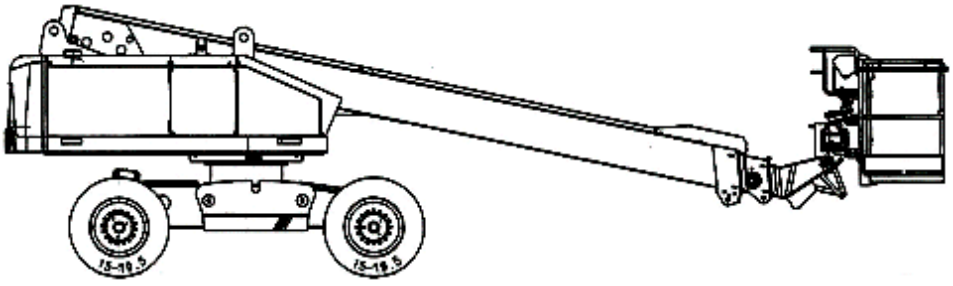
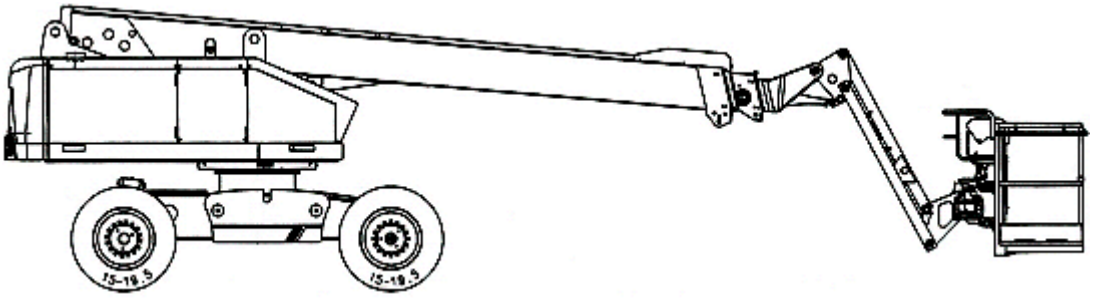
SME- 124B

SERVICE MANUAL

SP18A / ISP60
SP21A / ISP70
SP21AJ / ISP70J

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





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

Introduction

This manual describes correct adjustment and servicing procedures for Wheel type self- propelled Elevation work platforms: SP18A/ISP60, SP21A/ISP70 and SP21AJ/ISP70J 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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3. Hydraulic section

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6. Inspection and Adjustment

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1. General information

SP18A / ISP60 Specifications

Model				***SP18A / ISP60***	
Weight	Gross weight			12,300 kg	27,120 LBS
	Maximum tire loading force			9,800 kg	21,610 LBS
	Maximum tire ground contact pressure			7.0 kg/cm^2	100 PSI
Gradeability				45 % (24 degrees)	←
Maximum allowable tilt angle				5 degrees	←
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		1,300 rpm	←
		High		2,200 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			6.905 ~ 16.625 meters	22ft- 8in ~ 54ft- 7in
	Boom angle			- 12 ~ 70 degrees	←
	Rotation angle			360 degrees (Continuous)	←
Tires	Type			Foam filled tire	←
	Size			15 x 19.5	←
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	Forward	5.5±0.8 km/hour	3.42±0.50 MPH
			Reverse	5.5±0.8 km/hour	3.42±0.50 MPH
		Mid speed	Forward	2.8±0.4 km/hour	1.74±0.25 MPH
			Reverse	2.8±0.4 km/hour	1.74±0.25 MPH
		Low speed	Forward	1.3±0.2 km/hour	0.81±0.12 MPH
			Reverse	1.3±0.2 km/hour	0.81±0.12 MPH
Hydraulic system	Hydraulic oil	Tank capacity		150 liters	39.6 gallons
		Recommended oil		Shell Tellus oil T22	←
	Specific pressure	Travelling system		340 kg/cm^2	4,840 PSI
		Boom functions		210 kg/cm^2	2,990 PSI
		Platform rotation, Steering functions		140 kg/cm^2	1,990 PSI

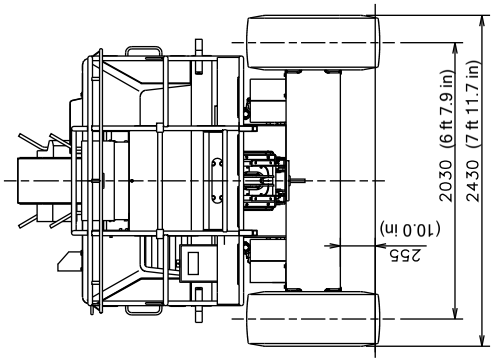
SP21A / ISP70 Specifications

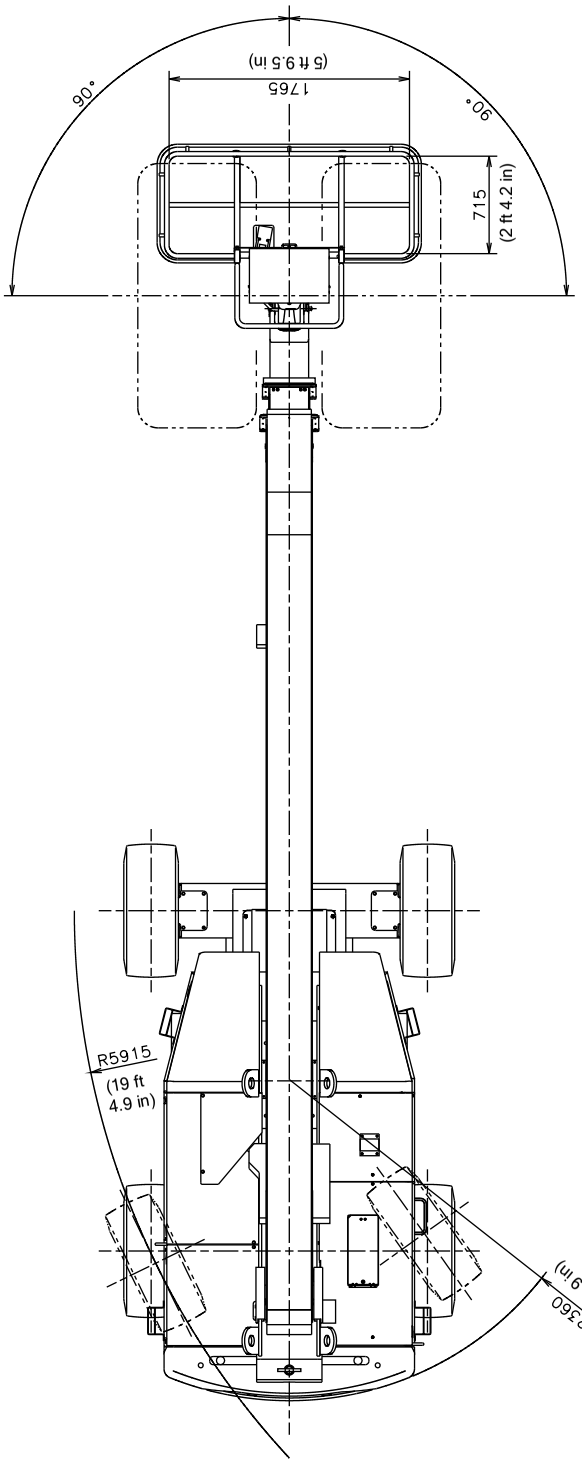
Model				***SP21A / ISP70***	
Weight	Gross weight			14,500 kg	31,970 LBS
	Maximum tire loading force			11,400 kg	25,130 LBS
	Maximum tire ground contact pressure			8.0 kg/cm^2	114 PSI
Gradeability				45 % (24 degrees)	←
Maximum allowable tilt angle				5 degrees	←
Maximum allowable wind speed				12.5 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		1,300 rpm	←
		High		2,200 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)	←
Tires	Type			Foam filled tire	←
	Size			15 x 19.5	←
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)		CW	90±12 seconds	←
			CCW	90±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	Forward	5.5±0.8 km/hour	3.42±0.50 MPH
			Reverse	5.5±0.8 km/hour	3.42±0.50 MPH
		Mid speed	Forward	2.8±0.4 km/hour	1.74±0.25 MPH
			Reverse	2.8±0.4 km/hour	1.74±0.25 MPH
		Low speed	Forward	1.3±0.2 km/hour	0.81±0.12 MPH
			Reverse	1.3±0.2 km/hour	0.81±0.12 MPH
Hydraulic system	Hydraulic oil	Tank capacity		150 liters	39.6 gallons
		Recommended oil		Shell Tellus oil T22	←
	Specific pressure	Travelling system		340 kg/cm^2	4,840 PSI
		Boom functions		210 kg/cm^2	2,990 PSI
		Platform rotation, Steering functions		140 kg/cm^2	1,990 PSI

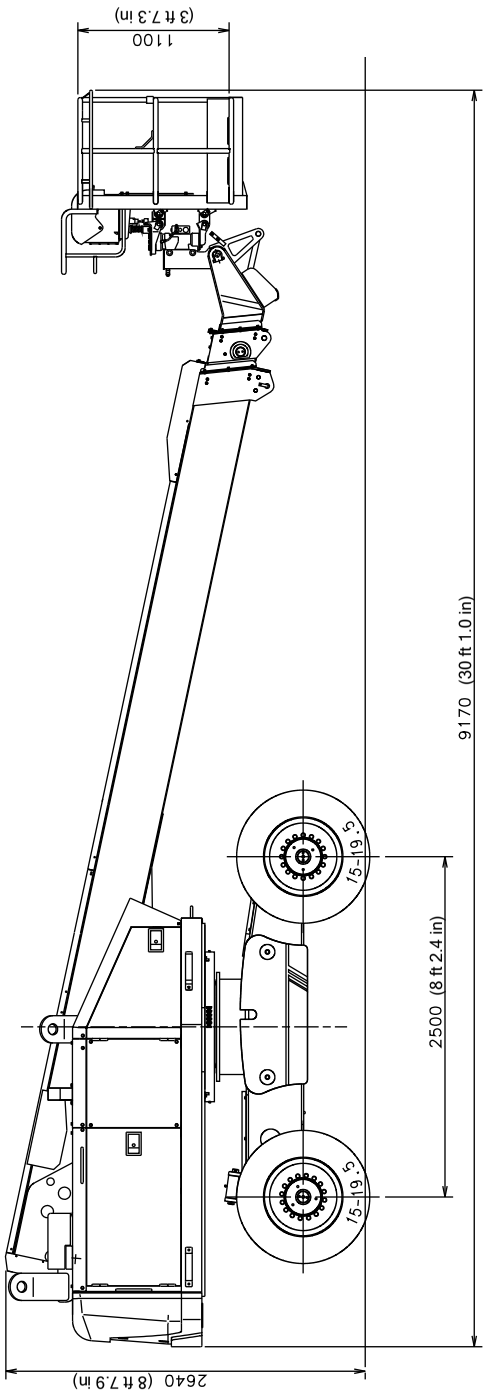
SP21AJ / ISP70J Specifications

Model				*SP21AJ / ISP70J*	
Weight	Gross weight			14,700 kg	32,410 LBS
	Maximum tire loading force			11,300 kg	24,910 LBS
	Maximum tire ground contact pressure			8.0 kg/cm^2	114 PSI
Gradeability				45 % (24 degrees)	←
Maximum allowable tilt angle				5 degrees	←
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		1,300 rpm	←
		High		2,200 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 articulating angle			- 60 ~ 70 degrees	←
Tires	Type			Foam filled tire	←
	Size			15 x 19.5	←
Actuating speed	Boom elevation (with the boom fully retracted)		Up	40±6 seconds	←
			Down	40±6 seconds	←
	Fly- jib elevation		Up	30±5 seconds	←
			Down	25±5 seconds	←
	Boom telescope		Out	40±6 seconds	←
			In	30±5 seconds	←
	Boom rotation (with the boom fully retracted)		CW	110±12 seconds	←
			CCW	110±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	Forward	5.5±0.8 km/hour	3.42±0.50 MPH
			Reverse	5.5±0.8 km/hour	3.42±0.50 MPH
		Mid speed	Forward	2.8±0.4 km/hour	1.74±0.25 MPH
			Reverse	2.8±0.4 km/hour	1.74±0.25 MPH
		Low speed	Forward	1.3±0.2 km/hour	0.81±0.12 MPH
			Reverse	1.3±0.2 km/hour	0.81±0.12 MPH
Hydraulic system	Hydraulic oil	Tank capacity		150 liters	39.6 gallons
		Recommended oil		Shell Tellus oil T22	←
	Specific pressure	Travelling system		340 kg/cm^2	4,840 PSI
		Boom functions		210 kg/cm^2	2,990 PSI
		Fly- jib, Platform rotation, Steering functions		140 kg/cm^2	1,990 PSI

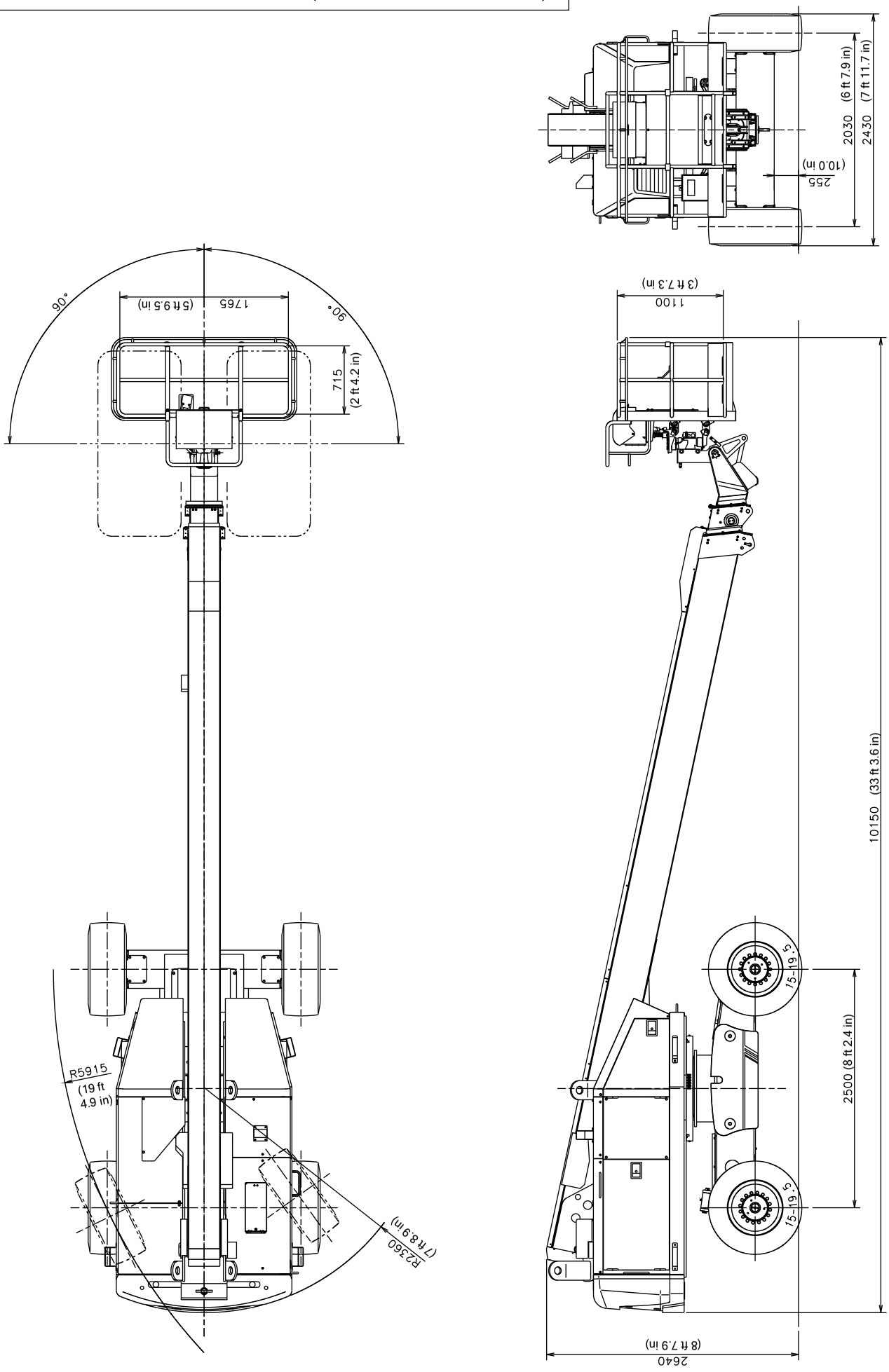
Overall dimensions (SP18A / ISP60)





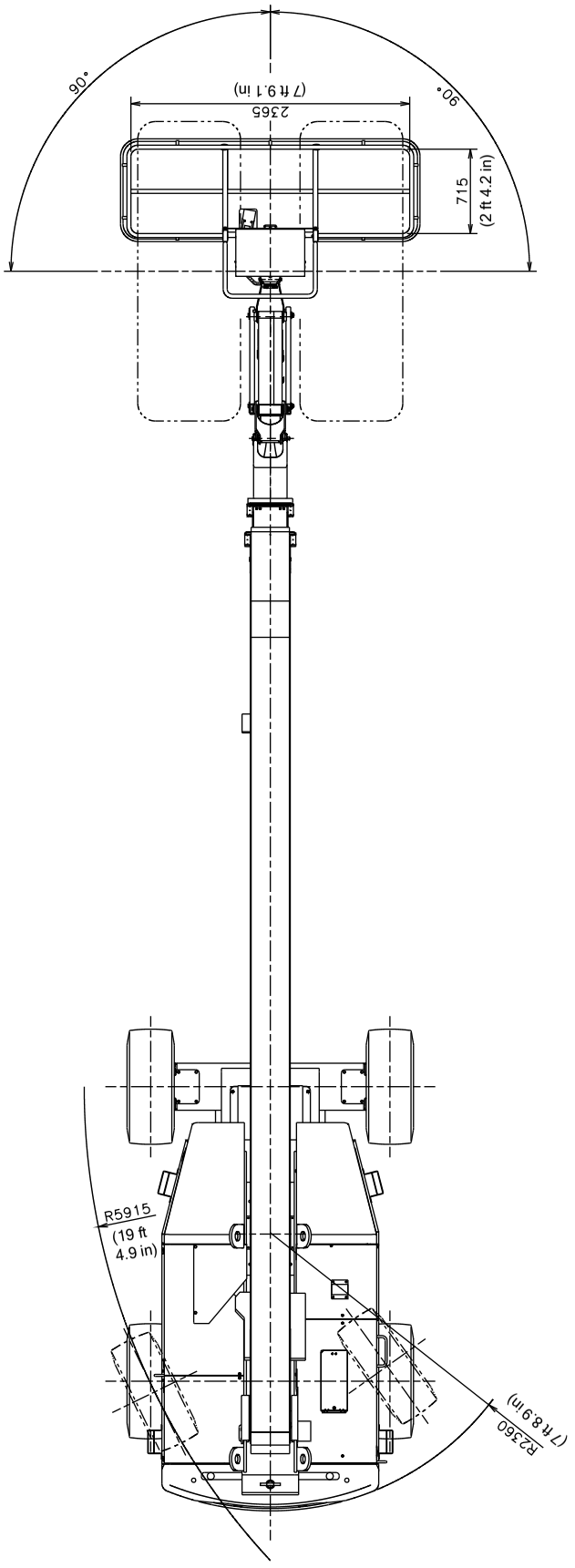


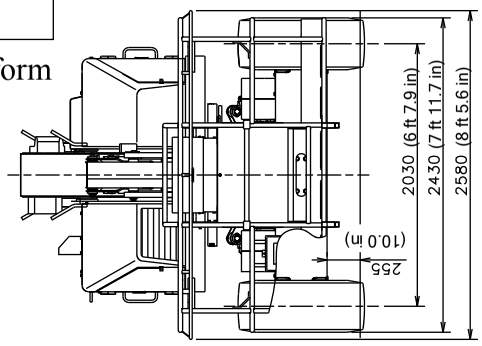
Overall dimensions (SP21A / ISP70)

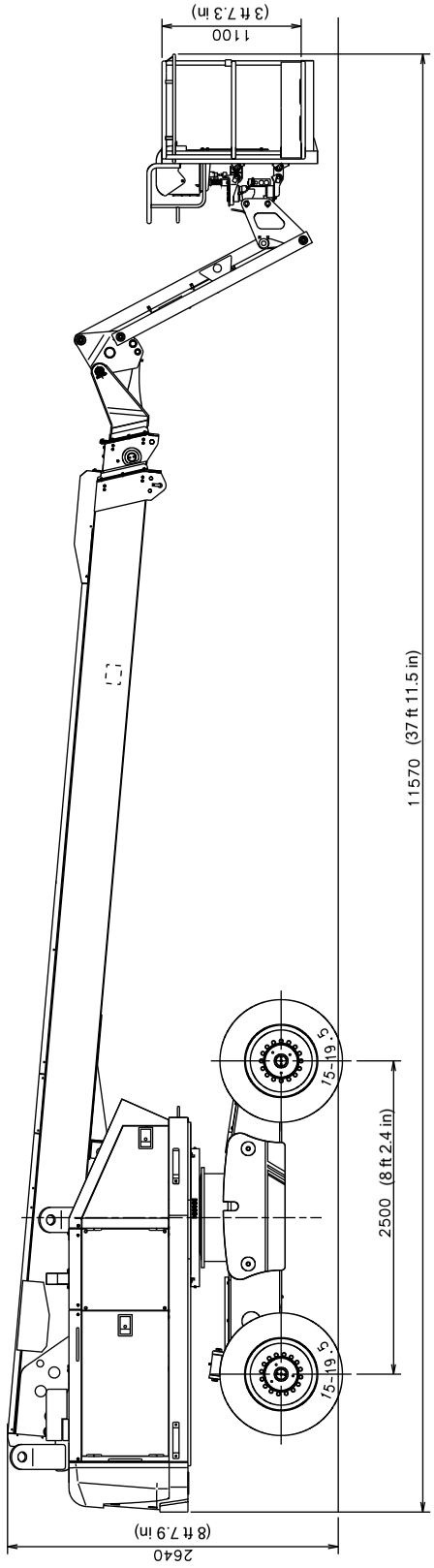


Overall dimensions (SP21AJ / ISP70J)

This drawing shows the machine that is equipped with 8-foot platform

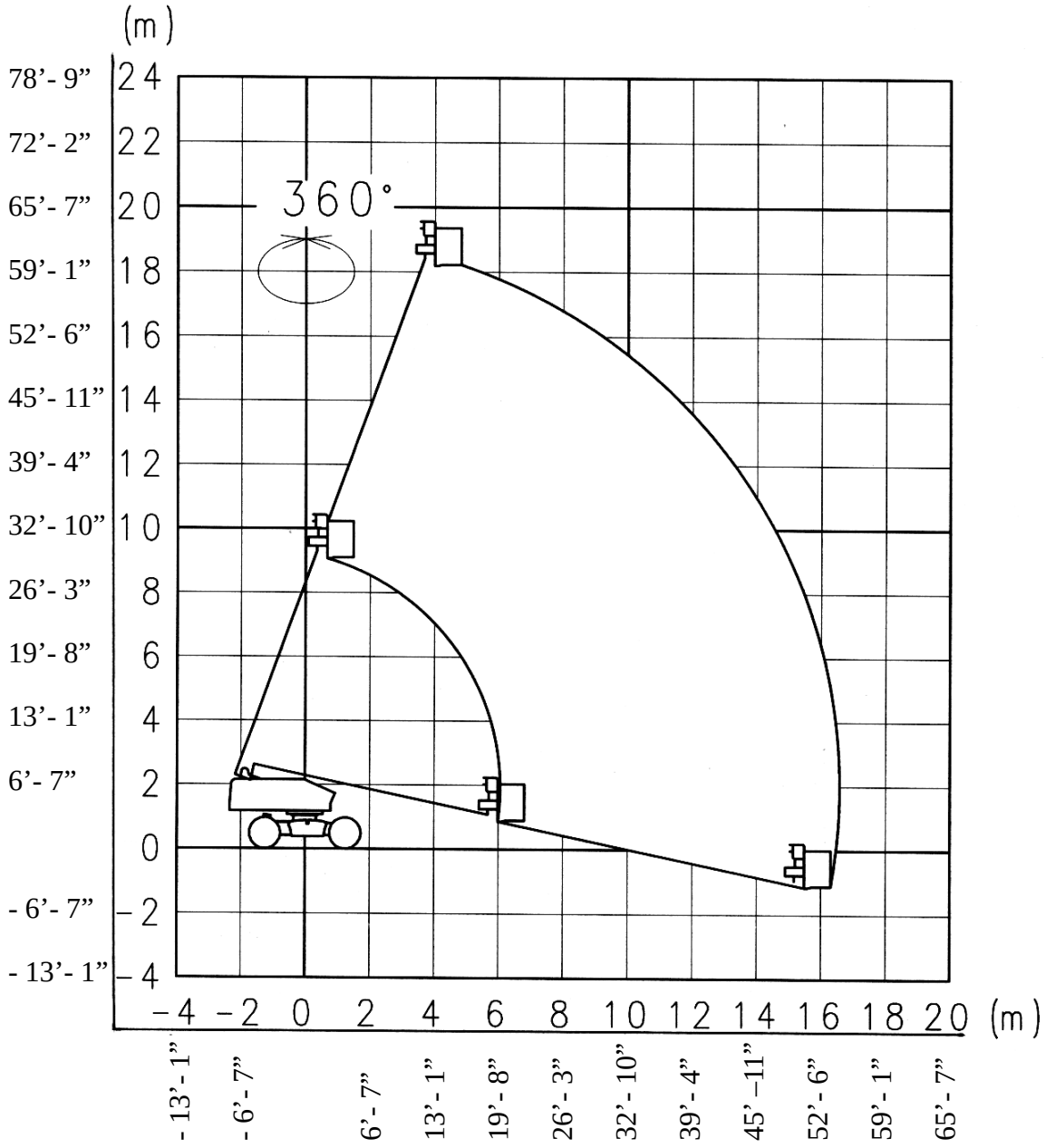






Working range diagram (SP18A / ISP60)

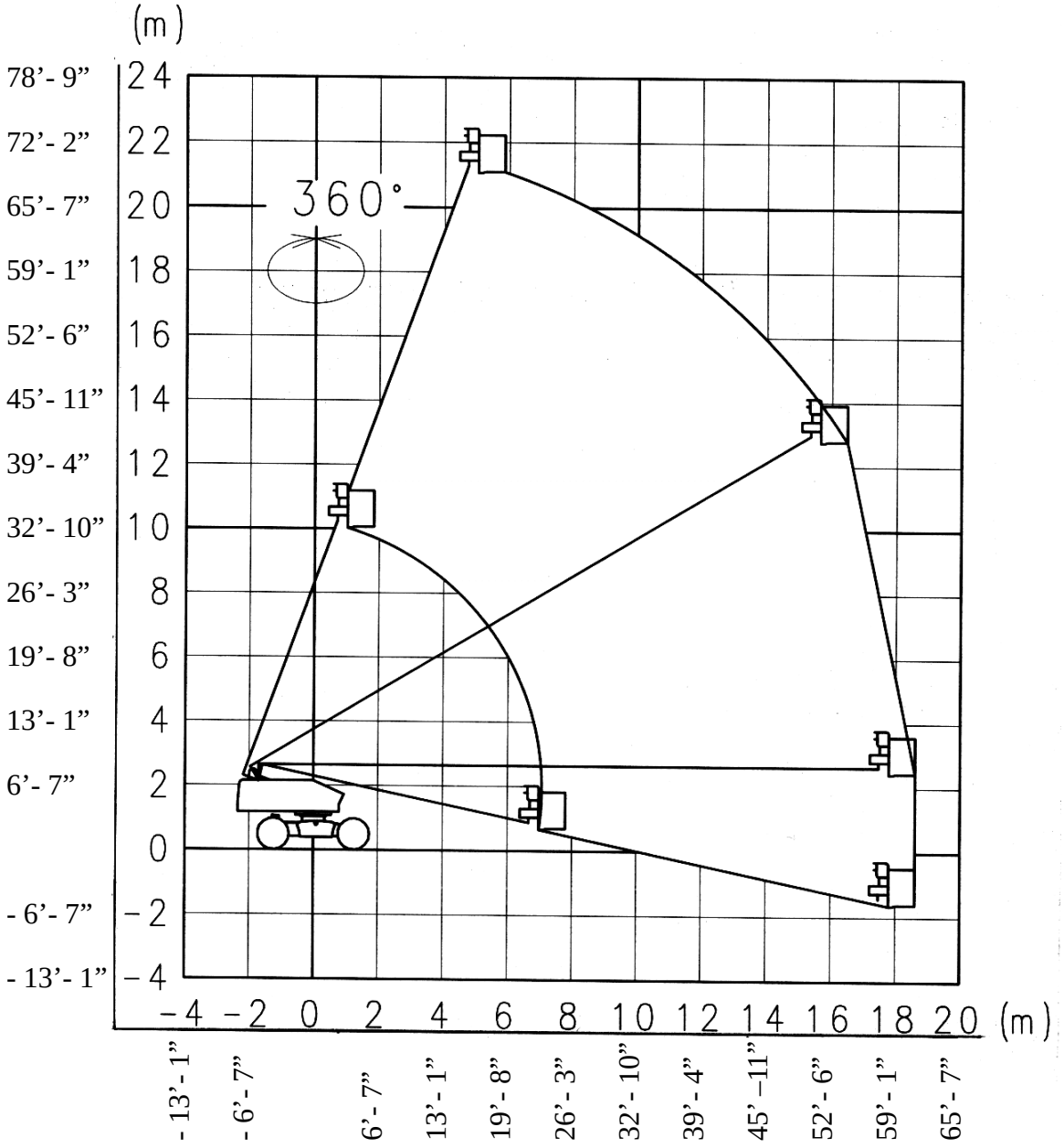
Specific working load: 227 kg (500 LBS)



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

Working range diagram (SP21A / ISP70)

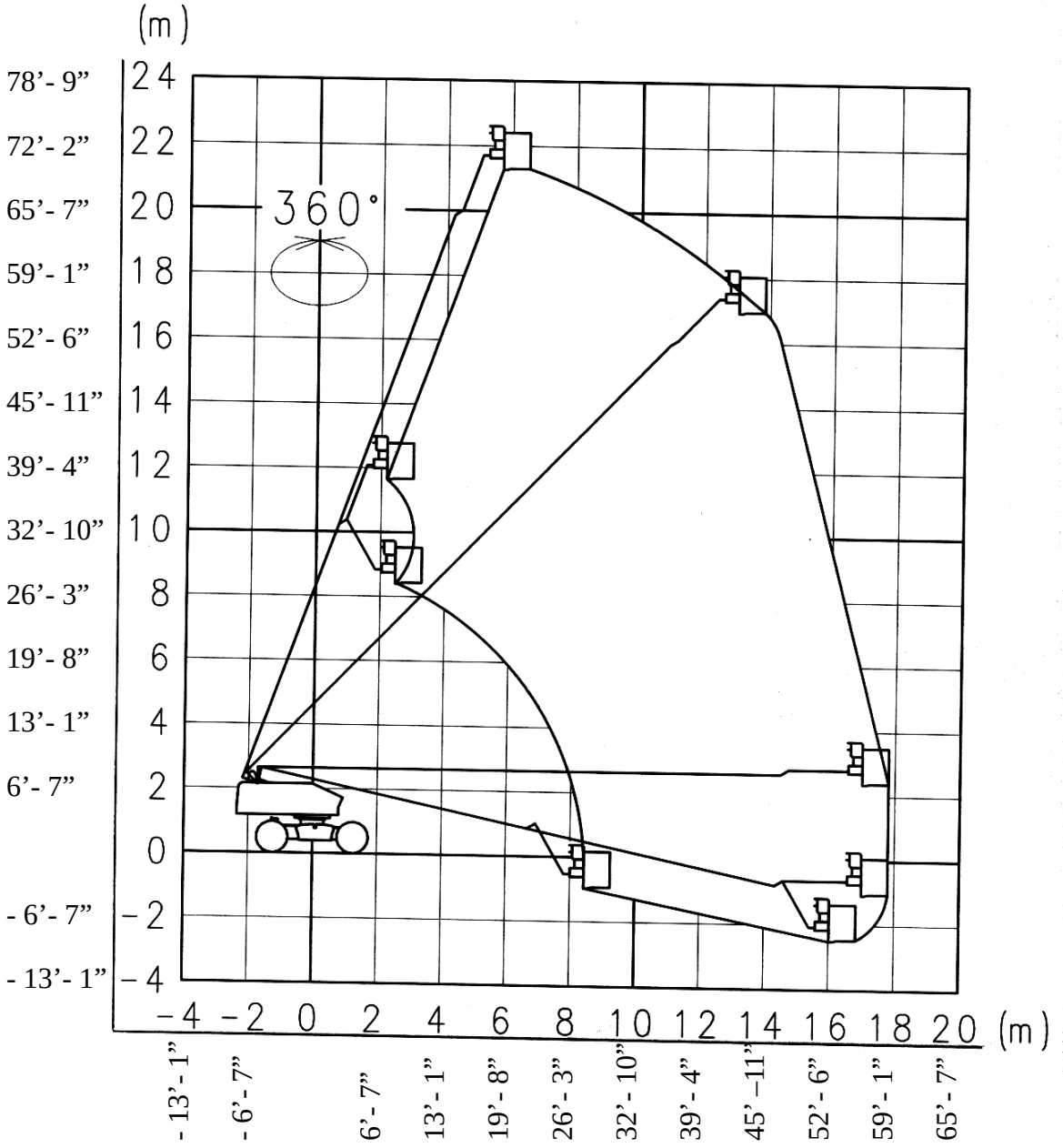
Specific working load: 227 kg (500 LBS)



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

Working range diagram (SP21AJ / ISP70J)

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.

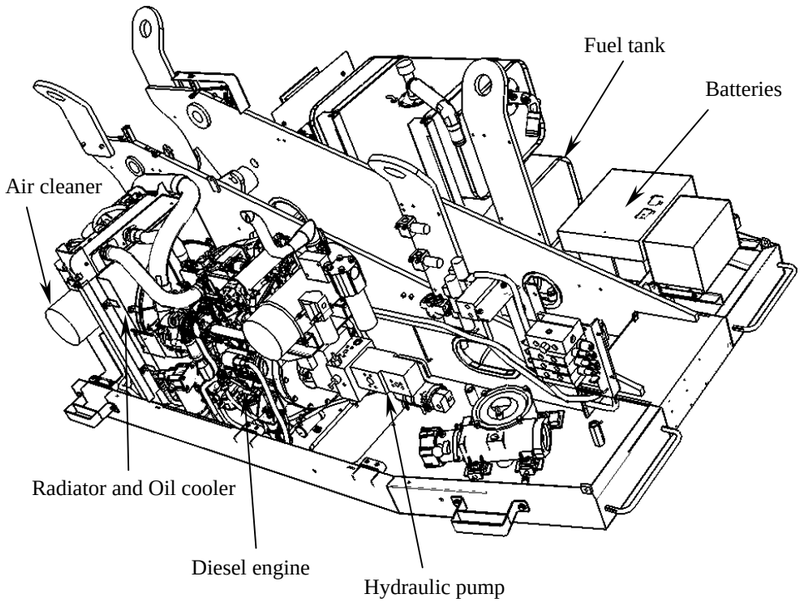
Safety Devices

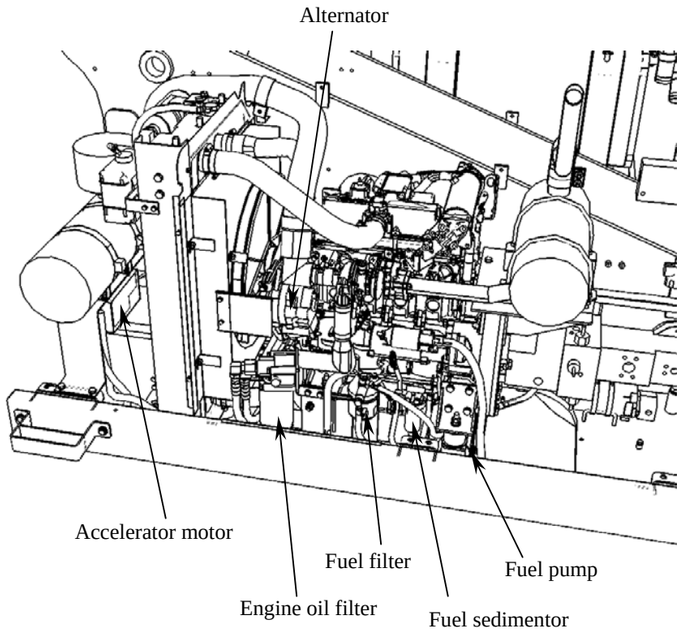
The safety devices ensure safety and prevent damage to the machine.

Name	Main function
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 (or pilot check) valve on Upper leveling cylinder	Maintains the platform level in the event of hydraulic hose breakage.
Foot switch	The boom, traveling and platform rotating functions are disabled unless the foot switch is depressed.
Motion alarm buzzer	The motion alarm buzzer sounds when the machine is in motion to warn the people nearby.
Emergency stop switch	Stops all of the movements of the machine when this switch is pressed.
Tilt alarm buzzer	The tilt alarm buzzer sounds, if the machine tilts more than 5 degrees.
Travel speed limit system	The high and mid speed traveling is disabled, unless the boom is retracted and is lowered under the horizontal.
Rotation lock pin	Fixes the turntable to the chassis to prevent the turntable from being rotated when transporting the machine.
Emergency pump	Auxiliary hydraulic pump driven by the battery. And used to lower the platform in the event of engine or main pump failure.
Alarm horn	Before moving the machine, sound the alarm horn to warn the people around the machine.
Boom rotating speed limit system	This system automatically reduces the boom rotation speed to ensure the safe speed as the boom is extended.
Boom elevating speed limit system	This system automatically reduces the boom rising and lowering speed to ensure the safe speed as the boom is extended.
Traveling speed limit system	This system automatically reduces the traveling speed to ensure the safe speed as the boom extended.
Work range limit system	This system automatically limits the work radius (Outreach) of the platform within the specific range. (This system is not equipped on SP18A/ISP60.)
Boom wire rope failure detecting system	This system disables the boom extending functions in the event of the boom extension wire rope failure.
Overload sensing system (CE model)	This system disables all of the functions when the platform is overloaded. (This system is equipped only on CE specifications.)
Boom / Travel function interlock system (CE model)	This system stops all of the functions when the travel and boom operations are conducted simultaneously. (This system is equipped only on CE specifications.)

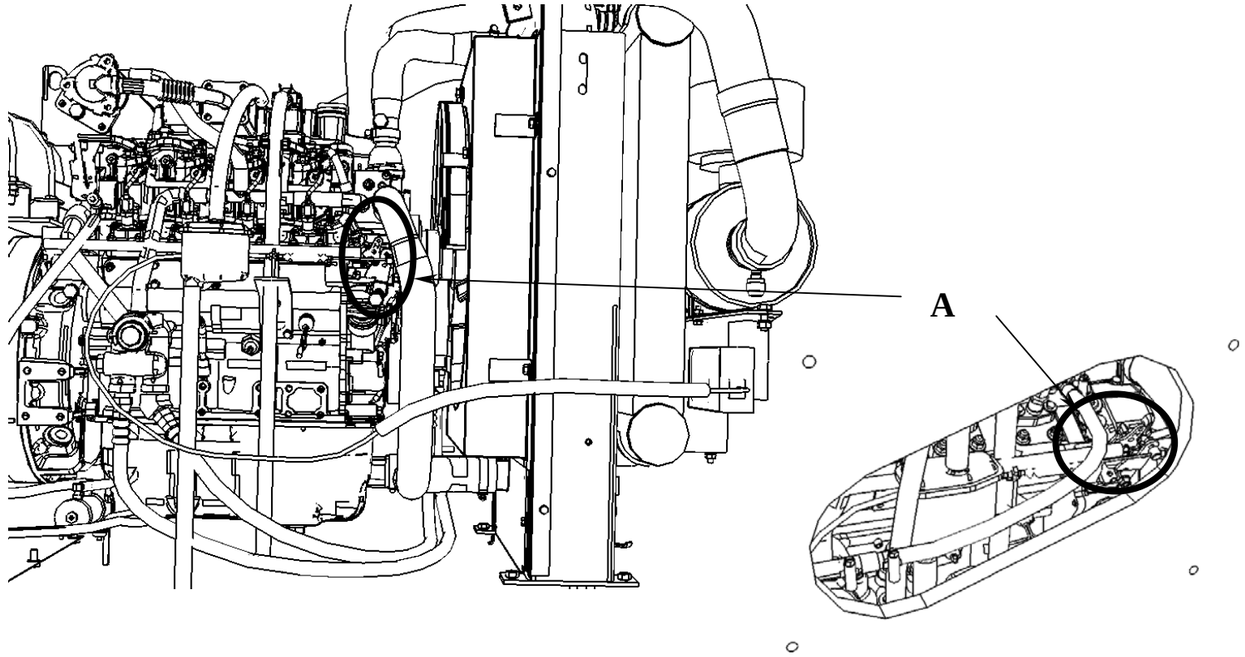
2. Mechanical section

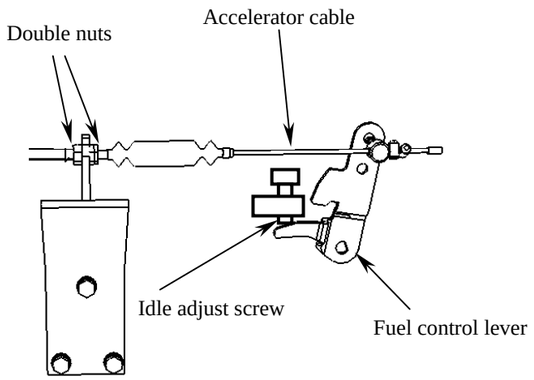
Diesel engine



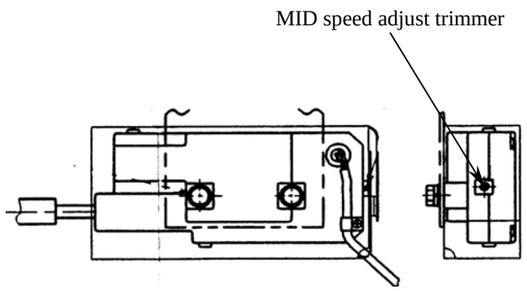


Fuel system





A - detail



Accelerator motor - detail

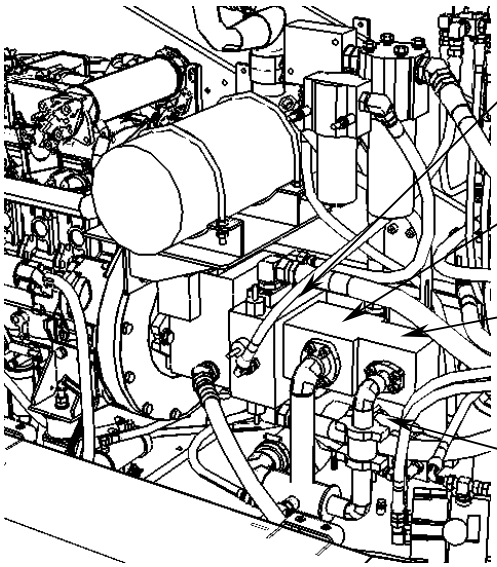
Adjustment procedures of Engine rpm

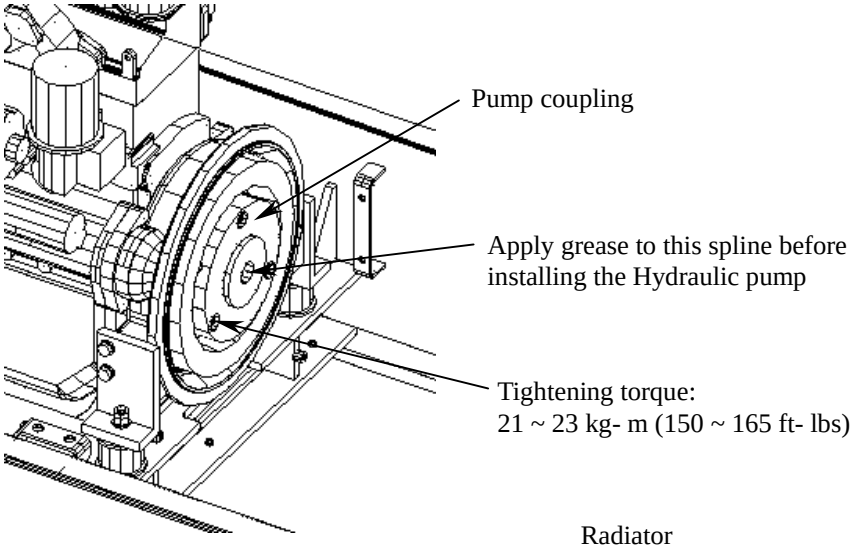
See the section of ***6. Inspection and Adjustment*** for detail.

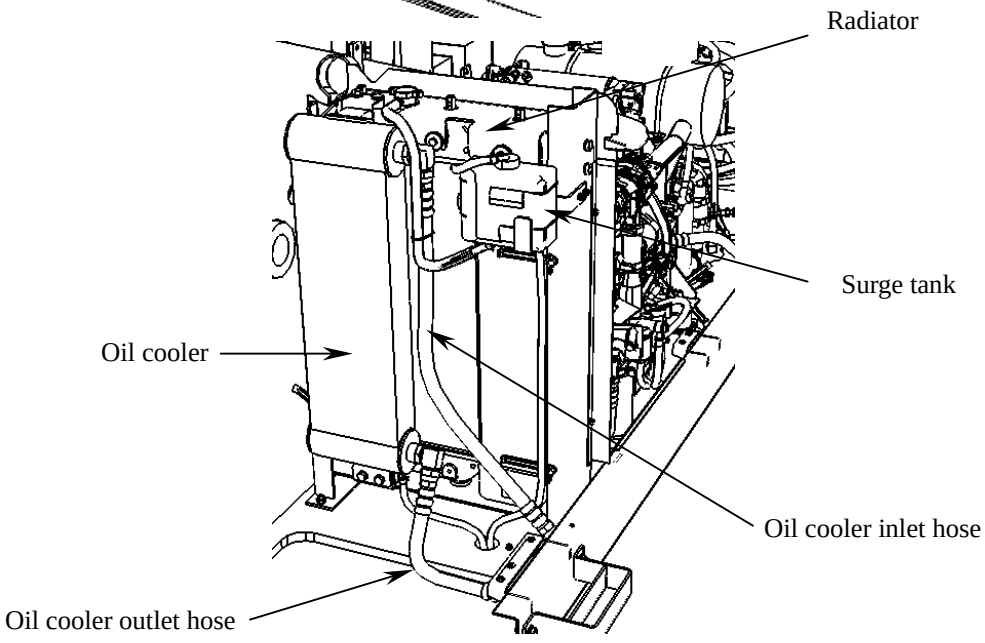
1	Warm up the engine.
2	Turn the ***Idle adjust screw*** to adjust the Low (Idling) speed to 1,020 rpm.
3	Turn the ***Double nuts*** to adjust the High speed to 2,200 rpm.
4	Turn the ***Mid speed adjust trimmer*** that is installed on the accelerator motor to adjust the Mid speed to 1,300 rpm.

- Load the engine by imposing the relief pressure, when adjusting the High and Mid speeds.

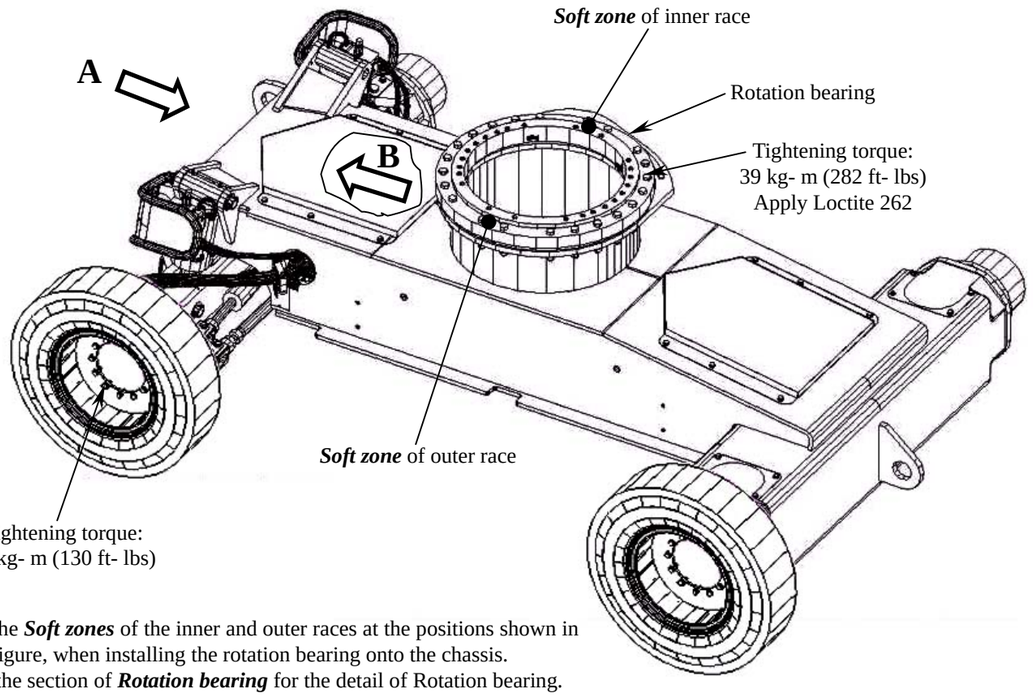
Hydraulic pump and Oil cooler installations





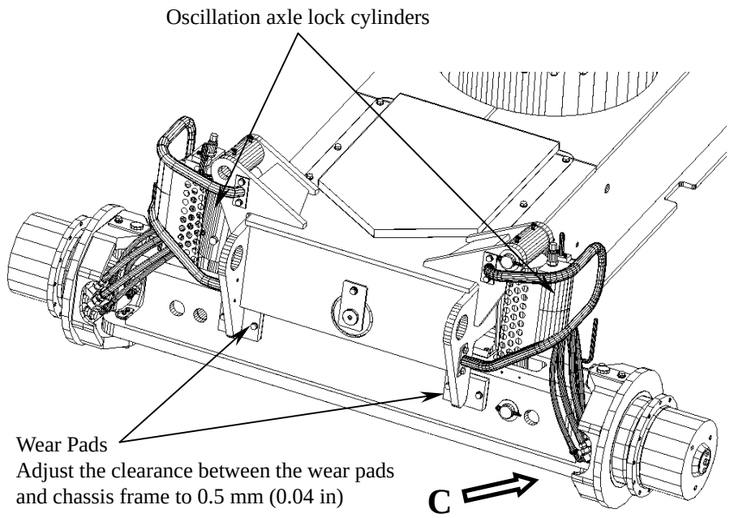


Chassis

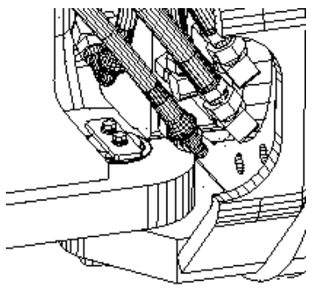


Note:

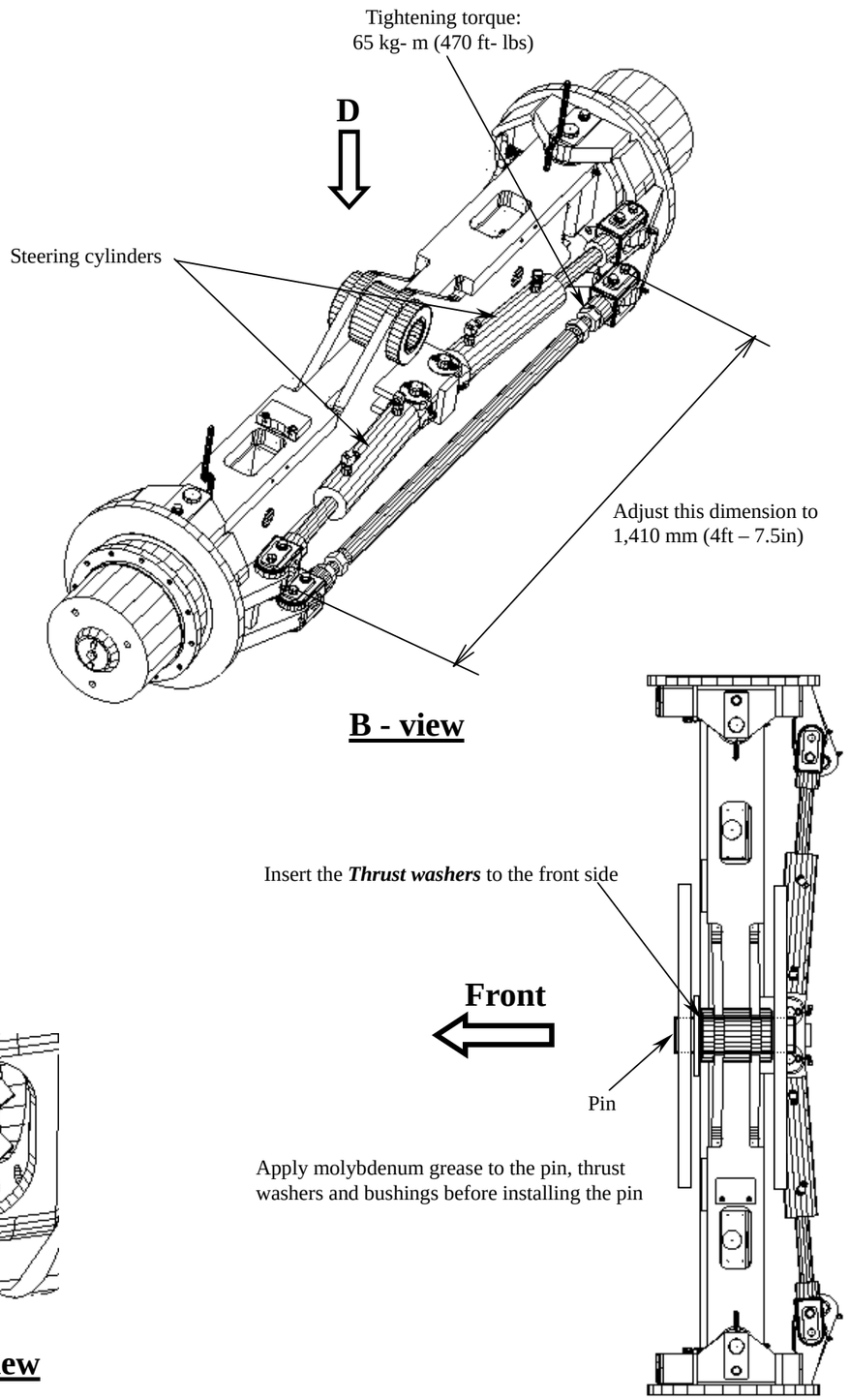
- Set the ***Soft zones*** of the inner and outer races at the positions shown in the figure, when installing the rotation bearing onto the chassis.
- See the section of ***Rotation bearing*** for the detail of Rotation bearing.



A - view



C - view

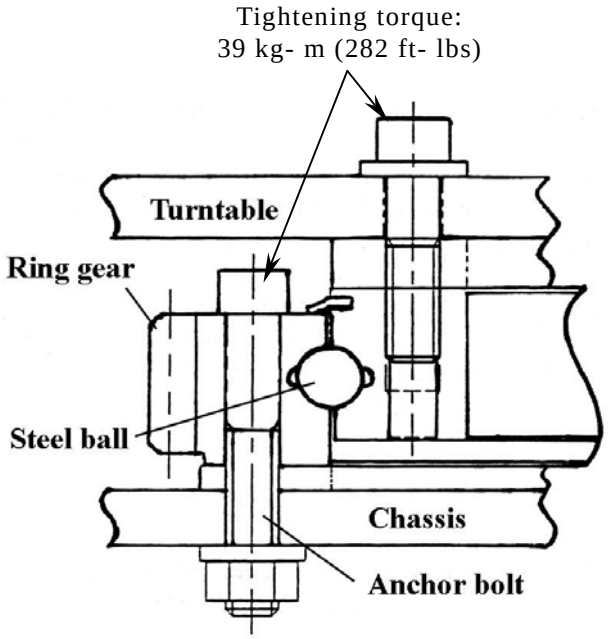


B - view

D - view

Rotation bearing

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



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.

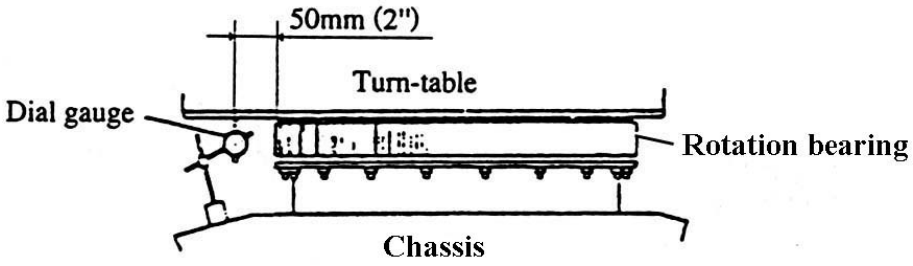
2. Check the ring gear for cracks and any other damage.
   To make the cracks obvious, use a liquid penetrant test such as a color check.

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 numerical value of free-play.

- Standard free-play: 0.9 mm (0.035 in).
- Serviceable limit: 3.0 mm (0.118 in).

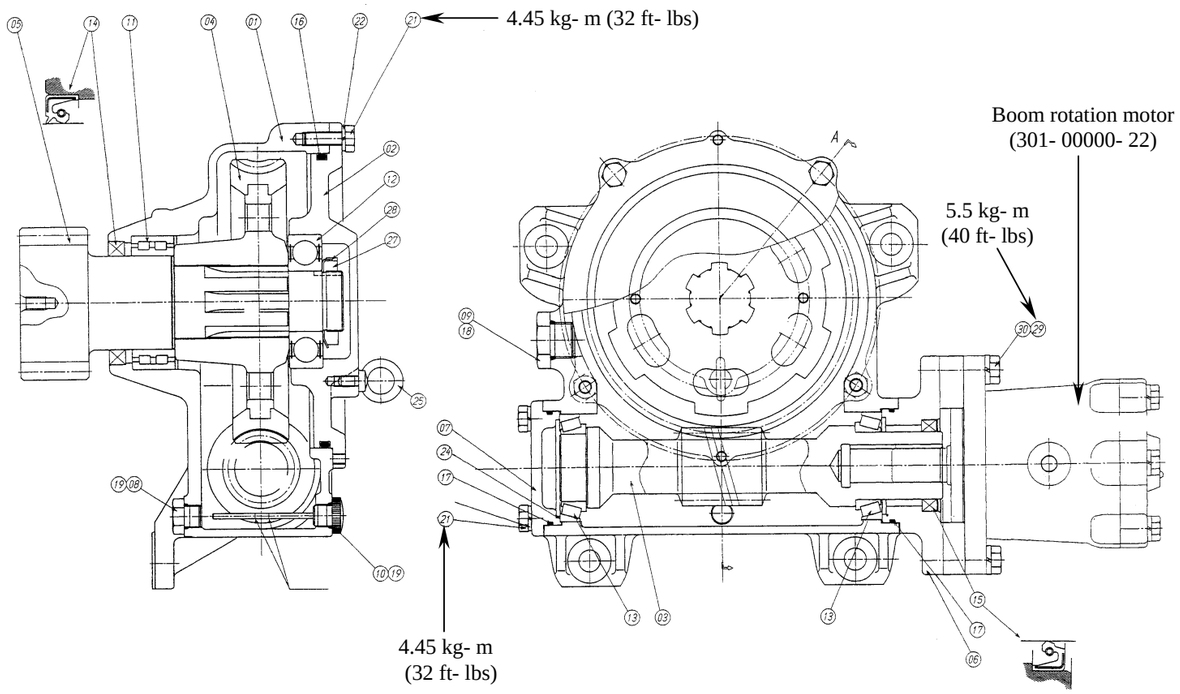
NOTE:

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



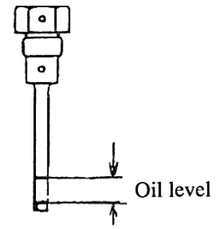
01	Case	11	Needle roller bearing	21	Bolt
02	Cover	12	Ball bearing	22	Spring washer
03	Worm shaft	13	Taper roller bearing	23	----------
04	Worm wheel	14	Oil seal	24	Shim
05	Pinion shaft	15	Oil seal	25	Eye bolt
06	Motor flange	16	O- ring	26	----------
07	Cover	17	O- ring	27	Bearing nut
08	Oil drain plug	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.

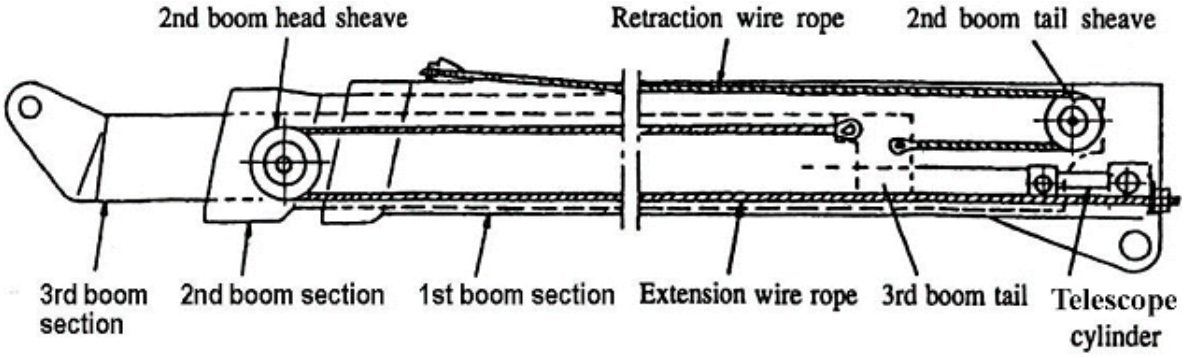
While, the 3rd boom section is connected to the 2nd boom section by the extension and retraction wire ropes as shown in the figure below.

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.

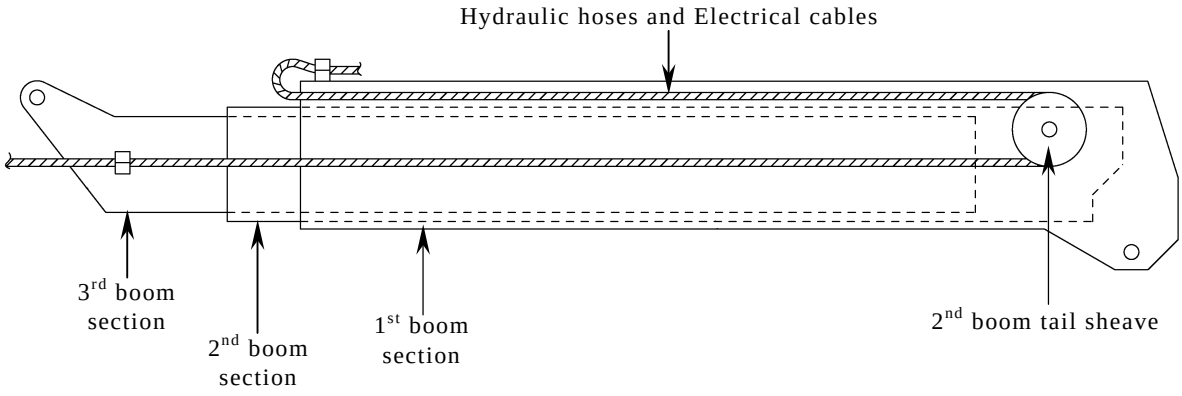
The extension wire ropes are also connected to the tail of the 3rd boom section through the head sheave that is installed on the head of the 2nd boom section.

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



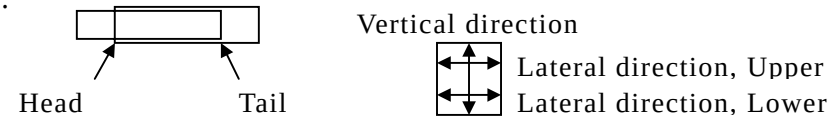
3. Inspection procedures

The boom is to be disassembled for a detailed inspection every 4 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.

   NOTE :

   - Check each wear pad for wear, and replace it if necessary.
   - Apply a thread lock agent to the thread of each setscrew for wear pad before setting.

     Recommended thread lock agent: Loctite 262.

2. Bend of boom section.

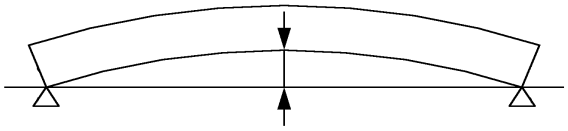
   1) Set the boom horizontally and extend it fully.

   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:

	SP18A	SP18AJ	SP21A	SP21AJ
Vertical direction	10.6 mm (0.417”)	9.8 mm (0.386”)	12.1 mm (0.476”)	12.1 mm (0.476”)
Lateral direction	7.1 mm (0.280”)	6.5 mm (0.256”)	8.1 mm (0.319”)	8.1 mm (0.319”)

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 = 50 mm (1.97 in) or more” and “Depth = 2 mm (0.08 in) or more”

4. 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.

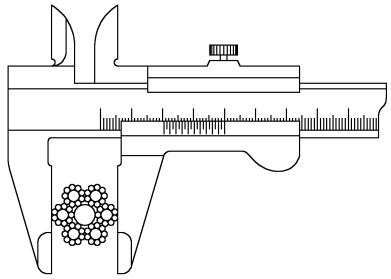
5. Lubrications

   Check the grease on the wear pad- sliding surface of each boom section and apply multipurpose grease, if necessary.

4. Extension / Retraction wire ropes

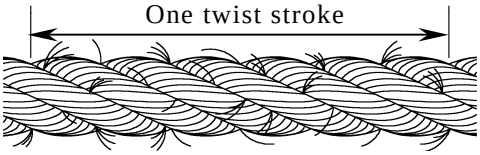
After disassembling the boom, inspect the extension and retraction wire ropes as follows.

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.

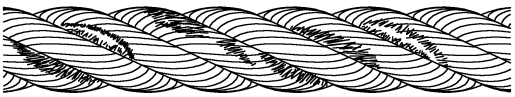


	Nominal diameter	Serviceable limit
Retraction wire rope	ϕ 8.0 mm (0.32 in)	ϕ 7.8 mm (0.31 in) or less
Extension wire rope	ϕ 12.0 mm (0.47 in)	ϕ 11.7 mm (0.46 in) or less

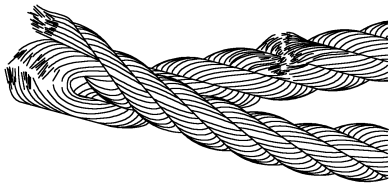
2. Check for broken wires.
   If you find 3 or more single wires cut in one twist stroke, replace the wire rope.



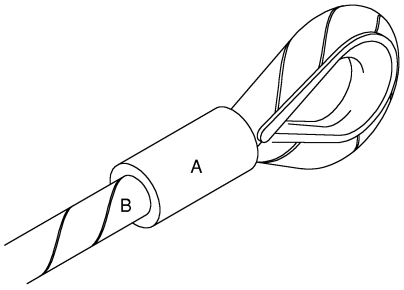
3. Check wire ropes for rust formation.
   If the rust is penetrated into the rope, replace the wire rope.



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

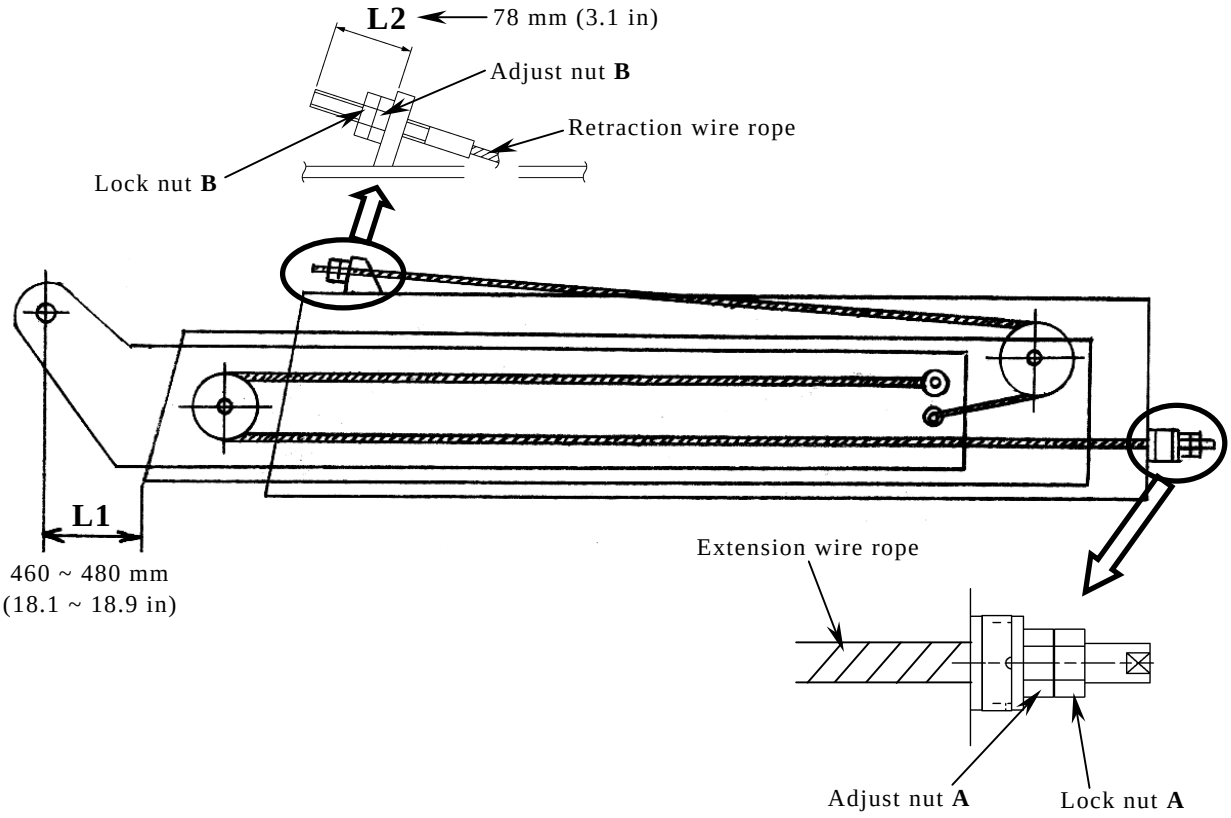


5. Check carefully the end sections of the wire rope, especially sections A and B.
   Replace the wire rope, if any defects are found.

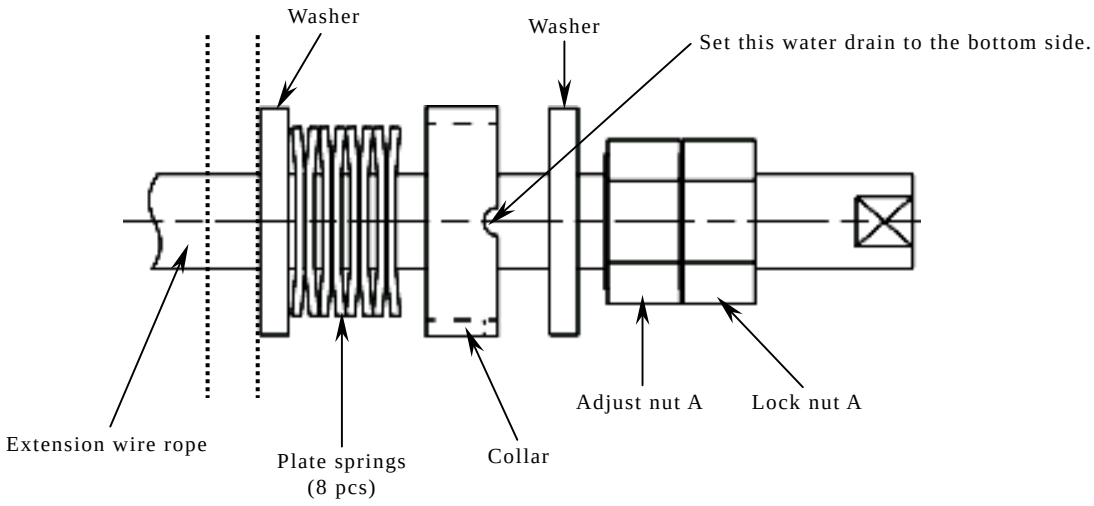


5. Adjustment of Extension/Retraction wire ropes

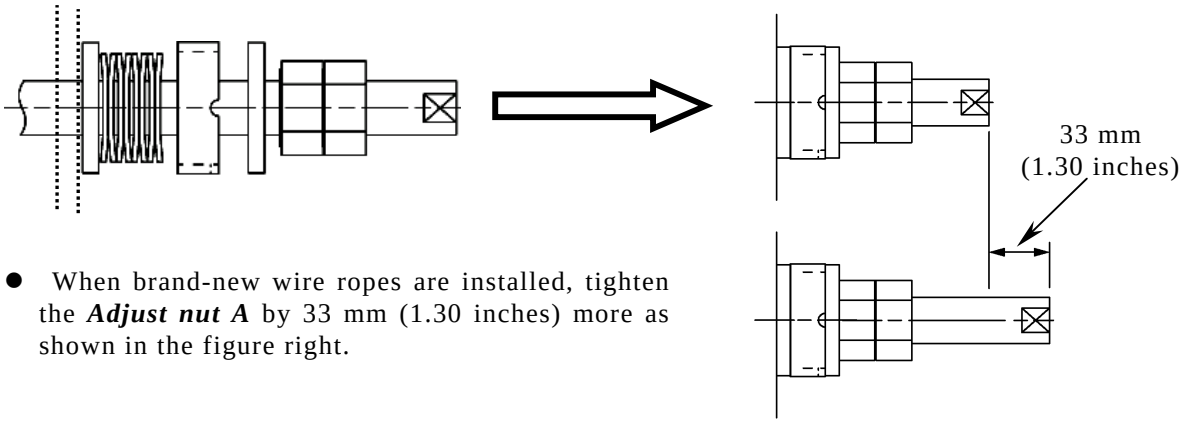
Adjust the tension of the Extension/Retraction wire ropes as follows.



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.

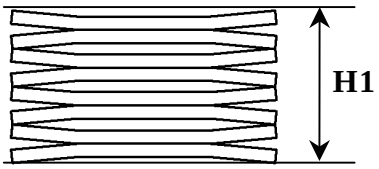
5. Measure the ***"Dimension L1"*** and make sure that it is 460 ~ 480 mm (18.1 ~ 18.9 inches).
6. Adjust the ***"Dimension L1"*** as follows, if the ***"Dimension L1"*** is not 460 ~ 480 mm (18.1 ~ 18.9 inches).
   - In case the ***"Dimension L1"*** is shorter than 460 mm (18.1 inches).

     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).

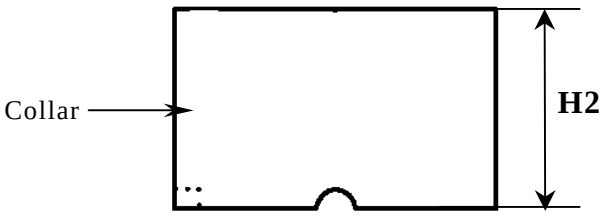
- When replacing the ***Plate springs*** with the new ones, make sure to use the suitable collar by following the next instructions.

  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.

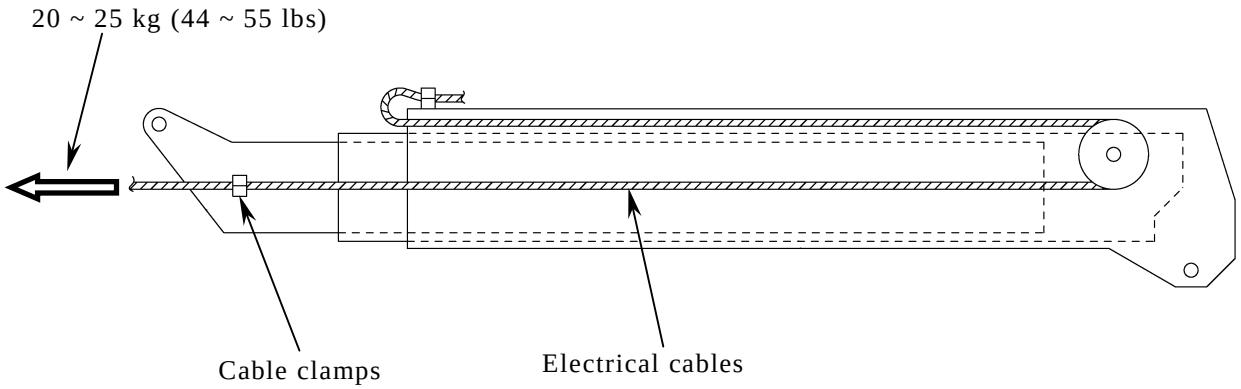
Height (H1) of 8 plate springs	mm	22.0 ~ 22.6	22.6 ~ 23.2	23.2 ~ 23.8	23.8 ~ 24.4	24.4 ~25.0	25.0 ~ 25.6
	inch	0.86 ~ 0.89	0.89 ~ 0.91	0.91 ~ 0.94	0.94 ~ 0.96	0.96 ~ 0.98	0.98 ~ 1.01
Height (H2) of suitable collar	mm	16.1	17.0	17.7	18.3	19.1	19.8
	inch	0.63	0.67	0.70	0.72	0.75	0.78
Part number of the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



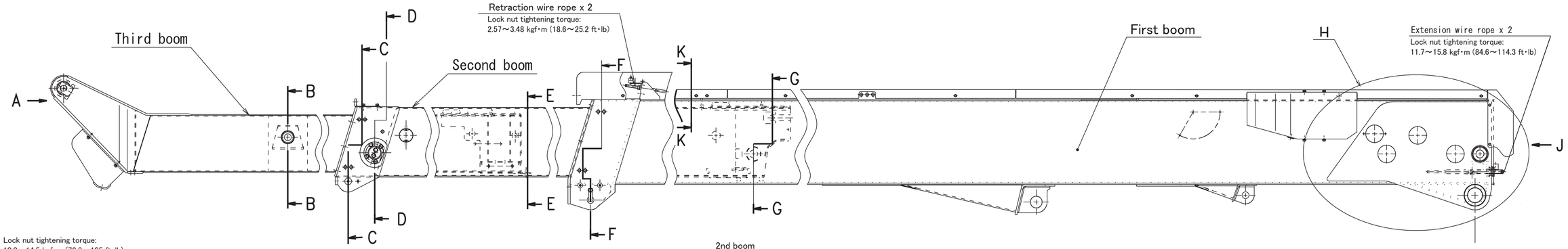
6. Tension on Electrical cables

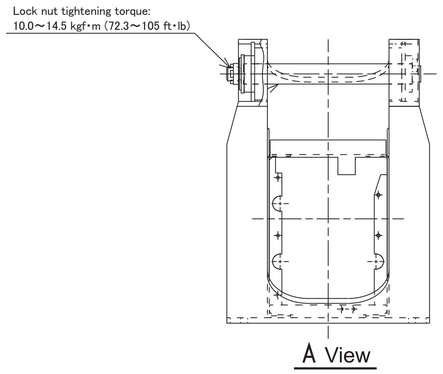
Impose the proper tension onto the electrical cables as follows every 6 months or 600 hours.
It is necessary to impose the tension after adjusting the boom extension/retraction wire ropes.

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.

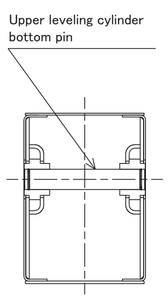


7. Sectional drawing (1/2)

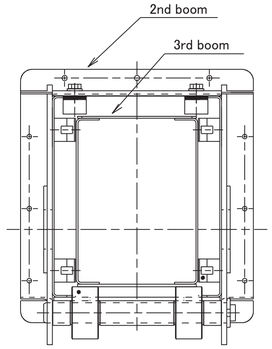




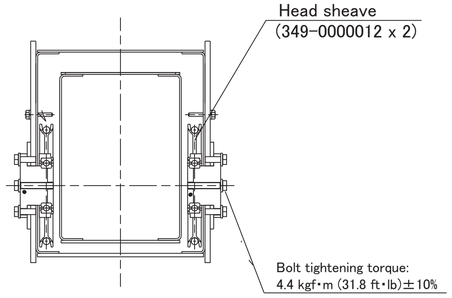
A View



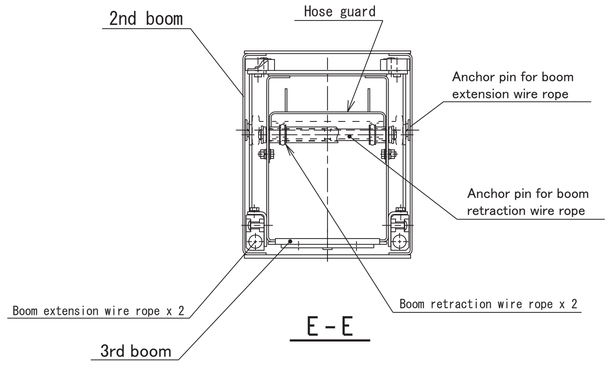
B-B



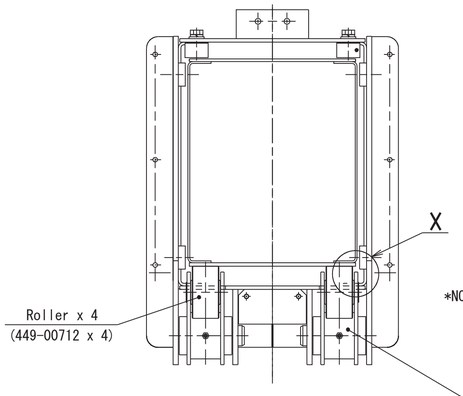
C - C



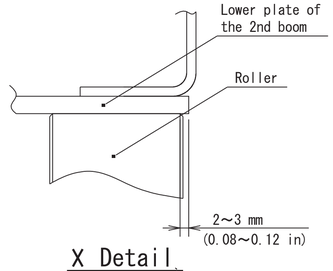
D-D



E-E

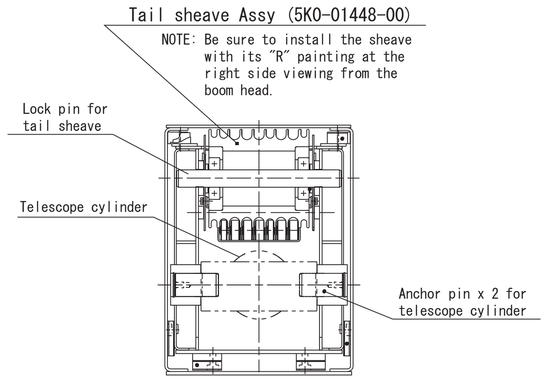


F-F

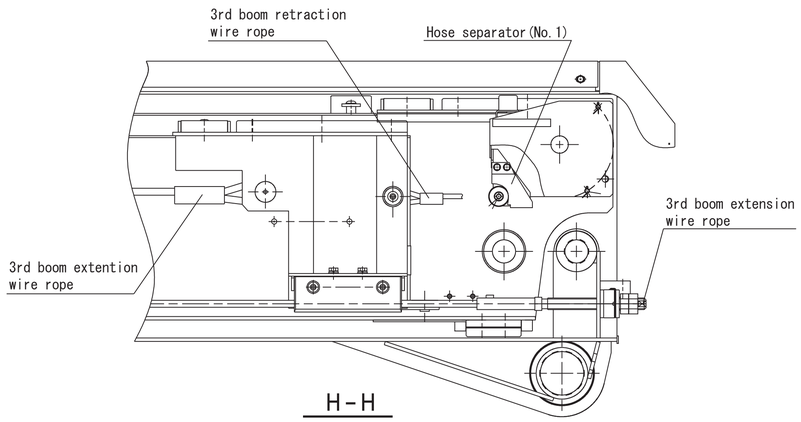


X Detail

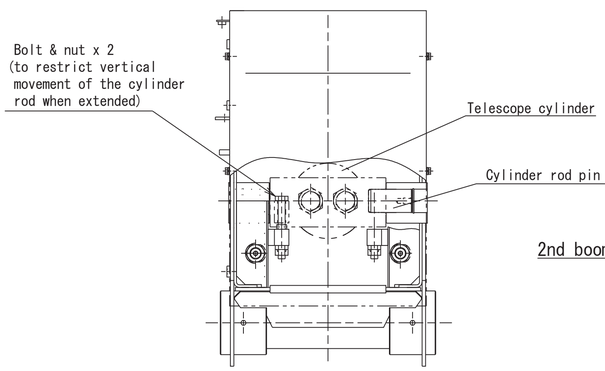
*NOTE: Adjust the position of roller bracket by spacers so that the outer line of roller comes inside of the edge of the 2nd boom lower plate as shown in figure above.



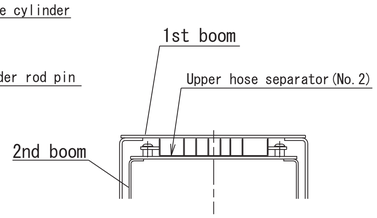
G-G



H-H

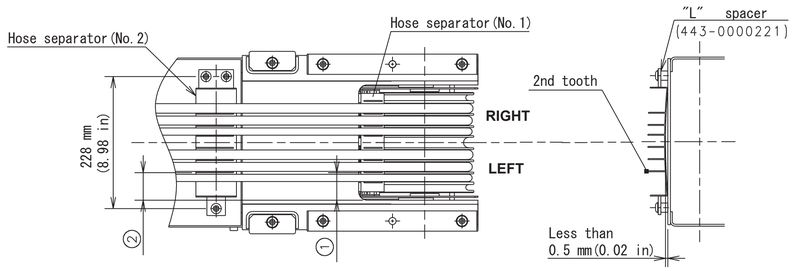


J View



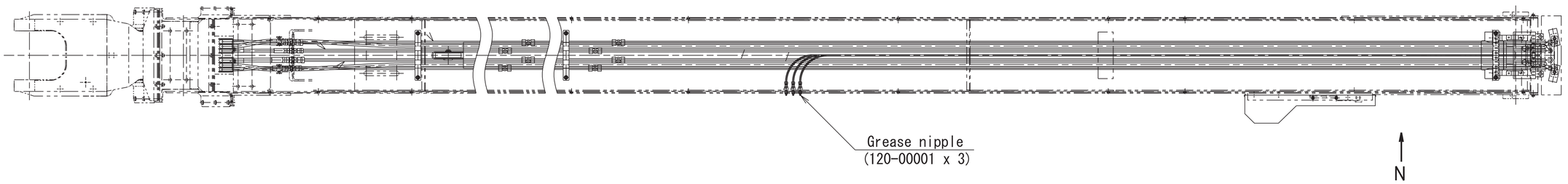
K-K

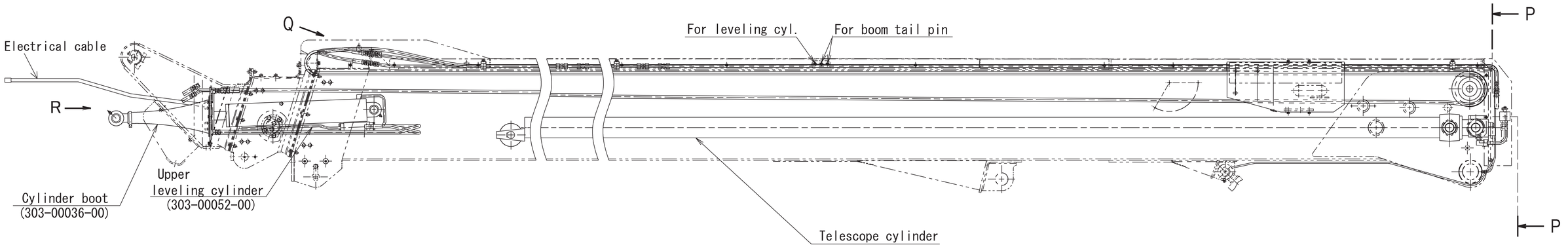
*NOTE: (1) Measure the dimension ① (between the 1st and 2nd tooth of the No. 1 separator from the left.
(2) Install the No. 2 separator so that the dimensions ① and ② are the same.
(3) The No. 2 separator should have firm contact with the upper plate of the 2nd boom.
In case any gap is observed, insert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

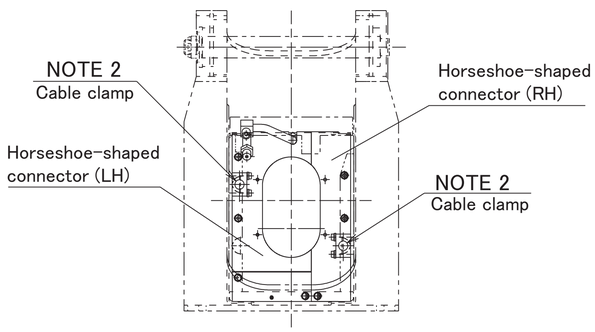


2nd boom tail Detail

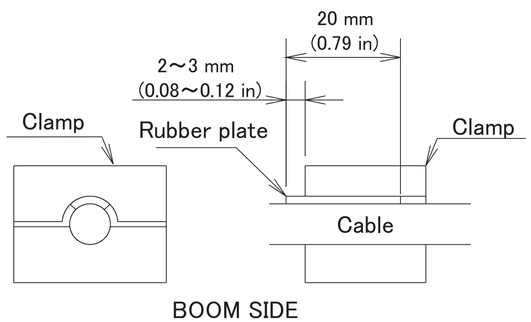
Sectional drawing (2/2)



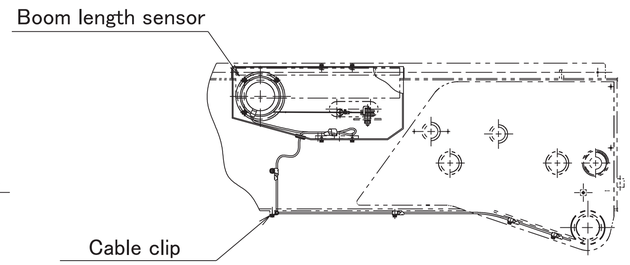




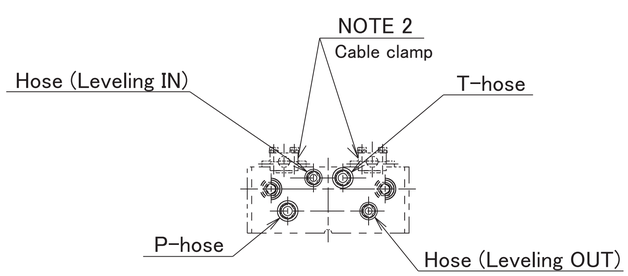
R view



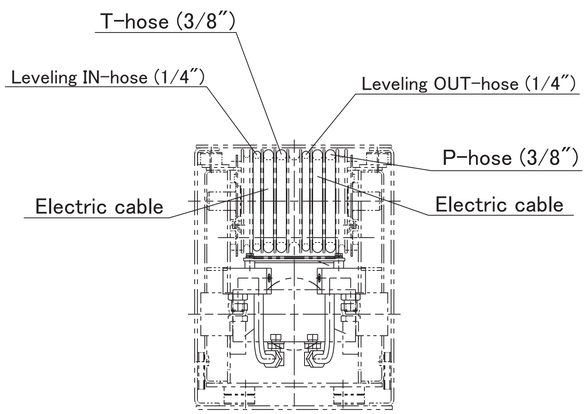
Cable clamp detail



N view



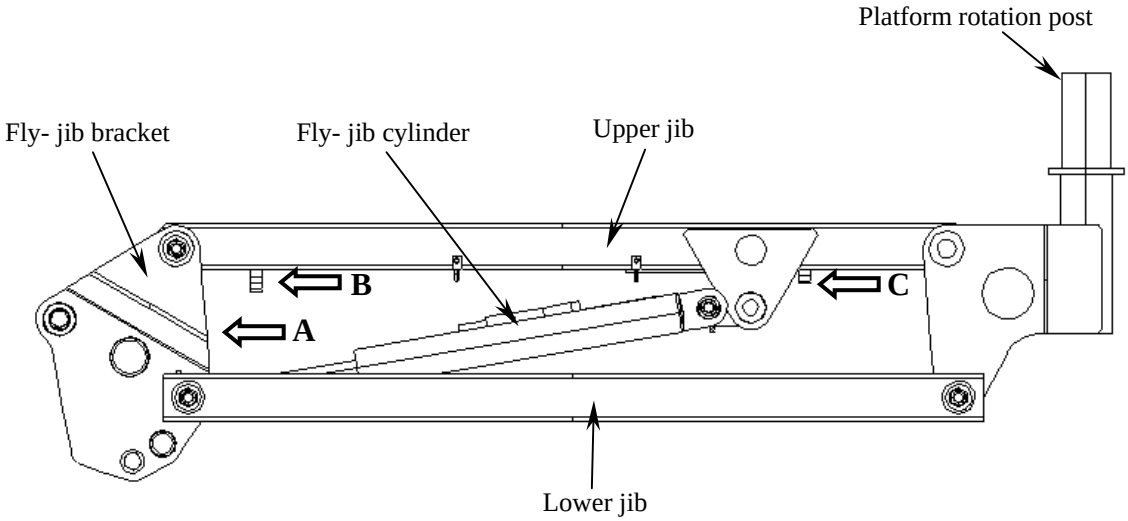
Q view

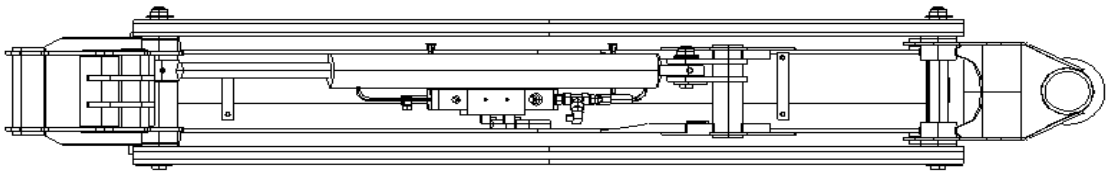


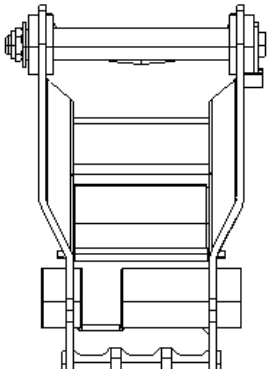
P - P

＊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.

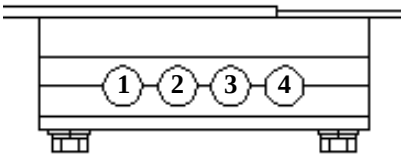
Fly- jib



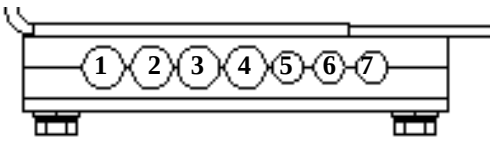




A - view



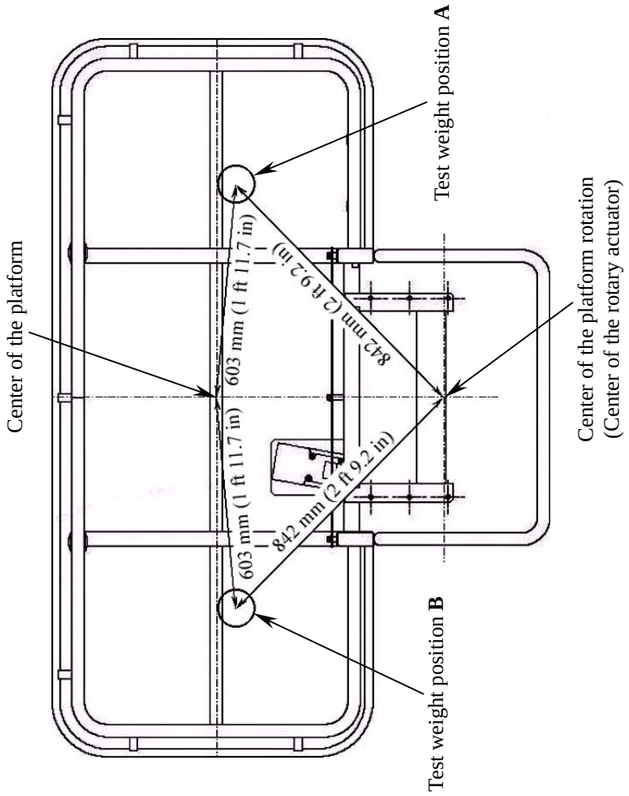
B - view

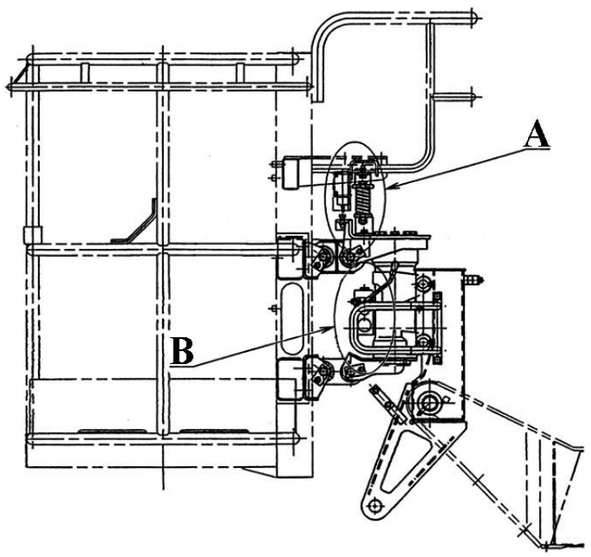


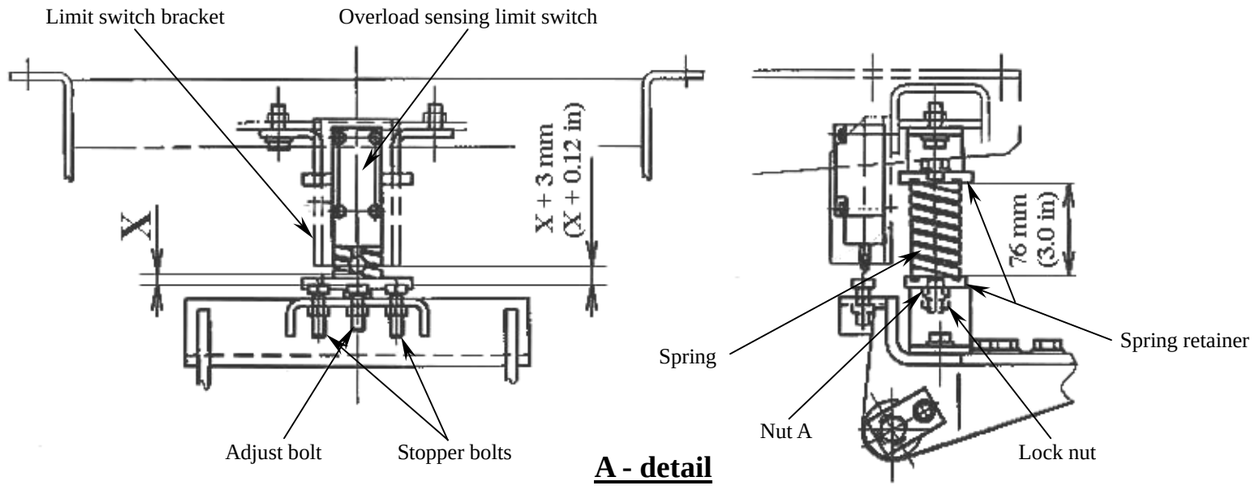
C - view

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 for SP18A/ISP60 and SP21A/ISP70





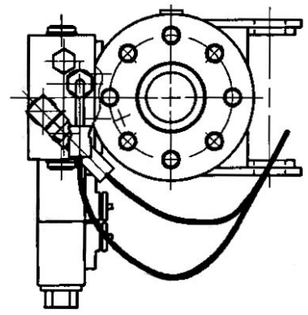


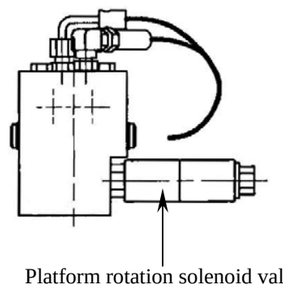
A - detail

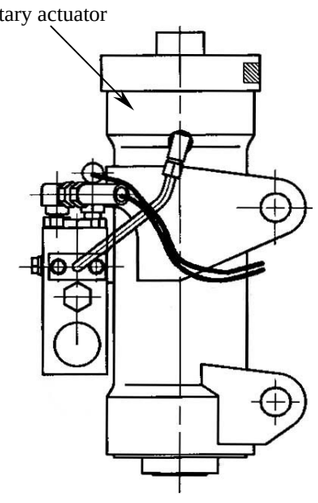
Adjustment procedures of Overload sensing limit switch

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.

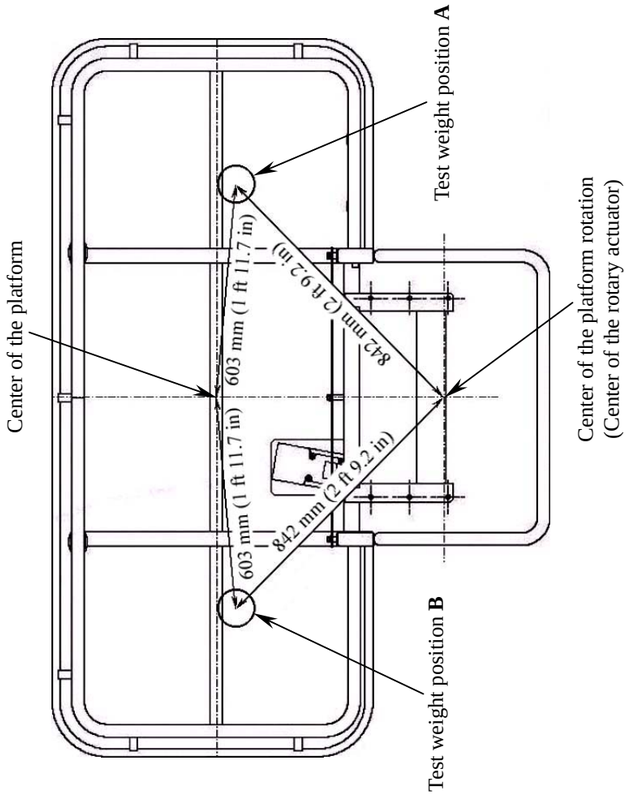


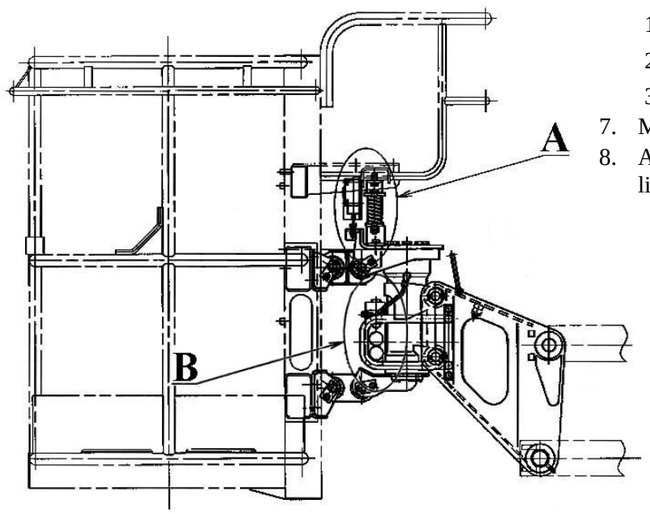


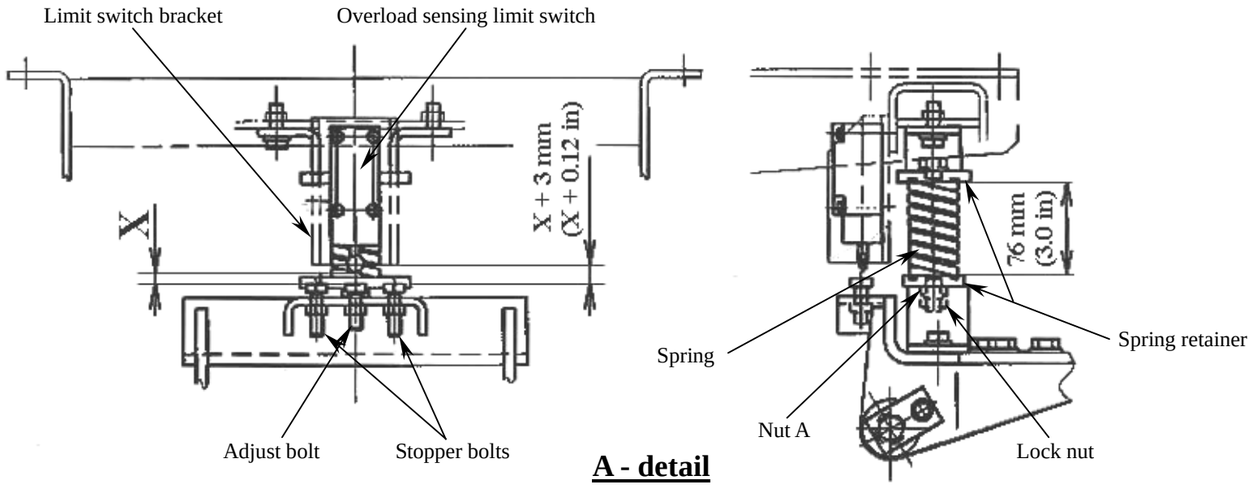


B - detail

Platform for SP21AJ/ISP70J





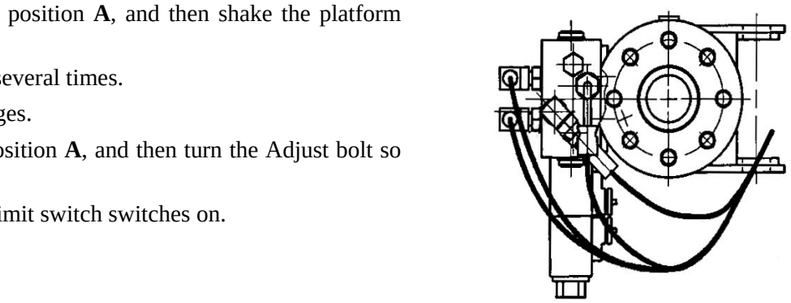


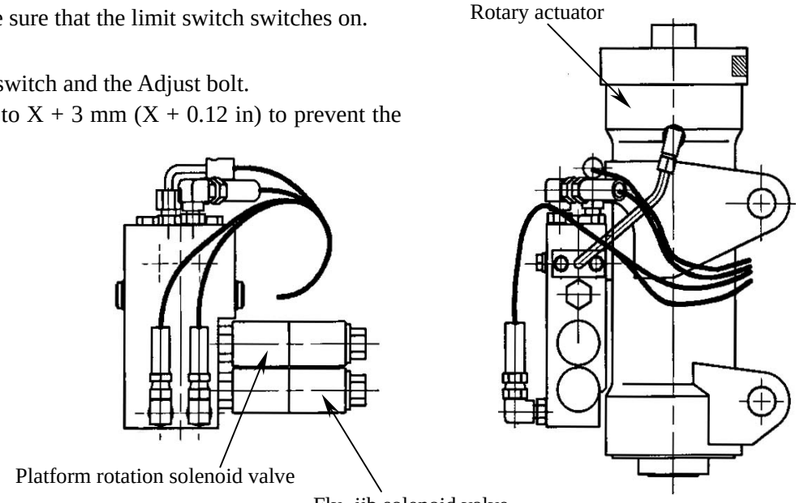
A - detail

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.



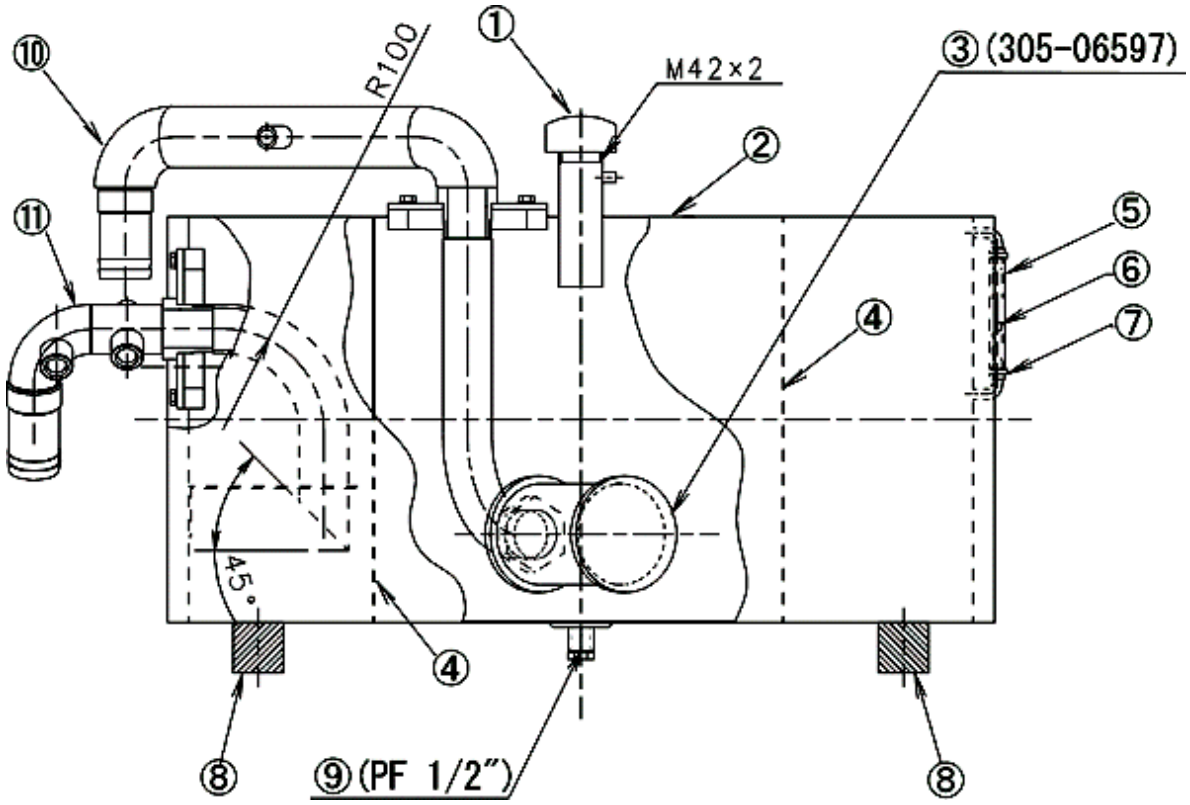


B - detail

3. Hydraulic section

Oil reservoir

Oil capacity	150 liters (39.6 gallons)
Recommended hydraulic oil	Shell Tellus T22
Oil change interval	Every 1200 working hours or annually



No.	Description	No.	Description
1	Filler cap	7	Tube band
2	Body	8	Stay
3	Suction filter	9	Drain plug (with O-ring)
4	Baffle plate	10	Suction pipe
5	Vinyl tube	11	Return pipe
6	Level float	-------	----------

NOTE:

1. For new machines, the first oil change should be carried out after 300 working hours or 3 months of use.
2. Clean the Suction filter, and replace the In-line filter at the same time when changing the hydraulic oil.
3. When changing or checking the oil level, be sure to retract and lower the boom fully.

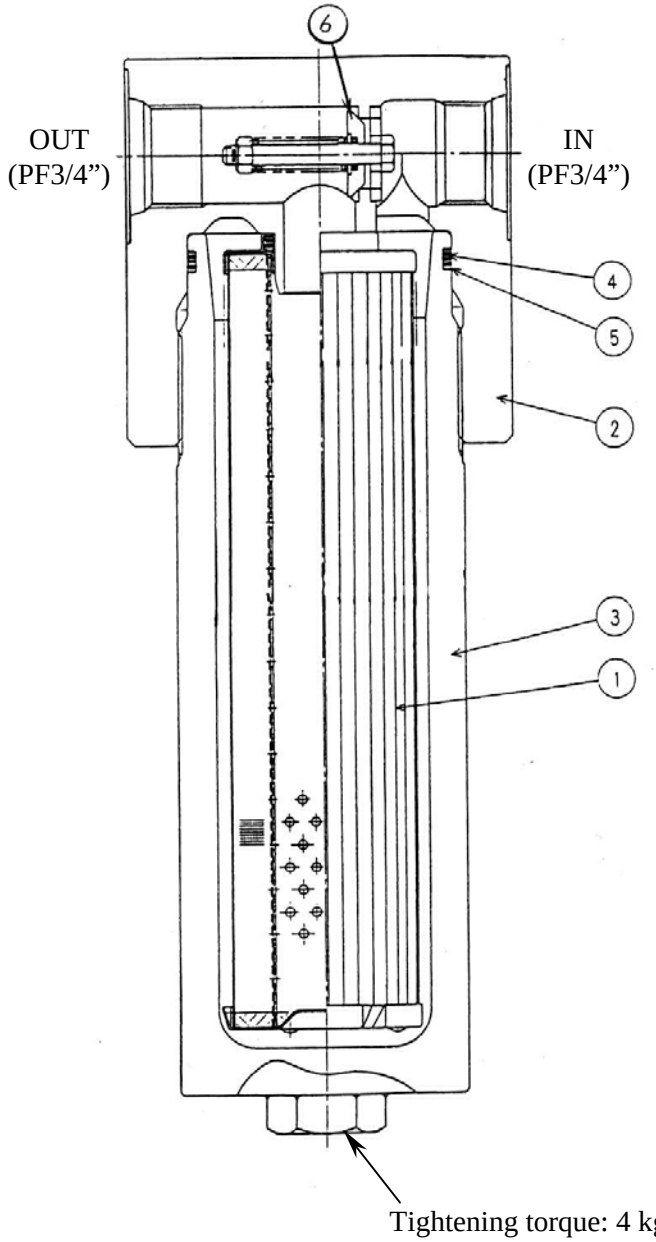
High- pressure line filter for Boom functions

This high- pressure line filter is installed in the output line of the main hydraulic pump for boom functions to eliminate contaminations contained in the oil.
It is advisable to replace the filter element every 1200 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-ring and the back- up ring when once removed.

Rated pressure	175 kg/cm^2 (2,500 PSI)
Proof pressure	315 kg/cm^2 (4,480 PSI)
Rated flow	100 liters/min (26.4 GPM)
Filtration accuracy	10 micron



1	Filter element
2	Filter head
3	Case
4	O- ring
5	Back -up ring
6	By-pass valve

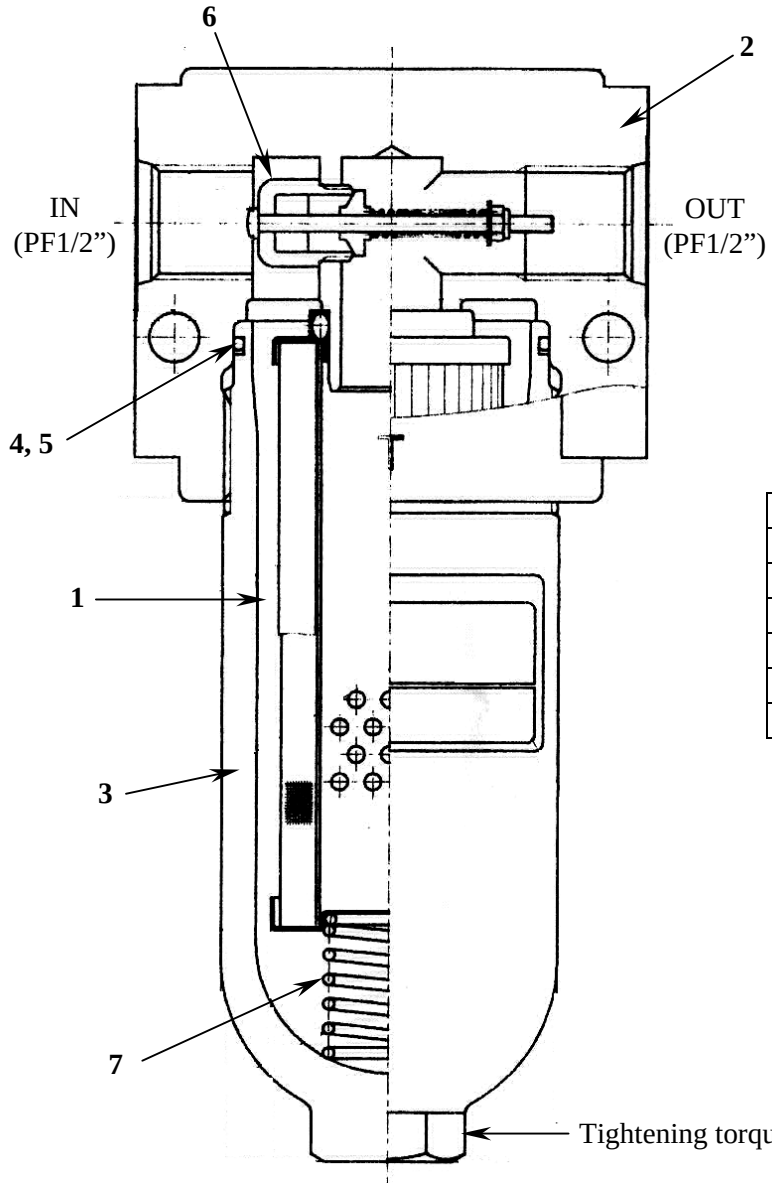
High- pressure line filter for Charge pump

This high- pressure line filter is installed in the output line of the Charge pump to eliminate contaminations contained in the oil.
It is advisable to replace the filter element every 1200 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-ring and the back- up ring when once removed.

Rated pressure	140 kg/cm^2 (1,990 PSI)
Rated flow	30 liters/min (7.9 GPM)
Filtration accuracy	30 micron
By- pass valve cracking pressure	5 kg/cm^2 (71 PSI)



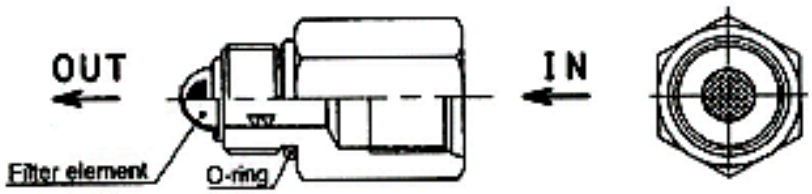
1	Filter element
2	Filter head
3	Case
4	O- ring
5	Back -up ring
6	By- pass valve
7	Spring

305- 00000- 04
305- 00000- 51
305- 00000- 64
305- 00000- 69

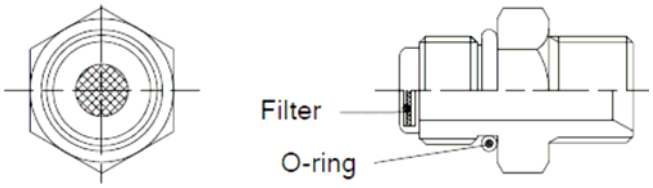
Adaptor filter

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.

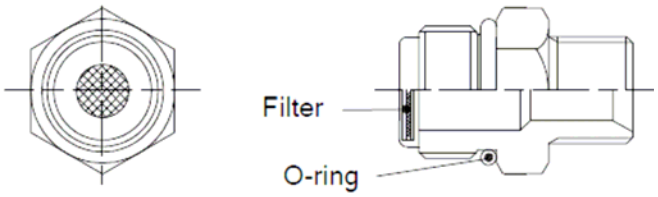
Part number	305-00000-04		
Port	P	Rated pressure	17.2 MPa (175 kg/cm^2) [2,500 PSI]
Mesh size	100 mesh	Rated flow	100 liters/min. (26.4 GPM)



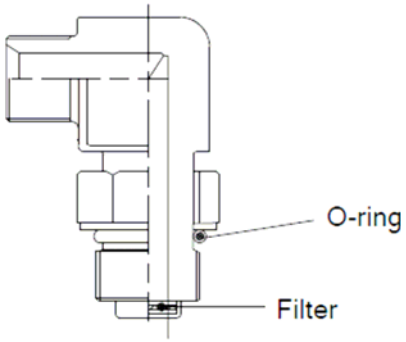
Part number	305-00000-51		
Port	A1, B1, A2 and B2	Rated pressure	20.6 MPa (210 kg/cm^2) [3,000 PSI]
Mesh size	100 mesh	Rated flow	60 liters/min. (15.9 GPM)



Part number	305-00000-64		
Port	A3	Rated pressure	20.6 MPa (210 kg/cm^2) [3,000 PSI]
Mesh size	100 mesh	Rated flow	40 liters/min. (10.6 GPM)

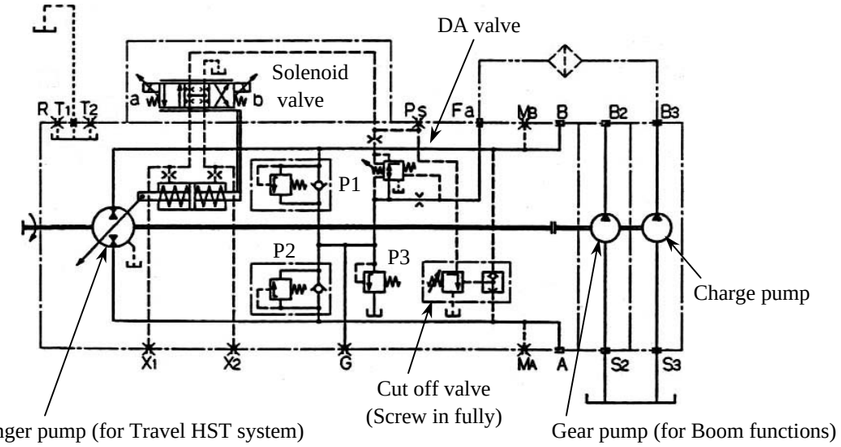


Part number	305-00000-69		
Port	B3	Rated pressure	20.6 MPa (210 kg/cm^2) [3,000 PSI]
Mesh size	100 mesh	Rated flow	40 liters/min. (10.6 GPM)



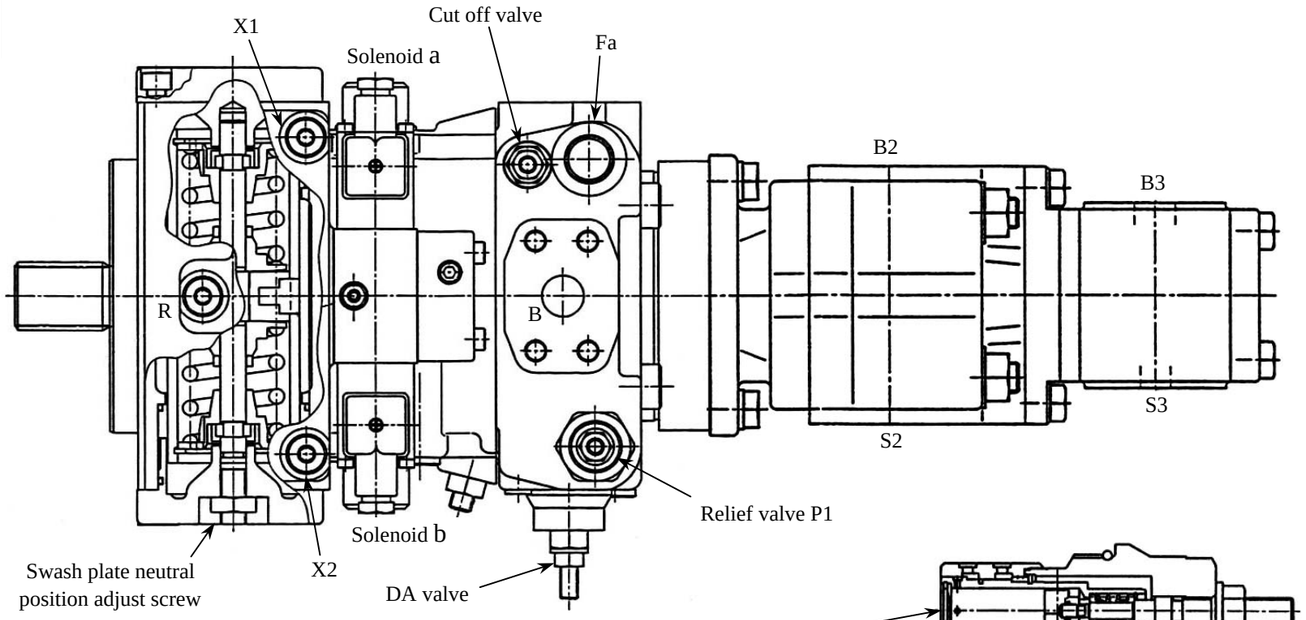
Hydraulic pump

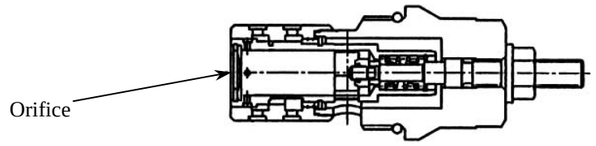
	Displacement	Rated pressure
Plunger pump (for Travel	0 ~ 56 cc / rev (0 ~ 3.42 in^3 / rev)	405 kg / cm^2 (5,760 PSI)
Gear pump (for Boom functions)	40.0 cc / rev (2.44 in^3 / rev)	210 kg / cm^2 (2,990 PSI)
Charge pump	12.1 cc / rev (0.74 in^3 / rev)	250 kg / cm^2 (3,560 PSI)



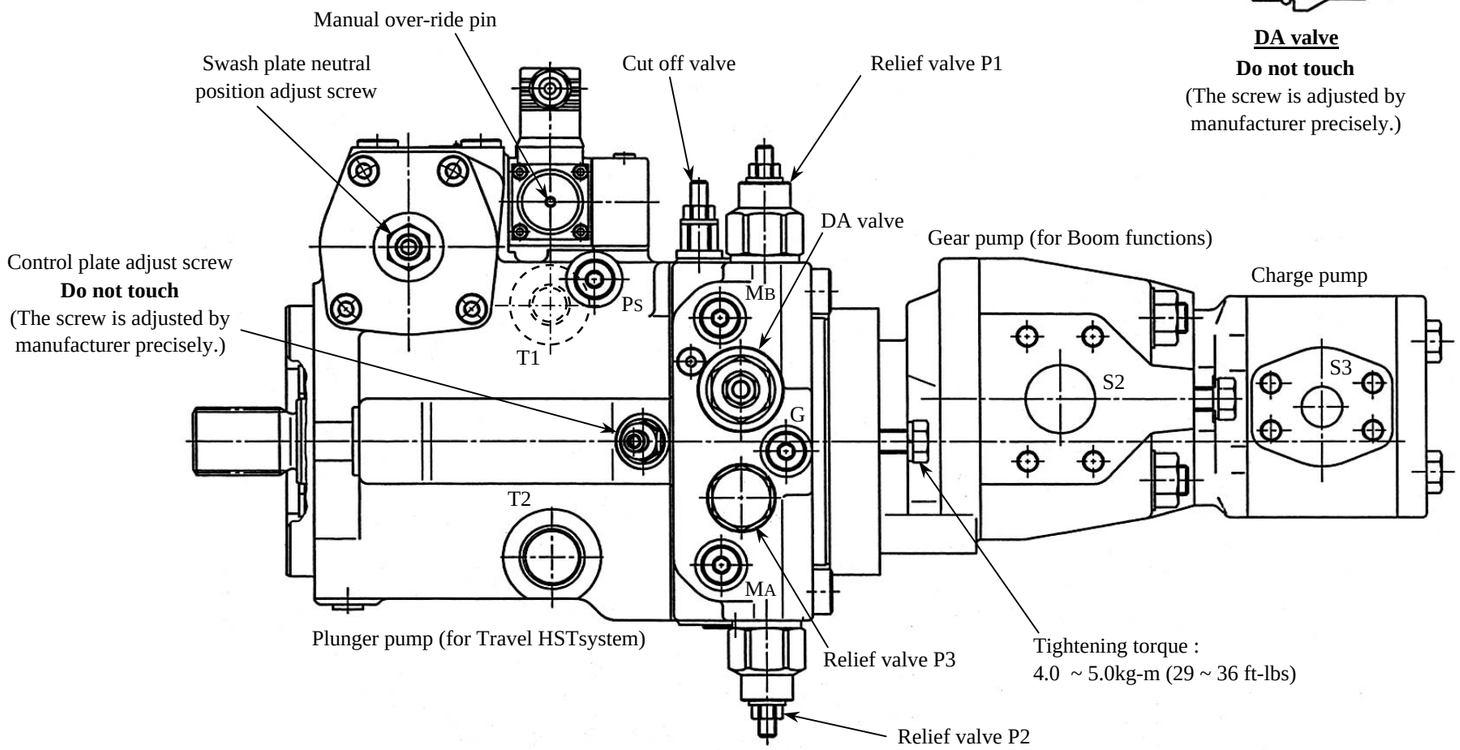
Releif valve reset pressure

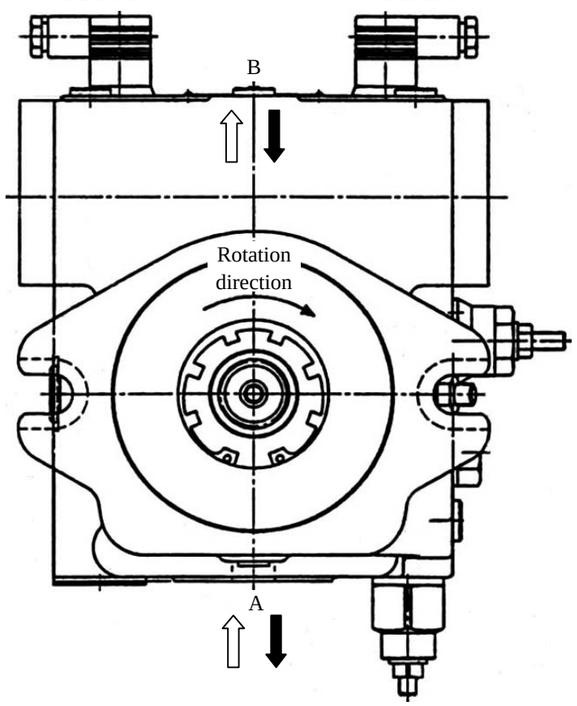
P1 ---------- 340 kg / cm^2 (4,840 PSI)
P2 ---------- 340 kg / cm^2 (4,840 PSI)
P3 ---------- 20 kg / cm^2 (290 PSI)





DA valve
Do not touch
(The screw is adjusted by manufacturer precisely.)



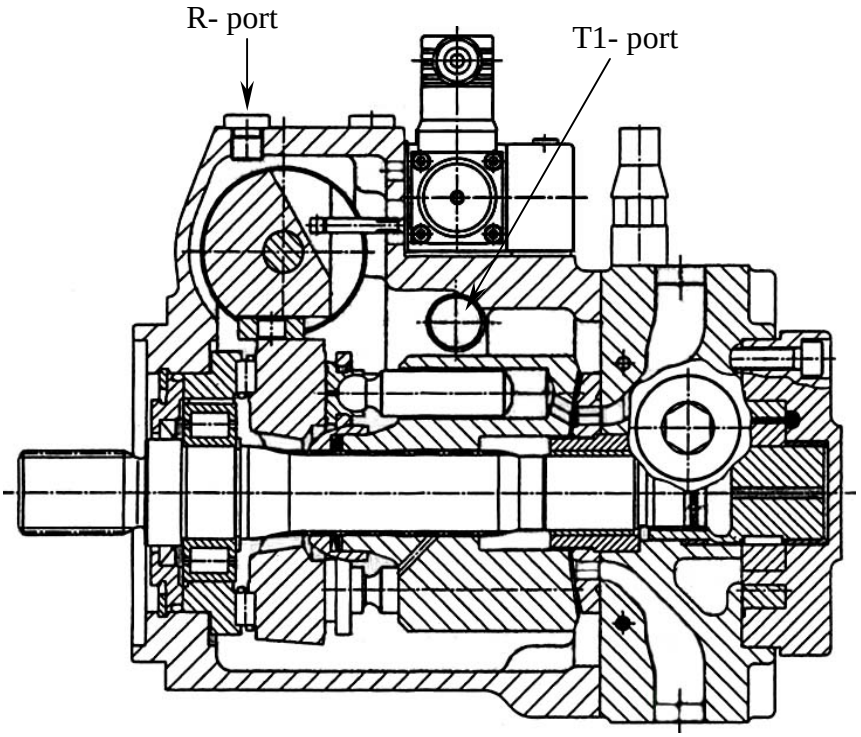


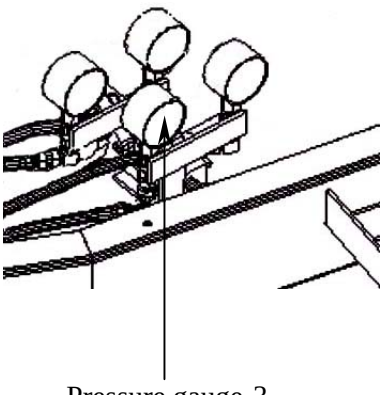
Flow direction ⇨ When the solenoid "a" is energized.
⇦ When the solenoid "b" is energized.

1. Replacement procedures

Perform the following items when replacing the hydraulic pump.

1. Fill the new hydraulic pump with hydraulic oil from the T1- port before installing it.
2. If hydraulic oil spilled while installing the pump, add the hydraulic oil again from the R- port after being installed.
3. Start the engine, then keep it running at idling speed with no load for 2 ~ 3 minutes until the charge pump pressure reading on the pressure gauge 3 becomes stable and any noise can not be heard.

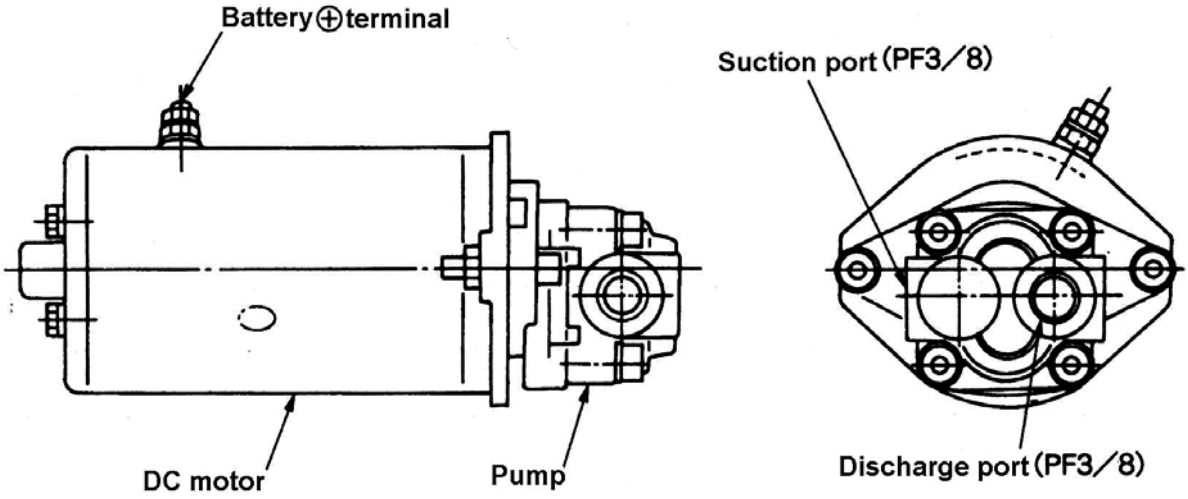




Emergency pump

This emergency pump consists of a DC motor and a gear pump, and is driven by the chassis batteries to supply hydraulic pressure in the event of failure on the main pump or the engine.

DC motor	1.0 kw / 24 v DC
Displacement	1.7 cc / rev. (0.10 in^3 / rev.)
Rated pressure	175 kgf / cm^2 (2,490 PSI)



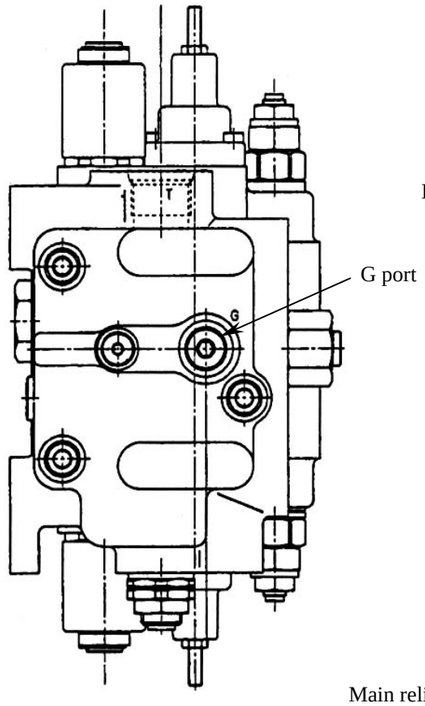
NOTE:

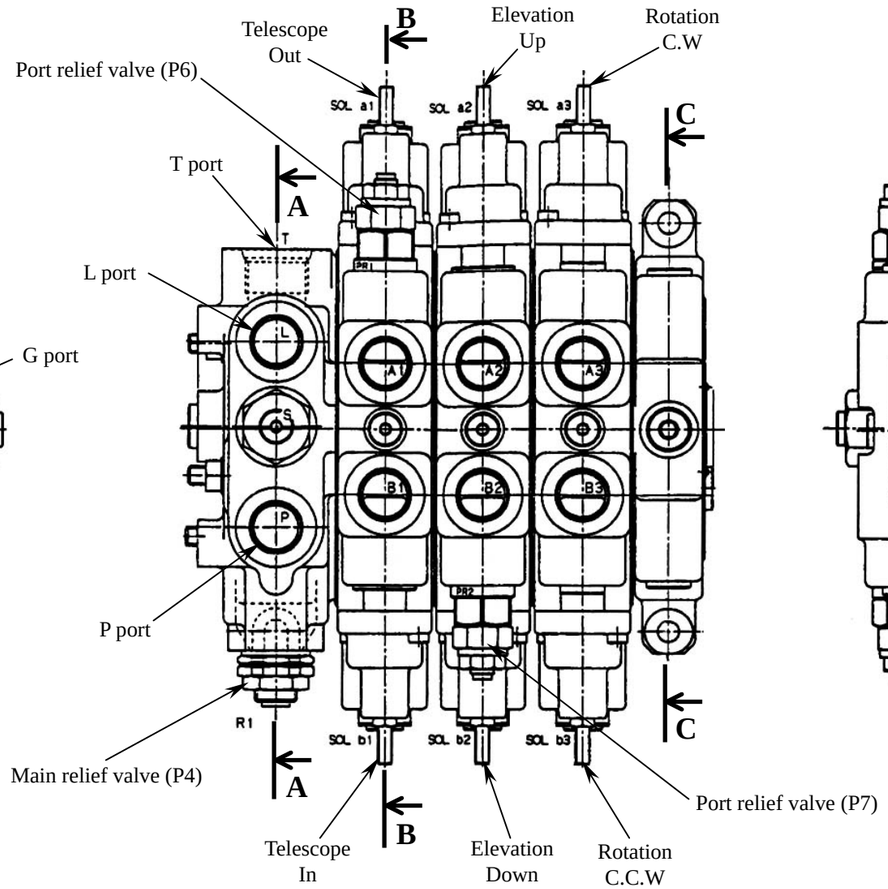
- Do not operate the emergency pump for more than 30 seconds continuously.
- Allow the interval of 30 seconds or more to resume operating the pump.
- The continuous operation of the pump will cause the DC motor to burn out.

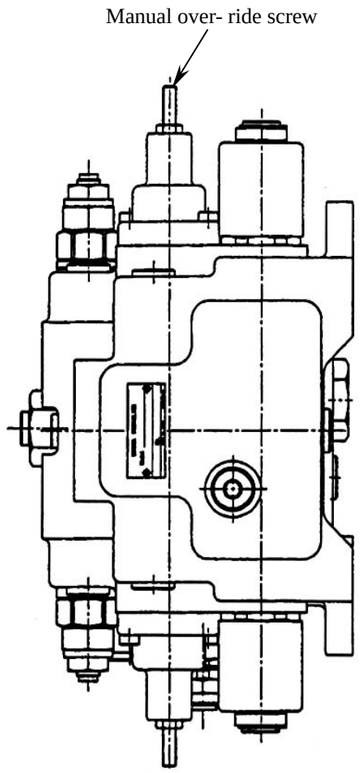
Main control valve

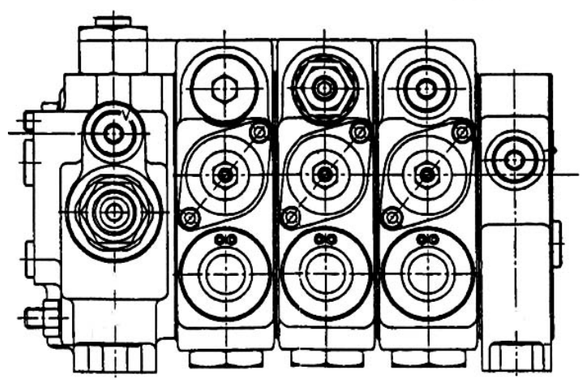
The main control valve proportionally controls the Boom elevation, telescope and rotation functions

Rated pressure		210 kg/cm^2 (2,990 PSI)	Solenoid	Rated voltage	DC24 volts
Rated flow		100 liters/min (26.4 GPM)		Rated current	800 mA
Relief valve preset pressure	P4	210 kg/cm^2 (2,990 PSI)		Coil resistance	15.6 ohms (at 20^{o}C)
	P6	90 kg/cm^2 (1,280 PSI)			
	P7	150 kg/cm^2 (2,130 PSI)			





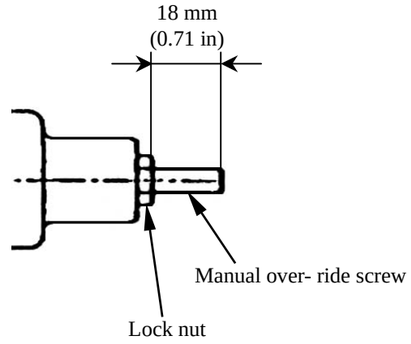


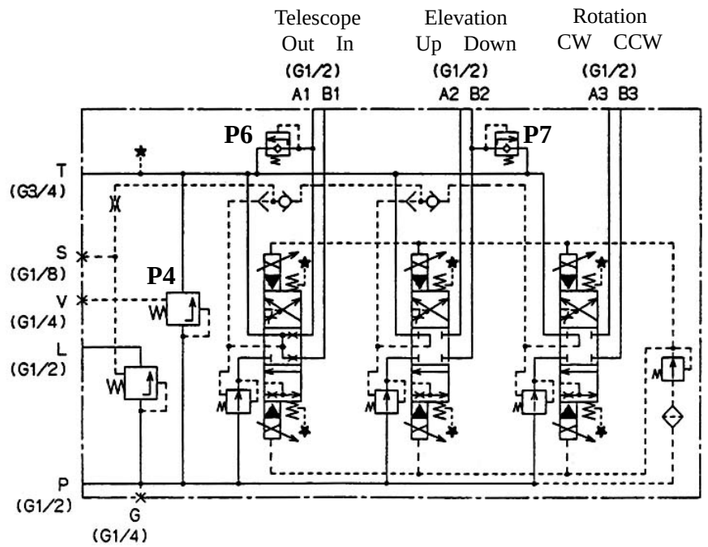


Manual over- ride screw

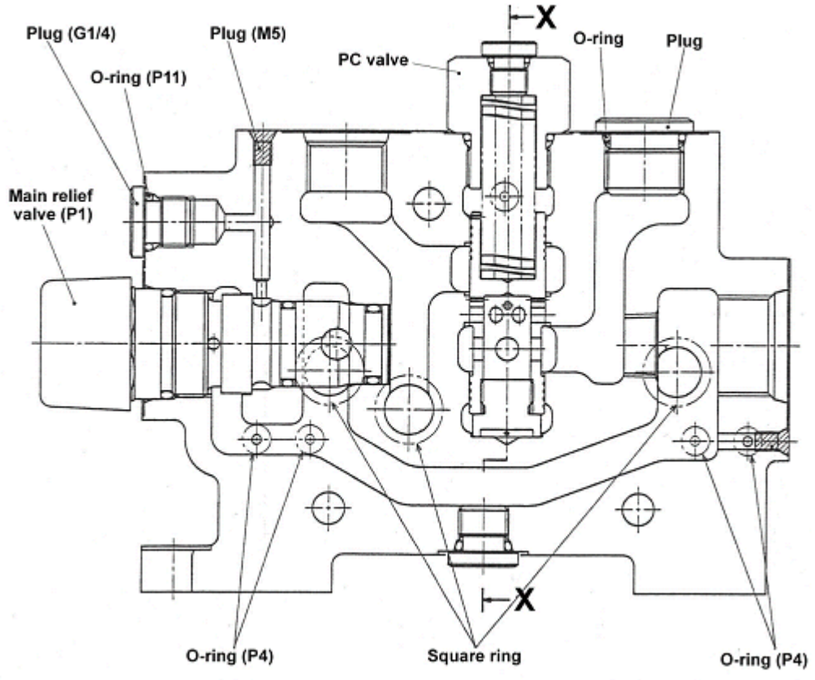
Operate the boom function manually as follows in case of emergency.

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.

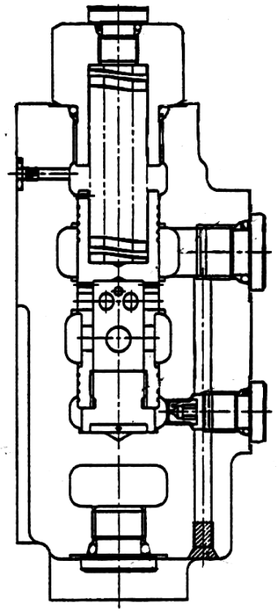




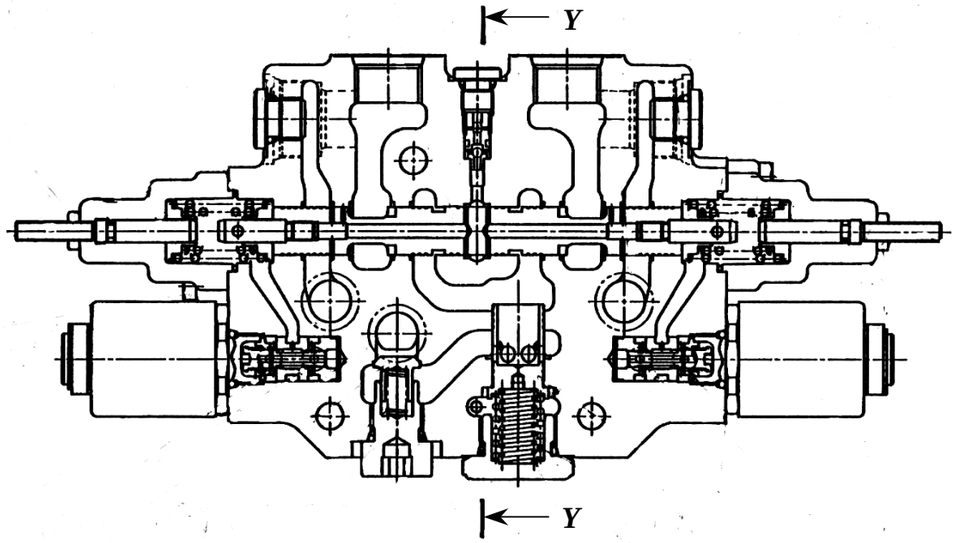
1. Sectional drawings



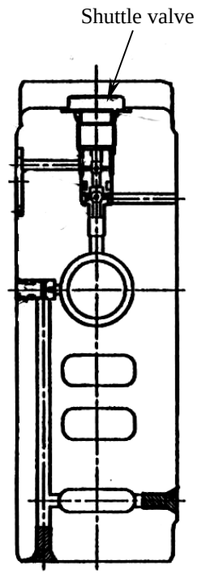
A- A section



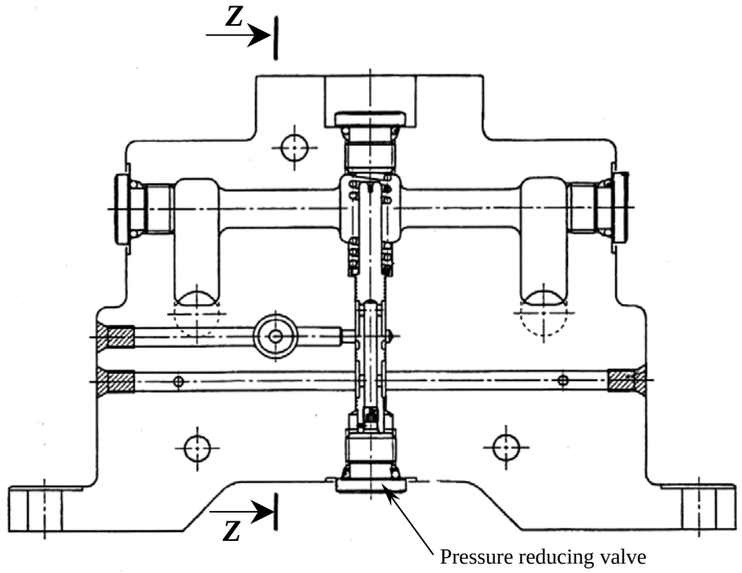
X- X section



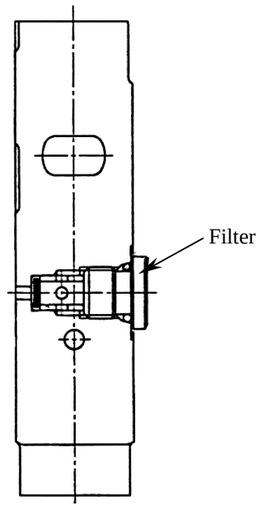
B- B section



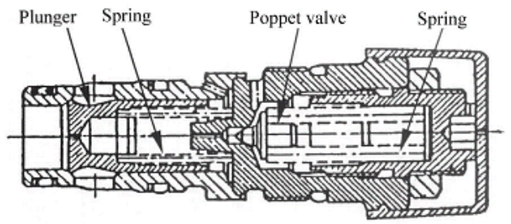
Y- Y section



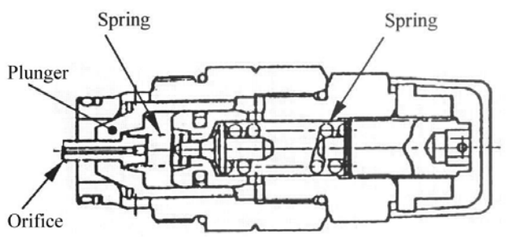
C- C section



Z- Z section



Main relief valve Detail

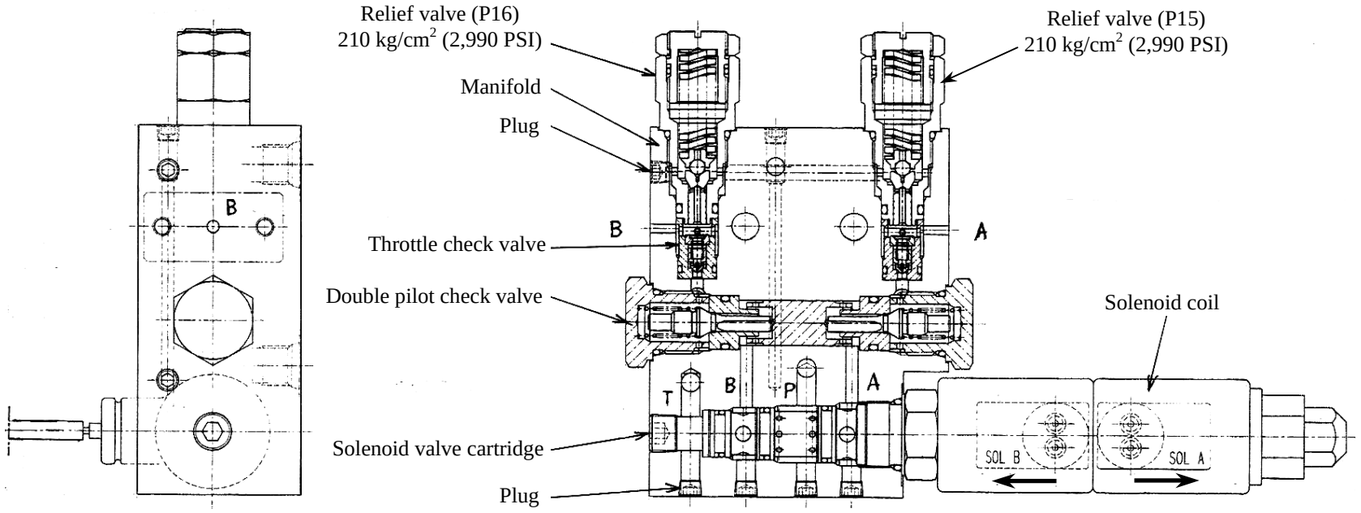


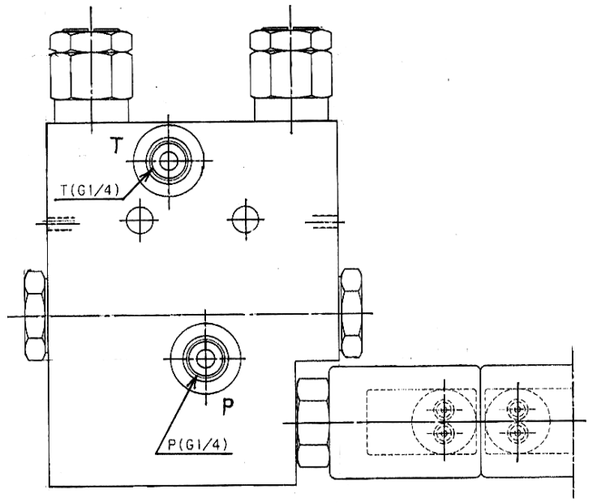
Port relief valve Detail

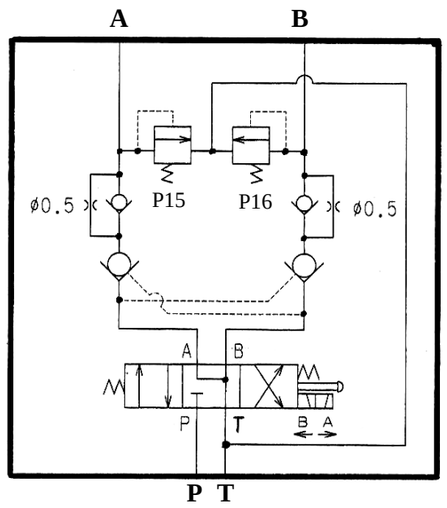
Platform rotation solenoid valve (302- 00153- 00D)

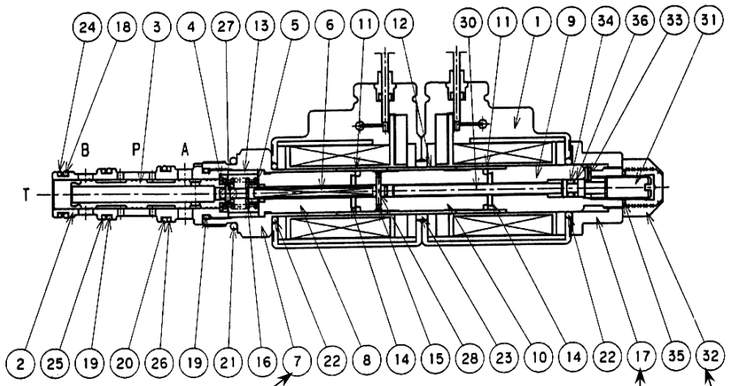
For the machine without Fly- jib

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







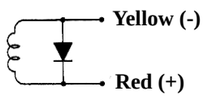


Solenoid valve

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.

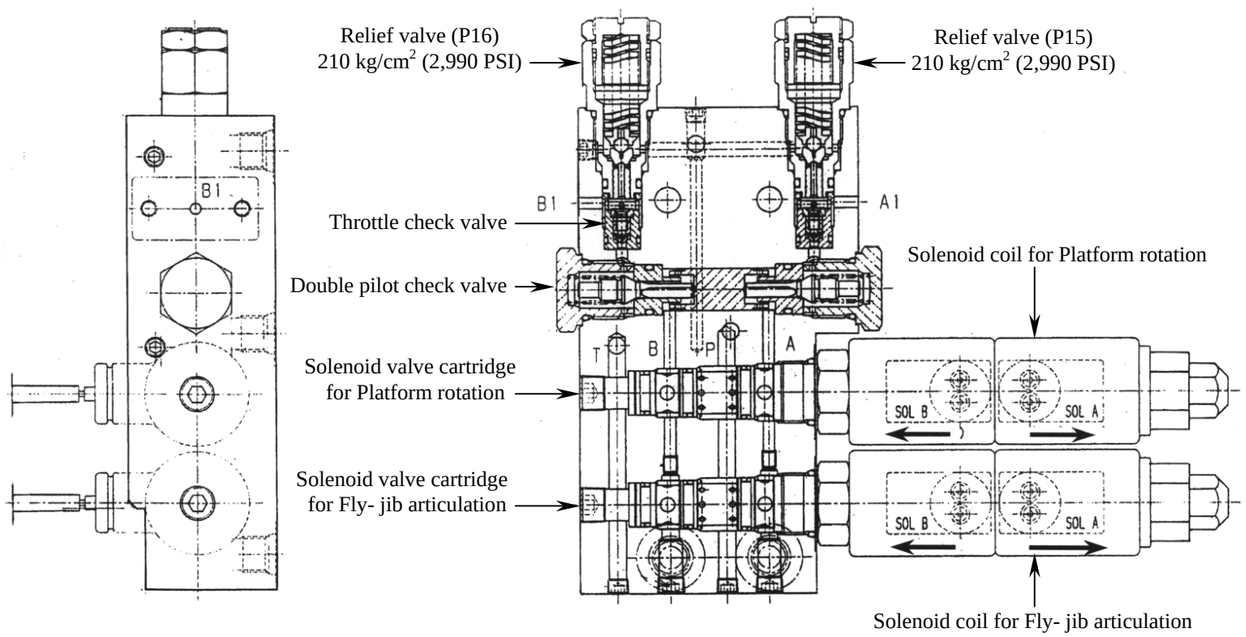
1. Insert the “Solenoid valve cartridge” (7) into the manifold, and then tighten the cartridge by the tightening torque of 4.2 ~ 4.4 kg- m (30 ~ 32 ft- lbs).
2. Install the 2 pieces of the “Solenoids coils” (1) onto the valve cartridge, and then tighten the “Nut” (17) by the tightening torque of 0.41 ~ 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).

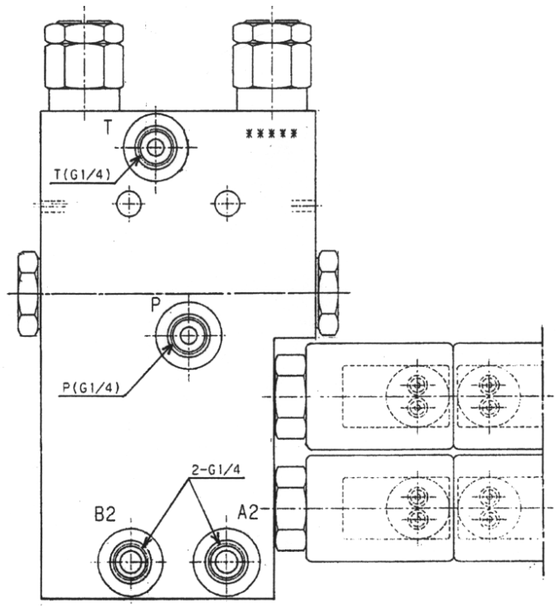
   Caution: Do not allow the “Adjust screw” (31) to be turned when tightening the “Cap nut” (32).

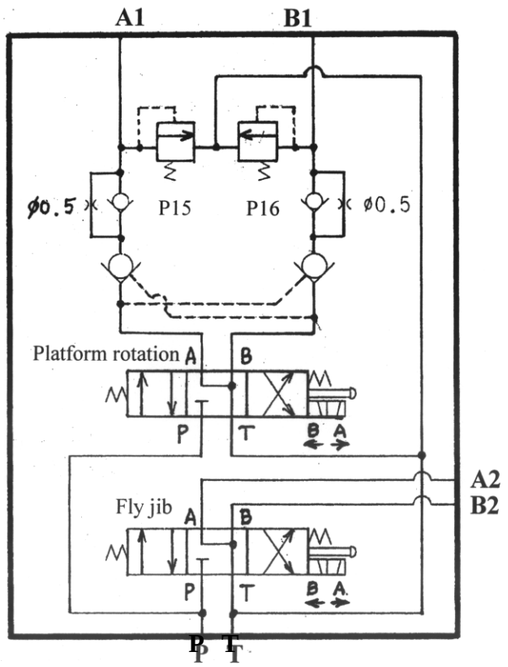
Platform rotation / Fly jib solenoid valve (302- 00152- 00D)

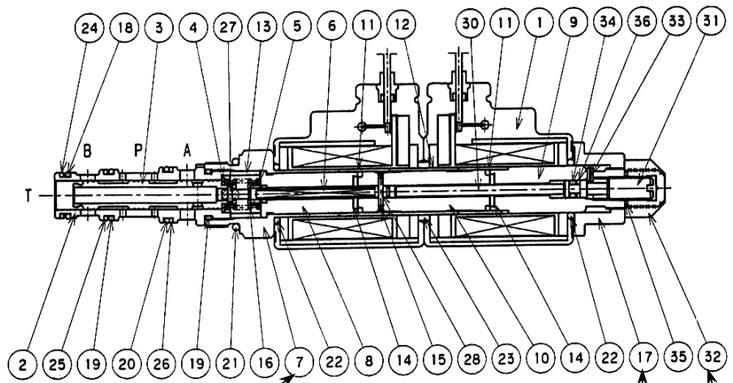
For the machine with Fly- jib

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







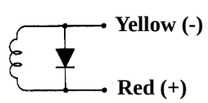


Solenoid valve

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

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

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



Solenoid coil

Solenoid valve installation procedures

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

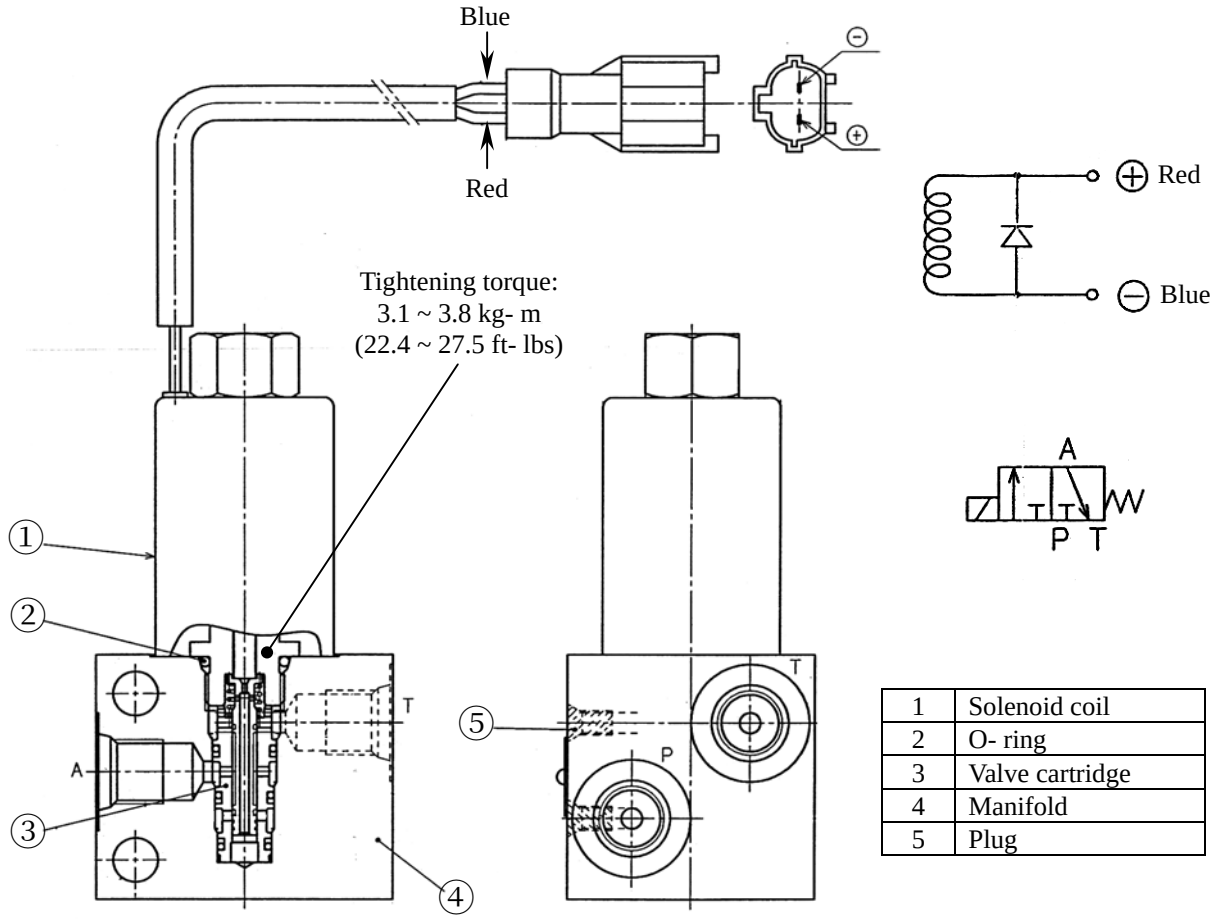
1. Insert the “Solenoid valve cartridge” (7) into the manifold, and then tighten the cartridge by the tightening torque of 4.2 ~ 4.4 kg- m (30 ~ 32 ft- lbs).
2. Install the 2 pieces of the “Solenoids coils” (1) onto the valve cartridge, and then tighten the “Nut” (17) by the tightening torque of 0.41 ~ 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).

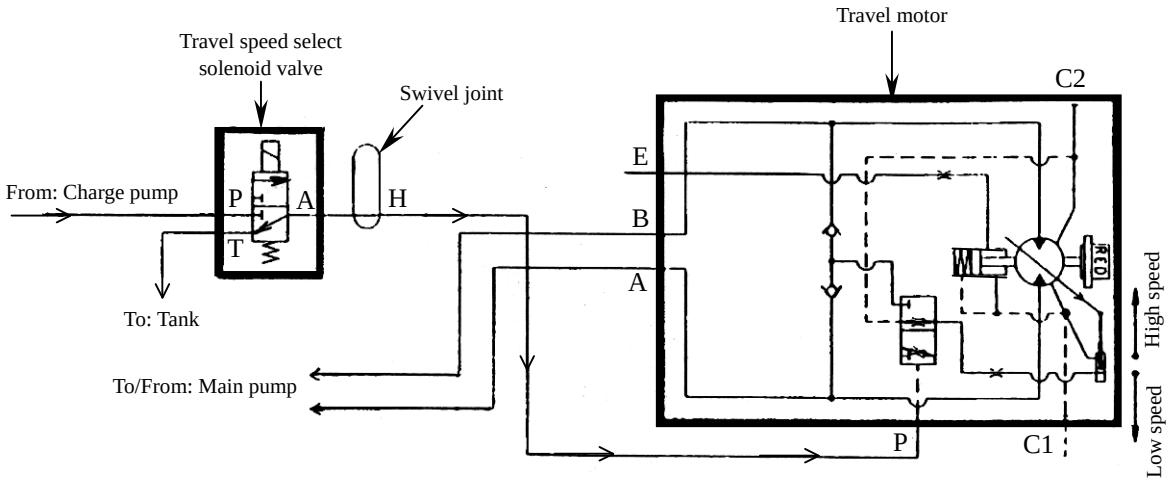
Travel speed select solenoid valve

This solenoid valve is installed in the hydraulic circuit between the Charge pump and the four Travel motors. When this solenoid valve is switched on, the valve supplies the pilot pressure to the Speed select valves incorporated in the travel motors to turn the motors into the “High- speed modes”.

Rated voltage	DC24V (DC18 ~ 30V) Less than 13W
Rated pressure	210 kg/cm^2 (2,990 PSI)
Rated flow	3 liters/min. (0.79 GPM)



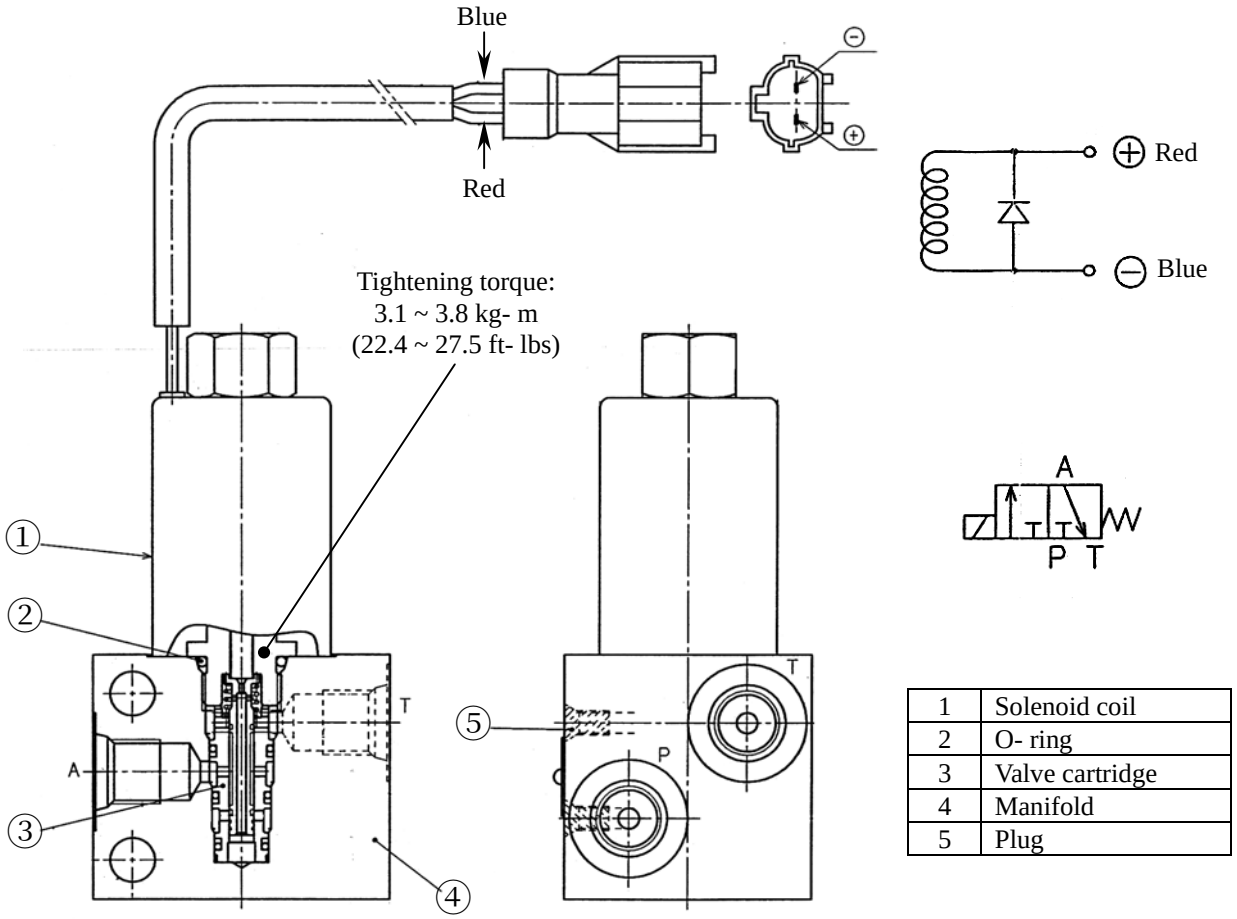
1	Solenoid coil
2	O- ring
3	Valve cartridge
4	Manifold
5	Plug



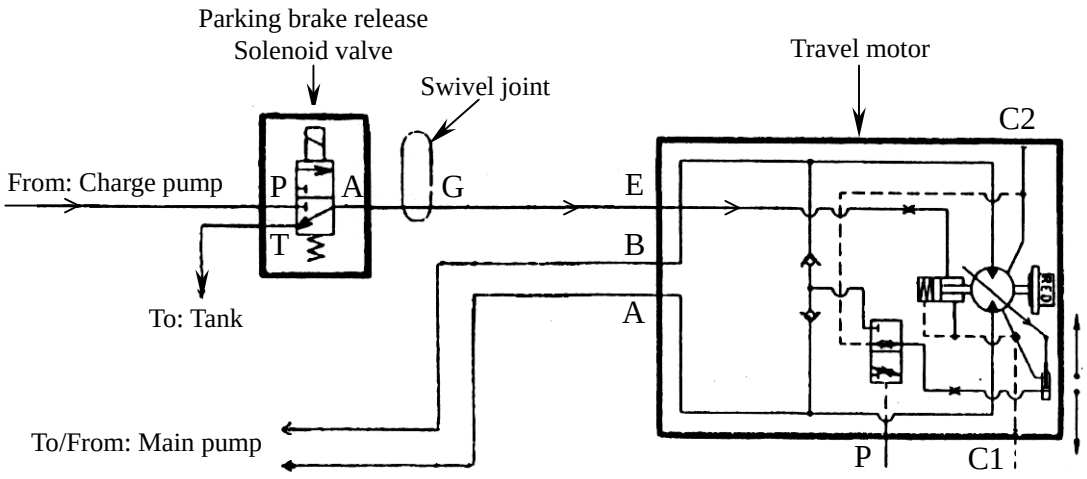
Parking brake release solenoid valve

This solenoid valve is installed in the hydraulic circuit between the Charge pump and the four Travel motors. When this solenoid valve is switched on, the valve supplies the hydraulic pressure to the parking brakes incorporated in the travel motors to release the parking brake.

Rated voltage	DC24V (DC18 ~ 30V) Less than 13W
Rated pressure	210 kg/cm^2 (2,990 PSI)
Rated flow	3 liters/min. (0.79 GPM)



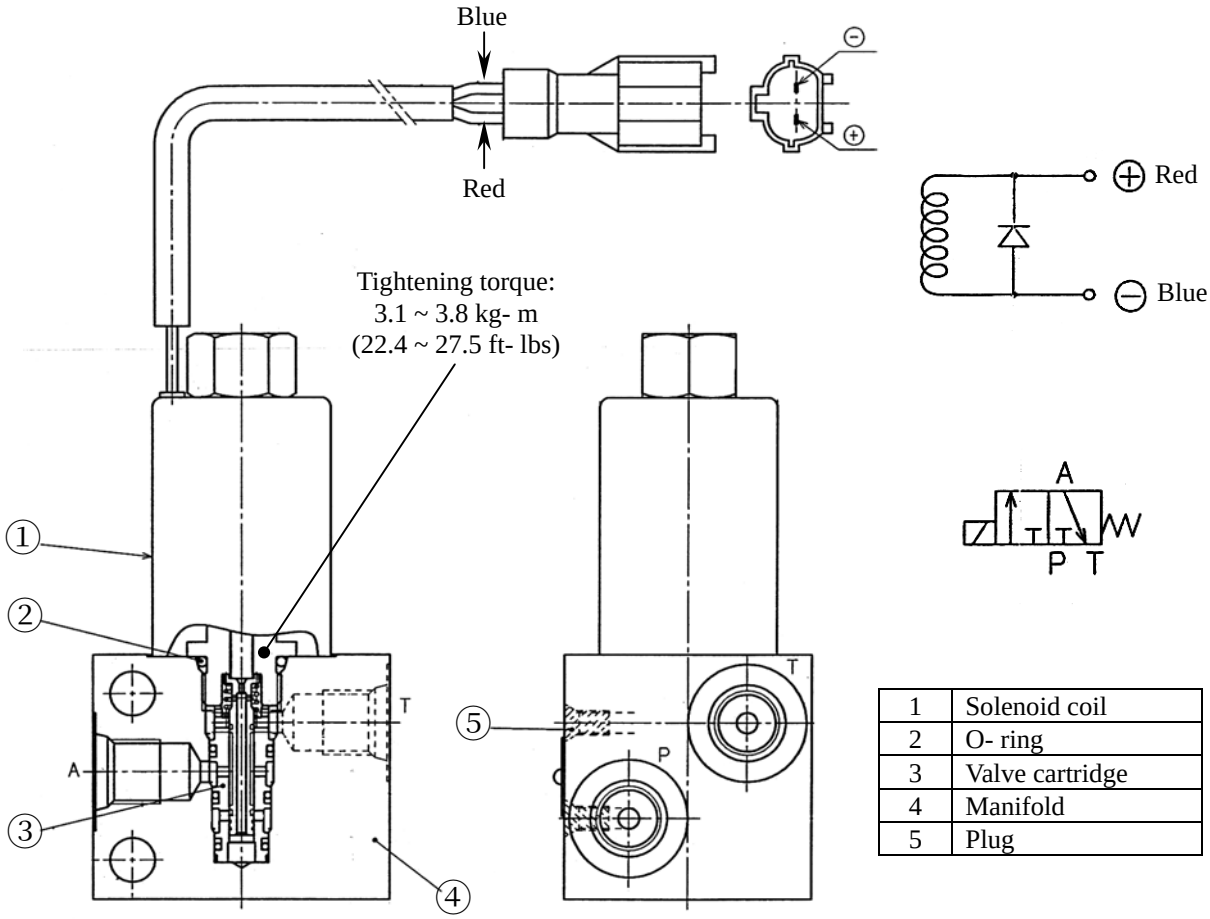
1	Solenoid coil
2	O- ring
3	Valve cartridge
4	Manifold
5	Plug



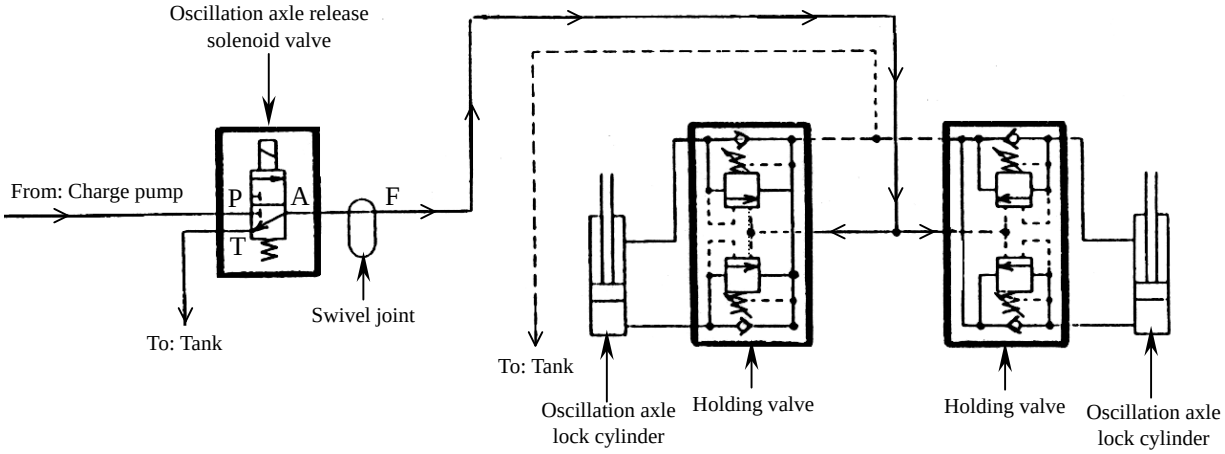
Oscillation axle release solenoid valve

This solenoid valve is installed in the hydraulic circuit between the Charge pump and the two oscillation axle lock cylinders. When this solenoid valve is switched on, the valve supplies the hydraulic pressure to release both of the oscillation axle lock cylinders.

Rated voltage	DC24V (DC18 ~ 30V) Less than 13W
Rated pressure	210 kg/cm^2 (2,990 PSI)
Rated flow	3 liters/min. (0.79 GPM)

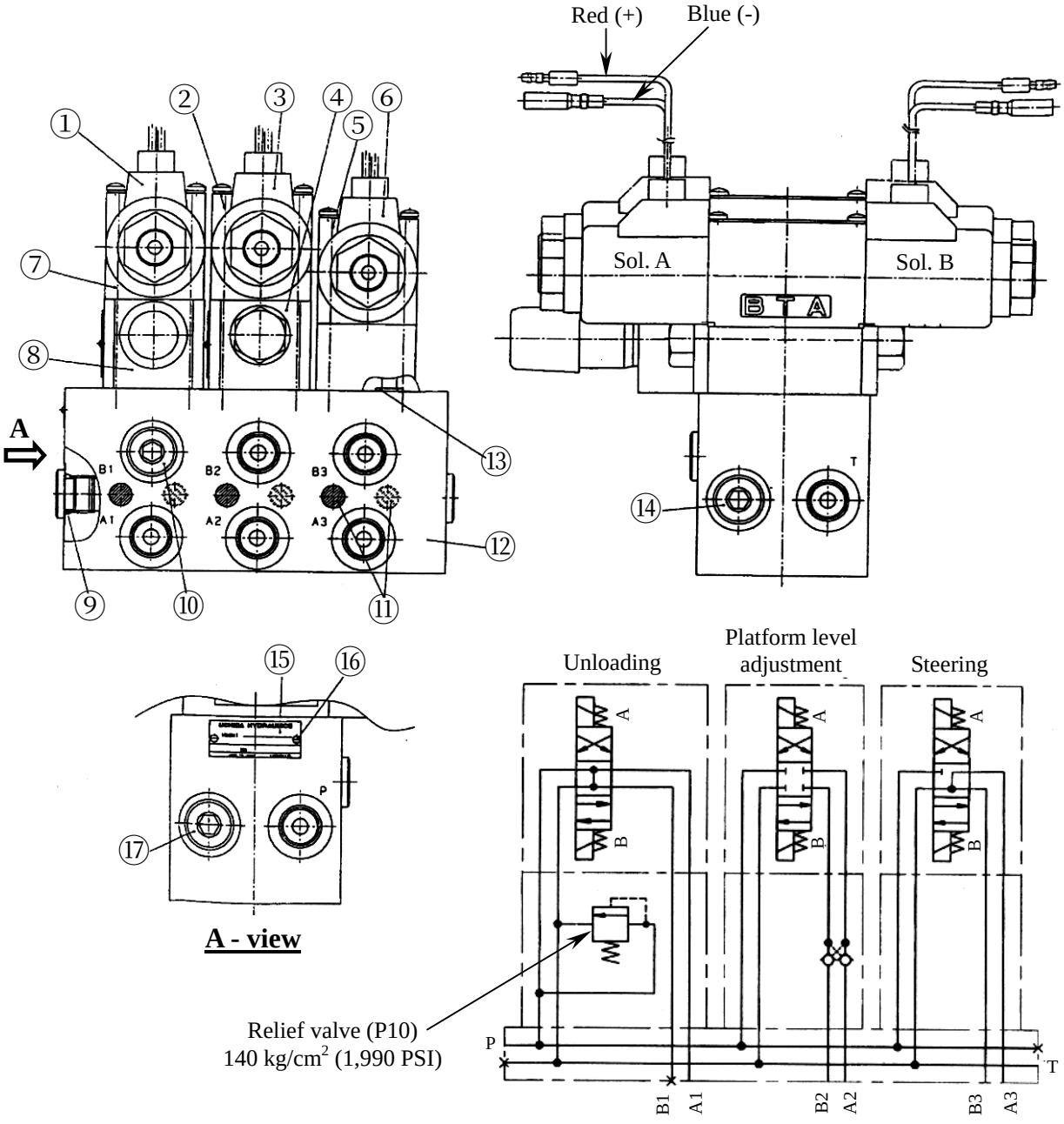


1	Solenoid coil
2	O- ring
3	Valve cartridge
4	Manifold
5	Plug



Unit valve

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

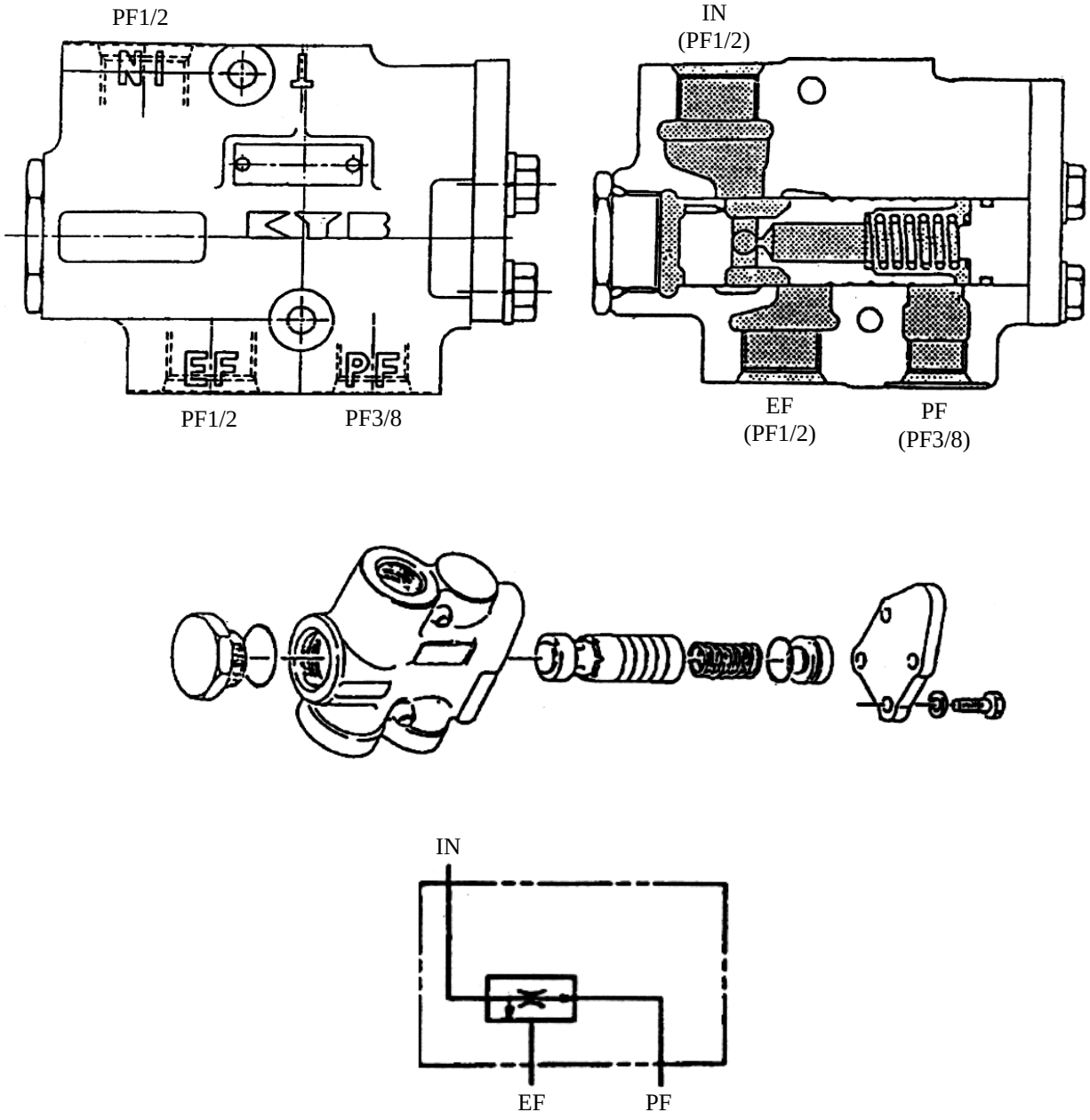


1	Unloading solenoid valve	10	Plug (3/8)
2	Bolt	11	Plug (M8)
3	Platform level adjust solenoid valve	12	Manifold
4	Double pilot check valve	13	O- ring
5	Bolt	14	Plug (3/8)
6	Steering solenoid valve	15	Serial number plate
7	Bolt	16	Rivet
8	Relief valve (P10)	17	Plug (3/8)
9	O- ring		

Flow priority valve

This valve maintains the flow that comes of the PF port at the constant level regardless of the flow fluctuation that is supplied to the IN port. The rest of the flow comes out of the EF port.

Rated pressure	260 kg/cm^2 (3,700 PSI)
Rated flow	100 liters/min (26.4 GPM)
Constant flow of PF port	17 $\pm$ 2 liters/min (4.5 $\pm$ 0.5 GPM)

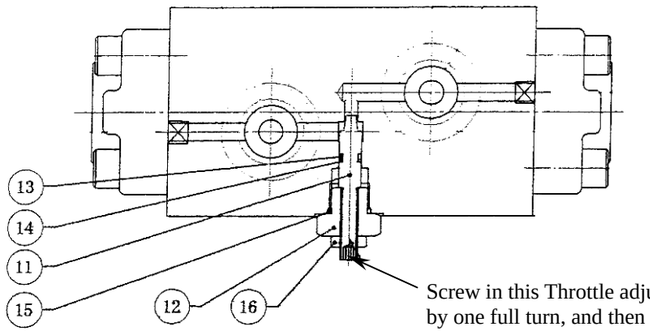


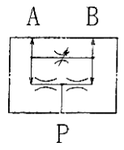
Flow divider valve

1 piece of Flow divider valve #302- 00104- 00 and 2 pieces of Flow divider valves #302- 00105- 00 are installed in the hydraulic circuit of the Traveling system to supply equal flow to the 4 pieces of Travel motors.

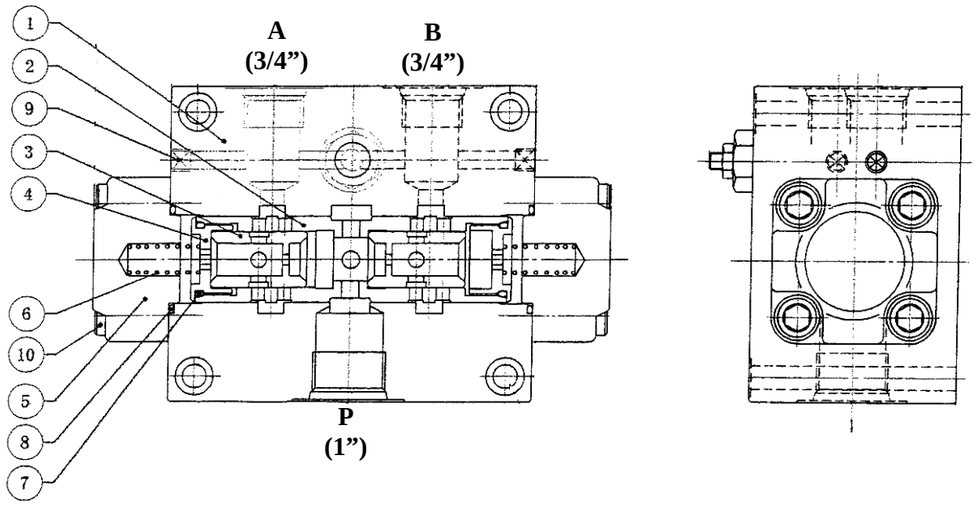
1. Flow divider valve #302- 00104- 00

Rated pressure	340 kg/cm^2 (4,980 PSI)
Rated flow	130 liters/min (34.3 GPM)
Flow dividing ratio to A and B ports	1 : 1





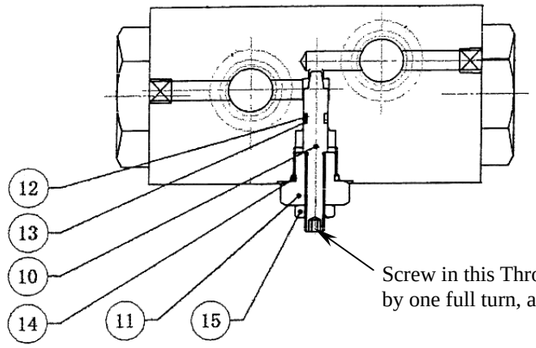
Screw in this Throttle adjust screw (11) fully, screw it out by one full turn, and then lock it by the lock nut (16).

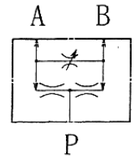


1	Body	9	Plug (PT 1/8)
2	Main spool	10	Cap screw (M12 x 40)
3	Sub spool	11	Throttle adjust screw
4	Spool plug	12	Bushing
5	Cover	13	O- ring (P7)
6	Spring	14	Back- up ring (for O- ring P7)
7	O- ring (P29)	15	O- ring (P16)
8	O- ring (G45)	16	Lock nut (M8)

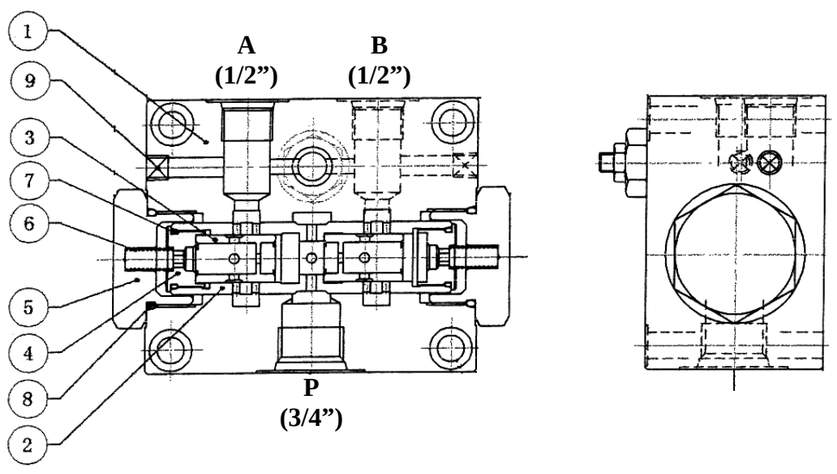
2. Flow divider valve #302- 00105- 00

Rated pressure	340 kg/cm^2 (4,980 PSI)
Rated flow	65 liters/min (17.2 GPM)
Flow dividing ratio to A and B ports	1 : 1





Screw in this Throttle adjust screw (10) fully, screw it out by one full turn, and then lock it by the lock nut (15)

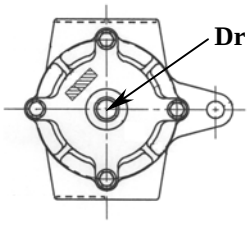


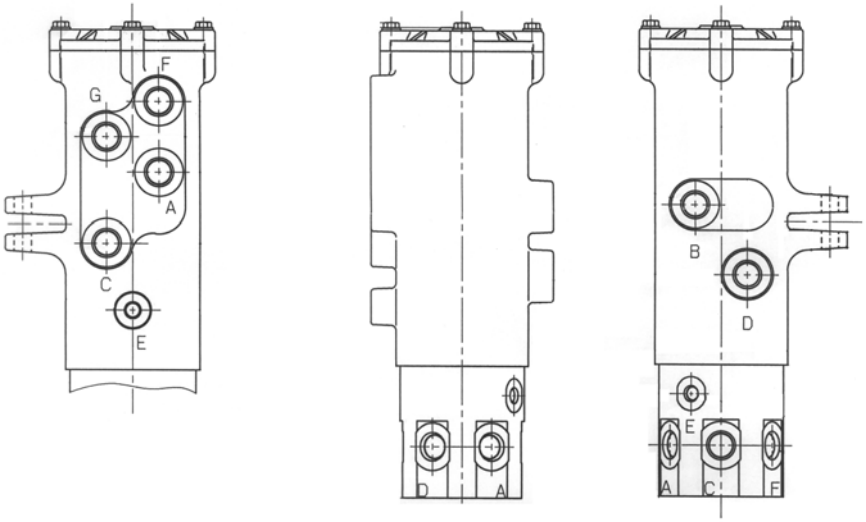
1	Body	9	Plug (PT 1/8)
2	Main spool	10	Throttle adjust screw
3	Sub spool	11	Bushing
4	Spool plug	12	O- ring (P7)
5	Cover	13	Back- up ring (for O- ring P7)
6	Spring	14	O- ring (P16)
7	O- ring (P21)	15	Lock nut (M8)
8	O- ring (P36)		

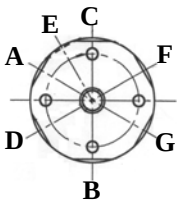
Swivel joint

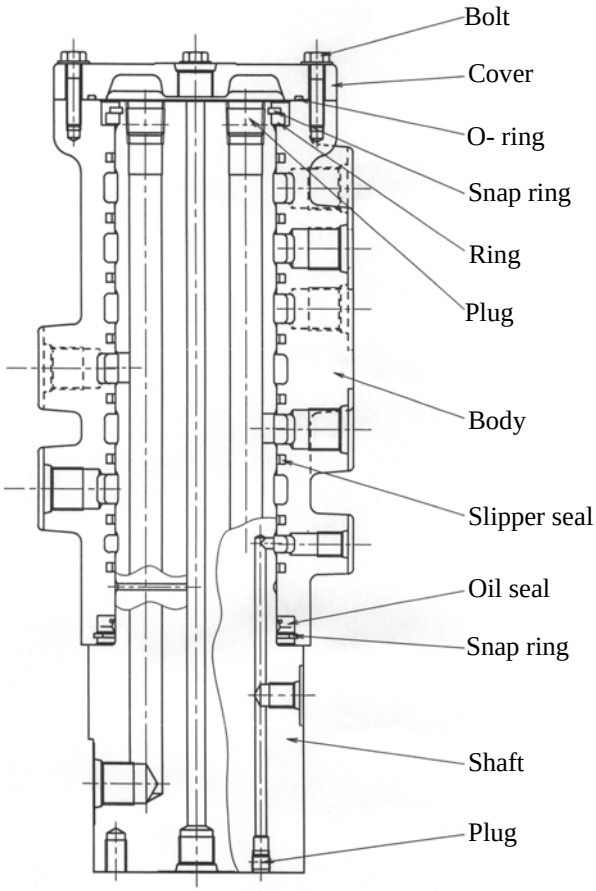
The swivel joint is installed at the rotation center of the turntable to provide the hydraulic oil passages between the turntable and chassis.

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)

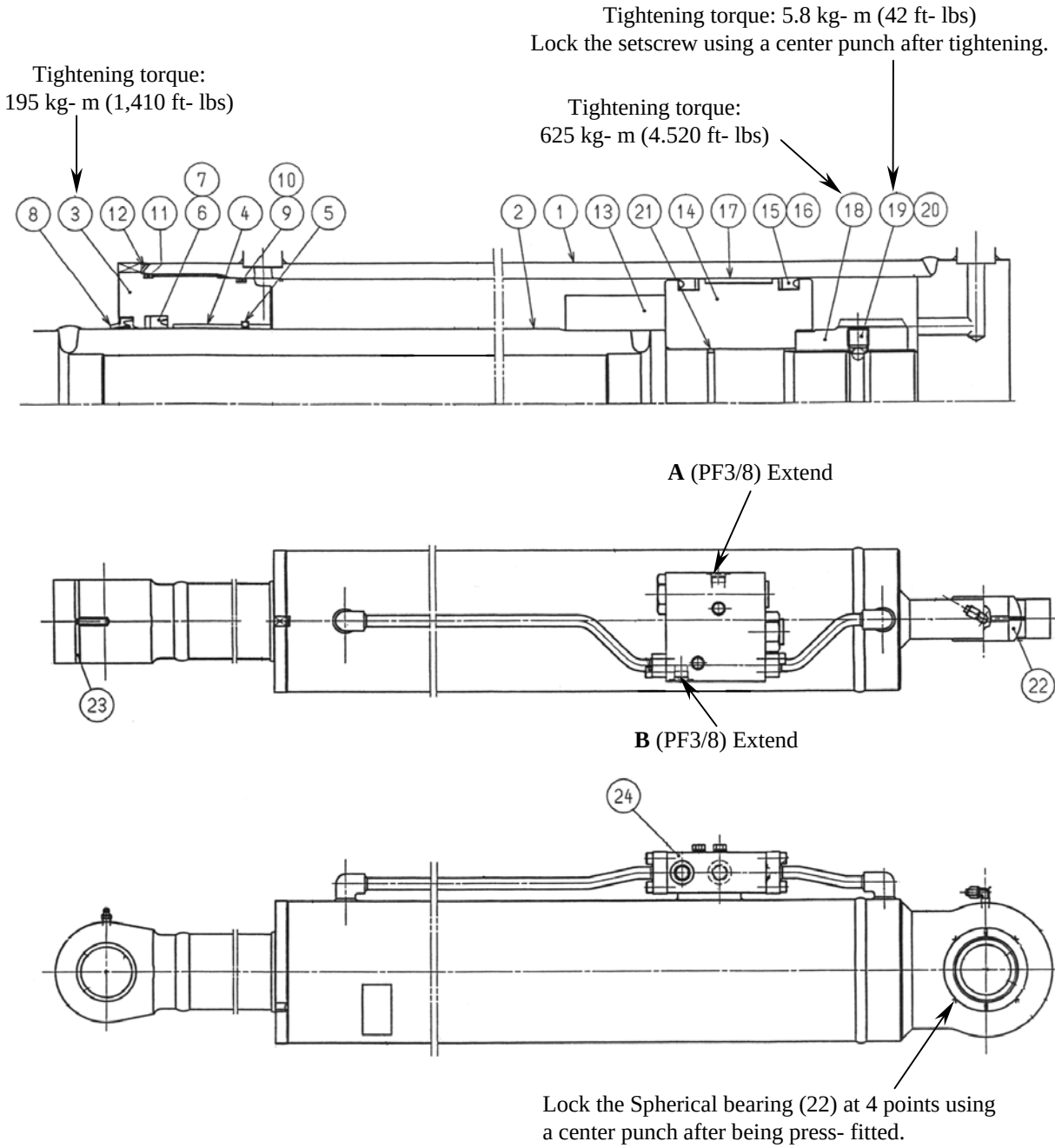




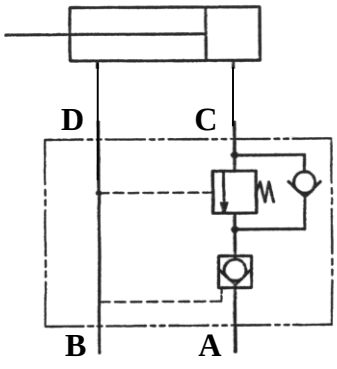




Boom elevation cylinder



No.	Description	No.	Description
1	Cylinder tube	13	Spacer
2	Piston rod	14	Piston
3	Cylinder head	15	U- ring
4	Bushing	16	Backup ring
5	Snap ring	17	Wear ring
6	U- ring	18	Nut
7	Backup ring	19	Set screw
8	Dust seal	20	Steel ball
9	O- ring	21	O- ring
10	Backup ring	22	Spherical bearing
11	O- ring	23	Bushing
12	Lock washer	24	Single holding valve

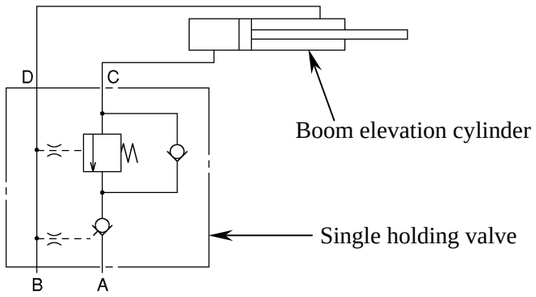


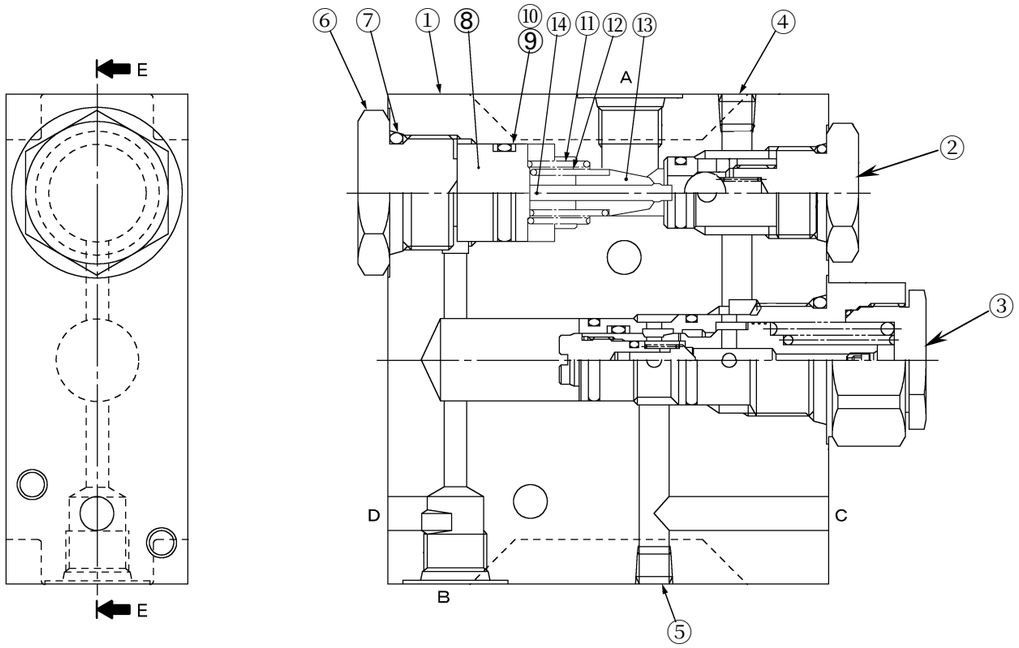
Hydraulic circuit diagram

Single holding valve (for Boom elevation cylinder)

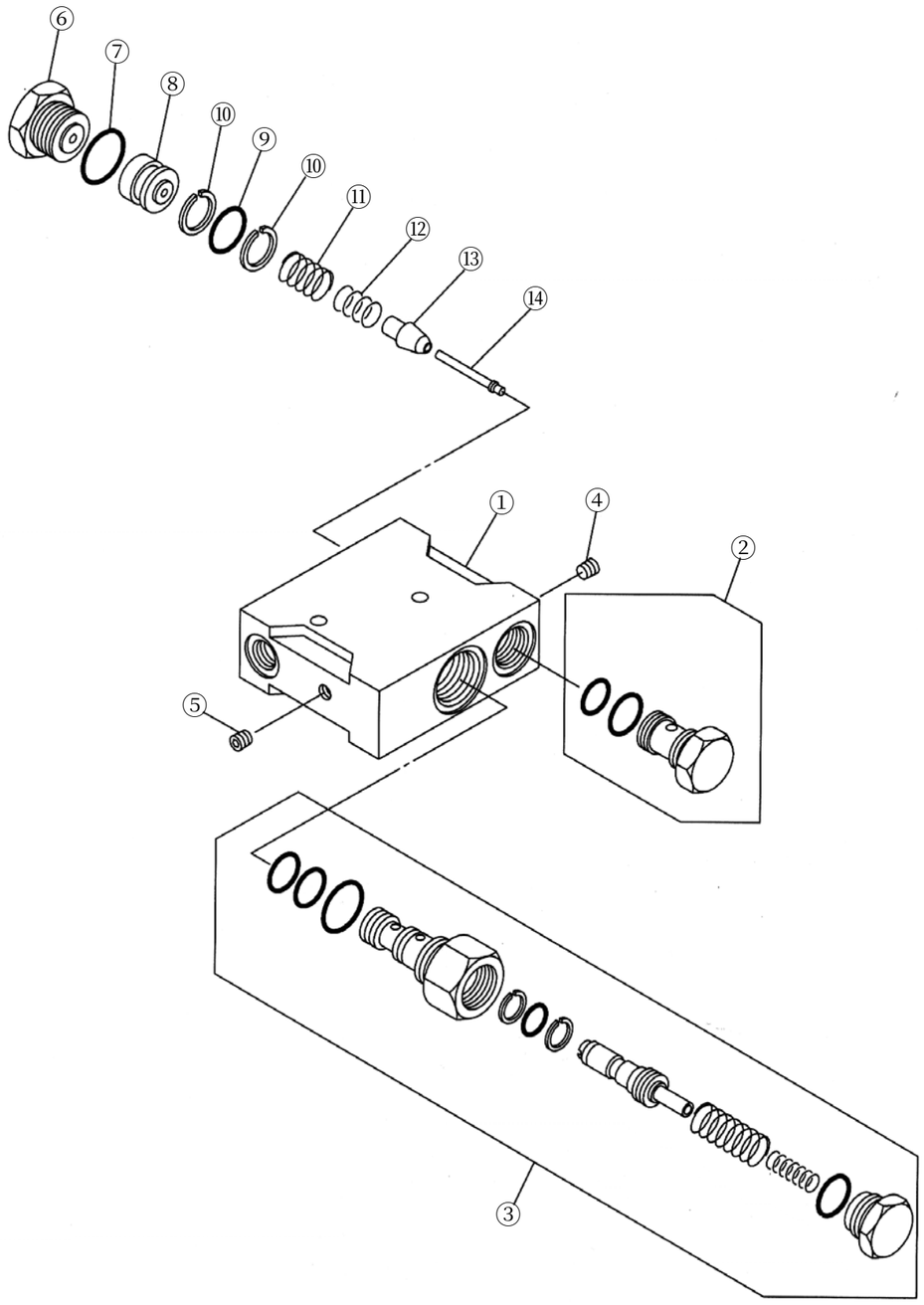
The Single holding valve is mounted on the Boom elevation cylinder to prevent the cylinder from natural retraction.

- Rated pressure ---------- 210 kg/cm^2 (2,990 PSI)
- Rated flow ---------- 50 liters/min. (13.2 GPM)





E – E section



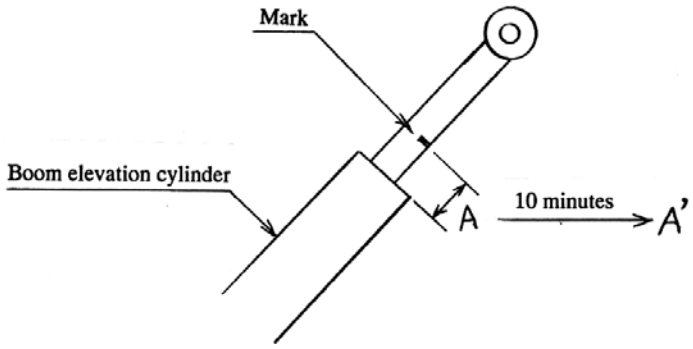
1	Valve housing	6	Cap	11	Spring
2	Pilot check valve cartridge	7	O- ring	12	Spring
3	Holding valve cartridge	8	Pilot piston	13	Guide
4	Plug	9	O- ring	14	Push rod
5	Plug	10	Back- up ring		

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).

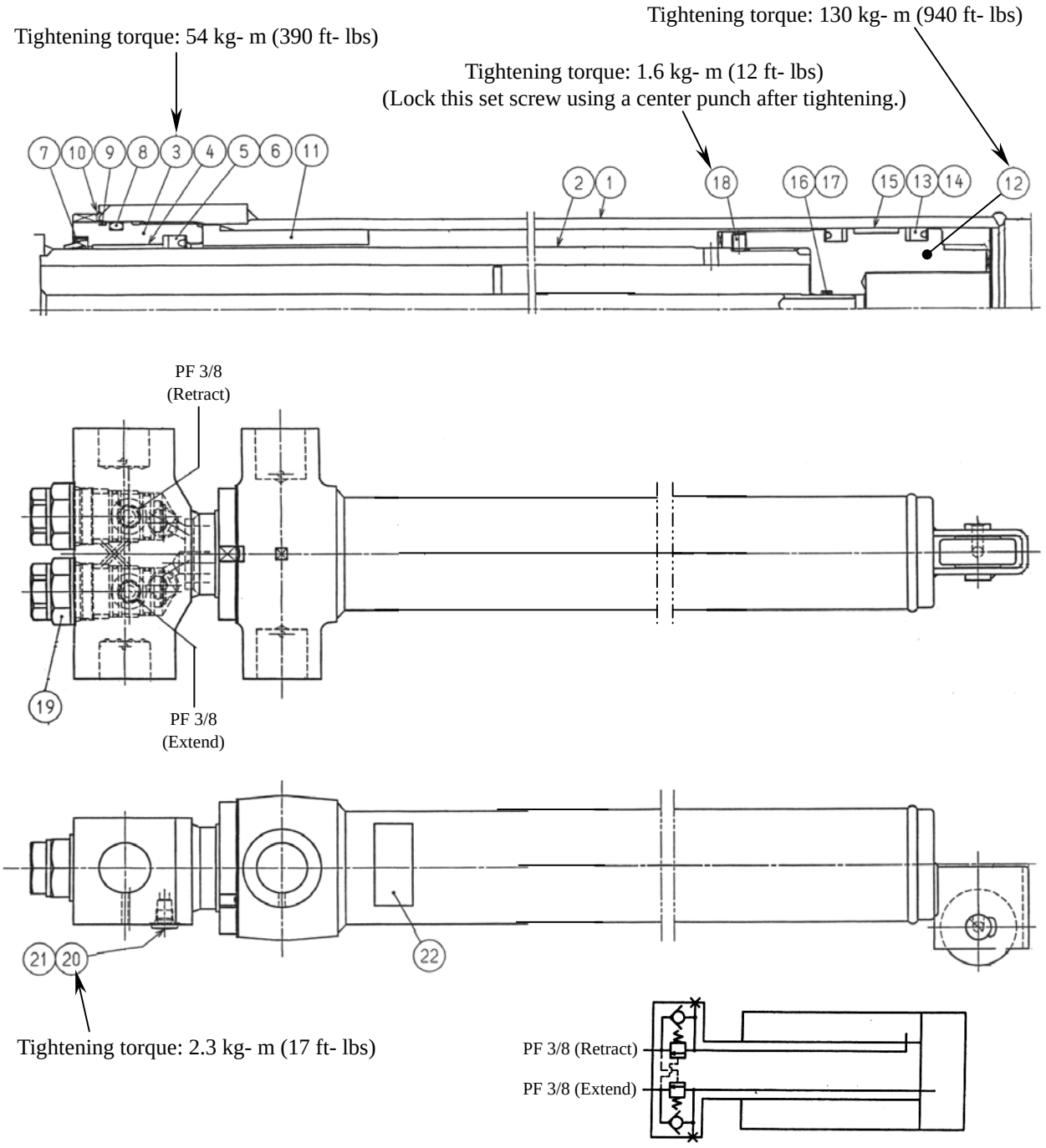
   1) Support the boom using a crane to prevent the boom from unexpected descent.
   2) Disconnect the hydraulic hose that is connected to the "A port" of the single holding valve.

      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.

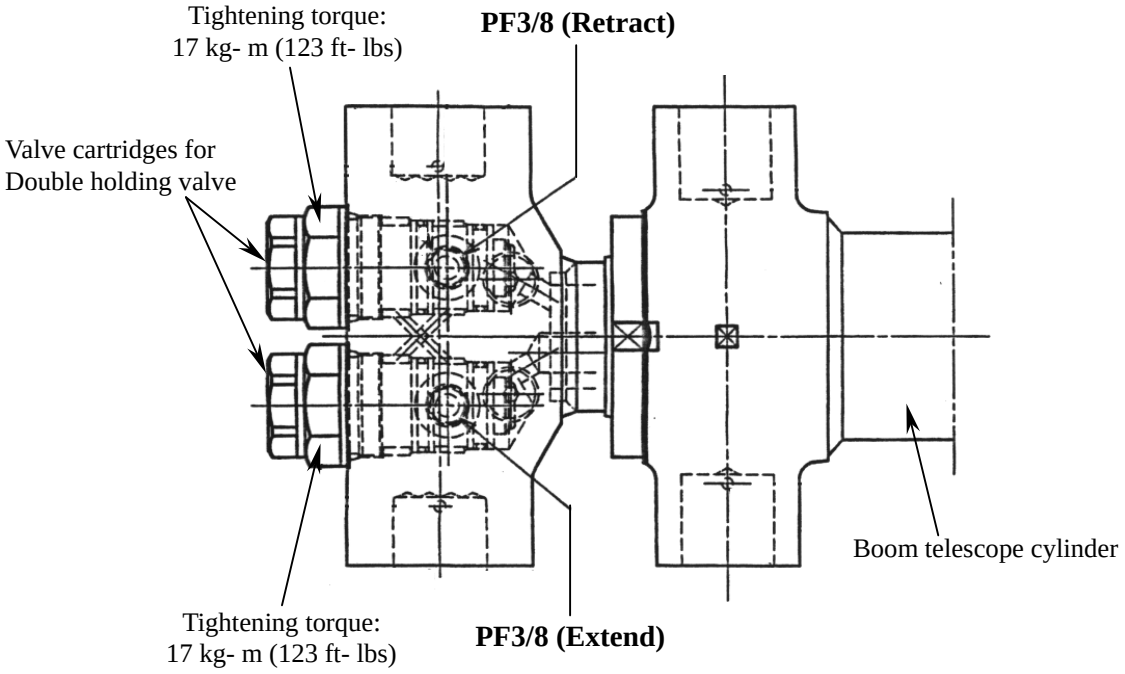
Boom telescope cylinder

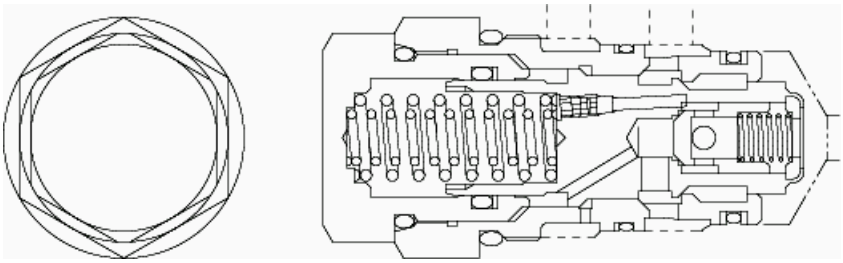


1	Cylinder tube	12	Piston
2	Piston rod	13	U- ring
3	Cylinder head	14	Back- up ring
4	Bushing	15	Wear ring
5	U- ring	16	O- ring
6	Back- up ring	17	Back- up ring
7	Dust seal	18	Set screw
8	O- ring	19	Holding valve cartridge
9	O- ring	20	Plug
10	Lock washer	21	O- ring
11	Spacer	22	Serial number plate

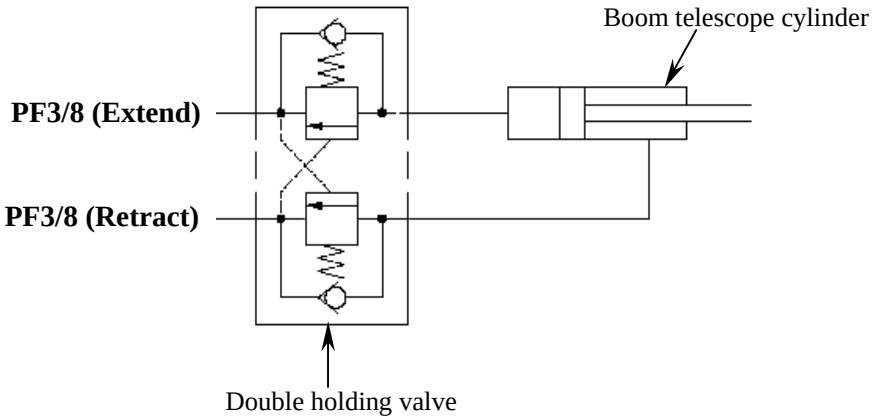
Double holding valve (for Boom telescope cylinder)

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





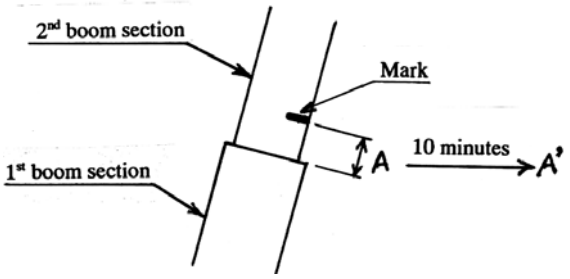
Valve cartridge detail



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.

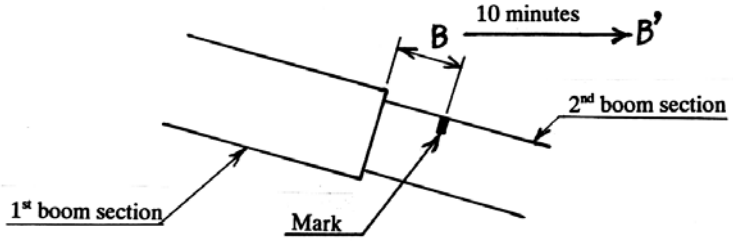


4. Leave the machine for 10 minutes, and then measure the ***Dimension A'***.

   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.

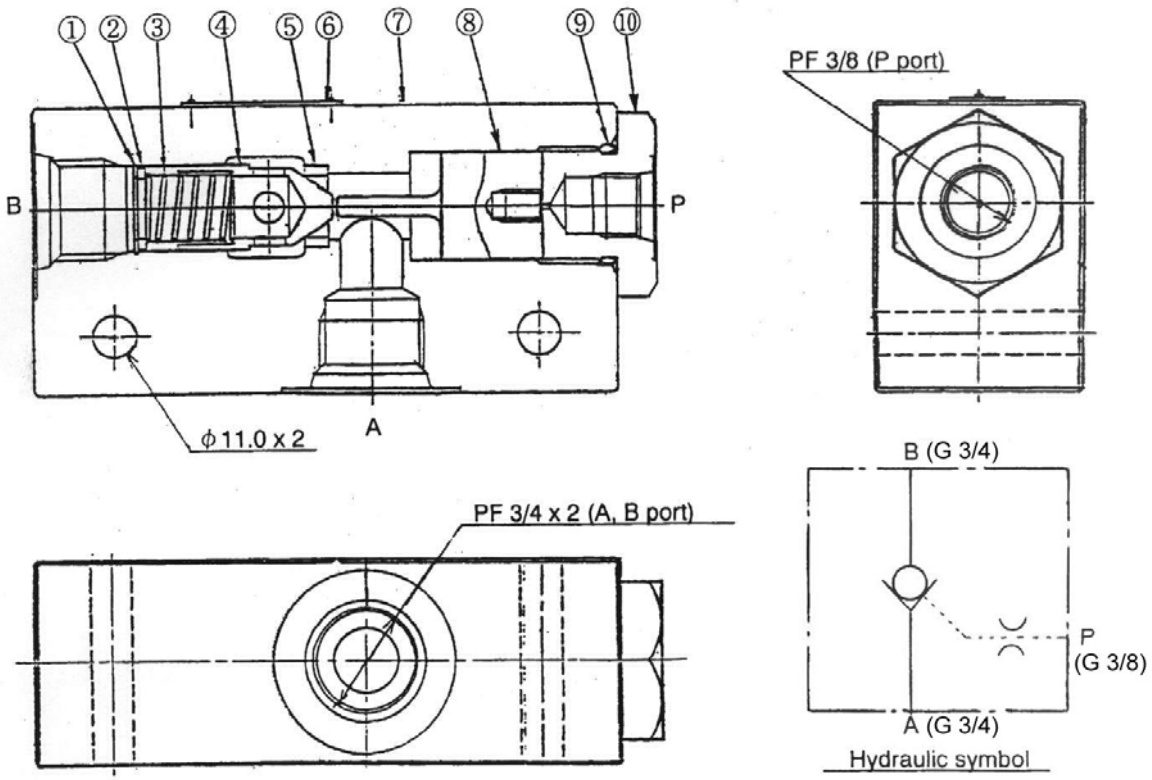
   Caution: Loosen the hydraulic hose fittings slowly when disconnecting the hydraulic hoses.

   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.

Single pilot check vale (for Boom telescope cylinder)

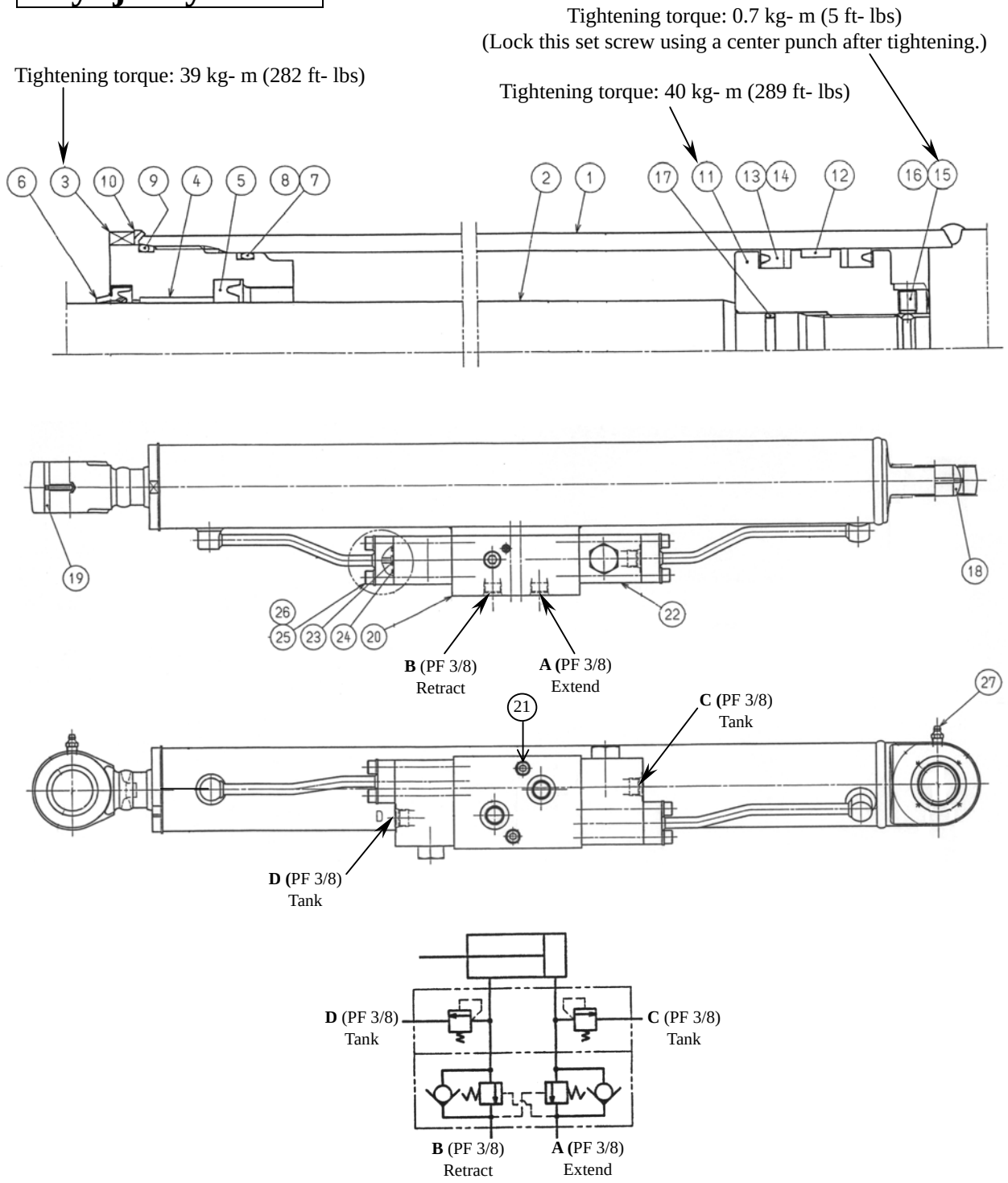
This valve, together with the double holding valve, is to prevent a “Natural retraction” of the Boom telescope cylinder caused by the gravity of the boom and the platform.

Rated pressure	175 kg / cm^2 (2500 PSI)
Rated flow	60 litters / min. (15.9 gallons / min)
Check valve cracking pressure	0.1 kg / cm^2 (1.42 PSI)



No.	Description		No.	Description
1	Snap ring		6	Name plate
2	Spring seat		7	Body
3	Spring		8	Pilot valve
4	Check valve		9	O-ring
5	Valve seat		10	Cap

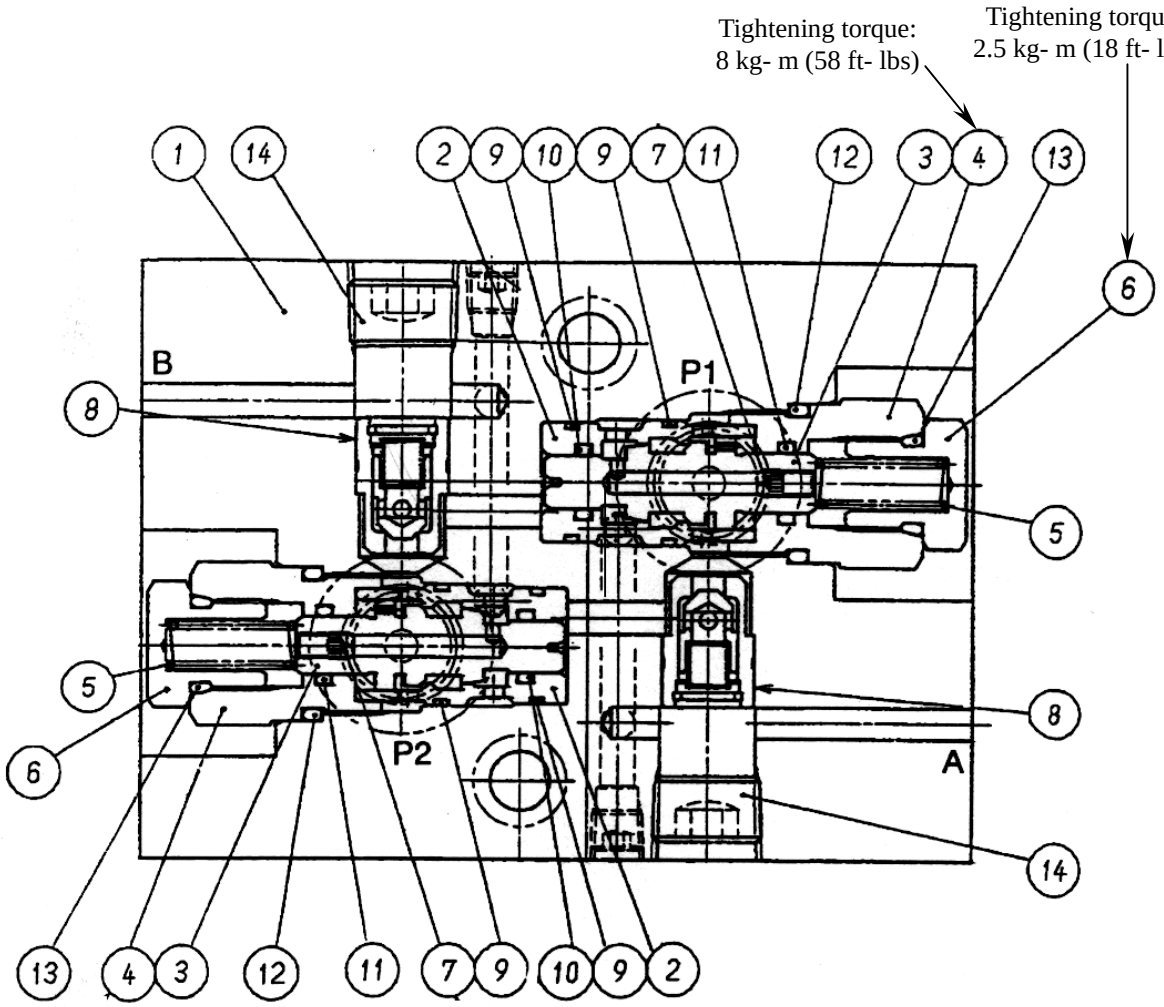
Fly- jib cylinder

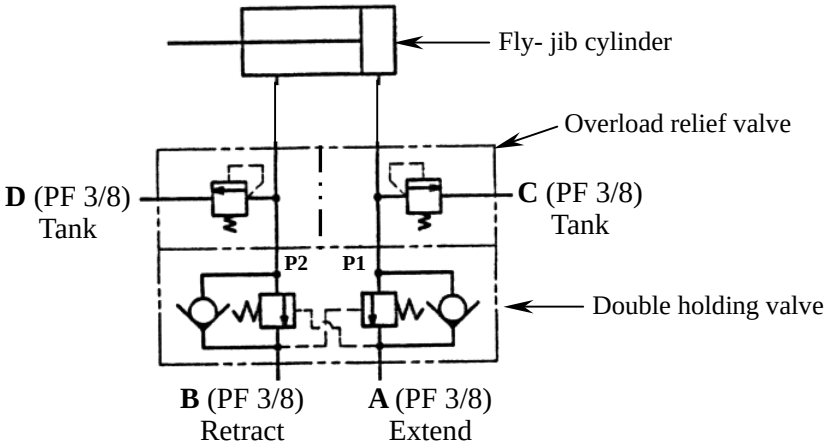


1	Cylinder tube	10	Lock washer	19	Bushing
2	Piston rod	11	Piston	20	Double holding valve
3	Cylinder head	12	Wear ring	21	Bolt
4	Bushing	13	U- ring	22	Overload relief valve
5	U- ring	14	Back- up ring	23	Filter
6	Dust seal	15	Set screw	24	O- ring
7	O- ring	16	Steel ball	25	Bolt
8	Back- up ring	17	O- ring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



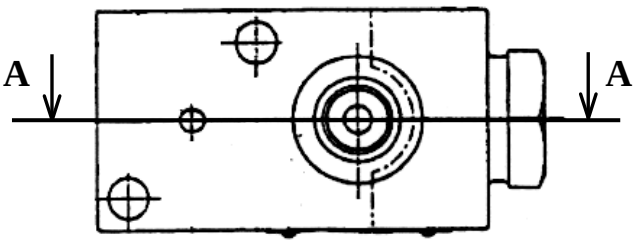


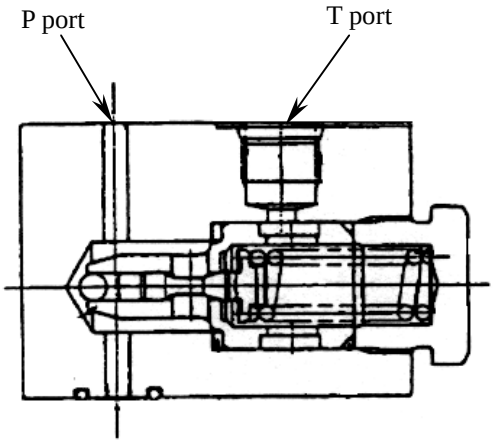
1	Body	6	Cap	11	O- ring
2	Valve seat	7	Orifice	12	O- ring
3	Valve spool	8	Check valve	13	O- ring
4	Valve hosing	9	O- ring	14	Plug
5	Spring	10	O- ring		

Overload relief valve (for Fly- jib cylinder)

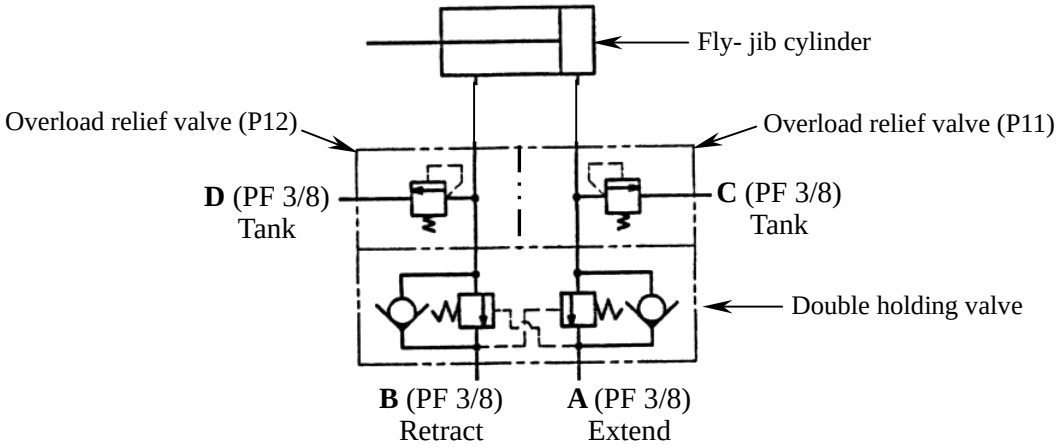
Two Overload relief valves (P11 and P12) are equipped on the Fly- jib cylinder to release abnormally high pressure produced in the Fly- jib cylinder.

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

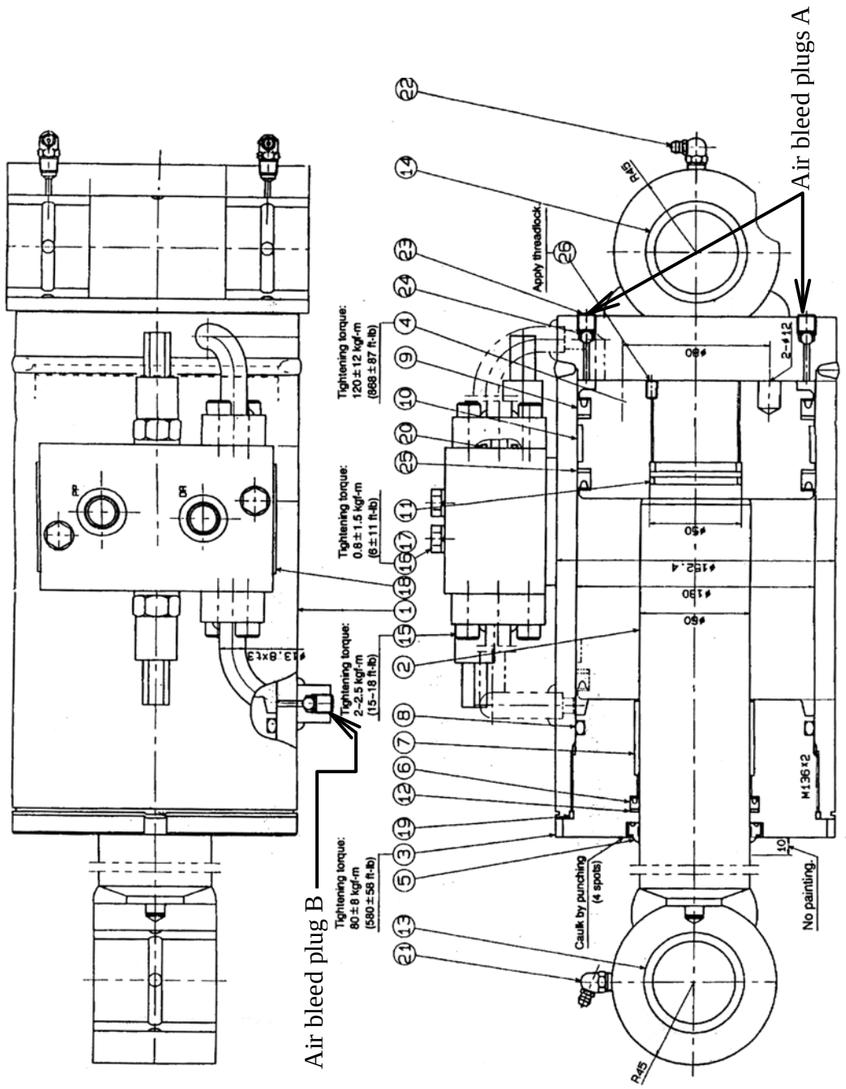




A – A section



Oscillation axle lock cylinder



No.	Description	No.	Description
1	Cylinder tube	14	Bushing
2	Piston rod	15	Cap bolt
3	Cylinder head	16	Bolt
4	Piston	17	Spring washer
5	Dust seal	18	Lock valve
6	Packing	19	O-ring
7	Bushing	20	O-ring
8	O-ring	21	Grease nipple
9	Packing	22	Grease nipple
10	Wear ring Lock washer	23	Set screw
11	O-ring Spacer	24	Steel ball
12	Backup ring	25	Backup ring
13	Bushing	26	Set screw

Air bleeding procedures

Bleed air from the ***"Oscillation axle lock cylinders"*** as follows when the air is suspected in the ***"Oscillation axle lock system".***

(1) Set up the machine on firm and level surface, and then unload the platform.

(2) Set the boom under the horizontal and retract it fully.

(3) Loosen the ***"Air bleed plugs A"*** shown in the figure left on the ***"Oscillation lock cylinder (L/H)"***.

(4) Drive the machine, have the ***"Left/ Front wheel"*** on a curb as shown in Fig. 1 to retract the ***"Oscillation lock cylinder (L/H)"*** fully and to bleed air from the ***bottom room*** of the cylinder.

(5) Tighten the ***"Air bleed plugs A"*** loosened in step (3).

(6) Loosen the ***"Air bleed plug B"*** shown in the figure left on the ***"Oscillation lock cylinder (L/H)"***.

(7) Drive the machine, have the ***"Right / Front wheel"*** on a curb as shown in Fig. 2 to extend the ***"Oscillation lock cylinder (L/H)"*** fully and to bleed air from the ***rod room*** of the cylinder.

(8) Tighten the ***"Air bleed plug B"*** loosened in step (6).

(9) Loosen the ***"Air bleed plug B"*** shown in the figure left on the ***"Oscillation lock cylinder (R/H)"***.

(10) Drive the machine, have the ***"Left / Front wheel"*** on a curb as shown in Fig. 1 to extend the ***"Oscillation lock cylinder (R/H)"*** fully and to bleed air from the ***rod room*** of the cylinder.

(11) Tighten the ***"Air bleed plug B"*** loosened in step (9).

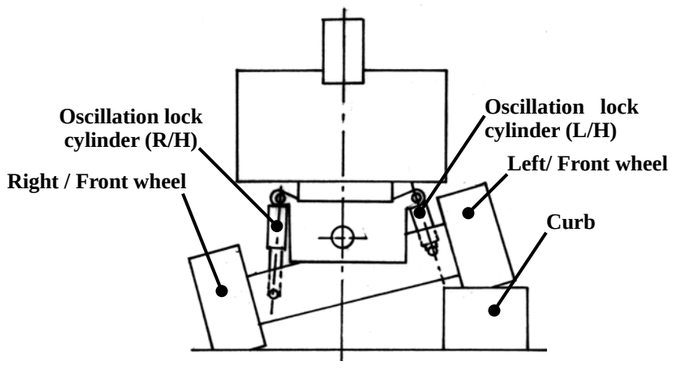
(12) Loosen the ***"Air bleed plugs A"*** shown in the figure left on the ***"Oscillation lock cylinder (R/H)"***.

(13) Drive the machine, have the ***"Right / Front wheel"*** on a curb as shown in Fig. 2 to retract the ***"Oscillation lock cylinder (R/H)"*** fully and to bleed air from the ***bottom room*** of the cylinder..

(14) Tighten the ***"Air bleed plugs A"*** loosened in step (12).

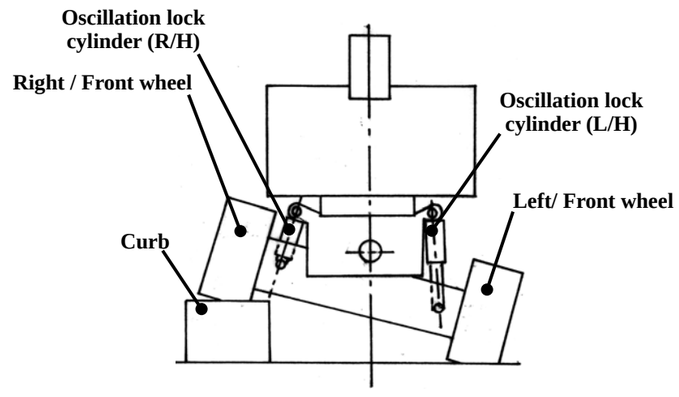
(15) Repeat the above steps until no air comes out from all of the air bleed plugs.

Fig. 1



View from front

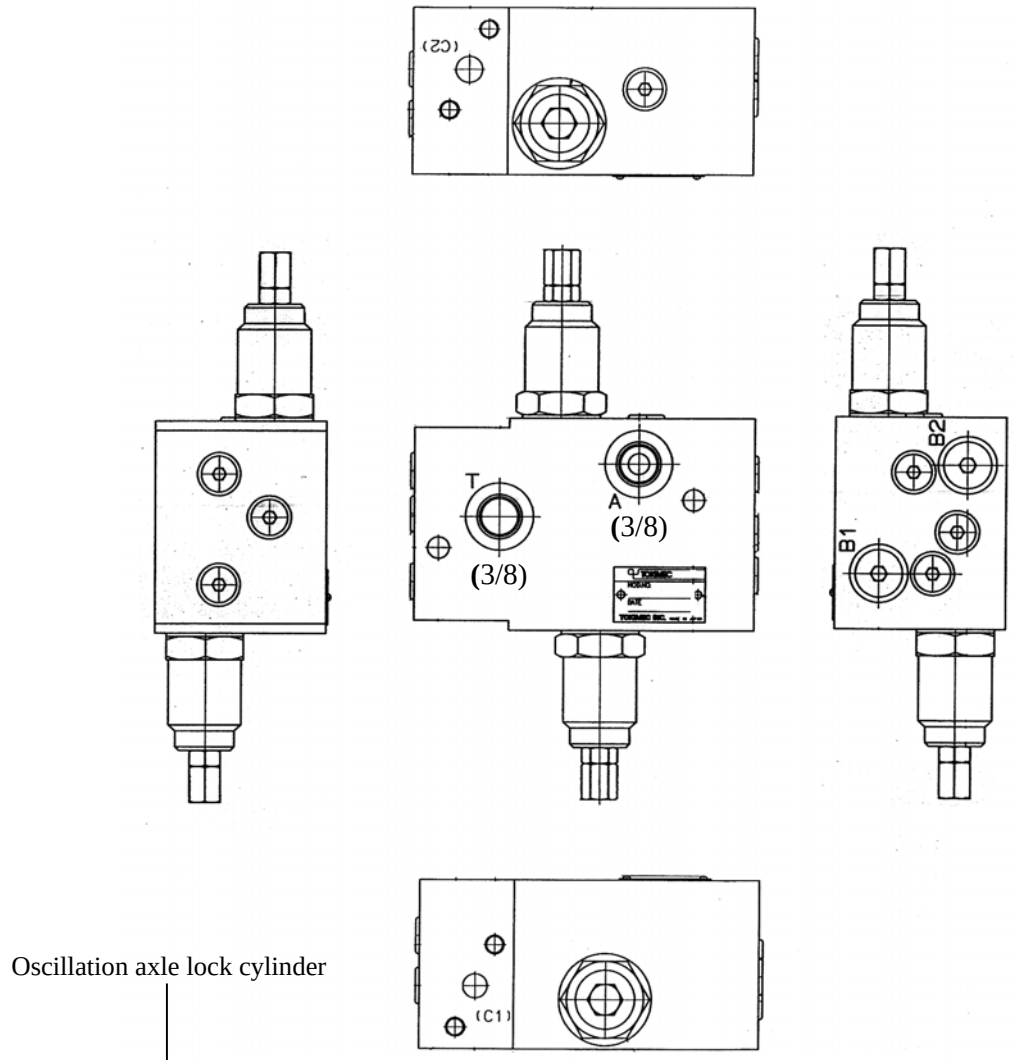
Fig. 2

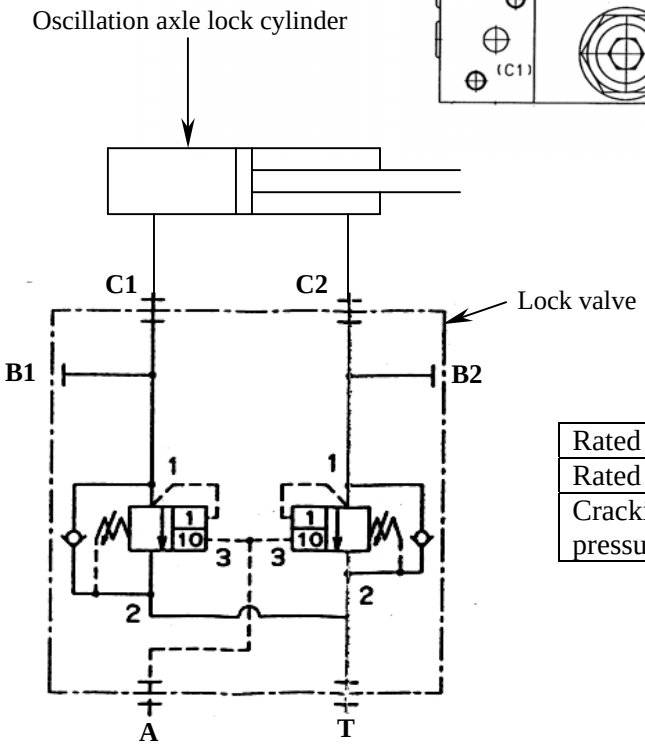


View from front

Lock valve (for Oscillation axle lock cylinder)

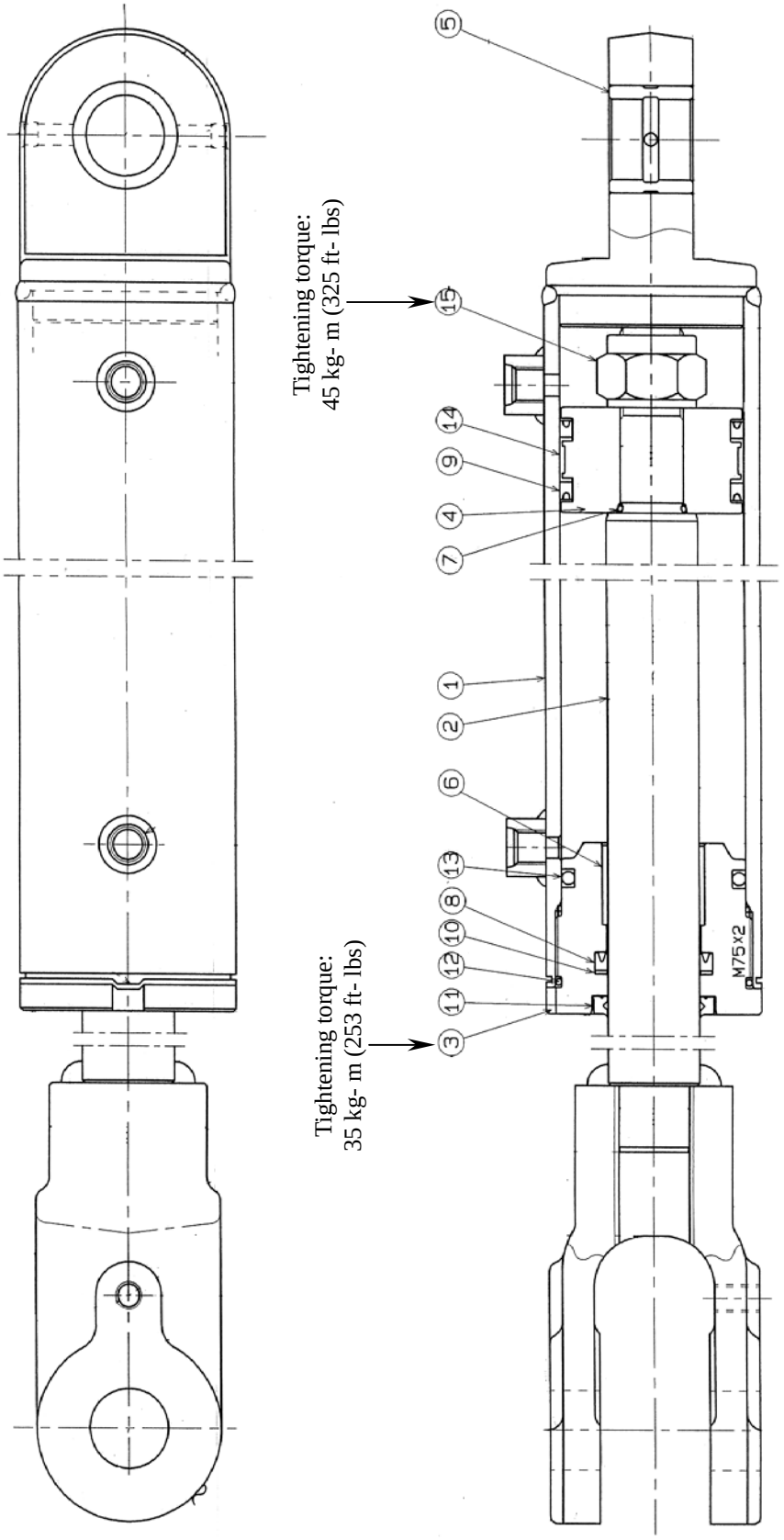
This Lock valve is equipped on the Oscillation axle lock cylinder to lock the cylinder. This valve also releases abnormally high pressure produced in the Oscillation axle lock cylinder to protect the cylinder.





Rated pressure	350 kg/cm^2 (4,980 PSI)
Rated flow	30 liters/min (7.9 GPM)
Cracking pressure (1)	210 kg/cm^2 (2.990 PSI)

Steering cylinder

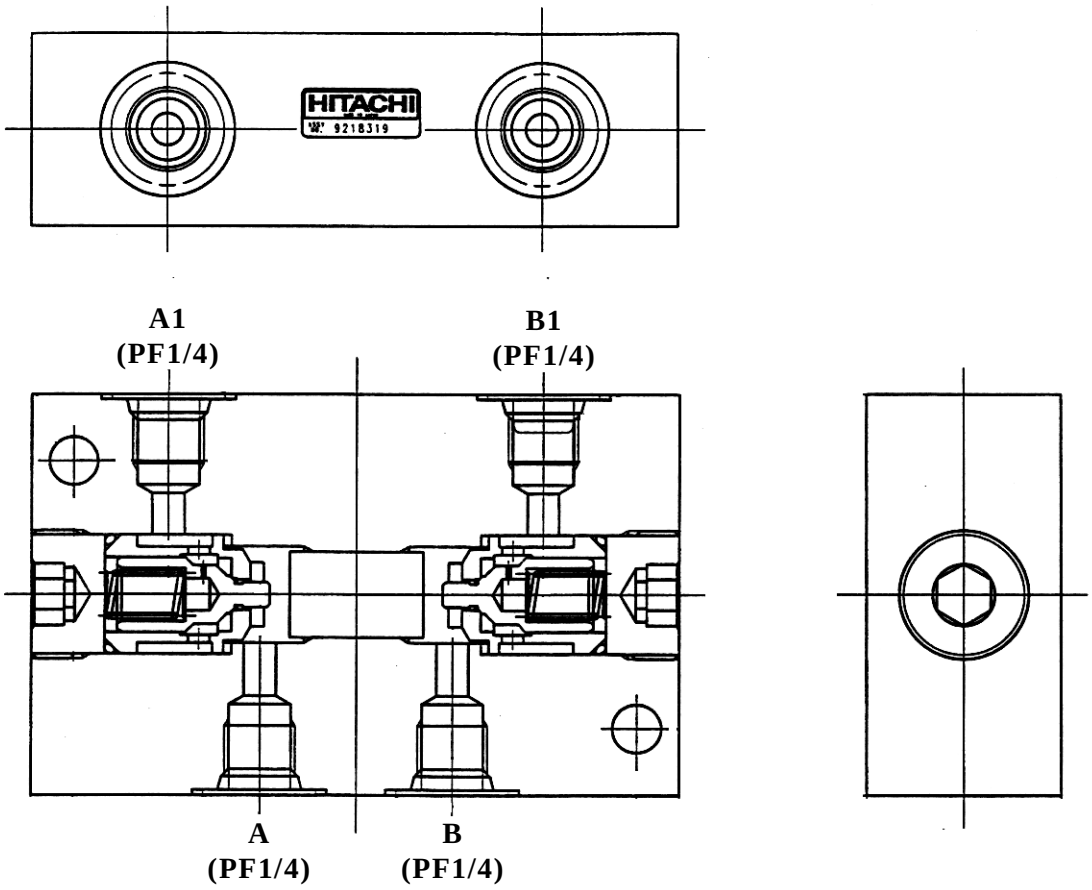


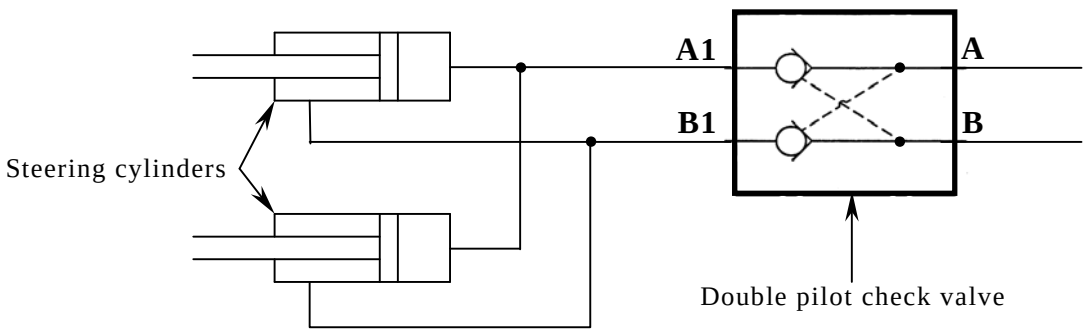
1	Cylinder tube	6	Bushing	11	Dust seal
2	Piston rod	7	O- ring	12	O- ring
3	Cylinder head	8	U- ring	13	O- ring
4	Piston	9	U- ring	14	Wear ring
5	Bushing	10	Back- up ring	15	Self- lock nut

Double pilot check valve (for Steering cylinder)

This double pilot check valve is installed in the Steering hydraulic circuit to prevent the steering cylinders from being extended or retracted naturally, while the steering function is not operated.

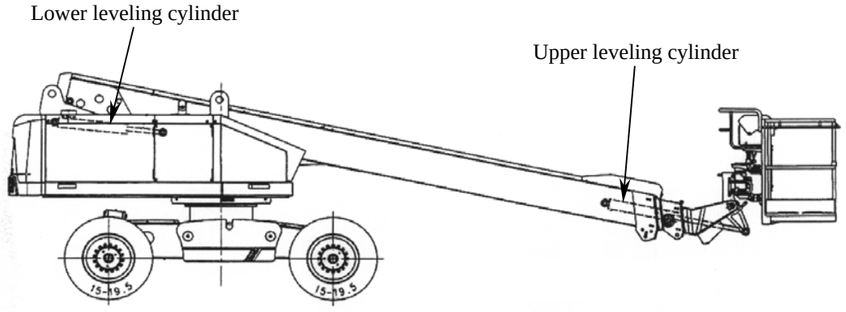
- Rated pressure ---------- 210 kg/cm^2 (2,990 PSI)
- Rated flow ---------- 30 liters/min (7.9 gallons/min)



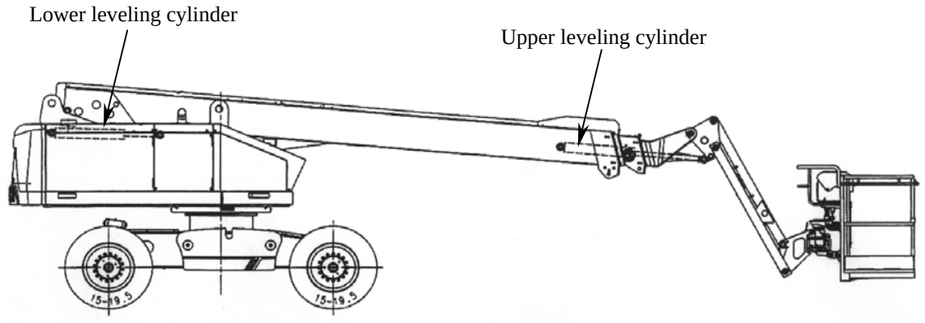


Platform leveling system

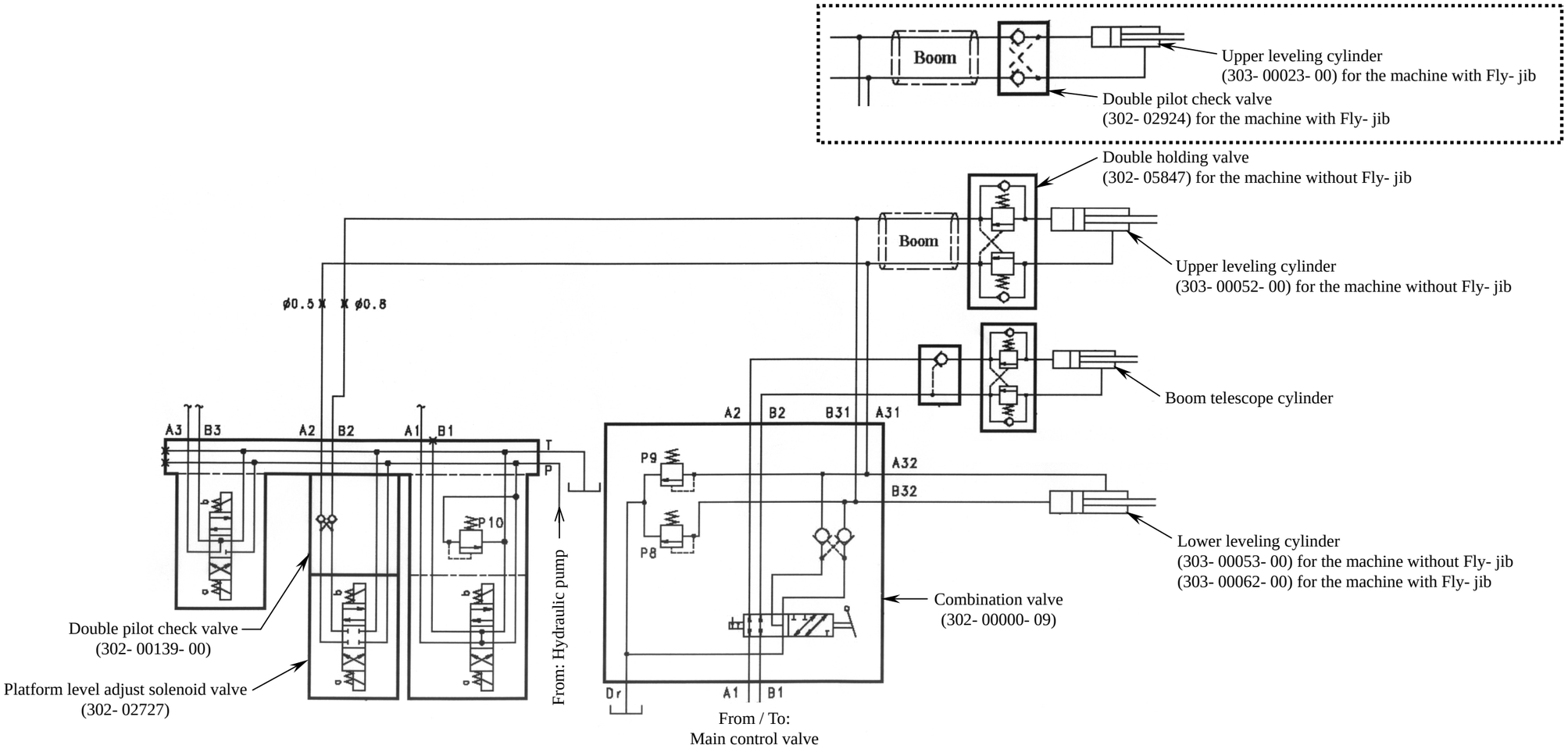
This system automatically maintains the platform at its level position regardless of the boom UP/Down movements, and consist of the Upper and Lower leveling cylinders, Double holding or pilot check valve mounted on Upper leveling cylinder and the combination valve for adjusting platform level as shown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

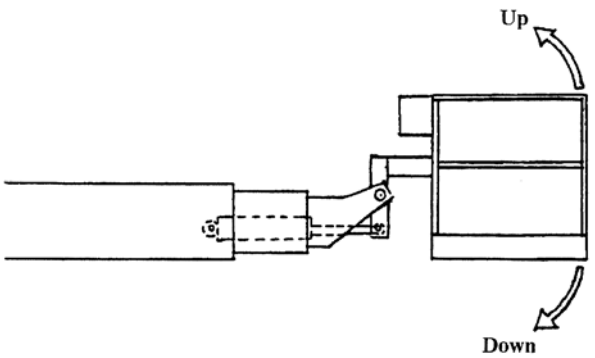
(1) Tilt of platform
Perform Boom elevation and telescope operations several times, and check that the platform always stays level.
If the platform does not stay level, check the leveling system as follows.
1) Thoroughly check the system for external oil leakage.
2) Follow the instructions described 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.

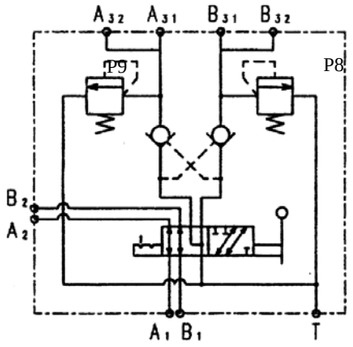
1) Pull the platform level adjust lever equipped on the Combination valve while pressing the lock lever.
2) Operate the Boom telescope switch to its ***IN*** position to tilt the platform fully upward.
3) Operate the Boom telescope switch to its ***OUT*** position to tilt the platform fully downward.
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.

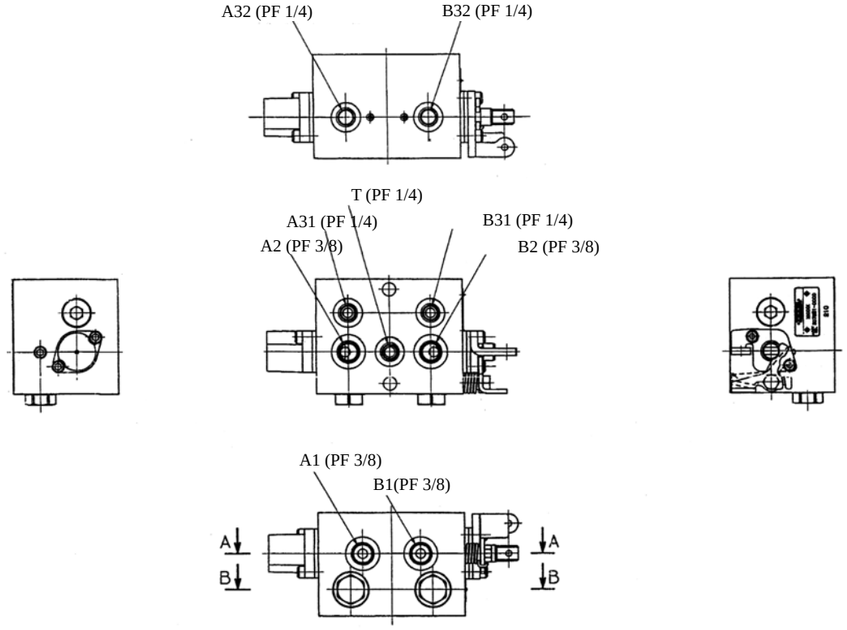


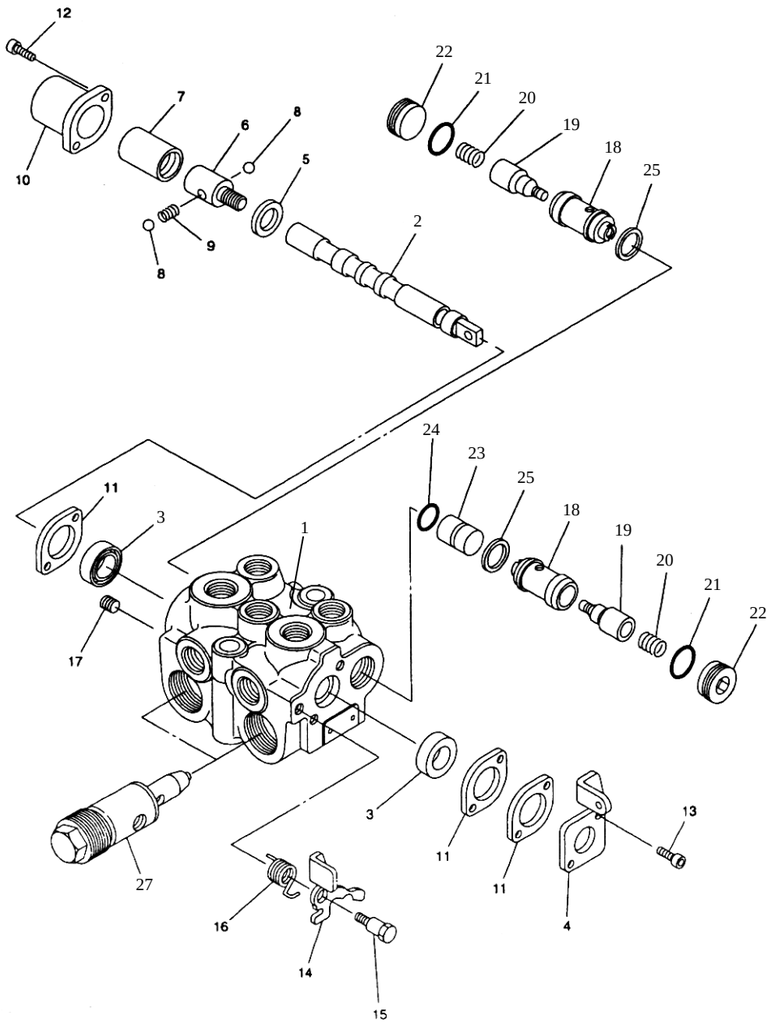
Combination valve (for Platform leveling system)

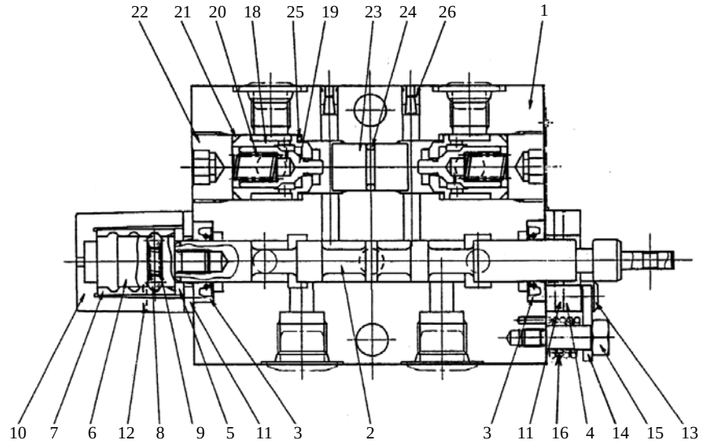
The Combination valve is used in the Platform leveling system and incorporates the Directional control valve, the Double pilot check valve and two Overload relief valves.

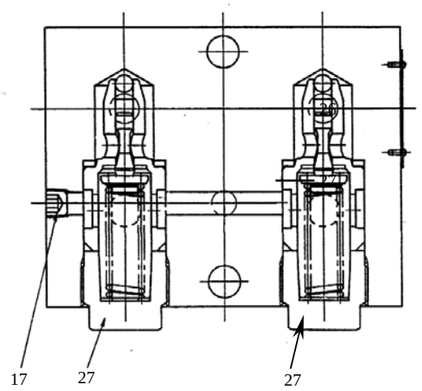
Rated pressure	300 kg/cm^2	4,270 PSI
Rated flow	50 liters/min	13 gallons/min
Preset pressure for Overload relief valves (P8 and P9)	230 kg/cm^2	3,272 PSI
Rated flow	50 liters/min	13.2 GPM









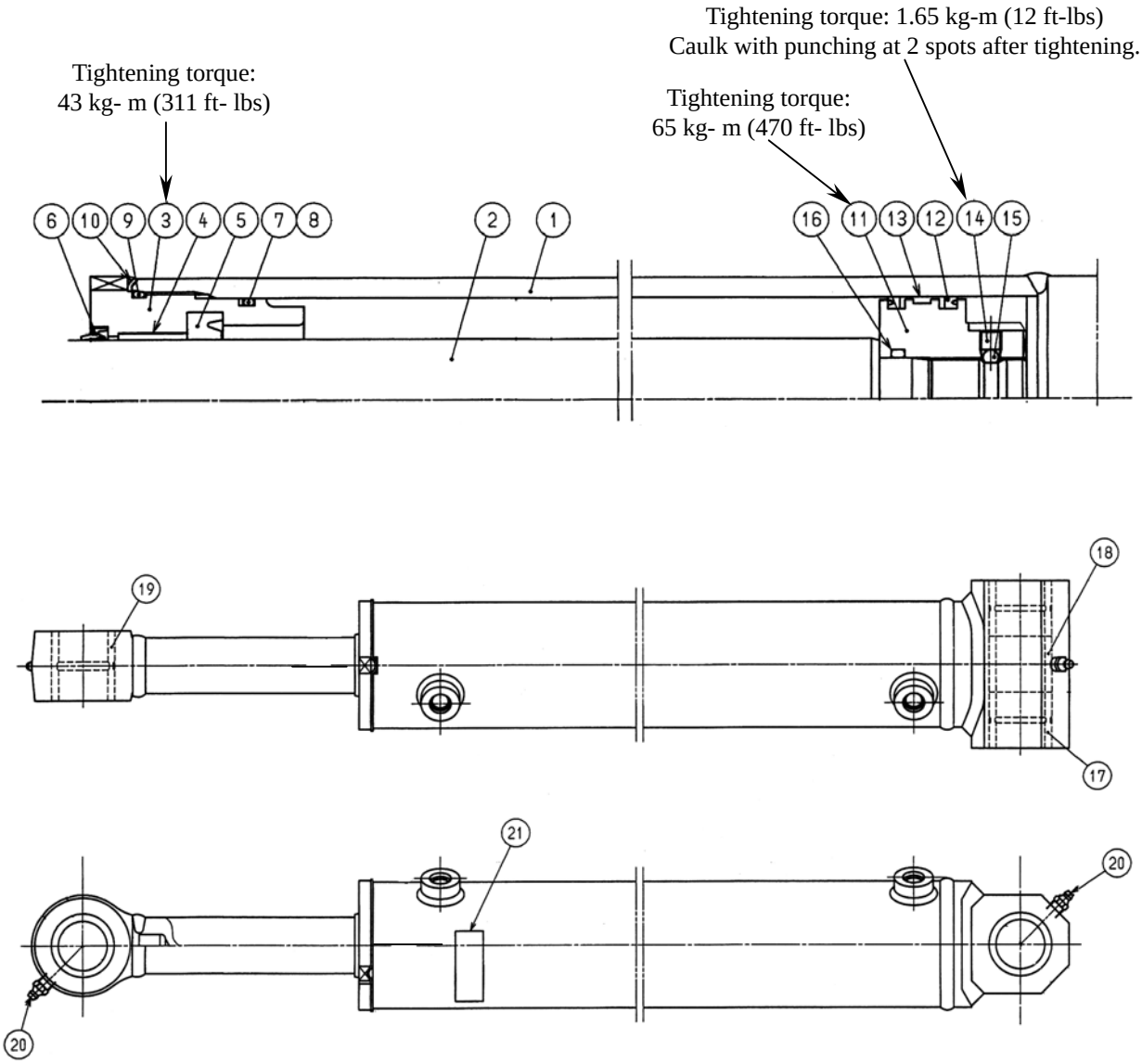


A-A Section

B-B Section

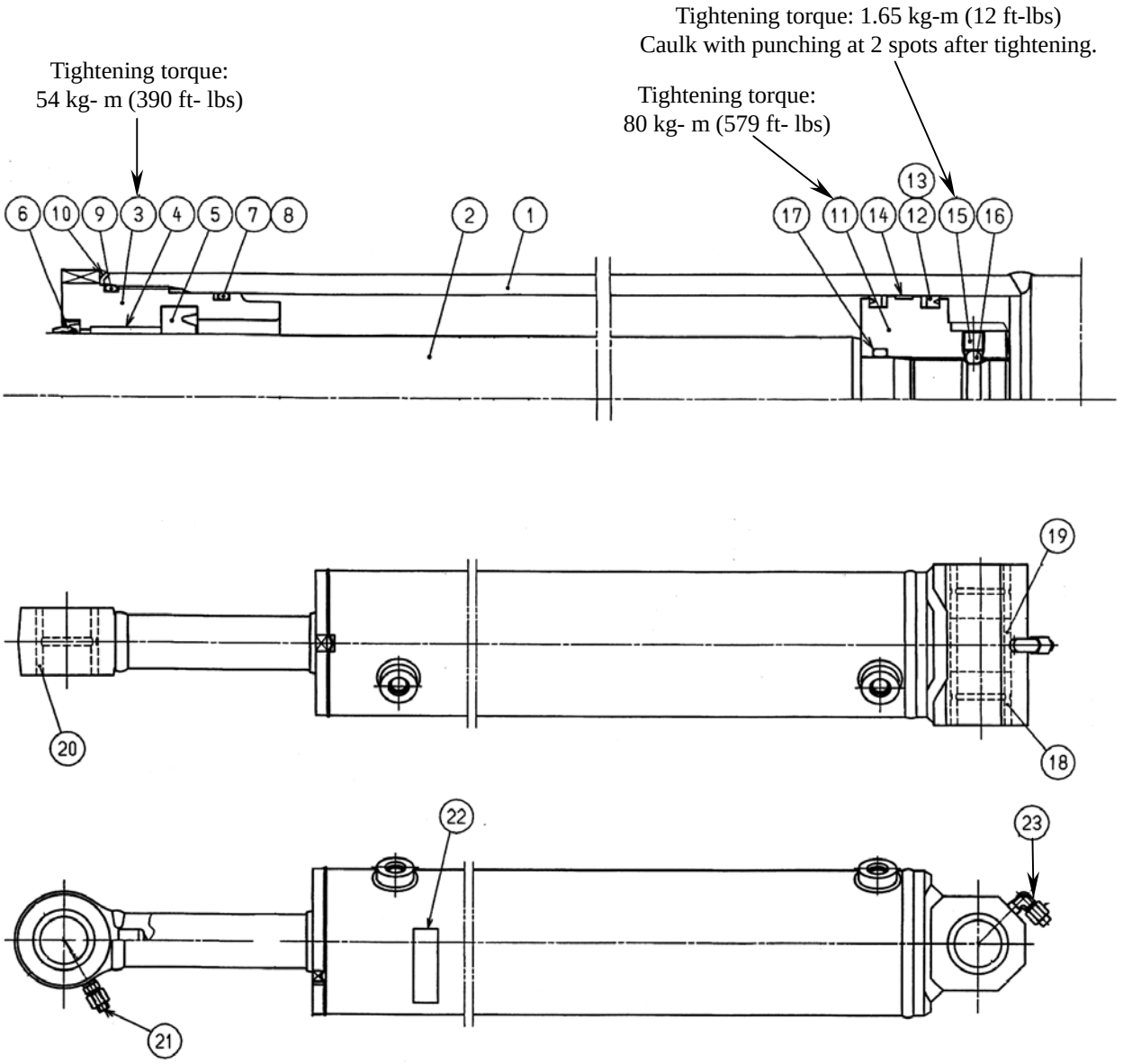
No.	Description	No.	Description	No.	Description
1	Body	11	Plate	21	O-ring
2	Spool	12	Bolt	22	Plug
3	Oil seal	13	Bolt	23	Piston
4	Bracket	14	Spool lock lever	24	O- ring
5	Washer	15	Bolt	25	Gasket
6	Bolt	16	Spring	26	Expand plug
7	Bushing	17	Plug	27	Overload relief valve
8	Steel ball	18	Valve seat	28	
9	Spring	19	Valve	29	
10	Cap	20	Spring	30	

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



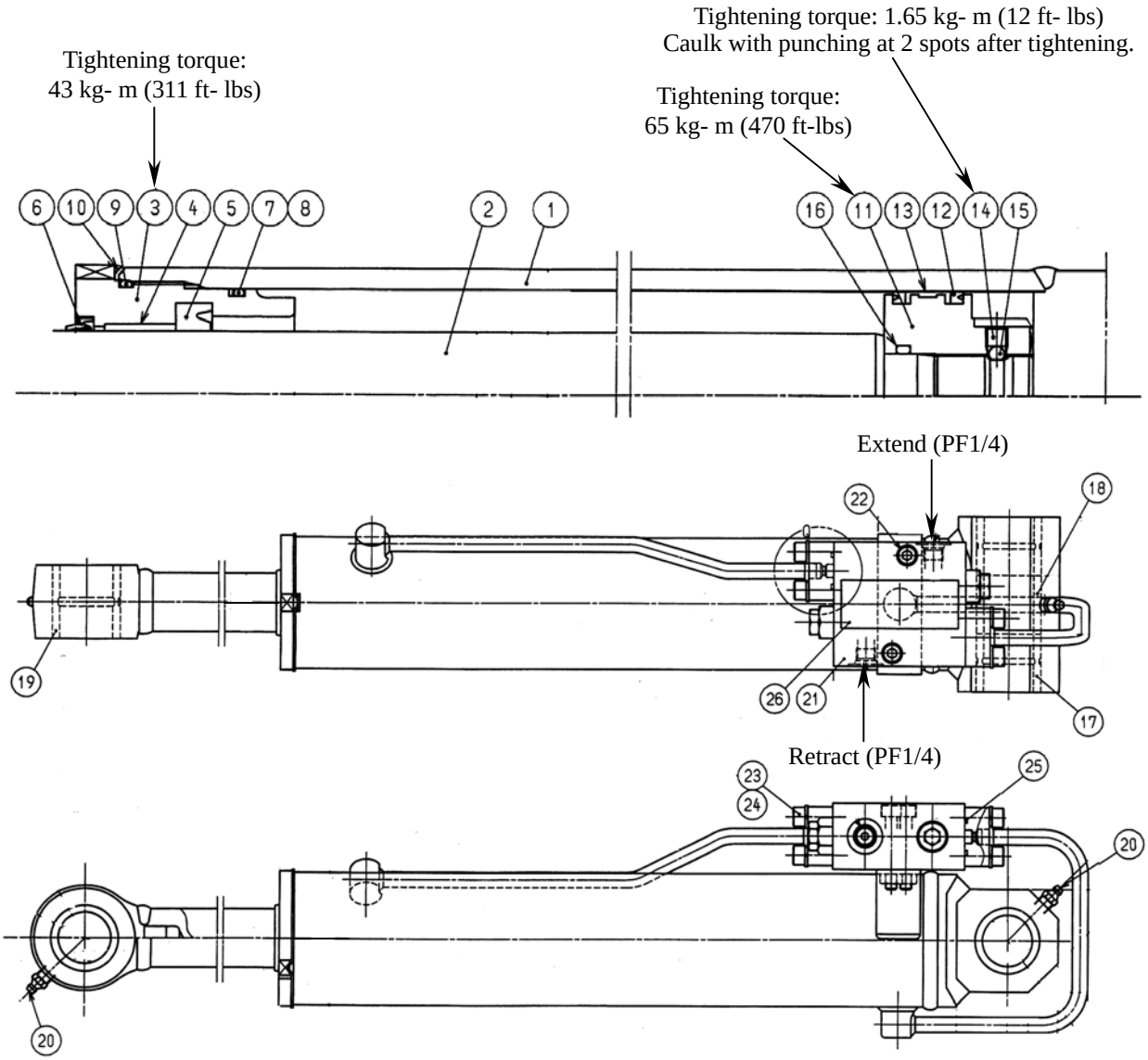
No.	Description	No.	Description
1	Cylinder tube	12	U- ring
2	Piston rod	13	Wear ring
3	Cylinder head	14	Set screw
4	Bushing	15	Steel ball
5	U-ring	16	O- ring
6	Dust seal	17	Bushing
7	O- ring	18	Collar
8	Backup ring	19	Bushing
9	O- ring	20	Grease fitting
10	Lock washer	21	Name plate
11	Piston	------	----------

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

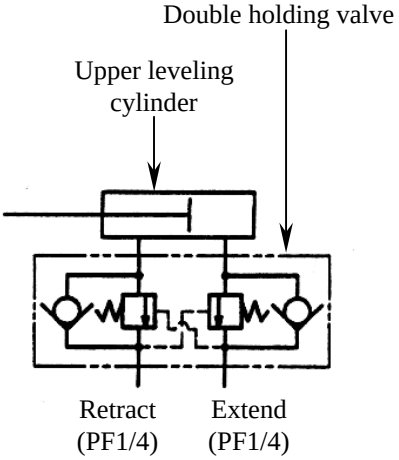


No.	Description	No.	Description
1	Cylinder tube	12	Back- up ring
2	Piston rod	14	Wear ring
3	Cylinder head	15	Set screw
4	Bushing	16	Steel ball
5	U-ring	17	O- ring
6	Dust seal	18	Bushing
7	O- ring	19	Collar
8	Back- up ring	20	Bushing
9	O- ring	21	Grease fitting
10	Lock washer	22	Name plate
11	Piston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

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



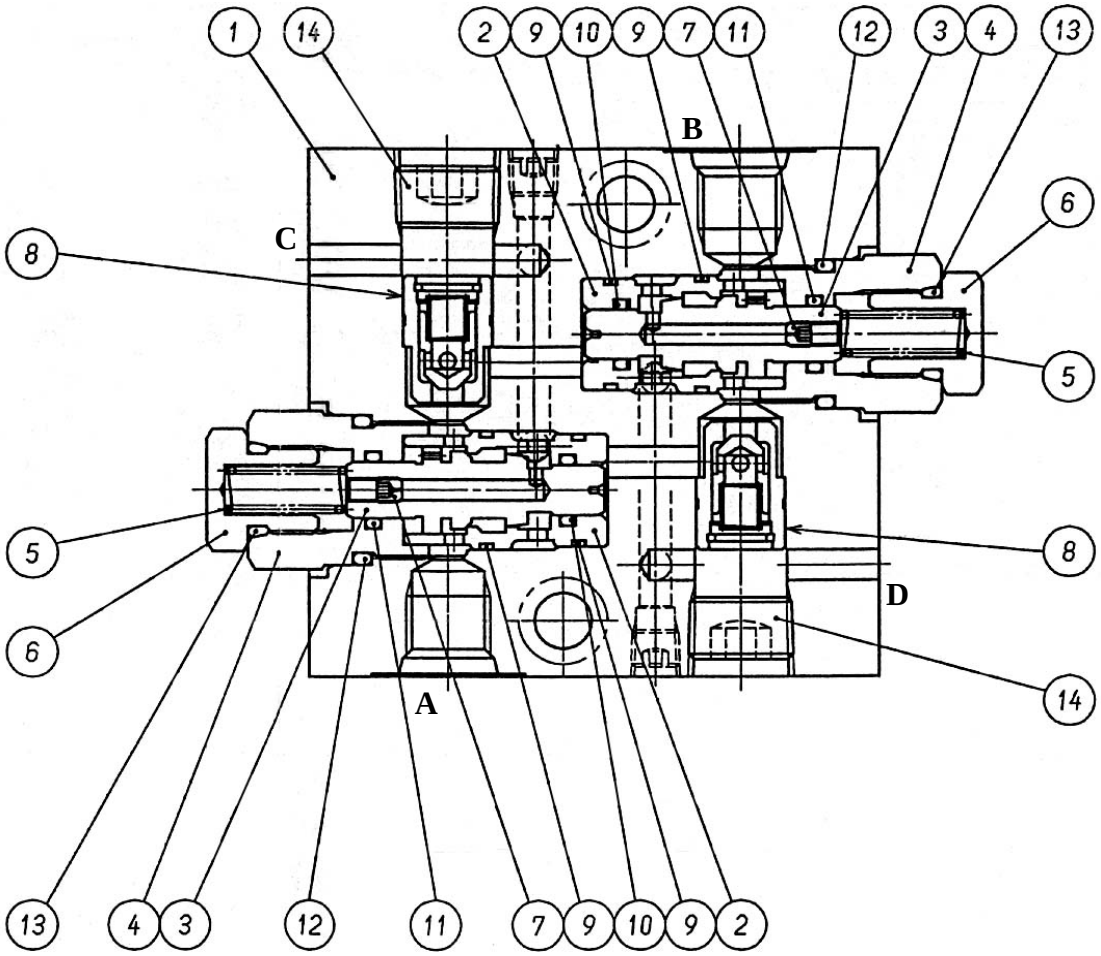
No.	Description	No.	Description
1	Cylinder tube	14	Set screw
2	Piston rod	15	Steel ball
3	Cylinder head	16	O- ring
4	Bushing	17	Bushing
5	U- ring	18	Collar
6	Dust seal	19	Bushing
7	O- ring	20	Grease fitting
8	Back- up ring	21	Double holding valve
9	O- ring	22	Bolt
10	Lock washer	23	Bolt
11	Piston	24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

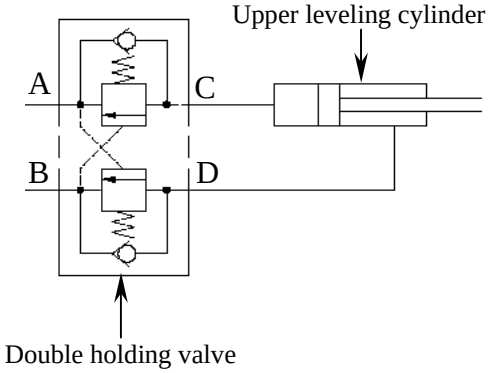


Double holding valve (for Upper leveling cylinder without Fly- jib)

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

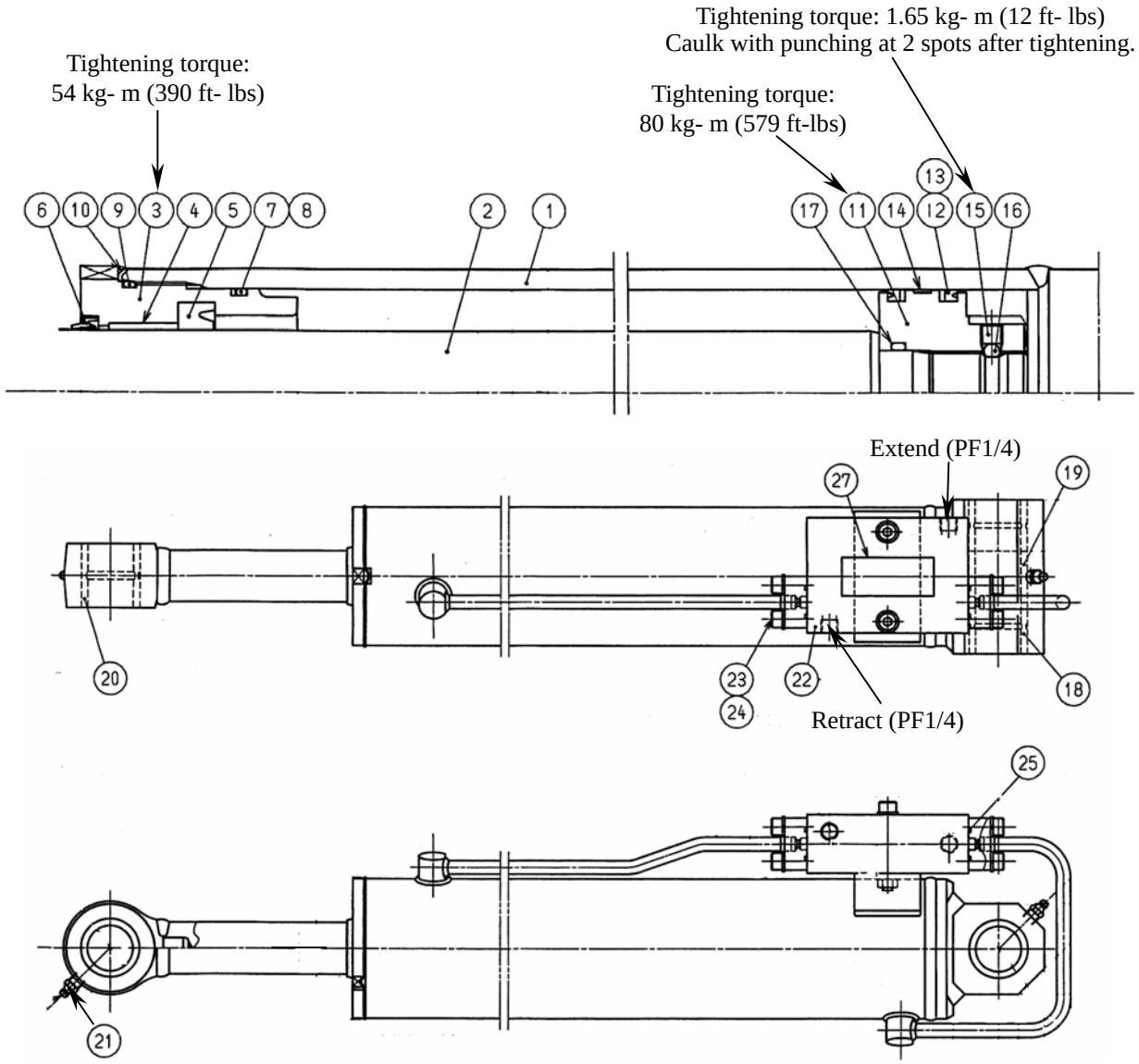
- Rated pressure ---------- 230 kg/cm^2 (3,270 PSI)
- Rated flow ---------- 10 liters/min (2.64 gallons/mi n)



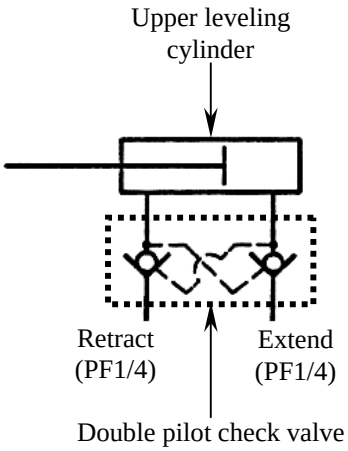


1	Body	8	Check valve
2	Valve seat	9	O- ring
3	Valve spool	10	O- ring
4	Cap	11	O- ring
5	Spring	12	O- ring
6	Cap	13	O- ring
7	Orifice	14	Plug

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

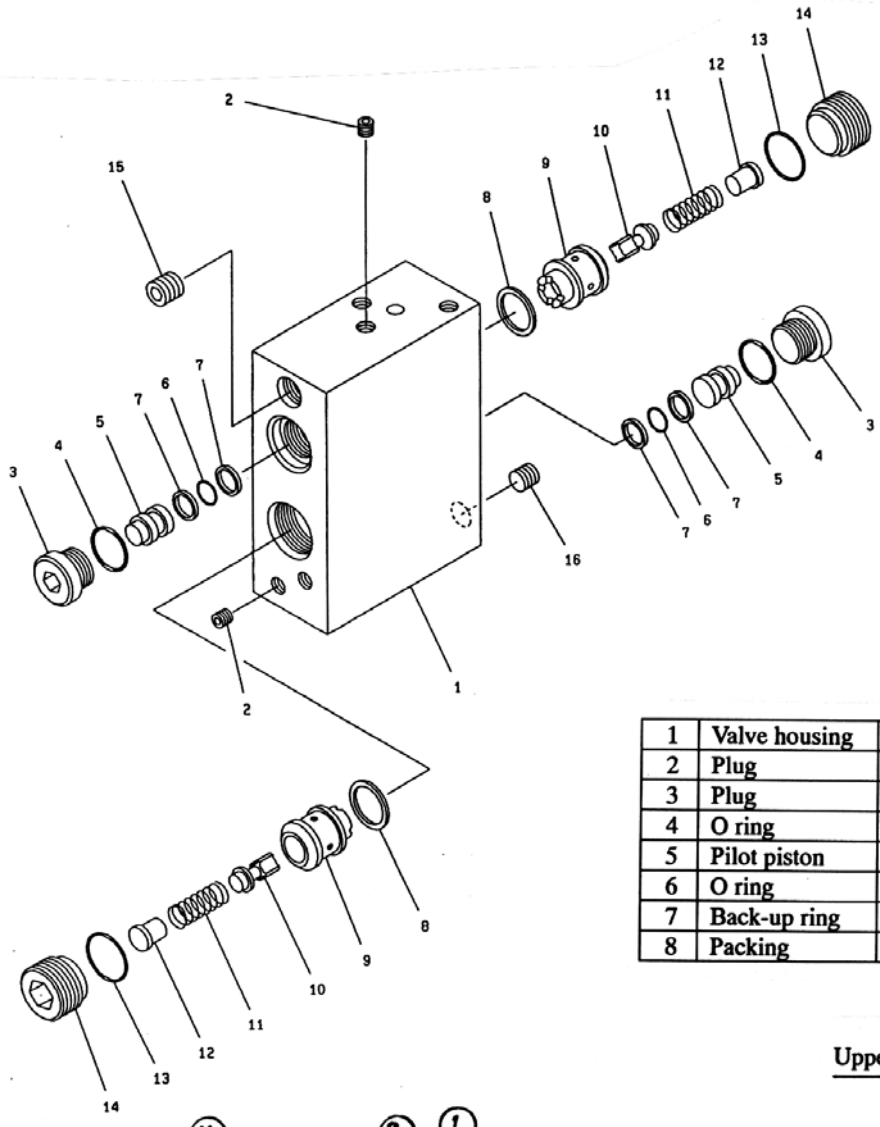


No.	Description	No.	Description
1	Cylinder tube	14	Wear ring
2	Piston rod	15	Set screw
3	Cylinder head	16	Steel ball
4	Bushing	17	O- ring
5	U- ring	18	Bushing
6	Dust seal	19	Collar
7	O- ring	20	Bushing
8	Back- up ring	21	Grease fitting
9	O- ring	22	Double pilot check valve
10	Lock washer	23	Bolt
11	Piston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

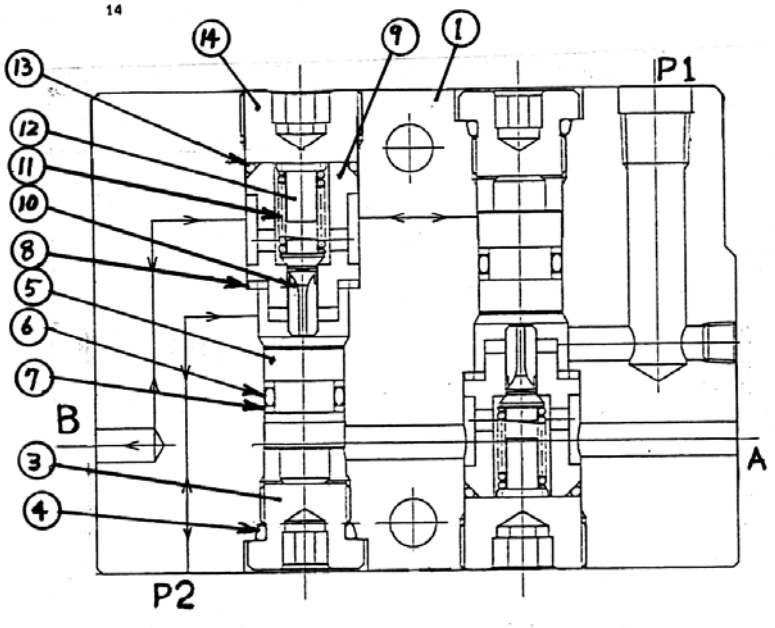


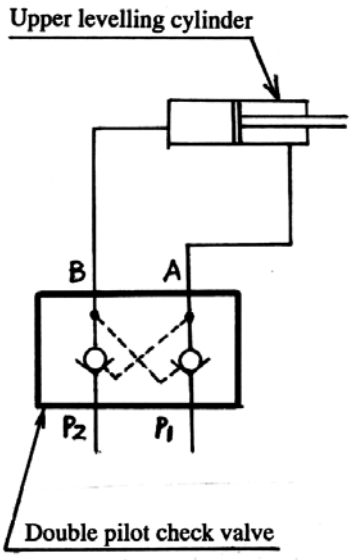
Double pilot check valve (for Upper leveling cylinder with Fly- jib)

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

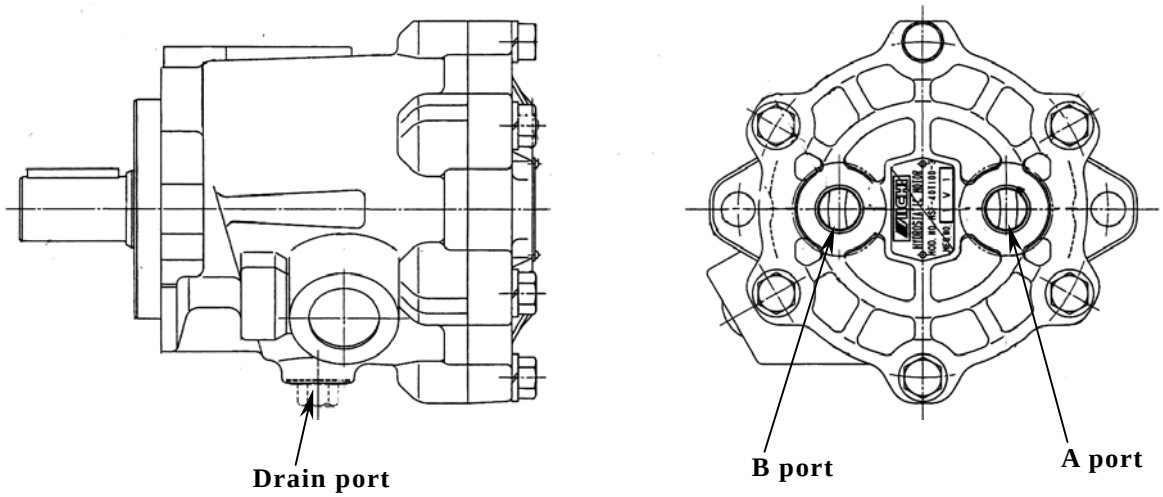


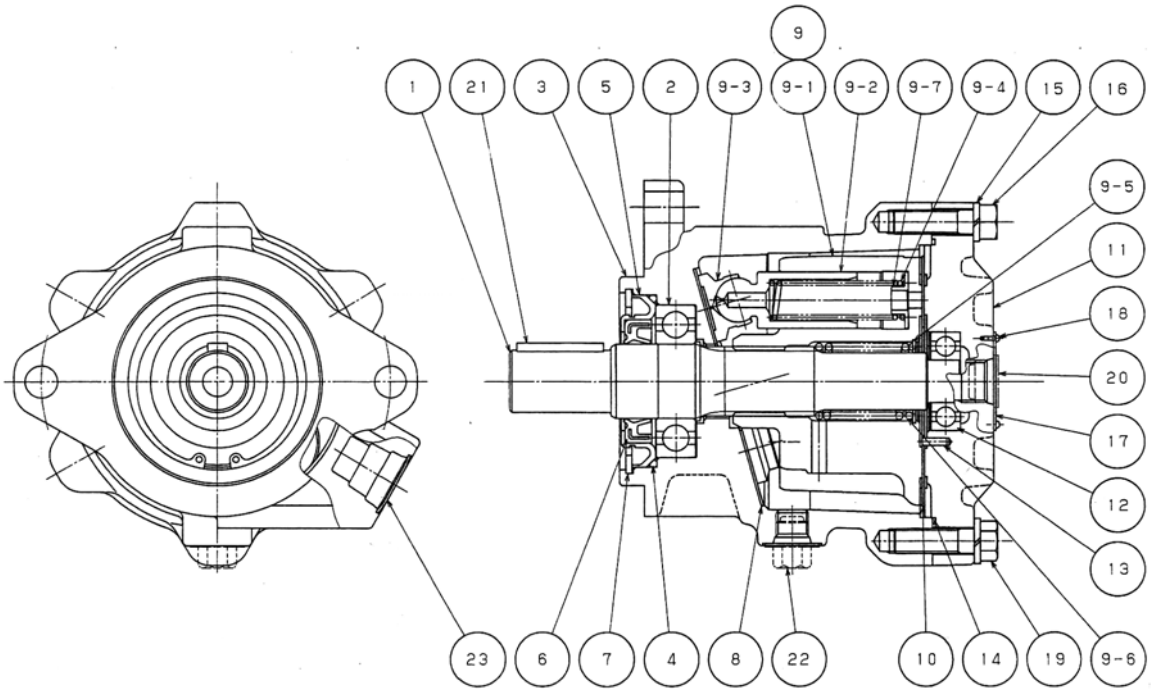


Boom rotation motor

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

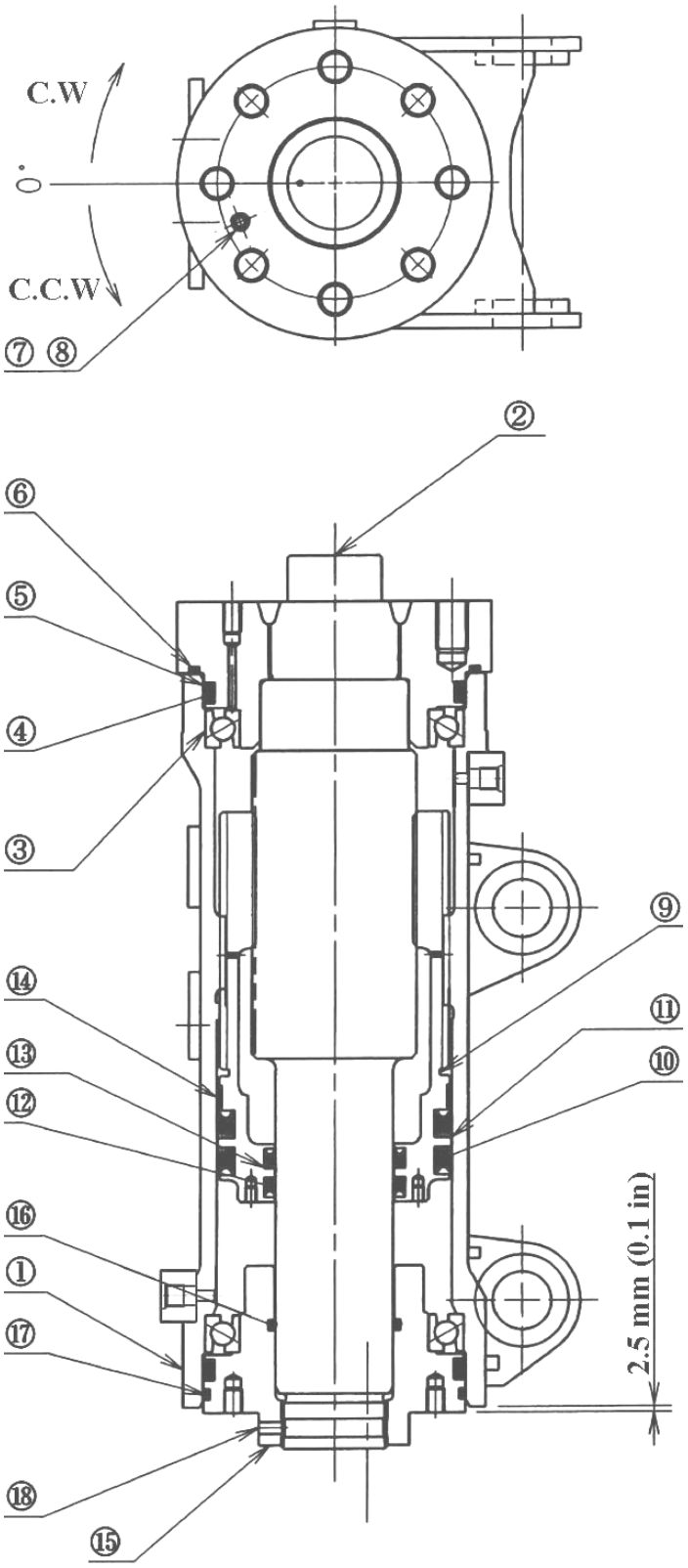
Type ---------- Plunger type
Rated pressure ---------- 210 kg/cm^2 (3,000 PSI)
Drain pressure ---------- 1.5 kg/cm^2 (21 PSI)
Displacement ---------- 39.3 cc/rev (2.4 in^3/rev)





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.

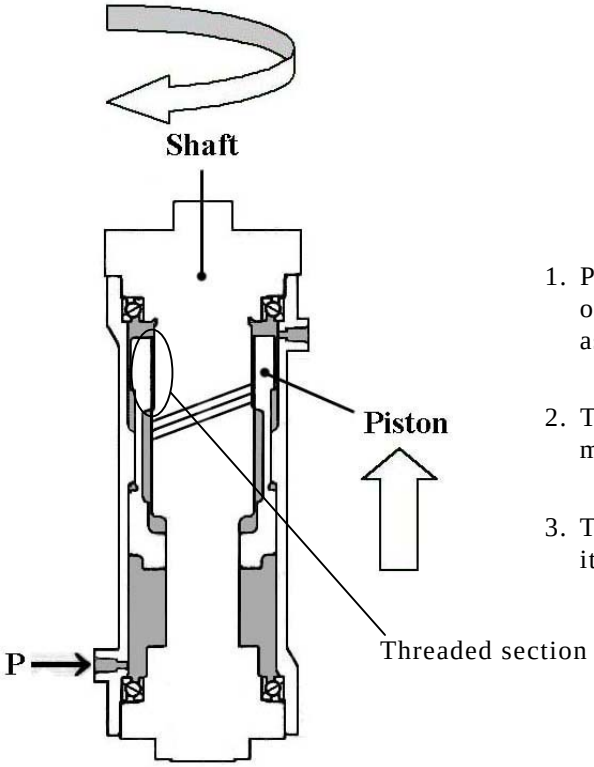


Tightening torque : 5.1 kg-m (37 ft-lbs)

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

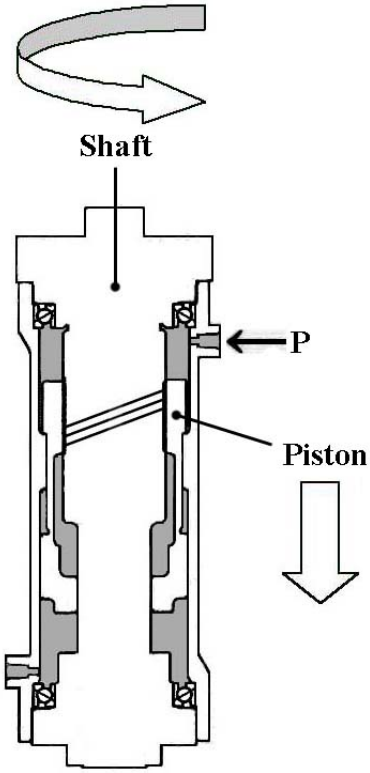
1. Function of Rotary actuator

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

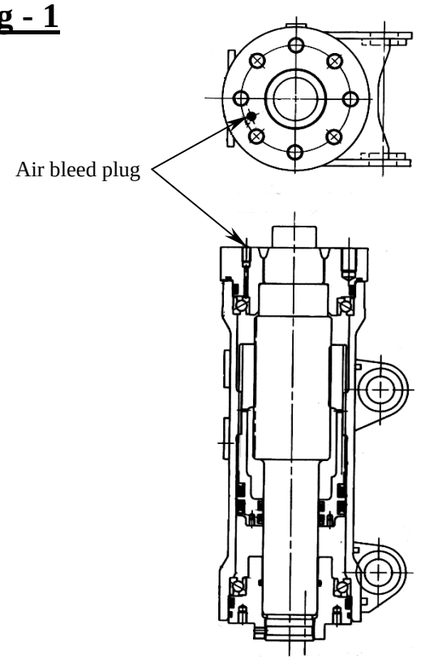
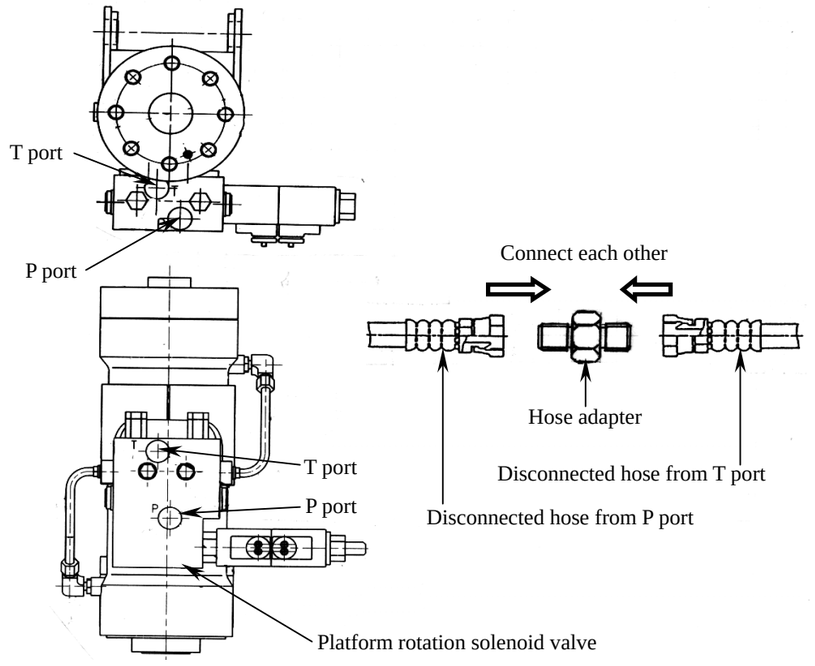
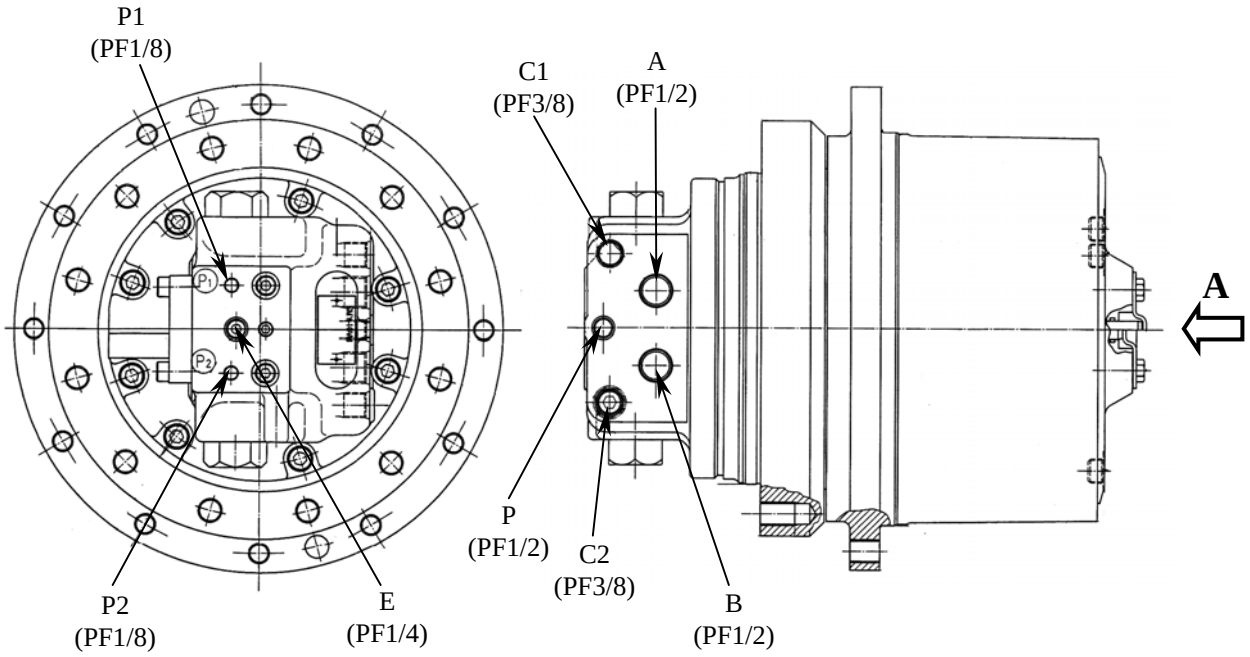


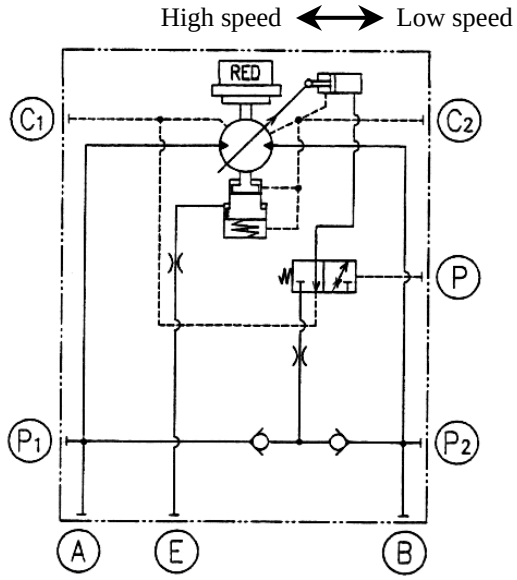
Fig - 2

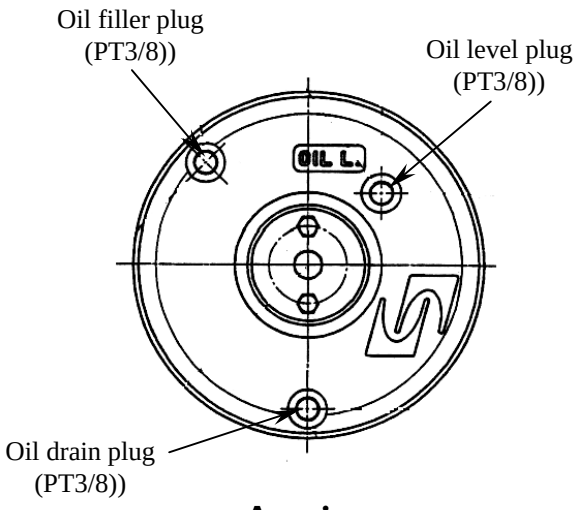


Travel motor

Hydraulic motor	Motor type	Plunger motor
	Rated pressure	350 kg /m^2 (4,980 PSI)
	Displacement	26.8 or 52.7 cc / rev. (1.64 or 3.22 in^3 / rev.)
Gearbox	Gear type	Planetary gear
	Reduction ratio	1 / 37.7
	Recommended gear oil	Shell Spirax EP90
	Gear oil capacity	1.7 liters (0.45 gallons)

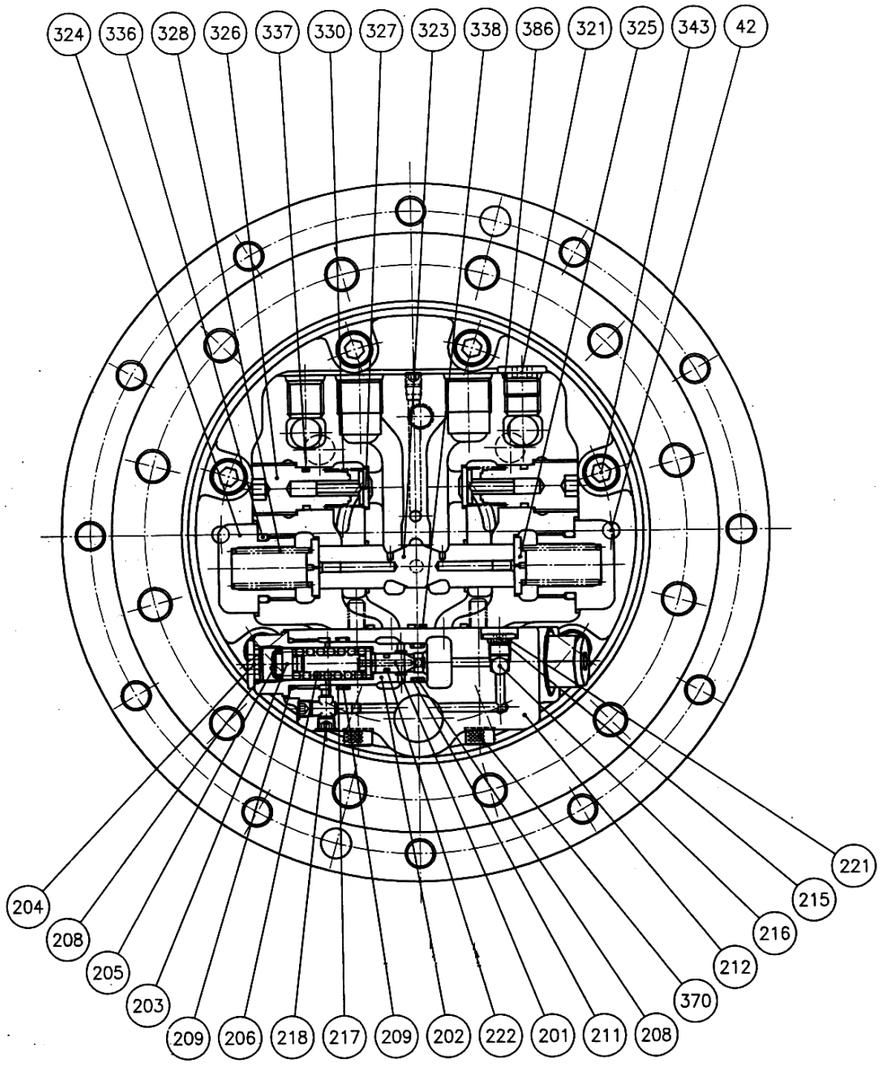




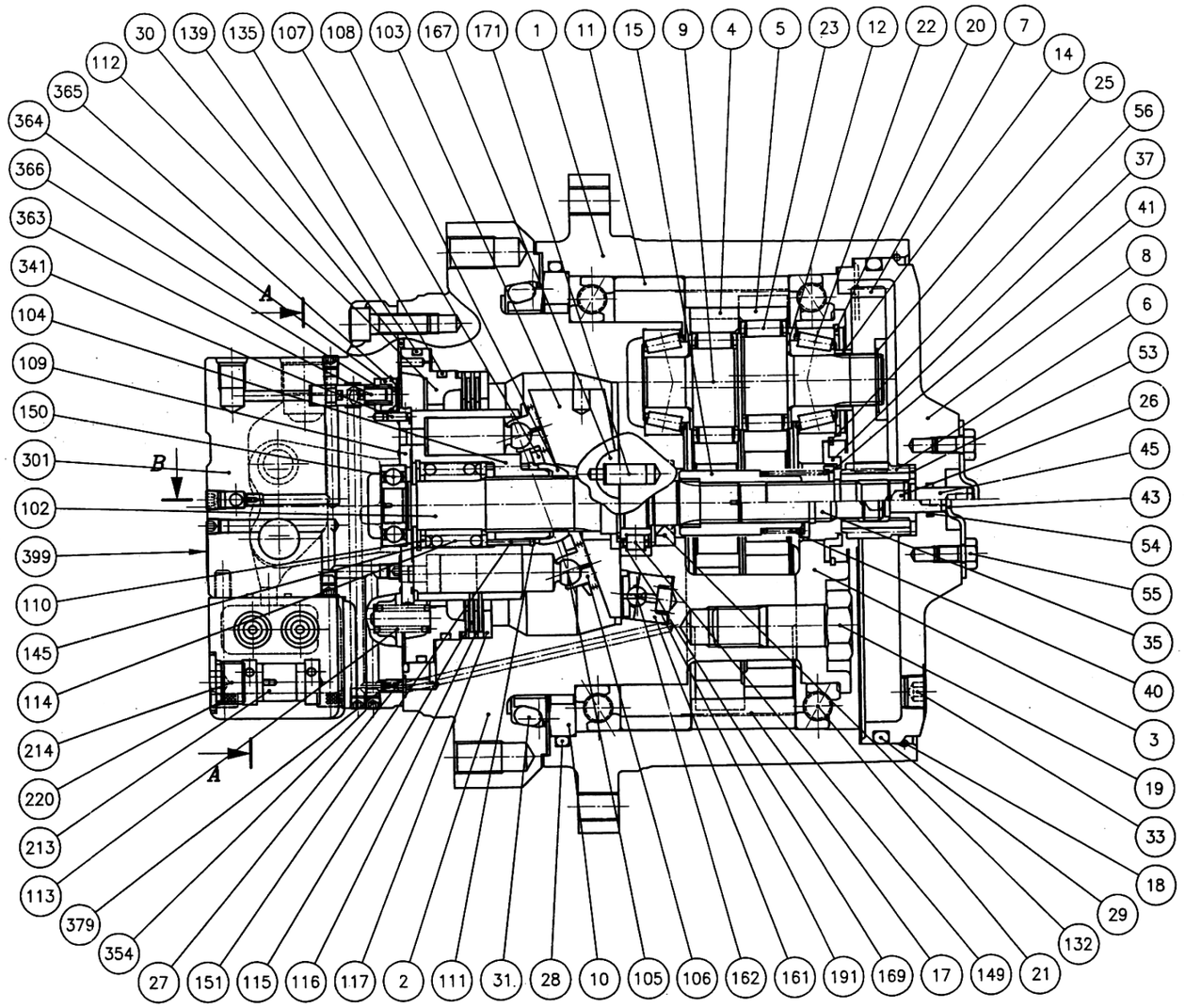


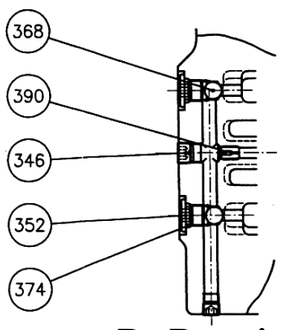
A - view

1. Sectional drawings



A – A section



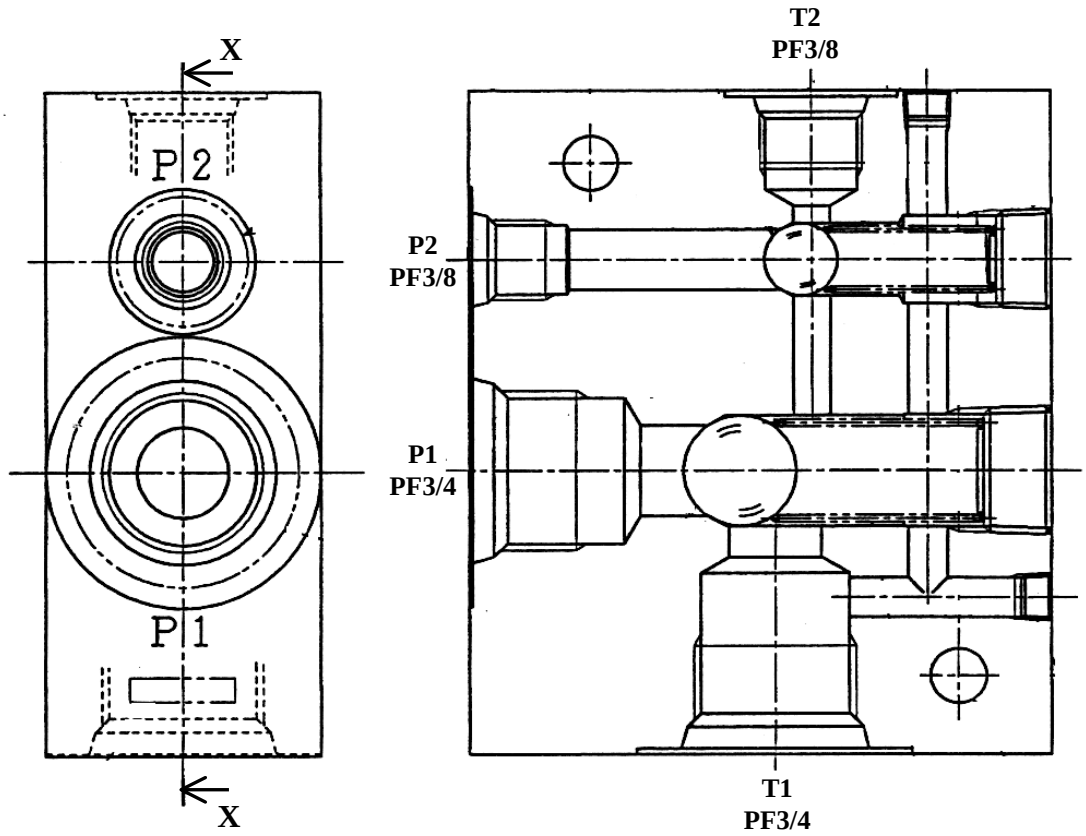


B - B section

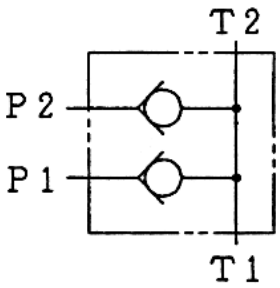
Check valve block

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

Rated pressure		210 kg / cm^2 (2,990 PSI)
Rated flow	P1 → T1	100 litters /min (26.4 gallons / min)
	P2 → T2	5 litters /min (1.3 gallons / min)



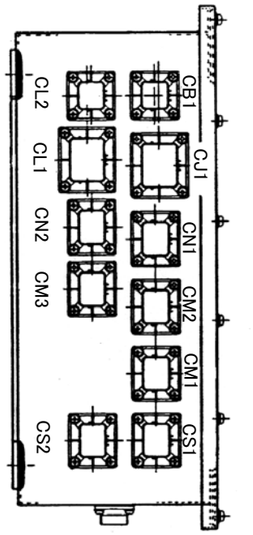
X – X section

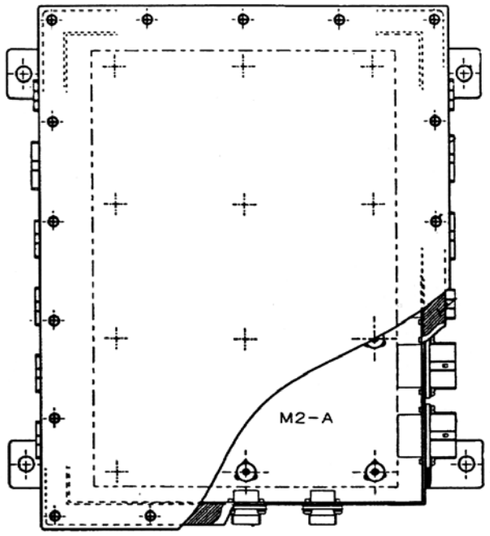


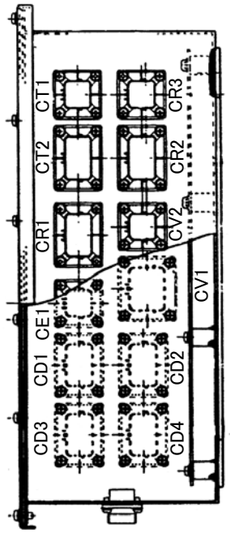
4. Electrical section

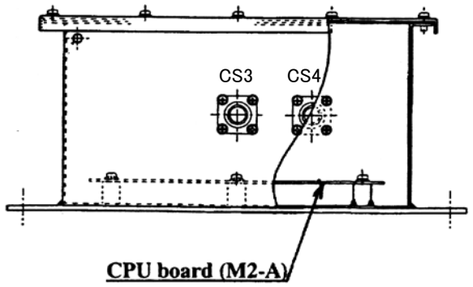
Main CPU box (M2A)

This main CPU box is installed on the turntable to control the machine together with the ***Sub- CPU board (M4A***) in the upper control box.









CL2

L13	L14
L15	L16

CB1

V p	V p
V s	GND

CL1

L1	L2	L3	L4
L5	L6	L7	L8
L9	L10	L11	L12

CJ1

JV1	JA1	JG1	JV4
JV2	JA2	JG2	JA4
JV3	JA3	JG3	JG4

CN2

NV3	NA3	NG3
NV4	NA4	NG4

CN1

NV1	NA1	NG1
NV2	NA2	NG2

CM3

MV5	MA5	MG5
MV6	MA6	MG6

CM2

MV3	MA3	MG3
MV4	MA4	MG4

CM1

S5V	MA1	MG1
MV2	MA2	MG2

CS2

RS 485+	FG	RS 485+
RS 485−		TM+

CS1

RS 485+	FG	RS 485+
RS 485−		TM+

CS3

MTX	MRX
MFG	MFG

CS4

PRX	PTX	
WE1	PFG	PSG
	WE2	PSG

CT1

ET1	ET2
ET3	ET4

CT2

OT1	OT2	OT3	OT4
OT5	OT6	OT7	OT8

CR1

R1	R2	R3	R4
R5	R6	R7	R8

CE1

ES	EH
Vbak	

CD1

D1	D2	D3	D4
D5	D6	D7	D8

CD3

D17	D18	D19	D20
D21	D22	D23	

CR3

R17	R18
R19	R20

CR2

R9	R10	R11	R12
R13	R14	R15	R16

CV2

VH7	VL7
VH8	VL8

CV1

VH1	VL1	VH2	VL2
VH3	VL3	VH4	VL4
VH5	VL5	VH6	VL6

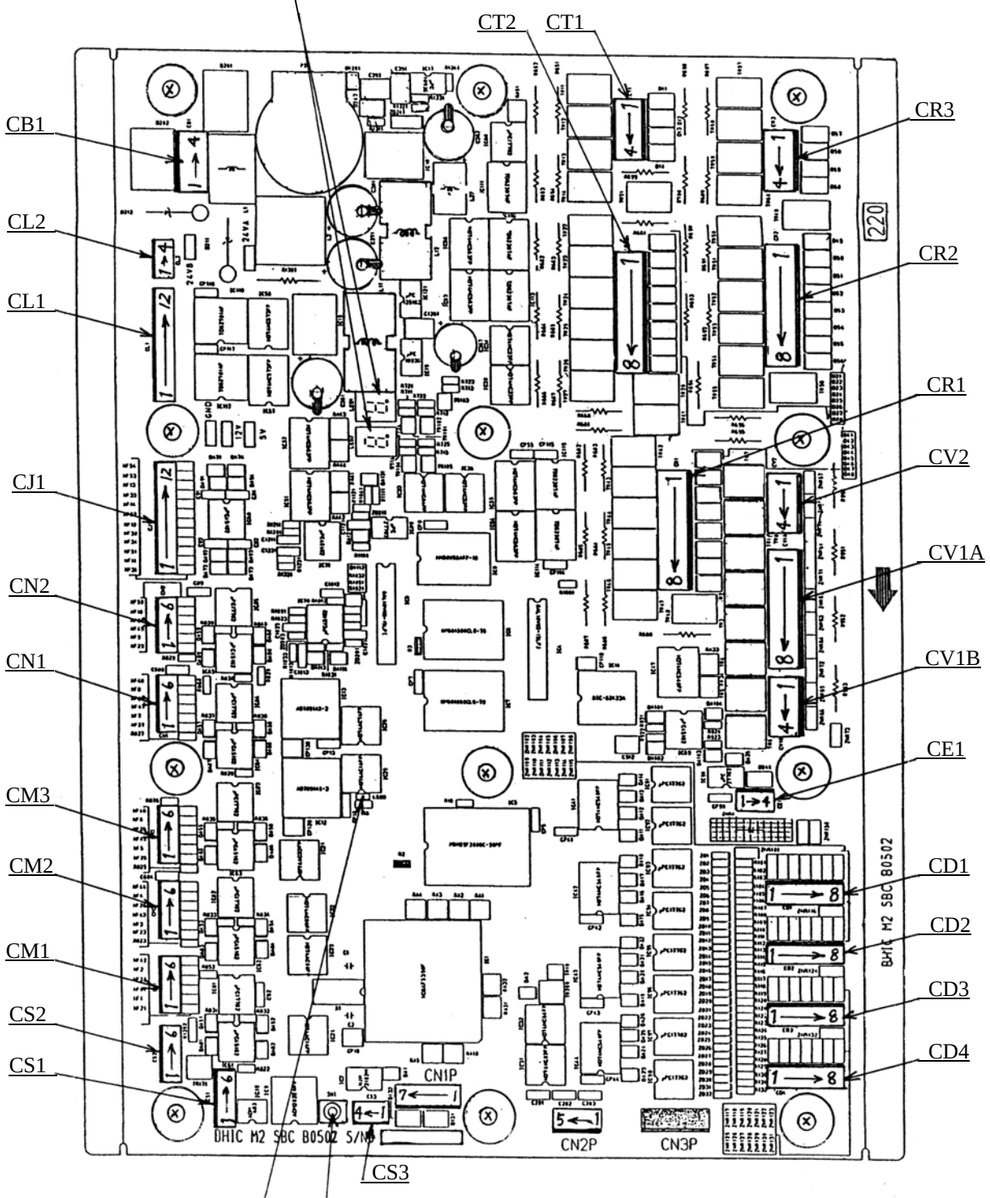
CD2

D9	D10	D11	D12
D13	D14	D15	D16

CD4

D24	D25	D26	D27
D28	D29	D30	D31

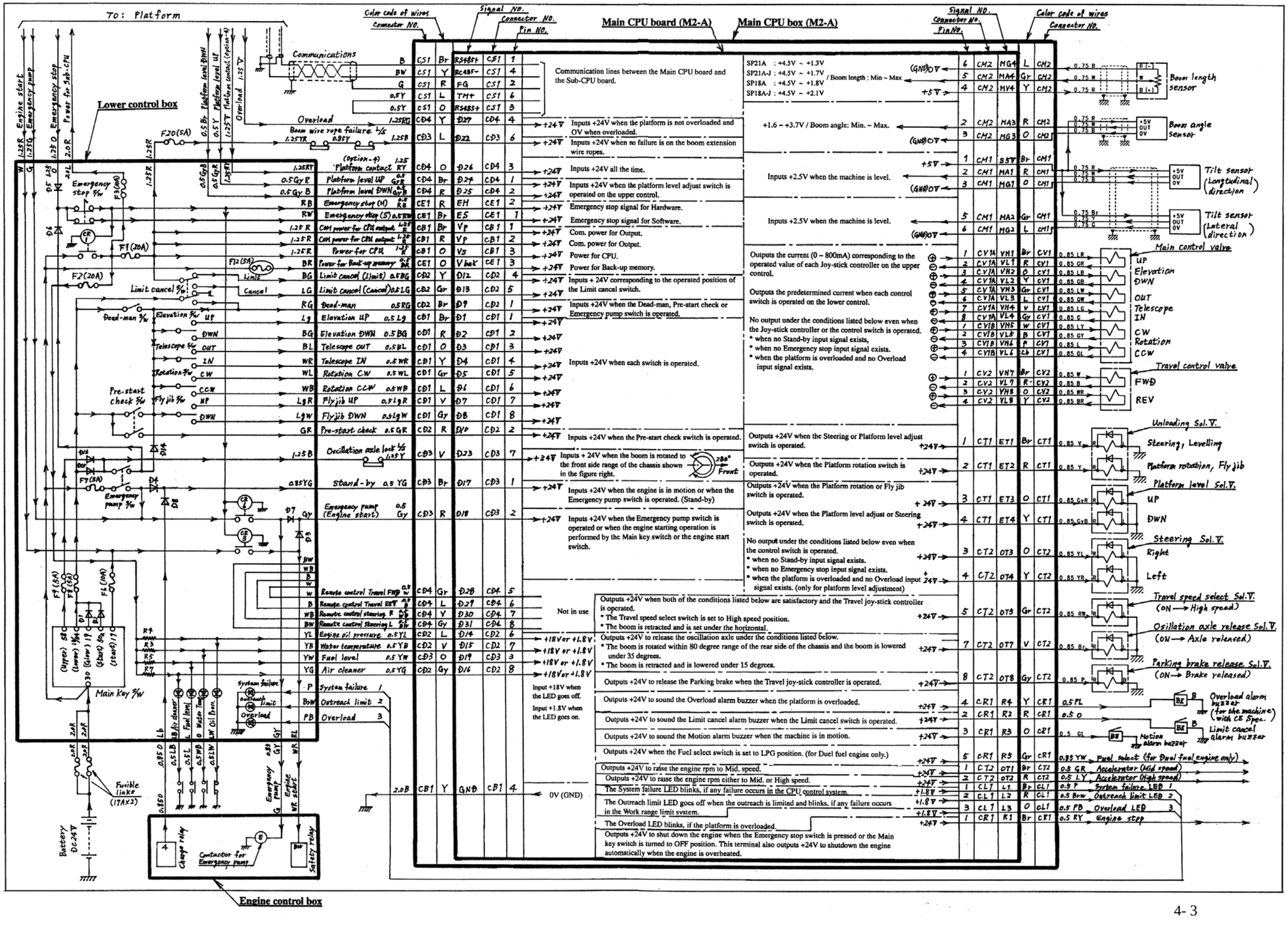
7- segment diodes
These 7- segment diodes show error codes in the event of system failures. See the pages 4- 5 and 4- 6 for the details of Error codes and their countermeasures.



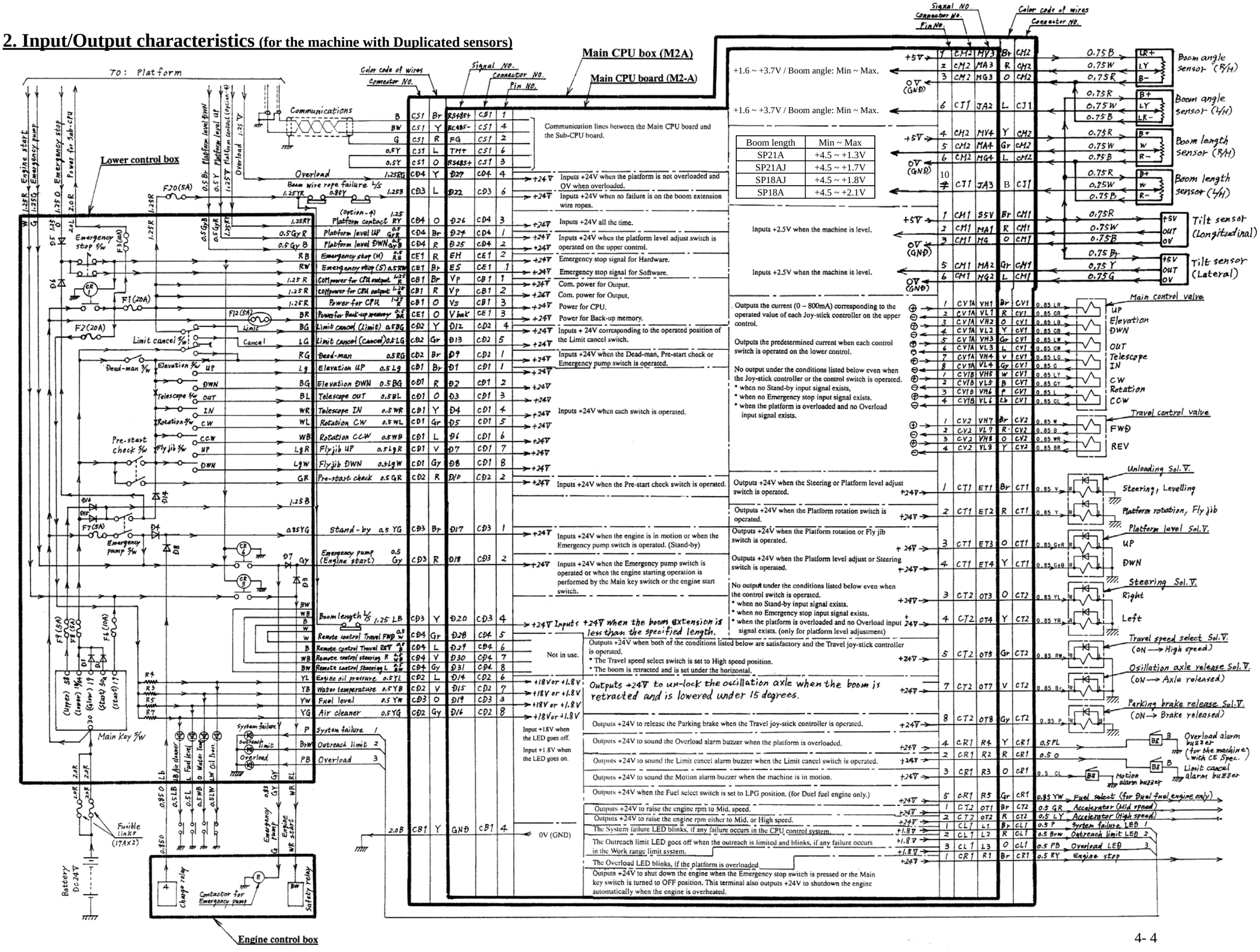
Switch (SW1) CPU reset switch (Manufactures use only)

LED3
This LED blinks when the CPU is working properly and goes off, if the CPU fails.

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



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



3. Error codes and their countermeasures **Machines applied: Manufactured in April 2003 and after**

In the event that any error was found, the 7 segment diodes on the Main CPU board (M2A) indicate the error code as listed below.

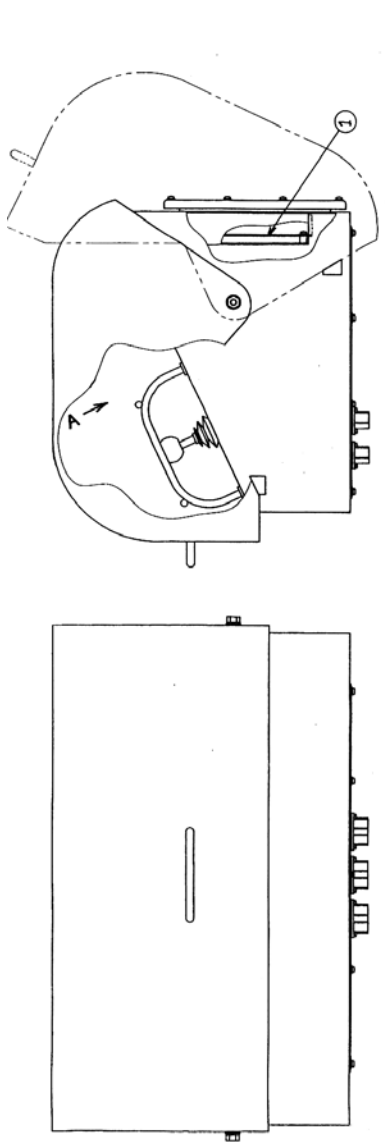
NOTE: If several errors were found at the same time, only one error code that has the highest priority will be indicated on the 7 segment diodes.

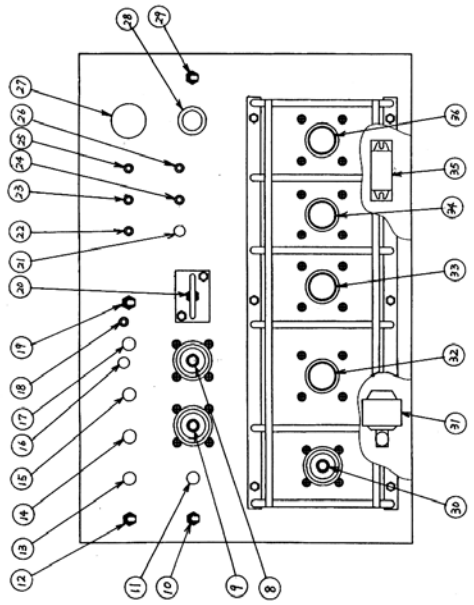
Priority	Error code	Upper control box		Lower control box		Error descriptions	Cause	Countermeasures
		System failure LED	Outreach limit LED	System failure LED	Outreach limit LED			
1	**30**	Blinks	Off	Blinks	Off	1. M2A. Divided by Zero 2. M2A. ROM error 3. M2A. RAM error 4. Exceptional error	1. Incorrect parameters are memorized in the Main CPU box (M2A). 2. Faulty ROM in the Main CPU box (M2A) 3. Faulty Main CPU box (M2A)	1. Write the correct parameters into the Main CPU box (M2A), using the Laptop computer. 2. Replace the Main CPU box (M2A).
2	**32**	Blinks	Off	Blinks	Off	1. M4A. Divided by Zero 2. Exceptional error	Faulty Sub-CPU board (M4A)	Replace the Sub-CPU board (M4A).
3	**23**	Blinks	Off	Blinks	Off	M2A. E2PROM error	1. Incorrect or damaged parameters are memorized in the Main CPU box (M2A). 2. Faulty Main CPU box (M2A)	1. Write the correct parameters into the Main CPU box (M2A), using the Laptop computer. 2. Replace the Main CPU box (M2A).
4	**24**	Blinks	Off	Blinks	Off	M2A. E2P Bios error	1. Incorrect or damaged parameters are memorized in the Main CPU box (M2A). 2. Faulty Main CPU box (M2A)	1. Write the correct parameters into the Main CPU box (M2A), using the Laptop computer. 2. Replace the Main CPU box (M2A).
5	**64**	Off	Off	Off	Off	M2A. Power source voltage (24 volts) error	1. The main power voltage for the Main CPU box (M2A) is lower than 18 volts or higher than 30 volts. 2. Faulty Main CPU box (M2A)	1. Check the main power voltage and rectify. 2. Replace the Main CPU box (M2A).
6	**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).
7	**71**	Blinks	Off	Blinks	Off	1. M2A 12 bit AD timeout error 2. M2A 12 bit AD converter error 3. M2A 10 bit AD timeout error 4. M2A 10 bit AD converter error	Faulty Main CPU box (M2A)	Replace the Main CPU box (M2A).
8	**74**	Blinks	Off	Blinks	Off	M2A. AD power source voltage (5 volts) error	Faulty Main CPU box (M2A)	Replace the Main CPU box (M2A).
9	**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).
10	**90**	Blinks	Off	Blinks	Off	1. M2A. PWM 1 error: Elevation UP 2. M2A. PWM 2 error: Elevation DOWN	The Main CPU box (M2A) has output to the Elevation UP or DOWN solenoid in spite of no command. 1. Short circuit in the output lines to the Elevation UP or DOWN solenoid(s). 2. Faulty Elevation UP or DOWN solenoid 3. Faulty Main CPU box (M2A)	1. Rectify the output lines to the Elevation UP and DOWN solenoids. 2. Replace the Elevation UP or/ and DOWN solenoid(s). 3. Replace the Main CPU box (M2A).
11	**92**	Blinks	Off	Blinks	Off	1. M2A. PWM 3 error: Telescope OUT 2. M2A. PWM 4 error: Telescope IN	The Main CPU box (M2A) has output to the Telescope OUT or IN solenoid in spite of no command. 1. Short circuit in the output lines to the Telescope OUT or IN solenoid 2. Faulty Telescope OUT or IN solenoid 3. Faulty Main CPU box (M2A)	1. Rectify the output lines to the Telescope OUT and IN solenoids. 2. Replace the Telescope OUT or/ and IN solenoid(s). 3. Replace the Main CPU box (M2A).
12	**94**	Blinks	Off	Blinks	Off	1. M2A. PWM 5 error: Boom rotation CW 2. M2A. PWM 6 error: Boom rotation CCW	The Main CPU box (M2A) 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 (M2A)	1. Rectify the output lines to the Rotation CW and CCW solenoids. 2. Replace the Rotation CW or/ and CCW solenoid(s). 3. Replace the Main CPU box (M2A).
13	**96**	Blinks	Off	Blinks	Off	1. M2A. PWM 7 error: Travel FWD 2. MA. PWM 8 error: Travel REV	The Main CPU box (M2A) has output to the Travel FWD or REV solenoid in spite of no command. 1. Short circuit in the output lines to the Travel FWD or REV solenoid 2. Faulty Travel FWD or REV solenoid 3. Faulty Main CPU box (M2A)	1. Rectify the output lines to the Travel FWD or REV solenoid. 2. Replace the Travel FWD or/ and REV solenoid(s). 3. Replace the Main CPU box (M2A).
14	**77**	Blinks	Off	Blinks	Off	1. M2A: ET1 error: Unload sol. A 2. M2A: ET2 error: Unload sol. B 3. M2A: ET3 error: Platform level UP sol. 4. M2A: ET4 error: Platform level DWN sol.	The Main CPU box (M2A) 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 (M2A)	1. Rectify the output lines to the solenoid(s). 2. Replace the solenoid(s). 3. Replace the Main CPU box (M2A).
15	**79**	Blinks	Off	Blinks	Off	1. M4A. ET1 error: Platform rotation CW sol. 2. M4A. ET2 error: Platform rotation CCW sol.	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 CCW solenoids. 2. Replace the Platform rotation CW or/ and CCW solenoid(s). 3. Replace the Sub-CPU board (M4A).
16	**81**	Blinks	Off	Blinks	Off	M2A. RS485 Reception error (M4A → M2A)	The Main CPU box (M2A) has failed to receive the data from the Sub-CPU board (M4A). 1. Faulty communication lines between the Main CPU box (M2A) and the Sub-CPU board (M4A) 2. Faulty Main CPU box (M2A) 3. Faulty Sub-CPU board (M4A)	1. Rectify the communication lines. 2. Replace the Main CPU box (M2A). 3. Replace the Sub-CPU board (M4A).
17	**82**	Blinks	Off	Blinks	Off	M4A. RS485 Reception error (M2A → M4A)	The sub CPU board (M4A) has failed to receive the data from the Main CPU box (M2A). 1. Faulty communication lines between the Main CPU box (M2A) and the Sub-CPU board (M4A) 2. Faulty Main CPU box (M2A) 3. Faulty Sub-CPU board (M4A)	1. Rectify the communication lines. 2. Replace the Main CPU box (M2A). 3. Replace the Sub-CPU board (M4A).
18	**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 (M2A) 2. Incorrect Boom angle sensor calibrations 3. Faulty Boom angle sensor 4. Faulty Main CPU box (M2A) 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 (M2A).
19	**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 (M2A) 2. Incorrect Boom angle sensor calibrations 3. Faulty Boom angle sensor 4. Faulty Main CPU box (M2A)	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 (M2A).
20	**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 (M2A) 2. Incorrect Boom length sensor calibrations 3. Faulty Boom length sensor 4. Faulty Main CPU box (M2A) 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 (M2A).

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			
21	**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 (M2A). 2. Incorrect Boom length sensor calibrations. 3. Faulty Boom length sensor. 4. Faulty Main CPU box (M2A) 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 (M2A). 5. Rectify the electrical lines to the Boom wire rope failure L/S, Replace the Boom wire rope failure L/S.
22	**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 (M2A). 2. Incorrect Tilt sensor (X) calibrations 3. Faulty Tilt sensor (X) 4. Faulty Main CPU box (M2A)	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 (M2A).
23	**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 (M2A) 2. Incorrect Tilt sensor (X) calibrations 3. Faulty Tilt sensor (X) 4. Faulty Main CPU box (M2A)	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 (M2A).
24	**55**	Blinks	Off	Blinks	Off	AD Lower limit: Tilt (Y)	Abnormally high AD value has been input from the Tilt (Y), Longitudinal sensor. 1. Faulty electrical lines between the Tilt sensor (Y) and the Main CPU box (M2A) 2. Incorrect Tilt sensor (Y) calibrations 3. Faulty Tilt sensor (Y) 4. Faulty Main CPU box (M2A)	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 (M2A).
25	**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 (M2A) 2. Incorrect Tilt sensor (Y) calibrations 3. Faulty Tilt sensor (Y) 4. Faulty Main CPU box (M2A)	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 (M2A).
26	**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 (M2A) 2. Faulty Limit cancel switch 3. Faulty Main CPU box (M2A)	1. Rectify the lines between the Limit cancel switch and the Main CPU box (M2A). 2. Replace the Limit cancel switch. 3. Replace the Main CPU box (M2A).
27	**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
28	**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 (M2A)	1. Rectify the Hydraulic system. 2. Rectify the output lines to solenoid(s). 3. Replace solenoid(s). 4. Replace the Main CPU box (M2A).

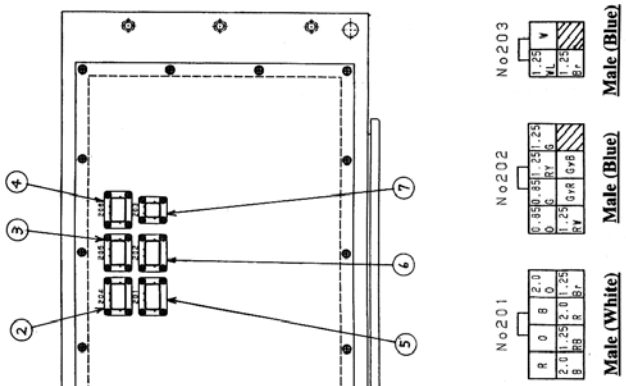
Upper control box

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	Fly jib switch	For the machine with Fly jib only.
9	Platform rotation switch	
10	Travel speed select switch	
11	Blind cap for optional switch	
12	Emergency pump switch	
13	Work light switch	Option
14	Head light switch	Option
15	Fuel select switch	For the machine with Duel fuel engine only.
16	Hydraulic generator LED	Option for USA only.
17	Hydraulic generator switch	Option for USA only.
18	Horizontal/Vertical LED	
19	Horizontal/Vertical select switch	
20	Platform level adjust switch	
21	Overload LED	
22	System failure LED	
23	Fuel level LED	
24	Outreach limit LED	SP18A/ISP60 is not equipped with this LED..
25	Engine failure LED	
26	Tilt LED	
27	Emergency stop switch	
28	Horn switch	
29	Engine start switch	
30	Steering switch	
31	Tilt/Overload alarm buzzer	
32	Joy stick controller for Rotation	
33	Joy stick controller for Telescope	
34	Joy stick controller for Elevation	
35	Horizontal/Vertical buzzer	
36	Joy stick controller for Travelling	



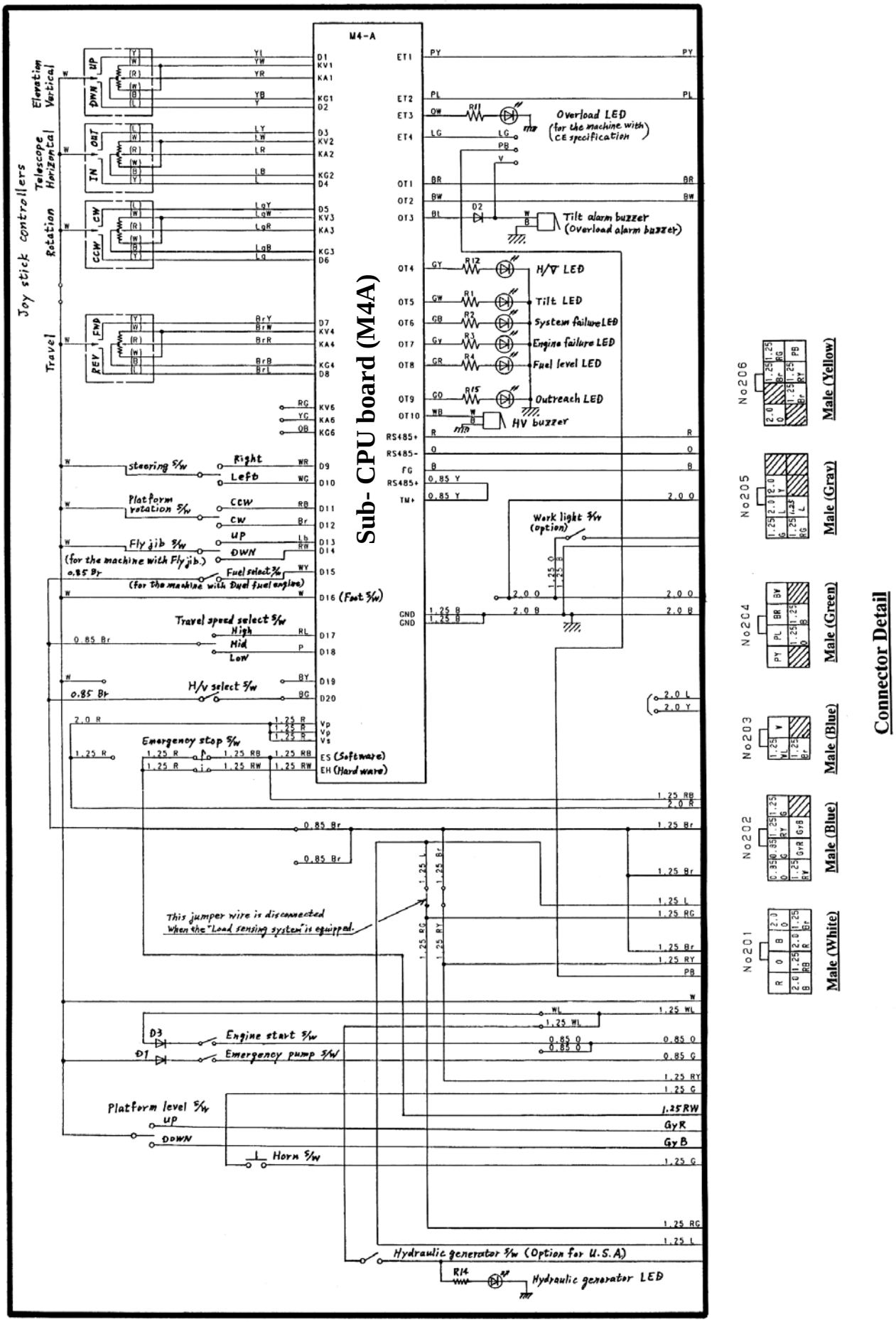


A – View (Control panel)



Connector Detail

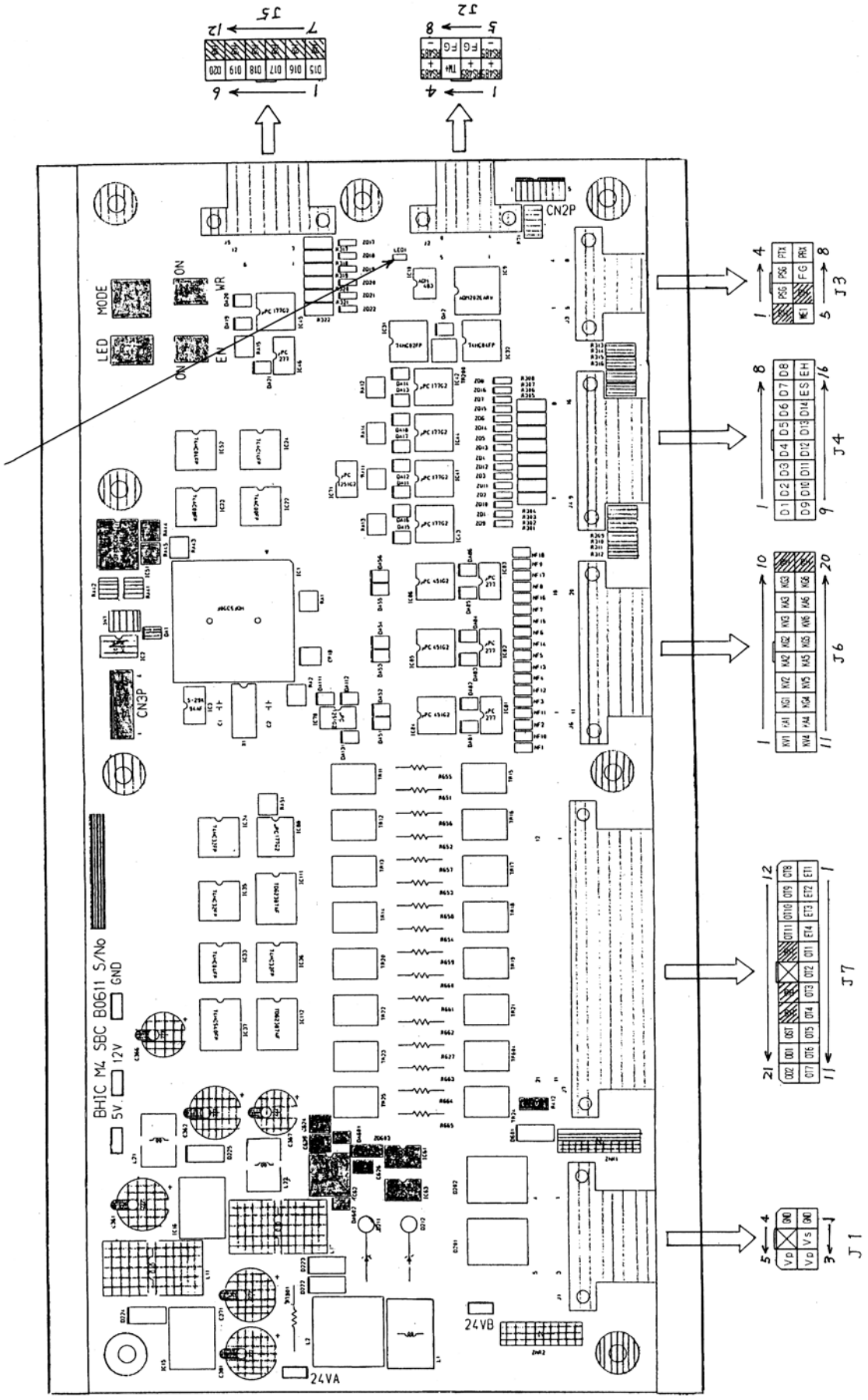
1 Electrical schematic



Sub- CPU board (M4A)

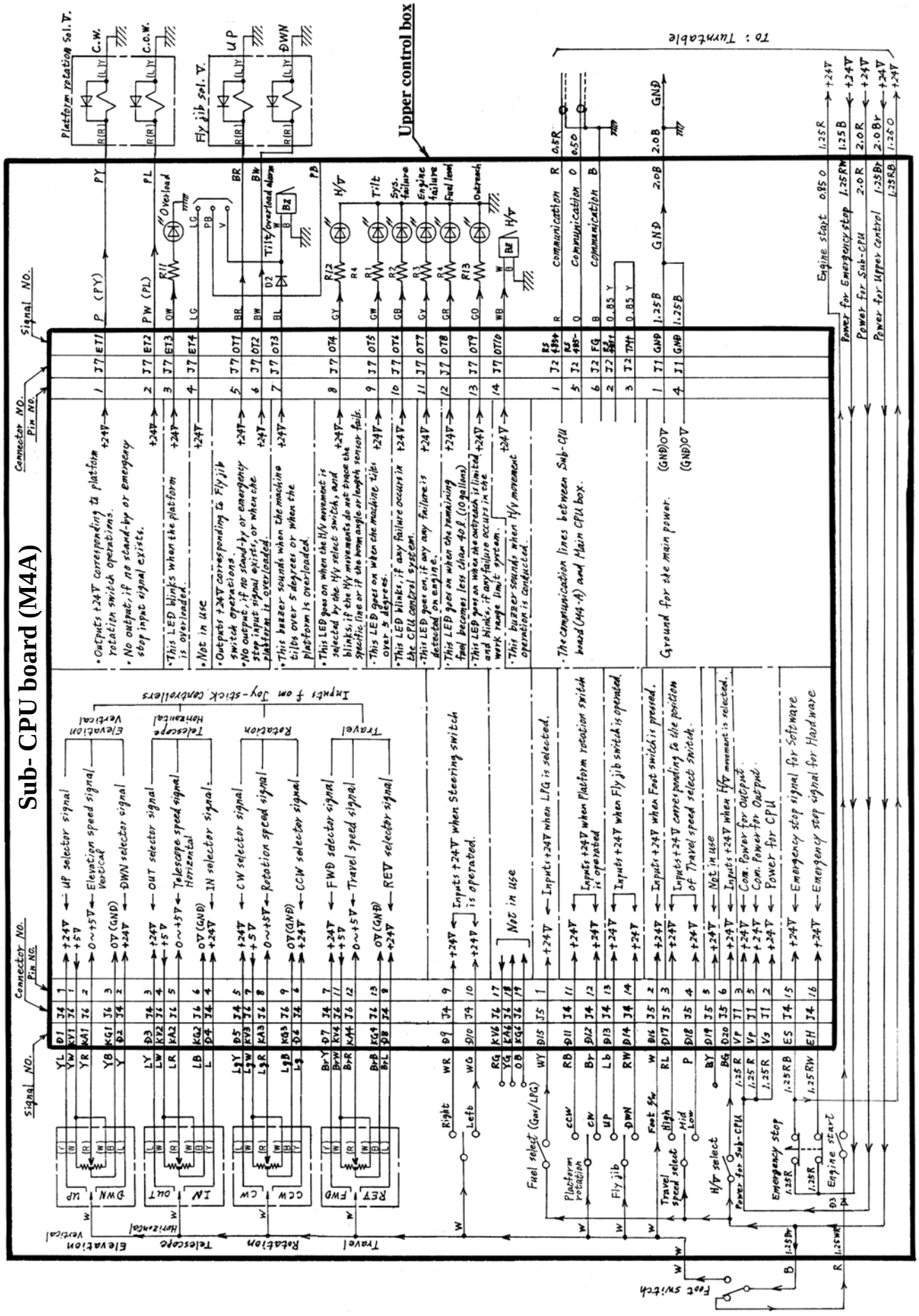
329- 00223- 00

This board is installed in the Upper control box to control the machine together with the ***Main CPU box (M2A)*** located at the turntable.



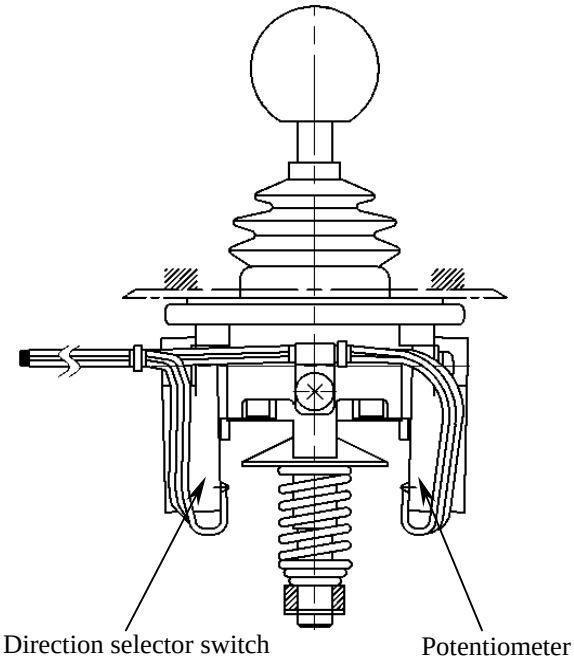
1. Input / output characteristics

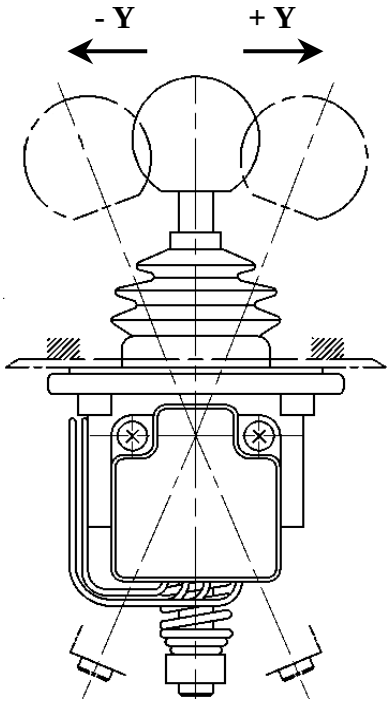
329- 00223- 00

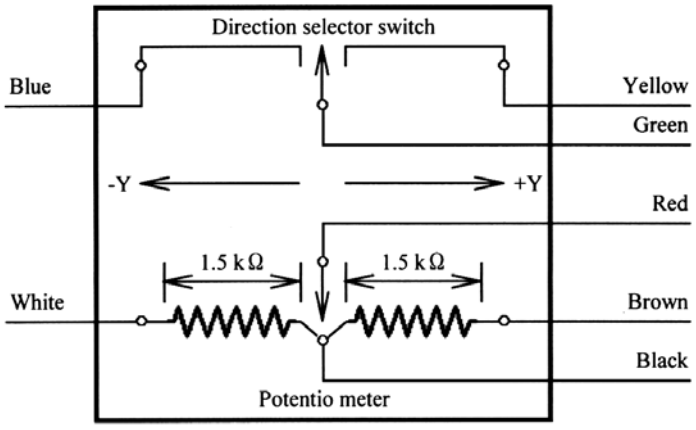


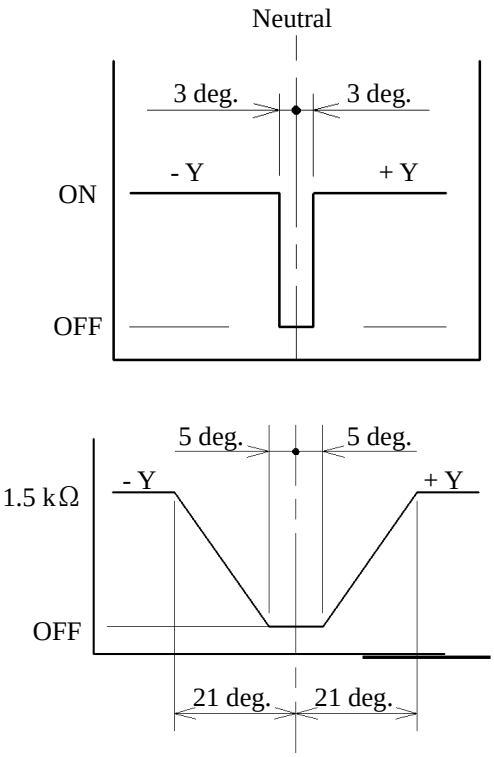
Joystick controller

Four joystick controllers are installed on the upper control box to control the Boom elevation, Boom telescope, Boom rotation and Traveling functions.



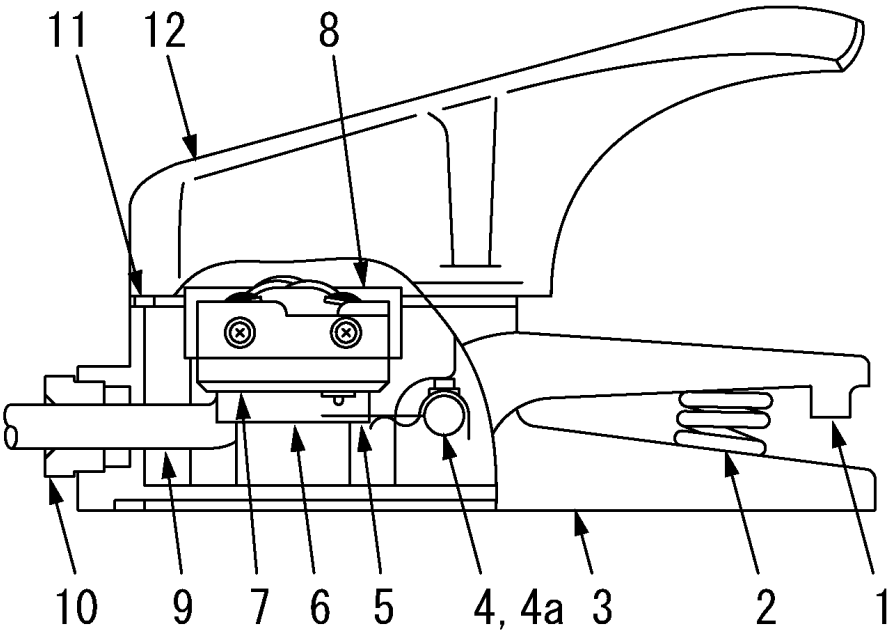


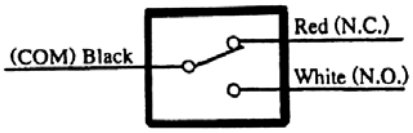




Foot switch

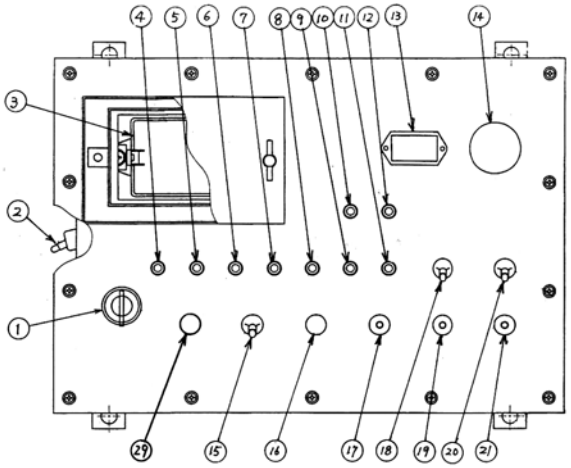
This foot switch is installed on the platform floor to disable the functions unless the foot switch is depressed.

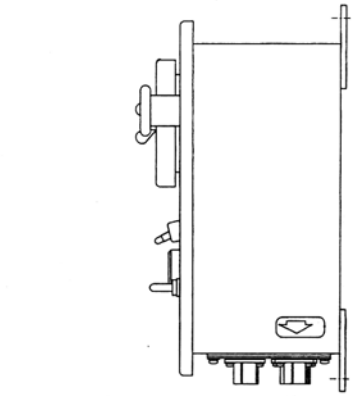


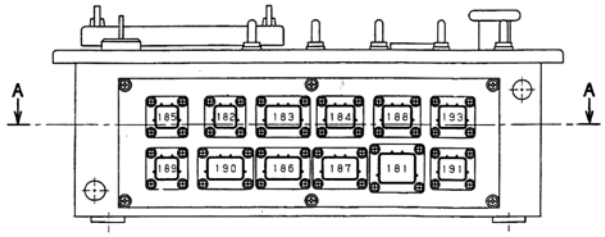


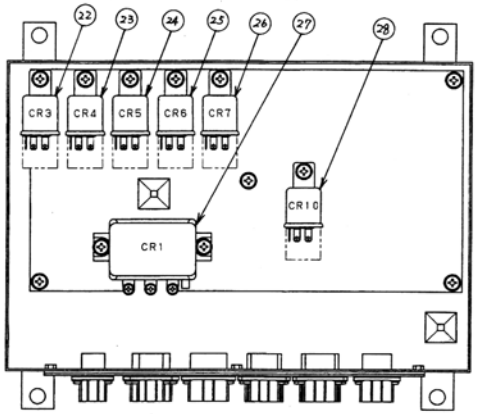
No.	Description	No.	Description
1	Pedal	7	Micro switch (MZ20-7117)
2	Spring	8	Insulator
3	Body	9	Electric cable
4	Pedal shaft	10	Cable gland
4a	O-ring	11	Rubber packing
5	Lever	12	Cover
6	Switch holder	----	----------

Lower control box

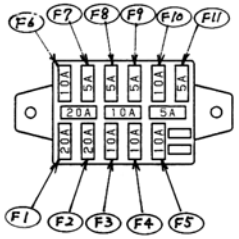








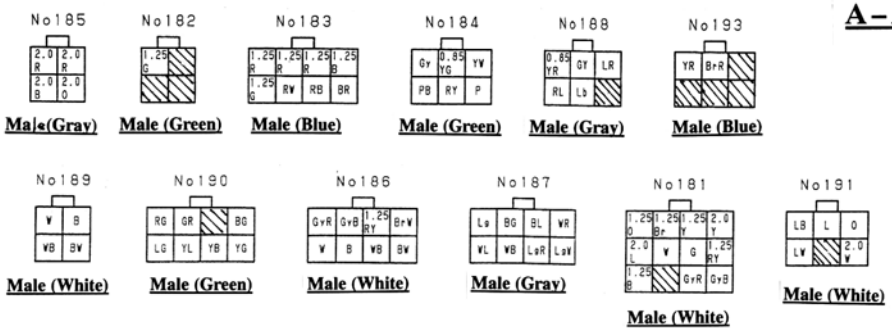
A – A section



Fuse holder detail

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

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	SR18A/ISR60 is not equipped with this LED.
12	Overload LED	
13	Hour meter	
14	Emergency stop switch	
15	Dead-man 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	SR18A/ISR60 is not equipped with this 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 CR10	329-05792
29	Fuel select switch	For the machine with Duel fuel engine only.

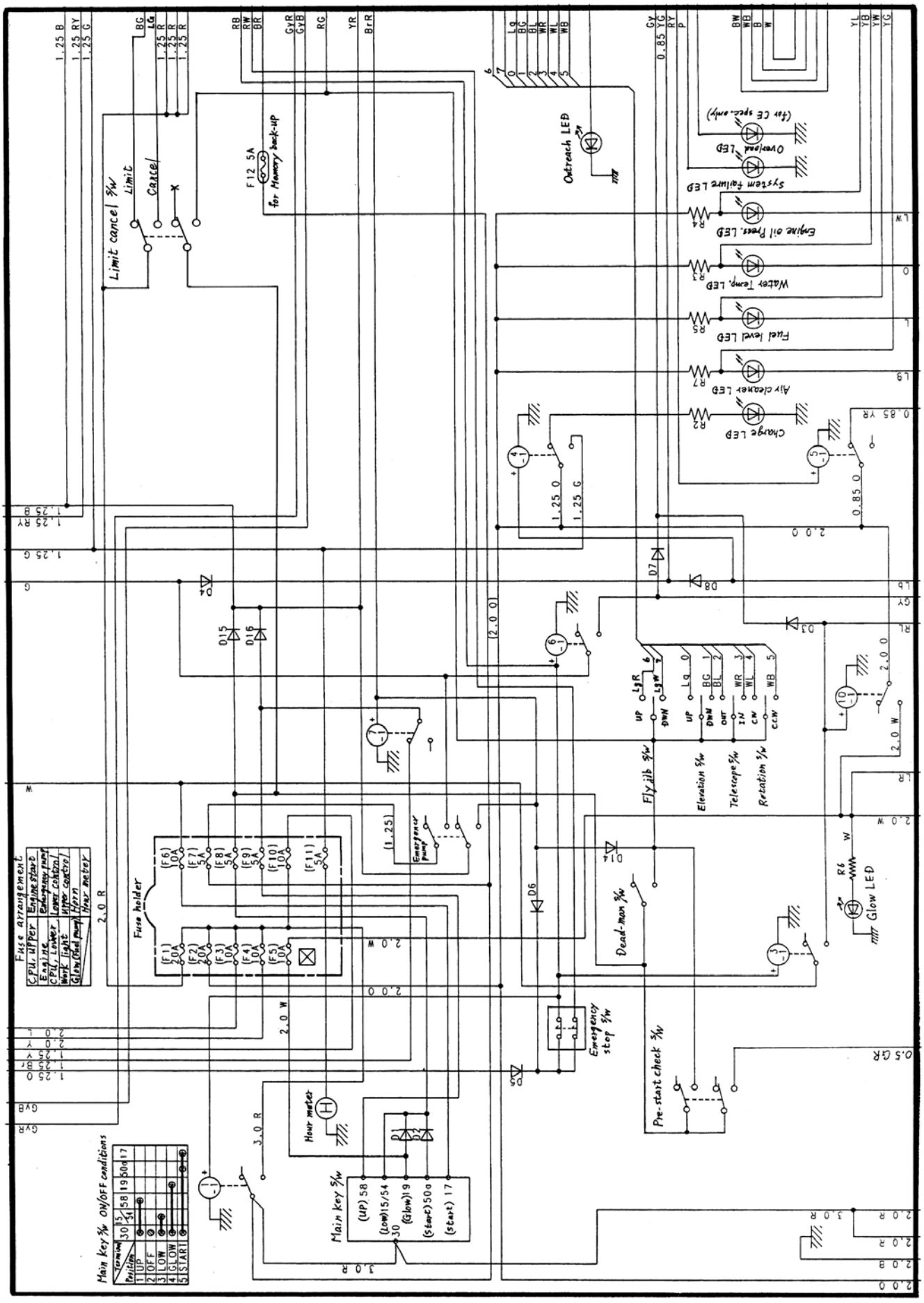


Connector detail

329- 00052- 00C
329- 00053- 00B
329- 00055- 00C

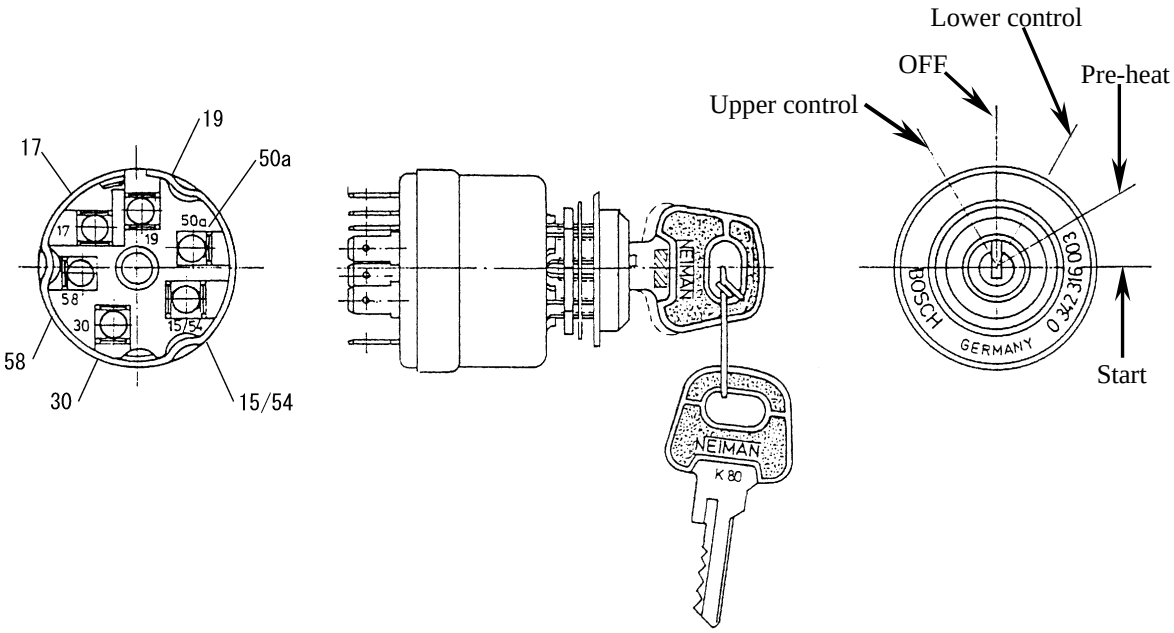
329- 00052- 00C
329- 00053- 00B
329- 00055- 00C

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.



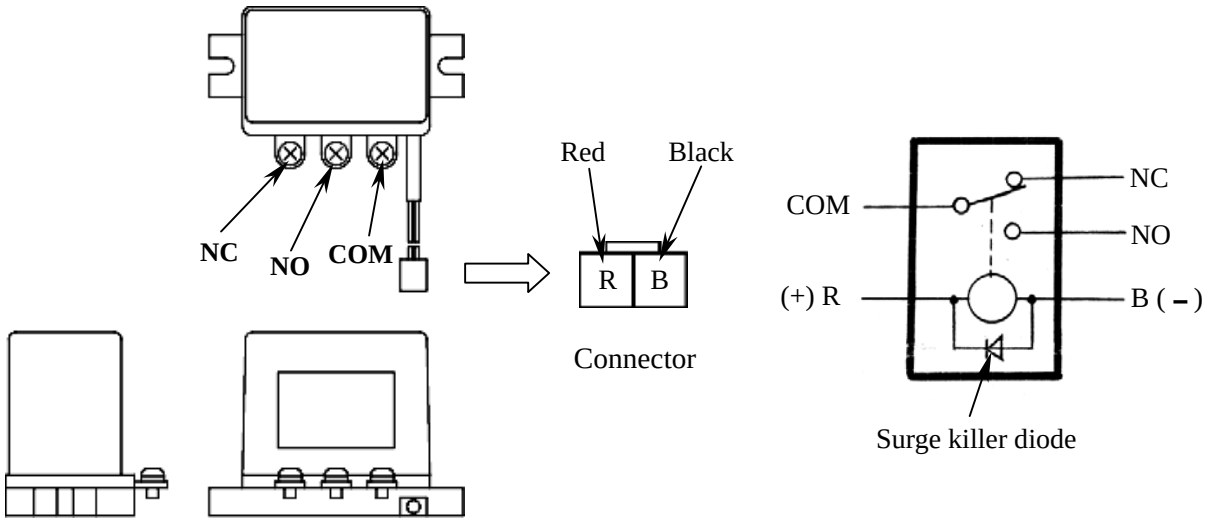
		Terminals					
		30	15/54	58	19	17	50a
Key positions	OFF	○					
	Upper control	○		○			
	Lower control	○	○				
	Pre-heat	○			○		
	Start	○				○	○

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.

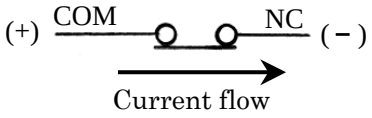
Rated voltage ---------- DC 24 v
Coil resistance ---------- 130 Ω



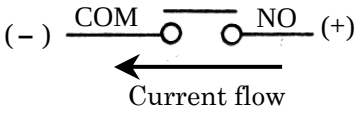
CAUTION

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

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



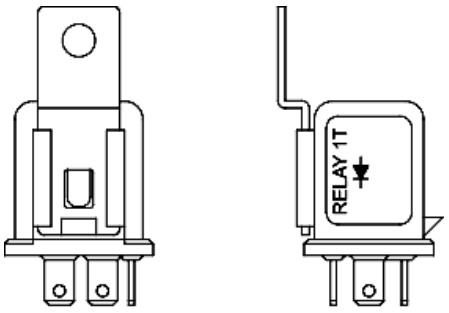
*When using "***Normally open***" contact.

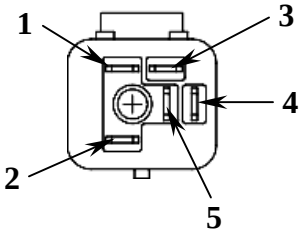


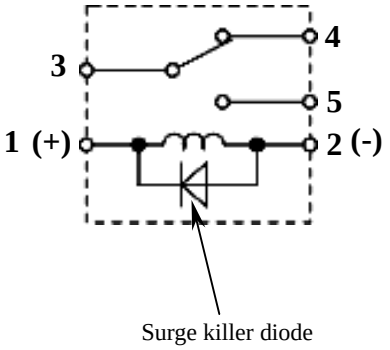
2. Relays CR3, 4, 5, 6, 7 and 10 (320- 05792)

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

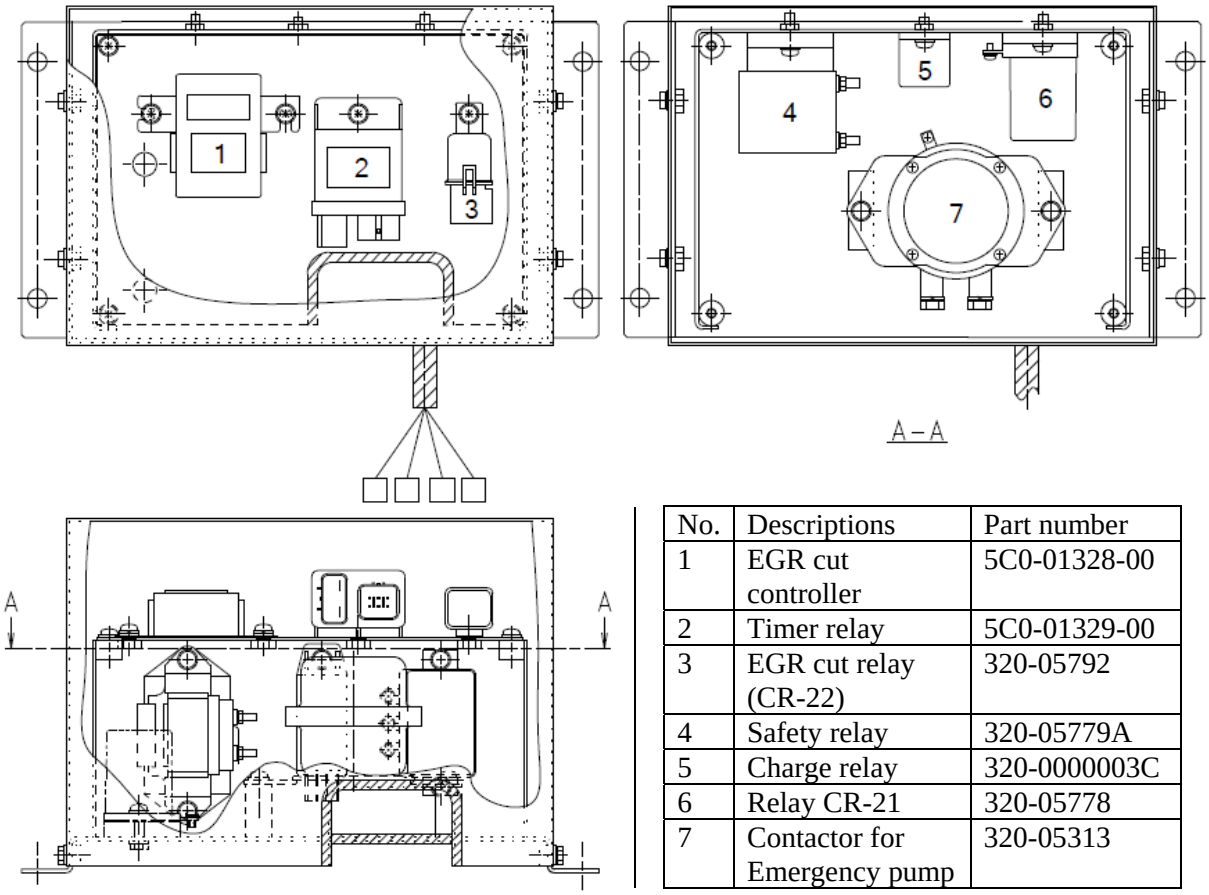






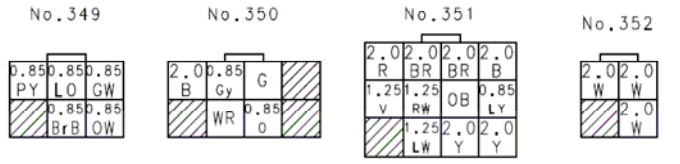
Engine control box

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.

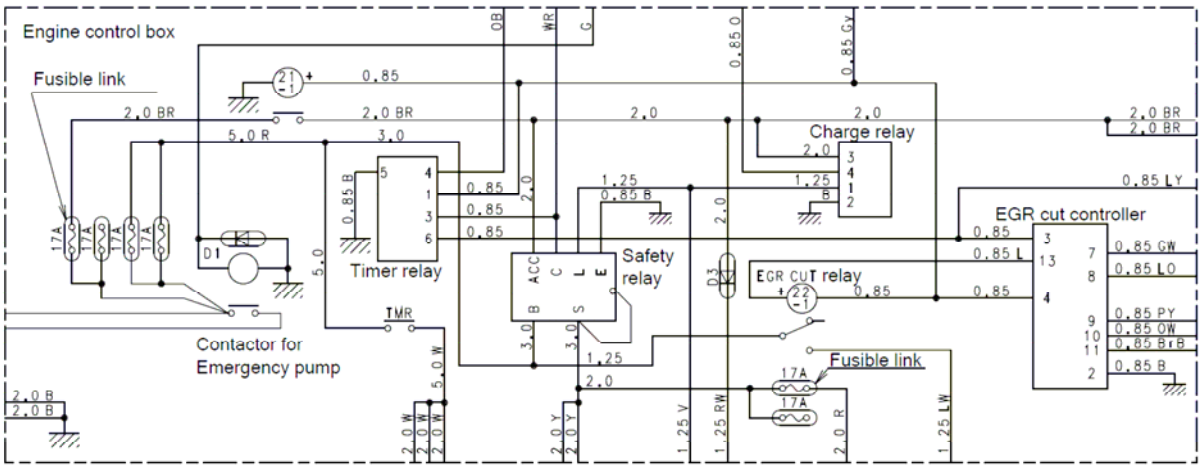


No.	Descriptions	Part number
1	EGR cut controller	5C0-01328-00
2	Timer relay	5C0-01329-00
3	EGR cut relay (CR-22)	320-05792
4	Safety relay	320-05779A
5	Charge relay	320-0000003C
6	Relay CR-21	320-05778
7	Contactor for Emergency pump	320-05313

Connector

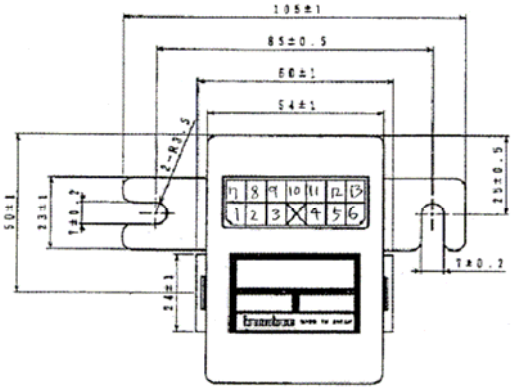


Electric circuit

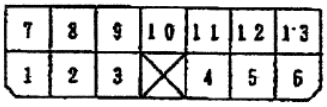


1. EGR cut controller (5C0-01328-00)

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



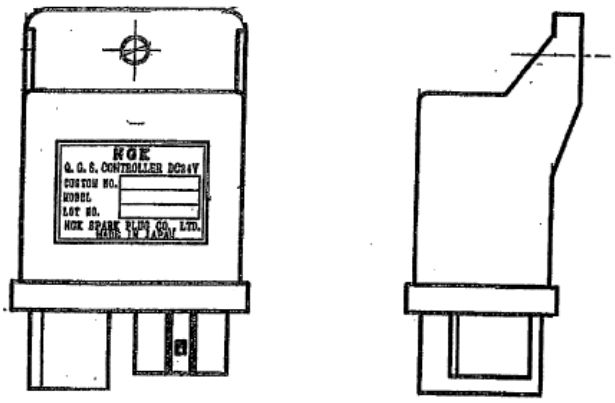
Connector

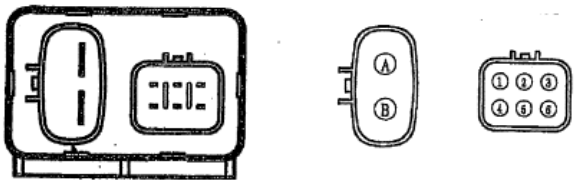


1	Starter s/w
2	Battery (-) C/U/GND
3	Thermo sensor
4	IGkey (+)
5	(TXD)
6	Stop R/L
7	Tacho (+)
8	Tacho (-)
9	Boost VCC
10	Boost SIG
11	Boost GND
12	(RXD)
13	EGR R/L

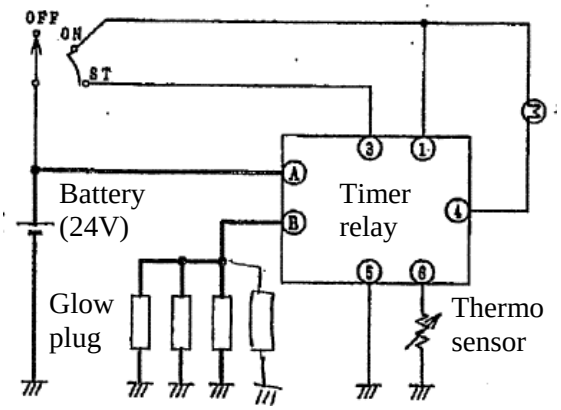
2. Timer relay (5C0-01329-00)

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



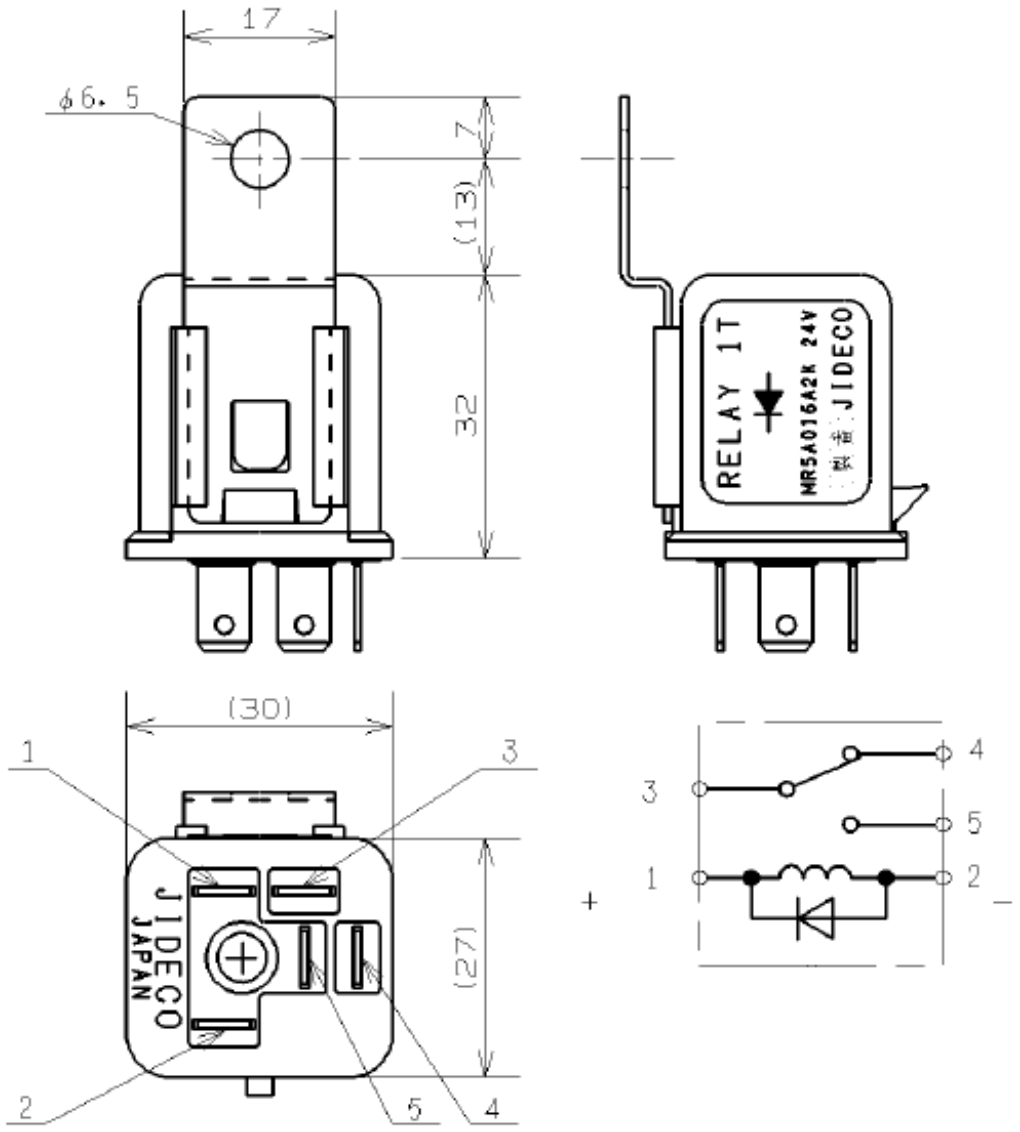


Key s/w



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

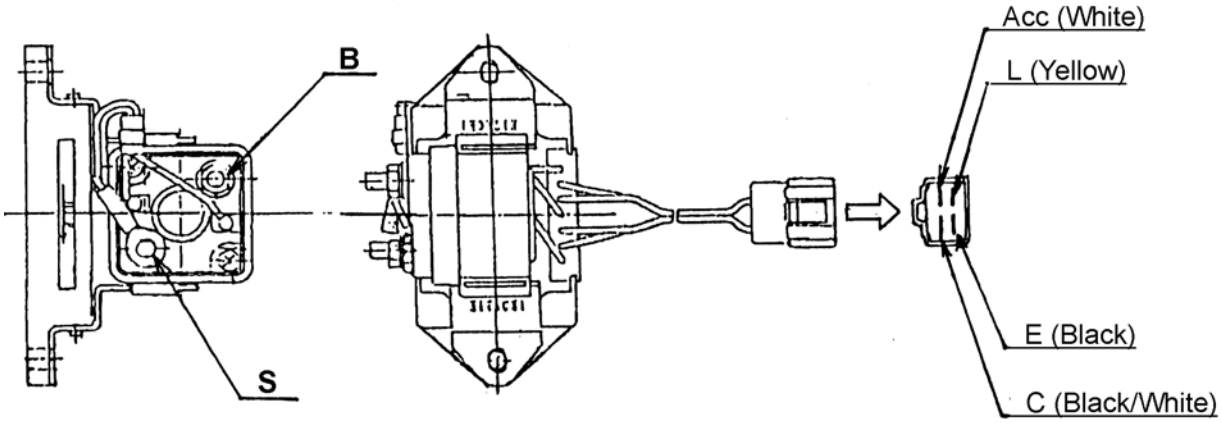
This EGR cut relay is installed in the engine control box to supply power to the EGR cut solenoid.

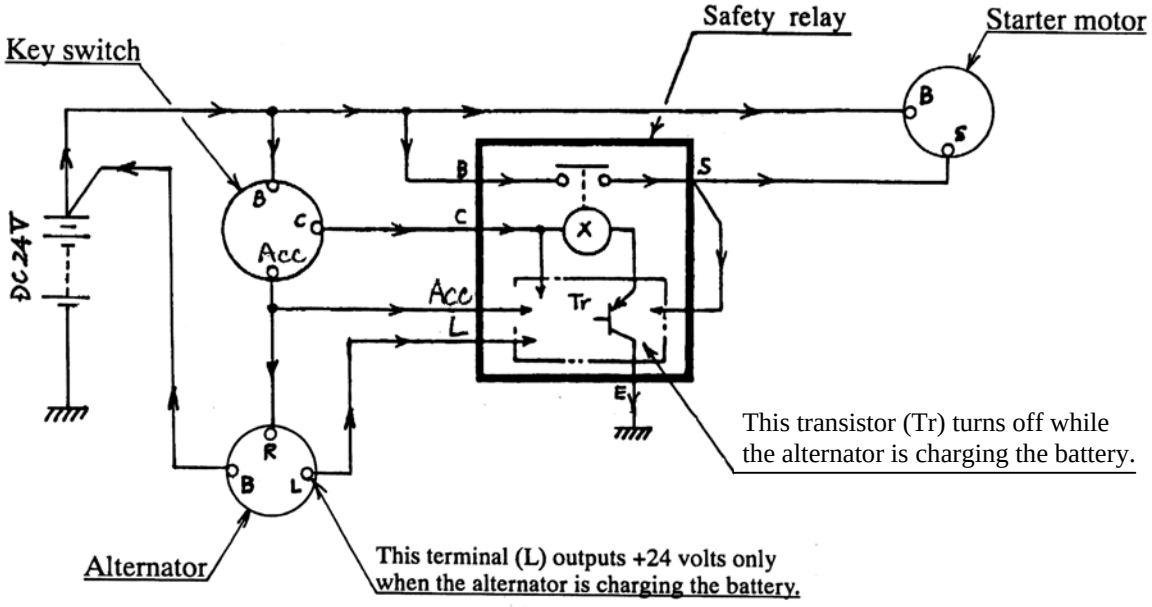


4. Safety relay (320- 05779A)

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





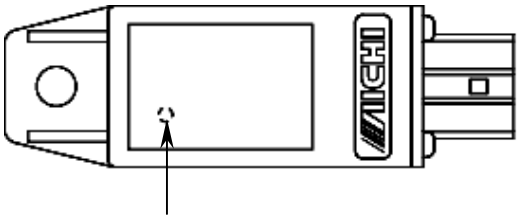
ON/OFF conditions of the key switch

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

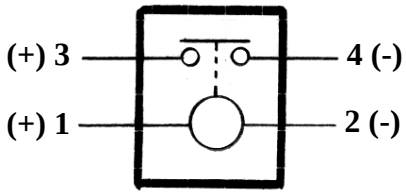
5. Charge relay (320- 00000- 03C)

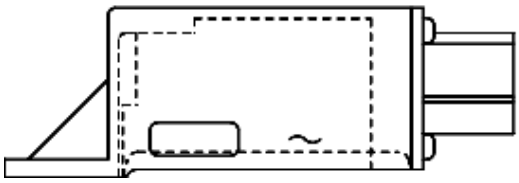
This charge relay is installed in the engine control box and switches on when the alternator charges the batteries.

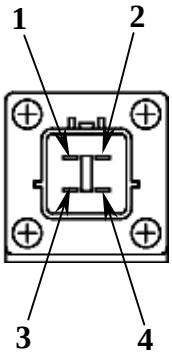
Rated voltage	DC 24 v
Switching on voltage	DC 18 v or higher
Switching off voltage	DC 10v or lower



This LED goes on when the relay is switched on.



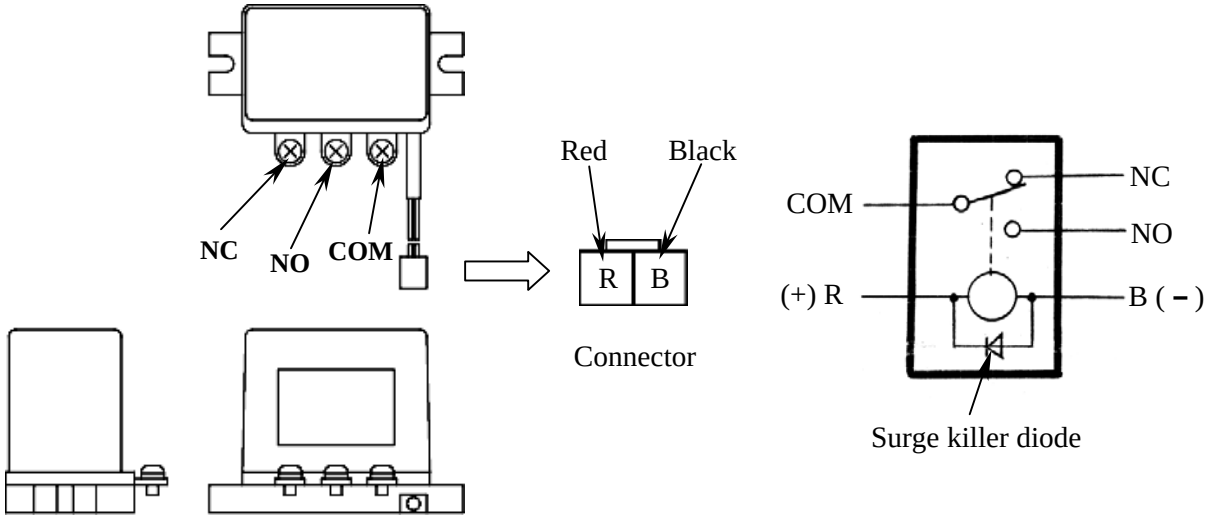




6. Relay CR21 (320- 05778)

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.

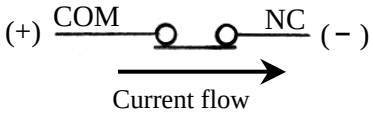
Rated voltage ---------- DC 24 v
Coil resistance ---------- 130 Ω



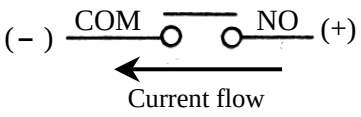
CAUTION

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

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



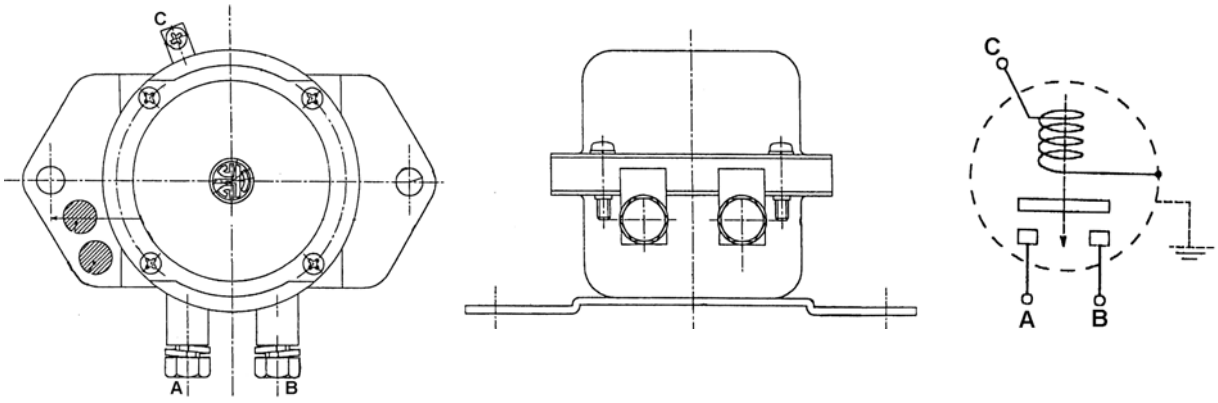
*When using "***Normally open***" contact.



7. Contactor for Emergency pump (320- 05313)

This contactor is installed in the engine control box to supply power to the emergency pump.

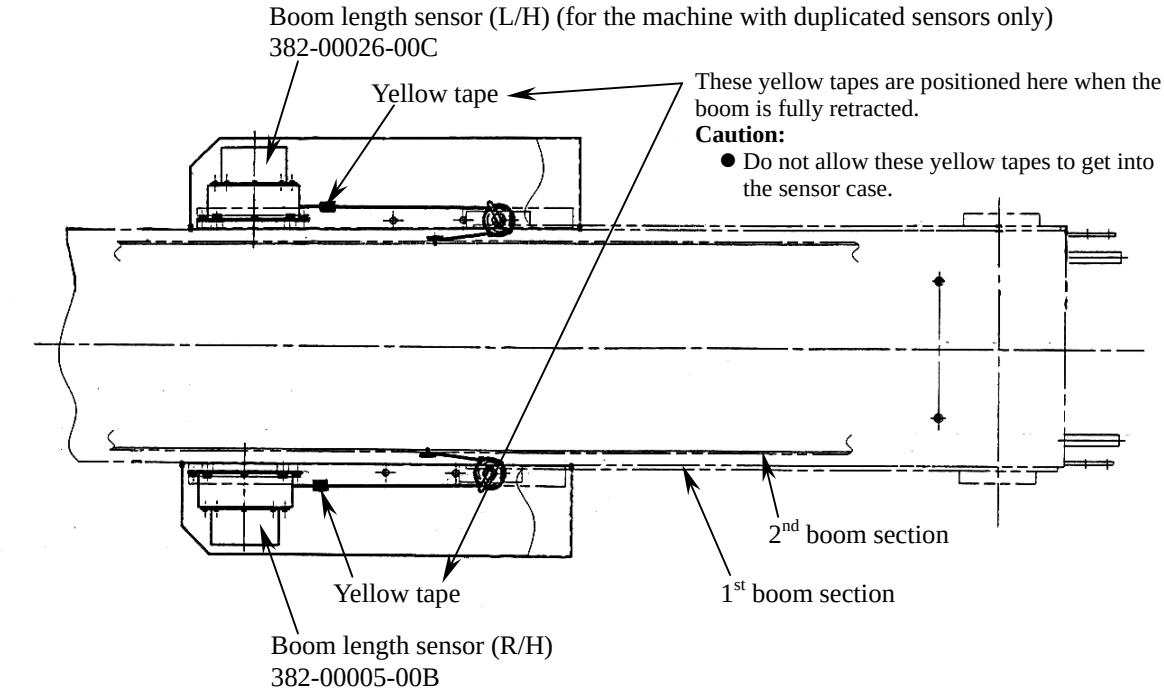
Rated voltage	DC 24 v
Rated current	200 A (Continuously), 700 A (for two minutes)

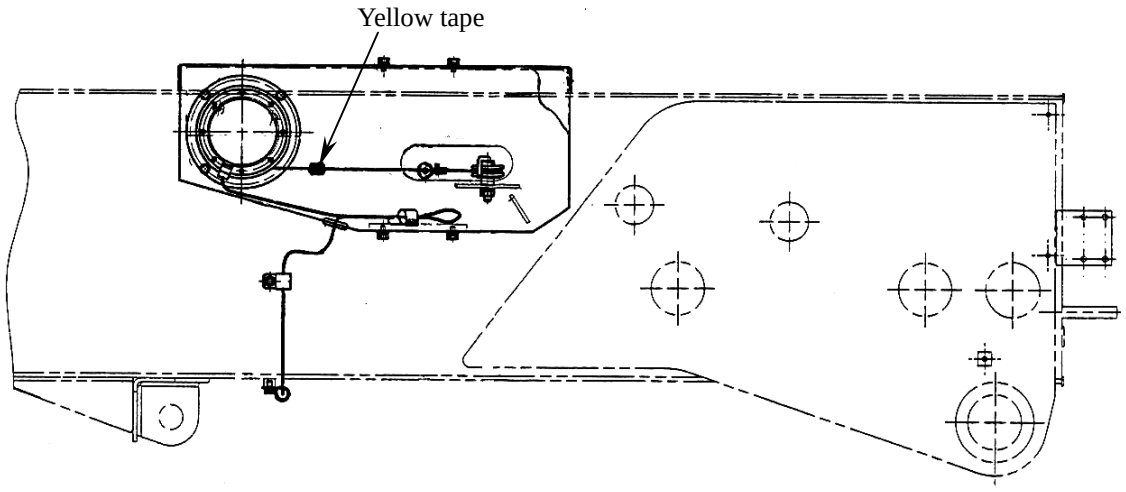


Boom length sensor

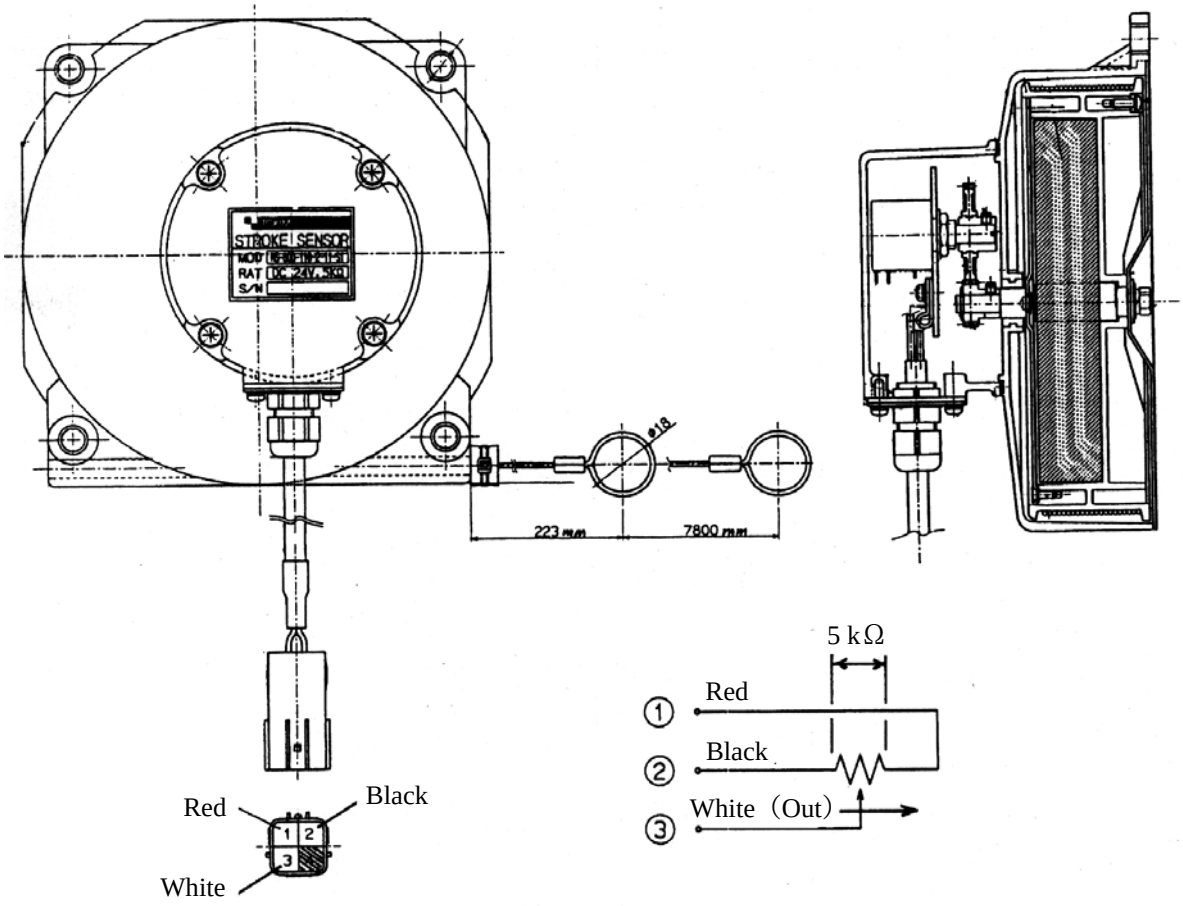
For the machine with duplicated sensors:
The boom length sensors (R/H) and (L/H) are installed on the both sides of the 1st boom section to sense the boom length.

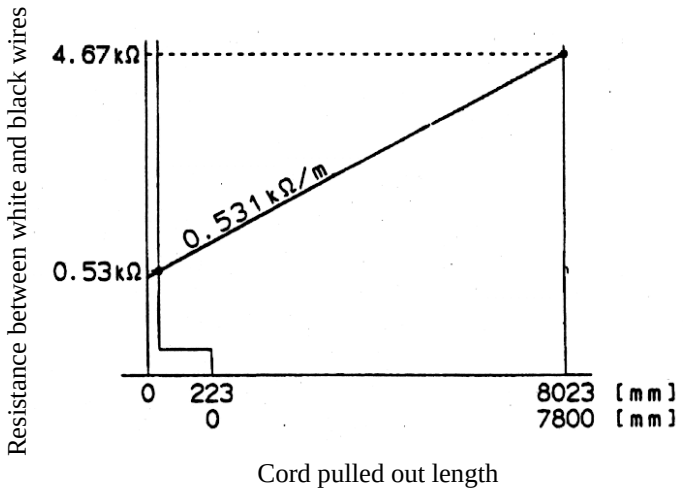
For the machine without duplicated sensors:
The boom length sensors (R/H) is installed on the right side of the 1st boom section to sense the boom length.





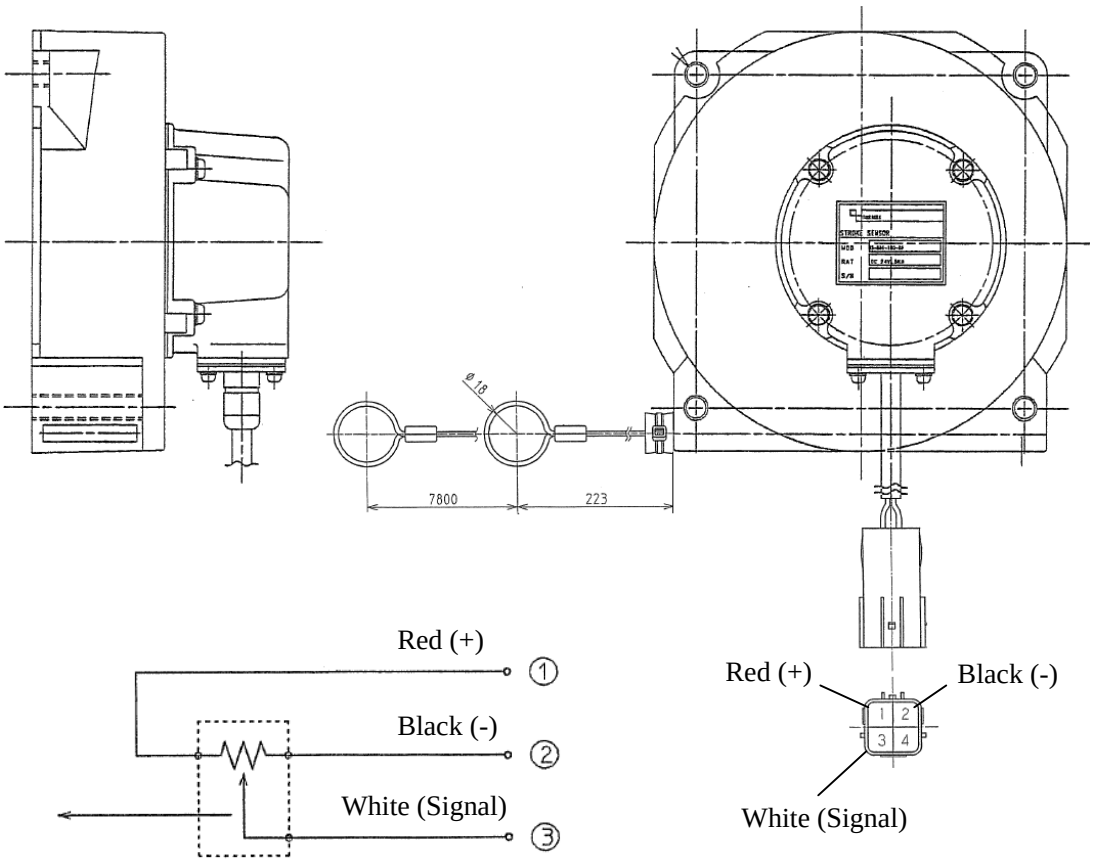
1. Boom length sensor (R/H)

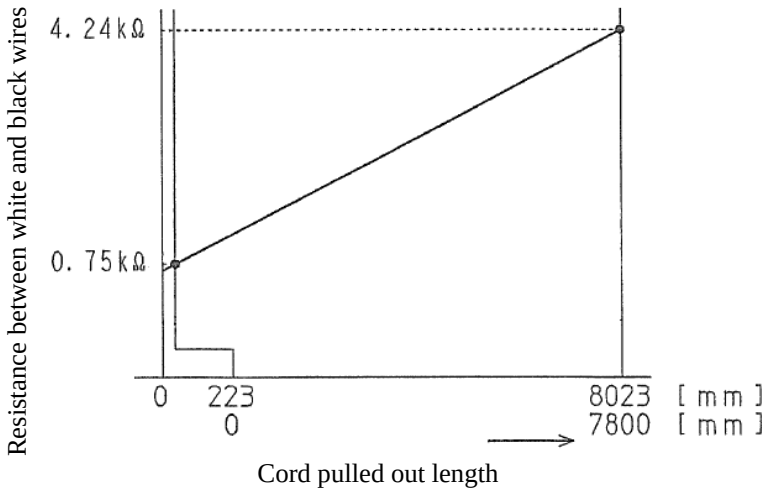




Resistance characteristics

2. Boom length sensor (L/H)

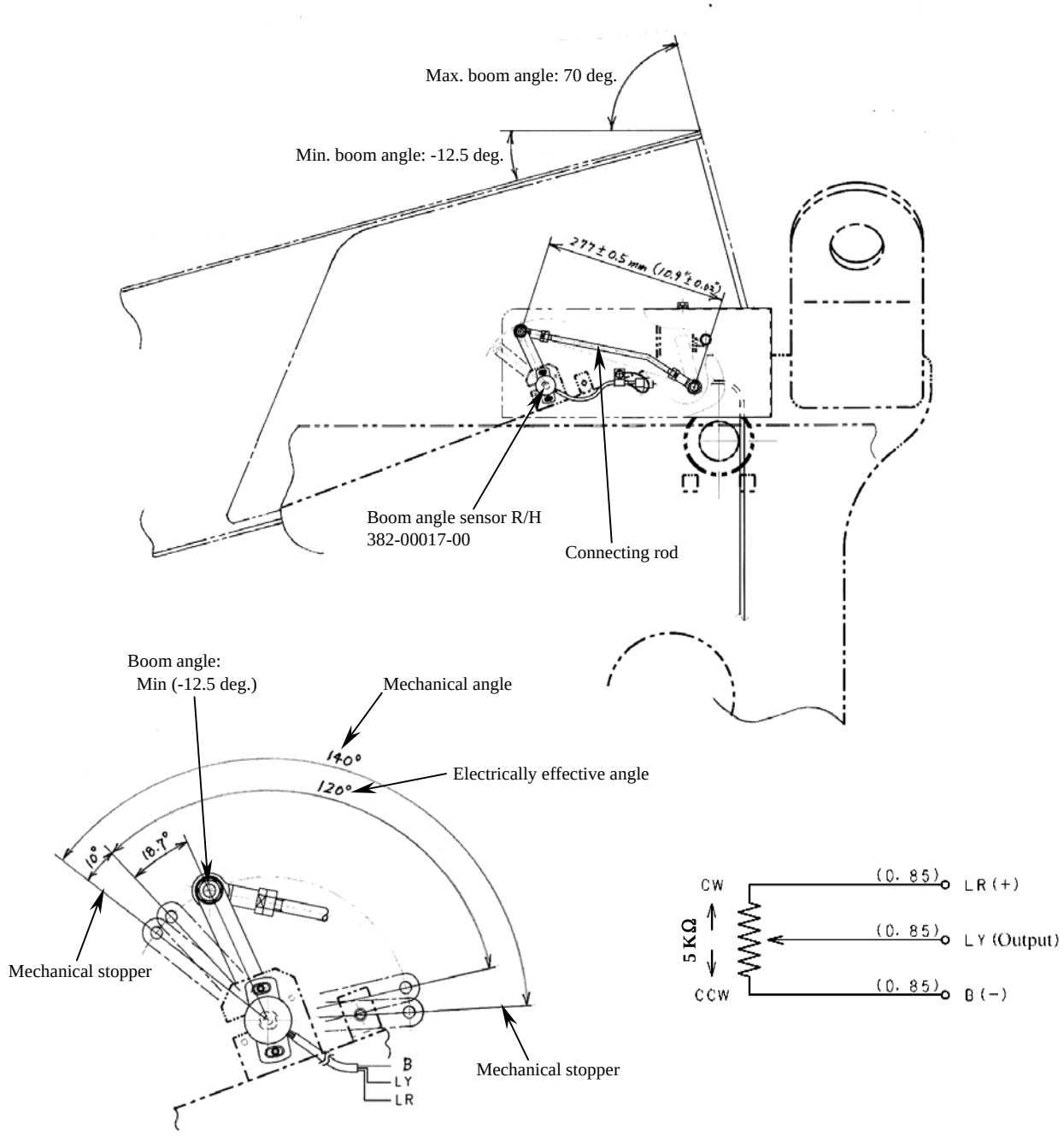




Resistance characteristics

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.

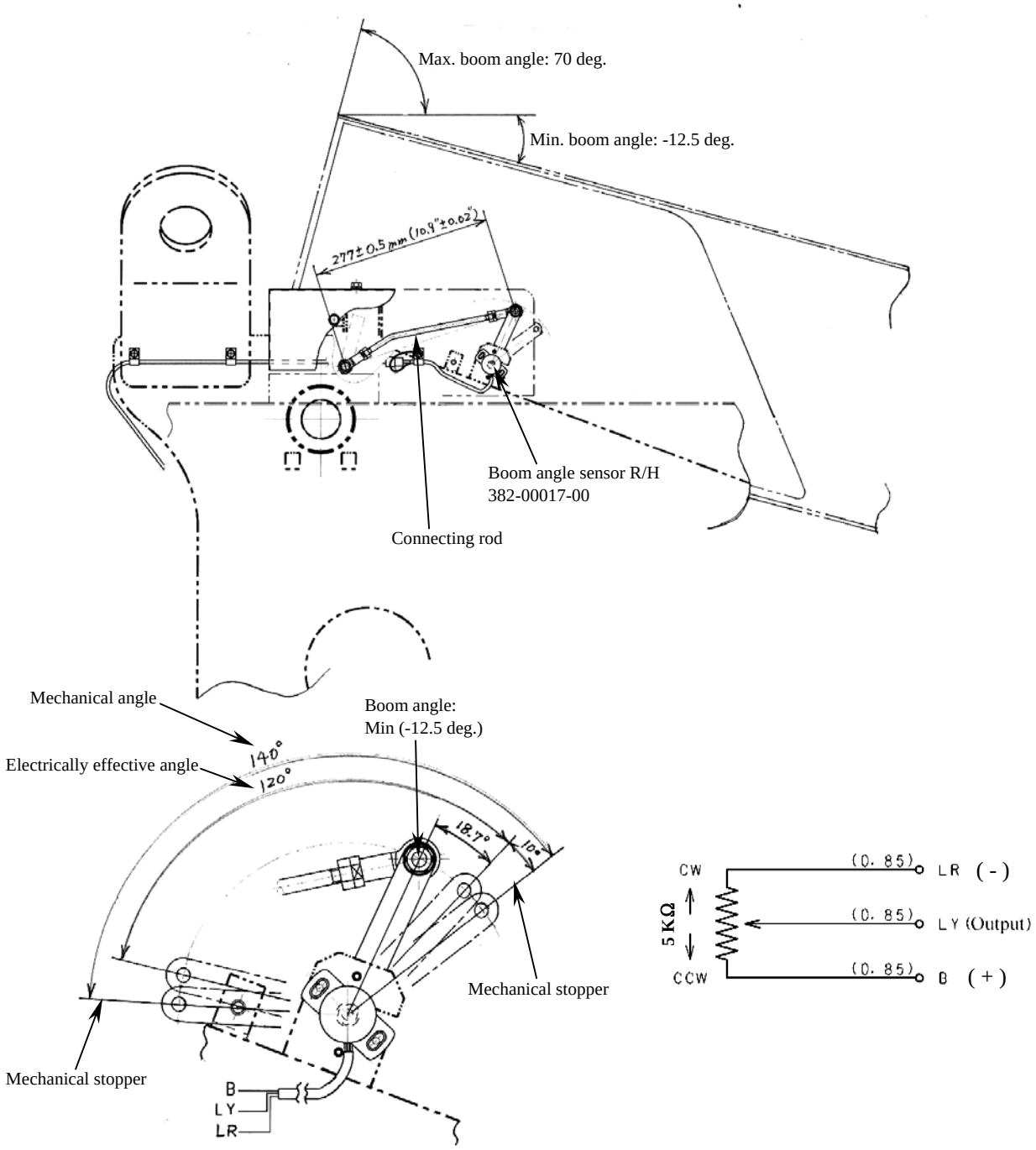


Sensor installation procedures

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.



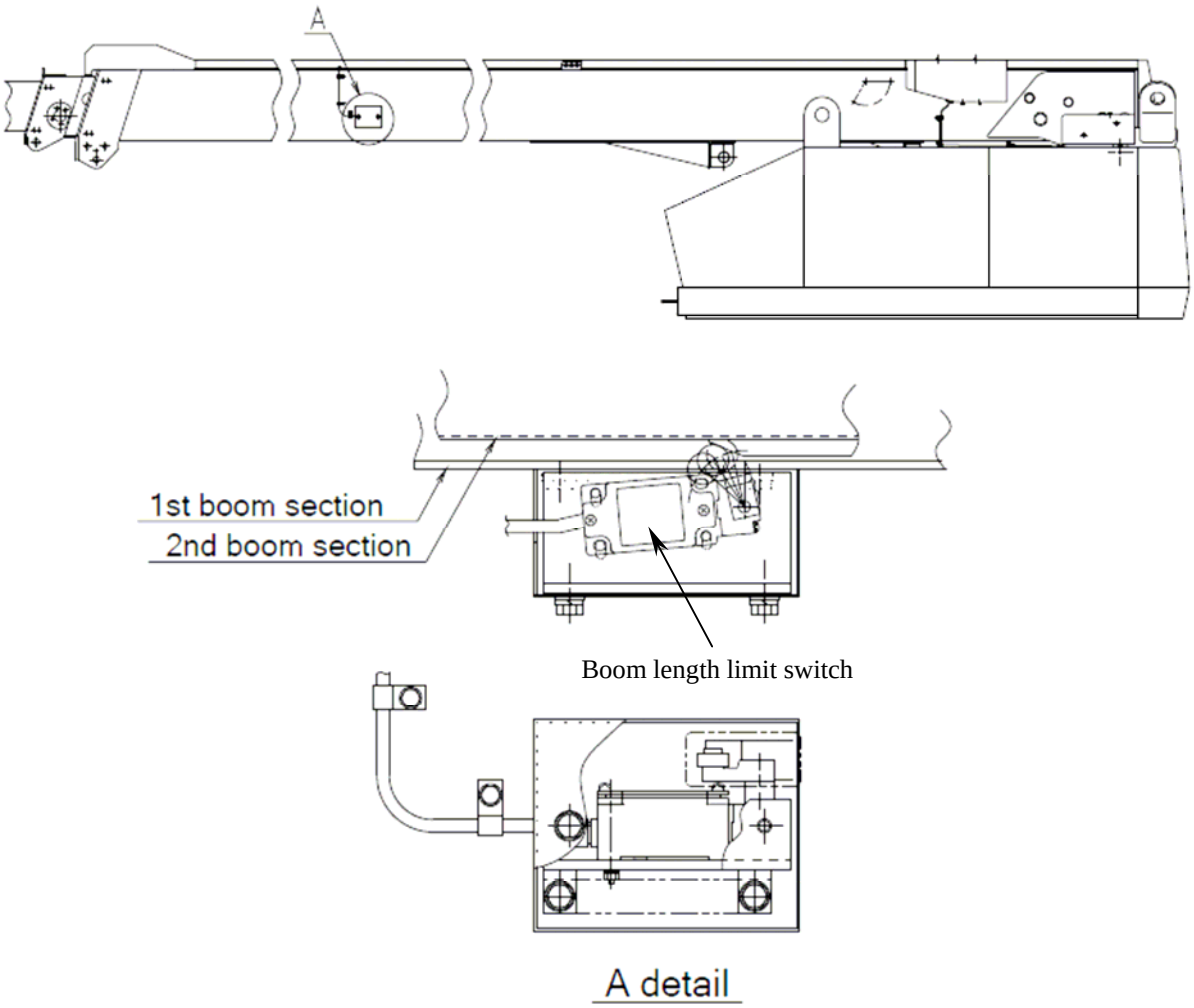
Sensor installation procedures

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
SP21AJ	3,592 mm (141.4 inches)
SP21A	5,080 mm (200.0 inches)
SP18AJ	3,400 mm (133.9 inches)

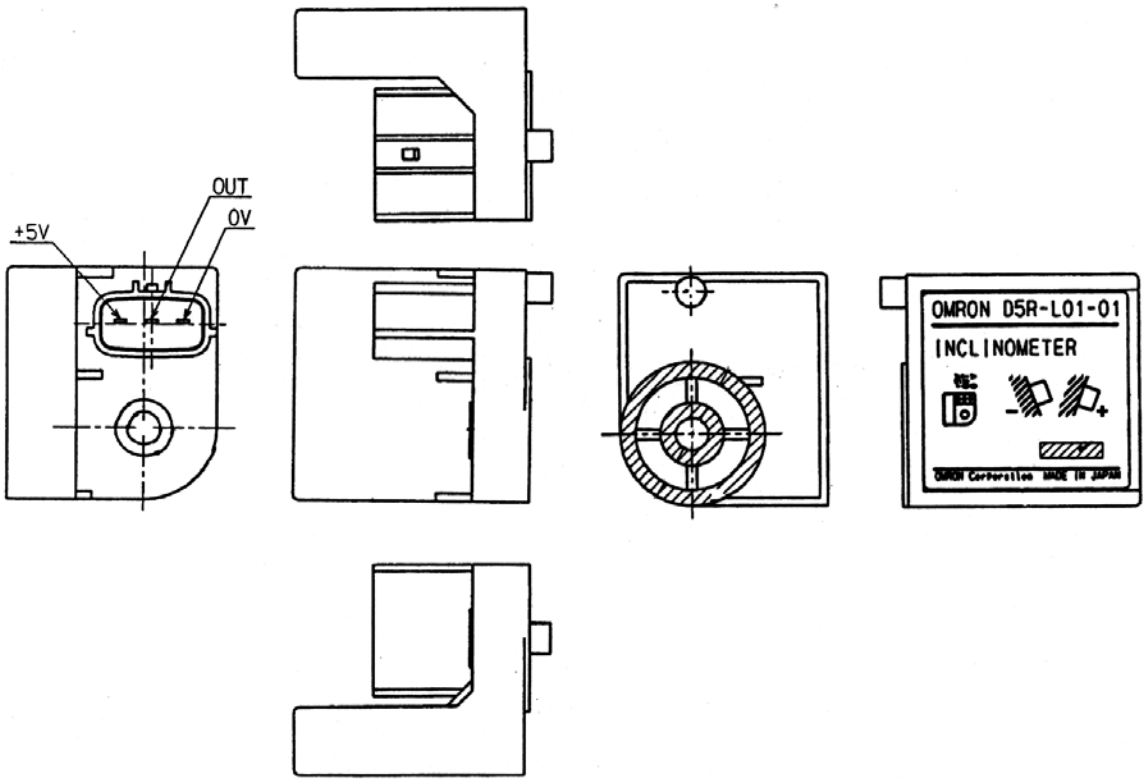


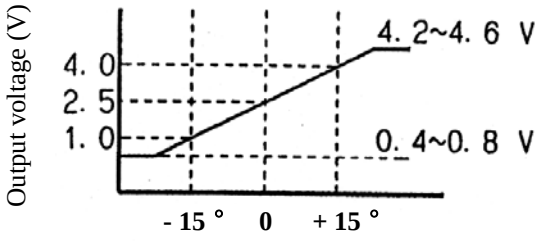
Tilt sensor

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)



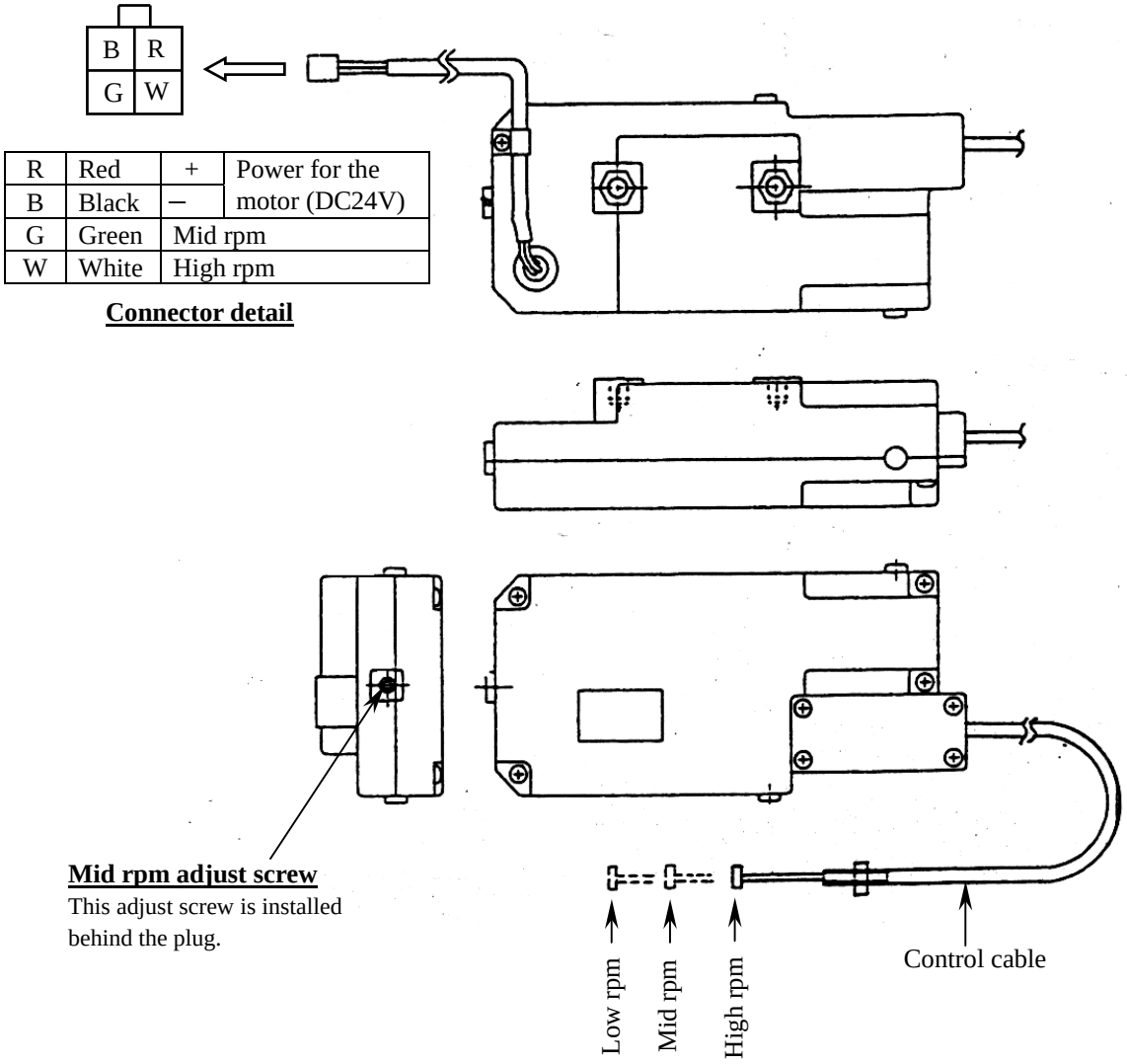


Output characteristics

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

Mid rpm adjust screw
This adjust screw is installed behind the plug.

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

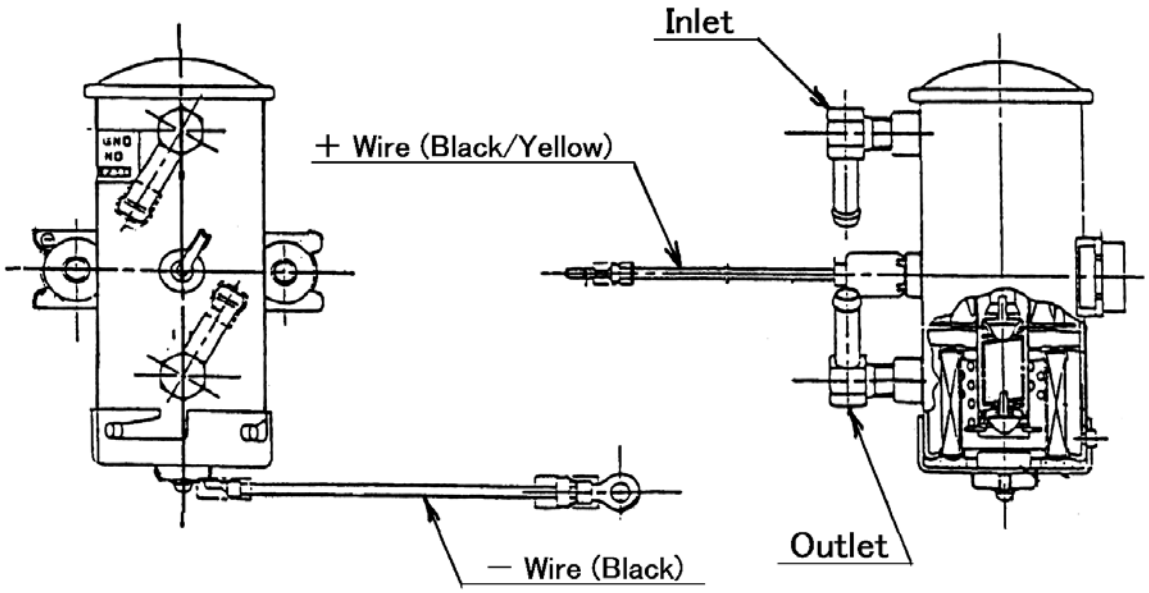
Low	1,020 rpm (Engine Idling)
Mid	1,300 rpm
High	2,200 rpm

897041- 5211

Fuel pump for automatic air bleeding system

For diesel engine

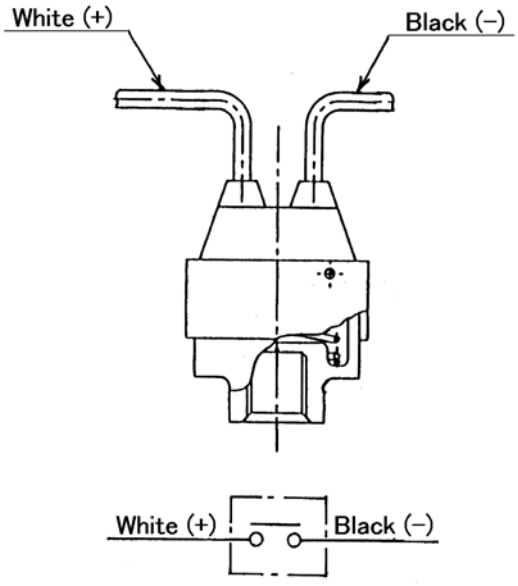
This fuel pump is actuated when the Main key switch is turned to the **ON**, the **START**, or **the GLOW** position to feed fuel to the injection pump on the diesel engine.



Air cleaner clog detect switch

897166- 4100

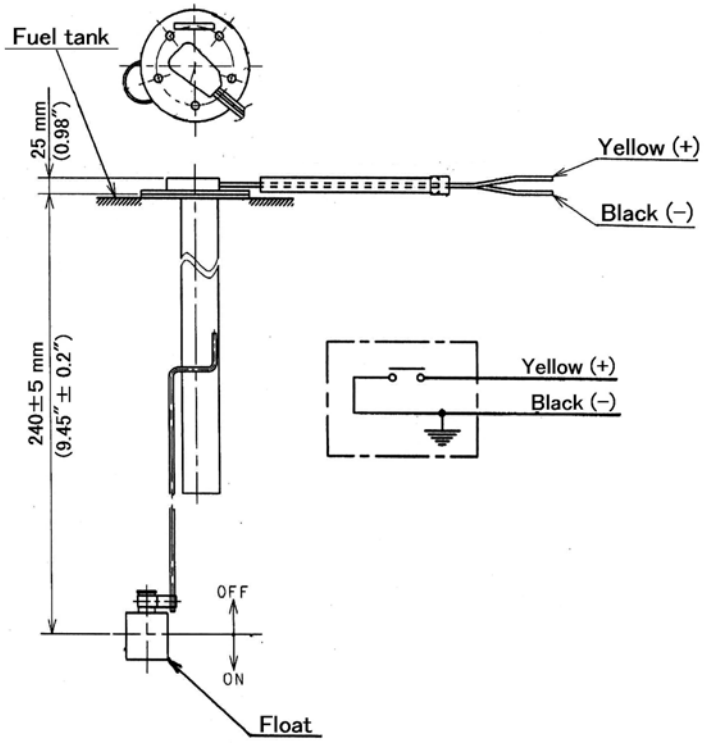
This switch is installed at the air cleaner inlet to sense the air cleaner clogging.
The contact of this switch closes when the vacuum of the intake air reaches 6.23 kPa (635 mmAq).



Low fuel level detect switch

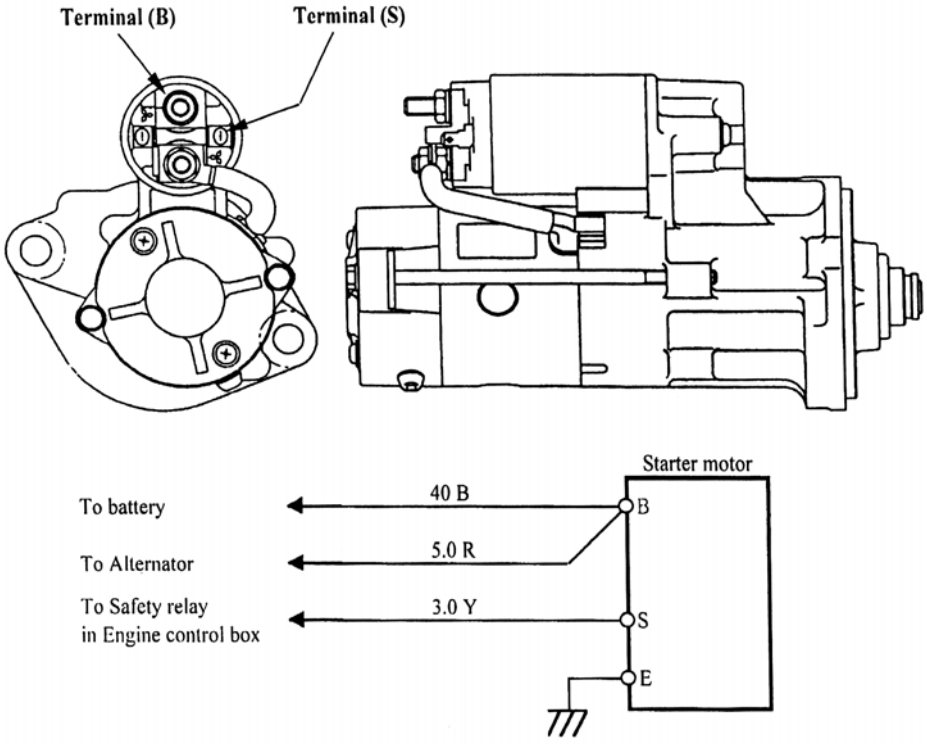
382- 00000- 26A

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



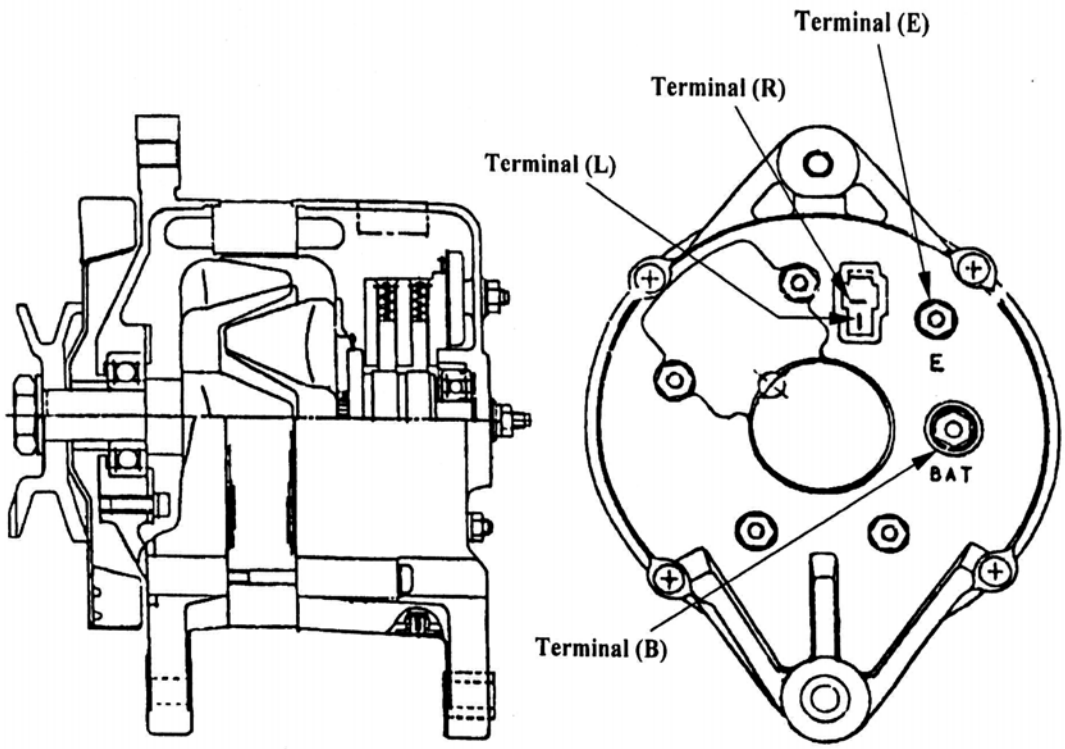
Starter motor

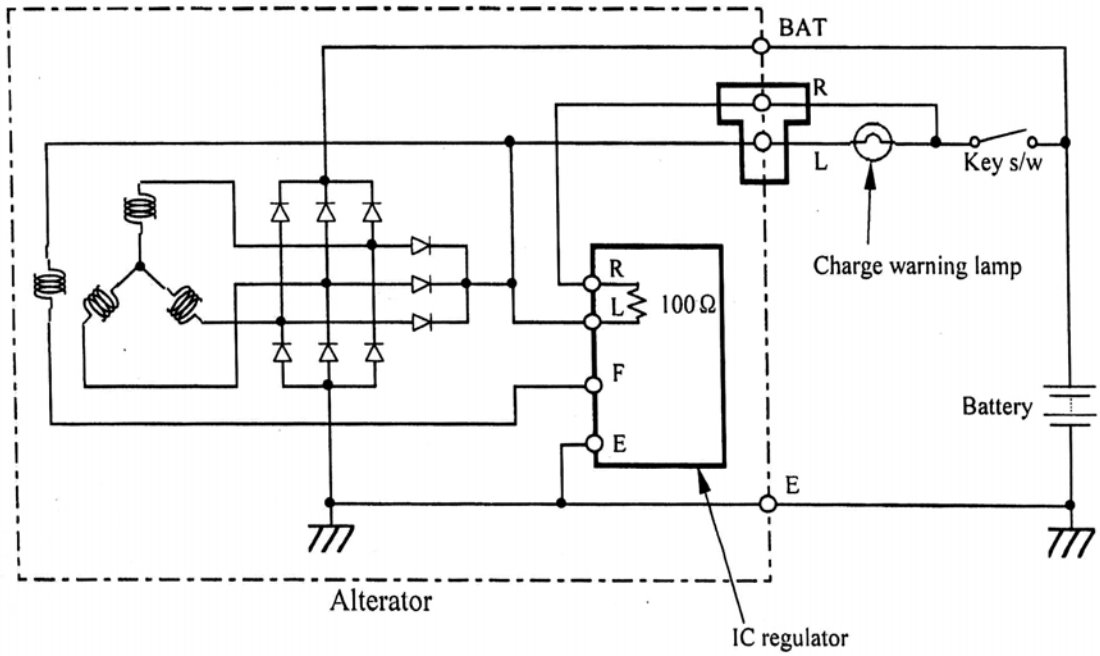
For diesel engine (898072- 3151)



Alternator

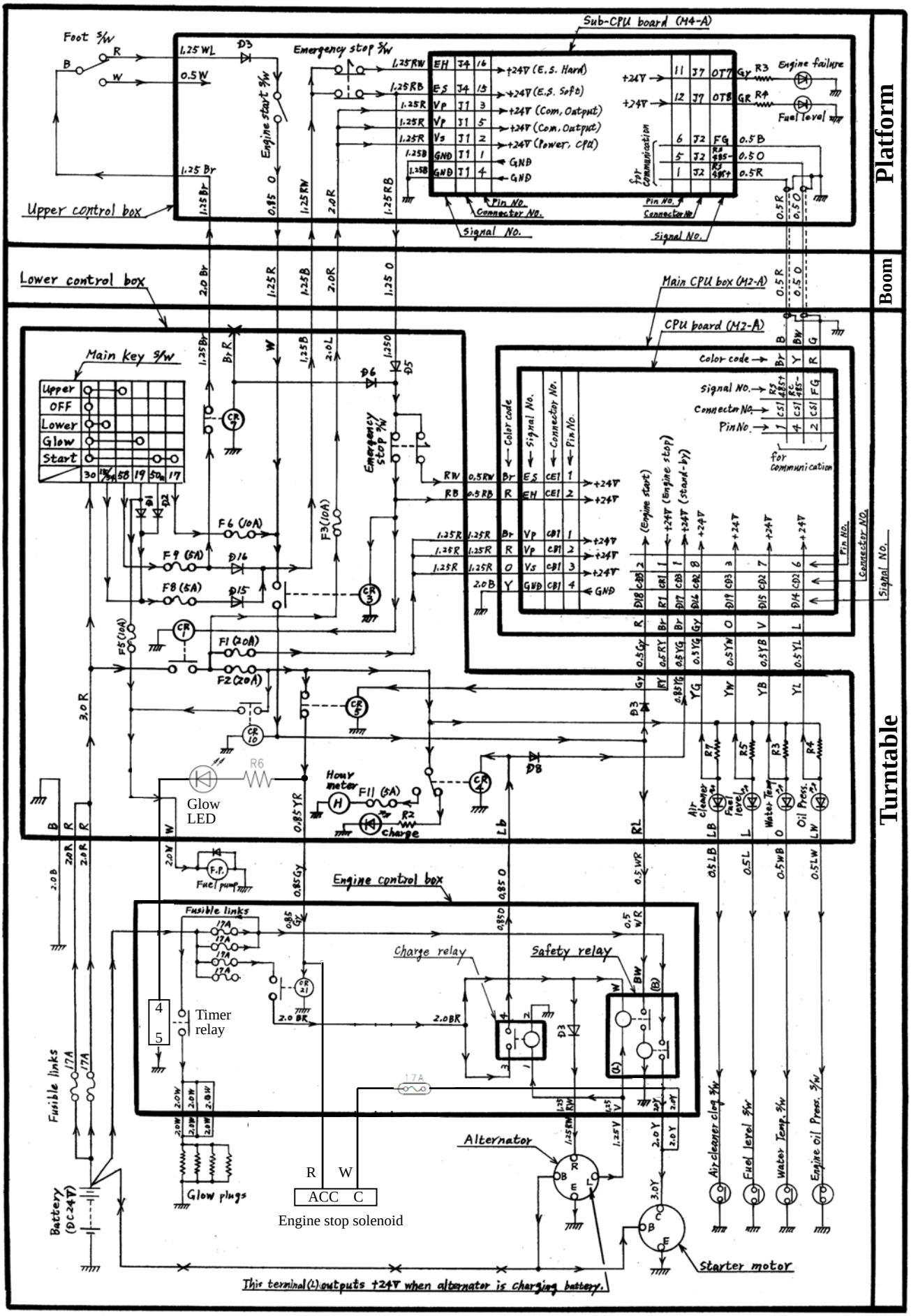
Rated voltage: DC24V
Rated current: 15A



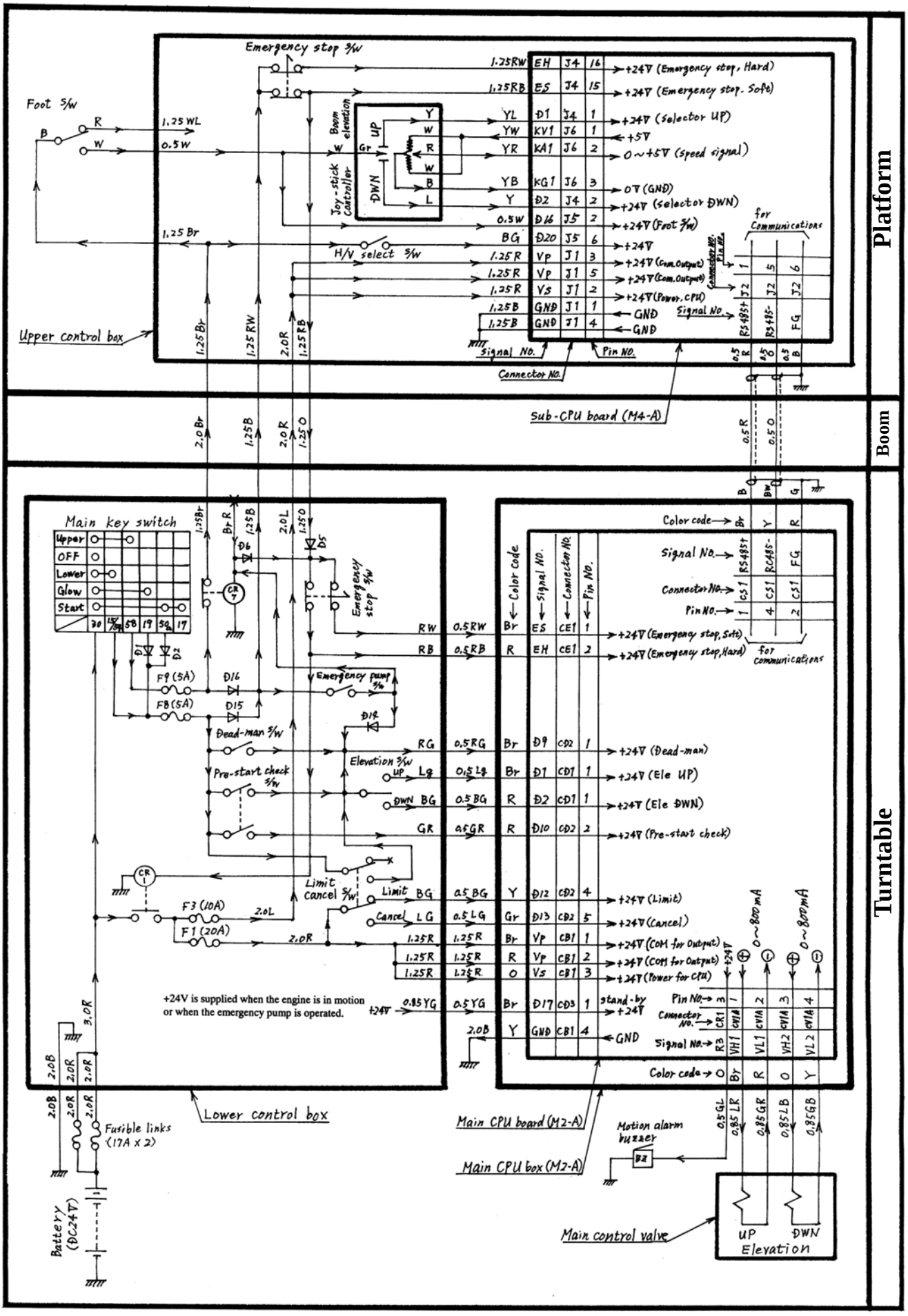


5. Electrical circuit for individual system

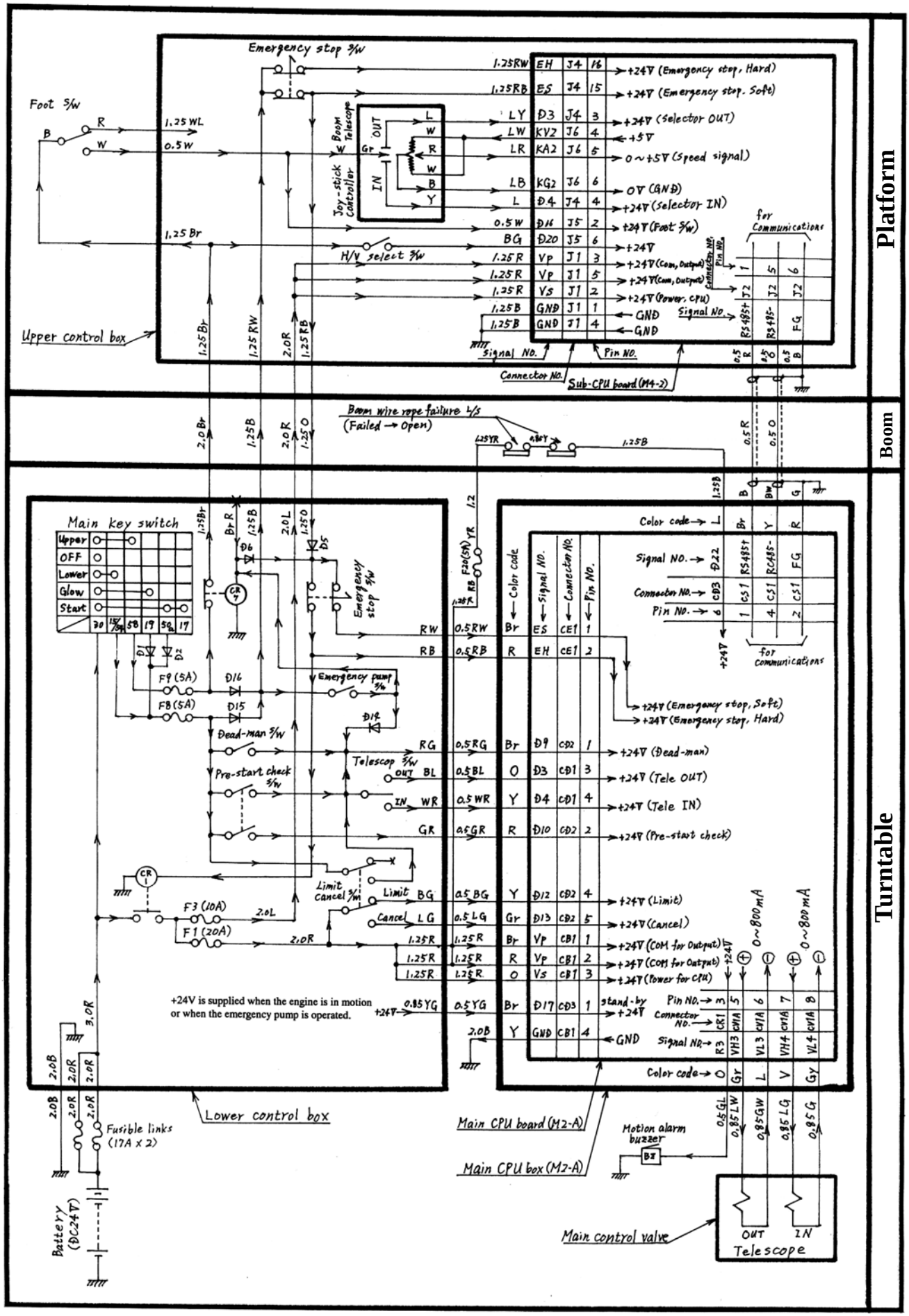
Engine start and stop system (Isuzu 4LE2)



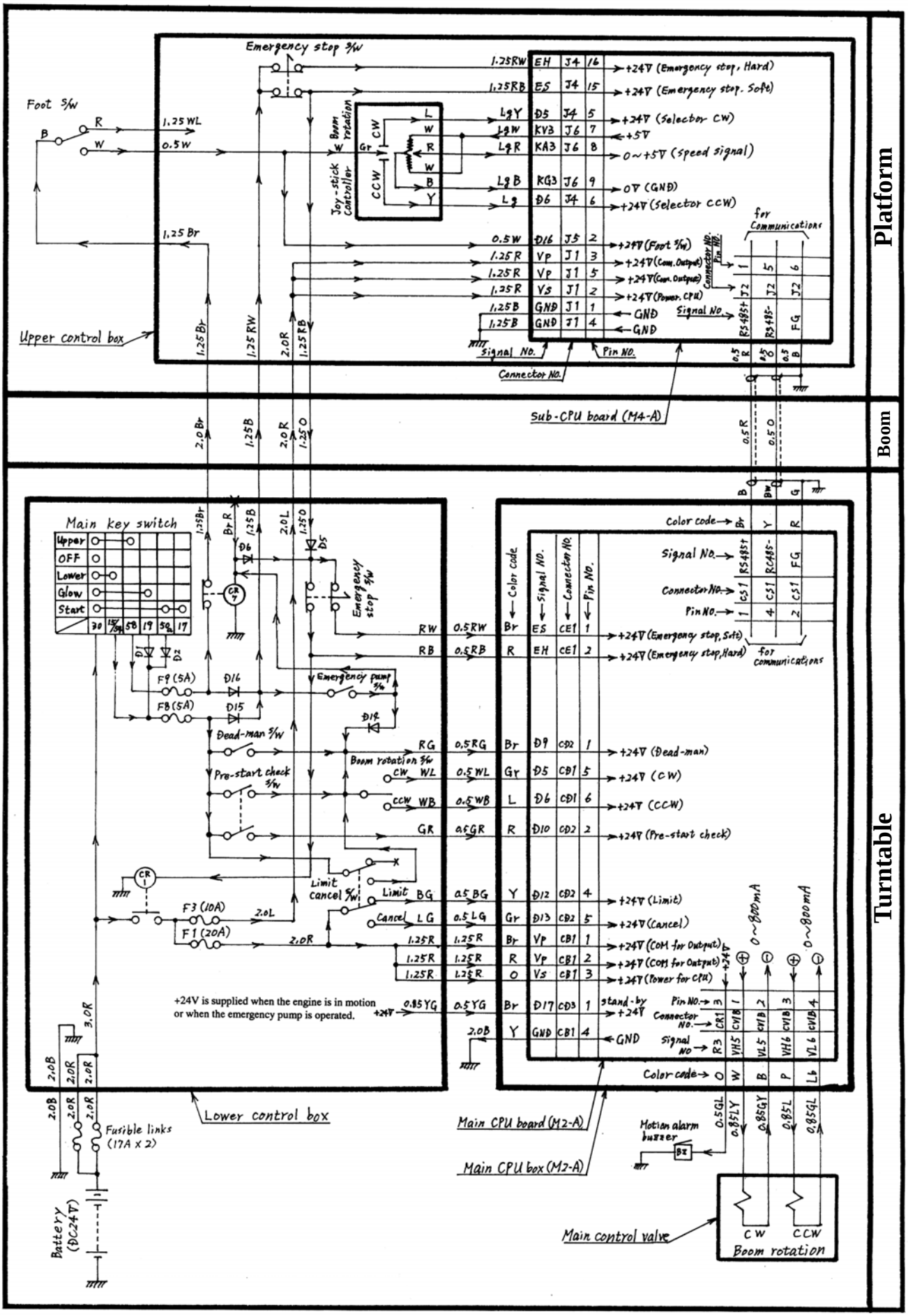
Boom elevation system



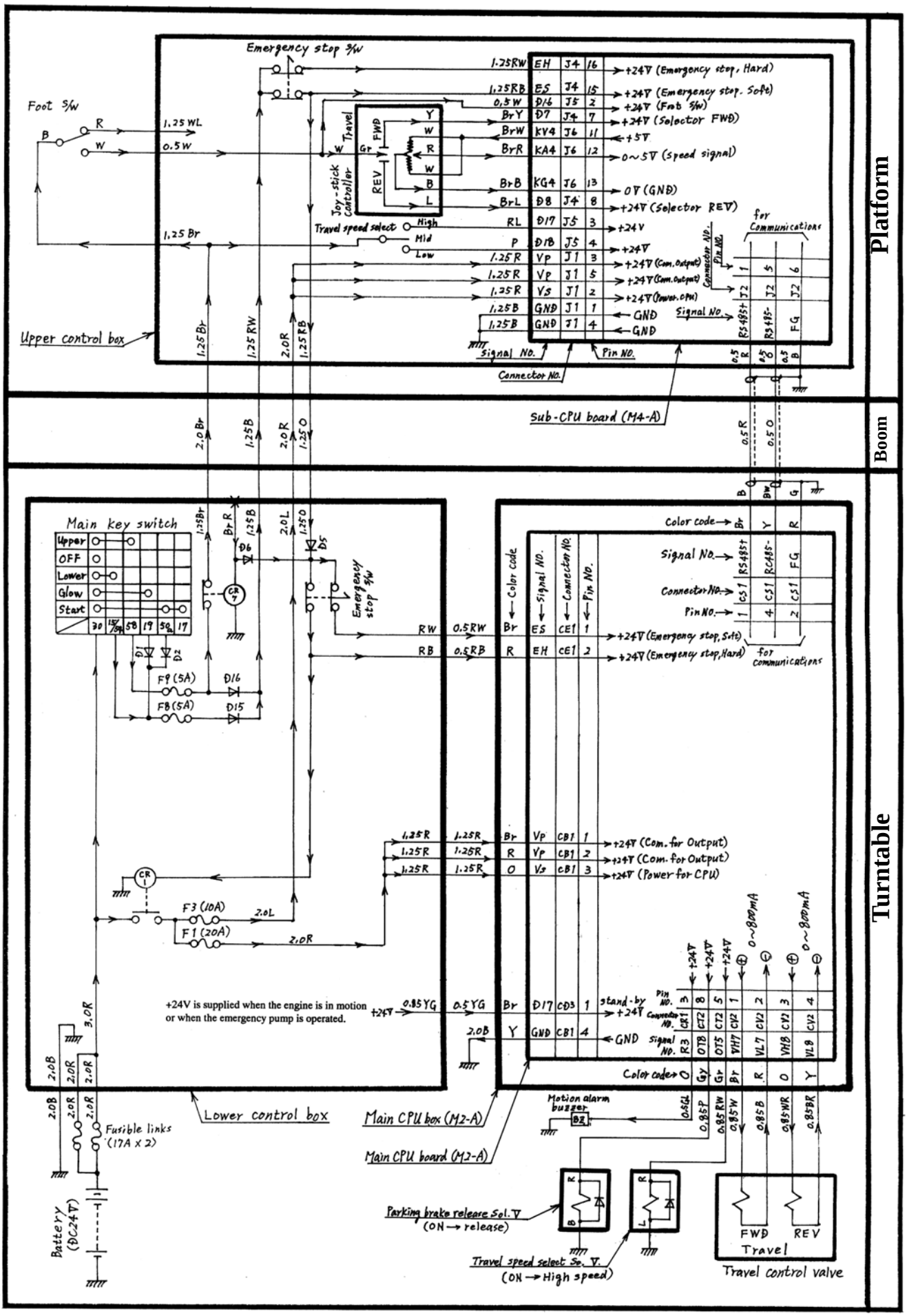
Boom telescope system



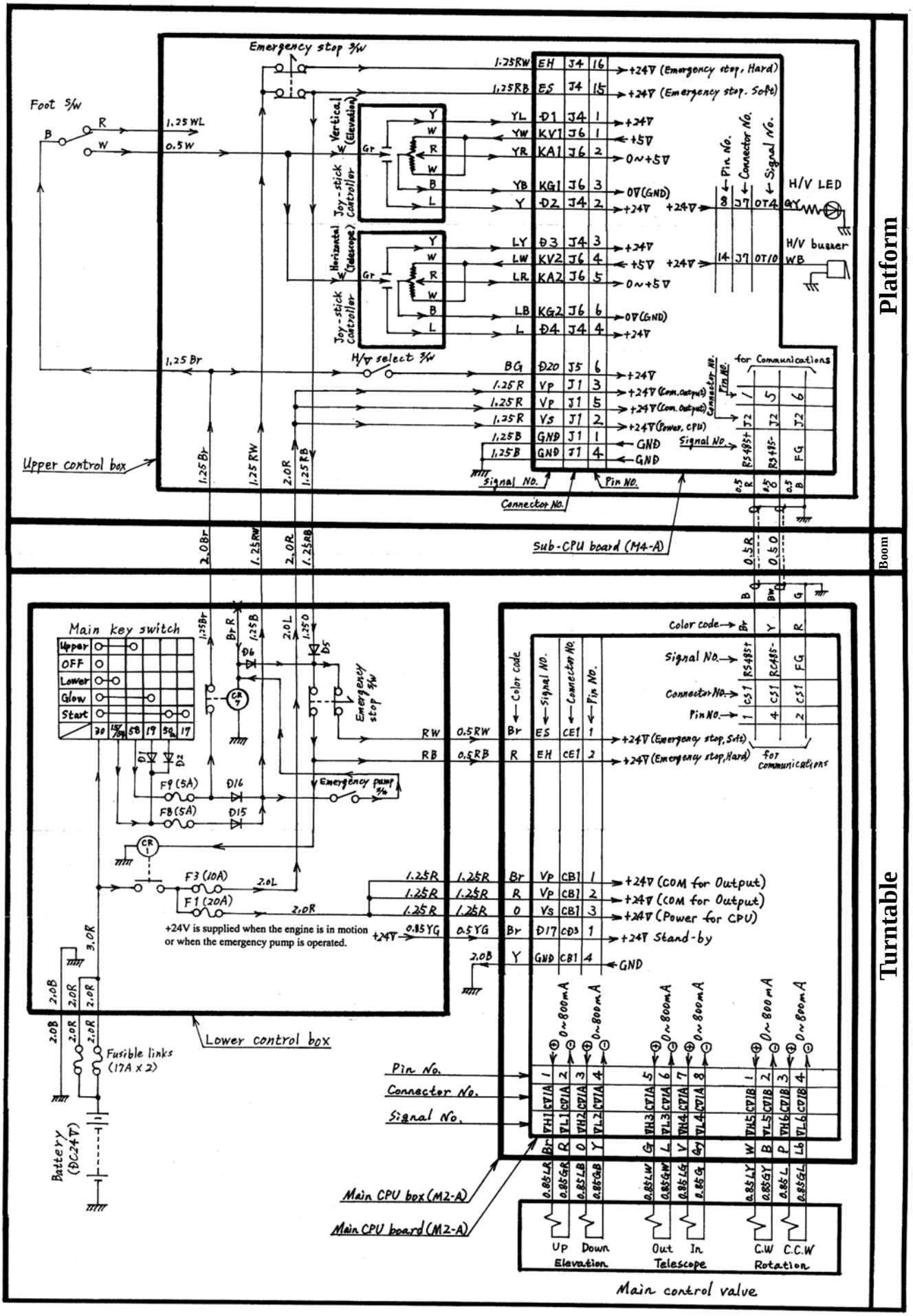
Boom rotation system



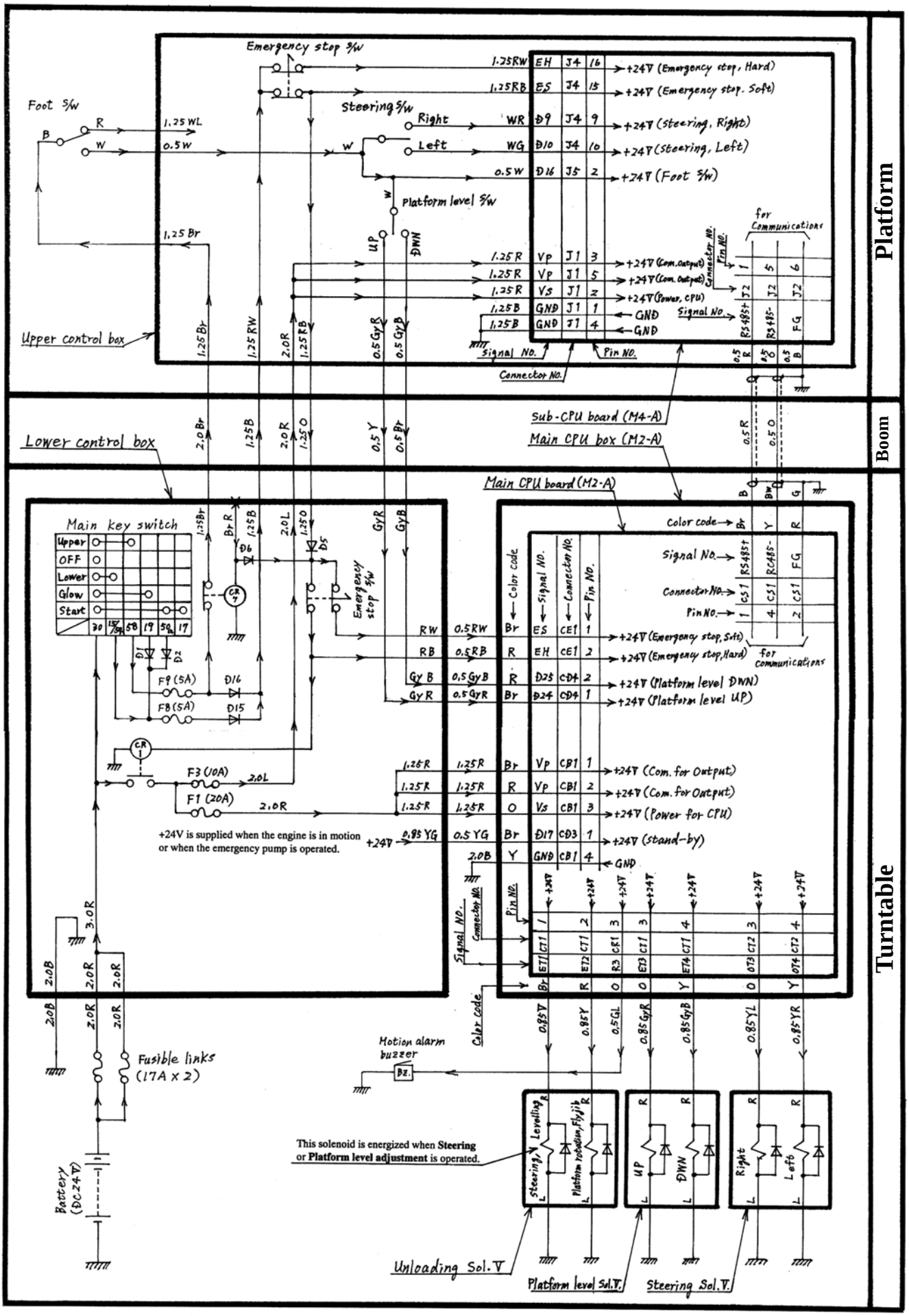
Traveling system



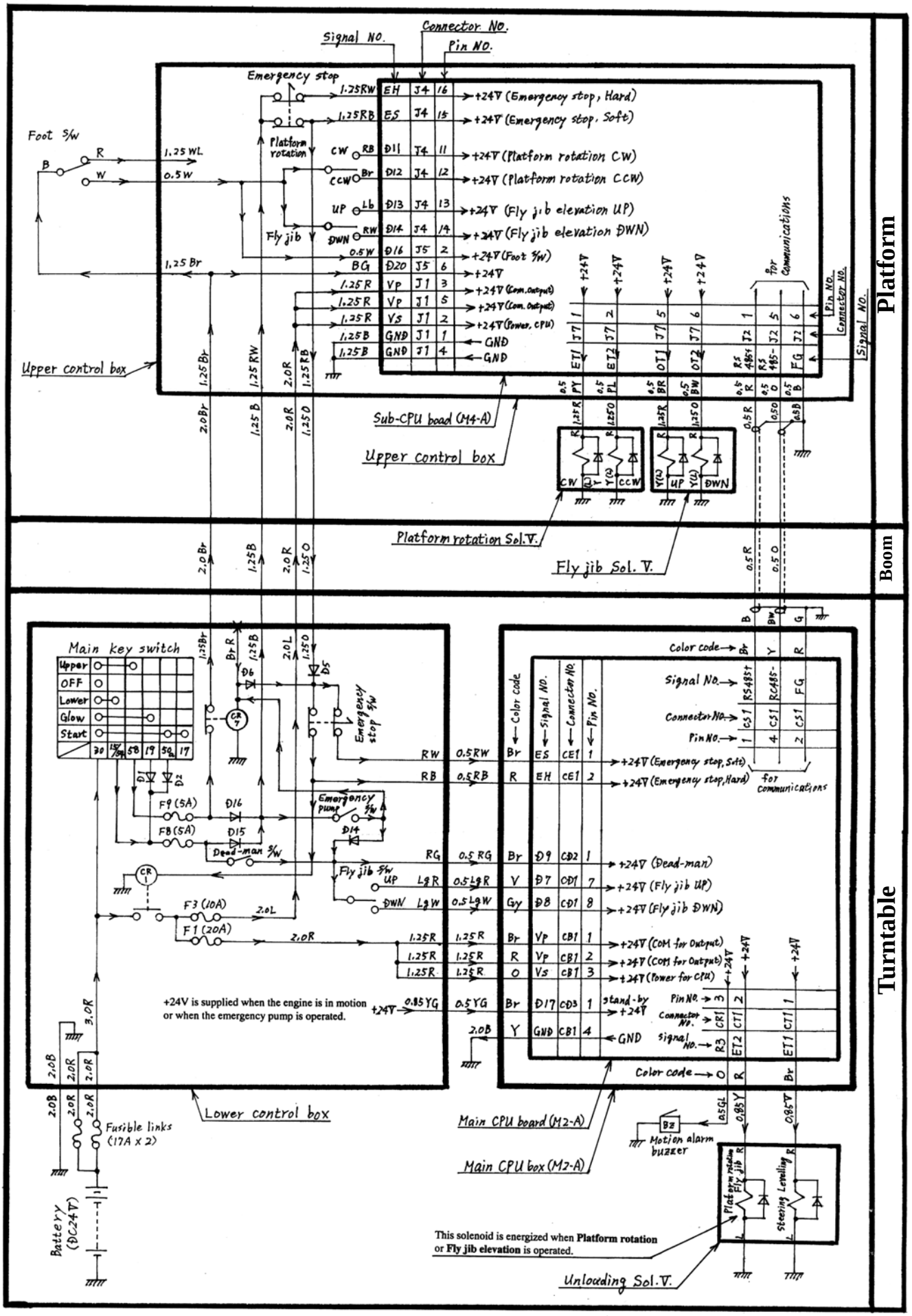
H / V control system



Steering and Platform level adjust systems

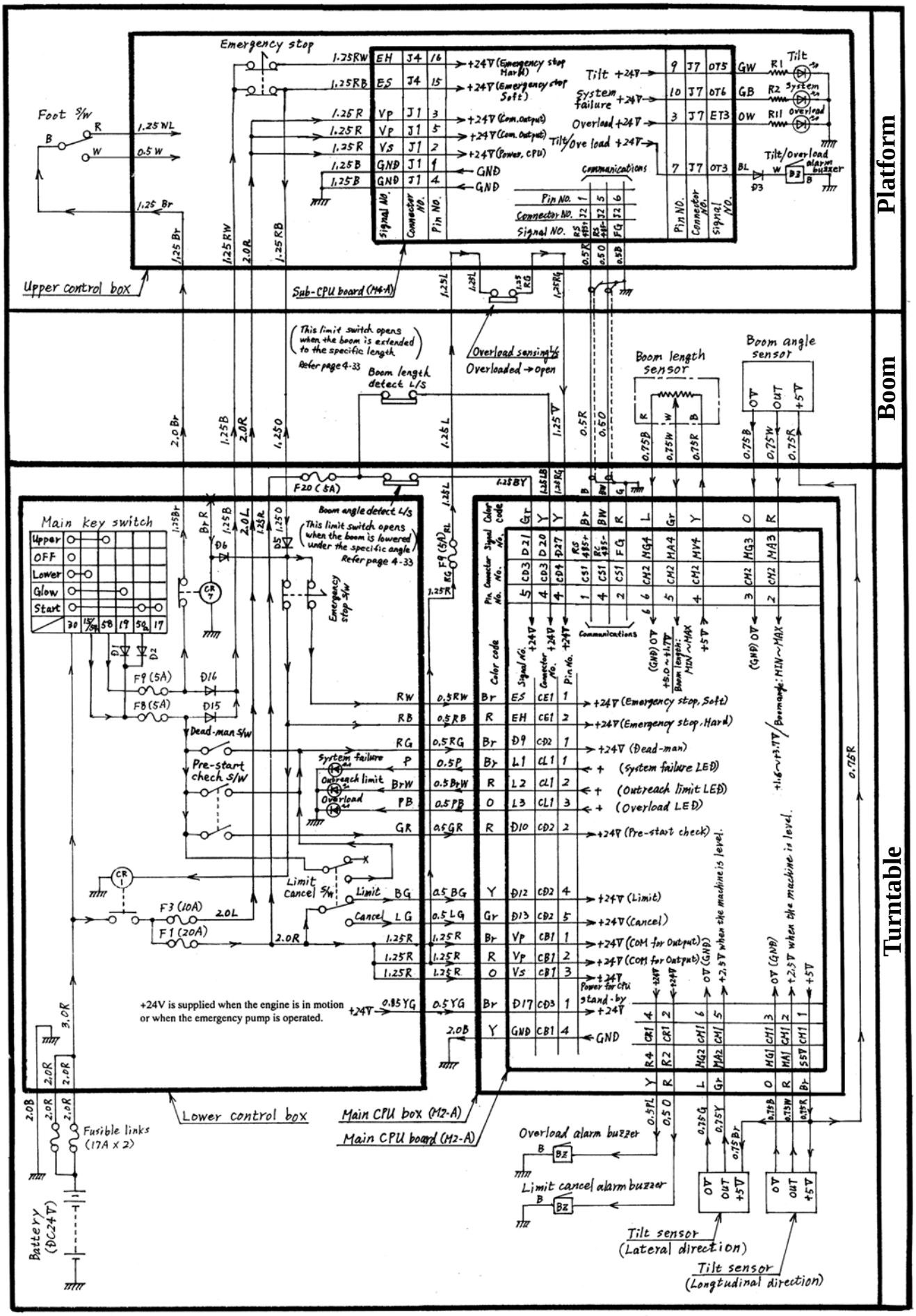


Platform rotation and Fly- jib articulation systems



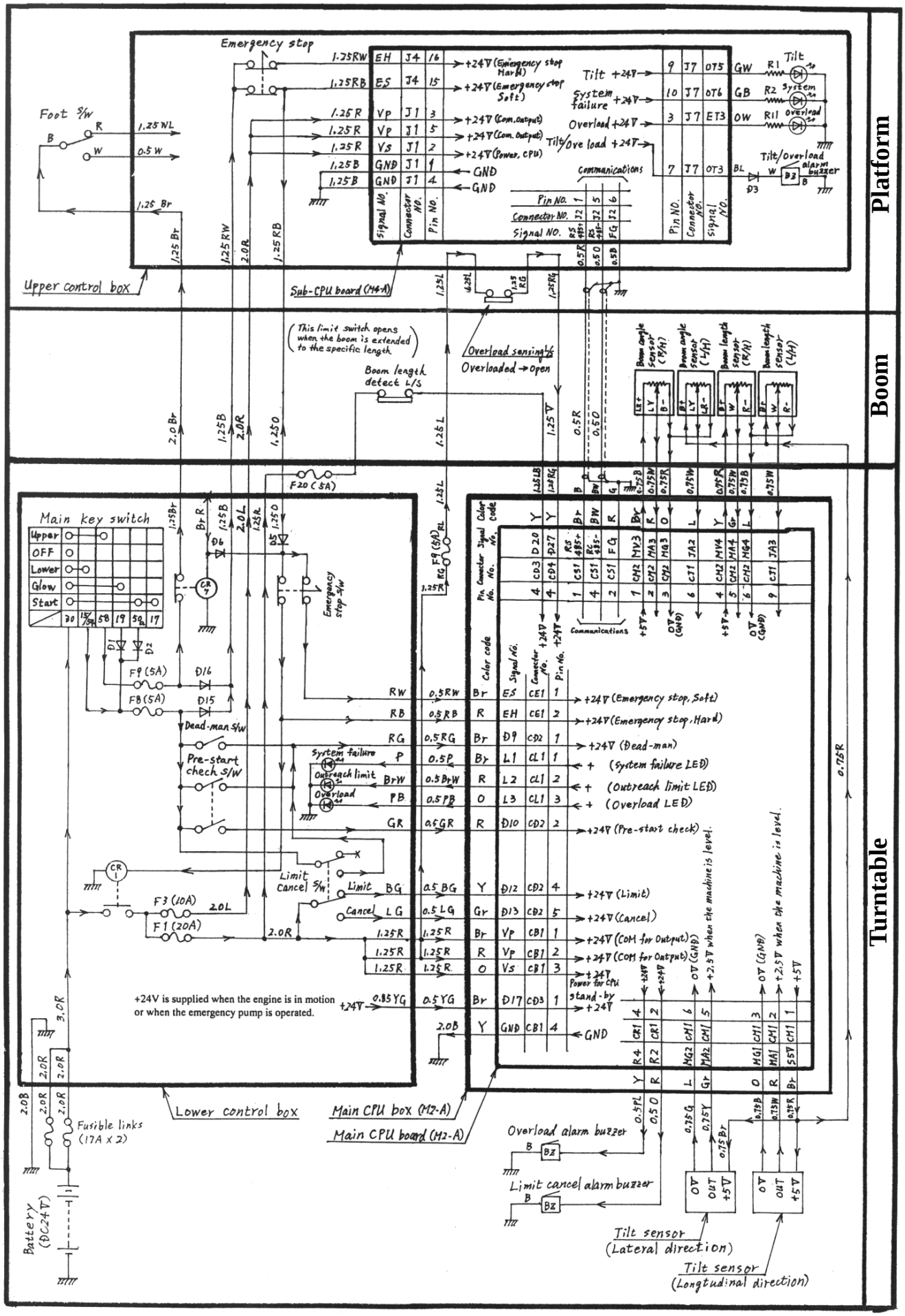
Work range limit and Overload sensing systems

For the machine without Duplicated sensors



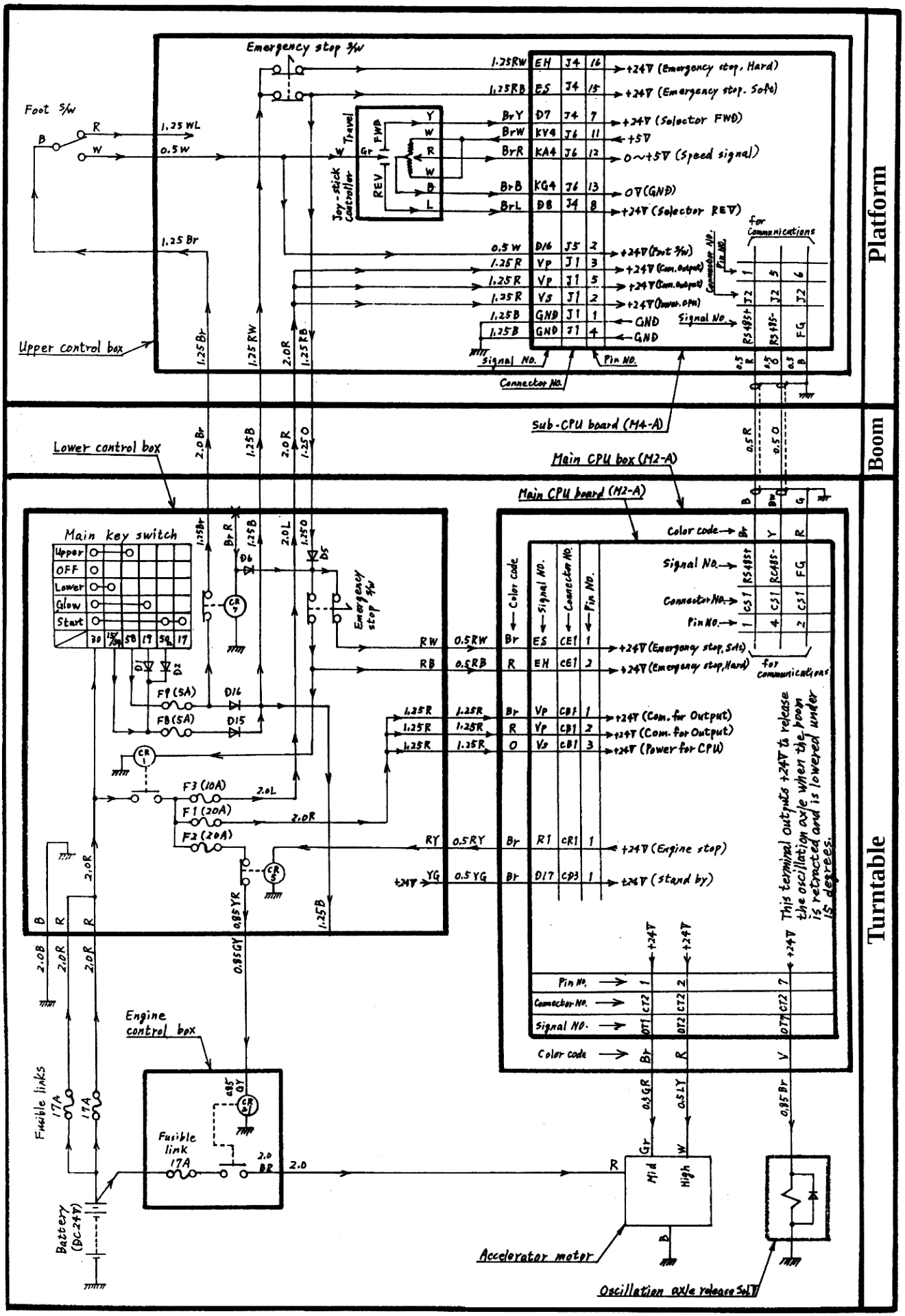
Work range limit and Overload sensing systems

For the machine with Duplicated sensors

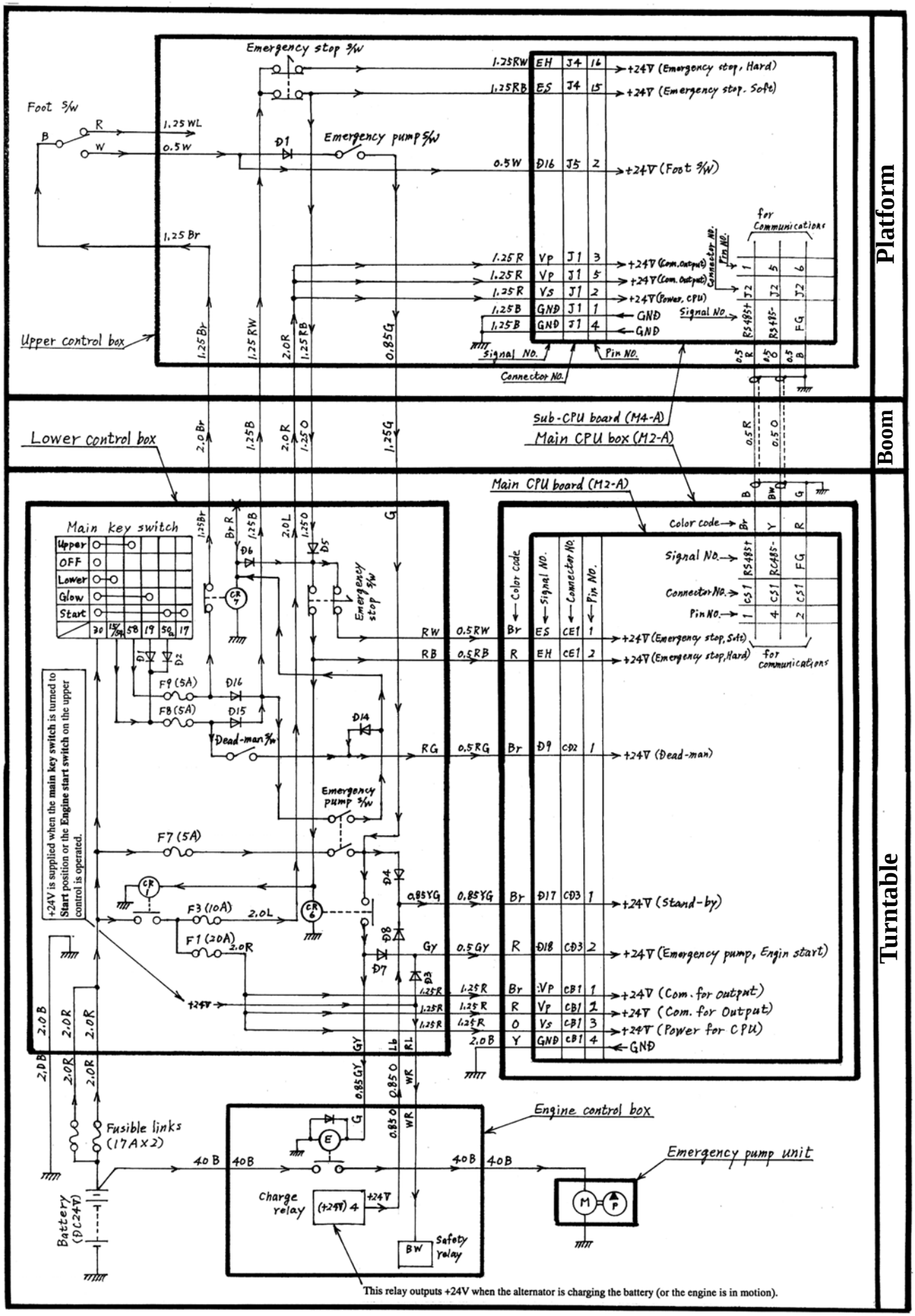


Accelerator and Oscillation axle release systems

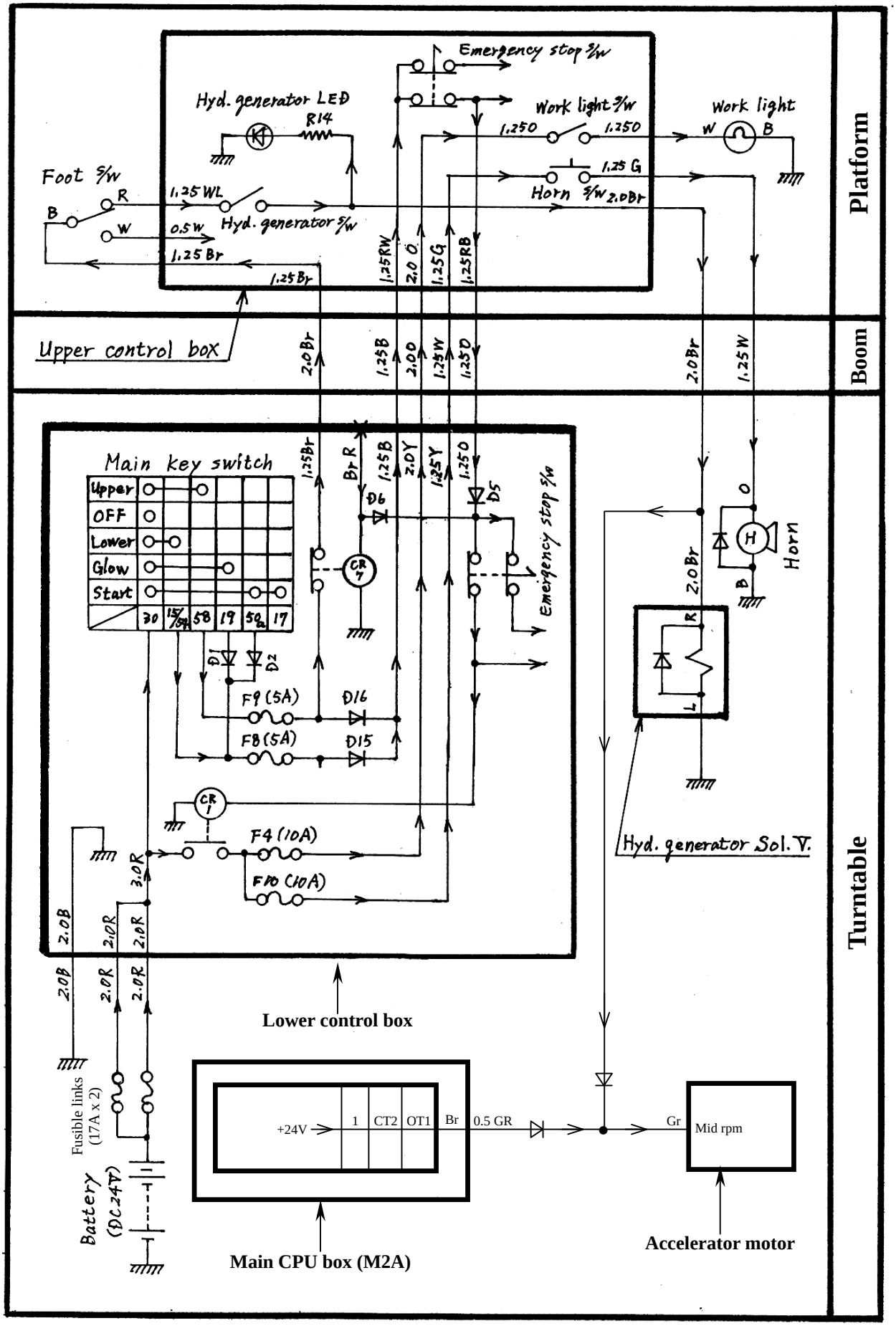
For the machine without Oscillation axle release limit switch



Emergency pump system



Horn, Work light and Hydraulic generator systems



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: SP18AJ / ISP60J — 15.8 meters — 51ft - 10in SP21A / ISP70 — 18.6 meters — 61ft - 0 in SP21AJ / ISP70J — 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. SP18AJ / ISP60J — 15.4 ~ 15.8 meters — 50ft - 6in ~ 51ft - 10in SP21A / ISP70 — 18.2 ~ 18.6 meters — 59ft - 8in ~ 61ft - 0in SP21AJ / ISP70J — 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. SP18AJ / ISP60J — 35 degrees SP21A / ISP70 — 31 degrees SP21AJ / ISP70J — 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. SP18AJ / ISP60J — 35 ~ 38 degrees SP21A / ISP70 — 31 ~ 34 degrees SP21AJ / ISP70J — 46 ~ 49 degrees

Fig- 1

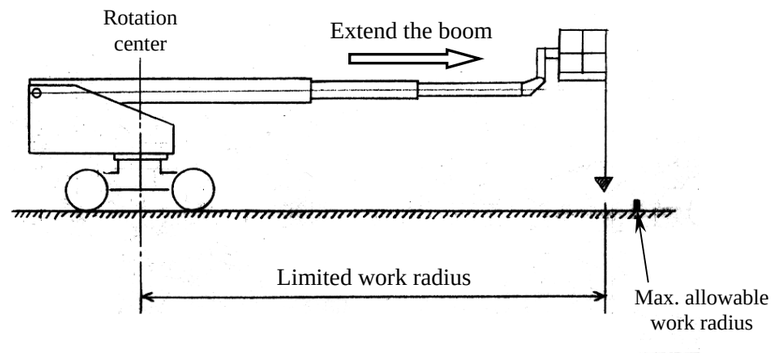
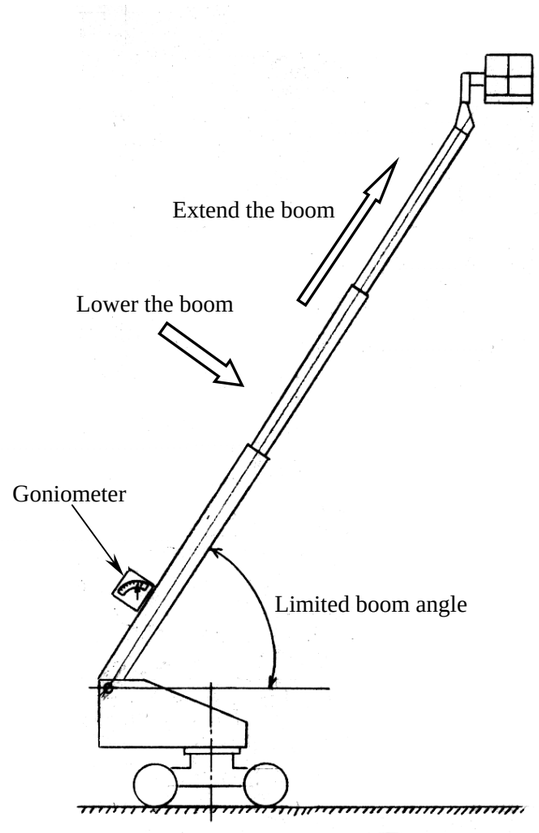


Fig- 2



SP18A / ISP60 Inspection data sheet

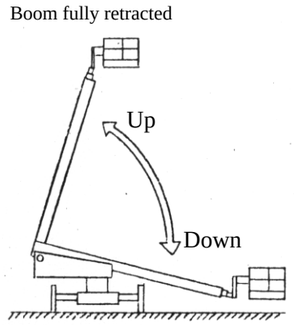
Model	*Serial No.*	*Specification No.*	*Date of Inspection*	*Inspector*

Item			*Specific rpm*	*Inspected rpm*	*Remarks*
Engine rpm	Diesel engine	Low (Idling)	1,020 rpm		Check the Mid and High rpm with the relief valves being actuated.
		Mid	1,300 rpm		
		High	2,200 rpm		

Item		*Specific pressure*	*Inspected pressure*	*Remarks*
Relief valve preset pressure	Relief valve (P1)	340 kg/cm^2 (4,840 PSI)		
	Relief valve (P2)	340 kg/cm^2 (4,840 PSI)		
	Relief valve (P3)	25 kg/cm^2 (360 PSI)		
	Relief valve (P4)	210 kg/cm^2 (2,990 PSI)		
	Relief valve (P10)	140 kg/cm^2 (1,990 PSI)		

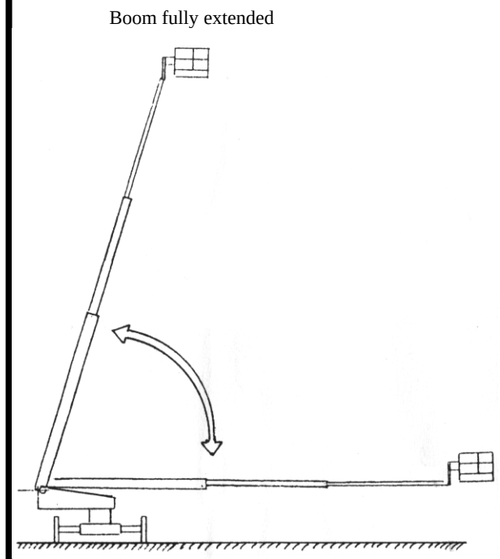
Item				*Specific speed*	*Inspected speed*	*Remarks*	
Actuating speed	Boom elevation	Maximum speed	UP	40±6 seconds		Fig-1	See the figures right to check each actuating speed.
			DOWN	40±6 seconds			
		Limited speed	UP	100±15 seconds		Fig-2	
			DOWN	100±15 seconds			
	Boom telescope	OUT		35±5 seconds		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	High speed	FWD	6.6±1.0 sec/10 m (33 ft)		Fig-6	
			REV	6.6±1.0 sec/10 m (33 ft)			
		Mid speed	FWD	13±2 sec/10m (33 ft)			
			REV	13±2 sec/10m (33 ft)			
		Low speed	FWD	28±5 sec/10m (33ft)			
			REV	28±5 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



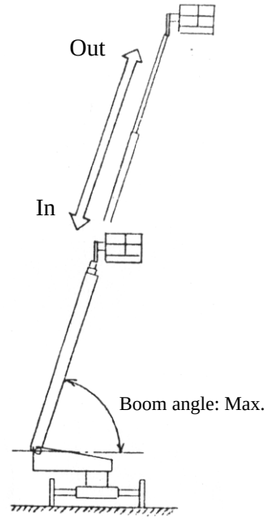
Boom elevation Maximum speed

Fig- 2



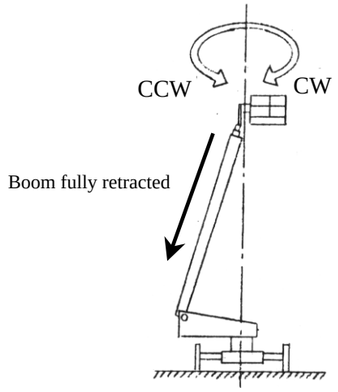
Boom elevation Limited speed

Fig- 3



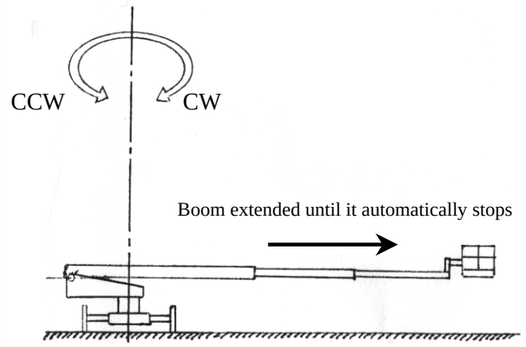
Boom telescope speed

Fig- 4



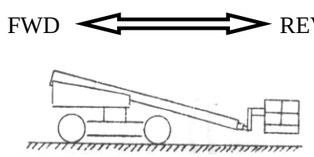
Boom rotation Maximum speed

Fig- 5



Boom rotation Limited speed

Fig- 6



Traveling Low, Mid and High speed

SP21A / ISP70 Inspection data sheet

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

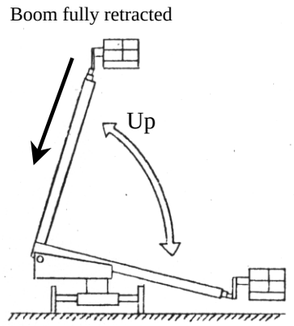
Item			*Specific rpm*	*Inspected rpm*	*Remarks*
Engine rpm	Diesel engine	Low (Idling)	1,020 rpm		Check the Mid and High rpm with the relief valves being actuated.
		Mid	1,300 rpm		
		High	2,200 rpm		

Item		*Specific pressure*	*Inspected pressure*	*Remarks*
Relief valve preset pressure	Relief valve (P1)	340 kg/cm^2 (4,840 PSI)		
	Relief valve (P2)	340 kg/cm^2 (4,840 PSI)		
	Relief valve (P3)	25 kg/cm^2 (360 PSI)		
	Relief valve (P4)	210 kg/cm^2 (2,990 PSI)		
	Relief valve (P10)	140 kg/cm^2 (1,990 PSI)		

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	50±7 seconds		Fig-2	
			DOWN	50±7 seconds			
	Telescope	OUT		45±7 seconds		Fig-3	
		IN		35±5 seconds			
	Boom rotation	Max. speed	CE spec. CW	90±13 seconds		Fig-4	
			CE spec. CCW	90±13 seconds			
			USA spec. CW	80±12 seconds			
			USA spec. CCW	80±12 seconds			
		Limited speed	CW	240±36 seconds		Fig-5	
			CCW	240±36 seconds			
	Traveling	High speed	FWD	6.6±1.0 sec/10 m (33 ft)		Fig-6	
			REV	6.6±1.0 sec/10 m (33 ft)			
		Mid speed	FWD	13±2 sec/10m (33 ft)			
			REV	13±2 sec/10m (33 ft)			
		Low speed	FWD	28±5 sec/10m (33ft)			
			REV	28±5 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)			

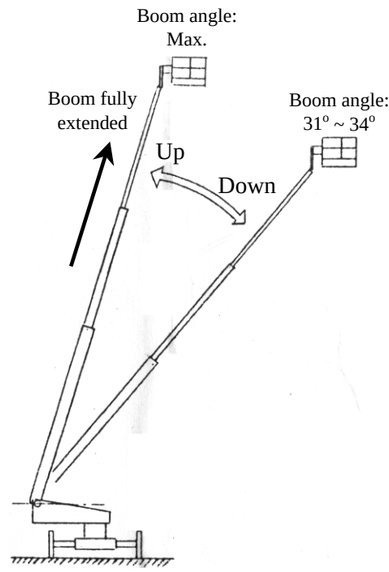
Item	*Specific limited work radius*	*Inspected work radius*	*Remarks*
Limited work radius	18.2 ~ 18.6 m (59ft-8in ~ 61ft-0in)		
Item	***Specific limited boom angle***	***Inspected boom angle***	***Remarks***
Limited boom angle	31 ~ 34 degrees		

Fig- 1



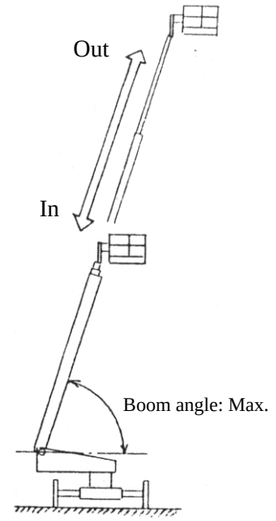
Boom elevation Maximum speed

Fig- 2



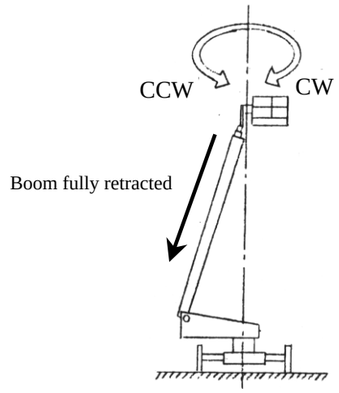
Boom elevation Limited speed

Fig- 3



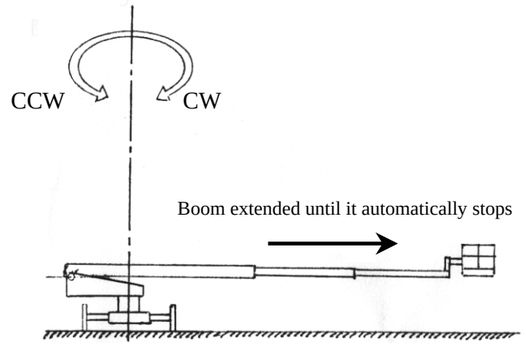
Boom telescope speed

Fig- 4



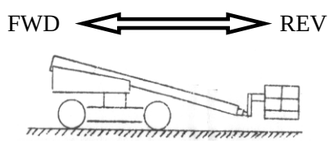
Boom rotation Maximum speed

Fig- 5



Boom rotation Limited speed

Fig- 6



Traveling Low, Mid and High speed

SP21AJ / ISP70J Inspection data sheet

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

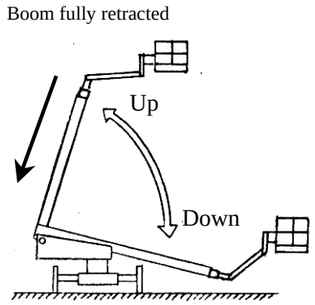
Item			*Specific rpm*	*Inspected rpm*	*Remarks*
Engine rpm	Diesel engine	Low (Idling)	1,020 rpm		Check the Mid and High rpm with the relief valves being actuated.
		Mid	1,300 rpm		
		High	2,200 rpm		

Item		*Specific pressure*	*Inspected pressure*	*Remarks*
Relief valve preset pressure	Relief valve (P1)	340 kg/cm^2 (4,840 PSI)		
	Relief valve (P2)	340 kg/cm^2 (4,840 PSI)		
	Relief valve (P3)	25 kg/cm^2 (360 PSI)		
	Relief valve (P4)	210 kg/cm^2 (2,990 PSI)		
	Relief valve (P10)	140 kg/cm^2 (1,990 PSI)		

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	50±7 seconds		Fig-2	
				DOWN	50±7 seconds			
	Telescope	OUT			40±6 seconds		Fig-3	
		IN			30±5 seconds			
	Boom rotation	Max. speed	CE spec.	CW	110±15 seconds		Fig-4	
				CCW	110±15 seconds			
			USA spec.	CW	80±12 seconds			
				CCW	80±12 seconds			
		Limited speed		CW	240±36 seconds		Fig-5	
				CCW	240±36 seconds			
	Traveling	High speed		FWD	6.6±1.0 sec/10 m (33 ft)		Fig-6	
				REV	6.6±1.0 sec/10 m (33 ft)			
		Mid speed		FWD	13±2 sec/10m (33 ft)			
				REV	13±2 sec/10m (33 ft)			
		Low speed		FWD	28±5 sec/10m (33ft)			
				REV	28±5 sec/10m (33ft)			
	Platform rotation	CW			15±5 seconds			
		CCW			15±5 seconds			
	Fly jib elevation	UP			30±5 seconds			
		DOWN			25±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)			

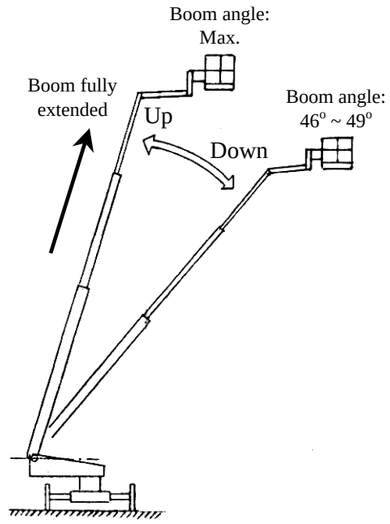
Item	*Specific limited work radius*	*Inspected work radius*	*Remarks*
Limited work radius	17.4 ~ 17.8 m (57ft-1in ~ 58ft-5in)		
Item	*Specific limited boom angle*	*Inspected boom angle*	*Remarks*
Limited boom angle	46 ~ 49 degrees		

Fig- 1



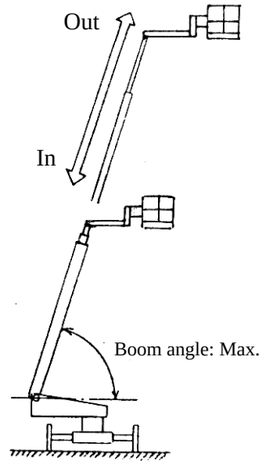
Boom elevation Maximum speed

Fig- 2



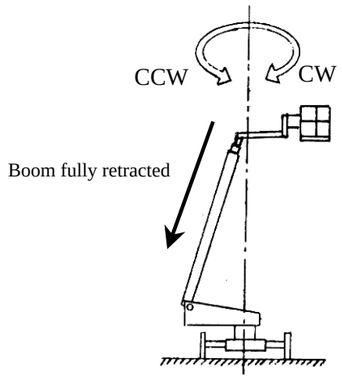
Boom elevation Limited speed

Fig- 3



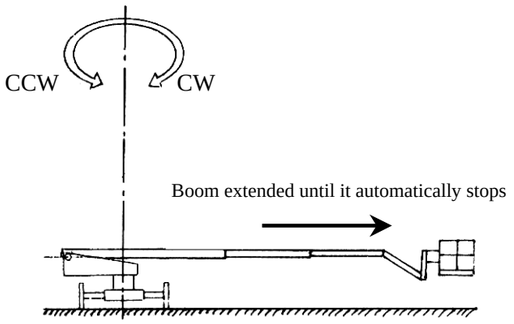
Boom telescope speed

Fig- 4



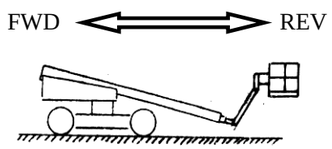
Boom rotation Maximum speed

Fig- 5



Boom rotation Limited speed

Fig- 6



Traveling Low, Mid and High speed

Engine RPM measurement procedures

1. Specific engine

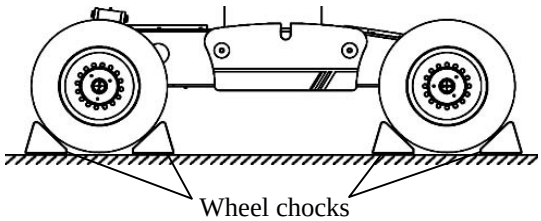
	Diesel engine
Low (Idling)	1.020 rpm
Mid	1.300 rpm
High	2,200 rpm

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, and then shut down the engine.
   (2) Disconnect the connector CM2 from the Main CPU box (M2A).
   See the page 4- 2 for the location of connector CM2.
   (3) Turn the engine 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- 13 for the location of System failure LED.
   (4) Re- start the engine with the engine key switch.
   (5) Hold the Limit cancel switch in its ON position, and operate the Telescope switch to its IN position to load the engine.
   See the page 4- 13 for the location of Limit cancel switch.
   (6) Under the above conditions, measure the engine ***Mid rpm***.

   Caution:

   Do not extend the outreach of the platform when operating the machine using the Limit cancel switch. Because, the safety system does not work and it may cause the machine to tip over.
4. Measure the engine ***High rpm*** as follows.
   (1) Set up the wheel chocks in front and rear of all tires as shown in the figure below.



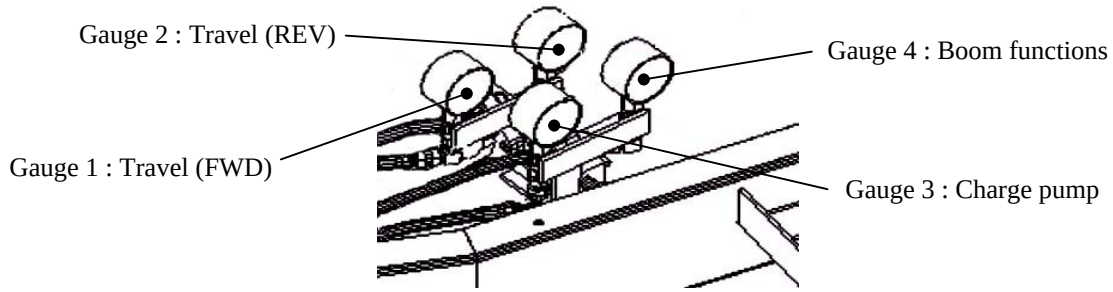
   (2) Retract the boom fully and set it under the horizontal.
   (3) Set the travel speed select switch to its High- speed position.
   (4) Operate the travel joystick controller to Forward or Reverse direction to load the engine.
   (5) Under the above conditions, measure the engine ***High rpm***.

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

System pressure adjustment procedures

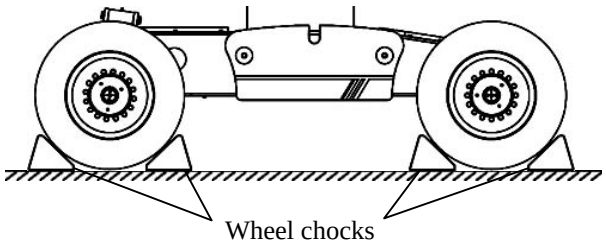
Specific pre- set pressure

Relief valve	Pre-set pressure	Relief valve locations	Pump RPM (Engine RPM)	Functions	Pressure gauge
P1	340 ~ 350 kg / cm^2 (4,840 ~ 4,980 PSI)	Hydraulic pump	2,200 rpm	Travel (Forward)	Gauge 1
P2	340 ~ 350 kg / cm^2 (4,840 ~ 4,980 PSI)	Hydraulic pump	2,200 rpm	Travel (Reverse)	Gauge 2
P4	210 ~ 215 kg / cm^2 (2,990 ~ 3,060 PSI)	Main control valve	1,300 rpm	Elevation (Up) Telescope (In) Boom rotation	Gauge 4
P6	90 ~ 95 kg / cm^2 (1,280 ~ 1,350 PSI)	Main control valve	1,300 rpm	Telescope (Out)	Gauge 4
P7	150 ~ 155 kg / cm^2 (2,130 ~ 2,200 PSI)	Main control valve	1,300 rpm	Elevation (Down)	Gauge 4
P10	140 ~ 145 kg / cm^2 (1,990 ~ 2,060 PSI)	Unit valve	1,300 rpm	Platform rotation Platform level adjust Fly jib, Steering	Gauge 4



Pressure measurement procedures

(1) Set the machine on firm and level surface.
(2) Warm up the engine.
(3) Operate the machine to warm up the hydraulic system.
(4) Measure the pre- set pressure of the relief valves P1 and P2 as follows.
1. Set up the wheel chocks in front and rear of all tires.



2. Retract the boom fully and lower it under the horizontal.
3. Set the travel speed select switch to its High speed position.
4. Operate the Travel joystick controller to Forward direction to activate the relief valve P1.
5. Read the pressure gauge (Gauge 1) and make sure that the pre- set pressure of the relief valve (P1) is within the specific value.
   Specific pre-set pressure ---- 340 ~ 350 kg/cm^2 (4,840 ~ 4,980 PSI)
6. Operate the Travel joystick controller to Reverse direction to activate the relief valve P2.
7. Read the pressure gauge (Gauge 2) and make sure that the pre- set pressure of the relief valve (P2) is within the specific value.
   Specific pre-set pressure ---- 340 ~ 350 kg/cm^2 (4,840 ~ 4,980 PSI)

(5) Measure the pre -set pressure of the relief valve P4 as follows.

1. Retract the boom fully.
2. Disconnect the connector CM2 from the Main CPU box (M2-A).
   See the page 4- 2 for the location of the connector CM2.
3. Turn the engine key switch to its "Lower control" position and make sure that the system failure LED blinks.
   See the page 4- 13 for the location of the system failure LED.
4. Start the engine with the engine key switch.
5. Hold the limit cancel switch in its ON position, and operate the boom telescope switch to IN position to activate the relief valve (P4).
   See the page 4- 13 for the location of the limit cancel switch.
6. Read the pressure gauge (Gauge 4) and make sure that the pre- set pressure of the relief valve (P4) is within the specific value.

   Specific pre- set pressure ---- 210 ~ 215 kg / cm^2 (2,990 ~ 3,060 PSI)

CAUTION : Do not extend the outreach of the platform when operating the machine using the limit cancel switch.
Because, the safety system does not work and the machine may tip over.

(6) Measure the pre- set pressure of the relief valve P6 as follows.

1. Raise the boom fully and extend it fully.
2. Disconnect the connector CM2 from the Main CPU box (M2-A).
   See the page 4- 2 for the location of the connector CM2.
3. Turn the engine key switch to its "Lower control" position and make sure that the system failure LED blinks.
   See the page 4- 13 for the location of the system failure LED.
4. Start the engine with the engine key switch.
5. Hold the limit cancel switch in its ON position, and operate the boom telescope switch to OUT position to activate the relief valve (P6).
   See the page 4- 13 for the location of the limit cancel switch.
6. Read the pressure gauge (Gauge 4) and make sure that the pre- set pressure of the relief valve (P6) is within the specific value.

   Specific pre- set pressure ---- 90 ~ 95 kg / cm^2 (1,280 ~ 1,350 PSI)

CAUTION : Do not extend the outreach of the platform when operating the machine using the limit cancel switch.
Because, the safety system does not work and the machine may tip over.

(7) Measure the pre- set pressure of the P7 as follows.

1. Retract and lower the boom fully.
2. Disconnect the connector CM2 from the Main CPU box (M2-A).
   See the page 4- 2 for the location of the connector CM2.
3. Turn the engine key switch to its "Lower control" position and make sure that the system failure LED blinks.
   See the page 4- 13 for the location of the system failure LED.
4. Start the engine with the engine key switch.
5. Hold the limit cancel switch in its ON position, and operate the boom elevation switch to DOWN position to activate the relief valve (P7).
   See the page 4- 13 for the location of the limit cancel switch.
6. Read the pressure gauge (Gauge 4) and make sure that the pre- set pressure of the relief valve (P7) is within the specific value.

   Specific pre- set pressure ---- 150 ~ 155 kg / cm^2 (2,130 ~ 2,200 PSI)

CAUTION : Do not extend the outreach of the platform when operating the machine using the limit cancel switch.
Because, the safety system does not work and the machine may tip over.

(8) Measure the pre- set pressure of the relief valve P10 as follows.

1. Rotate the platform fully to C.W or C.C.W, then hold the platform rotation switch either in C.W or C.C.W position.
2. Read the pressure gauge (Gauge 4) and make sure that the pre- set pressure of the relief valve (P10) is within the specific value.

   Specific pre- set pressure ---- 140 ~ 145 kg / cm^2 (1,990 ~ 2,060 PSI)

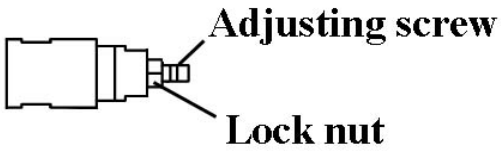
Pressure adjustment procedures

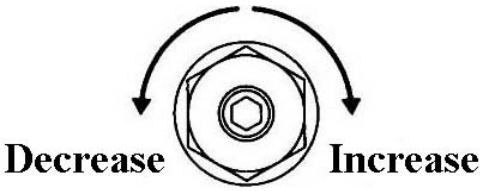
Adjust the relief valve as follows, if the pre- set pressure is not within the specific value.

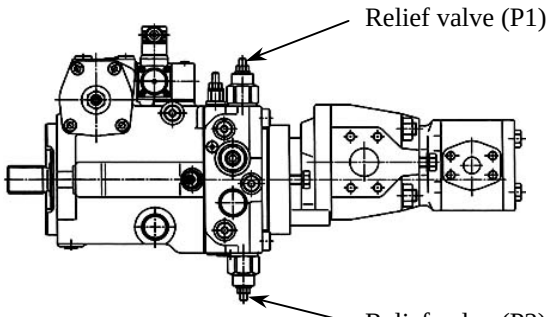
(1) Loosen the lock nut.

(2) Adjust the pre- set pressure by turning the adjusting screw.
   To increase the pressure, turn the adjusting screw clockwise.
   To decrease the pressure, turn the adjusting screw counter- clockwise.

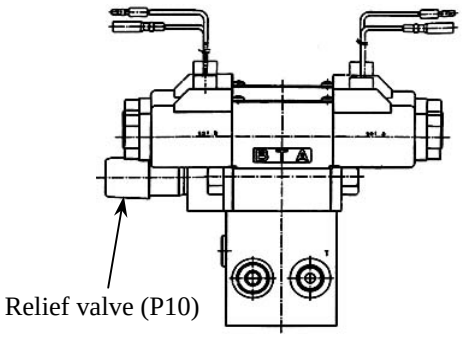
(3) Lock the adjusting screw by the lock nut, and then check the pre- set pressure again and make sure that the pressure is within the specific value.



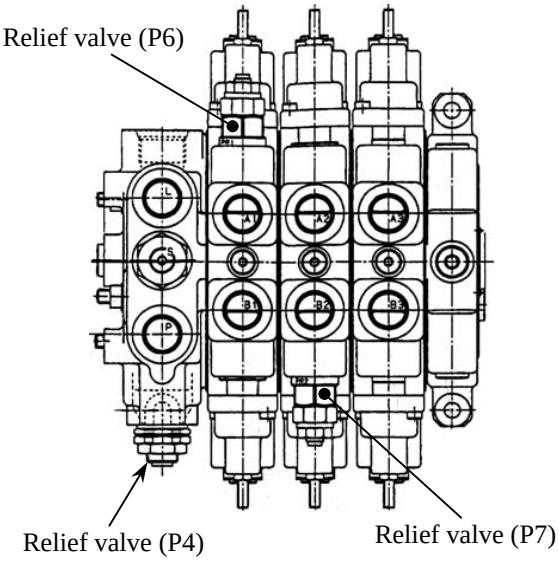




Hydraulic pump



Unit valve



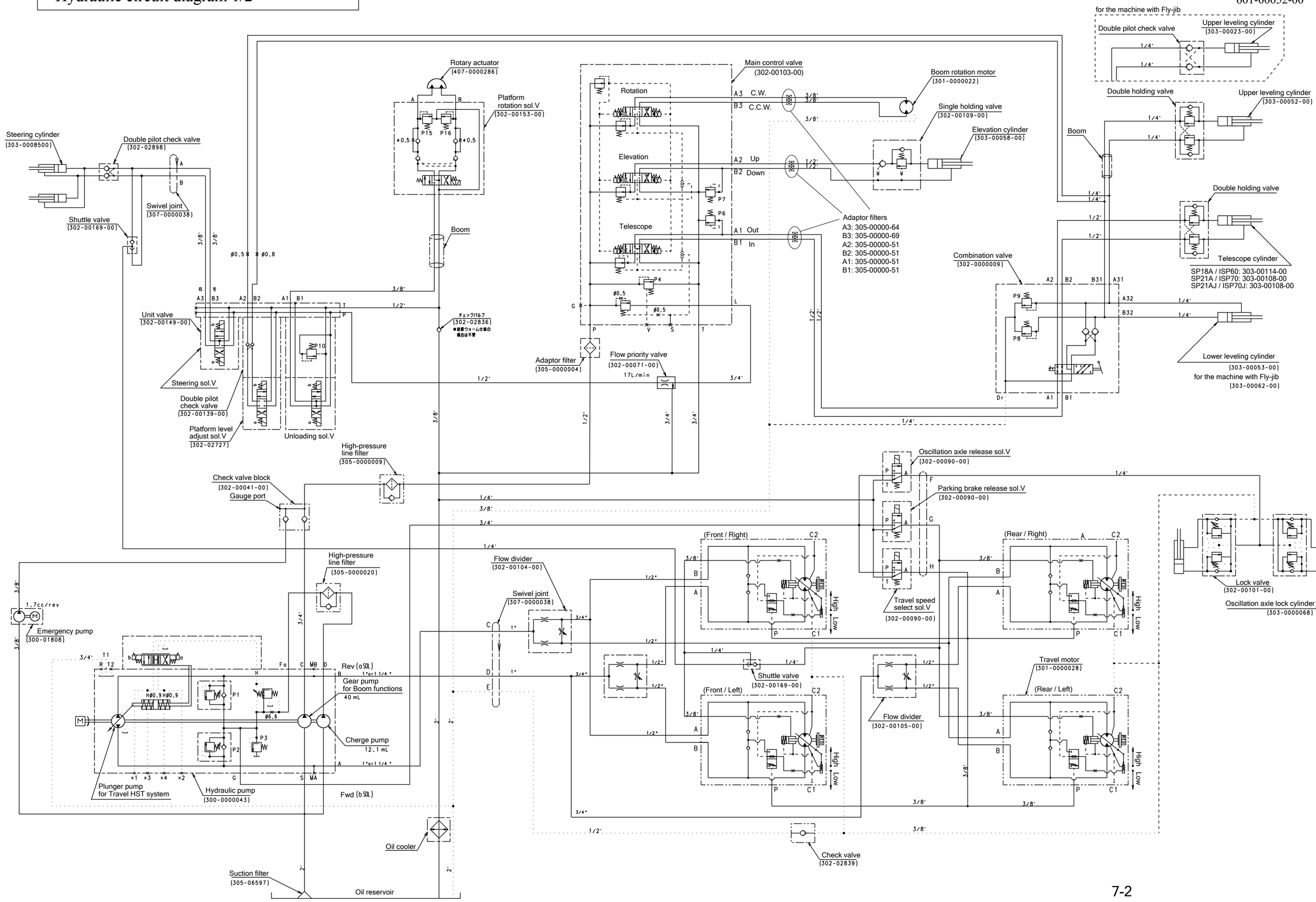
Main control valve

***** See the pages 7- 13 to 7- 15 for the location of these hydraulic components.

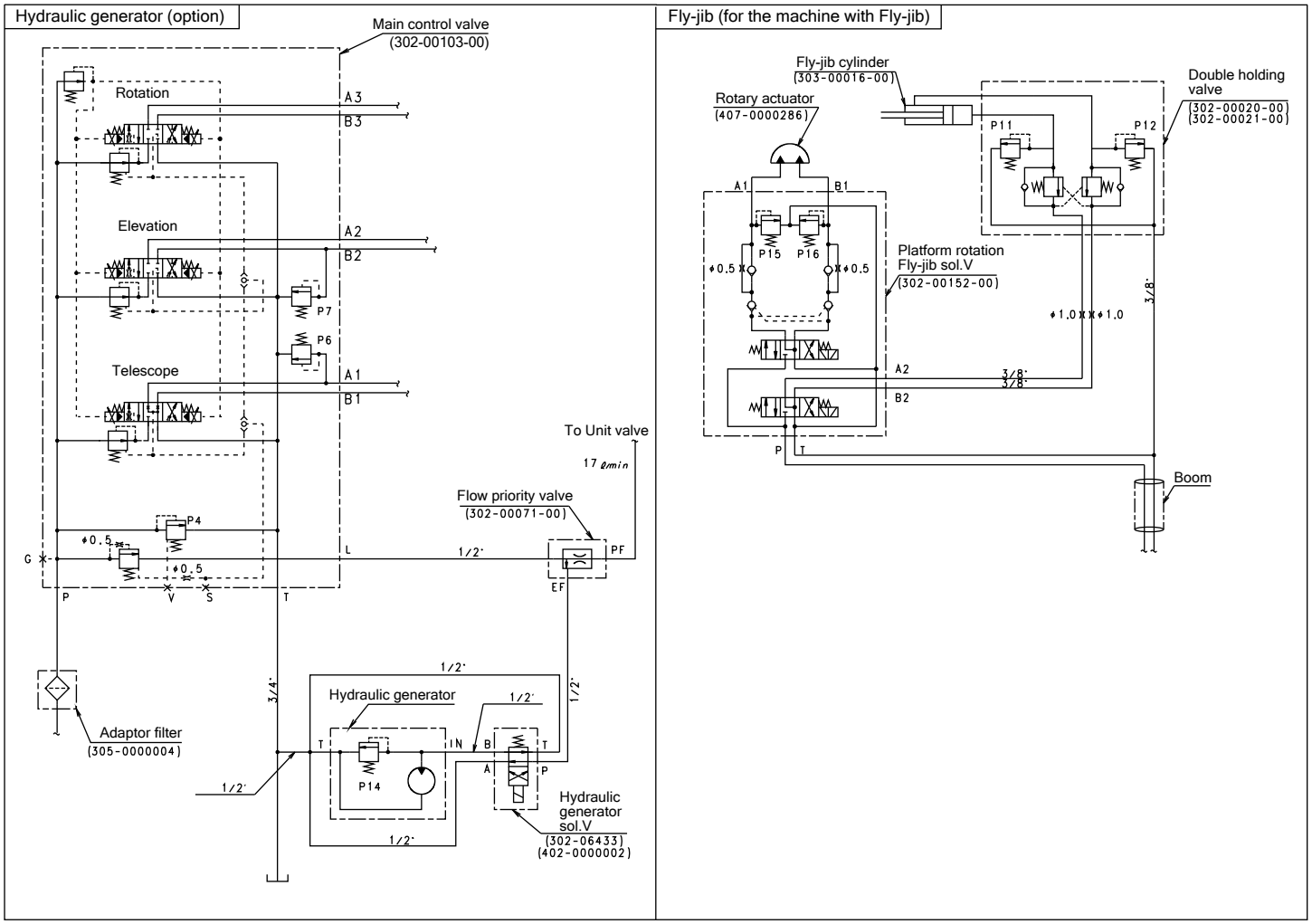
7. Appendix

Hydraulic circuit diagram 1/2

601-00052-00



Hydraulic circuit diagram 2/2

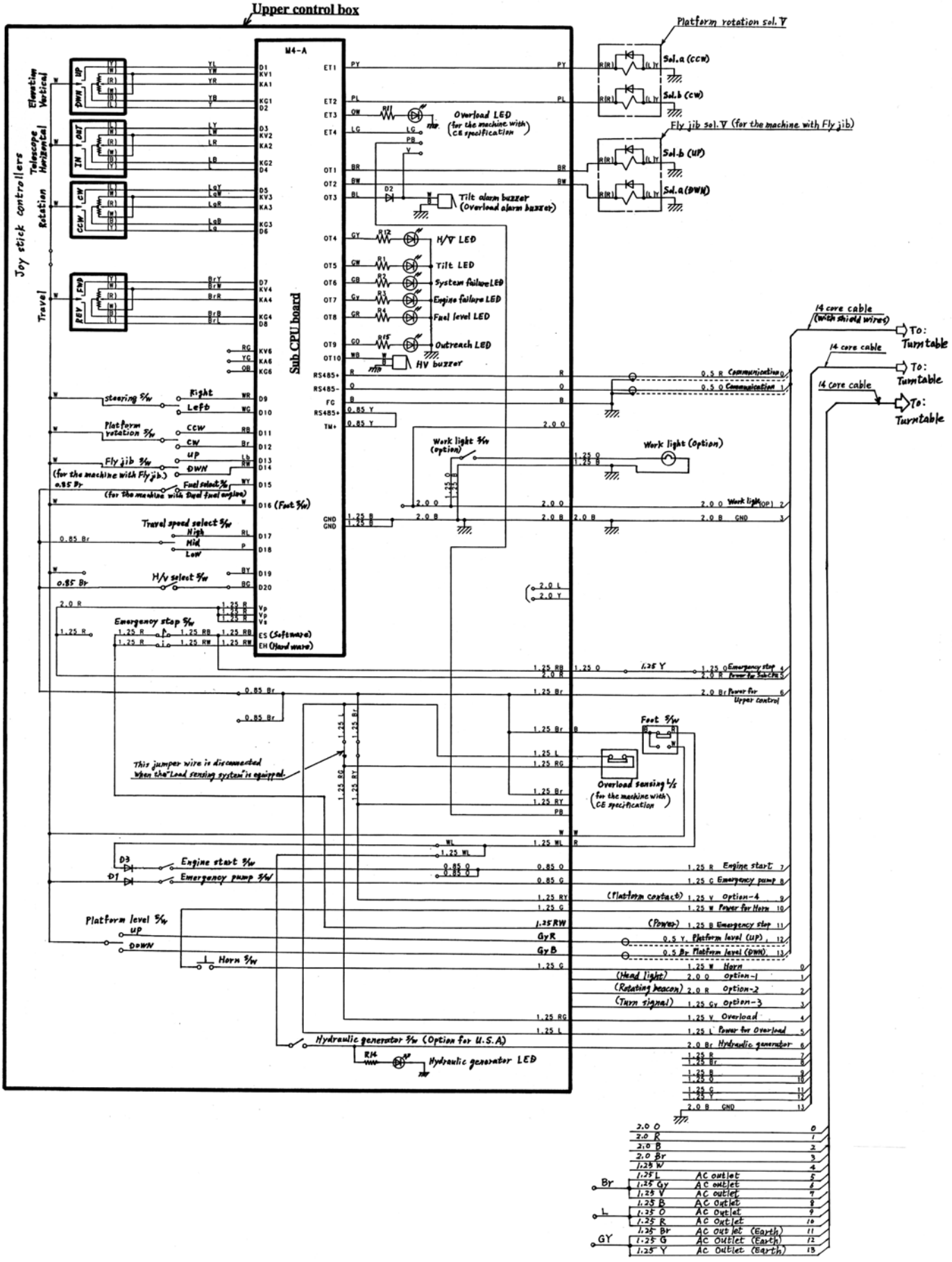


Relief valve pre-set pressure

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

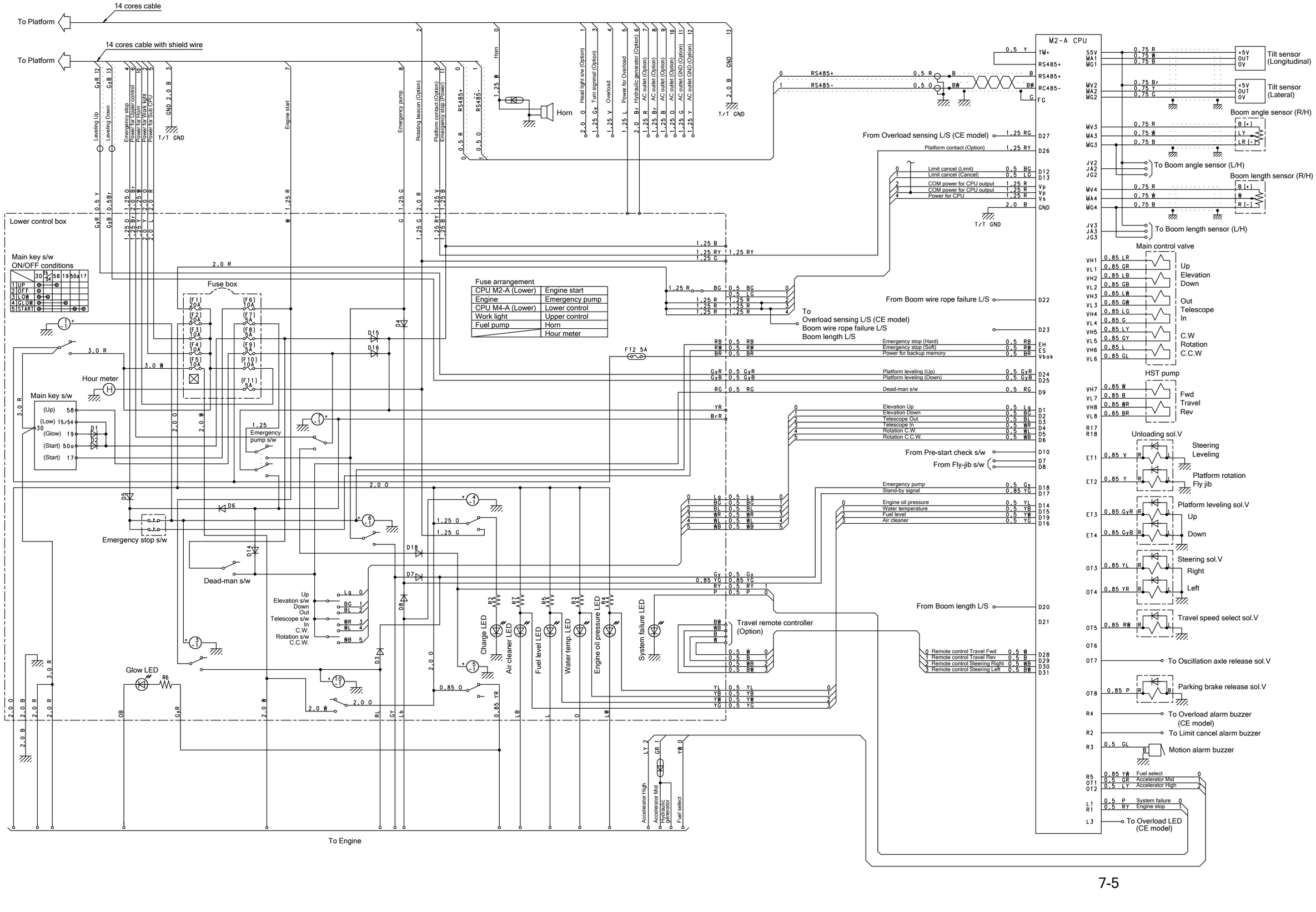
Relief valve	Pre-set pressure						Pump speed (rpm)
	MPa		Kg/cm2		PSI		
P1	33.3	+0.98 0	340	+10 0	4,830	+140 0	2,200
P2	33.3	+0.98 0	340	+10 0	4,830	+140 0	2,200
P3	2.0	+0.49 0	20	+5 0	290	+70 0	1,300
P4	20.6	+0.49 0	210	+5 0	3,000	+70 0	2,200
P6	8.8	+0.49 0	90	+5 0	1,280	+70 0	2,200
P7	14.7	+0.49 0	150	+5 0	2,130	+70 0	Do not adjust
P8	22.5	+0.88 0	230	+9 0	3,260	+130 0	Do not adjust
P9	22.5	+0.88 0	230	+9 0	3,260	+130 0	Do not adjust
P10	13.7	+0.49 0	140	+5 0	2,000	+70 0	1,300
P11	14.7	+0.88 0	150	+9 0	2,130	+130 0	Do not adjust
P12	14.7	+0.88 0	150	+9 0	2,130	+130 0	Do not adjust
P14	13.7	+0.49 0	140	+5 0	2,000	+70 0	Do not adjust
P15	20.6	+2.0 0	210	+20 0	3,000	+290 0	Do not adjust
P16	20.6	+2.0 0	210	+20 0	3,000	+290 0	Do not adjust

Electrical circuit diagram, Platform



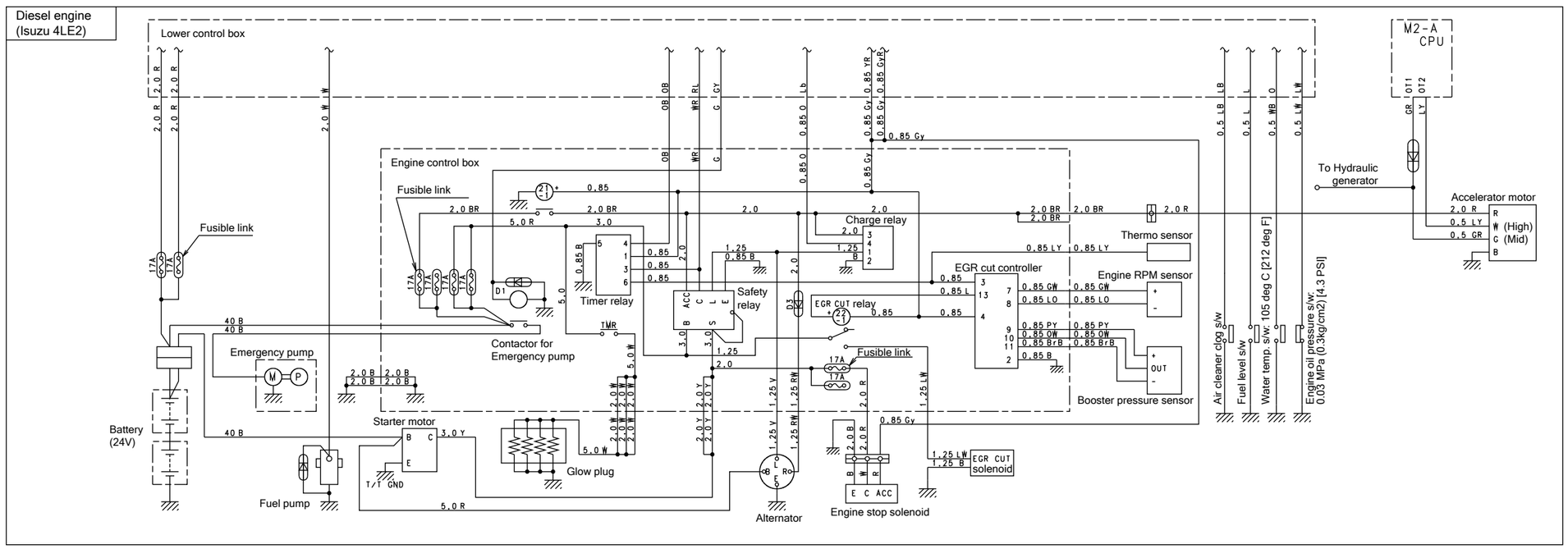
Electric circuit diagram, Turntable 1/2

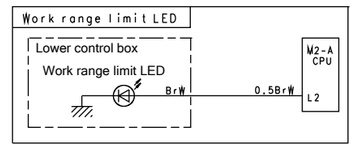
602-00718-00

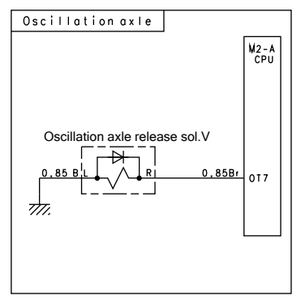


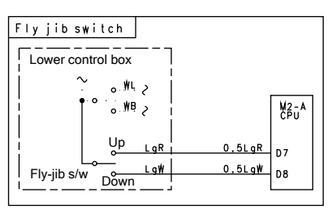
Electric circuit diagram, Turntable 2/2

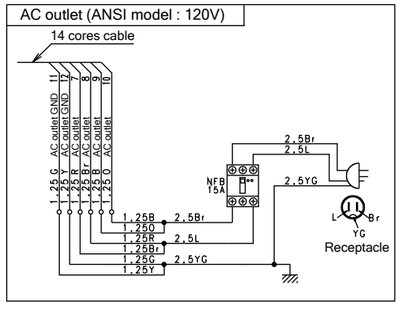
602-00718-00

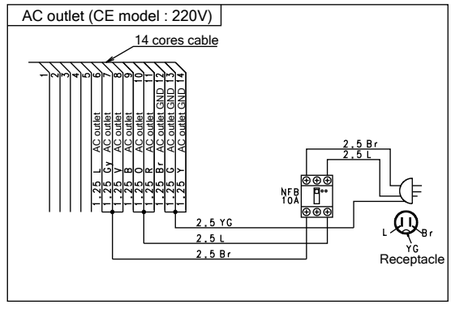


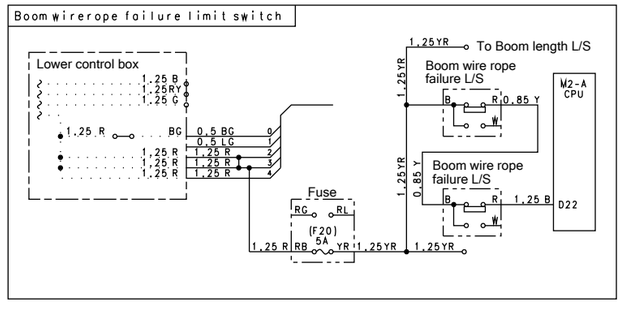


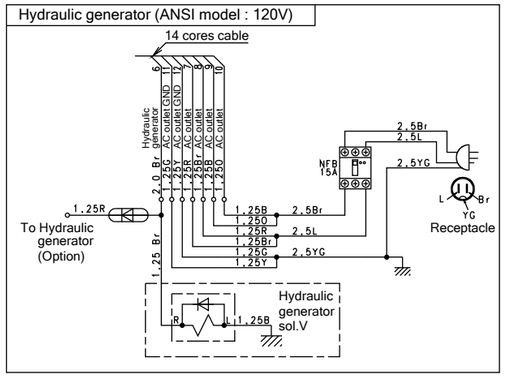


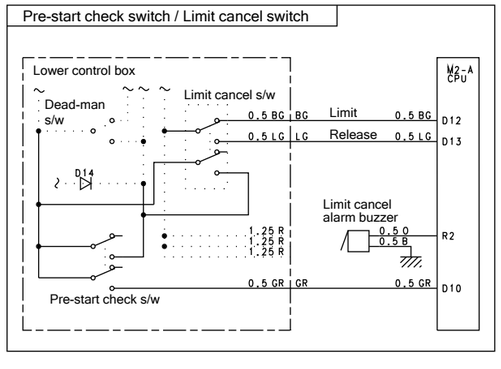


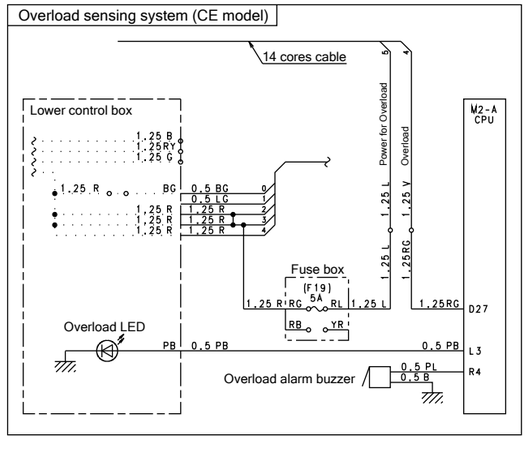


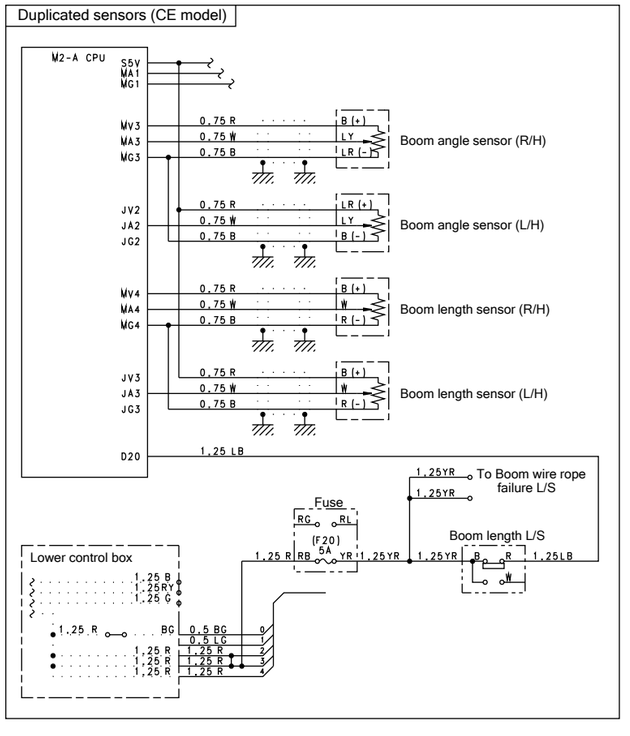




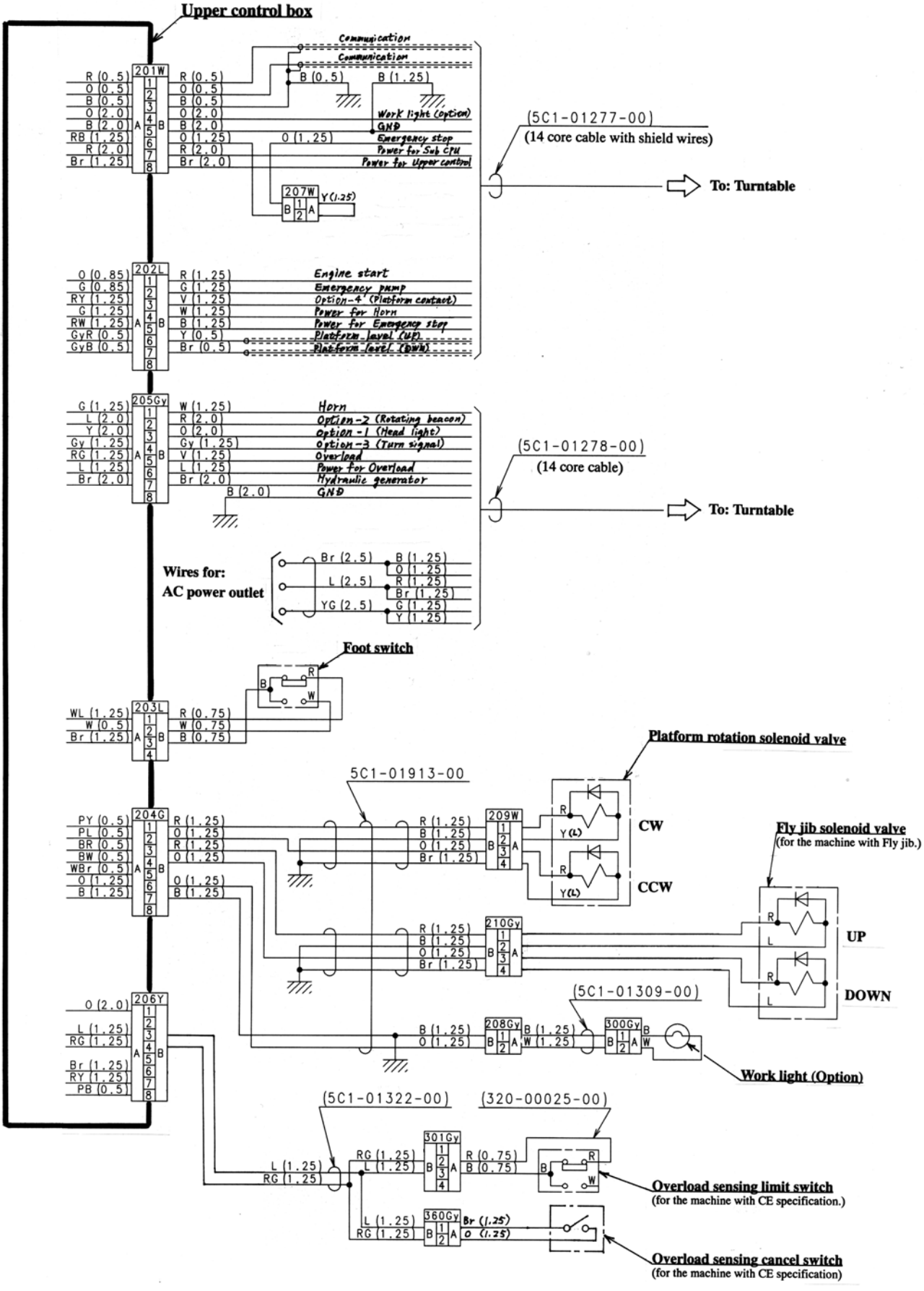




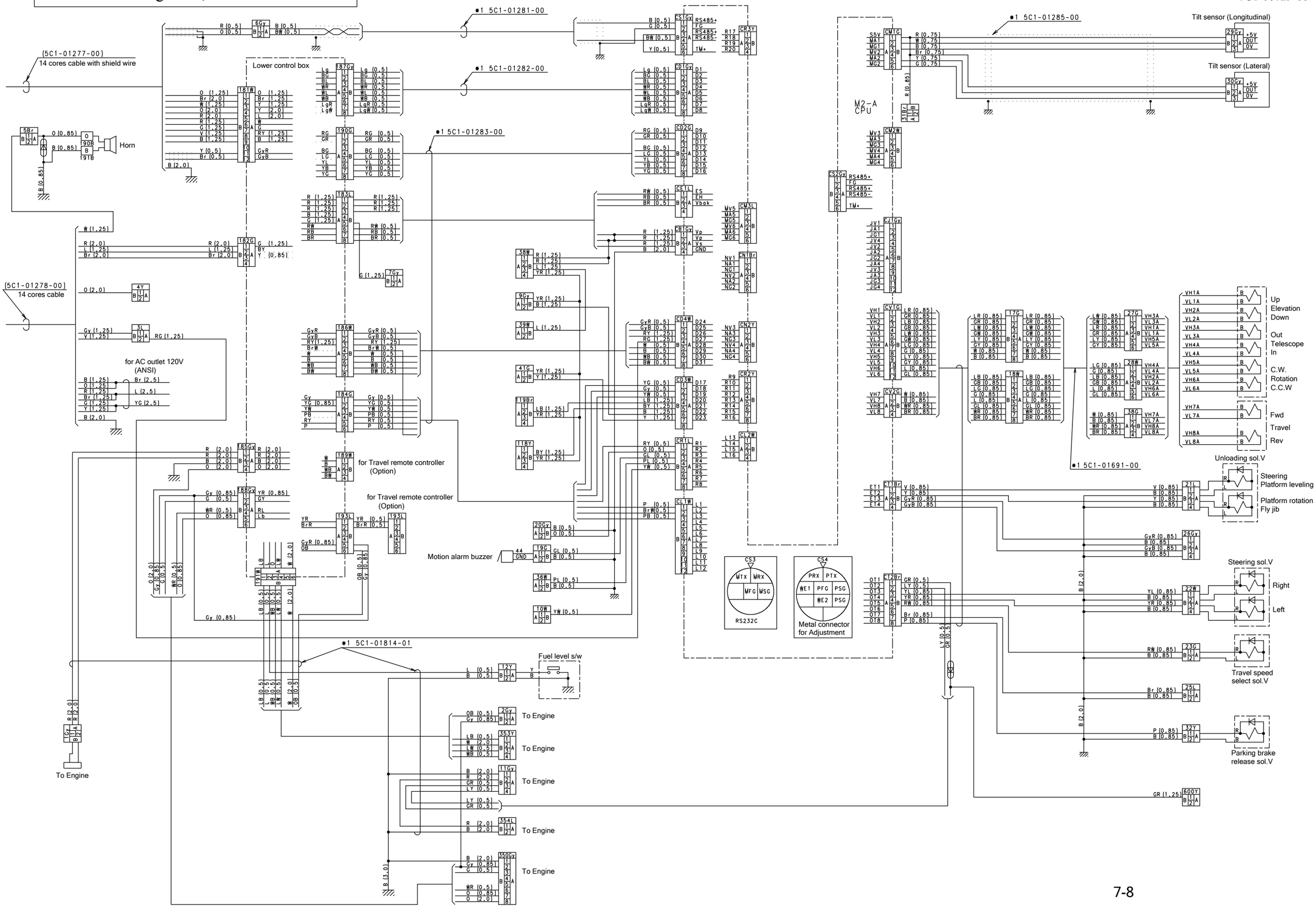




Electrical wiring chart, Platform

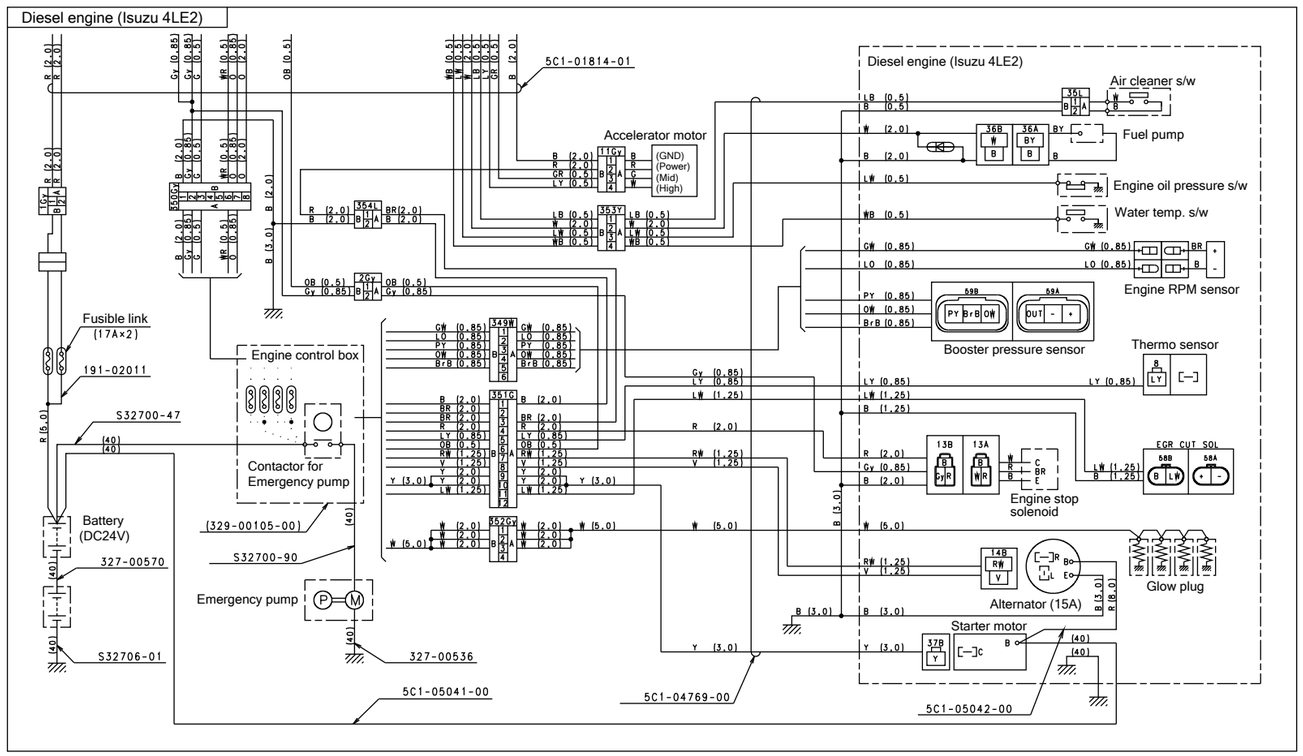


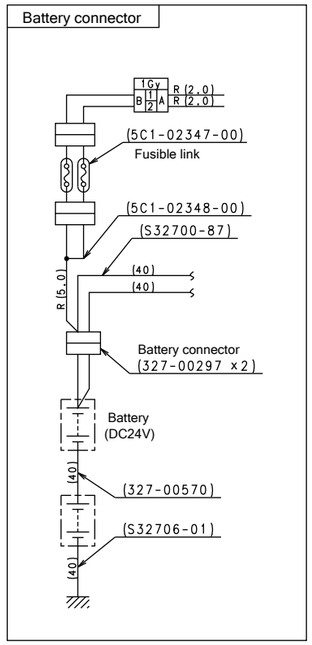
Electrical wiring chart, Turntable 1/2

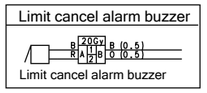


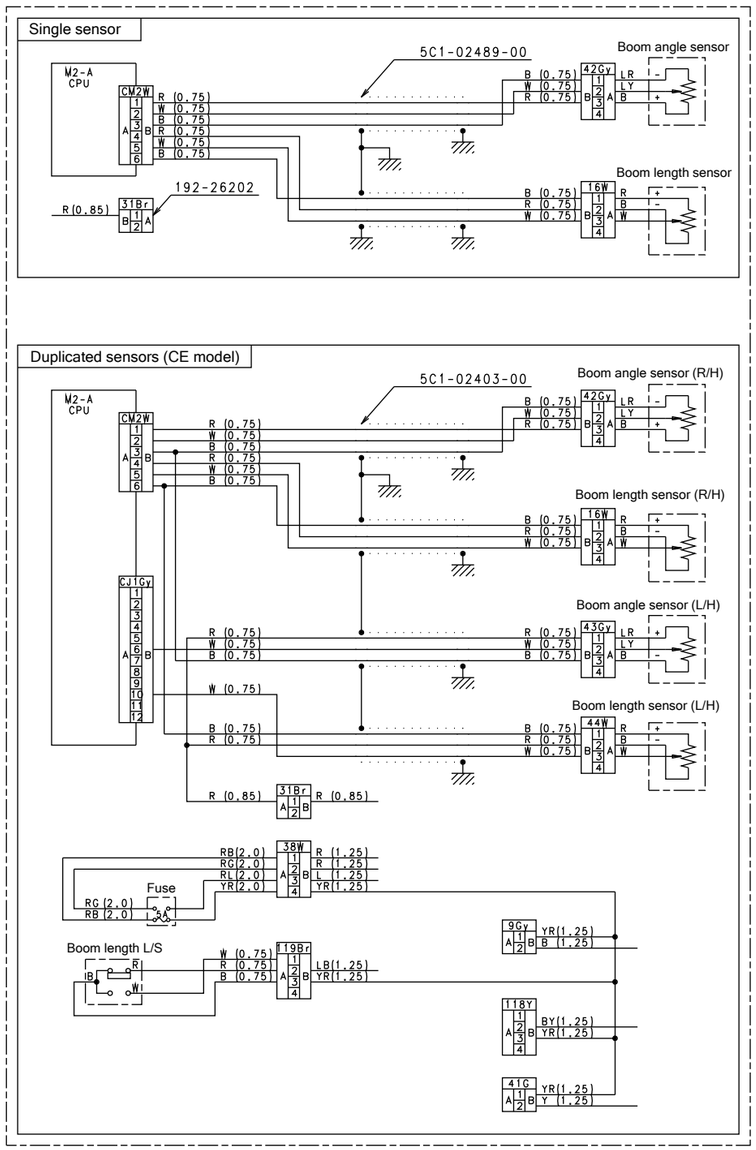
Electrical wiring chart, Turntable 2/2

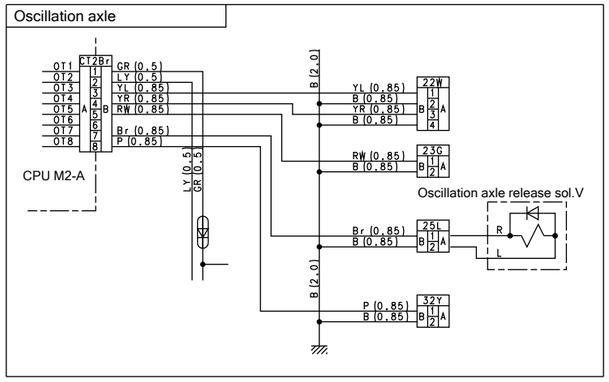
7C1-00729-00

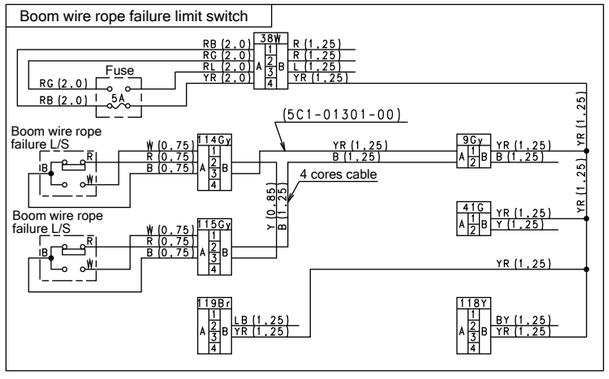


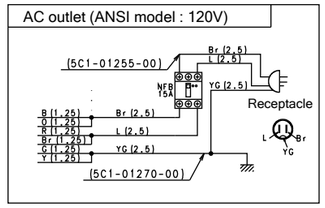


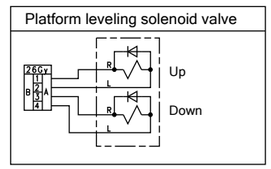


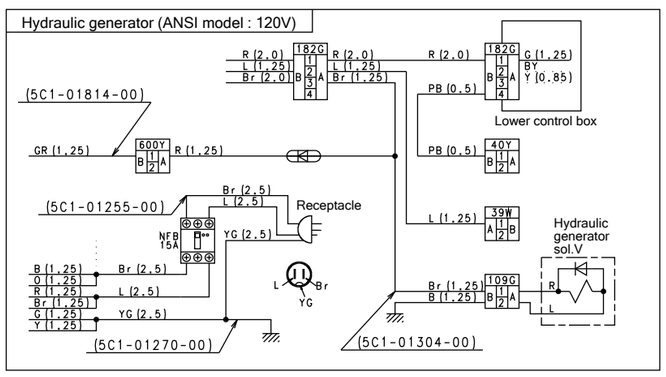


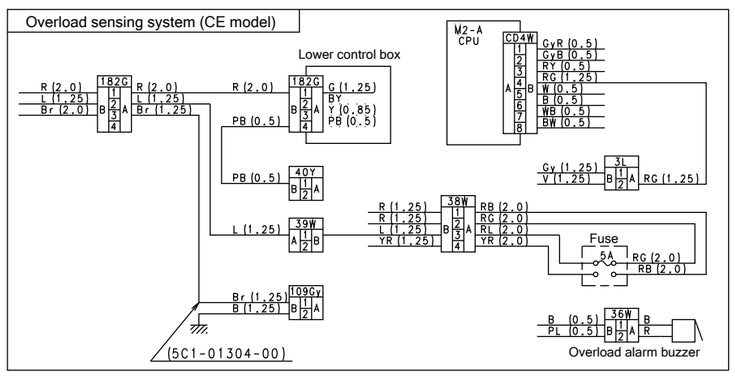


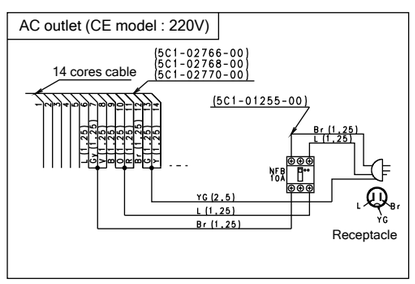


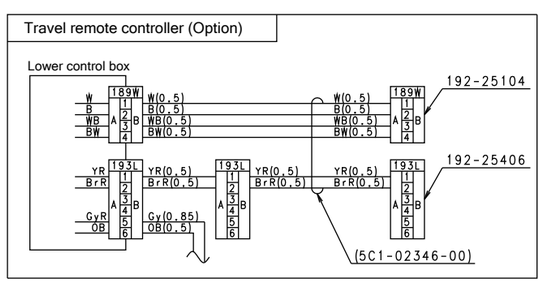




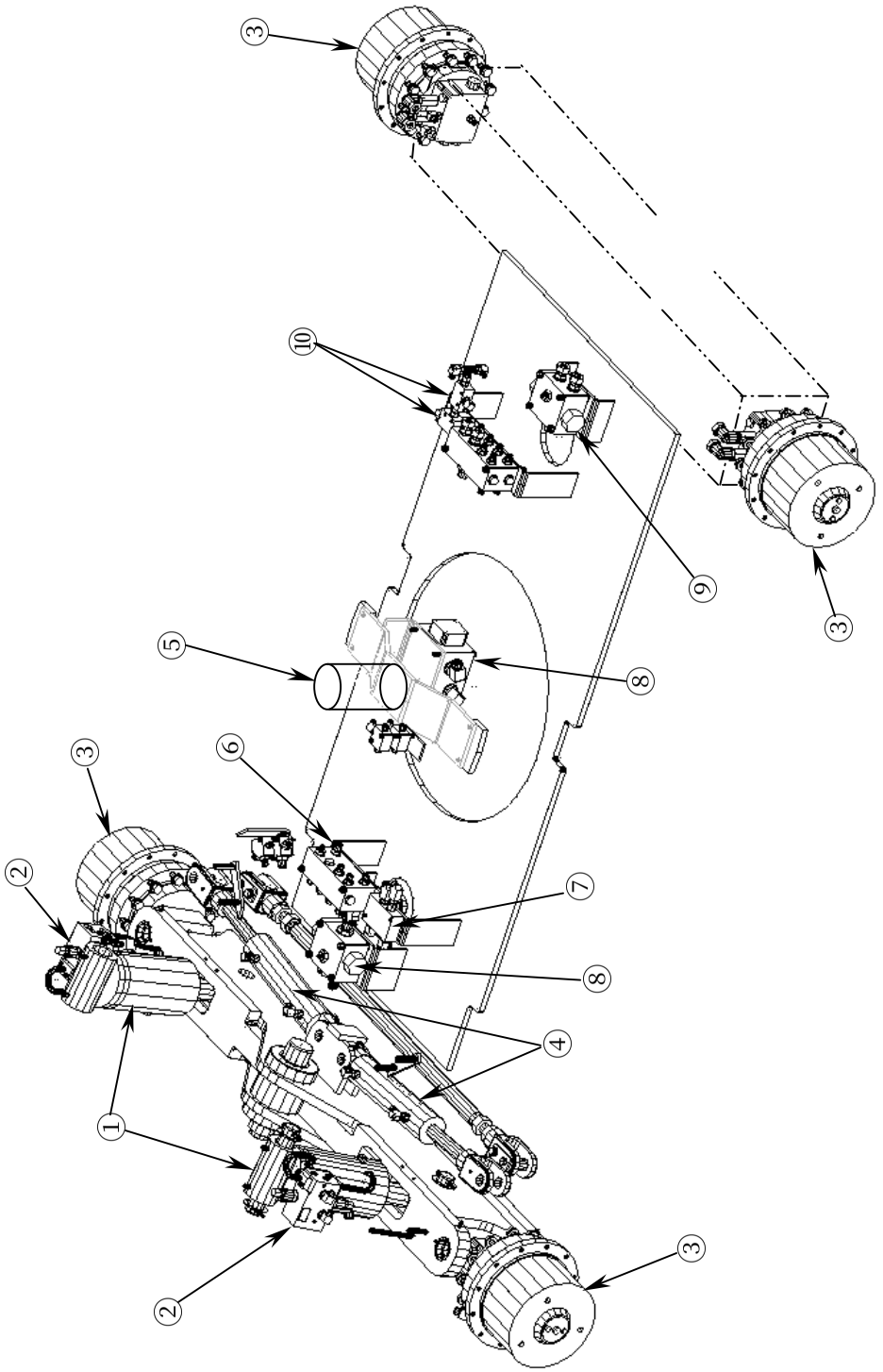






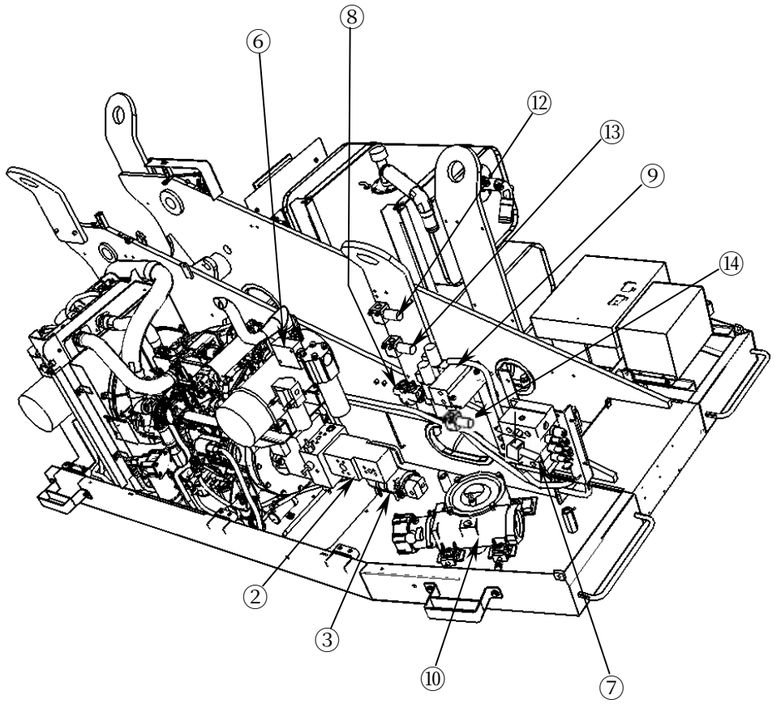


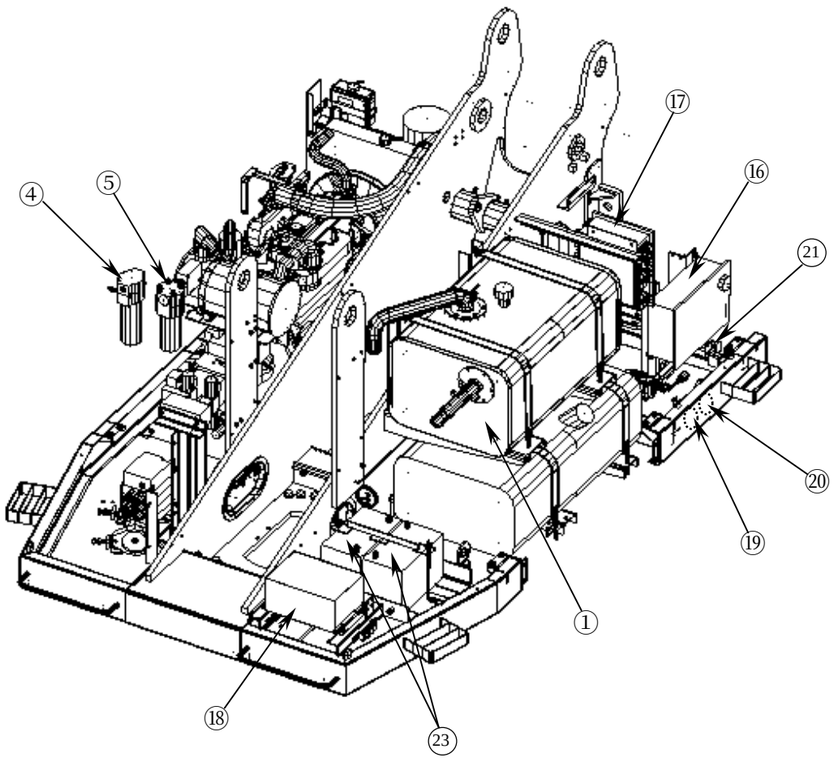
Locations of Hydraulic & Electrical components (1/3)

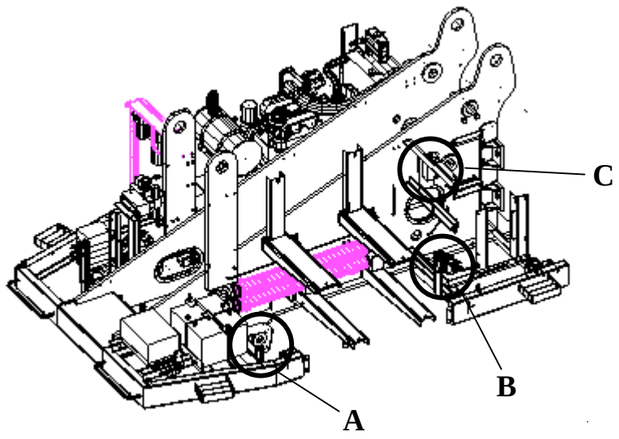


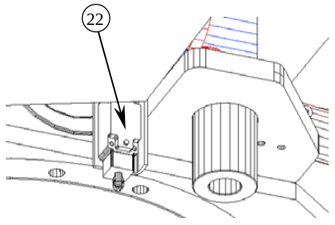
No.	Descriptions	Qty	Part number	No	Descriptions	Qty	Part number
1	Oscillation axle lock cylinder	2	303- 00086- 00	6	Inline check valve	1	302- 02839
2	Lock valve	2	302- 00101- 00	7	Double pilot check valve	1	302- 02898
3	Travel motor	4	301- 00000- 35	8	Flow divider valve	2	302- 00105- 00
4	Steering cylinder	2	303- 00085- 00	9	Flow divider valve	1	302- 00104- 00
5	Swivel joint	1	307- 00000- 38	10	Shuttle valve	1	302-00169- 00

Locations of Hydraulic and Electrical components (2/3)

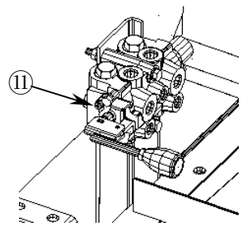




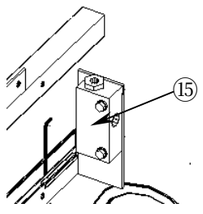




A - Detail



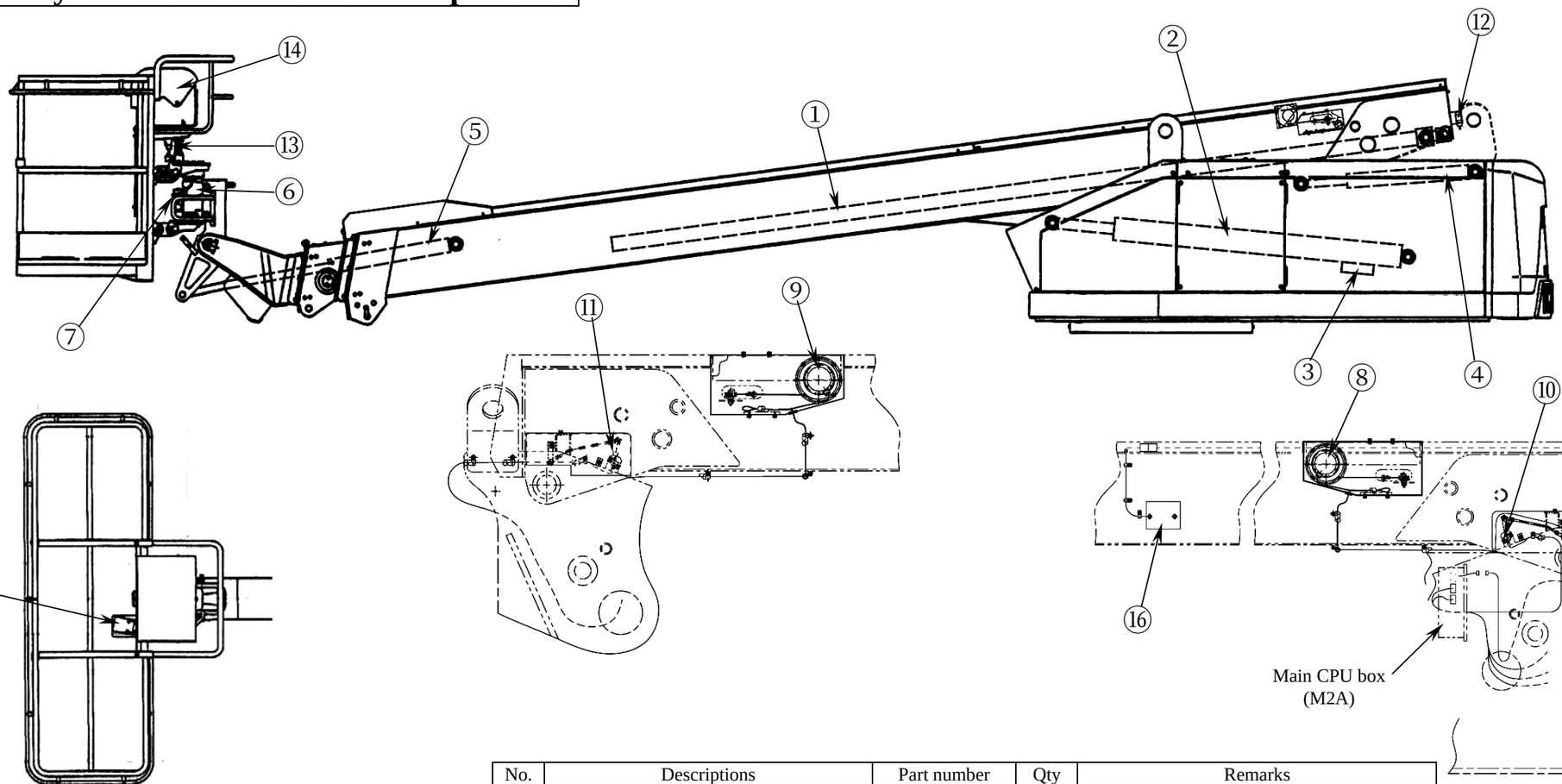
B - Detail

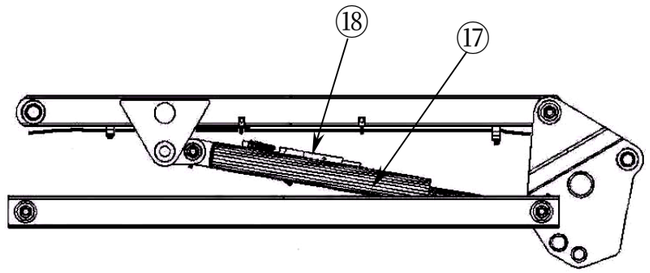


C - Detail

No.	Descriptions	Part number	Qty	Remerks
1	Oil reservoir	378- 00001- 63	1	Suction strainer (305- 06597) is incorporated in the oil reservoir.
2	Hydraulic pump	300- 00000- 43	1	
3	Emergency pump	300- 01808	1	
4	High- pressure line filter	305- 00000- 18	1	
5	High- pressure line filter	305- 00000- 09	1	
6	Check valve block	302- 00041- 00	1	
7	Main control valve	302- 00103- 00	1	Last chance filter (305- 00000- 04) is installed at the P port of the Main control valve.
8	Flow priority valve	302- 00071- 00	1	
9	Unit valve	302- 00149- 00	1	
10	Boom rotation motor	301- 00000- 22	1	
11	Combination valve	302- 00000- 09	1	
12	Oscillation axle release solenoid valve	302- 00090- 00	1	
13	Parking brake release solenoid valve	302- 00090- 00	1	
14	Travel speed select solenoid valve	302- 00090- 00	1	
15	Single pilot check valve	302- 00000- 67	1	
16	Lower control box	329- 00135- 00	1	
17	Main CPU box (M2A)	329- 00001- 51	1	
18	Engine control box	329- 00925- 00	1	
19	Horn	5C1- 01668- 00	1	
20	Motion alarm buzzer	324- 00023- 00	1	
21	Tilt sensor	382- 00016- 00	2	
22	Oscillation axle release limit switch	320- 00025- 00	1	
23	Battery	378- 00443	2	

Locations of Hydraulic and Electrical components





No.	Descriptions	Part number	Qty	Remarks
1	Boom telescope cylinder	303- 00114- 00	1	For SP18A / ISP60
		303- 00108- 00	1	For SP21A / ISP70 and SP21AJ / ISP70J
2	Boom elevation cylinder	303- 00058- 00	1	
3	Single holding valve	302- 00109- 00	1	
4	Lower leveling cylinder	303- 00053- 00	1	For SP18A / ISP60 and SP21A / ISP70
		303- 00062- 00	1	For SP21AJ / ISP70J
5	Upper leveling cylinder	303- 00052- 00	1	For SP18A / ISP60 and SP21A / ISP70
		303- 00023-00	1	For SP21AJ / ISP70J
6	Rotary actuator	407- 00002- 84	1	
7	Platform rotation solenoid valve	302- 00153- 00	1	For SP18A / ISP60 and SP21A / ISP70
	Platform rotation / Fly-jib solenoid valve	302- 00152- 00	1	For SP21AJ / ISP70J
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 SP21AJ / ISP70J
18	Double holding valve	302- 00020- 00	1	For SP21AJ / ISP70J
		302- 00021- 00	2	For SP21AJ / ISP70J

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

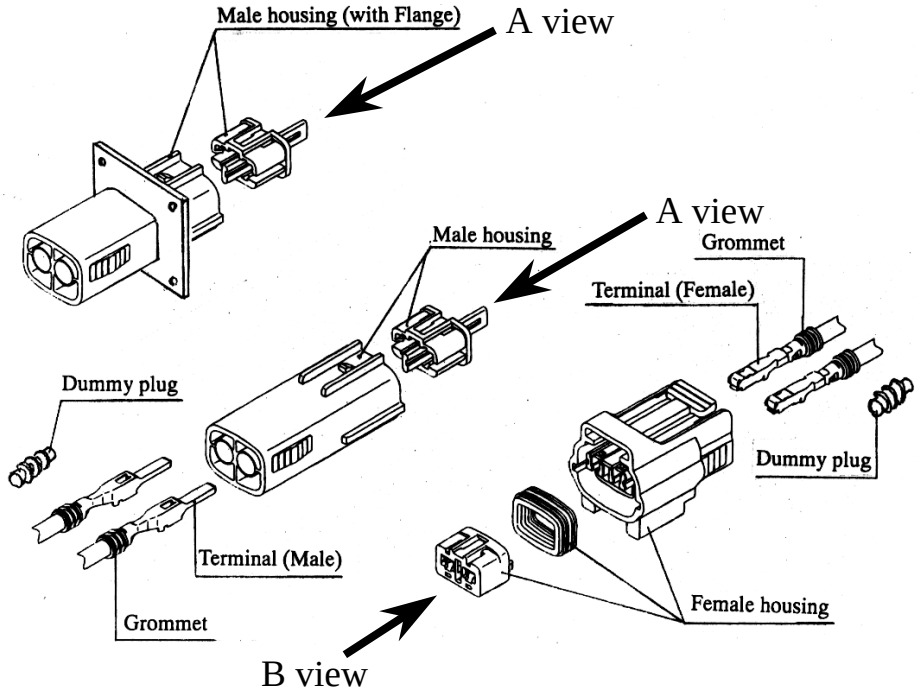
Number of pole	Color	Part number
2 poles	White	192-22102
	Gray	192-22202
	Green	192-22302
	Blue	192-22402
	Brown	192-22502
	Yellow	192-22602
4 poles	White	192-22104
	Gray	192-22204
	Green	192-22304
	Blue	192-22404
	Brown	192-22504
	Yellow	192-22604
6 poles	White	192-22106
	Gray	192-22206
	Green	192-22306
	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)

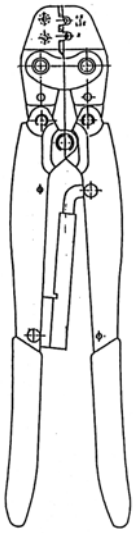
Number of pole	Color	Part number
4 poles	White	192-24104
	Gray	192-24204
	Green	192-24304
	Blue	192-24404
	Brown	192-24504
	Yellow	192-24604
6 poles	White	192-24106
	Gray	192-24206
	Green	192-24306
	Blue	192-24406
	Brown	192-24506
	Yellow	192-24606
8 poles	White	192-24108
	Gray	192-24208
	Green	192-24308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

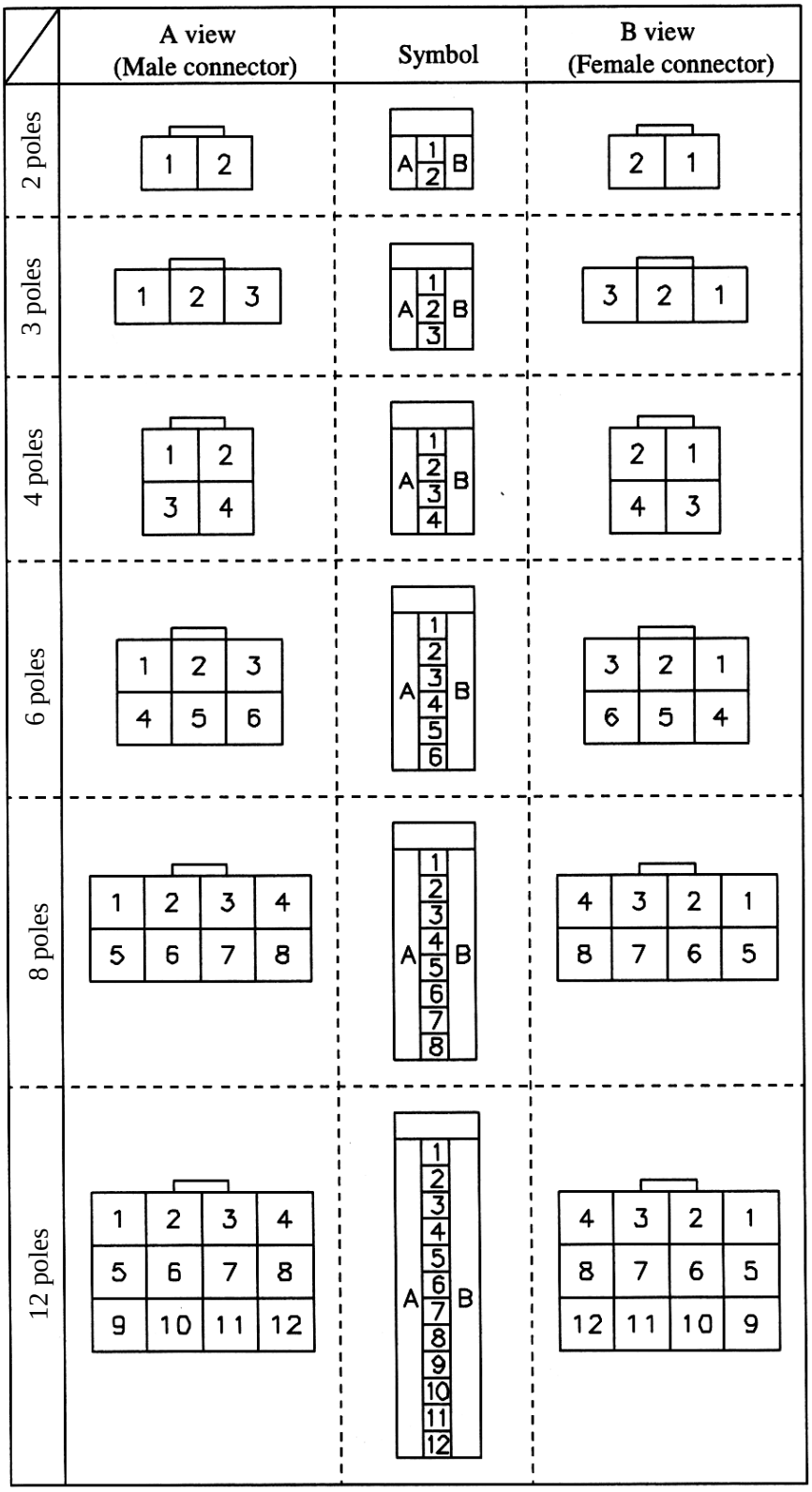


Terminal crimping tool
Part #: MZ99- 9259



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 or in accordance with local regulations.

Set the machine on firm and level surface when conducting function tests.

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. 2. 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.
Brake test	Stopping distance	1. Retract the boom fully, and then lower it under the horizontal. 2. Set the travel speed select switch to its “High” position. 3. Drive the machine forward at high speed and then release the joystick controller quickly. 4. Measure the stopping distance, then make sure that the distance is shorter than 3 meters. 5. Test the backward stopping distance in the same way.

Periodical inspection check sheet

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

The items marked (*) should be inspected annually or in accordance with local regulations.

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		
Brake test	Stopping distance	FWD		
		REV		

Major alterations and repairs