

SERVICE MANUAL

**CRAWLER EXCAVATOR
R160LC-3**

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CONTENTS

CRAWLER TYPE EXCAVATOR [R160LC-3]

FOREWORD

SECTION 1

GENERAL

- Group 1 Safety Hints
- Group 2 Specifications

SECTION 2

STRUCTURE AND FUNCTION

- Group 1 Pump Device
- Group 2 Main Control Valve
- Group 3 Swing Device
- Group 4 Travel Device
- Group 5 RCV Lever
- Group 6 RCV Pedal

SECTION 3

HYDRAULIC SYSTEM

- Group 1 Hydraulic Circuit
- Group 2 Main Circuit
- Group 3 Pilot Circuit
- Group 4 Single Operation
- Group 5 Combined Operation

SECTION 4

ELECTRICAL SYSTEM

- Group 1 Component Location
- Group 2 Electrical Circuit
- Group 3 Electrical Component Specification
- Group 4 Connectors

SECTION 5

MECHATROMICS SYSTEM

- Group 1 Outline
- Group 2 Mode selection System
- Group 3 Automatic Deceleration System
- Group 4 Power Boost System
- Group 5 Travel Speed Control System

- Group 6 Automatic Warming Up Function
- Group 7 Engine Overheat Prevention Function
- Group 8 Arm Half Flow System
- Group 9 Anti-Restart System
- Group 10 Self-Diagnostic System
- Group 11 Engine Control System
- Group 12 EPPR(Electro Proportional Pressure Reducing) Valve
- Group 13 Prolix Switch
- Group 14 Monitoring System

SECTION 6

TROUBLESHOOTING

- Group 1 Before Troubleshooting
- Group 2 Hydraulic and Mechanical System
- Group 3 Electrical System
- Group 4 Mechatronics System

SECTION 7

MAINTENANCE STANDARD

- Group 1 Operational Performance Test
- Group 2 Major Components
- Group 3 Track and Work Equipment

SECTION 8

DISASSEMBLY AND ASSEMBLY

- Group 1 Precaution
- Group 2 Tightening Torque
- Group 3 Pump Device
- Group 4 Main Control Valve
- Group 5 Swing Device
- Group 6 Travel Device
- Group 7 RCV Lever
- Group 8 Turning Joint
- Group 9 Boom, Arm and Bucket Cylinder
- Group 10 Undercarriage
- Group 11 Work Equipment

1. STRUCTURE

This service manual has been prepared as an aid to improve the quality of repairs by giving the serviceman an accurate understanding of the product and by showing him the correct way to perform repairs and make judgements. Make sure you understand the contents of this manual and use it to full effect at every opportunity.

This service manual mainly contains the necessary technical information for operations performed in a service workshop.

For ease of understanding, the manual is divided into the following sections.

SECTION 1 GENERAL

This section explains the safety hints and gives the specification of the machine and major components.

SECTION 2 STRUCTURE AND FUNCTION

This section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting.

SECTION 3 HYDRAULIC SYSTEM

This section explains the hydraulic circuit, single and combined operation.

SECTION 4 ELECTRICAL SYSTEM

This section explains the electrical circuit, monitoring system and each component. It serves not only to give an understanding electrical system, but also serves as reference material for trouble shooting.

SECTION 5 MECHATRONICS SYSTEM

This section explains the computer aided power optimization system and each component.

SECTION 6 TROUBLESHOOTING

This section explains the troubleshooting charts correlating **problems** to **causes**.

SECTION 7 MAINTENANCE STANDARD

This section gives the judgement standards when inspecting disassembled parts.

SECTION 8 DISASSEMBLY AND ASSEMBLY

This section explains the order to be followed when removing, installing, disassembling or assembling each component, as well as precautions to be taken for these operations.

The specifications contained in this shop manual are subject to change at any time and without any advance notice. Contact your HYUNDAI distributor for the latest information.

2. HOW TO READ THE SERVICE MANUAL

Distribution and updating

Any additions, amendments or other changes will be sent to HYUNDAI distributors.

Get the most up-to-date information before you start any work.

Filing method

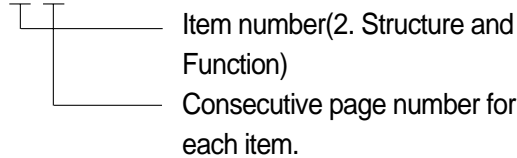
1. See the page number on the bottom of the page.

File the pages in correct order.

2. Following examples shows how to read the page number.

Example 1

2 - 3



3. Additional pages : Additional pages are indicated by a hyphen(-) and number after the page number. File as in the example.

10 - 4

10 - 4 - 1

10 - 4 - 2

Added pages

10 - 5

Revised edition mark(①②③...)

When a manual is revised, an edition mark is recorded on the bottom outside corner of the pages.

Revisions

Revised pages are shown at the **list of revised pages** on the between the contents page and section 1 page.

Symbols

So that the shop manual can be of ample practical use, important places for safety and quality are marked with the following symbols.

Symbol	Item	Remarks
	Safety	Special safety precautions are necessary when performing the work.
		Extra special safety precautions are necessary when performing the work because it is under internal pressure.
	Caution	Special technical precautions or other precautions for preserving standards are necessary when performing the work.

3) GEAR PUMP

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	10cc/rev
Maximum pressure	40kgf/cm ² (570psi)
Rated oil flow	22 l /min(5.8U.S. gpm/4.8U.K. gpm)

4) MAIN CONTROL VALVE

Item	Specification
Type	9 spools two-block
Operating method	Hydraulic pilot system
Main relief valve pressure	320kgf/cm ² (4550psi) [350kgf/cm ² (4980psi)]
Overload relief valve pressure	380kgf/cm ² (5405psi)

[] : Power boost

5) SWING MOTOR

Item	Specification
Type	Fixed displacement axial piston motor
Capacity	99.2cc/rev
Relief pressure	260kgf/cm ² (3911psi)
Braking system	Automatic, spring applied, hydraulic released
Braking torque	42kgf · m(304lbf · ft)
Brake release pressure	4.5~20kgf/cm ² (64~284psi)
Reduction gear type	2 - stage planetary
Swing speed	12.1rpm

6) TRAVEL MOTOR

Item	Specification
Type	Variable displacement axial piston motor
Relief pressure	350kgf/cm ² (4980psi)
Capacity(max / min)	87.3/55.5cc/rev
Reduction gear type	3-stage planetary
Braking system	Automatic, spring applied, hydraulic released
Brake release pressure	11kgf/cm ² (156psi)
Braking torque	1060~1780kgf · m(7667~12874lbf · ft)

7) REMOTE CONTROL VALVE

Item		Specification
Type		Pressure reducing type
Operating pressure	Minimum	5.5kgf/cm ² (78psi)
	Maximum	19.5kgf/cm ² (277psi)
Single operation stroke	Lever	82.7mm(3.3in)
	Pedal	123mm(4.8in)

8) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Rod dia × Stroke	∅ 110 × ∅ 80 × 1180mm
	Cushion	Extend only
Arm cylinder	Bore dia × Rod dia × Stroke	∅ 120 × ∅ 85 × 1320mm
	Cushion	Extend and retract
Bucket cylinder	Bore dia × Rod dia × Stroke	∅ 105 × ∅ 75 × 1005mm
	Cushion	Extend only

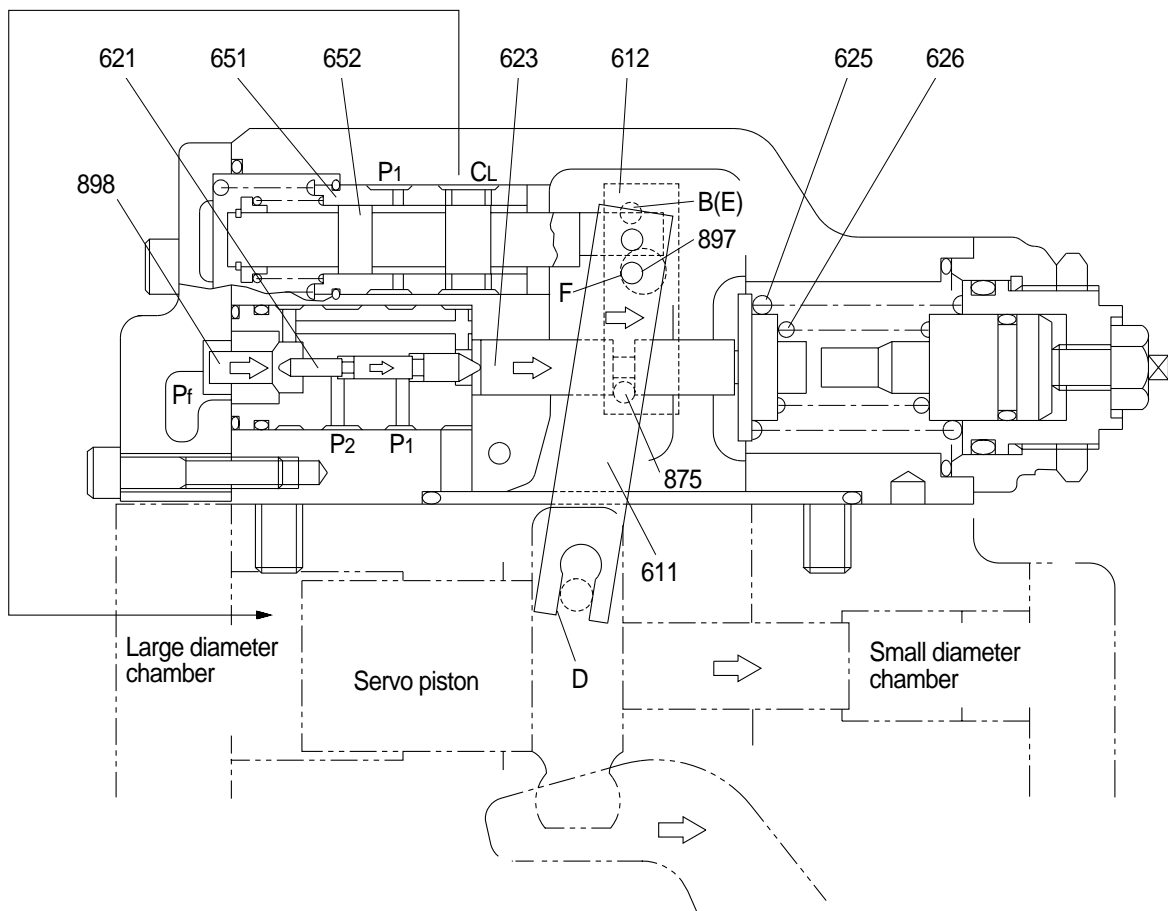
9) SHOE

Item	Width	Ground pressure	Link quantity	Overall width
STD	600mm(24")	0.40kgf/cm ² (5.69psi)	49	2590mm(8' 6")
OPT	500mm(20")	0.47kgf/cm ² (6.68psi)	49	2490mm(8' 2")
	700mm(28")	0.35kgf/cm ² (4.98psi)	49	2690mm(8' 10")
	800mm(32")	0.31kgf/cm ² (4.41psi)	49	2790mm(9' 2")

10) BUCKET

Item	Capacity		Tooth quantity	Width	
	PCSA heaped	CECE heaped		Without side cutter	With side cutter
STD	0.65m ³ (0.85yd ³)	0.55m ³ (0.72yd ³)	5	930mm(37")	1050mm(41")
OPT	0.39m ³ (0.51yd ³)	0.35m ³ (0.46yd ³)	3	620mm(24")	740mm(29")
	0.57m ³ (0.75yd ³)	0.50m ³ (0.65yd ³)	4	840mm(33")	960mm(38")
	0.70m ³ (0.92yd ³)	0.60m ³ (0.78yd ³)	5	990mm(39")	1110mm(44")
	0.80m ³ (1.05yd ³)	0.70m ³ (0.92yd ³)	5	1080mm(43")	1200mm(47")

(3) Power shift control



The set horsepower valve is shifted by varying the command current level of the proportional pressure reducing valve attached to the pump.

Only one proportional pressure reducing valve is provided.

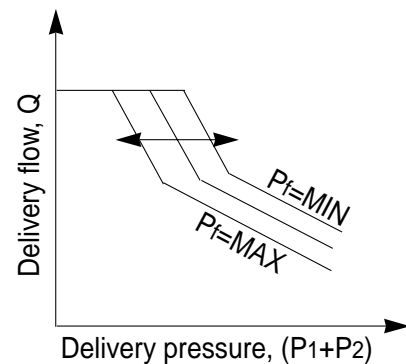
However, the secondary pressure P_f (power shift pressure) is admitted to the horsepower control section of each pump regulator through the pump's internal path to shift it to the same set horsepower level.

This function permits arbitrary setting of the pump output power, thereby providing the optimum power level according to the operating condition.

The power shift pressure P_f controls the set horsepower of the pump to a desired level, as shown in the figure.

As the power shift pressure P_f rises, the compensating rod (623) moves to the right via the pin (898) and compensating piston (621).

This decreases the pump tilting angle and then the set horsepower in the same way as explained in the overload preventive function of the horsepower control. On the contrary, the set horsepower rises as the power shift pressure P_f falls.



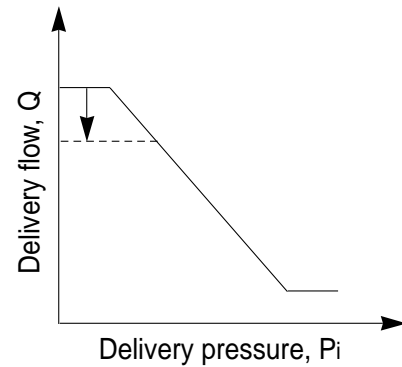
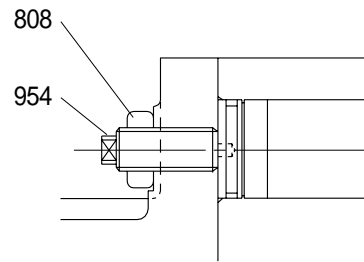
(4) Adjustment of maximum and minimum flows

① Adjustment of maximum flow

Adjust it by loosening the hexagon nut(808) and by tightening(Or loosening) the set screw(954).

The maximum flow only is adjusted without changing other control characteristics.

Speed	Adjustment of max flow	
	Tightening amount of adjusting screw (954)	Flow change amount
(min ⁻¹)	(Turn)	(l /min)
2200	+1/4	-3.5



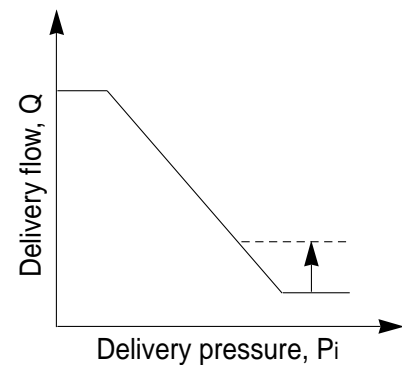
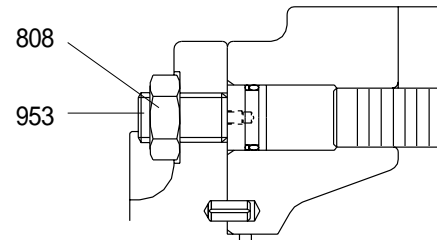
② Adjustment of minimum flow

Adjust it by loosening the hexagon nut (808) and by tightening(Or loosening) the hexagonal socket head set screw (953).

Similarly to the adjustment of the maximum flow, other characteristics are not changed.

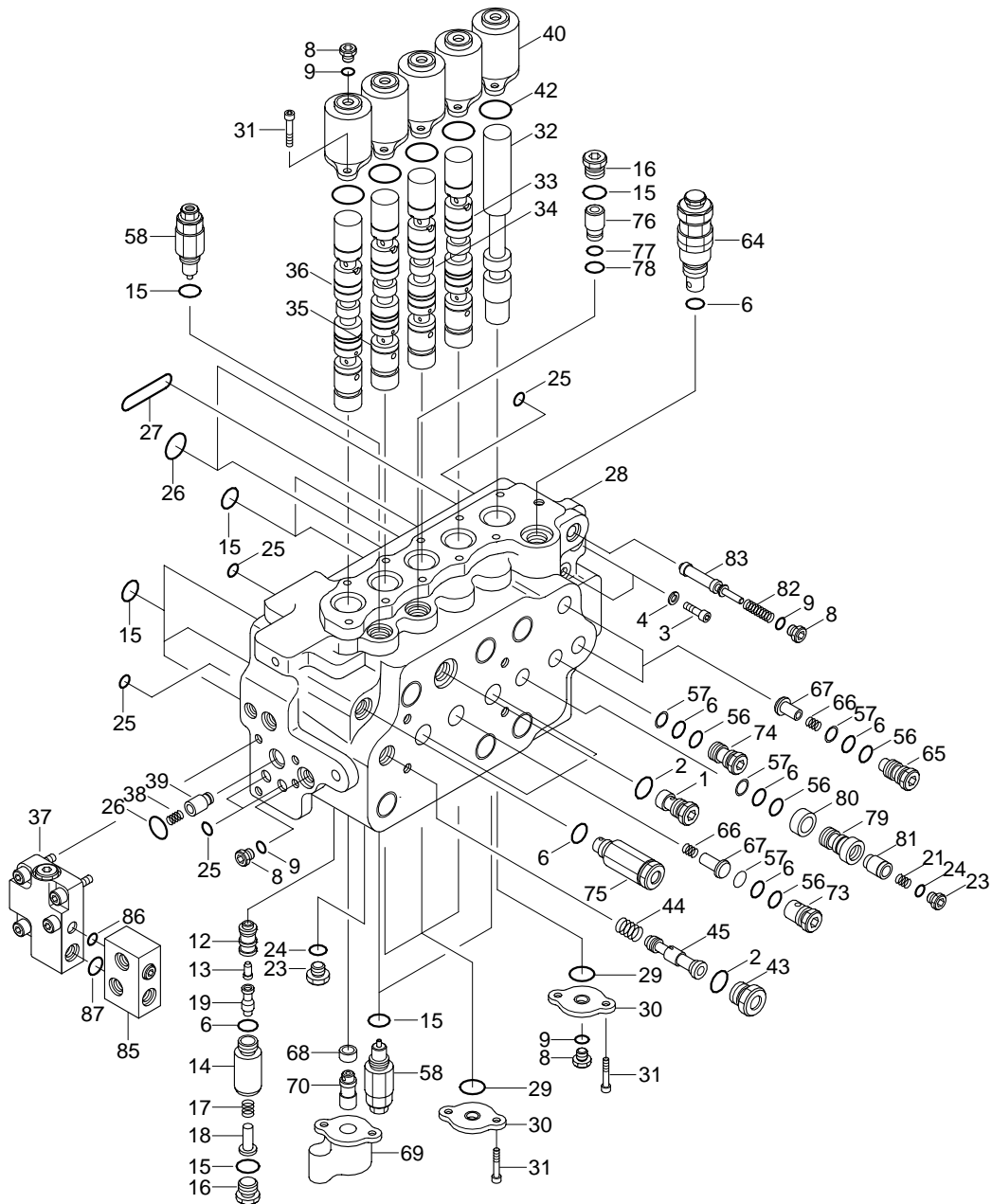
However, remember that, if tightened too much, the required horsepower during the maximum delivery pressure(Or during relieving) may increase.

Speed	Adjustment of min flow	
	Tightening amount of adjusting screw (953)	Flow change amount
(min ⁻¹)	(Turn)	(l /min)
2200	+1/4	-3.5



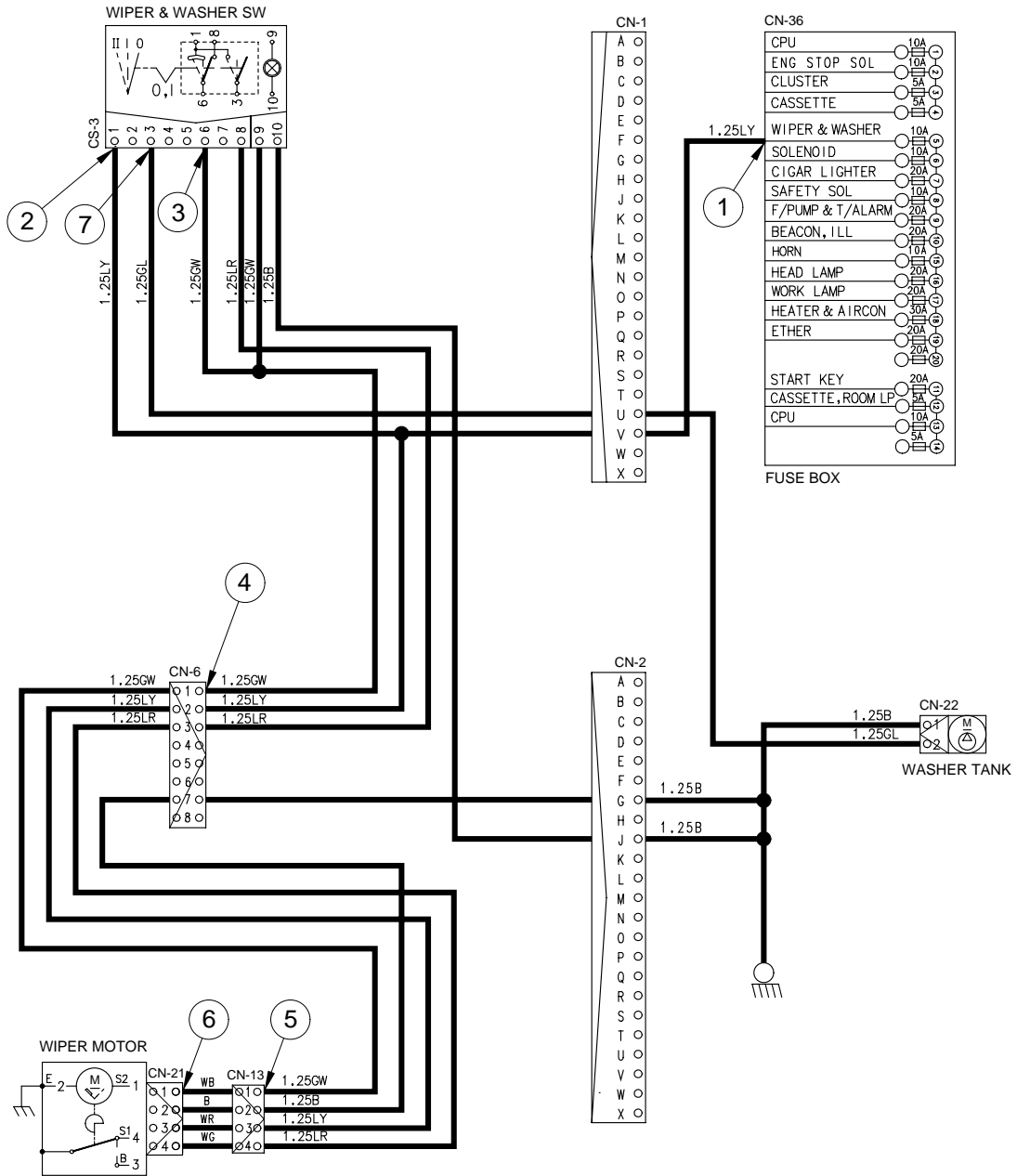
GROUP 2 MAIN CONTROL VALVE

1. STRUCTURE(1/2)

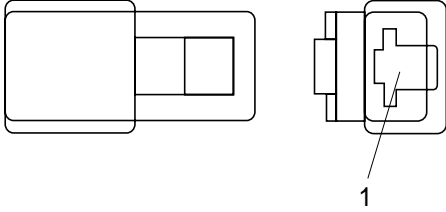
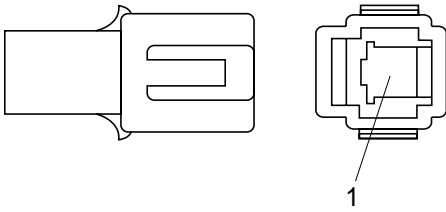
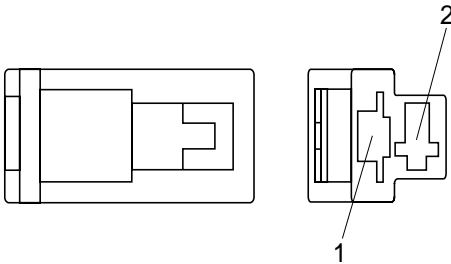
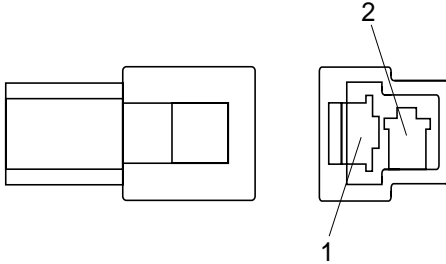
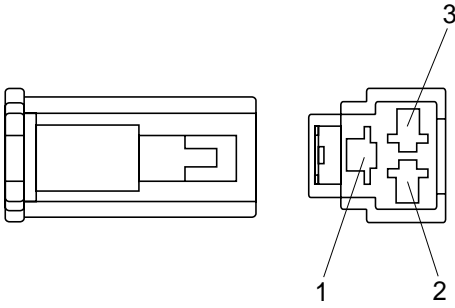
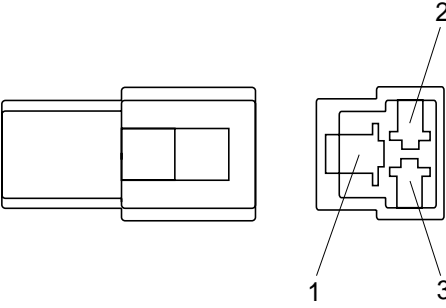
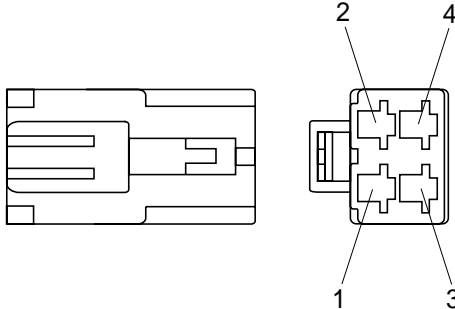
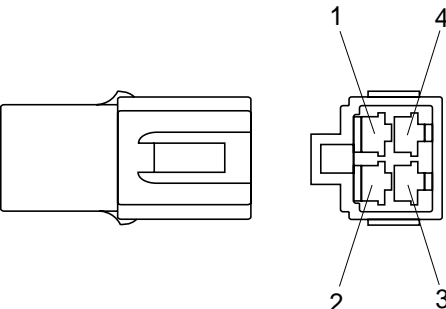


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|----|---------------|----|--------------|----|----------------------|
| 1 | Cap | 14 | Cap | 27 | O-ring |
| 2 | O-ring | 15 | O-ring | 28 | Housing |
| 3 | Socket bolt | 16 | Cap | 29 | O-ring |
| 4 | Spring washer | 17 | Spring | 30 | Retainer |
| 5 | Overload assy | 18 | Spring guide | 31 | Socket bolt |
| 6 | O-ring | 19 | Spring guide | 32 | Plunger assy(TS) |
| 7 | Orifice | 20 | Cap | 33 | Plunger assy(TL, TR) |
| 8 | Cap | 21 | Spring | 34 | Plunger assy(SW) |
| 9 | O-ring | 22 | Check | 35 | Plunger assy(BM2) |
| 10 | Cover | 23 | Cap | 36 | Plunger assy(AM1) |
| 11 | Socket bolt | 24 | O-ring | 37 | Cover assy |
| 12 | Sleeve | 25 | O-ring | | |
| 13 | Check | 26 | O-ring | | |

WIPER AND WASHER CIRCUIT



7) CN TYPE CONNECTOR

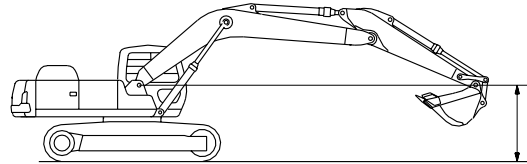
No. of pin	Receptacle connector(Female)	Plug connector(Male)
1	 <p style="text-align: center;">S810-001202</p>	 <p style="text-align: center;">S810-101202</p>
2	 <p style="text-align: center;">S810-002202</p>	 <p style="text-align: center;">S810-102202</p>
3	 <p style="text-align: center;">S810-003202</p>	 <p style="text-align: center;">S810-103202</p>
4	 <p style="text-align: center;">S810-004202</p>	 <p style="text-align: center;">S810-104202</p>

6) SWING SPEED

(1) Measure the time required to swing three complete turns.

(2) Preparation

- ① Check the lubrication of the swing gear and swing bearing.
- ② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.
- ③ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. The bucket must be empty.
- ④ Keep the hydraulic oil temperature at $50 \pm 5^\circ\text{C}$.



(3) Measurement

- ① Select the following switch positions.
 - Mode selector : Each mode
- ② Operate swing control lever fully.
- ③ Swing 1 turn and measure time taken to swing next 3 revolutions.
- ④ Repeat steps ② and ③ three times and calculate the average values.

(4) Evaluation

The time required for 3 swings should meet the following specifications.

Unit : Seconds / 3 revolutions

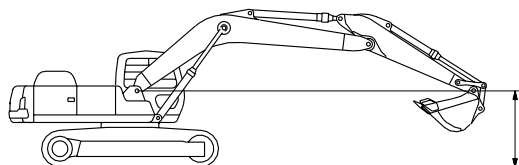
Model	Power selector switch	Standard	Maximum allowable
R160LC-3	H mode	15.0 ± 1.5	17.5 ± 1.5

7) SWING FUNCTION DRIFT CHECK

- (1) Measure the swing drift on the bearing outer circumference when stopping after a 360° full speed swing.

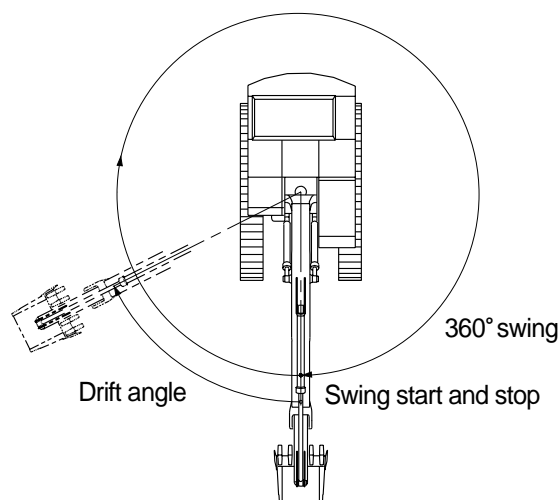
(2) Preparation

- ① Check the lubrication of the swing gear and swing bearing.
- ② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.
- ③ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. The bucket must be empty.
- ④ Make two chalk marks: one on the swing bearing and one directly below it on the track frame.
- ⑤ Swing the upperstructure 360°.
- ⑥ Keep the hydraulic oil temperature at $50 \pm 5^\circ\text{C}$.



(3) Measurement

- ① Conduct this test in the H mode.
- ② Select the following switch positions.
 - Mode selector : H mode
- ③ Operate the swing control lever fully and return it to the neutral position when the mark on the upperstructure aligns with that on track frame after swinging 360°.
- ④ Measure the distance between the two marks.
- ⑤ Align the marks again, swing 360°, then test the opposite direction.
- ⑥ Repeat steps ③ and ⑤ three times each and calculate the average values.



(4) Evaluation

The measured drift angle should be within the following specifications.

Unit : Degree

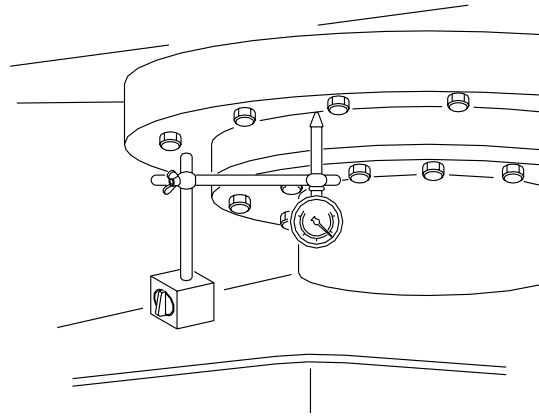
Model	Mode select switch	Standard	Maximum allowable	Remarks
R160LC-3	H mode	90 below	120	

8) SWING BEARING PLAY

- (1) Measure the swing bearing play using a dial gauge to check the wear of bearing races and balls.

(2) Preparation

- ① Check swing bearing mounting cap screws for loosening.
- ② Check the lubrication of the swing bearing. Confirm that bearing rotation is smooth and without noise.
- ③ Install a dial gauge on the track frame as shown, using a magnetic base.
- ④ Position the upperstructure so that the boom aligns with the tracks facing towards the front idlers.
- ⑤ Position the dial gauge so that its needle point comes into contact with the bottom face of the bearing outer race.
- ⑥ Bucket should be empty.

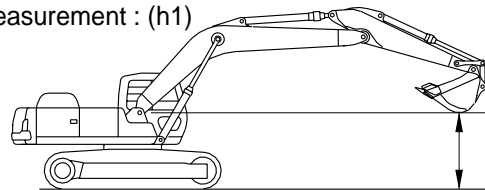


(3) Measurement

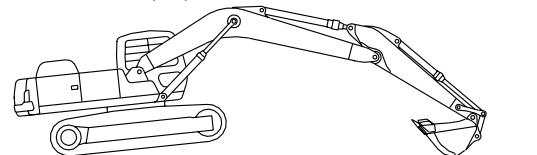
- ① With the arm rolled out and bucket rolled in, hold the bottom face of the bucket to the same height of the boom foot pin. Record the dial gauge reading(h1).
- ② Lower the bucket to the ground and use it to raise the front idler 50cm. Record the dial gauge reading(h2).
- ③ Calculate bearing play(H) from this data(h1 and h2) as follows.

$$H = h2 - h1$$

Measurement : (h1)



Measurement : (h2)



(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

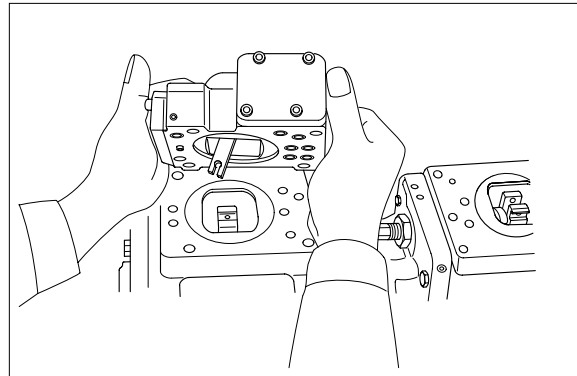
Model	Standard	Maximum allowable	Remarks
R160LC-3	1.5 below	3.0	

3) DISASSEMBLY

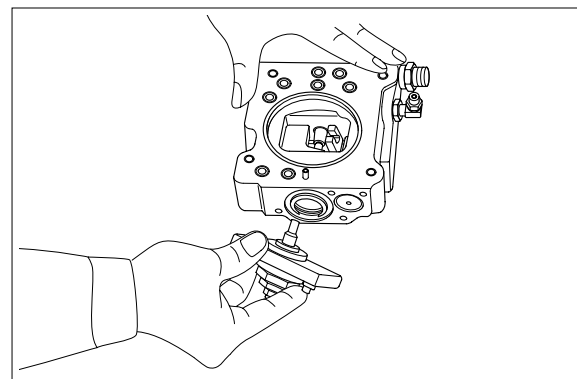
Since the regulator consists of small precision finished parts, disassembly and assembly are rather complicated.

For this reason, replacement of a regulator assembly is recommended, unless there is a special reason, but in case disassembly is necessary for an unavoidable reason, read through this manual to the end before starting disassembly.

- (1) Choose a place for disassembly.
 - ※ Choose a clean place.
 - ※ Spread rubber sheet, cloth, or so on on top of work-bench to prevent parts from being damaged.
- (2) Remove dust, rust, etc. from surfaces of regulator with clean oil.
- (3) Remove hexagon socket head screw (412, 413) and remove regulator main body from pump main body.
 - ※ Take care not to lose O-ring.



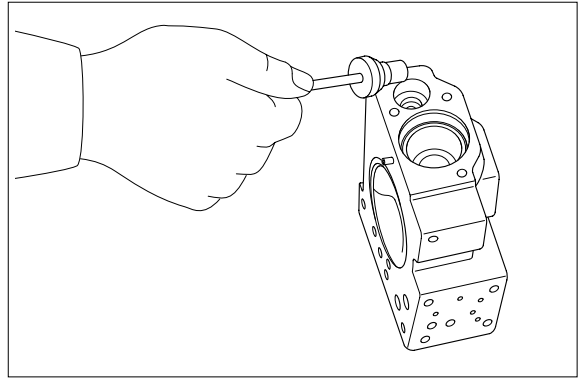
- (4) Remove hexagon socket head screw (438) and remove cover(C,629)
 - ※ Cover(C) is fitted with adjusting screw (C,QI) (628, 925), adjusting ring(C, 627), lock nut(630), hexagon nut(801) and adjusting screw(924).
Do not loosen these screws and nuts.
If they are loosened, adjusted pressure-flow setting will vary.



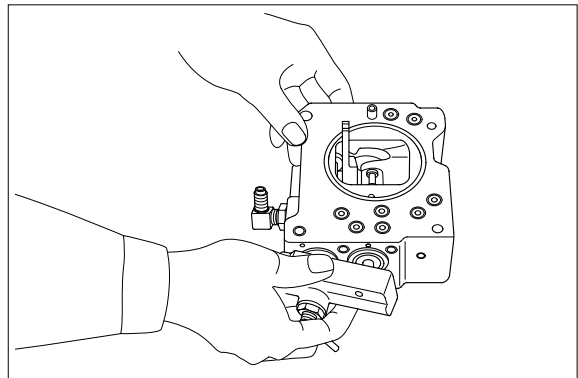
- (5) After removing cover(C, 629) subassembly, take out outer spring(625), inner spring (626) and spring seat(C, 624) from compensating section.

Then draw out adjusting ring(Q, 645), pilot spring(646) and spring seat(644) from pilot section.

- ※ Adjusting ring(Q,645) can easily be drawn out with M4 bolt.

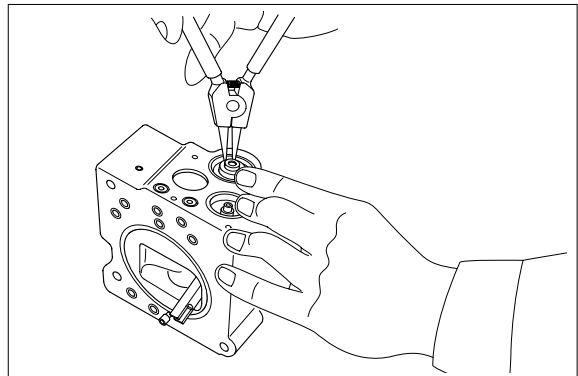


- (6) Remove hexagon socket head screws (436, 438) and remove pilot cover(641). After removing pilot cover, take out set spring(655) from pilot section.



- (7) Remove snap ring(814) and take out spring seat(653), return spring(654) and sleeve(651).

- ※ Sleeve(651) is fitted with snap ring(836).
- ※ When removing snap ring(814), return spring(654) may pop out. Take care not to lose it.



- (8) Remove snap ring(858) and take out fulcrum plug(614) and adjusting plug (615).

- ※ Fulcrum plug(614) and adjusting plug (615) can easily be taken out with M6 bolt.

