



EX135

TECHNICAL MANUAL - OPERATIONAL PRINCIPLE

TECHNICAL MANUAL- TROUBLESHOOTING

WORKSHOP MANUAL EXCAVATOR

WORKSHOP MANUAL ENGINE

EX135 EXCAVATOR

TECHNICAL MANUAL OPERATIONAL PRINCIPLE



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.

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 information concerning the service procedures.
 - If you have any questions or comments, or if you found any errors regarding the contents of this manual, please contact:

FIAT KOBELCO CONSTRUCTION
MACHINERY S.p.A.
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PRODUCT SUPPORT
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ADDITIONAL REFERENCES

- Please refer to the materials listed below in addition to this service manual:
 - **Operation and Maintenance Instruction Manual**
 - **Parts Catalog**
-

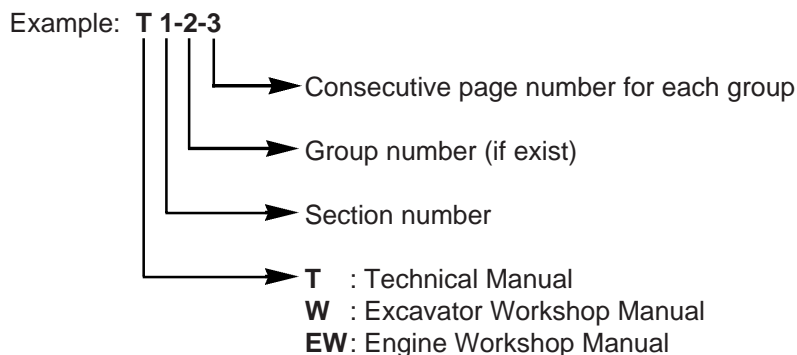
SERVICE MANUAL COMPOSITION

- The complete service manual consists of four books:
 - **Technical Manual** - Operational Principle
 - **Technical Manual** - Troubleshooting
 - **Excavator Workshop Manual**
 - **Engine Workshop Manual**
- The Technical Manual (Operational Principle) includes the technical information concerning the operation of main devices and systems.
- The Technical Manual (Troubleshooting) includes the technical information needed for operational performance tests, and troubleshooting procedures.
- The Excavator and the Engine Workshop Manuals include information needed for maintenance and repair of the machine, tools and devices needed for maintenance and repair, maintenance standards, removal/installation and assembly/disassembly procedures.
- The Service Manual for EX135 Excavator consists of the following book/print numbers:

BOOK	PART NUMBER
- Technical Manual - Operational Principle	604.13.141
- Technical Manual - Troubleshooting	604.13.146
- Workshop Manual - Excavator	604.13.151
- Workshop Manual - Engine	604.13.136

PAGE NUMBER

- Each page has a number, located on the external upper corner of the page. Each page number contains the following information:



SYMBOLS

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

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 behinds SI units.

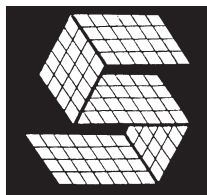
Example: 24.5 Mpa (250 kgf/cm², 3560 psi)

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

Quantity	To convert from (SI)	Into (Others)	Multiply by	Quantity	To convert from (SI)	Into (Others)	Multiply by
Length	mm	in	0.039 37	Pressure	MPa	kgf/cm ²	10.197
	mm	ft	0.003 281		MPa	psi	145.0
Volume	L	US gal	0.264 2	Power	kW	PS	1.360
	L	US qt	1.057		kW	HP	1.341
	m	yd	1.308	Temperature	°C	°F	°C x 1.8 + 32
Weight	Kg	lb	2.205	Velocity	Km/h	mph	0.621 4
Force	N	kgf	0.101 97		min ⁻¹	rpm	1.0
	N	lbf	0.224 8	Flow rate	L/min	US gpm	0.264 2
Torque	N.m	Kgf.m	0.101 97		ML/rev	Cc/rev	1.0
	N.m	lbf.ft	0.737 5				

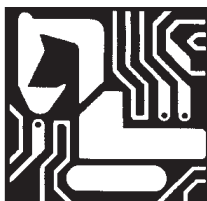
OPERATIONAL PRINCIPLE

SECTION AND GROUP CONTENTS



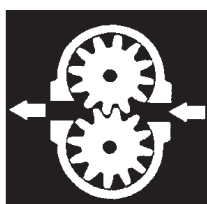
Section 1 - GENERAL

- Group 1 Specifications
- Group 2 Component Layout



Section 2 - SYSTEM

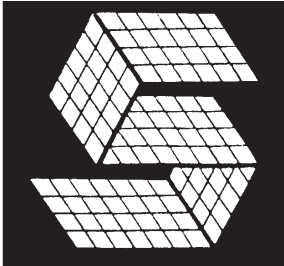
- Group 1 Control System
- Group 2 Hydraulic System
- Group 3 Electrical System



Section 3 - COMPONENT OPERATION

- Group 1 Pump Device
- Group 2 Swing Device
- Group 3 Control Valve
- Group 4 Pilot Valve
- Group 5 Travel Device
- Group 6 Others (Upperstructure)
- Group 7 Others (Undercarriage)

GENERAL

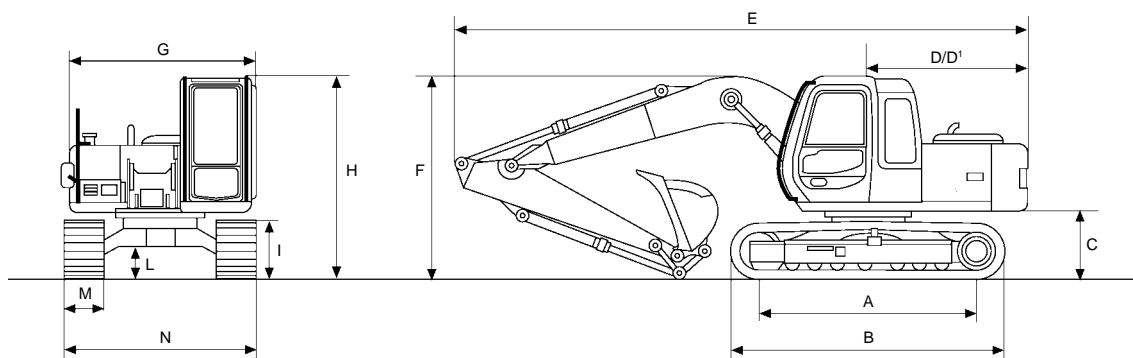


CONTENTS

Group 1 - Specification	Group 2 - Components layout
Excavator Dimensions..... T1-1-1	Main components T1-2-1
Excavator performance T1-1-2	Electrical system
Engine T1-1-2	(Overall system) T1-2-2
Engine accessory T1-1-2	Electrical system (Relays) T1-2-3
Hydraulic Device T1-1-3	Electrical system
Electrical Equipment..... T1-1-4	(Monitor and Switch panels) T1-2-4
	Electrical system (Fuses) T1-2-5
	Pump and related parts T1-2-6
	Other components T1-2-7

SPECIFICATIONS

EXCAVATOR DIMENSIONS

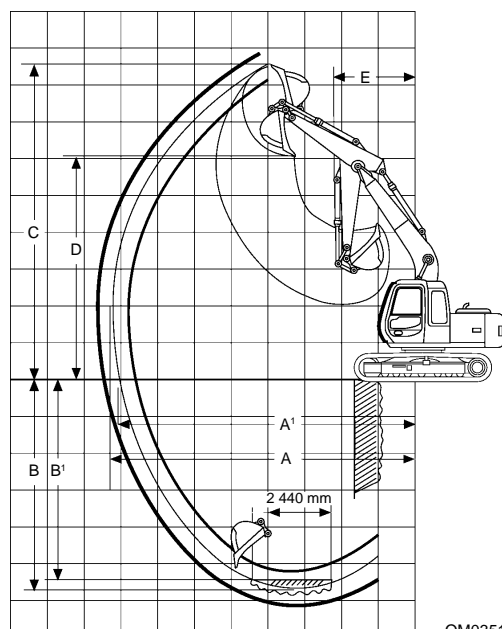


OM0350

	A	B	C	D	Dí (*)	E	F	G	H	I	L
EX135 (mm)	2 880	3 580	890	2 100	2 130	7 580	2 680	2 500	2 720	800	440

	EX135			
M-Track shoe width (mm)	500	600	700	800
N-Maximum width (mm)	2 490	2 590	2 690	2 790
Working weight (kg)	12 600	12 850	13 100	13 350
Spec. Ground Press. (bar)	0,44	0,37	0,33	0,29

DIGGING DATA



OM0351

4 600 mm Boom				
Arm	mm	2 100	2 520	3 010
A	mm	7 900	8 270	8 740
Aí	mm	7 750	8 120	8 610
B	mm	5 160	5 570	6 060
Bí	mm	4 640	5 010	5 480
C	mm	8 350	8 550	8 880
D	mm	5 940	6 140	6 470
E	mm	2 310	2 330	2 590
Break out force:				
• Bucket	kg	8 500	8 500	8 500
• Arm	kg	7 000	6 500	5 700

EXCAVATOR PERFORMANCE

GRADEABILITY 35° (70%) in continuous

TRAVEL SPEED 2.2 / 3.4 mph (3.5/5.5 km/h)

- Slow 0 to 2.2 mph (0 to 3.5 km/h)

- Fast 0 to 3.4 mph (0 to 5.5 km/h)

ENGINE**MAIN SPECIFICATIONS**

- Manufacturer IVECO

- Model 8045.25.282

- Type 4 stroke Diesel type, direct injection, turbocharged

- Net power to flywheel
(DIN 6 271) 85-90 HP (*) / 63-66 kW (*)

- Net power to flywheel
(SAE J1 349) 63-66 kW (*)

- Net power to flywheel
(ISO 9249) 63-66 kW (*)

- Net power to flywheel
(CEE 80/1 269) 63-66 kW (*)

- Rated Speed 2 000 - 2 200 giri/min (*)

- Displacement 3 907 cm³

- Number of cylinders 4

- Bore and stroke 104 x 115 mm

(*) With HP mode switch on.

STARTER MOTOR

- Voltage - Output 24V - 4 kW

INTAKE AIR HEATER (PRE-HEAT) CIRCUIT

- Intake air Heater Controller IVECO

- Voltage 24V

ALTERNATOR

- Voltage - Output 28V - 55A

ENGINE ACCESSORY**RADIATOR ASSEMBLY**

- Type Radiator/Oil Cooler tandem type assembly

- Weight 67 kg

- Radiator Capacity 5.8 L

- Oil Cooler Capacity 4.4 L

BATTERY

- Capacity 75 Ah x 2

- Voltage 12V x 2

SPECIFICATIONS

HYDRAULIC DEVICE**MAIN PUMP**

- Model.....HPV050FW
- Type.....Variable displacement plunger pump: regulator attached type
- Max. flow (Theoretical value).....94.5 L/min x 2

PILOT PUMP

- Model.....HY/ZFS 11/16,8
- Type.....Fixed displacement type gear pump
- Max. flow (Theoretical value).....30.7 L/min; HP mode: 32.2 L/min

CONTROL VALVE

- Type.....Pilot pressure operated type
(4-spool + 5-spool)
- Main relief pressure.....34.3 MPa (350 kgf/cm²) @ 80 L/min
- Overload relief pressure.....37.3 MPa (380 kgf/cm²) @ 50 L/min
(Boom raise / lower, Arm roll-in, Bucket roll-in)
39.2 MPa (400 kgf/cm²) @ 50 L/min
(Arm roll-out, Bucket roll-out)

SWING DEVICE

- Type.....Two-stage planetary reduction type

SWING MOTOR

- Model.....AP5S72
- Type.....Swash-plate type, fixed-displacement plunger motor

SWING BRAKE VALVE

- Type.....Non counter balance valve type
- Relief pressure.....31.4 MPa (320 kgf/cm²) @ 94.5 L/min

SWING PARKING BRAKE

- Type.....Multiple-wet-plate negative type
- Cracking pressure for release.....1.96 to 2.94 MPa (20 to 30 kgf/cm²)

TRAVEL DEVICE

- Type.....Two-stage planetary reduction gear

TRAVEL MOTOR

- Model.....MAG85VP-6
- Type.....Swash-plate type, variable displacement plunger motor

TRAVEL BRAKE VALVE

- Type.....Counter balance valve type
- Relief pressure.....35.3 MPa (360 kgf/cm²)

TRAVEL PARKING BRAKE

- Type.....Single-wet-plate negative type
- Cracking pressure for release.....1.37 MPa (14 kgf/cm²)

SPECIFICATIONS

CYLINDERS

	Boom	Arm	Bucket
Rod diameter	70 mm	80 mm	65 mm
Cylinder bore	105 mm	110 mm	95 mm
Stroke	940 mm	1135 mm	875 mm
Fully retracted length	1447 mm	1650 mm	1350 mm

FRONT ATTACHMENT PILOT VALVE

- ModelHVP04S-040-101

TRAVEL PILOT VALVE

- ModelHVP05D-040-101

SOLENOID VALVE UNIT

- FunctionsSC: Arm regenerative control
 SI: Travel motor swash angle control

OIL COOLER BYPASS CHECK VALVE

- Cracking pressure392 KPa (4 kgf/cm²) at 5 L/min

ELECTRICAL EQUIPMENT

BATTERY RELAY

- Voltage - Current24V - 100A

HORN

- Specifications24V - 1,5A, 113dB

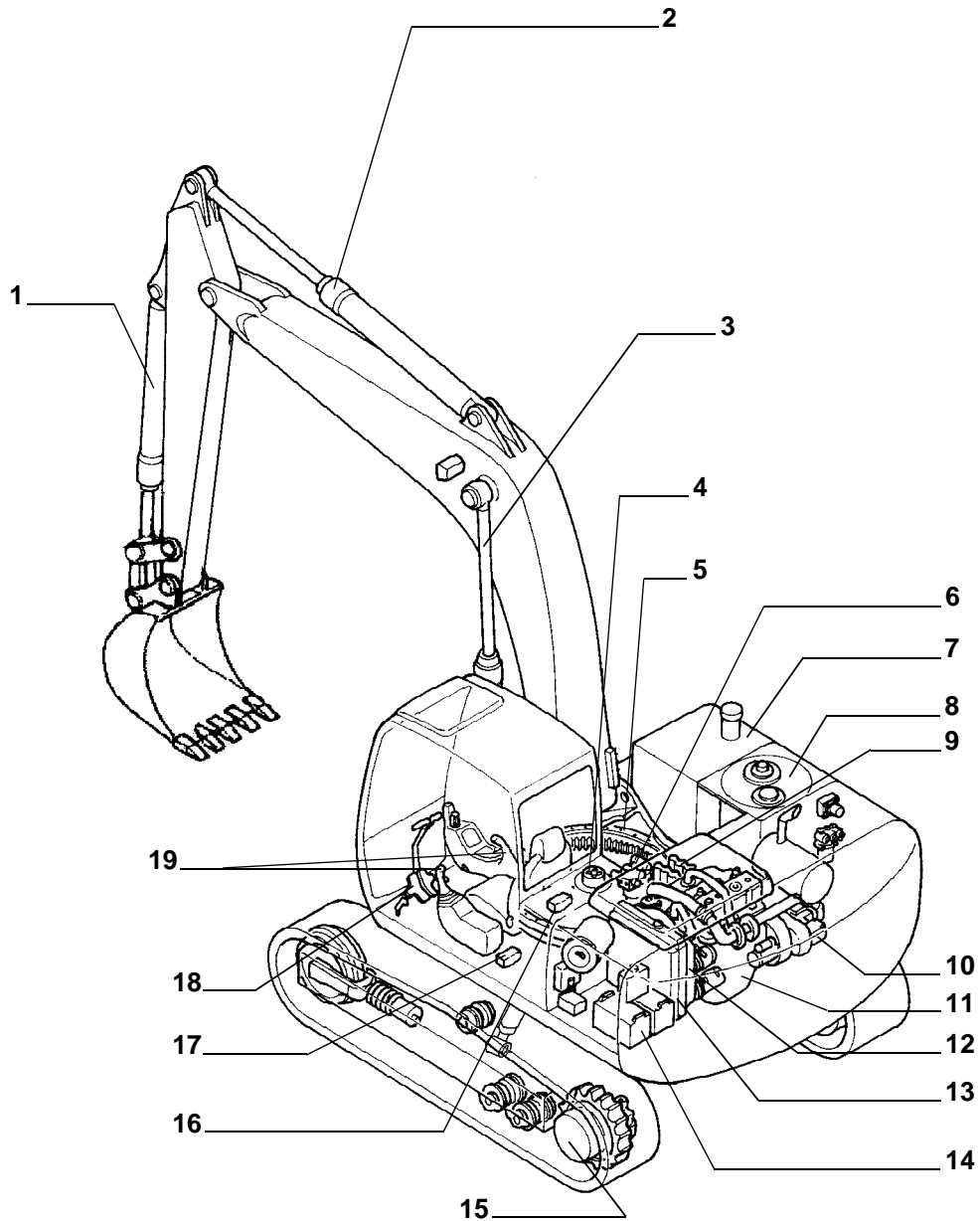
LIGHT

- SpecificationsWork lights: Halogen 24V - 70W
 Dome light: 24V - 10W

INTAKE AIR HEATER CONTROLLER

- TypeIVECO
 - Voltage24V

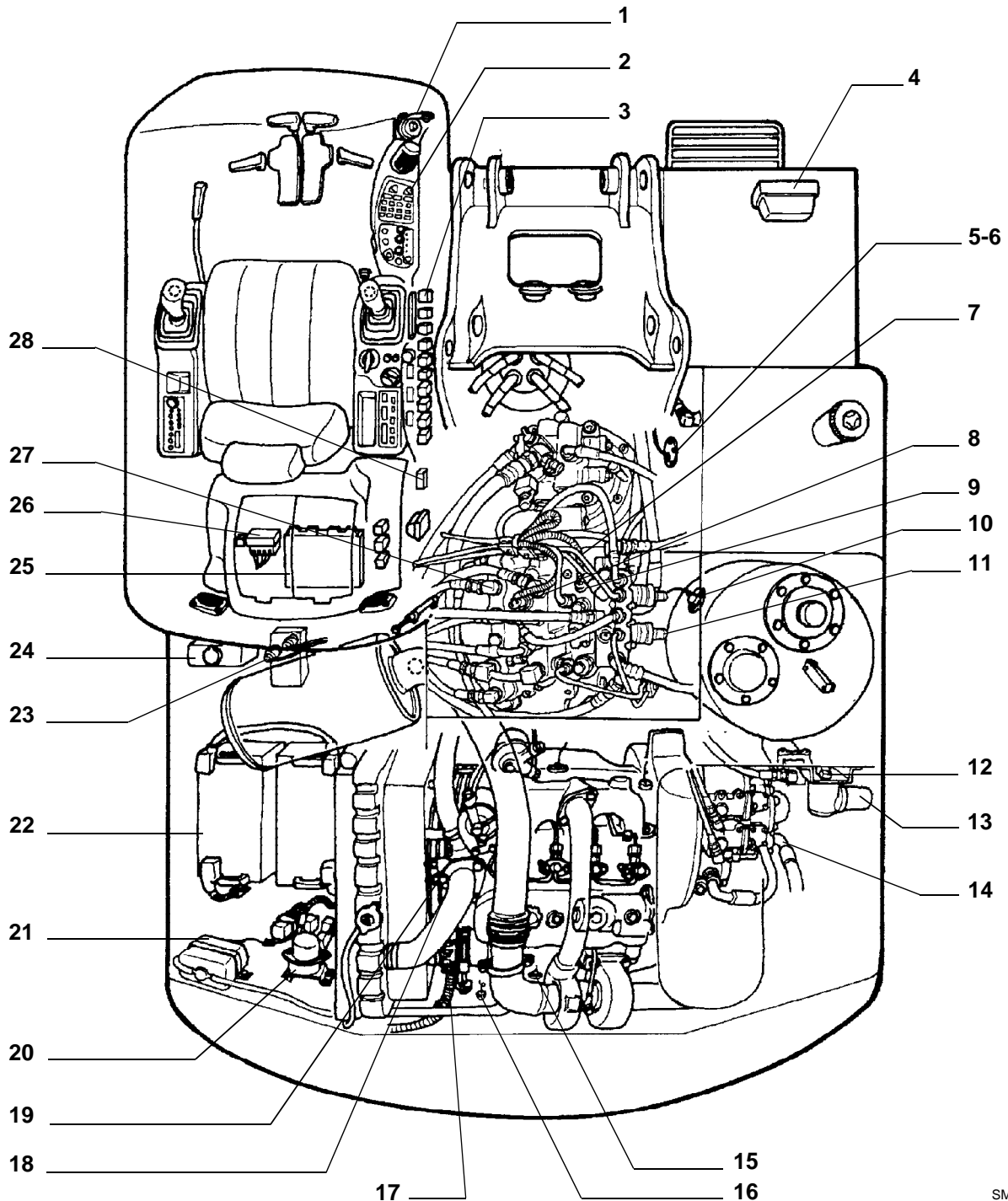
COMPONENT LAYOUT

MAIN COMPONENTS

- 1 - Bucket Cylinder
- 2 - Arm Cylinder
- 3 - Boom Cylinder
- 4 - Center Joint
- 5 - Swing Bearing
- 6 - Swing Device
- 7 - Fuel Tank
- 8 - Hydraulic Oil Tank
- 9 - Control Valve
- 10 - Pump Device

- 11 - Engine
- 12 - Radiator
- 13 - Oil Cooler
- 14 - Battery
- 15 - Travel Device
- 16 - Shockless Valve
- 17 - Pilot Shut-Off Valve
- 18 - Travel Pilot Valve
- 19 - Front/Swing Pilot Valve

COMPONENT LAYOUT

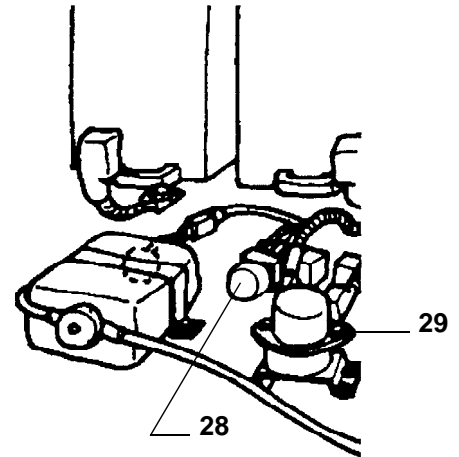
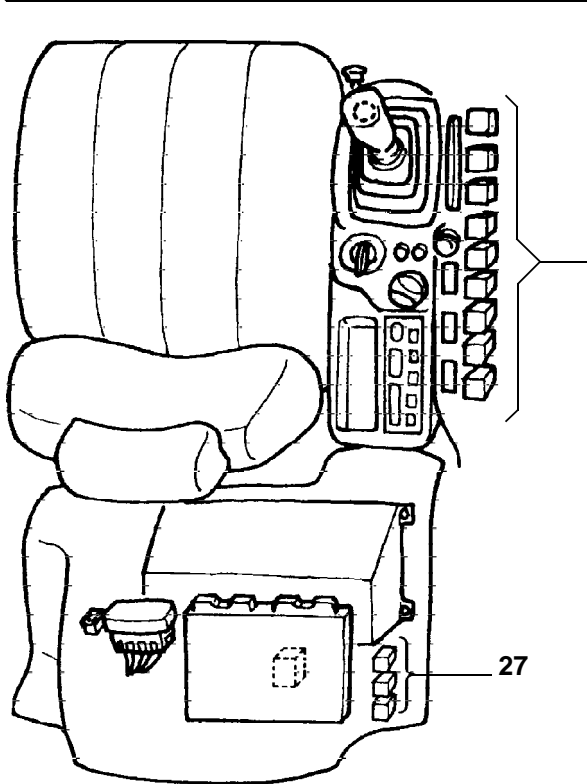
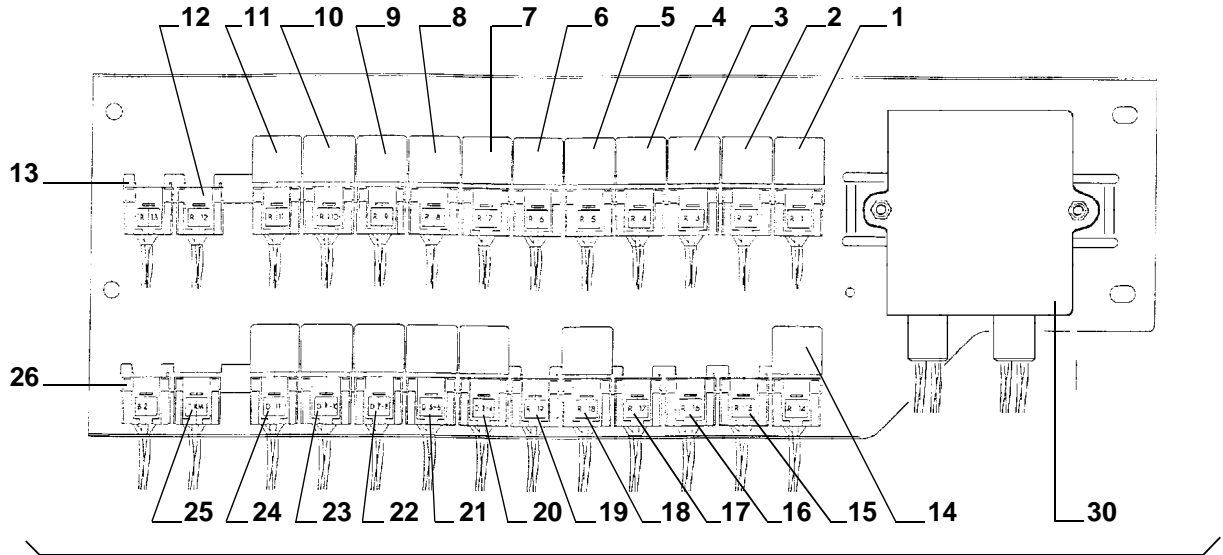
ELECTRICAL SYSTEM (Overall system)

SM2002

- | | |
|---------------------------------------|--|
| 1 - Wiper Motor | 15 - Engine Oil Level Switch |
| 2 - Monitor Panel | 16 - Engine Oil Pressure Switch |
| 3 - Relays | 17 - Alternator |
| 4 - Work Light | 18 - Overheat Switch |
| 5 - Fuel Sensor | 19 - Coolant Temperature Sensor |
| 6 - Low Fuel Level Switch | 20 - Battery Relay |
| 7 - PC Pressure Sensor (4-Spool Side) | 21 - Coolant Level Switch |
| 8 - Pressure Switch (Front) | 22 - Battery |
| 9 - Pressure Switch (Travel) | 23 - Pressure Switch and Sensor |
| 10 - Hydraulic Oil Level Switch | 24 - Windshield Washer Tank |
| 11 - Solenoid Valve Unit | 25 - MC (Main Controller) |
| 12 - EC Sensor | 26 - Fuse Box |
| 13 - EC Motor | 27 - PC Pressure Sensor (5-Spool Side) |
| 14 - Pump Delivery Pressure Sensor | 28 - Intake Air Heater Controller |

COMPONENT LAYOUT

ELECTRICAL SYSTEM (Relays)

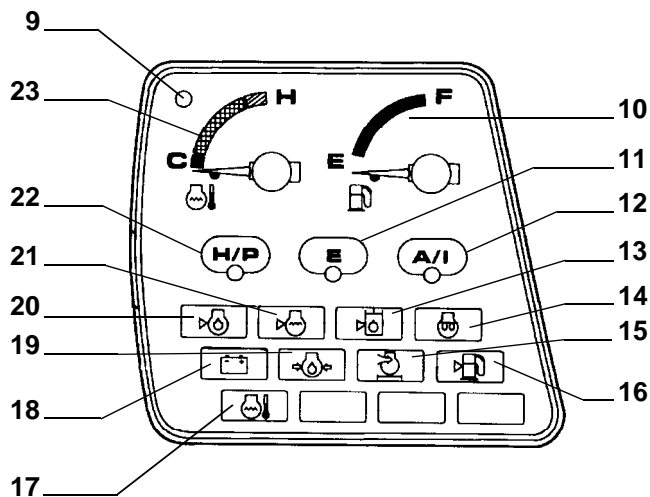
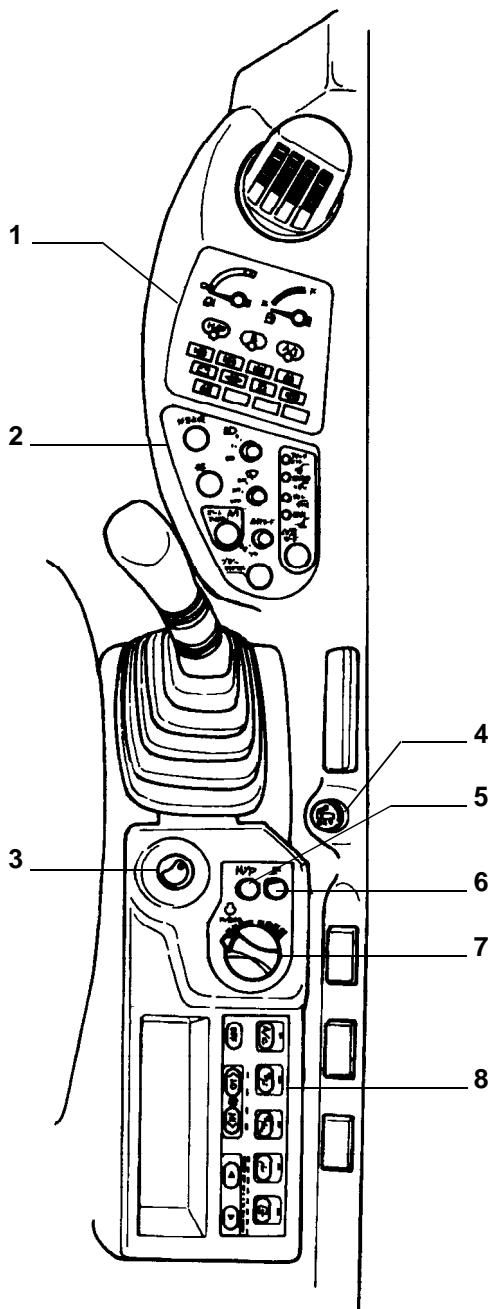


- 1 - Alternator relay (R1)
- 2 - Safety relay (R2)
- 3 - Anti Load Dump relay (R3)
- 4 - Washer relay (R4)
- 5 - Light relay 2 (R5)
- 6 - Light relay 1 (R6)
- 7 - Horn relay (R7)
- 8 - Wiper relay A (R8)
- 9 - Wiper relay B1 (R9)
- 10 - Wiper relay B2 (R10)
- 11 - Wiper relay BM (R11)
- 12 - Fuel heat indicator relay (R12) (opt.)
- 13 - Fuel heat switch relay (R13) (opt.)
- 14 - Air heater indicator relay (R14)
- 15 - Nordic kit relay (R15) (opt.)

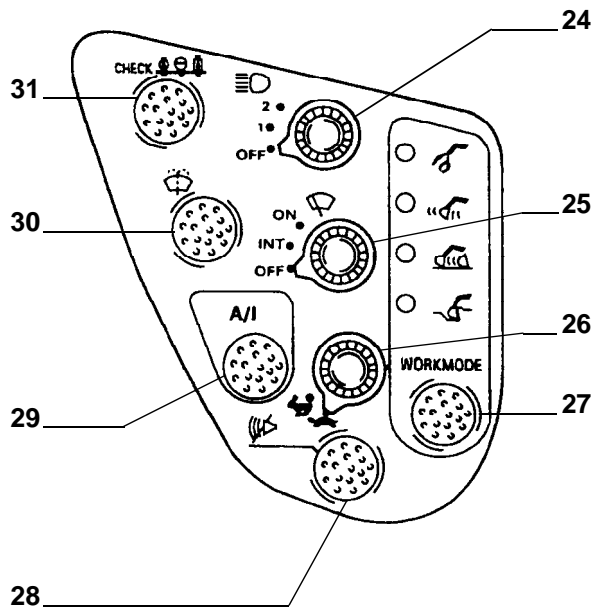
- 16 - Rotary bucket relay (R16) (opt.)
- 17 - TBG relay (R17) (opt.)
- 18 - Engine stop relay (R18)
- 19 - Hammer relay (R19) (opt.)
- 20 - Diodes 2-4
- 21 - Diodes 5-6
- 22 - Diodes 7-8
- 23 - Diode 9 (10-Not used)
- 24 - Diode 11
- 25 - (Not used)
- 26 - Buzzer for TBG (opt.)
- 27 - Air conditioning relays (opt.)
- 28 - Starter relay
- 29 - Battery relay
- 30 - Intake air heater controller

COMPONENT LAYOUT

ELECTRICAL SYSTEM (Monitor and Switch panels)



SM0610



SM0611

SM0612

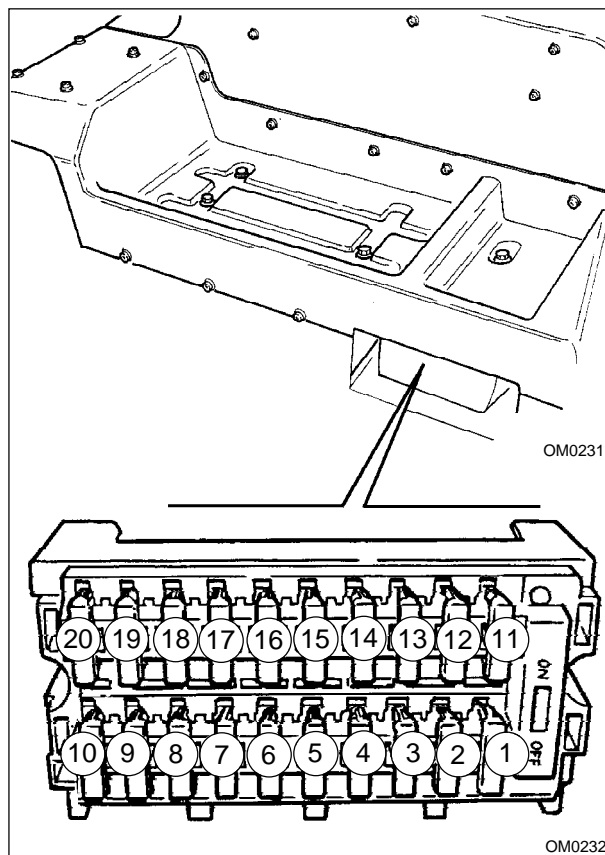
- 1 - Monitor Panel
- 2 - Switch Panel
- 3 - Key Switch
- 4 - Cigar Lighter
- 5 - HP Mode Switch
- 6 - E Mode Switch
- 7 - Engine Control Dial
- 8 - Air Conditioner Panel
- 9 - Warm Up Complete Indicator
- 10 - Fuel Gauge
- 11 - E Mode Indicator
- 12 - Auto-Idle Indicator
- 13 - Hydraulic Oil Level Indicator
- 14 - Air heater (Preheat) Indicator
- 15 - Air Filter Restriction Indicator
- 16 - Fuel Level Indicator

- 17 - Overheat Indicator
- 18 - Alternator Indicator
- 19 - Engine Oil Pressure Indicator
- 20 - Engine Oil Level Indicator
- 21 - Coolant Level Indicator
- 22 - HP Mode Indicator
- 23 - Coolant Temperature Gauge
- 24 - Work Light Switch
- 25 - Wiper Switch
- 26 - Travel Mode Switch
- 27 - Work Mode Switch
- 28 - Buzzer Stop Switch
- 29 - Auto-Idle Switch
- 30 - Washer Switch
- 31 - Level Check Switch

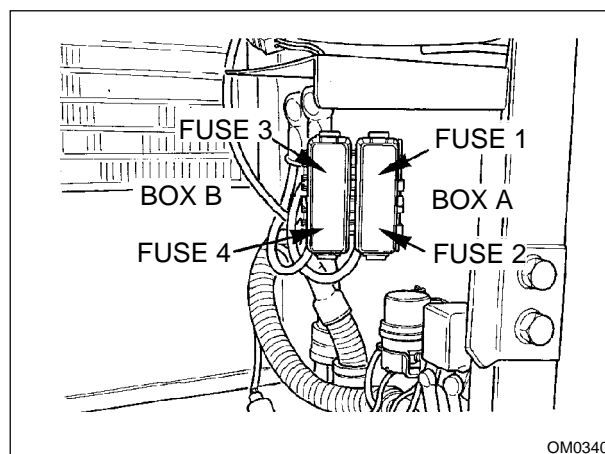
COMPONENT LAYOUT

ELECTRICAL SYSTEM (Fuses)

Fuse No.	PROTECTED CIRCUIT	Rating (AMP)
FUSES IN THE BOX		
1	Backup power source	5
2	MC (Power Source)	10
3	EC Motor	10
4	Power supply	5
5	Pump control solenoid	5
6	Switch panel	5
7	Heated seat/breaker (opt)	10
8	Heated fuel filters (opt)	5
9	Bucket rot. & overturn sensor (opt)	10
10	Kit for Northern Countries	10
11	Lights	20
12	Wiper	10
13	Heater	20
14	Intake air heater controller (15)	3
15	Horn	10
16	Radio	5
17	Cigar lighter	10
18	Cab light	5
19	Air conditioner (opt)	10
20	Intake air heater controller (30)	30
FUSES IN THE AIR FILTER, BATTERIES AND RADIATOR BAY		
BOX A FUSE 1	Main power supply with key	40
BOX A FUSE 2 (OPT)	Heated fuel filters	40
BOX B FUSE 3	Engine start-up line protection	80
BOX B FUSE 4	Available	40

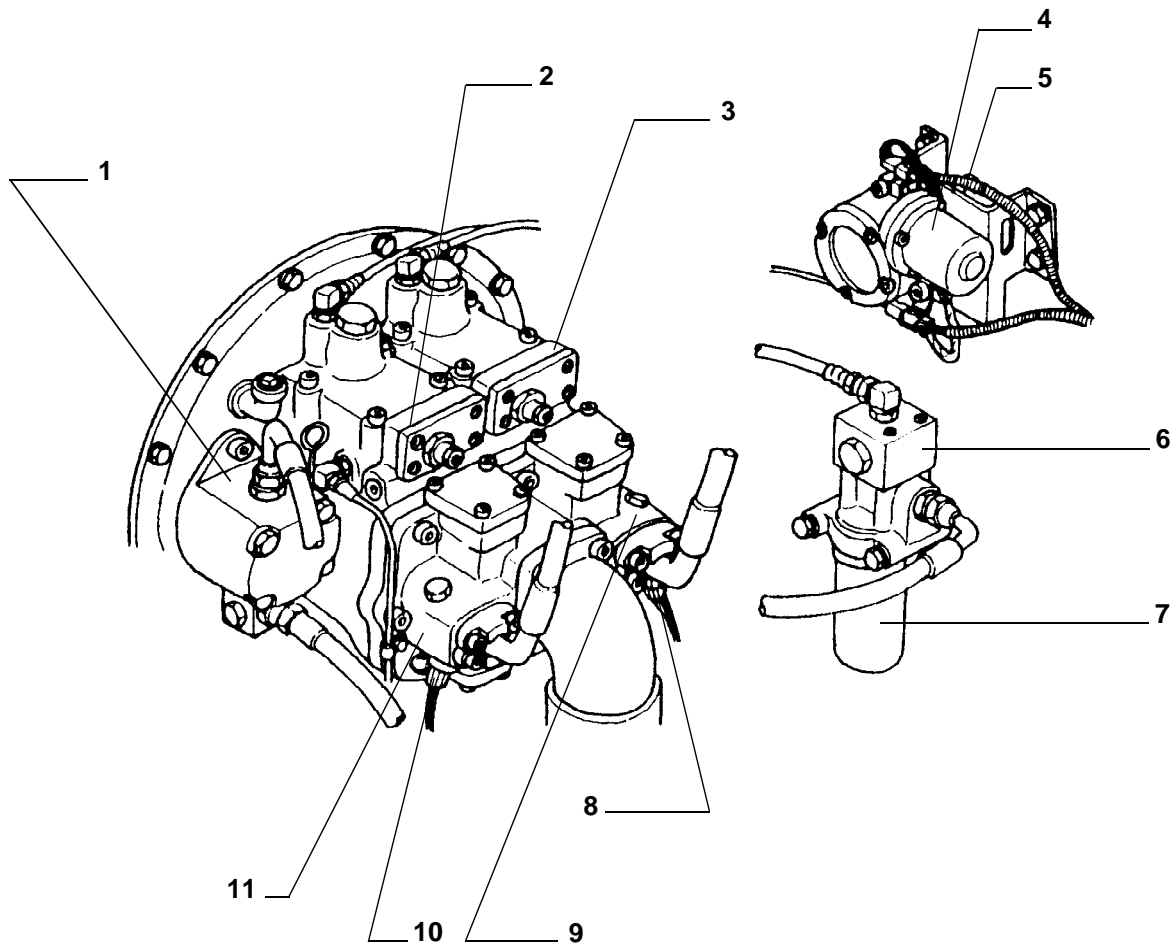


Fuses in the fuse box



Fuses in the air filter, batteries and radiator bay

COMPONENT LAYOUT

PUMP AND RELATED PARTS

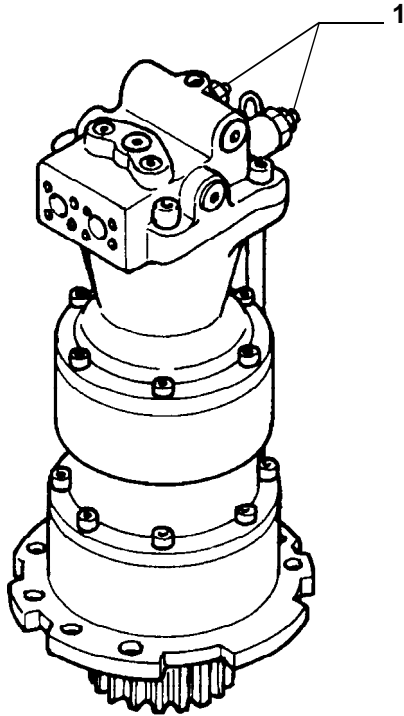
- 1 - Pilot Pump
- 2 - Regulator (Pump 2)
- 3 - Regulator (Pump 1)
- 4 - EC motor
- 5 - EC sensor
- 6 - Pilot Relief Valve

- 7 - Pilot Filter
- 8 - Pump Delivery Pressure Sensor (Pump 1)
- 9 - Pump 1
- 10 - Pump Delivery Pressure Sensor (Pump 2)
- 11 - Pump 2

COMPONENT LAYOUT

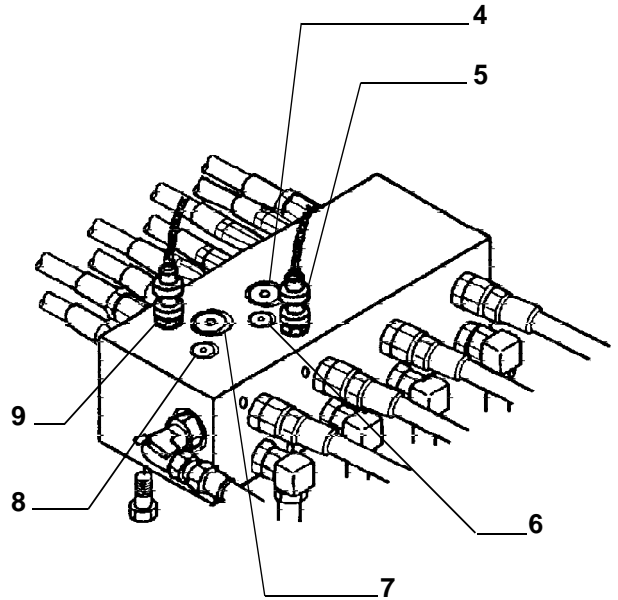
OTHER COMPONENTS

Swing Device



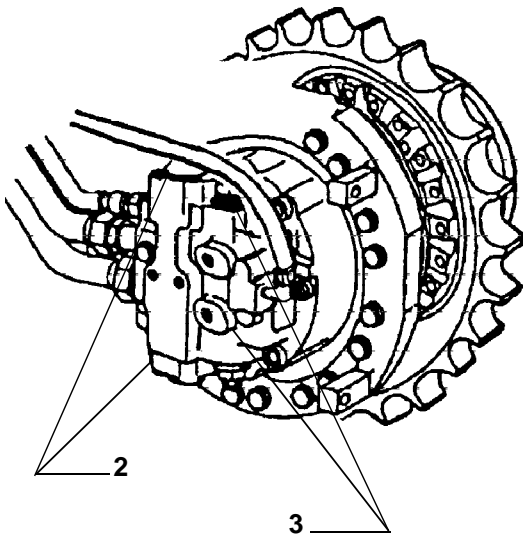
SM2005

Shockless Valve



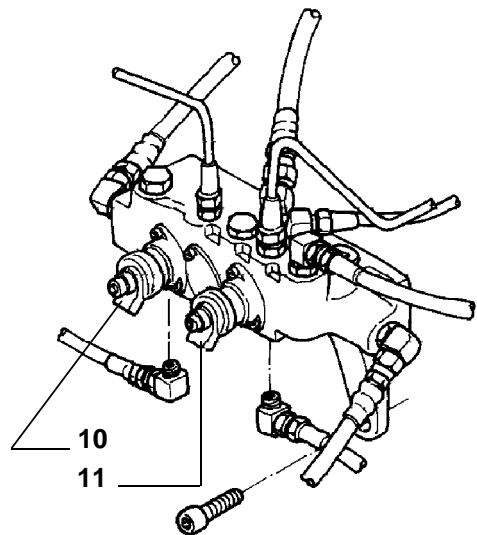
SM0627

Travel Device



SM2006

Solenoid Valve Unit



SM2007

- 1 - Swing Relief Valve
- 2 - Counterbalance Valve
- 3 - Travel Relief Valve
- 4 - Shockless Valve
- 5 - Pressure Switch (Boom Raise)
- 6 - Check Valve

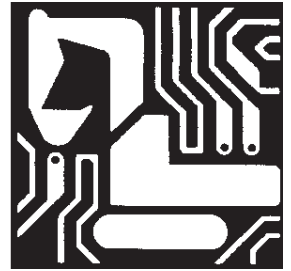
- 7 - Shockless Valve
- 8 - Check Valve
- 9 - Pressure Sensor (Arm Roll-In)
- 10 - Solenoid Valve Unit (SC)
- 11 - Solenoid Valve Unit (SI)

T1-2-8

COMPONENT LAYOUT

NOTES

SYSTEM



CONTENTS

Group 1 - Control system

Outline	T2-1-1
Engine control	T2-1-2
Valve control	T2-1-8
Other control function	T2-1-11

Group 2 - Hydraulic system

Main circuit	T2-2-1
Pilot circuit	T2-2-2
Neutral circuit	T2-2-3
Single actuator operation	T2-2-3
Combined operation	T2-2-4

Group 3 - Electrical system

Outline	T2-3-1
Electric power circuit	T2-3-2
Bulb check circuit	T2-3-3
Intake air heater circuit	T2-3-4
Starting circuit	T2-3-6
Charging circuit	T2-3-8
Surge voltage prevention circuit	T2-3-9
Accessory circuit	T2-3-10
Engine stop circuit	T2-3-11
Engine emergency stop	T2-3-12

CONTROL SYSTEM

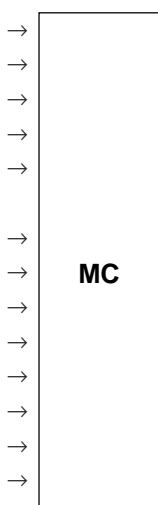
OUTLINE

Micromputer built-in main controller (MC) is provided to control machine operation. Electronic sensing signals from the engine control dial, various sensors and switches are sent to the MC.

After processing the sensing signals in the logic circuits, the MC sends out the control signals to the EC motor, and solenoid valve unit to control the engine and valve operations.

Sensing Signals (Input Signals)

- EC Sensor →
- Engine Control Dial →
- Pump Control Pressure Sensor →
- Pump Delivery Pressure Sensor →
- Pressure Switches (Travel and Front) →
- Pilot Pressure Sensor (Arm Roll-In) →
- Pilot Pressure Switch (Boom Raise) →
- Auto-Idle Switch →
- Learning Switch →
- HP Mode Switch →
- Travel Mode Switch →
- Work Mode Switch →
- Key Switch →



Control Signals (Output Signals)

- EC Motor: Engine Control
 - Normal Control
 - HP Model Control
 - E Mode Control
 - Auto-Idle Control
 - Engine Learning Control
- Solenoid Valve (SC, SI): Valve Control
 - Arm Regenerative Control
 - Travel Motor Swash Angle Control
- Work Mode Control