm maintenance standards 1-5
3. BUCKET
   - 3.1 Bucket dimensional drawings 1-7
   - 3.2 Detail dimensional drawings of lug section 1-8
   - 3.3 Detail dimensional drawings of boss section 1-9
4. DOZER
   - 4.1 Dozer dimensional drawings 1-10
   - 4.2 Dozer maintenance standards 1-11
5. SWING
   - 5.1 Swing bracket dimensional drawings 1-12
   - 5.2 Swing maintenance standards 1-13

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SHOP MANUAL SK15MSR SK16MSR

PF11

TOOLS

TABLE OF CONTENTS

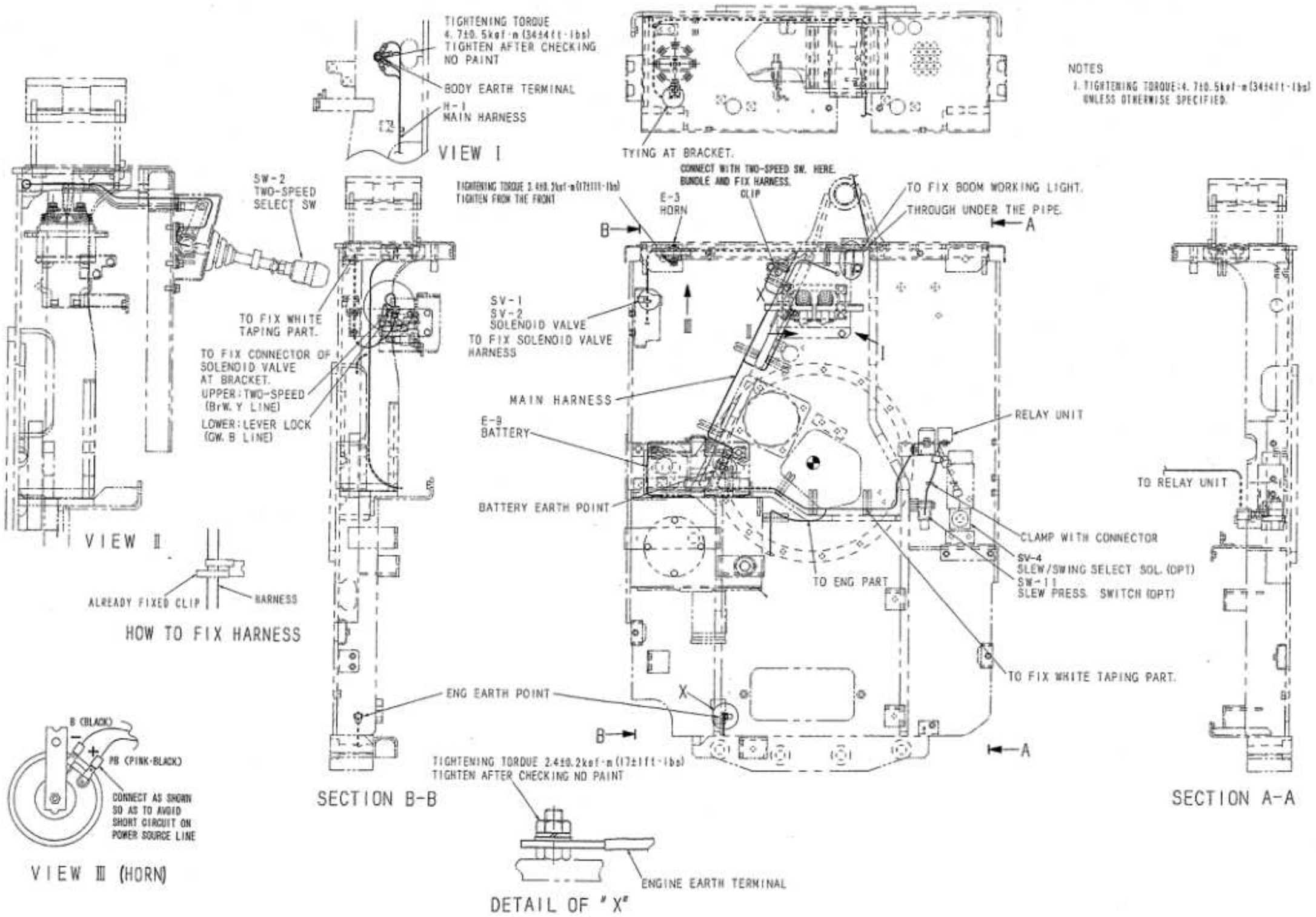
1. TORQUE SPECIFICATIONS FOR CAPSCREWS AND NUTS 1-1
2. SCREW SIZES TO TOOL SIZES 1-2
3. TORQUE SPECIFICATIONS FOR JOINTS AND HOSES 1-2
4. TORQUE SPECIFICATIONS FOR SLEEVE TYPE TUBE FITINGS 1-3
5. PLUGS 1-4
6. SPECIAL SPANNERS FOR TUBES 1-6
7. APPLICATION OF SCREW LOCKING AND SEALING COMPOUNDS 1-6

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3.3 COMPONENTS & HARNESS ARRANGEMENT

3.3.1 Upper Frame Portion



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	Symptom of trouble / Cause	Fails to start: Engine will not start.	Fails to start: Engine starts but stops soon: Exhaust smoke: Nil	Fails to start: Engine starts but stops soon: Exhaust smoke: Less	Fails to start: Engine starts but stops soon: Exhaust smoke: More	Insufficient engine output: Exhaust calor: Regular	Insufficient engine output: Exhaust calor: White	Insufficient engine output: Exhaust calor: Black	Poor exhaust calor: During work: White	Poor exhaust calor: During work: Black	High knocking sound during combustion	Trouble with the engine	Uneven combustion sound	Hunting: During idling	Hunting: During work	Large engine vibration	Poor return to low speed	Excessive fuel consumption	Lubricating oil: Excessive consumption	Lubricating oil: Diluted by fuel oil	Lubricating oil: Mixture with water	Lubricating oil: Low L.O. pressure	Much flow-by gas	Cooling water: Overheat	Cooling water: Low water temperature	Air intake: Pressure drop	Air intake: Pressure rise	Exhaust temperature rise							
Lubricating Oil System	Improper properties of lubricating oil	○	○			○													○			○	○											Use proper lube oil (Refer to Chapter 3, 3-2.)
	Leakage from lubricating oil piping system																		○			○													Repair
	Insufficient delivery capacity of trocheid pump																																	Check and repair (Refer to Chapter 7, 7-9)
	Clogged lubricating oil filter																					○	○											Cleaning or replace
	Poor pressure control valve																					○												Clean, Adjust or replace
	Insufficient lubricating oil capacity																					○												Proper lube oil supply
Fuel System	Excessively early timing of fuel injection pump								○	○	○					○																		Check and adjust. (Refer to Chapter 6, 6-5.)
	Excessively late timing of fuel injection pump						○	○	○	○							○																	Check and adjust. (Refer to Chapter 6, 6-5.)
	Improper properties of diesel gas oil					○	○	○	○	○			○																					Use proper diesel gas oil. (Refer to Chapter 3, 3-3.)
	Water entering fuel system	○			○		○		○				○	○	○																			Inspect and repair (Refer to Chapter 6, 6-7)
	Clogged fuel filter	○	○			○																												Cleaning or replace.
	Air entering fuel system	○	○			○																												Perform air bleed.
	Clogged or cracked fuel pipe	○	○			○																												Cleaning or replace.
	Fuel insufficiently supplied to fuel injection pump	○	○			○																												Inspect the fuel tank valve cock, fuel filter, fuel piping, and fuel feed pump.
	Uneven injection volume of fuel injection pump						○	○	○	○			○	○	○	○															○			Inspect and adjust (Refer to Chapter 11 and 12)
	Excessive fuel injection volume									○							○	○				○	○			○	○							Inspect and adjust (Refer to Chapter 11 and 12)
	Poor spray pattern from fuel injection nozzle						○	○	○	○			○	○	○	○	○																	Inspect and adjust (Refer to Chapter 6, 6-4-(2))
Air/exhaust-gas System	Clogged air filter				○			○		○			○													○									Cleaning
	Engine used at high temperature or at high altitude							○		○							○						○		○									Use more high-output engine
	Clogged exhaust pipe							○		○			○																○					Cleaning
Electric Wiring System	Malfunction starting motor	○																																Repair or replace
	Malfunction alternator	○																																Repair or replace
	Open-circuit of wires	○																																Repair
	Under voltage of battery	○																																Recharge of battery (Refer to Chapter 6, 6-8.)

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1-4 3TNE78A

*Output conditions: Intake back pressure ≤ 250 mmAq, Exhaust back pressure ≤ 550 mmAq, other conditions complying with JIS D 1005–1986. After minimum 30 hour's run-in.

Item			Model / Unit	3TNE78A												
SPECIFICATIONS	Application		—	CL		VM						CH		VH		
	Type		—	Vertical, 4-cycle water-cooled diesel engine												
	Combustion system		—	Direct injection system												
	No. of cylinders – Bore × Stroke		mm	3 – 78 × 84												
	Displacement		ℓ	1.204												
	Firing order		—	1 – 3 – 2 – 1												
	Revolution speed		rpm	1500	1600	2000	2200	2400	2600	2800	3000	3000	3600	3200	3400	3600
	Output*	Continuous rating	kW(HP)	9.1 (12.2)	10.8 (14.5)	—	—	—	—	—	—	18.0 (24.1)	21.0 (28.2)	—	—	—
		Max. rating	kW(HP)	9.9 (13.3)	11.9 (16.0)	13.2 (17.7)	14.6 (19.6)	15.9 (21.3)	17.2 (23.1)	18.5 (24.8)	19.9 (26.7)	19.9 (26.7)	23.2 (31.1)	20.5 (27.5)	21.5 (29.0)	23.2 (31.1)
	Max. revolution speed at no load		rpm	1575 +50 0	1870 +50 0	2180 +50 0	2375 +50 0	2570 +50 0	2780 +50 0	2970 +50 0	3180 +50 0	3150 +50 0	3745 +55 0	3455 +50 0	3670 +50 0	3890 +50 0
	Min. revolution speed at no load		rpm	≤1200		≤800						≤1500		≤800		
	Direction of rotation		—	Counterclockwise (viewed from flywheel)												
	Power take off		—	Flywheel												
	Compression ratio		—	18.0												
	Fuel injection timing (FID, b.T.D.C.)		deg	10±1		12±1		14±1		16±1		24±1		18±1	20±1	24±1
	Compression pressure		MPa (kgf/cm²)	3.14±0.1 (32±1), at 250 rpm												
	Fuel injection pressure		MPa (kgf/cm²)	19.6 +1.0 0 (200 +10 0)												
	Recommended diesel gas oil		—	ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.: 45 min.)												
	Lubrication system		—	Forced lubrication with trochoid pump												
	Lubricating oil capacity Max/Effective		ℓ	3.6/1.3								5.0/1.7				
	Recommended lubricating oil		—	API grade CC class or higher												
	Cooling system		—	Liquid cooling/Radiator												
	Cooling water capacity		ℓ	1.8 (for engine only)												
	Cooling fan No. of blade × dia.		mm	Pusher type, 6 × φ335												
	Crank V-pulley dia./ Fan V-pulley dia.		mm	φ120/φ90		φ110/φ110										
	Governor		—	Mechanical centrifugal governor (All speed type)												
	Starting system		—	Electrical												
	*1 Dimensions L × W × H		mm	553×489×565		520.5 × 489 × 565 / 528 × 489 × 565						528 × 489 × 565		520.5 × 489 × 565/ 528 × 489 × 565		
	*1 Dry weight		kg	138		112/128						124		112 / 124		
PERFORMANCE	Governing perform-ance (full speed range)	Transient speed difference	%	≤10	≤8	≤12						≤10	≤8	≤12		
		Steady state speed band	%	≤5	≤4	≤9	≤8	≤7		≤6		≤5	≤4	≤8		
		Recovery time	sec	≤5		≤6						≤5		≤6		
		Fluctuation of revolution	rpm	≤15		≤25						≤30				
	L.O. press.	Rated operation	MPa (kgf/cm²)	0.29±0.05 (3.0±0.5)								0.34±0.05 (3.5±0.5)				
		Idling		≥0.06 (≥0.6)												

*1. Designation of engine dimension and dry weight in numerals.
CL/CH application: engine with flywheel housing
VM/VH application: engine with back plate/with flywheel housing

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3.3 TRAVEL OPERATING CIRCUIT

The pilot oil pressure system with operating lever is provided.

3.3.1 2nd Speed Operating Circuit

(Independent-forward travel)

(1) Pilot Circuit

1) Shifting signal for 2nd speed travel

When the "Rabbit and Tortoise" mark (at the power cut-off, it automatically takes back for 1st speed) on the nob of travel right lever is pushed down, it actuates the 1st and 2nd speed travel shifting valve of solenoid valve (13). The pressurized oil signal for 2nd speed shifting is discharged from the A2 port of solenoid valve(13), and led to the PP port on travel motor (4) through swivel joint (6), and shifts the 2-speed shifting valve (404).

2) Shifting travel valve spool

By "travel forward" operation, pilot secondary pressure is supplied from the pilot valve (29). The pressurized oil is led to the Pb4 and Pb7 ports of control valve (1), and the pressurized oil shift the travel valve spool.

(2) Main Circuit

1) Circuit up to Travel Motor (4)

The discharged oil from variable pump enters into the P1 and P2 ports of control valve (1), and is led to the B4 and B7 ports through the travel valve. Then it is led to the B and A ports on right and left travel motors through the swivel joint.

2) Travel Motor

- The pressurized oil supplied to the travel motor shifts the spool in counter balance valve (405), and opens the return oil line that is being closed by the check valve, then rotates the travel motor. When the 2nd speed signal is given, the pressurized oil passed through the 2-speed shifting valve (404) shifts shuttle valve (403) to high pressure, and actuates 2-speed shifting piston (401), and then makes the motor high speed with low torque.
- When the motor reaches near to a self-running condition (over-running) at going down a slope and so on, the oil pressure of supply side gets down to lower pressure, and the counter balance valve spool moves to the neutral position with the spring force. As the results, the passage in return oil side is throttled, and the motor speed is suppressed by a back-pressure, then the motor is controlled to the speed corresponding to the supplied oil volume of the pump.
- The counter balance valve spool is so designed that it is gradually shifted by a throttle effect to stop or start the motor resulting shock absorption at the start and stop of the machine.

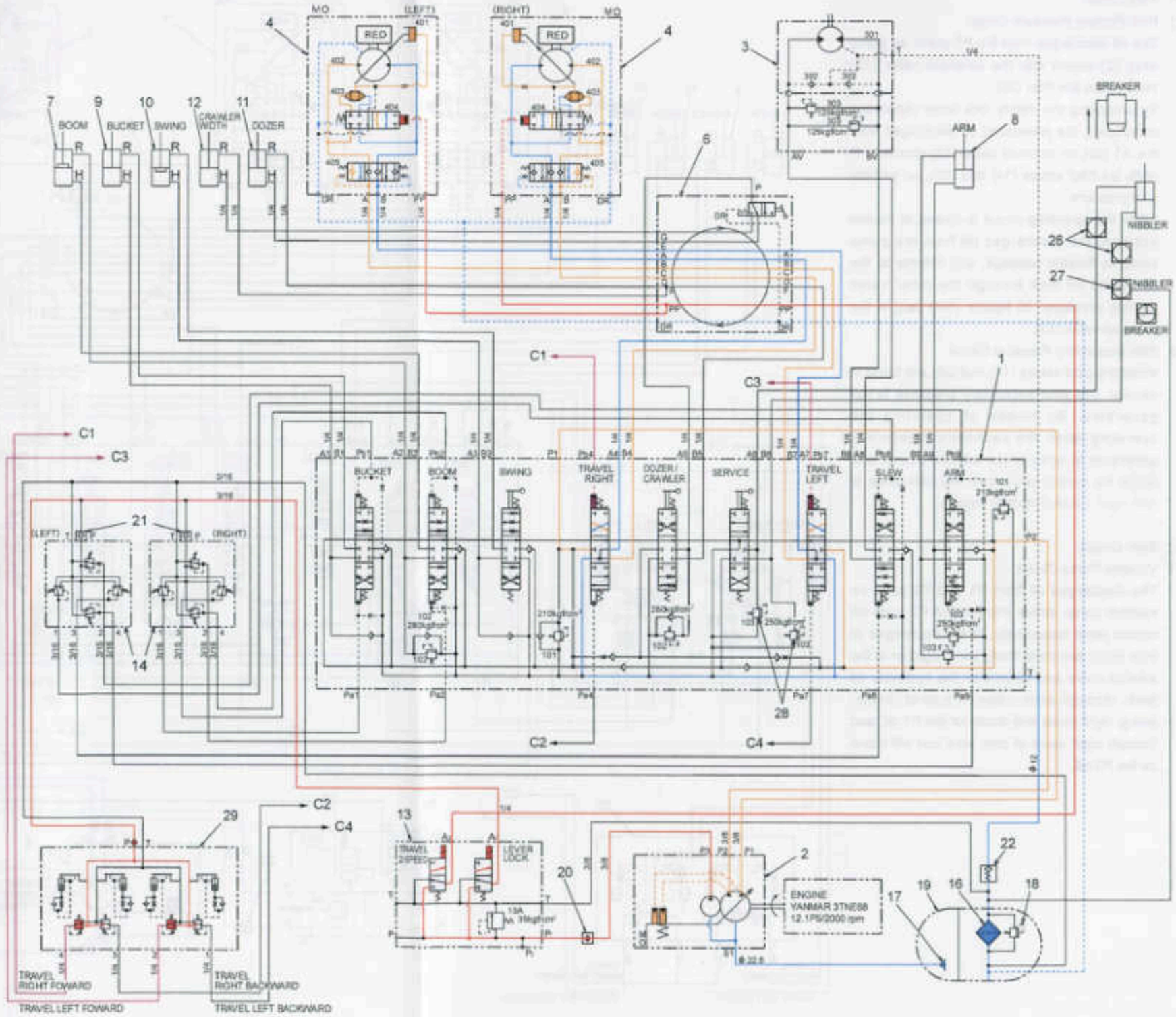


Fig.6 2nd speed operating circuit (Independent-forward travel)

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