WEAR PROTECTIVE CLOTHING

- Wear close fitting clothing and safety equipment appropriate to the job.

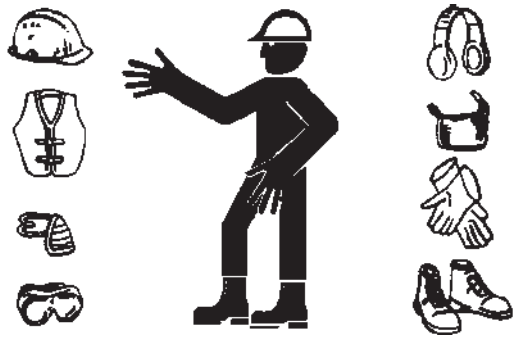
  You may need:
  - A hard hat
  - Safety shoes
  - Safety glasses, goggles, or face shield
  - Heavy gloves
  - Hearing protection
  - Reflective clothing
  - Wet weather gear
  - Respirator or filter mask.

  Be sure to wear the correct equipment and clothing for the job. Do not take any chances.

  - Avoid wearing loose clothing, jewelry, or other items that can catch on control levers or other parts of the machine.

- Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating the machine.

005-E01A-0438



SA-438

PROTECT AGAINST NOISE

- Prolonged exposure to loud noise can cause impairment or loss of hearing.

  - Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortably loud noises.

006-E01A-0434

SA-434

INSPECT MACHINE

- Inspect your machine carefully each day or shift by walking around it before you start it to avoid personal injury.

  - In the walk-around inspection be sure to cover all points described in the “PRE-START INSPECTION” chapter in the operator’s manual.

S007-E01A-0435

SA-435

BEWARE OF EXHAUST FUMES

- Prevent asphyxiation. Engine exhaust fumes can cause sickness or death.
  - If you must operate in a building, be sure there is adequate ventilation. Either use an exhaust pipe extension to remove the exhaust fumes or open doors and windows to bring enough outside air into the area.

509-E01A-0016

SA-016

AVOID HEATING NEAR PRESSURIZED FLUID LINES

- Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders.
  - Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials.
  - Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area. Install temporary fire-resistant guards to protect hoses or other materials before engaging in welding, soldering, etc..

SA-030

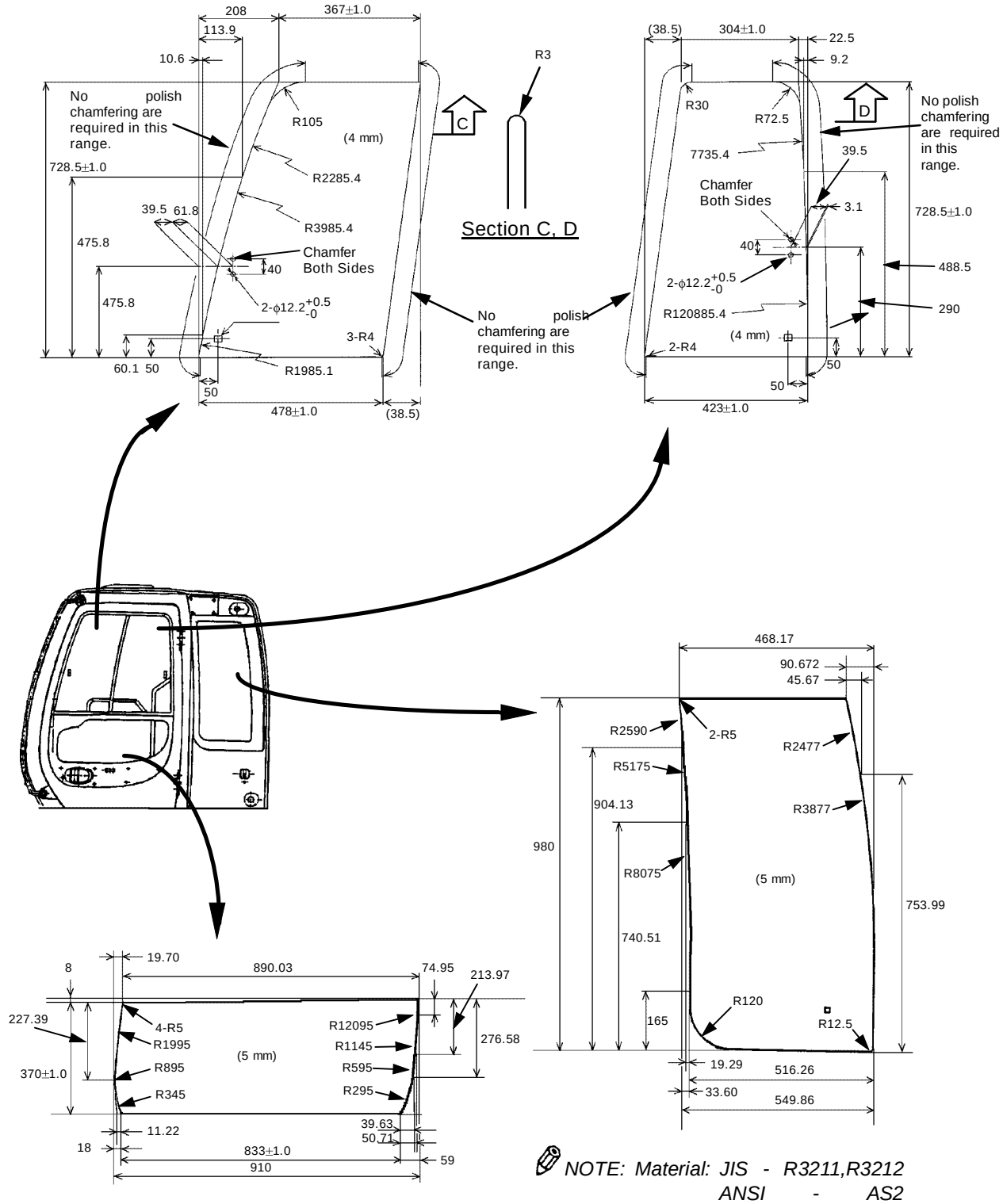
AVOID APPLYING HEAT TO LINES CONTAINING FLAMMABLE FLUIDS

- Do not weld or flame cut pipes or tubes that contain flammable fluids.
- Clean them thoroughly with nonflammable solvent before welding or flame cutting them.

510-E01B-0030

Machines produced from beginning Nov. '96
Unit : mm

NOTE: 1 mm=0.03937 in

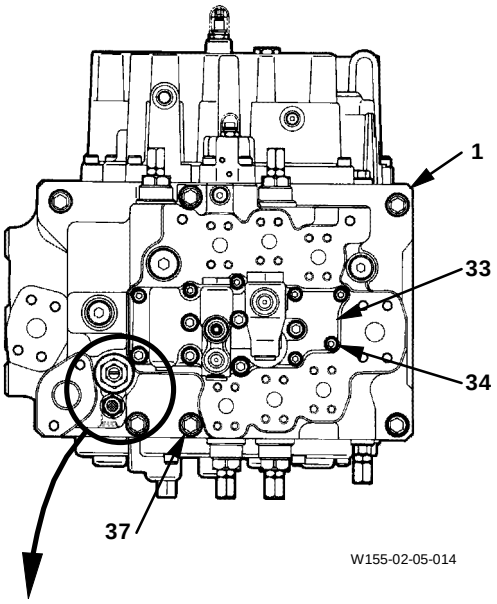


NOTE: Material: JIS - R3211,R3212
ANSI - AS2
ECE - ANNEX5 or equivalent

W157-02-01-018

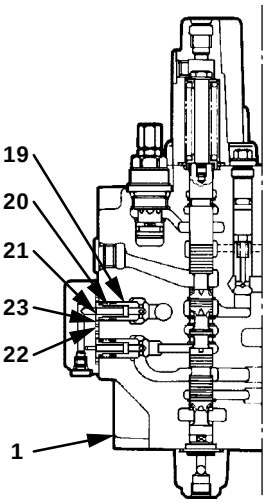
ASSEMBLE CONTROL VALVE 1

Side View of 4-Spool Control Valve



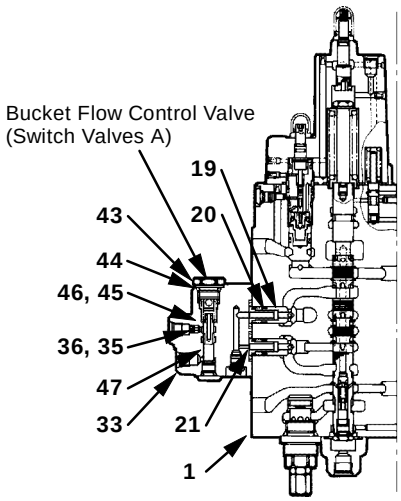
W155-02-05-014

Arm 2



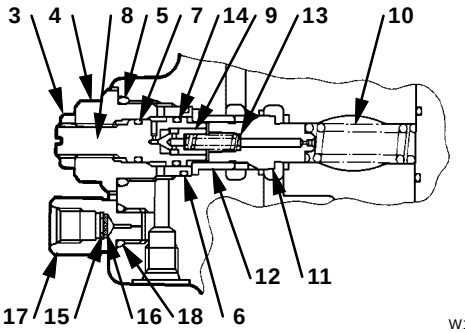
W155-02-05-027

Boom 1



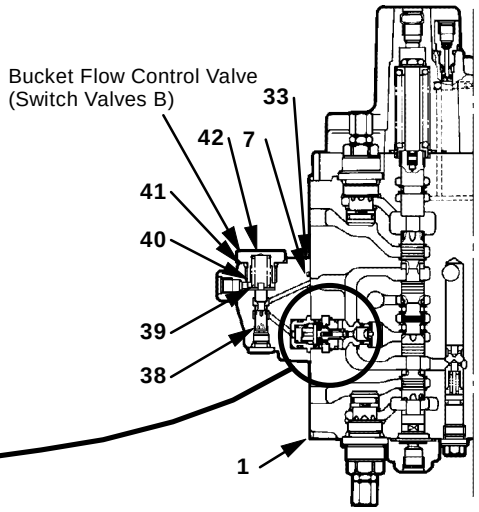
W155-02-05-028

Pump Control Valve

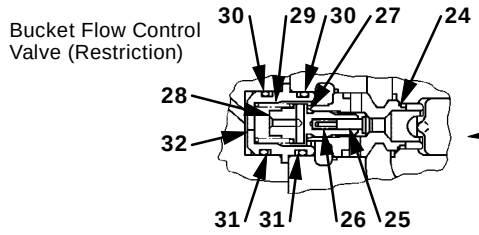


W155-02-05-011

Bucket

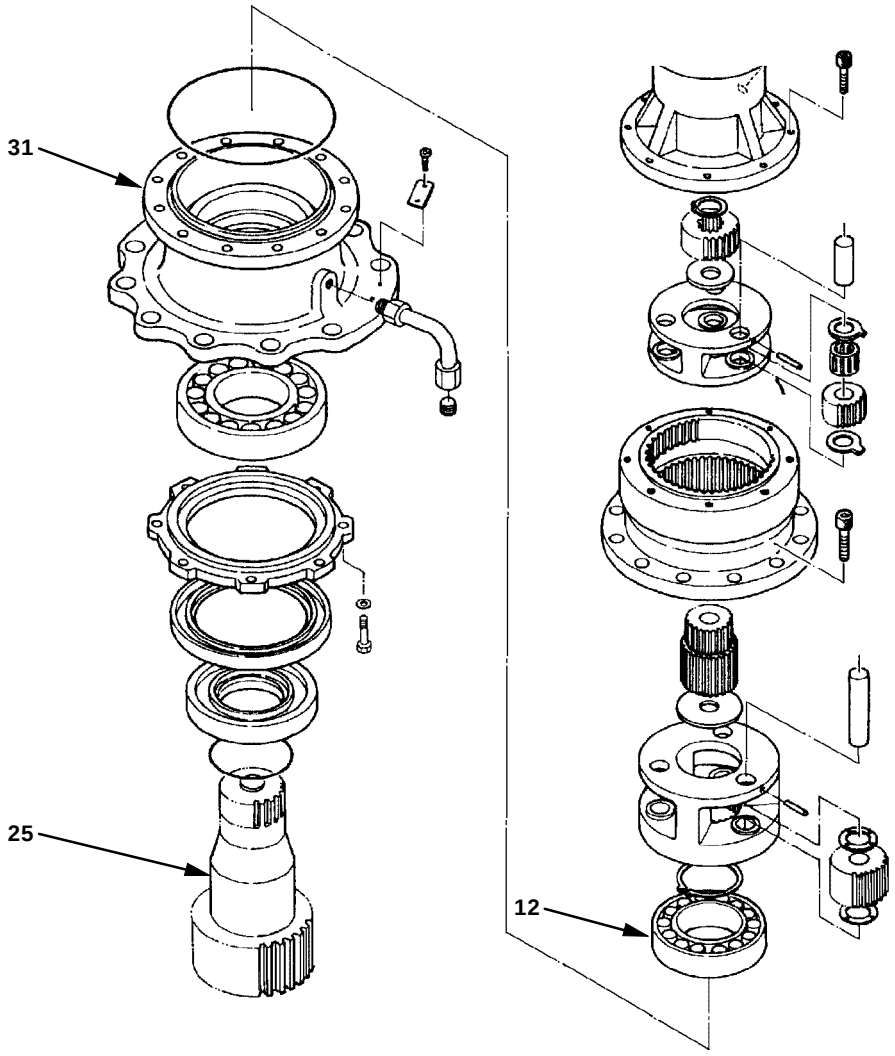


W155-02-05-029



W155-02-05-010

1 - Housing (4-Spool Side)
3 - Lock Nut
4 - Body
5 - O-Ring
6 - O-Ring
7 - O-Ring
8 - Adjusting Screw
9 - Valve
10 - Spring
11 - Piston
12 - Bushing
13 - Spring
14 - O-Ring
15 - Snap Ring
16 - Filter
17 - Adapter
18 - O-Ring
19 - Check Valve
20 - Spring
21 - Seat
22 - Backup Ring
23 - O-Ring
24 - Valve Seat
25 - Check Valve
26 - Spring
27 - O-Ring
28 - Plug
29 - Spring
30 - O-Ring
31 - Backup Ring
32 - Bushing
33 - Pilot Plate
34 - Socket Bolt
35 - Filter
36 - Screw
37 - Socket Bolt
38 - Spool
39 - Washer
40 - Spring
41 - O-Ring
42 - Plug
43 - Plug
44 - O-Ring
45 - Spring
46 - Washer
47 - Spool



W155-02-06-002

Disassemble Right and Left Pilot Valve

- Be sure to thoroughly read “Precautions for Disassembly and Assembly" on page W1-1-1 before starting the disassembly work.
- As casing (17) and spools (19) are precision parts specially made to fit each other, they must be replaced as a set. Do not attempt to replace these parts individually.
- Note that return spring A (22) and balance spring A (23), which are used in ports 1 and 3, differ from return spring B (24) and balance spring B (25), which are used in ports 2 and 4, respectively.
- For this reason, be sure to indicate the port number from which it is removed. Port numbers are stamped on casing (17).

1. Remove screw joint (1) and cam (2).

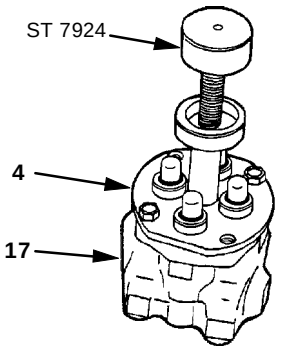
   : 19 mm, 32 mm

2. Temporarily tighten plate (4) using two bolts (M8, Pitch 1.25). Loosen universal joint (3) to remove it from casing (17).

3. Turn over casing (17) and place it in a vise. Remove socket bolt (13).

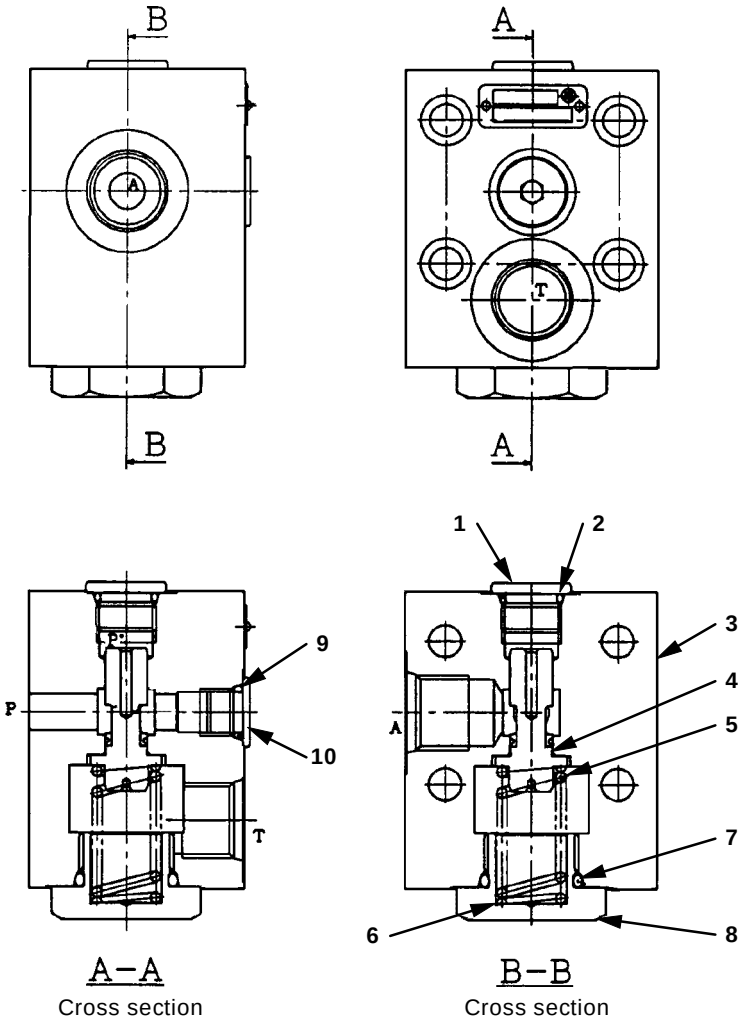
   : 10 mm

4. Pull out plate (14) using a pulling bolt (M16, Pitch 2). Remove O-ring (15) from the plate. Remove seal washer (16) from casing (17).
5. Remove piston (18) from spool (19) in each port. (Four pistons in total)
6. Turn over casing (17). Attach special tool (ST 7924) to the universal joint connecting hole. Tighten plate (4) using the special tool.
7. Remove the bolts (2 used) temporarily installed in the step 2. Gradually loosen the special tool until pushers A (8), B (11) and plate (4) are fully raised, unloading spring compresssion.
8. Remove plate (4) and pushers A (8), B (11) from casing (17).
9. Remove pusher A (8), O-ring (6), and oil seal (5) from each bushing A (7). Remove pusher B (11), O-ring (6), and oil seal (5) from each bushing B (12).
10. Remove spools (19) (4 used) from casing (17).
11. Compress balance spring A (23) or B (25) to remove spacer (20) from each spool (19).
    Remove balance spring A (23) or B (25), shim (21), spring guide A (9) or B (10), and return spring A (22) or B (24) from each spool (19).



W105-02-07-009

ASSEMBLE PILOT RELIEF VALVE



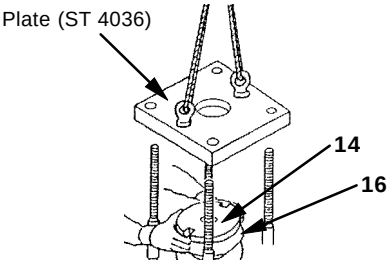
A–A
Cross section

B–B
Cross section

W154-02-10-003

1 - Plug
2 - O-Ring
3 - Body
4 - Poppet
5 - Spring
6 - Shim
7 - O-Ring
8 - Plug
9 - O-Ring
10 - Plug

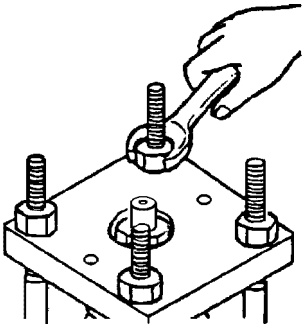
8. Install washer (14) on spring (16).
   Install the plate (ST 4036).



W105-03-04-016

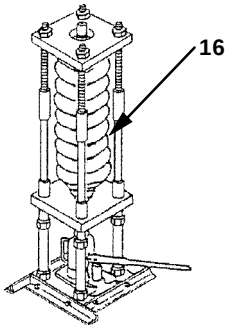
9. Align the jack and track adjuster with the hole in plate.
   Tighten the nuts to secure the track adjuster.

   : 46 mm



W105-03-04-012

10. Operate the jack to compress spring (16) to specification.
    Compressed Length:415.5 mm (1 ft 4.4 in)



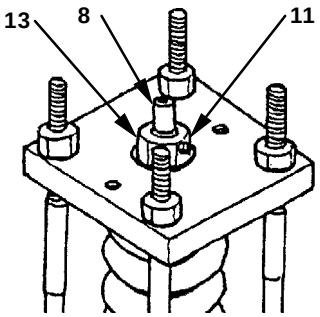
W105-03-04-026

11. Instal nut (13) and plug (11) to rod (8).

    : 65 mm

    : 5 mm

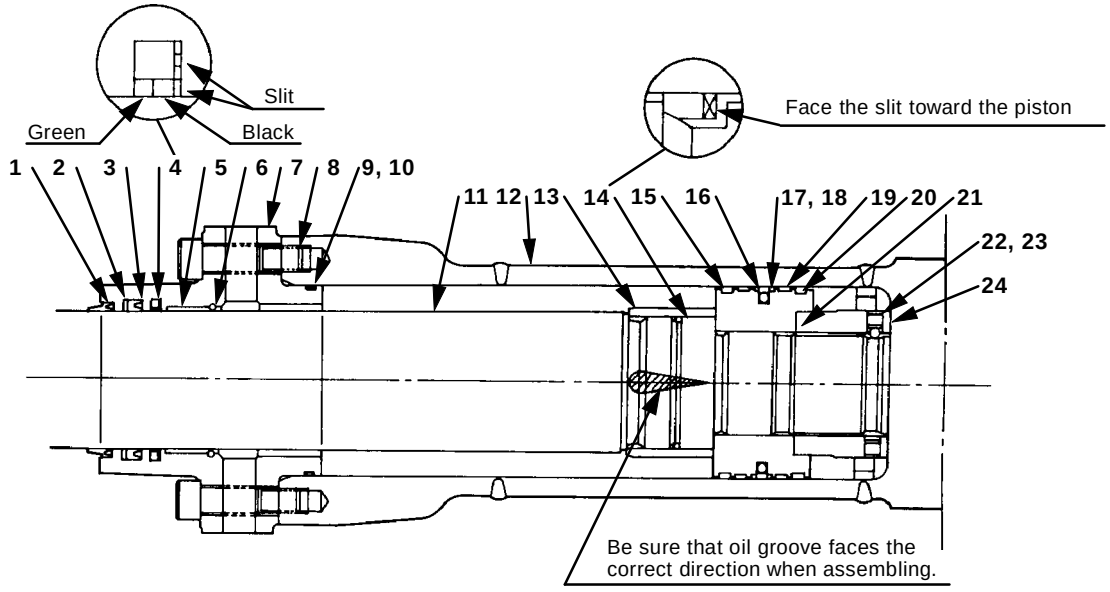
    : 9.8 N·m (1.0 kgf·m, 7.2 lbf·ft)



W105-03-04-014L

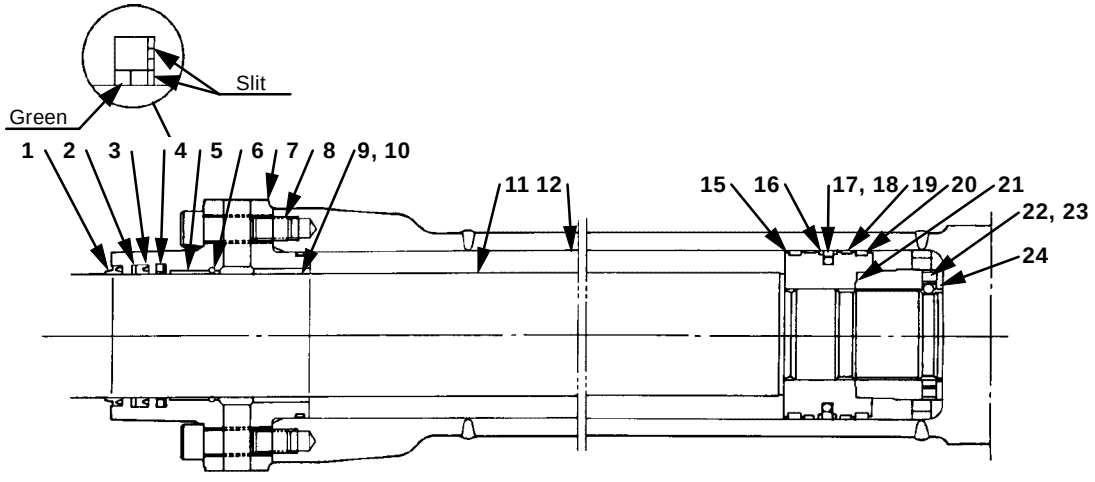
ASSEMBLE CYLINDER

Boom Cylinder



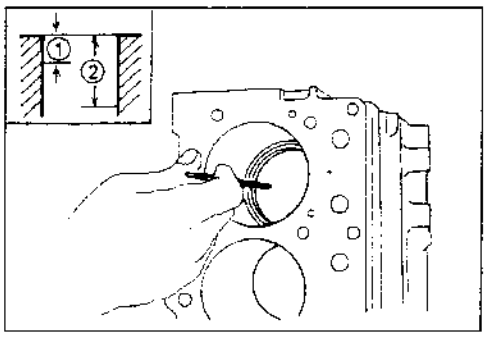
W157-04-02-003

Bucket Cylinder



W155-04-02-001

1 - Wiper Ring
2 - Backup Ring
3 - U-Ring
4 - Buffer Ring
5 - Bushing
6 - Snap Ring
7 - Cylinder Head
8 - Socket Bolt
9 - Backup Ring
10 - O-Ring
11 - Cylinder Rod
12 - Cylinder Tube
13 - Cushion Bearing
14 - Cushion Seal
15 - Piston
16 - Backup Ring
17 - Seal Ring
18 - O-Ring
19 - Slide Ring
20 - Slide Ring
21 - Shim
22 - Set Screw
23 - Steel Ball
24 - Nut



Piston Ring Gap

1. Insert the piston ring horizontally (in the position it would assume if it were installed to the piston) into the cylinder liner.
2. Use an inverted piston to push the piston ring into the cylinder liner until it reaches either measuring point ① or measuring point ②. Cylinder liner diameter is the smallest at these two points.

   Do not allow the piston ring to slant to one side or the other. It must be perfectly horizontal.

   Cylinder Liner Measuring Point ①: 10mm (0.39 in)

   Cylinder Liner Measuring Point ②: 130mm (5.12 in)
3. Use a feeler gauge to measure the piston ring gap.

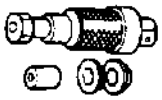
   If the measured value exceeds the specified limit, the piston ring must be replaced.

4BG1 mm (in)

	Standard	Limit
1st Compression Ring	0.25–0.45 (0.010–0.018)	1.5 (0.059)
2nd Compression Ring	0.35–0.50 (0.014–0.020)	
Oil Ring	0.30–0.50 (0.012–0.020)	

4BG1T, 6BG1T mm (in)

	Standard	Limit
1st Compression Ring	0.35–0.50 (0.014–0.020)	1.5 (0.059)
2nd Compression Ring	0.35–0.50 (0.014–0.020)	
Oil Ring	0.30–0.50 (0.014–0.020)	

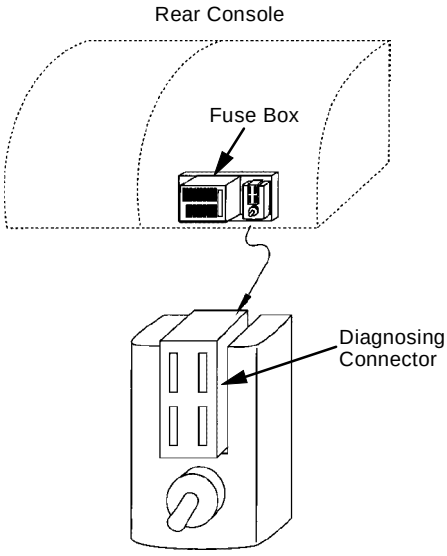
ITEM NO.	ILLUSTRATION	PART NO.	PARTS NAME	PAGE
11.		9-8522-0033-0	Crankshaft gear installer	4-28
12.		9-8523-1369	Connecting rod bushing installer	4-20
13.		9-8522-1254-0	Crankshaft rear oil seal installer	4-28
14.		9-8522-0034-0	Crankshaft front oil seal installer	4-29
15.		1-85221-005-0	Valve stem oil seal installer	5-5
16.		9-8522-1251-0	Piston ring compressor	5-12
17.		9-8521-0097-0	Water pump impeller remover	7-4
18.		1-85210-056-0	Oil seal wear ring remover	4-27
19.		1-85220-031-0	Oil seal wear ring installer	4-27

Dr.EX

Dr.EX is a handy micro computer used for diagnosing malfunctions of the machine control system, including the MC (Main Controller).

When the Dr.EX is connected to the MC, malfunctions recorded in the MC memory are indicated as fault codes on the Dr.EX display.
(Self-Diagnosing Function)

Input signals from the sensors or switches that are connected to the MC, or output signals from the MC to solenoid valves can be monitored on a real-time basis while the machine is being operated.
(Read-Time Monitoring Function)



T157-07-04-001

Dr.EX START-UP PROCEDURE

1. Connect the harness of the Dr.EX to the diagnosing connector of the MC, located near fuse box behind the operator's seat.

NOTE: Only this connecting harness can be used to connect the Dr.EX to the controller. Do not use any other harness to connect Dr.EX to the controller.

2. Turn the key switch to the ON position or start the engine.

3. Turn the Dr.EX ON. After a few seconds, following patterns will appear on the Dr.EX display :

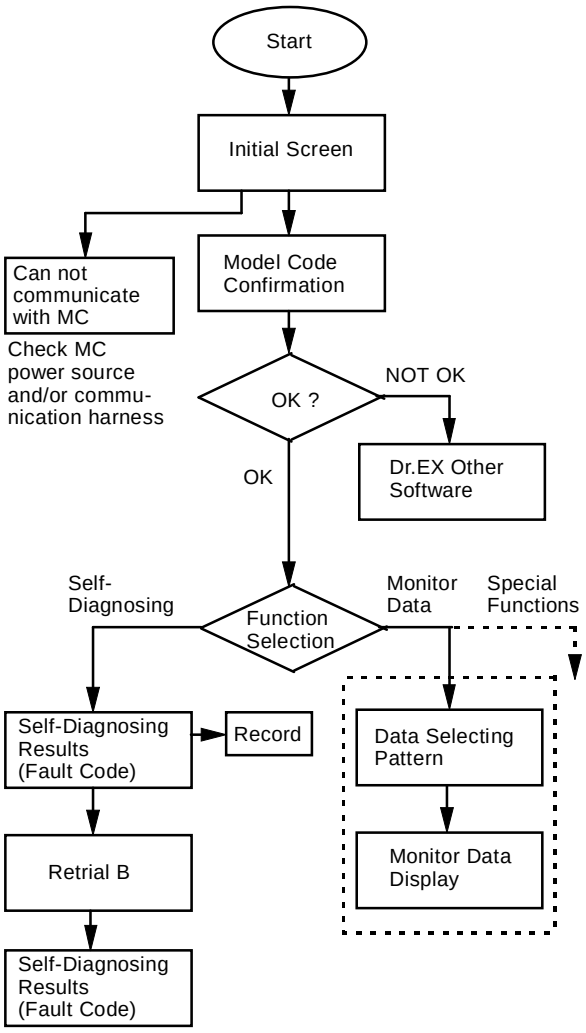
   3-1. Initial Pattern

   3-2. Model Code Pattern
   Example :
   Model : EX200-5
   Ver : XXXX

   3-3. Function Selection Pattern
   F-1 : "Self-diagnosing Results"
   F-2 : "Monitor Data"
   F-3 : "Special Functions"

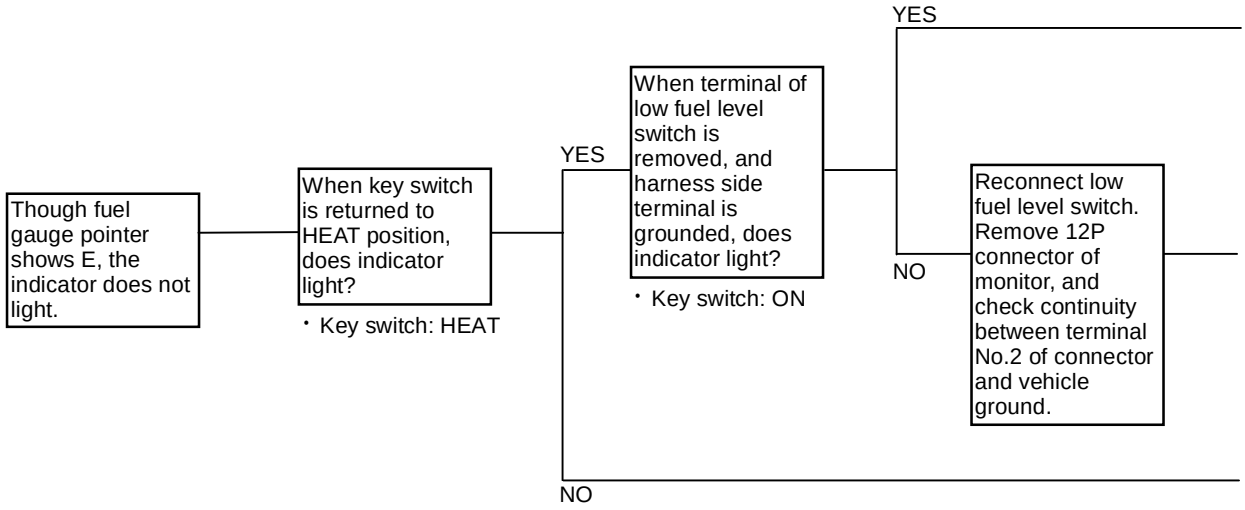
4. Select key F1 (Proceed according to the instructions that appear on the display.)

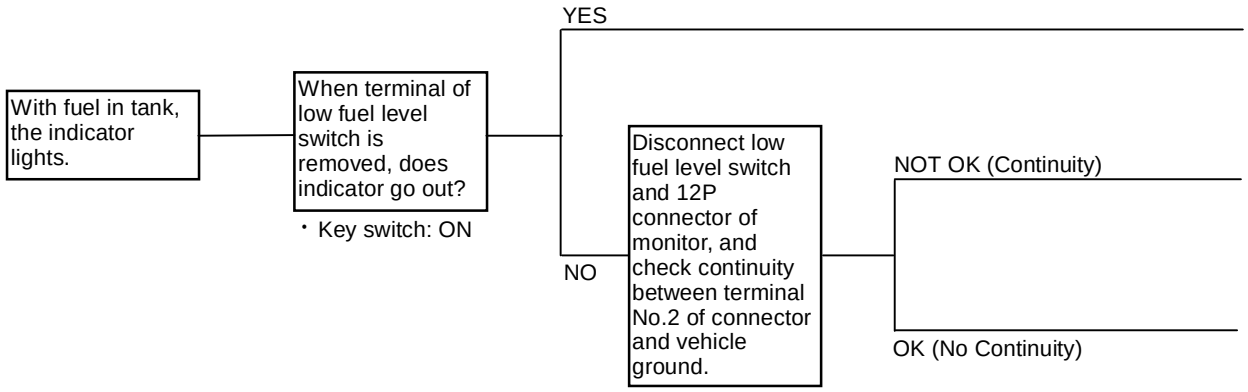
NOTE: For the operation procedure of the Dr.EX, refer to the Dr.EX OPERATOR'S MANUAL.



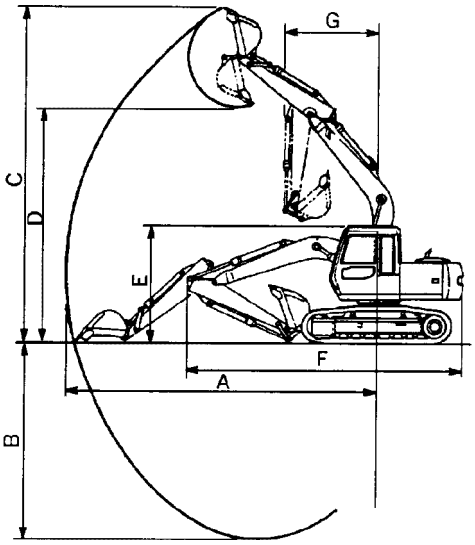
MALFUNCTION OF FUEL LEVEL INDICATOR

- Be sure to inspect wiring connections prior to troubleshooting.

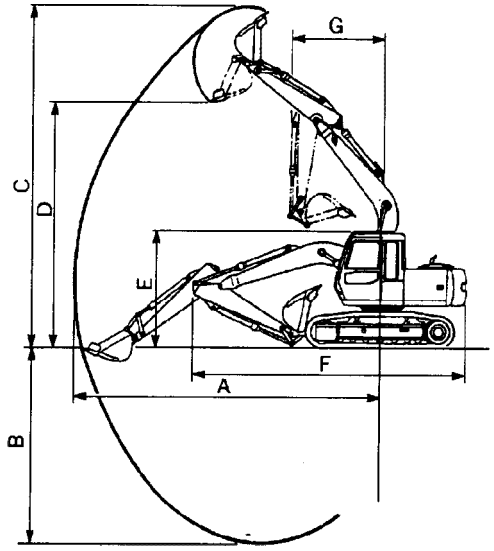




Working Ranges and Machine Dimensions for Transportation



M155-11-003



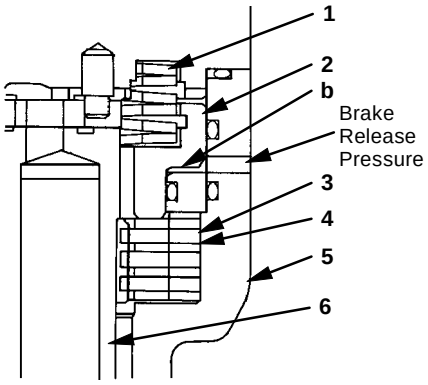
M155-11-004

Item	Category	2.10 m (6'11") Arm		2.52 m (8'3") Arm		3.01 m (9'11") Arm	
		Backhoe	Shovel	Backhoe	Shovel	Backhoe	Shovel
A: Maximum Digging Reach	mm (ft·in)	7 900 (25'11")	8 050 (26'5")	8 270 (27'2")	8 410 (27'7")	8 740 (28'8")	8 880 (29'2")
∗B: Maximum Digging Depth	mm (ft·in)	5 160 (16'11")	5 300 (17'5")	5 570 (18'3")	5 720 (18'9")	6 060 (19'11")	6 210 (20'5")
∗C: Maximum Cutting Height	mm (ft·in)	8 350 (27'5")	8 540 (28'0")	8 550 (28'1")	8 750 (28'9")	8 880 (29'2")	9 070 (29'9")
∗D: Maximum Dumping Height	mm (ft·in)	5 940 (19'6")	6 020 (19'9")	6 140 (20'2")	6 220 (20'5")	6 470 (21'3")	6 530 (21'5")
E: Transport Height	mm (ft·in)	2 720 (8'11")	2 720 (8'11")	2 720 (8'11")	2 720 (8'11")	∗∗2 720 (8'11")	∗∗2 720 (8'11")
F: Overall Transport Length	mm (ft·in)	7 570 (24'10")	7 570 (24'10")	7 580 (24'10")	7 580 (24'10")	∗∗2 590 (24'11")	∗∗7 590 (24'11")
G: Minimum Swing Radius	mm (ft·in)	2 310 (7'7")	2 310 (7'7")	2 330 (7'8")	2 330 (7'8")	2 590 (8'6")	2 590 (8'6")

*NOTE: * The dimensions do not include the height of the shoe lug.*
***For trasport pin position.*

SWING PARKING BRAKE

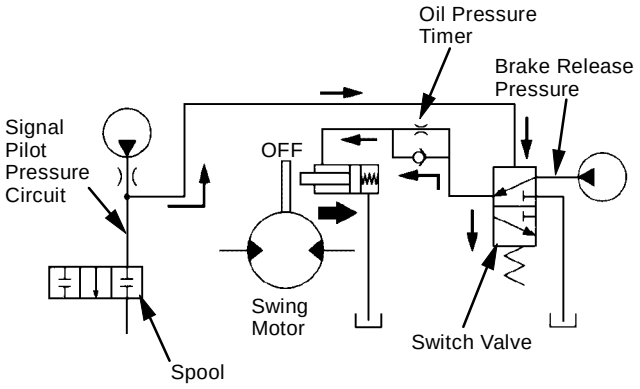
The parking brake is a wet-type multiple disc brake. The brake is released only when brake release pressure enters into brake piston chamber (b), (negative type brake). When swing and/or front attachment operation is made brake release pressure is supplied from the pilot pump.
During operations other than swing and/or front, or while the engine is stopped, brake release pressure is routed to the hydraulic oil tank and the parking brake is automatically applied by spring (1).



T155-02-02-001

- When the swing and/or front function is operated, the brake is released:
  When the swing and/or front control lever is operated, the control valve spool for swing and/or front function is moved from the neutral position, closing the spool passage for the signal pilot pressure circuit. Then, the pilot oil pressure increases, and the increased pressure pilot oil is sent to the pilot port of the switch valve in the brake release circuit. Therefore, the switch valve is opened, allowing the brake release pilot oil pressure from the pilot pump to act on brake piston (2) via the oil pressure timer check valve. Accordingly, brake piston (2) is moved up against spring (1), breaking contact between friction plates (4) and plates (3). Then, the brake is released.

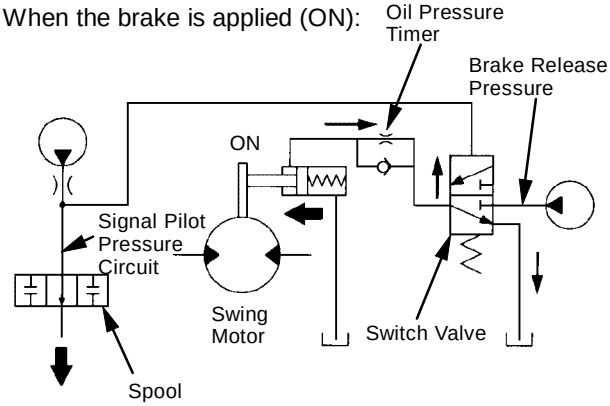
When the brake is released (OFF):



T157-02-04-005

- When the swing and/or front function is not operated, the brake is applied:
  When the swing and/or front control lever is not operated, the control valve spool for swing and/or front function is in the neutral position, holding the spool passage for the signal pilot pressure circuit open. Then, the pilot oil pressure does not increase. Therefore, the switch valve in the brake circuit is kept closed, allowing the brake release pilot oil pressure on brake piston (2) to flow out to the hydraulic oil tank via the oil pressure timer orifice. Accordingly, brake piston (2) is moved down by spring (1) force so that friction plates (4) come into contact with plates (3). As friction plates (4) engage the inner circumference of motor housing (5) and plates (3) engage the outer circumference of rotor (6), is braked by friction force developed between plates (3) and friction plates (4).

When the brake is applied (ON):



T157-02-04-004

1 - Spring
2 - Brake Piston
3 - Plate
4 - Friction Plate
5 - Motor Housing
6 - Rotor