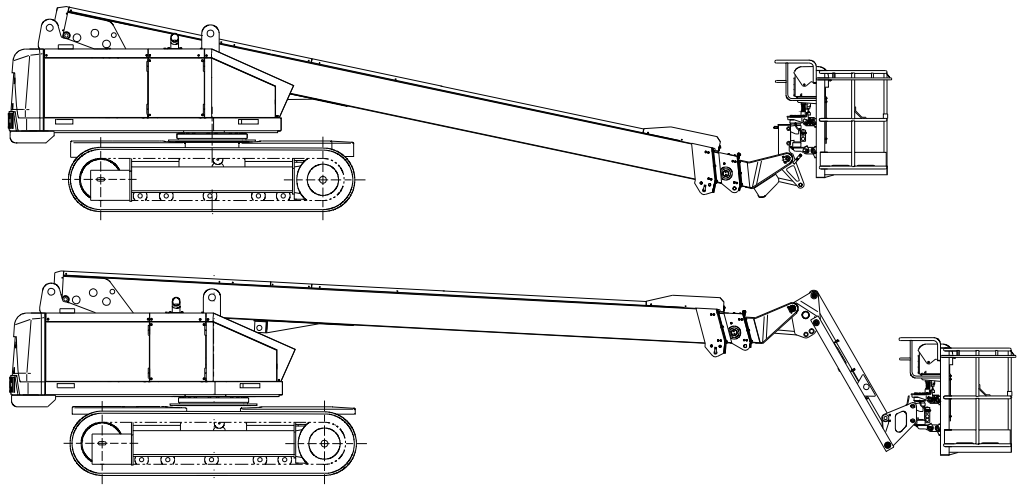
SME- 125E

SERVICE MANUAL

SR18A / ISR60 SR18AJ / ISR60J
SR21A / ISR70 SR21AJ / ISR70J

For the machine with Isuzu 4LE2 engine
(Emission standard: EPA Interim Tier 4 / EU Stage 3-A)
with KOBELCO chassis



MICHI
CORPORATION
1152, RYOKE, AGEO, SAITAMA, JAPAN.

Introduction

This manual describes correct adjustment and servicing procedures for Crawler type self- propelled Elevation work platforms: SR18A/ISR60, SR18AJ/ISR60J, SR21A/ISR70 and SR21AJ/ISR70J in order to ensure the most effective use of superb performance and excellent features for your satisfaction.

Read this manual carefully and understand the descriptions correctly before making any repair or maintenance works.

Always be sure of the following items when conducting repair or maintenance works.

- **Use only the spare parts approved by the manufacturer, particularly for load- supporting and safety- related components.**
- **Do not make any modifications to the machine without obtaining the manufacturer's approval. The design check, the manufacturing check as well as the practical test should be conducted by the approved agent, if the modification which would affect the stability, strength or performance of the machine is made.**

Please, note that the numerical values in this manual may be subject to change due to engineering improvement.

Service Division
Aichi Corporation

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1. General information

SR18A / ISR60 Specifications

Model					***SR18A / ISR60***	
Weight	Gross weight				13,050 kg	28,770 LBS
	Maximum track loading force				12,230 kg	26,960 LBS
	Maximum tire ground contact pressure				85 kPa (0.87 kg/cm^2)	12 PSI
Gradeability					48 % (25 degrees)	←
Maximum allowable tilt angle		CE model			5 degrees	←
		ANSI model			Level (0 degree)	←
Maximum allowable wind speed					12.5 meters / second	28 MPH
Diesel Engine	Model				Isuzu AU-4LE2XYBB-01	←
	Total displacement				2,179 cc	133.0 in^3
	Maximum output power				41.1 kw / 2,200 rpm	55.1 HP / 2,200 rpm
	Maximum output torque				207 N- m / 1,600 rpm (21 kg-m / 1,600 rpm)	153 ft- lbs / 1,600 rpm
	Fuel tank capacity				150 liters	39.6 gallons
	Engine oil capacity				7.6 ~ 10.3 liters	2.00 ~ 2.72 gallons
	Coolant capacity				8.6 liters	2.27 gallons
	Battery				DC12V / 70Ah x 2	←
	Engine rpm	Low (Idling)			1,020 rpm	←
		Mid			1,400 – 1,450 rpm	←
		High	CE model		1,950 – 2,000 rpm	←
			ANSI model		1,800 – 1,850 rpm	←
Platform	Specific working load				227 kg or 2 persons + Tools (67 kg)	500 LBS or 2 persons + Tools (148 LBS)
	Maximum allowable side force				41 kg	90 LBS
	Maximum floor height				18 meters	59ft – 1in
	Maximum work radius				16.7 meters	54ft – 9in
	Rotation angle				180 degrees	←
Boom	Boom length				7,425 ~ 17,145 meters	24ft- 4in ~ 56ft- 3in
	Boom angle				- 12 ~ 70 degrees	←
	Rotation angle				360 degrees (Continuous)	←
Actuating speed	Boom elevation (with the boom fully retracted)			Up	40±6 seconds	←
				Down	40±6 seconds	←
	Boom telescope			Out	35±5 seconds	←
				In	30±5 seconds	←
	Boom rotation (with the boom fully retracted)			CW	80±12 seconds	←
				CCW	80±12 seconds	←
	Platform rotation			CW	15±5 seconds	←
				CCW	15±5 seconds	←
	Horizontal movement			Out	200±30 mm/second	7.9±1.2 inches/second
				In	200±30 mm/second	7.9±1.2 inches/second
	Vertical movement			Up	200±30 mm/second	7.9±1.2 inches/second
				Down	200±30 mm/second	7.9±1.2 inches/second
	Traveling	High speed	CE model		1.8±0.3 km/hour	1.12±0.12 MPH
			ANSI model		3.0±0.6 km/hour	1.86±0.37 MPH
		Mid speed	CE model		1.3±0.2 km/hour	0.81±0.12 MPH
			ANSI model		1.5±0.3 km/hour	0.93±0.19 MPH
		Low speed	CE model		0.5±0.2 km/hour	0.31±0.12 MPH
			ANSI model		0.5±0.2 km/hour	0.31±0.12 MPH
Hydraulic system	Hydraulic oil	Tank capacity			200 liters	52.8 gallons
		Recommended oil			Shell Tellus oil T22	←
	Specific pressure	Traveling system			34.3 MPa (320 kg/cm^2)	4,979 PSI
		Boom functions			20.6 MPa (210 kg/cm^2)	2,990 PSI
		Platform rotation functions			13.7 MPa (140 kg/cm^2)	1,990 PSI

The CE model has been manufactured to conform to European Standard EN280.

The ANSI model has been manufactured to conform to all applicable requirements of Occupational Safety and Health Administration (OSHA) and American National Standards Institute (ANSI)

SR18AJ / ISR60J Specifications

Model				*SR18AJ / ISR60J*	
Weight	Gross weight			13,150 kg	28,990 LBS
	Maximum track loading force			12,230 kg	26,960 LBS
	Maximum tire ground contact pressure			85 kPa (0.87 kg/cm^2)	12 PSI
Gradeability				48 % (25 degrees)	←
Maximum allowable tilt angle		CE model		5 degrees	←
		ANSI model		Level (0 degree)	←
Maximum allowable wind speed				12.5 meters / second	28 MPH
Diesel Engine	Model			Isuzu AU-4LE2XYBB-01	←
	Total displacement			2,179 cc	133.0 in^3
	Maximum output power			41.1 kw / 2,200 rpm	55.1 HP / 2,200 rpm
	Maximum output torque			207 N- m / 1,600 rpm (21 kg-m / 1,600 rpm)	153 ft- lbs / 1,600 rpm
	Fuel tank capacity			150 liters	39.6 gallons
	Engine oil capacity			7.6 ~ 10.3 liters	2.00 ~ 2.72 gallons
	Coolant capacity			8.6 liters	2.27 gallons
	Battery			DC12V / 70Ah x 2	←
	Engine rpm	Low (Idling)		1,020 rpm	←
		Mid		1,400 – 1,450 rpm	←
		High	CE model	1,950 – 2,000 rpm	←
			ANSI model	1,800 – 1,850 rpm	←
Platform	Specific working load			227 kg or 2 persons + Tools (67 kg)	500 LBS or 2 persons + Tools (148 LBS)
	Maximum allowable side force			41 kg	90 LBS
	Maximum floor height			18 meters	59ft – 1in
	Maximum work radius			15.8 meters	51ft – 10in
	Rotation angle			180 degrees	←
Boom	Boom length			6.905 ~ 15.475 meters	22ft- 8in ~ 50ft- 9in
	Boom angle			- 12 ~ 70 degrees	←
	Rotation angle			360 degrees (Continuous)	←
Fly- jib	Jib length			1.65 meters	5ft- 5in
	Jib articulation angle			- 60 ~ +70 degrees	←
Actuating speed	Boom elevation (with the boom fully retracted)		Up	40±6 seconds	←
			Down	40±6 seconds	←
	Boom telescope		Out	35±5 seconds	←
			In	25±5 seconds	←
	Boom rotation (with the boom fully retracted)		CE model	95±14 seconds	←
			ANSI model	80±12 seconds	←
	Fly- jib elevation		Up	30±5 seconds	←
			Down	25±5 seconds	←
	Platform rotation			15±5 seconds	←
	Horizontal movement		Out	200±30 mm/second	7.9±1.2 inches/second
			In	200±30 mm/second	7.9±1.2 inches/second
	Vertical movement		Up	200±30 mm/second	7.9±1.2 inches/second
			Down	200±30 mm/second	7.9±1.2 inches/second
	Traveling	High speed	CE model	1.8±0.3 km/hour	1.12±0.12 MPH
			ANSI model	3.0±0.6 km/hour	1.86±0.37 MPH
		Mid speed	CE model	1.3±0.2 km/hour	0.81±0.12 MPH
			ANSI model	1.5±0.3 km/hour	0.93±0.19 MPH
		Low speed		0.5±0.2 km/hour	0.31±0.12 MPH
Hydraulic system	Hydraulic oil	Tank capacity		200 liters	52.8 gallons
		Recommended oil		Shell Tellus oil T22	←
	Specific pressure	Traveling system		34.3 MPa (320 kg/cm^2)	4,979 PSI
		Boom functions		20.6 MPa (210 kg/cm^2)	2,990 PSI
		Platform rotation, Fly- jib functions		13.7 MPa (140 kg/cm^2)	1,990 PSI

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SR21A / ISR70 Specifications

Model					***SR21A / ISR70***	
Weight	Gross weight				15,150 kg	33,400 LBS
	Maximum track loading force				14,130 kg	31,150 LBS
	Maximum tire ground contact pressure				98 kPa (1.0 kg/cm^2)	14 PSI
Gradeability					48 % (25 degrees)	←
Maximum allowable tilt angle		CE model			5 degrees	←
		ANSI model			Level (0 degree)	←
Maximum allowable wind speed					12.5 meters / second	28 MPH
Diesel Engine	Model				Isuzu AU-4LE2XYBB-01	←
	Total displacement				2,179 cc	133.0 in^3
	Maximum output power				41.1 kw / 2,200 rpm	55.1 HP / 2,200 rpm
	Maximum output torque				207 N- m / 1,600 rpm (21 kg-m / 1,600 rpm)	153 ft- lbs / 1,600 rpm
	Fuel tank capacity				150 liters	39.6 gallons
	Engine oil capacity				7.6 ~ 10.3 liters	2.00 ~ 2.72 gallons
	Coolant capacity				8.6 liters	2.27 gallons
	Battery				DC12V / 70Ah x 2	←
	Engine rpm	Low (Idling)			1,020 rpm	←
		Mid			1,400 – 1,450 rpm	←
		High	CE model		1,950 – 2,000 rpm	←
			ANSI model		1,800 – 1,850 rpm	←
Platform	Specific working load				227 kg or 2 persons + Tools (67 kg)	500 LBS or 2 persons + Tools (148 LBS)
	Maximum allowable side force				41 kg	90 LBS
	Maximum floor height				21 meters	68ft – 11in
	Maximum work radius				18.6 meters	61ft – 0in
	Rotation angle				180 degrees	←
Boom	Boom length				8.440 ~ 20.190 meters	27ft- 8in ~ 66ft- 3in
	Boom angle				- 12 ~ 70 degrees	←
	Rotation angle				360 degrees (Continuous)	←
Actuating speed	Boom elevation (with the boom fully retracted)		Up		40±6 seconds	←
			Down		40±6 seconds	←
	Boom telescope		Out		45±7 seconds	←
			In		35±5 seconds	←
	Boom rotation (with the boom fully retracted)		CE model	CW	100±14 seconds	←
				CCW	100±14 seconds	←
			ANSI model	CW	80±12 seconds	←
				CCW	80±12 seconds	←
	Platform rotation		CW		15±5 seconds	←
			CCW		15±5 seconds	←
	Horizontal movement		Out		200±30 mm/second	7.9±1.2 inches/second
			In		200±30 mm/second	7.9±1.2 inches/second
	Vertical movement		Up		200±30 mm/second	7.9±1.2 inches/second
			Down		200±30 mm/second	7.9±1.2 inches/second
	Traveling	High speed	CE model		1.8±0.3 km/hour	1.12±0.12 MPH
			ANSI model		3.0±0.6 km/hour	1.86±0.37 MPH
		Mid speed	CE model		1.3±0.2 km/hour	0.81±0.12 MPH
			ANSI model		1.5±0.3 km/hour	0.93±0.19 MPH
		Low speed	CE model		0.5±0.2 km/hour	0.31±0.12 MPH
			ANSI model		0.5±0.2 km/hour	0.31±0.12 MPH
Hydraulic system	Hydraulic oil	Tank capacity			200 liters	52.8 gallons
		Recommended oil			Shell Tellus oil T22	←
	Specific pressure	Traveling system			34.3 MPa (320 kg/cm^2)	4,979 PSI
		Boom functions			20.6 MPa (210 kg/cm^2)	2,990 PSI
		Platform rotation functions			13.7 MPa (140 kg/cm^2)	1,990 PSI

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SR21AJ / ISR70J Specifications

Model				***SR21AJ / ISR70J***	
Weight	Gross weight			15,360 kg	33,860 LBS
	Maximum track loading force			14,450 kg	31,855 LBS
	Maximum tire ground contact pressure			100 kPa (1.02 kg/cm^2)	14 PSI
Gradeability				48 % (25 degrees)	←
Maximum allowable tilt angle		CE model		5 degrees	←
		ANSI model		Level (0 degree)	←
Maximum allowable wind speed				12.5 meters / second	28 MPH
Diesel Engine	Model			Isuzu AU-4LE2XYBB-01	←
	Total displacement			2,179 cc	133.0 in^3
	Maximum output power			41.1 kw / 2,200 rpm	55.1 HP / 2,200 rpm
	Maximum output torque			207 N- m / 1,600 rpm (21 kg-m / 1,600 rpm)	153 ft- lbs / 1,600 rpm
	Fuel tank capacity			150 liters	39.6 gallons
	Engine oil capacity			7.6 ~ 10.3 liters	2.00 ~ 2.72 gallons
	Coolant capacity			8.6 liters	2.27 gallons
	Battery			DC12V / 70Ah x 2	←
	Engine rpm	Low (Idling)		1,020 rpm	←
		Mid		1,400 – 1,450 rpm	←
		High	CE model	1,950 – 2,000 rpm	←
			ANSI model	1,800 – 1,850 rpm	←
Platform	Specific working load			227 kg or 2 persons + Tools (67 kg)	500 LBS or 2 persons + Tools (148 LBS)
	Maximum allowable side force			41 kg	90 LBS
	Maximum floor height			21 meters	68ft – 11in
	Maximum work radius			17.8 meters	58ft – 5in
	Rotation angle			180 degrees	←
Boom	Boom length			8.440 ~ 18.690 meters	27ft- 8in ~ 61ft- 4in
	Boom angle			- 12 ~ 70 degrees	←
	Rotation angle			360 degrees (Continuous)	←
Fly- jib	Jib length			1.65 meters	5ft- 5in
	Jib articulation angle			- 60 ~ +70 degrees	←
Actuating speed	Boom elevation (with the boom fully retracted)		Up	40±6 seconds	←
			Down	40±6 seconds	←
	Boom telescope		Out	40±6 seconds	←
			In	30±5 seconds	←
	Boom rotation (with the boom fully retracted)		CE model	110±15 seconds	←
			ANSI model	80±12 seconds	←
	Fly- jib elevation		Up	30±5 seconds	←
			Down	25±5 seconds	←
	Platform rotation			15±5 seconds	←
	Horizontal movement		Out	200±30 mm/second	7.9±1.2 inches/second
			In	200±30 mm/second	7.9±1.2 inches/second
	Vertical movement		Up	200±30 mm/second	7.9±1.2 inches/second
			Down	200±30 mm/second	7.9±1.2 inches/second
	Traveling	High speed	CE model	1.8±0.3 km/hour	1.12±0.12 MPH
			ANSI model	3.0±0.6 km/hour	1.86±0.37 MPH
		Mid speed	CE model	1.3±0.2 km/hour	0.81±0.12 MPH
			ANSI model	1.5±0.3 km/hour	0.93±0.19 MPH
		Low speed	CE model	0.5±0.2 km/hour	0.31±0.12 MPH
			ANSI model	0.5±0.2 km/hour	0.31±0.12 MPH
Hydraulic system	Hydraulic oil	Tank capacity		200 liters	52.8 gallons
		Recommended oil		Shell Tellus oil T22	←
	Specific pressure	Traveling system		34.3 MPa (320 kg/cm^2)	4,979 PSI
		Boom functions		20.6 MPa (210 kg/cm^2)	2,990 PSI
		Platform rotation, Fly- jib functions		13.7 MPa (140 kg/cm^2)	1,990 PSI

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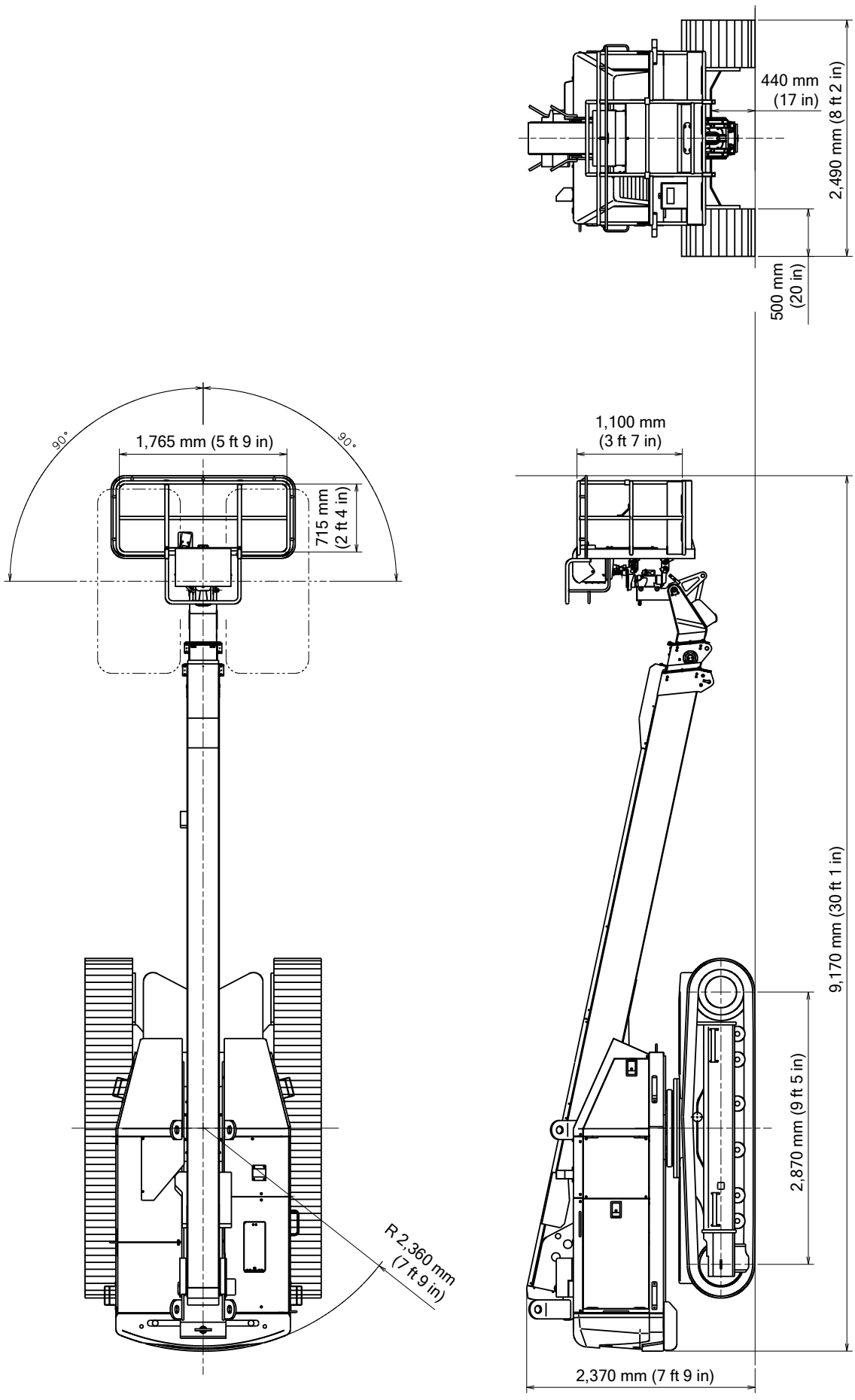
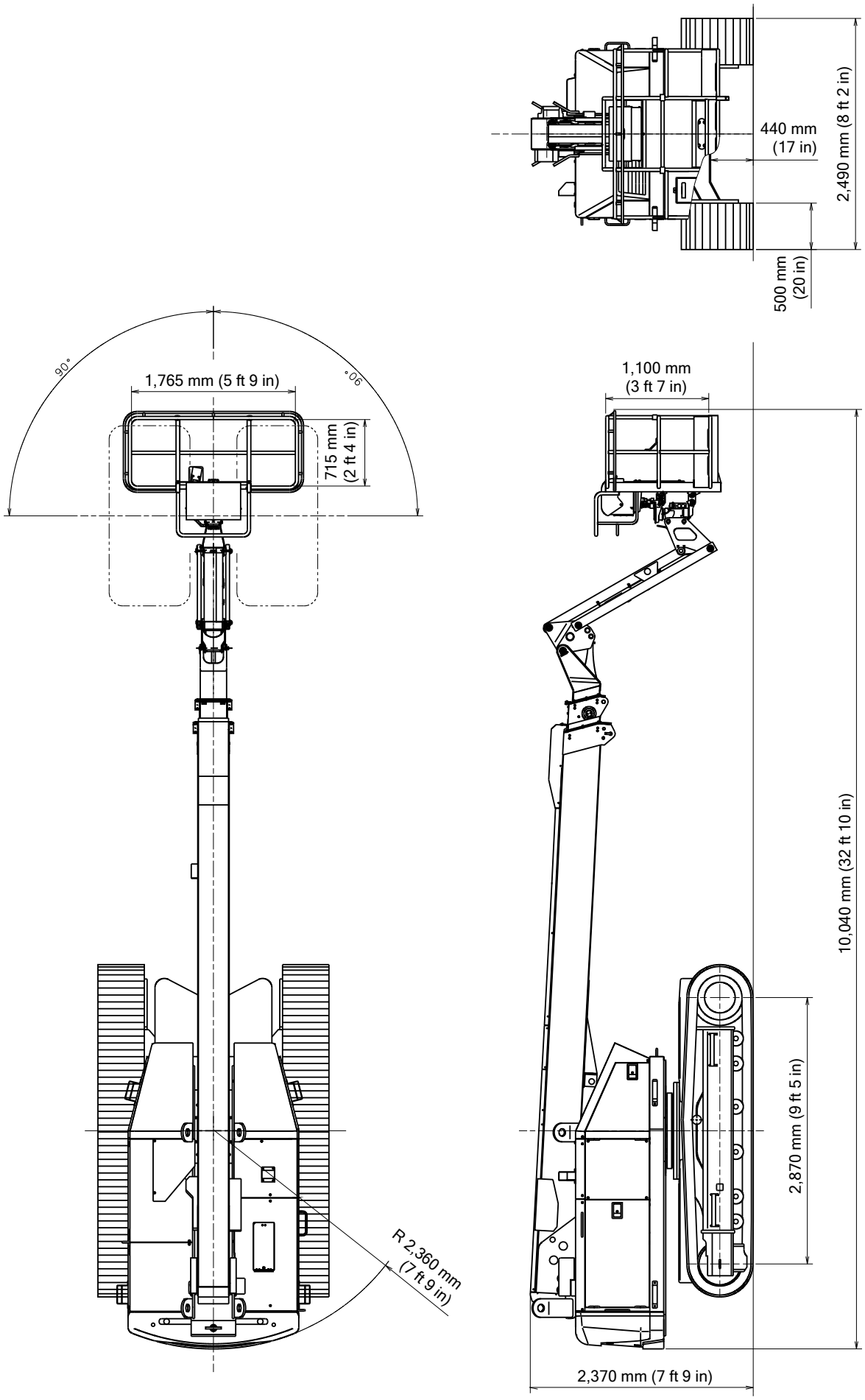
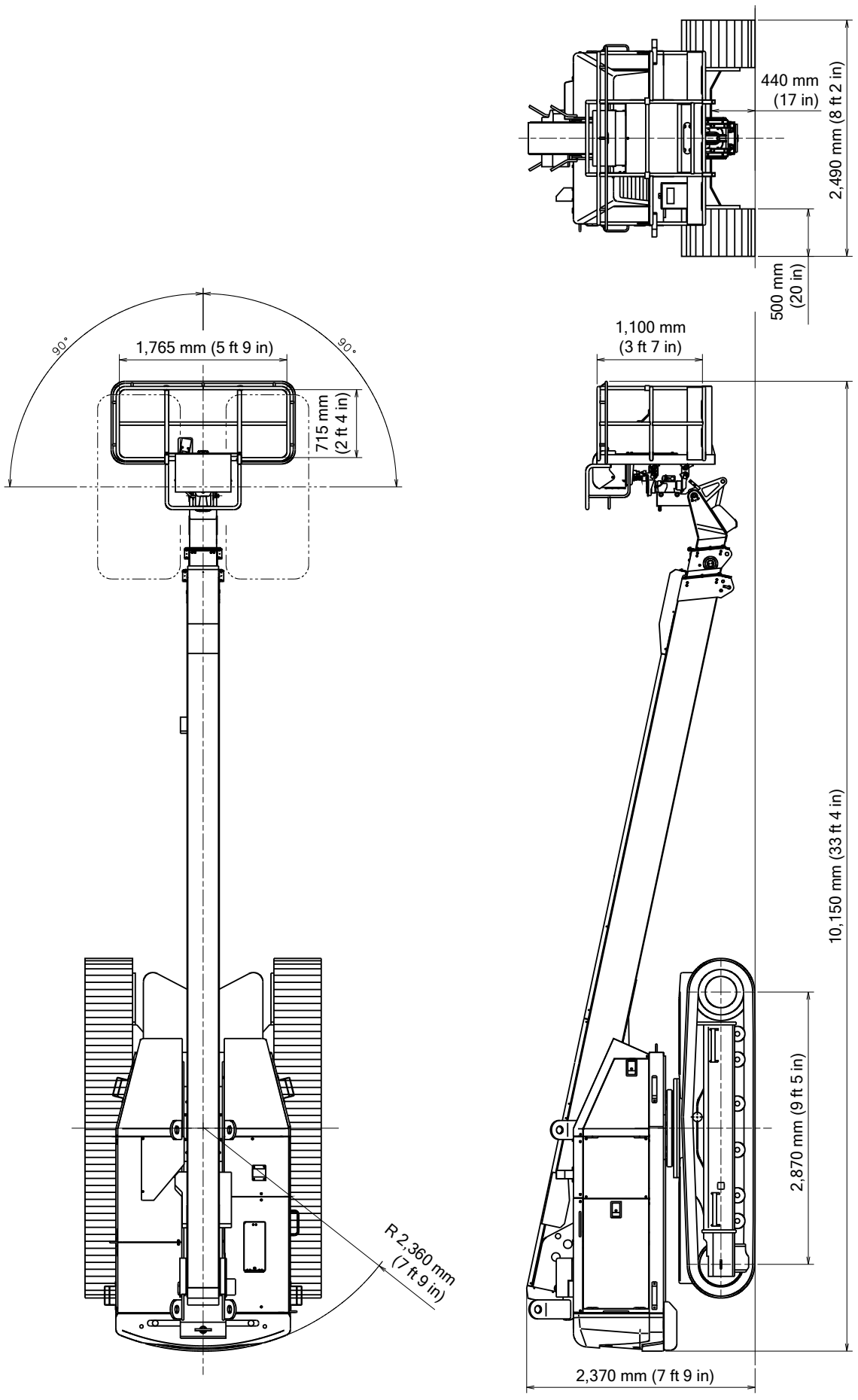
Overall dimensions (SR18A / ISR60)



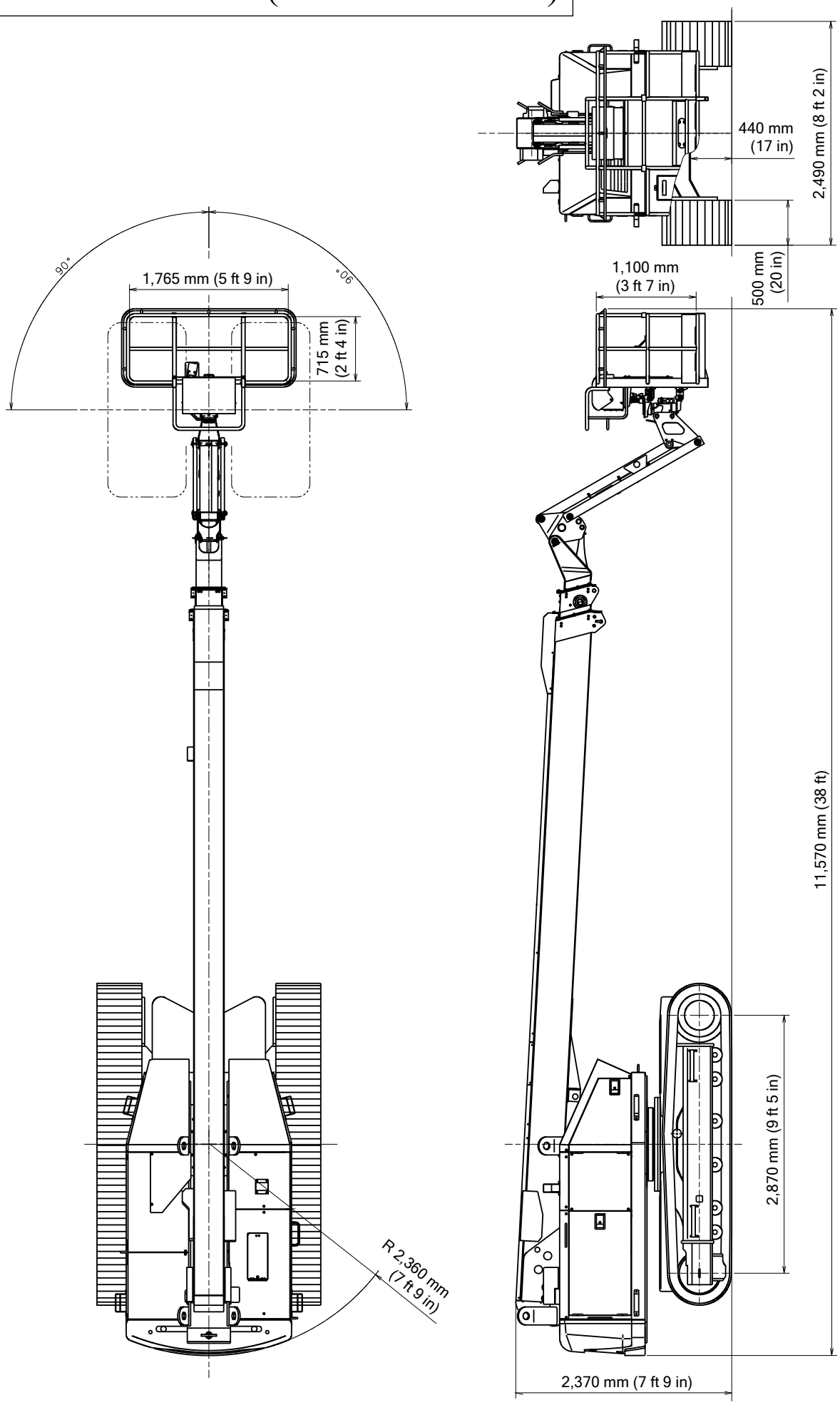
Overall dimensions (SR18AJ / ISR60J)



Overall dimensions (SR21A / ISR70)

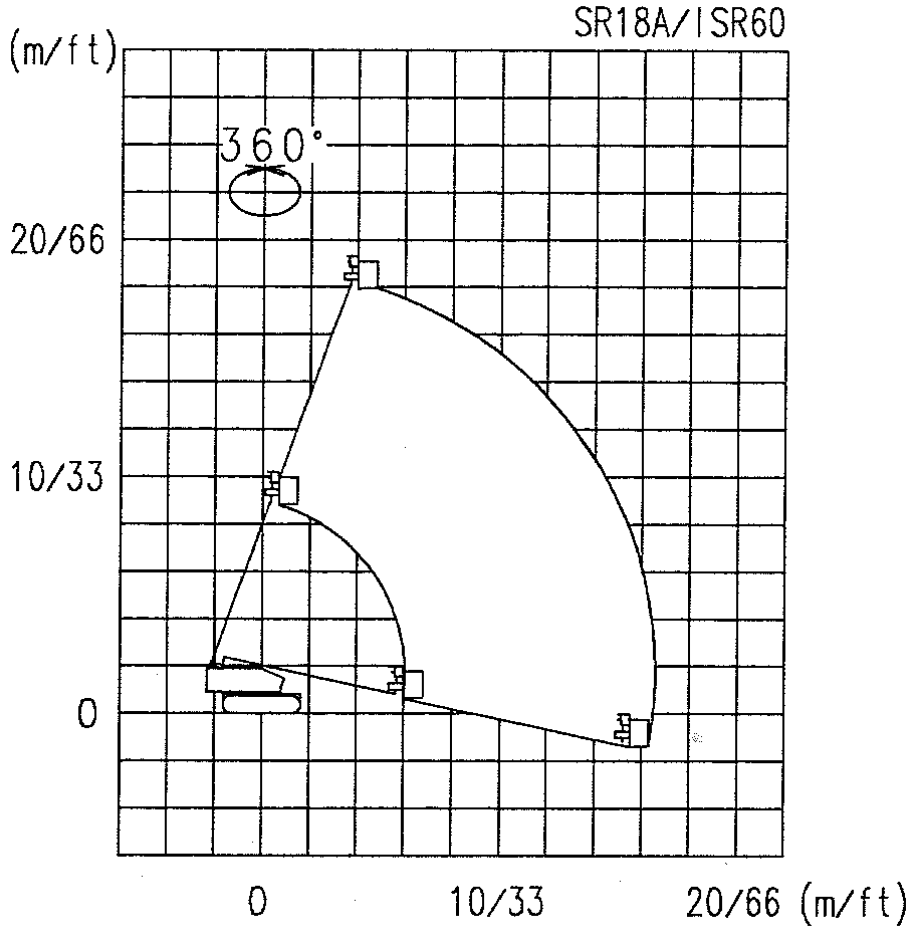


Overall dimensions (SR21AJ / ISR70J)



Working range diagram (SR18A / ISR60)

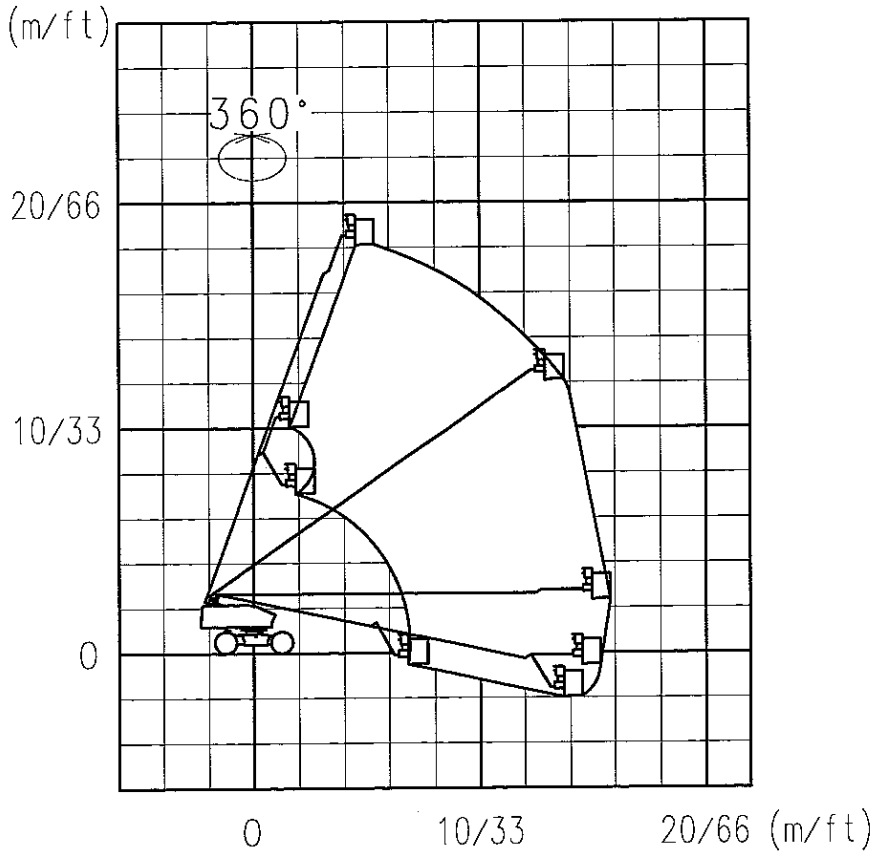
Specific working load: 227 kg (500 LBS)



The working range of the platform shown in the above diagram is obtained at any boom-rotated directions.

Working range diagram (SR18AJ / ISR60J)

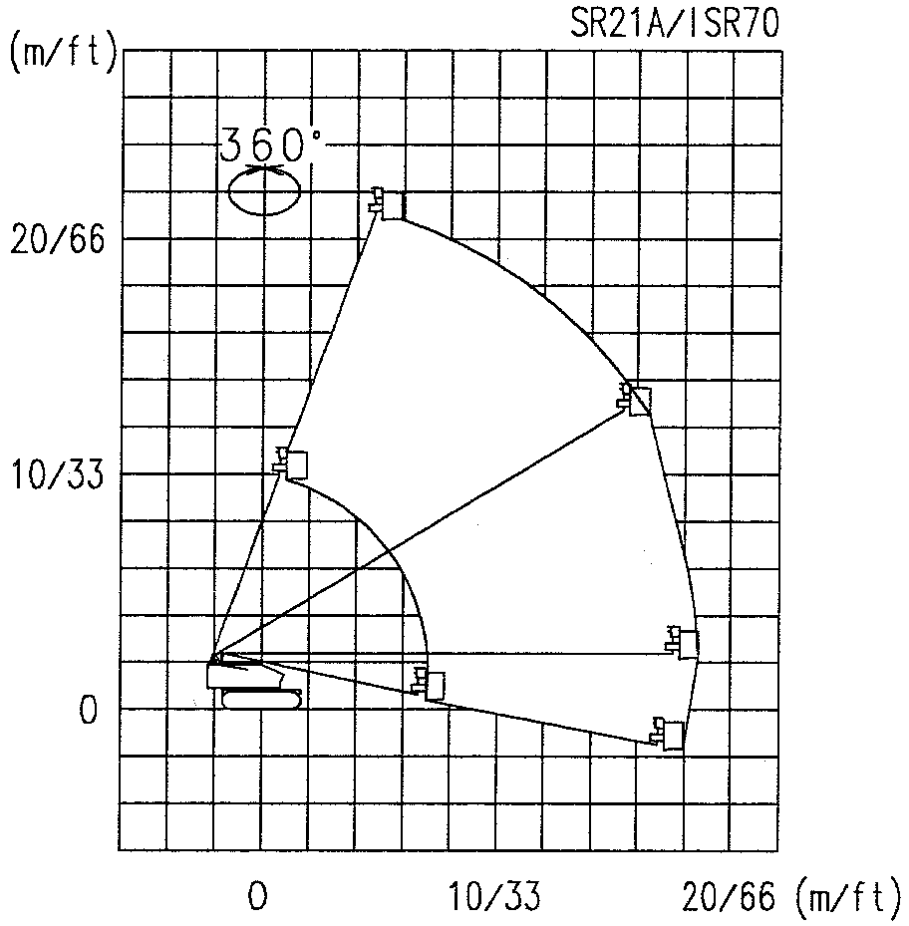
Specific working load: 227 kg (500 LBS)



The working range of the platform shown in the above diagram is obtained at any boom-rotated directions.

Working range diagram (SR21A / ISR70)

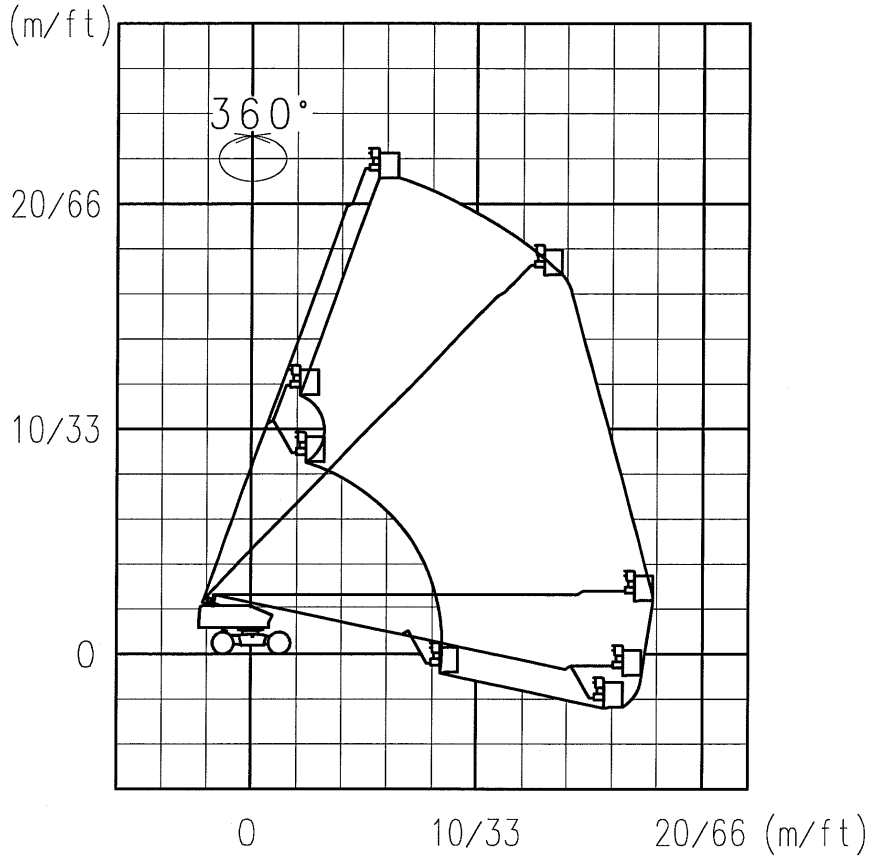
Specific working load: 227 kg (500 LBS)



The working range of the platform shown in the above diagram is obtained at any boom-rotated directions.

Working range diagram (SR21AJ / ISR70J)

Specific working load: 227 kg (500 LBS)



The working range of the platform shown in the above diagram is obtained at any boom-rotated directions.

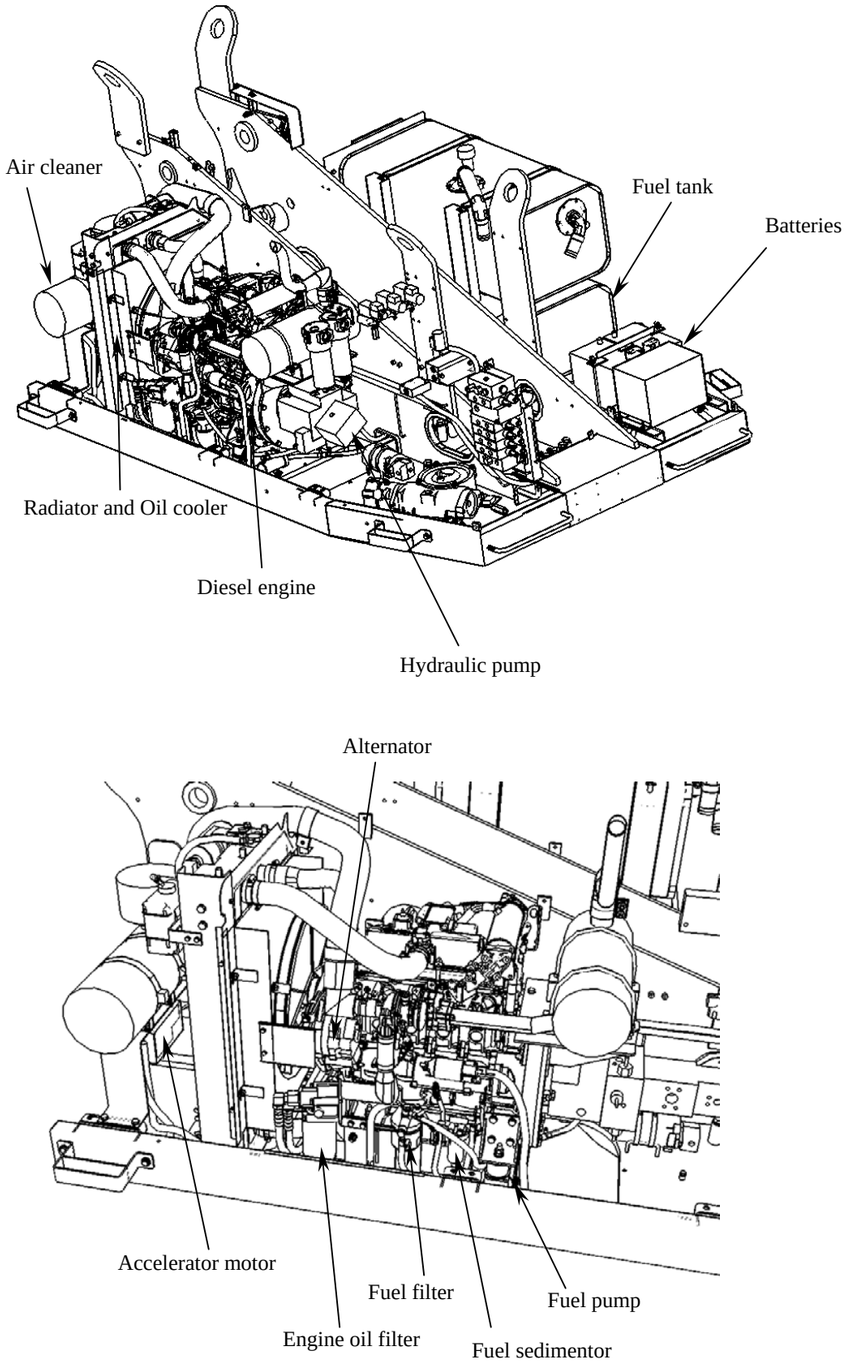
Safety Devices

The safety devices ensure safety and prevent damage to the machine.

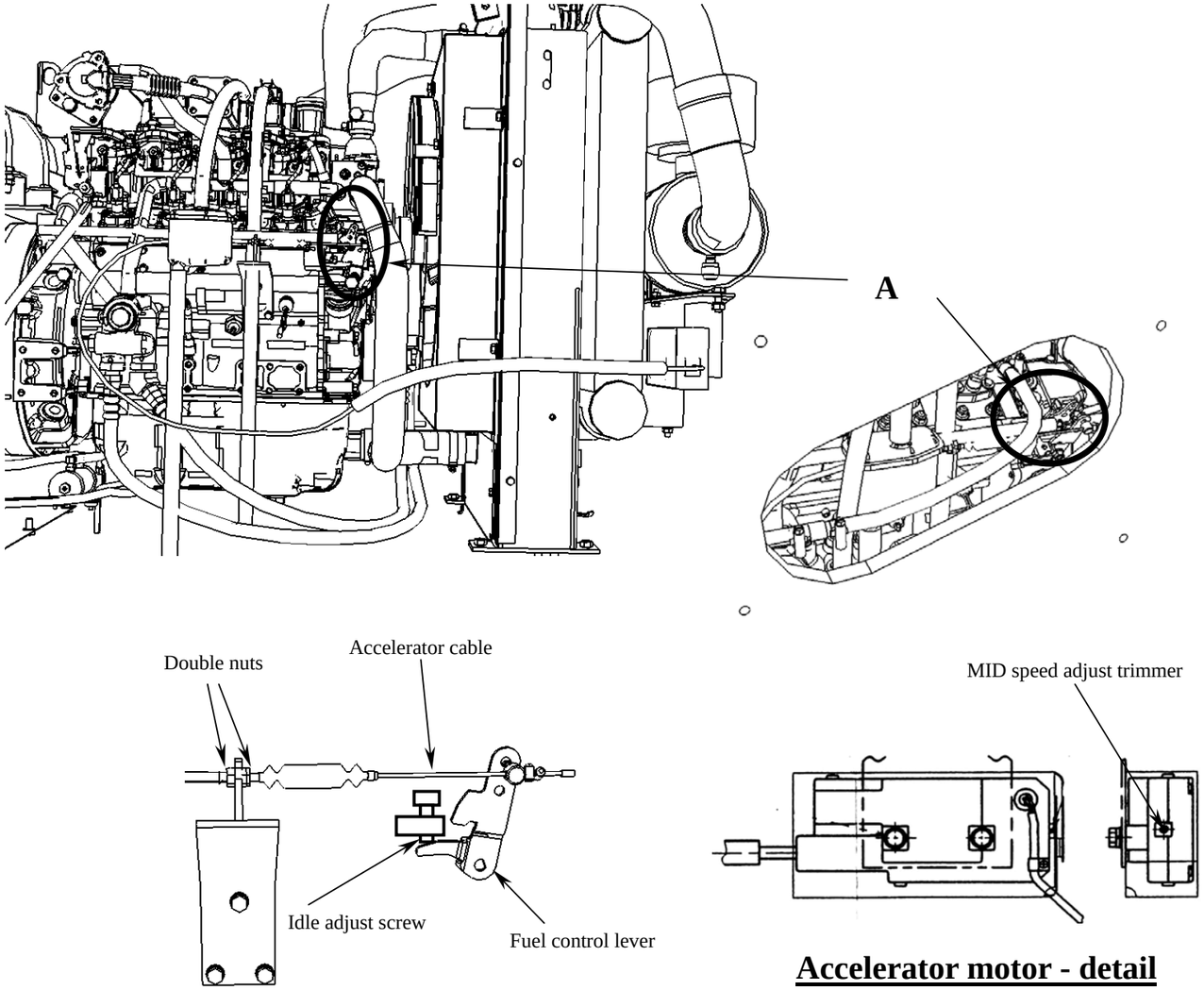
Safety device	Functions
Relief valves	Protect the hydraulic components by relieving abnormally high pressure in the hydraulic system.
Single holding valve on Boom elevation cylinder	Prevents the boom from natural descent in the event of hydraulic hose breakage.
Double holding valve on Boom telescope cylinder	Prevents the boom from natural retraction and extension in the event of hydraulic hose breakage.
Double holding valve on Fly- jib cylinder	Prevents the natural descent of the fly- jib in the event of hydraulic hose breakage.
Double holding (or pilot check) valve on Upper leveling cylinder	Maintains the platform level in the event of hydraulic hose breakage.
Motion alarm buzzer	The motion alarm buzzer sounds while the machine is in motion to warn the personnel nearby.
Foot switch	The boom, fly- jib, traveling and platform rotating operations from the platform are disabled unless the foot switch is pressed.
Emergency stop switch	Stops all of the movements of the machine when this switch is pressed.
Tilt Alarm buzzer	When the machine tilts more than 5 degrees, the tilt alarm buzzer sounds.
Emergency pump	Auxiliary hydraulic pump driven by the battery. And used to lower the platform in the event of engine or main pump in failure.
Alarm horn	Before starting operation, sound the alarm horn to warn the personnel near the working area.
Work range limit system	This system automatically limits the work range (outreach) of the platform within the specific range. (This system is not equipped on SR18A/ISR60.)
Travel speed limit device	The high and mid speed traveling is disabled, if the boom is extended or is raised over the horizontal.
Boom wire rope failure detecting system	This system stops the boom extending movements in the event of the wire rope failure.
Overload sensing system (CE model)	This system disables all of the functions when the platform is overloaded.
Boom rotation speed limit system	This system automatically reduces the boom rotation speed to ensure the safe speed as the boom extends.
Boom elevation speed limit system	This system automatically reduces the boom raising and lowering speed to ensure the safe speed as the boom extends.
Boom / Travel function interlock system (CE model)	This system disables all of the functions when the travel and boom or fly jib functions are conducted simultaneously.
Travel limit system (CE model)	The travel function is disabled when the boom is extended to the red mark located on the 3rd boom section. Under this condition, the “Tilt / Travel” light blinks when the travel control lever is operated. The travel function automatically stops, if the machine tilts over 5 degrees and either of the following conditions applies. a) The boom is raised over 45 degrees. b) The boom is extended more than 1 meter (3ft – 3 in).

2. Mechanical section

Diesel engine



Fuel system



A - detail

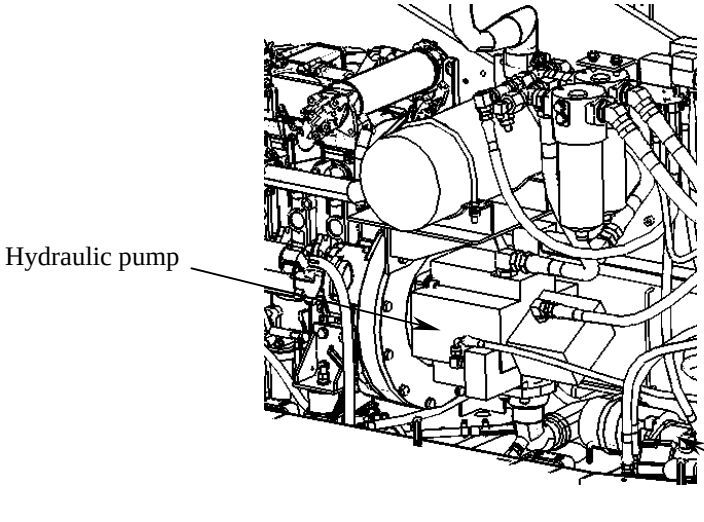
Accelerator motor - detail

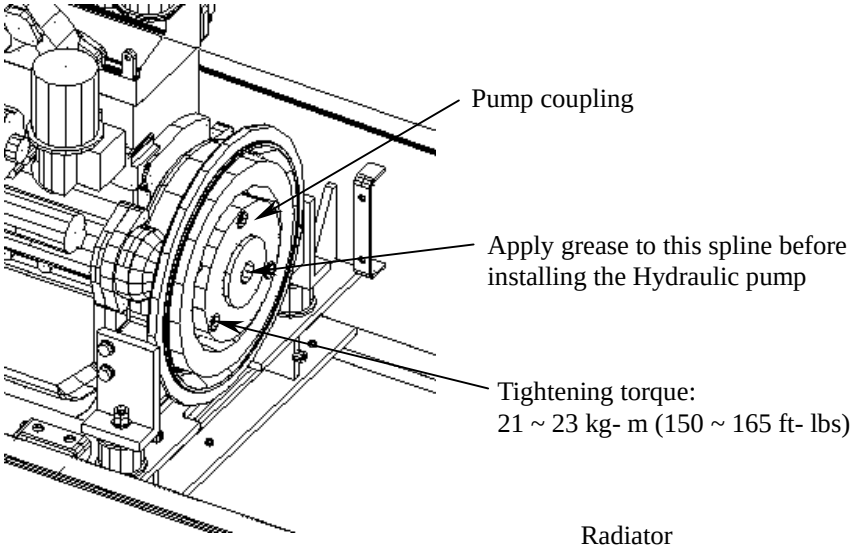
Adjustment procedures of Engine rpm

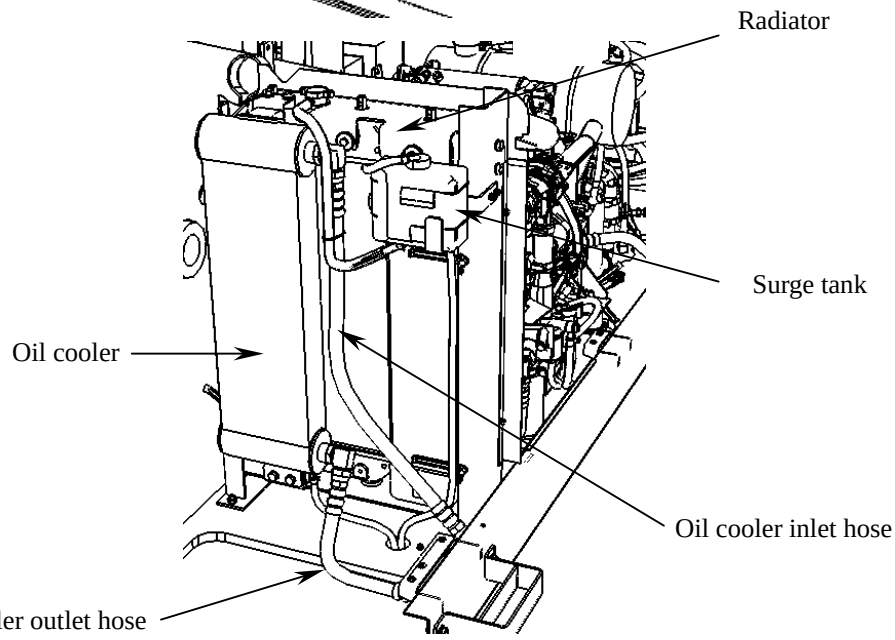
- It is necessary to load the engine by imposing the relief pressure when adjusting or measuring the Mid and High rpm. See the section of 6. Inspection and Adjustment to measure the engine rpm.

1	Warm up the engine.
2	Turn the ***Idle adjust screw*** to adjust the Low (Idling) speed to 1,020 rpm
3	Turn the ***Double nuts*** to adjust the High speed to 1,950 – 2,000 rpm (CE model) or 1,800 – 1,850 rpm (ANSI model).
4	Turn the ***Mid speed adjust trimmer*** that is installed on the accelerator motor to adjust the Mid speed to 1,400 – 1,450 rpm.

Hydraulic pump and Oil cooler installations

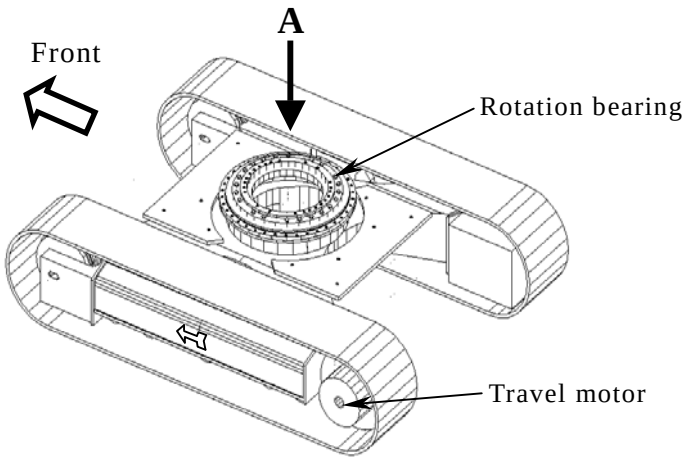


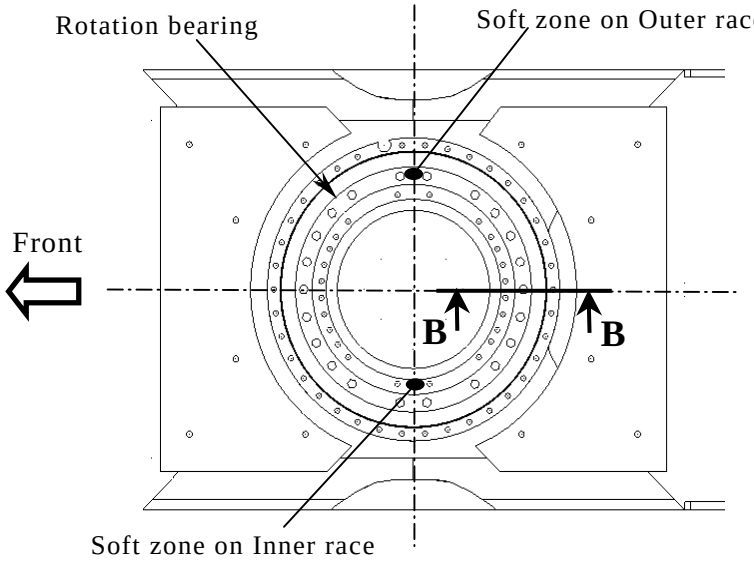




Rotation bearing

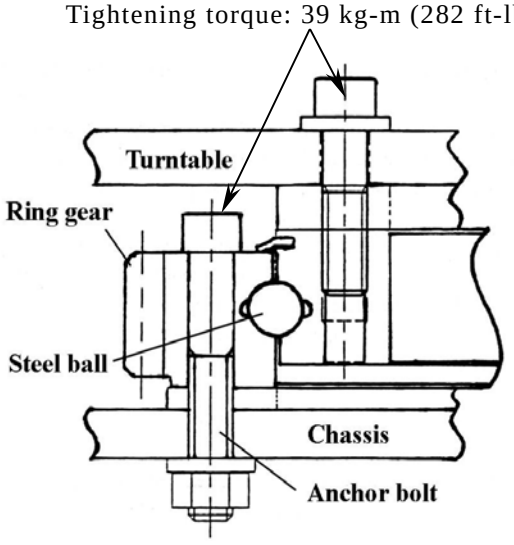
This rotation bearing is mounted between the chassis and the turntable, and enables the turntable to rotate freely over the chassis.





Note:
Set the Soft zones on the inner and outer races of the rotation bearing at positions shown in the figure, when installing the rotation bearing.

A - view



B - B section

1. Inspection procedures

1. Check the anchor bolts and nuts for looseness, omission and any other damage.
   a. Loose bolts should be removed and checked for damaged threads and deformation.
   b. When re- installing anchor bolts or nuts, apply thread lock agent to the threads.
      - Recommended thread lock agent: Loctite 262.
   c. Tighten anchor bolts by the specific tightening torque.
      - Specified tightening torque: 39 kg- m (282 ft- lbs)

   NOTE:

   In case it is hard to loosen anchor bolts due to lock agent, heat them up by using a gas burner to melt the agent.
   The heated or removed bolts and nuts should be replaced with new ones.

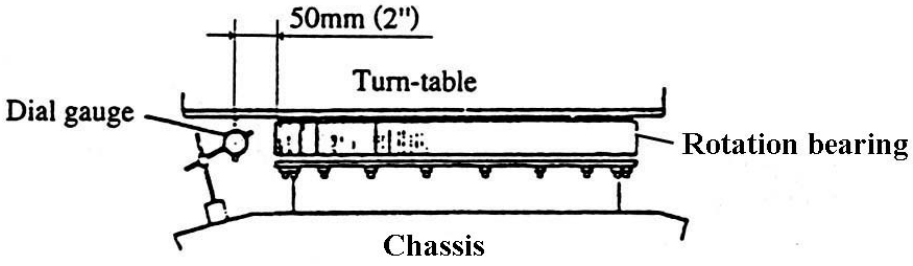
2. Check the ring gear for cracks and any other damage.
   To make the cracks obvious, use a liquid penetrant test such as a color check.

3. Check the backlash between the ring gear of the rotation bearing and the pinion gear of the rotation gearbox.
   - Standard backlash: 0.6 mm (0.024 in) or less.

   NOTE:

   To check the backlash, rotate the turntable and insert a lead wire between the ring gear and the pinion gear of the rotation gearbox to crush the wire, and then measure the thickness of the crushed lead wire.
   If the backlash is inadequate, adjust it by moving the rotation gearbox.

4. Check the free- play between inner and outer races of the rotation bearing as follows.



   a. Set a dial gauge between the turntable and the chassis as shown in the figure above.
   b. Retract and raise the boom fully, and set the pointer of the dial gauge at ZERO.
   c. Lower the boom, set it horizontally, extend it fully to its maximum outreach, and then read the dial gauge again.

   The reading of the gauge is the free- play.
   - Standard free- play: 0.9 mm (0.035 in).
   - Serviceable limit: 3.0 mm (0.118 in).

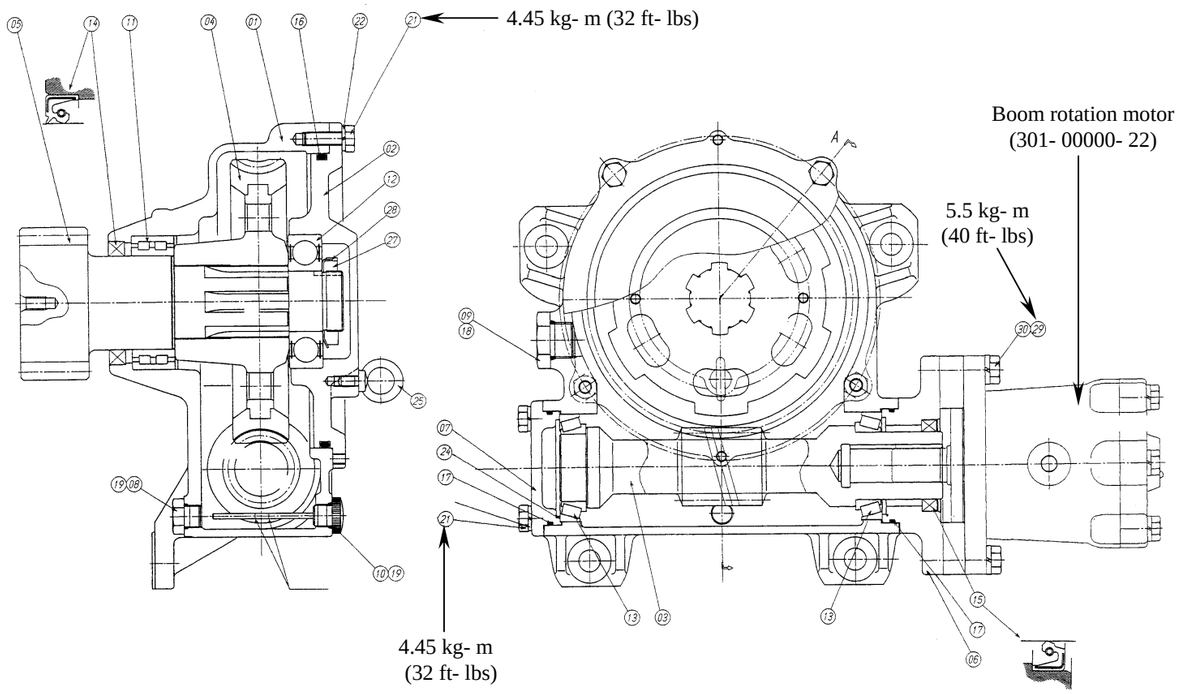
   NOTE:

   The rotation bearing should be replaced, if the free- play exceeds the serviceable limit.

Boom rotation gearbox

The boom rotation gearbox reduces the rotation speed of the hydraulic motor and increases the torque to rotate the turntable through the boom rotation bearing.

- Type ---------- Worm gear
- Reduction ratio ---------- 1/50
- Gear oil ---------- Shell Spirax EP- 90 (1.7 liters, 0.45 gallons)
- Oil change interval ----- 1,200 hours or annually



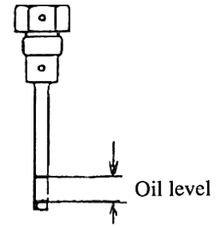
01	Case	11	Needle roller bearing	21	Bolt
02	Cover	12	Ball bearing	22	Spring washer
03	Worm shaft	13	Taper roller bearing	23	----------
04	Worm wheel	14	Oil seal	24	Shim
05	Pinion shaft	15	Oil seal	25	Eye bolt
06	Motor flange	16	O- ring	26	----------
07	Cover	17	O- ring	27	Bearing nut
08	Oil drain plug	18	O- ring	28	Lock washer
09	Plug	19	O- ring	29	Bolt
10	Oil level gauge	20	----------	30	Spring washer

1. Inspection

1. Check the gear oil level and replenish or change the oil, if necessary.

   Recommended gear oil --------- Shell Spirax EP- 90 (1.7 liters, 0.45 gallons)

   To check the oil level, screw in the oil level gauge (Dipstick) fully into the gearbox first, then remove the dipstick. The proper oil level is between the two lines on the dipstick as shown in the figure below.



2. Check the backlash between the pinion of the rotation gearbox and the ring gear of the rotation bearing.

   Standard backlash ---------- 0.6 mm (0.024 in) or less.

   Follow the next procedures to check the backlash.

   1) Place a lead wire between the pinion and the ring gear of the Rotation bearing.

   2) Rotate the turntable slowly and crush the lead wire.

   3) Measure the thickness of the crushed lead wire to determine the backlash.

   4) If the backlash is inadequate, loosen the fixing bolts and nuts of the Boom rotation gearbox, and then adjust the backlash by shifting the position of the rotation gearbox.

2. Disassembly and Re- assembly

1. Remove both of the ***Oil level gauge*** (10) and the ***Oil drain plug*** (08) to drain the gear oil thoroughly.
2. Remove the ***Boom rotation motor*** from the rotation gearbox.
3. Remove the ***Cover*** (02), the ***Cover*** (07) and the ***Motor flange*** (06) from the ***Case*** (01).
4. Pull out the ***Worm shaft*** (03) from the ***Case*** (01) by rotating the ***Pinion shaft*** (05).
5. Unlock the ***Lock washer*** (28), remove the ***Bearing nut*** (27), and then pull out the ***Pinion shaft*** (05) from the ***Case*** (01).
6. Remove the ***Worm wheel*** (04) from the ***Case*** (01).
7. Remove all of the bearings and the oil seals, if necessary.
8. Check each part and replace the part, if necessary.
9. Reverse the above procedures to re- assemble the rotation gearbox.
10. Re- install the ***Boom rotation motor*** onto the rotation gearbox, and then refill the gear oil.

Boom

1. Structures

The boom consists of the 1st, 2nd, and 3rd boom sections, Boom telescope cylinder, the Extension/ Retraction wire ropes, Hydraulic hoses, Electric cables and Sheaves.

The 2nd boom section is extended or retracted directly by the Boom telescope cylinder.

However, the 3rd boom section is telescoped by the movement of the 2nd boom section through the extension and retraction wire ropes.

The 1st and 2nd boom sections are connected by the Boom telescope cylinder, which directly extends and retracts the 2nd boom section.

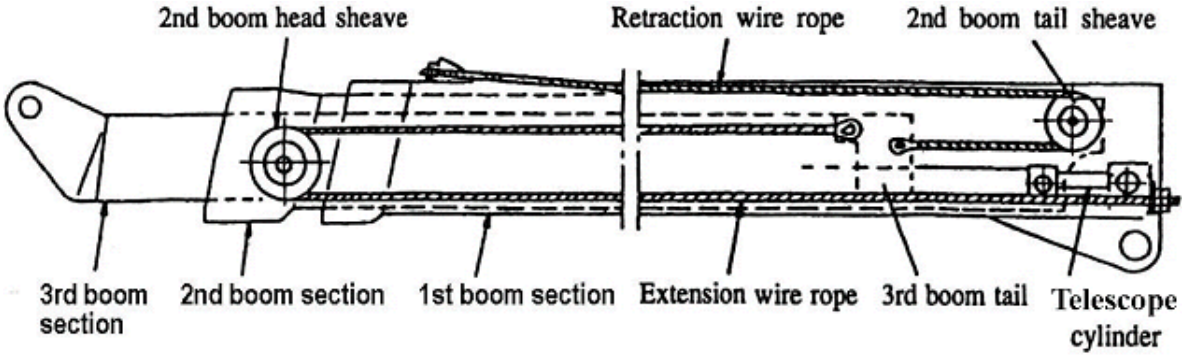
While, the 3rd boom section is connected to the 2nd boom section by the extension and retraction wire ropes as shown in the figure below.

The retraction wire ropes are connected to the tail of the 3rd boom section through the tail sheave installed on the tail of the 2nd boom section.

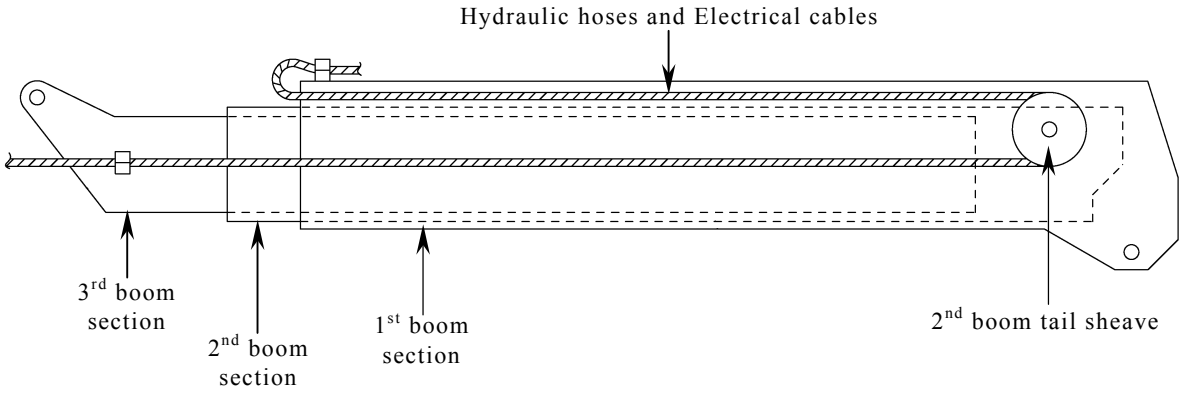
The extension wire ropes are also connected to the tail of the 3rd boom section through the head sheave that is installed on the head of the 2nd boom section.

The 2nd boom section is extended by the Boom telescope cylinder together with the head sheave coming along. As a result, the 3rd boom section is pulled by the extension wire rope and accordingly goes out of the 2nd boom section.

When retracting the boom, the 2nd boom section is retracted by the Boom telescope cylinder together with the tail sheave coming along. As a result, the 3rd boom section is pulled by the retraction wire rope and accordingly goes into the 2nd boom section.



2. Hydraulic hoses and Electrical cables arrangements



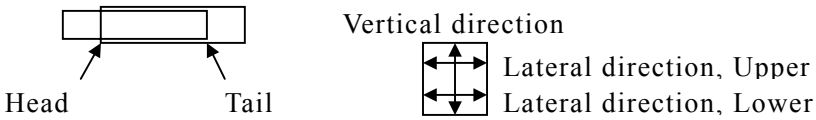
3. Inspection procedures

The boom is to be disassembled for a detailed inspection every 5 years.

1. Clearance between each boom section.

1) Check the clearance between each wear pad and boom section.

- Specific clearance:



		Vertical direction	Lateral direction, Upper Sum of Right and Left	Lateral direction, Lower Sum of Right and Left
Clearance between 1st and 2nd boom sections	boom head	0.5 ~ 0.9 mm (0.020 ~ 0.035")	1.0 ~ 2.0 mm (0.039 ~ 0.079")	6.0 ~ 7.0 mm (0.236 ~ 0.276")
	boom tail	0.5 ~ 0.9 mm (0.020 ~ 0.035")	1.0 ~ 2.0 mm (0.039 ~ 0.079")	1.0 ~ 2.0 mm (0.039 ~ 0.079")
Clearance between 2nd and 3rd boom sections	boom head	0.5 ~ 1.0 mm (0.020 ~ 0.039")	1.0 ~ 2.0 mm (0.039 ~ 0.079")	6.0 ~ 7.0 mm (0.236 ~ 0.276")
	boom tail	2.0 ~ 3.0 mm (0.079 ~ 0.118")	1.0 ~ 2.0 mm (0.039 ~ 0.079")	1.0 ~ 2.0 mm (0.039 ~ 0.079")

2) If the clearance is not adequate, adjust the clearance by adding or reducing the spacers installed under each wear pad.

Check each wear pad for wear, and replace them if the thickness is thinner than serviceable limit.

Serviceable limit of wear pads

1st boom section side

Nominal thickness : 12 mm

Serviceable limit : 10 mm

2nd boom section side

Nominal thickness : 15 mm

Serviceable limit : 13 mm

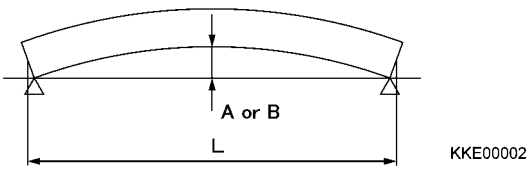
Apply thread lock agent to the thread of each set screw for wear pad before setting.

Recommended thread lock agent: Loctite 262

2. Bend of boom section.

1) Set the boom horizontally and extend it fully.

2) Visually check the bend of each boom section and disassemble the boom to measure the bend, if the excessive bend is observed.



Serviceable limit

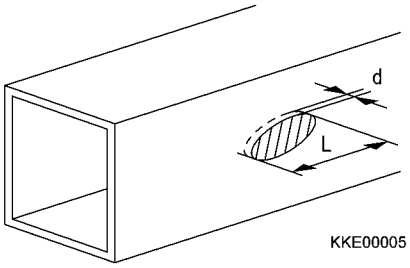
			1st boom section	2nd boom section	3rd boom section
Length		L	8,600 mm	9,200 mm	9,000 mm
Serviceable limit	Vertical direction	A	12.9 mm	13.8 mm	13.5 mm
	Lateral direction	B	8.6 mm	9.2 mm	9.0 mm

3. Dents, scratches

Check the each boom section for both dents and scratches thoroughly. If any dent or scratch that exceeds the serviceable limit is observed, replace the boom section.

* Serviceable limit:

Length: L = 50 mm [1.97 in], and/or Depth: d = 2 mm [0.08 in].



4. Dents on bottom plate of the 2nd and 3rd boom sections

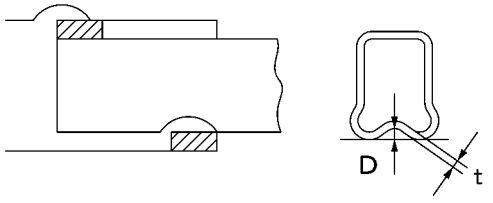
Check the bottom plate of the 2nd and 3rd boom section for dents caused by contact with wear pads.

If any dent that exceeds the serviceable limit is observed, replace the boom section.

* Serviceable limit:

2nd boom section = 3.0 mm

3rd boom section = 2.25 mm



D: Depth

t: Thickness of the bottom plate

2nd boom section: 6.0 mm

3rd boom section: 4.5 mm

5. Cracks.

Check each boom section thoroughly for cracks. For fine cracks, use COLOR CHECK or penetrant check.

Pay special attention, when checking each pin boss and welded section.

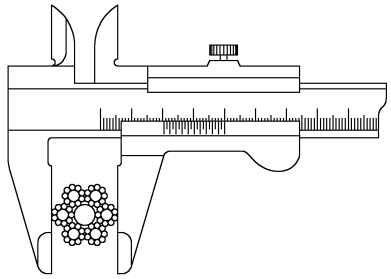
6. Lubrications

Check the grease on the wear pad contacting surface of inside of each boom section and apply molybdenum grease.

4. Extension / Retraction wire ropes

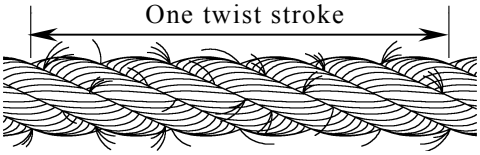
After disassembling the boom, inspect the extension and retraction wire ropes as follows.

1. Measure the diameter of both the extension and retraction wire ropes, using a slide calipers.
   Replace the wire rope, if the decrease of the diameter is more than 3 % of the nominal diameter.

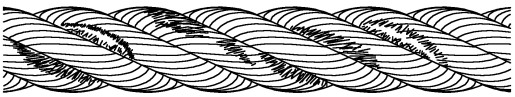


	Nominal diameter	Serviceable limit
Retraction wire rope	ϕ 8.0 mm (0.32 in)	ϕ 7.8 mm (0.31 in) or less
Extension wire rope	ϕ 12.0 mm (0.47 in)	ϕ 11.7 mm (0.46 in) or less

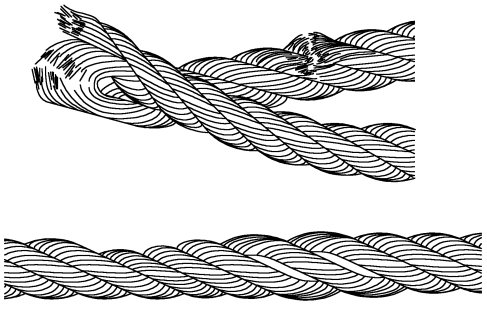
2. Check for broken wires.
   If you find 3 or more single wires cut in one twist stroke, replace the wire rope.



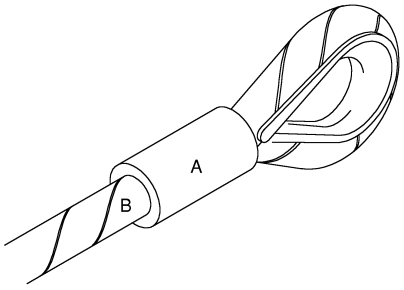
3. Check wire ropes for rust formation.
   If the rust is penetrated into the rope, replace the wire rope.



4. If any kinks are observed, replace the wire rope.
   Also, a deformed wire rope requires replacement.

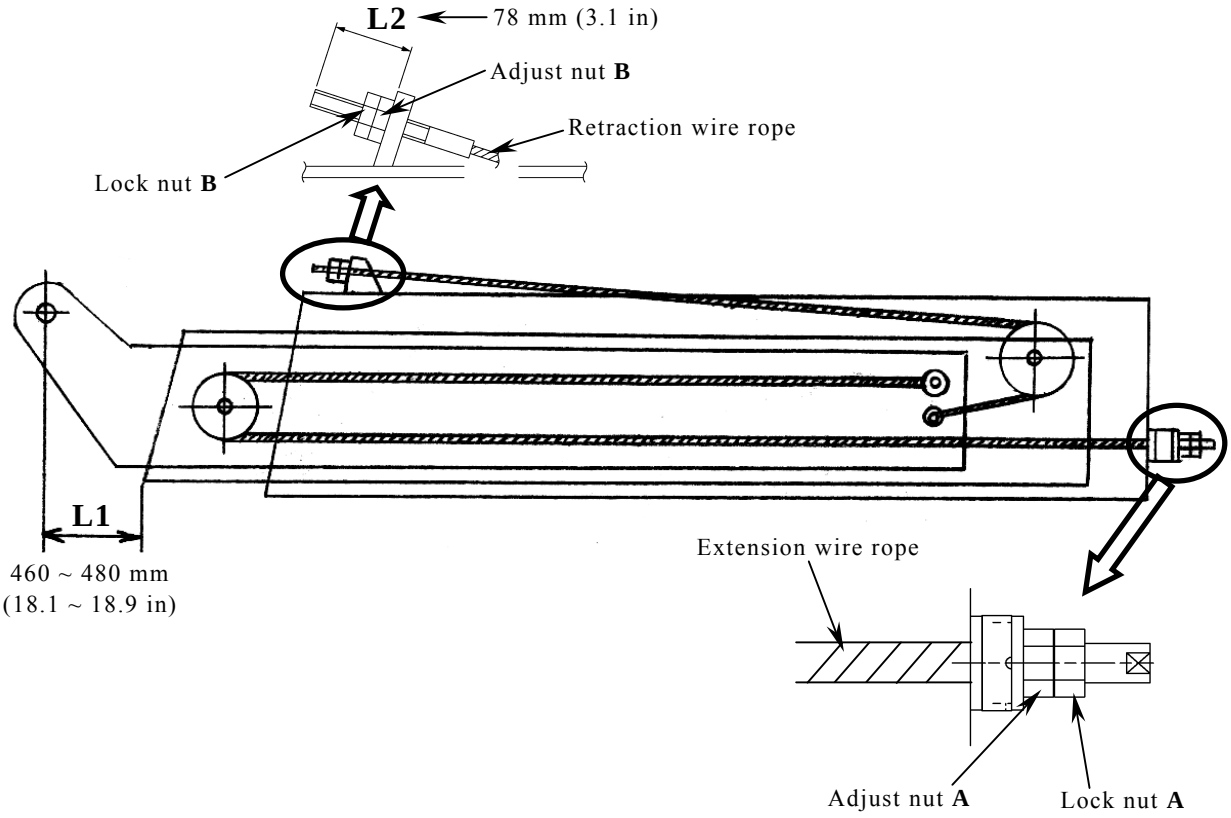


5. Check carefully the end sections of the wire rope, especially sections A and B.
   Replace the wire rope, if any defects are found.

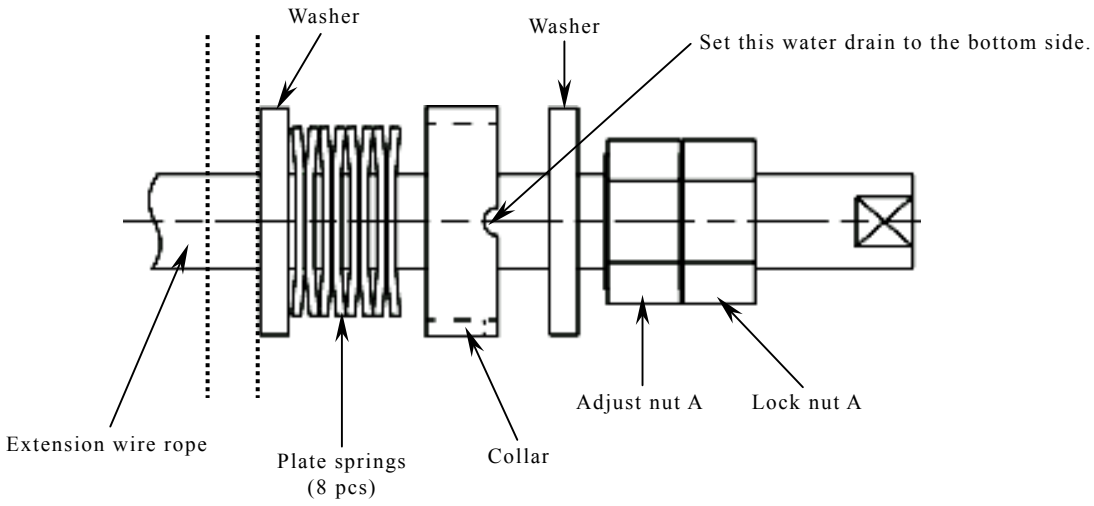


5. Adjustment of Extension/Retraction wire ropes

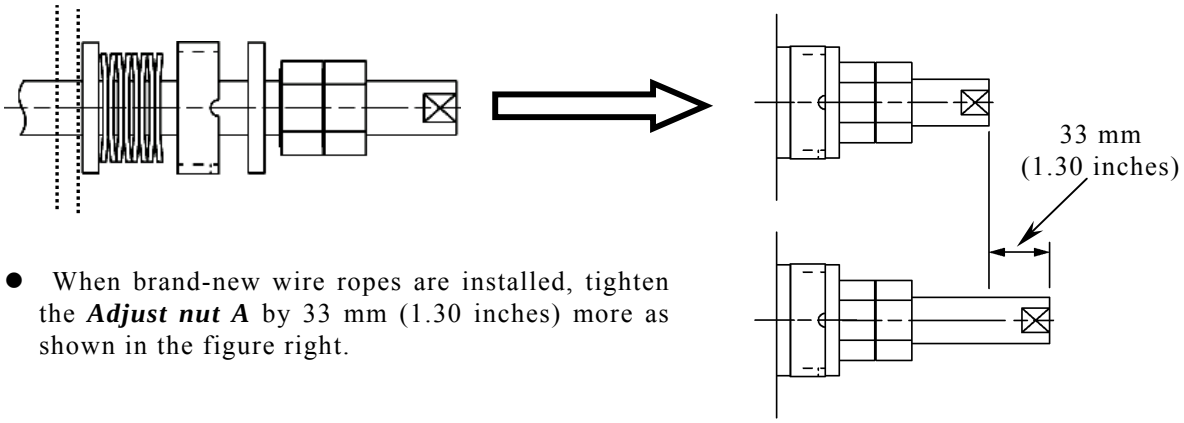
Adjust the tension of the Extension/Retraction wire ropes as follows.



1. Set the boom horizontally and retract it fully.
2. Unlock the ***Lock nuts B***, turn the ***Adjust nuts B*** and adjust the ***"Dimension L2"*** to 78 mm (3.1 inches).
   - **Caution:** Do not twist the wire ropes when turning the adjust and lock nuts.
3. Loosen the ***Lock nuts A*** and the ***Adjust nuts A*** at the terminal end of the extension wire ropes, and then make sure that the 8 plate springs, 2 washers and 1 collar are assemble at the end of the extension wire rope as shown in the figure below.



4. Tighten the ***Adjust nut A*** until the washers touch the collar as shown in the figure below.



- When brand-new wire ropes are installed, tighten the ***Adjust nut A*** by 33 mm (1.30 inches) more as shown in the figure right.

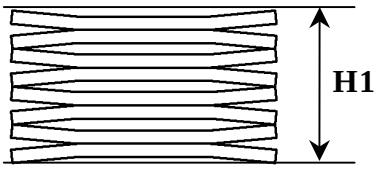
5. Measure the ***"Dimension L1"*** and make sure that it is 460 ~ 480 mm (18.1 ~ 18.9 inches).
6. Adjust the ***"Dimension L1"*** as follows, if the ***"Dimension L1"*** is not 460 ~ 480 mm (18.1 ~ 18.9 inches).
   - In case the ***"Dimension L1"*** is shorter than 460 mm (18.1 inches).

     Screw out the ***Adjust nuts B*** and screw in the ***Adjust nuts A*** to adjust the ***"Dimension L1"*** to 460 ~ 480 mm (18.1 ~ 18.9 inches).
   - In case the ***"Dimension L1"*** is longer than 480 mm (18.1 inches).

     Screw out the ***Adjust nuts A*** and screw in the ***Adjust nuts B*** to adjust the ***"Dimension L1"*** to 460 ~ 480 mm (18.1 ~ 18.9 inches).
7. Repeat the steps 3 and 4, and then tighten the ***Lock nuts A and B***.
8. Telescope the boom several times, retract the boom fully, and then make sure that ***"Dimension L1"*** is 460 ~ 480 mm (18.1 ~ 18.9 inches).

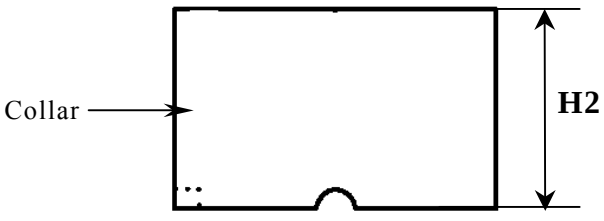
- When replacing the ***Plate springs*** with the new ones, make sure to use the suitable collar by following the next instructions.

  1) Stack the new 8 ***Plate springs*** on level surface, and then measure the ***Overall height (H1)*** of the plate springs.



  2) See the table below to select the suitable collar corresponding to the Overall height (H1) of the plate springs.

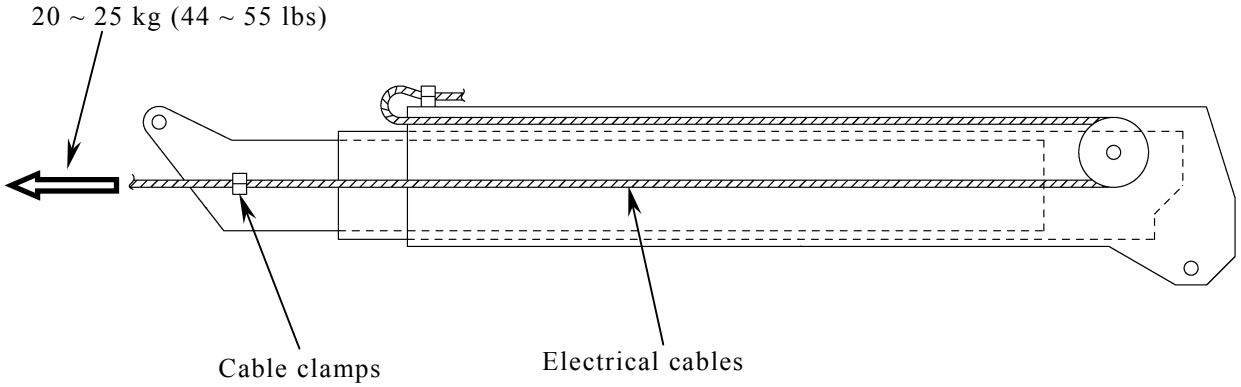
Height (H1) of 8 plate springs	mm	22.0 ~ 22.6	22.6 ~ 23.2	23.2 ~ 23.8	23.8 ~ 24.4	24.4 ~25.0	25.0 ~ 25.6
	inch	0.86 ~ 0.89	0.89 ~ 0.91	0.91 ~ 0.94	0.94 ~ 0.96	0.96 ~ 0.98	0.98 ~ 1.01
Height (H2) of suitable collar	mm	16.1	17.0	17.7	18.3	19.1	19.8
	inch	0.63	0.67	0.70	0.72	0.75	0.78
Part number of the suitable collar		S44340- 07	S44340- 08	S44340- 09	S44340- 10	S44340- 11	S44340- 12



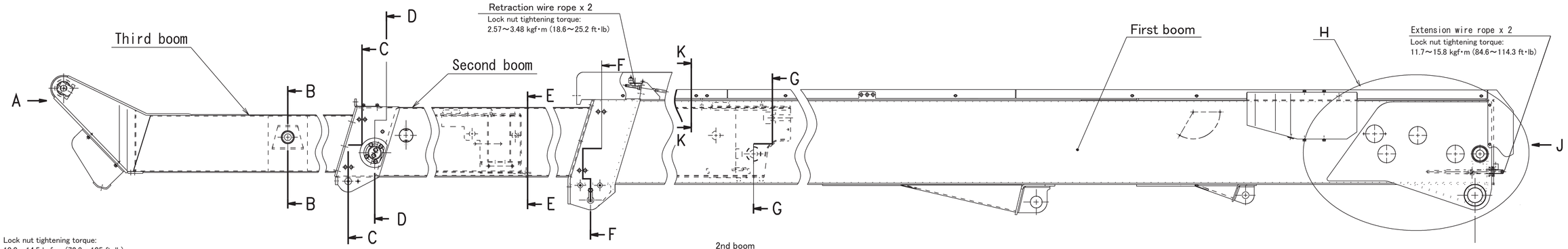
6. Tension on Electrical cables

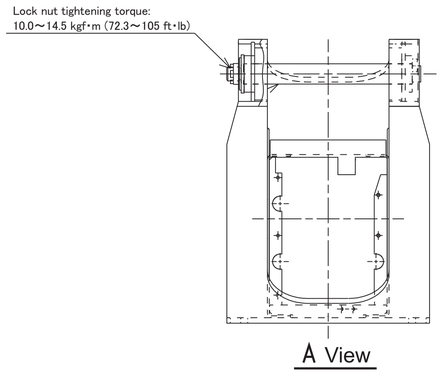
Impose the proper tension onto the electrical cables as follows every 6 months or 600 hours.
It is necessary to impose the tension after adjusting the boom extension/retraction wire ropes.

1. Telescope the boom several times, set the boom horizontally, and then retract it fully.
2. Loosen the cable clamps at the top end of the 3rd boom section.
3. Pull the electrical cables by the force of 20 ~ 25 kg (44 ~ 55 lbs), and then tighten the cable clamps.

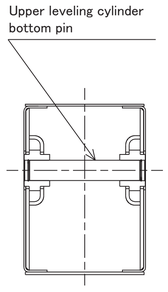


7. Sectional drawing (1/2)

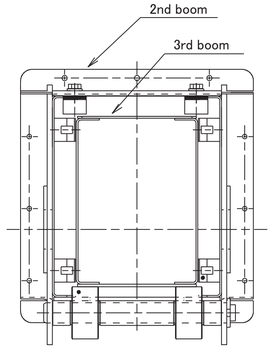




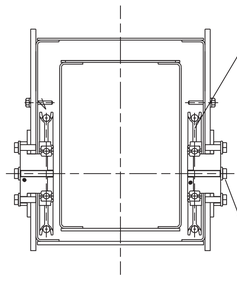
A View



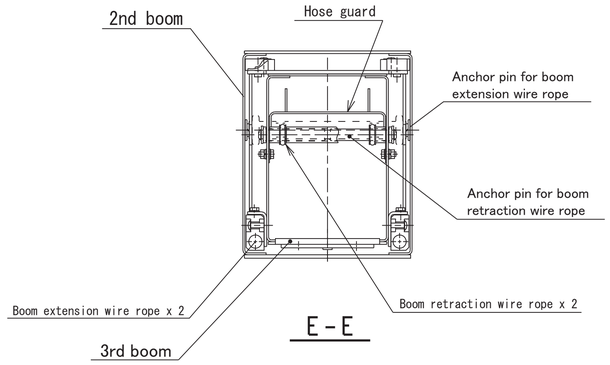
B-B



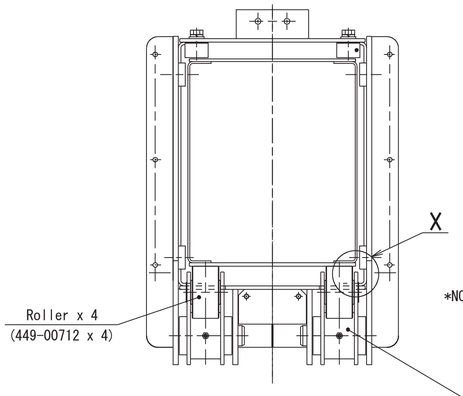
C - C



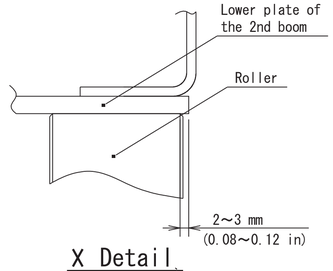
D-D



E-E

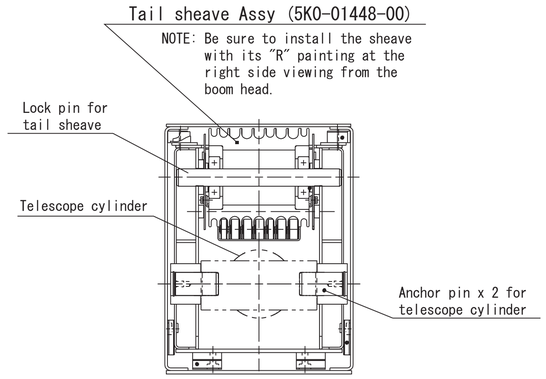


F-F

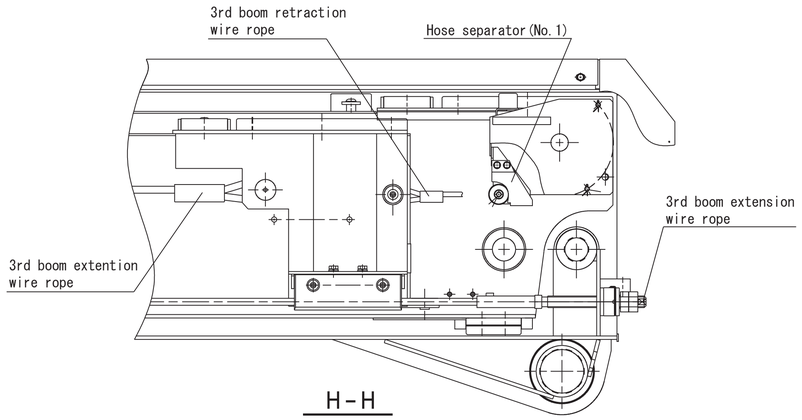


X Detail

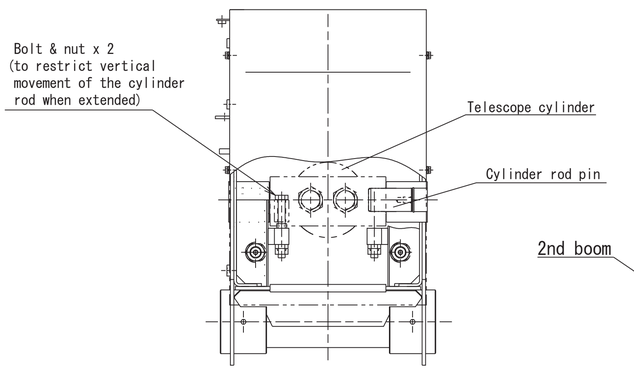
*NOTE: Adjust the position of roller bracket by spacers so that the outer line of roller comes inside of the edge of the 2nd boom lower plate as shown in figure above.



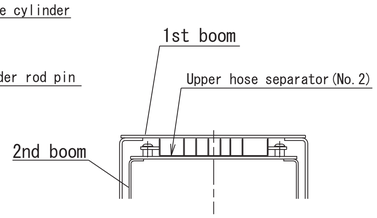
G-G



H-H

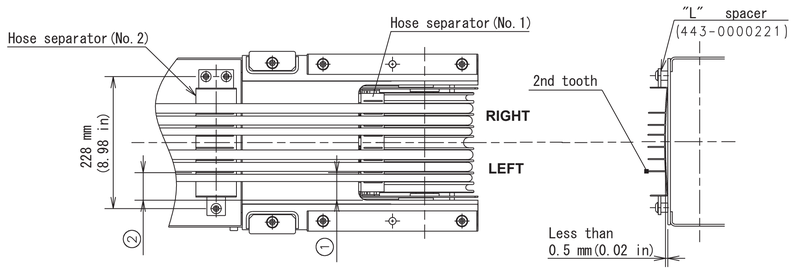


J View



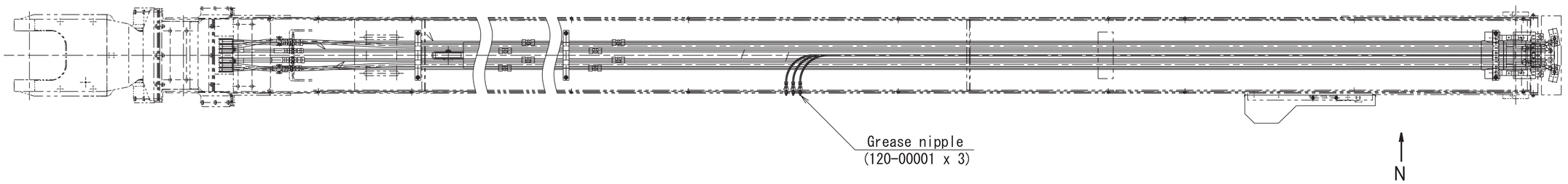
K-K

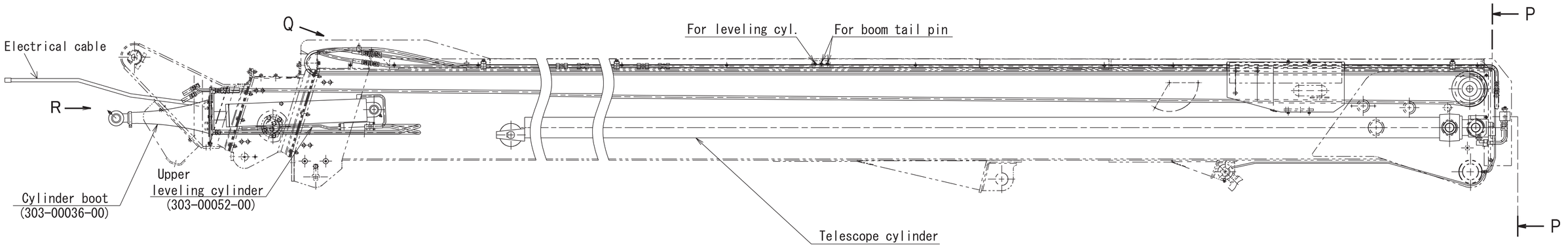
*NOTE: (1) Measure the dimension ① (between the 1st and 2nd tooth of the No. 1 separator from the left.
(2) Install the No. 2 separator so that the dimensions ① and ② are the same.
(3) The No. 2 separator should have firm contact with the upper plate of the 2nd boom.
In case any gap is observed, insert spacers (443-0000221) at "L" so that the gap becomes less than 0.5 mm (0.02 in).

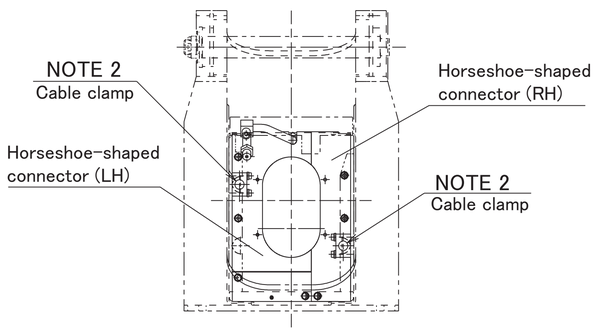


2nd boom tail Detail

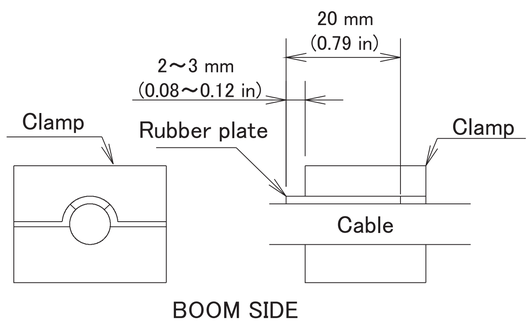
Sectional drawing (2/2)



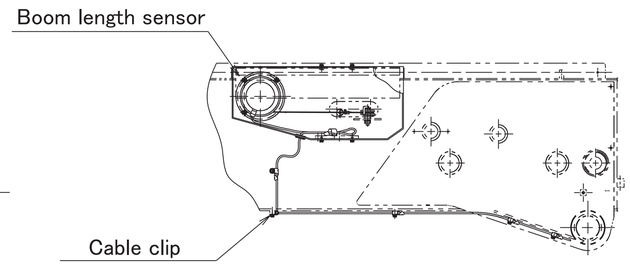




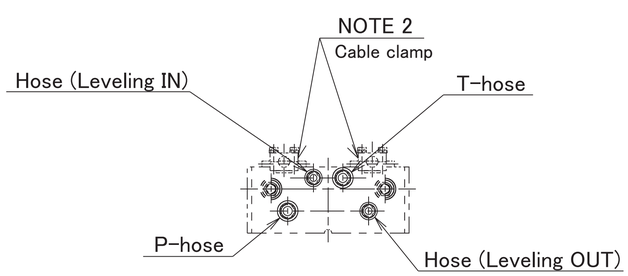
R view



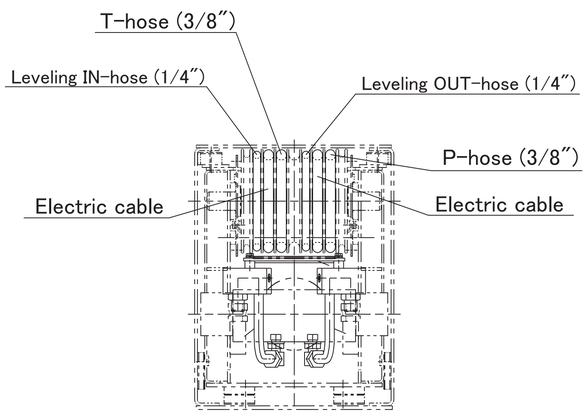
Cable clamp detail



N view



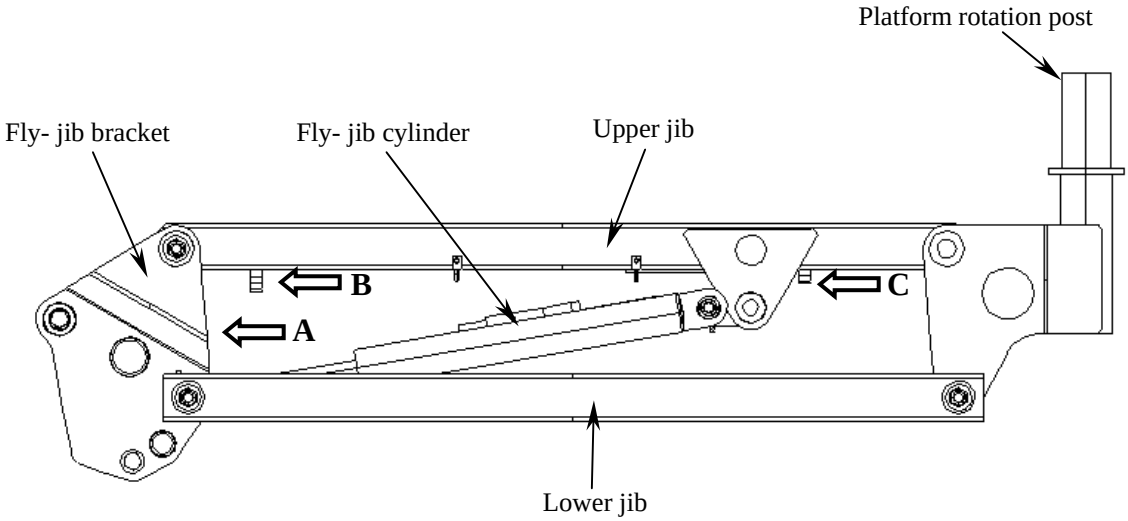
Q view

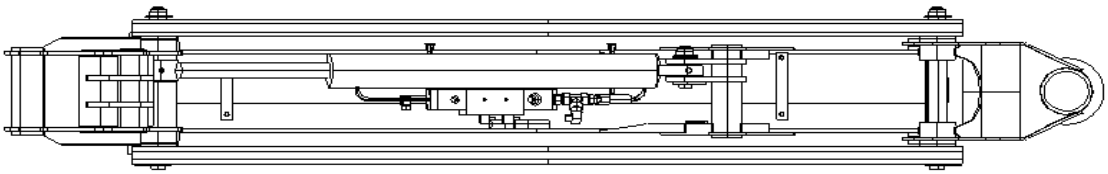


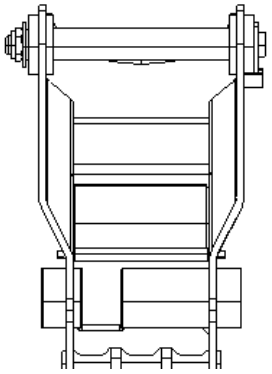
P - P

＊NOTE 2 :
Glue a piece of rubber plate (L : 10mm=0.39in, W : 20mm=0.79in, t : 3mm=0.12in) to the clamp as shown in the figure above right and remove grease before tightening the clamp.

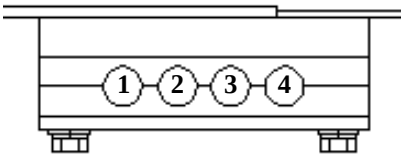
Fly- jib



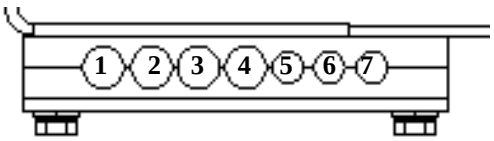




A - view



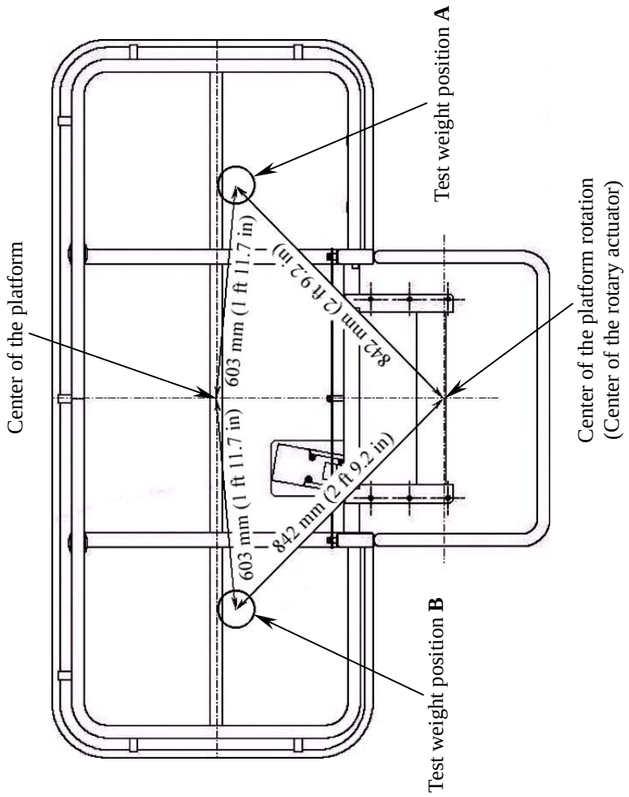
B - view

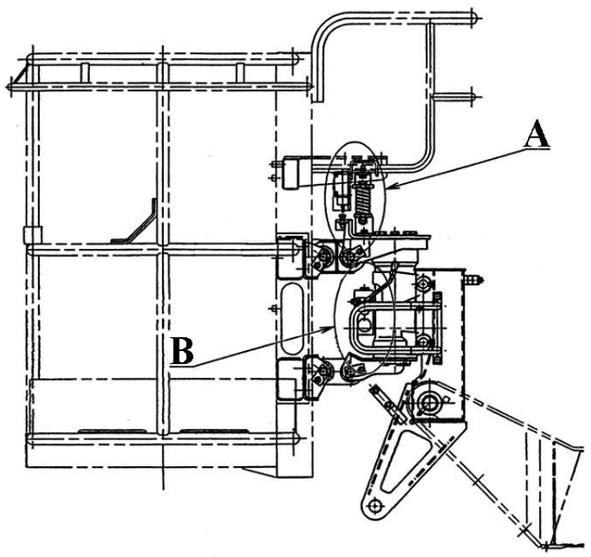


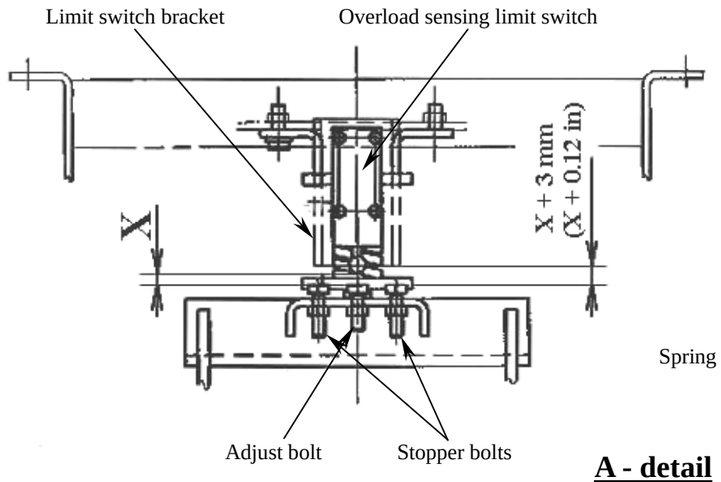
C - view

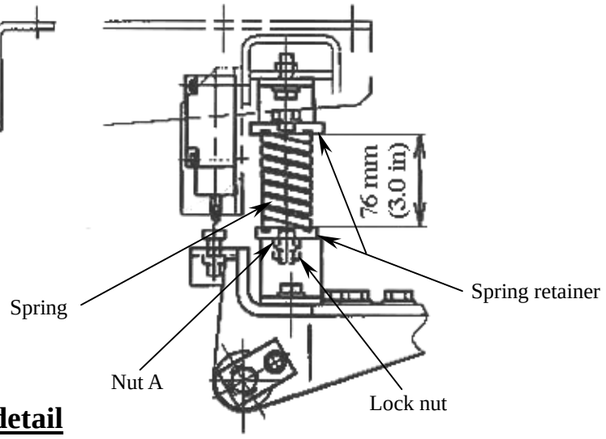
1	Electric cable - 1
2	Hydraulic hose (P)
3	Hydraulic hose (T)
4	Electric cable - 2
5	Hydraulic hose - 1 for Fly- jib cylinder
6	Hydraulic hose - 2 for Fly- jib cylinder
7	Hydraulic hose - 3 for Fly- jib cylinder

Platform (Adjustment of Overload sensing limit switch) (CE model: SR18A and SR21A)









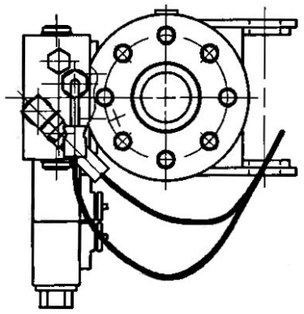
A - detail

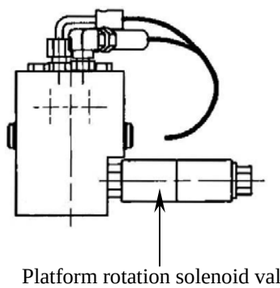
Adjustment procedures of Overload sensing limit switch

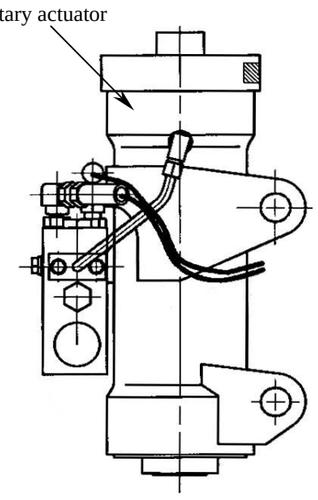
1. Adjust the dimension between the 2 Spring retainers to 76 mm (3.0 in) by tightening the Nut A, and then lock the lock nut.
2. Load the platform with the weight of 240 kg (530 lbs) at the Test weight position **A**, and then shake the platform several times.
3. Move the weight to the Test weight position **B**, and then shake the platform several times.
4. Perform the above steps 2 ~ 3 several times to settle the spring and the linkages.
5. Load the platform with the weight of 240 kg (530 lbs) at the Test weight position **A**, and then turn the Adjust bolt so that the limit switch is switched on.
6. Move the weight to the Test weight position **B**, and then make sure that the limit switch switches on.

   If the limit switch does not switch on, perform the followings.

   1) Turn the Adjust bolt again until the limit switch switches on.
   2) Move the test weight to the Test weight position **A** again, and then make sure that the limit switch switches on.
   3) If the limit switch does not switch on, repeat the steps 2 to 6.
7. Measure the clearance "**X**" between the Roller of the overload sensing limit switch and the Adjust bolt.
8. Adjust the clearance between the limit switch bracket and the stopper bolts to X + 3 mm (X + 0.12 in) to prevent the limit switch from breakage that is caused by overloading.

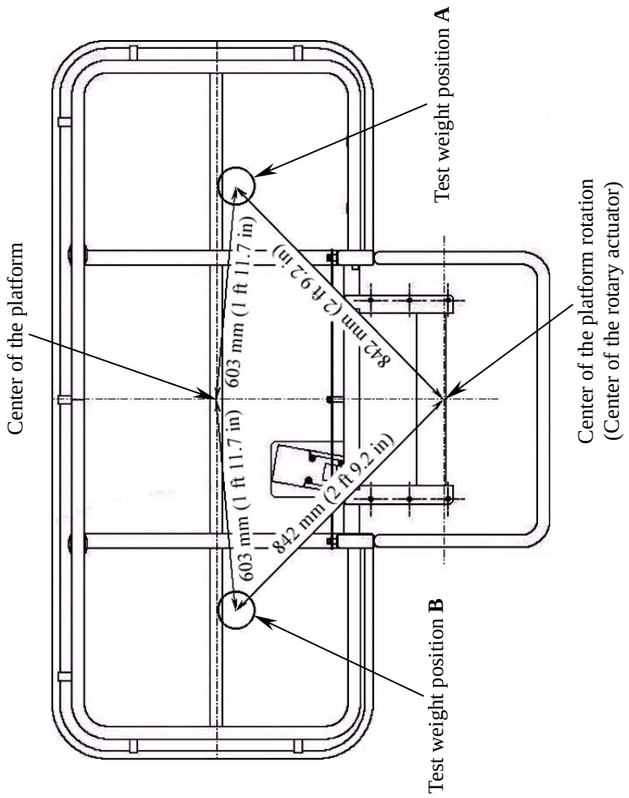


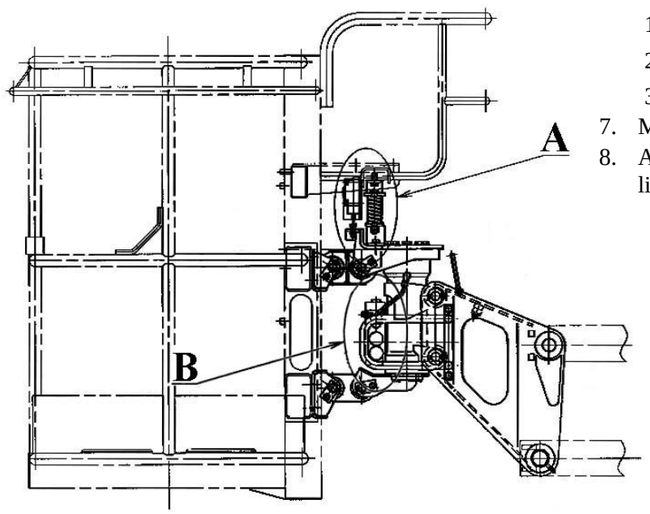


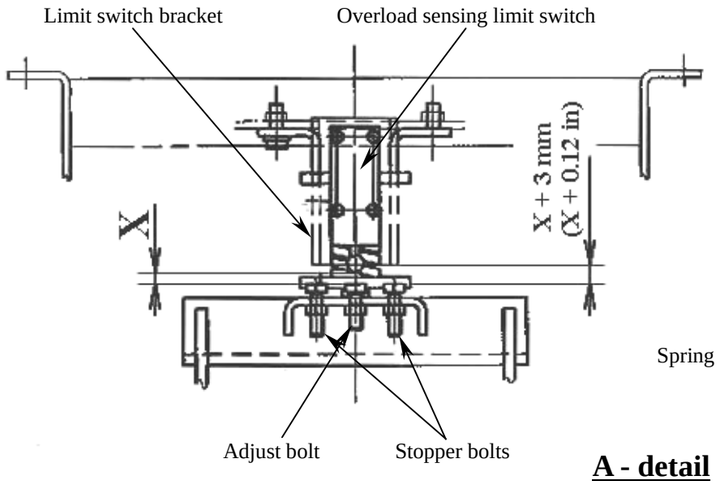


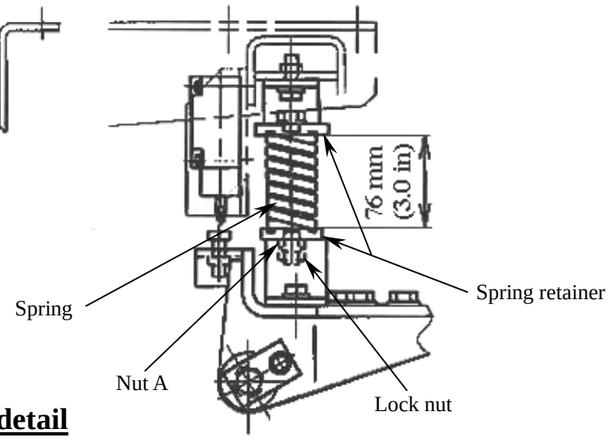
B - detail

Platform (Adjustment of Overload sensing limit switch) (CE model: SR18AJ and SR21AJ









A - detail

Adjustment procedures of Overload sensing limit switch

1. Adjust the dimension between the 2 Spring retainers to 76 mm (3.0 in) by tightening the Nut A, and then lock the lock nut.
2. Load the platform with the weight of 240 kg (530 lbs) at the Test weight position **A**, and then shake the platform several times.
3. Move the weight to the Test weight position **B**, and then shake the platform several times.
4. Perform the above steps 2 ~ 3 several times to settle the spring and the linkages.
5. Load the platform with the weight of 240 kg (530 lbs) at the Test weight position **A**, and then turn the Adjust bolt so that the limit switch is switched on.
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   If the limit switch does not switch on, perform the followings.
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   2) Move the test weight to the Test weight position **A** again, and then make sure that the limit switch switches on.
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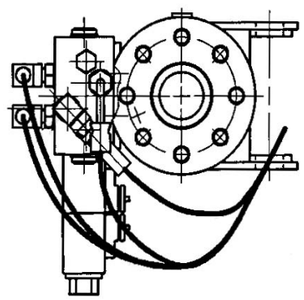
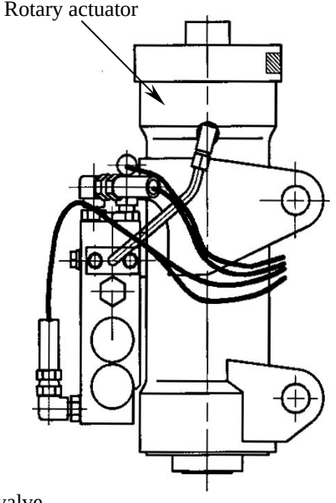
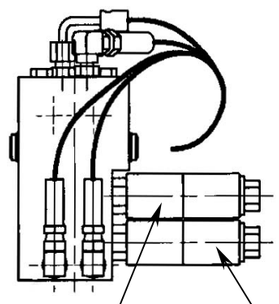
7. Measure the clearance "**X**" between the Roller of the overload sensing limit switch and the Adjust bolt.
8. Adjust the clearance between the limit switch bracket and the stopper bolts to X + 3 mm (X + 0.12 in) to prevent the limit switch from breakage that is caused by overloading.







B - detail

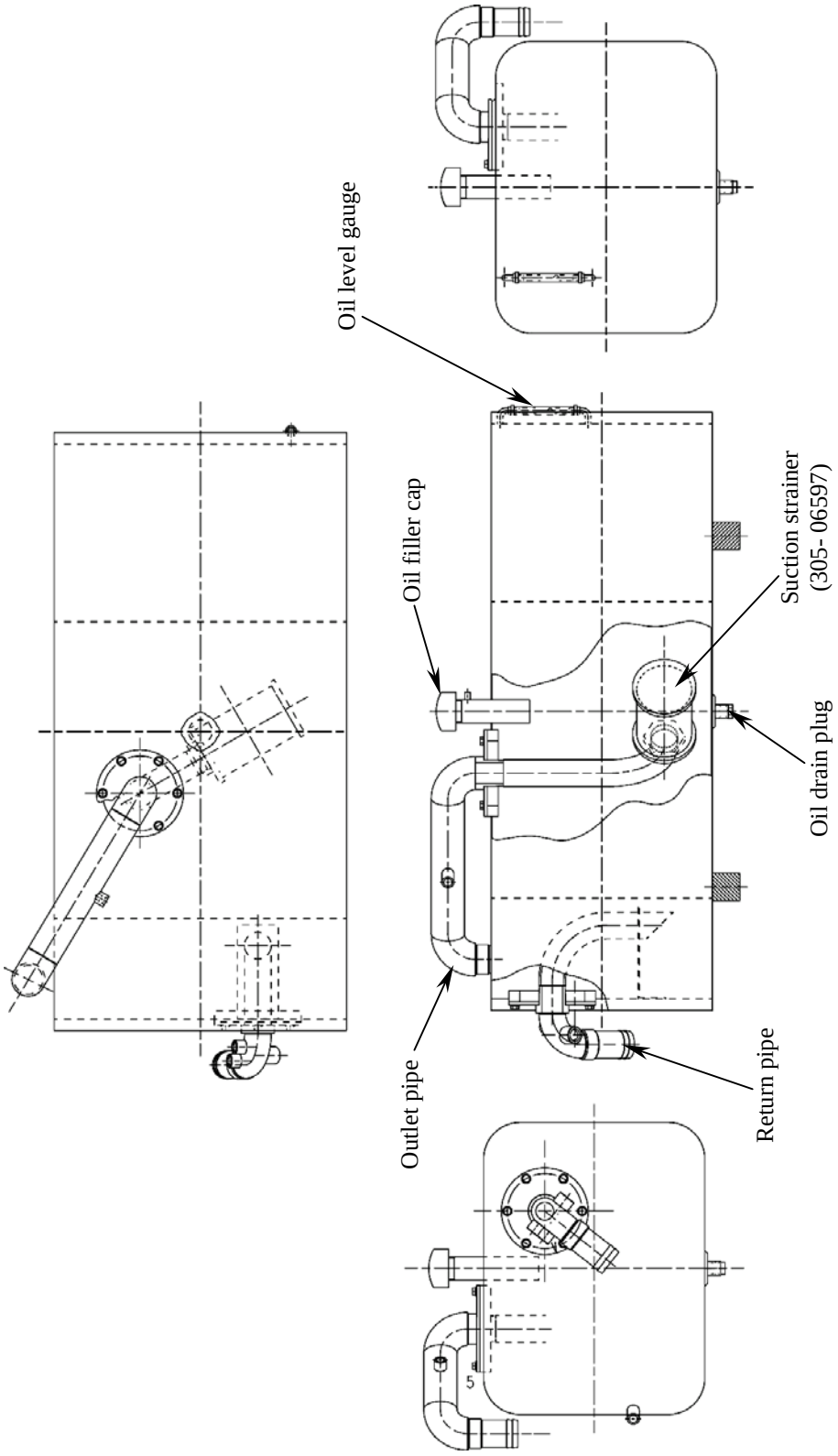
3. Hydraulic section

Oil reservoir

Oil capacity	200 liters (52.8 gallons)
Recommended oil	Shell Tellus oil T22
Oil change interval	Every 1,200 hours or annually

Note:

- For a new machine, the first oil change should be performed after 300 hours or 3 months of use.
- Clean the suction strainer and replace the High- pressure line filters when changing the hydraulic oil.
- When checking the oil level, retract the boom fully and lower it fully.



Filter

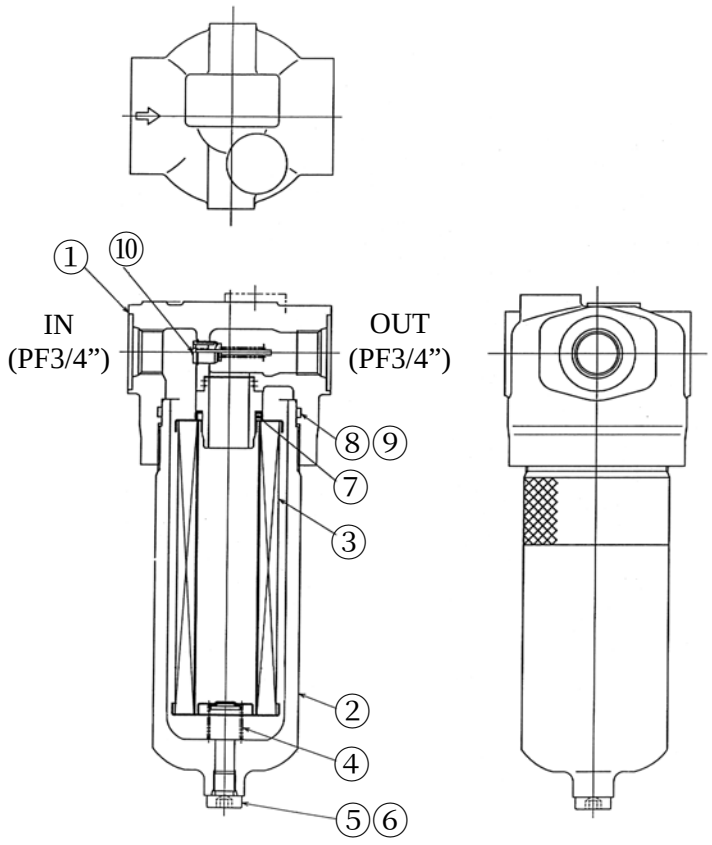
High-pressure filter (305-0000025)

Two high- pressure line filters shown below are installed in the output lines of the main hydraulic pump to eliminate contaminations contained in the oil.
It is advisable to replace the filter element every 1,200 working hours or annually.

NOTE:

- For a new machine, the first replacement of the element should be carried out in 300 working hours or 3 months of use.
- Do not reuse the O- rings and the back- up rings when once removed.

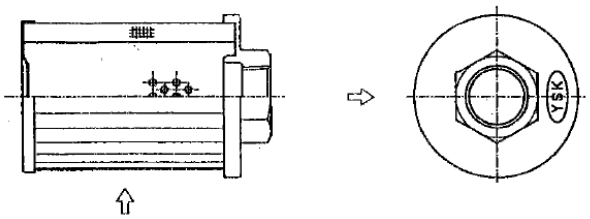
Rated pressure	320 kg/cm^2 (4,550 PSI)
Rated flow	100 liters/min (26.4 GPM)
Filtration accuracy	10 micron
By- pass valve cracking pressure	3.6 kg/cm^2 (50 PSI)



1	Filter head
2	Filter case
3	Filter element
4	Spring
5	Drain plug
6	O- ring (P- 11)
7	O- ring (P- 32)
8	O- ring (G- 80)
9	Back- up ring
10	By- pass valve

Suction filter (305-06597)

Rated flow volume	200 litters/min [52.8gal/min]
Filtration accuracy	105 microns
Replacement interval	Every 1,200 working hours or annually

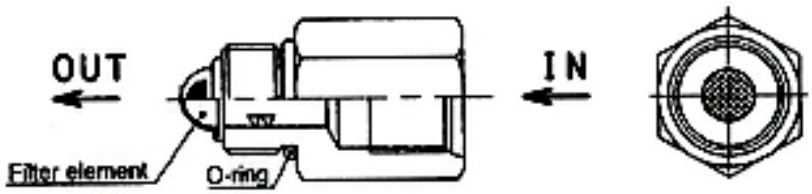


Adaptor filter

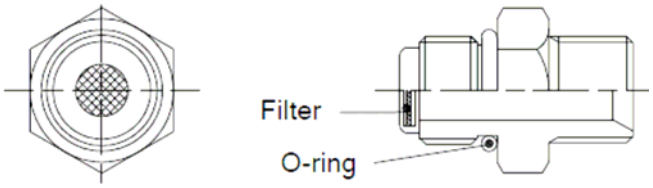
305- 00000- 04 305- 00000- 51 305- 00000- 64
305- 00000- 69 305- 00000- 27 305- 00000- 56
305- 00000- 58 305- 00000- 65 305- 00000- 67

This Adaptor filters are installed at the A1, B1, A2, B2, A3, B3 and P port of the main control valve to eliminate contaminations contained in the oil.

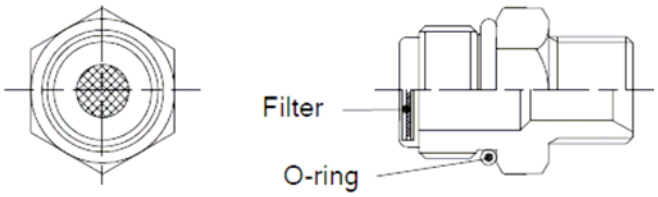
Part number	305-00000-04		
Port	P	Rated pressure	17.2 MPa (175 kg/cm^2) [2,500 PSI]
Mesh size	100 mesh	Rated flow	100 liters/min. (26.4 GPM)



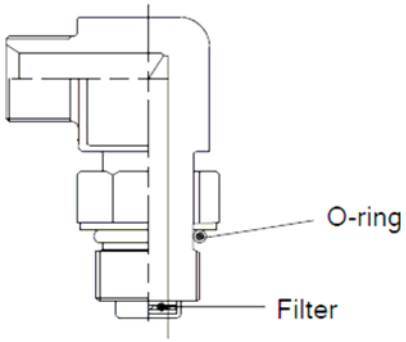
Part number	305-00000-51		
Port	A2, B2, A3 and B3	Rated pressure	20.6 MPa (210 kg/cm^2) [3,000 PSI]
Mesh size	100 mesh	Rated flow	60 liters/min. (15.9 GPM)



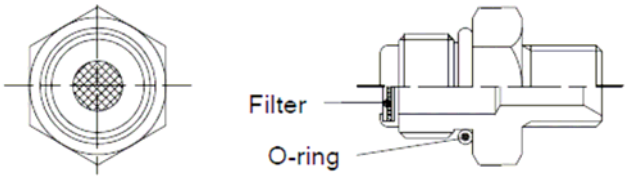
Part number	305-00000-64		
Port	B4	Rated pressure	20.6 MPa (210 kg/cm^2) [3,000 PSI]
Mesh size	100 mesh	Rated flow	40 liters/min. (10.6 GPM)



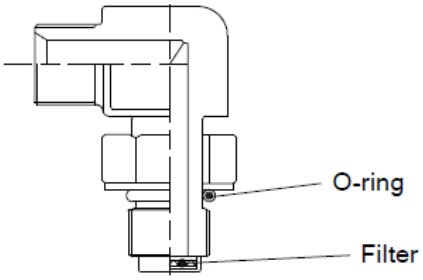
Part number	305-00000-69		
Port	A4	Rated pressure	20.6 MPa (210 kg/cm^2) [3,000 PSI]
Mesh size	100 mesh	Rated flow	40 liters/min. (10.6 GPM)

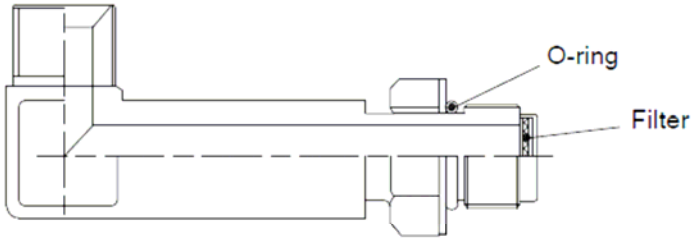


Part number	305-00000-27		
Port	A1 and A5	Rated pressure	20.6 MPa (210 kg/cm^2) [3,000 PSI]
Mesh size	100 mesh	Rated flow	30 liters/min. (7.9 GPM)

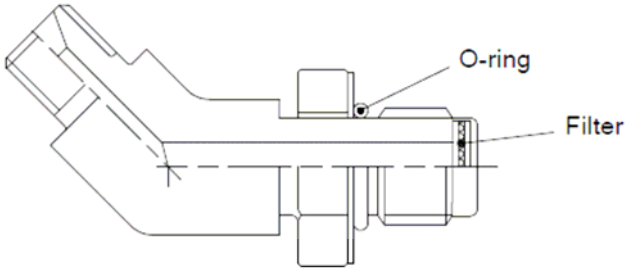


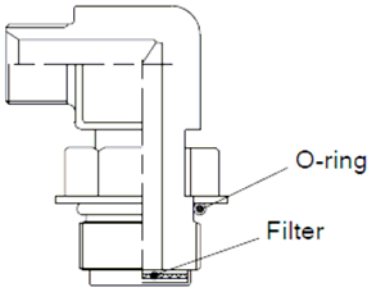
Part number	305-00000-56	305-00000-58
Port	A1 and A5	B1 and B5
Mesh size	100 mesh	100 mesh
Rated pressure	20.6 MPa (210 kg/cm^2) [3,000 PSI]	20.6 MPa (210 kg/cm^2) [3,000 PSI]
Rated flow	60 liters/min. (15.9 GPM)	60 liters/min. (15.9 GPM)





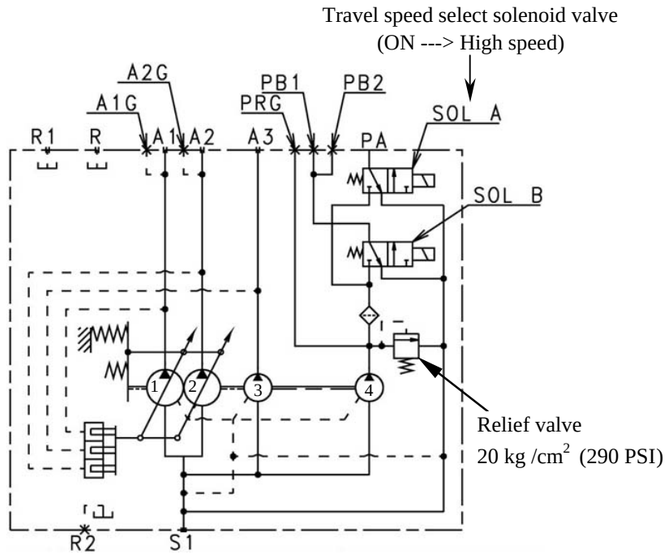
Part number	305-00000-65	305-00000-67
Port	B5	B1
Mesh size	100 mesh	100 mesh
Rated pressure	20.6 MPa (210 kg/cm^2) [3,000 PSI]	20.6 MPa (210 kg/cm^2) [3,000 PSI]
Rated flow	15 liters/min. (4.0 GPM)	15 liters/min. (4.0 GPM)

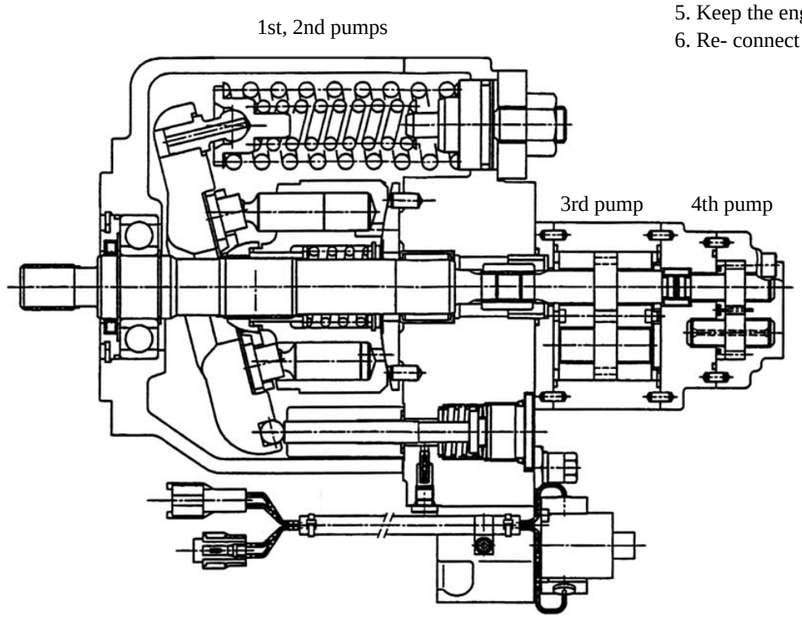




Hydraulic pump

	Type	Displacement	Rated pressure
1st pump	Plunger type	34.0 cc / rev (2.07 in ^{3}/ rev)	320 kg / cm^2 (4,550 PSI)
2nd pump	Plunger type	34.0 cc / rev (2.07 in ^{3}/ rev)	320 kg / cm^2 (4,550 PSI)
3rd pump	Gear type	8.6 cc / rev (0.52 in ^{3}/rev)	140 kg / cm^2 (1,990 PSI)
4th pump	Gear type	3.8 cc / rev (0.23 in ^{3}/ rev)	20 kg / cm^2 (285 PSI)

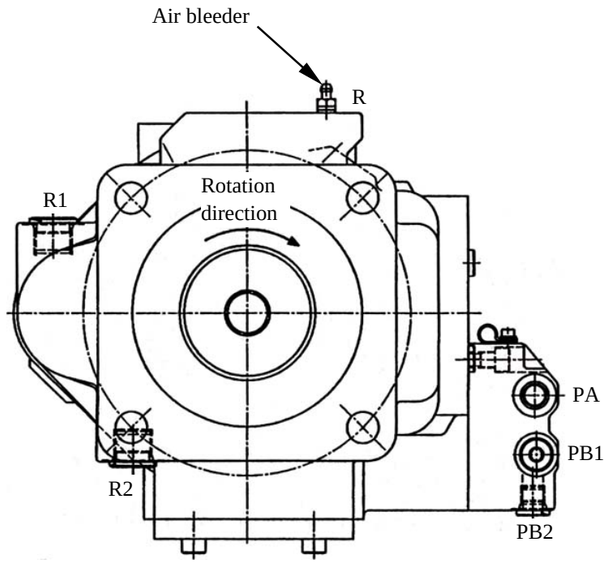


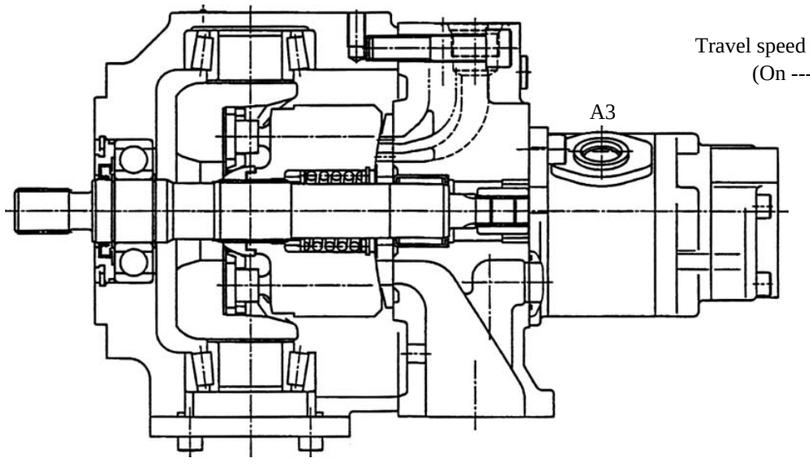


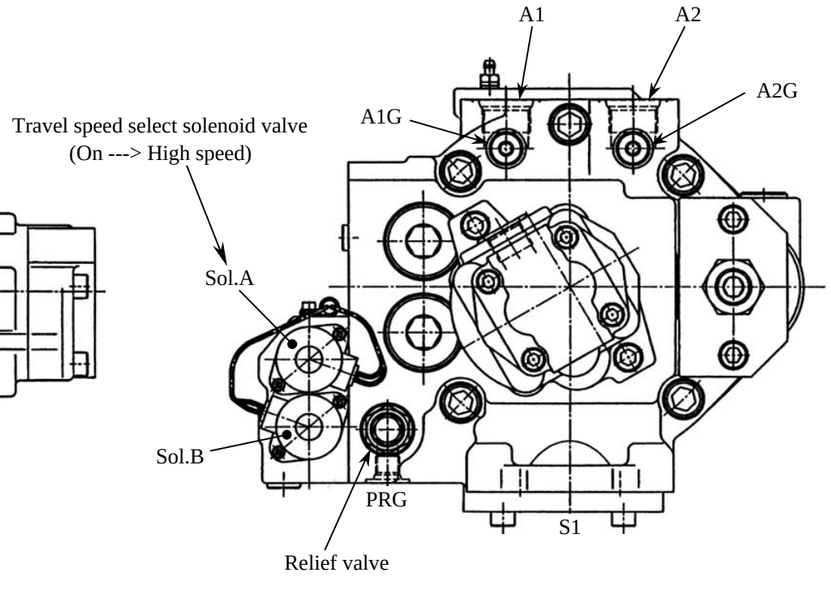
Air bleeding procedures

Bleed air from the hydraulic system after replacing the hydraulic pump as follows.
1. Bleed air by using air bleeder (R- port) before starting the engine.
2. Start the engine, and then keep it running at idling speed with no load for 2 ~ 3 minutes.
3. Disconnect the connector CT1 on the Main CPU box (M2D) Slave.
   * See the page 7- 12 for the rocation of the Main CPU box (M2D) Slave.
   * See the page 4- 7 for location of the connector CT1
4. Operate each function more than 3 times.
5. Keep the engine running at idling speed with no load for 5 minutes.
6. Re- connect the connector CT1.

Symbol	Descriptions	Port size (in)
S1	Suction port	2 1/2
A1, A2	Discharge port	3/4
A3	Discharge port	1/2
A1G, A2G	Gauge port	1/4 (Pluged)
PA	Pilot port	1/4
PB1, PB2	Pilot port	1/4 (Pluged)
PRG	Pilot port	1/4
R	Air bleed port	M10
R1, R2	Drain port	1/2 (Pluged)







Emergency pump

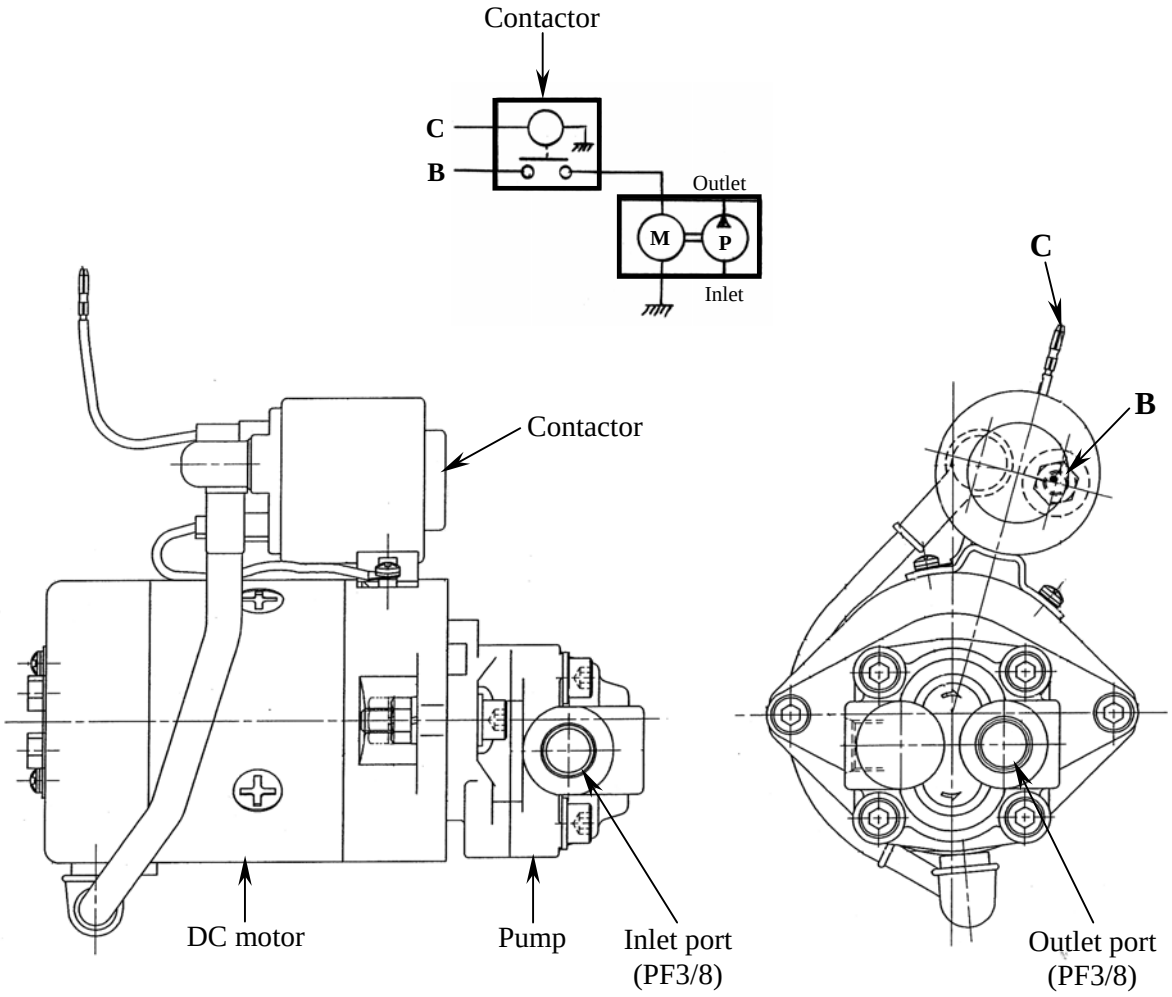
The emergency pump consists of the DC motor and the hydraulic pump, and driven by the chassis battery.

DC motor ---------- DC24V / 1.4 kw

Hydraulic pump

Rated pressure ------- 17.2 Mpa (2,990 PSI)

Displacement -------- 1.7 cc/rev (0.1 in^3/rev)



Caution:

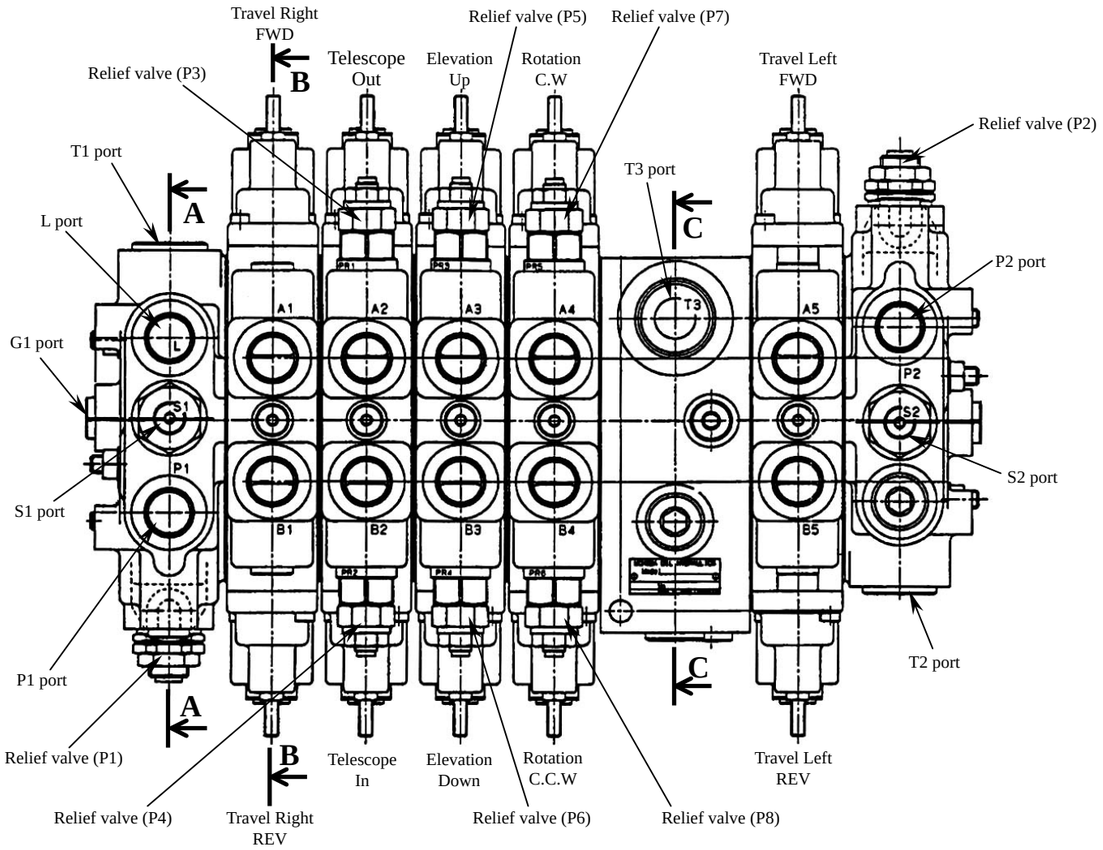
Do not run the emergency pump for more than 30 seconds continuously. The continuous operation may cause burnt-out DC motor.

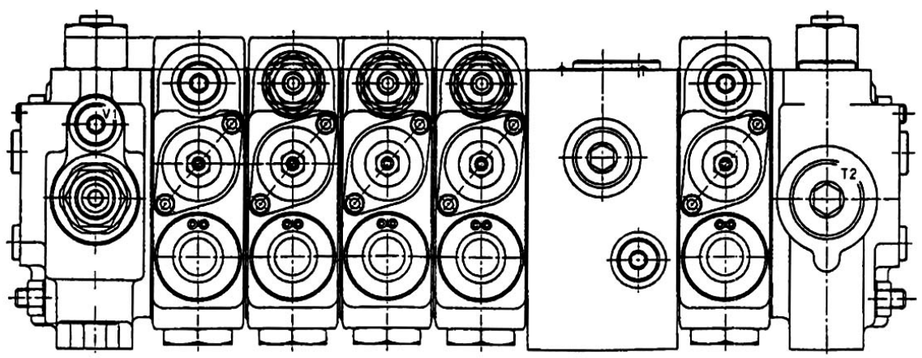
Main control valve

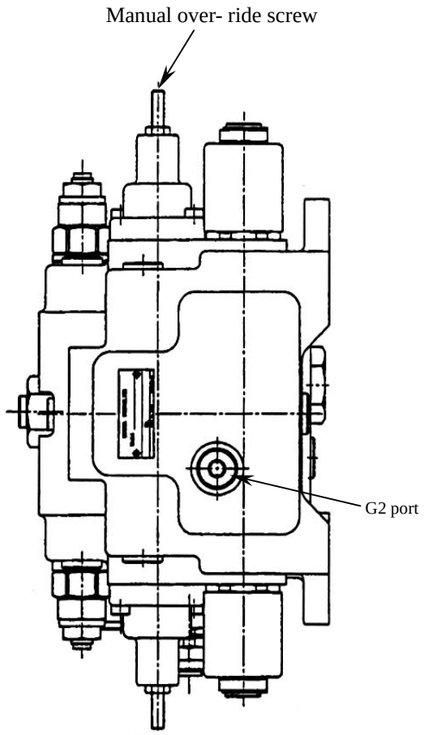
The main control valve proportionally controls the Boom elevation, Boom telescope, Boom rotation and traveling functions

Rated pressure		320 kg/cm^2 (4,550 PSI)
Rated flow		100 + 100 liters/min (26.4 + 26.4 GPM)
Relief valve preset pressure	P1, P2	320 kg/cm^2 (4,550 PSI)
	P3	90 kg/cm^2 (1,280 PSI)
	P4, P5, P7, P8	210 kg/cm^2 (2,990 PSI)
	P6	75 kg/cm^2 (1,070 PSI)

Solenoid	Rated voltage	DC24 volts
	Rated current	800 mA
	Coil resistance	15.6 ohms (at 20^{o}C)



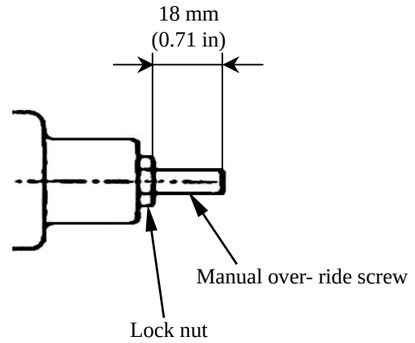


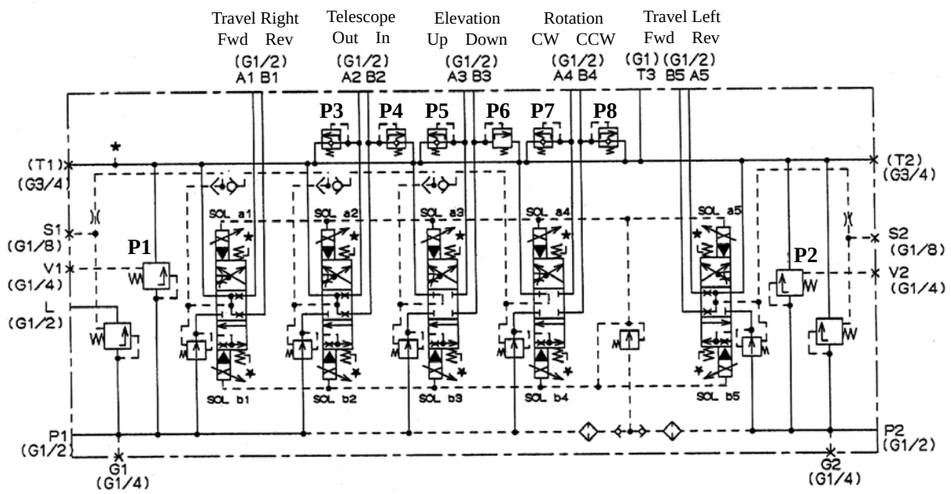


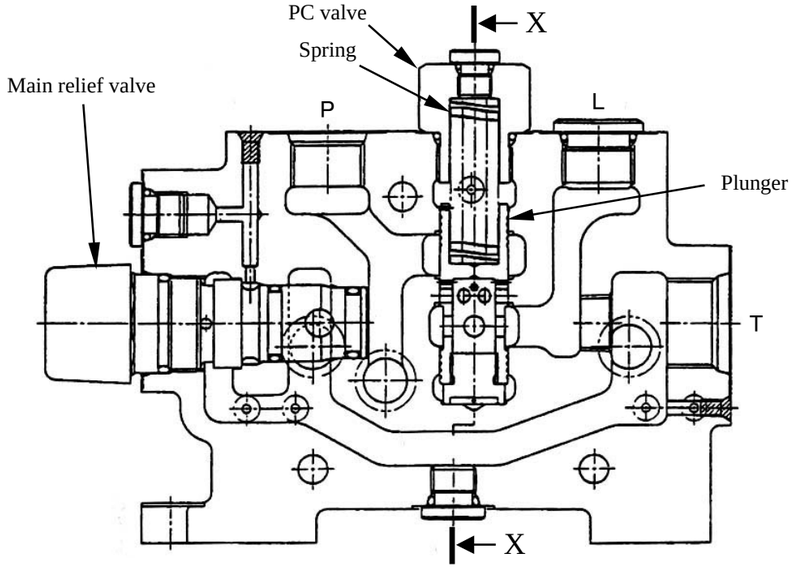
Manual over- ride screw

Operate the boom function manually as follows in case of emergency.

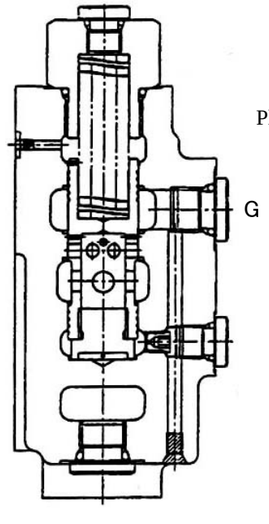
1. Loosen the lock nut.
2. Screw in the manual over- ride screw until the boom begins to move slowly.
3. Screw out the manual over - ride screw to stop the movement of the boom.
4. Set the screw length to 18 mm (0.71 in) after using the manual over- ride screw.
5. Tighten the lock nut.



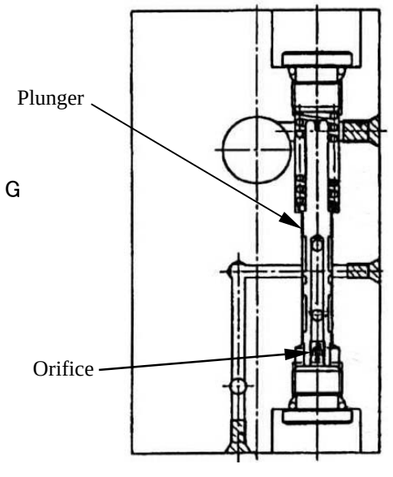




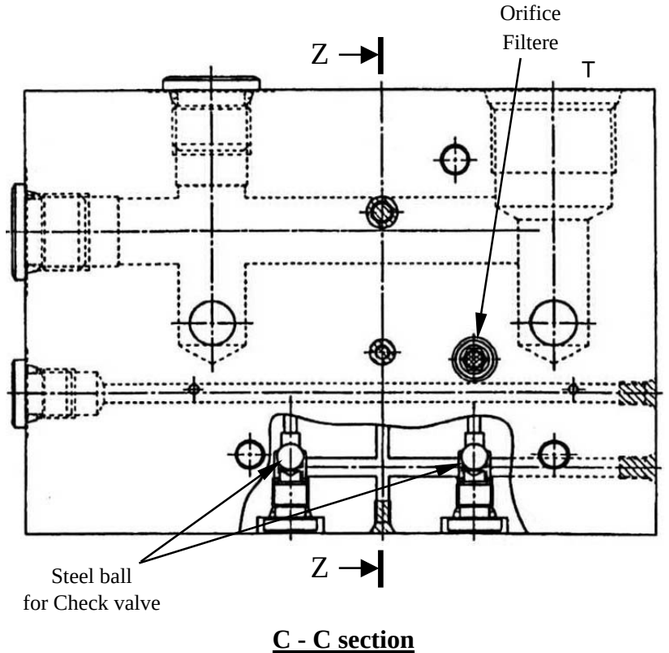
A - A section



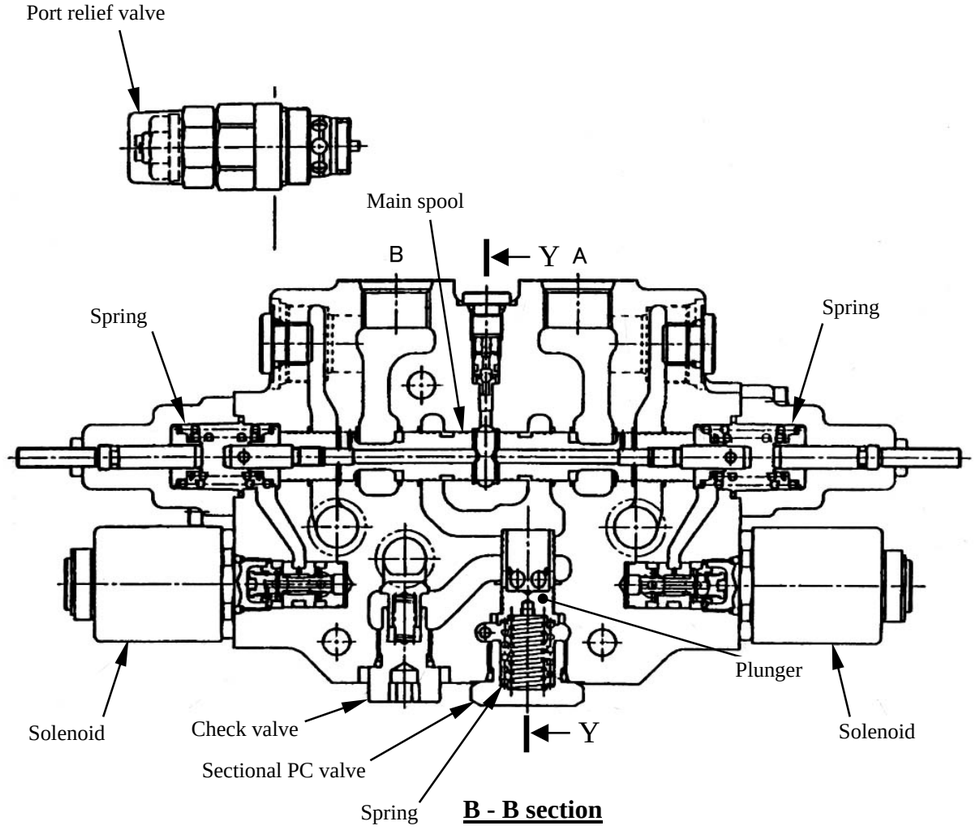
X - X section



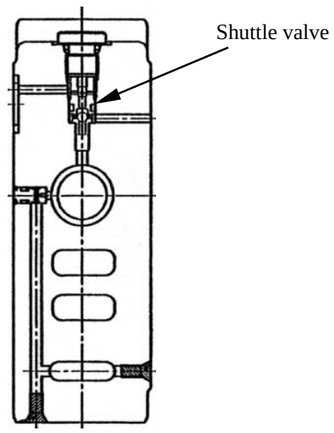
Z - Z section



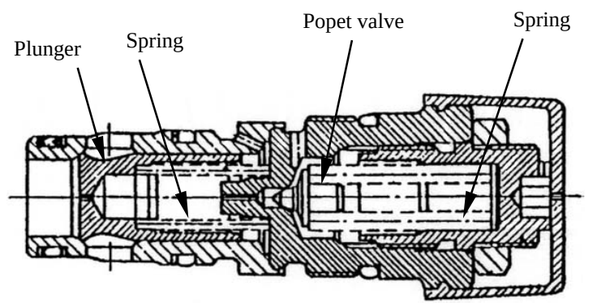
C - C section



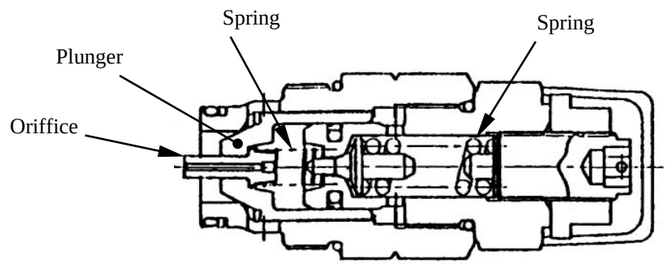
B - B section



Y - Y section



Main relief valves (P1, P2)

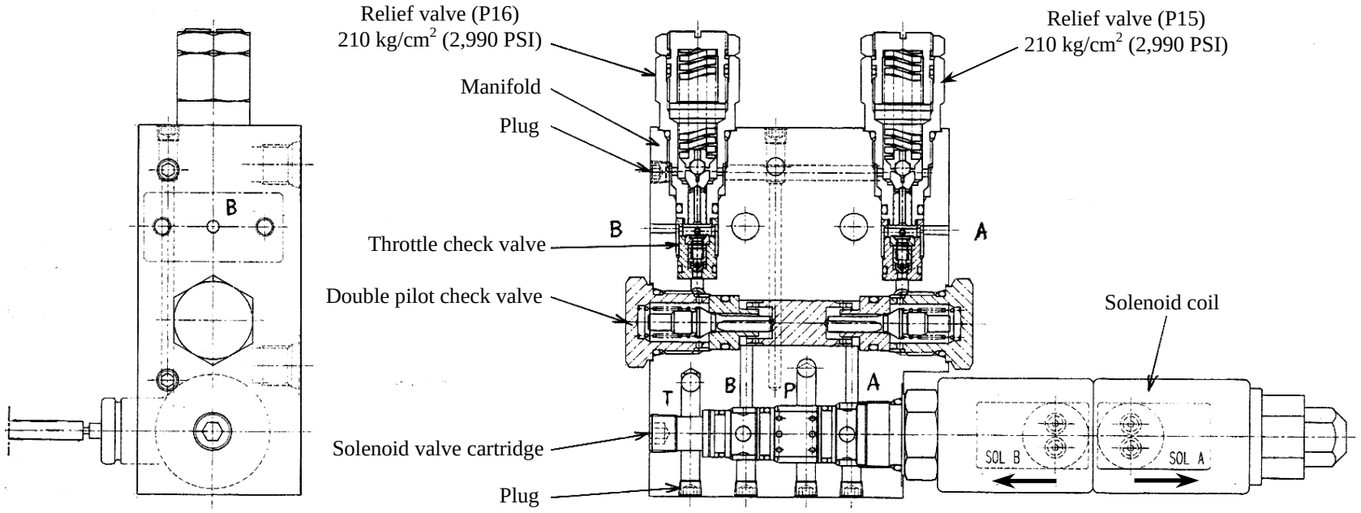


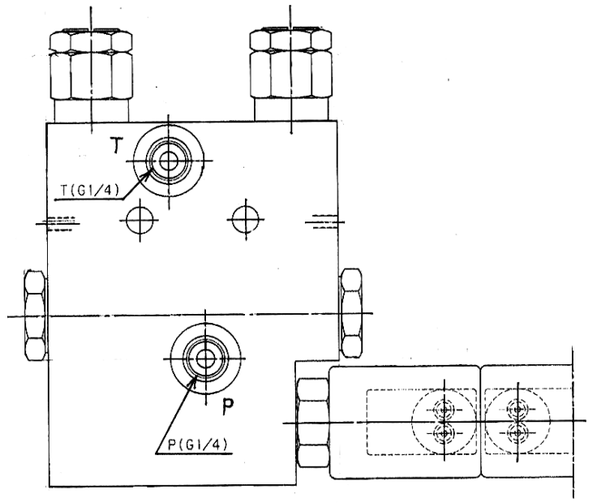
Port relief valves (P3 ~ P8)

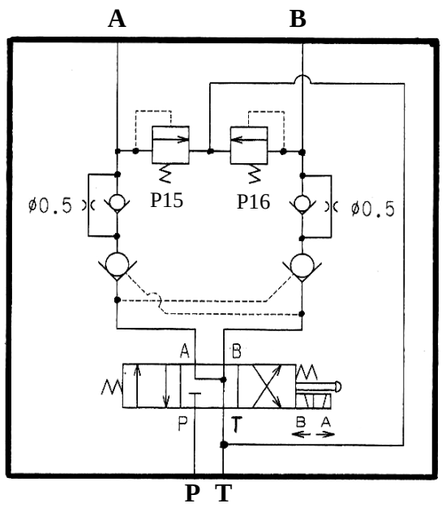
Platform rotation solenoid valve (302- 00153- 00D)

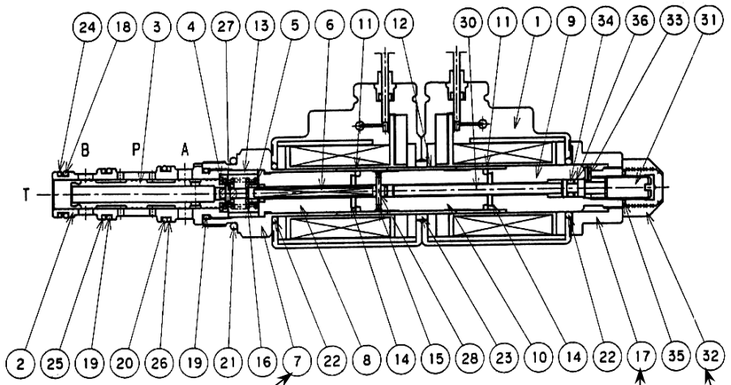
For the machine without Fly- jib

This valve is mounted on the Rotary actuator for Platform rotation to control the platform rotation functions.







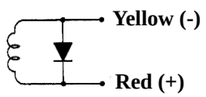


Solenoid valve

4.2 ~ 4.4 kg- m (30 ~ 32 ft- lbs)

0.5 ~ 0.6 kg- m (3.6 ~ 4.4 ft- lbs)

0.41 ~ 0.51 kg- m (3.0 ~ 3.7 ft- lbs)



Solenoid coil

Solenoid valve installation procedures

Follow the instructions below to install the Solenoid valve onto the manifold.

1. Insert the “Solenoid valve cartridge” (7) into the manifold, and then tighten the cartridge by the tightening torque of 4.2 ~ 4.4 kg- m (30 ~ 32 ft- lbs).
2. Install the 2 pieces of the “Solenoids coils” (1) onto the valve cartridge, and then tighten the “Nut” (17) by the tightening torque of 0.41 ~ 0.51 kg-m (3.0 ~ 3.7 ft- lbs).
3. Turn the “Adjust screw” (31) counter-clockwise to screw it out fully.
4. Install the “Cap nut” (32), and tighten it by the tightening torque of 0.5 ~ 0.6 kg- m (3.6 ~ 4.4 ft- lbs).

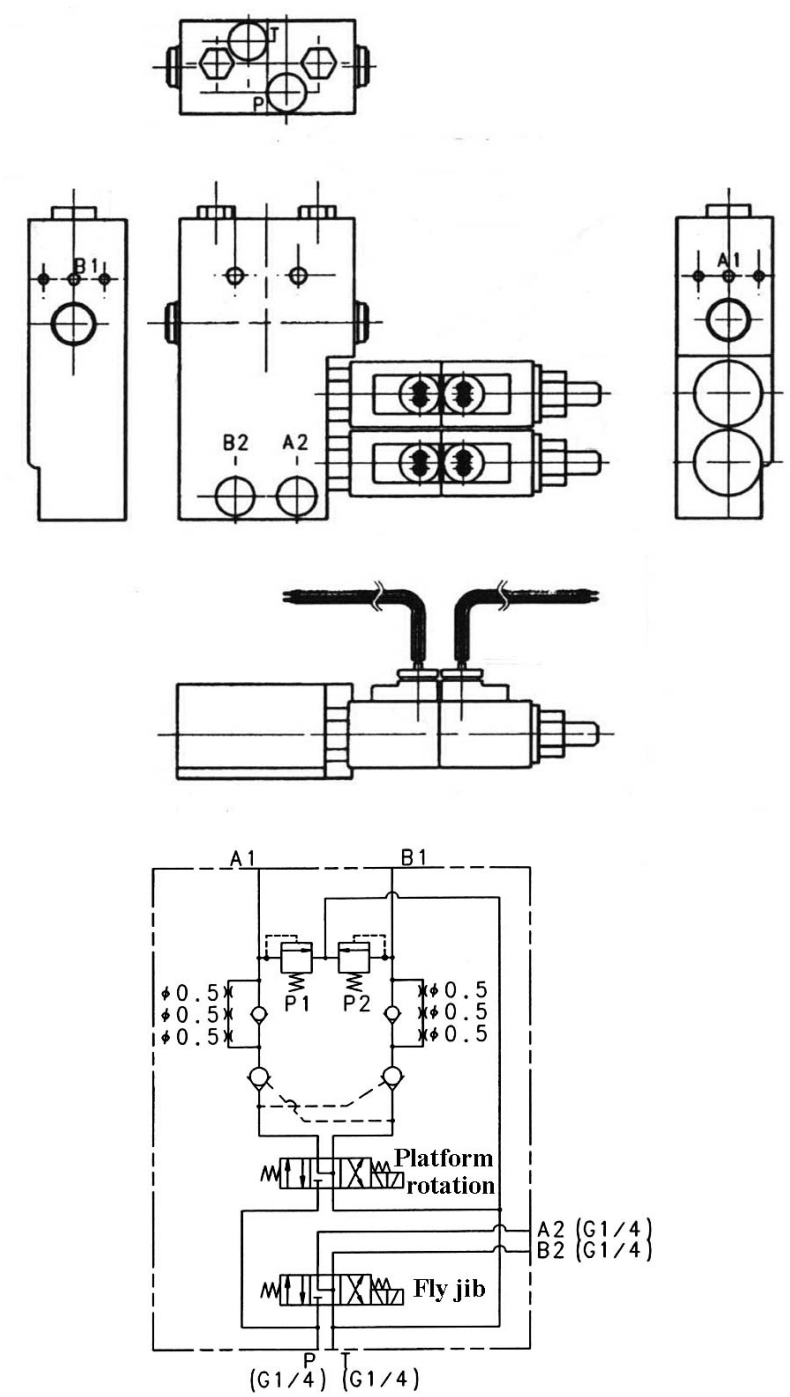
   Caution: Do not allow the “Adjust screw” (31) to be turned when tightening the “Cap nut” (32).

Platform rotation/Fly- jib solenoid valve (302- 00152- 00B)

For the machine with Fly-jib

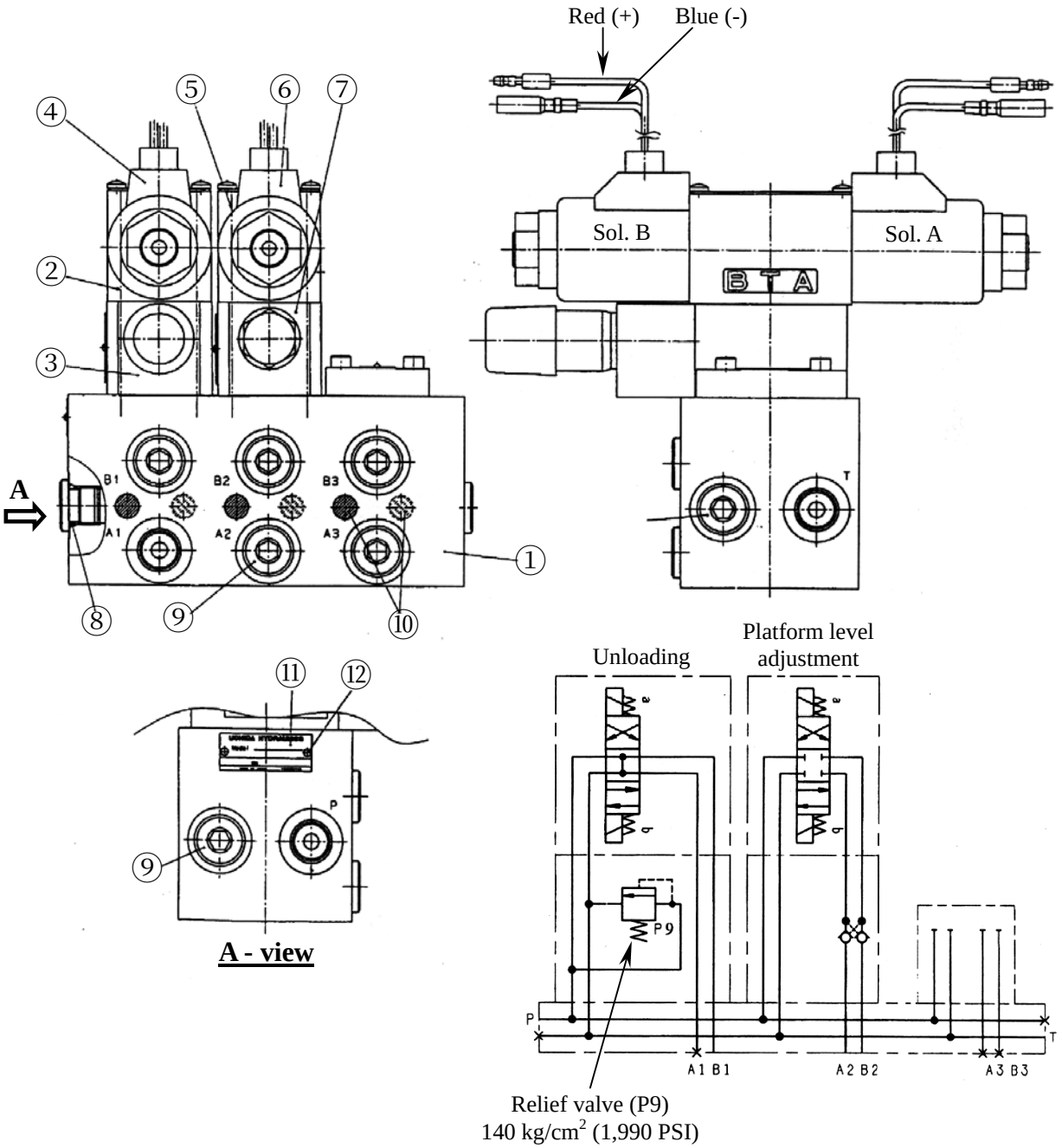
This solenoid valve is mounted on the Rotary actuator for Platform rotation to control the platform rotation and Fly- jib articulation functions.

Rated voltage		DC24V
Relief valve preset pressure	P15	210 kg/cm^2 (2,990 PSI)
	P16	210 kg/cm^2 (2,990 PSI)
Cracking pressure of Double pilot check valve		1.1 kg/cm^2 (16 PSI)



Unit valve

This unit valve is installed on the turntable to control the Platform rotation and Platform level adjustment functions.

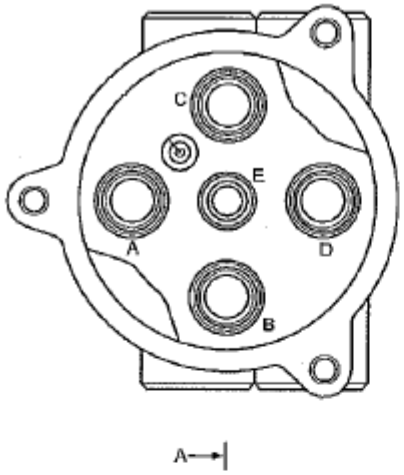


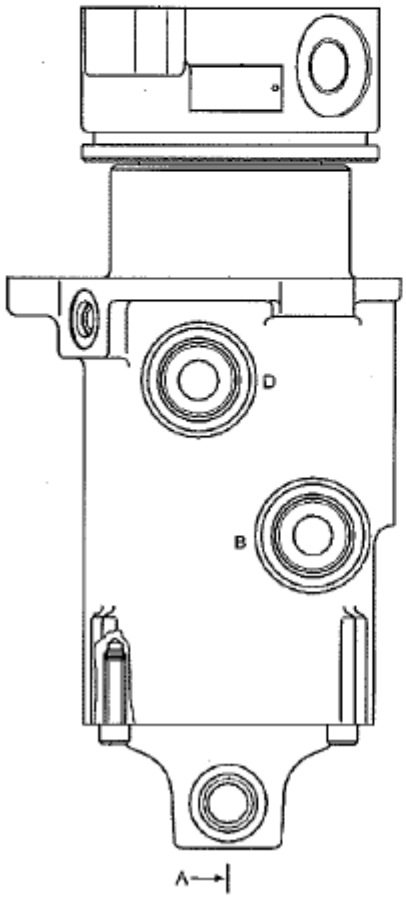
1	Manifold	7	Double pilot check valve
2	Cap bolt (M5 x 90)	8	O- ring
3	Relief valve (P9)	9	Plug (3/8)
4	Solenoid valve (Unloading)	10	Plug (M8)
5	Cap bolt (M5 x 90)	11	Serial number plate
6	Solenoid valve (Platform level adjustment)	12	Rivet

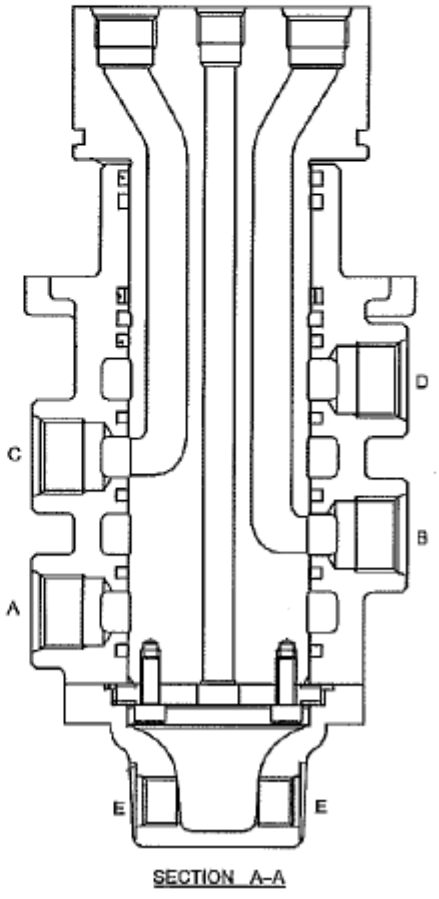
Swivel joint

The swivel joint is installed at the rotation center of the turntable to provide the hydraulic oil passages between the turntable and chassis.

Rated pressure	A, B, C, D, F and G ports	350 kg/cm^2 (4,980 PSI)
	E port	210 kg/cm^2 (2,990 PSI)
	Dr port	2 kg/cm^2 (28 PSI)
Rated flow	A, B, C, D, F and G ports	150 liters/min (39.6 GPM)
	E port	15 liters/min (3.96 GPM)
	Dr port	18 liters/min (4.76 GPM)

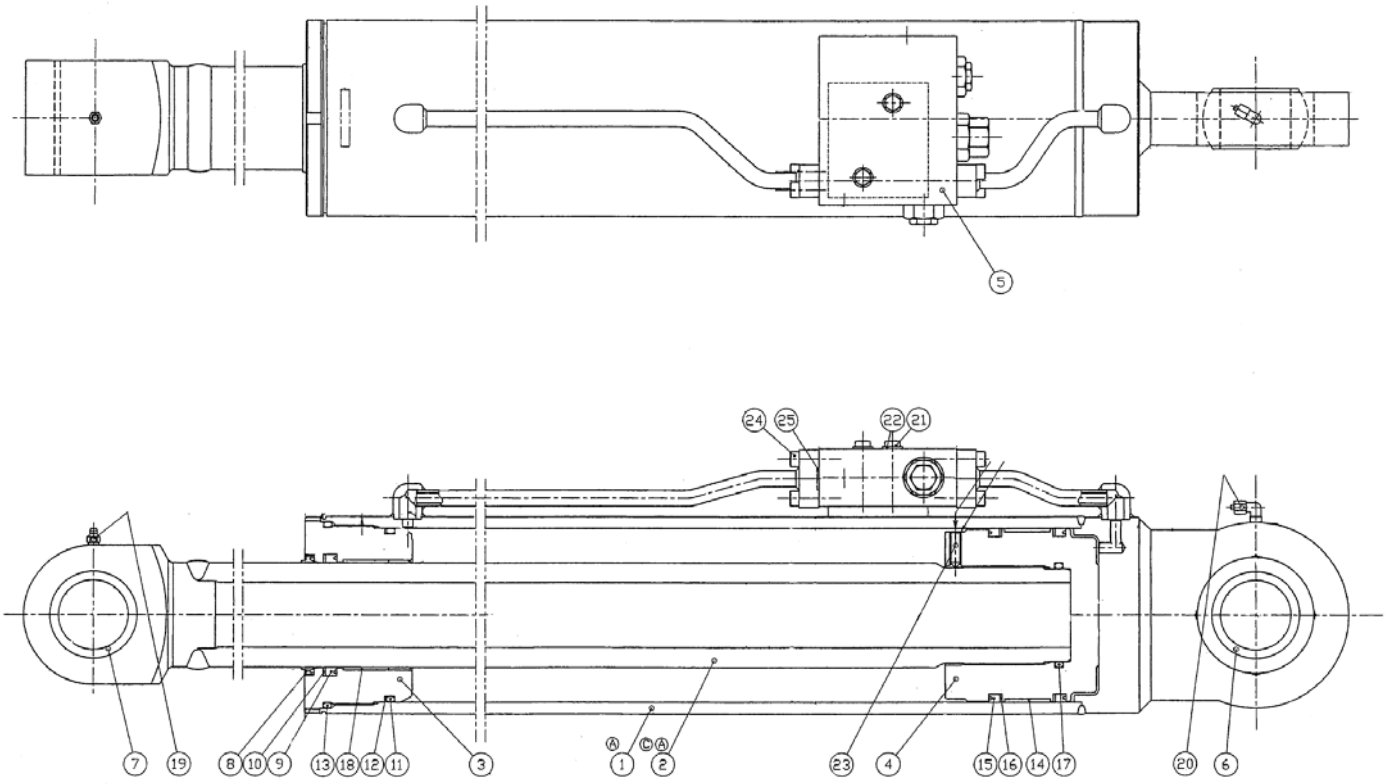




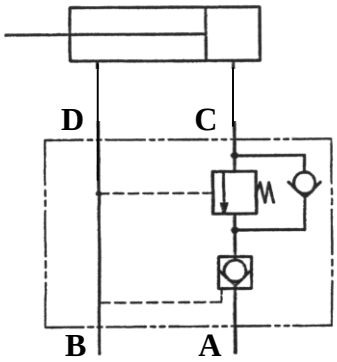


SECTION A-A

Boom elevation cylinder



No.	Description	No.	Description
1	Cylinder tube	13	O-ring
2	Piston rod	14	Wear ring
3	Cylinder head	15	U- ring
4	Piston	16	Backup ring
5	Holding valve	17	O-ring
6	Spherical bearing	18	Bushing
7	Bushing	19	Grease fitting
8	Dust seal	20	Grease fitting
9	U- ring	21	Bolt
10	Backup ring	22	Washer
11	O- ring	23	Screw
12	Backup ring	24	Bolt
25	O-ring		



Hydraulic circuit diagram

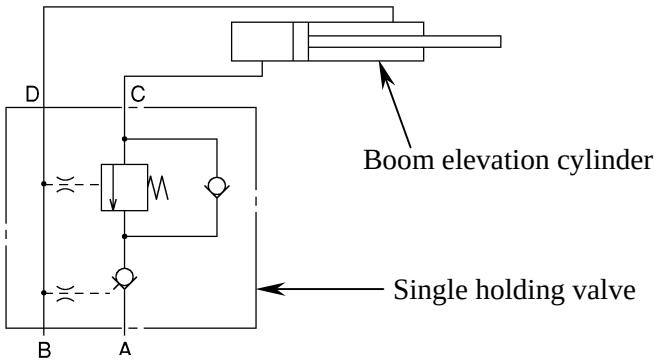
Single holding valve (for Boom elevation cylinder)

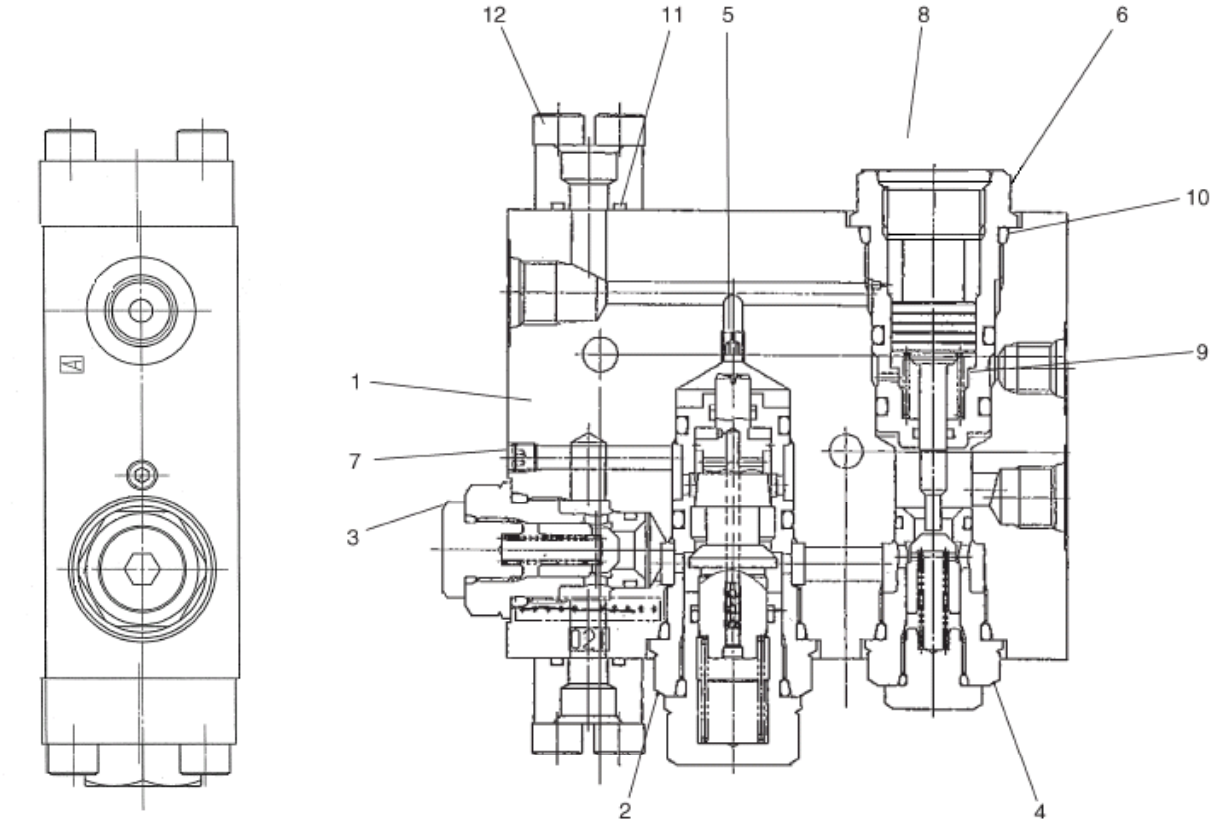
The Single holding valve is mounted on the Boom elevation cylinder to prevent the cylinder from natural retraction.

- Rated pressure ---------- 20.6 MPa (210 kg/cm^2)
- Rated flow ---------- 50 liters/min.

SR18A : 688-033~

SR18AJ,SR21A(J):692-370~





E – E section

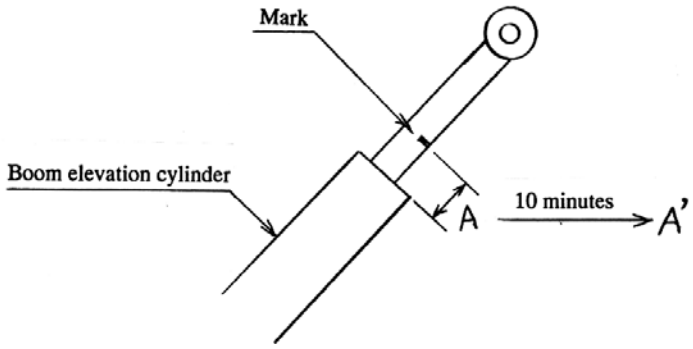
1	Valve body	6	Cap	11	O-ring
2	Holding valve cartridge	7	Plug	12	Bolt
3	Plug	8	-		
4	Pilot check valve cartridge	9	Spring		
5	Orifice	10	O-ring		

1. Inspections

Measure the natural retraction of the boom elevation cylinder as follows to check the internal oil leakage of the single holding valve.

1. Set up the machine on firm and level surface.
2. Raise the boom and set the boom at the boom angle of 45 degrees, and then shut down the engine.
3. Apply the mark on the piston rod of the boom elevation cylinder, and then measure the ***Dimension A*** as shown in the figure below.

   Caution: Do not damage the piston rod when marking.



4. Leave the machine for 10 minutes, then measure the ***Dimension A'***.

   A – A' = Natural retraction

   Serviceable limit of natural retraction ----- 2 mm (0.08 in)/10 minutes.

5. If the natural retraction exceeds the serviceable limit, check the single holding valve and the boom elevation cylinder for internal oil leakage.

   Follow the next procedures to specify which has internal oil leakage (the single holding valve or the boom elevation cylinder).

   1) Support the boom using a crane to prevent the boom from unexpected descent.
   2) Disconnect the hydraulic hose that is connected to the "A port" of the single holding valve.

      Caution: Loosen the hydraulic hose fitting slowly when disconnecting the hydraulic hose.

   3) Lower the hoisting hook of the crane to load the boom elevation cylinder with the gravity of the boom, and then check if hydraulic oil leaks from the single holding valve.

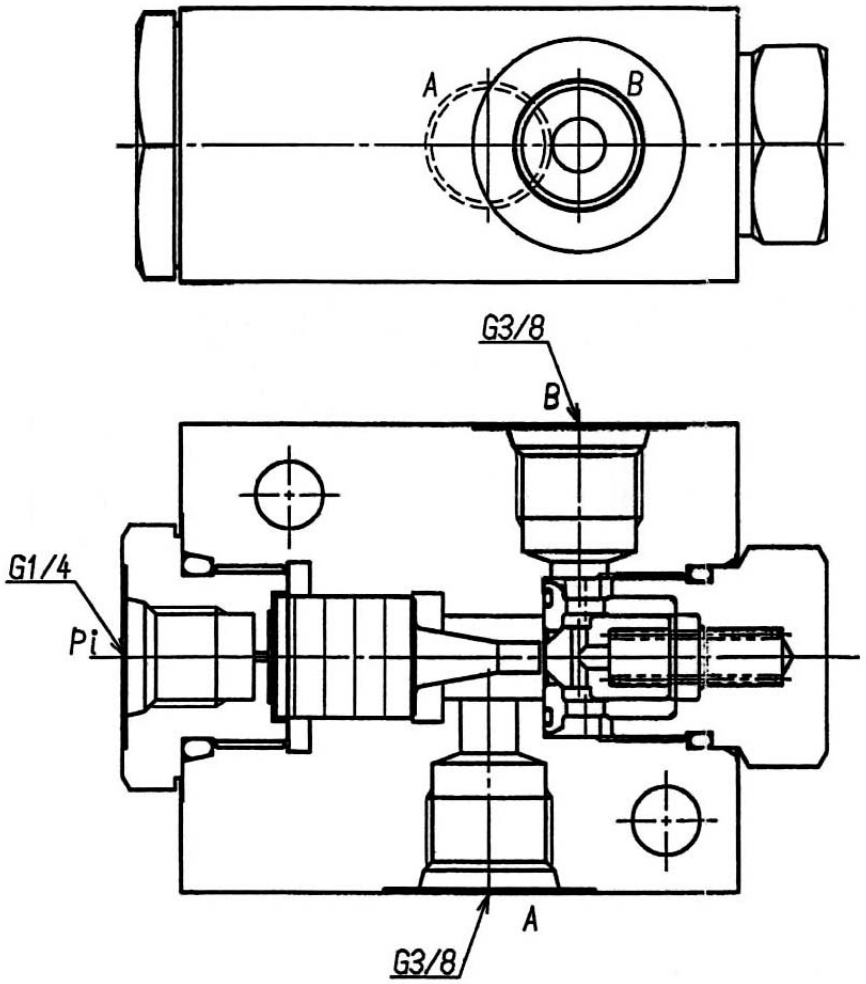
      If the hydraulic oil leaks from the single holding valve, it indicates that the internal oil leakage is in the single holding valve. No oil leakage indicates that the internal oil leakage is in the boom elevation cylinder.

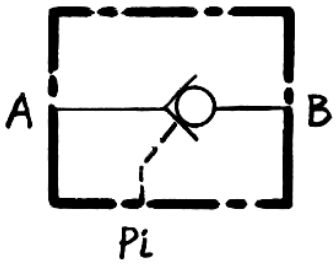
Pilot check valve (for Elevation cylinder)

The single pilot check valve is installed in the hydraulic line of elevation cylinder to prevent the cylinder from natural extension while lifting up the crawler by pressing down the boom for adjustment of tension of the crawler.

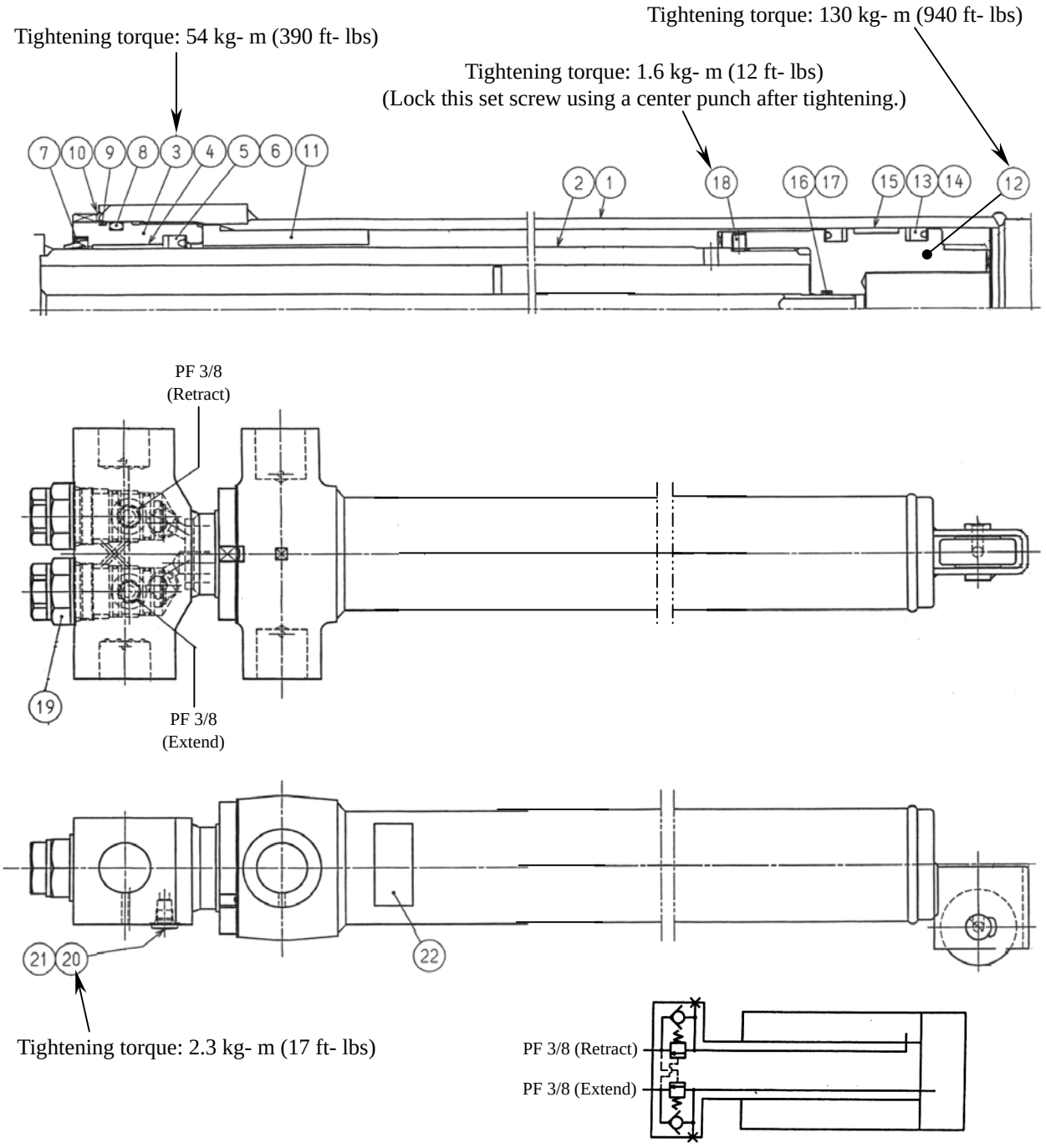
Rated pressure ---------- 250 kg / cm^2 (3,560 PSI)

Rated flow ---------- 30 liters / min (7.9 gallons / min)





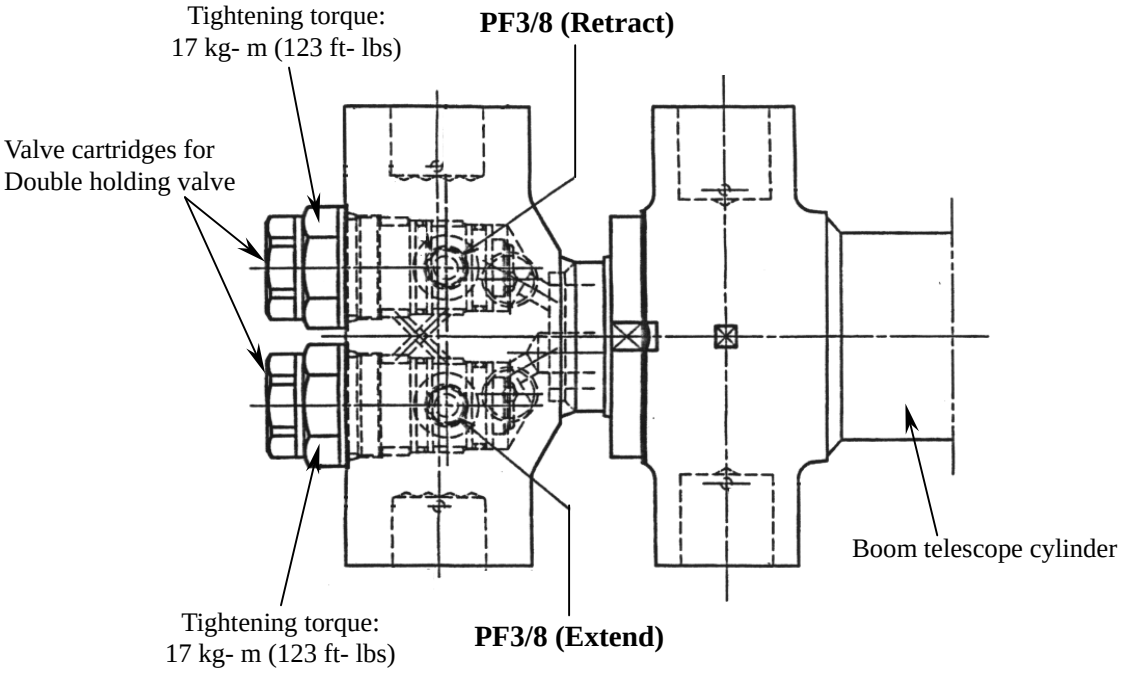
Boom telescope cylinder

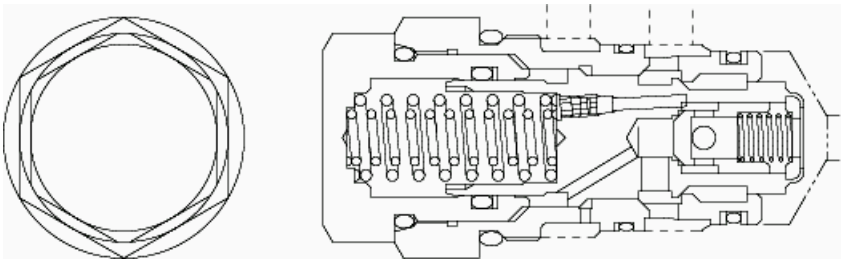


1	Cylinder tube	12	Piston
2	Piston rod	13	U- ring
3	Cylinder head	14	Back- up ring
4	Bushing	15	Wear ring
5	U- ring	16	O- ring
6	Back- up ring	17	Back- up ring
7	Dust seal	18	Set screw
8	O- ring	19	Holding valve cartridge
9	O- ring	20	Plug
10	Lock washer	21	O- ring
11	Spacer	22	Serial number plate

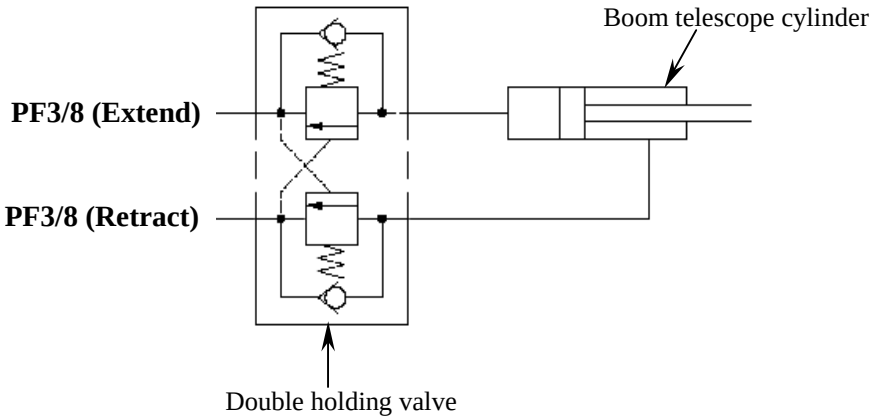
Double holding valve (for Boom telescope cylinder)

The Double holding valve is equipped on the Boom telescope cylinder to prevent the cylinder from natural retraction and extension.





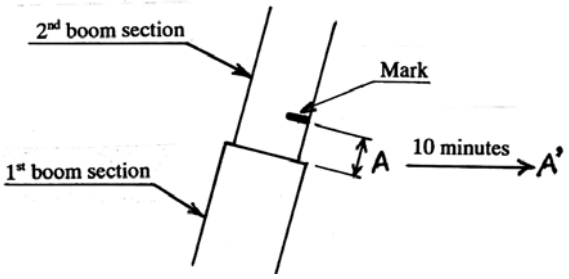
Valve cartridge detail



1. Inspections

Measure the natural retraction and extension of the boom telescope cylinder to check the internal oil leakage of the Double holding valve.

1. Set up the machine on firm and level surface.
2. Raise the boom fully and extend the boom about 1 meter (3 feet), and then shut down the engine.
3. Apply the mark on the 2nd boom section, and then measure the ***Dimension A*** as shown in the figure below.

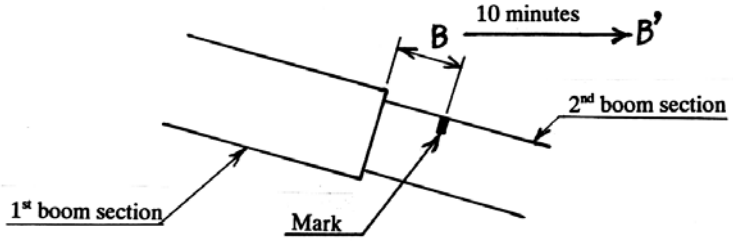


4. Leave the machine for 10 minutes, and then measure the ***Dimension A'***.

   A – A' = Natural retraction

   Serviceable limit of natural retraction ----- 2 mm (0.08 in)/10 minutes.

5. Lower the boom fully, extend it about 0.5 meter (1.5 feet), shut down the engine, and then measure the ***Dimension B*** as shown in the figure below.



6. Leave the machine for 10 minutes, and then measure the ***Dimension B'***.

   B' – B = Natural extension

   Serviceable limit of natural extension ------ 2 mm (0.08 in)/10 minutes.

7. If the natural retraction and/or extension exceed the serviceable limit, check the Double holding valve and the boom telescope cylinder for internal oil leakage.

Follow the next procedures to specify which has internal oil leakage (the Double holding valve or the Boom telescope cylinder).

1) Set the boom as follows.

   * When natural retraction exceeds the serviceable limit:

     Boom angle --- Max. (Fully raised) Boom extended length --- About 1 meter (3 feet)

   * When natural extension exceeds the serviceable limit:

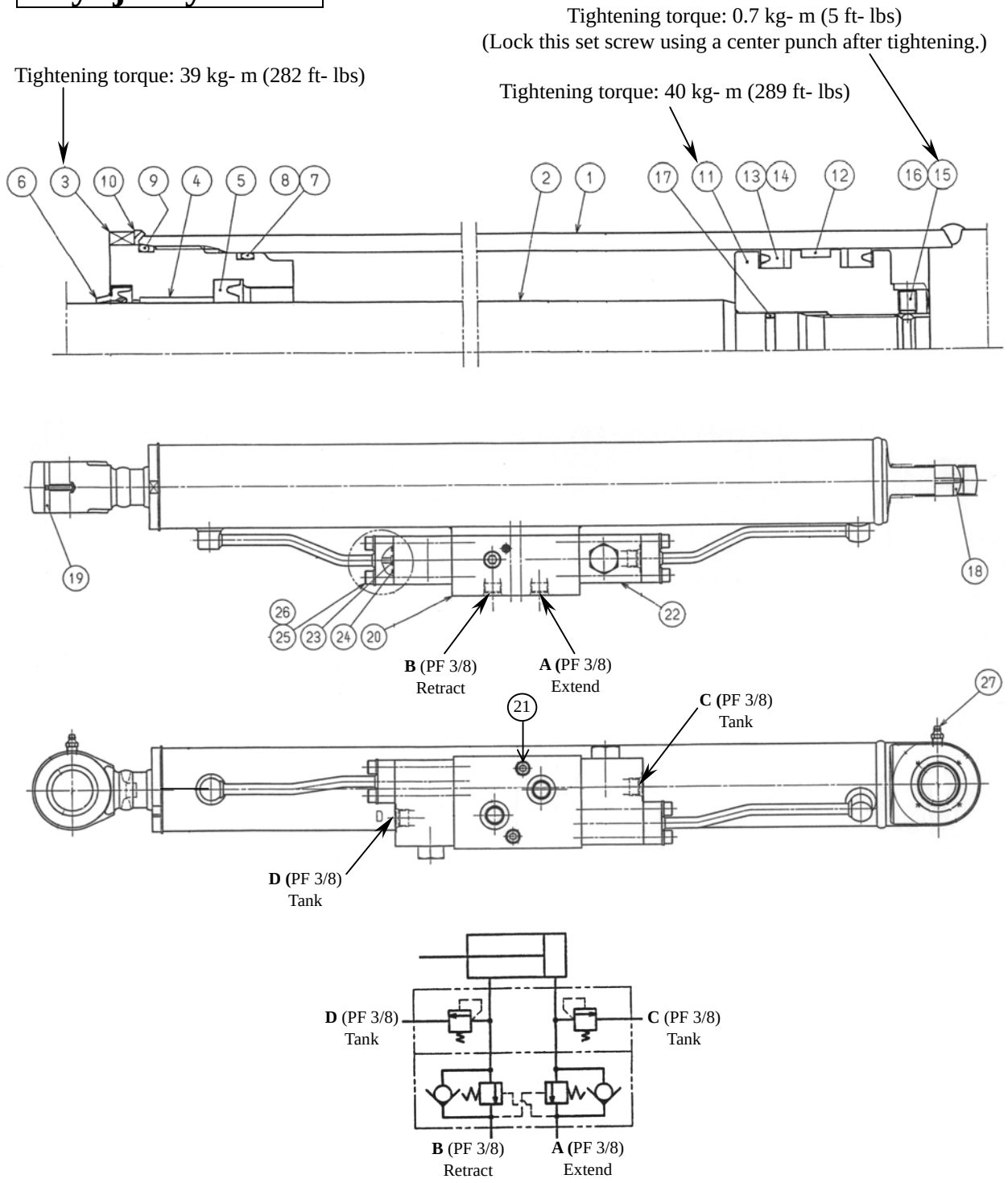
     Boom angle --- Min. (Fully lowered) Boom extended length --- About 0.5 meter (1.5 feet)

2) Disconnect both of the hydraulic hoses that are connected to the boom telescope cylinder, and then check if the hydraulic oil leaks from the boom telescope cylinder.

   Caution: Loosen the hydraulic hose fittings slowly when disconnecting the hydraulic hoses.

   If the hydraulic oil leaks from the boom telescope cylinder, it indicates that the internal oil leakage is in the double holding valve. No oil leakage indicates that the internal oil leakage is in the boom telescope cylinder.

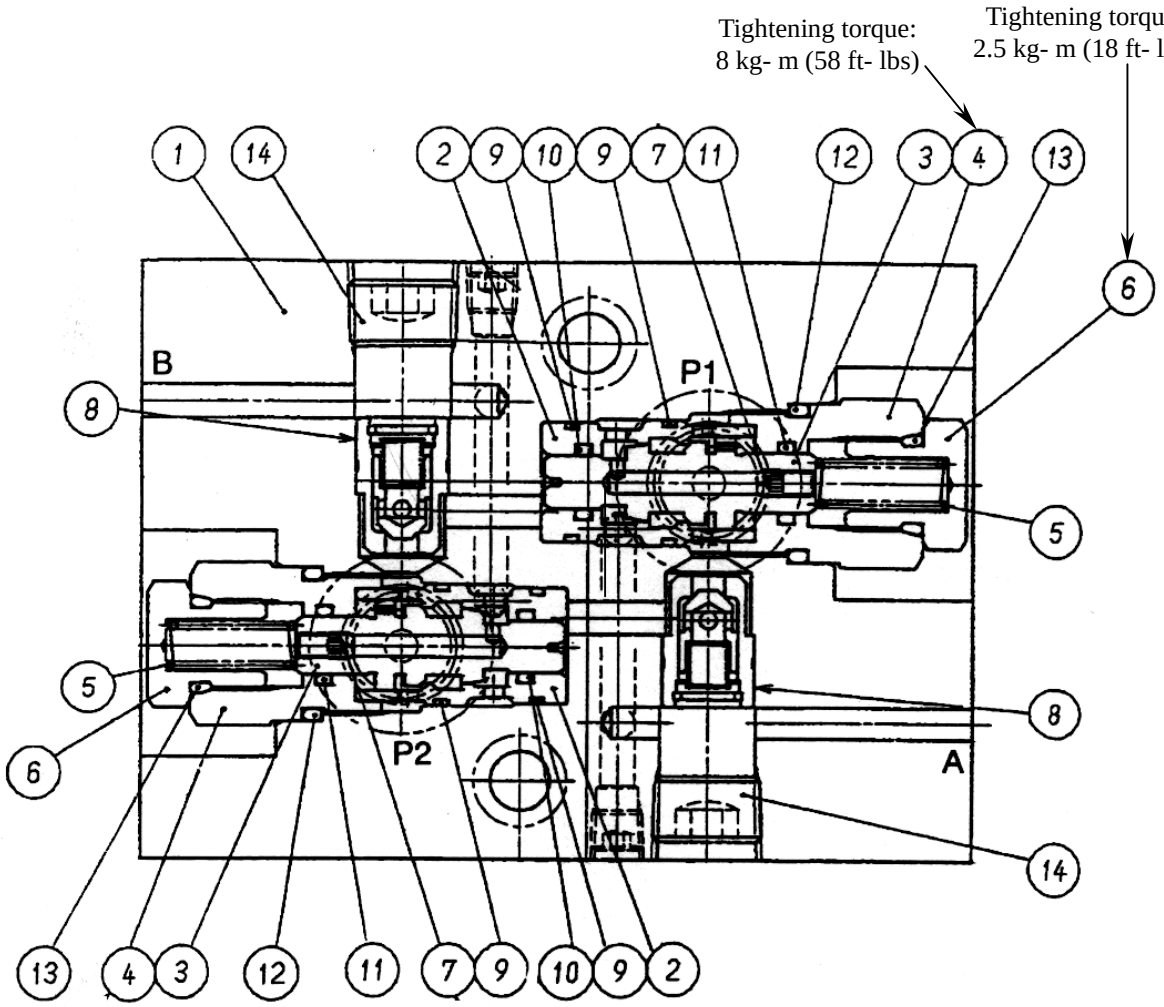
Fly- jib cylinder

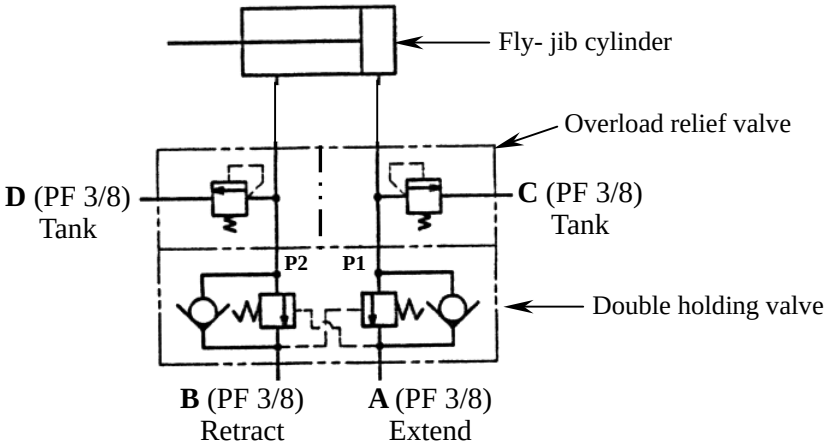


1	Cylinder tube	10	Lock washer	19	Bushing
2	Piston rod	11	Piston	20	Double holding valve
3	Cylinder head	12	Wear ring	21	Bolt
4	Bushing	13	U- ring	22	Overload relief valve
5	U- ring	14	Back- up ring	23	Filter
6	Dust seal	15	Set screw	24	O- ring
7	O- ring	16	Steel ball	25	Bolt
8	Back- up ring	17	O- ring	26	Spring washer
9	O- ring	18	Spherical bearing	27	Grease fitting

Double holding valve (for Fly- jib cylinder)

This Double holding valve is equipped on the Fly- jib cylinder to prevent the cylinder from natural retraction and extension.



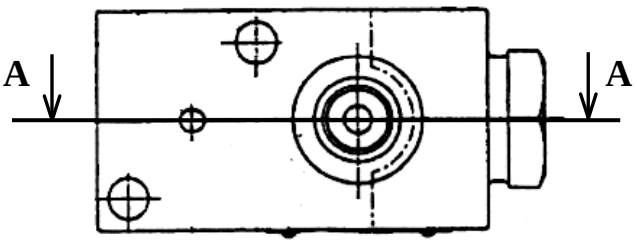


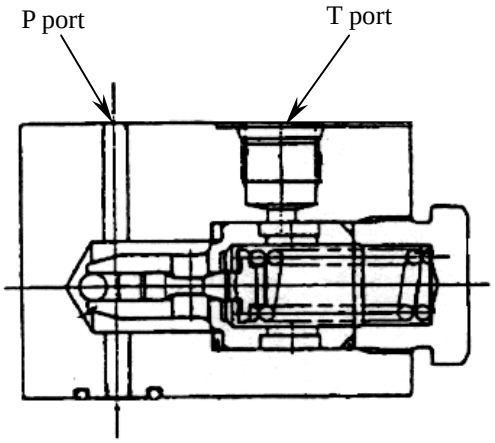
1	Body	6	Cap	11	O- ring
2	Valve seat	7	Orifice	12	O- ring
3	Valve spool	8	Check valve	13	O- ring
4	Valve hosing	9	O- ring	14	Plug
5	Spring	10	O- ring		

Overload relief valve (for Fly- jib cylinder)

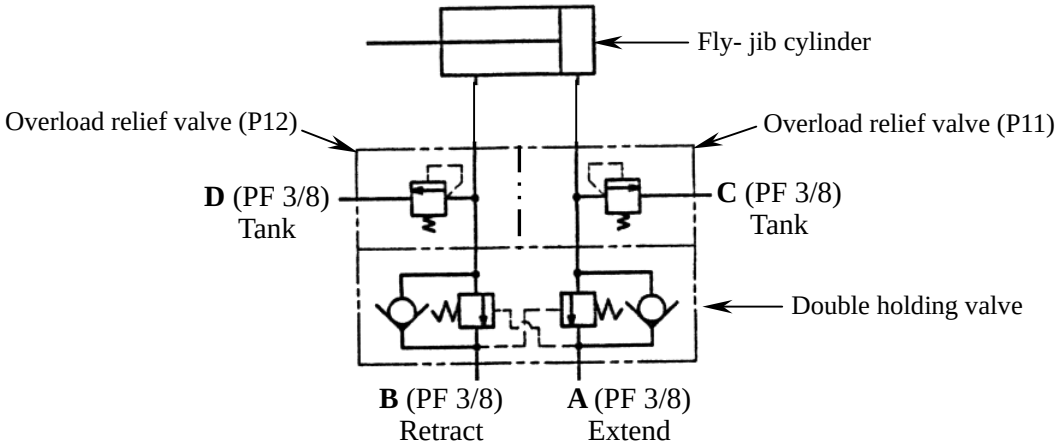
Two Overload relief valves (P11 and P12) are equipped on the Fly- jib cylinder to release abnormally high pressure produced in the Fly- jib cylinder.

Pre- set pressure: 150 kg/cm^2 (2,130 PSI)



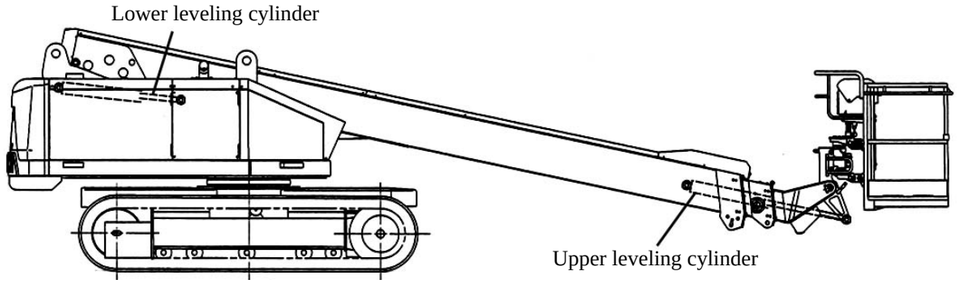


A – A section

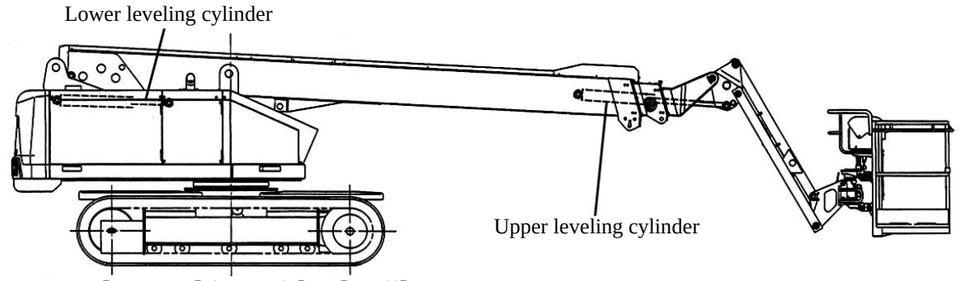


Platform leveling system

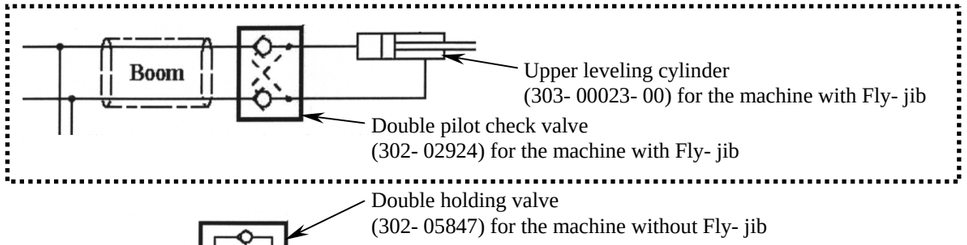
This system automatically maintains the platform at its level position regardless of the boom UP/Down movements, and consist of the Upper and Lower leveling cylinders, Double holding or pilot check valve mounted on Upper leveling cylinder and the combination valve for adjusting platform level as shown in the figures.

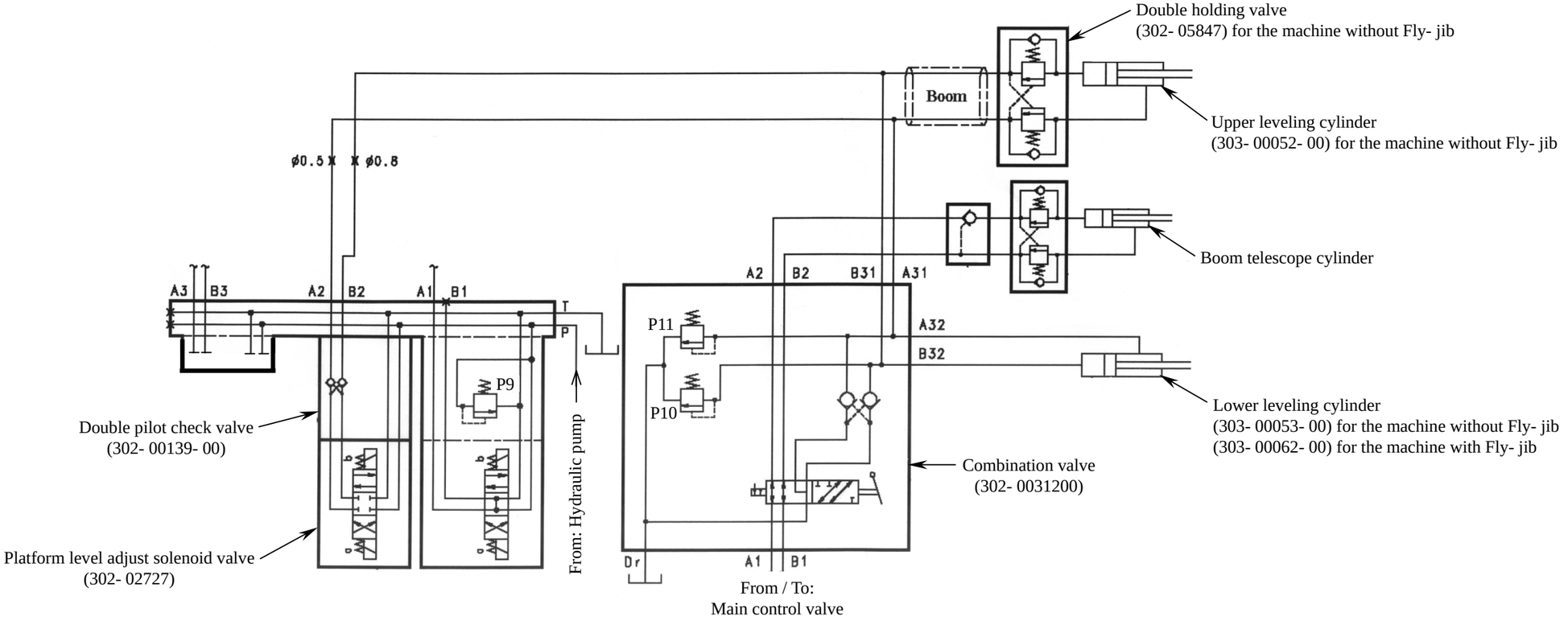


For the machine without Fly- jib



For the machine with Fly- jib





1. Note on function

When the boom is lowered, the Lower leveling cylinder retracts and the hydraulic oil in the bottom room of the cylinder flows into the bottom room of the Upper leveling cylinder.
Since the sizes of both leveling cylinders are exactly the same, the Upper leveling cylinder extends simultaneously in according with the retraction of the Lower leveling cylinder.
Thus, the platform is balanced by the two leveling cylinders to maintain its level, as the boom is lowered.
When the boom is raised, the leveling cylinders work vice versa.

2. Inspection procedures

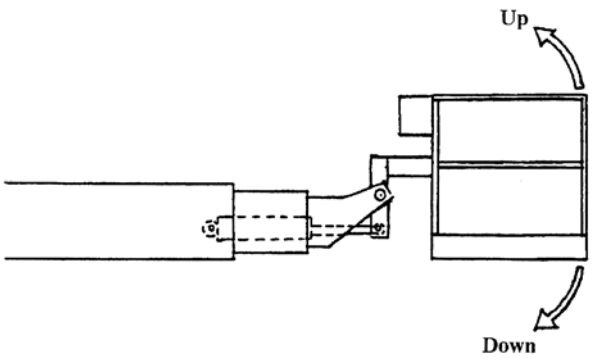
(1) Tilt of platform
Perform Boom elevation and telescope operations several times, and check that the platform always stays level.
If the platform does not stay level, check the leveling system as follows.
1) Thoroughly check the system for external oil leakage.
2) Follow the instructions described in the ***3. Air bleeding procedures*** to bleed air from the Platform leveling system.
3) Check the internal oil leakage of the Combination valve.
4) Check the internal oil leakage of the Double holding valve or Double pilot check valve mounted on the Upper leveling cylinder.
5) Check the internal oil leakage of the Upper and Lower leveling cylinders.

(2) Natural descent
Load the platform with its maximum specified load (250 kg, 550 lbs), and then visually check for any sign of the platform tilting downward.
If the platform tilts naturally, thoroughly check the leveling system for external oil leakage, and then check the components listed below for internal oil leakage.
- Double holding valve or Double pilot check valve mounted on Upper leveling cylinder
- Combination valve
- Upper and lower leveling cylinders

3. Air bleeding procedures

CAUTION
- When bleeding air, always operate the machine from the lower control.
- Do not allow any load on the platform when carrying out these procedures.

1) Pull the platform level adjust lever equipped on the Combination valve while pressing the lock lever.
2) Operate the Boom telescope switch to its ***IN*** position to tilt the platform fully upward.
3) Operate the Boom telescope switch to its ***OUT*** position to tilt the platform fully downward.
4) Perform the above steps 2 and 3 several times.
5) Adjust the platform to its level position, and then set the platform level adjust lever to its original position.

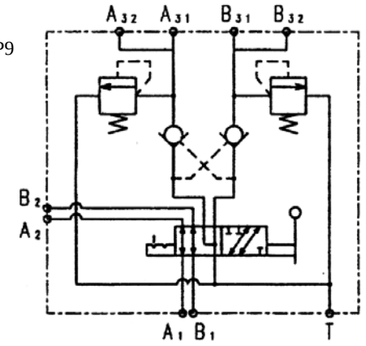


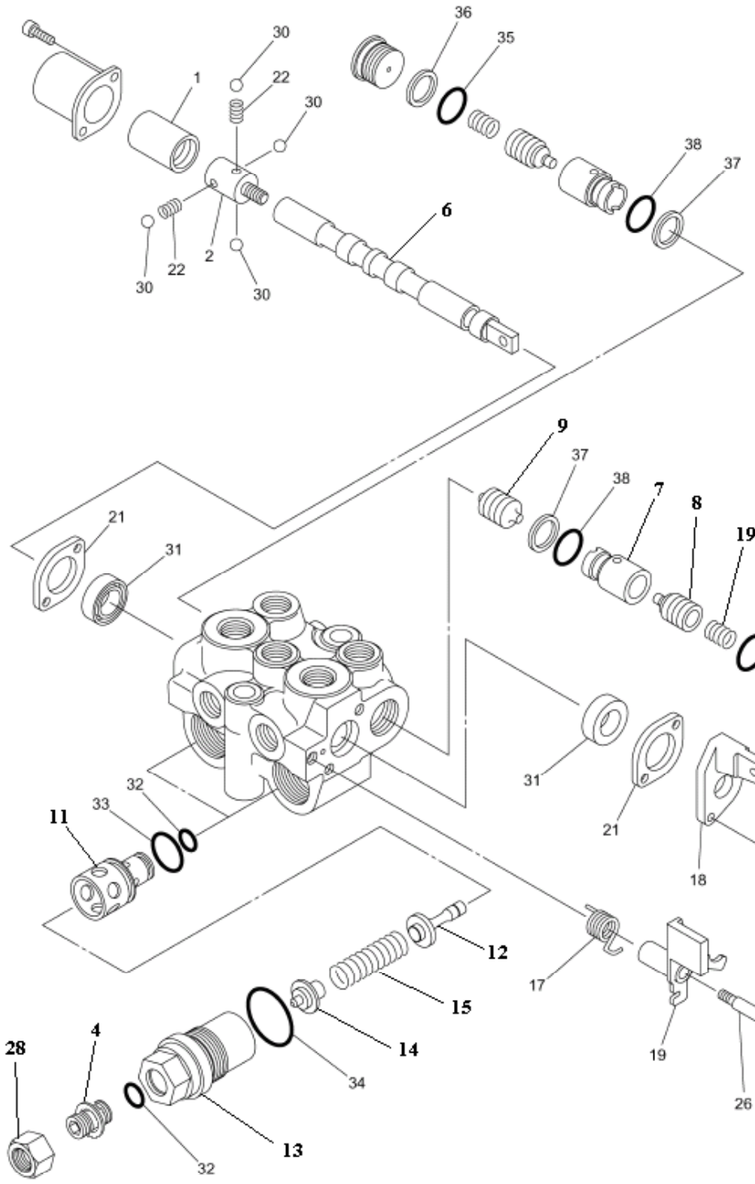
Combination valve (for Platform leveling system)

The Combination valve is used in the Platform leveling system and incorporates the Directional control valve, the Double pilot check valve and two Overload relief valves.

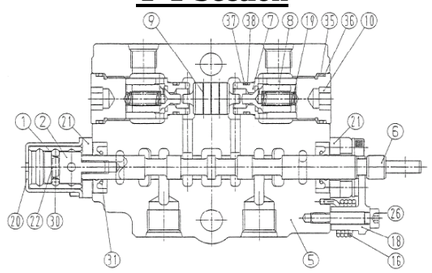
Rated pressure	300 kg/cm^2	4,270 PSI
Rated flow	50 liters/min	13 gallons/min
Preset pressure for Overload relief valves (P8 and P9)	230 kg/cm^2	3,272 PSI
Rated flow	50 liters/min	13.2 GPM

P9

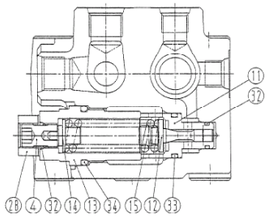


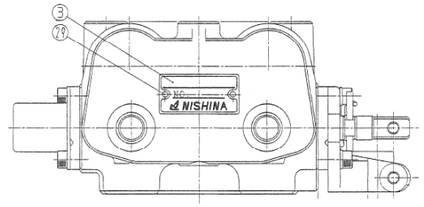


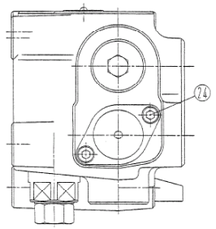
Y-Y Section

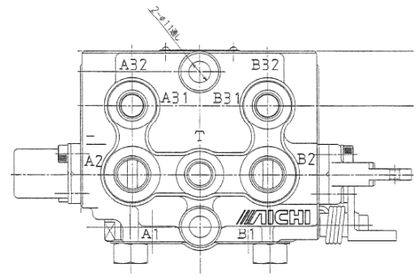


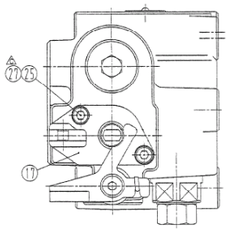
Z-Z Section

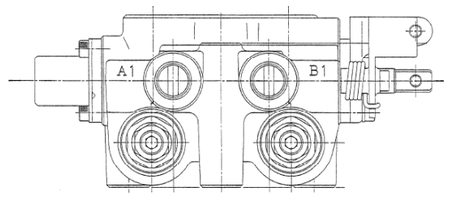






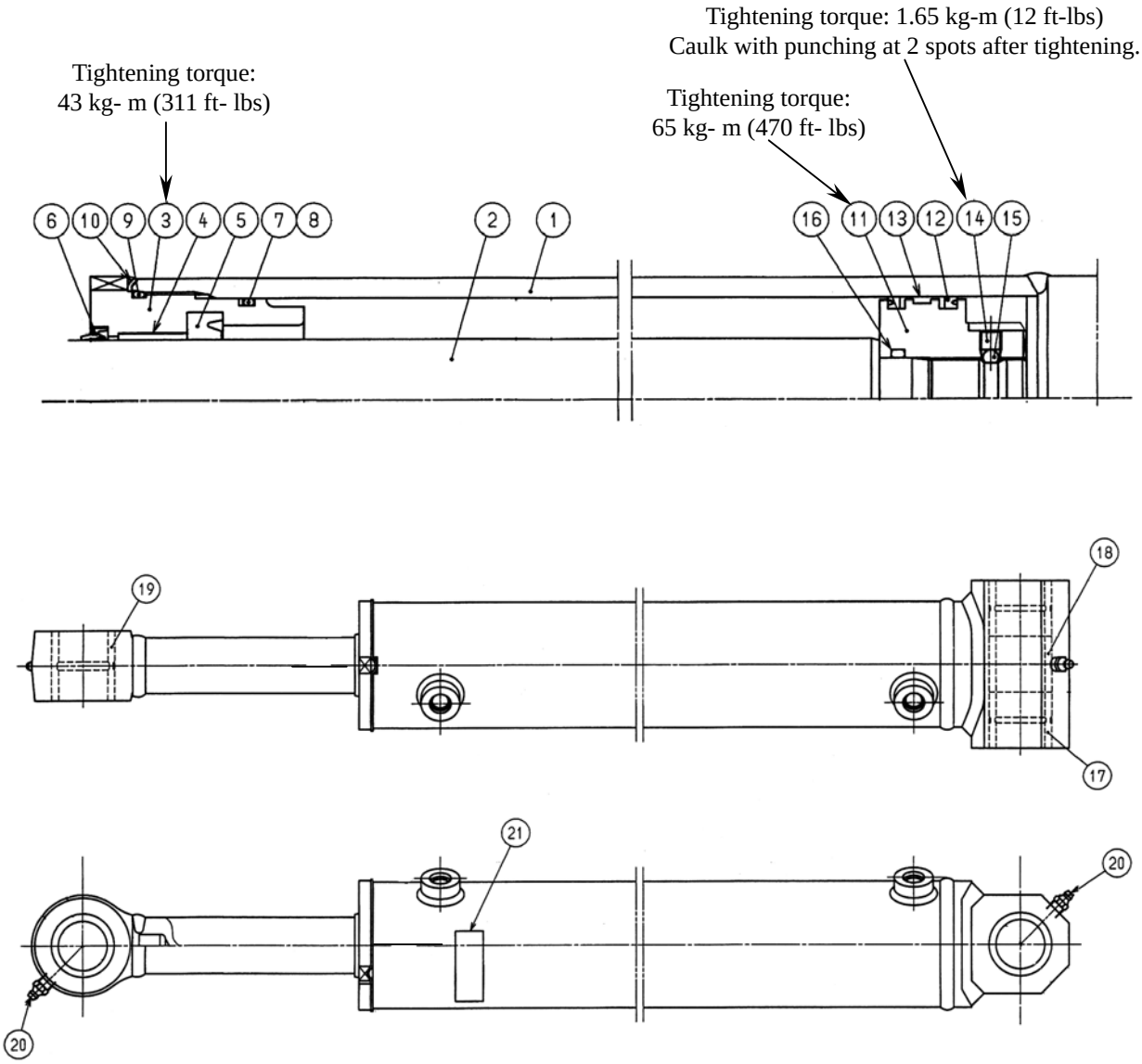






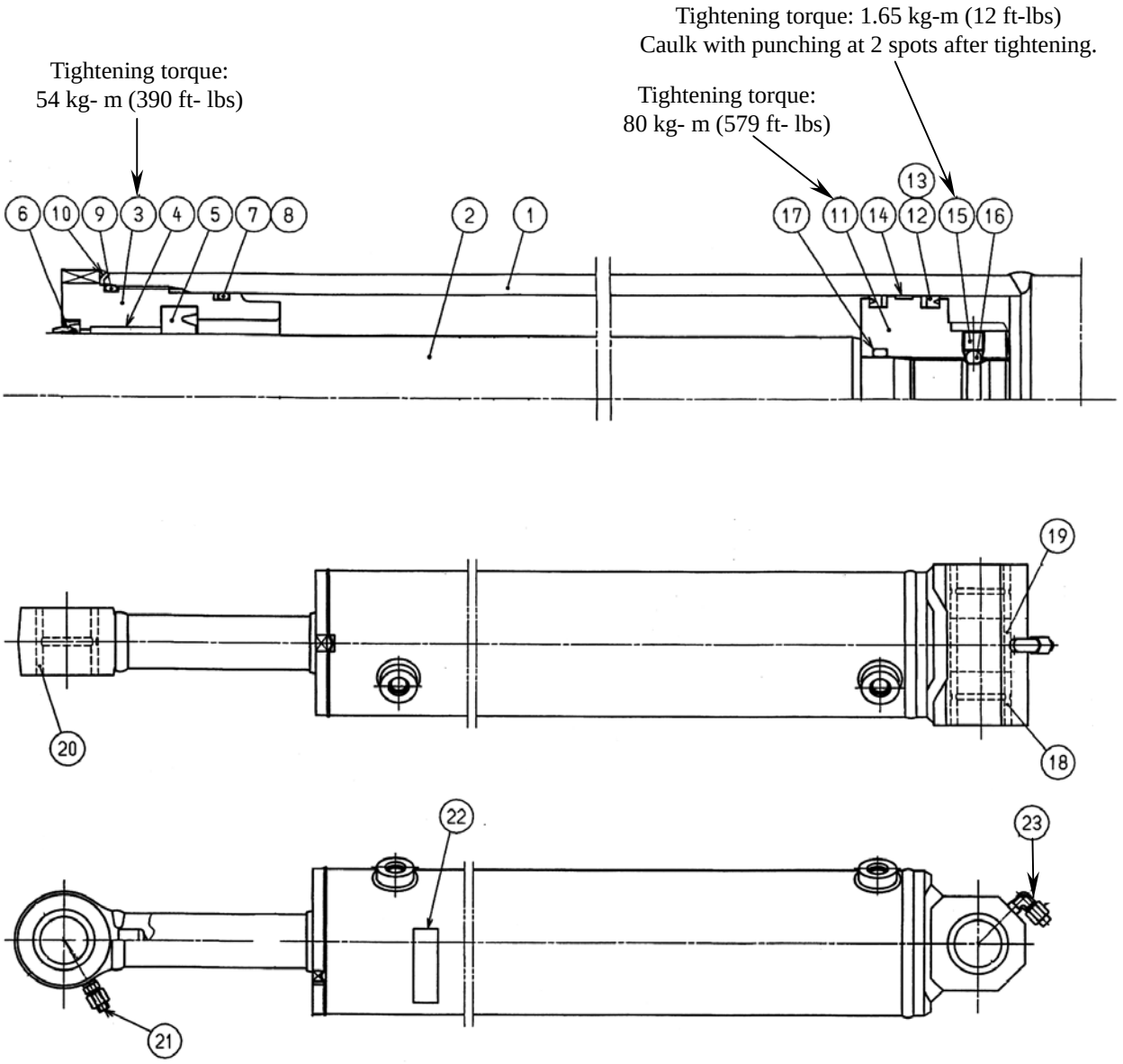
No.	Description	No.	Description	No.	Description
1	Sleeve	14	Stopper	27	Washer
2	Stopper	15	Spring	28	Nut
3	Serial number plate	16	Spring	29	Rivet screw
4	Screw	17	Bracket	30	Steel ball
5	Body	18	Spool look lever	31	Valve seal
6	Spool	19	Spring	32	O-ring
7	Sleeve	20	Spring cover	33	O-ring
8	Valve	21	Flange	34	O-ring
9	Piston	22	Spring	35	O-ring
10	Plug	23		36	Buck-up ring
11	Valve seat	24	Bolt	37	Buck-up ring
12	Valve	25	Bolt	38	O-ring
13	Sleeve	26	Bolt		

Lower leveling cylinder (for the machine without Fly- jib)



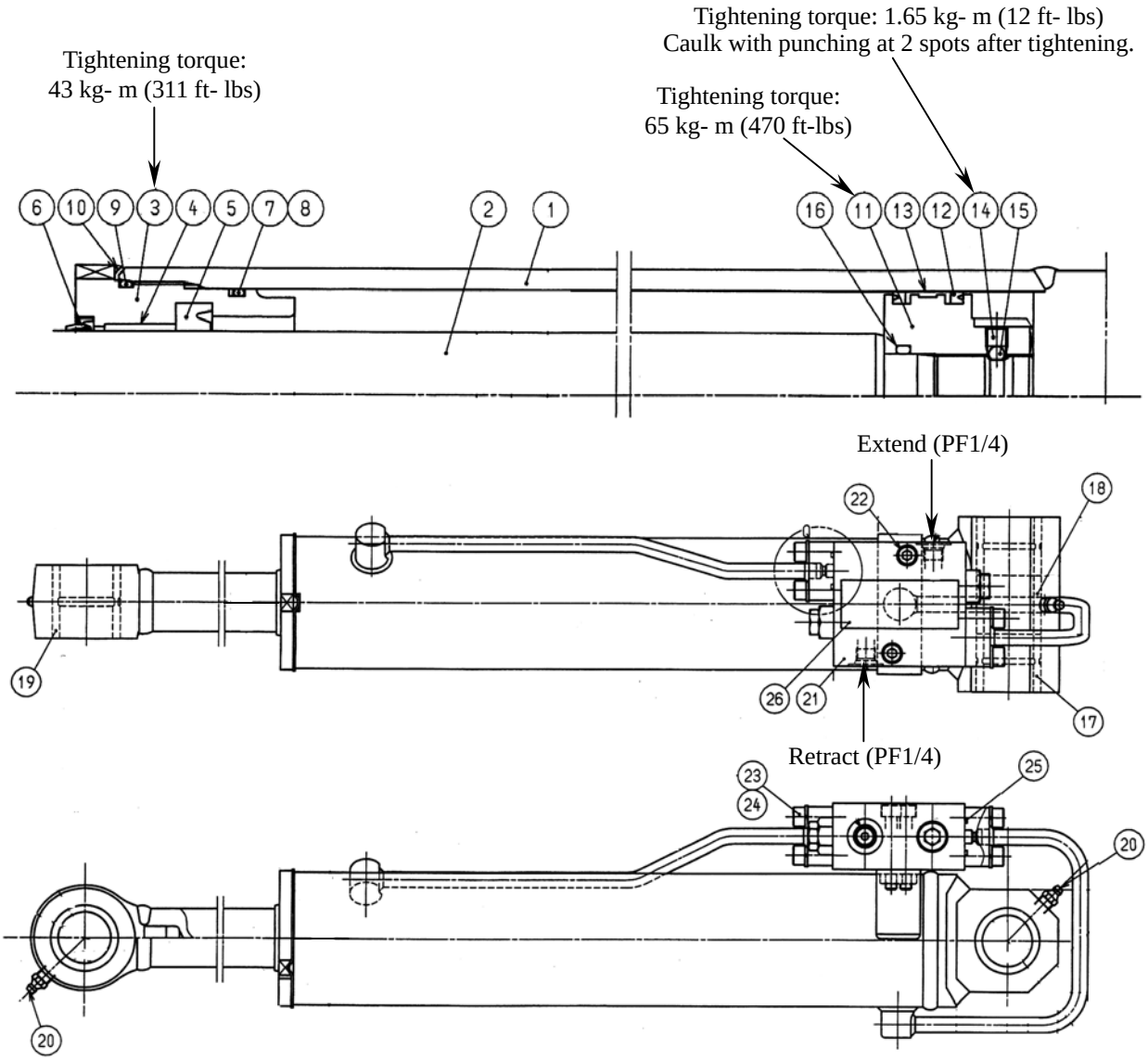
No.	Description	No.	Description
1	Cylinder tube	12	U- ring
2	Piston rod	13	Wear ring
3	Cylinder head	14	Set screw
4	Bushing	15	Steel ball
5	U-ring	16	O- ring
6	Dust seal	17	Bushing
7	O- ring	18	Collar
8	Backup ring	19	Bushing
9	O- ring	20	Grease fitting
10	Lock washer	21	Name plate
11	Piston	------	----------

Lower leveling cylinder (for the machine with Fly- jib)

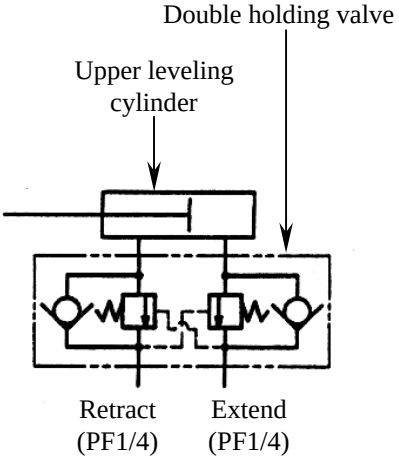


No.	Description	No.	Description
1	Cylinder tube	12	Back- up ring
2	Piston rod	14	Wear ring
3	Cylinder head	15	Set screw
4	Bushing	16	Steel ball
5	U-ring	17	O- ring
6	Dust seal	18	Bushing
7	O- ring	19	Collar
8	Back- up ring	20	Bushing
9	O- ring	21	Grease fitting
10	Lock washer	22	Name plate
11	Piston	23	Grease fitting
12	U- ring	--	----------

Upper leveling cylinder (for the machine without Fly- jib)



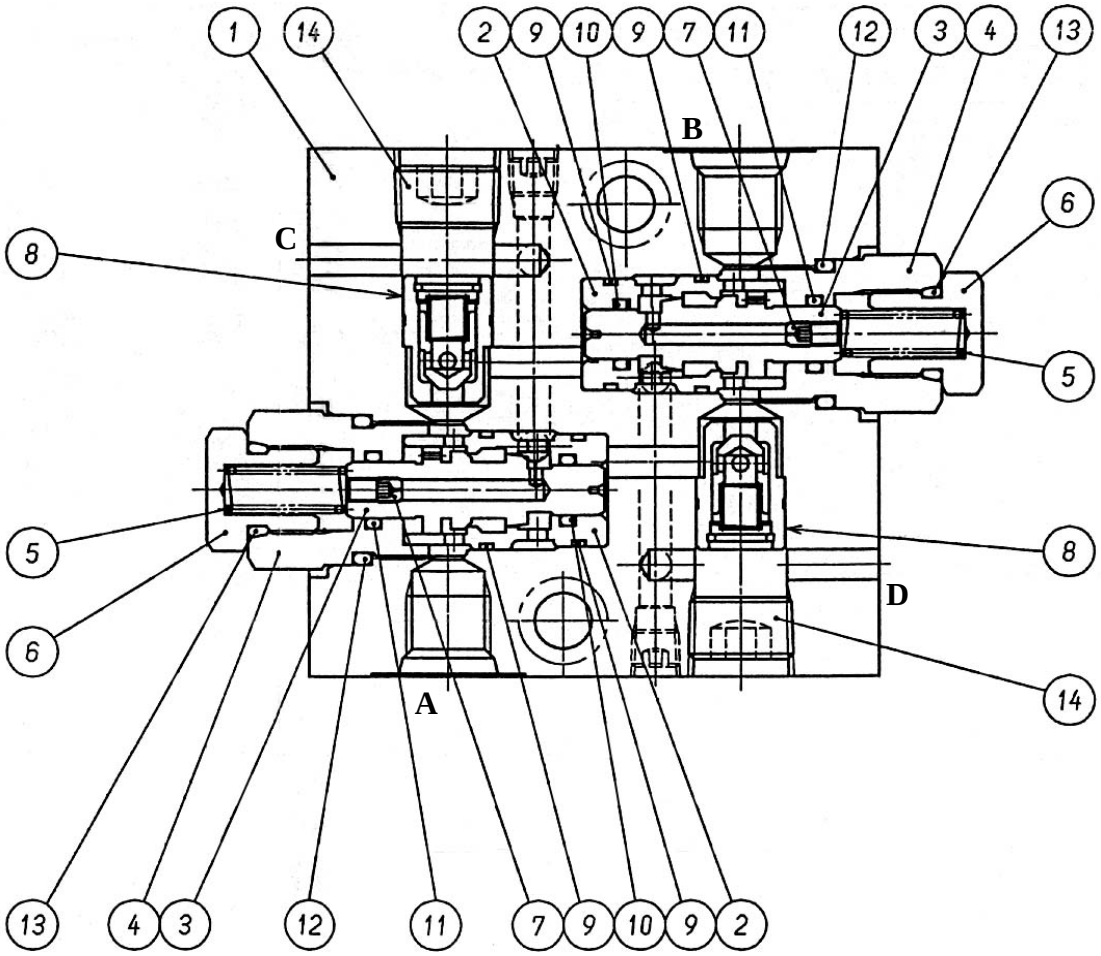
No.	Description	No.	Description
1	Cylinder tube	14	Set screw
2	Piston rod	15	Steel ball
3	Cylinder head	16	O- ring
4	Bushing	17	Bushing
5	U- ring	18	Collar
6	Dust seal	19	Bushing
7	O- ring	20	Grease fitting
8	Back- up ring	21	Double holding valve
9	O- ring	22	Bolt
10	Lock washer	23	Bolt
11	Piston	24	Spring washer
12	U- ring	25	O- ring
13	Wear ring	26	Name plate

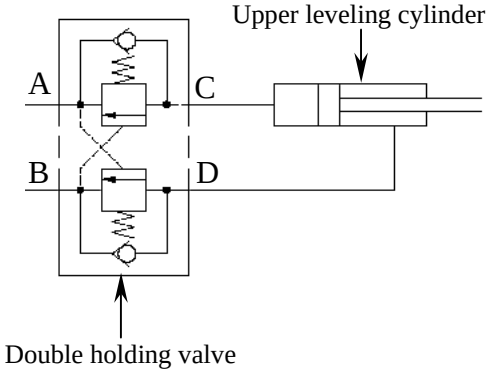


Double holding valve (for Upper leveling cylinder without Fly- jib)

This Double holding valve is mounted on the Upper leveling cylinder to maintain the platform level in the event of hydraulic hose breakage.

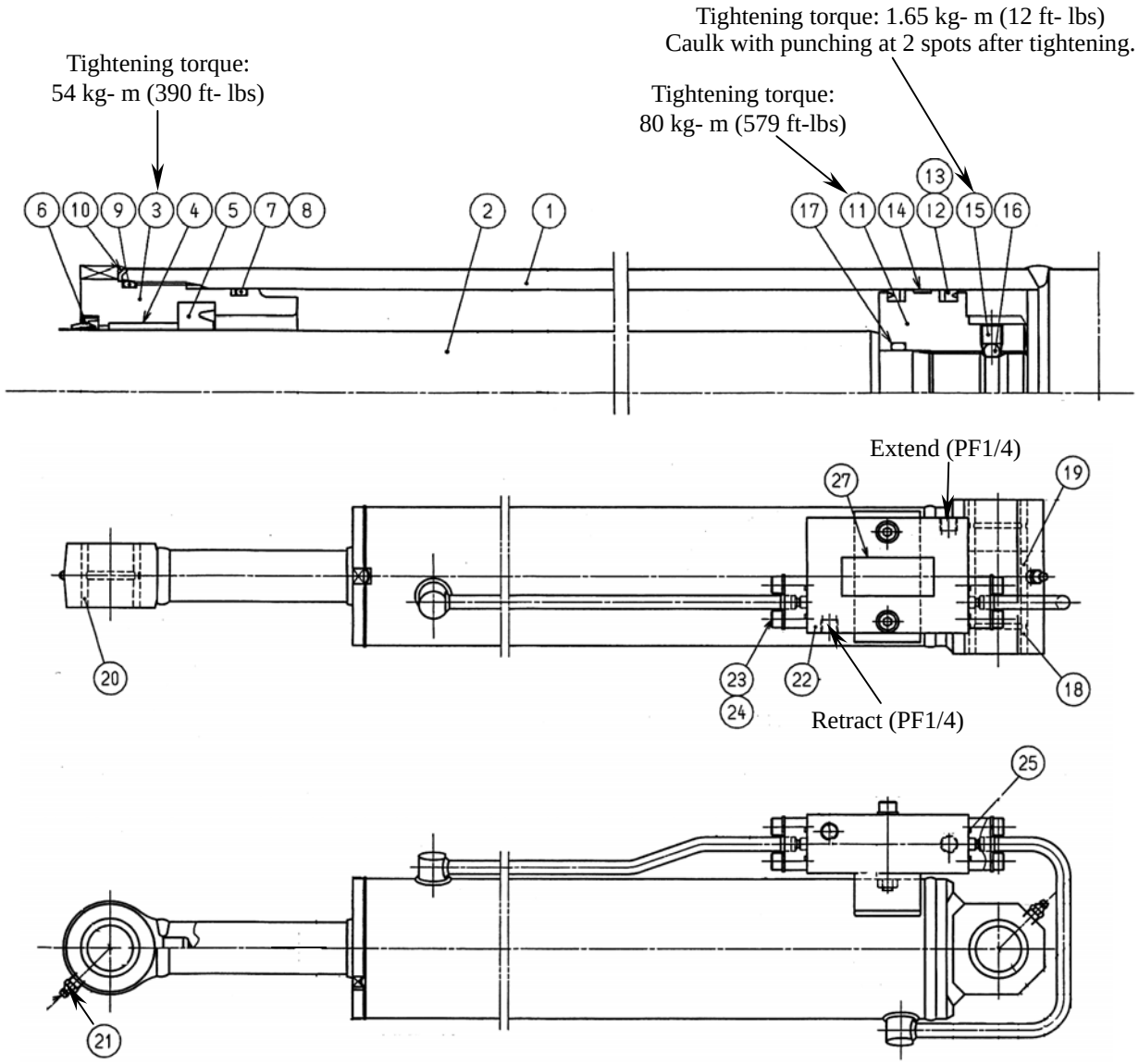
- Rated pressure ---------- 230 kg/cm^2 (3,270 PSI)
- Rated flow ---------- 10 liters/min (2.64 gallons/mi n)



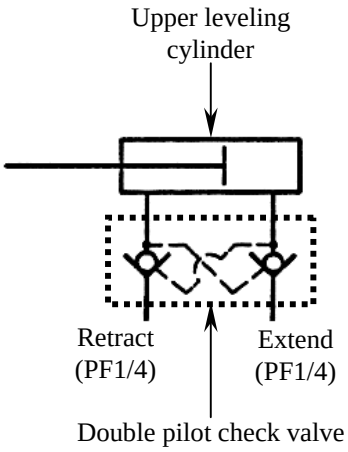


1	Body	8	Check valve
2	Valve seat	9	O- ring
3	Valve spool	10	O- ring
4	Cap	11	O- ring
5	Spring	12	O- ring
6	Cap	13	O- ring
7	Orifice	14	Plug

Upper leveling cylinder (for the machine with Fly- jib)

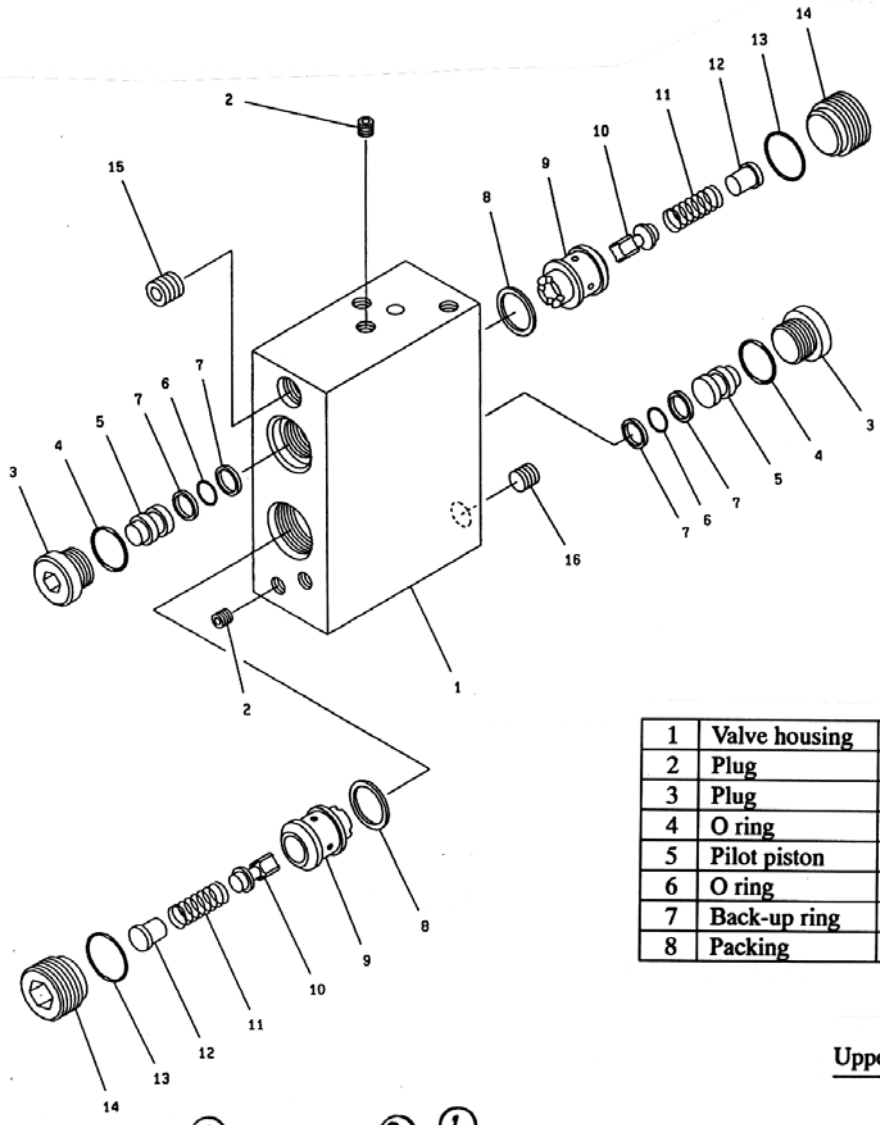


No.	Description	No.	Description
1	Cylinder tube	14	Wear ring
2	Piston rod	15	Set screw
3	Cylinder head	16	Steel ball
4	Bushing	17	O- ring
5	U- ring	18	Bushing
6	Dust seal	19	Collar
7	O- ring	20	Bushing
8	Back- up ring	21	Grease fitting
9	O- ring	22	Double pilot check valve
10	Lock washer	23	Bolt
11	Piston	24	Spring washer
12	U- ring	25	O- ring
13	Back- up ring	27	Name plate

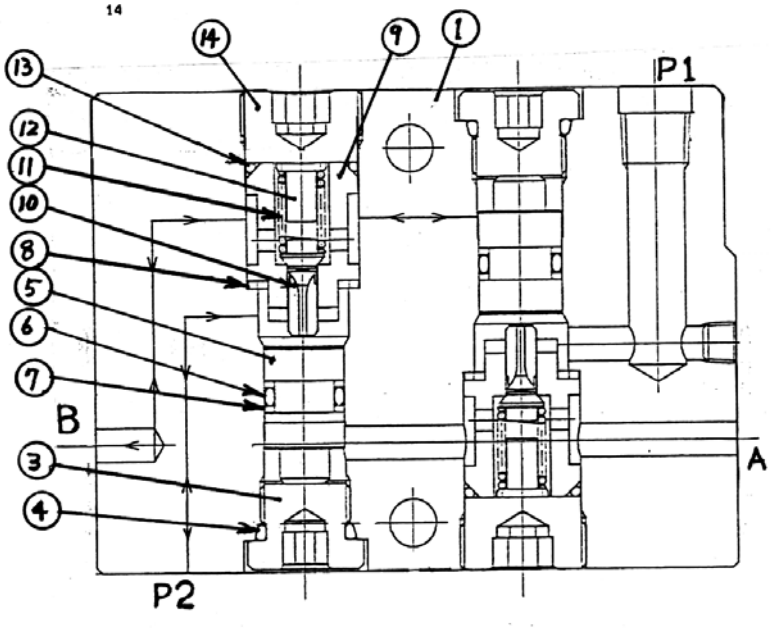


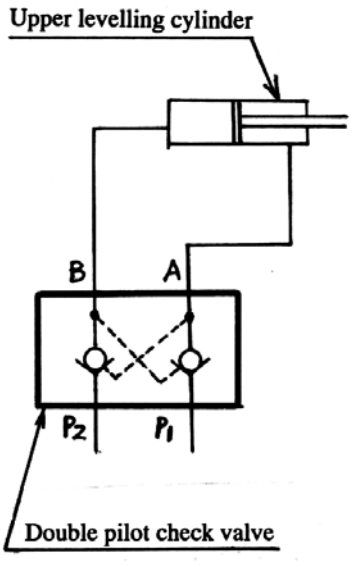
Double pilot check valve (for Upper leveling cylinder with Fly- jib)

This double pilot check valve is mounted on the Upper leveling cylinder to maintain the platform level in the event of hydraulic hose breakage.



1	Valve housing	9	Valve seat
2	Plug	10	Check valve
3	Plug	11	Spring
4	O ring	12	Spring retainer
5	Pilot piston	13	O ring
6	O ring	14	Plug
7	Back-up ring	15	Plug
8	Packing	16	Plug

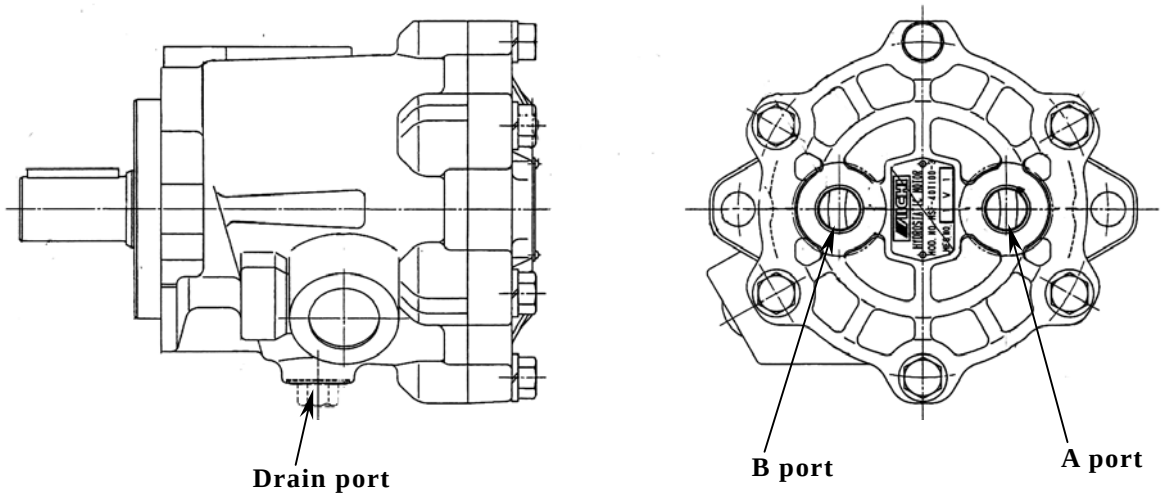


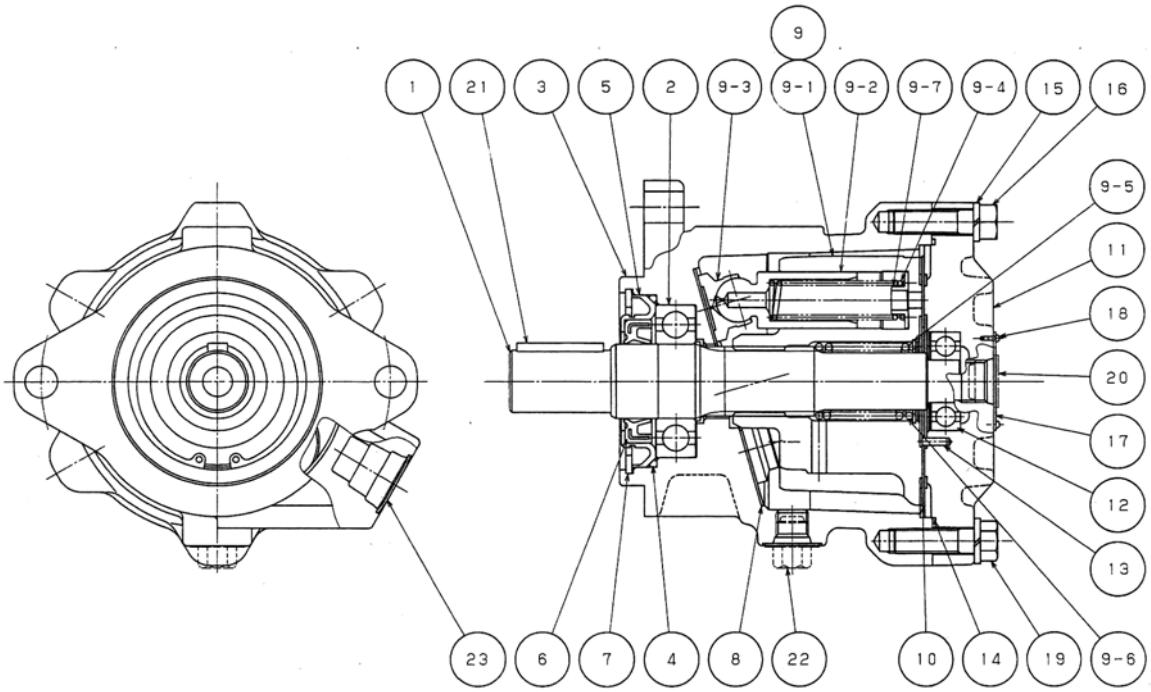


Boom rotation motor

The boom rotation motor is installed on the rotation gearbox to rotate the turntable.

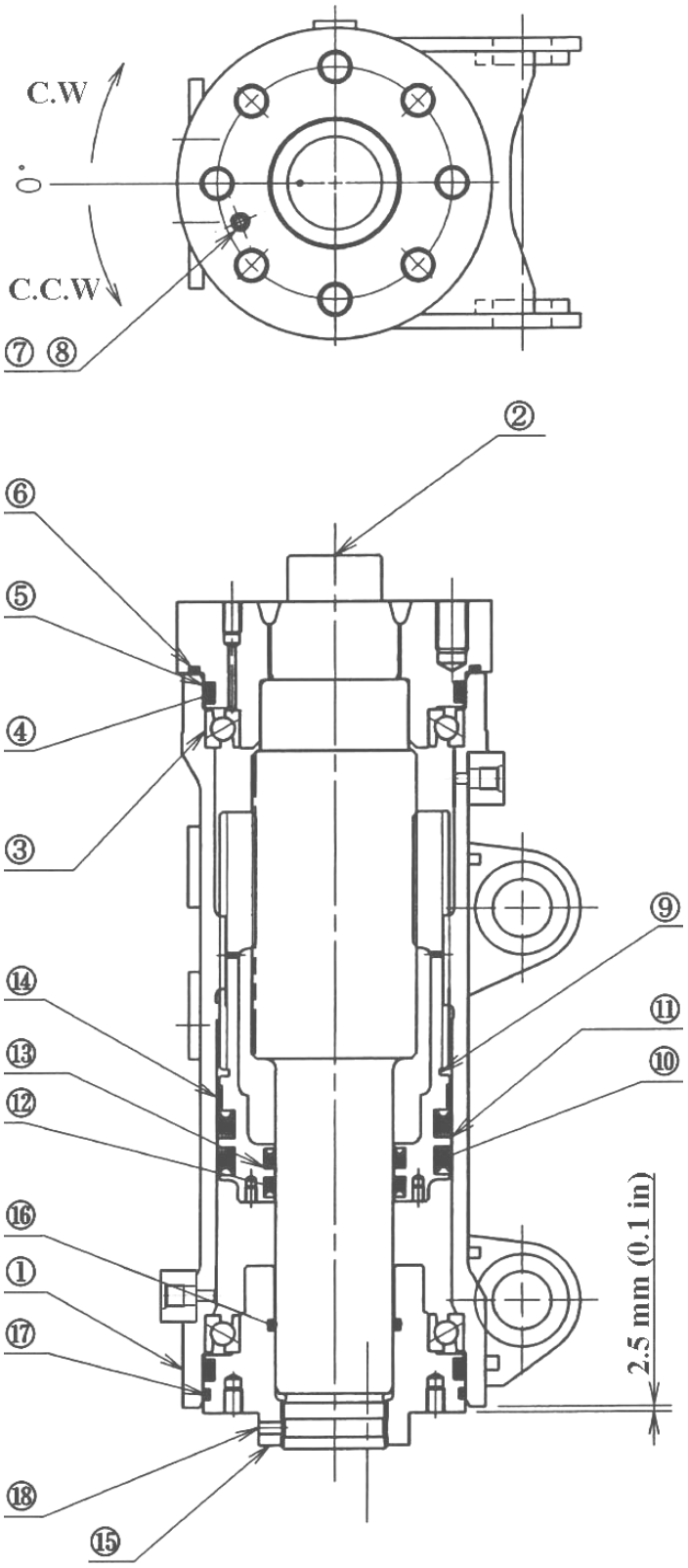
Type ---------- Plunger type
Rated pressure ---------- 210 kg/cm^2 (3,000 PSI)
Drain pressure ---------- 1.5 kg/cm^2 (21 PSI)
Displacement ---------- 39.3 cc/rev (2.4 in^3/rev)





Platform rotary actuator

The Platform rotary actuator is installed between the platform and the top of 3rd boom or Fly- jib to rotate the platform.

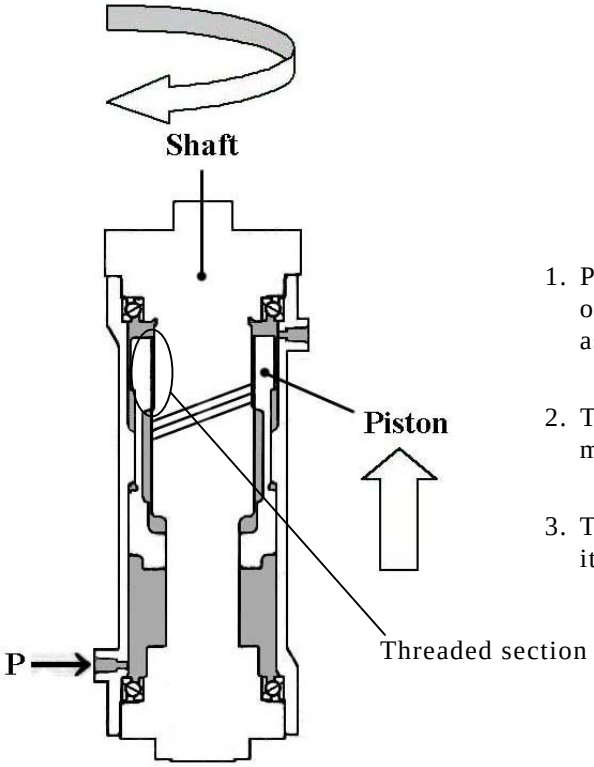


Tightening torque : 5.1 kg-m (37 ft-lbs)

1	Body
2	Shaft
3	Ball bearing
4	O- ring
5	Back- up ring
6	O- ring
7	Air bleed plug
8	Steel ball
9	Piston
10	Packing
11	Back- up ring
12	Packing
13	Back- up ring
14	Wear ring
15	Head
16	O- ring
17	O- ring
18	Set screw

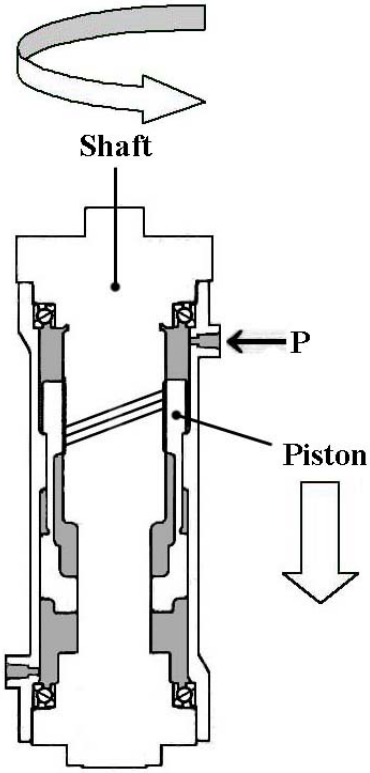
1. Function of Rotary actuator

1 Clockwise



1. Pressurized oil comes in to the lower room of the rotary actuator and push up the piston as shown in the figure left.
2. The piston and the shaft are threaded and mesh each other.
3. The piston rotates the shaft clockwise while it goes up.

2. Counter clockwise



1. Pressurized oil comes in to the upper room of the rotary actuator and push down the piston as shown in the figure left.
2. The piston rotates the shaft counter-clockwise while it goes down.

2. Platform rotary actuator air bleeding procedures

Bleed air form the platform rotary actuator as follows when the air is suspected in the rotary actuator and causes excessive free play.

1. For the machine with Fly- jib.

1) Start the engine, raise and lower the fly- jib to its full stroke more than 5 times to bleed air from the hydraulic hoses installed in the boom, and then lower the platform close to the ground.
   Caution: Do not operate the platform rotating functions while raising and lowering the fly- jib.
2) Rotate the platform fully CW and CCW more than 10 times.
3) Rotate the platform CCW fully, loosen the “Air bleed plug” shown in the Fig - 1 to bleed air from the rotary actuator, then tighten the air bleed plug.
4) Rotate the platform CW and CCW fully 2 ~ 3 times, repeat the above step 3) until no air comes out of the rotary actuator, and then tighten the air bleed plug securely.
5) Move the platform by hands, and make sure that the rotary actuator does not have excessive free play.

1) For the machine without Fly- jib

1) Shut down the engine, disconnect both of the hydraulic hose connected to the P and T port of the platform rotation solenoid valve shown in Fig - 2, and then connect the hoses each other using the hose adaptors.
2) Start the engine, depress the foot switch and hold the platform rotation switch either in CW or CCW position for about 2 minutes to bleed air from the hydraulic hoses installed in the boom.
3) Shut down the engine, disconnect the hydraulic hoses, and then re- connect them to their original positions.
4) Re- start the engine, rotate the platform CW and CCW fully more tan 10 times.
5) Rotate the platform CCW fully, loosen the “Air bleed plug” shown in Fig - 1 to bleed air from the rotary actuator, and then tighten the air bleed plug.
6) Rotate the platform CW and CCW fully 5 times, repeat the above step 5) until no air comes out from the rotary actuator, and then tighten the air bleed plug securely.
7) Move the platform by hands, and make sure that the rotary actuator does not have excessive free play.

Fig - 1

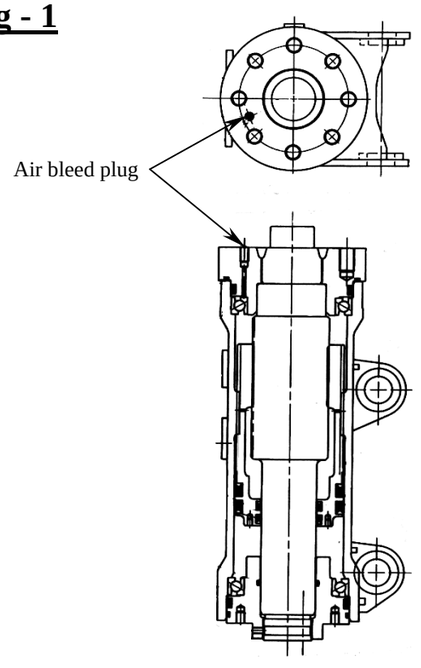
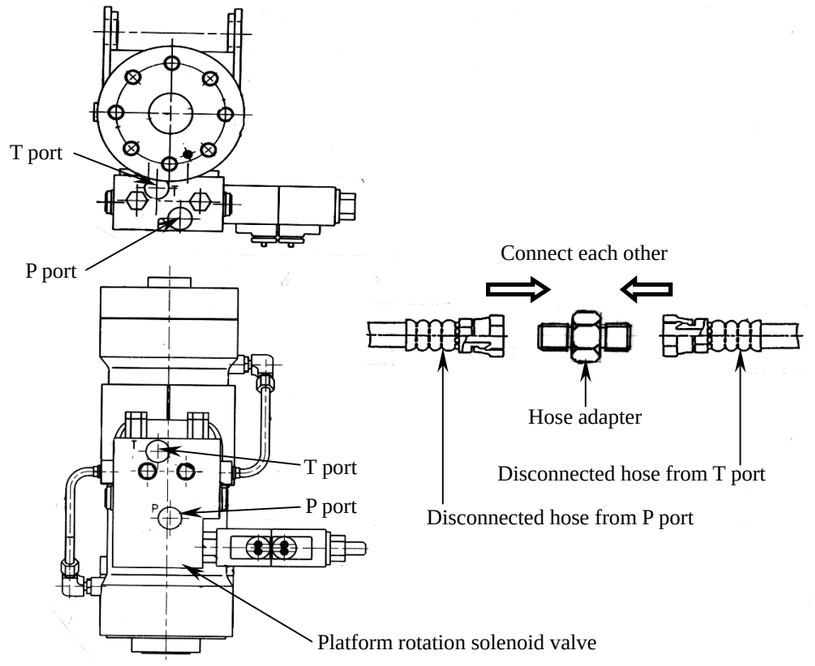


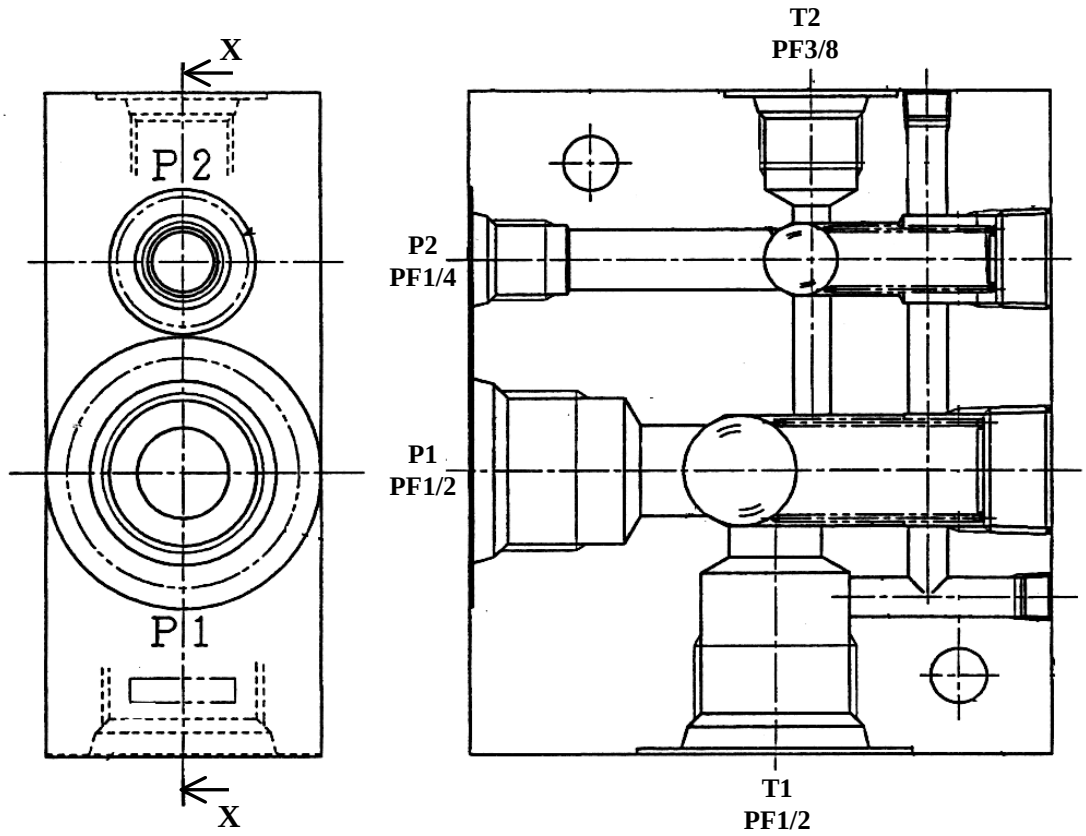
Fig - 2



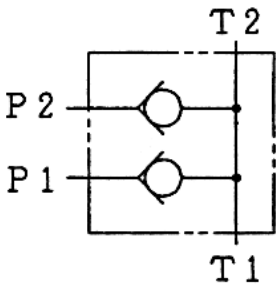
Check valve block

This check valve block is installed at the outlet lines of the main and emergency pumps to prevent the counter- flow.

Rated pressure		350 kg / cm^2 (4,980 PSI)
Rated flow	P1 → T1	50 litters /min (13.2 gallons / min)
	P2 → T2	5 litters /min (1.3 gallons / min)



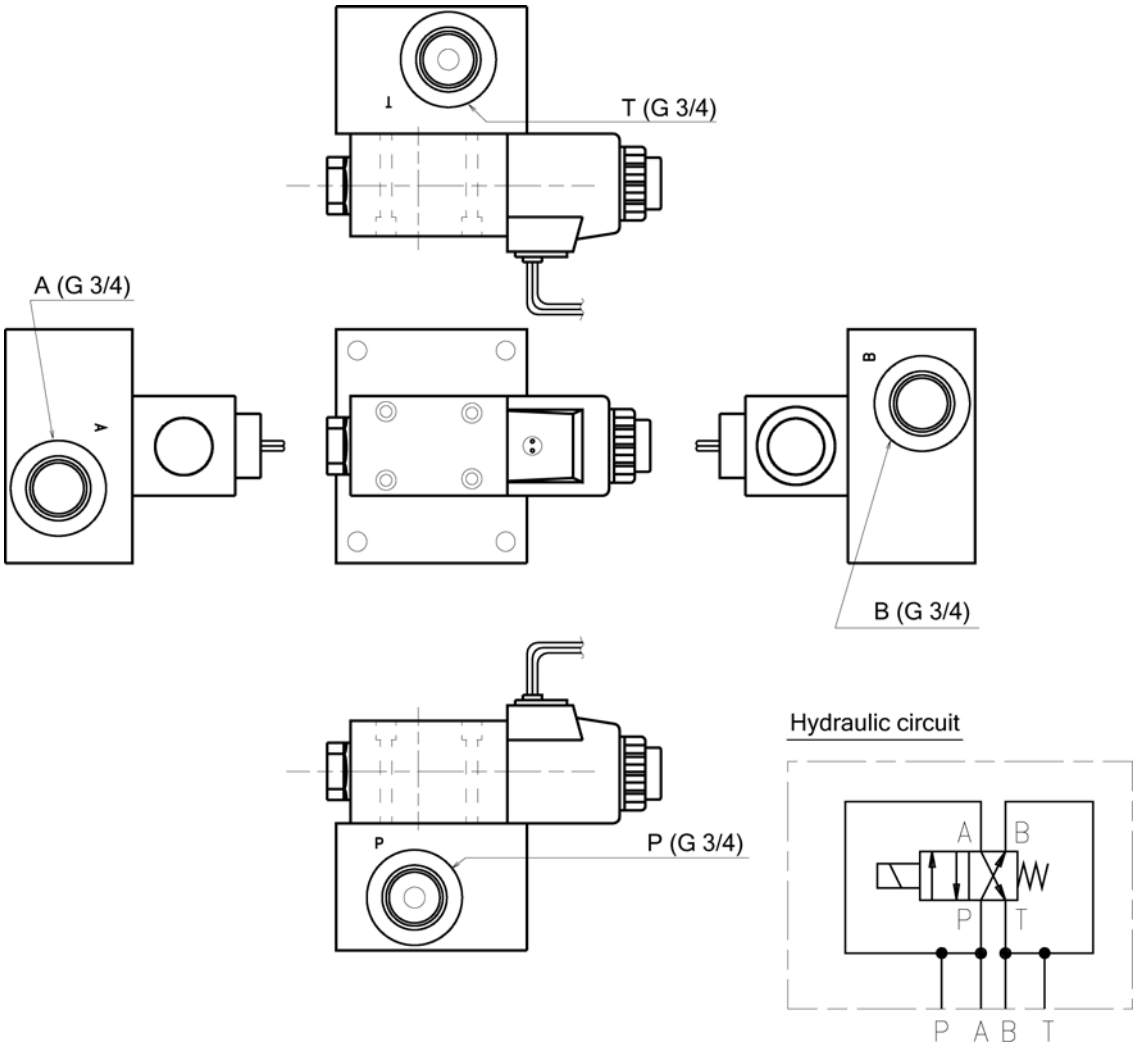
X – X section



Unloading solenoid valve

Two solenoid valves are installed in the turntable to returns the hydraulic oil from hydraulic pump to the hydraulic oil tank unless some of Boom elevation, Boom telescope, Boom rotation, Travel and Hydraulic generator are operated.

Rated voltage	DC24V (DC21.6 ~ 30V)
Rated pressure	35 MPa (357 kg/cm^2) [5,070 PSI]
Rated flow	80 liters/min. [21 GPM]

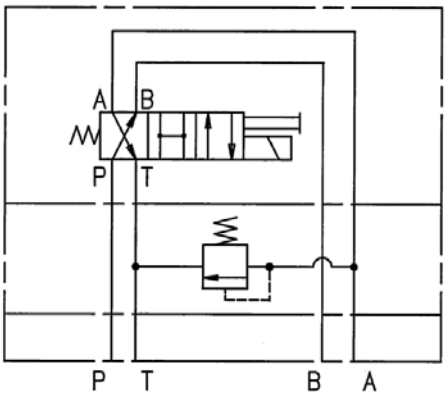


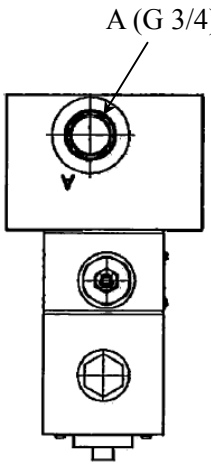
Hydraulic generator solenoid valve

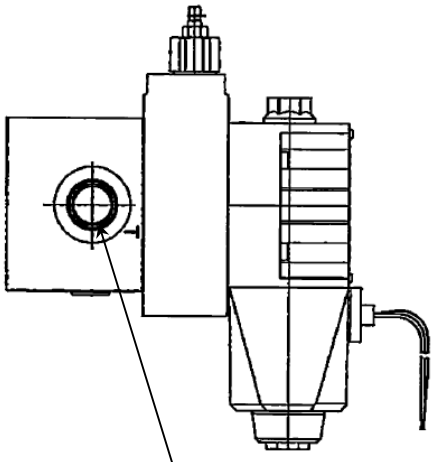
This solenoid valve sends the hydraulic oil to optional hydraulic generator to generate 220 volts power supply to the platform.

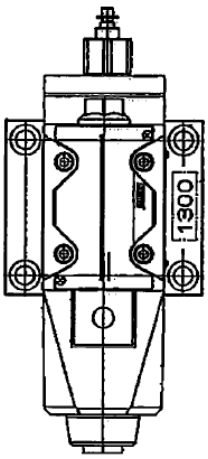
Rated voltage	DC24V (DC18 ~ 30V)
Rated pressure	31.4 MPa (320 kg/cm^2) [4,550 PSI]
Rated flow	120 liters/min. (31.7 GPM)

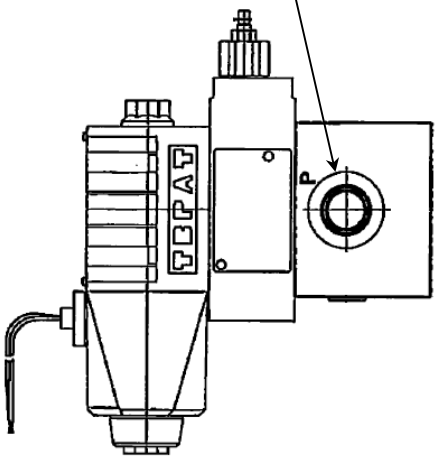
Hydraulic circuit



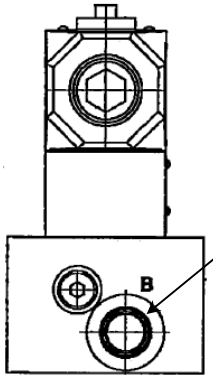








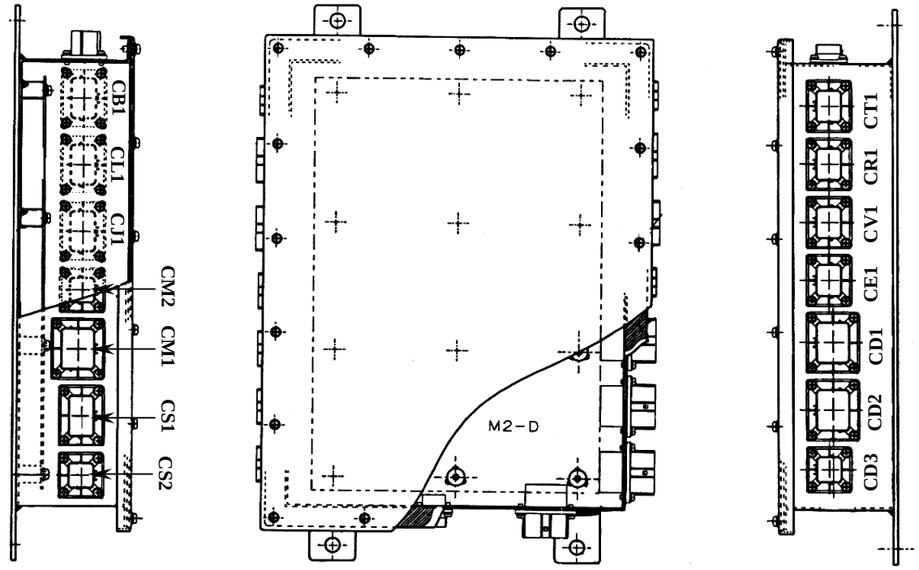
T (G 3/4)



4. Electrical section

Main CPU box (M2D), Master

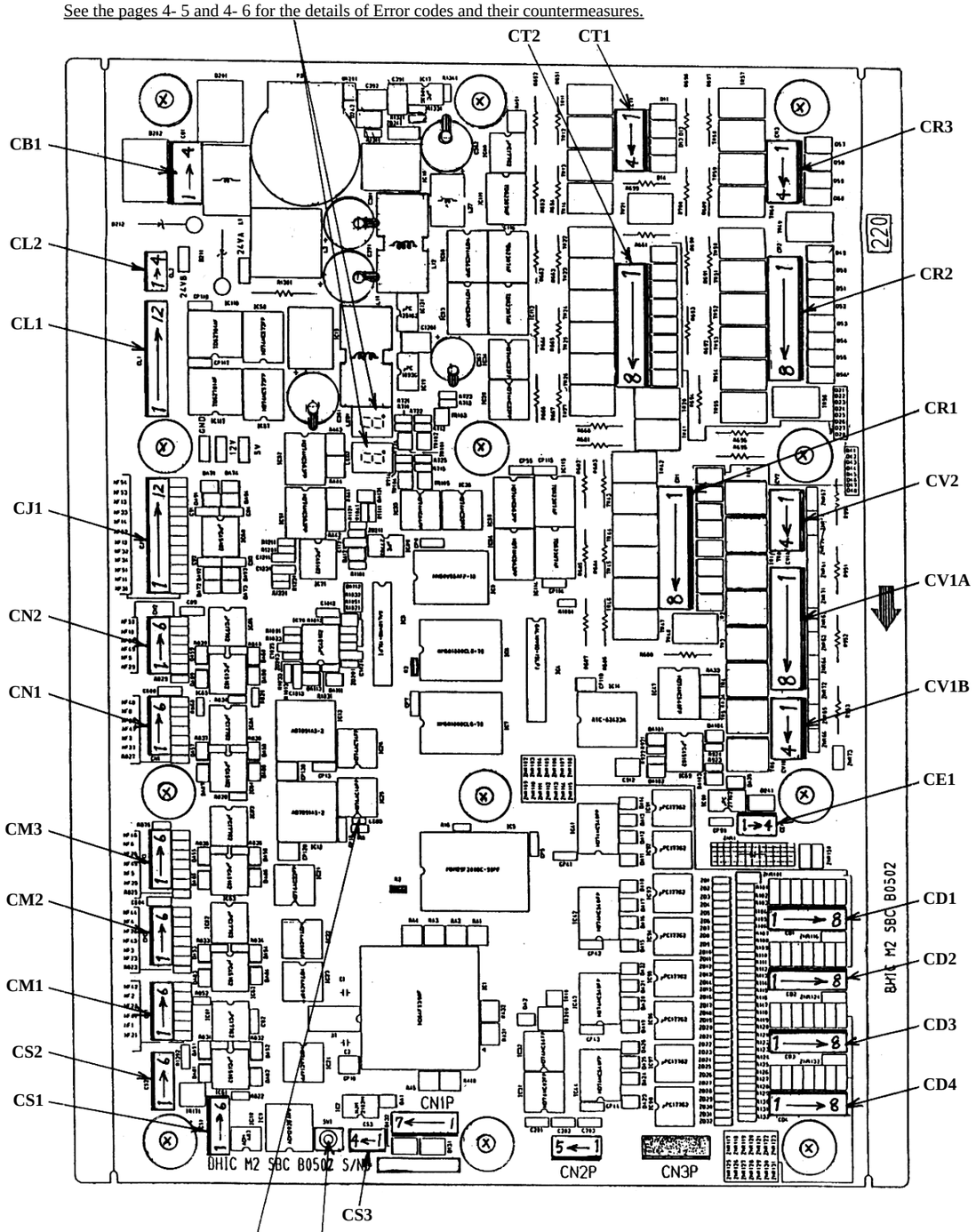
This ***Main CPU box (M2D), Master*** is installed on the turntable to control the machine functions together with the ***Main CPU box (M2D), Slave*** installed on the turntable and the ***Sub- CPU board (M4A)*** installed in the upper control box.



7- segment LEDs

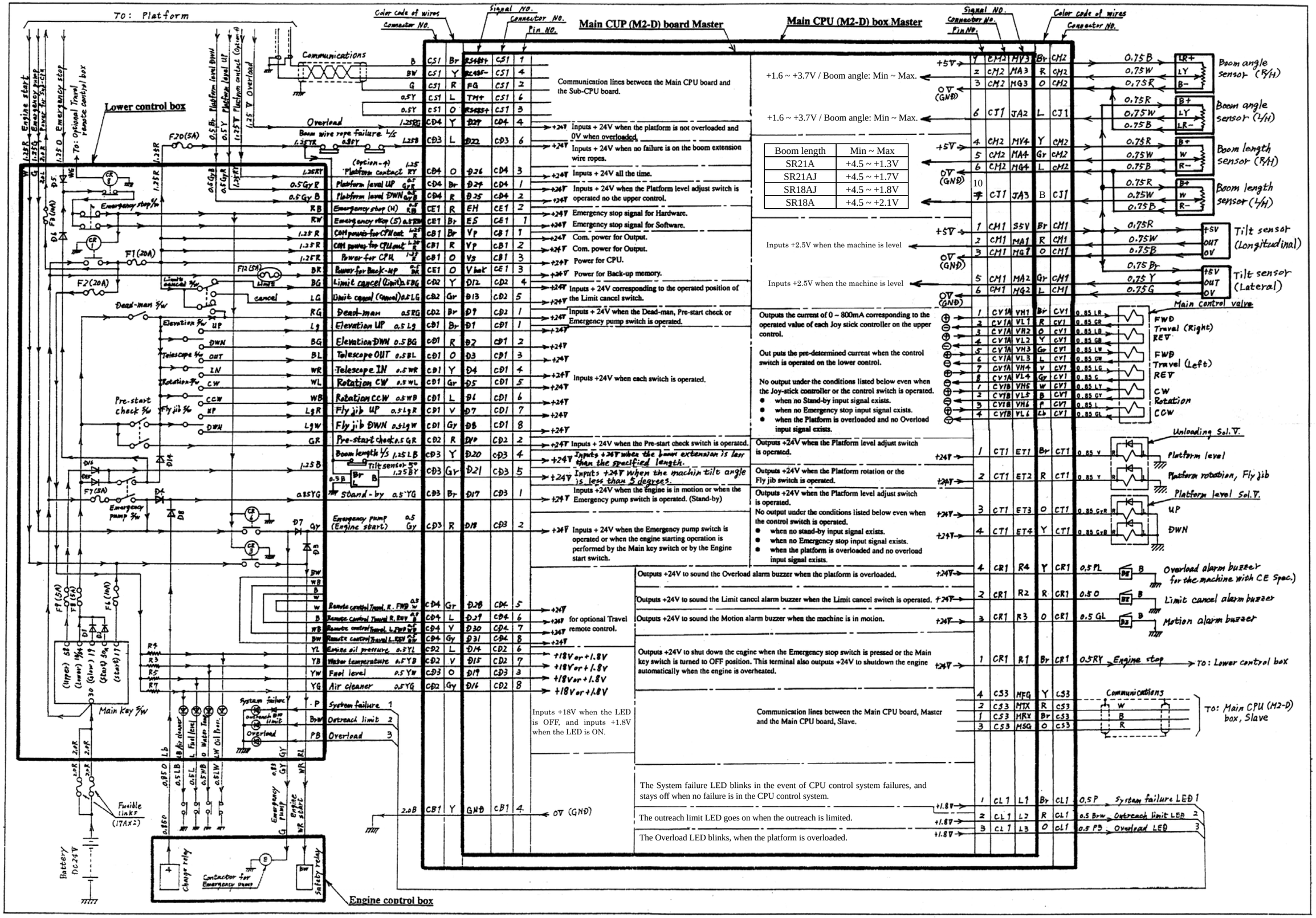
These 7- segment LEDs show error codes in the event of system failures.

See the pages 4- 5 and 4- 6 for the details of Error codes and their countermeasures.

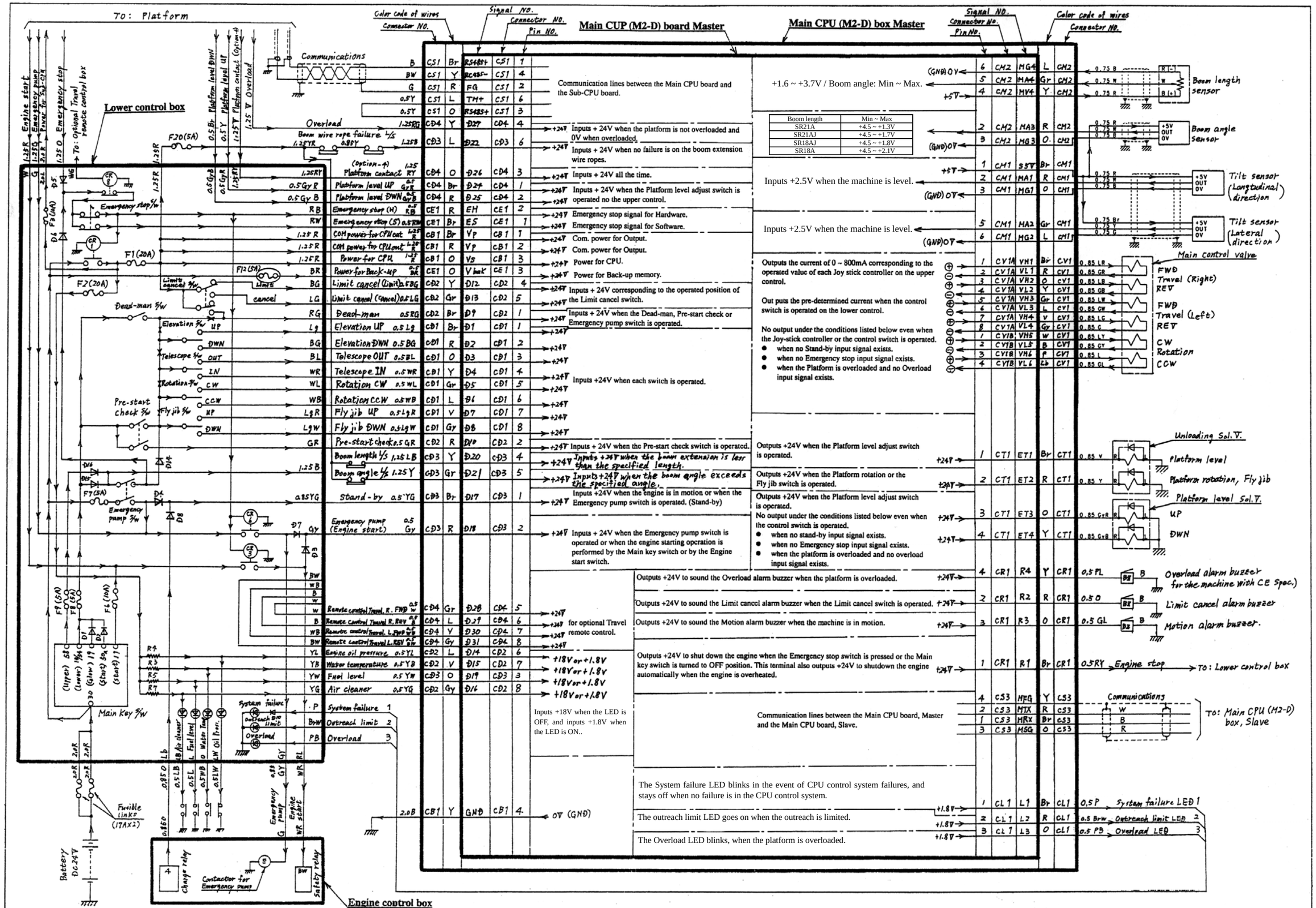


LED3 This LED blinks when the CPU is working normally, and goes off in the event of CPU failure.

2. Input/Output characteristics (for the machine with Duplicated sensors)



3. Input/Output characteristics (for the machine without Duplicated sensors)



Boom length	Min ~ Max
SR21A	+4.5 ~ +1.3V
SR21AJ	+4.5 ~ +1.7V
SR18AJ	+4.5 ~ +1.8V
SR18A	+4.5 ~ +2.1V

Inputs +2.5V when the machine is level.

Inputs +2.5V when the machine is level.

Outputs the current of 0 ~ 800mA corresponding to the operated value of each Joy stick controller on the upper control.

Out puts the pre-determined current when the control switch is operated on the lower control.

No output under the conditions listed below even when the Joy-stick controller or the control switch is operated.
- when no Stand-by input signal exists.
- when no Emergency stop input signal exists.
- when the Platform is overloaded and no Overload input signal exists.

Inputs +24V when each switch is operated.

Inputs + 24V when the platform is not overloaded and 0V when overloaded.

Inputs + 24V when no failure is on the boom extension wire ropes.

Inputs + 24V all the time.

Inputs + 24V when the Platform level adjust switch is operated no the upper control.

Emergency stop signal for Hardware.

Emergency stop signal for Software.

Com. power for Output.

Com. power for Output.

Power for CPU.

Power for Back-up memory.

Inputs + 24V corresponding to the operated position of the Limit cancel switch.

Inputs + 24V when the Dead-man, Pre-start check or Emergency pump switch is operated.

Inputs + 24V when the Pre-start check switch is operated.

Inputs +24V when the boom extension is less than the specified length.

Inputs +24V when the boom angle exceeds the specified angle.

Inputs +24V when the engine is in motion or when the Emergency pump switch is operated. (Stand-by)

Inputs + 24V when the Emergency pump switch is operated or when the engine starting operation is performed by the Main key switch or by the Engine start switch.

for optional Travel remote control.

Inputs +18V when the LED is OFF, and inputs +1.8V when the LED is ON..

0V (GND)

Outputs +24V when the Platform level adjust switch is operated.

Outputs +24V when the Platform rotation or the Fly jib switch is operated.

Outputs +24V when the Platform level adjust switch is operated.
No output under the conditions listed below even when the control switch is operated.
- when no stand-by input signal exists.
- when no Emergency stop input signal exists.
- when the platform is overloaded and no overload input signal exists.

Outputs +24V to sound the Overload alarm buzzer when the platform is overloaded.

Outputs +24V to sound the Limit cancel alarm buzzer when the Limit cancel switch is operated.

Outputs +24V to sound the Motion alarm buzzer when the machine is in motion.

Outputs +24V to shut down the engine when the Emergency stop switch is pressed or the Main key switch is turned to OFF position. This terminal also outputs +24V to shutdown the engine automatically when the engine is overheated.

Communication lines between the Main CPU board, Master and the Main CPU board, Slave.

The System failure LED blinks in the event of CPU control system failures, and stays off when no failure is in the CPU control system.

The outreach limit LED goes on when the outreach is limited.

The Overload LED blinks, when the platform is overloaded.

4. Error codes and their countermeasures

Machines applied: Manufactured in April 2003 and after

In the event that any error was found, the 7 segment LEDs on the Main CPU board (M2D) Master indicate the error code as listed below.

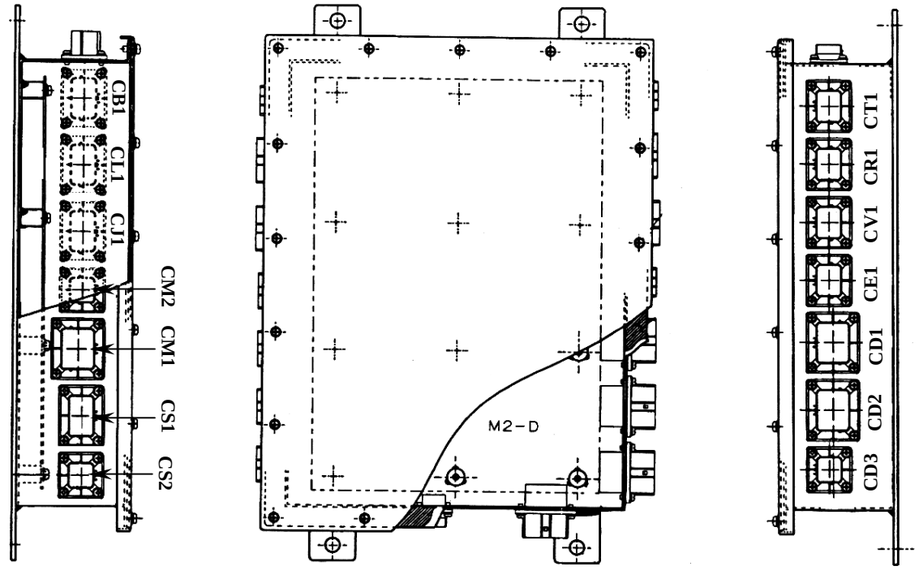
NOTE: If several errors were found at the same time, only one error code that has the highest priority will be indicated on the 7 segment LEDs.

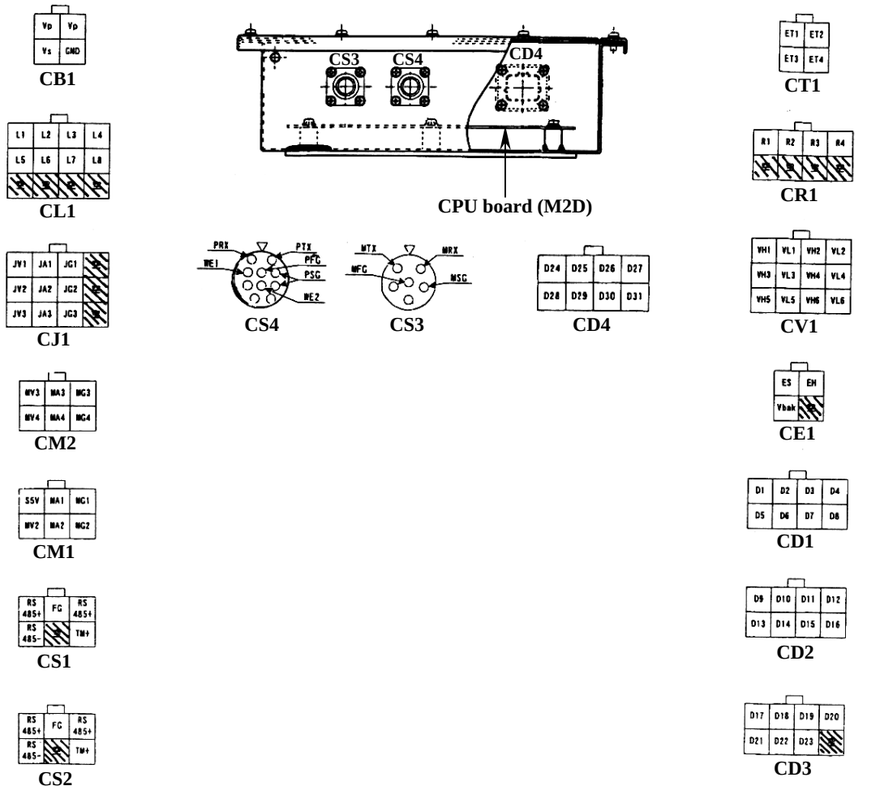
Priority	Error code	Upper control box		Lower control box		Error descriptions	Cause	Countermeasures
		System failure LED	Outreach limit LED	System failure LED	Outreach limit LED			
1	**30**	Blinks	Off	Blinks	Off	1. M2D Master. Divided by Zero 2. M2D Master. ROM error 3. M2D Master. RAM error 4. Exceptional error	1. Incorrect parameters are memorized in the Main CPU box (M2D) Master. 2. Faulty ROM in the Main CPU box (M2D) Master 3. Faulty Main CPU box (M2D) Master	1. Write the correct parameters into the Main CPU box (M2D) Master, using the Laptop computer. 2. Replace the Main CPU box (M2D) Master.
2	**31**	Blinks	Off	Blinks	Off	1. M2D Slave. Divided by Zero 2. M2D Slave. ROM error 3. M2D Slave. RAM error 4. Exceptional error	1. Incorrect parameters are memorized in the Main CPU box (M2D) Slave. 2. Faulty ROM in the Main CPU box (M2D) Slave 3. Faulty Main CPU box (M2D) Slave	1. Write the correct parameters into the Main CPU box (M2D) Slave, using the Laptop computer. 2. Replace the Main CPU box (M2D) Slave.
3	**32**	Blinks	Off	Blinks	Off	1. M4A. Divided by Zero 2. Exceptional error	Faulty Sub-CPU board (M4A)	Replace the Sub-CPU board (M4A).
4	**23**	Blinks	Off	Blinks	Off	M2D Master: E2PROM error	1. Incorrect or damaged parameters are memorized in the Main CPU box (M2D) Master. 2. Faulty Main CPU box (M2D) Master	1. Write the correct parameters into the Main CPU box (M2D) Master, using the Laptop computer. 2. Replace the Main CPU box (M2D) Master.
5	**24**	Blinks	Off	Blinks	Off	M2D Master: E2P Bios error	1. Incorrect or damaged parameters are memorized in the Main CPU box (M2D) Master. 2. Faulty Main CPU box (M2D) Master	1. Write the correct parameters into the Main CPU box (M2D) Master, using the Laptop computer. 2. Replace the Main CPU box (M2D) Master.
6	**64**	Off	Off	Off	Off	M2D Master. Power source voltage (24 volts) error	1. The main power voltage for the Main CPU box (M2D) Master is lower than 18 volts or higher than 30 volts. 2. Faulty Main CPU box (M2D) Master	1. Check the main power voltage and rectify. 2. Replace the Main CPU box (M2D) Master.
7	**66**	Off	Off	Off	Off	M4A. Power source voltage (24 volts) error	1. The main power voltage for the Sub-CPU board (M4A) is lower than 18 volts or higher than 30 volts. 2. Faulty Sub-CPU board (M4A)	1. Check the main power voltage and rectify. 2. Replace the Sub-CPU board (M4A).
8	**71**	Blinks	Off	Blinks	Off	1. M2D Master, 12 bit AD timeout error 2. M2D Master, 12 bit AD converter error 3. M2D Master, 10 bit AD timeout error 4. M2D Master, 10 bit AD converter error	Faulty Main CPU box (M2D) Master	Replace the Main CPU box (M2D) Master.
9	**74**	Blinks	Off	Blinks	Off	M2D Master. AD power source voltage (5 volts) error	Faulty Main CPU box (M2D) Master	Replace the Main CPU box (M2D) Master.
10	**72**	Blinks	Off	Blinks	Off	1. M2D Slave, 12 bit AD timeout error 2. M2D Slave, 12 bit AD converter error 3. M2D Slave, 10 bit AD timeout error 4. M2D Slave, 10 bit AD converter error	Faulty Main CPU box (M2D) Slave	Replace the Main CPU box (M2D) Slave.
11	**73**	Blinks	Off	Blinks	Off	1. M4A. 12 bit AD converter error 2. M4A. 10 bit AD converter error	Faulty Sub-CPU board (M4A)	Replace the Sub-CPU board (M4A).
12	**90**	Blinks	Off	Blinks	Off	1. M2D Master. PWM 1 error: Travel Right, FWD 2. M2D Master. PWM 2 error: Travel Right, REV	The Main CPU box (M2D) Master has output to the Travel Right FWD or REV solenoid in spite of no command. 1. Short circuit in the output lines to the Travel Right FWD or REV solenoid 2. Faulty Travel Right FWD or REV solenoid 3. Faulty Main CPU box (M2D) Master	1. Rectify the output lines to the Travel Right FWD and/or REV solenoids. 2. Replace the Travel Right FWD and/or REV solenoid(s). 3. Replace the Main CPU box (M2D) Master.
13	**92**	Blinks	Off	Blinks	Off	1. M2D Master. PWM 3 error: Travel Left, FWD 2. M2D Master. PWM 4 error: Travel Left, REV	The Main CPU box (M2D) Master has output to the Travel Left FWD or REV solenoid in spite of no command. 1. Short circuit in the output lines to the Travel Left FWD or REV solenoid 2. Faulty Travel Left FWD or REV solenoid 3. Faulty Main CPU box (M2D) Master	1. Rectify the output lines to the Travel Left FWD and/or REV solenoids. 2. Replace the Travel Left FWD and/or REV solenoid(s). 3. Replace the Main CPU box (M2D) Master.
14	**94**	Blinks	Off	Blinks	Off	1. M2D Master PWM 5 error: Boom rotation CW 2. M2D Master PWM 6 error: Boom rotation CCW	The Main CPU box (M2D) Master has output to the Rotation CW or CCW solenoid in spite of no command. 1. Short circuit in the output lines to the Rotation CW or CCW solenoid 2. Faulty Rotation CW or CCW solenoid 3. Faulty Main CPU box (M2D) Master	1. Rectify the output lines to the Rotation CW and /or CCW solenoids. 2. Replace the Rotation CW and/or CCW solenoid(s). 3. Replace the Main CPU box (M2D) Master.
15	**98**	Blinks	Off	Blinks	Off	1. M2D Slave PWM 1 error: Elevation UP 2. M2D Slave PWM 2 error: Elevation Down 3. M2D Slave PWM 3 error: Telescope Out 4. M2D Slave PWM 4 error: Telescope In	The Main CPU box (M2D) Slave has output to the PWM1, PWM 2, PWM 3, or PWM4 in spite of no command. 1. Short circuit in the output lines to the solenoid(s) 2. Faulty solenoid(s) 3. Faulty Main CPU box (M2D) Slave	1. Rectify the output lines to the solenoid(s). 2. Replace the solenoid(s). 3. Replace the Main CPU box (M2D) Slave.
16	**77**	Blinks	Off	Blinks	Off	1. M2D Master: ET1 error: Unload sol. A 2. M2D Master: ET2 error: Unload sol. B 3. M2D Master: ET3 error: Platform level UP 4. M2D Master: ET4 error: Platform level DWN.	The Main CPU box (M2D) Master has output to the ET1, ET2, ET3, or ET4 in spite of no command. 1. Short circuit in the output lines to the solenoid(s) 2. Faulty solenoid(s) 3. Faulty Main CPU box (M2D) Master	1. Rectify the output lines to the solenoid(s). 2. Replace the solenoid(s). 3. Replace the Main CPU box (M2D) Master.
17	**79**	Blinks	Off	Blinks	Off	1. M4A. ET1 error: Platform rotation CW 2. M4A. ET2 error: Platform rotation CCW.	The Sub-CPU board (M4A) has output to the Platform rotation solenoid CW or CCW in spite of no command. 1. Short circuit in the output lines to the Platform rotation solenoid CW or CCW 2. Faulty Platform rotation solenoid CW or CCW 3. Faulty Sub-CPU board (M4A)	1. Rectify the output lines to the Platform rotation CW and/or CCW solenoids. 2. Replace the Platform rotation CW and/or CCW solenoid(s). 3. Replace the Sub-CPU board (M4A).
18	**81**	Blinks	Off	Blinks	Off	M2D Master: RS485 Reception error (M4A → M2D Master)	The Main CPU box (M2D) Master has failed to receive the data from the Sub-CPU board (M4A). 1. Faulty communication lines between the Main CPU box (M2D) Master and the Sub-CPU board (M4A) 2. Faulty Main CPU box (M2D) Master 3. Faulty Sub-CPU board (M4A)	1. Rectify the communication lines. 2. Replace the Main CPU box (M2D) Master. 3. Replace the Sub-CPU board (M4A).
19	**82**	Blinks	Off	Blinks	Off	M4A. RS485 Reception error (M2D Master → M4A)	The sub CPU board (M4A) has failed to receive the data from the Main CPU box (M2D) Master. 1. Faulty communication lines between the Main CPU box (M2D) Master and the Sub-CPU board (M4A) 2. Faulty Main CPU box (M2D) Master 3. Faulty Sub-CPU board (M4A)	1. Rectify the communication lines. 2. Replace the Main CPU box (M2D) Master. 3. Replace the Sub-CPU board (M4A).

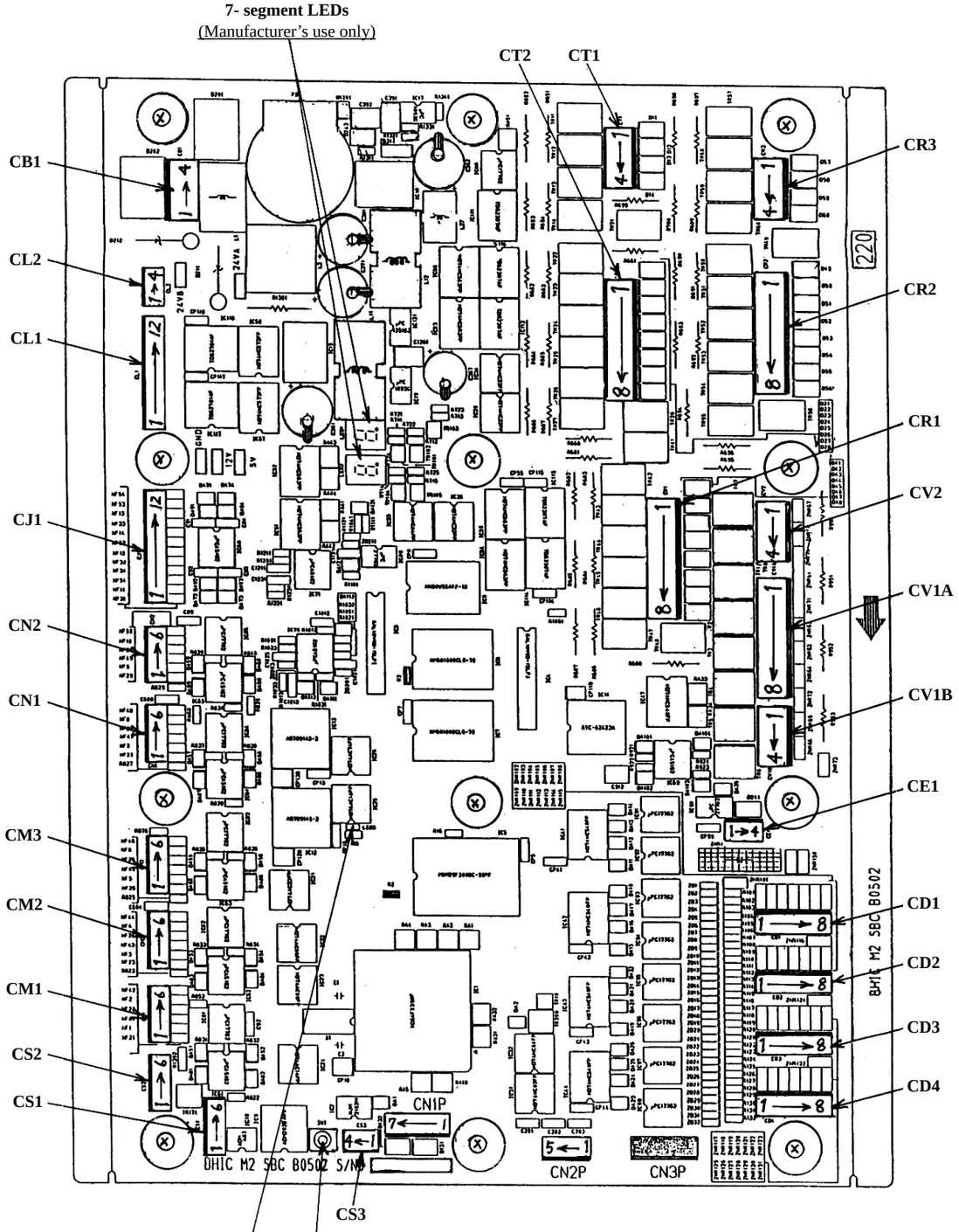
Priority	Error code	Upper control box		Lower control box		Error descriptions	Cause	Countermeasures
		System failure LED	Outreach limit LED	System failure LED	Outreach limit LED			
20	**06**	Blinks	Off	Blinks	Off	AD Lower limit: Boom angle	Abnormally low AD value has been input from the Boom angle sensor. 1. Faulty electrical lines between the Boom angle sensor and the Main CPU box (M2D) Master 2. Incorrect Boom angle sensor calibrations 3. Faulty Boom angle sensor. 4. Faulty Main CPU box (M2D) Master 5. **[For the machine with Duplicated sensor]** The difference of AD value between the main and sub sensors exceeds the specified value.	1. Rectify the electrical lines to the Boom angle sensor. 2. Perform the Boom angle sensor calibrations, using the Laptop computer. 3. Replace the Boom angle sensor. 4. Replace the Main CPU box (M2D) Master.
21	**07**	Blinks	Off	Blinks	Off	AD Upper limit: Boom angle	Abnormally high AD value has been input from the Boom angle sensor. 1. Faulty electrical lines between the Boom angle sensor and the Main CPU box (M2D) Master 2. Incorrect Boom angle sensor calibrations 3. Faulty Boom angle sensor 4. Faulty Main CPU box (M2D) Master	1. Rectify the electrical lines to the Boom angle sensor. 2. Perform the Boom angle sensor calibrations, using the Laptop computer. 3. Replace the Boom angle sensor. 4. Replace the Main CPU box (M2D) Master.
22	**08**	Blinks	Off	Blinks	Off	AD Lower limit: Boom length	Abnormally low AD value has been input from the Boom length sensor. 1. Faulty electrical lines between the Boom length sensor and the Main CPU box (M2D) Master 2. Incorrect Boom length sensor calibrations 3. Faulty Boom length sensor 4. Faulty Main CPU box (M2D) Master 5. **[For the machine with Duplicated sensor]** The difference of AD value between the main and sub sensors exceeds the specified value.	1. Rectify the electrical lines to the Boom length sensor. 2. Perform the Boom length sensor calibrations, using the Laptop computer. 3. Replace the Boom length sensor. 4. Replace the Main CPU box (M2D) Master.
23	**09**	Blinks	Off	Blinks	Off	AD Upper limit: Boom length	Abnormally high AD value has been input from the Boom length sensor. 1. Faulty electrical lines between the Boom length sensor and the Main CPU box (M2D) Master 2. Incorrect Boom length sensor calibrations 3. Faulty Boom length sensor 4. Faulty Main CPU box (M2D) Master 5. **[For the machine with Boom wire rope failure L/S]** No input from the Boom wire rope failure L/S.	1. Rectify the electrical lines to the Boom length sensor. 2. Perform the Boom length sensor calibrations, using the Laptop computer. 3. Replace the Boom length sensor. 4. Replace the Main CPU box (M2D) Master. 5. Rectify the electrical lines to the Boom wire rope failure L/S, Replace the Boom wire rope failure L/S.
24	**53**	Blinks	Off	Blinks	Off	AD Lower limit: Tilt (X)	Abnormally low AD value has been input from the Tilt (X), Longitudinal sensor. 1. Faulty electrical lines between the Tilt sensor (X) and the Main CPU box (M2D) Master 2. Incorrect Tilt sensor (X) calibrations 3. Faulty Tilt sensor (X) 4. Faulty Main CPU box (M2D) Master	1. Rectify the electrical lines to the Tilt sensor (X). 2. Perform the Tilt sensor (X), Longitudinal calibrations, using the Laptop computer. 3. Replace the Tilt sensor (X), Longitudinal. 4. Replace the Main CPU box (M2D) Master.
25	**54**	Blinks	Off	Blinks	Off	AD Upper limit: Tilt (X)	Abnormally high AD value has been input from the Tilt (X), Longitudinal sensor. 1. Faulty electrical lines between the Tilt sensor (X) and the Main CPU box (M2D) Master 2. Incorrect Tilt sensor (X) calibrations 3. Faulty Tilt sensor (X) 4. Faulty Main CPU box (M2D) Master	1. Rectify the electrical lines to the Tilt sensor (X). 2. Perform the Tilt sensor (X), Longitudinal calibrations, using the Laptop computer. 3. Replace the Tilt sensor (X), Longitudinal. 4. Replace the Main CPU box (M2D) Master.
26	**55**	Blinks	Off	Blinks	Off	AD Lower limit: Tilt (Y)	Abnormally low AD value has been input from the Tilt (Y), Lateral sensor. 1. Faulty electrical lines between the Tilt sensor (Y) and the Main CPU box (M2D) Master 2. Incorrect Tilt sensor (Y) calibrations 3. Faulty Tilt sensor (Y) 4. Faulty Main CPU box (M2D) Master	1. Rectify the electrical lines to the Tilt sensor (Y). 2. Perform the Tilt sensor (Y), Lateral calibrations, using the Laptop computer. 3. Replace the Tilt sensor (Y), Lateral. 4. Replace the Main CPU box (M2D) Master.
27	**56**	Blinks	Off	Blinks	Off	AD Upper limit: Tilt (Y)	Abnormally high AD value has been input from the Tilt (Y), Lateral sensor. 1. Faulty electrical lines between the Tilt sensor (Y) and the Main CPU box (M2D) Master 2. Incorrect Tilt sensor (Y) calibrations 3. Faulty Tilt sensor (Y) 4. Faulty Main CPU box (M2D) Master	1. Rectify the electrical lines to the Tilt sensor (Y). 2. Perform the Tilt sensor (Y), Lateral calibrations, using the Laptop computer. 3. Replace the Tilt sensor (Y), Lateral. 4. Replace the Main CPU box (M2D) Master.
28	**84**	Blinks	Off	Blinks	Off	M2D Master: RS232 Reception error (M2D Slave → M2D Master)	The Main CPU box (M2D) Master has failed to receive the data from the Main CPU box (M2D) Slave. 1. Faulty communication lines between the Main CPU box (M2D) Master and the Main CPU box (M2D) Slave 2. Faulty Main CPU box (M2D) Master 3. Faulty Main CPU box (M2D) Slave	1. Rectify the communication lines. 2. Replace the Main CPU box (M2D) Master. 3. Replace the Main CPU box (M2D) Slave.
29	**85**	Blinks	Off	Blinks	Off	M2D Slave: RS232 Reception error (M2D Master → M2D Slave)	The Main CPU box (M2D) Slave has failed to receive the data from the Main CPU box (M2D) Master. 1. Faulty communication lines between the Main CPU box (M2D) Master and the Main CPU box (M2D) Slave 2. Faulty Main CPU box (M2D) Master 3. Faulty Main CPU box (M2D) Slave	1. Rectify the communication lines. 2. Replace the Main CPU box (M2A) Master. 3. Replace the Main CPU box (M2D) Slave.
30	**60**	Blinks	Off	Blinks	Off	Limit cancel switch error	1. Open or short circuit in the lines between the ***"Limit cancel switch"*** and the Main CPU box (M2D) Master 2. Faulty Limit cancel switch 3. Faulty Main CPU box (M2D) Master	1. Rectify the lines between the Limit cancel switch and the Main CPU box (M2D) master. 2. Replace the Limit cancel switch. 3. Replace the Main CPU box (M2D) Master.
31	**61**	Blinks	Off	Blinks	Off	Pre-start check error	Pre-start check switch was operated while the platform is positioned out of the specified range for Pre-start check.	See the operation manual
32	**69**	Blinks	Off	Blinks	Off	Runaway movements	AD values for sensors have been changed in spite of no outputs. 1. Faulty Hydraulic system 2. Short circuit in the output lines to solenoid(s) 3. Faulty solenoid(s) 4. Faulty Main CPU box (M2D) Master 5. Faulty Main CPU box (M2D) Slave	1. Rectify the Hydraulic system. 2. Rectify the output lines to solenoid(s). 3. Replace the solenoid(s). 4. Replace the Main CPU box (M2D) Master. 5. Replace the Main CPU box (M2D) Slave.

Main CPU box (M2D), Slave

This ***Main CPU box (M2D), Slave*** is installed on the turntable to control the machine functions together with the ***Main CPU box (M2D), Master*** installed on the turntable and the ***Sub- CPU board (M4A)*** installed in the upper control box.

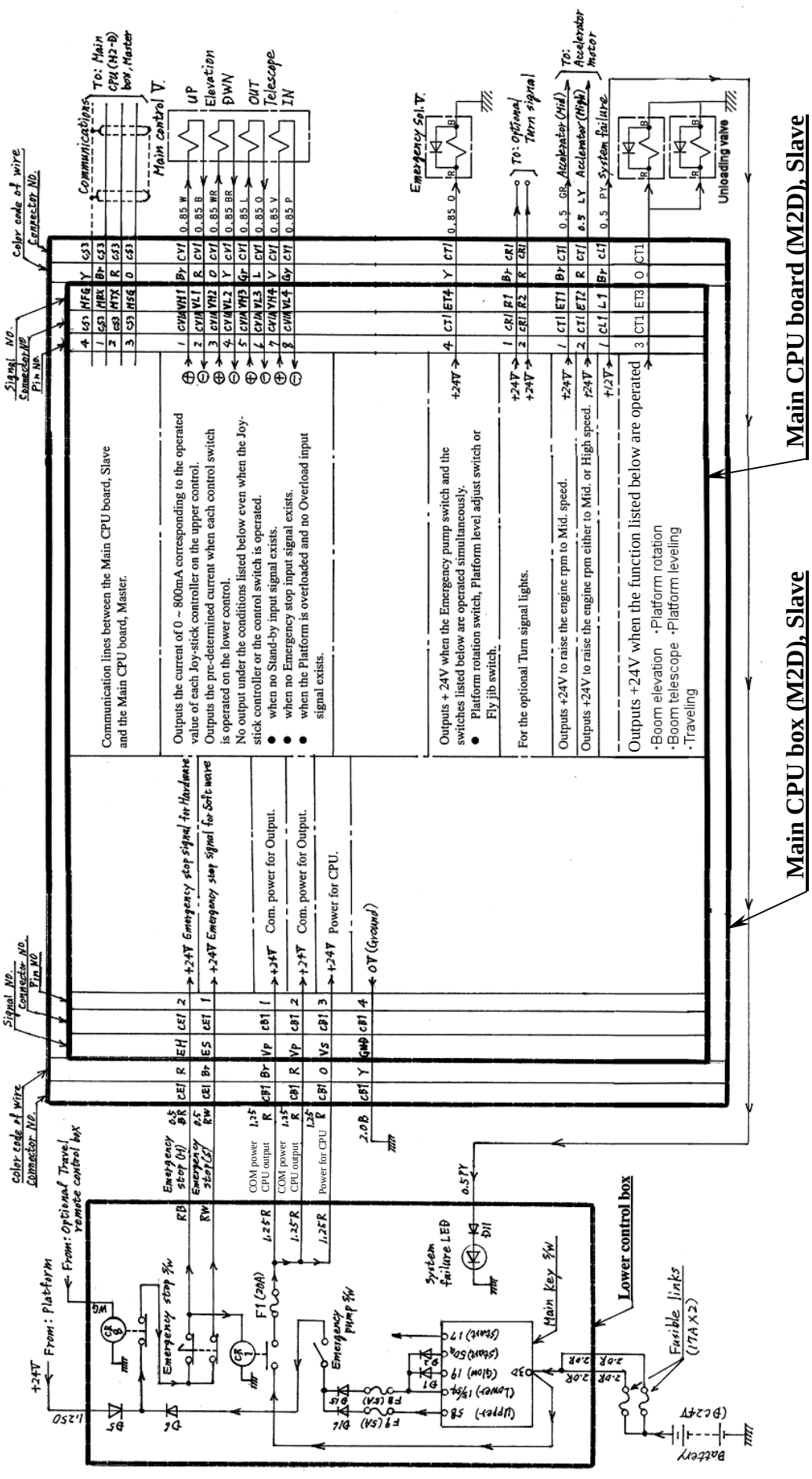






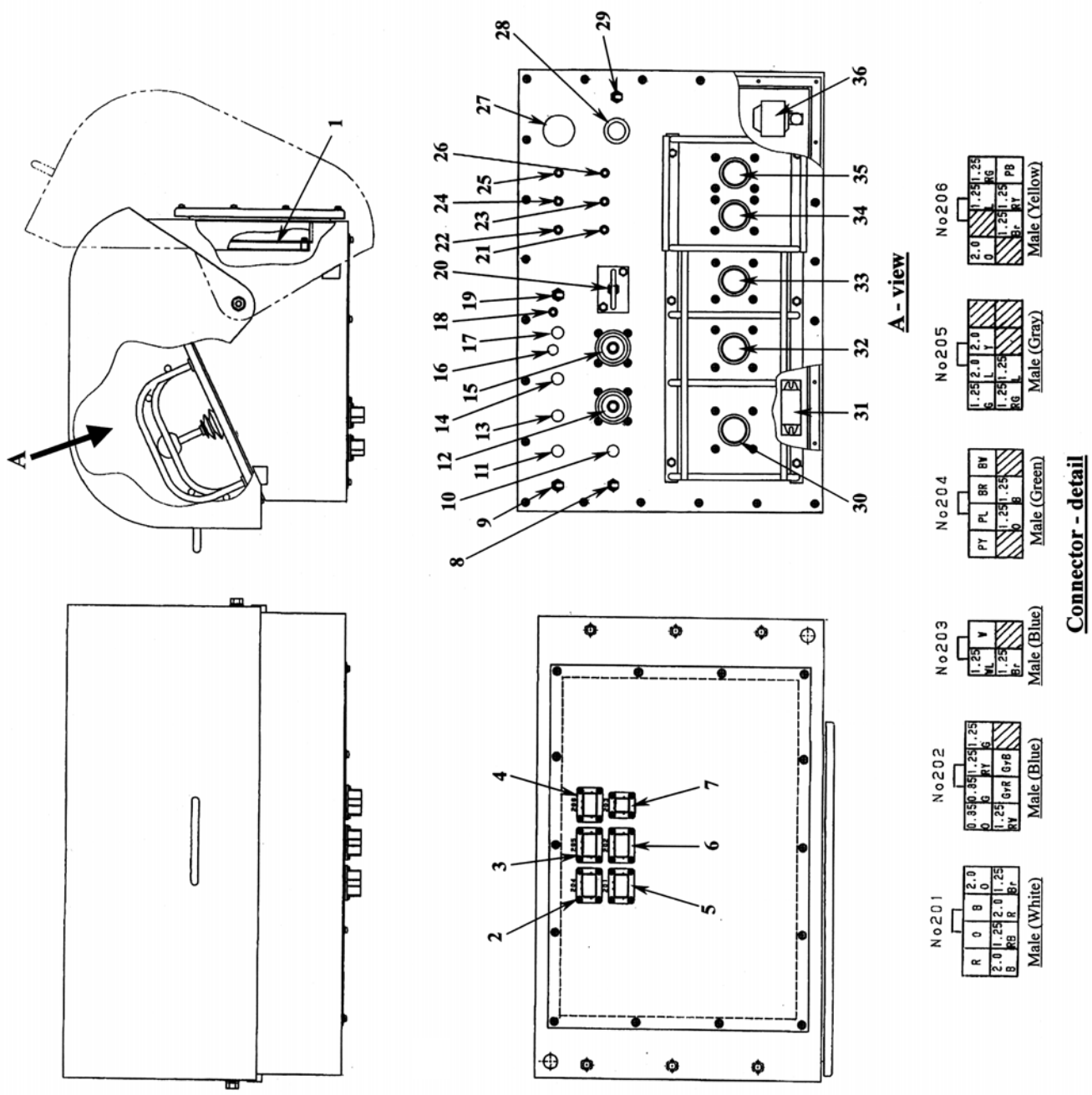
LED3 This LED blinks when the CPU is working normally, and goes off in the event of CPU failure.

1. Input/Output characteristics

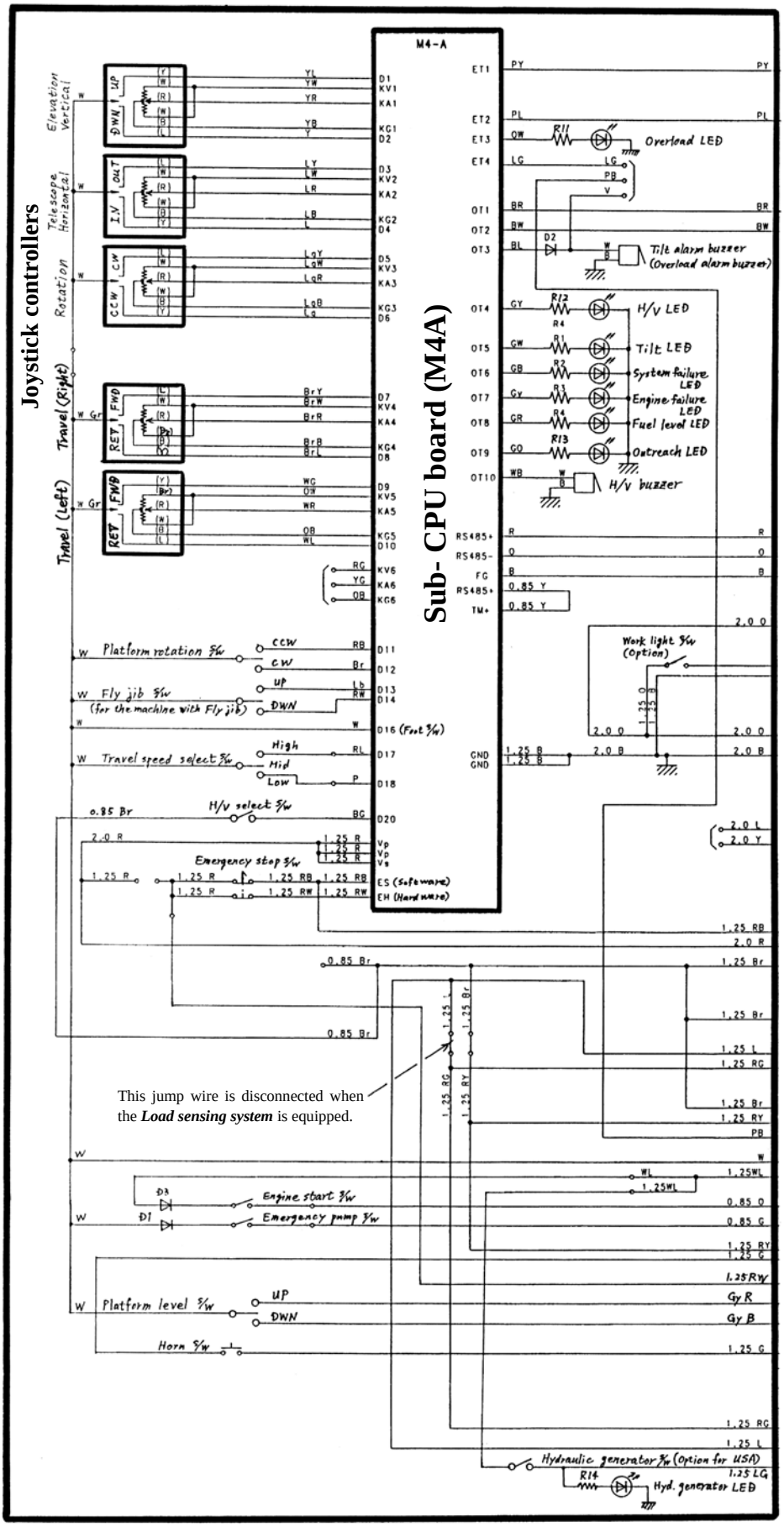


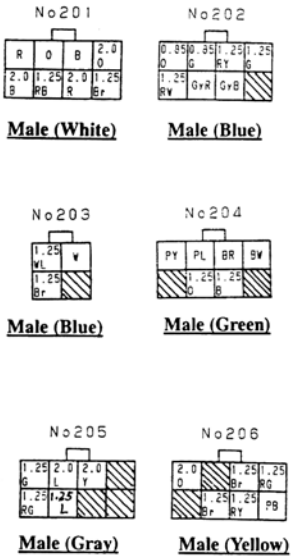
Upper control box (for the machine with Double joystick controllers)

No.	Descriptions	Remarks
1	Sub-CPU board (M4-A)	
2	Connector No. 204	
3	Connector No. 205	
4	Connector No. 206	
5	Connector No. 201	
6	Connector No. 202	
7	Connector No. 203	
8	Travel speed select switch	
9	Emergency pump switch	
10	Plug	Option
11	Work light switch	Option
12	Platform rotation switch	
13	Plug	
14	Plug	
15	Fly jib switch	For the machine with Fly jib only.
16	Hydraulic generator LED	Option for USA
17	Hydraulic generator switch	Option for USA
18	Horizontal/Vertical LED	
19	Horizontal/Vertical select switch	
20	Platform level adjust switch	
21	Overload LED	
22	System failure LED	
23	Outreach limit LED	SR18A/ISR60 is not equipped with this LED.
24	Fuel level LED	
25	Engine failure LED	
26	Tilt LED	
27	Emergency stop switch	
28	Horn switch	
29	Engine start switch	
30	Joystick controller for Rotation	
31	Horizontal/Vertical buzzer	
32	Joystick controller for Telescope	
33	Joystick controller for Elevation	
34	Joystick controller for Travel (Left)	
35	Joystick controller for Travel (Right)	
36	Tilt/Overload alarm buzzer	



1 Electrical schematic



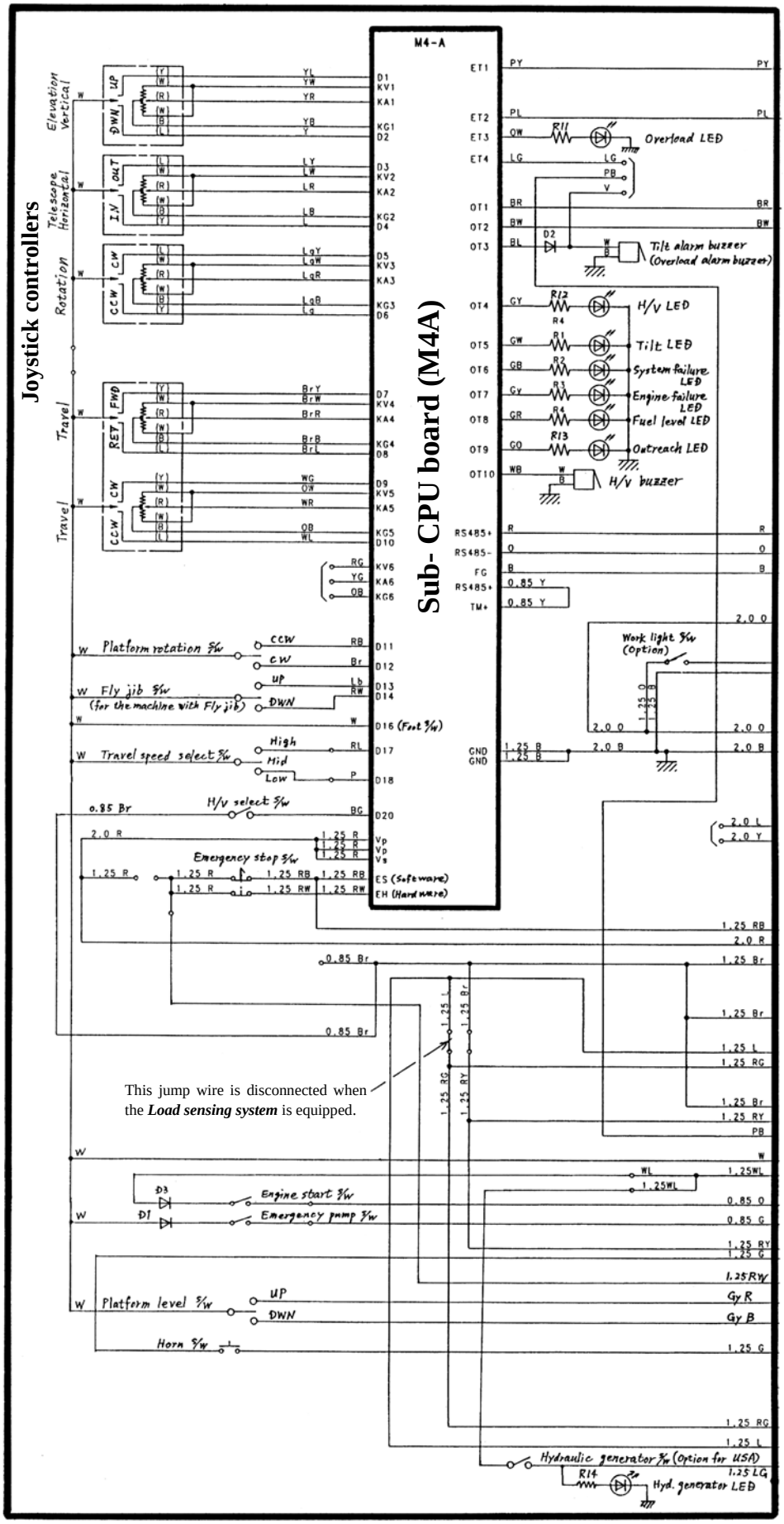


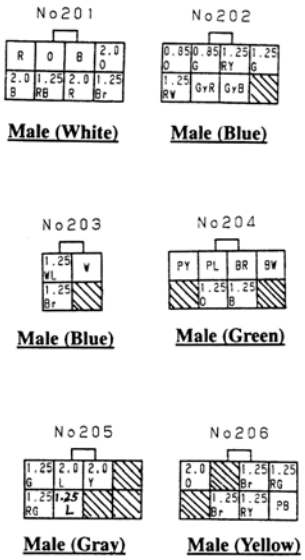
Connector detail

Upper control box (for the machine with Single joystick controller)

No.	Descriptions	Remarks
1	Sub-CPU board	
2	Connector No. 204	
3	Connector No. 205	
4	Connector No. 206	
5	Connector No. 201	
6	Connector No. 202	
7	Connector No. 203	
8	Travel speed select switch	
9	Emergency pump switch	
10	Work light switch	Option
11	Platform rotation switch	
12	Blind plug for optional switch	
13	Fly jib switch	For the machine with Fly jib only.
14	Hydraulic generator LED	Option for USA only.
15	Hydraulic generator switch	Option for USA only.
16	Horizontal/Vertical LED	
17	Horizontal/Vertical select switch	
18	Platform level adjust switch	
19	Overload LED	
20	System failure LED	
21	Outreach limit LED	SR18A/ISR60 is not equipped with this LED.
22	Fuel level LED	
23	Tilt LED	
24	Engine failure LED	
25	Emergency stop switch	
26	Horn switch	
27	Engine start switch	
28	Joy stick controller for Travelling	
29	Joy stick controller for Rotation	
30	Tilt/Overload alarm buzzer	
31	Joy stick controller for Telescope	
32	Horizontal/Vertical buzzer	
33	Joy stick controller for Elevation	

1 Electrical schematic



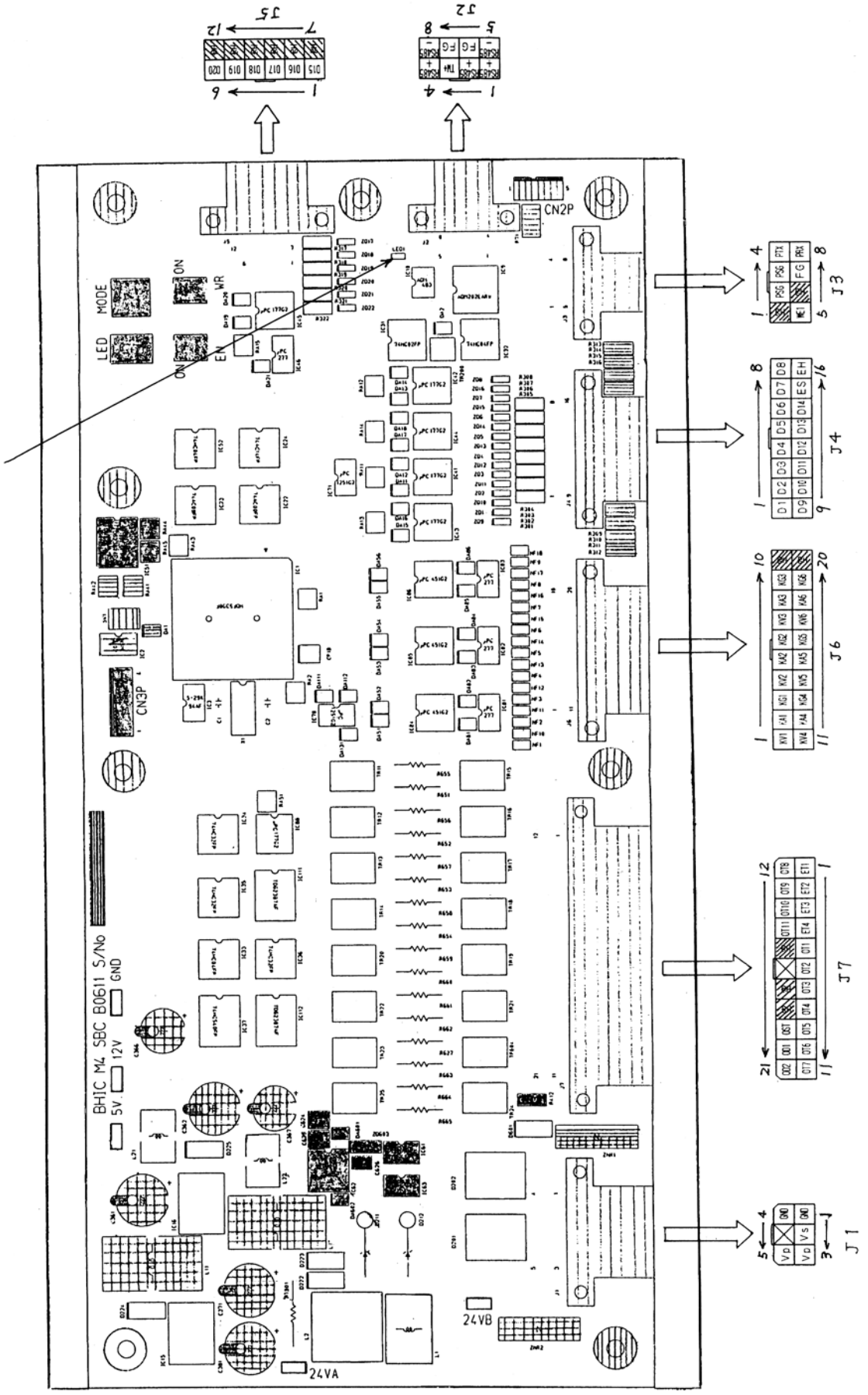


Connector detail

Sub- CPU board (M4A)

329- 00223- 00B

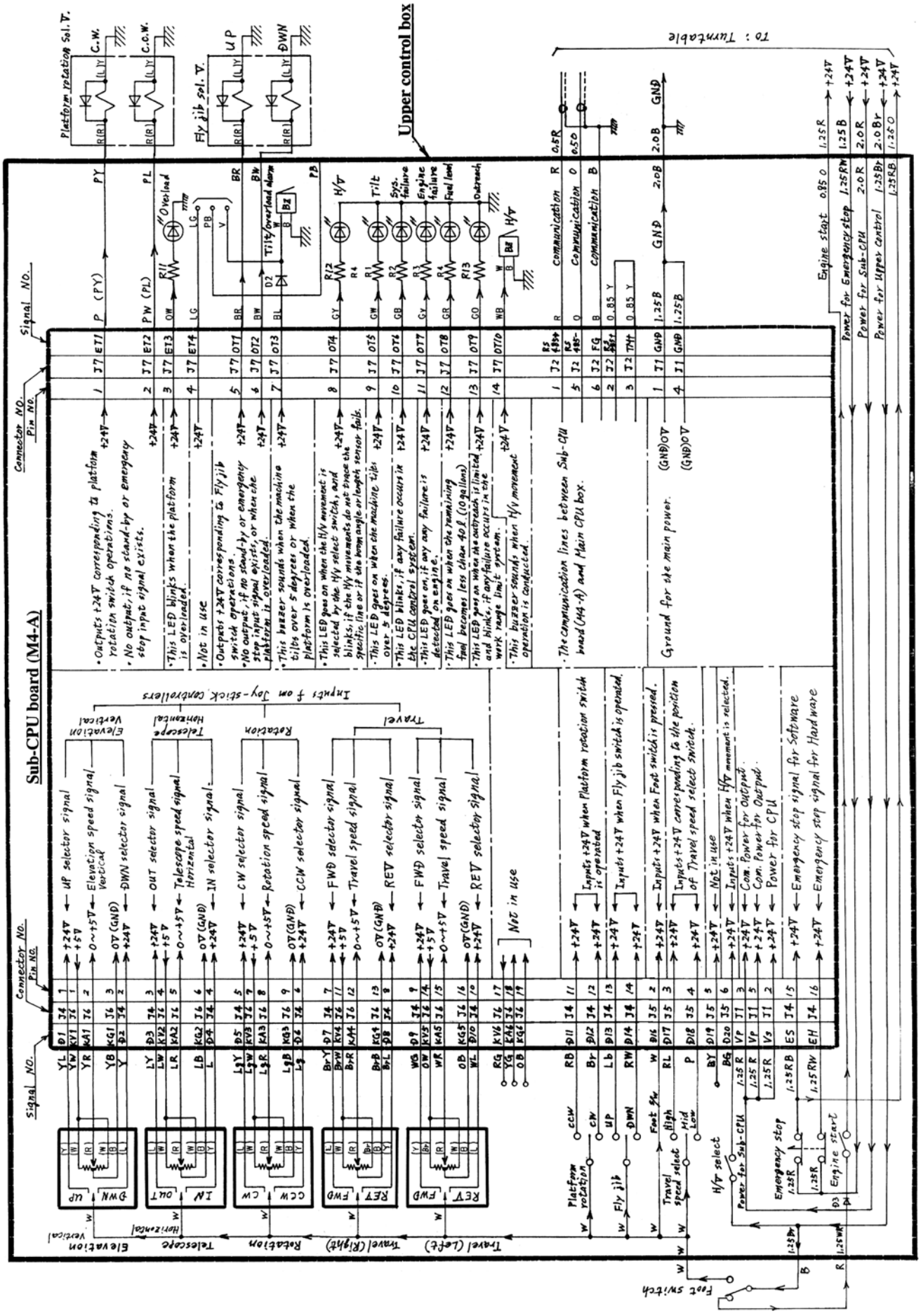
This board is installed in the Upper control box to control the machine together with the ***Main CPU boxes (M2D), Master and Slave*** located at the turntable.



1. Input / output characteristics

329- 00223- 00

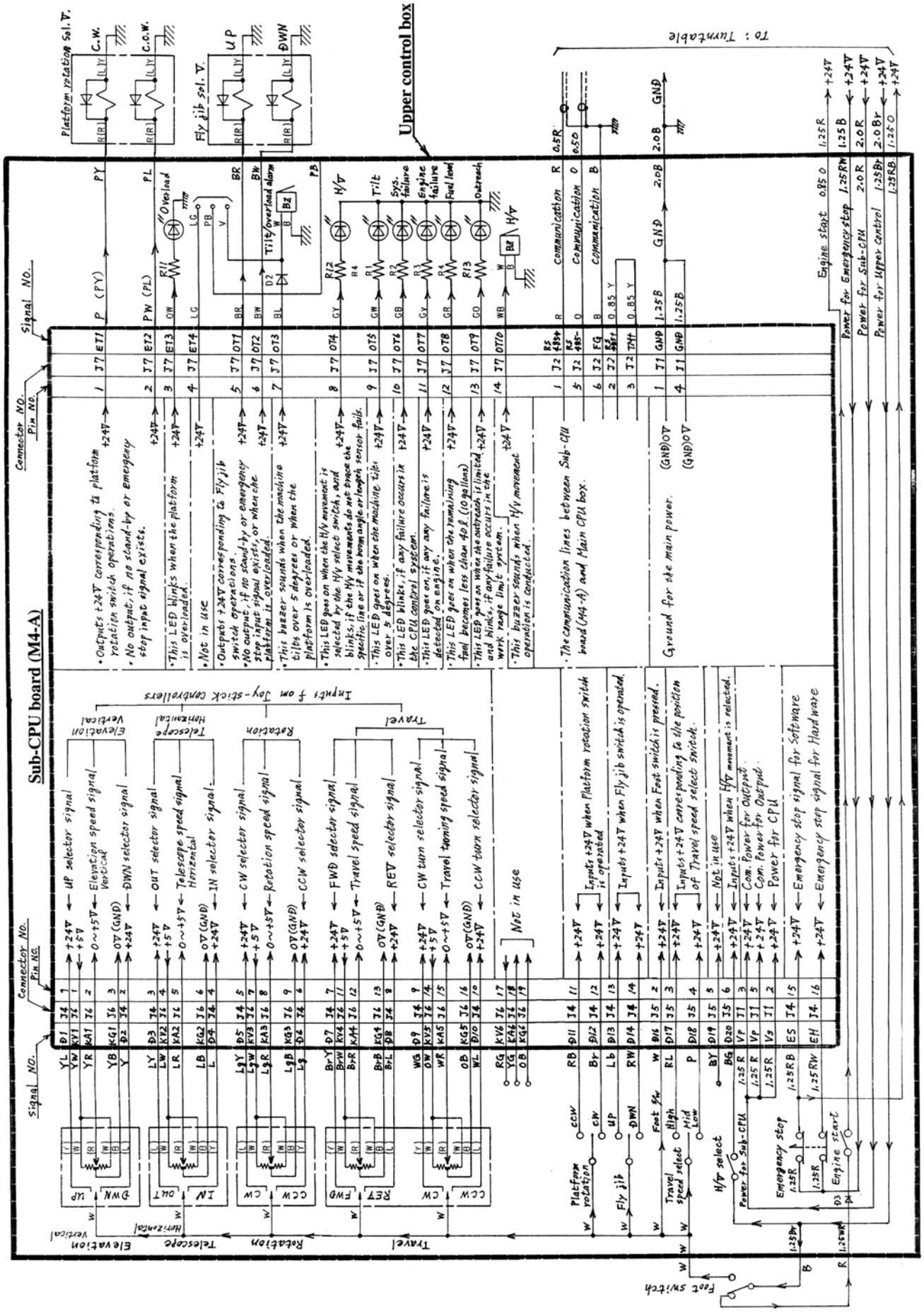
(For the machine with Double travel joystick controllers)



2. Input / output characteristics

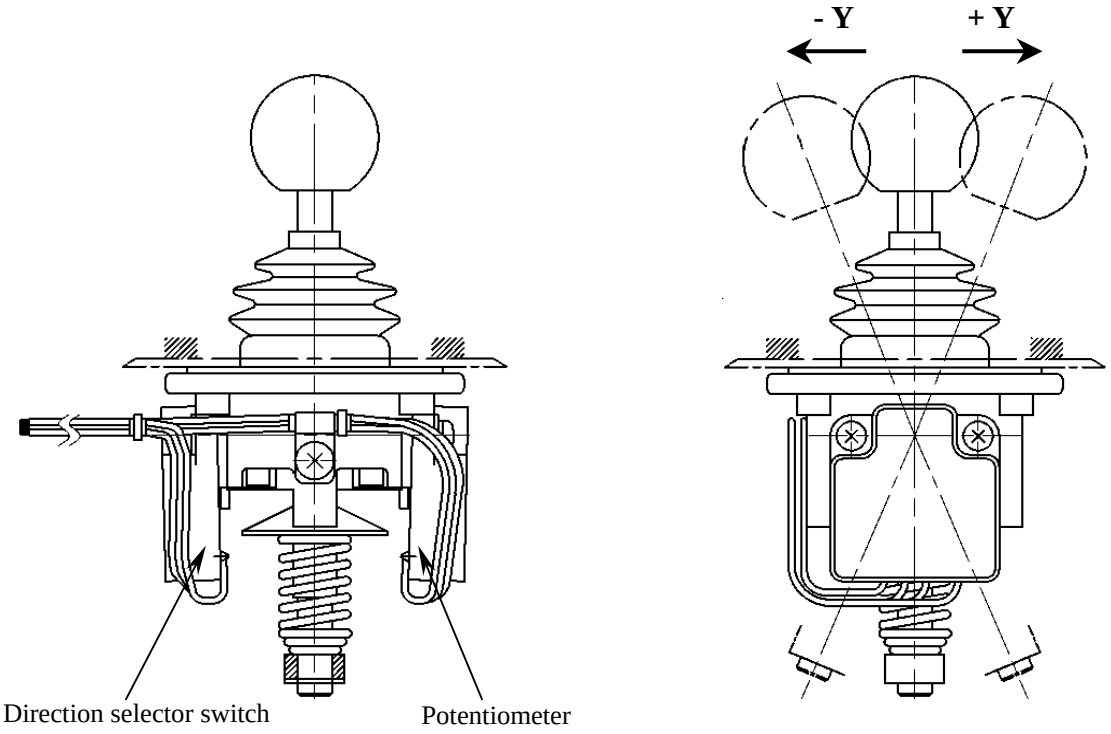
329- 00223- 00

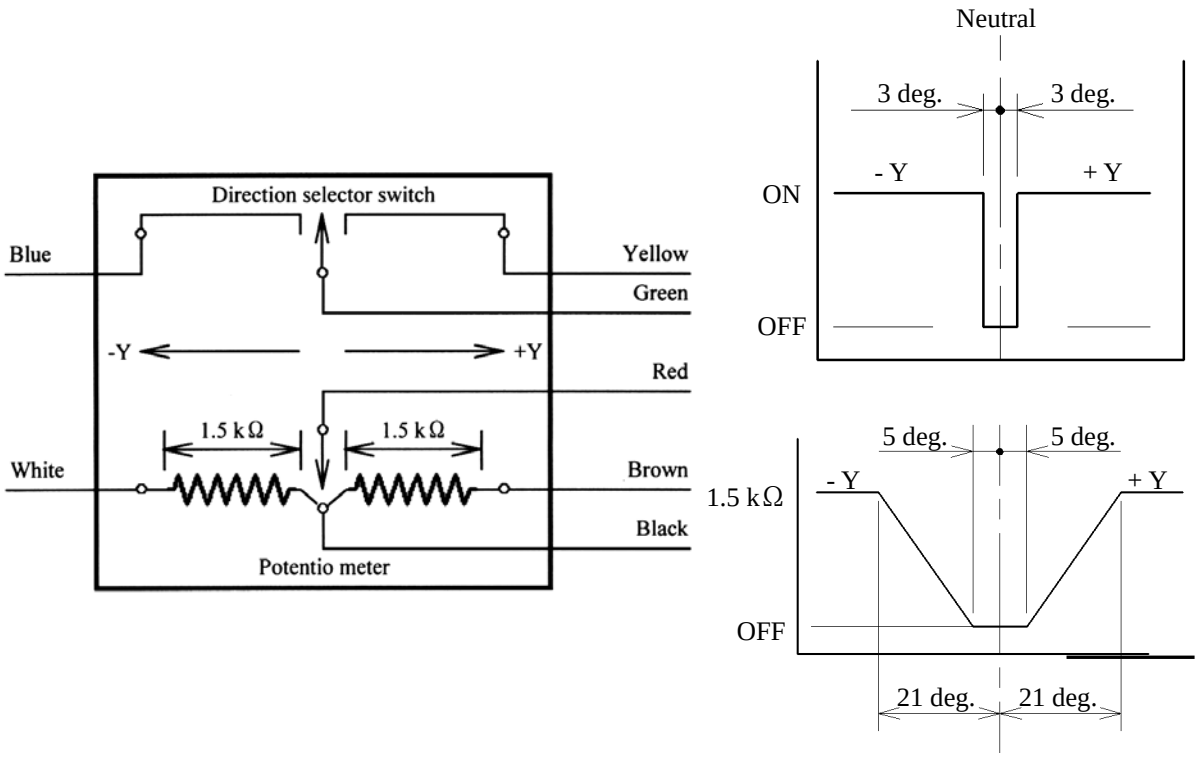
(For the machine with Single travel joystick controllers)



Joystick controller for Boom functions

Three joystick controllers shown below are installed on the upper control box to proportionally control the Boom elevation, Boom telescope and Boom rotation functions.

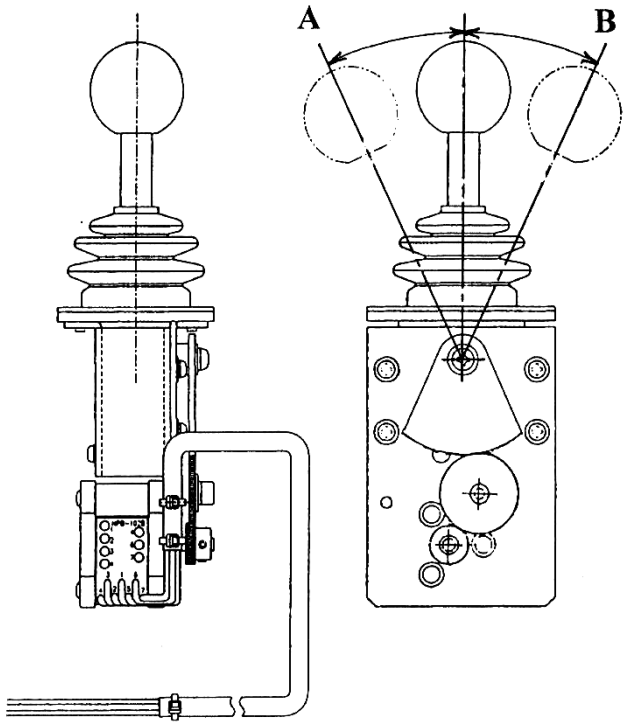


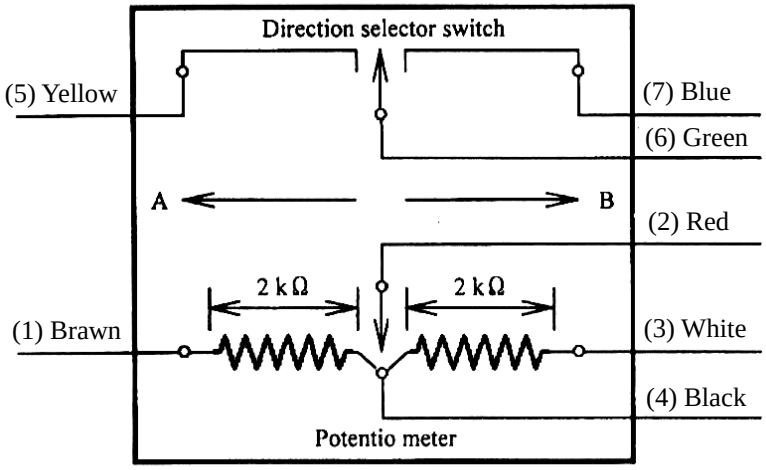


Joystick controller for Travel functions

(for the machine with Double travel joystick controllers)

Two joystick controllers shown below are installed on the upper control box to proportionally control the traveling functions.

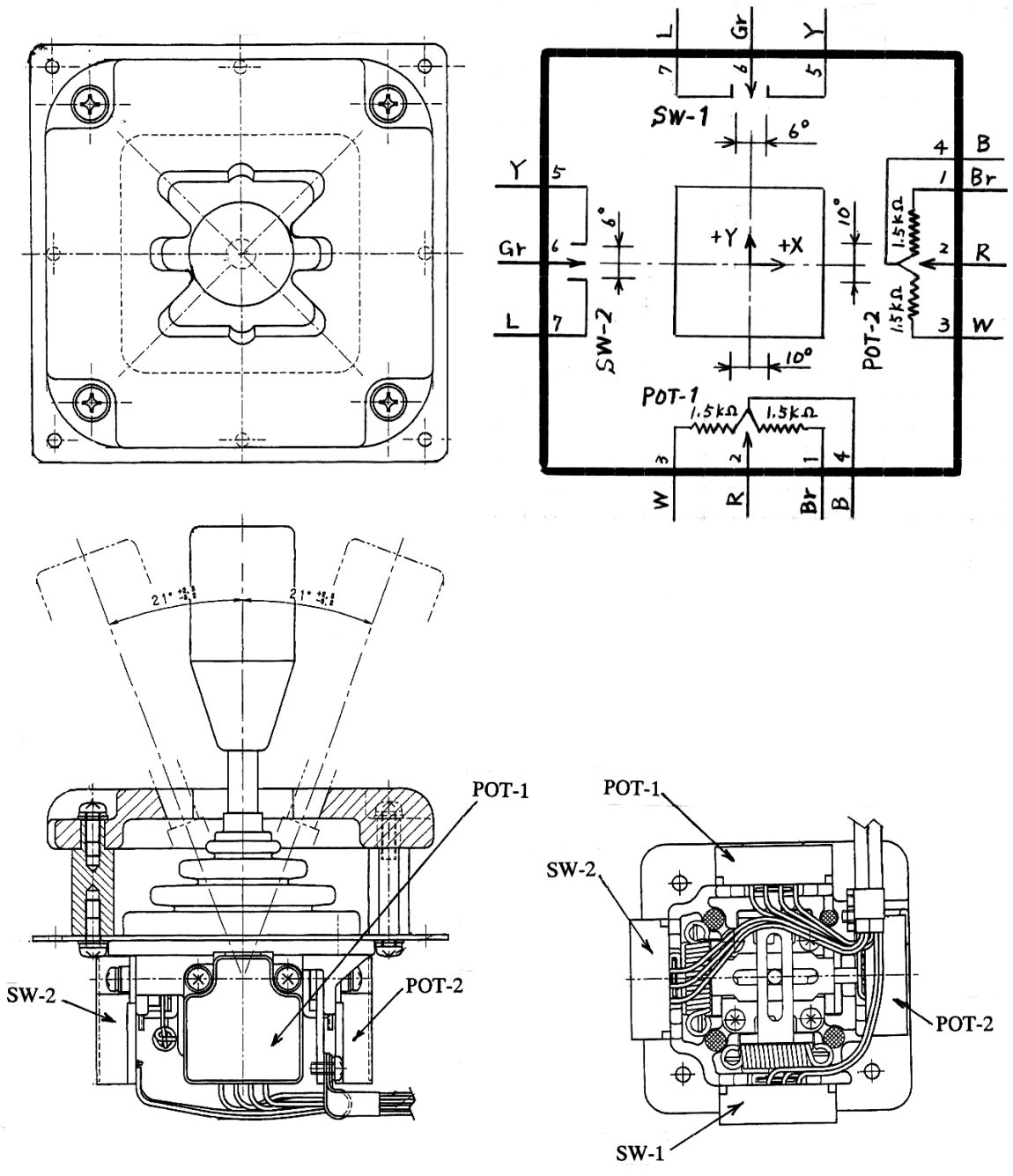




Joystick controller for Travel functions

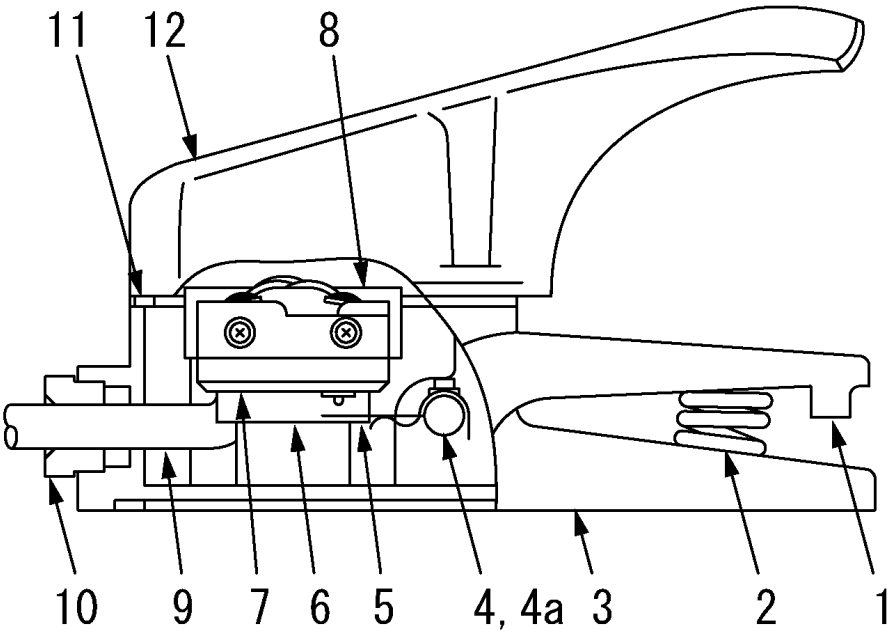
(for the machine with Single Travel joystick controller)

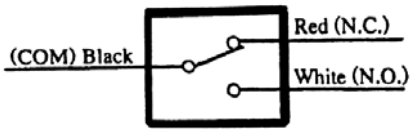
This joystick controller is installed on the upper control box to proportionally control the traveling functions.



Foot switch

This foot switch is installed on the platform floor to disable the functions unless the foot switch is depressed.

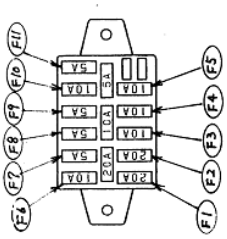




No.	Description	No.	Description
1	Pedal	7	Micro switch (MZ20-7117)
2	Spring	8	Insulator
3	Body	9	Electric cable
4	Pedal shaft	10	Cable gland
4a	O-ring	11	Rubber packing
5	Lever	12	Cover
6	Switch holder	----	----------

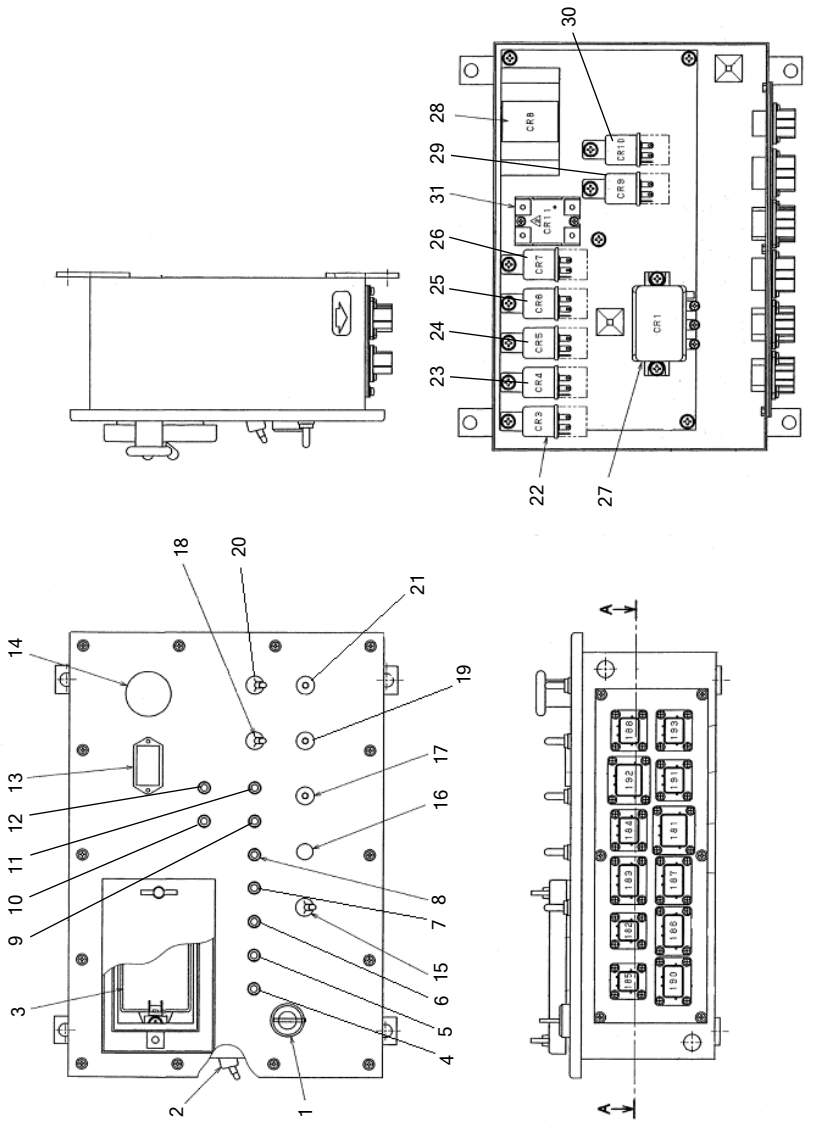
Lower control box

No.	Capacity	Descriptions
F1	20 A	CPU, Upper
F2	20 A	Engine
F3	10 A	CPU, Lower
F4	10 A	Work light
F5	10 A	Glow (Fuel pump)
F6	10 A	Engine start
F7	5 A	Emergency pump
F8	5 A	Lower control
F9	5 A	Upper control
F10	10 A	Horn
F11	5 A	Hour meter

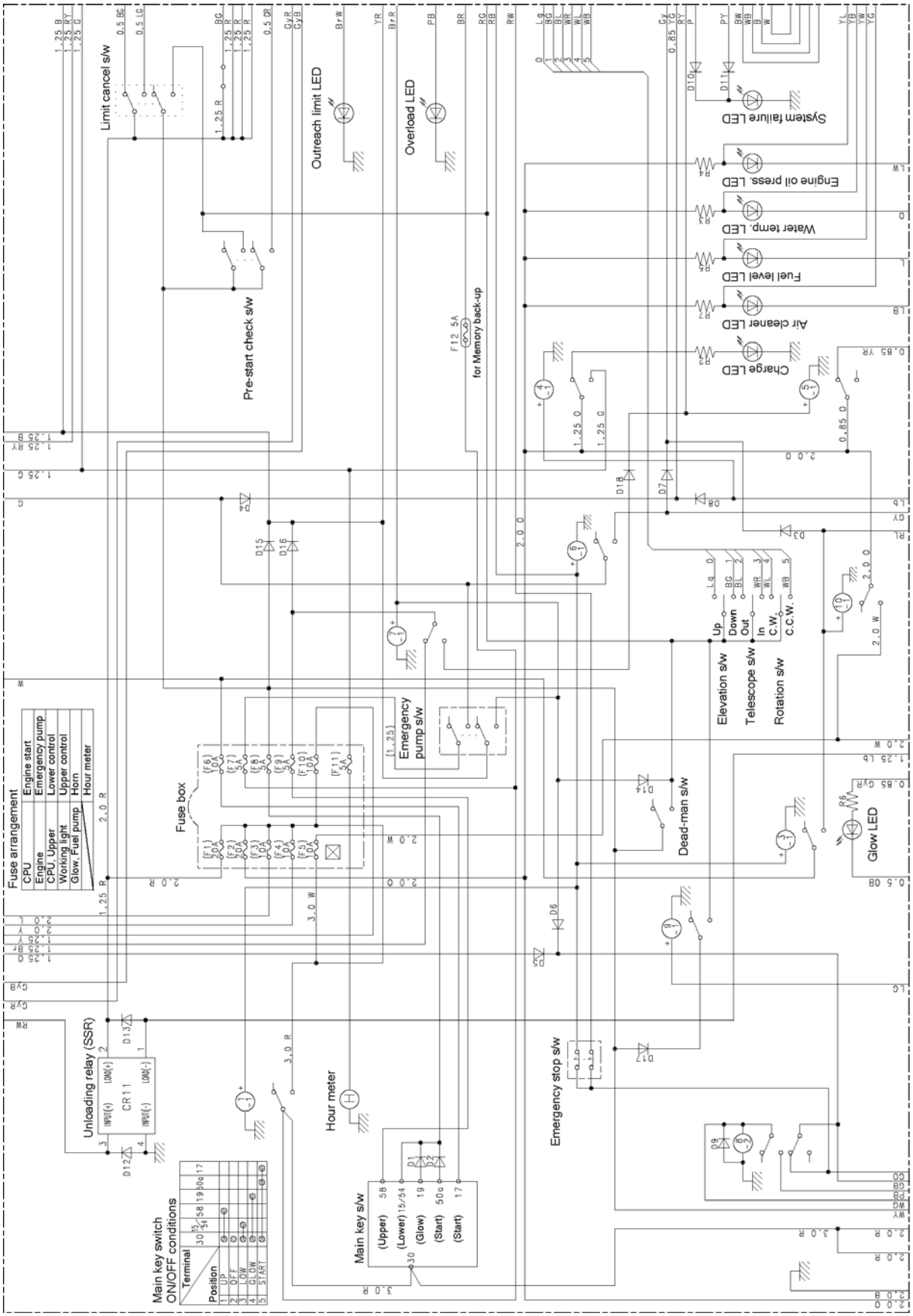


Fuse holder detail

No.	Descriptions	Remarks
1	Main key switch	
2	Limit cancel switch	
3	Fuse holder	
4	Glow LED	
5	Fuel level LED	
6	Engine oil pressure LED	
7	Water temperature LED	
8	Charge LED	
9	Air cleaner LED	
10	System failure LED	
11	Outreach limit LED	
12	Overload LED	
13	Hour meter	
14	Emergency stop switch	
15	Enable switch	
16	Fly jib switch	For the machine with Fly jib only.
17	Boom rotation switch	
18	Emergency pump switch	
19	Boom telescope switch	
20	Pre-start check switch	
21	Boom elevation switch	
22	Relay CR3	320-05792
23	Relay CR4	320-05792
24	Relay CR5	320-05792
25	Relay CR6	320-05792
26	Relay CR7	320-05792
27	Relay CR1	320-05778
28	Relay CR8	320-05792
29	Relay CR9	320-05792
30	Relay CR10	320-05792
31	Relay CR11	320-00094-00

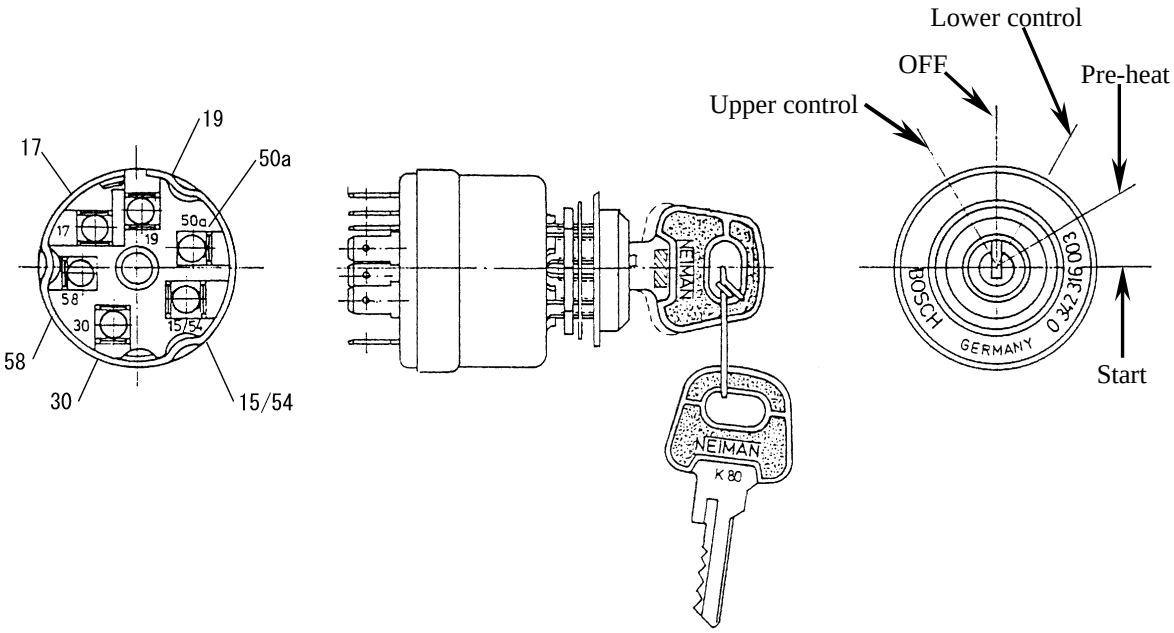


1. Electrical schematic



Main key switch

The Main key switch is installed on the lower control box to start or shut down the engine as well as to select the upper or lower control.



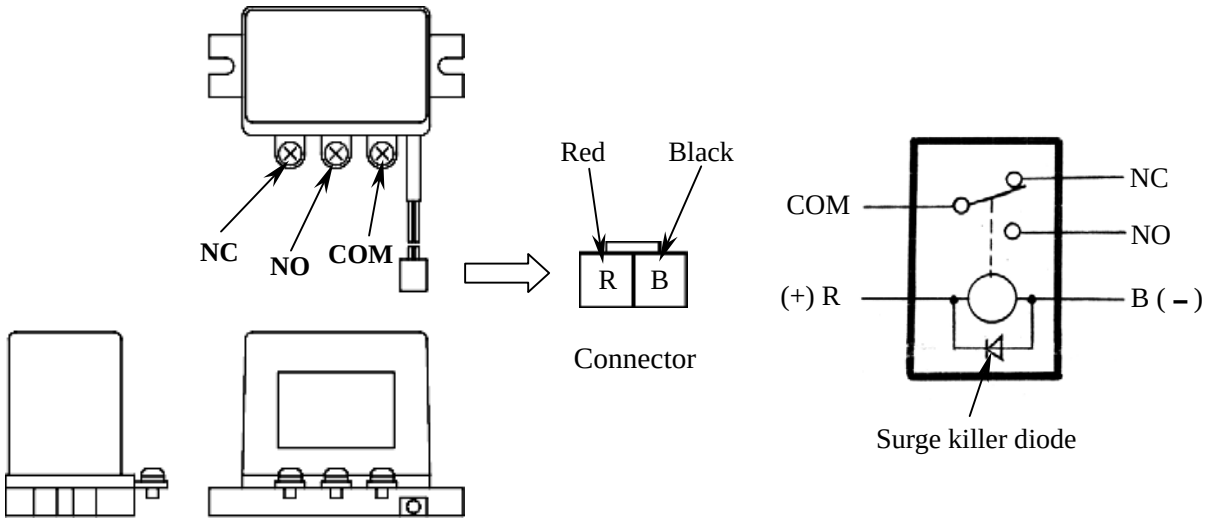
		Terminals					
		30	15/54	58	19	17	50a
Key positions	OFF	○					
	Upper control	○	—	○			
	Lower control	○	○				
	Pre-heat	○	—	—	○		
	Start	○	—	—	—	○	○

Relays in Lower control box

1. Relay CR1 (320- 05778)

This relay is installed in the lower control box to supply the main power to the machine.

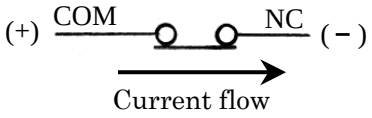
Rated voltage ---------- DC 24 v
Coil resistance ---------- 130 Ω



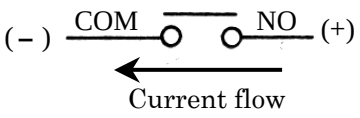
CAUTION

Connect the wires to the contacts of the relay as follows.

*When using ***"Normally closed"*** contact.



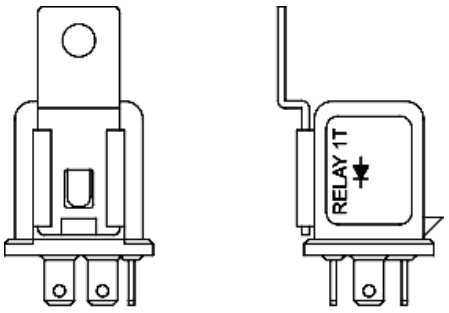
*When using "***Normally open***" contact.

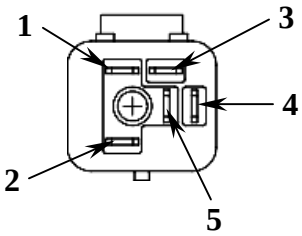


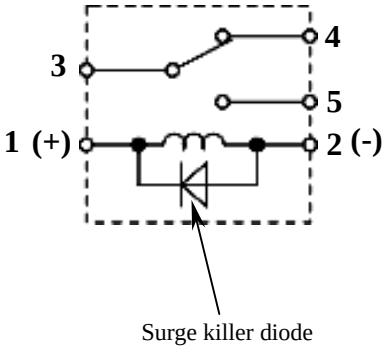
2. Relays CR3, 4, 5, 6, 7 and 10 (320- 05792)

These relays are installed in the lower control box to supply the power to the various electrical components.

Rated voltage ---------- DC 24 v
Coil resistance ---------- 290 Ω





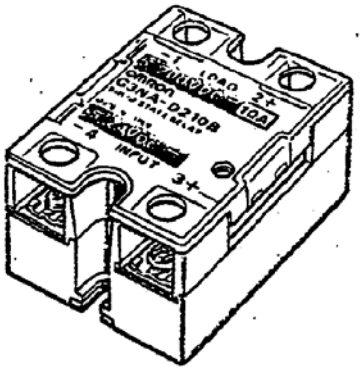


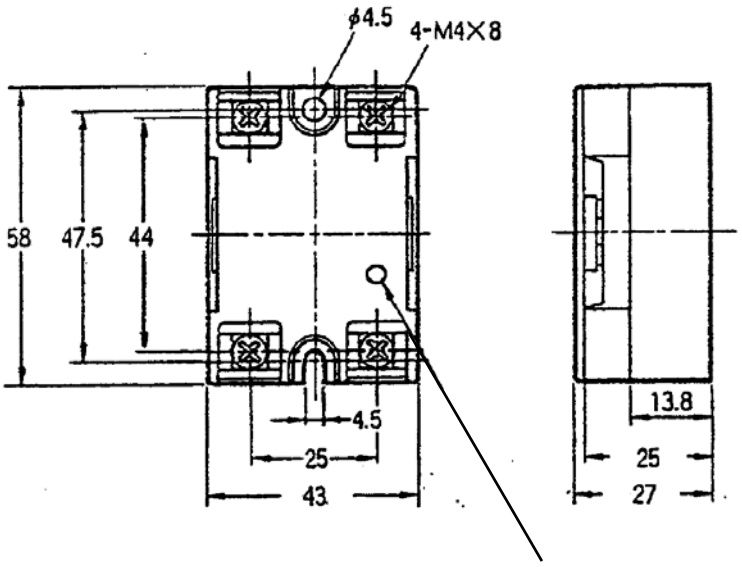
3. Relay CR-11 (320- 0009400)

This relay is installed in the lower control box to send signal to the unloading solenoid valves when the Boom elevation, Boom telescope, Boom rotation, Travel or Hydraulic generator is operated.

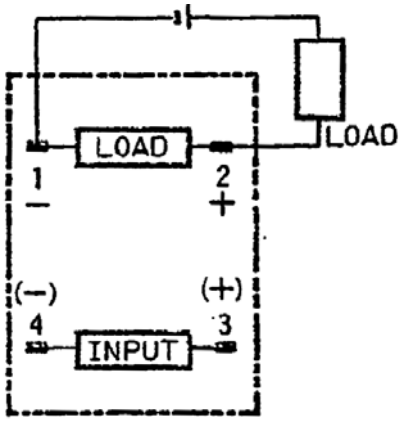
Rated voltage ---------- DC 24 v

Coil resistance ---------- 130 Ω



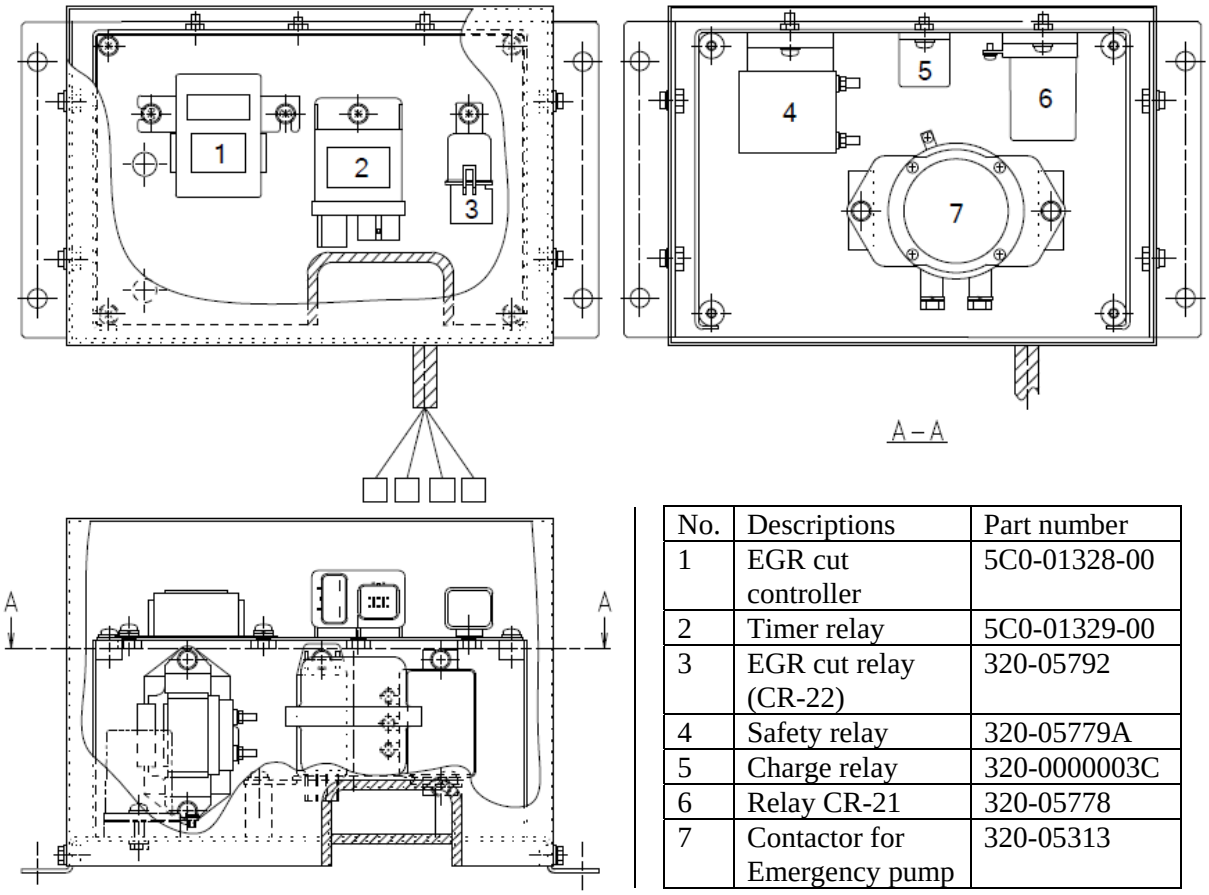


This LED goes on when outputting.



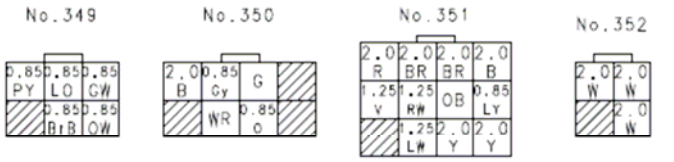
Engine control box

This Engine control box is installed at the right/front side of the turntable to control the engine, and to supplies the power (DC24 V) to the emergency pump.

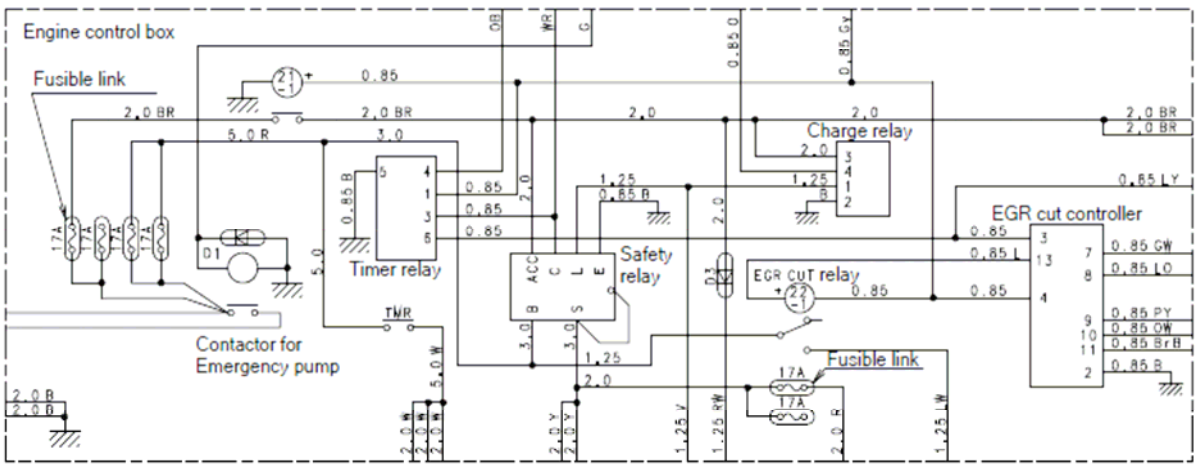


No.	Descriptions	Part number
1	EGR cut controller	5C0-01328-00
2	Timer relay	5C0-01329-00
3	EGR cut relay (CR-22)	320-05792
4	Safety relay	320-05779A
5	Charge relay	320-0000003C
6	Relay CR-21	320-05778
7	Contactor for Emergency pump	320-05313

Connector

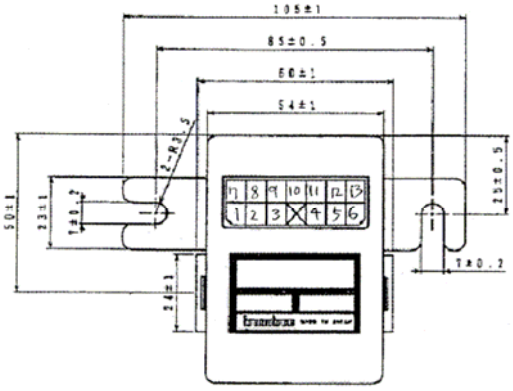


Electric circuit

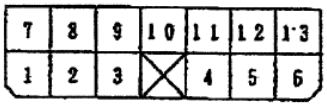


1. EGR cut controller (5C0-01328-00)

The EGR cut controller is installed in the engine control box to control the EGR cut solenoid.



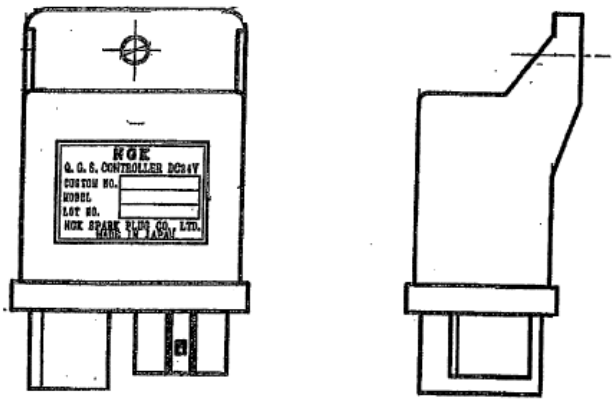
Connector

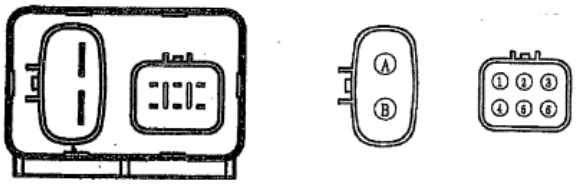


1	Starter s/w
2	Battery (-) C/U/GND
3	Thermo sensor
4	IGkey (+)
5	(TXD)
6	Stop R/L
7	Tacho (+)
8	Tacho (-)
9	Boost VCC
10	Boost SIG
11	Boost GND
12	(RXD)
13	EGR R/L

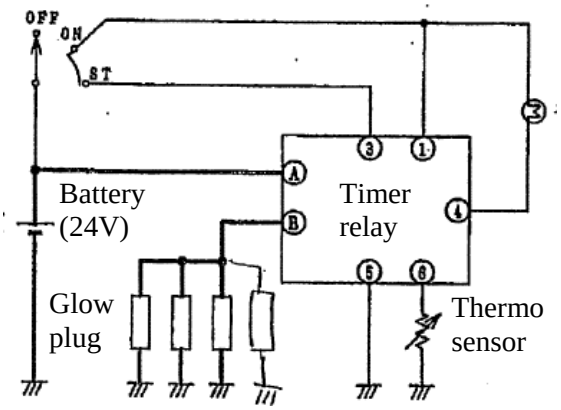
2. Timer relay (5C0-01329-00)

The timer relay is installed in the engine control box to supply power to the glow plugs on the diesel engine.



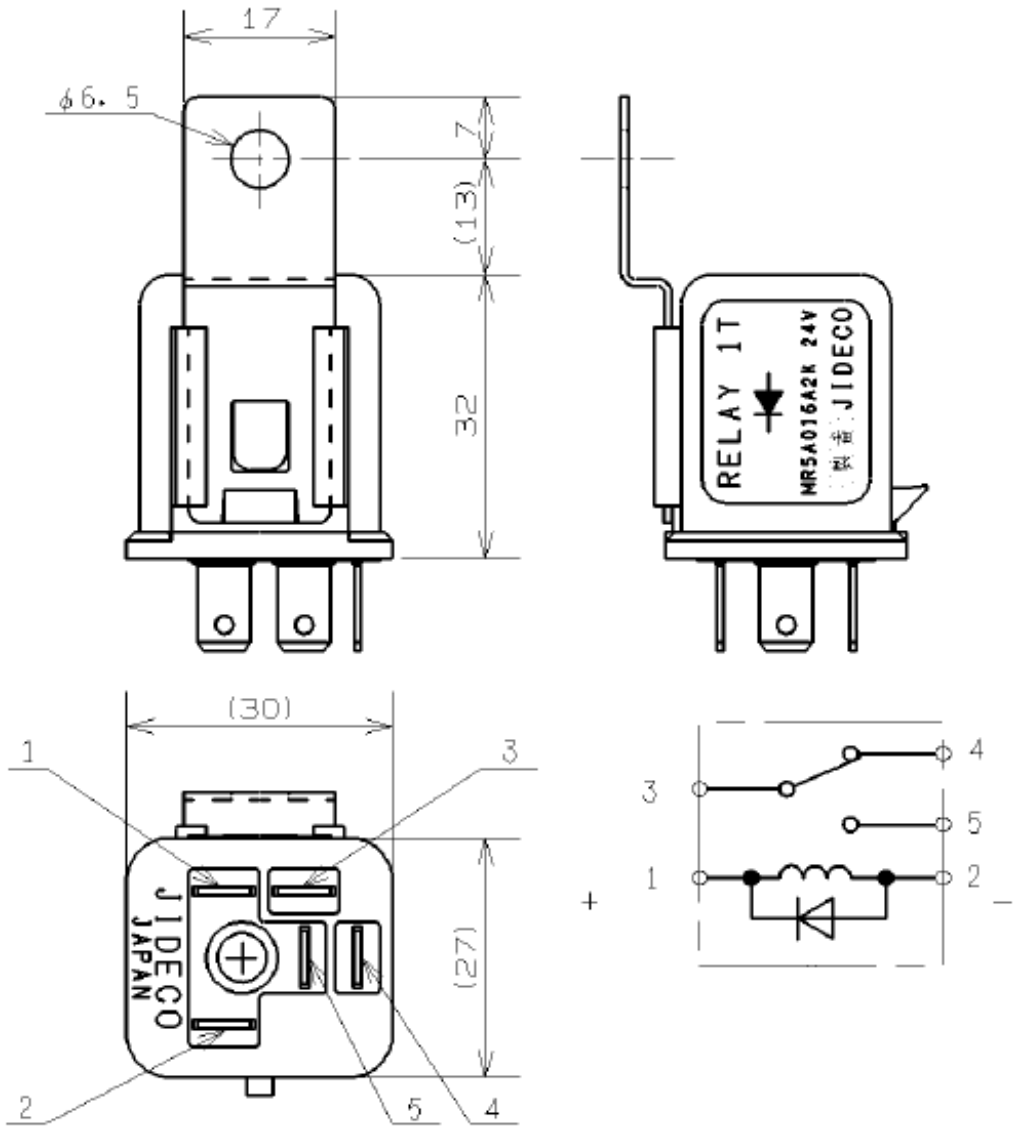


Key s/w



3. EGR cut relay (CR-22) (320- 05792)

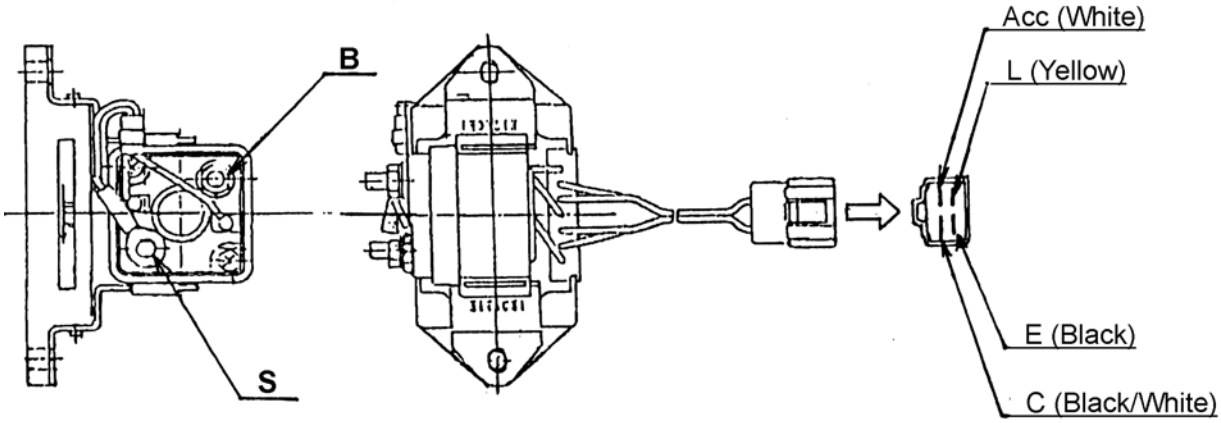
This EGR cut relay is installed in the engine control box to supply power to the EGR cut solenoid.

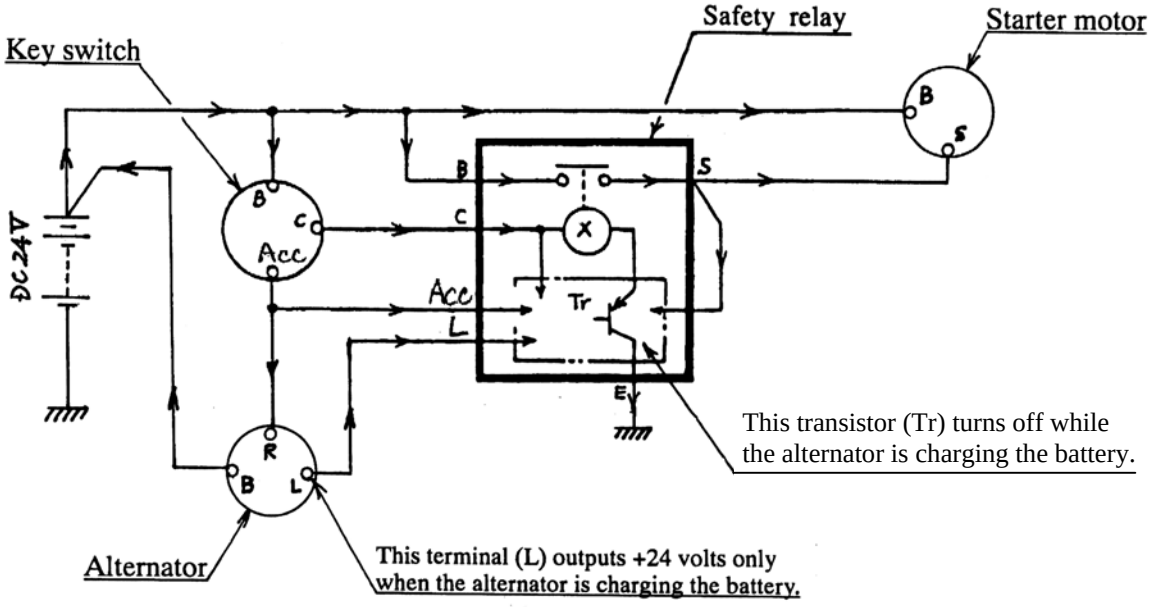


4. Safety relay (320- 05779A)

This safety relay is installed in the engine control box to prevent the starter motor from being driven while the engine is in motion.

Rated voltage	DC 24 v
Rated current	50 A





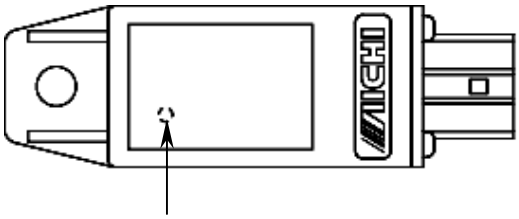
ON/OFF conditions of the key switch

Terminals / Key positions	B	ACC	C
OFF	○		
ON	○	○	
Engine start	○	○	○

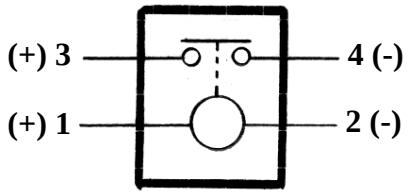
5. Charge relay (320- 00000- 03C)

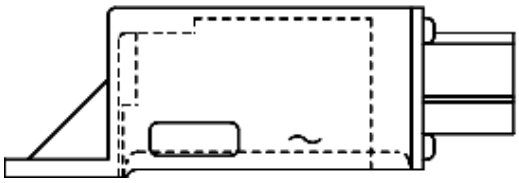
This charge relay is installed in the engine control box and switches on when the alternator charges the batteries.

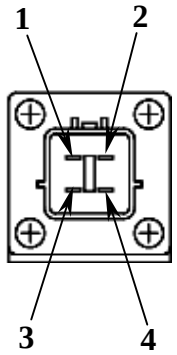
Rated voltage	DC 24 v
Switching on voltage	DC 18 v or higher
Switching off voltage	DC 10v or lower



This LED goes on when the relay is switched on.



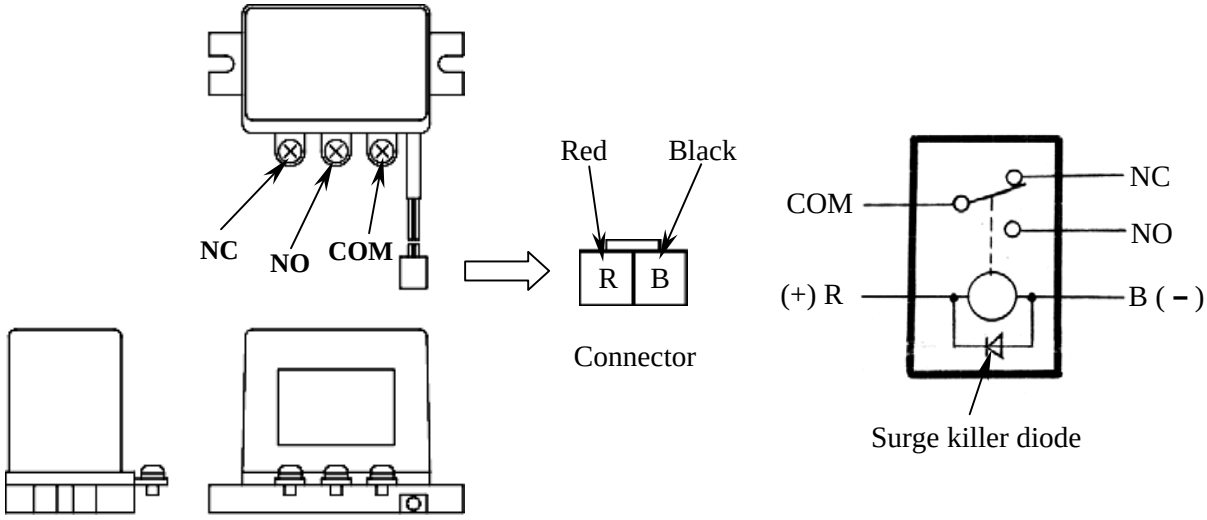




6. Relay CR21 (320- 05778)

These relays are installed in the engine control box.
The relay CR20 actuates the engine stop motor, and the relay CR21 supplies power to such components as the accelerator motor, the alternator, the charge relay and the safety relay.

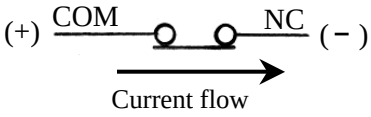
Rated voltage ---------- DC 24 v
Coil resistance ---------- 130 Ω



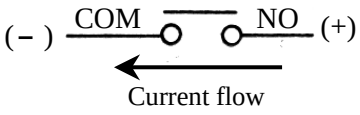
CAUTION

Connect the wires to the contacts of the relay as follows.

*When using ***"Normally closed"*** contact.



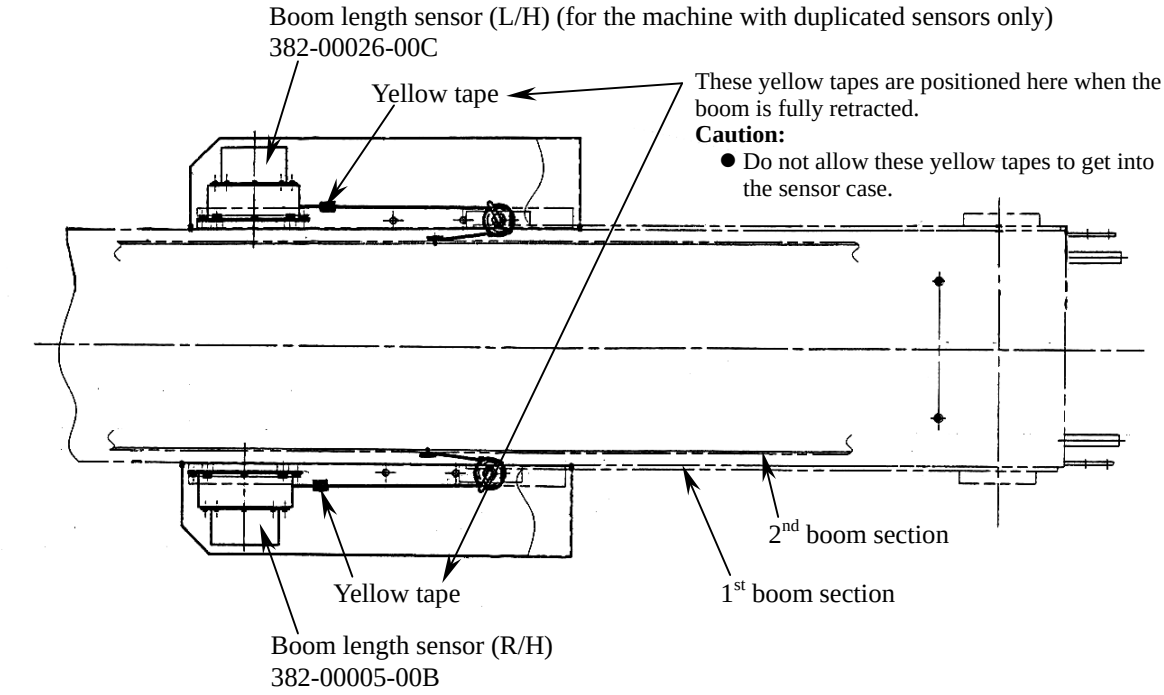
*When using "***Normally open***" contact.

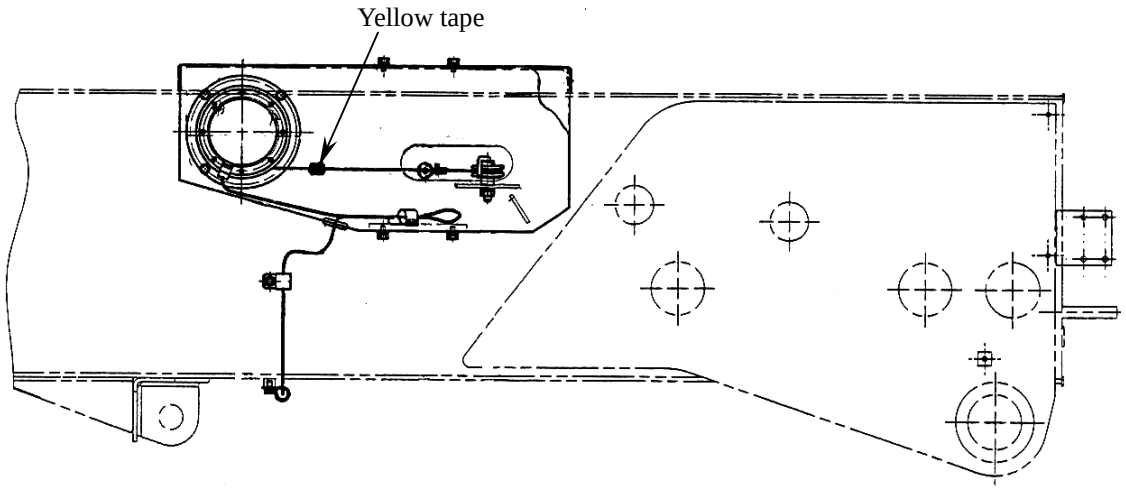


Boom length sensor

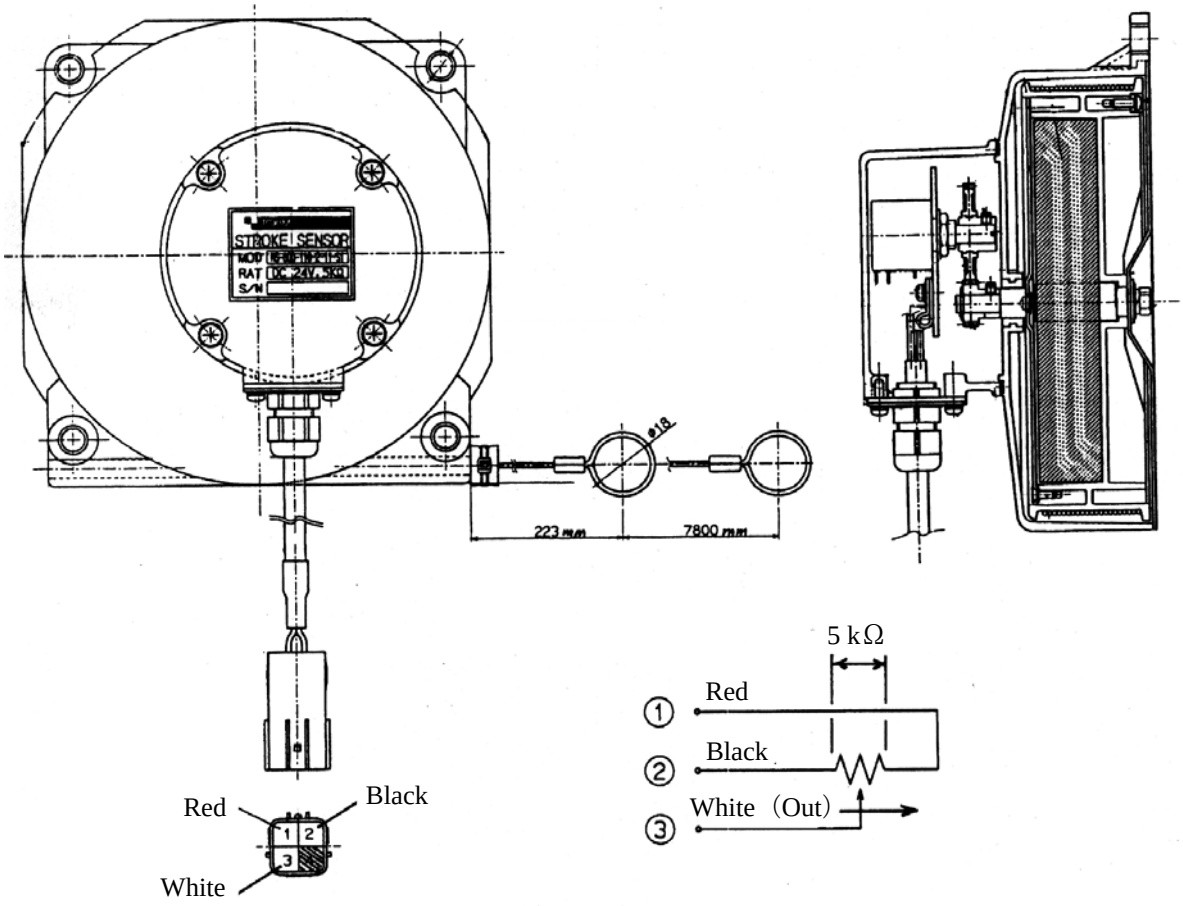
For the machine with duplicated sensors:
The boom length sensors (R/H) and (L/H) are installed on the both sides of the 1st boom section to sense the boom length.

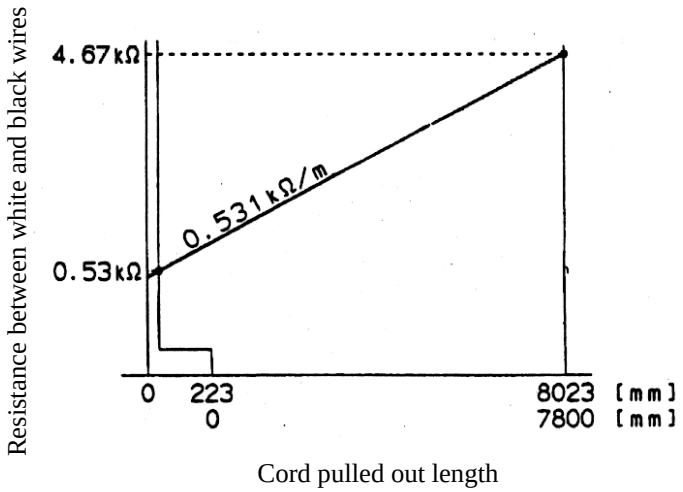
For the machine without duplicated sensors:
The boom length sensors (R/H) is installed on the right side of the 1st boom section to sense the boom length.





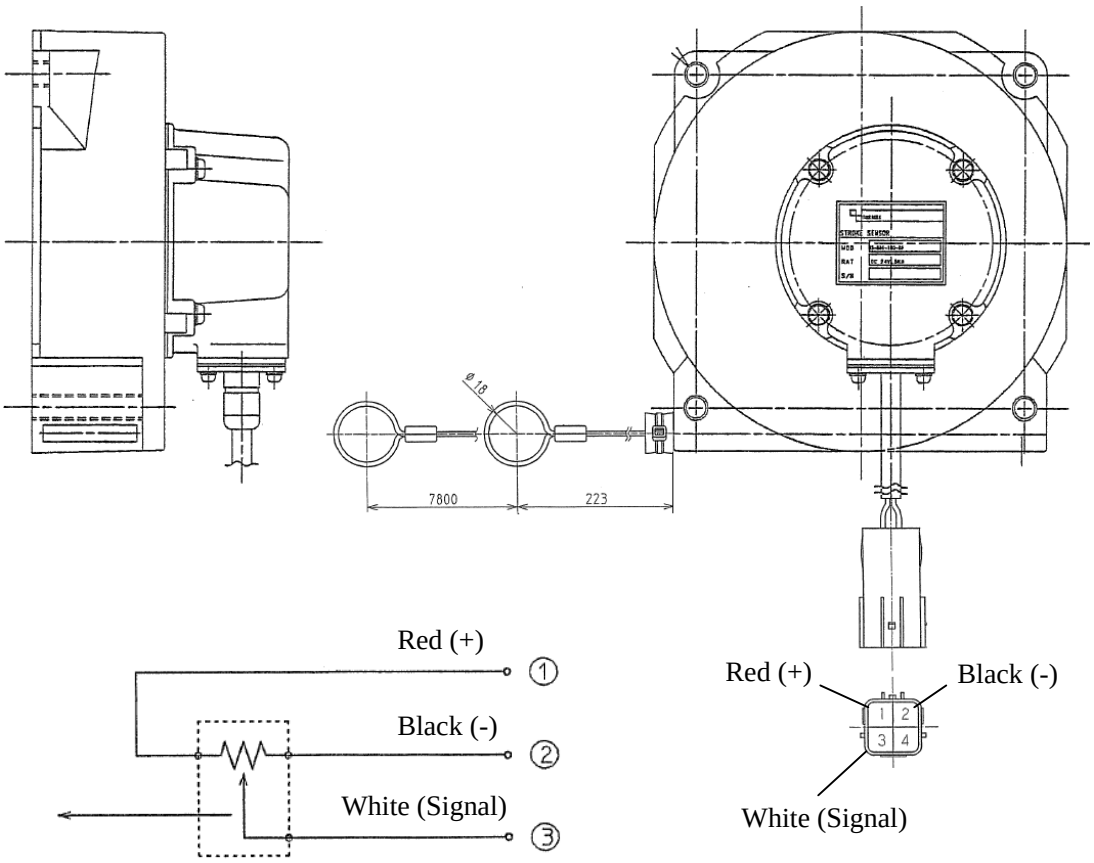
1. Boom length sensor (R/H)

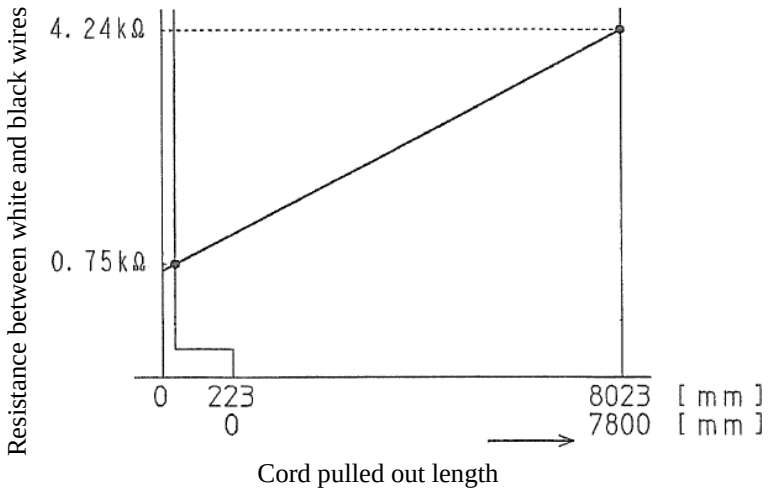




Resistance characteristics

2. Boom length sensor (L/H)

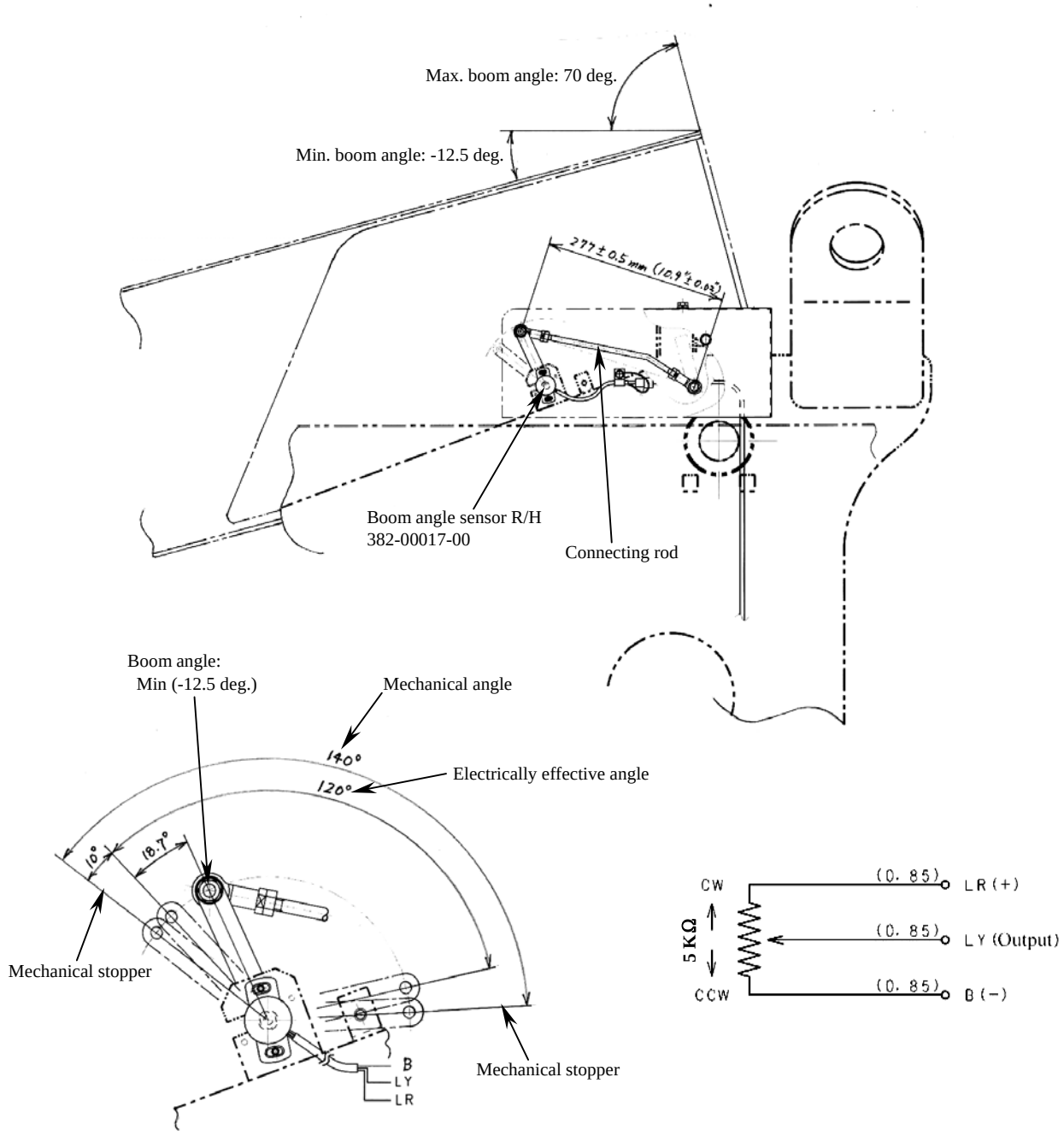




Resistance characteristics

Boom angle sensor (R/H)

The boom angle sensor (R/H) is located on the right side of the turntable to sense the boom angle.

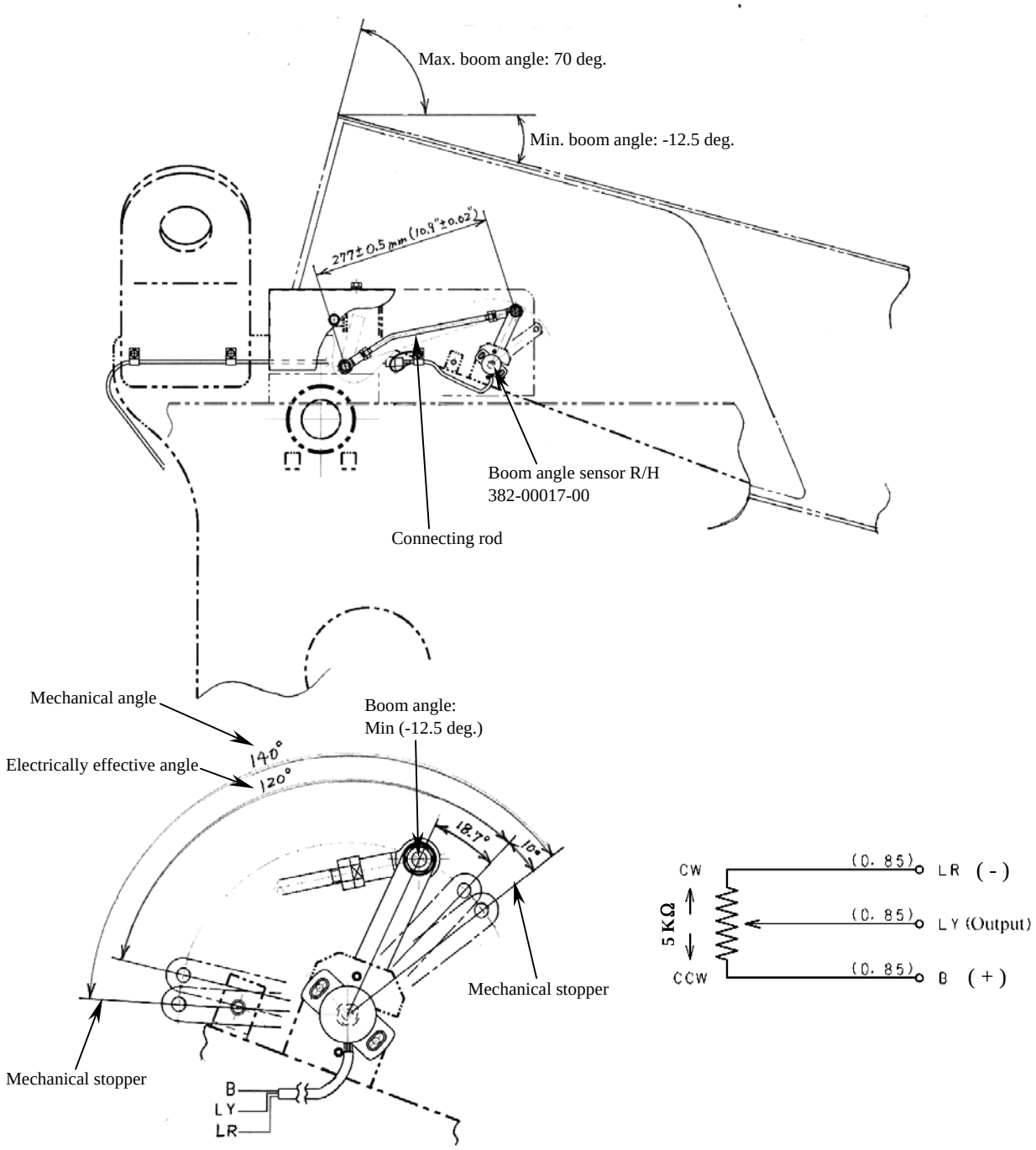


Sensor installation procedures

1. Lower the boom fully and make sure the boom angle is –12.5 degrees.
2. Adjust the length of the connecting rod to 277 ± 0.5 mm (10.9 ± 0.02 in).
3. Loosen the fixing bolts of the boom angle sensor, and then connect an “Ohm meter” between the LR and LY wires of the boom angle sensor.
4. Shift the position of the sensor to adjust the resistance to 1.0 ± 0.1 KΩ, and then tighten the fixing bolts.

Boom angle sensor (L/H) for the machine with Duplicated sensors.

The boom angle sensor (L/H) is located on the left side of the turntable to sense the boom angle.



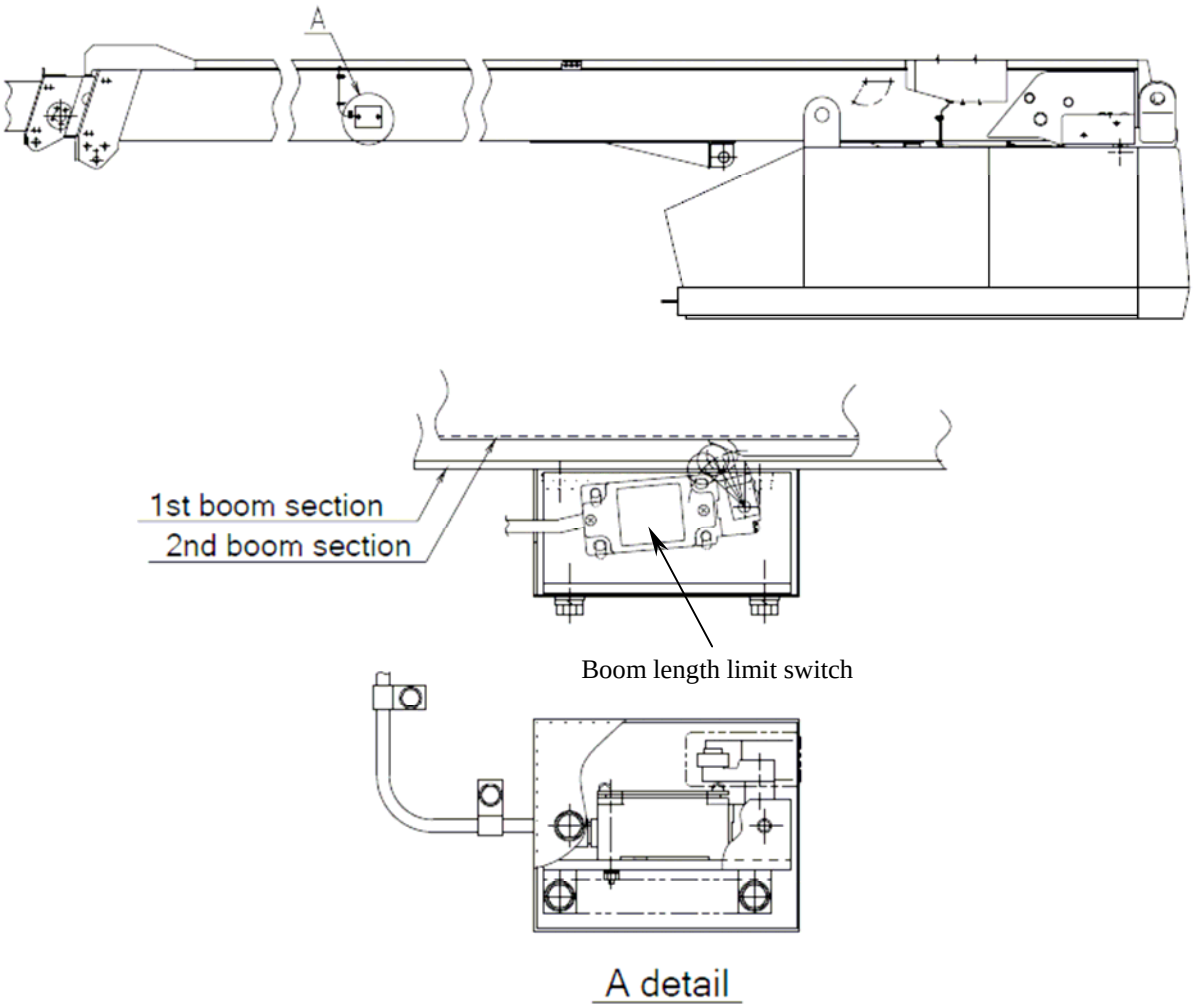
Sensor installation procedures

1. Lower the boom fully and make sure the boom angle is –12.5 degrees.
2. Adjust the length of the connecting rod to 277 ± 0.5 mm (10.9 ± 0.02 in).
3. Loosen the fixing bolts of the boom angle sensor, and then connect an “Ohm meter” between the LY and B wires of the boom angle sensor.
4. Shift the position of the sensor to adjust the resistance to 1.0 ± 0.1 KΩ, and then tighten the fixing bolts.

Boom length limit switches

The boom length limit switch detect the 2nd boom extended length shown in the table below to disable the Boom telescope Out and Boom elevation Down function to prevent the platform exceed the working range limit while the functions is operated with using Limit cancel switch due to the system error occurs.

Model	2nd boom extended length
SR21AJ / ISR70J	3,592 mm (141.4 inches)
SR21A / ISR70	5,080 mm (200.0 inches)
SR18AJ / ISR60J	3,400 mm (133.9 inches)

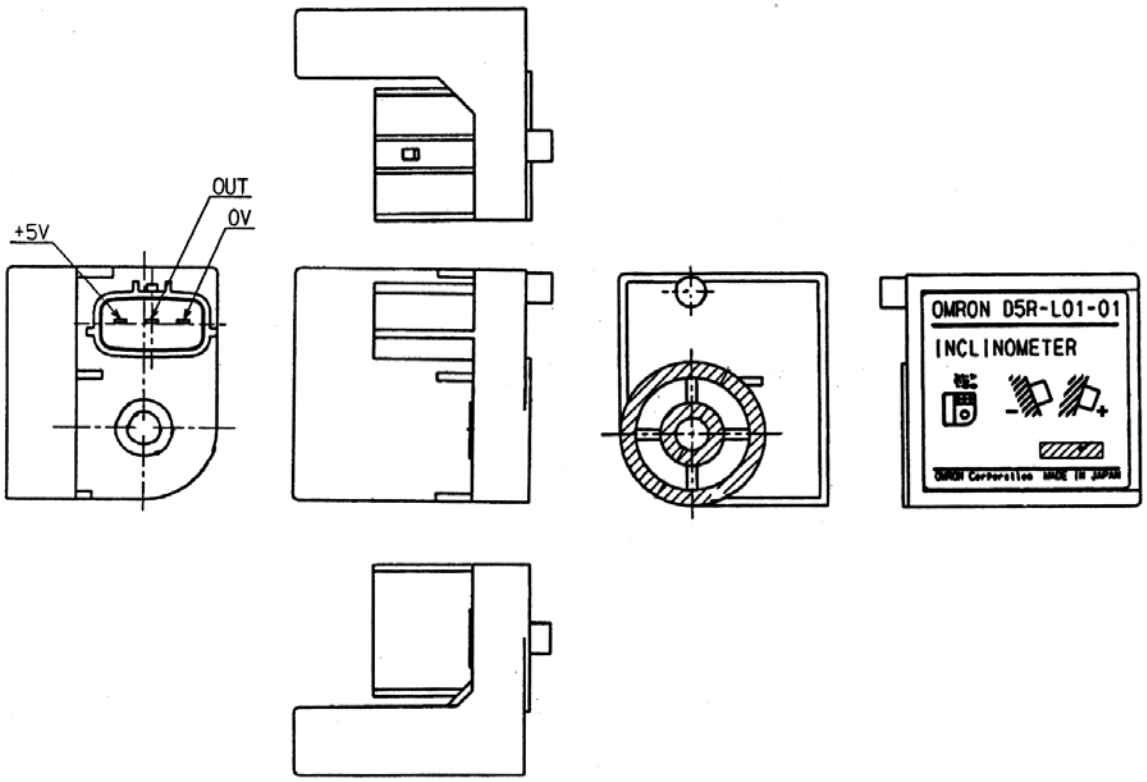


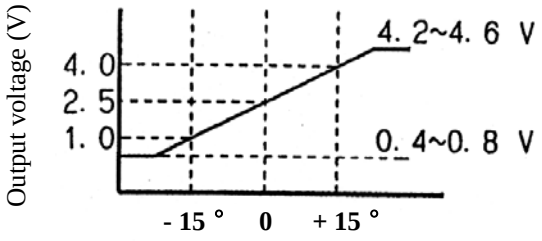
Tilt sensors, Longitudinal and Lateral

Two tilt sensors; one is for longitudinal direction and the other for lateral direction are installed on the turntable to sense the tilt angle of the machine.

Power voltage: DC5±0.5 V

Output voltage: 100 mV / 1 degree (2.5±0.05 volts when horizontal)





Output characteristics

Tilt sensor 5 degrees **for the machine with Duplicated sensors.**

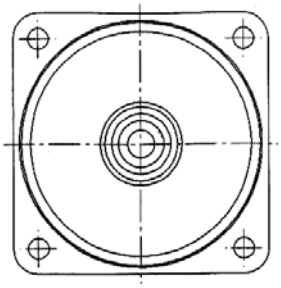
The ***"Tilt sensor 5 degrees"*** is installed on the turntable to sense the tilt angle of the machine.

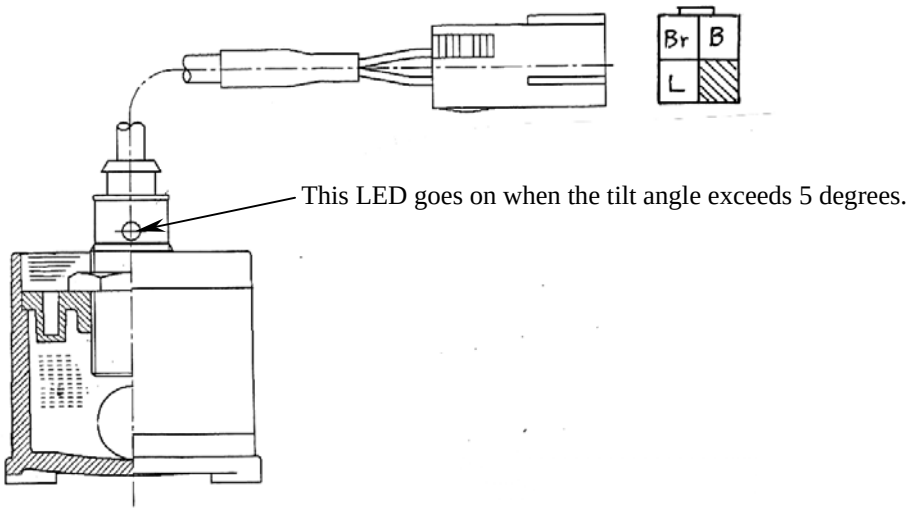
This tilt sensor is used to cancel the traveling functions when the machine tilts over 5 degrees and either the following condition applies.

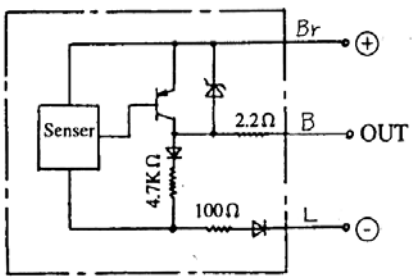
- Boom is raised over 45 degrees
- The boom is extended more than 1 meter (3ft- 3 in).

Note: This sensor is installed only on the machine with the "Duplicated sensors".

Rated voltage	DC24V (DC18V ~ DC30V)
Output current	200 mA
Pre- set angle	5.0 ± 0.5 degrees
Output characteristics	The sensor ceases its output when the tilt angle exceeds 5 degrees.



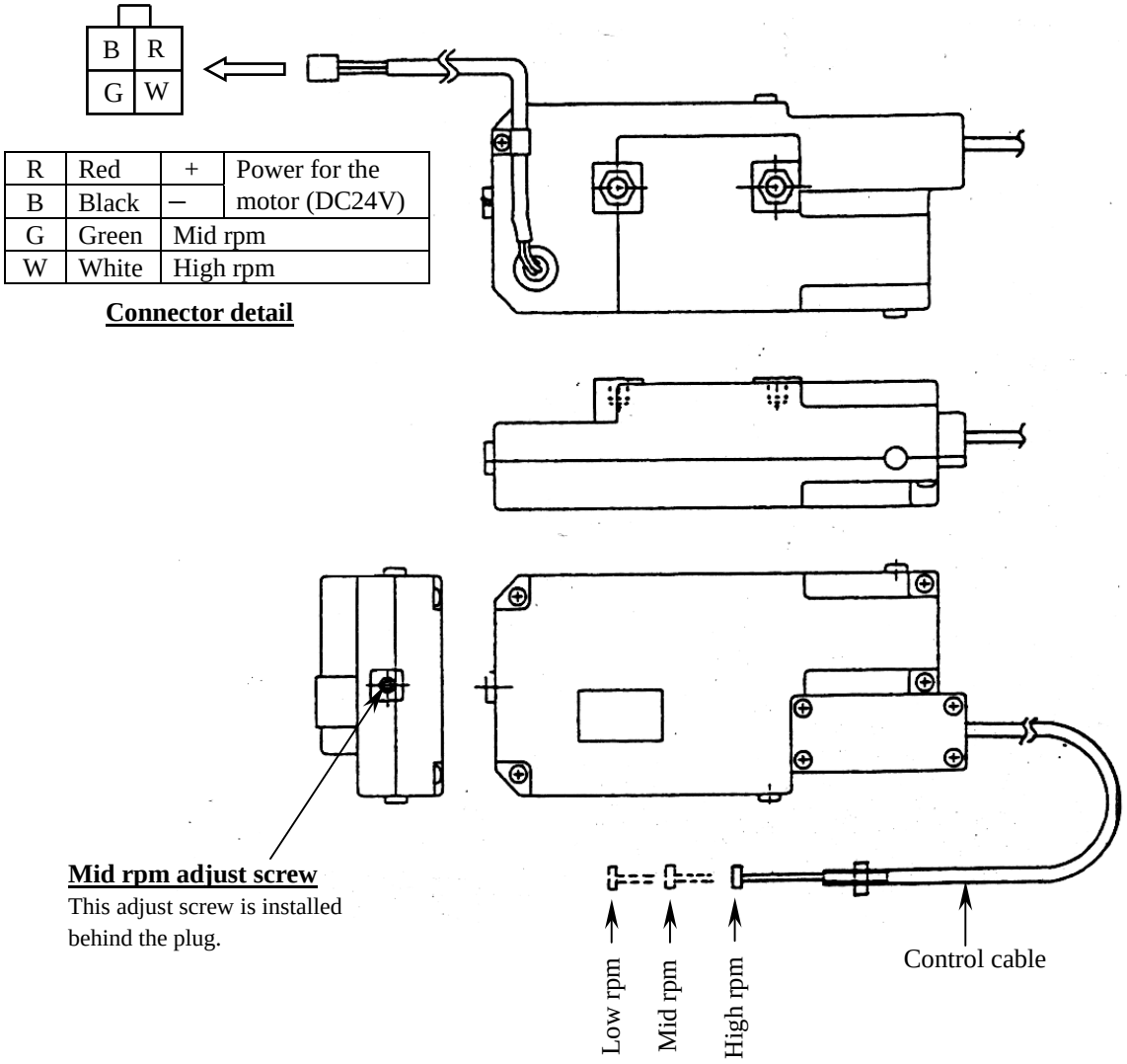




Accelerator motor **For Diesel engine**

This accelerator motor controls the engine rpm into three speeds: ***Low, Mid*** and ***High***.

Rated voltage	DC 24 V (DC 20 ~ 30 V)



R	Red	+	Power for the motor (DC24V)
B	Black	–	
G	Green	Mid rpm	
W	White	High rpm	

Connector detail

To check the functions of the accelerator motor, follow the instructions outlined below.

1. Connect the battery (DC24V) between the ***Red*** (+) and the ***Black*** (–) wires.
2. Supply +24V to the ***Green*** wire, and make sure that the control cable is pulled in to the ***Mid rpm*** position.
3. Supply +24V to both the ***Green*** and the ***White*** wires at the same time, and make sure that the control cable is pulled in to the ***High rpm*** position

Specific engine rpm

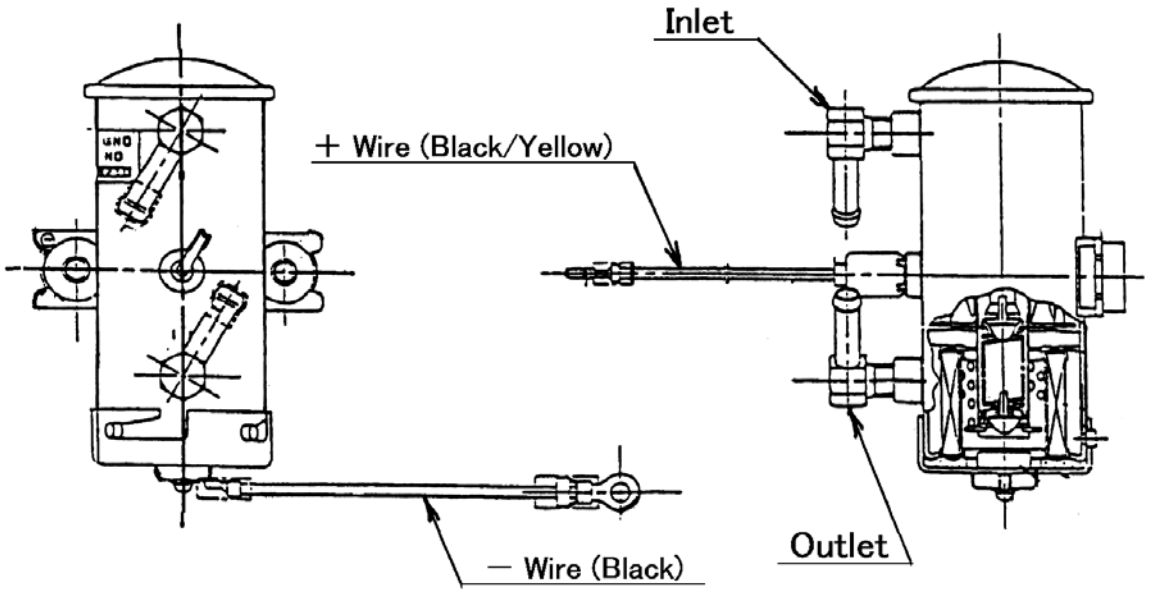
Low		1,020 rpm (Engine Idling)
Mid		1,400 rpm
High	CE model	2,000 rpm
	ANSI model	1,800 rpm

897041- 5211

Fuel pump for automatic air bleeding system

For diesel engine

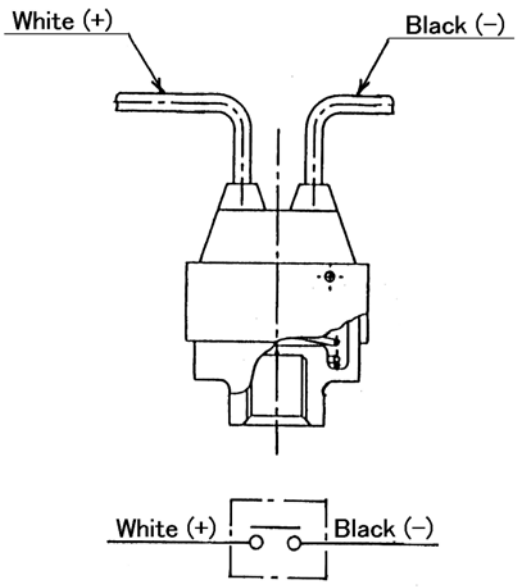
This fuel pump is actuated when the Main key switch is turned to the **ON**, the **START**, or **the GLOW** position to feed fuel to the injection pump on the diesel engine.



Air cleaner clog detect switch

897166- 4100

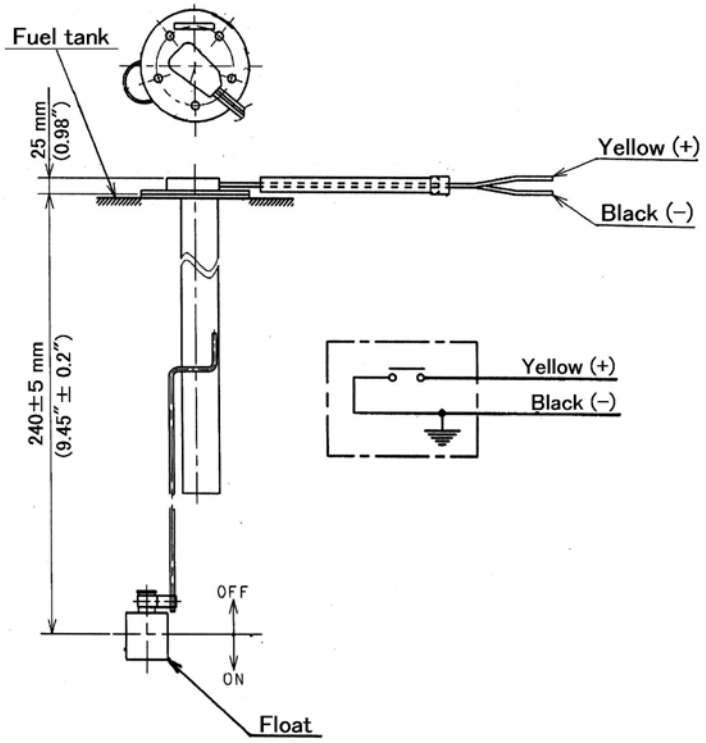
This switch is installed at the air cleaner inlet to sense the air cleaner clogging.
The contact of this switch closes when the vacuum of the intake air reaches 6.23 kPa (635 mmAq).



Low fuel level detect switch

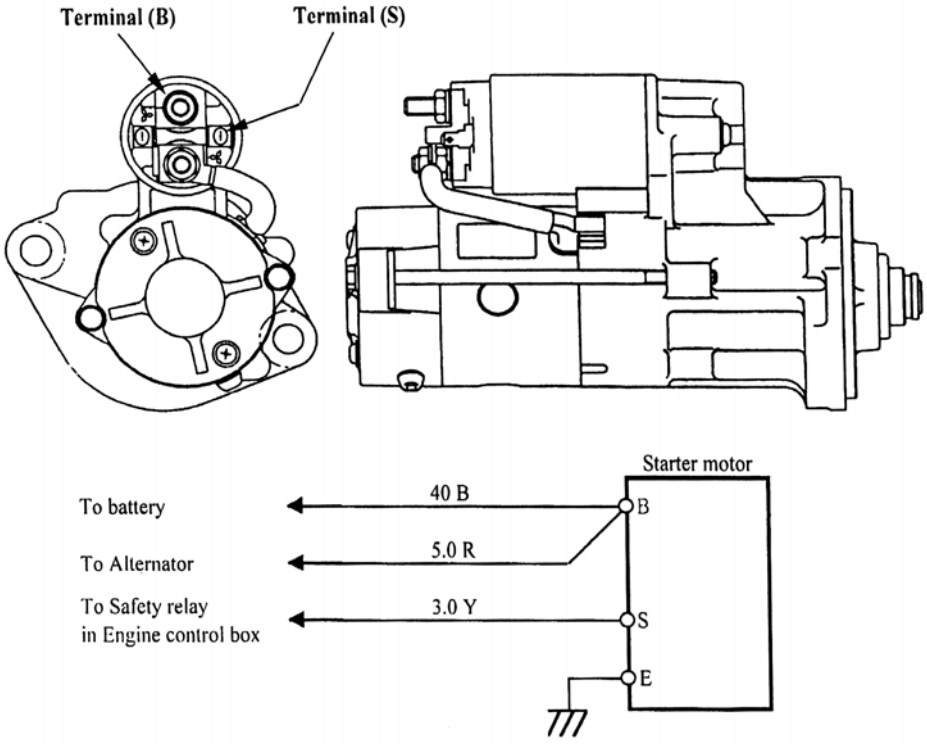
382- 00000- 26A

This switch is installed at the fuel tank to sense the fuel level.



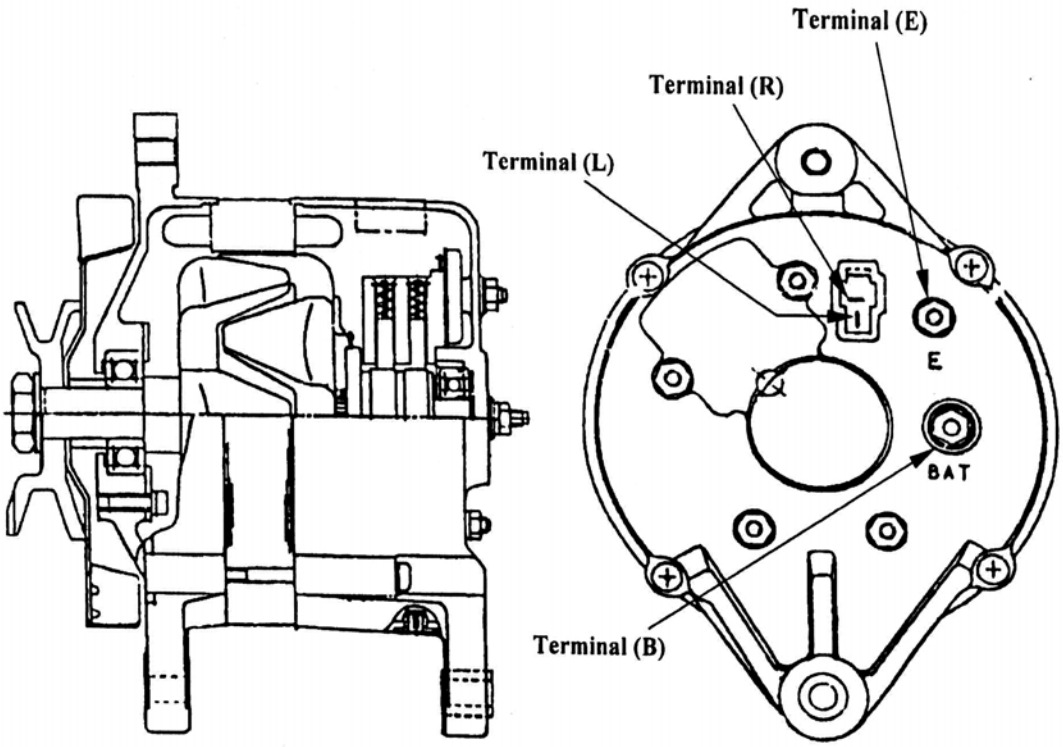
Starter motor

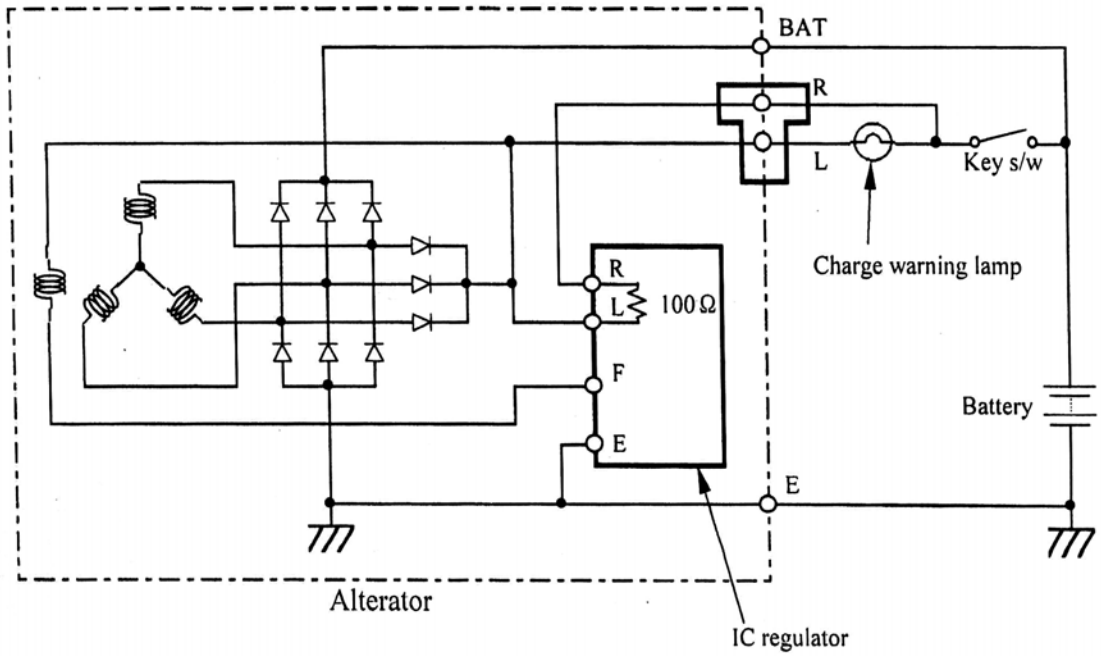
For diesel engine (898072- 3151)



Alternator

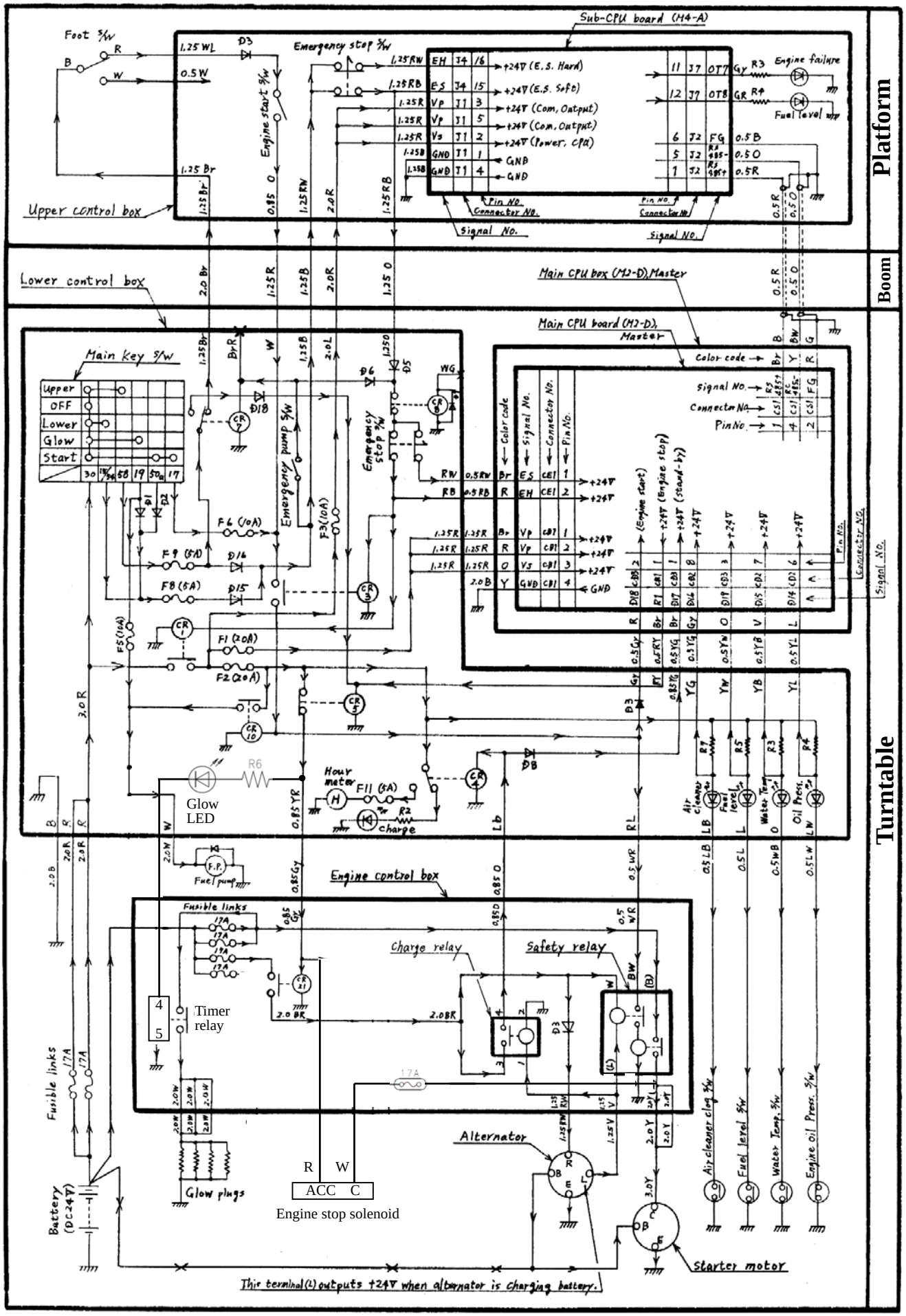
Rated voltage: DC24V
Rated current: 15A



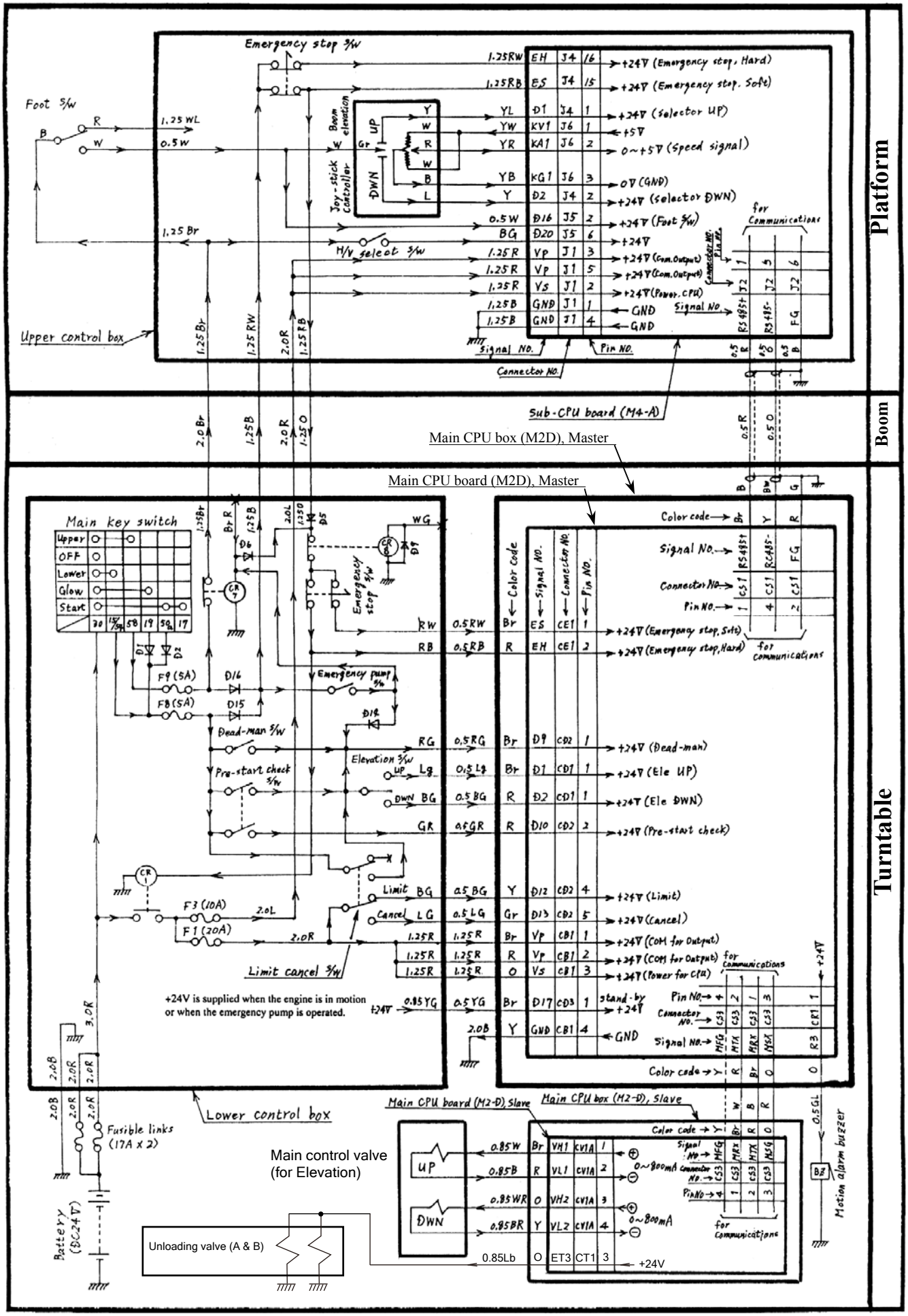


5. Electrical circuit for individual system

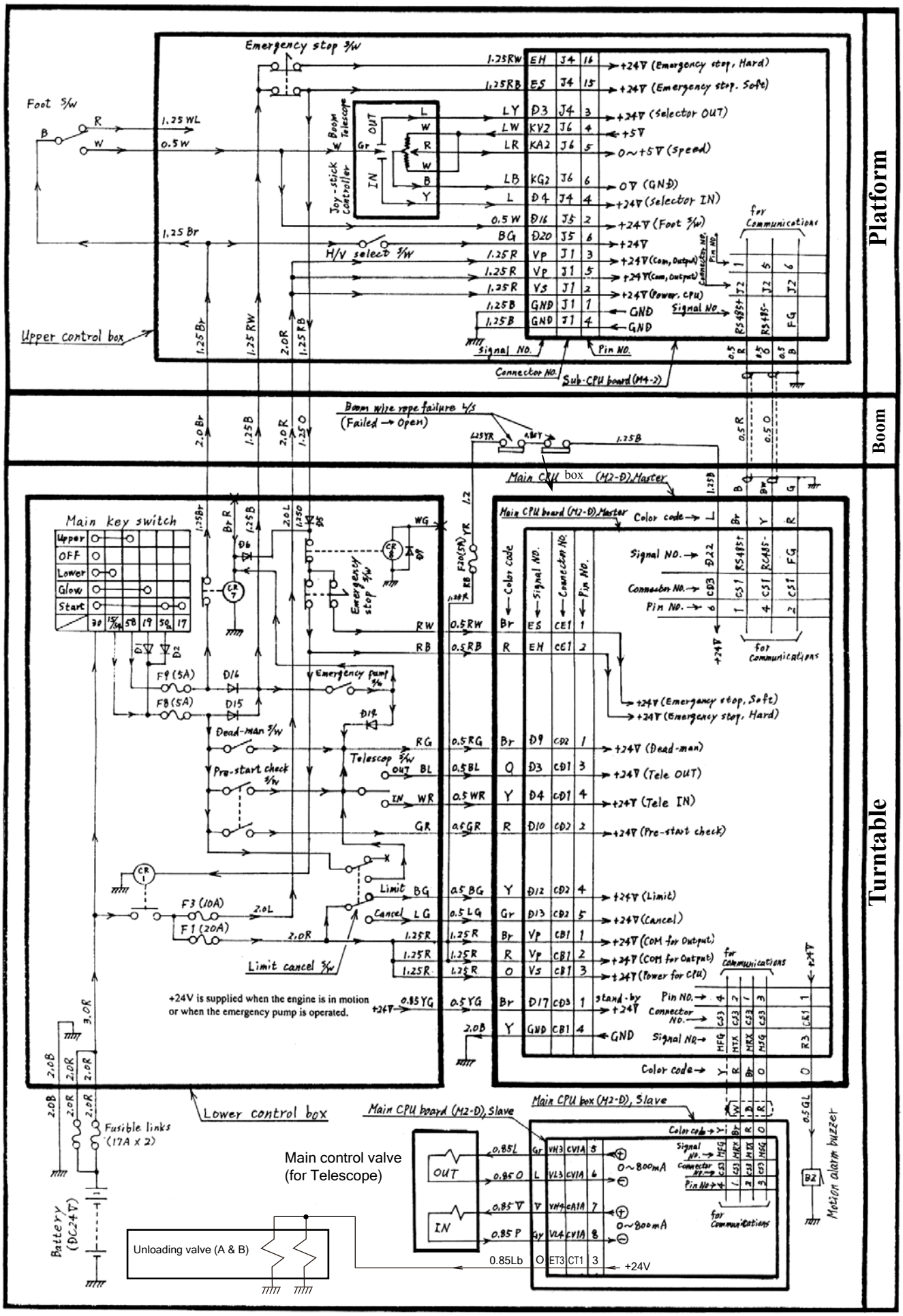
Engine start and stop system



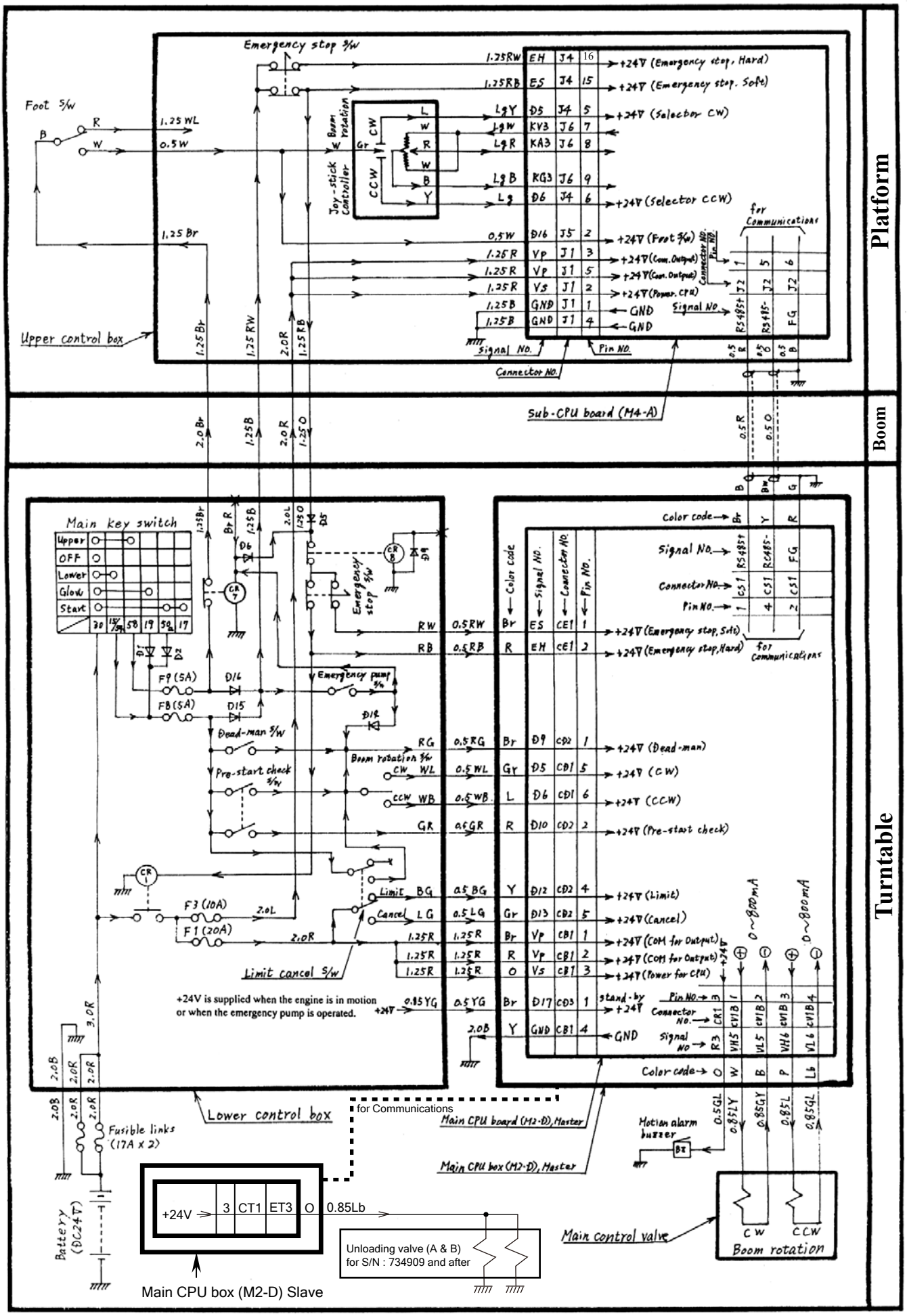
Boom elevation system



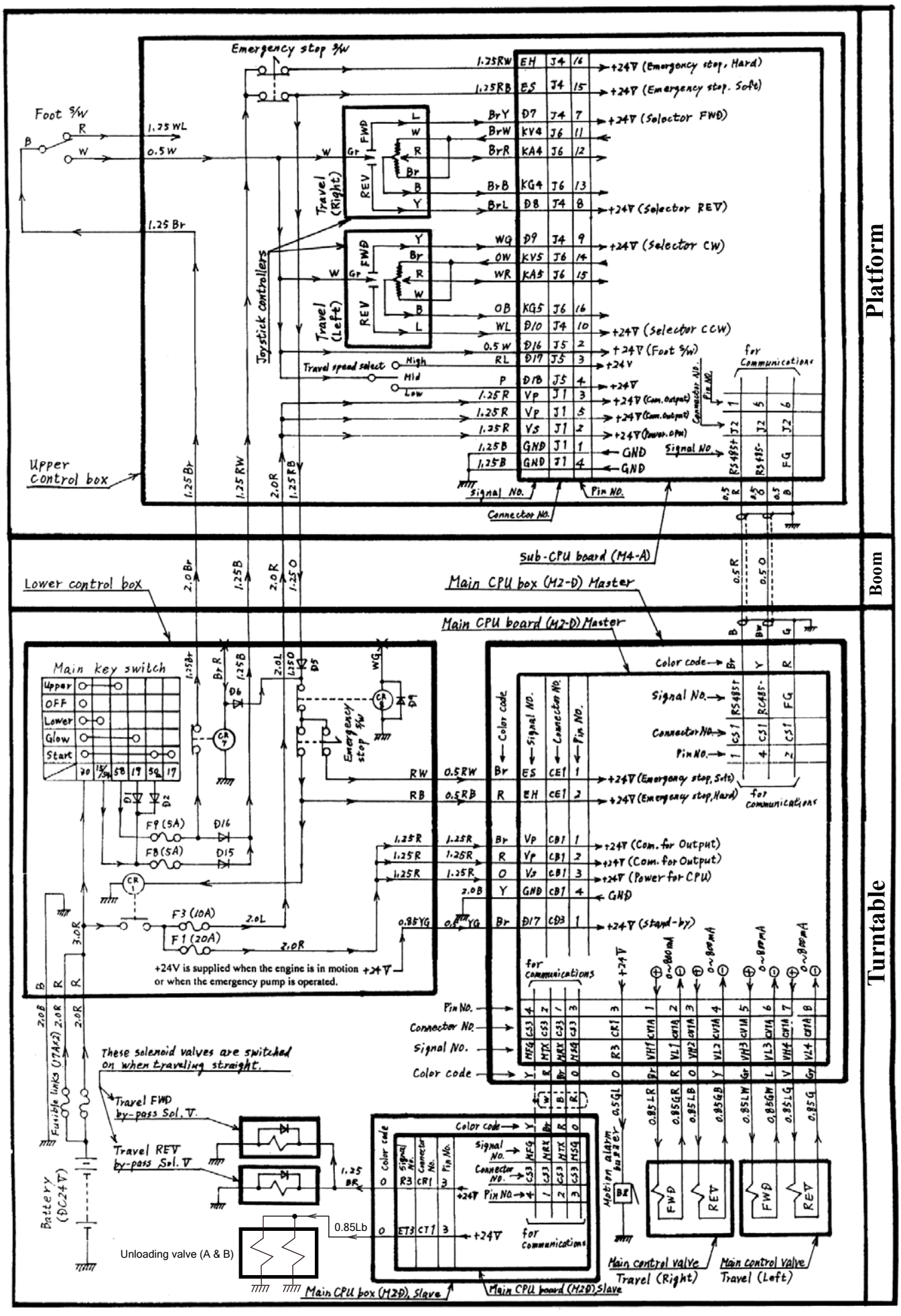
Boom telescope system



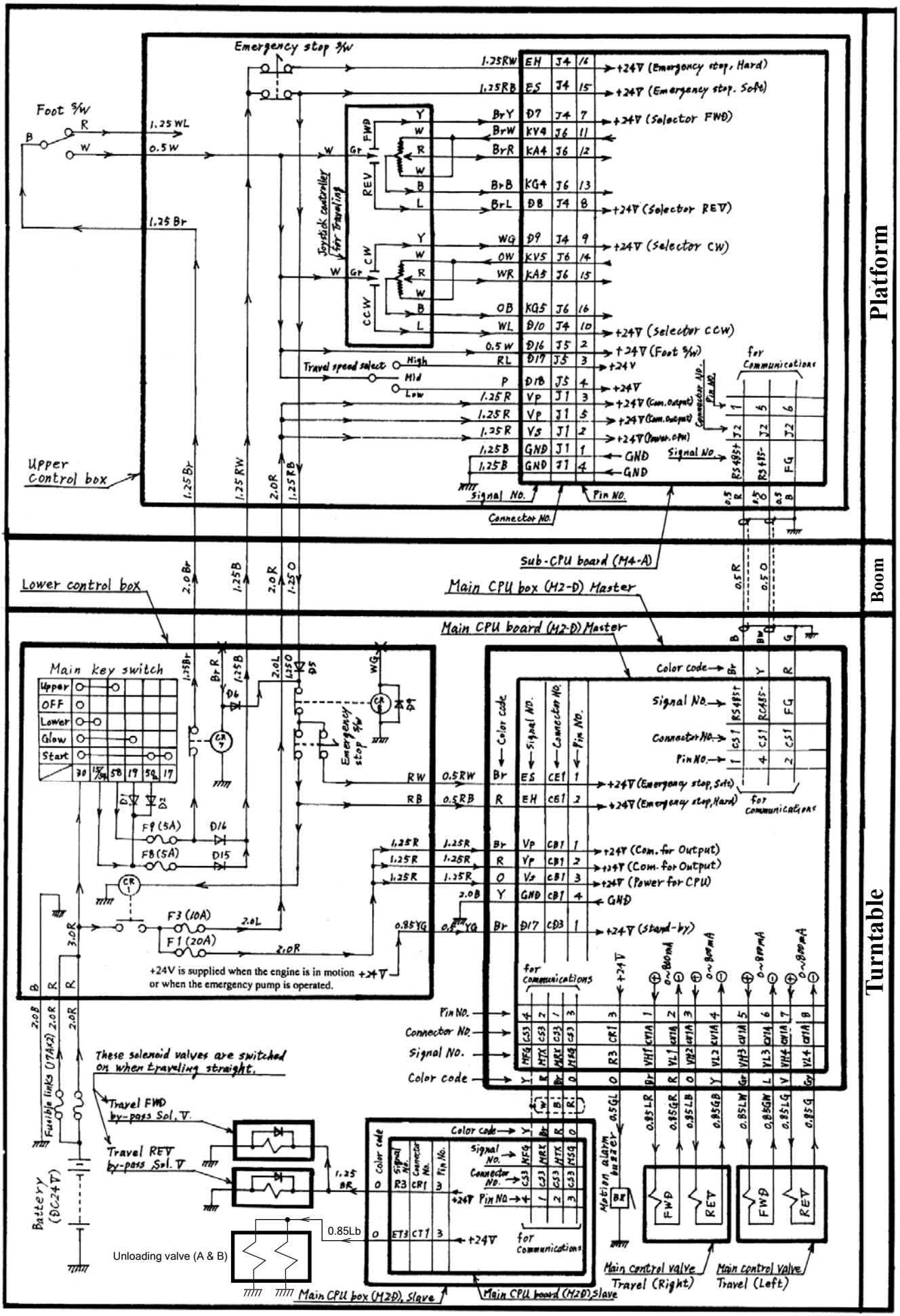
Boom rotation system



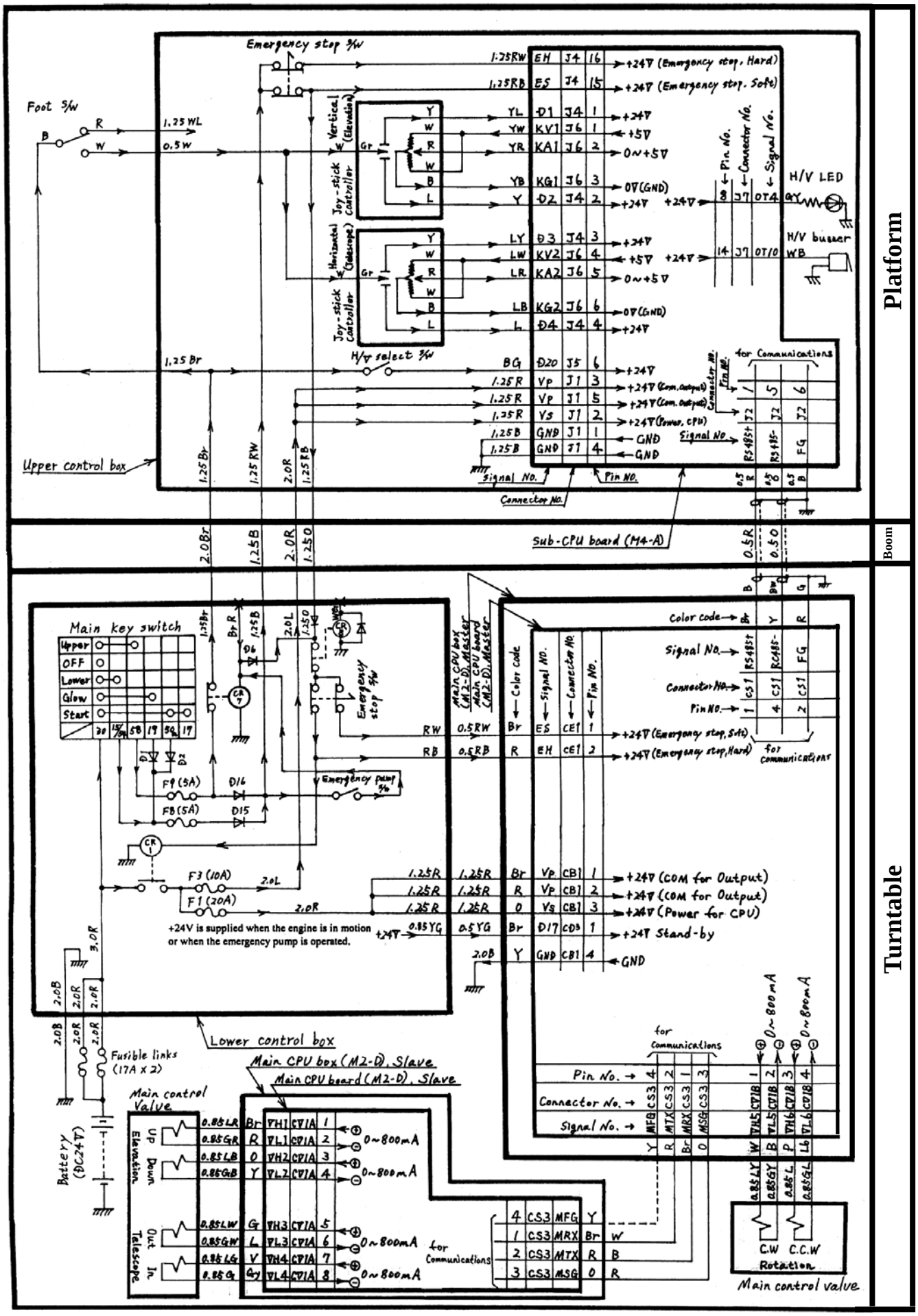
Traveling system (for the machine with Double Travel joystick controllers)



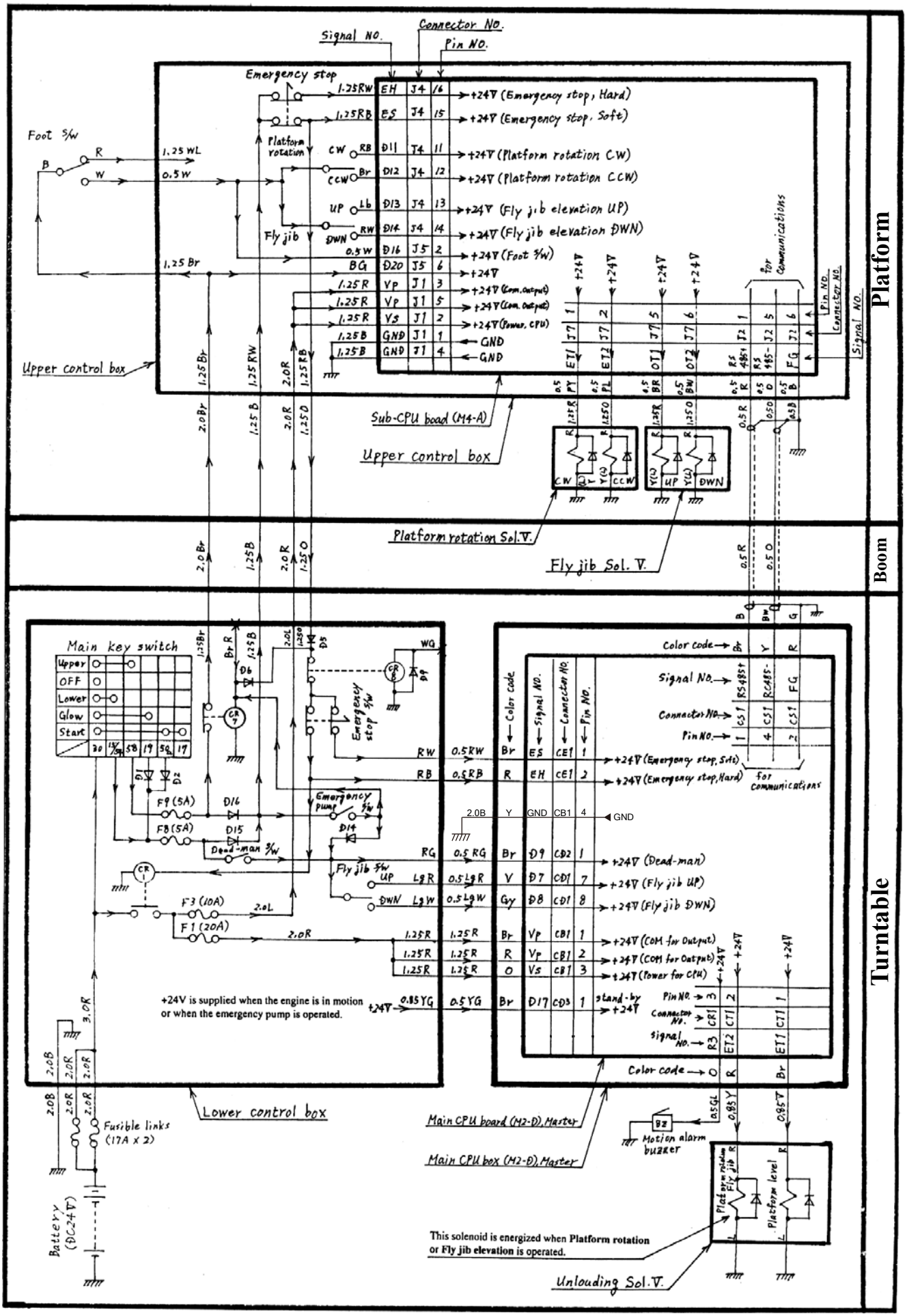
Traveling system (for the machine with Single Travel joystick controller)



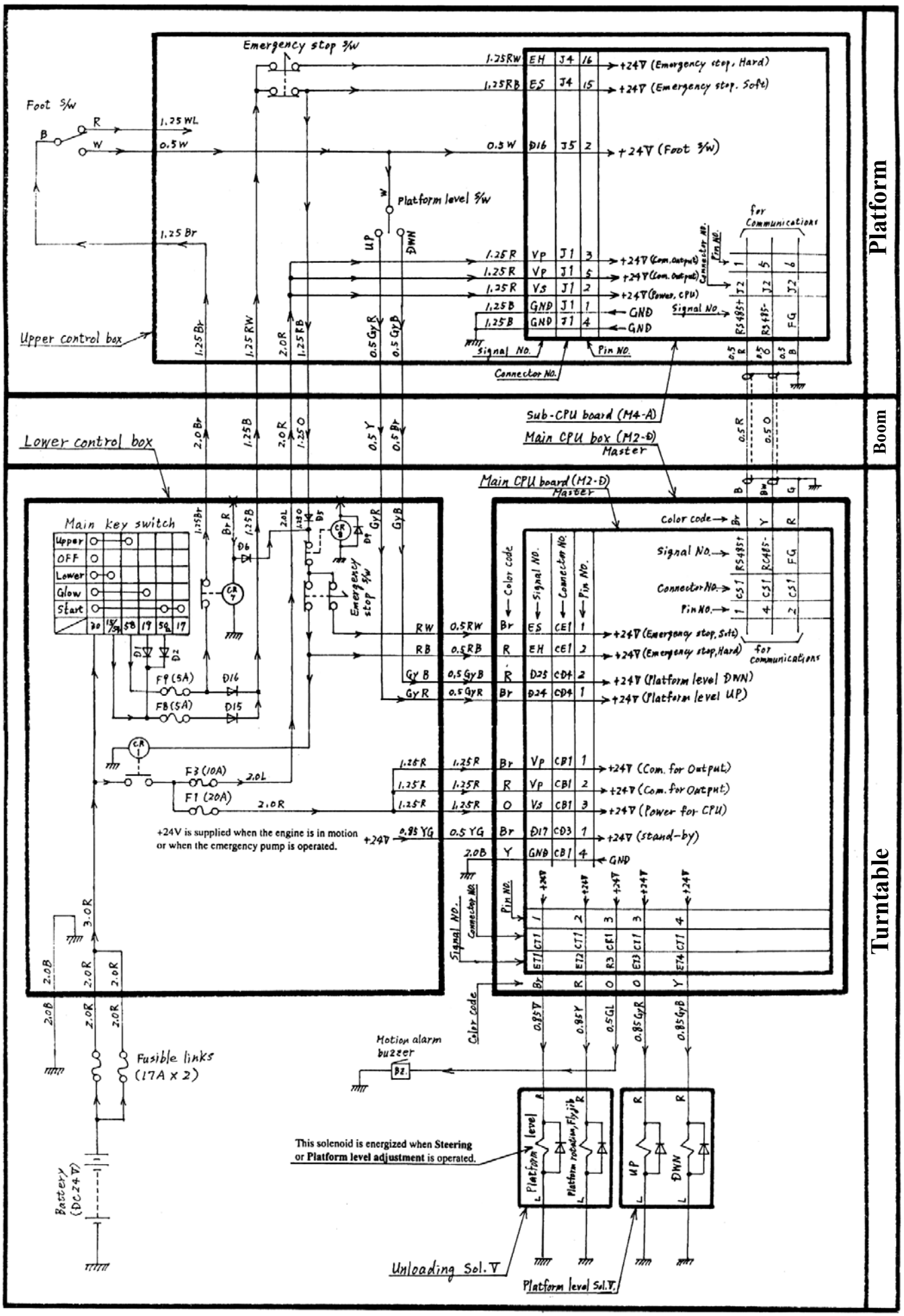
H / V control system



Platform rotation and Fly- jib articulation systems

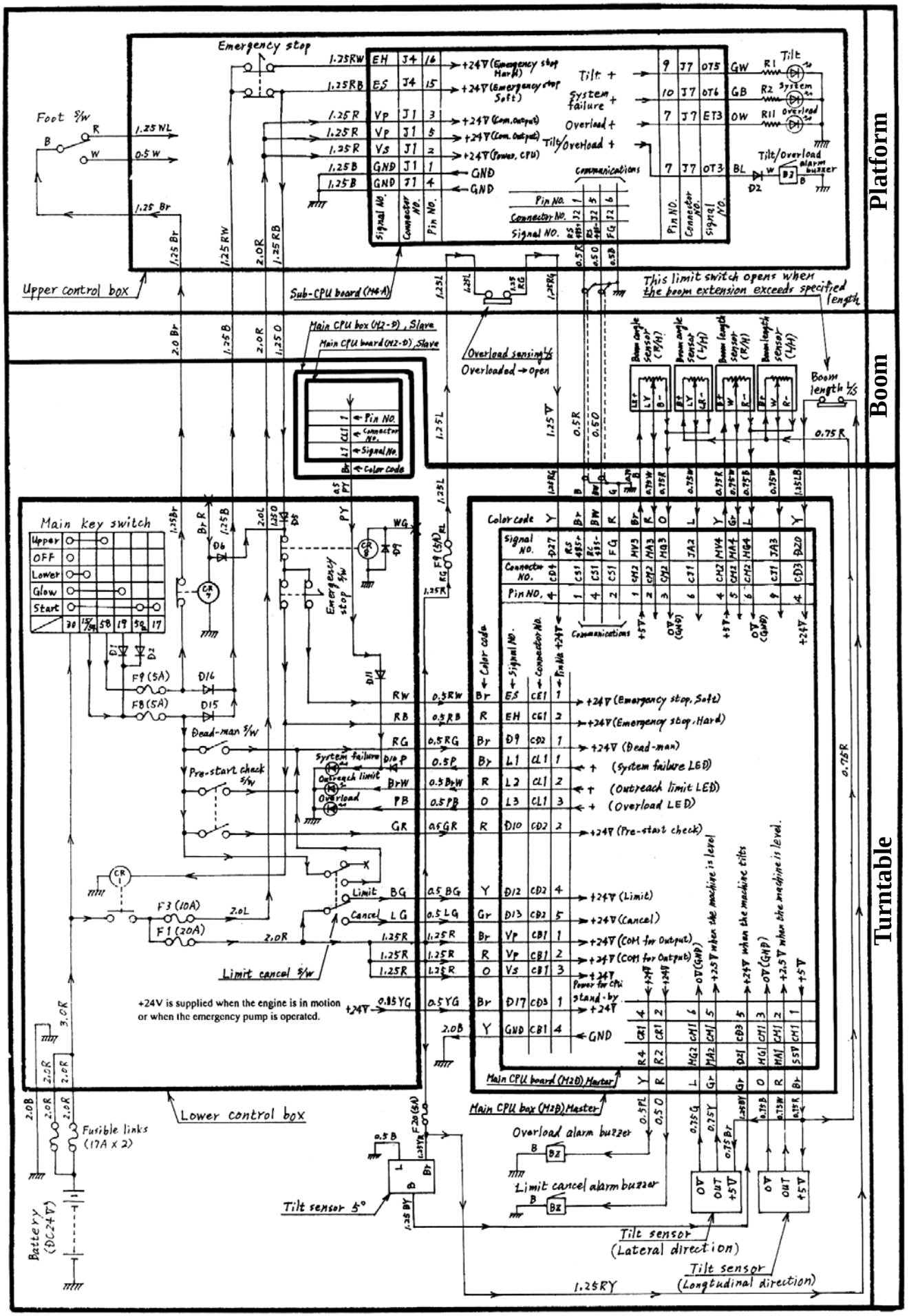


Platform level adjust system



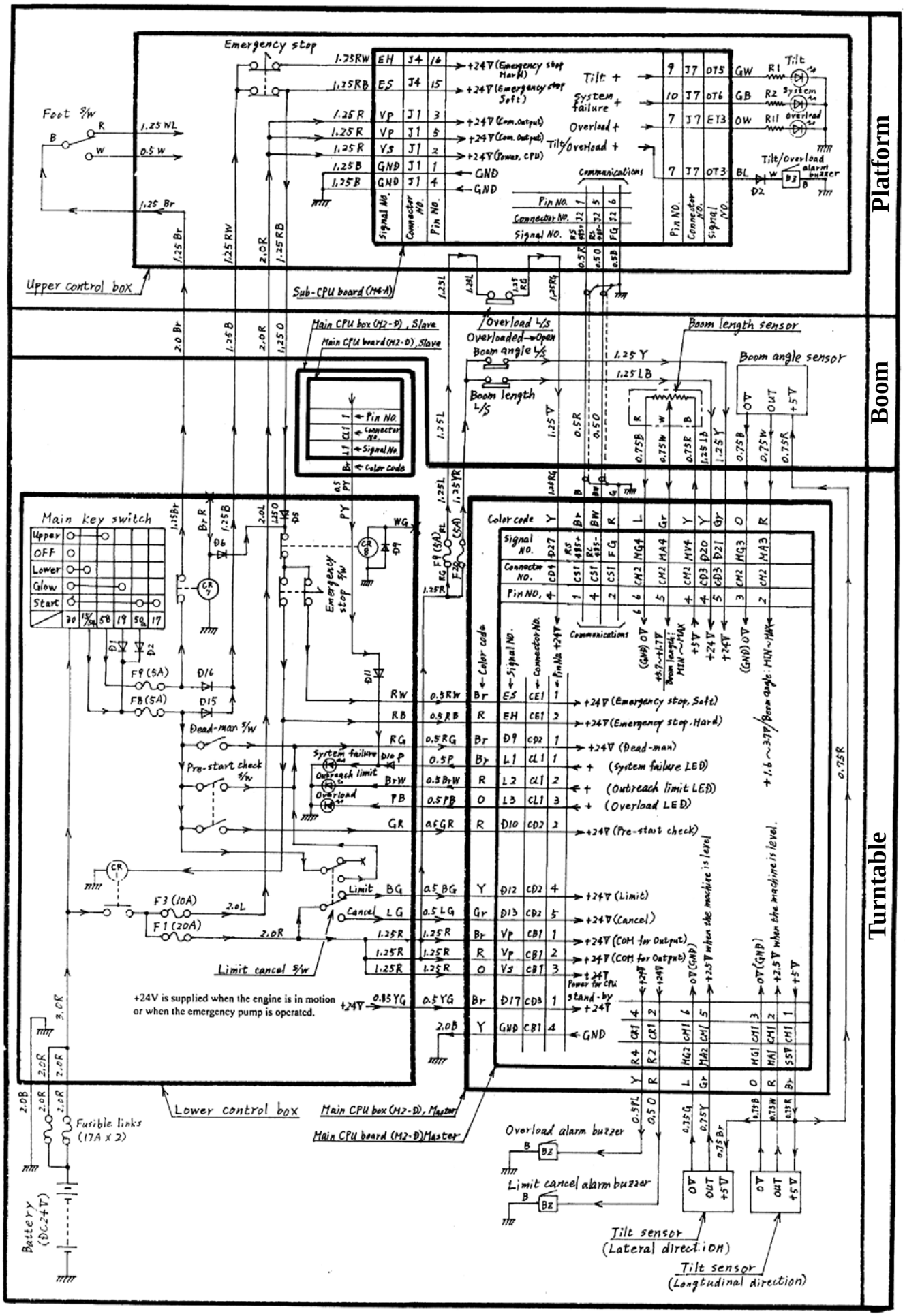
Work range limit and Overload sensing systems

For the machine with Duplicated sensors

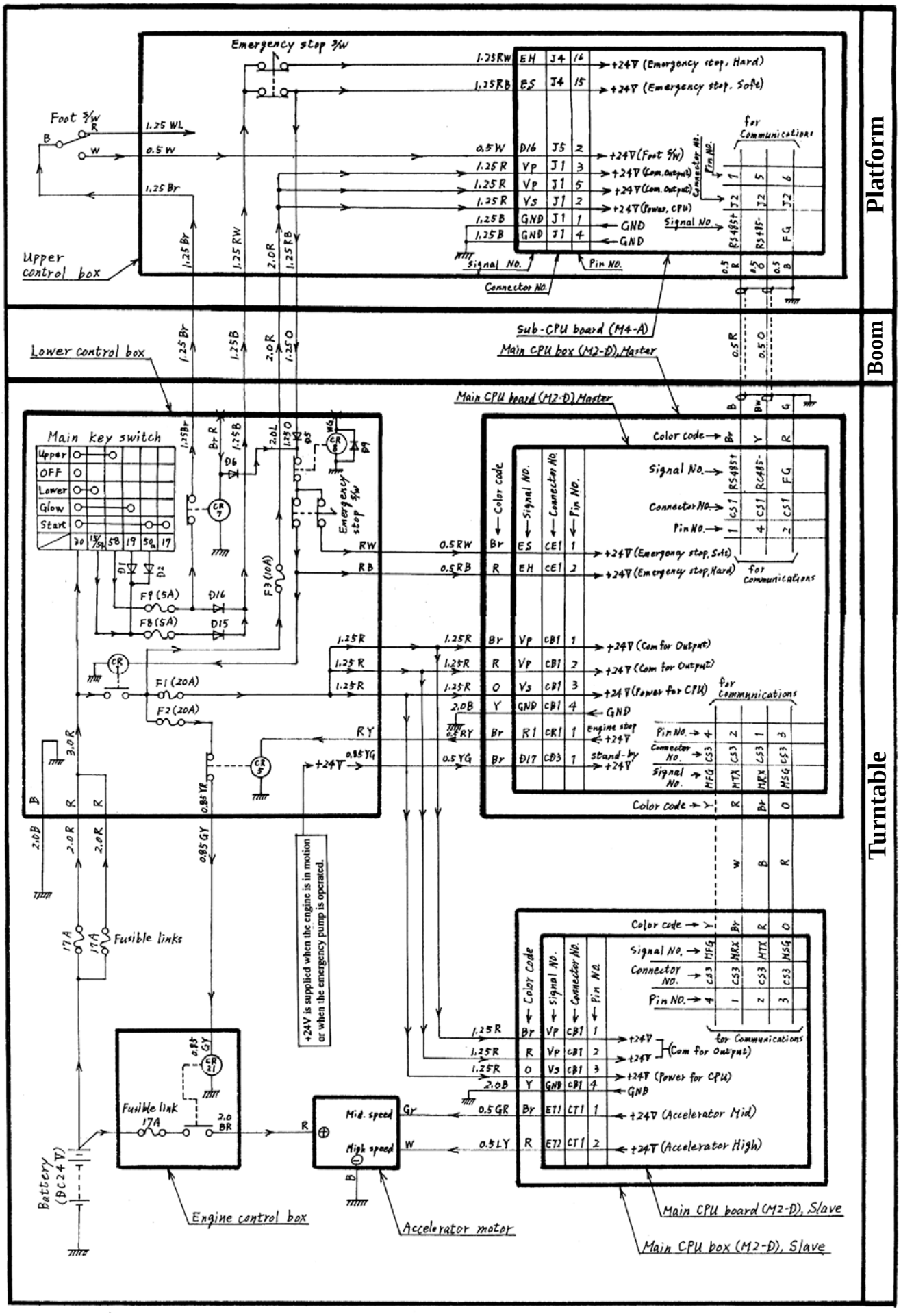


Work range limit and Overload sensing systems

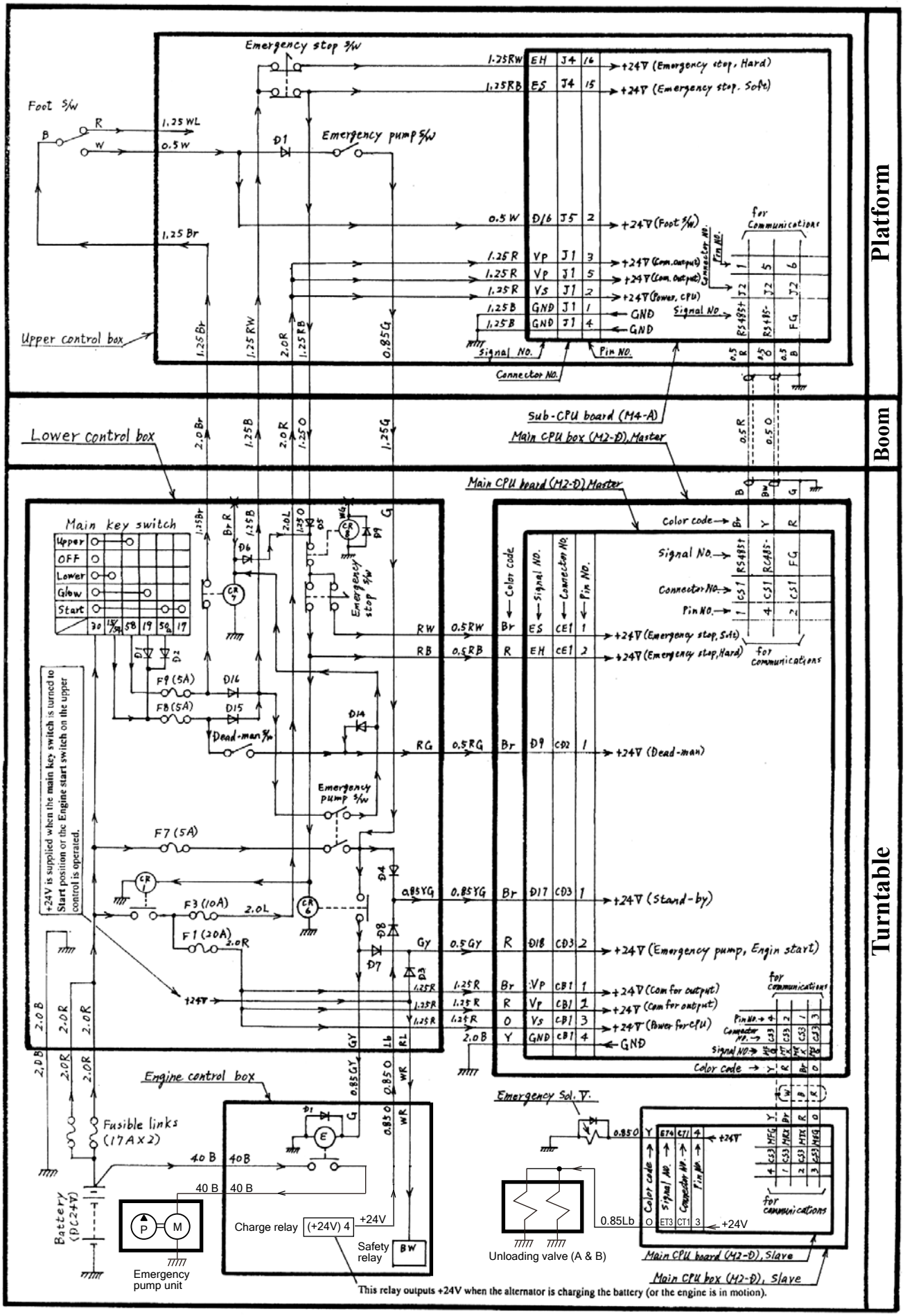
For the machine without Duplicated sensors



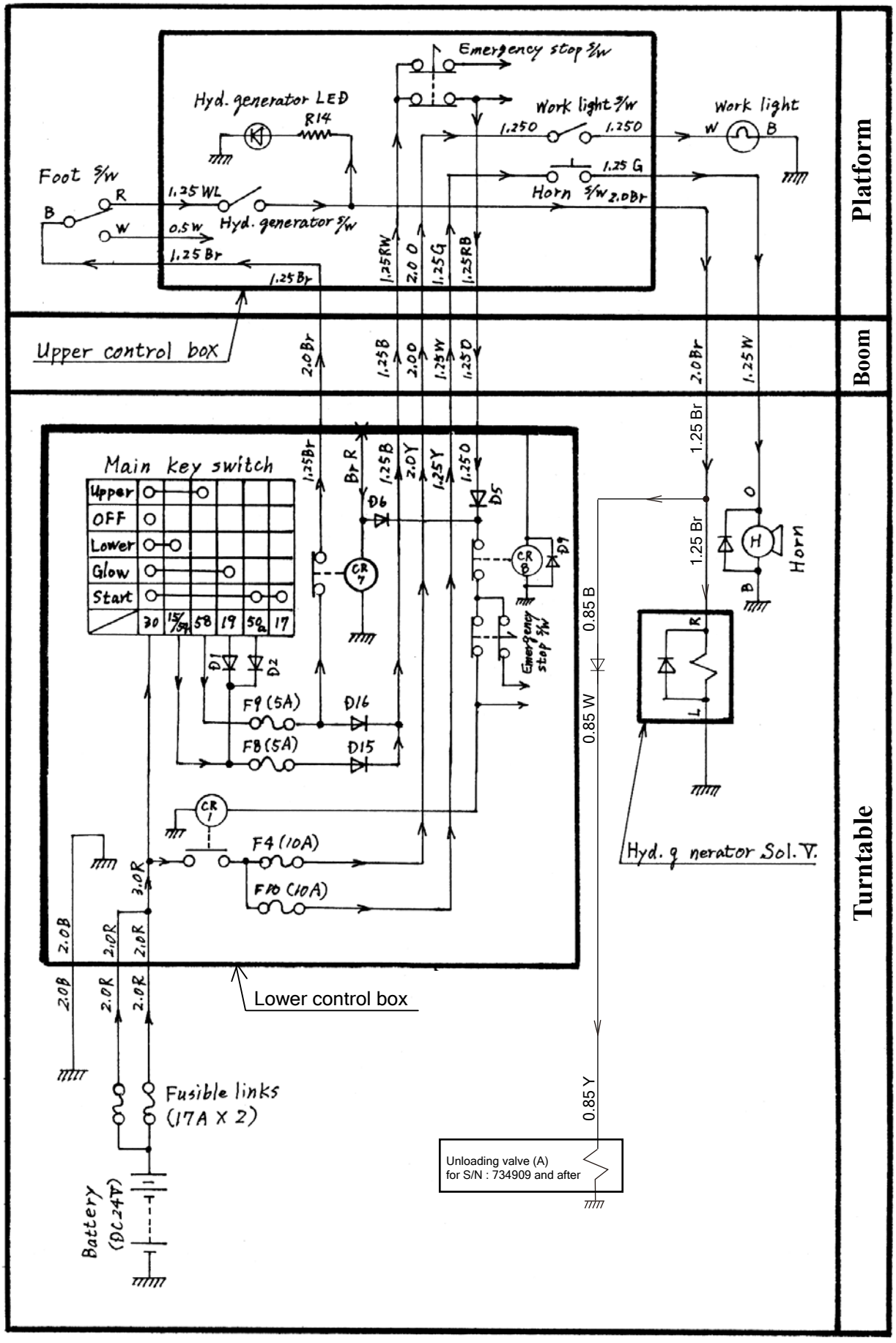
Accelerator system



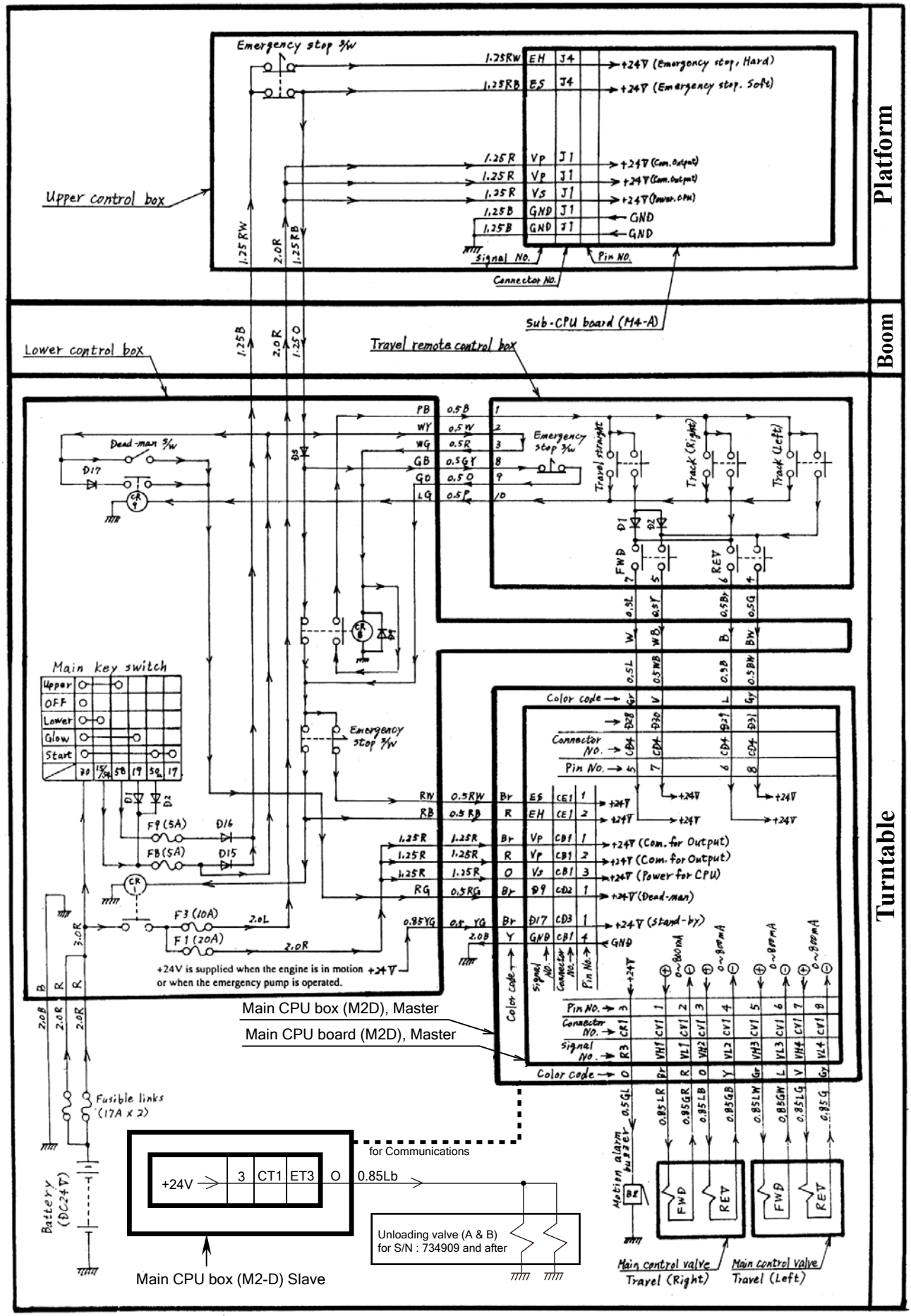
Emergency pump system



Horn, Work light and Hydraulic generator systems



Travel remote control system



6. Inspections and Adjustments

Inspection of Limited work radius and Limited boom angle

Caution:

The items listed below should be strictly obeyed when checking the limited work radius and the limited boom angle.

- Set up the machine on firm and level surface.
- Do not allow either any personnel or load on the platform.
- Do not operate the machine from the platform. The machine should be operated only from the lower control.
- Stop the inspection immediately and conduct adequate adjustments or repairs, if any failure is observed during the inspections.
- Rotate the platform and set up the platform at the central position.

1. Check the limited work radius as follows. (See Fig-1)

No	Inspection procedures
1	Check the Maximum allowable work radius of the platform and mark this work radius on the ground. Model: SR18AJ / ISR60J — Maximum allowable work radius: 15.8 meters (51ft - 10in) Model: SR21A / ISR70 — Maximum allowable work radius: 18.6 meters (61ft - 0 in) Model: SR21AJ / ISR70J — Maximum allowable work radius: 17.8 meters. (58ft - 5 in)
2	Retract the boom fully, set it horizontally, and then extend the boom until the boom extending movements automatically stops. (For the machine equipped with the fly- jib, adjust the fly- jib so that the jib becomes horizontal.) Caution: Do not extend the boom further, if the work radius reaches the maximum allowable limit. If so, stop the inspection and conduct adequate adjustments or repairs.
3	Make sure that the boom lowering function is disabled.
4	Measure the work radius of the platform and make sure that the work radius is within the specific value. Model: SR18AJ / ISR60J — Specific work radius: 15.4 ~ 15.8 meters (50ft - 6in ~ 51ft - 10in) Model: SR21A / ISR70 — Specific work radius: 18.2 ~ 18.6 meters (59ft - 8in ~ 61ft - 0in) Model: SR21AJ / ISR70J — Specific work radius: 17.4 ~ 17.8 meters (57ft - 1in ~ 58ft - 5in)

2. Check the limited boom angle as follows by using a goniometer. (See Fig-2)

No	Inspection procedures
1	Check the minimum allowable limited boom angle and mark it on a goniometer. Model: SR18AJ / ISR60J — Minimum allowable limited boom angle: 35 degrees Model: SR21A / ISR70 — Minimum allowable limited boom angle: 31 degrees Model: SR21AJ / ISR70J — Minimum allowable limited boom angle: 46 degrees
2	Raise the boom fully and extend it fully, set the goniometer on the upper surface of the 1st boom section, and then lower the boom until the boom lowering movement automatically stops. Caution: Do not lower the boom further, if the boom angle reaches the minimum allowable limit. If so, stop the inspection and conduct adequate adjustments or repairs.
4	Measure the boom angle and make sure that the boom angle is within the specific value. Model: SR18AJ / ISR60J — Specific limited boom angle: 35 ~ 38 degrees Model: SR21A / ISR70 — Specific limited boom angle: 31 ~ 34 degrees Model: SR21AJ / ISR70J — Specific limited boom angle: 46 ~ 49 degrees

Fig- 1

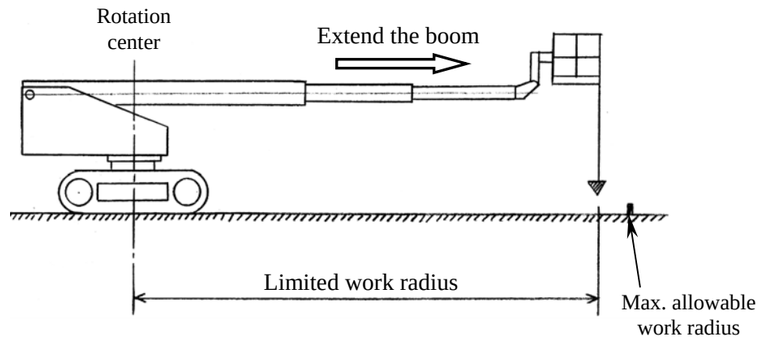
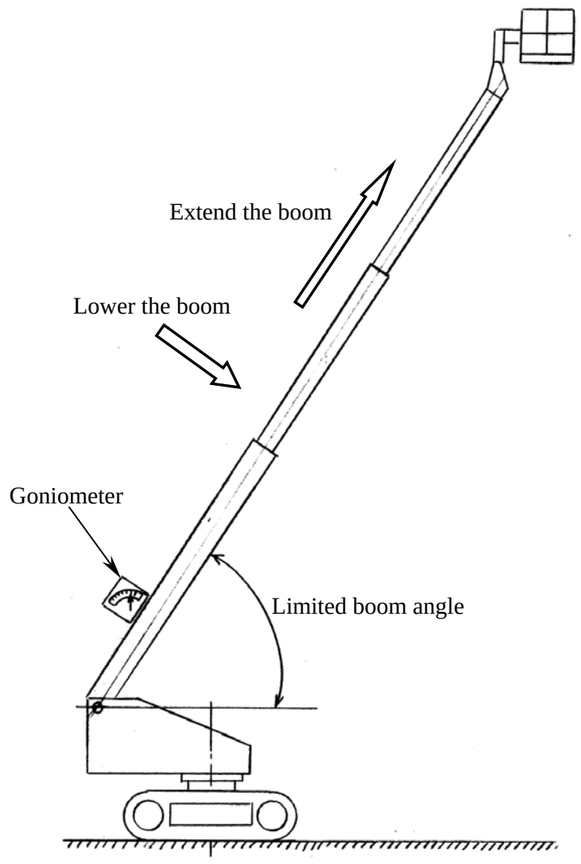


Fig- 2



SR18A / ISR60 Inspection data sheet

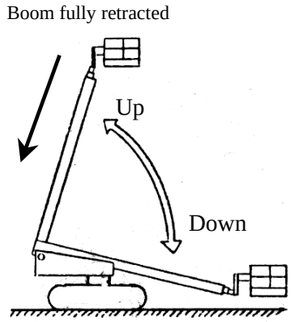
Model	*Serial No.*	*Specification No.*	*Date of Inspection*	*Inspector*

Item			*Specific rpm*	*Inspected rpm*	*Remarks*
Engine rpm	Low (Idling)		1,020 rpm		Check the Mid and High rpm with the relief valves being actuated.
	Mid		1,400 – 1,450 rpm		
	High	CE model	1,950 – 2,000 rpm		
		ANSI model	1,800 – 1,850 rpm		

Item		*Specific pressure*	*Inspected pressure*	*Remarks*
Relief valve preset pressure	Relief valve (P1)	31.4 MPa (320 kg/cm^2)		
	Relief valve (P2)	31.4 MPa (320 kg/cm^2)		
	Relief valve (P3)	8.8 MPa (90kg/cm^2)		
	Relief valve (P4)	20.6 MPa (210 kg/cm^2)		
	Relief valve (P5)	20.6 MPa (210 kg/cm^2)		
	Relief valve (P6)	7.4 MPa (75 kg/cm^2)		
	Relief valve (P7)	20.6 MPa (210 kg/cm^2)		
	Relief valve (P8)	20.6 MPa (210 kg/cm^2)		
	Relief valve (P9)	13.7 MPa (140 kg/cm^2)		

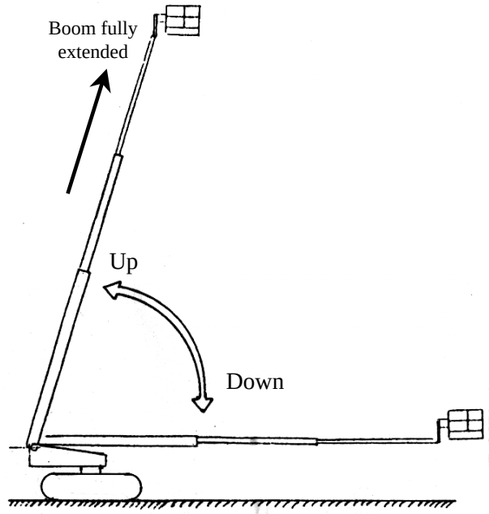
Item				*Specific speed*	*Inspected speed*	*Remarks*	
Actuating speed	Boom elevation	Maximum speed	UP	40±6 seconds		Fig- 1	See the figures right to check each actuating speed.
			DOWN	40±6 seconds			
		Limited speed	UP	100±15 seconds		Fig- 2	
			DOWN	100±15 seconds			
	Boom telescope	OUT		35±5 seconds		Fig- 3	
		IN		30±5 seconds			
	Boom rotation	Maximum speed	CW	80±12 seconds		Fig- 4	
			CCW	80±12 seconds			
		Limited speed	CW	240±36 seconds		Fig- 5	
			CCW	240±36 seconds			
	Traveling	Low speed	FWD	72±20 sec/10 m (33 ft)		Fig- 6	
			REV	72±20 sec/10 m (33 ft)			
		Mid speed CE model	FWD	28±4 sec/10m (33 ft)			
			REV	28±4 sec/10m (33 ft)			
		Mid speed ANSI model	FWD	24±4 sec/10m (33 ft)			
			REV	24±4 sec/10m (33 ft)			
		High speed CE model	FWD	20±2 sec/10m (33ft)			
			REV	20±2 sec/10m (33ft)			
		High speed ANSI model	FWD	12±2 sec/10m (33ft)			
			REV	12±2 sec/10m (33ft)			
	Platform rotation	CW		15±5 seconds			
		CCW		15±5 seconds			
	Horizontal movement	OUT		15±2 sec/3 m (9ft – 10in)			
		IN		15±2 sec/3 m (9ft – 10in)			
	Vertical movement	UP		15±2 sec/3 m (9ft – 10in)			
		DOWN		15±2 sec/3 m (9ft – 10in)			

Fig- 1



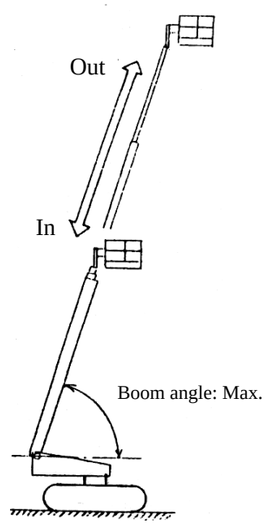
Boom elevation Maximum speed

Fig- 2



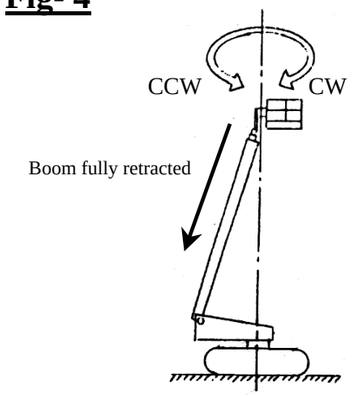
Boom elevation Limited speed

Fig- 3



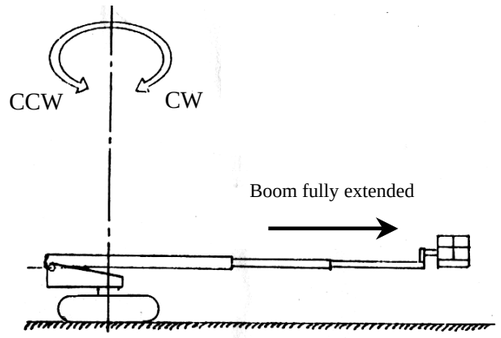
Boom telescope speed

Fig- 4



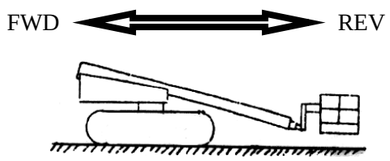
Boom rotation Maximum speed

Fig- 5



Boom rotation Limited speed

Fig- 6



Traveling Low, Mid and High speed

SR18AJ / ISR60J Inspection data sheet

Model	*Serial No.*	*Specification No.*	*Date of Inspection*	*Inspector*

Item			*Specific rpm*	*Inspected rpm*	*Remarks*
Engine rpm	Low (Idling)		1,020 rpm		Check the Mid and High rpm with the relief valves being actuated.
	Mid		1,400 – 1,450 rpm		
	High	CE model	1,950 – 2,000 rpm		
		ANSI model	1,800 – 1,850 rpm		

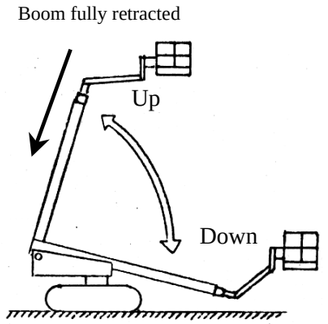
Item		*Specific pressure*	*Inspected pressure*	*Remarks*
Relief valve preset pressure	Relief valve (P1)	31.4 MPa (320 kg/cm^2)		
	Relief valve (P2)	31.4 MPa (320 kg/cm^2)		
	Relief valve (P3)	8.8 MPa (90kg/cm^2)		
	Relief valve (P4)	20.6 MPa (210 kg/cm^2)		
	Relief valve (P5)	20.6 MPa (210 kg/cm^2)		
	Relief valve (P6)	7.4 MPa (75 kg/cm^2)		
	Relief valve (P7)	20.6 MPa (210 kg/cm^2)		
	Relief valve (P8)	20.6 MPa (210 kg/cm^2)		
	Relief valve (P9)	13.7 MPa (140 kg/cm^2)		

Item				*Specific speed*	*Inspected speed*	*Remarks*
Actuating speed	Boom elevation	Maximum speed	UP	40±6 seconds		Fig- 1
			DOWN	40±6 seconds		
		Limited speed	UP	50±7 seconds		Fig- 2
			DOWN	50±7 seconds		
	Boom telescope	OUT		35±5 seconds		Fig- 3
		IN		25±5 seconds		
	Boom rotation	Maximum speed	CE model CW	95±14 seconds		Fig- 4
			CE model CCW	95±14 seconds		
			ANSI model CW	80±12 seconds		
			ANSI model CCW	80±12 seconds		
		Limited speed	CW	240±36 seconds		Fig- 5
			CCW	240±36 seconds		
	Traveling	Low speed	FWD	72±20 sec/10 m (33 ft)		Fig- 6
			REV	72±20 sec/10 m (33 ft)		
		Mid speed	CE model FWD	28±4 sec/10m (33 ft)		
			CE model REV	28±4 sec/10m (33 ft)		
			ANSI model FWD	24±4 sec/10m (33 ft)		
			ANSI model REV	24±4 sec/10m (33 ft)		
		High speed	CE model FWD	20±2 sec/10m (33ft)		
			CE model REV	20±2 sec/10m (33ft)		
			ANSI model FWD	12±2 sec/10m (33ft)		
			ANSI model REV	12±2 sec/10m (33ft)		
	Fly- jib	UP		30±5 seconds		
		DOWN		25±5 seconds		
	Platform rotation	CW		15±5 seconds		
		CCW		15±5 seconds		
	Horizontal movement	OUT		15±2 sec/3 m (9ft – 10in)		
		IN		15±2 sec/3 m (9ft – 10in)		
	Vertical movement	UP		15±2 sec/3 m (9ft – 10in)		
		DOWN		15±2 sec/3 m (9ft – 10in)		

See the figures right to check each actuating speed.

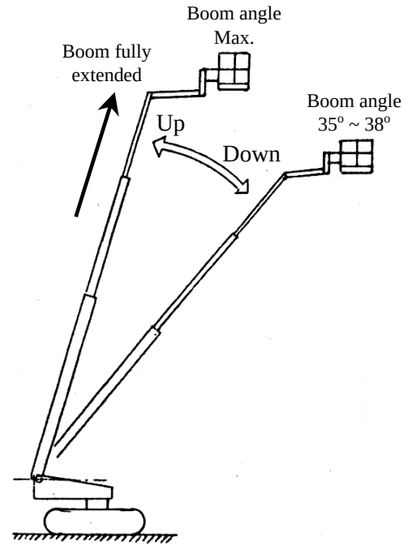
Item	*Specific limited work radius*	*Inspected work radius*	*Remarks*
Limited work radius	15.4 ~ 15.8 m (50ft- 6in ~ 51ft- 10in)		
Item	*Specific limited boom angle*	*Inspected boom angle*	*Remarks*
Limited boom angle	35 ~ 38 degrees		

Fig- 1



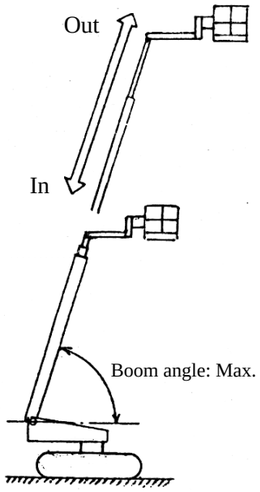
Boom elevation Maximum speed

Fig- 2



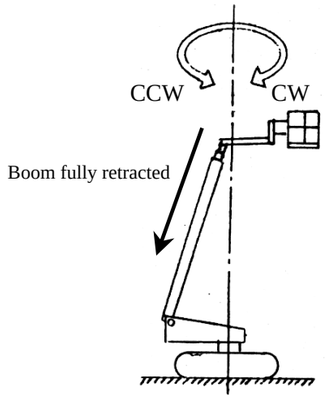
Boom elevation Limited speed

Fig- 3



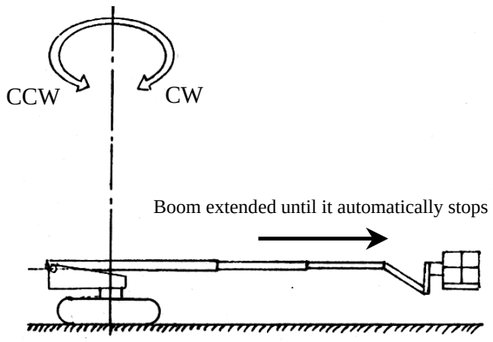
Boom telescope speed

Fig- 4



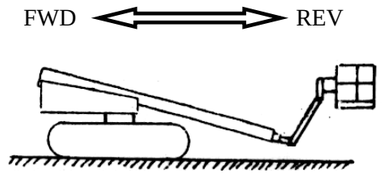
Boom rotation Maximum speed

Fig- 5



Boom rotation Limited speed

Fig- 6



Traveling Low, Mid and High speed

SR21A / ISR70 Inspection data sheet

Model	*Serial No.*	*Specification No.*	*Date of Inspection*	*Inspector*

Item			*Specific rpm*	*Inspected rpm*	*Remarks*
Engine rpm	Low (Idling)		1,020 rpm		Check the Mid and High rpm with the relief valves being actuated.
	Mid		1,400 – 1,450 rpm		
	High	CE model	1,950 – 2,000 rpm		
		ANSI model	1,800 – 1,850 rpm		

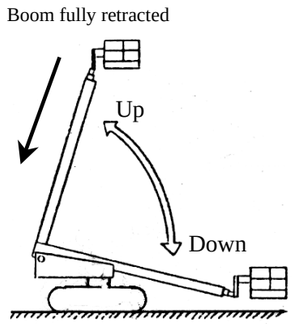
Item		*Specific pressure*	*Inspected pressure*	*Remarks*
Relief valve preset pressure	Relief valve (P1)	31.4 MPa (320 kg/cm^2)		
	Relief valve (P2)	31.4 MPa (320 kg/cm^2)		
	Relief valve (P3)	8.8 MPa (90kg/cm^2)		
	Relief valve (P4)	20.6 MPa (210 kg/cm^2)		
	Relief valve (P5)	20.6 MPa (210 kg/cm^2)		
	Relief valve (P6)	7.4 MPa (75 kg/cm^2)		
	Relief valve (P7)	20.6 MPa (210 kg/cm^2)		
	Relief valve (P8)	20.6 MPa (210 kg/cm^2)		
	Relief valve (P9)	13.7 MPa (140 kg/cm^2)		

Item				*Specific speed*	*Inspected speed*	*Remarks*
Actuating speed	Boom elevation	Maximum speed	UP	40±6 seconds		Fig- 1
			DOWN	40±6 seconds		
		Limited speed	UP	56±7 seconds		Fig- 2
			DOWN	56±7 seconds		
	Boom telescope	OUT		45±7 seconds		Fig- 3
		IN		35±5 seconds		
	Boom rotation	Maximum speed	CE model CW	100±14 seconds		Fig- 4
			CE model CCW	100±14 seconds		
			ANSI model CW	80±12 seconds		
			ANSI model CCW	80±12 seconds		
		Limited speed	CW	240±36 seconds		Fig- 5
			CCW	240±36 seconds		
	Traveling	Low speed	FWD	72±20 sec/10 m (33 ft)		Fig- 6
			REV	72±20 sec/10 m (33 ft)		
		Mid speed	CE model FWD	28±4 sec/10m (33 ft)		
			CE model REV	28±4 sec/10m (33 ft)		
			ANSI model FWD	24±4 sec/10m (33 ft)		
			ANSI model REV	24±4 sec/10m (33 ft)		
		High speed	CE model FWD	20±2 sec/10m (33ft)		
			CE model REV	20±2 sec/10m (33ft)		
			ANSI model FWD	12±2 sec/10m (33ft)		
			ANSI model REV	12±2 sec/10m (33ft)		
	Platform rotation	CW		15±5 seconds		
		CCW		15±5 seconds		
	Horizontal movement	OUT		15±2 sec/3 m (9ft – 10in)		
		IN		15±2 sec/3 m (9ft – 10in)		
	Vertical movement	UP		15±2 sec/3 m (9ft – 10in)		
		DOWN		15±2 sec/3 m (9ft – 10in)		

See the figures right to check each actuating speed.

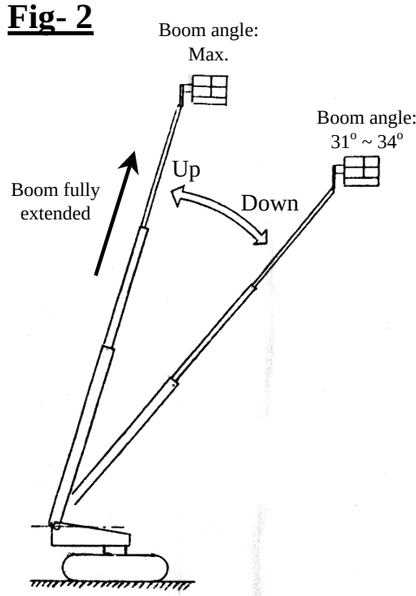
Item	*Specific limited work radius*	*Inspected work radius*	*Remarks*
Limited work radius	18.2 ~ 18.6 m (59ft- 8in ~ 61ft- 0in)		
Item	*Specific limited boom angle*	*Inspected boom angle*	*Remarks*
Limited boom angle	31 ~ 34 degrees		

Fig- 1



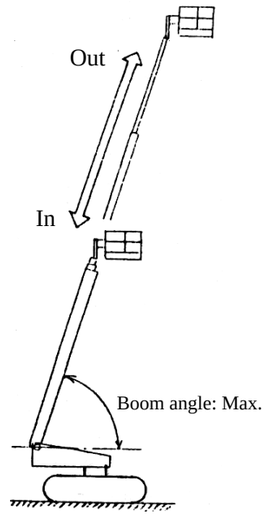
Boom elevation Maximum speed

Fig- 2



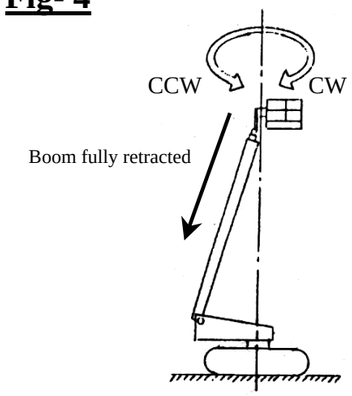
Boom elevation Limited speed

Fig- 3



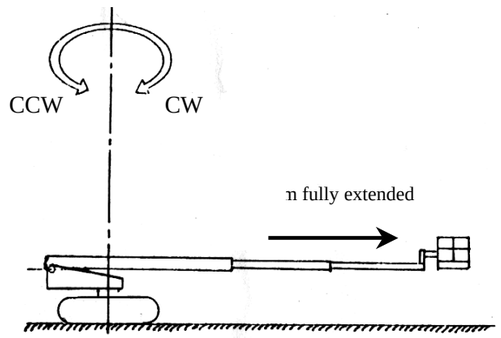
Boom telescope speed

Fig- 4



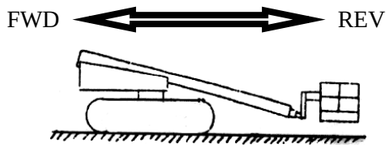
Boom rotation Maximum speed

Fig- 5



Boom rotation Limited speed

Fig- 6



Traveling Low, Mid and High speed

SR21AJ / ISR70J Inspection data sheet

Model	*Serial No.*	*Specification No.*	*Date of Inspection*	*Inspector*

Item			*Specific rpm*	*Inspected rpm*	*Remarks*
Engine rpm	Low (Idling)		1,020 rpm		Check the Mid and High rpm with the relief valves being actuated.
	Mid		1,400 – 1,450 rpm		
	High	CE model	1,950 – 2,000 rpm		
		ANSI model	1,800 – 1,850 rpm		

Item		*Specific pressure*	*Inspected pressure*	*Remarks*
Relief valve preset pressure	Relief valve (P1)	31.4 MPa (320 kg/cm^2)		
	Relief valve (P2)	31.4 MPa (320 kg/cm^2)		
	Relief valve (P3)	8.8 MPa (90kg/cm^2)		
	Relief valve (P4)	20.6 MPa (210 kg/cm^2)		
	Relief valve (P5)	20.6 MPa (210 kg/cm^2)		
	Relief valve (P6)	7.4 MPa (75 kg/cm^2)		
	Relief valve (P7)	20.6 MPa (210 kg/cm^2)		
	Relief valve (P8)	20.6 MPa (210 kg/cm^2)		
	Relief valve (P9)	13.7 MPa (140 kg/cm^2)		

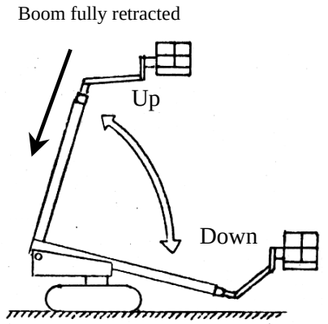
Item				*Specific speed*	*Inspected speed*	*Remarks*
Actuating speed	Boom elevation	Maximum speed	UP	40±6 seconds		Fig- 1
			DOWN	40±6 seconds		
		Limited speed	UP	34±5 seconds		Fig- 2
			DOWN	34±5 seconds		
	Boom telescope	OUT		40±6 seconds		Fig- 3
		IN		30±5 seconds		
	Boom rotation	Maximum speed	CE model CW	110±15 seconds		Fig- 4
			CE model CCW	110±15 seconds		
			ANSI model CW	80±12 seconds		
			ANSI model CCW	80±12 seconds		
		Limited speed	CW	240±36 seconds		Fig- 5
			CCW	240±36 seconds		
	Traveling	Low speed	FWD	72±20 sec/10 m (33 ft)		Fig- 6
			REV	72±20 sec/10 m (33 ft)		
		Mid speed	CE model FWD	28±4 sec/10m (33 ft)		
			CE model REV	28±4 sec/10m (33 ft)		
			ANSI model FWD	24±4 sec/10m (33 ft)		
			ANSI model REV	24±4 sec/10m (33 ft)		
		High speed	CE model FWD	20±2 sec/10m (33ft)		
			CE model REV	20±2 sec/10m (33ft)		
			ANSI model FWD	12±2 sec/10m (33ft)		
			ANSI model REV	12±2 sec/10m (33ft)		
	Fly- jib	UP		30±5 seconds		
		DOWN		25±5 seconds		
	Platform rotation	CW		15±5 seconds		
		CCW		15±5 seconds		
	Horizontal movement	OUT		15±2 sec/3 m (9ft – 10in)		
		IN		15±2 sec/3 m (9ft – 10in)		
	Vertical movement	UP		15±2 sec/3 m (9ft – 10in)		
		DOWN		15±2 sec/3 m (9ft – 10in)		

See the figures right to check each actuating speed.

Item	*Specific limited work radius*	*Inspected work radius*	*Remarks*
Limited work radius	17.4 ~ 17.8 m (57ft- 1in ~ 58ft- 5in)		

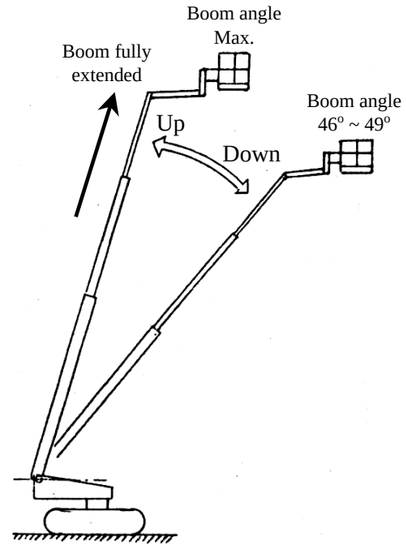
Item	*Specific limited boom angle*	*Inspected boom angle*	*Remarks*
Limited boom angle	46 ~ 49 degrees		

Fig- 1



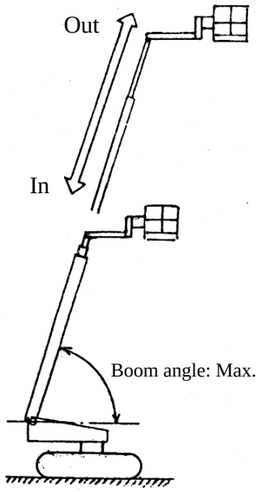
Boom elevation Maximum speed

Fig- 2



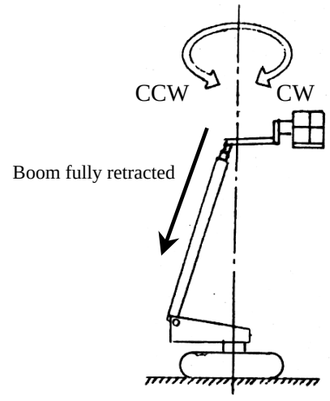
Boom elevation Limited speed

Fig- 3



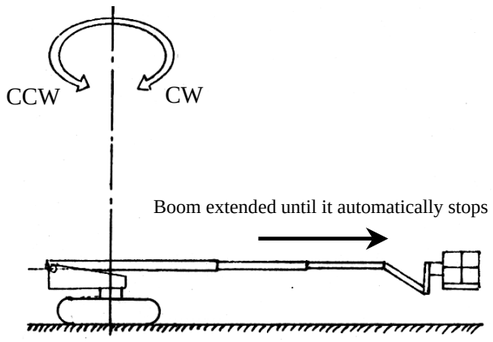
Boom telescope speed

Fig- 4



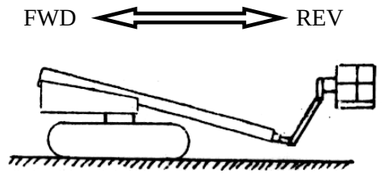
Boom rotation Maximum speed

Fig- 5



Boom rotation Limited speed

Fig- 6



Traveling Low, Mid and High speed

Engine RPM measurement procedures

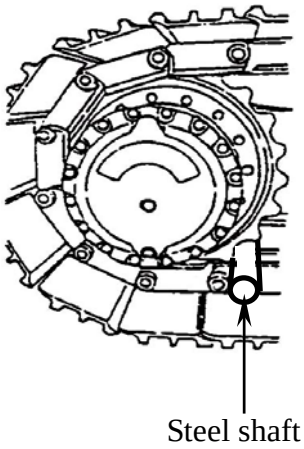
1. Specific engine

Low (Idling)		1.020 rpm
Mid		1.400 – 1,450 rpm
High	CE model	1,950 – 2,000 rpm
	ANSI model	1,800 – 1,850 rpm

2. Measurements

1. Set up the machine on firm and level surface, warm up the engine without load, and then operate the machine to warm up the hydraulic system.
2. Measure the engine ***Low (Idling) rpm*** without loading the engine.
3. Measure the engine ***Mid rpm*** as follows.
   (1) Retract the boom fully and set it under the horizontal.
   (2) Insert such as steel shafts between the sprockets and the track links on both right and left sides to stop the rotation of the travel motors as shown in the figure below.
   (3) Set the Travel speed select switch to its ***Mid- speed*** position.
   (4) Operate the Travel joystick controllers to their Forward direction to load the engine.
   (5) Under the above conditions, measure the engine ***Mid rpm***.
4. Measure the engine ***High rpm*** as follows.
   (1) Retract the boom fully and set it under the horizontal.
   (2) Insert such as steel shafts between the sprockets and the track links on both right and left sides to stop the rotation of the travel motors as shown in the figure below.
   (3) Set the Travel speed select switch to its ***High- speed*** position.
   (4) Operate the Travel joystick controllers to their Forward direction to load the engine.
   (5) Under the above conditions, measure the engine ***High rpm***.

- See the page 2- 2 for adjusting the engine rpm.

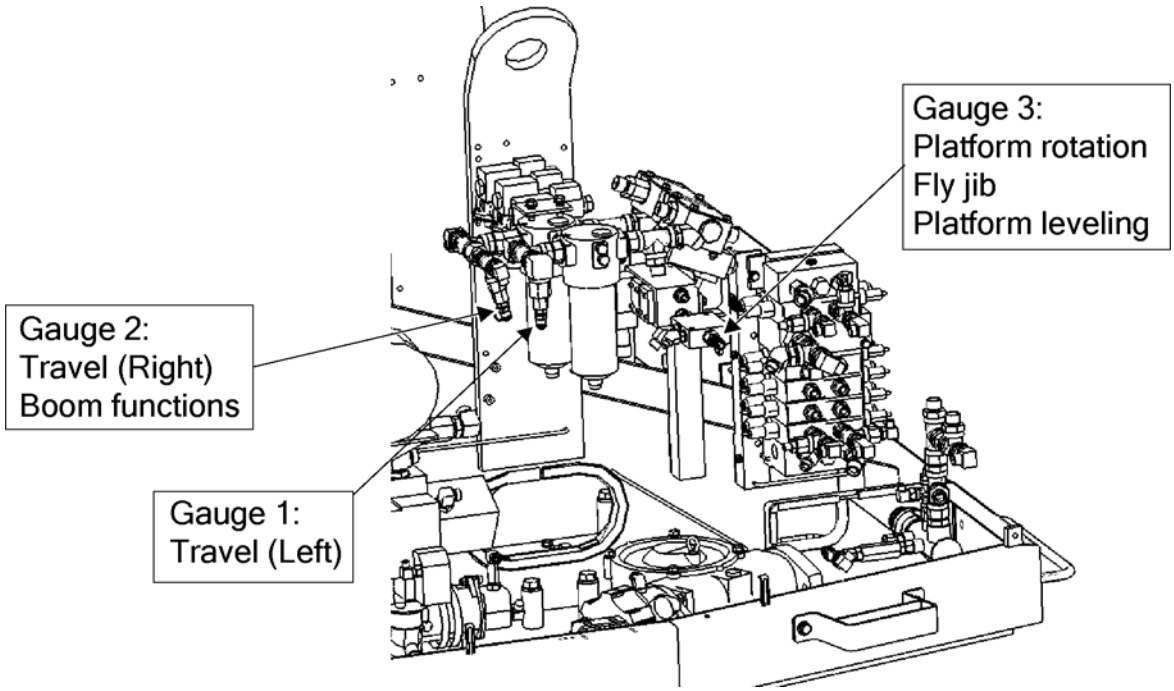


Relief valve pre- set pressure adjustment procedures

1. Specific pre- set pressure

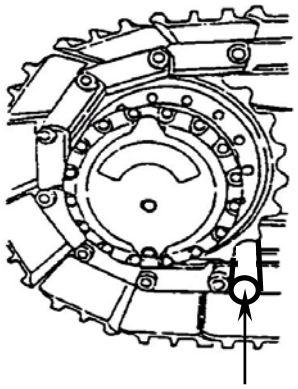
Relief valve	Pre- set pressure	Relief valve locations	Pump RPM (Engine RPM)	Functions	Gauge port
P1	34.3 ~ 34.8 MPa (350 ~ 355 kg/cm^2) [5,000 ~ 5,050 PSI]	Main control valve	1,950 rpm (CE) 1,800 rpm (ANSI) (High)	Traveling (Right)	Gauge 2
P2	34.3 ~ 34.8 MPa (350 ~ 355 kg/cm^2) [5,000 ~ 5,050 PSI]	Main control valve	1,950 rpm (CE) 1,800 rpm (ANSI) (High)	Traveling (Left)	Gauge 1
P3	8.8 ~ 9.3 MPa (90 ~ 95 kg/cm^2) [1,300 ~ 1,350 PSI]	Main control valve	1,400 rpm (Mid)	Boom telescope (Out)	Gauge 2
P4	20.6 ~ 21.1 MPa (210 ~ 215 kg/cm^2) [3,000 ~ 3,050 PSI]	Main control valve	1,400 rpm (Mid)	Boom telescope (In)	Gauge 2
P5	20.6 ~ 21.1 MPa (210 ~ 215 kg/cm^2) [3,000 ~ 3,050 PSI]	Main control valve	1,400 rpm (Mid)	Boom elevation (Up)	Gauge 2
P6	7.4 ~ 7.8 MPa (75 ~ 80 kg/cm^2) [1,050 ~ 1,150 PSI]	Main control valve	1,400 rpm (Mid)	Boom elevation (Down)	Gauge 2
P7	20.6 ~ 21.1 MPa (210 ~ 215 kg/cm^2) [3,000 ~ 3,050 PSI]	Main control valve	1,400 rpm (Mid)	Boom rotation (CW)	Gauge 2
P8	20.6 ~ 21.1 MPa (210 ~ 215 kg/cm^2) [3,000 ~ 3,050 PSI]	Main control valve	1,400 rpm (Mid)	Boom rotation (CCW)	Gauge 2
P9	13.7 ~ 14.2 MPa (140 ~ 145 kg/cm^2) [2,000 ~ 2,050 PSI]	Unit valve	1,400 rpm (Mid)	Platform rotation, Platform level adjust or Fly- jib articulation	Gauge 3

Locations of Gauge port



2. Relief valves (P1) and (P2)

1. Set up the machine on firm and level surface, warm up the engine without load, and then operate the machine to warm up the hydraulic system.
2. Retract the boom fully and set it under the horizontal.
3. Insert such as steel shafts between the sprockets and the track links on both right and left sides to stop the rotation of the travel motors as shown in the figure below.



4. Set the Travel speed select switch to its ***High- speed*** position.
5. Operate the Travel (Right) joystick controller to its ***Forward*** position to activate the ***Relief valve (P1).***
6. Read the ***Pressure gauge 2*** and make sure the pre- set pressure of ***Relief valve (P1)*** is 320 ~ 330 kg/cm^2 (4,550 ~ 4,695 PSI).
7. Operate the Travel (Left) joystick controller to its ***Forward*** position to activate the ***Relief valve (P2).***
8. Read the ***Pressure gauge 1*** and make sure the pre- set pressure of ***Relief valve (P2)*** is 320 ~ 330 kg/cm^2 (4,550 ~ 4,695 PSI).
9. See the page 6- 12 to adjust the pre- set pressure for Relief valves (P1) and (P2).

3. Relief valves (P3) and (P4)

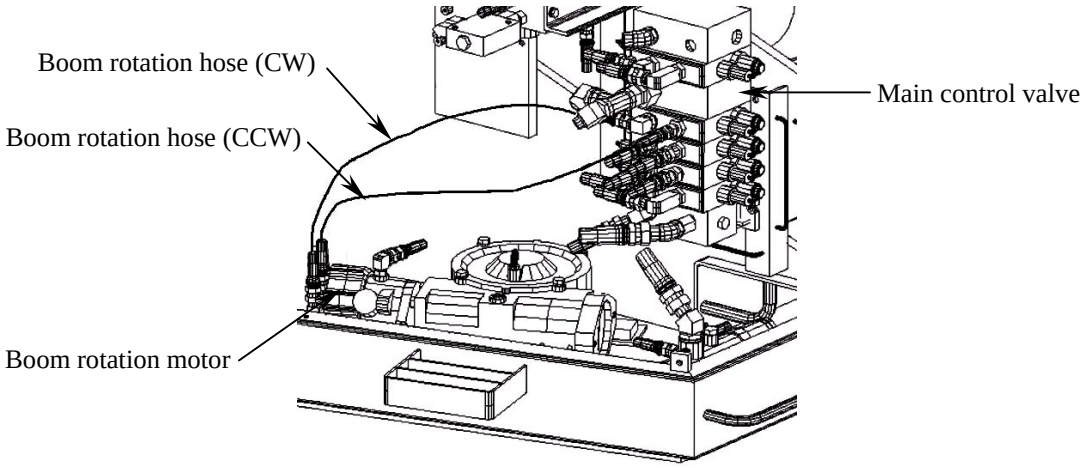
1. Set up the machine on firm and level surface, warm up the engine without load, and then operate the machine to warm up the hydraulic system.
2. Raise the boom fully and extend it fully, and then turn the Main key switch to its OFF position to shut down the engine.
3. Disconnect the connector ***CM2*** from the ***Main CPU box (M2D), Master***.
   See the page 4- 2 for the location of the connector CM2.
4. Turn the Main key switch to its ***Lower control*** position, and make sure that the ***System failure LED*** blinks on the Lower control panel.
   See the page 4- 20 for the location of the System failure LED.
5. Re- start the engine with the Main key switch, Hold the ***Limit cancel switch*** in its ON position and operate the Boom telescope switch to its OUT position to activate the ***Relief valve (P3).***
   See the page 4- 20 for the location of the Limit cancel switch.
6. Read the ***Pressure gauge 2*** and make sure the pre- set pressure of ***Relief valve (P3)*** is 90 ~ 95 kg/cm^2 (1,280 ~ 1,350 PSI).
7. Operate the Boom telescope switch to its IN position to retract the boom fully.
8. Hold the ***Limit cancel switch*** in its ON position and operate the Boom telescope switch to its IN position to activate the ***Relief valve (P4).***
9. Read the ***Pressure gauge 2*** and make sure the pre- set pressure of ***Relief valve (P4)*** is 210 ~ 215 kg/cm^2 (2,990 ~ 3,060 PSI).
10. See the page 6- 12 to adjust the pre- set pressure for Relief valves (P3) and (P4).

4. Relief valves (P5) and (P6)

1. Set up the machine on firm and level surface, warm up the engine without load, and then operate the machine to warm up the hydraulic system.
2. Raise the boom fully and retract it fully, and then turn the Main key switch to its OFF position to shut down the engine.
3. Disconnect the connector ***CM2*** from the ***Main CPU box (M2D), Master***.
   See the page 4- 2 for the location of the connector CM2.
4. Turn the Main key switch to its ***Lower control*** position, and make sure that the ***System failure LED*** blinks on the Lower control panel.
   See the page 4- 20 for the location of the System failure LED.
5. Re- start the engine with the Main key switch, Hold the ***Limit cancel switch*** in its ON position and operate the Boom elevation switch to its UP position to activate the ***Relief valve (P5).***
   See the page 4- 20 for the location of the Limit cancel switch.
6. Read the ***Pressure gauge 2*** and make sure the pre- set pressure of ***Relief valve (P5)*** is 210 ~ 215 kg/cm^2 (2,990 ~ 3,060 PSI).
7. Hold the Limit cancel switch to its ON position and operate the Boom elevation switch to its DOWN position to lower the boom fully.
8. Hold the ***Limit cancel switch*** in its ON position and operate the Boom elevation switch to its DOWN position to activate the ***Relief valve (P6).***
9. Read the ***Pressure gauge 2*** and make sure the pre- set pressure of ***Relief valve (P6)*** is 75 ~ 80 kg/cm^2 (1,070 ~ 1,140 PSI).
10. See the page 6- 12 to adjust the pre- set pressure for Relief valves (P5) and (P6).

5. Relief valves (P7) and (P8)

1. Set up the machine on firm and level surface, warm up the engine without load, and then operate the machine to warm up the hydraulic system.
2. Raise the boom fully and retract it fully, and then turn the Main key switch to its OFF position to shut down the engine.
3. Disconnect both of the boom rotation hoses from the Boom rotation motor shown in the figure below, and then plug them, using the hose plugs (3/8").



4. Re- start the engine with the Main key switch, and then operate the Boom rotation switch to its CW position to activate the ***Relief valve (P7).***
5. Read the ***Pressure gauge 2*** and make sure the pre- set pressure of ***Relief valve (P7)*** is 210 ~ 215 kg/cm^2 (2,990 ~ 3,060 PSI).
6. Operate the Boom rotation switch to its CCW position to activate the ***Relief valve (P8).***
7. Read the ***Pressure gauge 2*** and make sure the pre- set pressure of ***Relief valve (P8)*** is 210 ~ 215 kg/cm^2 (2,990 ~ 3,060 PSI).
8. See the page 6- 12 to adjust the pre- set pressure for Relief valves (P7) and (P8).

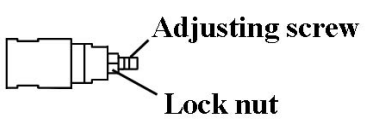
6. Relief valve (P9)

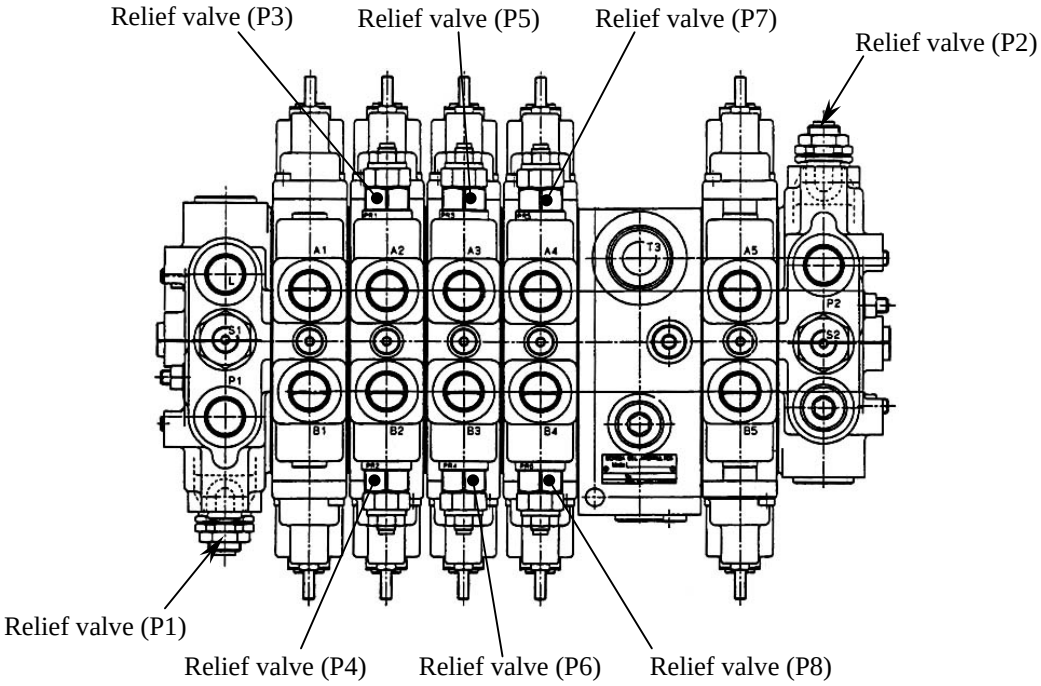
1. Set up the machine on firm and level surface, warm up the engine without load, and then operate the machine to warm up the hydraulic system.
2. Lower the platform, rotate the platform fully to CW or CCW direction, and then hold the platform rotation switch either to its CW or CCW position to activate the ***Relief valve (P9).***
3. Read the ***Pressure gauge 3*** and make sure the pre- set pressure of ***Relief valve (P9)*** is 140 ~ 145 kg/cm^2 (1,990 ~ 2,060 PSI).
4. See the page 6- 12 to adjust the pre- set pressure for Relief valve (P9).

7. Pre- set pressure adjustment procedures

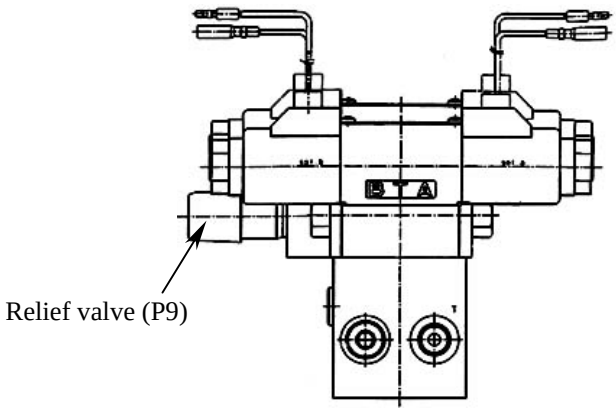
Adjust the relief valve as follows, if the pre- set pressure is not within its specific value.

1. Loosen the lock nut.
2. Turn the Adjusting screw to adjust the pre- set pressure.
   - Turn the adjusting screw clockwise to increase the pre-set pressure and turn it counter-clockwise to decrease the pre- set pressure.
3. Lock the adjusting screw by lock nut, and then recheck the pre- set pressure.





Main control valve

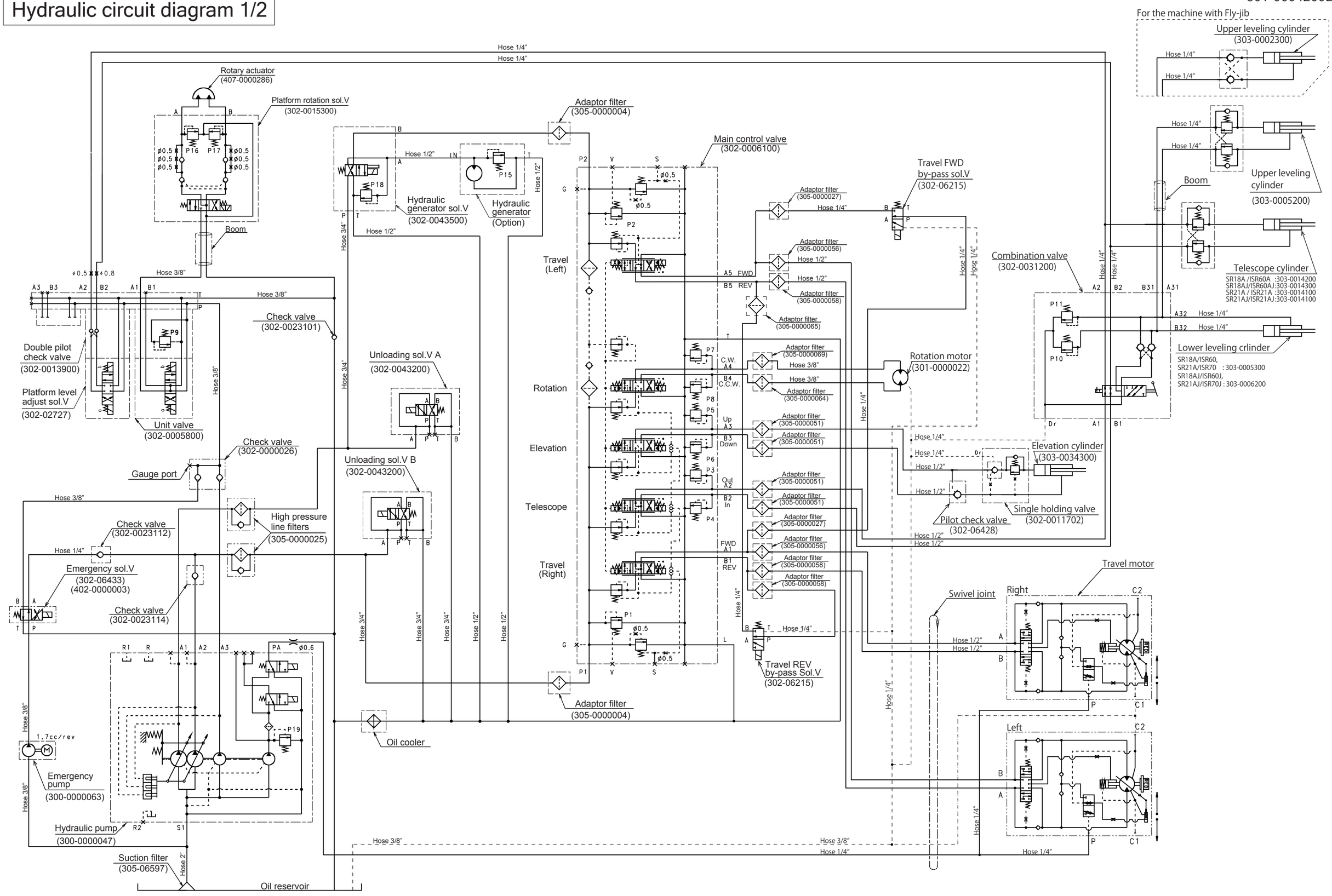


Unit valve

7. Appendix

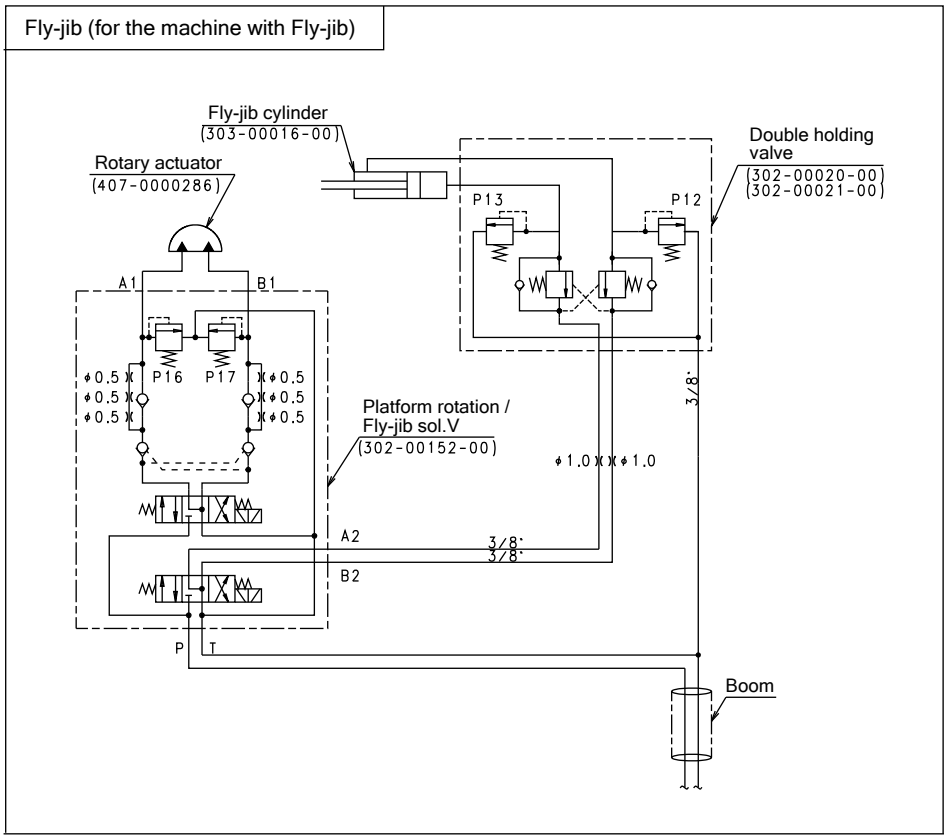
Hydraulic circuit diagram 1/2

601-0004200L



Hydraulic circuit diagram 2/2

Fly-jib (for the machine with Fly-jib)



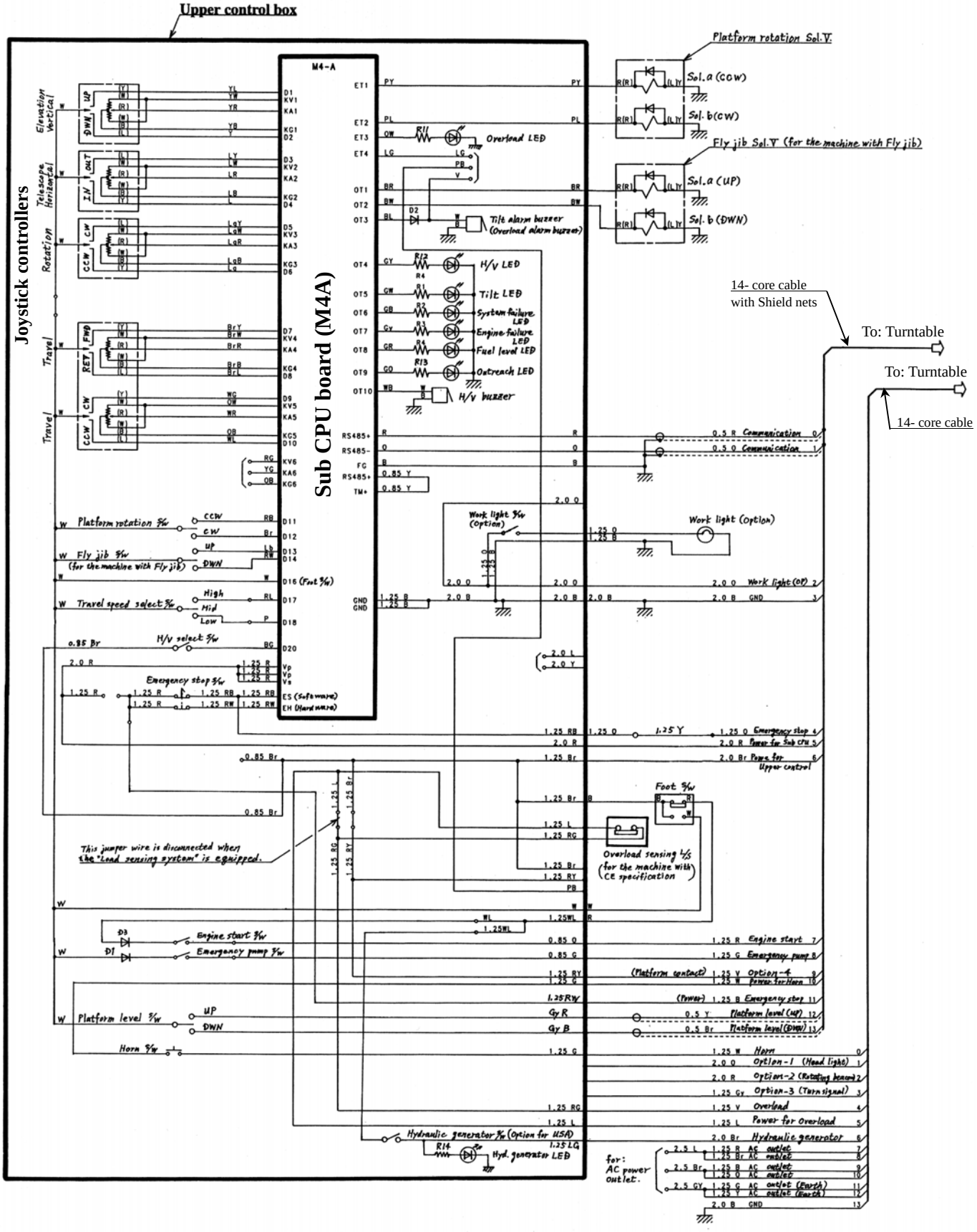
Hydraulic oil temperature: 40 +/- 10 deg C.

Relief valve pre-set pressure

Relief valve	Pre-set pressure			Pump speed (rpm)
	MPa	Kg/cm2	PSI	
P1	31.4 +0.5 0	320 +5 0	4,550 +70 0	CE model: 2,000 - 2,050 ANSI, Japan model: 1,800 - 1,850
P2	31.4 +0.5 0	320 +5 0	4,550 +70 0	CE model: 2,000 - 2,050 ANSI, Japan model: 1,800 - 1,850
P3	8.8 +0.5 0	90 +5 0	1,280 +70 0	1,400 - 1,450
P4	20.6 +0.5 0	210 +5 0	3,000 +70 0	1,400 - 1,450
P5	20.6 +0.5 0	210 +5 0	3,000 +70 0	1,400 - 1,450
P6	7.4 +0.5 0	75 +5 0	1,070 +70 0	1,400 - 1,450
P7	20.6 +0.5 0	210 +5 0	3,000 +70 0	1,400 - 1,450
P8	20.6 +0.5 0	210 +5 0	3,000 +70 0	1,400 - 1,450
P9	13.7 +0.5 0	140 +5 0	2,000 +70 0	1,400 - 1,450
P10	22.6 +0.9 0	230 +9 0	3,260 +130 0	Do not adjust
P11	22.6 +0.9 0	230 +9 0	3,260 +130 0	Do not adjust
P12	14.7 +0.9 0	150 +9 0	2,130 +130 0	Do not adjust
P13	14.7 +0.9 0	150 +9 0	2,130 +130 0	Do not adjust
P15	13.7 +0.5 0	140 +5 0	2,000 +70 0	Do not adjust
P16	20.6 +2.0 0	210 +20 0	3,000 +290 0	Do not adjust
P17	20.6 +2.0 0	210 +20 0	3,000 +290 0	Do not adjust
P18	20.6 +0.5 0	210 +5 0	3,000 +70 0	Do not adjust

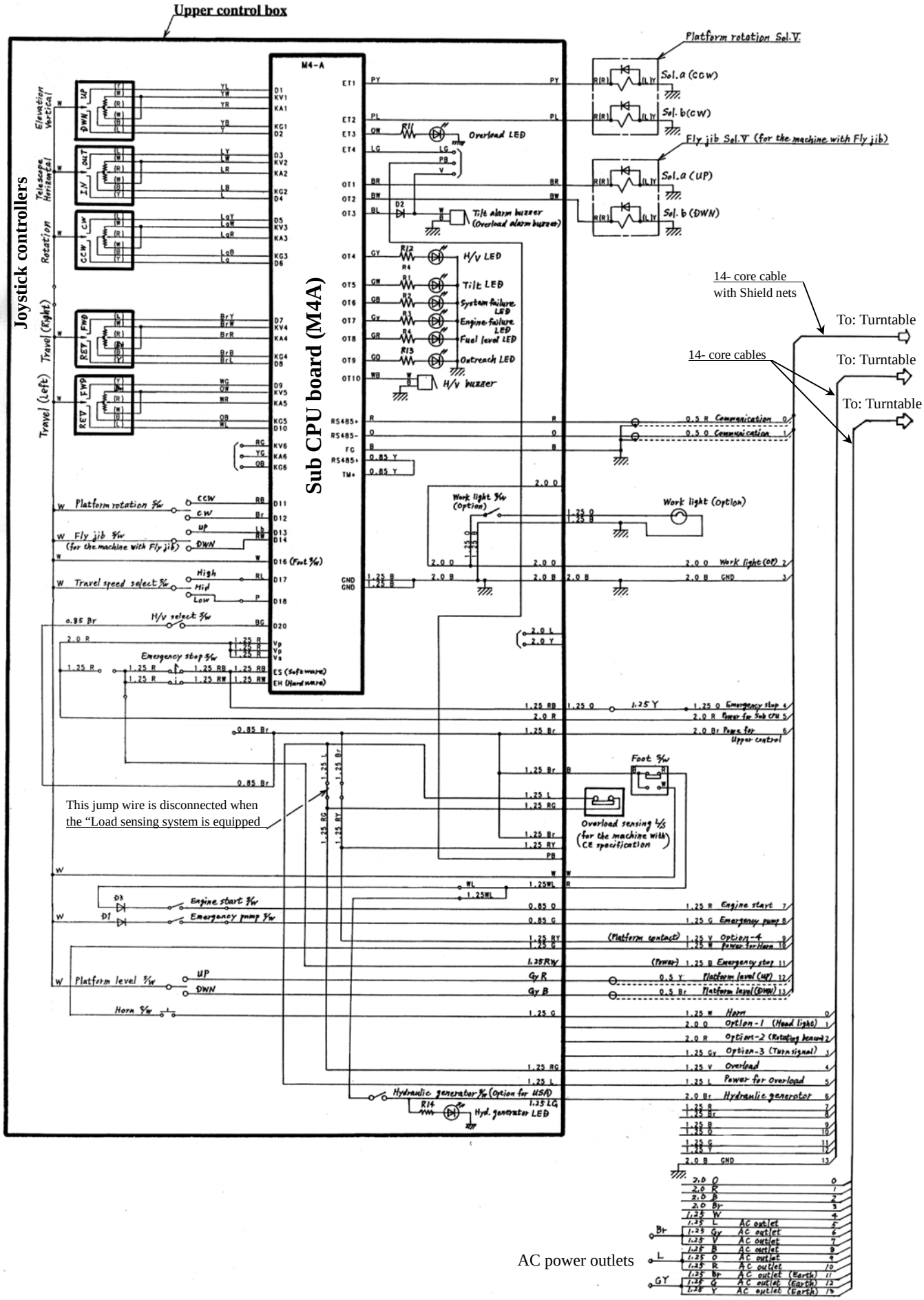
Electrical circuit diagram, Platform

For the machine with Single Travel joystick controller



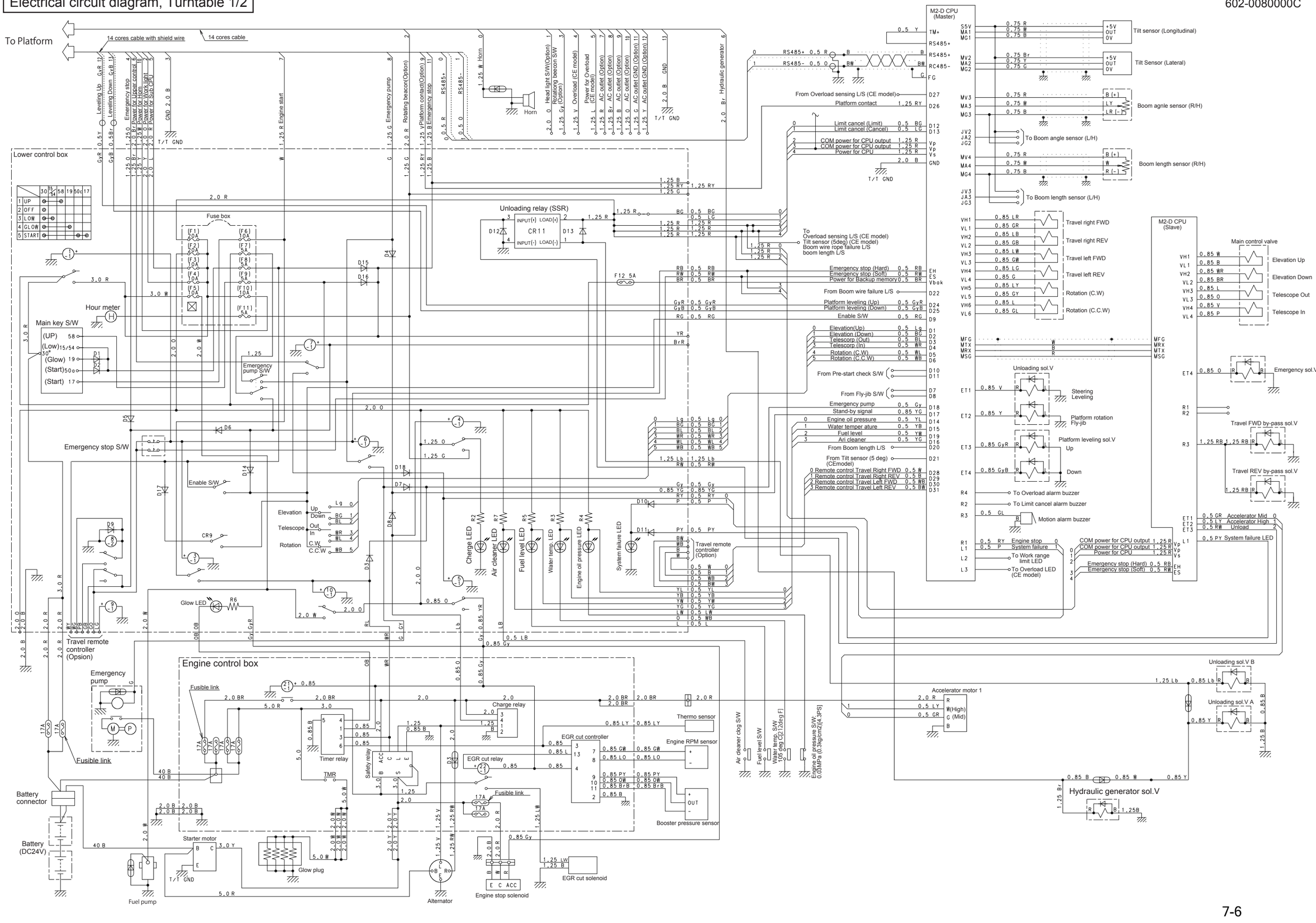
Electrical circuit diagram, Platform

For the machine with Double Travel joystick controllers



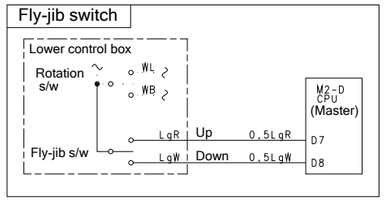
Electrical circuit diagram, Turntable 1/2

602-0080000C

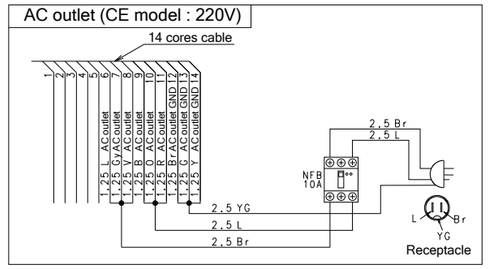


Electrical wiring chart, Turntable 2/2

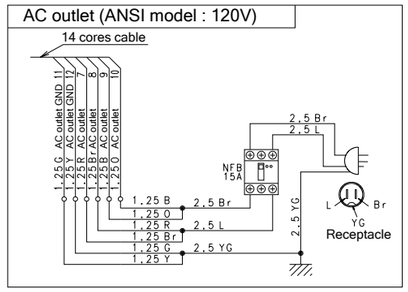
Fly-jib switch



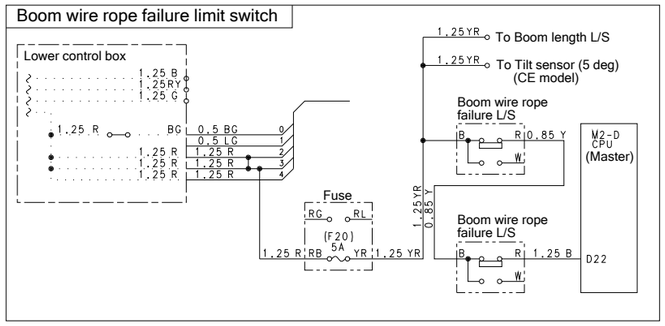
AC outlet (CE model : 220V)



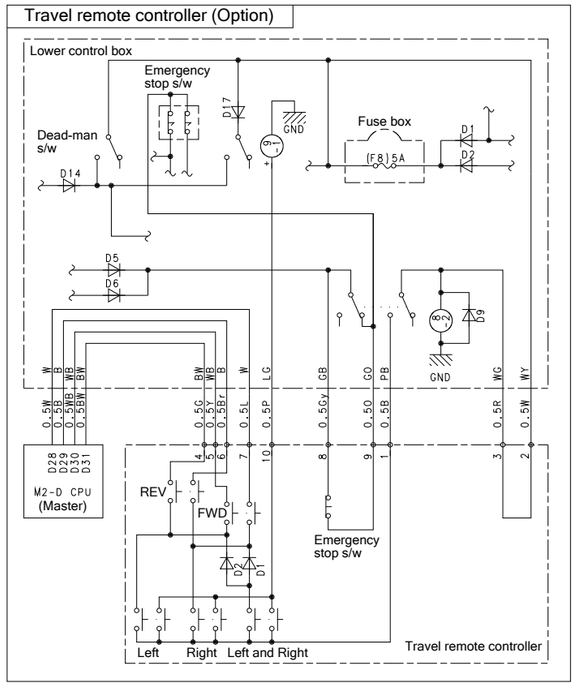
AC outlet (ANSI model : 120V)



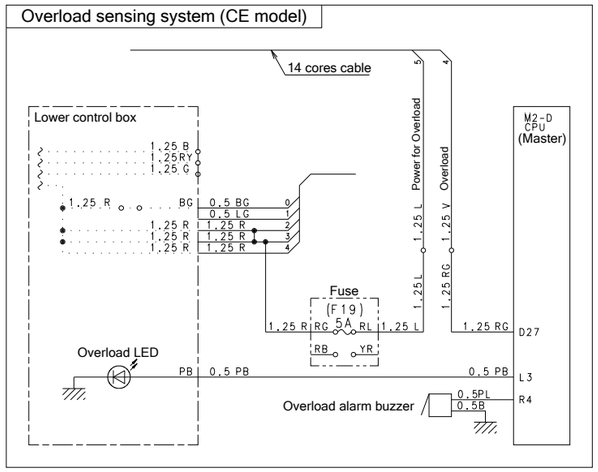
Boom wire rope failure limit switch



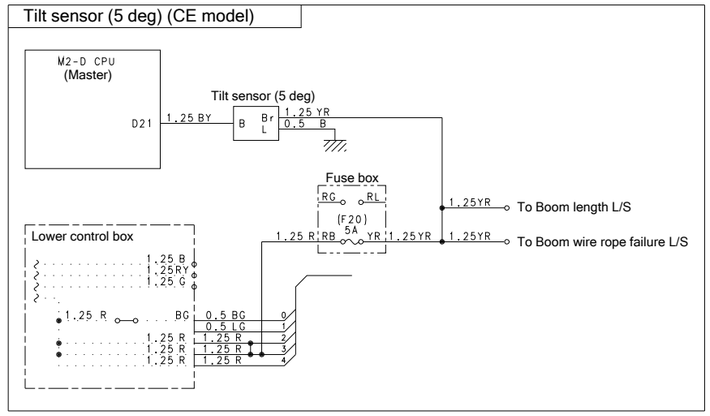
Travel remote controller (Option)



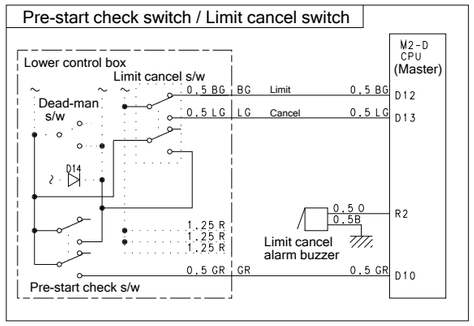
Overload sensing system (CE model)



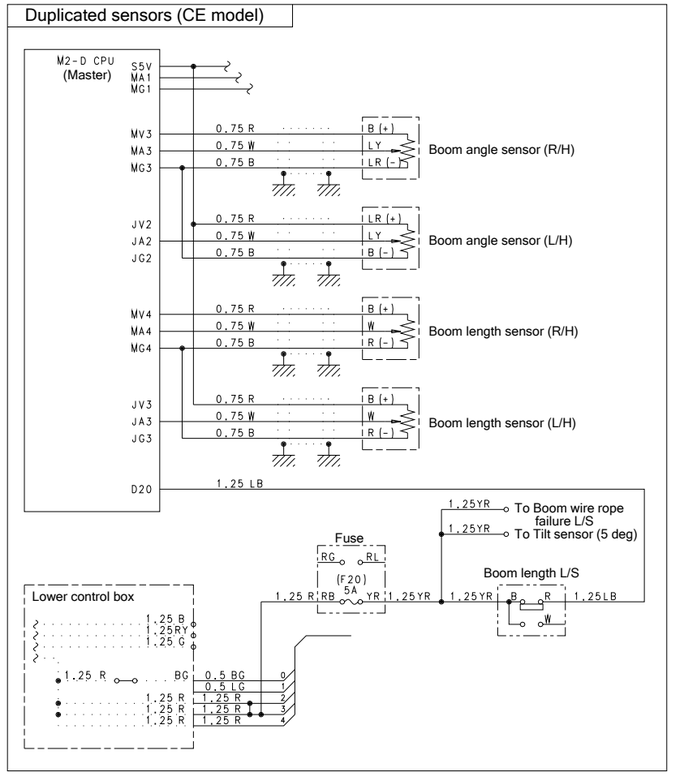
Tilt sensor (5 deg) (CE model)



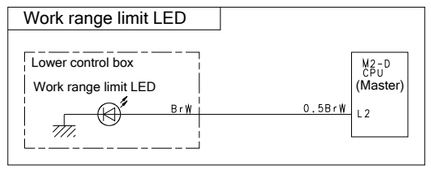
Pre-start check switch / Limit cancel switch



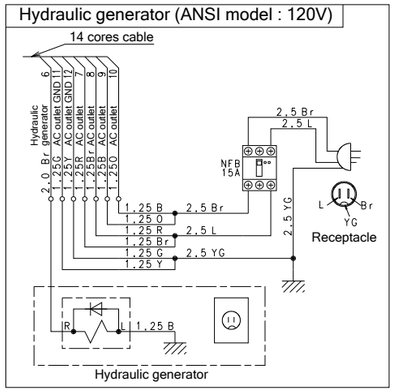
Duplicated sensors (CE model)



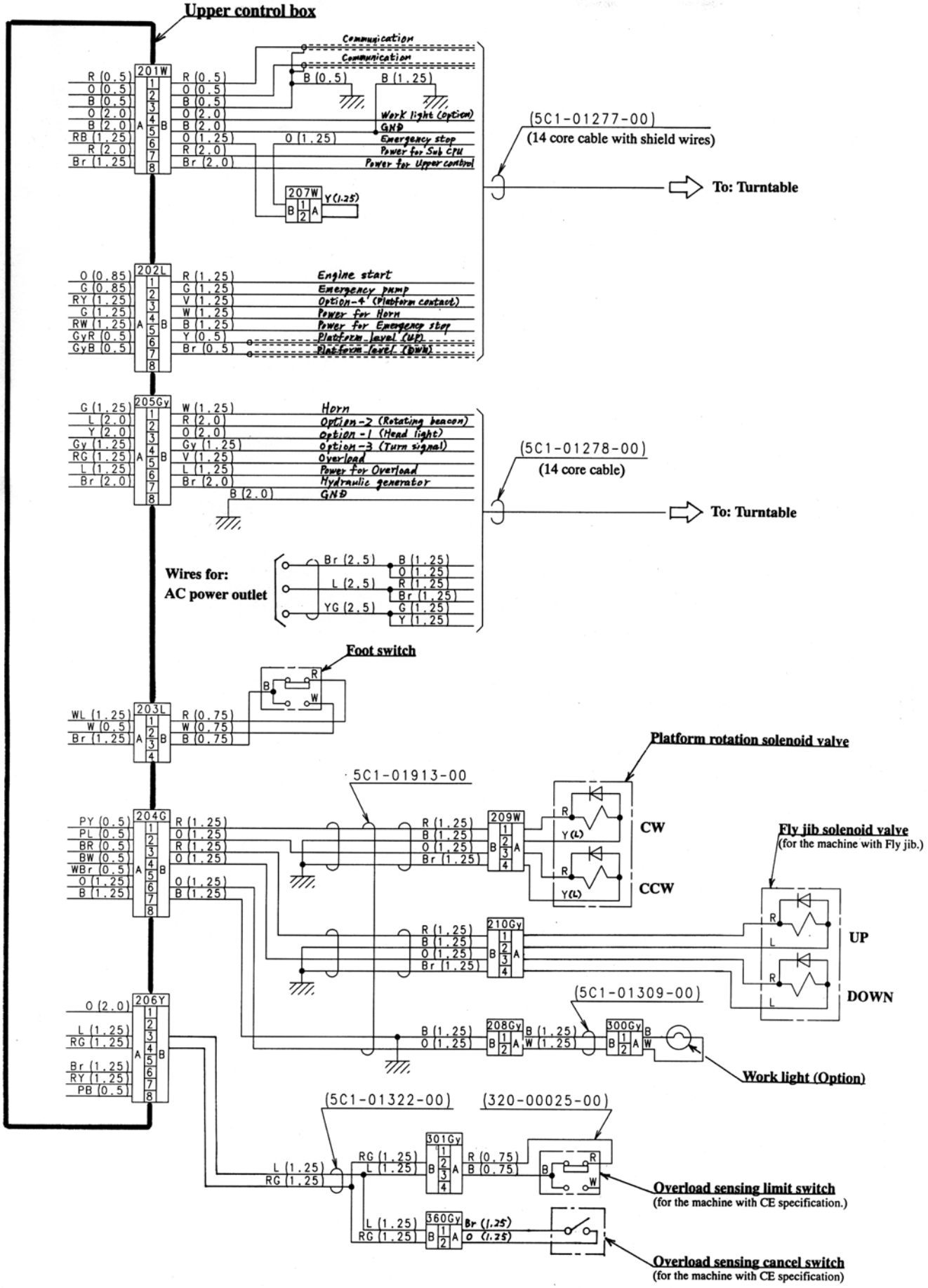
Work range limit LED



Hydraulic generator (ANSI model : 120V)

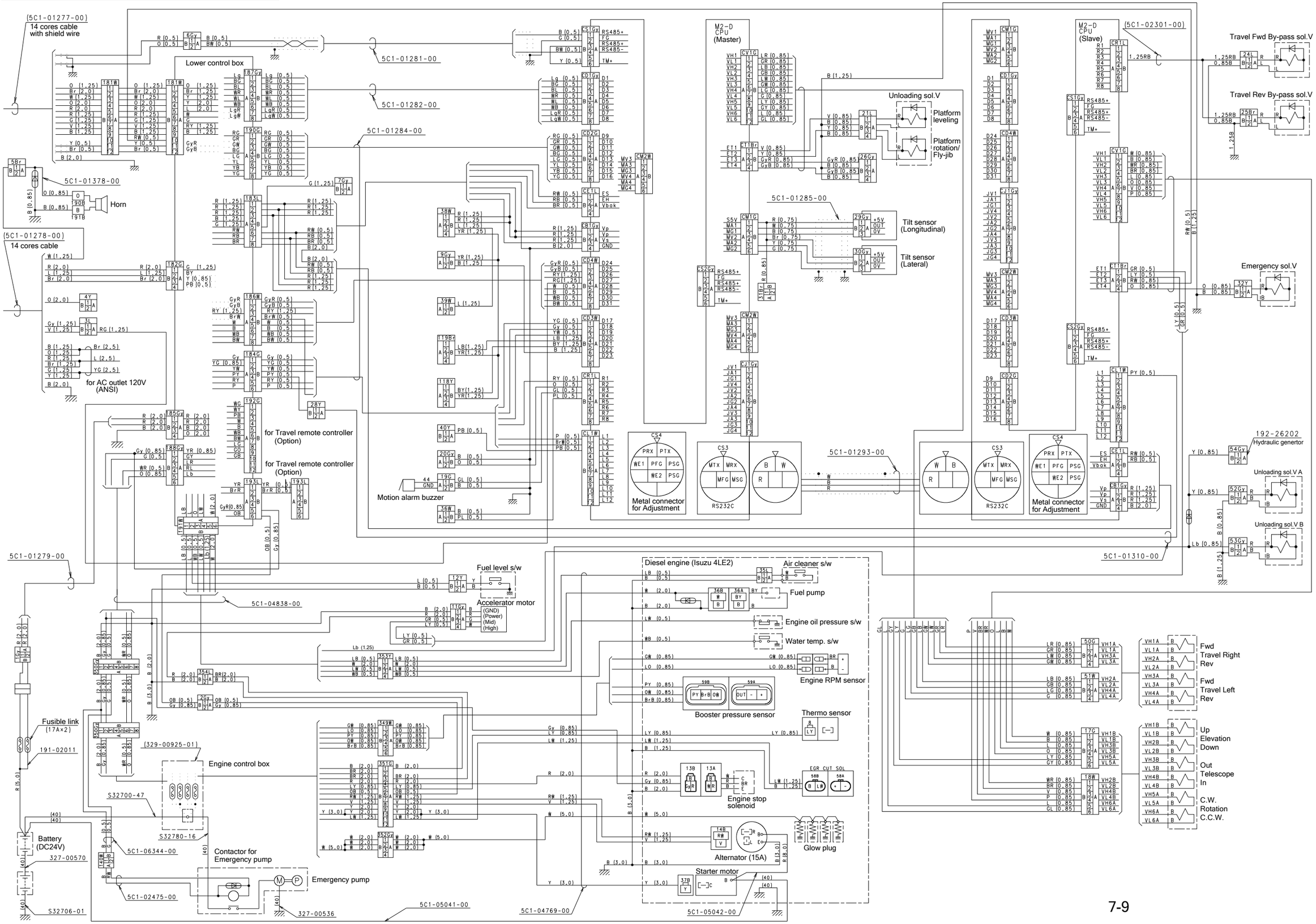


Electrical wiring chart, Platform



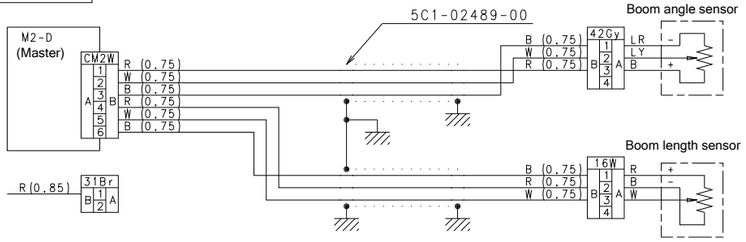
Electrical wiring chart, Turntable 1/2

7C1-00782-00

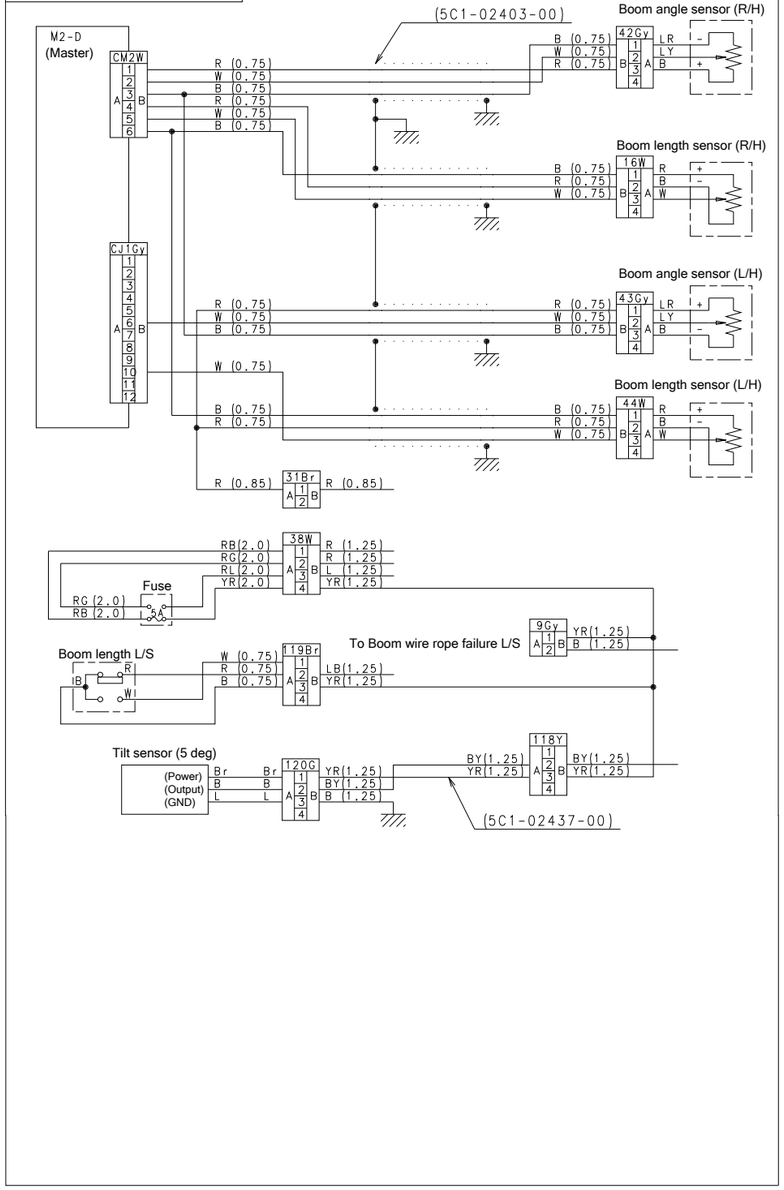


Electrical wiring chart, Turntable 2/2

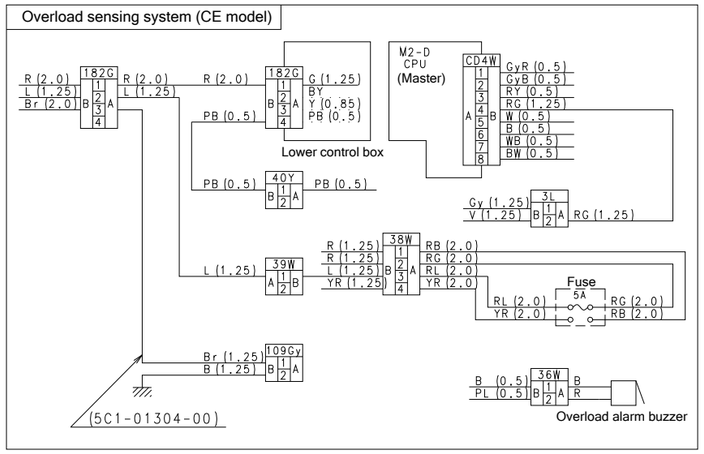
Single sensor



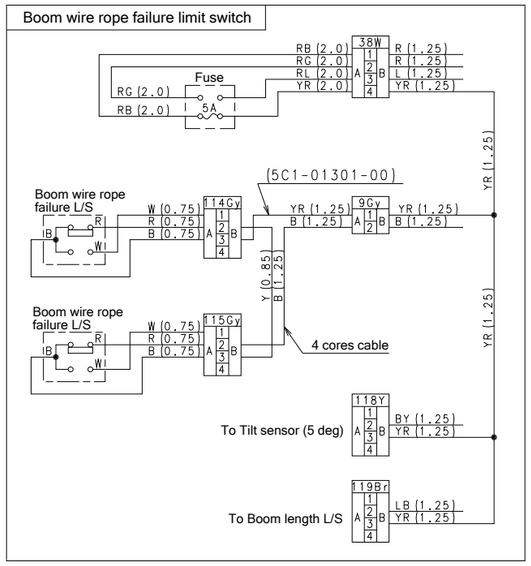
Duplicated sensors (CE model)



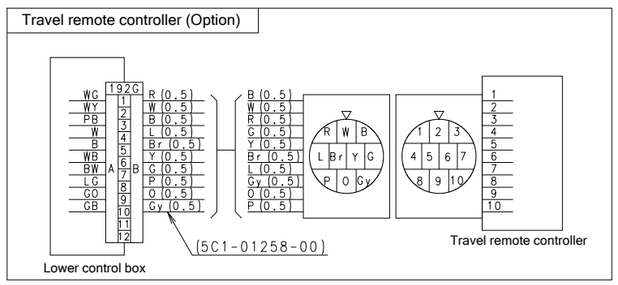
Overload sensing system (CE model)



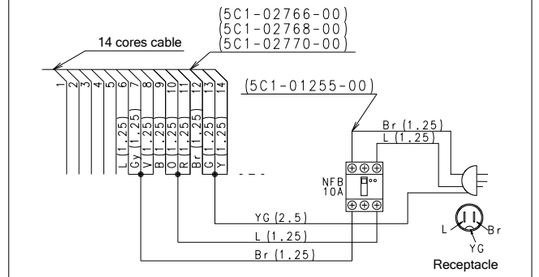
Boom wire rope failure limit switch



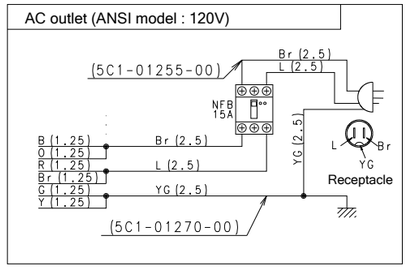
Travel remote controller (Option)



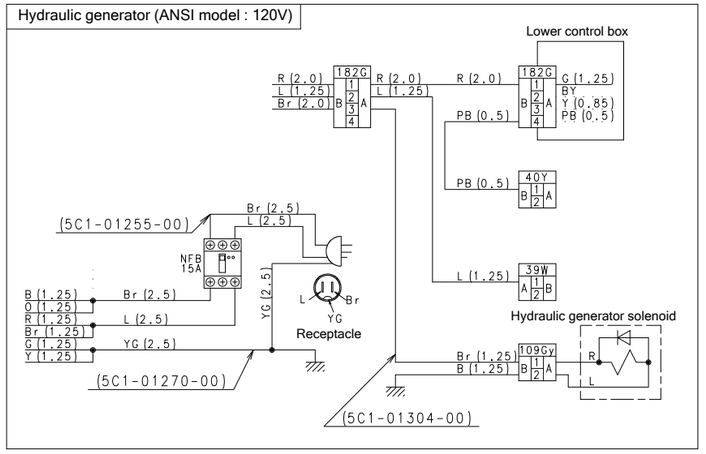
AC outlet (CE model : 220V)



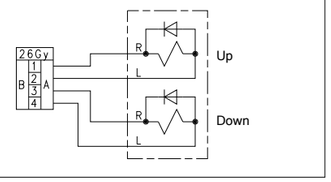
AC outlet (ANSI model : 120V)



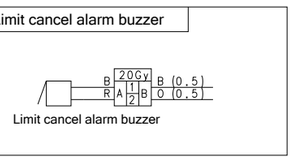
Hydraulic generator (ANSI model : 120V)



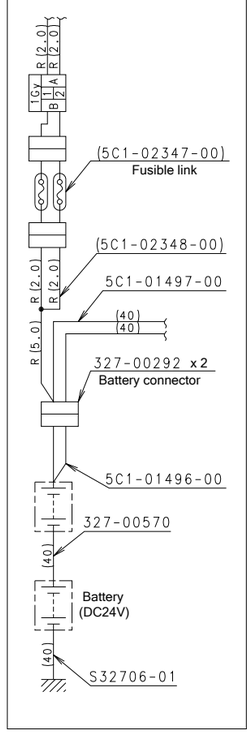
Platform leveling solenoid valve



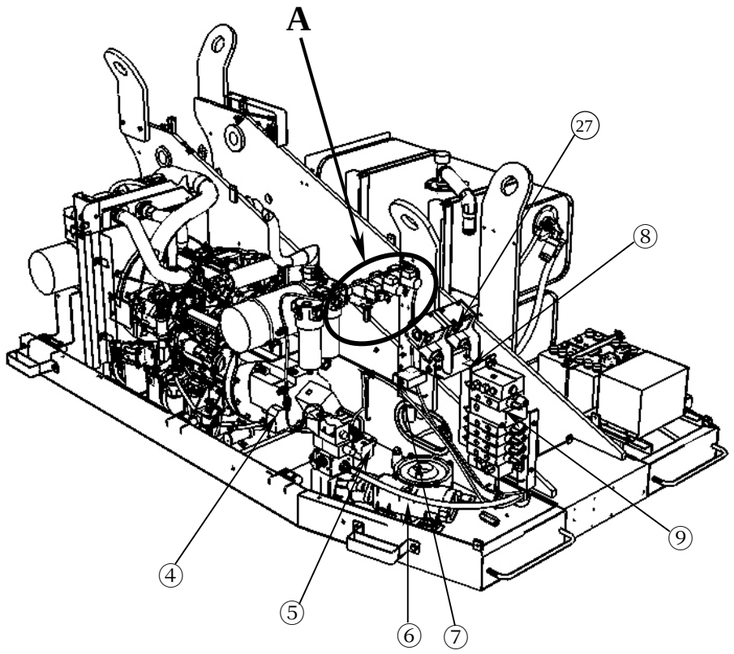
Limit cancel alarm buzzer

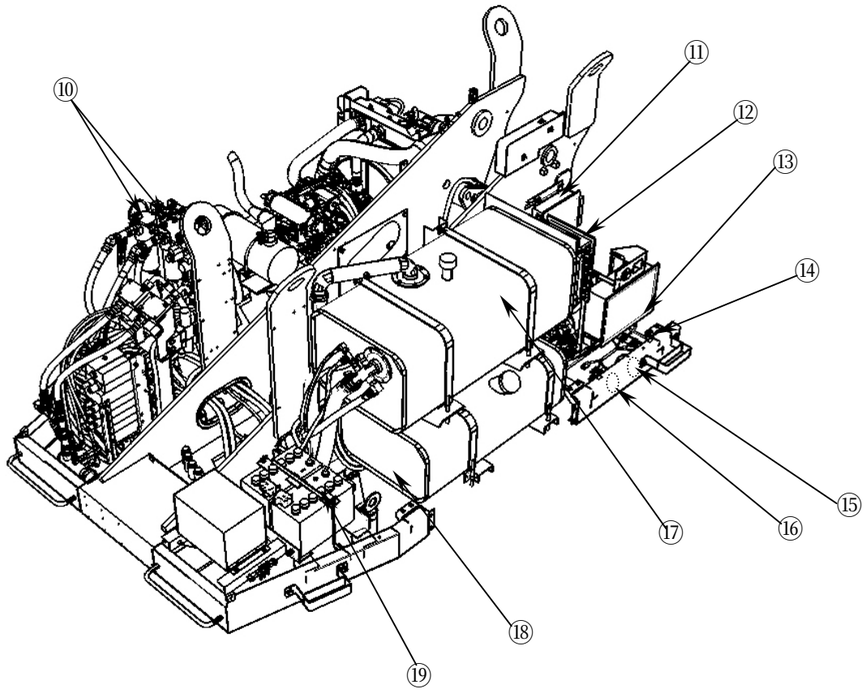


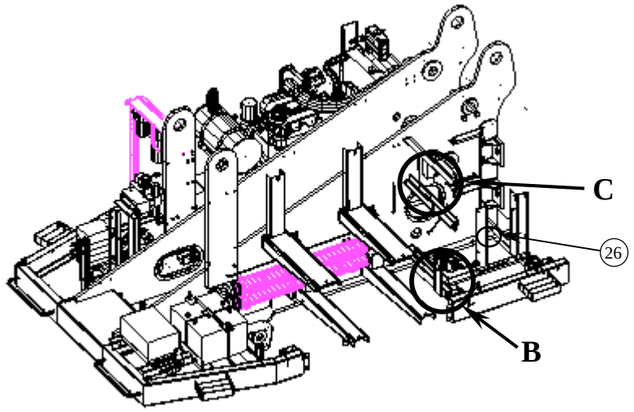
Battery connector

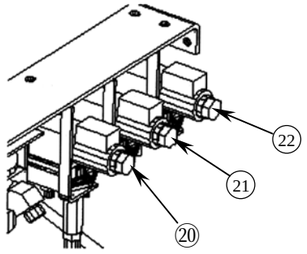


Locations of Hydraulic and Electrical components (1/2)

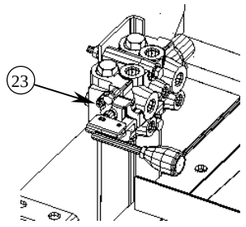




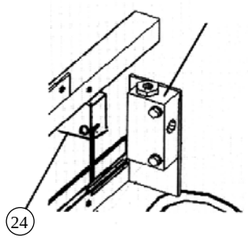




A - Detail



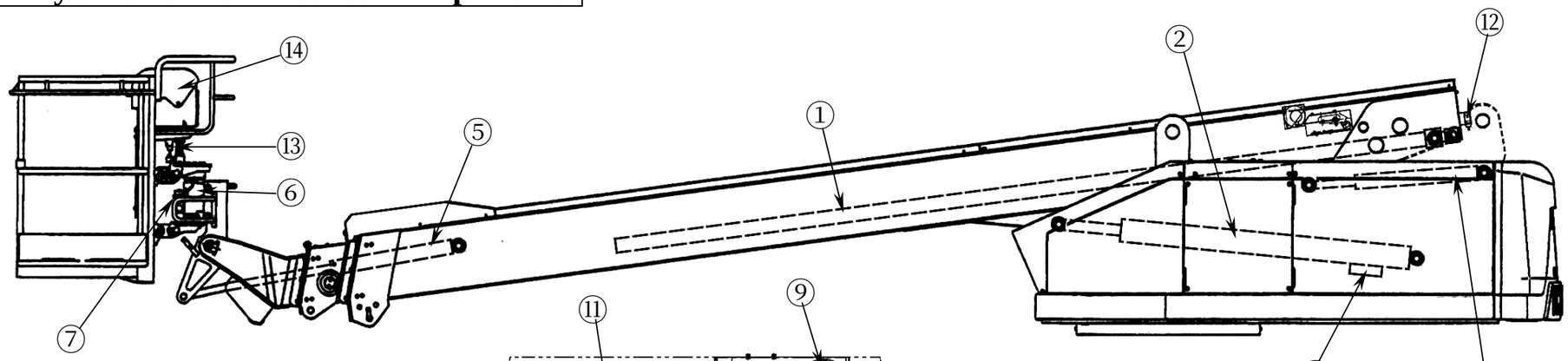
B - Detail

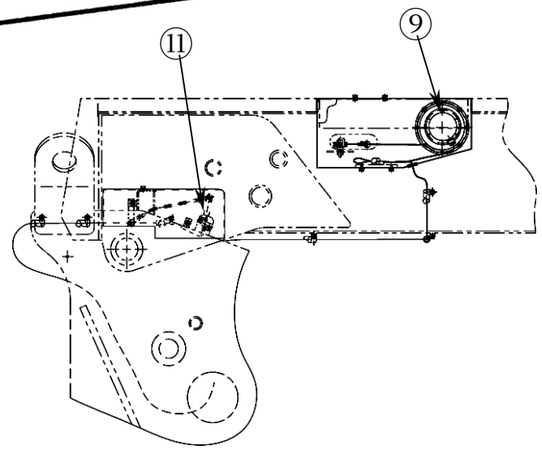


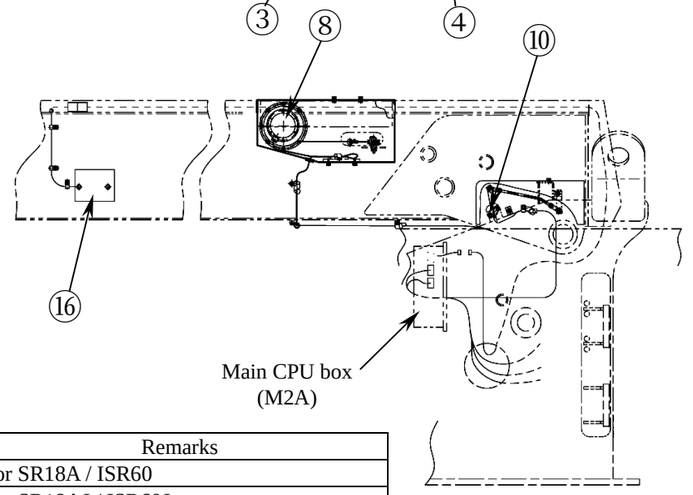
C - Detail

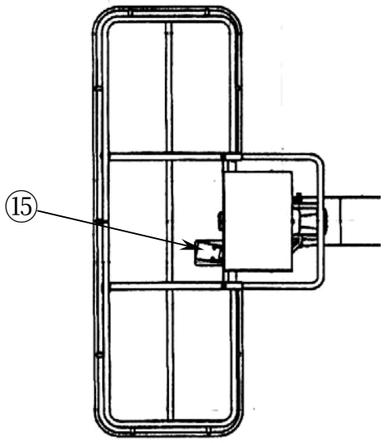
No.	Descriptions	Part number	Qty	Remarks
4	Hydraulic pump	300- 00000- 47	1	
5	Emergency pump	300- 00000-63	1	
6	Boom rotation motor	301- 00000- 22	1	
7	Check valve block	302- 00000- 54	1	
8	Unit valve	302- 00058- 00	1	
9	Main control valve	302- 00061- 00	1	
10	High- pressure line filter	305- 00000- 25	2	
11	Main CPU box (M2D), Slave	329- 00226- 00	1	
12	Main CPU box (M2D), Master	329- 00225- 00	1	
13	Lower control box	----------	1	
14	Tilt sensor (Longitudinal and Lateral)	382- 00016- 00	2	
15	Motion alarm buzzer	324- 00023- 00	1	
16	Horn	5C1- 01668- 00	1	
17	Oil reservoir	378- 00001- 64	1	
18	Battery	378- 00443	2	
19	Engine control box	329- 00925- 00	1	
20	Emergency solenoid valve	302- 06433	1	
21	Travel FWD by- pass solenoid valve	302- 06215	1	
22	Travel REV by- pass solenoid valve	302- 06215	1	
23	Combination valve	302- 00312- 03	1	
24	Single pilot check valve	302- 06428	1	
26	Tilt sensor (5 degrees)	382- 00000- 19	1	For CE model
27	Unloading valve	302-00432-00	2	

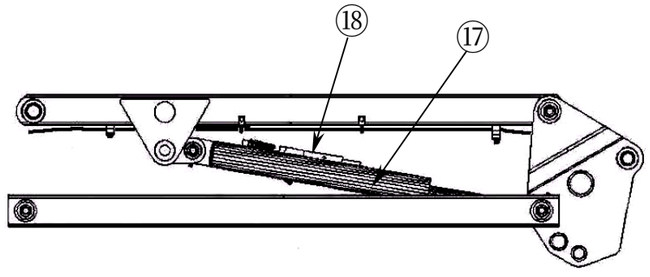
Locations of Hydraulic and Electrical components











No.	Descriptions	Part number	Qty	Remarks
1	Boom telescope cylinder	303- 00141- 00	1	For SR18A / ISR60
		303- 00142- 00	1	For SR18AJ / ISR60J
		303- 00143- 00	1	For SR21A / ISR70 and SR21AJ / ISR70J
2	Boom elevation cylinder	303- 00343- 00	1	
3	Single holding valve	302- 00117- 02	1	
4	Lower leveling cylinder	303- 00053- 00	1	For SR18A / ISR60 and SR21A / ISR70
		303- 00062- 00	1	For SR18AJ / ISR60J and SR21AJ / ISR70J
5	Upper leveling cylinder	303- 00052- 00	1	For SR18A / ISR60 and SR21A / ISR70
		303- 00023-00	1	For SR18AJ / ISR60J and SR21AJ / ISR70J
6	Rotary actuator	407- 00002- 84	1	
7	Platform rotation solenoid valve	302- 00153- 00	1	For SR18A / ISR60 and SR21A / ISR70
	Platform rotation / Fly-jib solenoid valve	302- 00152- 00	1	For SR18AJ / ISR60J and SR21AJ / ISR70J
8	Boom length sensor (R/H)	382- 00033- 00	1	
9	Boom length senor (L/H)	382- 00033- 01	1	For CE model
10	Boom angle sensor (R/H)	382- 00017- 00	1	
11	Boom angle sensor (L/H)	382- 00017- 00	1	For CE model
12	Boom wire rope failure limit switch	320- 00025- 00	2	
13	Overload sensing limit switch	320- 00025- 01	1	For CE model
14	Upper control box	----------	1	
15	Foot switch	320- 04017	1	
16	Boom length limit switch	320- 00058- 00	1	
17	Fly-jib cylinder	303- 00016- 00	1	For SR18AJ / ISR60J and SR21AJ / ISR70J
18	Double holding valve	302- 00020- 00	1	For SR18AJ / ISR60J and SR21AJ / ISR70J
		302- 00021- 00	2	For SR18AJ / ISR60J and SR21AJ / ISR70J

Water- proof connectors

1. Water- proof connectors

Female housing

Number of pole	Color	Part number
2 poles	White	192-21102
	Gray	192-21202
	Green	192-21302
	Blue	192-21402
	Brown	192-21502
	Yellow	192-21602
4 poles	White	192-21104
	Gray	192-21204
	Green	192-21304
	Blue	192-21404
	Brown	192-21504
	Yellow	192-21604
6 poles	White	192-21106
	Gray	192-21206
	Green	192-21306
	Blue	192-21406
	Brown	192-21506
	Yellow	192-21606
8 poles	White	192-21108
	Gray	192-21208
	Green	192-21308
	Blue	192-21408
	Brown	192-21508
	Yellow	192-21608
12 poles	White	192-21112
	Gray	192-21212
	Green	192-21312

Male housing

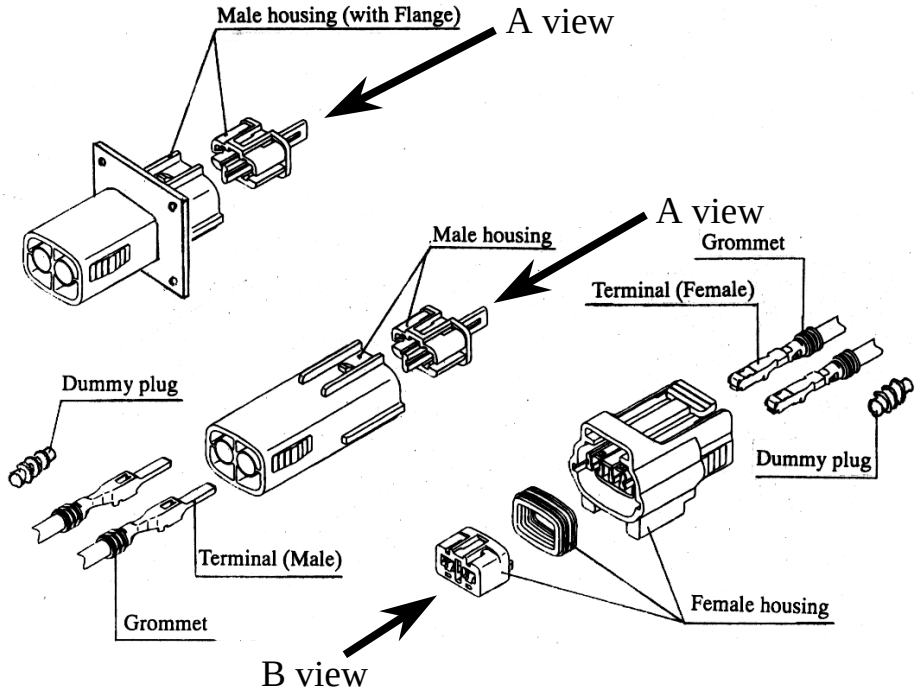
Number of pole	Color	Part number
2 poles	White	192-22102
	Gray	192-22202
	Green	192-22302
	Blue	192-22402
	Brown	192-22502
	Yellow	192-22602
4 poles	White	192-22104
	Gray	192-22204
	Green	192-22304
	Blue	192-22404
	Brown	192-22504
	Yellow	192-22604
6 poles	White	192-22106
	Gray	192-22206
	Green	192-22306
	Blue	192-22406
	Brown	192-22506
	Yellow	192-22606
8 poles	White	192-22108
	Gray	192-22208
	Green	192-22308
	Blue	192-22408
	Brown	192-22508
	Yellow	192-22608
12 poles	White	192-22112
	Gray	192-22212
	Green	192-22312

Male housing (with Flange)

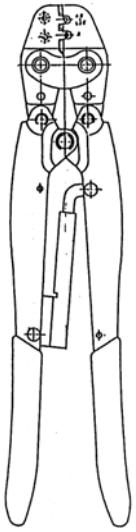
Number of pole	Color	Part number
4 poles	White	192-24104
	Gray	192-24204
	Green	192-24304
	Blue	192-24404
	Brown	192-24504
	Yellow	192-24604
6 poles	White	192-24106
	Gray	192-24206
	Green	192-24306
	Blue	192-24406
	Brown	192-24506
	Yellow	192-24606
8 poles	White	192-24108
	Gray	192-24208
	Green	192-24308
	Blue	192-24408
	Brown	192-24508
	Yellow	192-24608
12 poles	White	192-24112
	Gray	192-24212
	Green	192-24312

Others

Description	Part number	Remarks
Terminal (Female)	327-03607	
Terminal (Male)	327-03608	
Grommet S (Blue)	327-03660	for wire diameter: 1.5 ~ 2.0 mm
Grommet M (Brown)	327-03609	for wire diameter: 2.0 ~ 2.9 mm
Dummy plug	327-03663	

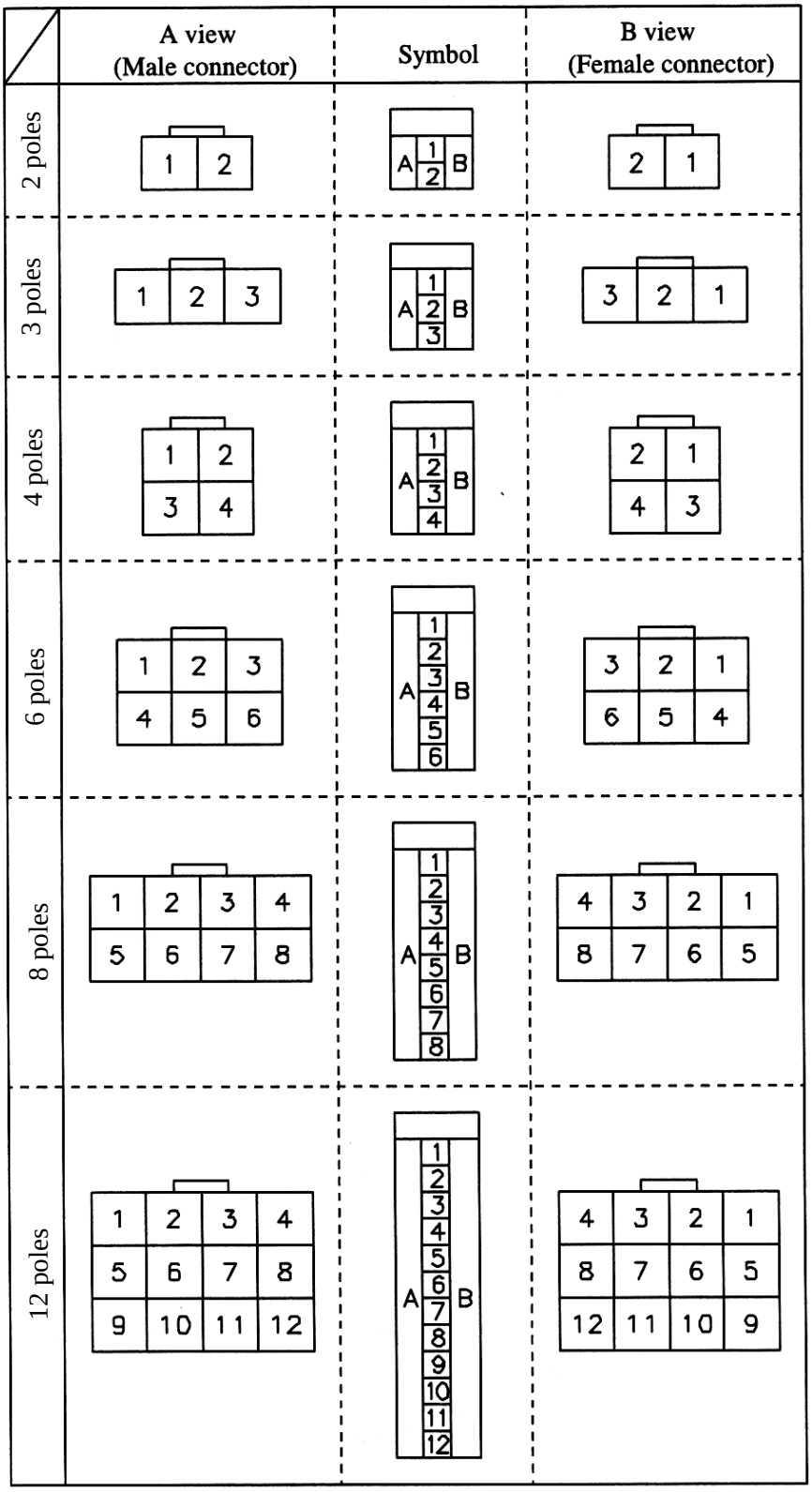


Terminal crimping tool
Part #: MZ99- 9259



2. Pin arrangements of Water- proof connectors

See the table below to specify the pin arrangements of water- proof connectors when reading "Electrical wiring diagrams".



Color code of wires

See the table below to specify the colors of wires from the “Color codes”.

No.	Color code	Color	No.	Color codes	Color
1	R	Red	31	GY	Green/ Yellow
2	Y	Yellow	32	GW	Green/ White
3	W	White	33	GB	Green/ Black
4	G	Green	34	GO	Green/ Orange
5	L	Blue	35	LR	Blue/ Red
6	B	Black	36	LY	Blue/ Yellow
7	V	Violet	37	LW	Blue/ White
8	P	Pink	38	LG	Blue/ Green
9	O	Orange	39	LB	Blue/ Black
10	Br	Brown	40	LO	Blue/ Orange
11	Lg	Light green	41	BR	Black/ Red
12	Lb	Light blue	42	BY	Black/ Yellow
13	Gy	Gray	43	BW	Black/ White
14	RY	Red/ Yellow	44	BG	Black/ Green
15	RW	Red/ White	45	BL	Black/ Blue
16	RG	Red/ Green	46	PY	Pink/ Yellow
17	RL	Red/ Blue	47	PL	Pink/ Blue
18	RB	Red/ Black	48	PB	Pink/ Black
19	YR	Yellow/ Red	49	OW	Orange/ White
20	YW	Yellow/ White	50	OB	Orange/ Black
21	YG	Yellow/ Green	51	BrR	Brown/ Red
22	YL	Yellow/ Blue	52	BrY	Brown/ Yellow
23	YB	Yellow/ Black	53	BrW	Brown/ White
24	WR	White/ Red	54	BrB	Brown/ Black
25	WY	White/ Yellow	55	LgR	Light green/ Red
26	WG	White/ Green	56	LgW	Light green/ White
27	WL	White/ Blue	57	LgB	Light green/ Black
28	WB	White/ Black	58	GyR	Gray/ Red
29	WBr	White/ Brown	59	GyB	Gray/ Black
30	GR	Green/ Red			

Tightening torque standard

1. Hexagon headed bolts (8T or 8.8T) and nuts (6T)

	Bolt	Nut
Strength grade	8T or 8.8T	6T
Material	S45C	S45C
Tensile strength	80 kg/cm^2	80 kg/cm^2

Size (mm)	Pitch (mm)	Tightening torque		
		N-m	kg-m	ft-lbs
5	0.8	3.71 ~ 5.87	0.32 ~ 0.60	2.31 ~ 4.34
6	1.0	5.42 ~ 10.0	0.56 ~ 1.04	4.05 ~ 7.52
8	1.25	13.0 ~ 24.2	1.33 ~ 2.47	9.62 ~ 17.9
10	1.5	25.7 ~ 47.6	2.59 ~ 4.81	18.7 ~ 34.8
12	1.75	44.6 ~ 82.7	4.55 ~ 8.45	32.9 ~ 61.1
14	2.0	71.2 ~ 132	7.00 ~ 13.00	50.6 ~ 94.0
16	2.0	109 ~ 201	11.2 ~ 20.8	81.0 ~ 150
18	2.5	157 ~ 291	16.1 ~ 29.9	116 ~ 216
20	2.5	220 ~ 407	22.4 ~ 41.6	162 ~ 301
22	2.5	296 ~ 549	30.1 ~ 55.9	218 ~ 404
24	3.0	379 ~ 703	38.5 ~ 71.5	278 ~ 517

2. Hexagon headed bolts (10.9T) and nuts (8T)

	Bolt	Nut
Strength grade	10.9T	8T
Material	SCM435	SCM435
Tensile strength	100 kg/cm^2	100 kg/cm^2

Size (mm)	Pitch (mm)	Tightening torque		
		N-m	kg-m	ft-lbs
5	0.8	7.21 ~ 8.79	0.73 ~ 0.90	5.28 ~ 6.51
6	1.0	12.3 ~ 15.1	1.26 ~ 1.54	9.11 ~ 11.1
8	1.25	29.7 ~ 36.2	3.06 ~ 3.74	22.1 ~ 27.1
10	1.5	58.5 ~ 71.3	5.94 ~ 7.26	43.0 ~ 52.5
12	1.75	102 ~ 124	9.90 ~ 12.10	71.6 ~ 87.5
14	2.0	162 ~ 197	16.2 ~ 19.8	117 ~ 143
16	2.0	247 ~ 302	25.2 ~ 30.8	182 ~ 223
18	2.5	364 ~ 422	35.1 ~ 42.9	254 ~ 310
20	2.5	483 ~ 589	49.5 ~ 60.5	358 ~ 438
22	2.5	652 ~ 795	66.6 ~ 81.4	482 ~ 589
24	3.0	835 ~ 1018	84.6 ~ 103	612 ~ 745

3. Hexagon socket headed cap screws (10.9T)

	Bolt
Strength grade	10.9T
Material	SCM435
Tensile strength	100 kg/cm^2

Size (mm)	Pitch (mm)	Tightening torque		
		N-m	kg-m	ft-lbs
5	0.8	4.81 ~ 5.87	0.49 ~ 0.60	3.54 ~ 4.34
6	1.0	8.24 ~ 10.0	0.81 ~ 0.99	5.86 ~ 7.16
8	1.25	19.8 ~ 24.2	2.07 ~ 2.53	15.0 ~ 18.3
10	1.5	39.0 ~ 47.6	3.96 ~ 4.84	28.6 ~ 35.0
12	1.75	67.8 ~ 82.7	6.93 ~ 8.47	50.1 ~ 61.3
14	2.0	108 ~ 132	10.8 ~ 13.2	78.1 ~ 95.5
16	2.0	165 ~ 201	17.1 ~ 20.9	124 ~ 151
18	2.5	239 ~ 291	24.3 ~ 29.7	176 ~ 215
20	2.5	333 ~ 407	34.2 ~ 41.8	247 ~ 302
22	2.5	450 ~ 549	45.9 ~ 56.1	332 ~ 406
24	3.0	576 ~ 703	58.5 ~ 71.5	423 ~ 517

8. Inspection manual

All of the inspection and test results should be recorded in the inspection check sheets and should be kept for three years.

The qualified personnel should perform the inspections and the tests.

Procedures of Daily inspections

The daily inspections should be conducted with the machine being set on firm and level ground.

Unit	*Item*	*Descriptions*
Engine	Cooling system	Check the coolant level and replenish the coolant, if necessary.
		Check the cooling system for water leakage.
		Check the fan belt for wear and tension.
	Lubrication system	Check the engine oil level and replenish the oil, if necessary.
		Check the engine for oil leakage.
	Fuel system	Check the fuel level and replenish the fuel, if necessary.
		Check the fuel system for fuel leakage.
Battery	Electrolyte	Check the electrolyte level and replenish the distilled water, if necessary.
	Terminals	Check the battery terminals for looseness
Hydraulic oil reservoir	Oil level	Stow the boom and axles, then check for hydraulic oil level and replenish the oil, if necessary.
	Oil leakage	Check the oil reservoir for oil leakage.
Chassis	Chassis frame	Check the chassis frame for deformations and cracks.
	Tires	Check the tires for wear, cuts and air pressure.
	Wheel bolts and nuts.	Check the bolts and nuts for looseness.
	Travel motor and gearbox	Check the travel motor and gearbox for oil leakage.
	Axle	Check the axle for deformations and cracks.
	Oscillation axle lock cylinder	Check the cylinder for oil leakage.
	Steering linkages	Check the steering linkages for deformations, cracks and excessive free play.
	Steering cylinder	Check the cylinder for oil leakage.
	Track links, shoes	Check the track links and shoes for wear and tension.
Turntable	Crack, deformation	Check the turntable for cracks and deformations.
	Abnormal noise, movements	Rotate the turntable, and check for any abnormal noise and movements.
Boom, Fly jib	Crack, deformation	Extend the boom fully and check each boom section and the fly jib for cracks and deformations.
	Boom and Fly jib pivot pins	Check the pivot pins for any damage.
	Abnormal noise, movements	Raise, lower, telescope the boom and the fly jib and check for any abnormal noise and movements.
	Oil leakage	Check the hydraulic cylinders for oil leakage.
	Natural descent	Elevate the platform and check if the elevation, telescope and fly jib cylinders retract or extend naturally.
Platform	Crack, deformation	Check the platform and the platform rotation device for cracks and deformations.
	Abnormal noise, movements	Rotate the platform and check for any abnormal noise and movements.
	Oil leakage	Check the platform levelling cylinders and the platform rotation motor for oil leakage.
	Platform levelling system	Raise and lower the boom several times and check if the platform stays level.
Safety devices.	Emergency stop system	Start the engine, then, operate the emergency stop switch and make sure that the engine stops and all of the functions are disabled.
	Emergency pump	Shut down the engine, then operate the machine using the emergency pump and make sure that the machine moves properly.
	Work range limit system, Moment limiter	For the machine equipped with the pre-start check switch, conduct the pre-start check and make sure that no failure is in the system.
	Foot switch	Operate the machine from the platform and make sure that the functions are disabled unless the foot switch is pressed down.

Unit	*Item*	*Descriptions*
Safety devices	Tilt alarm buzzer	Turn on the main key switch and make sure that the tilt alarm buzzer sounds just after turning on the main key switch.
	Motion alarm buzzer	Operate the machine and make sure that the motion alarm buzzer sounds while the machine is in motion.
	Alarm horn	Press the horn switch on the platform and make sure that the alarm horn sounds.
	Other safety devices	Check the functions of other safety devices, if any.
Decals	Readability	Check the decals for readability and replace the decals, if necessary.

Daily inspection check sheet

Unit	*Item*		*Results*													
Date →																
Engine	Cooling system	Coolant level														
		Water leakage														
		Fan belt														
	Lubrication system	Oil level														
		Oil leakage														
	Fuel system	Fuel level														
		Fuel leakage														
Battery	Electrolyte level															
	Battery terminals															
Hydraulic oil reservoir	Oil level															
	Oil leakage															
Chassis	Chassis frame	Cracks, deformations														
	Tires	Wear, cuts, Air pressure														
	Wheel bolts, nuts	Looseness														
	Travel motor, gearbox	Oil leakage														
	Axle	Cracks, deformations														
	Oscillation axle lock cylinder	Oil leakage														
	Steering linkages	Cracks, deformations free play														
	Steering cylinder	Oil leakage														
	Track links, shoes	Wear, tension														
Turntable	Crack, deformation															
	Abnormal noise, movements															
Boom, Fly jib	Cracks, deformations															
	Pivot pins	Damage														
	Abnormal noise, movements															
	Oil leakage															
	Elevation cylinder	Natural descent														
	Telescope cylinder	Natural descent														
	Fly jib cylinder	Natural descent														
Platform	Crack, deformation															
	Abnormal noise, movements															
	Oil leakage															
	Platform levelling system	Functions														
Safety devices	Emergency stop system	Functions														
	Emergency pump	Functions														
	Work range limit system, Moment limiter	Functions														
	Foot switch	Functions														
	Tilt alarm buzzer	Functions														
	Motion alarm buzzer	Functions														
	Alarm horn	Functions														
	Other safety devices	Functions														
Decals	Readability															
Remarks																

Procedures of Periodical inspections

Conduct the periodical inspection with the machine being set on firm and level surface.

Carry out the both descriptions of the monthly and annual inspections when conducting the annual inspections.

Unit	*Item*	*Monthly inspections*	*Annual inspections*
Engine	Engine oil	Check the engine oil and replenish or change the oil, if necessary.	Change the engine oil. Oil change interval: 200 hours.
	Oil filter	Check the oil filter and replace the filter element, if necessary.	Replace the oil filter element. Replacement interval: 400 hours.
	Oil leakage	Check the engine for oil leakage.	
	Coolant	Check the coolant and replenish or change the coolant, if necessary.	
	Water leakage	Check the engine for water leakage	
	Fan belt	Check the fan belt for wear and tension.	
	Radiator hose	Check the radiator hose for any damage.	
	Air filter	Check the air filter and clean or replace the filter element, if necessary.	
	Fuel filter	Check the fuel filter and replace the filter element, if necessary.	Replace the fuel filter element. Replacement interval: 600 hours.
	Bolts and nuts	Check each bolt and nut for looseness	
	Fuel leakage	Check the fuel system for fuel leakage.	
	Abnormal nose, performances	Operate the machine and check for abnormal nose and performances.	
Battery	Electrolyte	Check the electrolyte level and replenish with distilled water, if necessary.	
	Battery terminals	Check the battery terminals for corrosion and looseness.	
Hydraulic oil reservoir	Oil level, contamination.	Check the oil level and replenish, if necessary.	Change the hydraulic oil. Oil change interval: 1,200 hours or one year.
	Oil leakage.	Check the oil reservoir for oil leakage	
Hydraulic filters	Oil leakage.	Check the hydraulic filter for oil leakage.	
	Replacement		Replace the oil filter element. Replacement interval: 1,200 hours or one year.
Hydraulic pump	Bolts and nuts	Check the pump mounting bolts and nuts for looseness.	
	Abnormal noise	Operate the machine and check the pump for abnormal noise.	
	Oil leakage	Check the pump for oil leakage.	
Chassis frame	Cracks, deformations	Check the chassis frame for cracks and deformations.	
	Counter weight	Check the counter weight anchor bolts, nuts for looseness.	
Tires and wheels	Wear, cuts	Check the tire for wear and cuts.	
	Air pressure	Check the tires for air pressure	
	Clip bolts, nuts	Check the wheel clip bolts and nuts for looseness.	

Unit	*Item*	*Monthly inspections*	*Annual inspections*
Axles	Cracks, deformations	Check the axles for cracks and deformations.	
Oscillation axle lock cylinder	Oil leakage	Check the cylinder for oil leakage.	
	Functions	Check the oscillation axle lock cylinder if the cylinder locks and releases in the specific machine status	
Travel motor and gearbox	Gear oil	Check the gearbox for oil level and replenish the gear oil, if necessary.	Change the gear oil. Oil change interval: 1,200 hors or 12 months.
	Oil leakage	Check the motor and the gearbox for oil leakage.	
	Abnormal noise	Travel the machine and check for abnormal noise.	
Steering mechanism	Lubrication	Supply grease through each grease fitting.	
	Cracks, deformations	Check the steering linkages for cracks and deformations.	
	Wheel bearings		Jack up the machine and check the wheel bearings for free play and any damages.
Steering cylinder	Oil leakage	Check the steering cylinder for oil leakage.	
	Functions	Operate the steering switch and check for the functions.	
Jack cylinder	Oil leakage	Check the jack cylinder for oil leakage.	
	Natural descent	Extend the jack cylinder, support the machine by the jack cylinder, and then check the jack cylinders for natural descent. Serviceable limit: 1 mm (0.04 in)/10 min.	
Crawler	Track links	Check the track links for wear and tension.	
	Track shoes	Check the track shoes for wear and deformations.	
	Track rollers, Carrier rollers	Check the track and carrier rollers for wear and oil leakage.	
	Sprockets, Idler wheels	Check the sprockets and the idler wheels for wear and cracks.	
Rotation bearing	Bolts and nuts	Check each anchor bolt and nut for looseness.	
	Wear, cracks	Check the rotation bearing for wear and cracks.	
	Lubrication	Check for lubrication.	
Rotation gear box	Bolts and nuts	Check each anchor bolt and nut for looseness.	
	Oil leakage	Check the gearbox for oil leakage.	
	Gear oil	Check the gear oil and replenish, if necessary.	Change gear oil. Oil change interval: 1,200 hours or one year.
	Back-lash		Check the backlash between the pinion of the rotation gearbox and the ring gear of the rotation bearing. Standard back-lash: 0.6 mm (0.024 in)
	Abnormal noise	Rotate the turntable and check for abnormal noise.	

Unit	*Item*	*Monthly inspections*	*Annual inspections*
Turntable	Cracks, deformations	Check the turntable for cracks and deformations.	
	Bolts and nuts	Check each bolt and nut for looseness.	
Swivel joint	Bolts and nuts	Check each bolt and nut for looseness.	
	Oil leakage	Check for oil leakage.	
	Lubrication	Check for lubrication.	
Boom Fly jib	Cracks, deformations	Extend the boom and check each boom section and the fly jib for cracks and deformations.	
	Pivot pins	Check the boom and fly jib pivot pins for any damage.	
	Bolts and nuts	Check each bolt and nut for looseness.	
	Oil leakage	Check for oil leakage.	
	Lubrication	Check for lubrication and lubricate, if necessary.	
	Extension/retraction wire ropes	Check each wire rope for tension and any damage.	Disassemble the boom and check each wire rope thoroughly every 4 years.
	Electric cables and hydraulic hoses.		Check each electric cable and hydraulic hose if proper tension is applied to.
	Wear pads		Check each wear pad for wear.
	Abnormal noise, movement	Raise, lower, telescope the boom and the fly jib and check for abnormal noise and movements.	
Elevation, Telescope, Fly jib cylinders	Oil leakage	Check the cylinders for oil leakage.	
	Natural descent	Check the elevation, telescope and fly jib cylinders for natural descent. Serviceable limit: 2 mm (0.08 in)/10 min.	
Platform	Cracks, deformation	Check the platform and its mounting bracket for cracks and deformations.	
	Bolts and nuts	Check each bolt and nut for looseness.	
	Rotation motor, Rotary actuator	Check for oil leakage.	
		Rotate the platform and check for abnormal noise and movements.	
	Lubrication	Check the rotation worm gear and bushings for lubrication.	
Platform levelling system	Levelling cylinders	Check each levelling cylinder for oil leakage.	
	Function	Operate the boom and make sure that the platform stays level.	
Control panels	Joystick controllers, Control switches	Check each joystick controller and control switch for any damage.	
		Operate each joystick controller and control switch and check for the functions	
	Indicator lights	Check each indicator lights for any damage	
		Check each indicator lights for its functions.	

Unit	*Item*	*Monthly inspections*	*Annual inspections*
Safety devices	Emergency stop system	Start the engine, operate the emergency stop switches and make sure that engine stops and all of the functions are disabled.	
	Emergency pump	Shut down the engine, operate the machine using the emergency pump and make sure that the machine moves properly.	
	Moment limiter Work range limit system	Operate the boom and make sure that the moment limiter works properly.	Measure each work radius of the platform and make sure that the work radius is within the specific range.
	Pre-start check system	Conduct the pre-start check by using the pre-start check switch and make sure that no failure is in the system	
	Foot switch	Operate the machine from the platform and make sure that the functions are disabled unless the foot switch is pressed down.	
	Tilt alarm buzzer	Turn on the main key switch and make sure that the tilt alarm buzzer sounds just after turning on the key switch.	
	Motion alarm buzzer	Operate the machine and make sure that the motion alarm buzzer sounds while the machine is in motion.	
	Alarm horn	Press the horn switch and make sure that the horn sounds.	
	Overload sensing system	Overload the platform and make sure that the functions are disabled and the overload alarm buzzer sounds.	
	Other safety devices	Check the functions of other safety devices and make sure that they work properly.	
Decals	Readability	Check each decal for readability and replace the decal, if necessary.	

Procedures of Function tests

Conduct the function tests annually with the machine being set on firm and level surface.

Test	*Item*	*Descriptions*
Load test	Damage, function, Abnormal noise	1. Load the platform with 110% of the rated load, operate the boom and the fly jib thoroughly from the lower control and make sure that the boom and the fly jib moves smoothly without any abnormal noise. Caution: Do not allow any person on the platform. 3. Check the machine thoroughly and make sure that no damage is on the machine.
Natural descent test	Elevation, Telescope and Fly jib cylinders	1. Set the boom and the fly jib to the positions specified in the hydraulic section of this service manual to load the cylinders with the gravity of the boom and the platform. 2. Stop the engine and leave the machine in the above status for 10 minutes. 3. Measure the natural descent of each cylinder. Serviceable limit: 2 mm (0.08 in) / 10 minutes. Note: See the hydraulic section of this service manual for detail.
Speed test	Boom elevation speed	1. Retract the boom fully. 2. Raise and lower the boom to its full stroke, measure the boom rising and the lowering speed (seconds/stroke) and make sure that the speed is within the specific range.
	Boom telescope speed	1. Raise the boom fully. 2. Extend and retract the boom to its full stroke, measure the boom extending and the retracting speed (seconds/stroke) and make sure that the speed is within the specific range.
	Boom rotation speed	1. Retract and raise the boom fully. 2. Rotate the turntable 360 degrees CW and CCW, measure the rotation speed (seconds/360 degrees) and make sure that the speed is within the specific range.
	Fly jib speed	Raise and lower the fly jib to its full stroke, measure the fly jib raising and the lowering speed (seconds/stroke) and make sure that the speed is within the specific range.
	Vertical movement speed	Move the platform vertically for the distance of 3 meters (9ft – 10in), measure the platform moving speed and make sure that the speed is within the specific range.
	Horizontal movement speed	Move the platform horizontally for the distance of 3 meters (9ft – 10in), measure the platform moving speed and make sure that the speed is within the specific range.
	Platform rotation speed	Rotate the platform CW and CCW, measure the platform rotation speed (seconds/stroke), then make sure that the speed is within the specific range.

Periodical inspection check sheet

Model	*Spec No.*	*Serial No.*	*Hour meter*	*Date*	*Inspector*

The items marked (*) should be inspected only on the annual inspections.

Unit	*Item*		*Results*	*Remarks*
Engine	Engine oil	Oil level, contamination, leakage		Oil change interval: 200 hours
	Oil filter	Replacement		Replacement interval: 400 hours
	Coolant	Coolant level, contamination, leakage		
	Fan belt	Wear, tension		
	Radiator hose	Damage		
	Air filter	Cleaning, replacement		
	Fuel filter	Replacement		Replacement interval: 600 hours
	Fuel	Fuel level, leakage		
	Bolts, nuts	Looseness		
	Abnormal nose, Performance			
Battery	Electrolyte	Electrolyte level		
	Battery terminals	Corrosion, looseness		
Hydraulic oil reservoir	Oil level, contamination			Oil change interval: 1,200 hours or one year.
	Oil leakage			
Hydraulic filters	Oil leakage			Replacement interval: 1,200 hours or one year.
	Replacement			
Hydraulic pump	Loose bolts and nuts			
	Abnormal noise			
	Oil leakage			
Chassis frame	Cracks, deformation			
	Counterweight anchor bolts, nuts	Looseness		
Tires and wheels	Tires	Wear, cuts		
		Air pressure		
	Clip bolts, nuts	Looseness		
Axles	Cracks, deformations			
Oscillation axle lock cylinder	Oil leakage			
	Functions			
Travel motor and gearbox	Gear oil level, contamination			
	Oil leakage			
	Abnormal nose			
Steering mechanism	Lubrication			
	Cracks, deformations			
	Wheel bearings	Free play, damage		
Steering cylinder	Oil leakage			
	Functions			
Jack cylinder	Oil leakage			
	Natural descent			Serviceable limit: 1mm (0.04 in) / 10 minutes
Crawler	Track links	Wear, tension		
	Track shoes	Wear, deformations		
	Track rollers, Carrier rollers	Wear, oil leakage		
	Sprockets, Idler wheels	Wear, cracks		

Unit	*Item*		*Results*	*Remarks*
Rotation bearing	Loose bolts and nuts			
	Wear, cracks			
	Lubrication			
Rotation gear box	Loose bolts and nuts			Gear oil change interval: 1,200 hours or one year.
	Oil leakage			
	Gear oil			
	(*) Backlash between pinion and ring gear (Standard backlash: 0.6 mm, 0.024 in)			
	Abnormal noise			
Turn table	Cracks, deformations			
	Loose bolts and nuts			
Swivel joint	Loose bolts and nuts			
	Oil leakage			
	Lubrication			
Boom Fly jib	Cracks, deformations			Disassemble the boom to check each extension / retraction wire rope thoroughly every 4 years.
	Damaged pivot pins			
	Loose bolts and nuts			
	Oil leakage			
	Lubrication			
	Extension / retraction wire ropes	Damage, tension		
		(*) Tension		
	Electric cables, Hydraulic hoses	(*) Tension		
	Wear pads	(*) Wear		
	Abnormal noise, movements			
Elevation, Telescope, Fly jib cylinders	Oil leakage			
	Natural descent Serviceable limit: 2 mm (0.08 in) / 10 minutes.			
Platform	Cracks, deformations			
	Loose bolts and nuts			
	Rotation motor, Rotary actuator	Oil leakage		
		Abnormal noise, movements		
	Worm gear, Bushings	Lubrication		
Platform levelling system	Levelling cylinders	Oil leakage		
	Functions			
Control panels	Joystick controllers, Control switches,	Damage		
		Functions		
	Indicator lamps	Damage		
		Functions		
Safety devices	Emergency stop system	Functions		
	Emergency pump	Functions		
	Moment limiter	Functions		
	Work range limit system	(*) Work radius		
	Pre-start check system	Functions		
	Foot switch	Functions		
	Tilt alarm buzzer	Functions		
	Motion alarm buzzer	Functions		
	Alarm horn	Functions		
	Overload sensing system	Functions		
	Other safety devices	Functions		
Decals	Readability			

Function tests check sheet

Test	*Item*		*Results*	*Remarks*
Load test	Function			
	Abnormal noise			
	Damage			
Natural descent	Elevation cylinder			Serviceable limit: 2 mm (0.08 in) / 10 minutes
	Telescope cylinder			
	Fly jib cylinder			
Speed test	Boom elevation speed	Up		
		Down		
	Boom telescope speed	Out		
		In		
	Boom rotation speed	CW		
		CCW		
	Fly jib speed	Up		
		Down		
	Vertical movement speed	Up		
		Down		
	Horizontal movement speed	Out		
		In		
	Platform rotation speed	CW		
		CCW		

Major alterations and repairs

9. Travel system (KOBELCO Shop Manual)

PREFACE

(1) This Manual describes all the procedures from removing to attaching, arranging them by item.

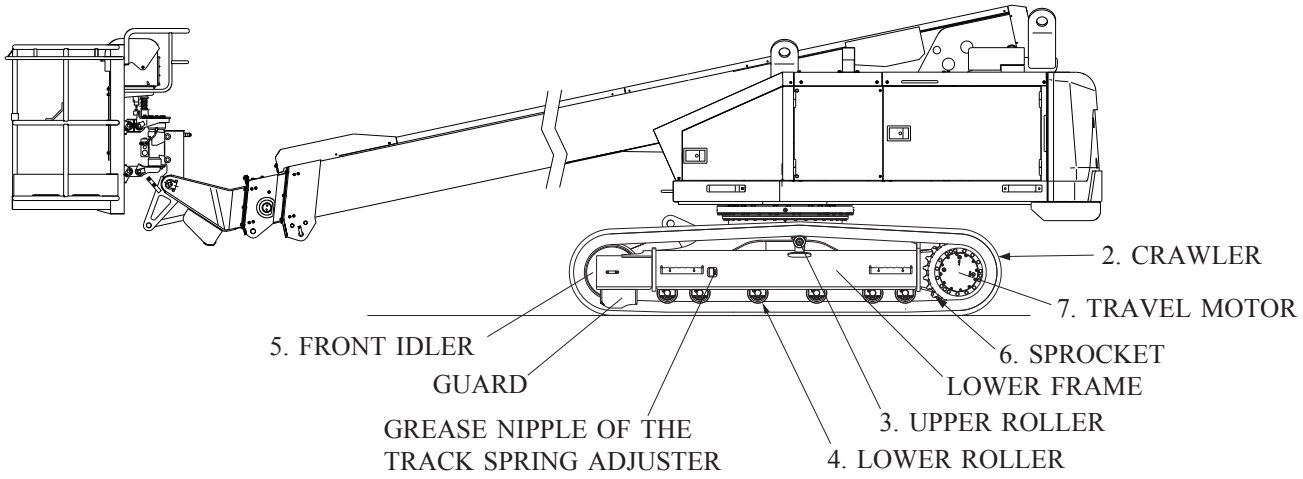
(2) The removing and attaching can be performed in the procedure specified in the Table of Contents, but in view of actual repairing or time saving some process can be omitted.

(3) The removing and attaching procedure does not completely cover all possible situations because of differences of field condition and defective section.

(4) Please be aware that the procedure to be followed must be determined according to the above conditions.

1.REMOVING AND INSTALLING

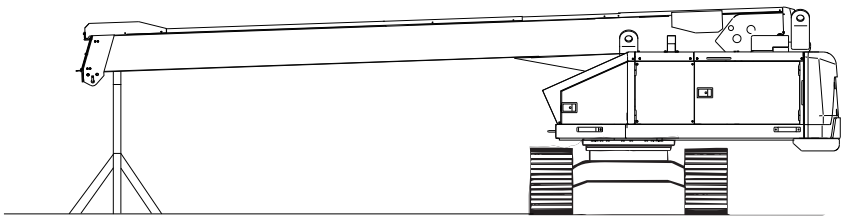
1.1 TRAVEL SYSTEM



Designation and location of undercarriage

1.2 CRAWLER

1.2.1 REMOVING CRAWLER



Crawler removing position

(1) Set the boom stand and the wood block to prop up the first boom end.
Use the wood block that is wider than the width of first boom end.
Make sure the stand is stable.

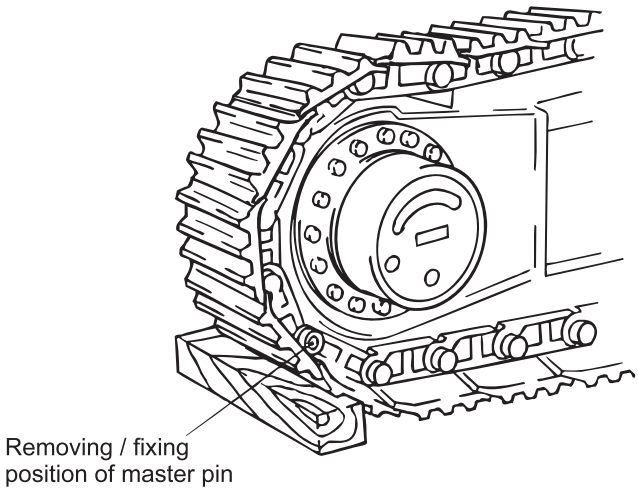
(2) Pushing out master pin.

1. Find the master pin and place it in its removing/fixing position (See pege 9-4)
2. Loosen the grease nipple and slacken crawler.

Tools : Socket 19 mm

⚠CAUTION

-When loosening the grease nipple of the adjuster, do not loosen it more than one turn.
-Where grease does not come out well, move the machine back and forth. The over loosening of grease nipple may cause it to jump out incurring danger of injury. So be careful not to over loosen the grease nipple.

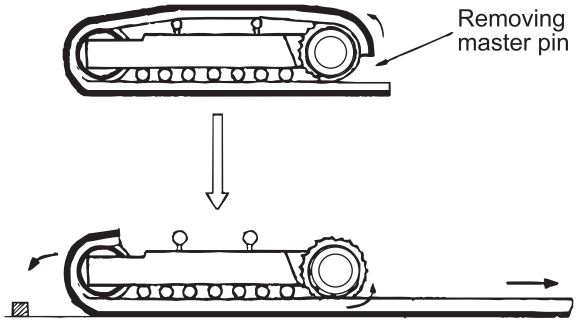


Removing/fixing position of master pin

3.Pushing out master pin
Apply jig on master pin and strike it out with a mallet.
(Refer to Fig. "Press fitting of master pin")

CAUTION

When using a big hammer, wear protective goggles and a long-sleeved uniform so you do not injure yourself by flying objects.



Removing crawler

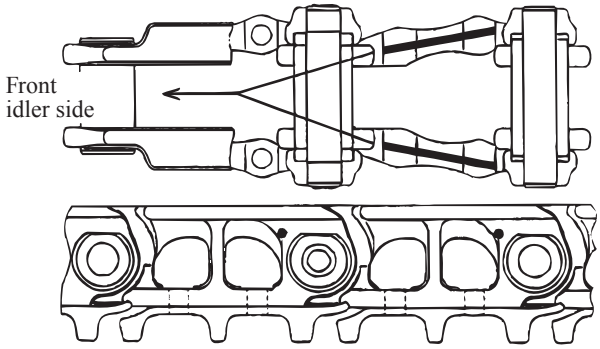
(3) Removing crawler
Lower the Boom slightly so that weight of the machine is not loaded to the crawler, and remove track link assy rotating sprocket.

CAUTION

Crawler end section may fall on the ground just before extending it on the ground incurring danger of injury.
Please keep well away from the equipment.

1.2.2 INSTALLING

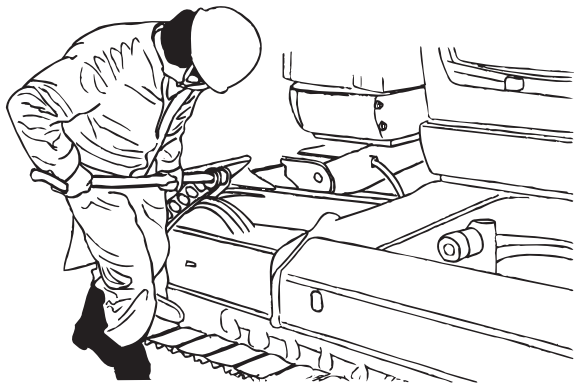
Installing is done in the reverse order of removing.



Installing direction of crawler

(1)Checking crawler installation direction.

Place the track links on the ground so they converge, facing the front idler, as shown in the figure above.



Winding crawler

(2) Installing crawler

1. Preparation for installation

Treat paint flaking protection with care not to damage lower flame.

2. Winding crawler

Insert a crowbar into the master pin hole and hold it by hand, lift the lower frame 1 to 2cm above the ground level so the machine body weight is not exerted on the shoe. Pull the crawler while rotating sprocket backward to wind the crawler.

(3) Preparation for press fitting master pin

1. Preparing for installation

Put square wood under the shoe plate.

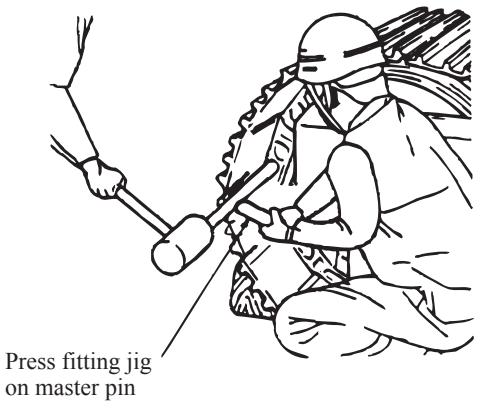
2. Aligning master pin holes

Aligning master pin holes through fine adjustment turning sprocket.

CAUTION

-When using a big hammer, exercise care so you are not injured by flying objects the same way as when pushing out the master pin.

-Coat the master pin with molybdenum disulfide grease, before pressing it in.

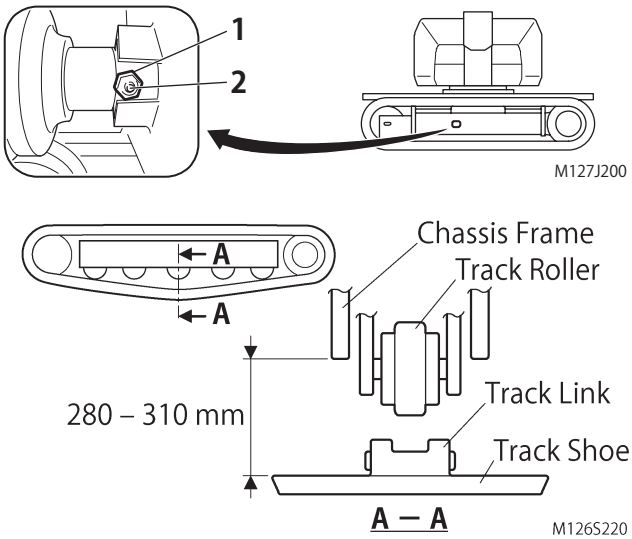


Press fitting of master pin

(4) Press fitting of master pin
Apply press fitting jig on master pin, and strike it with a mallet to press fit.

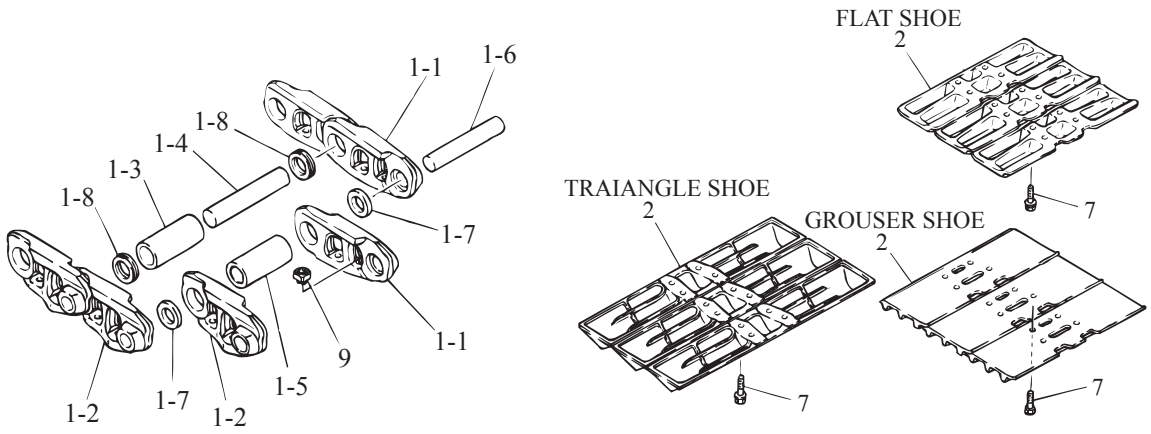
(5) Adjusting crawler tension (See below Fig.)
After installing, adjust tension of crawler.
Tools: Socket: 19 mm

	Standard dimension A
Dimension of iron crawler in a max. slackened condition	280 ~ 310 mm (11.0 ~ 12.2 in)



Adjusting crawler tension

1.2.3 CONSTRUCTION

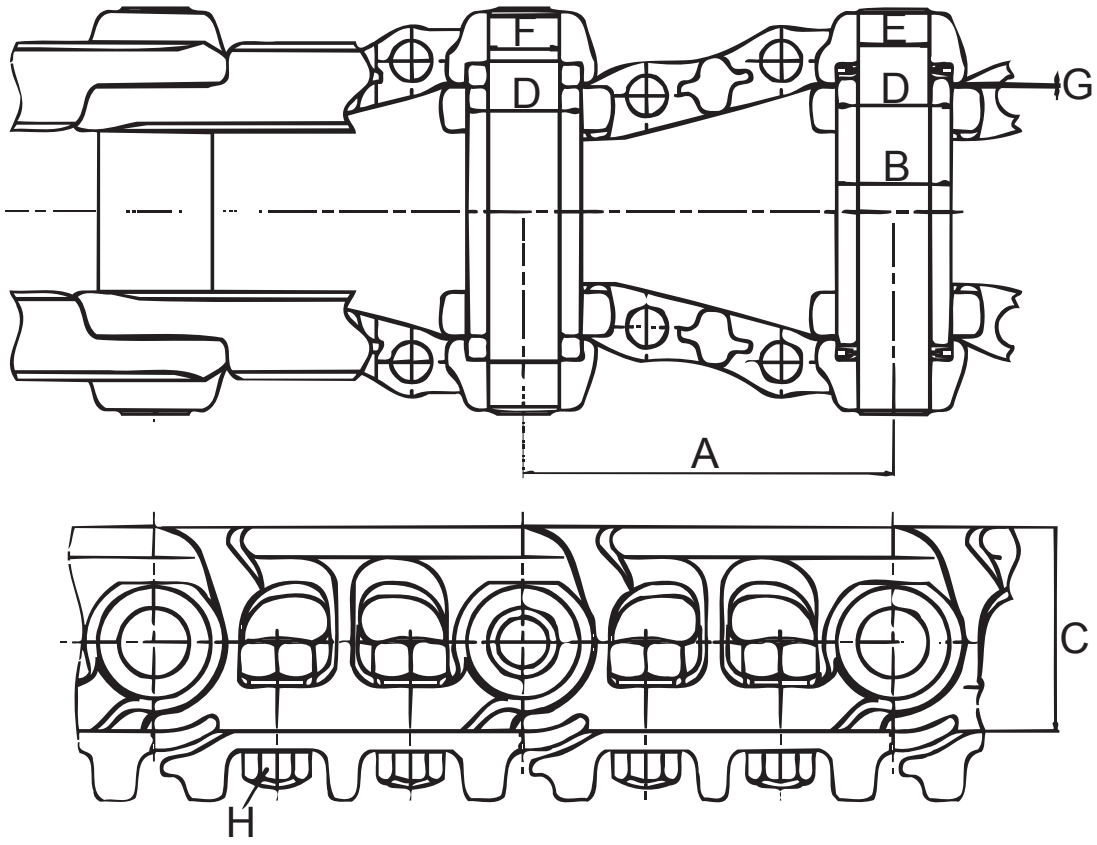


Track link assy and shoe plate

SK125SR / SK135SR-2

Shoe assy						
	YY60D00028F1					
	YY60D00028F2					
	YY60D00028F3					
	YY60D00028F4					
	YY60D00028F5					
No.	NAME	Q'TY				
1	· LINK ASSY YY62D00015F1	1	1	1	1	1
1-1	·· TRACK LINK R	44	44	44	44	44
1-2	·· TRACK LINK L	44	44	44	44	44
1-3	·· BUSHING	43	43	43	43	43
1-4	·· PIN	43	43	43	43	43
1-5	·· MASTER BUSHING	1	1	1	1	1
1-6	·· MASTER PIN	1	1	1	1	1
1-7	·· COLLAR	2	2	2	2	2
1-8	·· SEAL	86	86	86	86	86
2	· SHOE 500mm	44	—	—	—	—
	· SHOE 600mm	—	44	—	—	—
	· SHOE 700mm	—	—	44	—	—
	· SHOE 500mm	—	—	—	44	—
	· SHOE 800mm	—	—	—	—	44
7	· BOLT YY60D01004P1	176	176	176	—	—
	· BOLT YY60D01008P1	—	—	—	176	176
9	· NUT LP60D01002P1	176	176	176	176	176

1.2.4 MAINTENANCE STANDARDS



Unit : mm (in)

No.	ITEM	STANDARD VALUE			REPAIRABLE LEVEL	SERVICE LIMIT	REMEDY
A	Link pitch	171.45 ± 0.1 (6.750 ± 0.0039)			175 (6.89)	179 (7.05)	Replace the link assy if the service limit is exceeded
B	O.D. of bushing	ø 50.65 ± 0.05 (1.994 ± 0.002)			ø 47 (1.85)	ø 45 (1.77)	
C	Height of link	89 ± 0.3 (3.504 ± 0.012)			84 (3.31)	82 (3.23)	
D	Interference between bushing and link	Basic dimension	Tolerance		Fit	Fit	Replace
		ø 50.67 (1.995)	Shaft	+ 0.11 (+0.004) + 0.05 (+0.002)	Interference 0.05 (0.0020)	Interference 0	
E	Interference between track pin and link	ø 33.50 (1.319)	Shaft	+ 0.1 (+0.004) - 0.05 (-0.002)	Interference 0.05 (0.0020)	Interference 0	
F	Interference between master pin and link	ø 33.30 (1.311)	Shaft	+ 0.03 (+0.001) + 0.088 (+0.003)	Interference 0.05 (0.0020)	Interference 0	Replace Link
G	Clearance between links	1.5 (0.06) (both side)			8 (0.32) (both side)	10 (0.39) (both side)	Replace
H	Tightening torque of shoe bolt	412 ± 39 N•m (304 ± 28.8 lbf•ft)					Reassembly

1.2.5 TOOLS AND JIGS

(1)Å@Tightening tools
(2) Jig

Unit : mm (in)

NAME	OPPOSING FLATS
 Socket	24 (0.945)

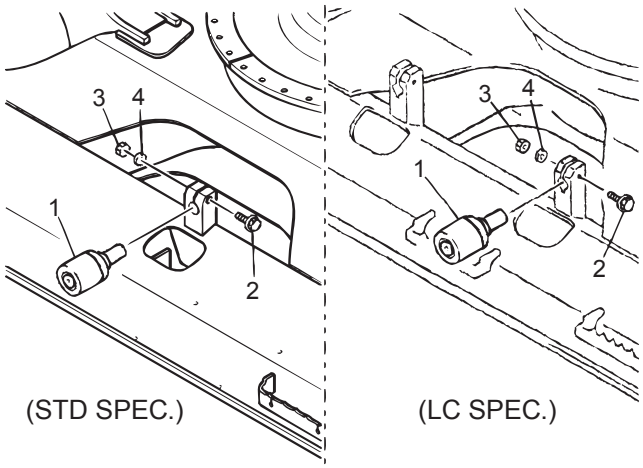
NAME	SHAPE
Master pin fixing jig for iron crawler	

1.3 UPPER ROLLER

1.3.1 UPPER ROLLER ASSY

ASSY No.	YY64D00004F1 (LC)		(01)	
	YY64D00016F1 (STD)		(01)	
ITEM	NAME	Q'TY		REMARKS
1	ROLLER ASSY	2	4	YY64D01002F1
2	CAPSCREW (SEMS SCREW)	2	4	M20XP2.5X110
3	NUT	2	4	
4	WASHER	4	8	

1.3.2 REMOVING



Removing upper roller

(1) Preparation for removal

Remove crawler (see page 9-3).

(2) Removing upper roller (1)

Remove nuts on support tightening section, and also remove capscrew (2) M20X110.

Tools: Socket: 30 mm

1.3.3 INSTALLING

Installing is done in the reverse order of removing.

(1) Inspection

Before installing, check it that it rotates smooth manually and for leak.

(2) Installing upper roller (1)

1.

To install the upper roller, turn socket bolts (2) toward the center of machine.

2.

Insert it until collar comes in contact with support.

3.

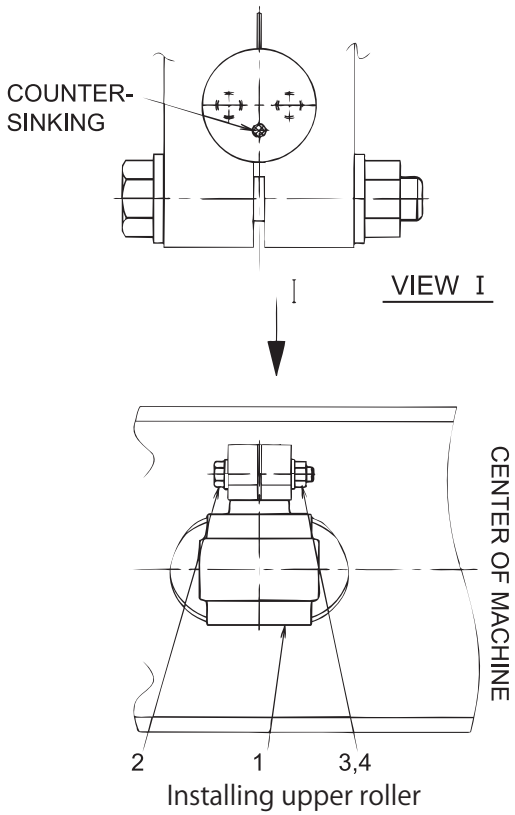
Fit it directing the countersinking mark of shaft end upward.

4.

Apply Loctite #262 on capscrew M20X110, and tighten it to the specified torque.

Tools: Socket: 30 mm

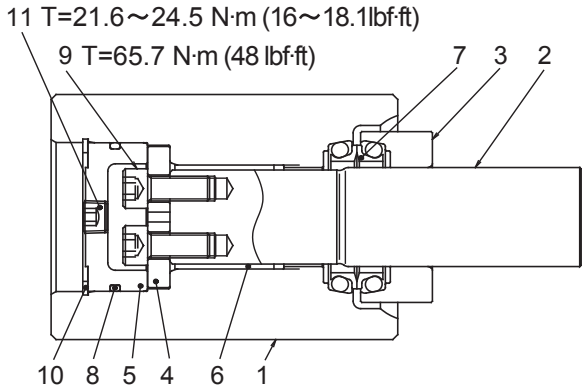
Tightening torque: 539 N-m (400 lbf-ft)



Installing upper roller

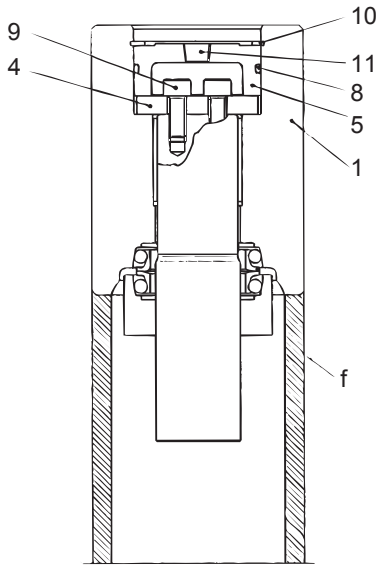
1.3.4 CONSTRUCTION

ROLLER ASSY PART NO.			YY64D01002F1		
No.	NAME	Q'TY	No.	NAME	Q'TY
1	ROLLER	1	7	FLOATING SEAL	1
2	SHAFT	1	8	O RING : 1A G55	1
3	COLLAR	1	9	SOCKET BOLT	2
4	PLATE	1	10	SNAP RING	1
5	COVER	1	11	PLUG PT1/8	1
6	BUSHING	1			



Construction of upper roller

1.3.5 DISASSEMBLY AND ASSEMBLY



Construction of upper roller

(1) Disassembly

1.

Draining out oil

Remove plug (11) and drain out oil.

Tools: Allen wrench: 6 mm

2.

Removing snap ring (10)

Mount the end face inside upper roller (1) on stand jig (f) and separate snap ring (10), using snap ring pliers.

3.

Removing cover (5)

Take off cover (5) upwards, utilizing the screwed hole for the plug.

4.

Removing O-ring (8)

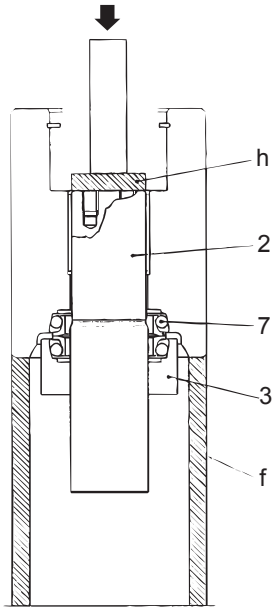
Separate O-ring (8) from cover (5).

5.

Removing plate (4)

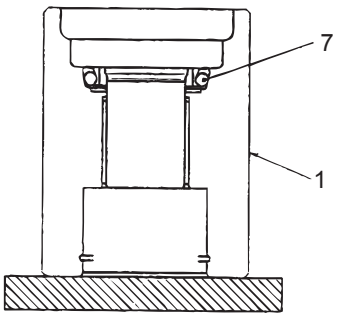
Loosen 2 socket bolts (9) and draw out plate (4) from roller (1).

Tools: Allen wrench: 10mm



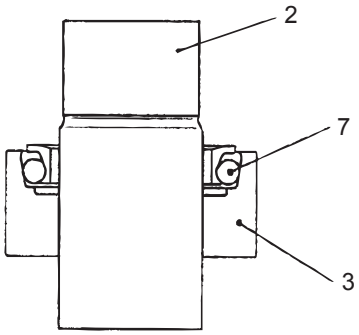
Extruding shaft

6.
Removing shaft (2)
Put the extrusion jig (h) against the end face of shaft (2) and push shaft (2) with collar (3) for floating seal (7), using a press or hammer.



Taking out floating seal

7.
Removing floating seal (7).
Take out floating seal (7) from roller (1).

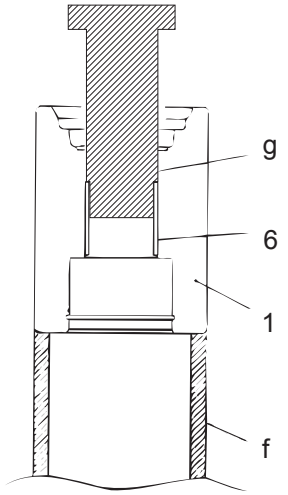


Removing floating seal

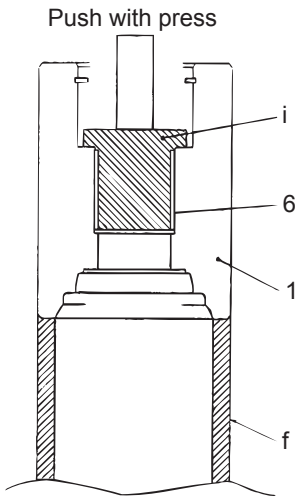
8.
Removing floating seal (7).
Remove from collar (3), floating seal (7) that is located on the side from which shaft (2) was disassembled.

Note

Collar (3) is press fitted into shaft (2). Therefore do not disassemble it.



Extruding bushing



Pushing in bushing

9.
Removing bushing (6)
Since the bushing is thin, machine it on a lathe or scrape it off, take care so as not to damage the bore of roller (1).
If the bushing is not worn much, mount upper roller (1) on jig (f), insert jig (g) into the end face of bushing (6) and push it out with a press.

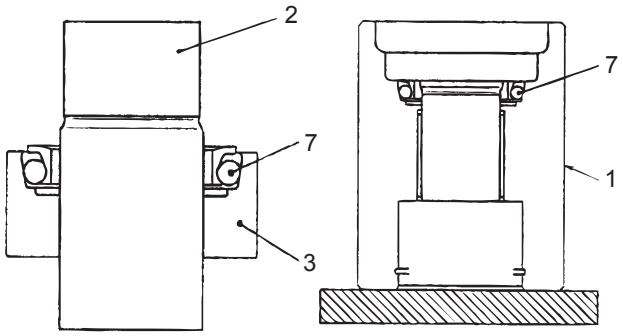
(2) Assembly
Assembly of the upper roller is done in the reverse order of disassembly.
1.
Place upper roller (1) on the top end face of jig (f), with its floating seal setting side facing down.

2.
Confirm that the outer surface of bushing (6) is not scuffed and coat the outer surface of the inserting side of the bushing, with molybdenum disulfide grease.

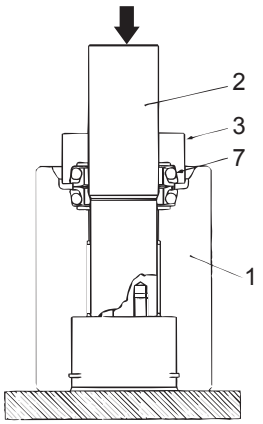
3.
Put jig (i) into bushing (6) and press it in, using the bore of the bushing and the bore of the roller as guides.

Note

If you fail in this operation by pressing the bushing unevenly, the bushing is distortedand gets unserviceable. In that case, do not re-use the bushing as it may develop malfunctioning after assembly.



Fixing floating seal

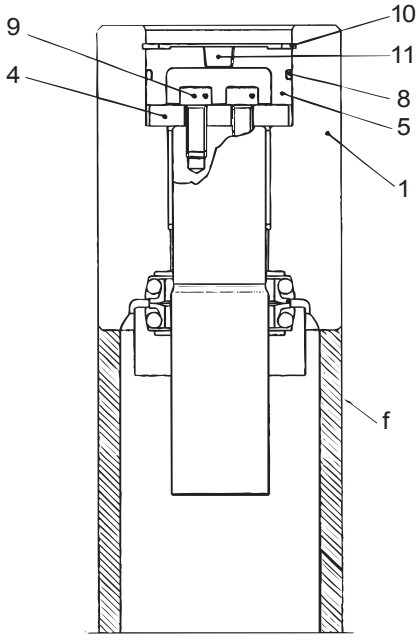


Inserting shaft

4. Installing floating seals (7)
Two floating seals (7) make a pair. Attach one floating seal to collar(3) fixed in shaft (2), and another to the inside of upper roller (1).

-Prior to placing floating seal (7) in, apply engine oil lightly to seal surface.

5. Inserting shaft (2)
Coat shaft (2) with a thin film of oil and insert it into upper roller (1).



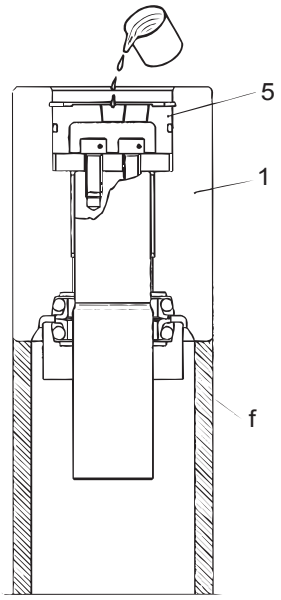
Installing cover

6. Installing plate (4)
Mount upper roller (1) on the stand jig (f) and attach plate (4) to the end face of the shaft with bolt (9).
Tools: Allen wrench: 8 mm,
Tightening torque: 65.7 N-m (48 lbf-ft)

7. Installing O-ring (8)
Fit O-ring (8) to the groove of cover (5).
-Apply grease to O-ring.

8. Installing cover (5)
Attach cover (5) to upper roller (1). Use a press in this operation as a press fit is used.

9. Installing snap ring (10)
Fix snap ring (10) into upper roller (1), using snap ring pliers.



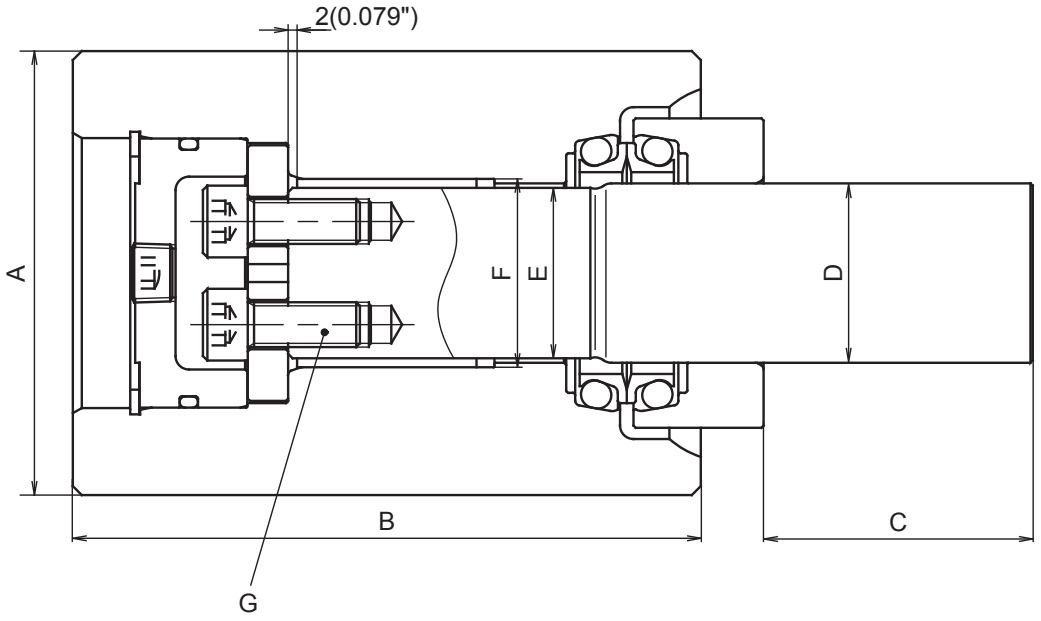
Filling oil

10. Filling oil
Fill in 20cc (1.22cuoin) of engine oil API grade CD #30 through the plug hole in cover (5).

11. Installing plug (11)
Wind seal tape around plug (11) and screw it into the plug hole of cover (5).
Tools: Allen wrench: 6mm,
Tightening torque: 21.6~24.5 N-m (16~18.1 lbf-ft)

-After assembling the upper roller, confirm that oil is not leaking from it and that it rotates smoothly by hand.

1.3.6 MAINTENANCE STANDARD



Unit : mm (in)

No.	ITEM	STANDARD VALUE			REPAIRABLE LEVEL	SERVICE LIMIT	REMEDY
A	Dia.	ø 99 (3.9)			ø 94 (3.7)	ø 90.5 (3.56)	Replace
B	Width	140 (5.51)			—	—	
C	Installing length	60 (2.36)			—	—	
D	Shaft dia.	ø $40^{+0.08}_{+0.06}$ ($1.576^{+0.003}_{+0.002}$)			—	—	
E	Clearance between shaft and bushing	Basic dimension	Tolerance		Fit	Fit	Replace bushing
		ø 38 (1.496)	Shaft	- 0.025 (-0.00098) - 0.050 (-0.0020)	Clearance 0.7 (0.028)	Clearance 1.0 (0.039)	
F	Interference between roller and bushing	ø 42 (1.654)	Hole	+ 0.025 (+0.00098) 0	Interference 0	Clearance 0.01 (0.0004)	
G	Tightening torque of socket bolt	65.7 N•m (48 lbf•ft)					
	Oil	Engine oil API grade CD #30, 20cc (1.22cu•in)					Refill
	Roller rotation	Roller rotates smoothly by hand.					Reassembly

1.3.7 TOOLS AND JIGS

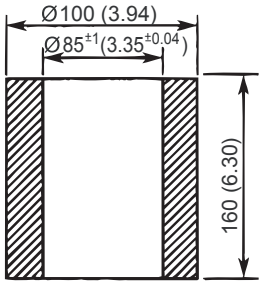
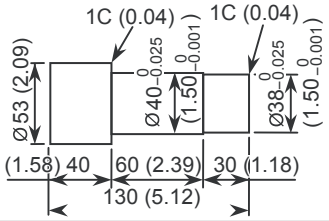
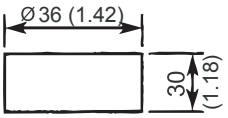
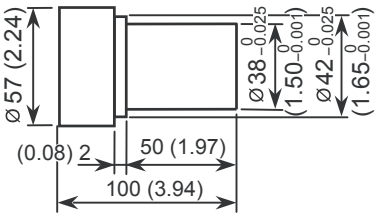
(1) Tightening tools

Unit : mm

NAME	OPPOSING FLATS
Socket	30
Allen wrench	6,8

(2) Jigs

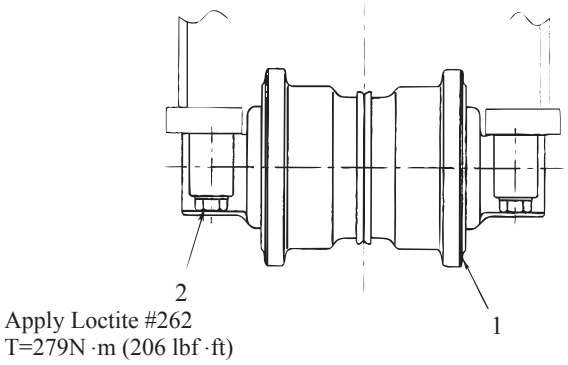
Unit : mm (in)

No.	NAME	SHAPE
f	Stand jig	
g	For extruding bushing	
h	For extruding shaft	
i	Bushing fixing jig	

1.4 LOWER ROLLER

1.4.1 LOWER ROLLER ASSY

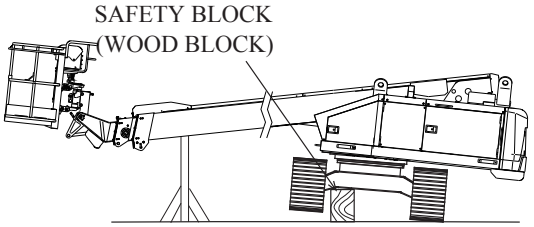
ROLLER ASSY	STD	YY64D00026F1		
	LC(HD)	YY64D00028F1		
ITEM	NAME	Q'TY		REMARKS
1	LOW ROLLER	14	12	YY64D00027F1
2	CAPSCREW	56	48	M16X75 (P=2.0)



Apply Loctite #262
T=279N ·m (206 lbf ·ft)

Lower roller assy and track guide

1.4.2 REMOVAL



Preparation for removal

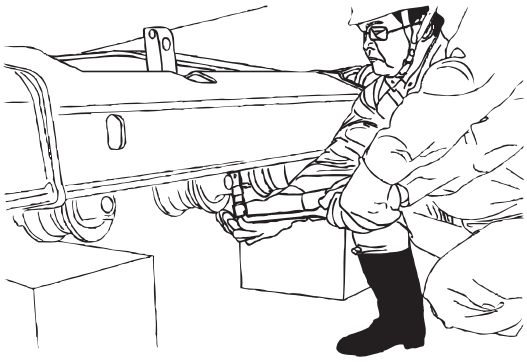
(1) Preparation for removal

1.

Loosen the tension of the crawler, lift up the lower frame by the lowering the boom attachment and stop the engine in that condition.

2.

Place a safety block (wood) at the front and back of the lower frame.



Installing lower roller

(2) Remove lower roller

Remove capscrews (2) and remove lower roller (1).

Tools: Socket: 24 mm,

Weight of lower roller: Approx. 25 kg (55 lbs)

1.4.3 INSTALLATION

(1) Installation of lower roller

Coat mounting capscrews (2) with Loctite #262 and fasten all 4 capscrews temporarily. Then tighten them to a specified torque.

Tools: Socket: 24 mm,

Tightening torque: 279 N-m (206 lbf-ft)

(2) Adjusting tension of crawler

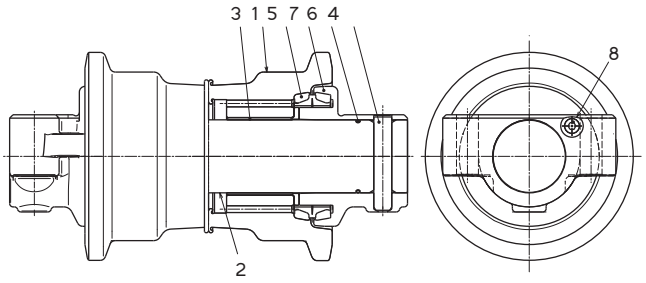
Tighten grease nipple and fill it with grease.

Tools: Socket: 19 mm,

Tightening torque: 59 N-m (43 lbf-ft)

1.4.4 CONSTRUCTION

LOWER ROLLER			YY64D00027F1
No.	NAME	Q'TY	REMARKS
1	ROLLER	1	
2	SHAFT	1	
3	BUSHING	2	
4	PIN	2	
5	FLOATING SEAL	2	
6	O-RING	2	1A G45
7	COLLAR	2	
8	PLUG	2	PT1/4



Construction of lower roller

1.4.5 **DISASSEMBLY AND ASSEMBLY**

(1) Disassembly

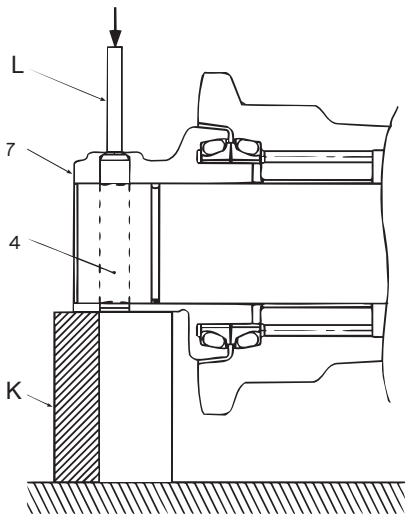
1. Drain oil

Remove plug (8) and drain out oil.

Tools: Allen wrench: 6mm

2. Removing pin (4)

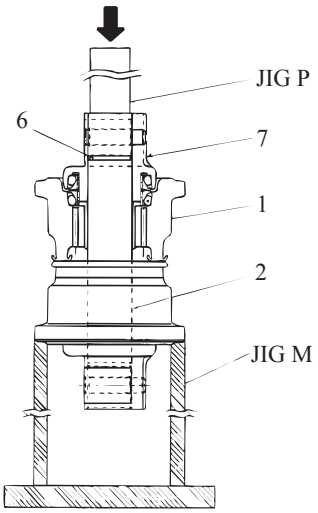
Put both ends of lower roller assy on the V-shaped blocks (K), apply push-out bar (L) on upper end face of pin (4),and push pin (4) out striking with mallet.



Pushing out collar fixing pin (4)

3. Removing collar (7), O-ring (6)
Put lower roller on jig (M) for repair stand so that the shaft (2) is perpendicularly located, apply push-out jig (P) on shaft end on upper side, and push shaft (2) until the O-ring (6) separate from collar (7) with press or mallet, and take out collar (7) and O-ring (6).

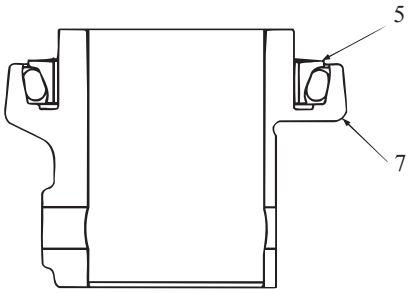
4. Removing shaft (2)
In addition, push out and remove shaft (2) together with the lower collar (7) and O-ring (6).



Removing shaft (2), collar (7), O-ring (6)

Note

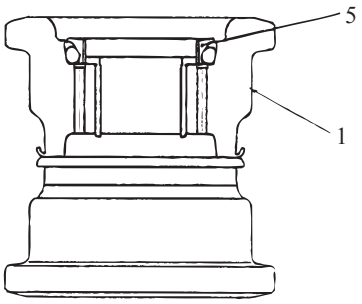
The shaft (2) extrusion operation may cause the remaining lube oil to flow out. Prepare an oil container beforehand.



Removing floating seal (5)

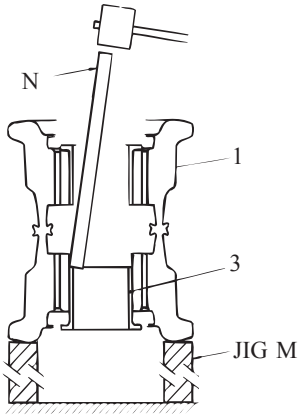
5. Removing collar (7), O-ring (6)
Remove O-ring (6) from shaft (2) that was drawn out in the previous paragraph.

6. Removing floating seal (5)
Remove floating seal (5) from collar (7).



Removing floating seal (5)

7. Removing floating seal (5)
Remove floating seal (5) from roller (1).

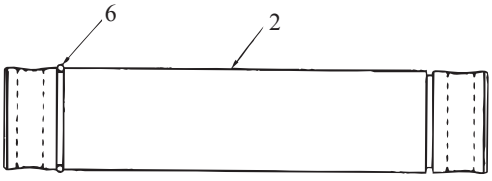


Extruding bushing (3)

8. Removing bushing (3)
Since thickness of bushing (3) is thin [thickness is 2.0mm (0.079in)], remove it through lathe or strip it with care not damage inner hole of roller. When the wear of bushing is not large, place upper roller (1) on jig (M) for repair stand and apply the end of push-out jig on the end face of bushing (3) end, and push it out striking it with mallet.

CAUTION

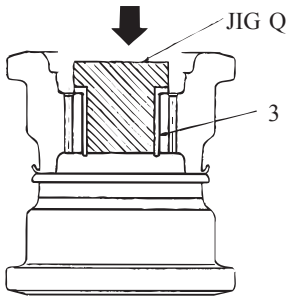
Hammer the inside surface of roller lightly so as not to damage the surface. Put the extrusion jig (N) uniformly over the circumference of bushing (3) and extrude it perpendicularly little by little.



Attach O-ring (6) to one side

(2) Installing
1. Attach O-ring (6) to one side
Install O-ring (6) to groove on shaft.

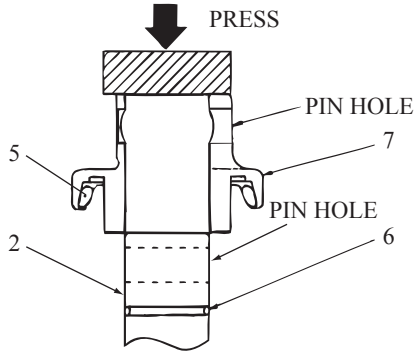
-Grease O-ring.
-Replace O-ring with new one without fail at reassembling.



Press fitting bushing (3)

2. Press fitting bushing (3)
Align inner hole of roller (1) and bushing (3) and press fit it vertically in capacity of press fit load, 5ton (11000 lbs), in the condition that bushing push-in jig (Q) is inserted into bushing (3).

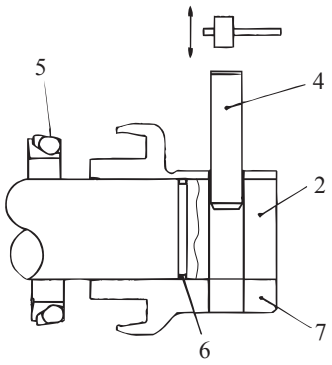
-Apply molybdenum disulfide grease on press-fit section of bushing, and press fit it in ordinary temperature.
-Bushing which fails to press-fit because of the one-side pressing should not be fitted.



Press fitting collar (7)

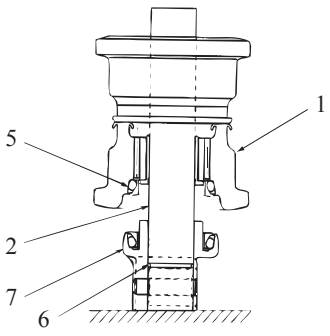
3. Press fitting collar (7)
Fit O-ring (6) to the one side of shaft (2) fiting pin hole of collar (7) on which floating seal (5) is fit with pin hole of shaft (2) in advance. Use the press of capacity 17 ton (37500 lbs) or more.

-Care should be taken not to damage O-ring (6) while press-fitting collar (7) to shaft (2).



Inserting pin (4)

4. Inserting pin (4)
Press-fit pin (4) to pin hole on aligning pin holes of shaft (2) and collar (7).

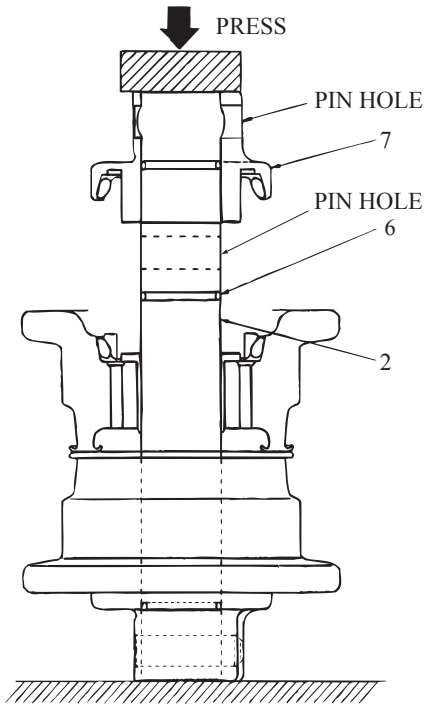


Inserting roller (1)

5. Attach floating seal (5) to roller side
Fit floating seal (5) to inner holes on both ends of roller (1).

-Check that the seal surface is free from flaws, rusts, etc. before reusing the floating seal.

6. Inserting roller (1)
Insert roller (1) from the side where collar (7),
O-ring (6) is not press-fitted to the shaft (2).



Installing O-ring (6), collar (7)

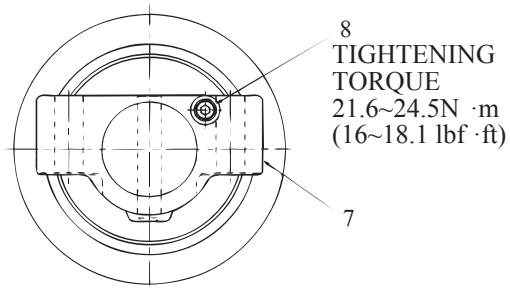
7. Installing O-ring (6)
Install O-ring (6) to groove on shaft.

-Grease O-ring.
-Replace O-ring with new one without fail at reassembling.

8. Press fitting collar (7)
Press-fit collar (7) to shaft (2).

-Press-fit collar (7) on aligning pin (4) hole.

9. Inserting pin (4)
Press-fit pin (4) in to the pin hole mating pin hole of collar (7) with pin hole on the end side of shaft (2).



Installing filling oil plug (8)

10. Filling oil
Remove plug (8) and fill in 150cc (9.2cuoin) of engi ne oil API grade CD #30.

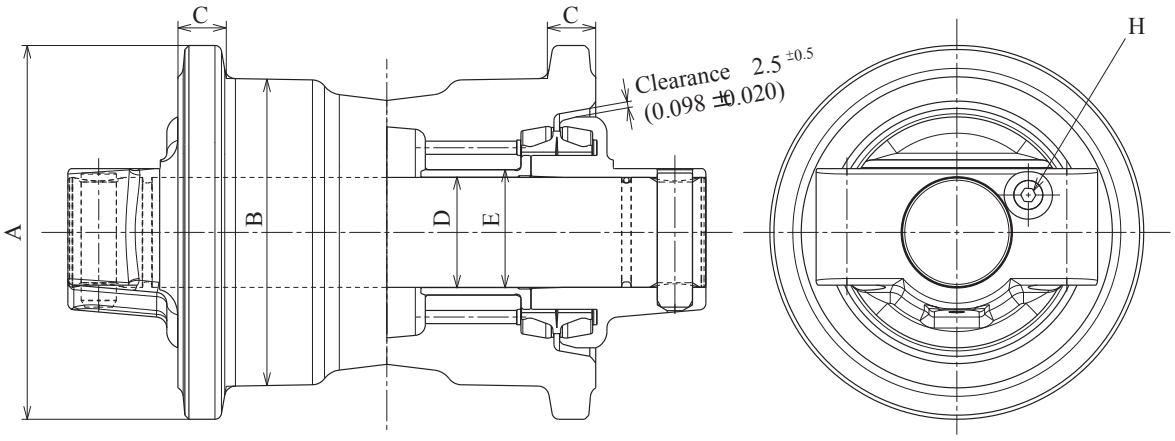
11. Check it for leakage
Before tightening plug (8), check it for leakage in the condition of air pressure 0.2MPa (29psi).

12. Installing plug (8)
Apply oil resistant sealant on plug (8), and tighten it in the plug hole on the collar (7) end face.
Tools: Allen wrench: 6 mm,
Tightening torque:
21.6 to 24.5 N-m (1 6 to 18.1 lbf-ft)

CAUTION

After assembling the lower roller, confirm that oil is not leaking and that the roller rotates smoothly by hand.

1.4.6 MAINTENANCE STANDARD



Lower roller (Track roller)

Unit : mm (in)

No.	ITEM	STANDARD VALUE			REPAIRABLE LEVEL	SERVICE LIMIT	REMEDY
A	O.D. of flange	ø 170 (6.70)			—	—	Reinforcement weld, repair or replace
B	Tread dia.	ø 140 (5.51)			ø 132 (5.20)	ø 126 (4.96)	
C	Flange width	19 (0.748)			14 (0.551)	11 (0.433)	Replace bushing
D	Clearance between shaft and bushing (Wrapped bushing)	Basic dimension	Tolerance		Fit	Fit	
		ø 50 (1.96850)	Shaft	- 0.060 (-0.00236) - 0.090 (-0.00354)	Clearance 0.7 (0.276)	Clearance 1.0 (0.394)	
E	Interference between roller and bushing	ø 57 (2.24409)	Hole	+ 0.030 (+0.00118) 0	Interference 0	Clearance 0.01 (0.0004)	
F	Oil	Engine oil API grade CD #30, 150cc (9.2 cu•in)					Refill
H	Plug (8)	Execute air leak test at 0.2MPa (28psi) before tightening the plug.					
	Roller rotation	Rotates smoothly by hand.					Reassembly

1.4.7 TOOLS AND JIGS

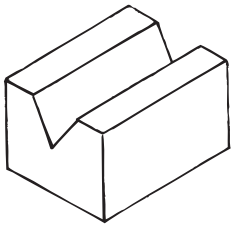
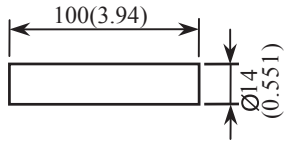
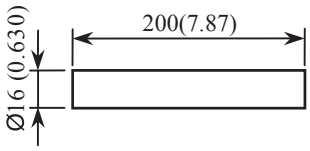
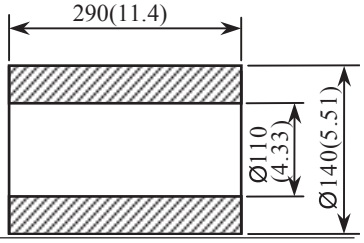
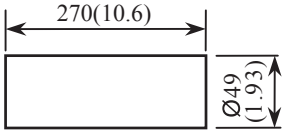
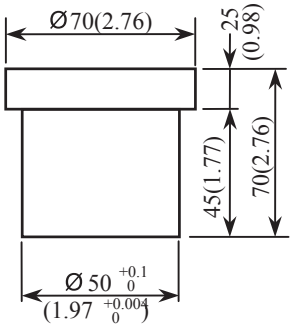
(1) Tightening tools

Unit : mm

NAME	OPPOSING FLATS
 Socket	24
 Allen wrench	6

(2) Jig

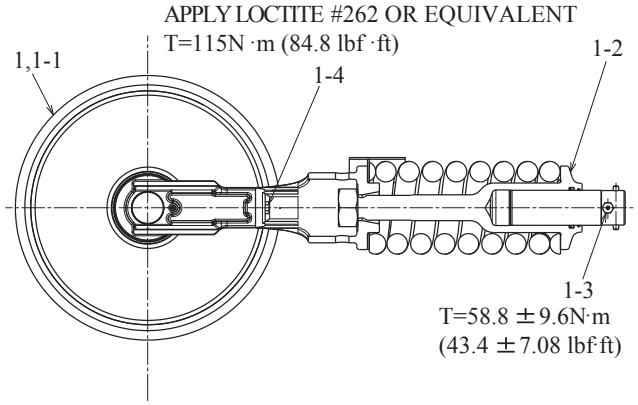
Unit : mm (in)

No.	NAME	SHAPE
K	V-block	
L	Pin (4) extrusion rod	
N	Bushing extrusion rod	
M	Stand jig	
P	Shaft extrusion jig	
Q	Bushing fixing jig	

1.5 FRONT IDLER (IDLER ADJUSTER ASSY)

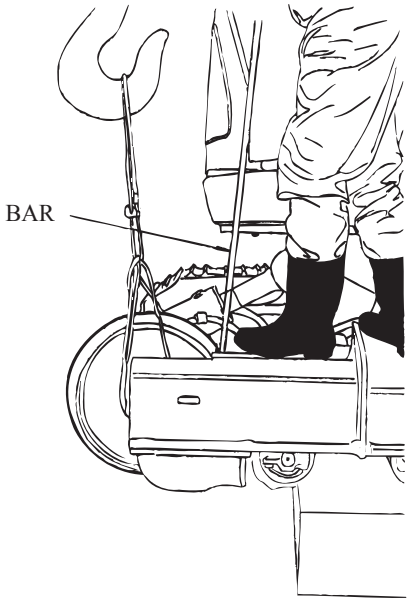
1.5.1 FRONT IDLER ASSY

FRONT IDLER ASSY			YY52D00010F1
No.	NAME	Q'TY	REMARKS
1	FRONT IDLER ASSY	2	YY52D00011F1
1-1	IDLER ASSY	1	YY52D00007F1
1-2	IDLER ADJUSTER ASSY	1	YY54D00003F1
1-3	GREASE NIPPLE	1	
1-4	CAPSCREW	2	M12X35



Front idler assy

1.5.2 REMOVING



Removing and installation the front idler

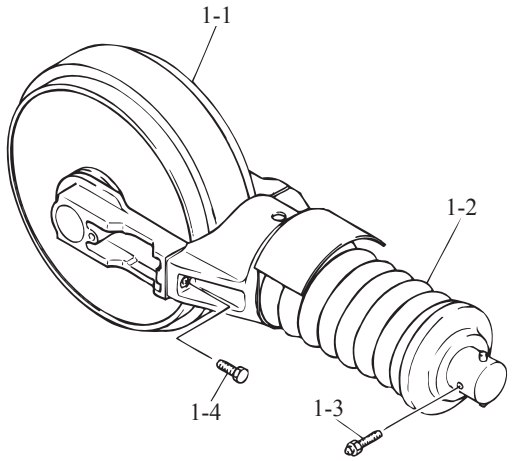
(1) Preparation for removal
Remove crawler. (See - page 9-3)

(2) Removing idler assy
Sling idler assy, and push it forward with bar.
Weight of front idler assy: 127 kg (280 lbs)

(3) Installing
Installing is done in the reverse order of removing.

WARNING

Keep away from the front side of front idler.



Separating idler assy (1-1) from idler adjuster

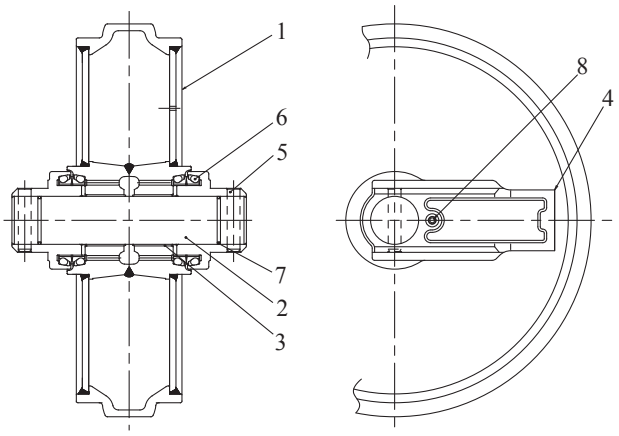
(4) Where idling assy (1-1) has to be separated
Loosen capscrew (1-4), and separate idler assy (1-1) from idler adjuster assy (1-2).
Tools: Socket: 19 mm
Weight of idler assy : 69 kg (152 lbs)
Weight of idler adjuster assy : 58 kg (128 lbs)

-The separated idler assy (1) should be placed on square timbers.

1.5.3 IDLER ASSY

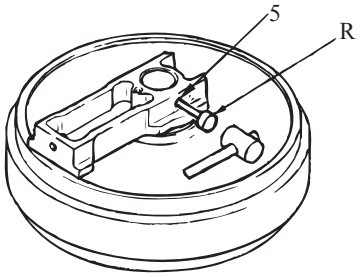
1.5.3.1 CONSTRUCTION

IDLER ASSY			YY52D00007F1
No.	NAME	Q'TY	REMARKS
1	IDLER	1	YY52D00006P1
2	SHAFT	1	
3	BUSHING	2	
4	COLLAR	2	LP52D01009P1
5	PIN	2	
6	FLOATING SEAL	2	
7	O-RING	2	1A G55
8	PLUG	2	PT1/8



Idler assy

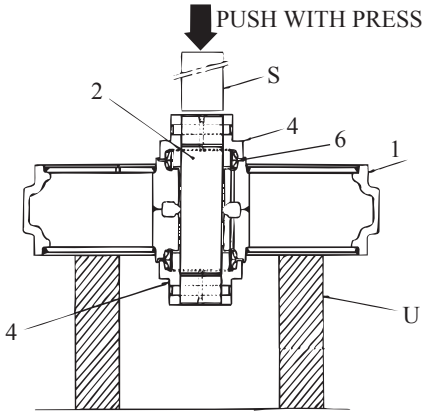
1.5.3.2 REMOVING AND INSTALLING



Removing pin (5)

(1) Removing
1. Drain oil
Remove plug (8) on the side of collar (4) to drain.
Tools: Allen wrench: 5 mm

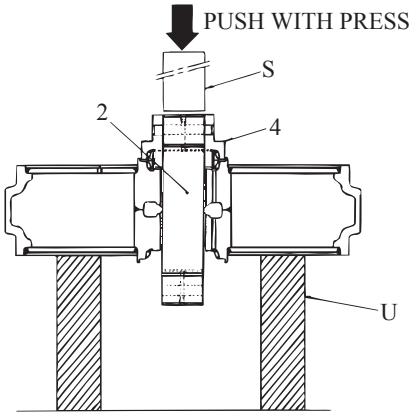
2. Removing pin (5)
Apply pin push bar (jig R) to the top of pin, and push out striking bar (jig R) lightly by hammer.



Removing collar (4)

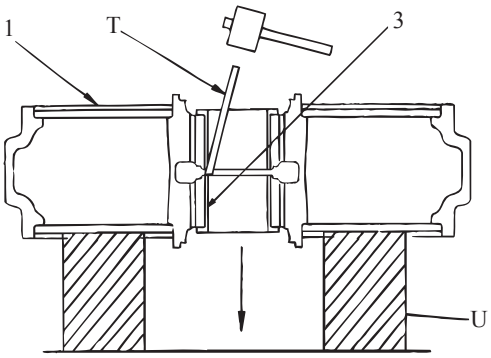
3. Removing collar (4)
Put idler (1) on stand (U), apply push-out jig (S) on shaft (2), push out shaft (2) with collar (4), then remove collar(4).

4. Removing floating seals (6)
Take out floating seals (6) from idler (1), collar (4). If youintend to re-use floating seals(6), confirm that there is no scoring and rusting on the contact surface and store the floating seals in pairs by placing card board between the sealing faces.



Removing collar (4)

5. Removing collar (4) from shaft (2)
If removal of collar (4) on the opposite side is required, turn over front idler and proceed with the procedure described in Par. 3.

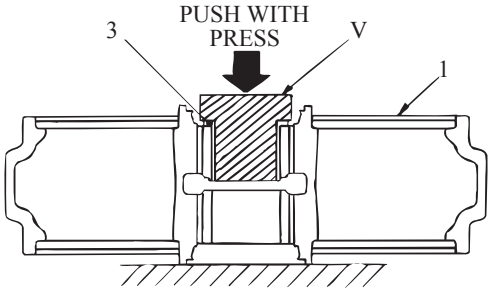


Removing bushing (3)

6. Removing bushing (3)
With idler (1) mounted on the stand, tap bushing (3) lightly by hammer, while placing the bushing drawing rod (T) against the end face of bushing (3) evenly all round, till it comes out.

7. Removing O-ring (7)
Separate O-ring (7) from shaft (2).

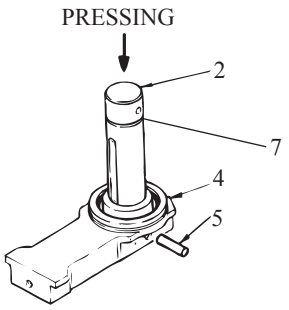
(2) Assembly



Pressing in bushing (3)

1. Pressing in bushing (3)
Align inner hole of idler (1) and bushing (3) and press fit it vertically with press so that jig (V) for bushing press-fitting is inserted into bushing (3).

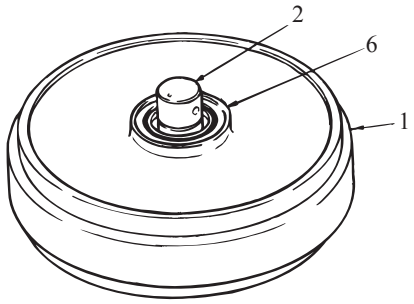
2. Installing O-ring (7)
Fit O-ring (7) to O-ring groove on shaft (2).
-Apply grease to O-ring



Installing collar (4), shaft (2)

3. Installing collar (4)
Press fit the O-ring (7) installed side of shaft (2) into collar (4), and drive pin (5).

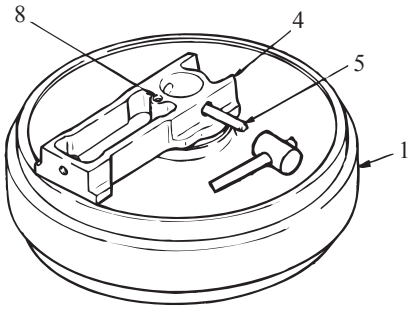
4. Installing floating seal (6)
Fit the half of floating seal (6) on each side of collar (4) and idler (1).



Inserting idler (1) and installing floating seal (6)

5. Inserting idler (1)
Insert floating seal (6) fitted side of idler (1) into shaft (2).

6. Installing floating seal (4)
Fit floating seal (4) on the other side of idler (1).

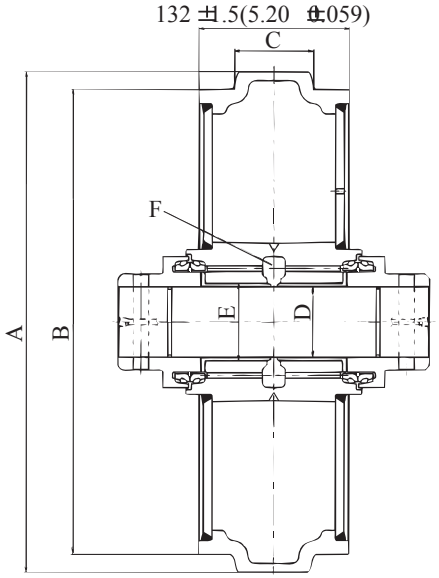


Installing collar (4) and filling oil

7. Installing collar (4)
Fit the half of floating seal (6) on the other collar (4), press fit it in shaft (2), and drive pin (5) in with hummer.

8. Filling oiloInspection
Fill in 200cc (12.2cuoin) of engine oil API grade CD #30 through the plug hole of collar (4), wind seal tape and tighten plug (8).
Tools: Allen wrench: 5 mm
-After installing the idler assy to the idler adjuster assy, make certain that no oil leaks from floating seal and plug (8) and that idler (1) rotates smoothly.

1.5.3.3 MAINTENANCE STANDARD



Front idler

Unit : mm (in)

No.	ITEM	STANDARD VALUE			REPAIRABLE LEVEL	SERVICE LIMIT	REMEDY
A	Dia. of idler projection	ø 496 (19.5)			—	—	Replace
B	Tread dia.	ø 456 (18.0)			ø 450 (17.7)	ø 448 (17.6)	
C	Flange width	68 ± 1 (2.677±0.04)			63 (2.48)	60 (2.36)	
D	Clearance between shaft and bushing	Basic dimension	Tolerance		Fit	Fit	Replace bushing
		ø 60 (2.36220)	Shaft	- 0.03 (-0.00118) - 0.06 (-0.00236)	Clearance 1.5 (0.059)	Clearance 2.0 (0.079)	
E	Interference between idler and bushing	ø 64 (2.51969)	Hole	- 0.03 (-0.00118) 0	Interference 0	Clearance 0.01 (0.0004)	
F	Oil	Engine oil API grade CD #30, 200cc (12.2cu•in)					Refill
	Idler rotation	Rotates smoothly by hand					Reassemble

1.5.3.4 TOOLS AND JIGS

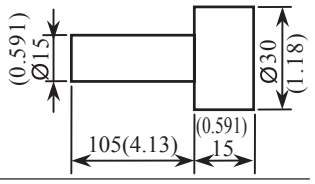
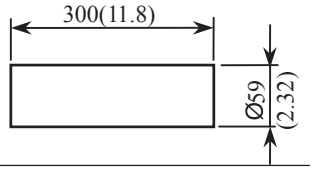
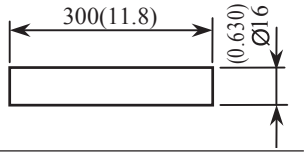
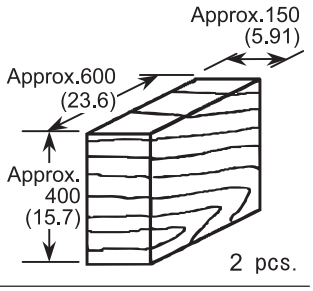
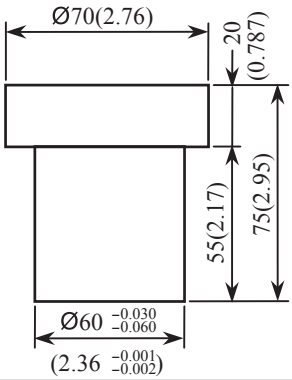
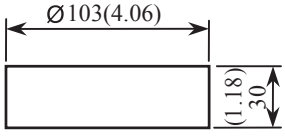
(1) Tightening tools

Unit : mm

NAME	OPPOSING FLATS
Socket	24
Allen wrench	5

(2) Jigs

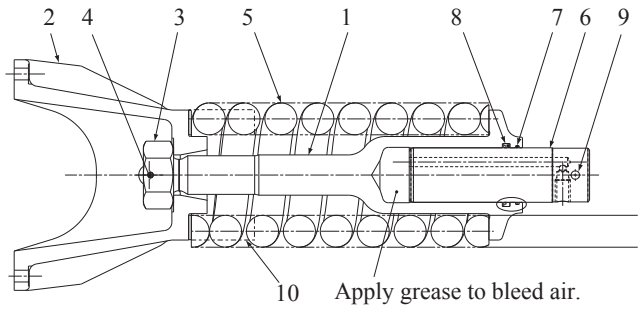
Unit : mm (in)

No.	NAME	SHAPE
R	Pin striking jig	
S	Shaft push out jig	
T	Bushing drawing rod	
U	Stand	
V	Bushing press fitting jig	
W	Collar press fitting jig	

1.5.4 IDLER ADJUSTER ASSY

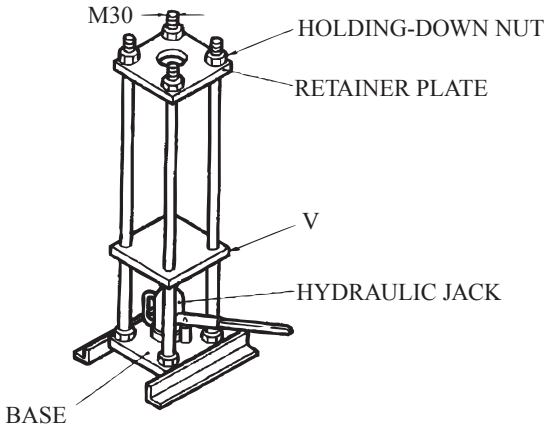
1.5.4.1 CONSTRUCTION

IDLER ADJUSTER ASSY			YY54D00003F1
No.	NAME	Q'TY	REMARKS
1	GREASE CYLINDER	1	
2	BRACKET	1	
3	NUT	1	
4	SPRING PIN	1	ϕ6X63
5	SPRING	1	
6	PISTON	1	
7	O-RING	1	1B G90
8	U-PACKING	1	
9	PIN	2	
10	COVER	1	



Idler adjuster assy

1.5.4.2 DISASSEMBLY AND ASSEMBLY



Spring set special jig (V)

(1) Disassembly

1. Spring set special jig

Before disassembling and assembling the idler adjuster assy, prepare spring setting jig (V).
Capacity of hydraulic jack : more than 20 tons (44000 lbs)
Tools: Spanner: 46 mm

2. Preparation for working

Place a hydraulic jack between the jig base and the stand.
Loosen the holding-down nuts of the jig and draw out the retainer plate upward.
Tools: Spanner: 46 mm

CAUTION

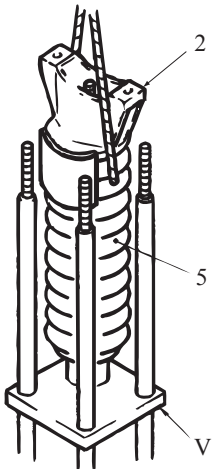
Large power is needed to set the spring. Prepare a special jig before disassembly and assembly.

3. Draw out piston(6) (See Fig. "Idler adjuster assy".)

Draw out piston (6) from grease cylinder (1) of the idler adjuster assy.

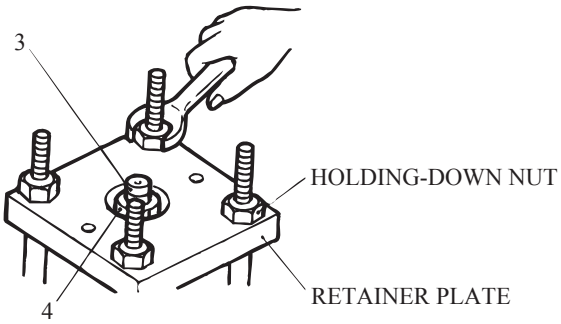
4. Removing U-packing (8), O-ring (7) (See Fig. "Idler adjuster assy".)

Remove U-packing (8) and O-ring (7) from grease cylinder (1).



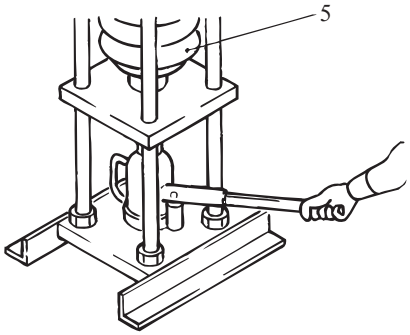
Slinging work idler adjuster

5. Slinging work idler adjuster
Set the idler adjuster assy on the stand of the jig, with its bracket side facing up.



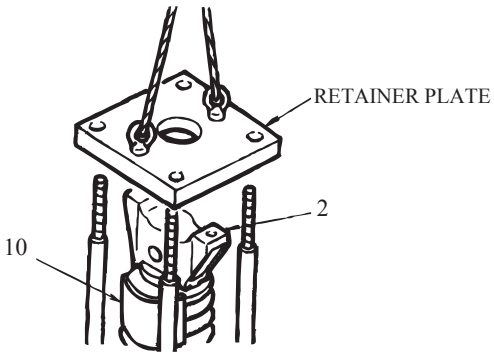
Fixing idler adjuster assy

6. Fixing idler adjuster assy
Fit retainer plate to bracket (2), tighten holding-down nuts alternately, and secure idler adjuster assy.
Tools: Spanner: 46 mm



Compression of spring (5)

7. Compression of spring (5)
Remove spring pin (4), press spring (5) lifting it with jack so that nut (3) can be turned freely, and remove nut (3).
Tools: Bar 7.5 dia.X120 dia.
Tools: Socket: 85 mm

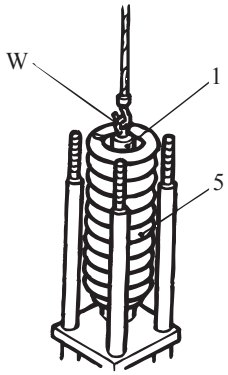


Removing retainer plate, bracket (2)

8. Removing bracket (2)

Allow the hydraulic jack to retract slowly till the spring is extended to its free length. Remove the retainer plate and take off bracket (2), cover (10).

The free length of the spring: 427 mm (16.8 in)

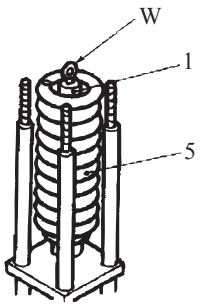


Removing spring (5), grease cylinder (1)

9. Removing spring (5), grease cylinder (1)

Hook lifting eye nut (W) to screw M45XP3 on grease cylinder (1) top end and hoist it. Then, remove the set of grease cylinder (1) and spring (5) using crane from the jig.

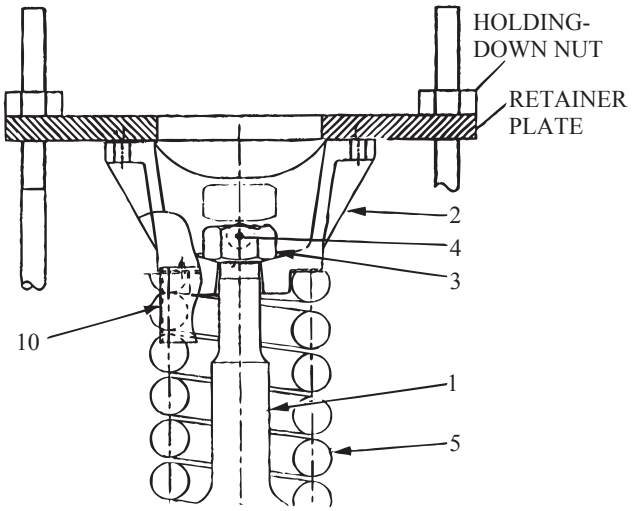
Remove spring (5), grease cylinder (1), in that order.



Attach spring (5) and grease cylinder (1) to the jig

(2) Assembly
Assembly is done in the reverse order of disassembly.

1. Installing spring (5), grease cylinder (1)
Insert grease cylinder (1), collar (7) into spring (5) and attach lifting eye nut (W) to screw M45XP3 at the tip of the grease cylinder. Lift the grease cylinder by crane and erect it in the center of the jig stand upright.



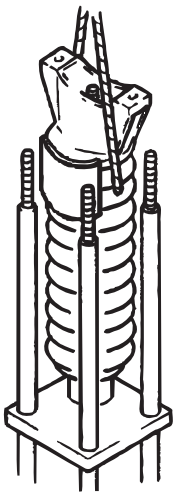
Compression of spring (5), and attaching nut (3) and spring pin (4)

2. Fixing idler adjuster assy
Install bracket (2), cover (10) on top of spring (5). Center the rod of grease cylinder (1) and the holes in bracket (2). Attach the retainer plate and four holding-down nuts. Fasten the nuts evenly all round and fix the idler adjuster assy to the jig body.
Tools: Spanner: 46 mm

3. Compressing spring (5) and tightening nut (3)
Extend the hydraulic jack, compress spring (5) to a set length and screw in nut (3) to the screwed part at the tip of grease cylinder (1).
Set length of the spring: 354.8 mm (14.0 in)

4. Installing spring pin (4)
Tighten nut (3) till the holes for locking spring pins (4) are aligned. Then fit spring pin (4).

Tools: Socket: 70 mm



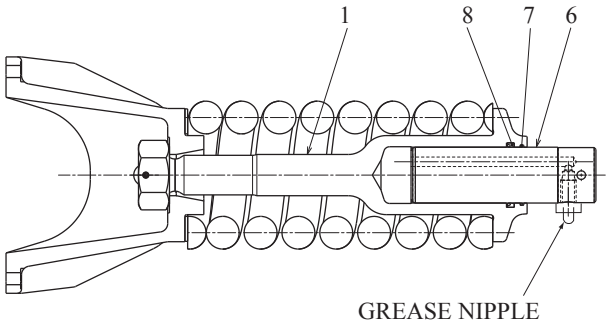
Removing idler adjuster assy

5. Removing idler adjuster assy
Remove idler adjust er assy from jig.

6. Installing U-packing (8), O-ring (7)
Fit U-packing (8) and O-ring (7) to grease cylinder (1).
-Grease oil seal (8) and O-ring (7).

7. Filling grease cylinder(1) with grease.
Fill up grease in cylinder (1), remove the grease nipple from piston (6) to discharge the inside air, and press in the piston by hand.
-Direct grease nipple hole downward to make air discharge easier.

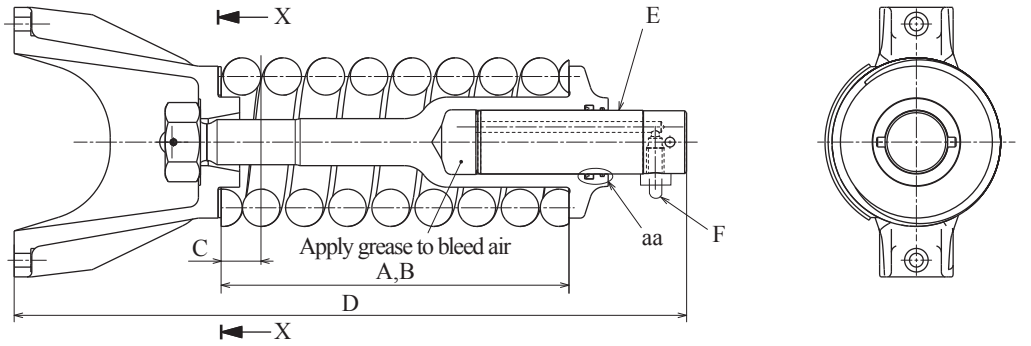
8. Installing grease nipple
Tighten grease nipple to piston (6).
Tools: Socket: 19 mm,
Tightening torque: 59 N-m (43 lbf-ft)



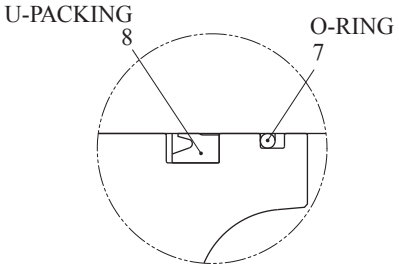
Grease cylinder (1)

1.5.4.3 MAINTENANCE STANDARD

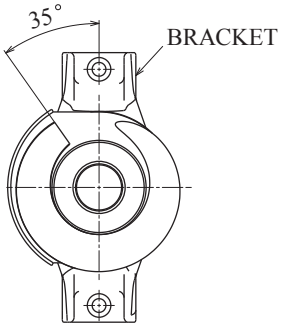
No.	ITEM	STANDARD VALUE
A	Installed length of spring	354.8 mm (14.0 in)
B	Free length of spring	Approx. 427 mm (16.8 in)
C	Stroke	39.4 mm (1.55 in)
D	Set length	686 mm (27 in)
E	Outside view of piston	Nor scoring and rusting
F	Tightening torque of grease nipple	59 N-m (43 lbf-ft)



INSTALL A SPRING WHOSE STARTING POINT AT BRACKET SIDE TO BE 35 DEGREE.



DETAIL aa

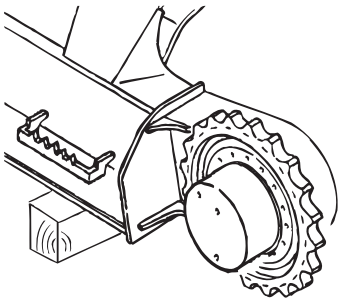


SECTION XX

1.6 SPROCKET

1.6.1 REMOVING

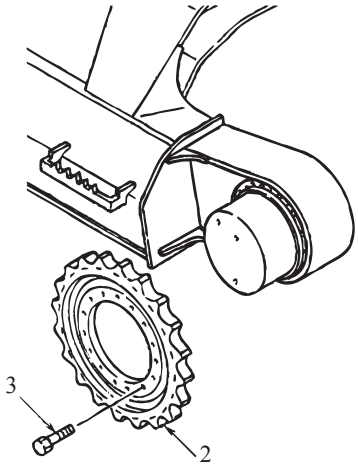
(1) Preparation for removal
Remove crawler "See page 9-3", lift up crawler frame by lowering the boom and put it on square timbersto float and stabilize.



Preparation for removal

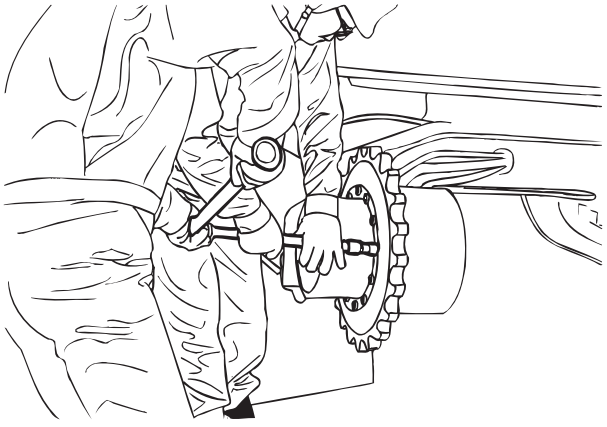
(2) Removing sprocket
Loosen 18 capscrews (3) M16X45, for the attaching of the sprocket by means of a socket and remove the sprocket(1).

Weight of sprocket: 39 kg (86 lbs)
Tools: Socket: 24 mm



Removing sprocket

1.6.2 INSTALLING



Installing sprocket completely

(1) Check before installing
Check the mating portion of the travel reduction unit and the sprocket, eliminate burrs and contamination thoroughly and install the sprocket.

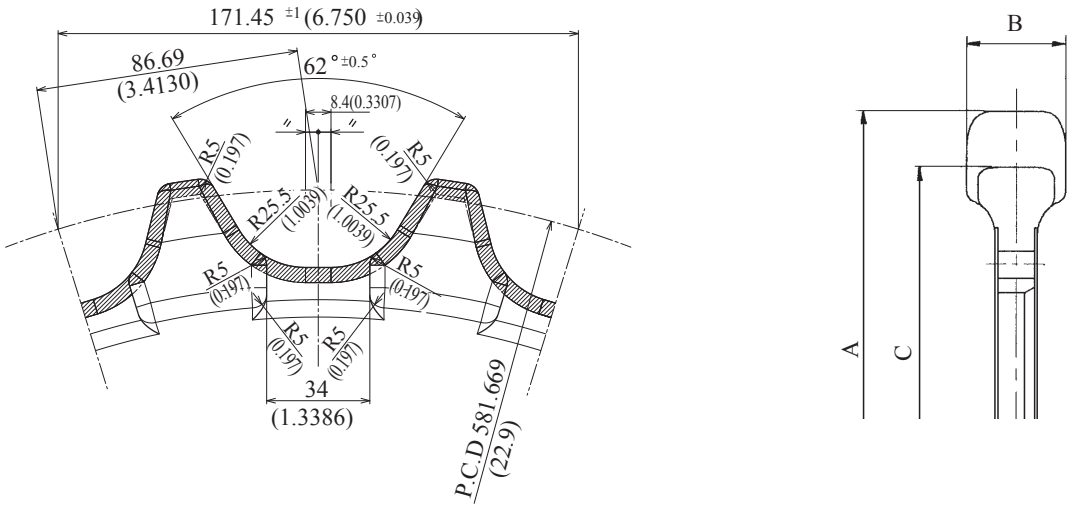
(2) Installing sprocket temporarily
Coat the sprocket attaching capscrews with Loctite #262 and fasten the sprocket temporarily.

(3) nstalling spro cket completely
Remove the wooden blocks under the truck frame, bring the machine down on the ground and tighten the sprocket.
Tools: Socket: 24 mm
Tightening torque: 279 N-m (206 lbf-ft)

1.6.3 MAINTENANCE STANDARD (YN51D01006P1)

SPECIFICATION	PITCH	86.69mm (3.4130in)	NUMBER OF TEETH	21
	ROLLER DIA.	Dia. 50.67 mm (1.9950in)	PITCH DIA.	581.669 (22.9in)

Unit : mm (in)



Sprocket

Unit:mm (in)

No.	NAME	STANDARD VALUE	REPAIRABLE LEVEL	SERVICE LIMIT	REMEDY
A	O.D. of sprocket	ø 594±3 (23.4±0.118)	ø 586 (23.1)	ø 584 (23.0)	Reinforcement weld, repair or replace.
B	Width of sprocket teeth	60 $^{0}_{-0.3}$ (2.36 $^{0}_{-0.118}$)	54 (2.13)	52 (2.05)	Replace.
C	O.D. of sprocket bottom	ø 510 (20.1)	ø 502 (19.8)	ø 500 (19.7)	Reinforcement weld, repair or replace.

1.6.4 TOOLS AND JIGS

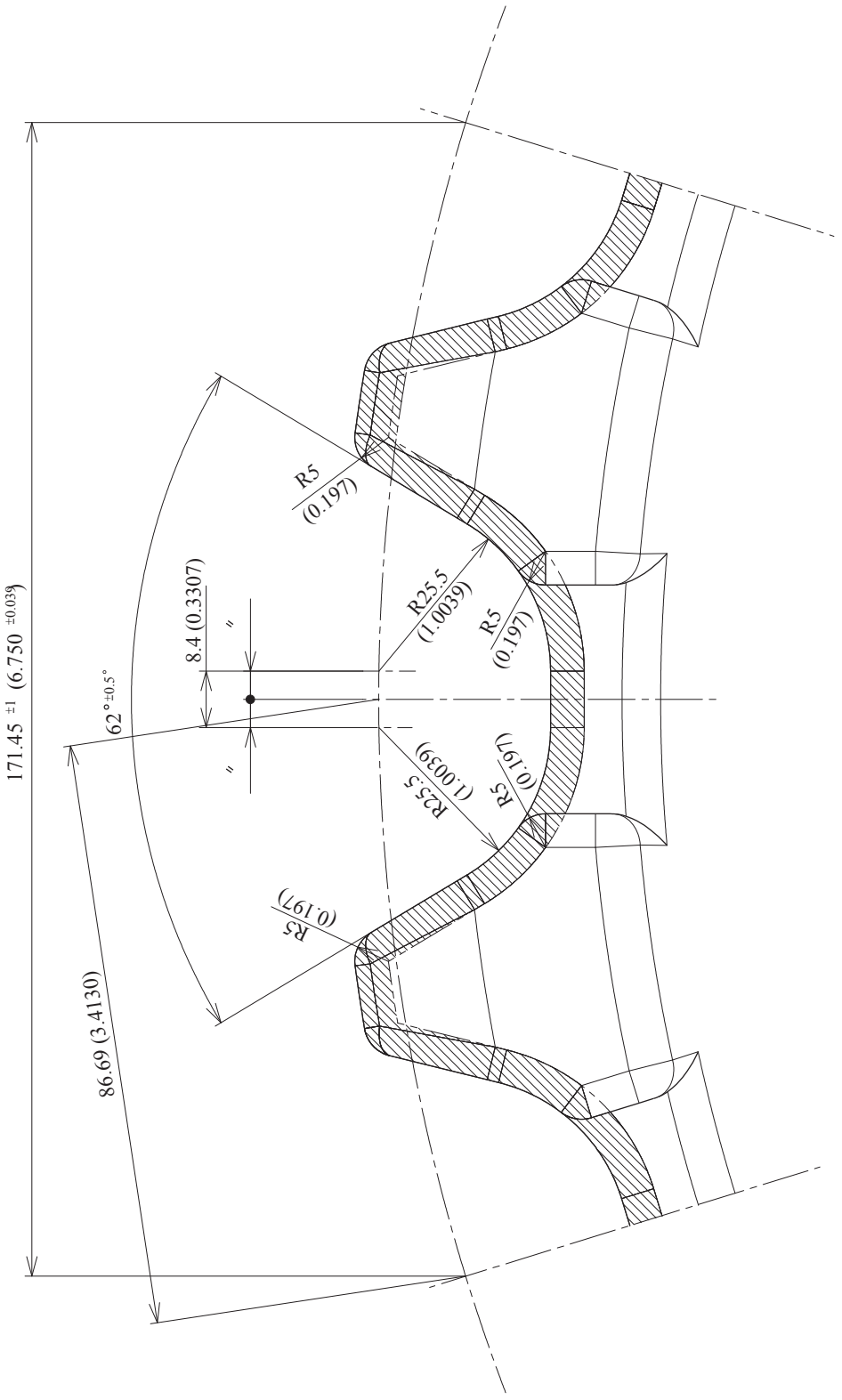
(1) Tools

Unit : mm

NAME	OPPOSING FLATS
Socket	24

(2) Sprocket tooth profile gauge: W

Unit : mm (in)

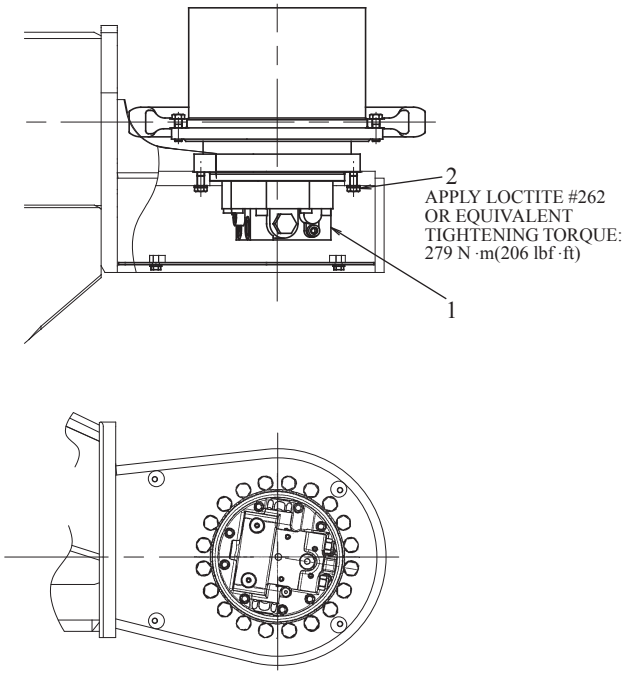


Tooth profile gauge (Full scale)

1.7 TRAVEL MOTOR

1.7.1 TRAVEL MOTOR

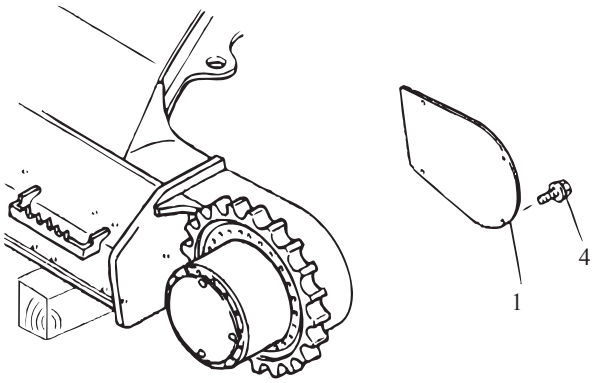
INSTALL ASSY			YY53D00006F1
No.	NAME	Q'TY	REMARKS
1	TRAVEL MOTOR ASSY	2	YY53D00007F1
2	CAPSCREW	40	M16X45



Installing travel motor

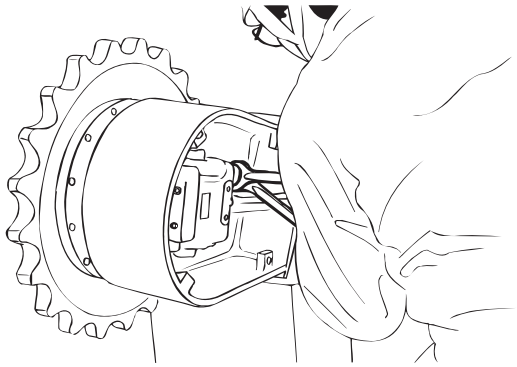
1.7.2 REMOVING

(1) Preparation for removal
Remove crawler (see page 9-3), liftup lower frame by lowering the boom, and plece a safety block(wood)to float and stabilize.
(2) Removing cover (1)
Remove sems bolt (4) M12X25 and also remove covers (1).
Tools: Socket: 19 mm



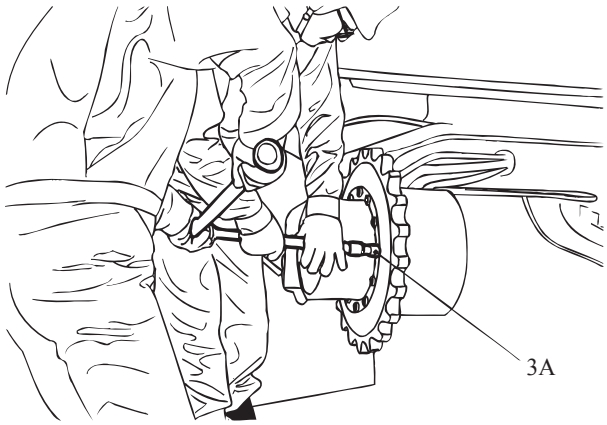
Removing and installing cover (1)

(3) Preparation of oil pan



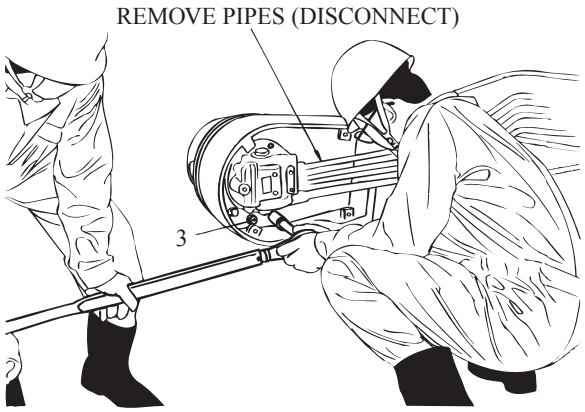
Removing and installing hydraulic pipe

(4) Removing hydraulic pipe
Release pressure from travel circuit, and bleed air in hydraulic oil tank, then remove all pipes connecting to travel motor. Then plug up all pipes and joint section to protect them from entry of dust.
Tools: Spanner: 19 mm, 27 mm, 36 mm



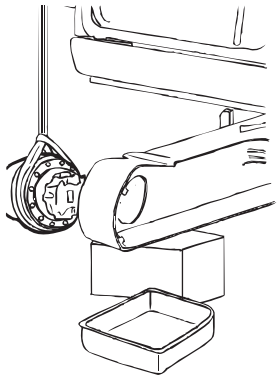
Removing and installing sprocket

(5) Removing sprocket
Removing eighteen (one side) capscrews (3A) M16X45.
Tools: Socket: 24 mm



Removing and installing travel motor attaching bolts

(6) Loosening travel motor attaching bolts (3)
Apply match marks on travel motor and crawler frame, and remove seventeen (one side) capscrews (3) M16X45.
Tools: Socket: 24 mm



Slinging travel motor

(7) Slinging travel motor assy
Sling travel motor with nylonsling applied on the side close to sprocket installing section and remove the motor.

Weight of motor: About. 103 kg (227 lbs)

1.7.3 INSTALLING

Installing of the travel motor piping is performed in the reverse order of removal.

NAME	SIZE	TOOLS HEX	NO.	TIGHTEING TORQUE N·m(lbf·ft)	REMARKS
SEMS BOLT	M12	19	6	83.4 (61)	APPLY LOCTITE #262
CAPSCREW	M16	24	3	279 (206)	
FLARELESS NUT FOR PIPES, SLEEVE	ϕ10X1.5	19	—	49(36)	
	ϕ15X2.0	27	—	118(87)	
	ϕ22X3.0	36	—	216(159)	
HOSE CAP	PF1/4	19	—	29.4(21.7)	
	PF1/2	27	—	78.5(57.9)	
CONNECTOR	PF1/4	19	—	36.3(27)	
	PF1/2	27	—	108(80)	
	PF3/4	36	—	162(119)	

1. Cleaning
   Check that contact surface of travel motor and crawler frame is free from burr and stain.
2. Tightening torque
   Tighten capscrew and hydraulic pipes to the torque specified in "Tightening Torque".
3. Fill inside from motor drain port to casing with hydraulic oil before piping for drain. When starting operation, operate motor in low idling and at low speed for several minutes, and check it for possible oil leakage and noise.