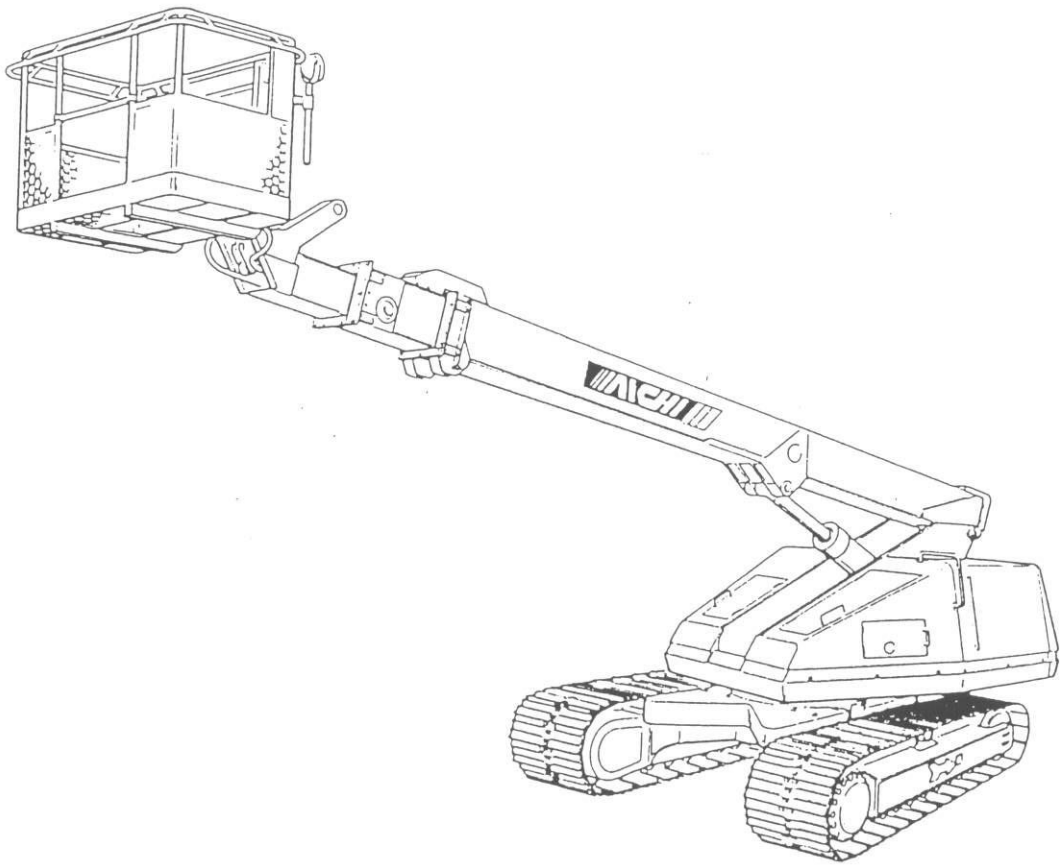
SME-112 B

SERVICE MANUAL

SELF PROPELLED AERIAL PLATFORM

SR182/ISR602



Applied to Specification A3, A4, A6.

AICHI
CORPORATION

1152, RYOKE, AGEO, SAITAMA, JAPAN.

INTRODUCTION

This manual describes the correct adjustment and maintenance procedures for SR-182 self propelled aerial platform.
These procedures will ensure the most effective use of the operation features, and will ensure satisfaction through excellent performance.
Read this manual carefully, and ensure you understand each descriptions correctly.
When carrying out any maintenance or repair work, please cafully note the following.

★Use only the spare parts approved by the manufacturer, particularly for load-supporting and safety-related components.
★Do not carry out any modification to the machine without obtaining the manufacturer's approval.

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

Customer Service Division
Aichi Corporation

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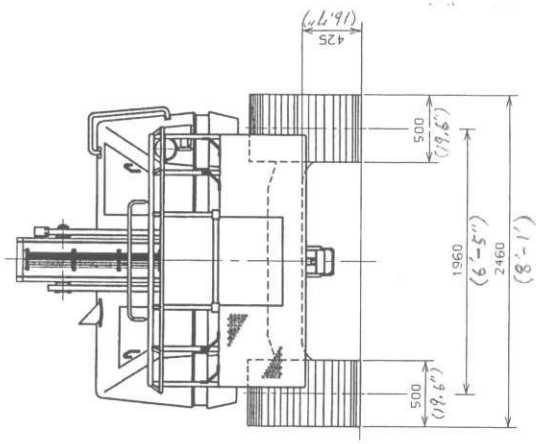
INSPECTION MANUAL (for SP, SR series)

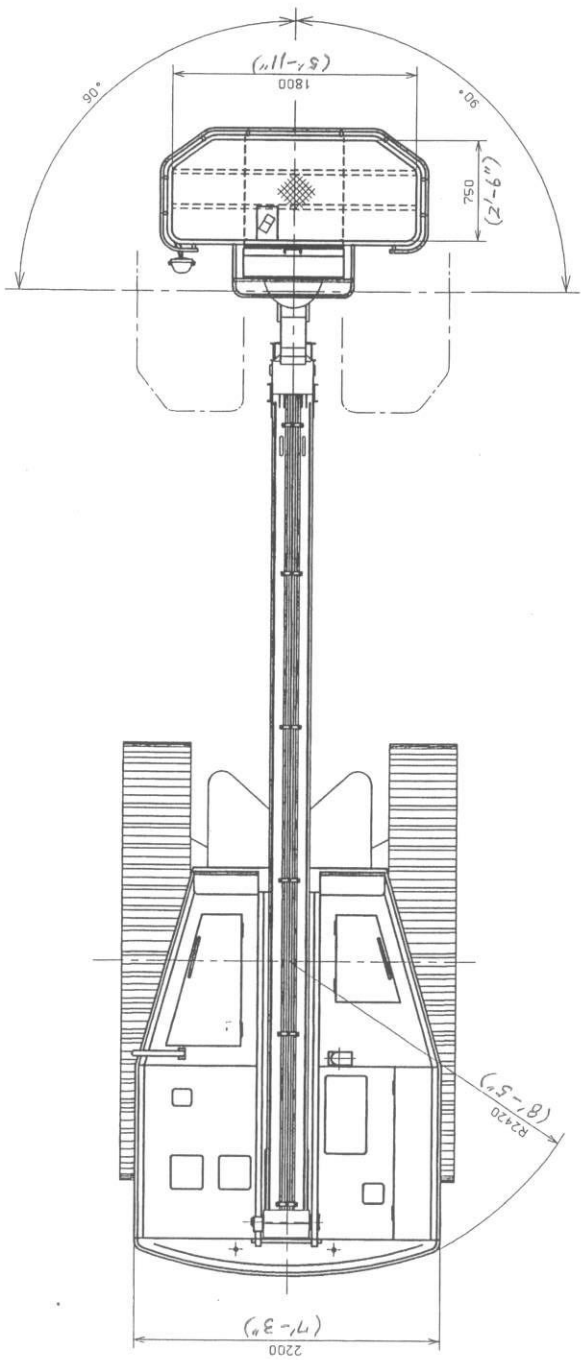
1
GENERAL INFORMATION

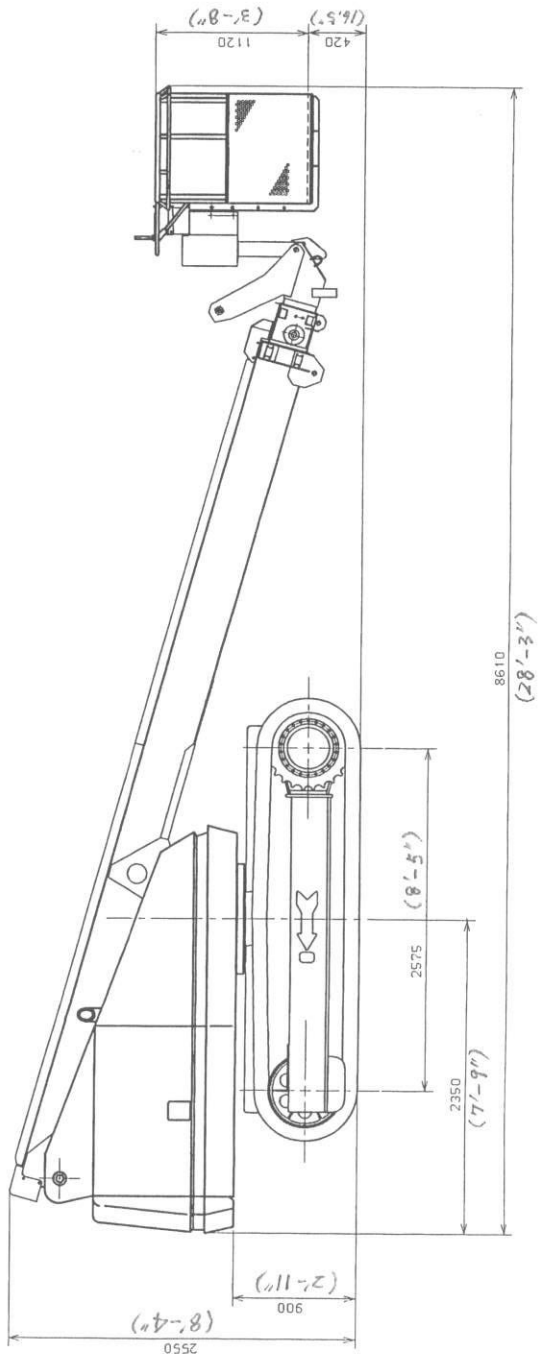
OVERALL DIMENSION (for Version: A3)

(600-09386)

Crawler : Komatsu PC100-5



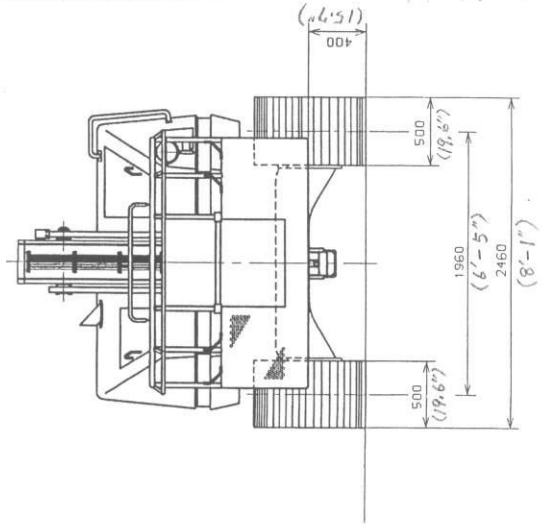


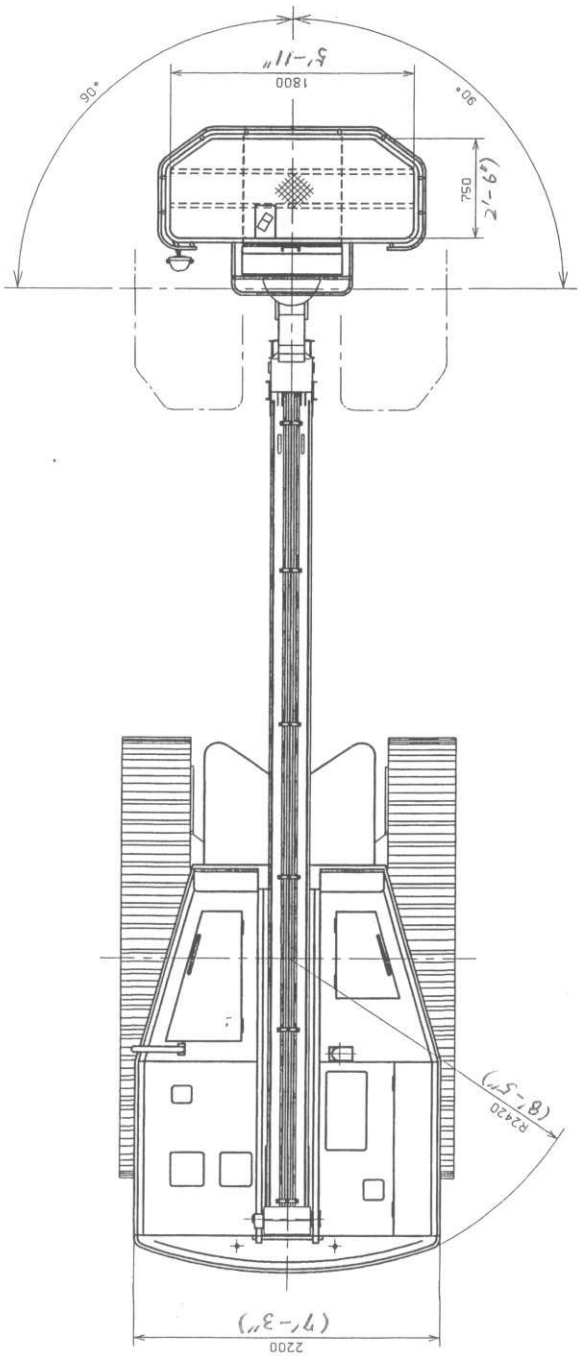


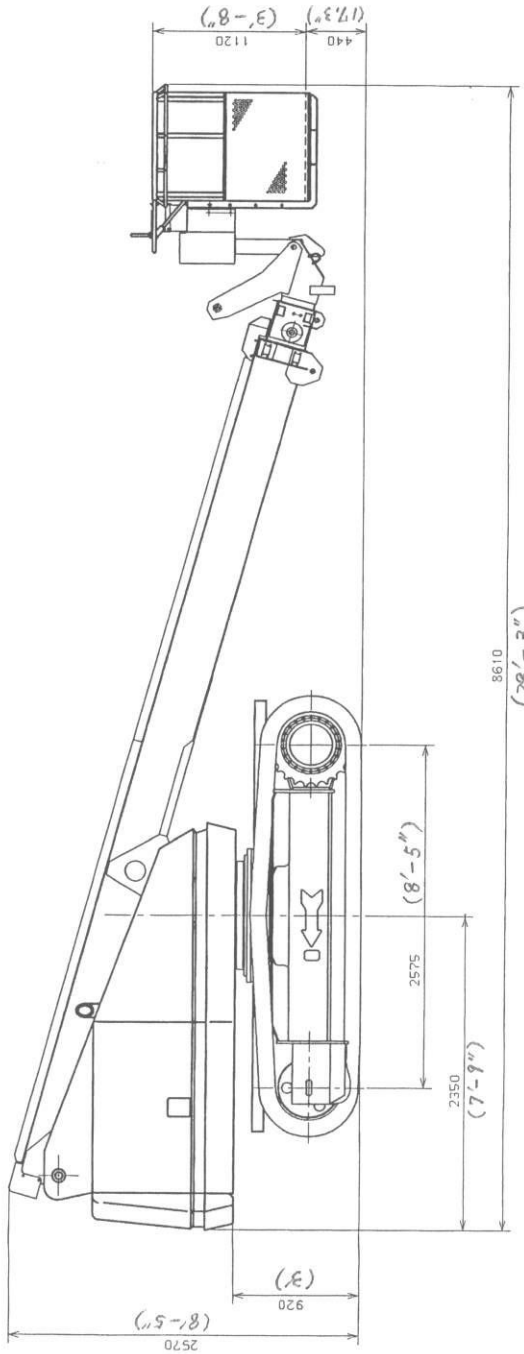
OVERALL DIMENSION (for Version: A4 A6)

(600-09428)

Crawler : Komatsu PC100-6





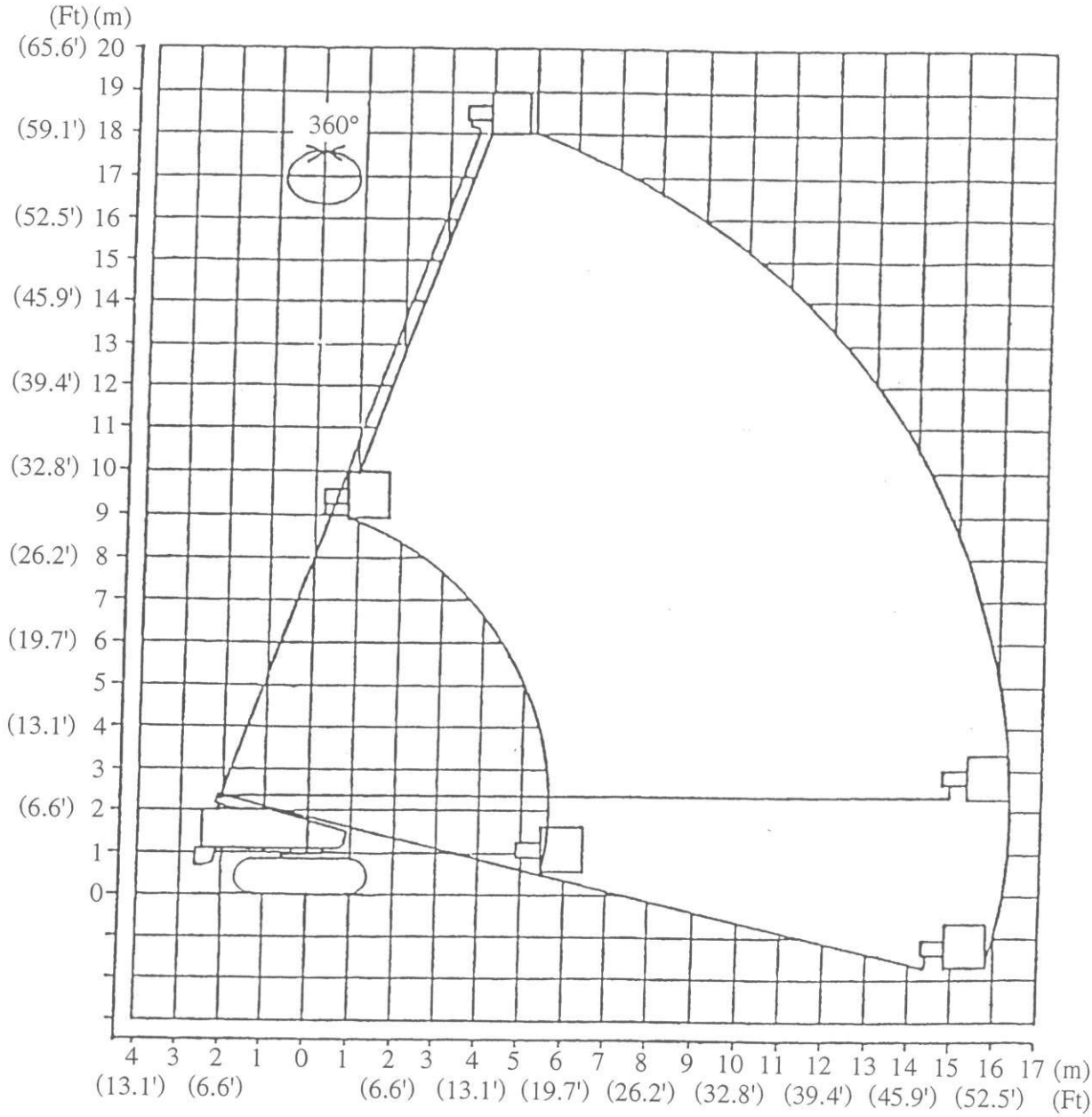


SPECIFICATIONS

Model				SR-182	ISR-602
Weight	Overall weight			13,500 kgf	29,760 lbs
	Max. ground contact pressure			0.78 kgf/cm^2	11 psi
Engine	Model			ISUZU 4BD1-PE03	←
	Total displacement			3,856 cc	235 in^3
	Output power			69.5 ps / 2,200 rpm	68.5 HP / 2,200 rpm
	Output torque			24.0 kgf-m/1,600 rpm	174 ft-lb / 1,600 rpm
Engine (From serial No. 661665 and after)	Model			A-4BG1-PE05	←
	Total displacement			4,329 cc	264 in^3
	Output power			84 ps/2,200 rpm	61.8 kw/2,200 rpm
	Output torque			28.0 kgf-m/1,600 rpm	203 ft-lb / 1,600 rpm
	Engine oil capacity			13 liters	3.43 gals
	Cooling water capacity			16,5 liters	4.36 gals
	Fuel tank capacity			230 liters	60.8 gals
	Engine speed			1,200～2,300 rpm	←
	Battery			DC 12v / 70 AH×2	←
Platform	Rated load			250 kgf or 2 persons + Tools (90 kgf)	550 lbs or 2 persons + Tools (200 lbs)
	Max. allowable side force			41 kgf (400N)	90 lbs
	Inner dimensions			1,800×750×1,120 mm	5'11"×2'6"×3 ft 8 in
	Rotation angle			180°	←
	Maximum floor height			18.0 meters	59 feet
	Maximum working radius			16.5 meters	54 ft 2 in
Boom	Boom length			7.19～16.86 meters	23 ft 7 in ~ 55 ft 4 in
	Boom angle			-20～70 degrees	←
	Rotation angle			360° continuously	←
Operational speed	Elevation	UP		70±5 seconds / stroke	50±5 seconds / stroke
		DOWN		70±5 seconds / stroke	55±5 seconds / stroke
	Extension	OUT		35±5 seconds / stroke	←
		IN		30±5 seconds / stroke	←
	Rotation	C. W.		150±10 seconds / 1 turn	70±5 seconds / 1 turn
		C. C. W.		150±10 seconds / 1 turn	70±5 seconds / 1 turn
	Travelling	High speed	Forward	32±4 seconds / 10 m	29±3 seconds / 10 yards
			Reverse	32±4 seconds / 10 m	29±3 seconds / 10 yards
		Low speed	Forward	51±8 seconds / 10 m	47±7 seconds / 10 yards
			Reverse	51±8 seconds / 10 m	47±7 seconds / 10 yards
	Platform rotation	Right		20±4 seconds / stroke	←
		Left		20±4 seconds / stroke	←

Hydraulic system	Hydraulic oil	Tank capacity	250 liters	66 gallons
		Recommended oil	Shell Tellus oil 32	←
	Hydraulic pump	Type	Gear pump (Double)	←
		Discharge volume	30.2 + 30.2 cc/rev.	1.84 + 1.84 in^3 / rev
		Pump speed	1,200~2,300 rpm	←
	Rated pressure	Main system (Elevation, Extension Rotation & Travelling)	210 $^{+5}_{-0}$ kgf/cm^2	3,000 $^{+70}_{-0}$ psi
		Sub system (Platform rotation)	140 $^{+5}_{-0}$ kgf/cm^2	2,000 $^{+70}_{-0}$ psi
Maximum allowable slope			5 degrees	←
Gradeability			27 degrees (51 %)	←

WORKING RANGE CHART

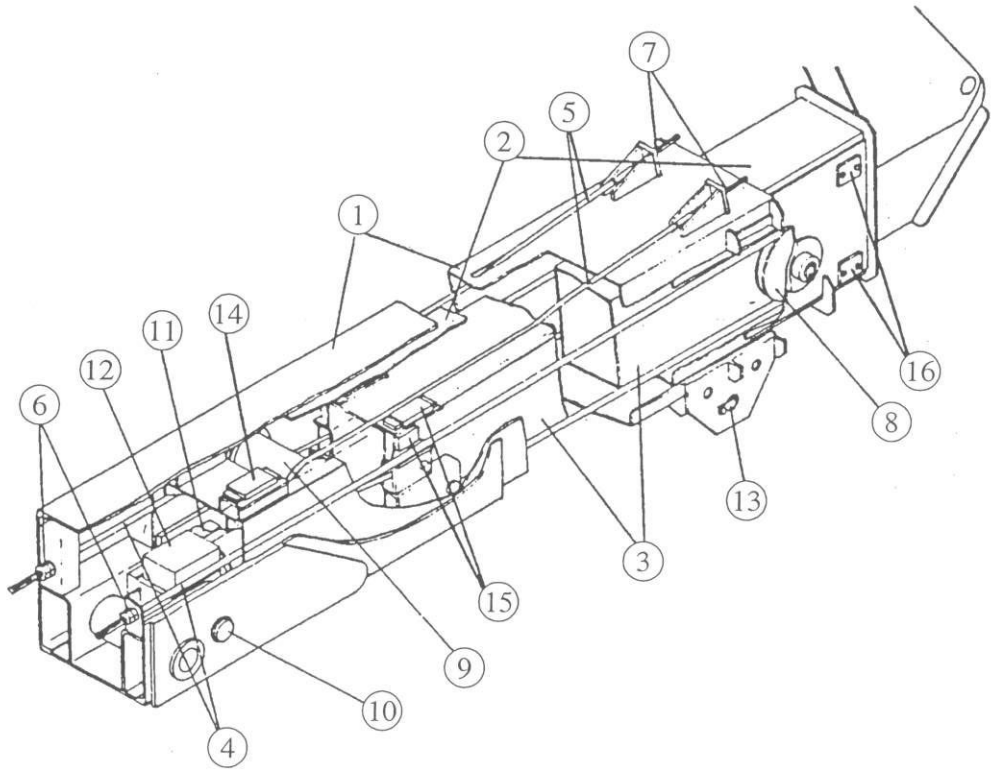


2
MECHANICAL SECTION

BOOM

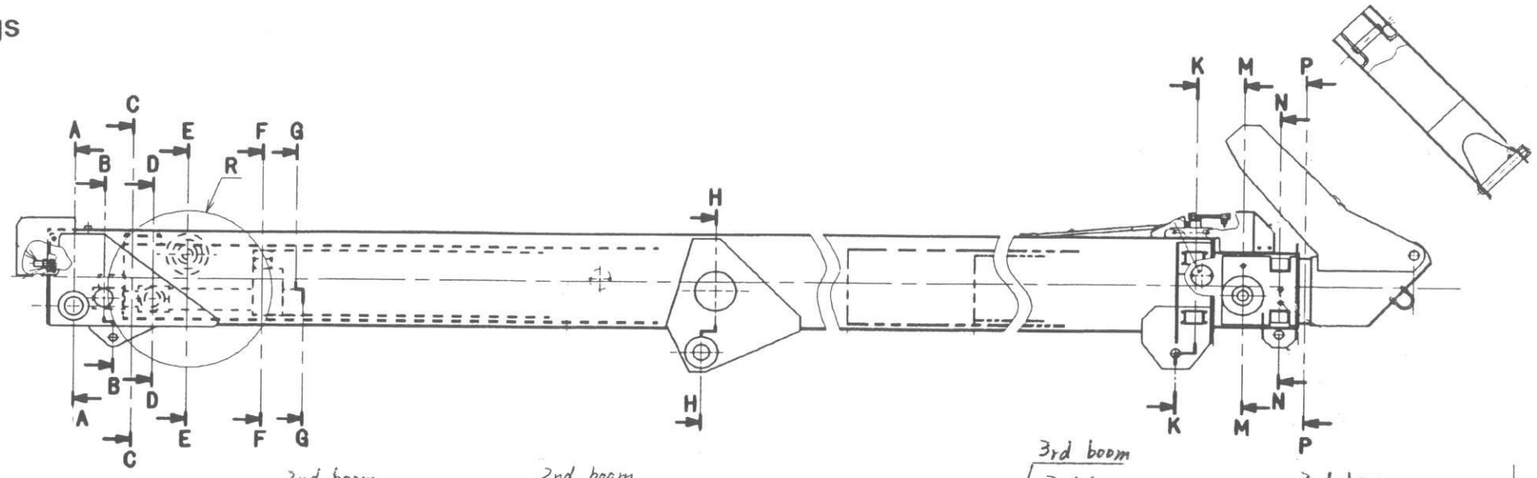
The boom Assy consists of 1st boom, 2nd boom, 3rd boom, extension cylinder, extension/retraction wire ropes, hydraulic plumbings, electric cables and their sheaves.
The 2nd boom is extended or retracted by the Extension cylinder directly. However, the 3rd boom is telescoped by the movement of 2nd boom through extension/retraction wire ropes.

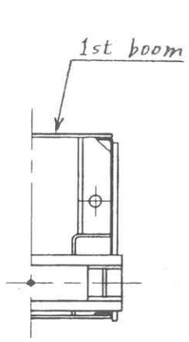
Fig:1



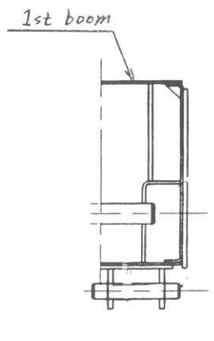
1. 1st boom.
2. 2nd boom.
3. 3rd boom.
4. Extension wire rope.
5. Retraction wire rope.
6. Lock-nut & Adjust-nut NO.1.
7. Lock-nut & Adjust-nut NO.2.
8. Sheave A.
9. Sheave B.
10. Set pin A. (for Extension cylinder)
11. Set pin B. (for Extension cylinder)
12. Extention cylinder.
13. Set pin. (for Roller)
14. Slider.
15. Slider.
16. Slider.

1. Sectional drawings





A–A



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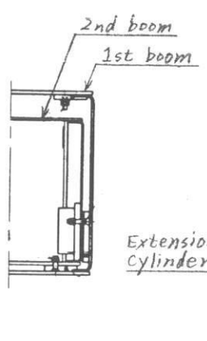

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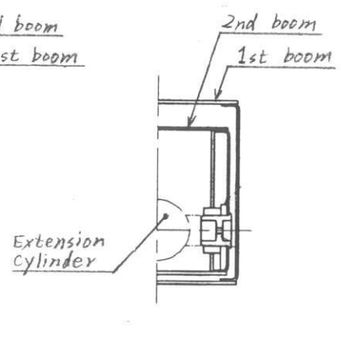
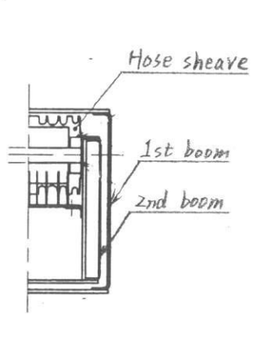


D–D



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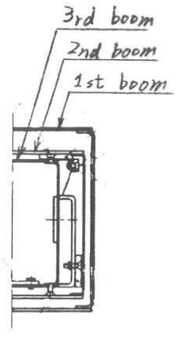
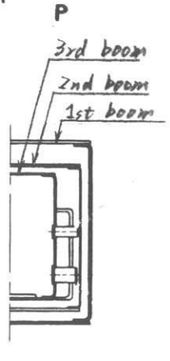
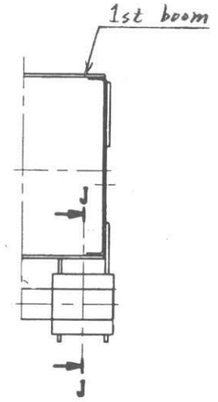


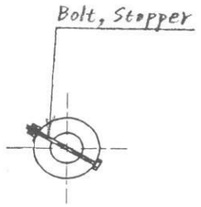
F–F



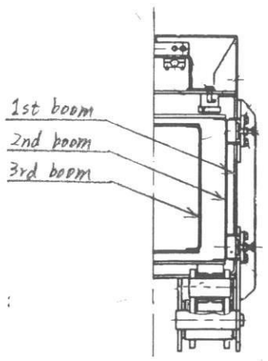
G–G



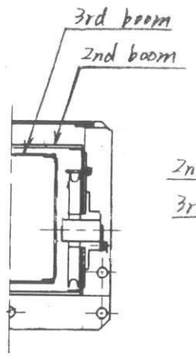
H–H



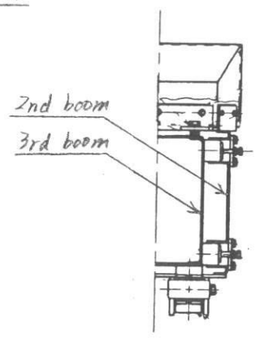
J–J



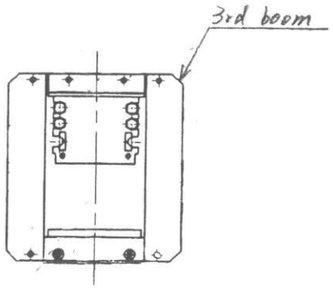
K–K



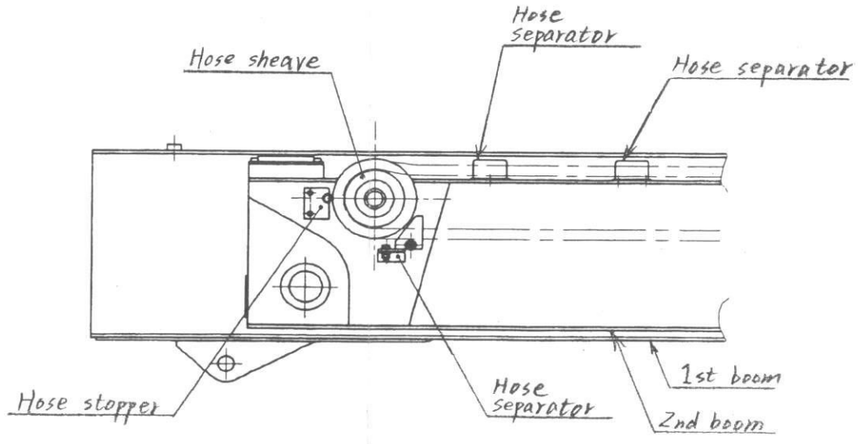
M–M



N–N



P–P



R

2 . 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 slider and boom section.
      * Specific clearance : 2.0mm or less. (0.08" or less)
   2) If the clearance is not adequate, adjust the clearance by adding or reducing the spacers installed under the each slider or by adjusting the screws.

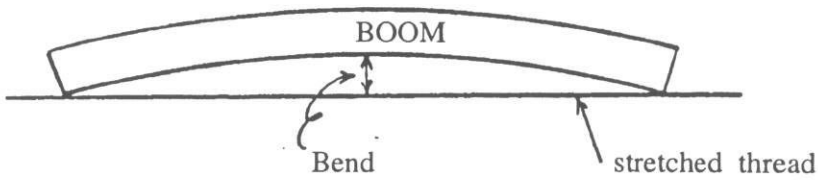
NOTE:

* Check each slider for wear, and replace if necessary.
* Apply a thread lock agent to the thread of each set screw for sliders before setting.
  Recommended thread lock agent : 3 Bond. 1374.

2. Bend of boom
   1) Set the boom horizontally and extend it fully.
   2) Visually check the bend of each boom.
   3) If the bend seems to be excessive, stretch a thread over the boom and measure the bend accurately as shown in the figure below.

NOTE: If the bend measured exceeds the serviceable limit (9.5mm, 0.37"), replace the boom.

Fig:2



3. Dents, scratches.
   Check the each boom for both dents and scratches thoroughly.
   If any dent or scratch which exceeds the serviceable limit
   (Length : 50mm or more, Depth : 2mm or more) exsists, replace the boom.
   (1.97") (0.08")

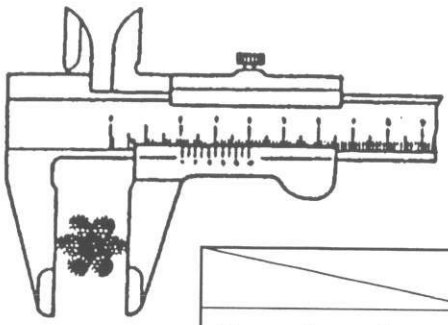
4. Cracks.
   Check each boom thoroughly for cracks.
   For fine cracks, use "COLOR CHECK" or penetrant check.
   * Pay special attention, when checking each pin boss and welded part.

3. Extension/Retraction wire ropes.

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

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

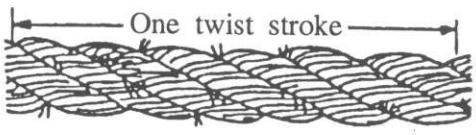
Fig:3



	Nominal diameter	Serviceable limit
Retraction wire rope	ϕ 8mm (0.315")	ϕ 7.76mm (0.306") or less
Extension wire rope	ϕ 12mm (0.472")	ϕ 11.64mm (0.458") or less

2) Check for broken wires.
If 3 or more wires of a wire rope are broken in a twist stroke, replace the wire rope.

Fig:4

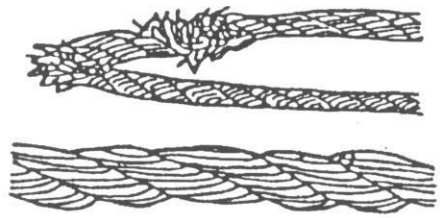


3) Check wire ropes for rust.
If rust is evident around the inside of the wire rope, replace it.

Fig:5

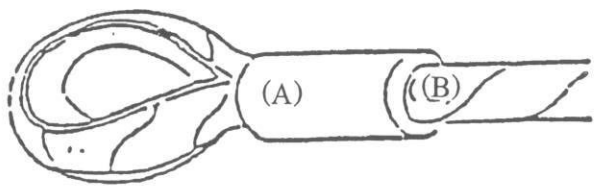
4) If any kinks are observed, replace the wire rope.
Also, an extremely deformed wire rope requires replacement.

Fig:6



5) Carefully check the end sections of a wire rope, especially sections A and B. Replace the wire rope if any defects are found.

Fig:7

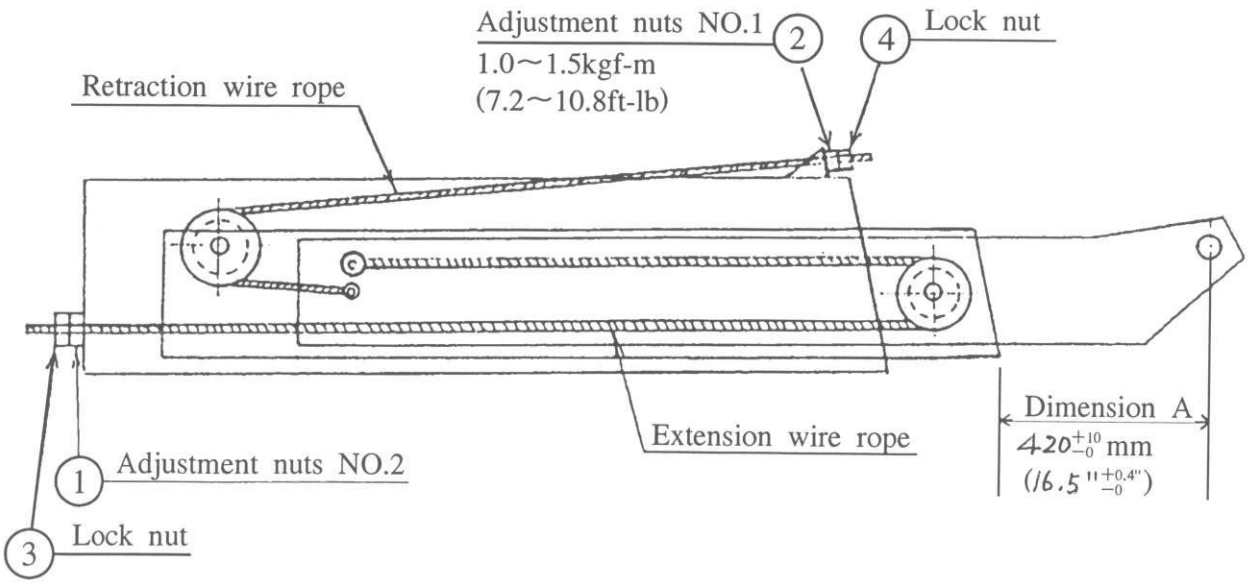


4. Tension of extension/retraction wire ropes

Extend/retract the boom for a full stroke, check for any jerky movements caused by loose or stretched extension/retraction wire ropes.
If the wire ropes are loose, adjust their tensions as follows.

1) Retract boom fully and set it horizontally.
2) Loosen both the lock-nuts and the Adjustment nuts NO.1② , which are located on both sides of the top part of the 1st boom.
3) Lubricate the Adjustment nuts NO.1 with machine oil, and make sure that the nuts turn smoothly on the threads.
4) Tighten both of the Adjustment nuts NO.1 . Do this alternatly using a torque wrench, until the specified tightening torque is reached.
   Specified tightening torque of Adjustment nuts NO.1:1.0~1.5kgf-m(7.2～10.8ft-1b)
5) Check dimension A shown in the figure below, and make sure that it is 420^{+10}_{0}mm. ($16.5''^{+0.4''}_{-0}$)
   If the mesurement of dimension A is less than 420mm (16.5"):
   - Screw out Adjustment nuts NO.1 ② and screw in Adjustment nuts NO.2 ① until the specified dimension A is obtained.

   If the mesurement of dimension A is more than 430mm (16.9"):
   - Screw out Adjustment nuts NO.2 ① and screw in Adjustment nuts NO.1 ② until the specified dimension A is obtained.
6) Extend/retract boom several times for a full stroke, and recheck the tightening torque of Adjustment nuts NO.1, and dimension A, then secure the Adjustment nuts with lock-nuts.

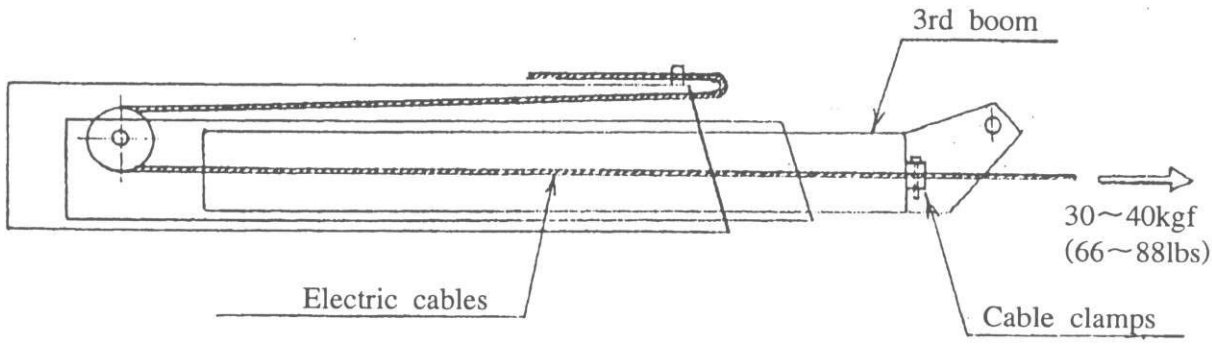


Note : Adjust the tension of wire ropes every 6 months.

5. Tension of Electric cable

Apply tension on the each electric cable after adjusting the tension of "Extension/Retraction wire ropes as follows.
It is advisable to apply the tension on each electric cable every 6 months or 600 working hours.

1) Position the boom horizontally, retract it fully, and check the tension of the "Extension/Retraction wire ropes."
   (Adjust the tension if necessary.)
2) Loosen the cable clamps at the top of the 3rd boom.
3) Pull each electric cable by applying 30~40kgf, and lock the cable with the cable clamp. (66~88lbs)

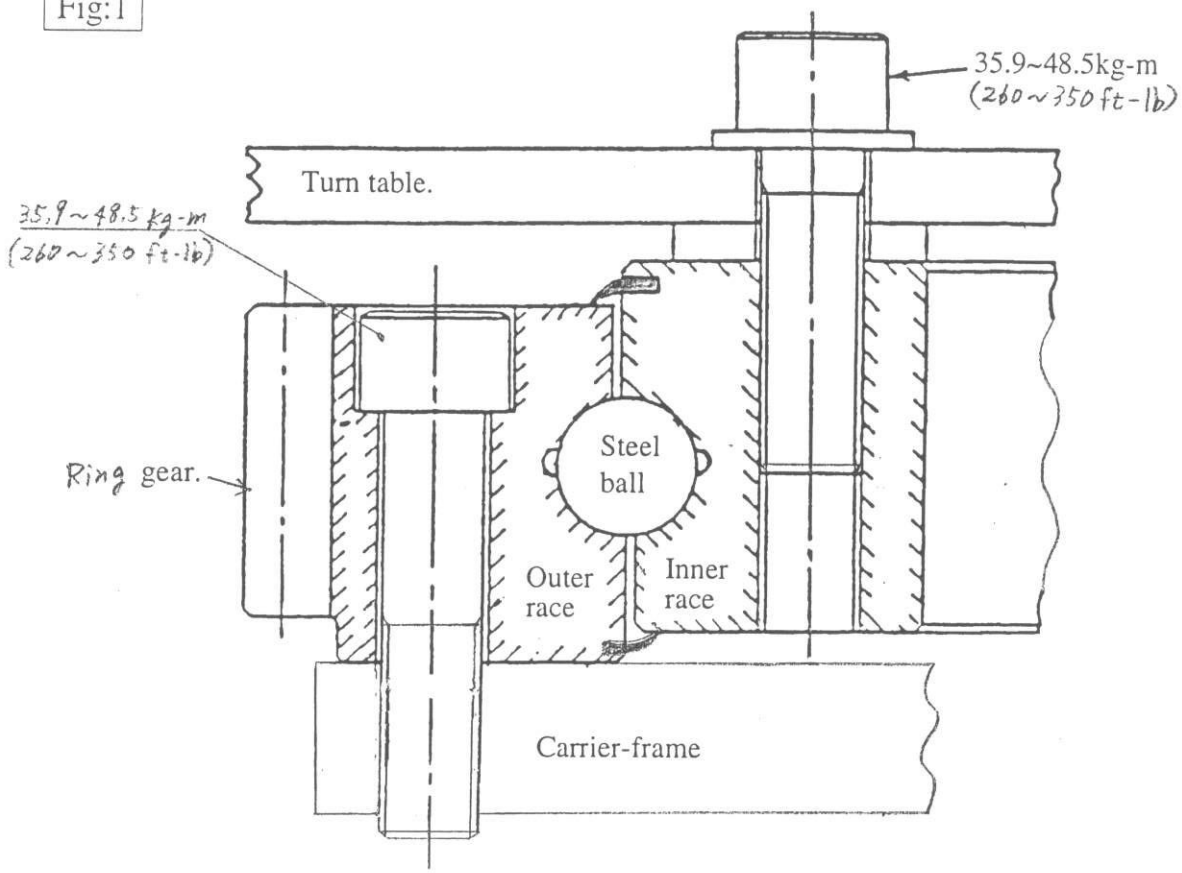


Note : Apply tension to the cables every 6 months.

T.T.B. (Turn Table Bearing)

The T.T.B. is mounted between the carrier-frame and the turn-table, it enables the turn-table to rotate freely over the carrier-frame.

Fig:1



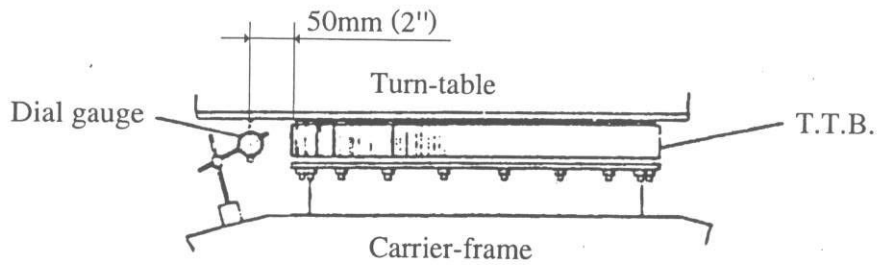
1. Inspection procedures.

1. Check anchor bolts and nuts for any looseness, omissions or any other damage.
   a. Loose bolts should be removed and checked for damaged threads and deformation.
   b. When resetting anchor bolts or nuts, apply thread lock agent to the threads.
      -Recommended thread lock agent : 3 Bond 1374.
   c. Tighten anchor bolts and nuts to the specified tightening torque.
      -Specified tightening torque : 35.9-48.5 kg-m (260~350 ft-lb).

NOTE : Before removing anchor bolts or nuts, use a gas bunner to heat them until they are red hot. This will remove the thread lock agent applied on the thread of each bolt and nut.

2. Check ring gear for cracks, scorings and any other damage.
   For any fine cracks, use a penetrant check such as a color check.
3. Check the back-lash between the ring gear of T.T.B. and the drive pinion of Rotation gear box.
   -Standerd back-lash : 0.6mm (0.024") or less.
   NOTE : To measure the value of back-lash, rotate turn-table and crush a lead-wire between the ring gear and the drive pinion, then measure the thickness of the crushed lead-wire.
   When the back-lash is not within the the tolerance, adjust it by moving the position of rotation gear box.
4. Check the free-play between inner and outer races of T.T.B..
   To check the free-play, use the following steps.

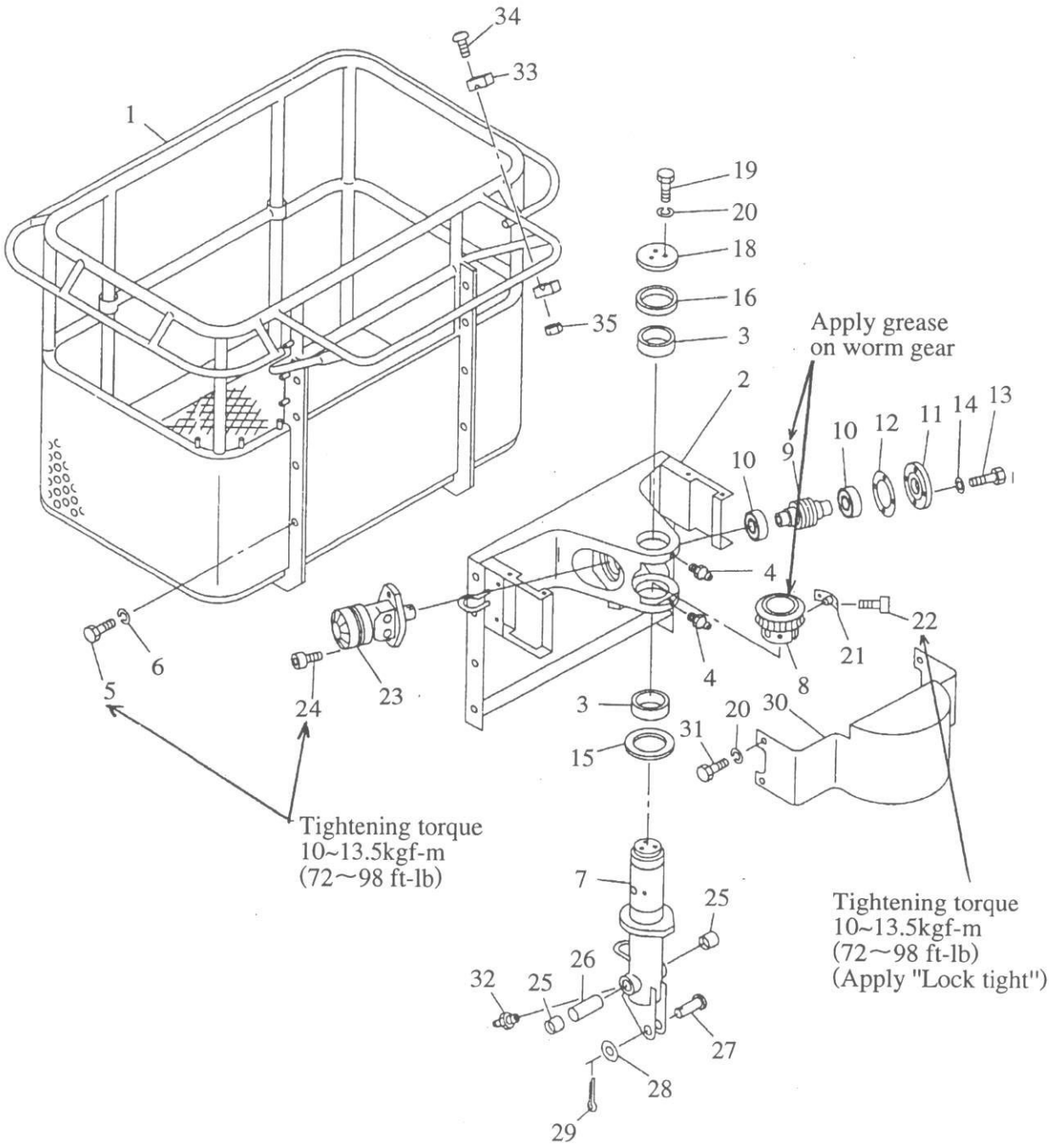
Fig:2



a. Set a dial gauge between the turn-table and the carrier-frame, as shown in Fig : 2.
b. Retract and raise the boom fully (with minimum boom length and maximum boom angle), and set the pointer of the dial gauge at "ZERO".
c. Lower the boom, set it horizontally and extend it fully, then re-check the dial gauge.
   The reading of the dial gauge is the value of free-play.
   -Standard free-play : 0.9mm (0.035").
   -Limit of free-play : 3.0mm (0.118").

NOTE :
The T.T.B. with free-play in excess of the limit 3.0mm (0.118") should be replaced.

PLATFORM SWING MECHANISM



3
HYDRAULIC SECTION

NOTE ON OVERHAULING THE HYDRAULIC SYSTEM

When repairing, servcing or overhauling the hydraulic system, take the following into consideration.

1. When disconnecting plumbing.
   a. Prepare a suitable container to catch the draining oil.
   b. Put "MATCH MARKS" on each part before disconnecting. This will make recoginition on the time of reconnection easier.
   c. Use double spanners as not to damage the plumbing and components.
   d. Clean the plumbing or components out before disconnection, to prevent foreign particles from entering into the hydraulic system.
   e. Install proper plugs to the disconnected plumbing or components, to prevent foreign particles from entering into the hydraulic system.
2. When connecting the plumbing.
   a. Check the "MATCH MARKS" made on disconnection to avoid incorrect connections.
   b. Clean the connecting plumbing, to prevent foreign particles from entering into the hydraulic system.
   c. When connecting the TP adaptors, wind seal-tape at least one and a half times around the threads.
   d. Use double spanners when tightening the connectors.
3. When assembling or disassembling hydraulic components.
   a. Put proper plugs onto the openings of oil passages to prevent foreign particles entering into the components.
   b. Before disassembling, clean the component thoroughly with a solvent and compressed air.
   c. Clean each disassembled part with solvent thoroughly. This will ensure easier check-up procedures, and prevent the introduction of foreign particles.
   d. When assembling 0 rings or packings, apply a little grease or lubricate them with hydraulic oil.
   e. When installing taper plugs, wind seal-tape at least one and a half times around the threads.

HYDRAULIC OIL

It should be noted that hydraulic system failures are often caused by defective hydraulic oil which in turn is caused by improper maintenance.

To insure maximum utilization, the followings should be observed.

1) Oil temperature should be below 70°c and ideally below 60°c (140°F), as heat causes earlier oxidation.
   On the other hand when the oil is very cold, a warm-up period is recommended before operation.
2) Regularly check for contaminants in the hydraulic oil.
   Contaminants in the oil may speed up the oxidation process.
3) Avoid introduction of water into the hydraulic system, as water will cause additives to deteriorate and if the amount of water is sufficiently large, it will cause the oil to emulsify.
4) As a rule, do not mix oils from different maufacturers.
   Furthermore, do not mix oils of the same make if they have different product names or viscosity differences.
   Improper mixing will cause the additives to deteriorate.
5) Eliminate oil leakage as much as possible from the hydraulic component and its plumbings.
6) Make it a habit to check the oil regularly.

Guidelines for oil change.

An oil change should be carried out every 1,200 working hours or on an annual basis.
(For new Machine : After 300 working hours or 3 months use.)
In the meantime, take a small amount of oil from the oil reservoir, and conduct the following inspections and tests.

1) Visually compare the sample taken from the oil reservoir, and a fresh, unused sample.
   - Color -
   As the oil deteriorates, the color becomes darker and less clear.
   If the oil is milky, let it settle for about 10 hours, then observe.
   a) If there is little or no change to the milky oil, the cause is water mixed into the oil.
      In this case a complete oil-change is necessary.

b) If the oil and water seperate, this indicates that the water has been introduced to the hydraulic system a short time ago. It can be reused after taking out water.

c) If the oil becomes clear with no water at the bottom of the container, it is an indication that air has been mixed into the oil.
- Access the cause of the air.

- Smell -

If the oil has a strong pungent odor, it is an indication that the deterioration has progressed to a point where an oil-change is needed.

- Contaminants -

If suspended contaminants are introduced to the hydraulic oil, leave the sample for 1 to 2 days and gather sediments for further tests of the development of contaminants.

2) Analytical tests.

Test the hydraulic oil for viscosity, water content, oxidation, contaminants, etc.

Test for	Shell Tellus 32	Shell Tellus T15
Contamination	Within NAS Class 12.	
Water content (%)	Less than 0.5%.	
Oxidation (mgKOH/g)	0.4mgKOH/g.	
Viscosity (cst) (at 40°c)	32 cst.	15 cst.

Suction strainer.

Be sure to clean suction strainer at the time of an oil change.
Wash and clean the strainer in kerosene or a similar solvent, then air-blast it from the inside.

Oil filters.

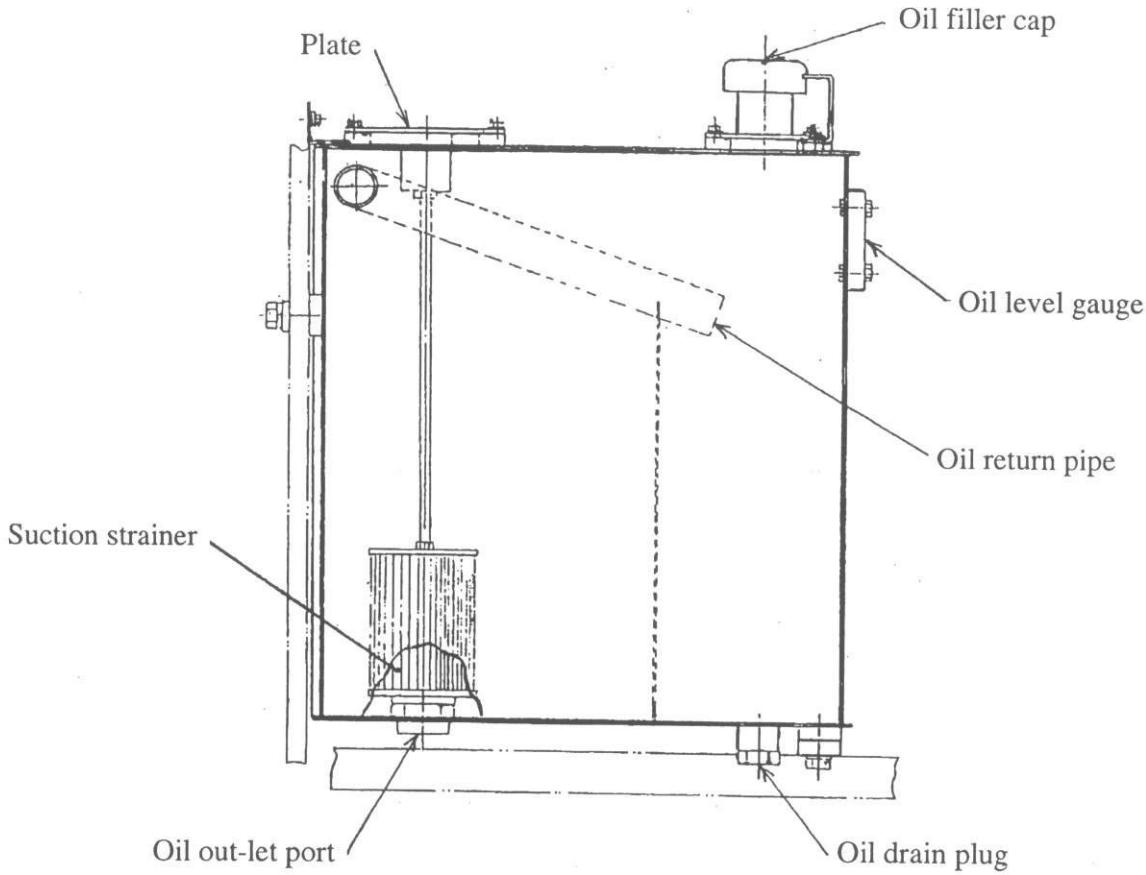
Regulary replace the filter element. If the machine is new, replace the element after 300 working hours or 3 months use.
Thereafter, replace it every 1,200 working hours or on an annual basis.
(The element should also be replaced at the time of an oil change.)

OIL RESERVOIR

The oil reservoir consists of such components as shown in the figure below, and supplies hydraulic oil to the whole hydraulic system.

Capacity ..... 250 liters (66 gals)

Recommended oil ..... Shell Tellus oil 32



Oil change interval

- Every 1,200 hours or annually
- For a new machine, the first oil change should be carried out after 300 hours or 3 months use.

Note

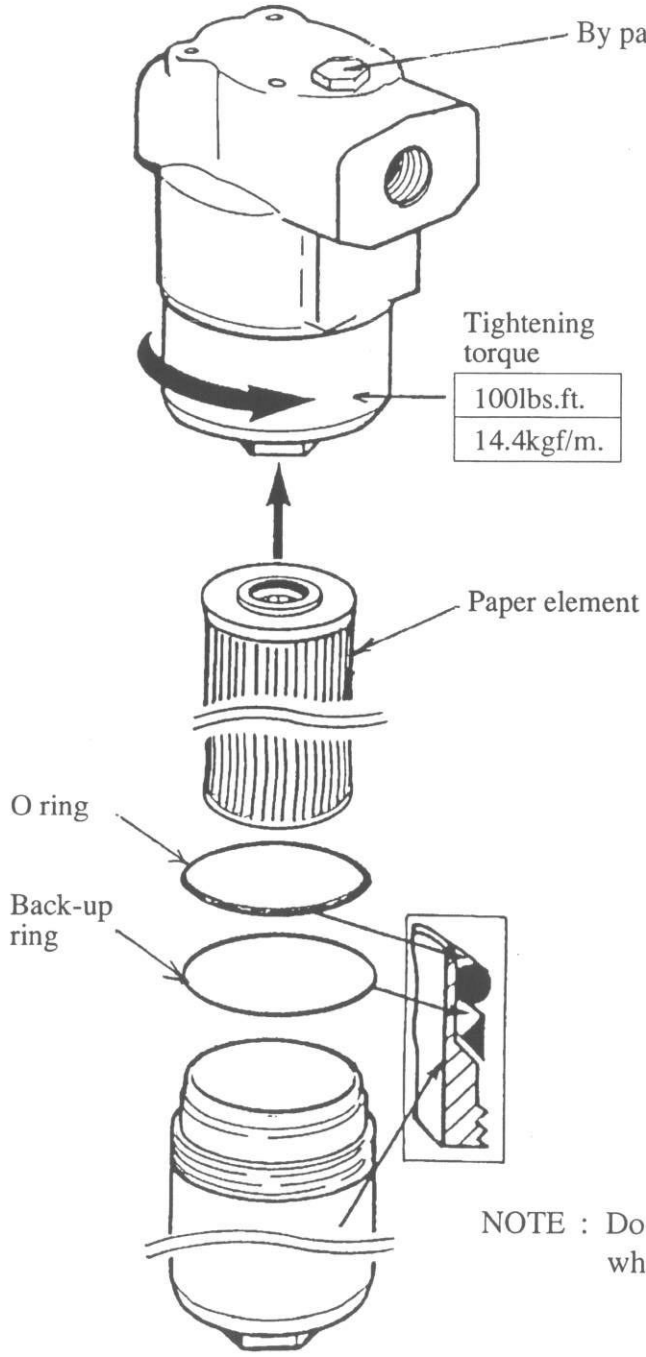
- When checking oil level, retract and lower the boom fully.
- Clean "Suction strainer" and replace "In-line filter", when changing the hydraulic oil.

IN-LINE FILTER

The in-line filter is installed at the outlet line of the hydraulic pump to eliminate the contaminants contained in the hydraulic oil.

Replacement interval : Every 1,200 working hours or annually.
(of filter element)

NOTE : The first replacement of the filter element for new machine should be carried out after 300 working hours or 3 months use.



NOTE : Do not reuse "Oring" and "Back up ring", when removed once.

HYDRAULIC PUMP

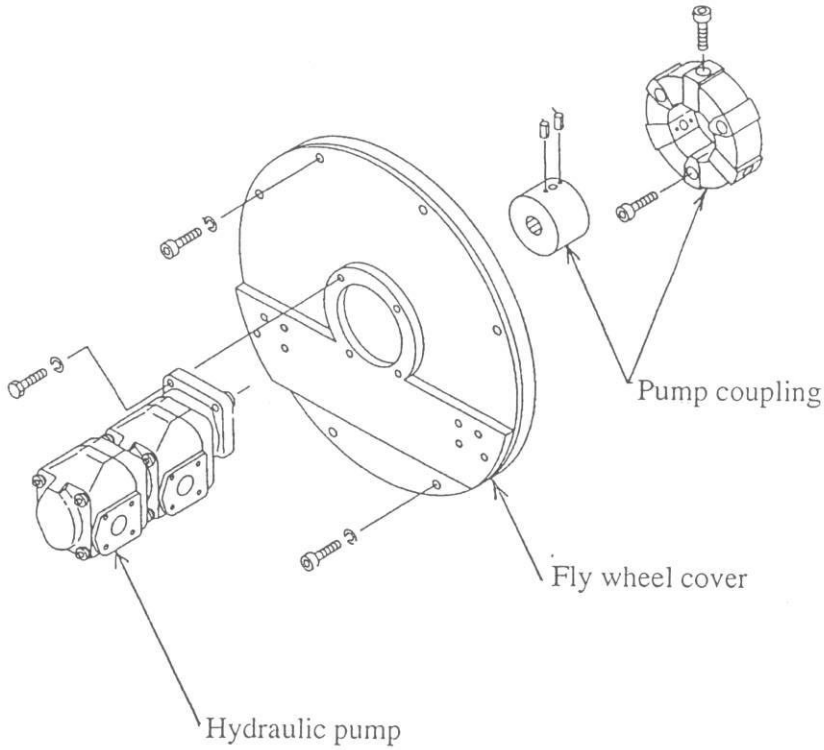
The pump is driven by engine directly, and supplies pressurized oil to hydraulic system

Type ..... Gear pump (Double)

Discharge volume ..... 30.2 + 30.2cc/rev (1.84+1.84 in^3/rev)

Rated pressure ..... 210kgf/cm^2 (3,000 PSI)

Rotating direction ..... Clock wise



MAIN CONTROL VALVE NO.1 and NO.2

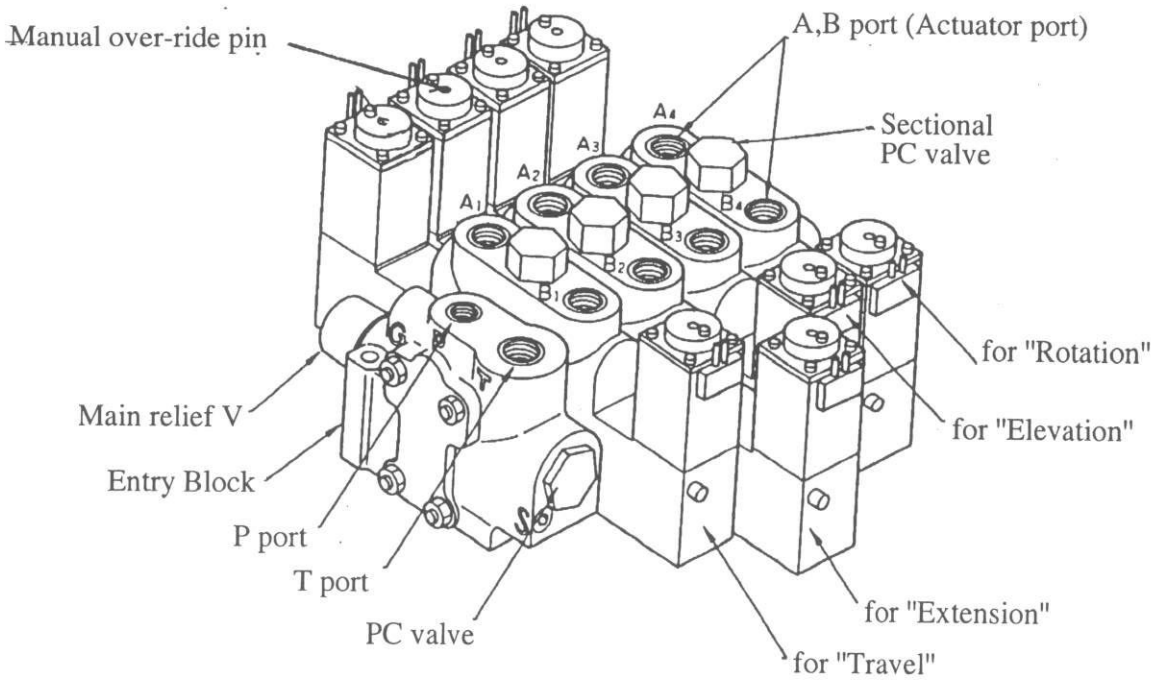
The main control valve is a "Soleniod Operated Proportional Type" and controls the following hydraulic systems.

1. Elevation system.
2. Extension system.
3. Rotation system.
4. Travel system.

When the main control valve is operated by the control levers (or Potentio meters) located at upper control box, the main spools of the valve are shifted proportionally in accordance with the operated value of the control levers.
Thus, the flow which is supplied to the each hydraulic actuator is controlled proportionally.

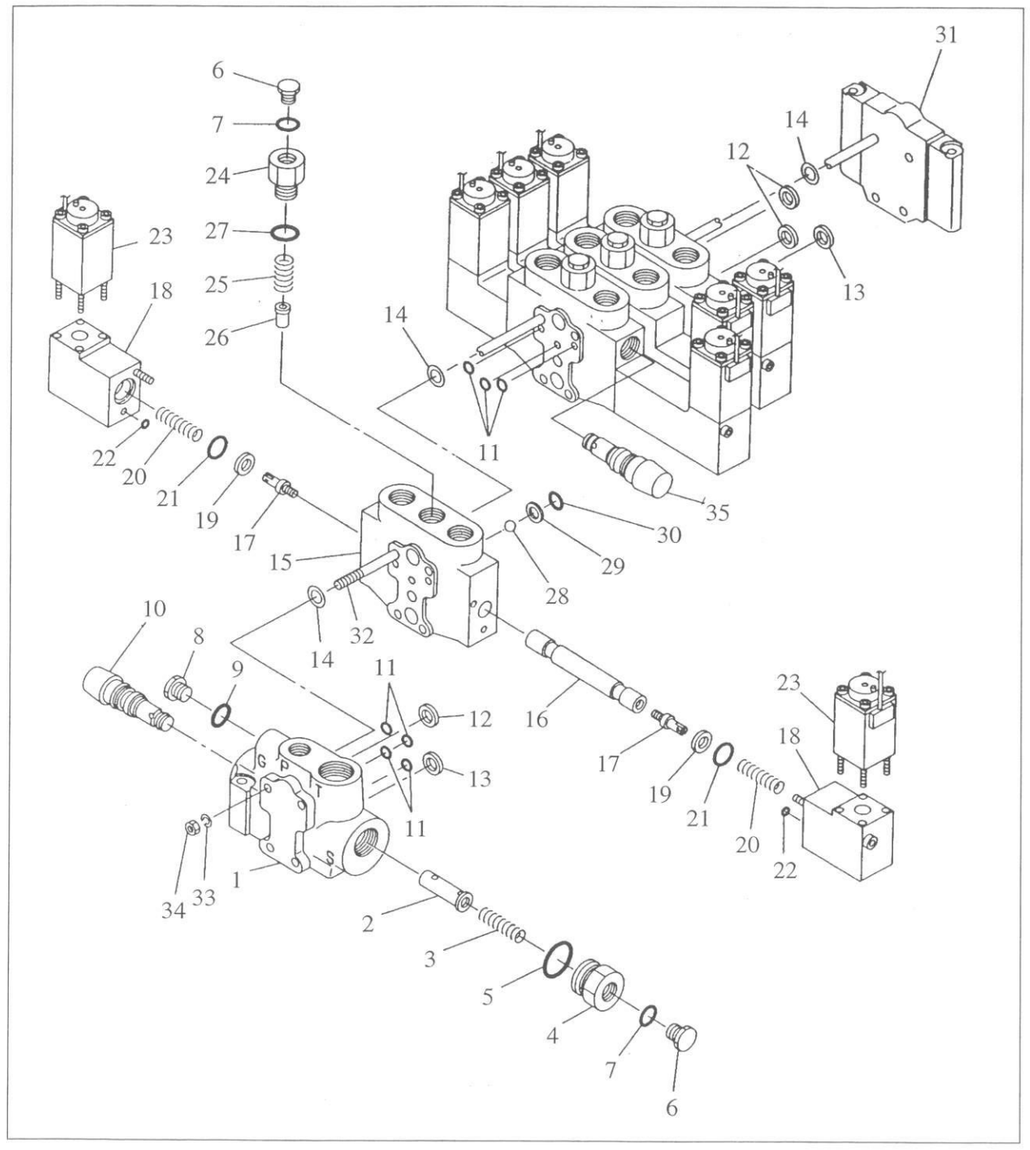
On the other hand, when the main control valve is operated by the control switches located at the lower control box, the valve is operated as a conventional solenoid valve.

* Rated pressure.
  - at P, A, B ports : 250 kg/cm². (3,555 PSI)
  - at T port : 10 kg/cm². (140 PSI)
* Solenoid.
  - Rated voltage : DC 24 V
  - Rated current : 650 mA
  - Resistance : 30 Ω

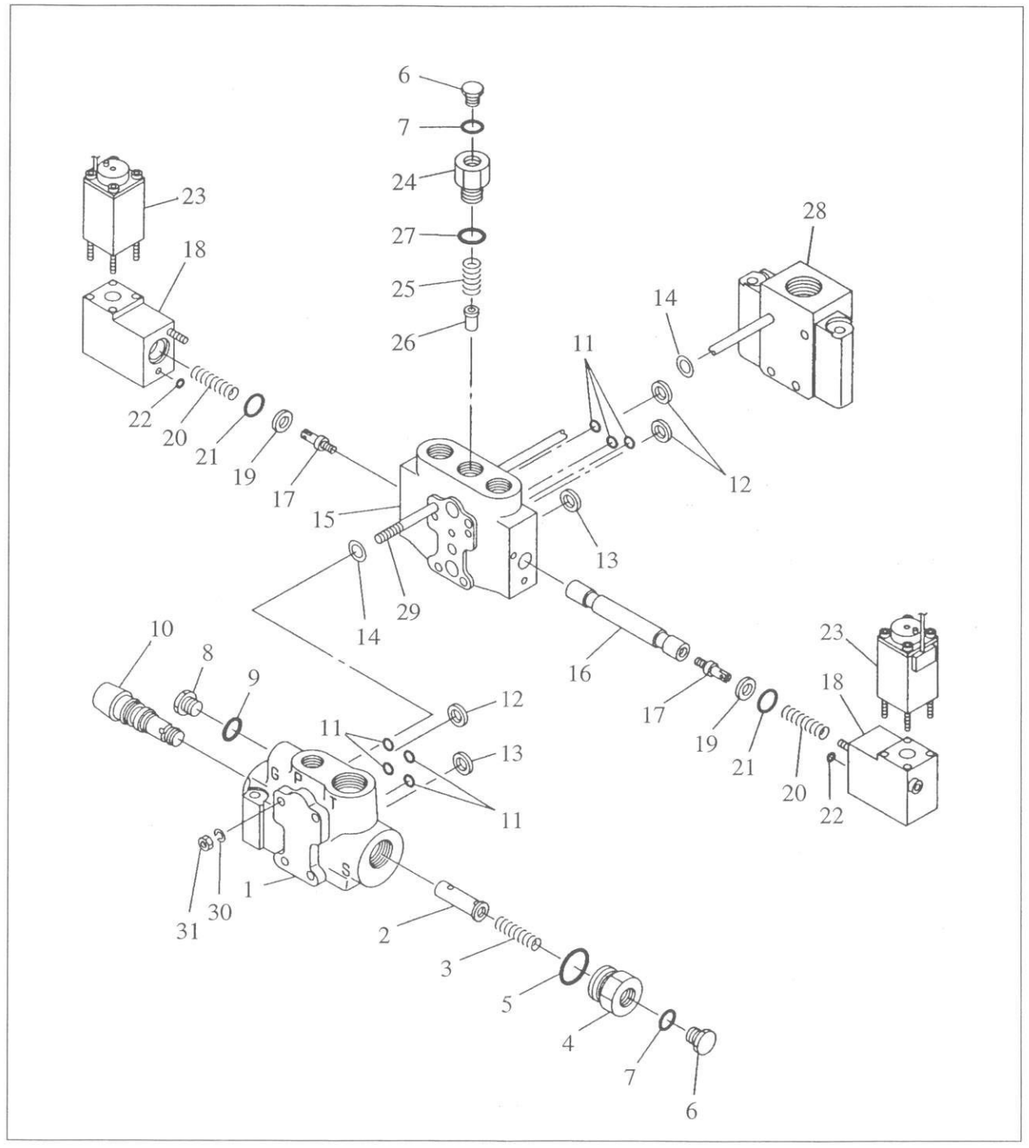


1. Illustrations

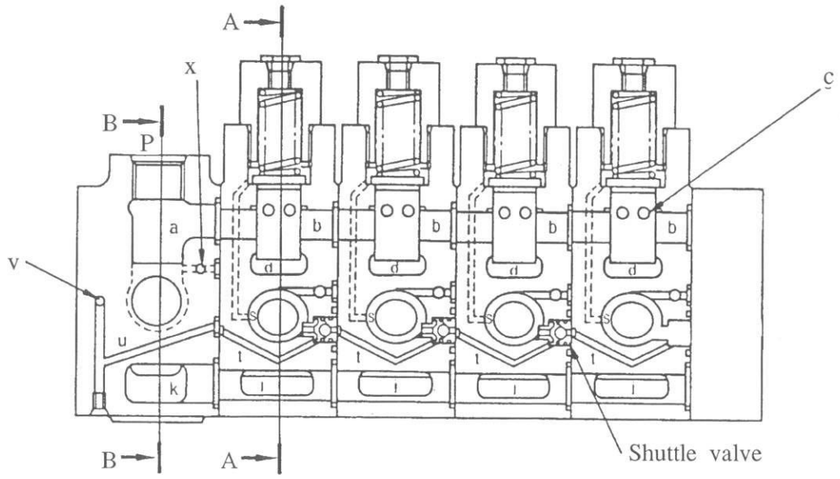
Main control valve NO.1(302-05214)

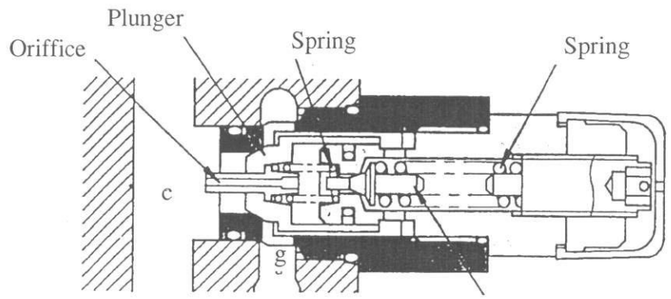


Main control valve NO.2(302-05213)

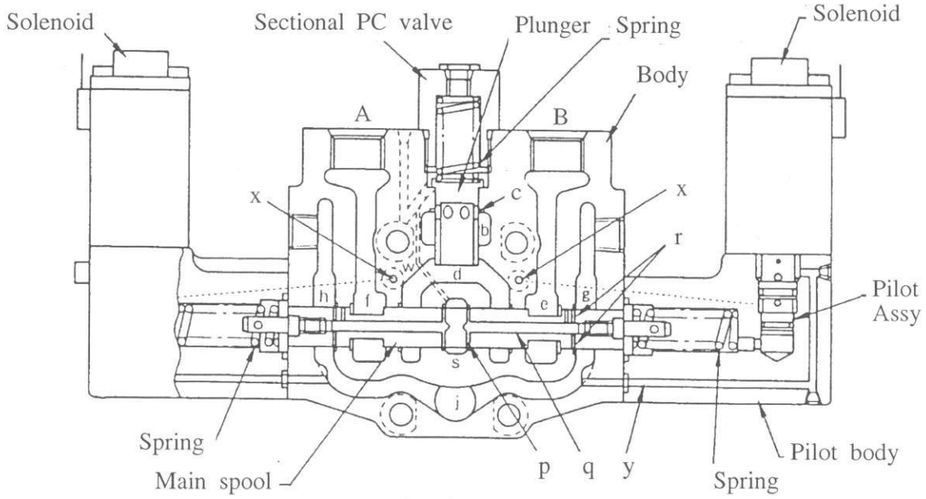


2. Sectional drawings

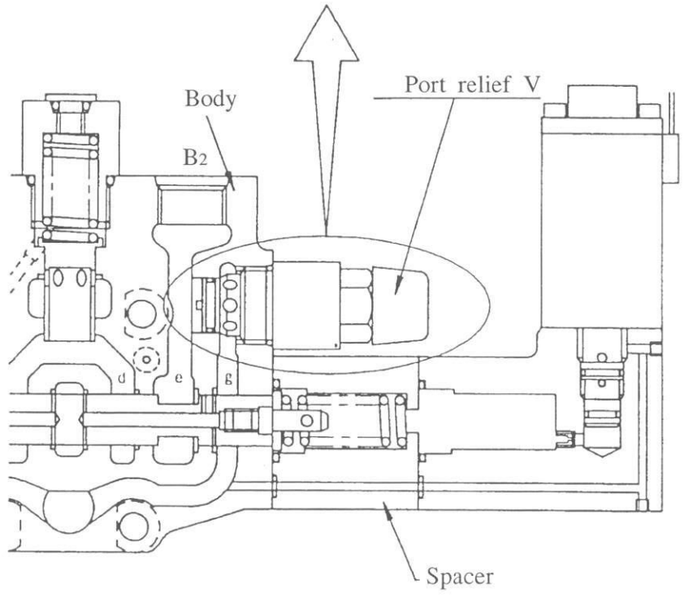


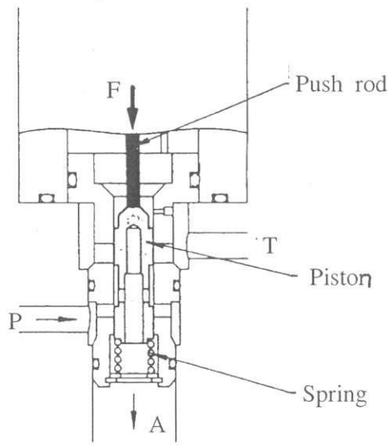


Detail of port relief V

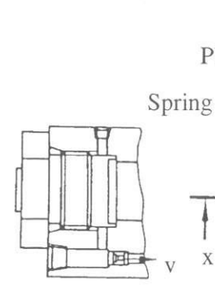


A - A section

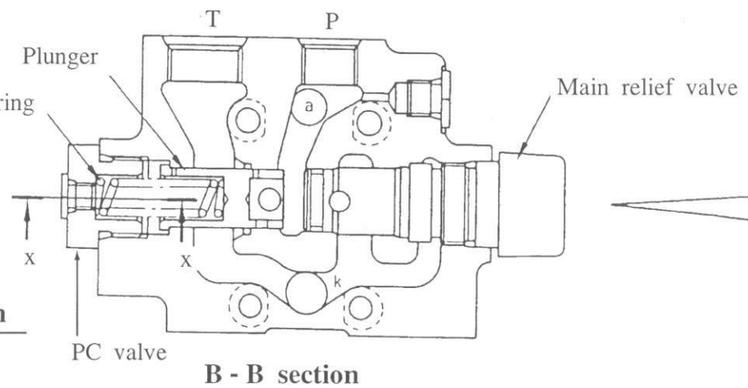




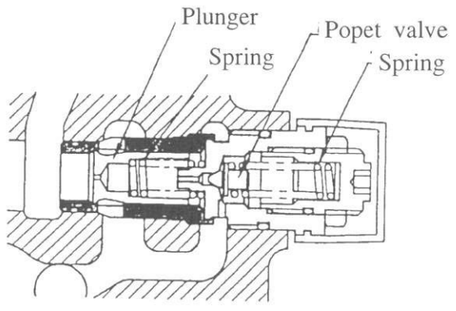
Detail of pilot valve



X - X section



B - B section



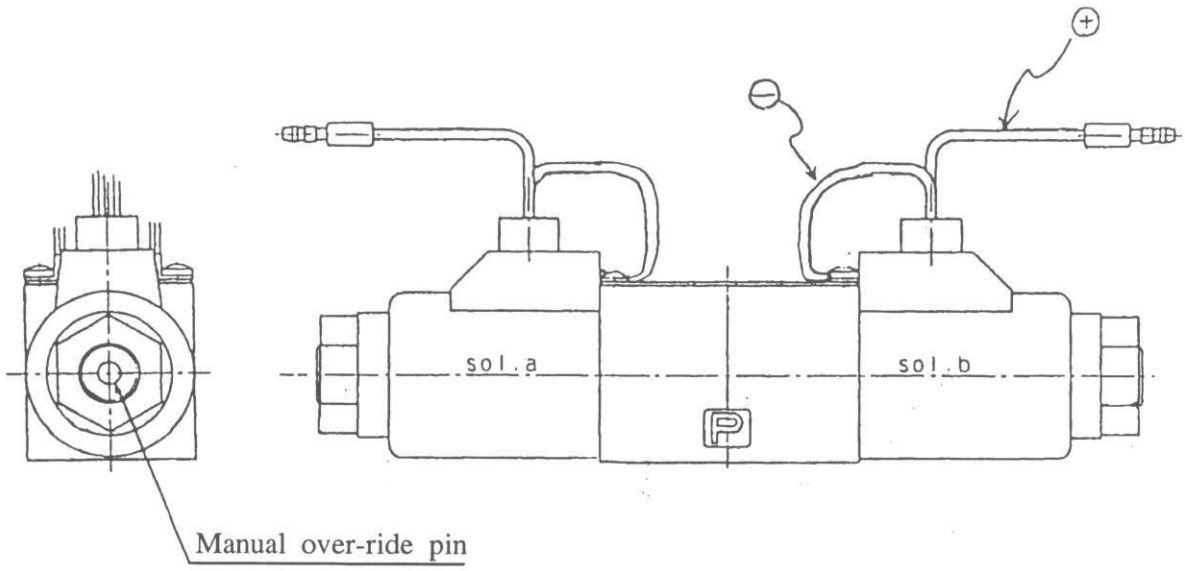
Detail of Main relief V

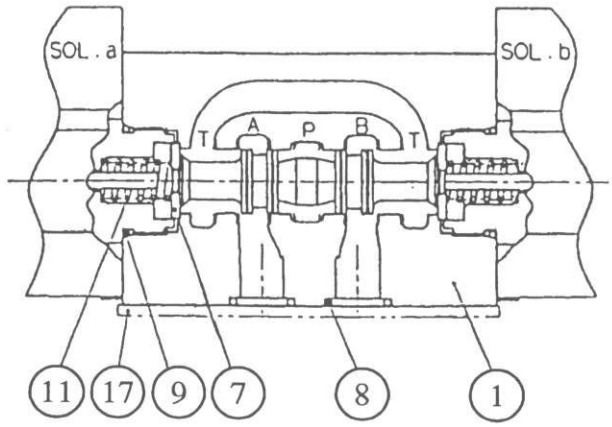
3. Trouble shooting

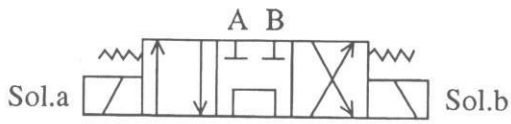
Trouble	Check point	Result	Cause	Remedy
Inoperative actuator or Operational speed of the actuator is too slow.	Check the "GAIN voltage" at "Valve control unit".	No "GAIN voltage" is obtained.	Defective "Potentio meter" or "Control switch".	Replace the "Potenio meter" or "Control switch".
			Inadequate adjustment of "GAIN voltage".	Readjust the "GAIN voltage" at the "Valve control unit".
			Defective "Valve control unit".	Replace the "Valve control unit".
			Defective electric wirings.	Repair the electric wirings.
		"GAIN voltage" is too low.	Battery voltage is too low.	Charge or replace the battery.
			Inadequate adjustment of "GAIN voltage".	Readjust the "GAIN voltage" at the "Valve control unit".
	In case the "GAIN voltage" is normal, press the "Manual over-ride pin" installed on "Solenoid".	Actuator is operative.	Defective solenoid.	Replace the solenoid.
			Sticked "Piston" in "Pilot valve" installed under the "Solenoid".	Clean or replace the "Pilot valve".
		Actuator is not operative.	Sticked "Main spool" or "Valves" caused by contaminated hydraulic oil.	Clean the hydraulic system, and replace the hydraulic oil.
			"PC valve" is sticked and the unloading pressure is not obtained.	Clean or replace the "PC valve".
			Sticked "Pilot valve" installed under the "Solenoid".	Clean or replace the "Pilot valve".
			Sticked "Main spool".	Clean or replace the "Main control valve Assy".
			Sticked "Sectional PC valve".	Clean or replace the "Sectional PC valve".
			Defective "Springs".	Replace the "Springs".
			Clogged "Orifice".	Clean or replace the "Orifice".
			Distorted "Valve body" caused by improper mounting.	Remount or replace the "Main control valve".
Operational speed is too fast, when operating control lever slightly.	Check the "NULL voltage" at "Valve control unit".	"NULL voltage" is too high.	Inadequate adjustment of "NULL voltage".	Readjust the "NULL voltage" at the "Valve control unit".
Actuator haunts, after overhauling hydraulic system.			Air is in the hydraulic system.	Bleed air by operating actuator several times".
				Loosen the "Air bleed screw" installed on "Solenoid", and bleed air.
Actuator is powerless.	Check the "MAX. pressure".	"MAX. pressure" is too low.	Improper adjustment of "Relief valve".	Readjust the "Relief valve".
			"PC valve" is loose.	Tighten the "PC valve".
Erratic hydraulic pressure, or higher pressure is not achieved.	Disassemble the "Relief & PC valves".		Defective spring.	Replace the spring.
			Worn out "Poppet" or "Poppet seat".	Replace the "Relief" or "PC valve".
			Sticked "Plunger".	Clean or replace the "Relief" or "PC valve".

PLATFORM SWING SOLENOID VALVE

The valve is operated by a solenoid, and is controled electrically by the platform swing switch located on the upper control box.





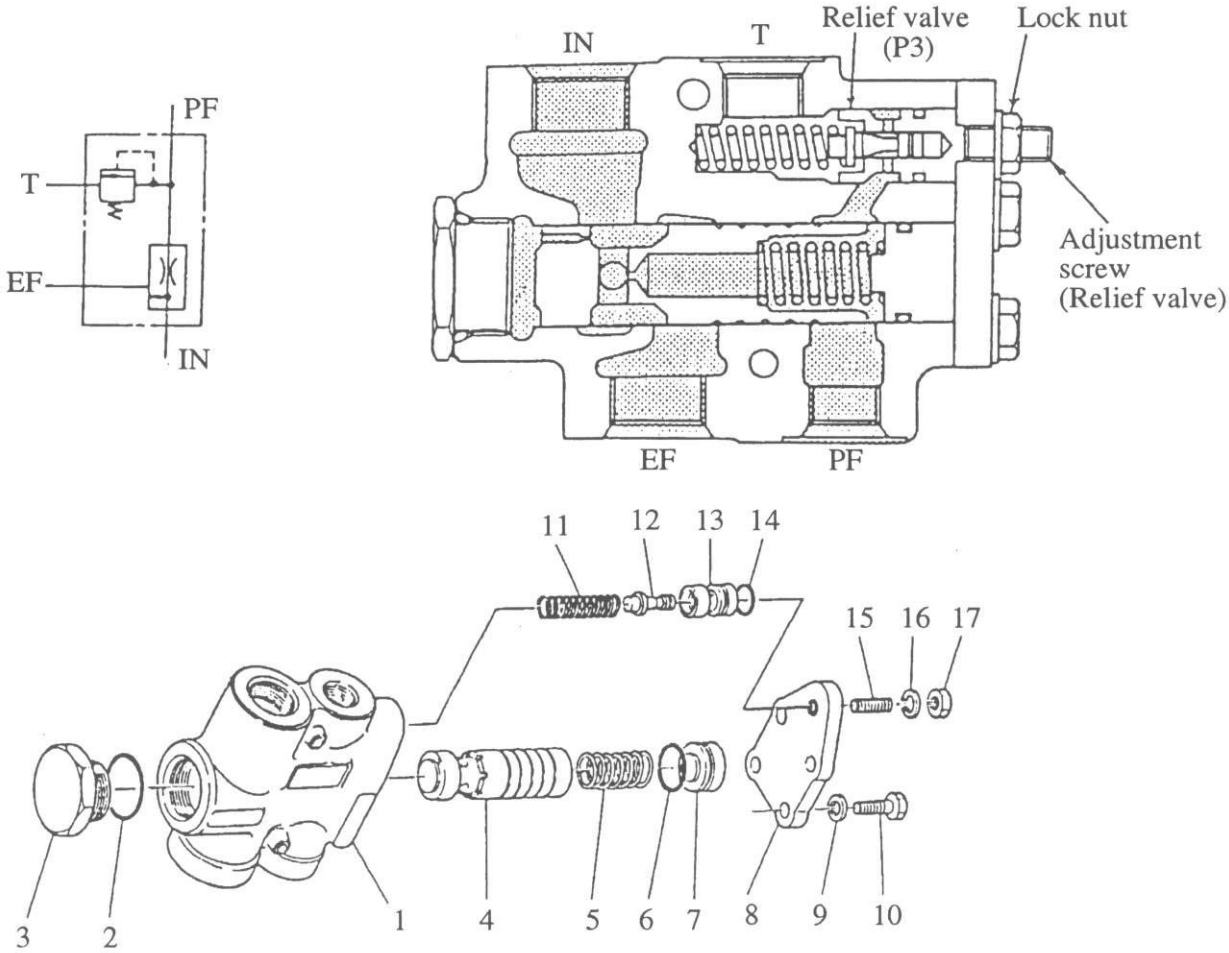


PRIORITY VALVE

The priority valve maintains the flow which comes out of the "PF port" at the constant level, regardless of any variation to the volume of pump discharge. While the rest of the pump discharge volume is by-passed through the "EF port". The relief valve incorporated in the valve is for limiting the maximum hydraulic pressure for the "PF port".

For SR-182, the flow and the maximum hydraulic pressure of the Platform swing system are both limited by the priority valve. This is because the system is supplied with hydraulic power through the "PF port".

* Rated pressure : 140 kg/㎠. (2,000 PSI)
* Constant flow : 8 liters/min. (2.1 gals/min)
  (at PF port)
* Relief valves (P3)
  Adjustable pressure range : 90~140 kg/㎠. (1,280~2,000 PSI)
  Pre-set pressure : 140 kg/㎠. (2,000 PSI)

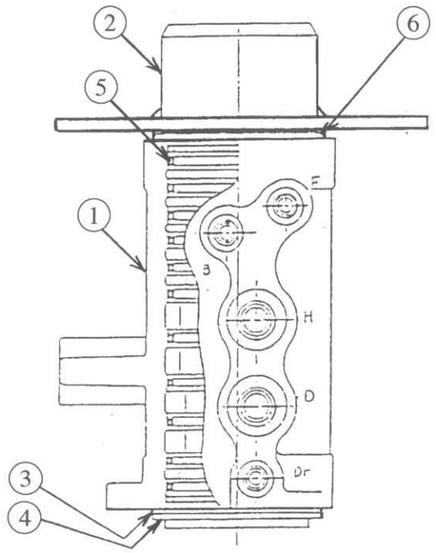


NOTE : Refer to ADJUSTMENT SECTION to adjust the Relief valve.

SWIVEL JOINT

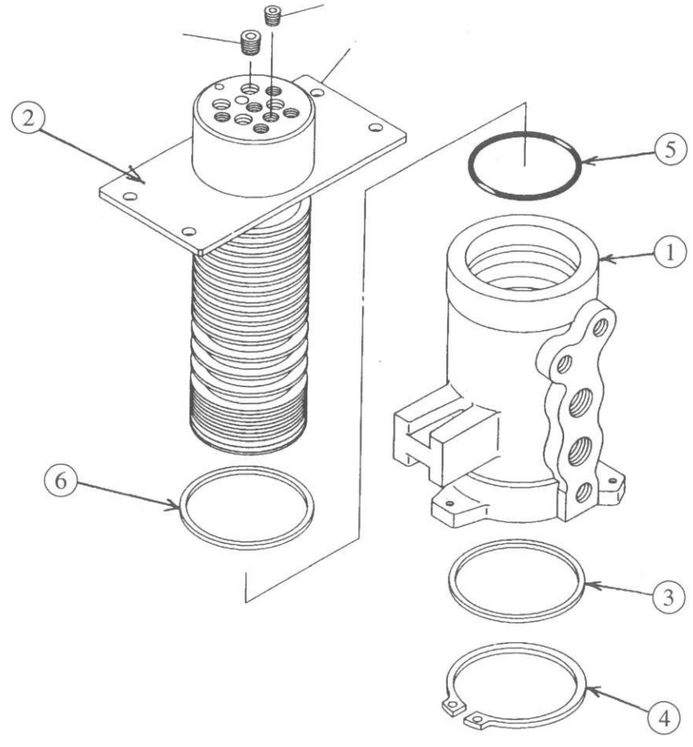
The swivel joint is installed at the rotation center of the turntable to supply pressurized oil to the "Travel motors".

Fig:1



1	Case
2	Shaft
3	Spacer
4	Snap ring
5	O ring
6	Spacer

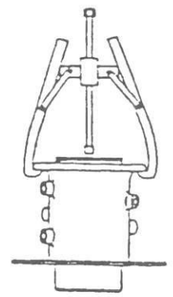
Fig:2



Disassembly

1. Remove snap ring ④ and spacer ③.
2. Press out the shaft ② from the case ① using a hydraulic press.
   (or pull the shaft ② out of the case ① using gear puller as shown in Fig:3.)

Fig:3



3. Remove the spacer ⑥ from the shaft.
4. Remove all of the O rings from the shaft.

Inspection

1. Check case ① and shaft ② for excessive wear, cracks, scorings, and any other damage.
2. Check the clearance between case ① and shaft ②.
   -If the clearance exceeds the limit, replace the shaft or the case.
   Limit of clearance : 0.4mm (0.016").
3. Check each groove on case ① and shaft ② for ridges, and sharp edges.
   -Ridges and sharp edges should be removed before installing O rings, as such faults may cause damage to the O rings.

Assembly

Assemble in the reverse order of disassembly, paying particular attention to the following points.

-Do not reuse O rings.

-Apply a slight amount of grease to O rings before installation.

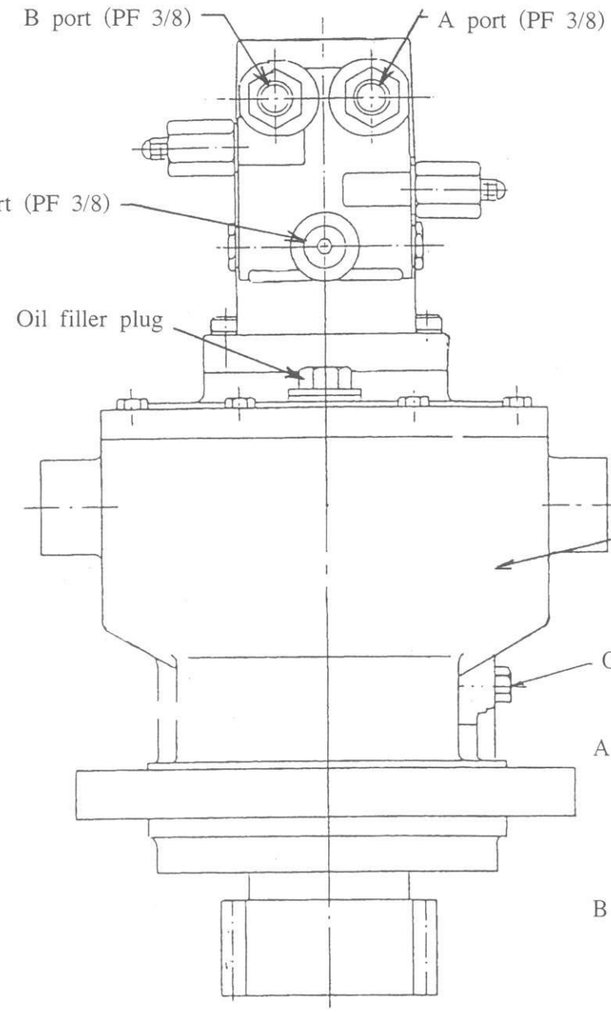
ROTATION MOTOR UNIT

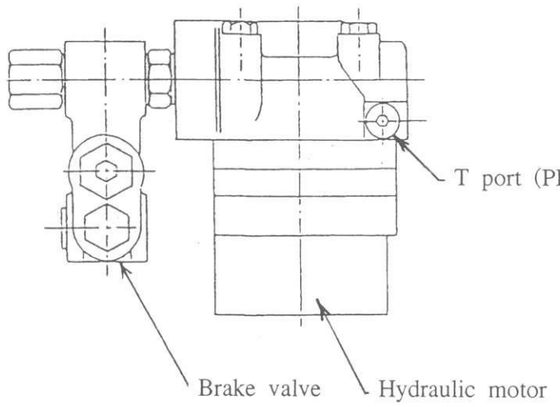
The unit consists of such major components as "Hydraulic motor" "Brake valve" and "Reduction gear box" as shown in the figure below.

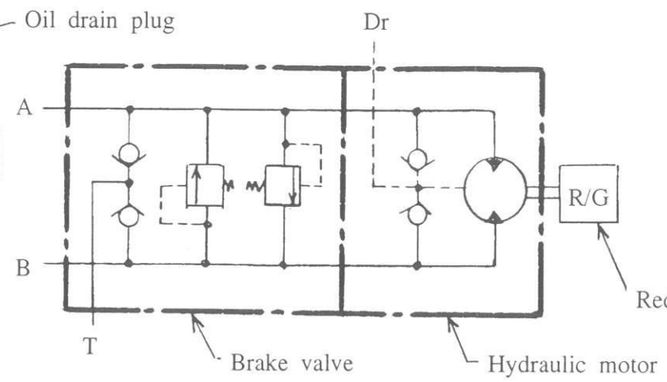
Hydraulic pump
- Type ---------- Orbit type
- Discharge volume ---------- 195cc/rev (11.9 in^3/rev)

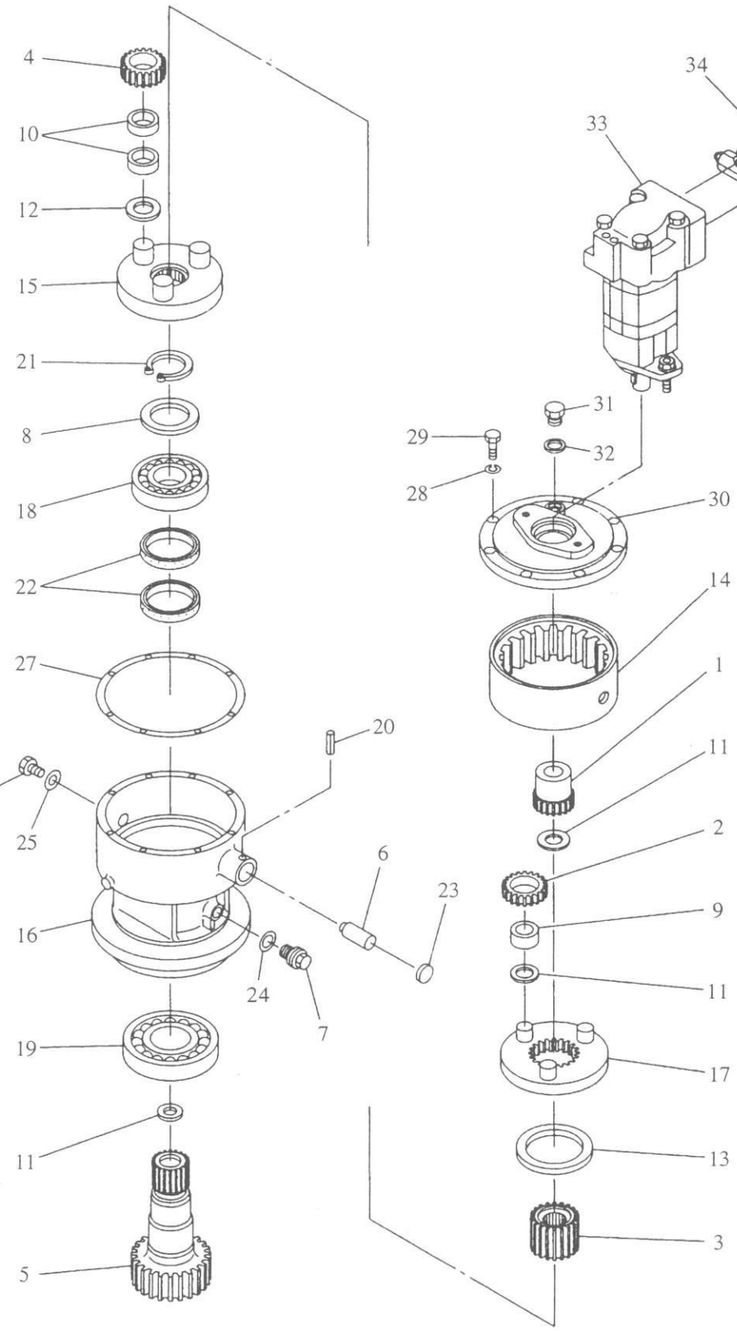
Brake valve
- Preset pressure ---------- 60kgf/cm^2 (850 PSI)

Reduction gear box
- Type ---------- Planetary gear
- Reduction ratio ---------- 1/16.6
- Gear oil ---------- Shell Omala oil 460 (1.1 liters, 0.3 gals)

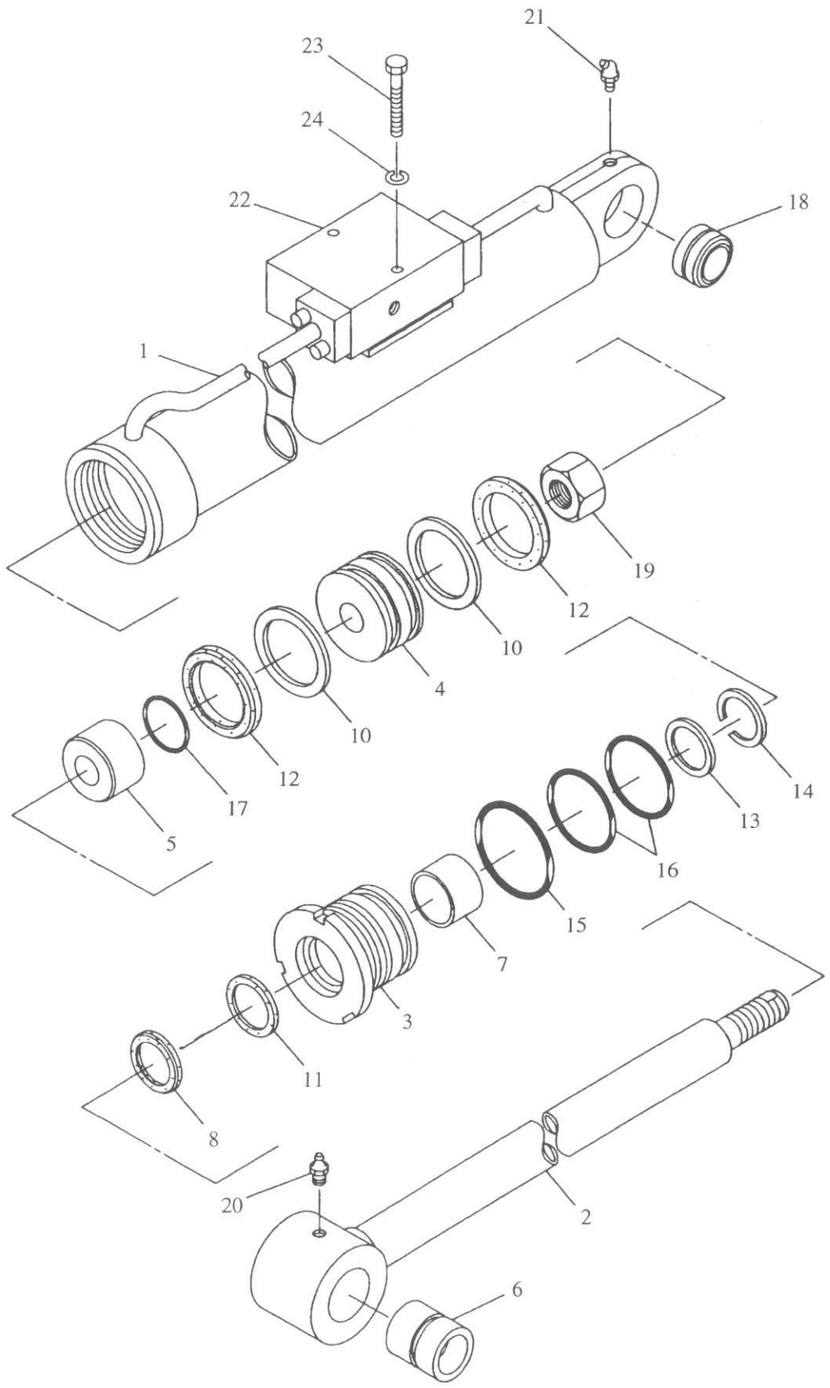


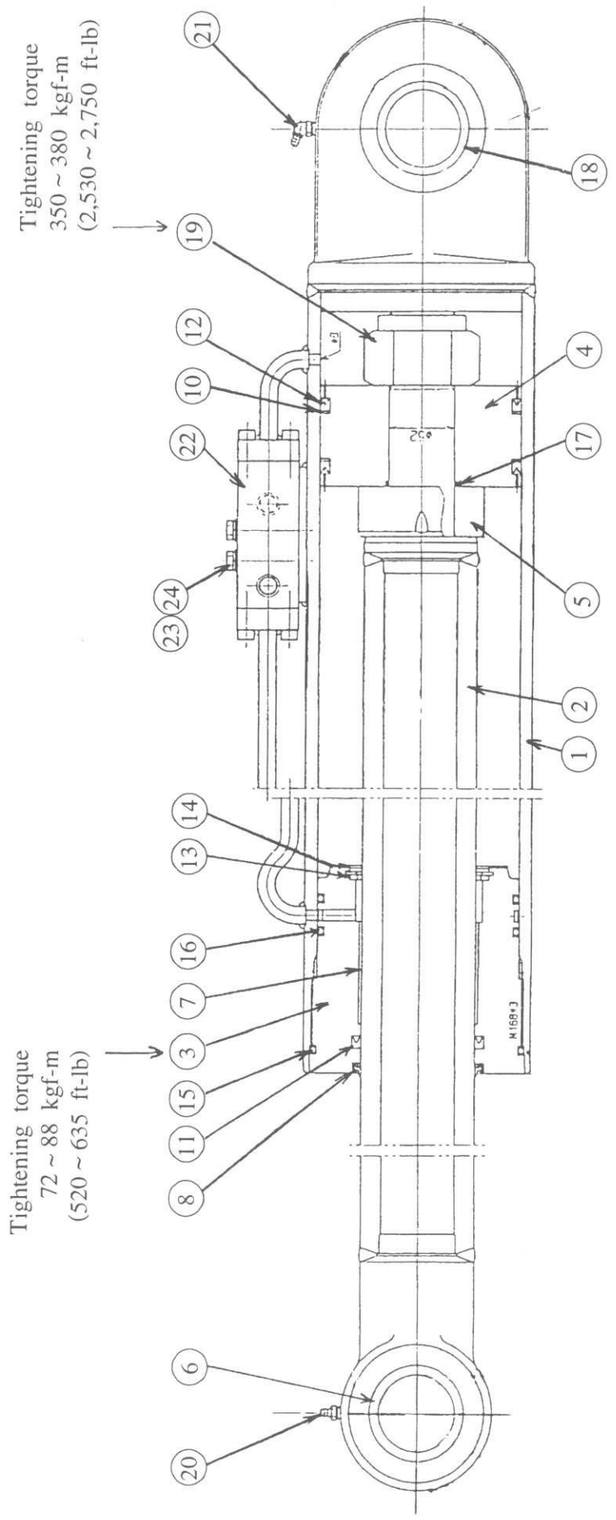






ELEVATION CYLINDER

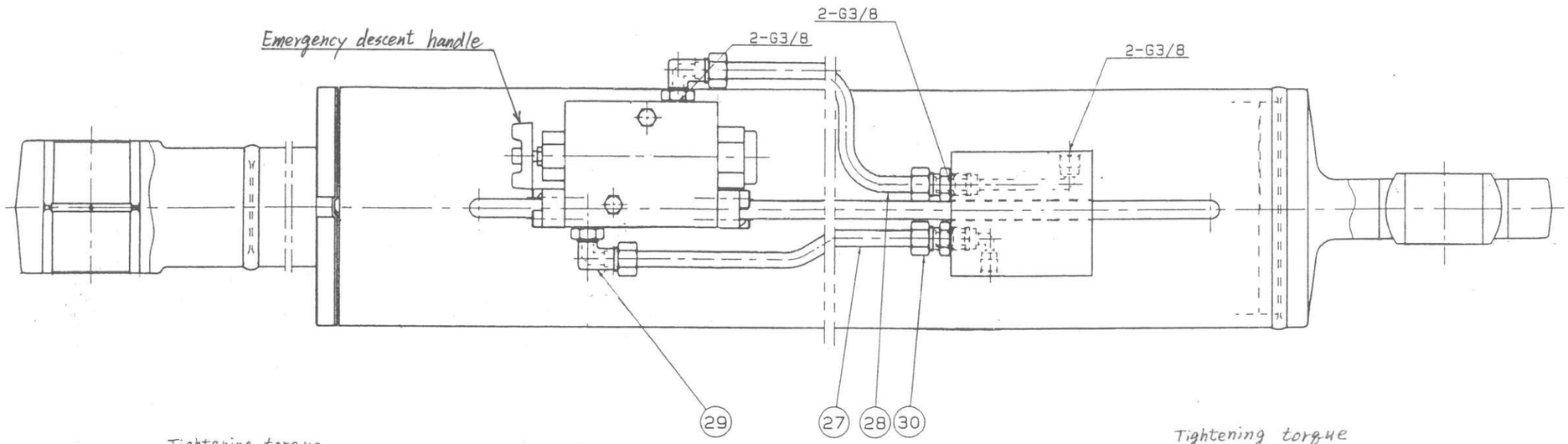


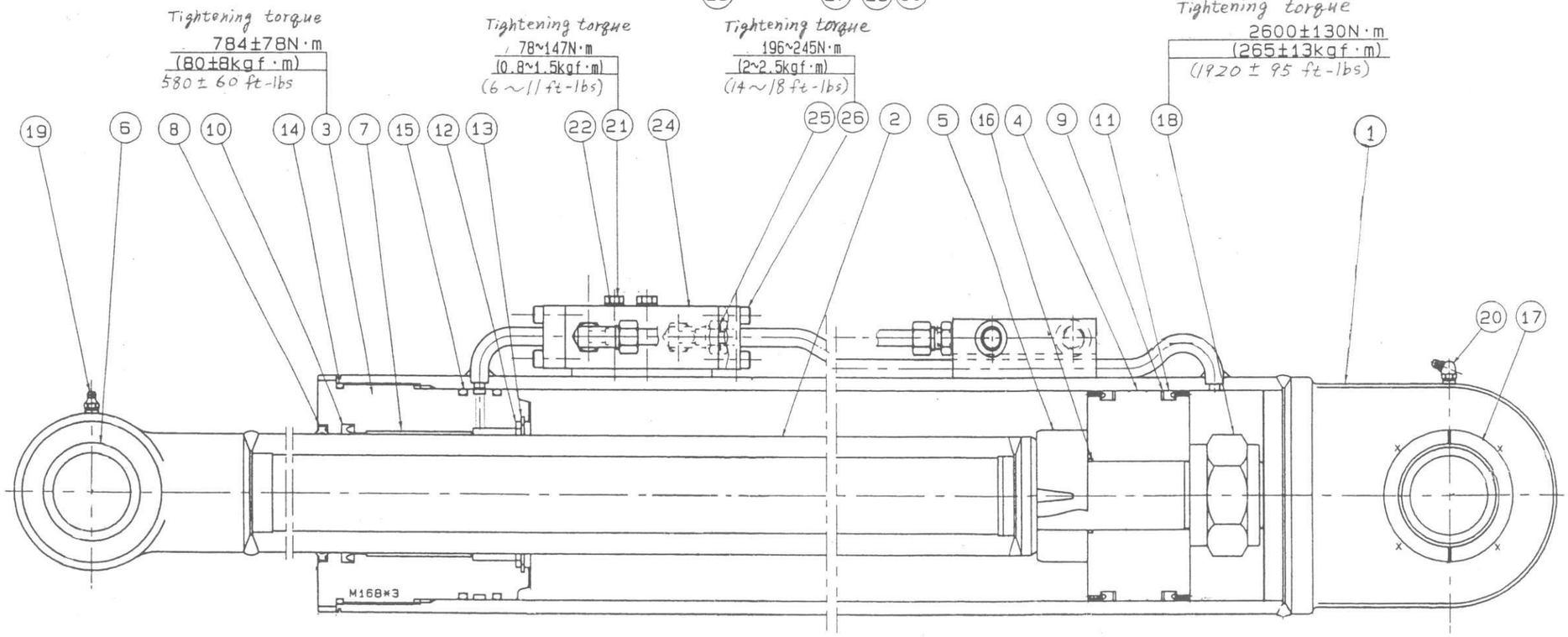


1	Cylinder tube	9	———	17	O ring
2	Piston rod	10	Backup ring	18	Spherical bushing
3	Cylinder head	11	U ring	19	Self-lock nut
4	Piston	12	U ring	20	Grease fitting
5	Cushion collar	13	Cushion ring	21	Grease fitting
6	Bushing	14	Snap ring	22	Single holding valve
7	Bushing	15	O ring	23	Bolt
8	Dust seal	16	O ring	24	Spring washer

ELEVATION CYLINDER

With Emergency descent handle.





NO.	Description
1	Cylinder tube
2	Piston rod
3	Cylinder head
4	Piston
5	Cushion collar
6	Bushing
7	Bushing
8	Dust seal
9	Back-up ring
10	U-ring
11	U-ring
12	Cushion ring
13	Snap ring
14	O-ring (G-160)
15	O-ring (P-150)
16	O-ring (G-50)
17	Spherical bearing
18	Self-lock nut
19	Grease fitting
20	Grease fitting
21	Bolt
22	Spring washer
23	———
24	Single holding valve
25	O-ring (P-15)
26	Bolt
27	Pipe
28	Pipe
29	Connector
30	Connector

SINGLE HOLDING VALVE (for Elevation cylinder)

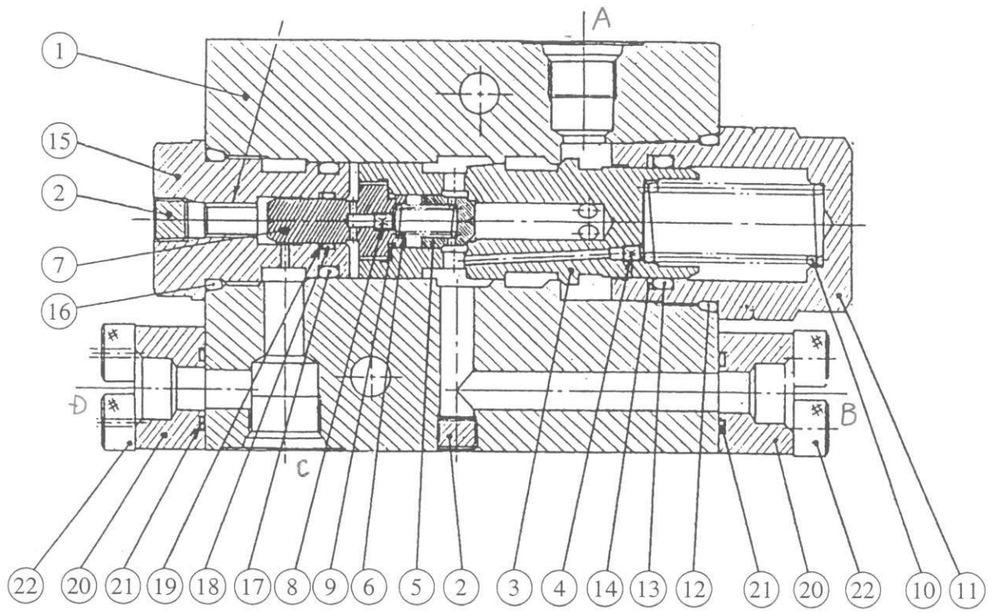
The "Single holding valve" is mounted on the "Elevation cylinder" to prevent "Natural descent" of the cylinder caused by the gravities of boom and platform.

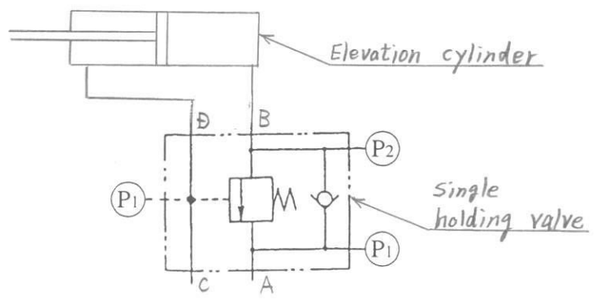
NOTE : "Natural descent" of cylinder.

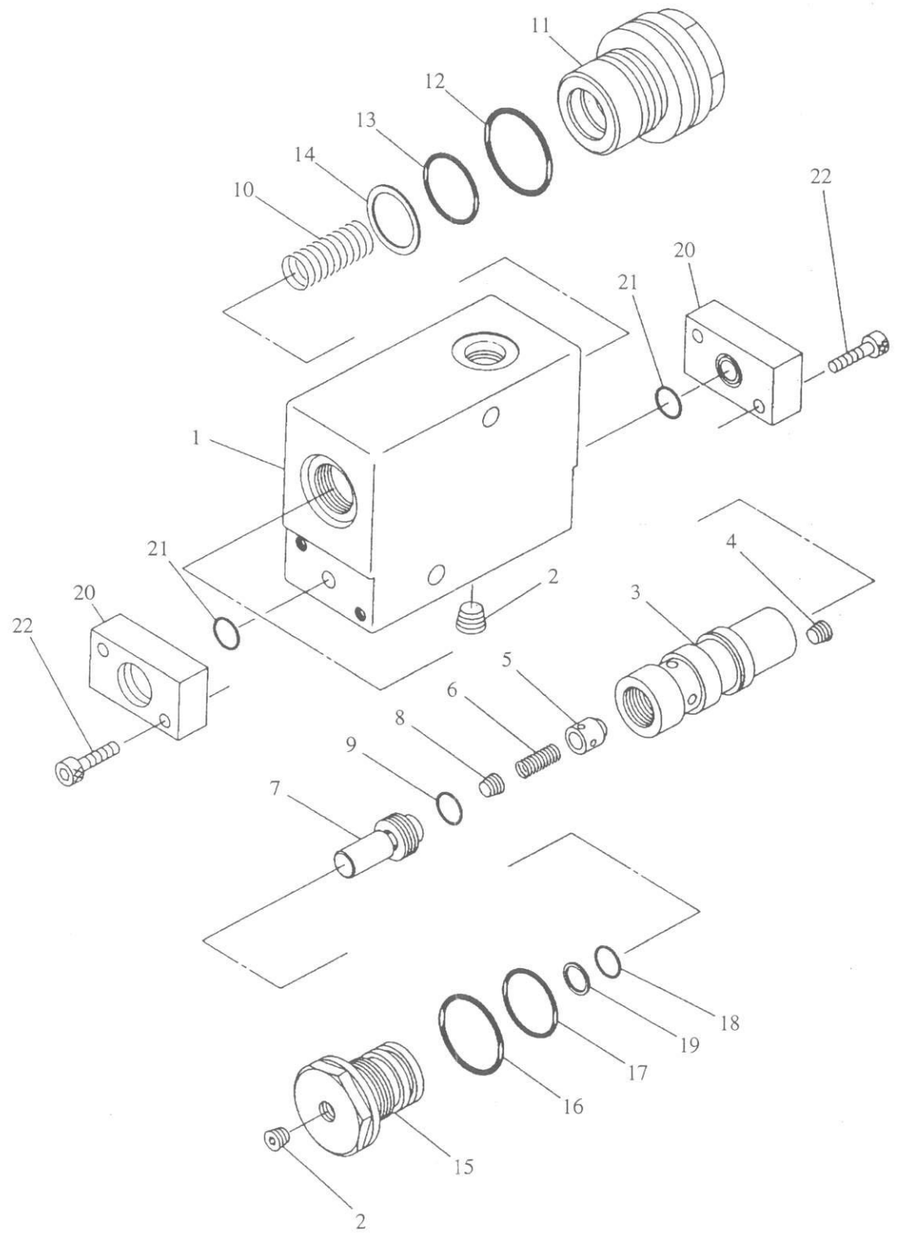
The phenomenon that the hydraulic cylinder is extended or retracted due to the external force excerted.

Rated pressure : 210 kg/㎠. (3,000 PSI)

Rated flow : 80 liters/min. (21.1 gals/min)







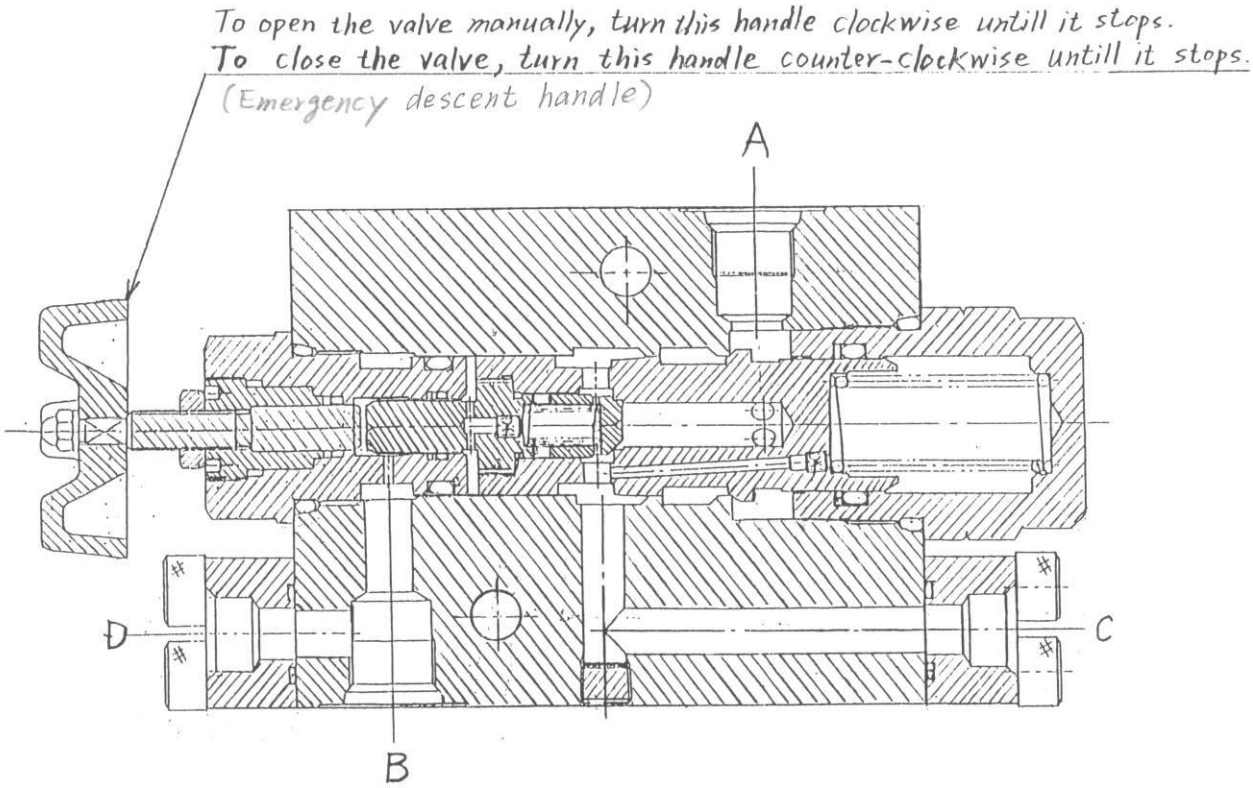
SINGLE HOLDING VALVE (for Elevation cylinder)

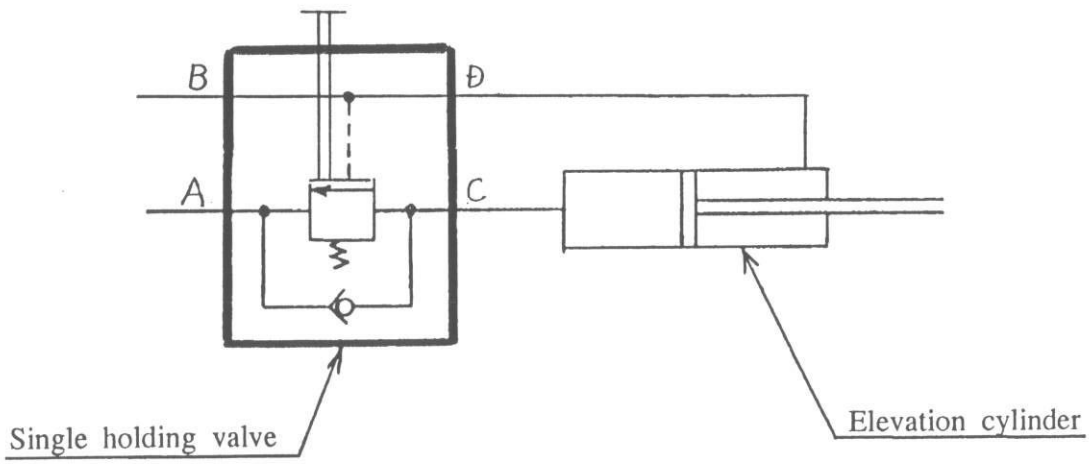
With Emergency descent handle

The Single holding valve is mounted on the Elevation cylinder to prevent any "Natural descent" of the cylinder caused by the gravities of the boom and the platform.

NOTE : Natural descent

This phenomenon causes the hydraulic cylinder to be extended or retracted due to external forces.



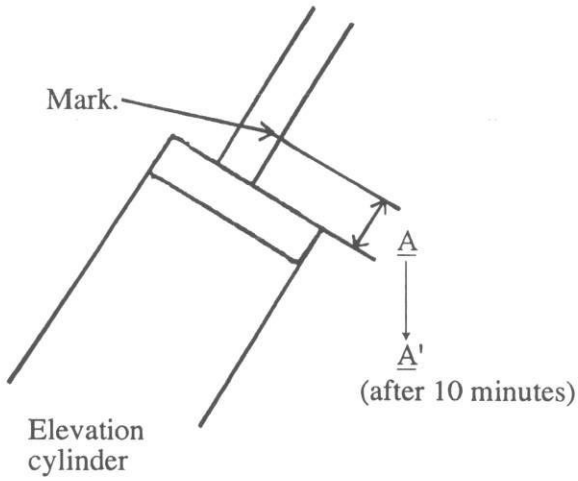


Inspection procedures

1. Check the external oil leakage thoroughly.
2. Check the internal oil leakage, using the following steps.
   (Internal oil leakage can be inspected by checking the "Natural descent" of the elevation cylinder.)
   1) Park the machine on an area of firm level ground.
   2) Start the machine, and position the boom, so that the boom angle is set at around 45degrees.
   3) Stop the engine, then put a mark on the piston rod of elevation cylinder as shown in Fig : 2.

   Caution : Take care when marking the piston rod so as not to damage it.

Fig:2



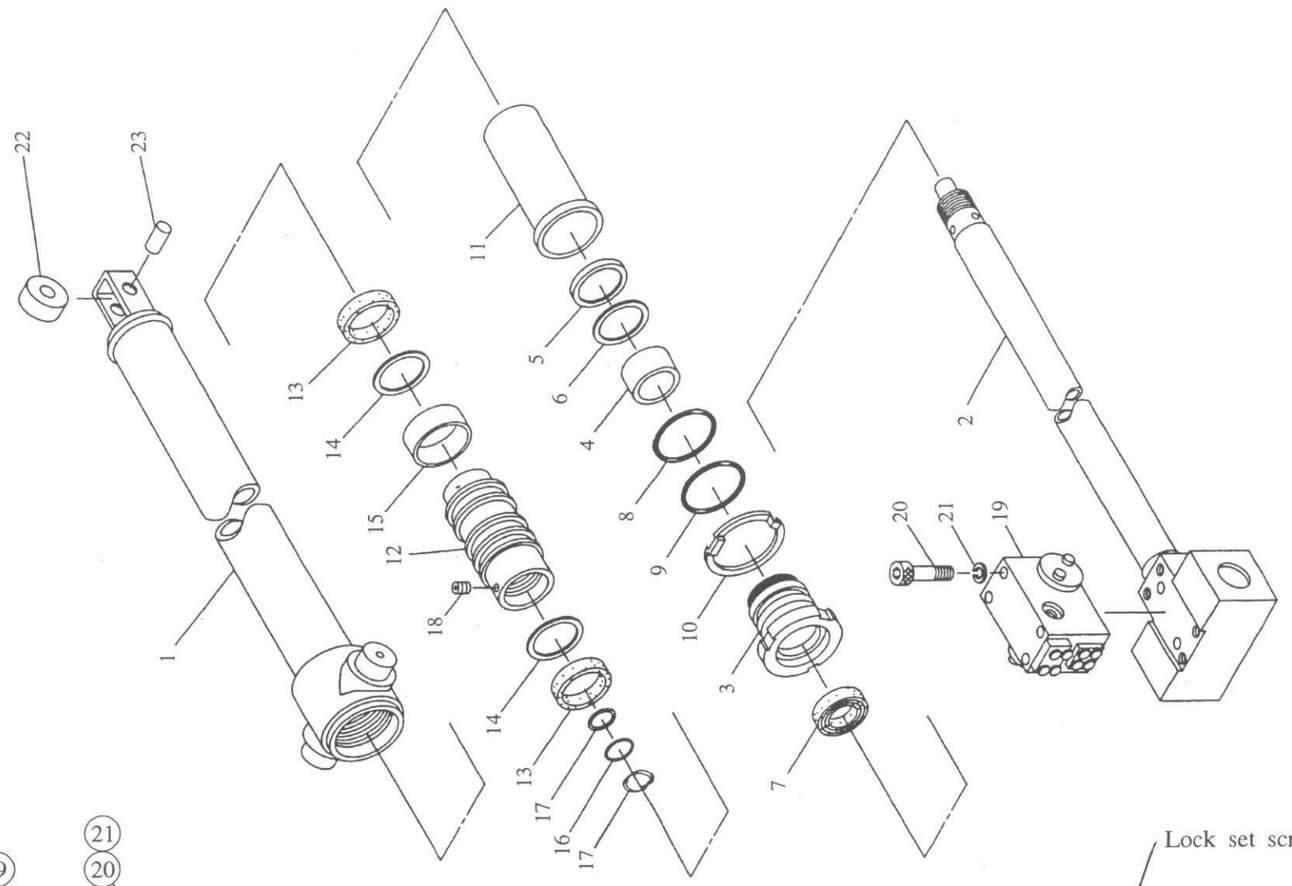
   4) After marking the rod, measure the dimension A (as shown in Fig : 2), then leave it for 10 minutes.
   5) After 10 minutes, measure the dimension A' between the mark made in step 3 and the edge of cylinder tube as shown in Fig : 2.
      A—A'=Natural descent of elevation cylinder.
      Serviceable limit·····2mm/10minutes. (0.08"/10min)
   6) If the "Natural descent" exceeds the limit (2mm/10min), check the single holding valve and the elevation cylinder for internal oil leakage.

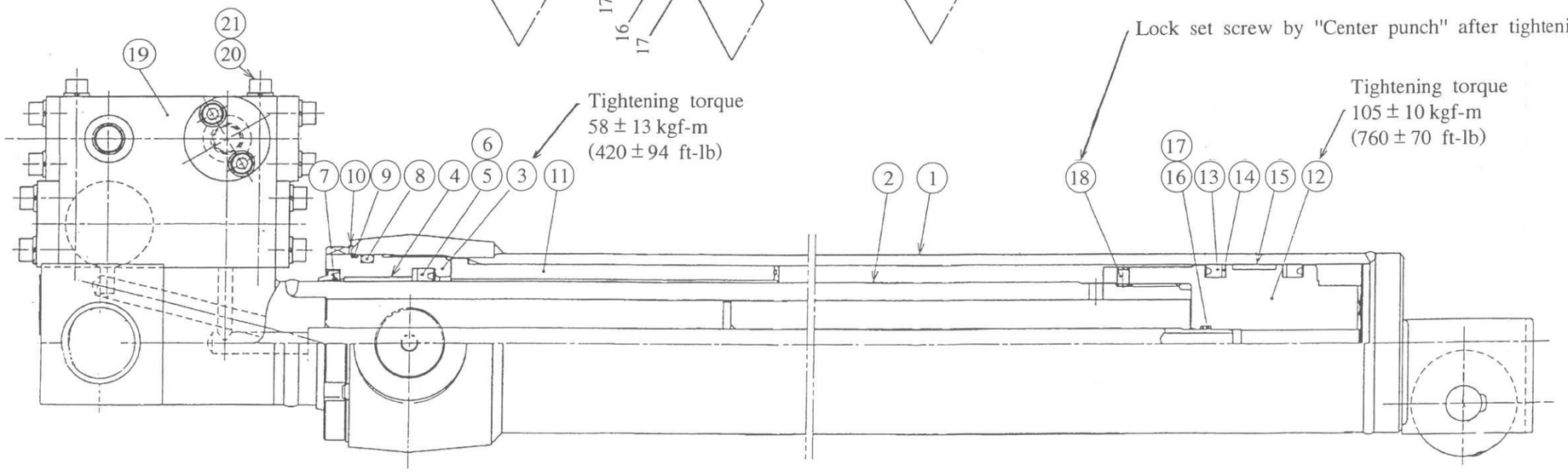
   NOTE : To indentify which has internal oil leakage (the single holding valve or the elevation cylinder), reter to the following steps.

1) Under the condition that the elevation cylinder is loaded with the gravities of boom and platform, disconnect the hydraulic hose connected to port—A at the single holding valve.
2) If hydraulic oil drips continuously from port—A of the single holding valve, this indicates internal oil leakage from the single holding valve.
However, if the oil-drips stop after a while, this indicates that elevation cylinder has internal oil leakage.

Caution : Before disconnecting the hydraulic hose, make sure to support the boom using such as crane to prevent the boom from unexpected descent.

EXTENSION CYLINDER



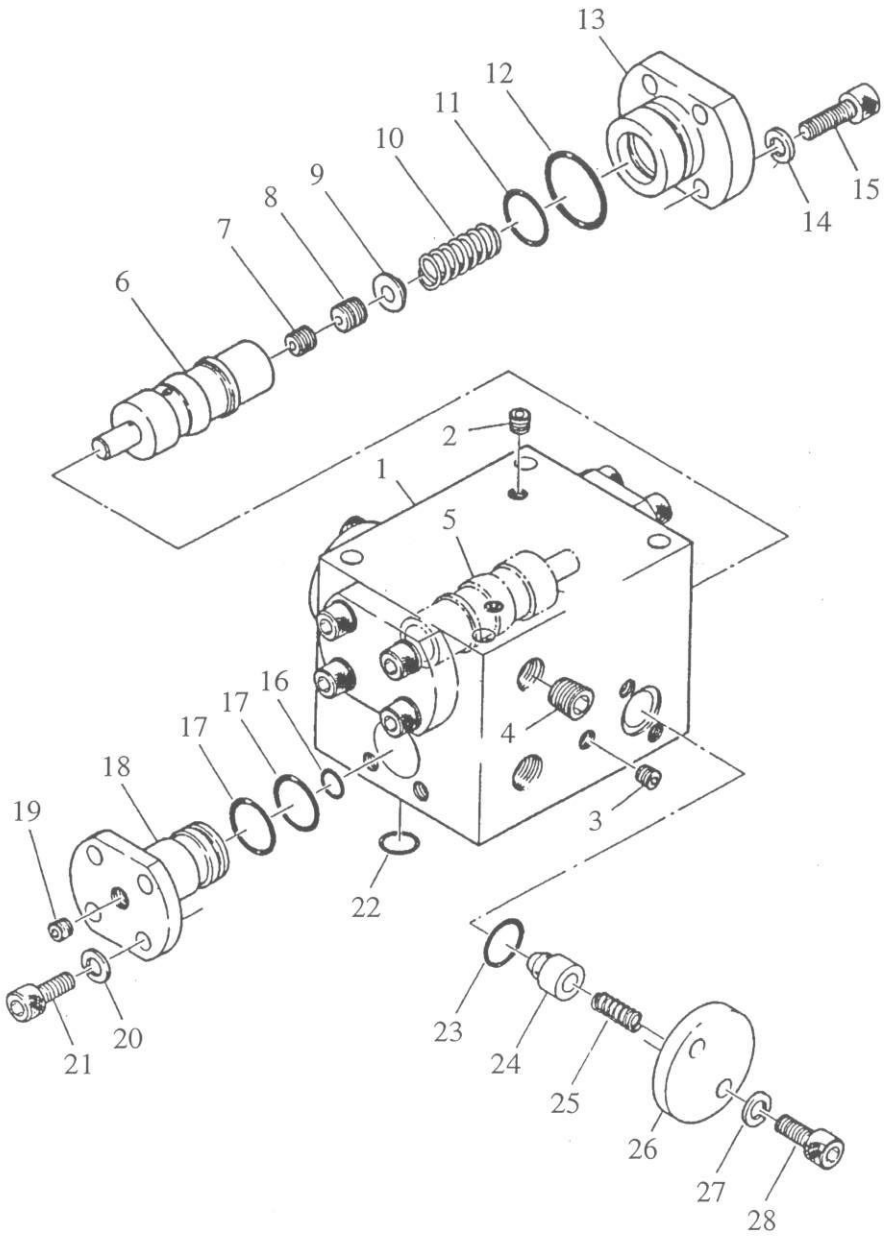


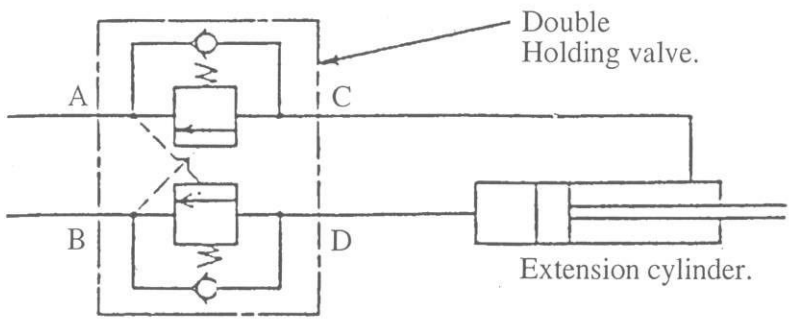
1	Cylinder tube
2	Piston rod
3	Cylinder head
4	Bushing
5	U ring
6	Back-up ring
7	Dust seal
8	O ring
9	O ring
10	Lock plate
11	Spacer
12	Piston
13	U ring
14	Back-up ring
15	Wear ring
16	O ring
17	Back-up ring
18	Set screw
19	Double holding valve
20	Bolt
21	Spring washer

DOUBLE HOLDING VALVE for Extension cylinder

The double holding valve is mounted on the Extension cylinder, since the cylinder tends to extend or retract due to the gravities of boom and platform.

Fig:1

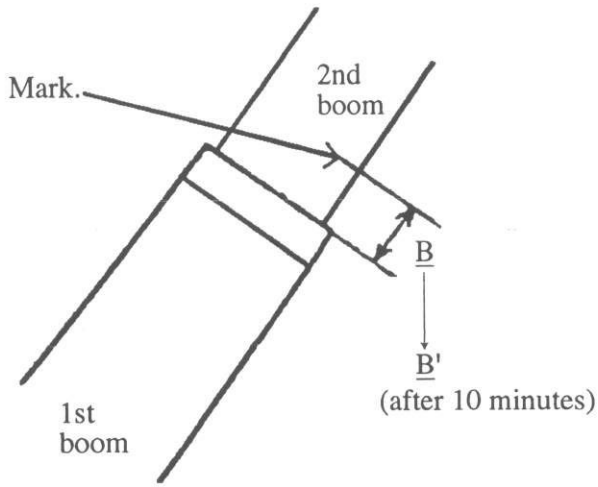




Inspection procedures

1. Check the external oil leakage thoroughly.
2. Check the internal oil leakage, using the following steps.
   (Internal oil leakage is inspected by checking the "Natural descent" of the Extension cylinder.)
   1) Park the machine on an area of firm level ground.
   2) Extend the boom by about 1 meter, and raise it fully.
   3) Stop the engine, and put a mark on the 2nd boom as shown in fig : 2 below.

Fig:2

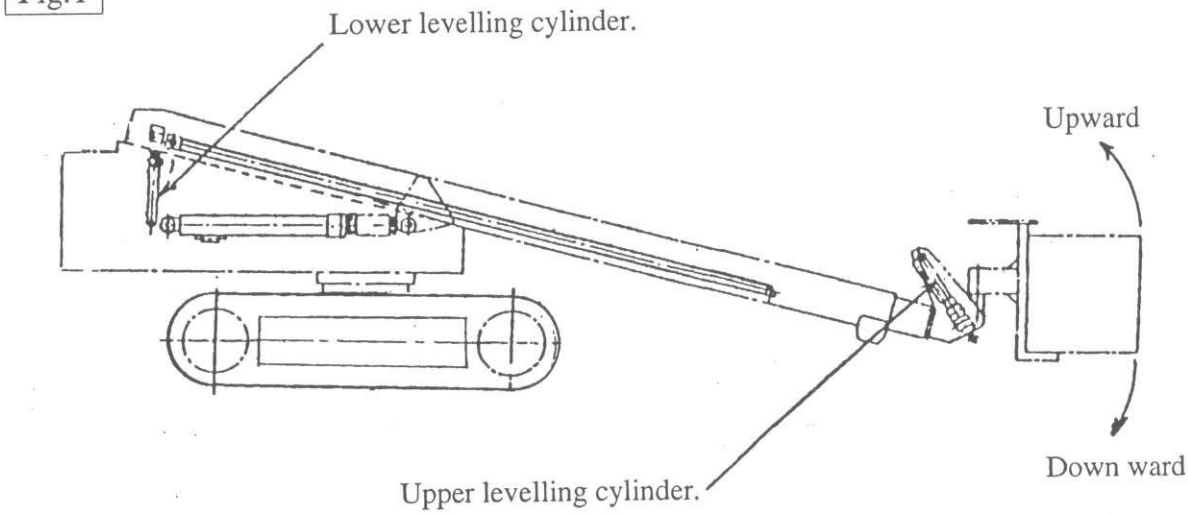


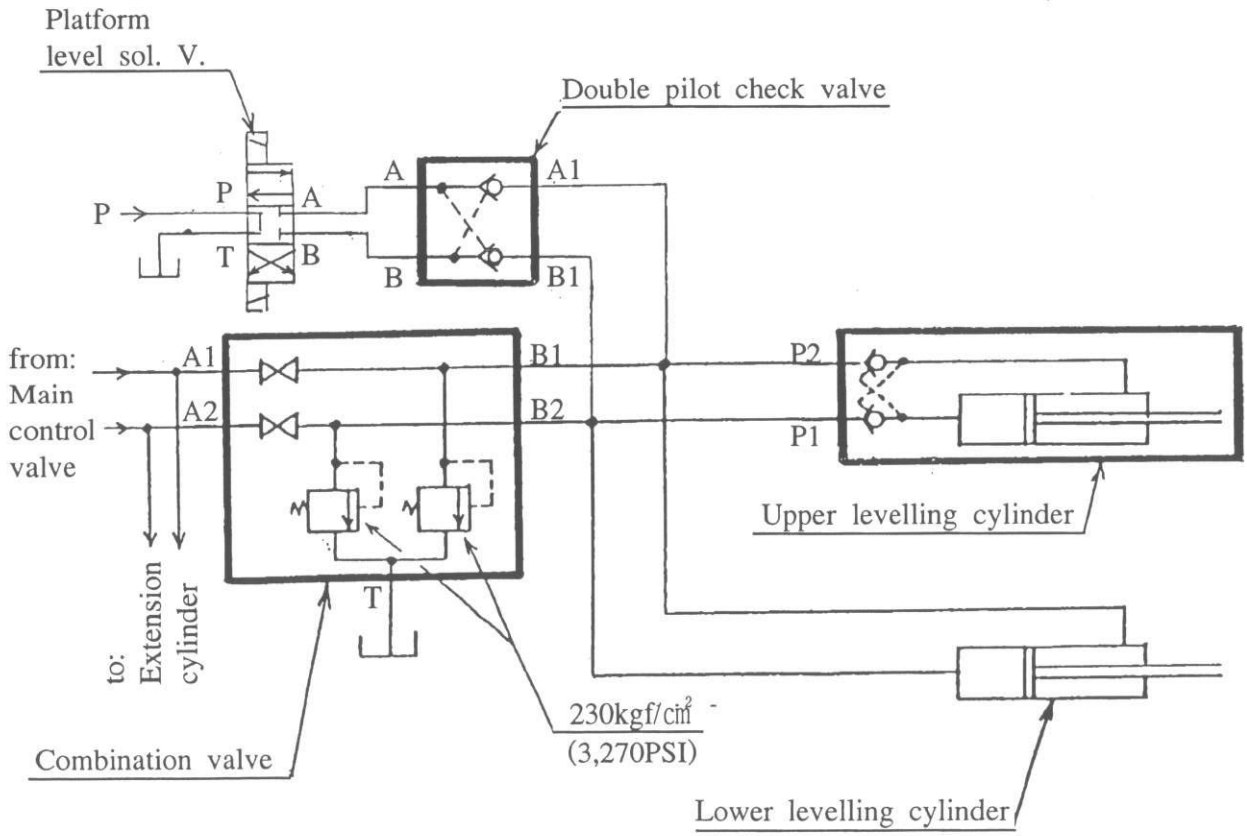
   4) Measure the Dimension B as shown in Fig : 2 above.
      then, leave it for 10 minutes.
   5) After 10 minutes, measure the Dimension B' as shown in Fig : 2.
      * B—B'=Natural descent of extension cylinder.
      * Serviceable limit·····2mm/10min. (0.08"/10min)
   6) If the "Natural descent" exceeds the Serviceable limit, further check the internal oil leakage of the Double holding valve or Extension cylinder by refering to the clause of SINGLE HOLDING VALVE. (for Elevation cylinder)

PLATFORM LEVELLING SYSTEM

The system maintains the platform at its level position automatically, regardless of boom's vertical movements.
It consists of Upper, and lower levelling cylinders, Double pilot check valve, Platform level solenoid valve, and Combination valve as shown in the figure below.

Fig:1





1. Note on function

Two levelling cylinders are in place, as shown in Fig : 1.
When the boom is lowered, the Lower levelling cylinder is retracted and the hydraulic oil in the bottom room of the cylinder flows into the bottom room of Upper levelling cylinder.
The sizes of the both levelling cylinders are exactly same.
Therefore, the Upper levelling cylinder extends simultaneously with the retraction of the Lower levelling cylinder.
Thus, the platform is balanced by the "Levelling cylinders" to maintain its level, as the boom is lowered.
When the boom is raised, the levelling cylinders work in an exactly opposite fashion to that described above.

2. Inspection procedures

1. Tilt of platform.
   Perform elevation and extension operations several times, and check that the platform always stays level.
   If the platform does not stay level, check the levelling system as follows.
   1) Thoroughly check the system for external oil leakage.
   2) Bleed air from the platform levelling system. (refer to the "Air bleeding procedures" on the next page.)
   3) Check the internal oil leakage of the "Combination valve".
      Make sure the two stop valves on the combination valve are closed firmly.
   4) Check the internal oil leakage of the "Double pilot check valve".
   5) Check the internal oil leakage of the "Upper and Lower levelling cylinders."

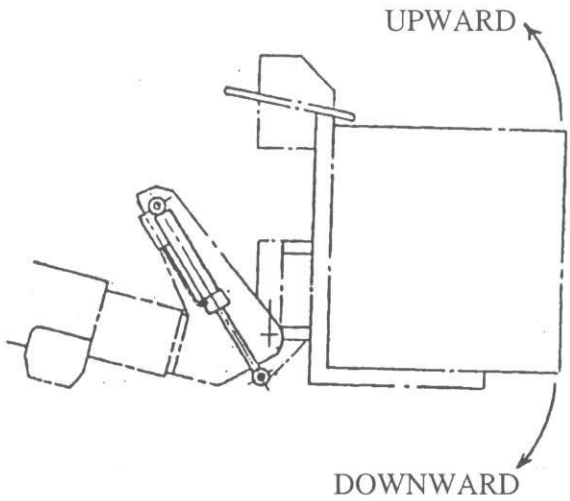
2. Natural descent.
   Load the platform with its maximum load (250kg), then visually check for any sign of the platform tilting downward. (550lbs)
   If the platform descends naturally, thoroughly check the levelling system for external oil leakage, Then check for internal oil leakage in the components listed below.
   - Double pilot check valve.
   - Combination valve.
   - Upper and lower levelling cylinders.

3. Adjustment of Platform level

CAUTION:

* Do not attempt the following procedures, when the platform is loaded.
* Operated the machine at the "Lower control", when carrying out the adjustment.

Fig:2



1. If the platform is tilted downward.
   1) Retract boom fully, and set it horizontally.
   2) Open the two "Stop valves" located at "Lower control".
   3) Operate the "Extension switch" to "IN", and move the platform upward.
   4) When the platform gets its level, return the control switch to its neutral, and close the "Stop valves" firmly.
   5) Operate the machine thoroughly at the "Lower control", and make certain that the platform always stays level.
2. If the platform is tilted upward.
   1) Retract boom fully, and set it horizontally.
   2) Open the two "Stop valves" located at "Lower control".
   3) Operate the "Extension switch" to "OUT", and move the platform downward.
   4) When the platform gets its level, return the control switch to its neutral, and close the "Stop valves" firmly.
   5) Operate the machine thoroughly at the "Lower control", and make certain that the platform always stays level.

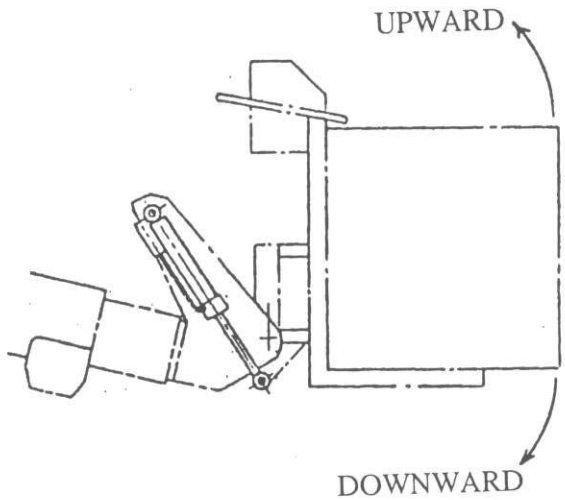
4. Air bleeding procedures

Caution:

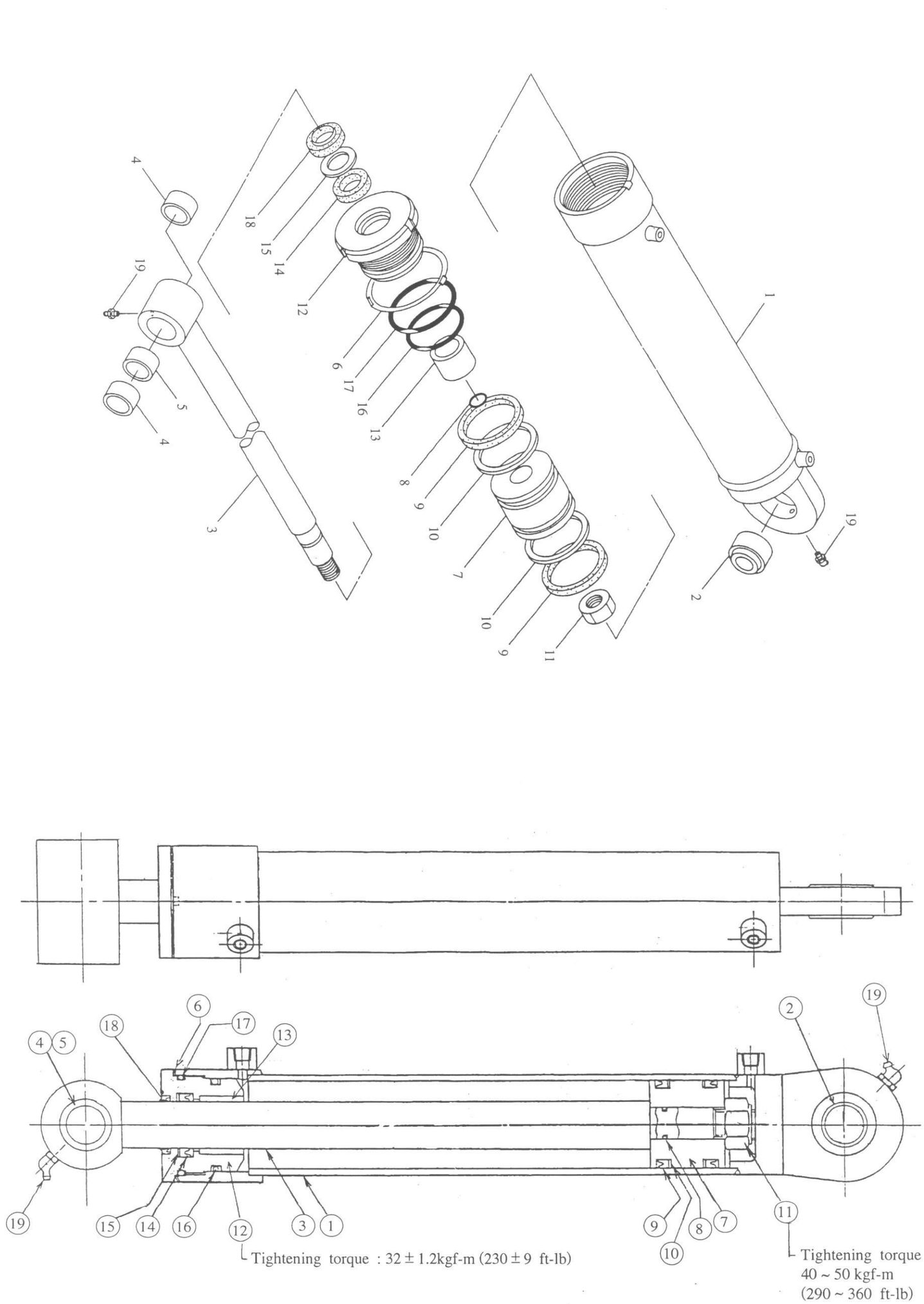
* When bleeding air, always operate the machine from the lower control panel.
* Always unload the platform completely, before carrying out these procedures.

1. Retract the boom fully and position it horizontally.
2. Fully open the two stop valves installed on the combination valve.
3. Switch the "Extension switch" to "IN" and tilt the platform fully upward.
4. Now switch the "Extension switch" to "OUT" and tilt the platform fully downward.
5. Perform the above steps 3 and 4 several times (3～4times).
6. Return the platform to its level position, and firmly close the two stop valves.

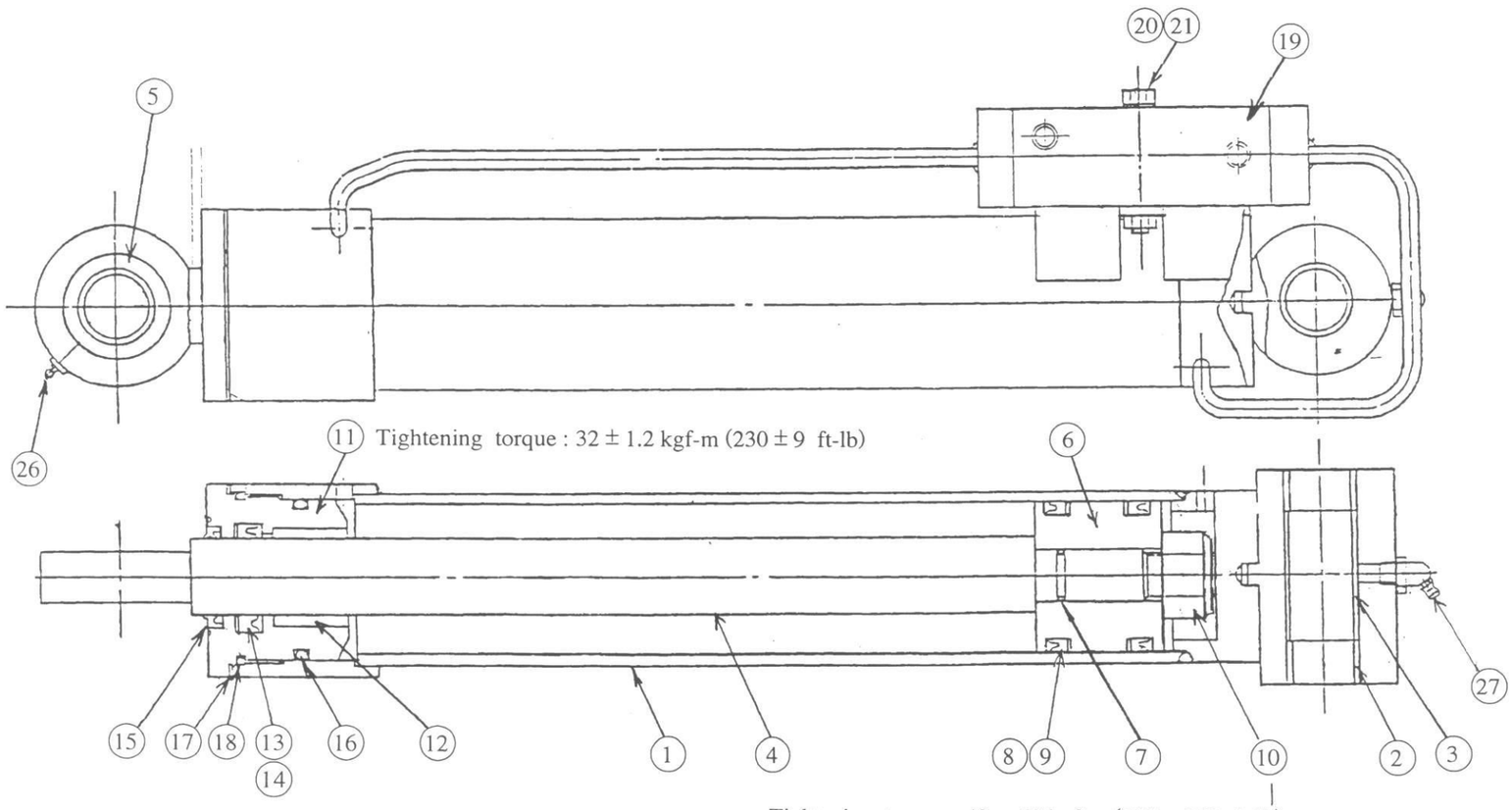
Fig:3

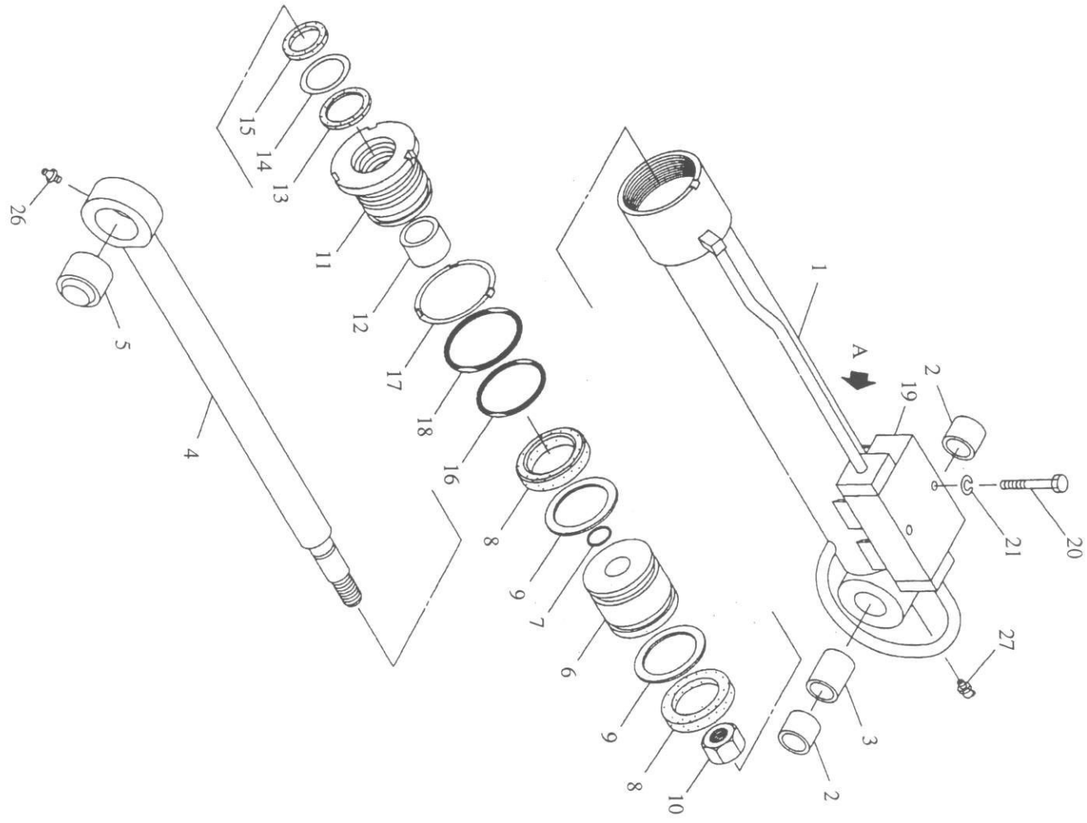


LOWER LEVELLING CYLINDER



1	Cylinder tube	8	O ring	15	Back-up ring
2	Bushing	9	U ring	16	O ring
3	Piston rod	10	Back-up ring	17	O ring
4	Bushing	11	Self-lock nut	18	Dust seal
5	Bushing	12	Cylinder head	19	Grease fitting
6	Lock plate	13	Bushing	—	————
7	Piston	14	U ring	—	————

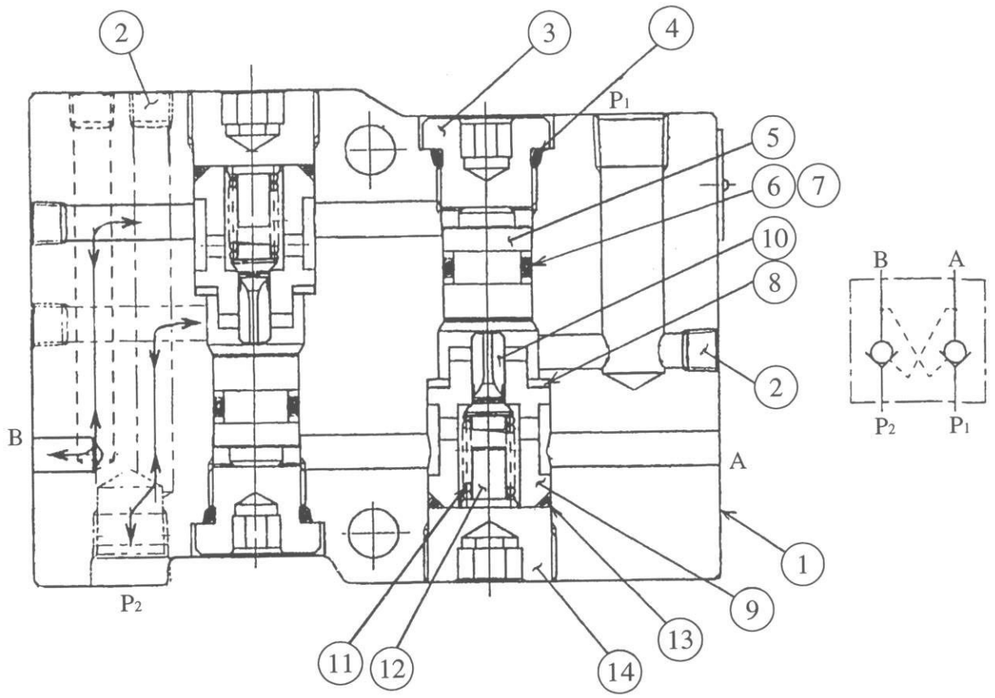




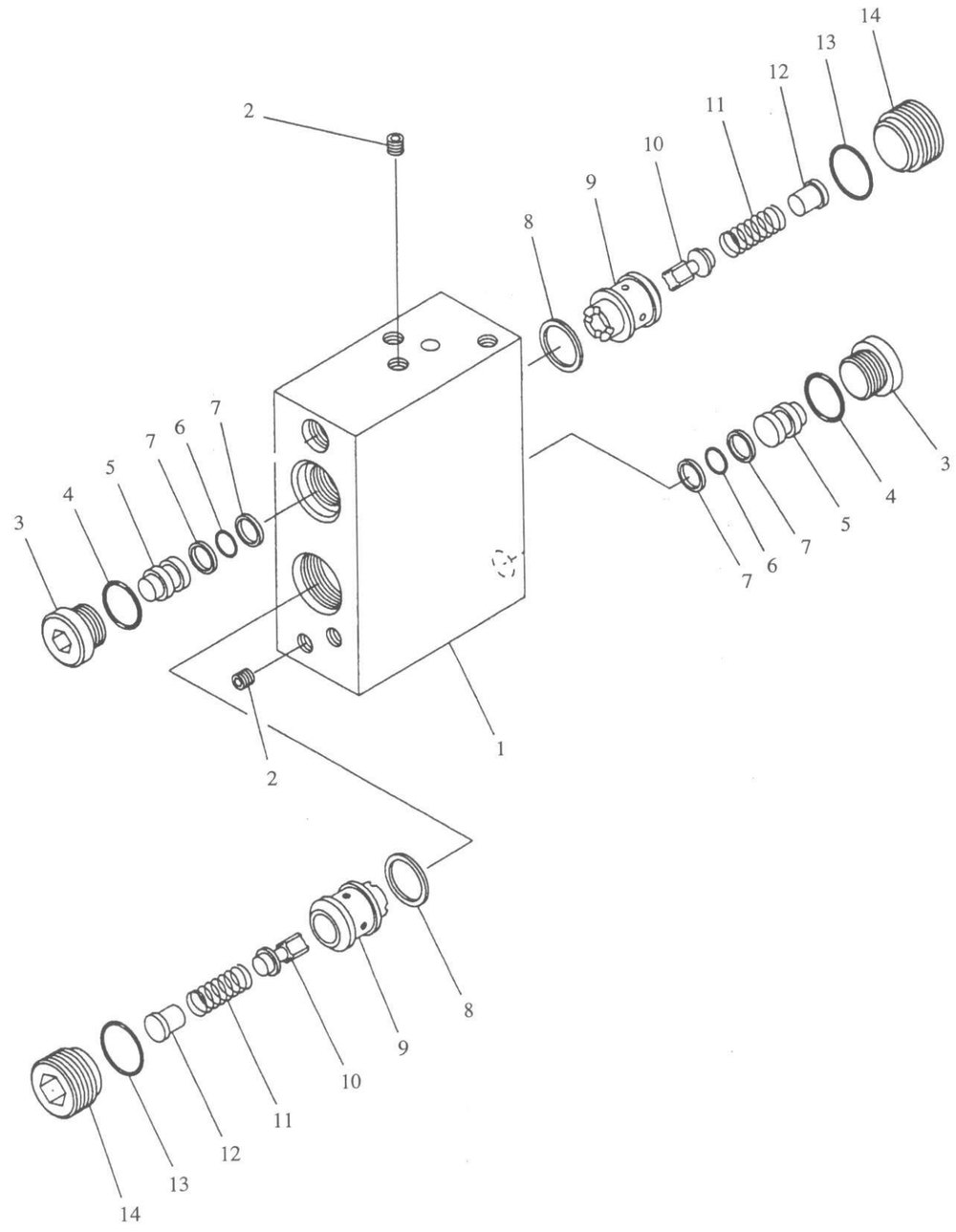
1	Cylinder tube	8	U ring	15	Dust seal
2	Bushing	9	Back-up ring	16	O ring
3	Collar	10	Self-lock nut	17	Lock plate
4	Piston rod	11	Cylinder head	18	O ring
5	Bushing	12	Bushing	19	Double pilot check valve
6	Piston	13	U ring	20	Bolt
7	O ring	14	Back-up ring	21	Spring washer

DOUBLE PILOT CHECK VALVE (for Upper levelling cylinder)

This valve is mounted on the Upper levelling cylinder.
It confines the hydraulic oil into the Upper levelling cylinder to keep the platform level in an emergency situation such as hydraulic line failure.

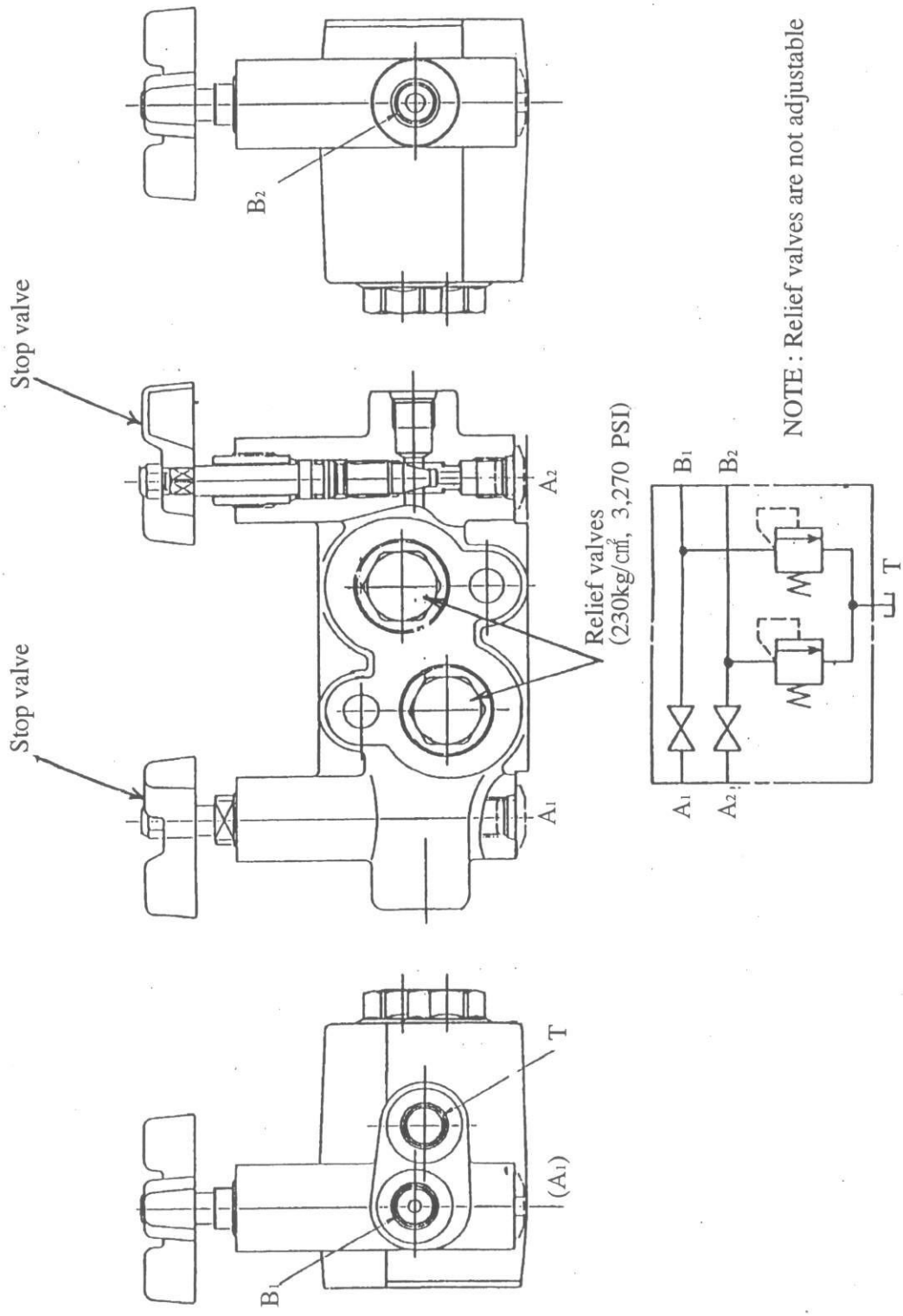


1	Valve housing	6	O ring	11	Spring
2	Plug	7	Back - up ring	12	Spring guide
3	Plug	8	Gasket	13	O ring
4	O ring	9	Valve seat	14	Plug
5	Piston	10	Check valve	15	Plug



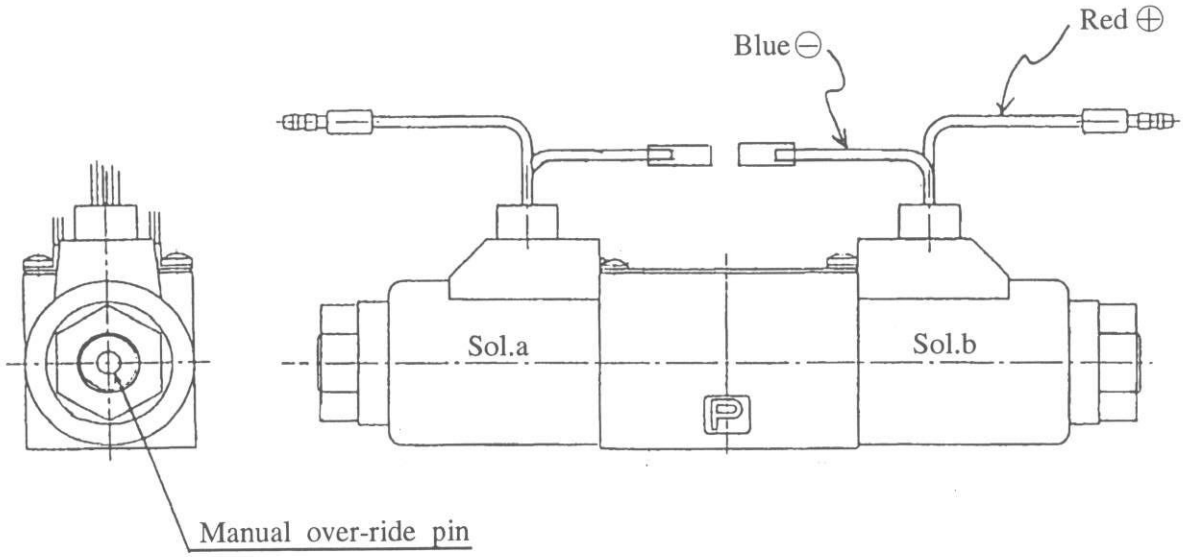
CONBINATION VALVE (for platform levelling system)

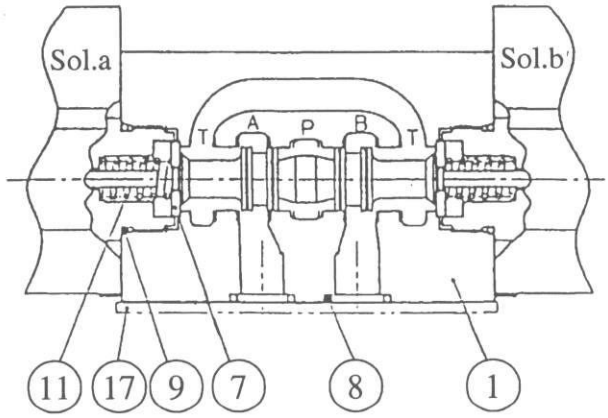
This valve consists of two Stop valves used for adjusting platform level, and two Relief valves which release excessively high pressure built up in the hydraulic circuit of the levelling system.

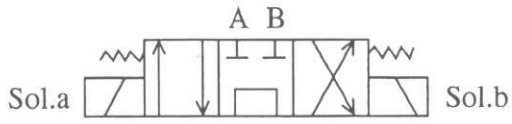


PLATFORM LEVEL SOLENOID VALVE

This valve is operated by the platform level switch to adjust the level of the platform.

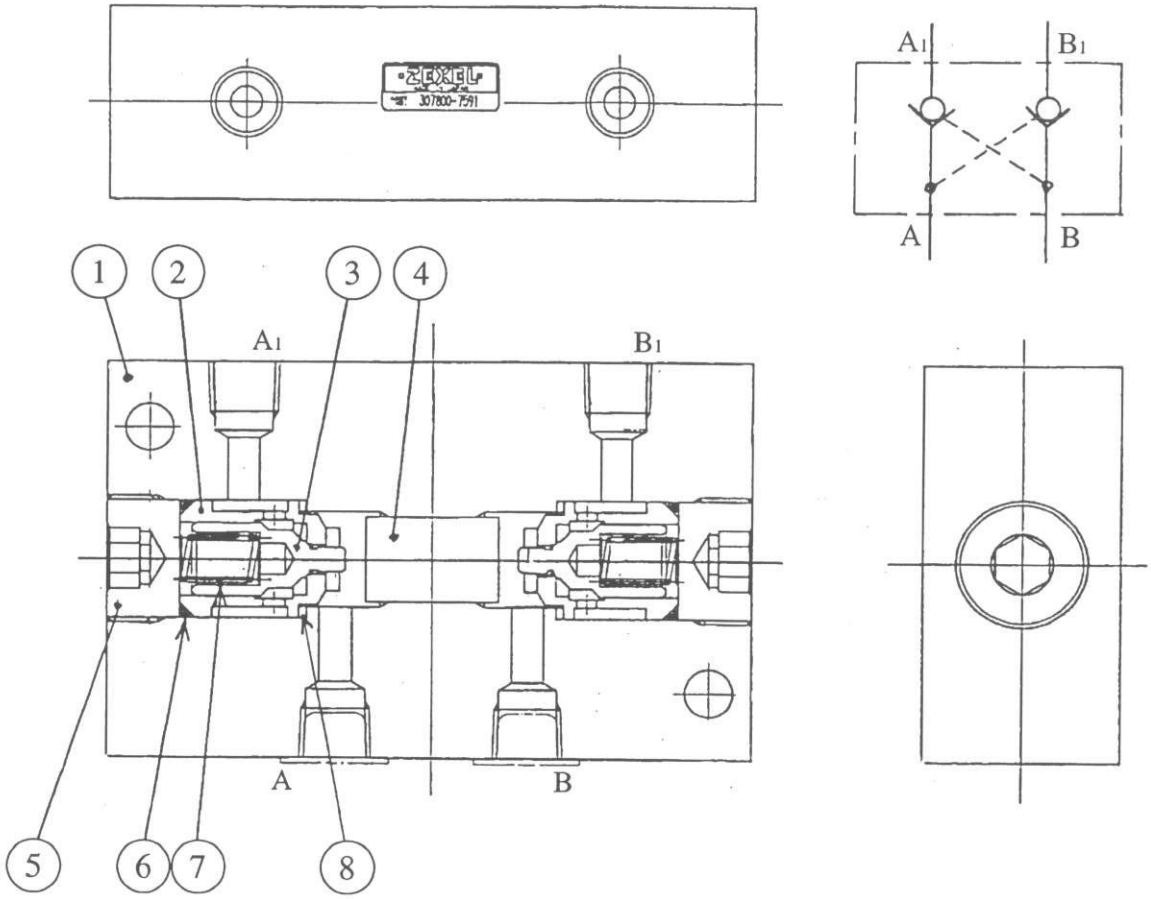






DOUBLE PILOT CHECK VALVE (for platform levelling system)

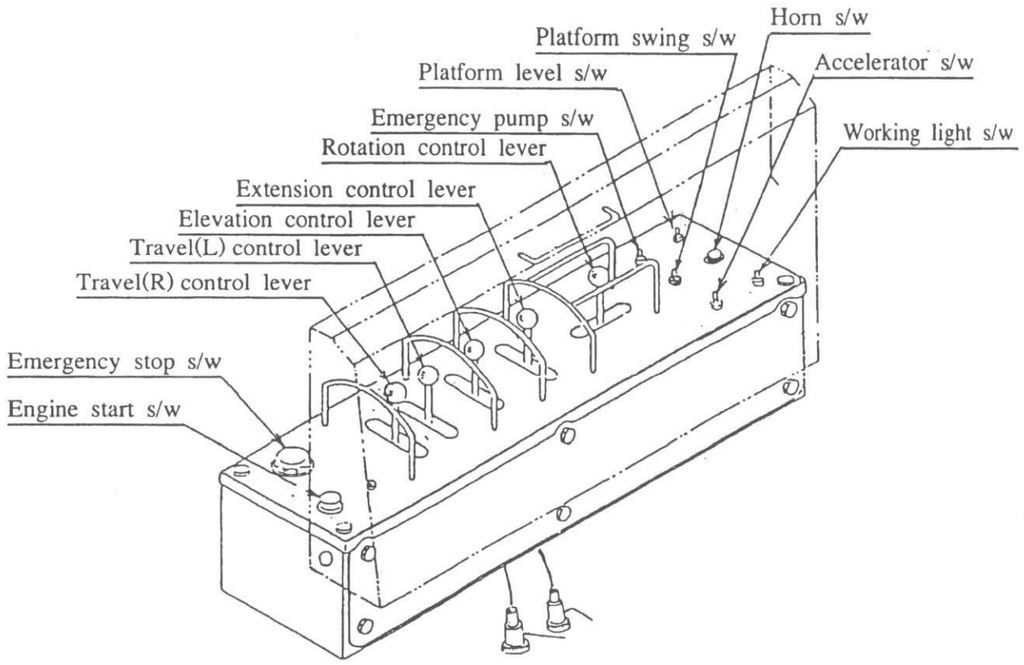
This valve confines the hydraulic oil to the platform levelling system to maintain the level of platform.

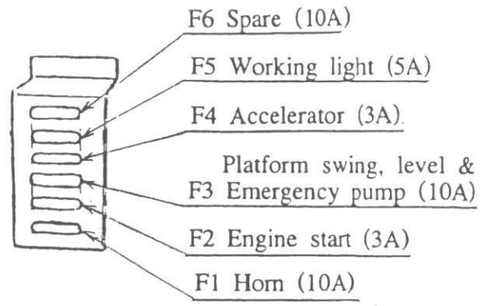


1	Valve housing
2	Valve seat
3	Check valve
4	Piston
5	Plug
6	O ring
7	Spring
8	Gasket

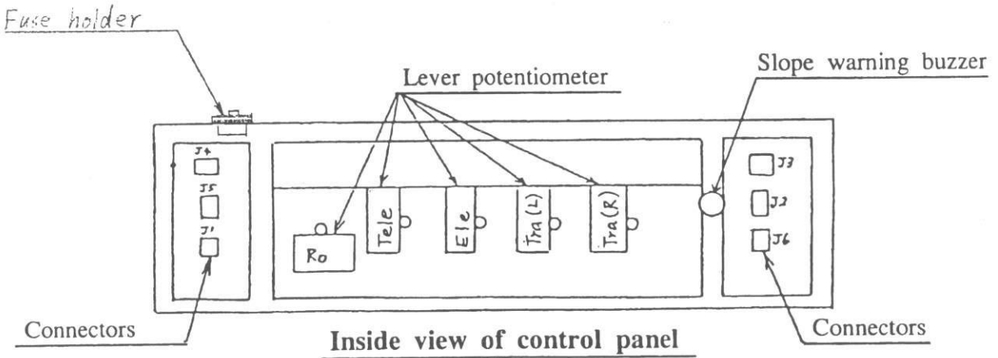
4
ELECTRIC SECTION

UPPER CONTROL BOX

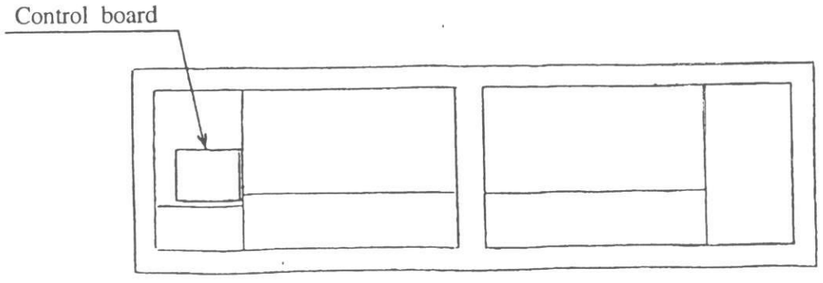




Fuse holder Detail

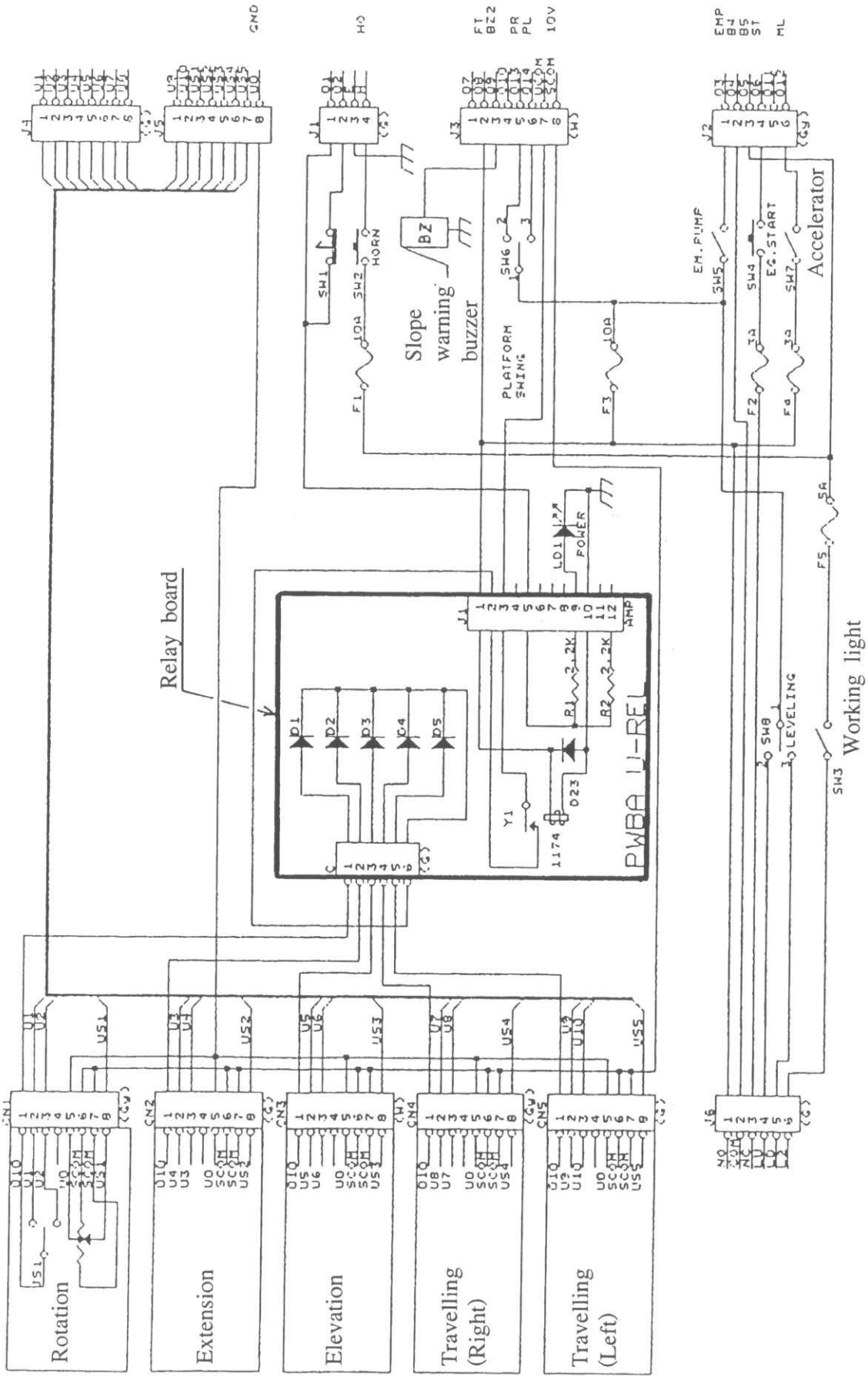


Inside view of control panel



Inside view of back panel

1. Electric circuit

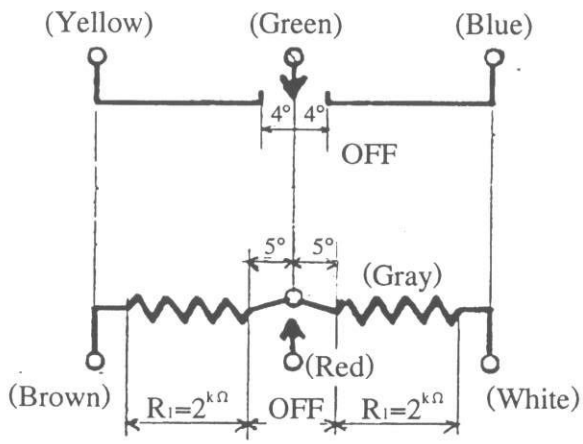


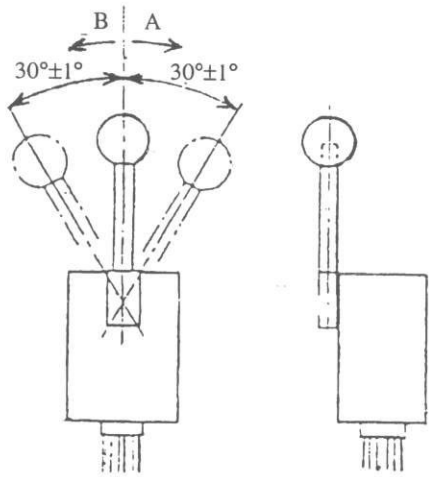
LEVER POTENTIOMETER

The lever potentiometer consists of two parts. One which functions as a switch and one which controls variations of resistance. These two parts are operated simultaneously by the control lever.

The "OFF" section of the switch extends 4° to either side of the lever's central position. The switch will be turned "ON" when the lever is inclined in excess of 4° to either side.

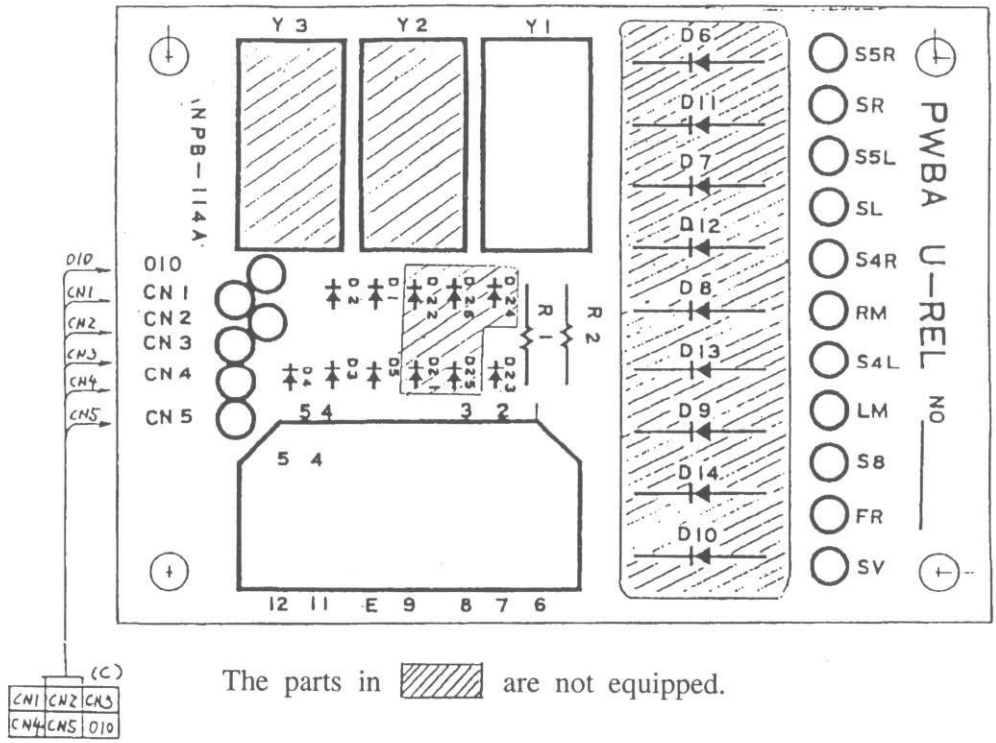
The "OFF" section of the resistance control extends 5° to either side, and from there the resistance (2kΩ) is varied as the control lever is inclined.



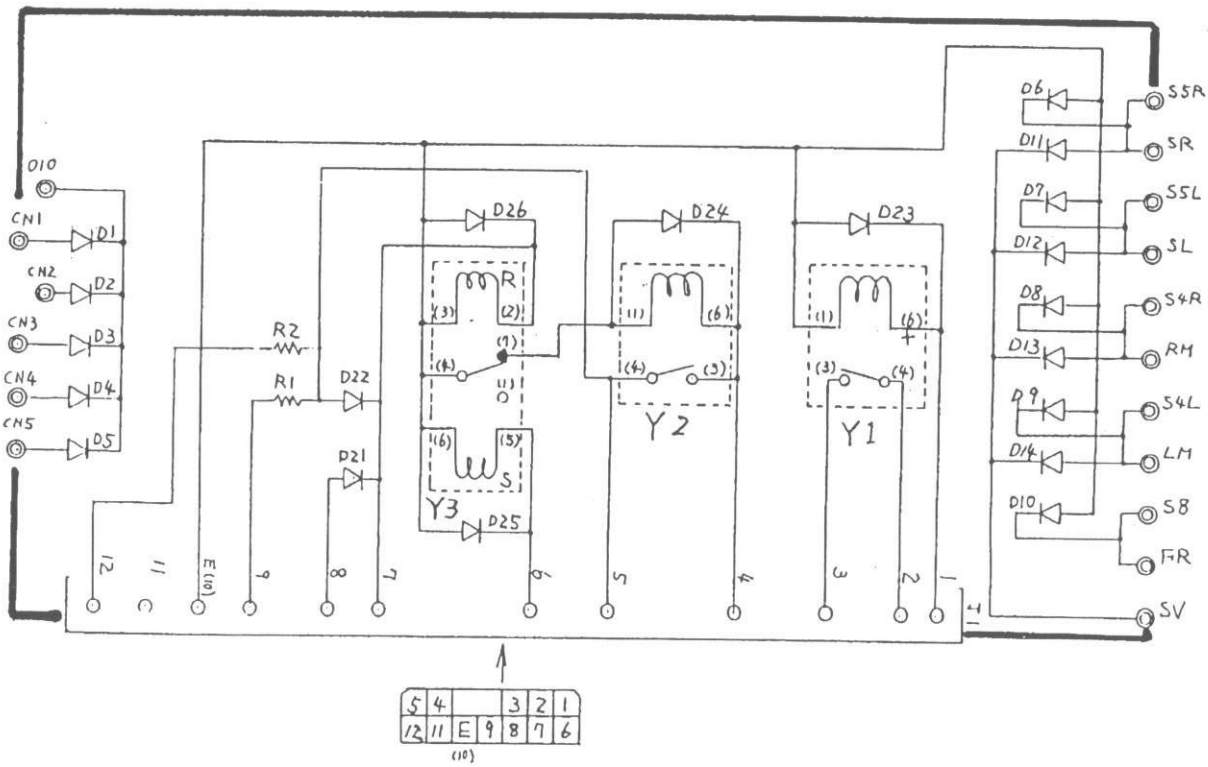


CONTROL BOARD

The board is installed in the "Upper control box".



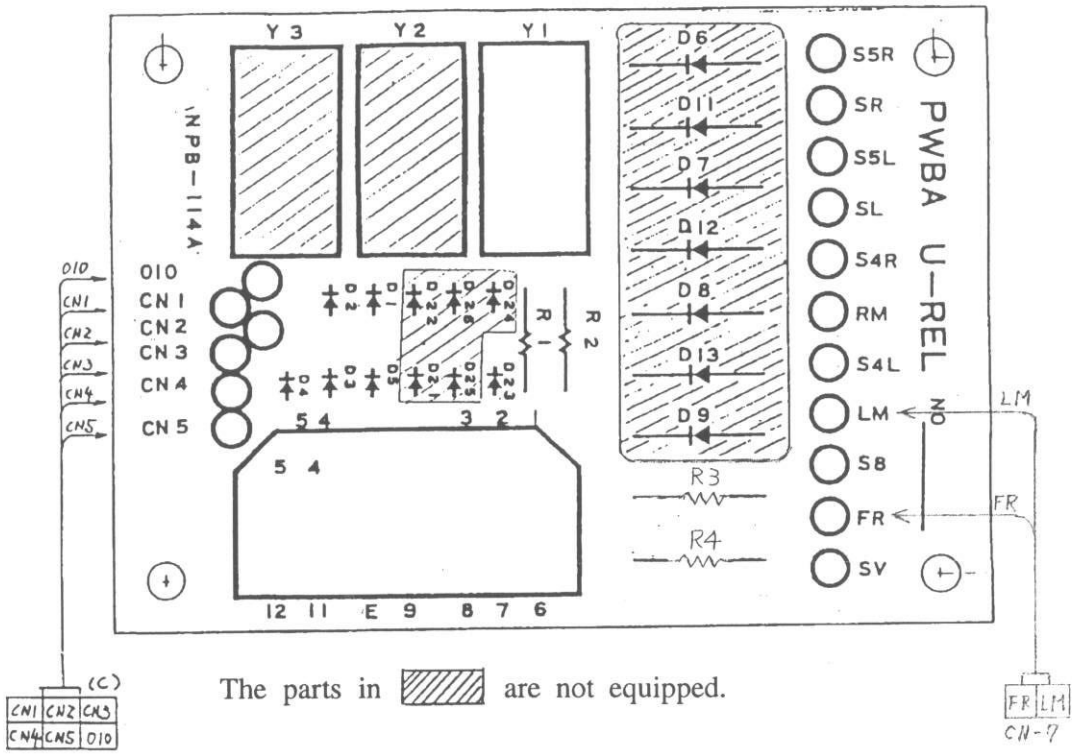
The parts in ▨ are not equipped.



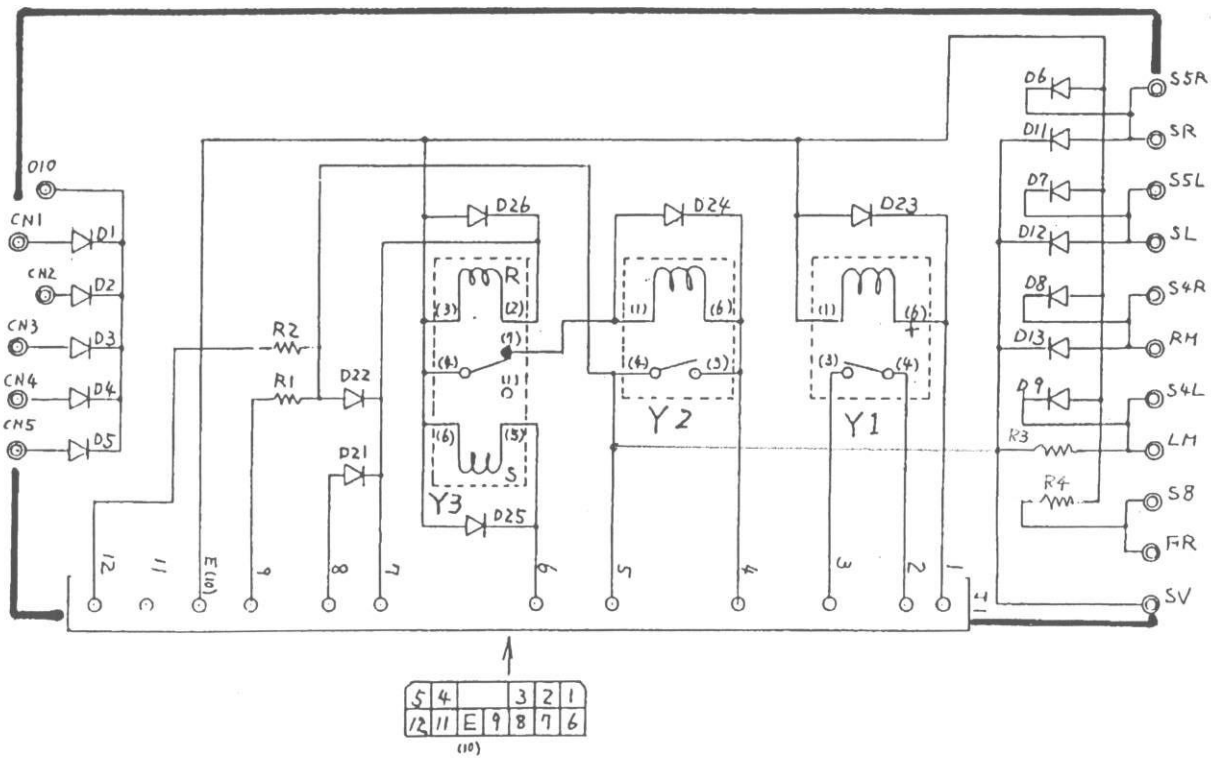
CONTROL BOARD

With resistance R3 and R4

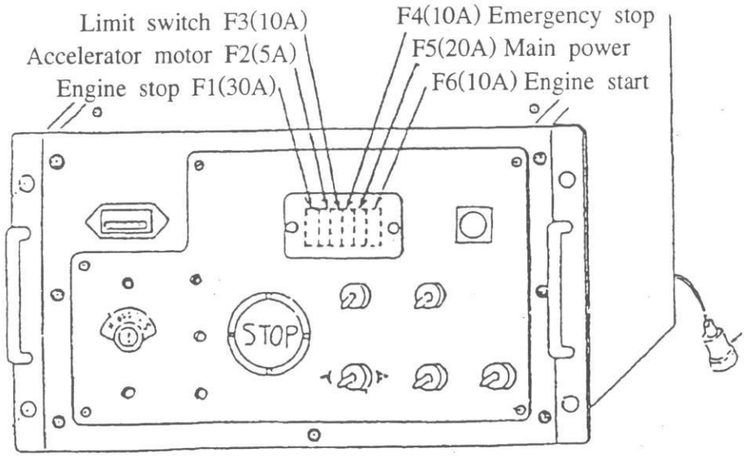
The board is installed in the "Upper control box".

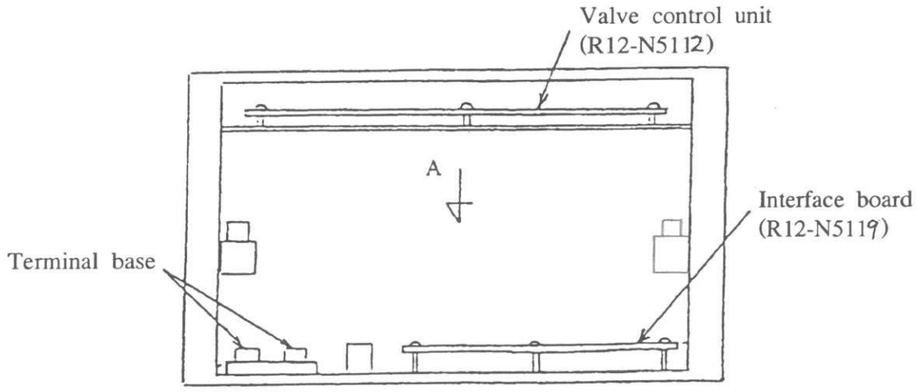


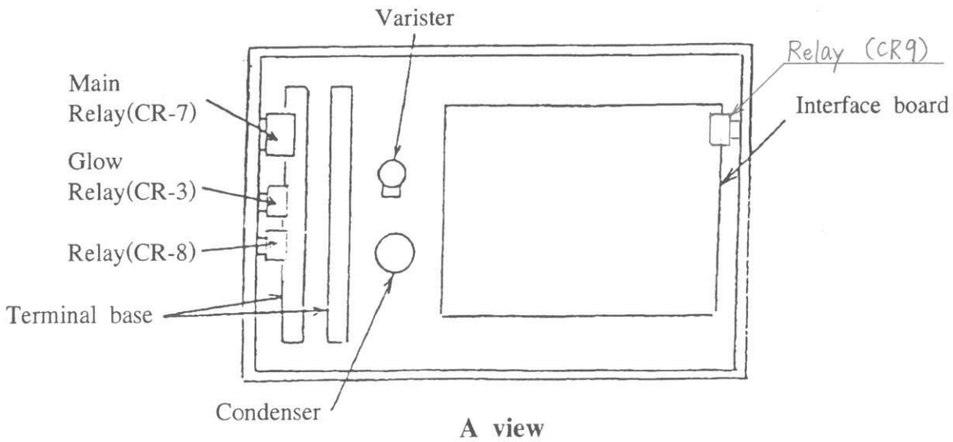
The parts in ▨ are not equipped.



LOWER CONTROL BOX







A view

UJ5 (Gray)

U9	U10	U51	US2
US3	US4	US5	U0

UJ4 (Green)

U1	U2	U3	U4
U5	U6	U7	U8

UJ3 (White)

O7	O8	O9	O10
O13	O14	U COM	S COM

UJ2 (Gray)

O3	O4	O5
O6	O11	O12

UJ1 (Green)

O1	O2
E	H

LJ10 (Gray)

F3		VL
VR	LS1	LS2

LJ11 (Green)

B	G	LS
BZ	G	HD

EJ6 (White)

1	E	E
9	LM	RM

EJ8 (Green)

L	L	7
5	5	8

VJ12 (White)

V1	V2
V3	V4

VJ13 (Green)

V5	V6	V7	V8
V9	V10	V11	V12

VJ14 (Gray)

V13	V14	V15	V16
V17	V18	V19	V20

EJ7 (Gray)

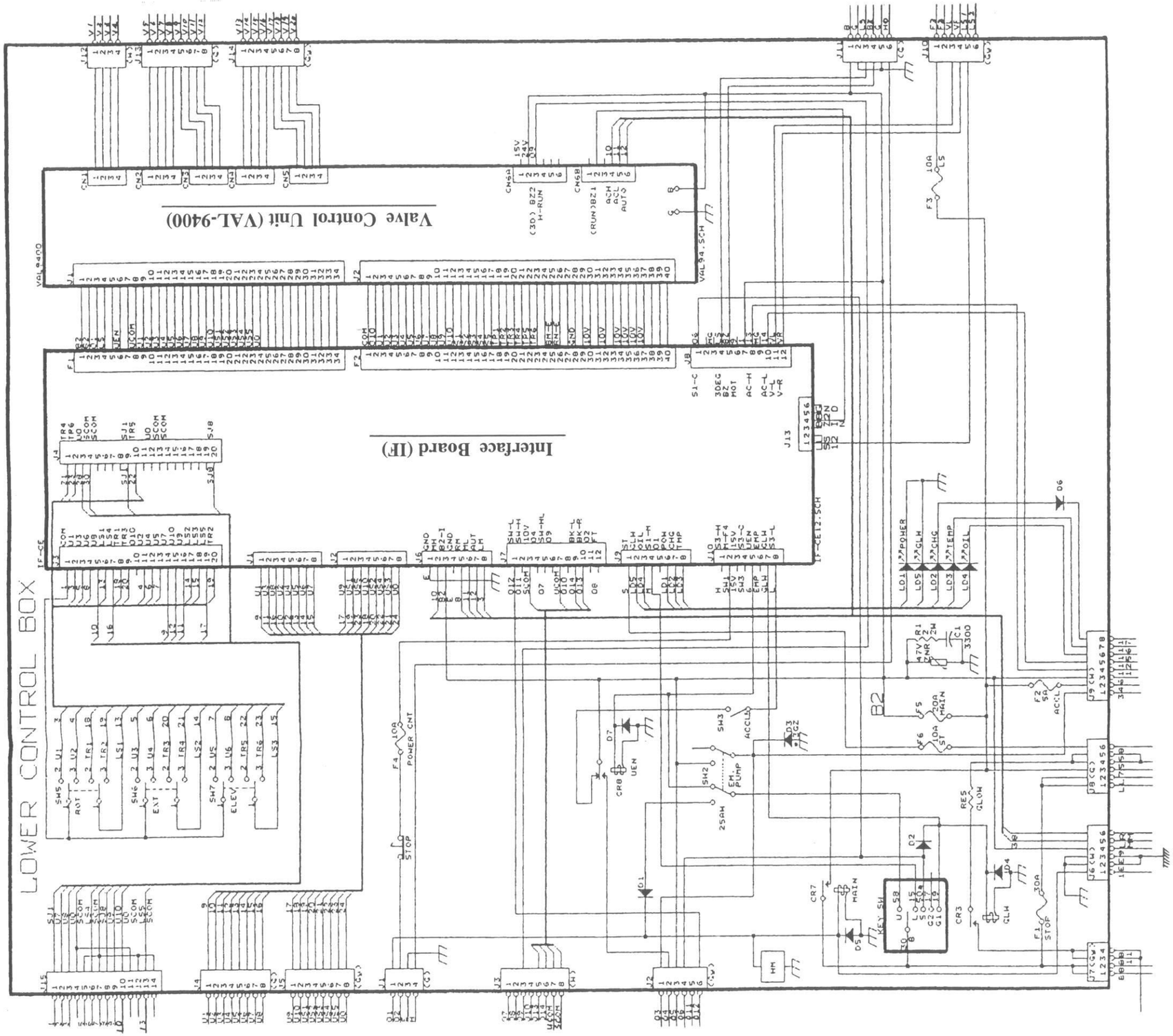
B	B
B1	B1

EJ9 (White)

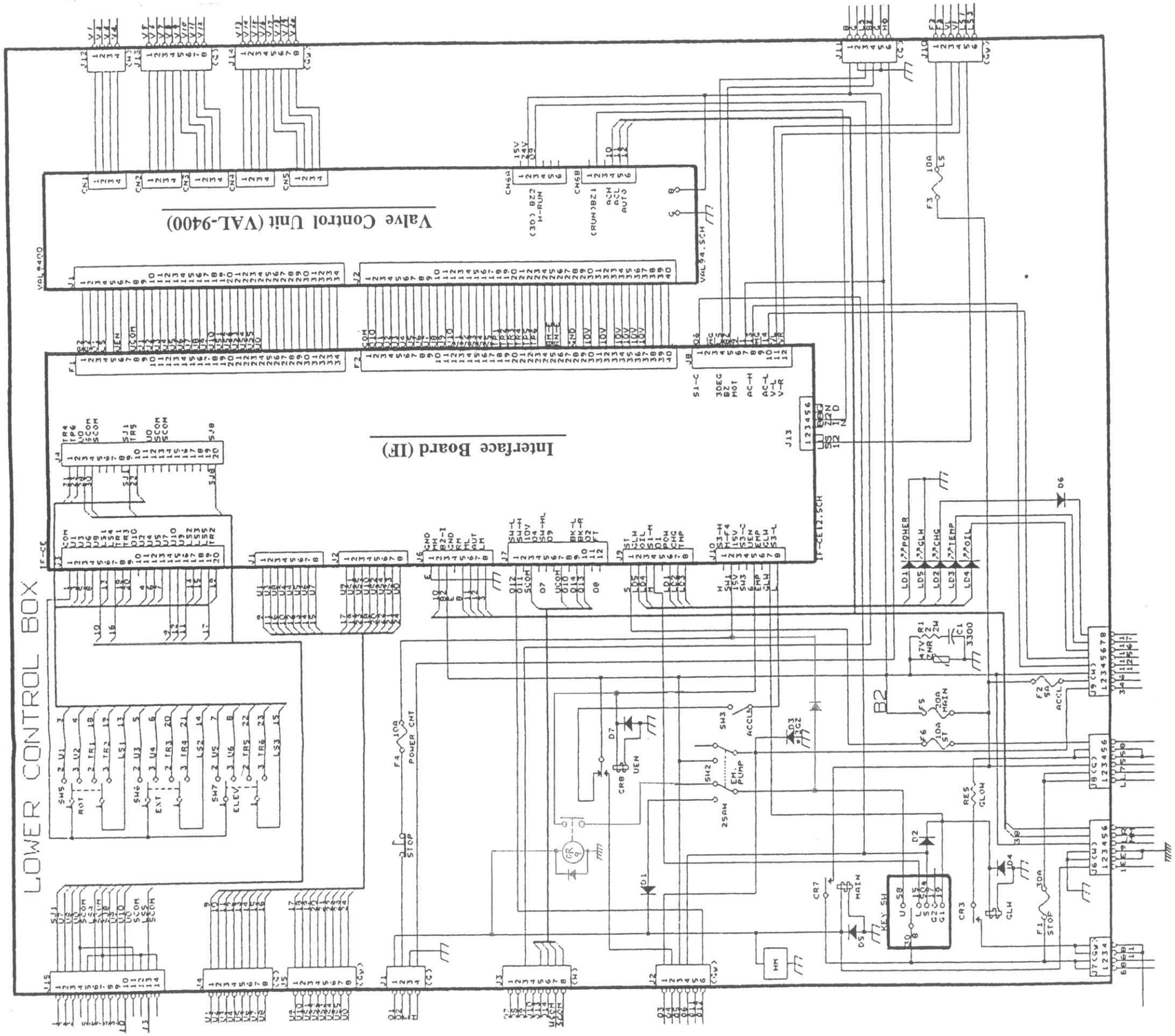
3	4	6	11
12	15	16	17

Identifications of Connectors

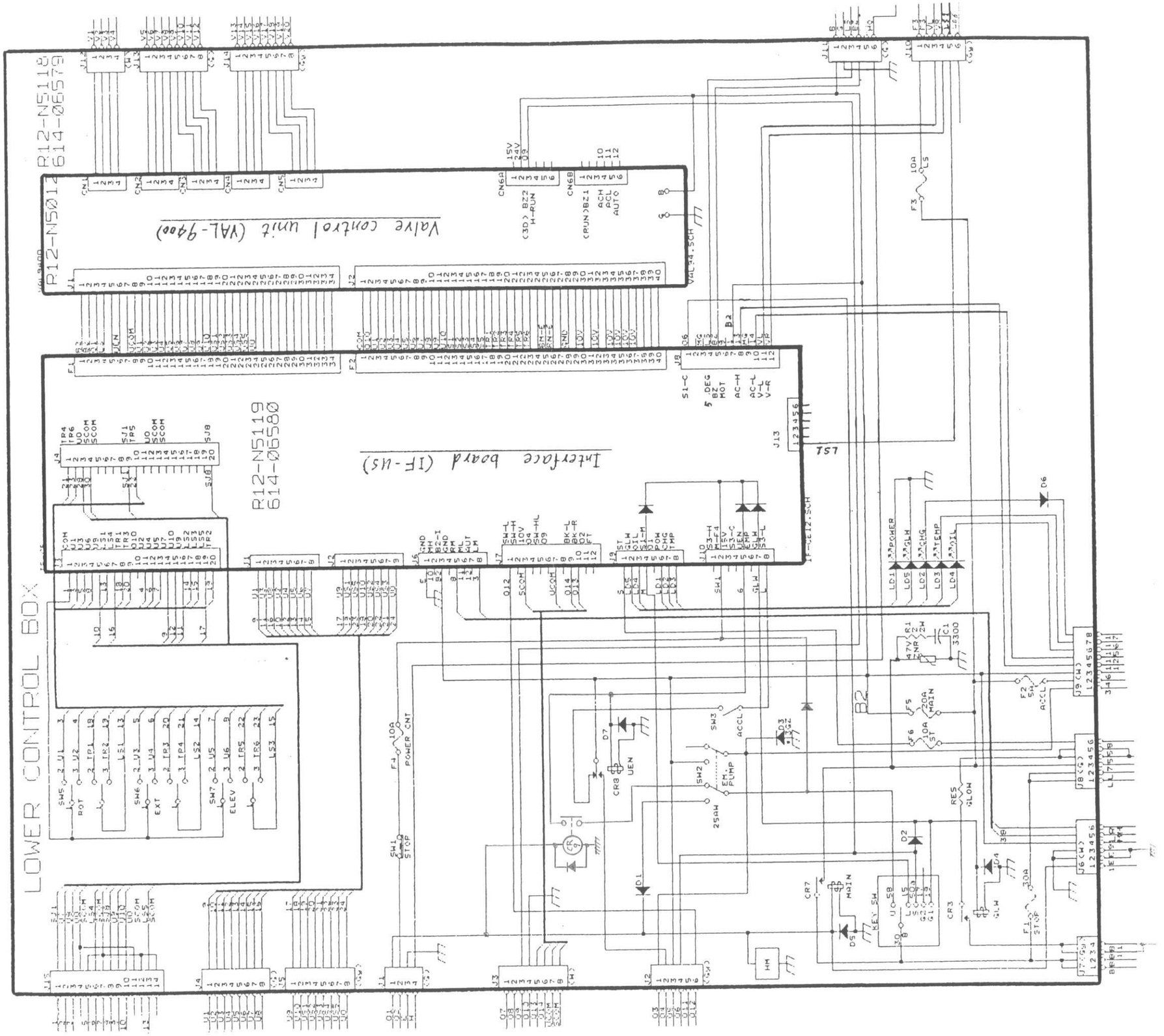
1. Electric circuit (for Spec : A3, A4)
(for serial NO : ~655367)



1. Electric circuit (for Spec: A3, A4)
(for Serial NO: 655368~)

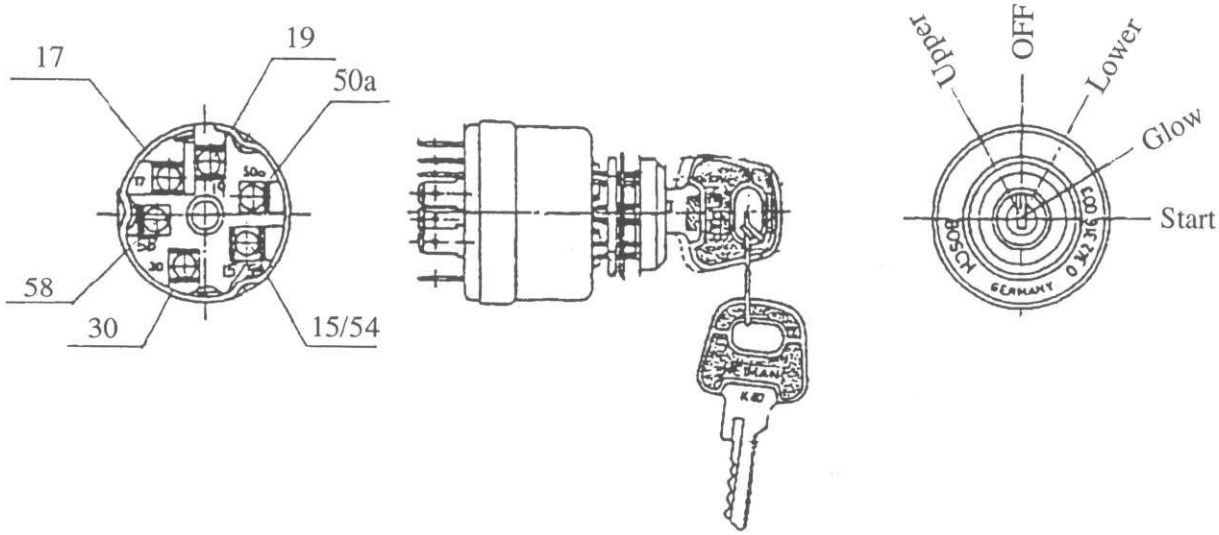


1. Electric circuit (for Spec : A6)



MAIN KEY SWITCH

The main key switch is located on the Lower control box.
This supplies power to the "Upper" or "Lower" control.



Key position and ON/OFF conditions of each terminal

		Terminal NO.					
		30	15/54	58	19	17	50a
Key position	OFF	○					
	Upper	○	—	○			
	Lower	○	○				
	Glow	○	—	—	○		
	Start	○	—	—	—	○	○

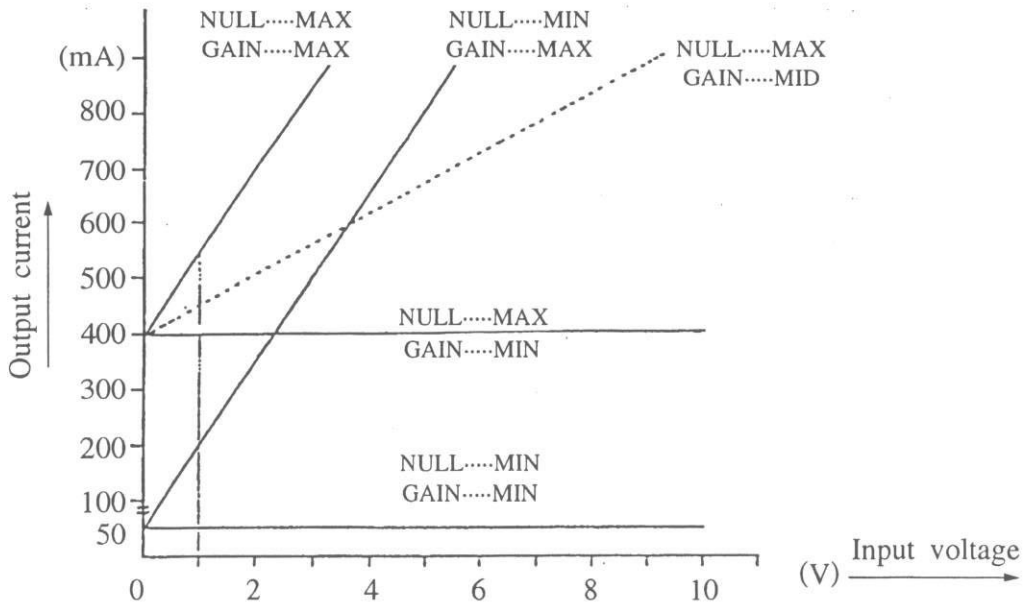
VALVE CONTROL UNIT

The Valve control unit is installed within the electric circuit between the "Potentio meters" (or control switches) and the "Solenoids" of the main control valve.
When the Valve control unit inputs "Voltage variation" (sent from Potentiometer), it converts this "Voltage variation" into the "Ampare variation", and outputs it to the "Solenoids" of the main control valve.
Thus, the proportional operation of main control valve is achieved, when the potentio meter is operated at the upper control.
However, in case the "Control switch" is operated at the lower control, the main control valve is actuated as a conventional solenoid valve, since the control switch does not output "Voltage variation", which is necessary for proportional operation.

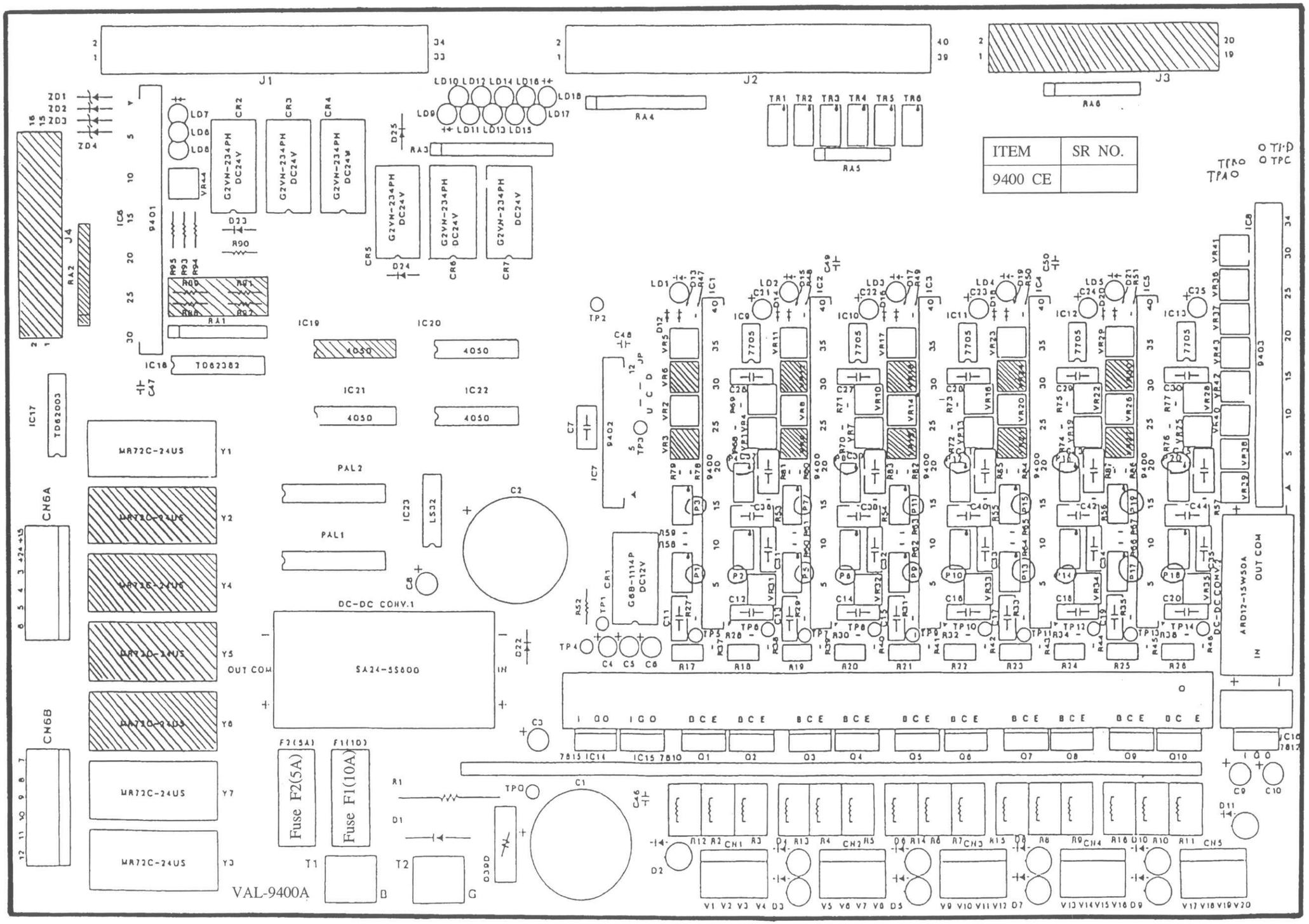
1.Specifications

Rated voltage	DC-24V
Input voltage	DC0~10V
Output current	0~800mA
Delay(Ramp)	0~7seconds(when input voltage is 10V)
Dither	50Hz

2.Input/output characteristic



1. External view



2. Trimmers and their functions

Operation \ Trimmer		NULL	GAIN	DELAY		DITHER	Tr
				UP	DOWN		
Rotation	C.W	P1	P2	VR-1	VR-2	VR-31	Tr-1
	C.C.W	P3	P4	VR-4	VR-5		Tr-2
Extension	OUT	P5	P6	VR-7	VR-8	VR-32	Tr-3
	IN	P7	P8	VR-10	VR-11		Tr-4
Elevation	UP	P9	P10	VR-13	VR-14	VR-33	Tr-5
	DOWN	P11	P12	VR-16	VR-17		Tr-6
Travelling (Right)	FWD	P13	P14	VR-19	VR-20	VR-34	
	REV	P15	P16	VR-22	VR-23		
Travelling (Left)	FWD	P17	P18	VR-25	VR-26	VR-35	
	REV	P19	P20	VR-28	VR-29		

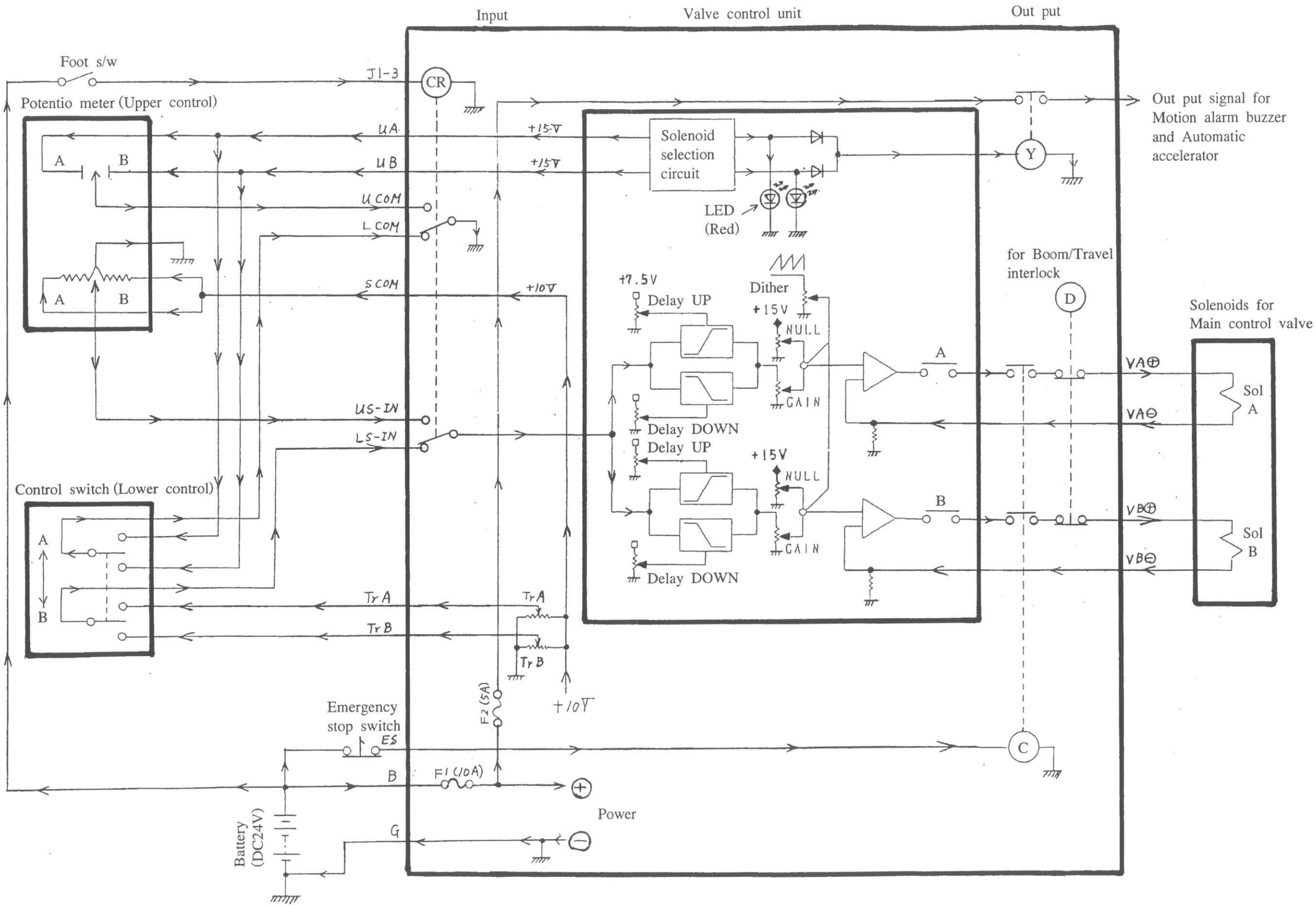
		Travelling (Right)	Travelling (Left)
Trimmer for adjusting "Input voltage" to Valve control unit, when conducting "Pivot turn".		VR-36	VR-37
Trimmer for adjusting "Input voltage" to Valve control unit, when conducting "Spin turn".	MIN	VR-38	VR-40
	MAX	VR-39	VR-41

3. LEDs and their functions

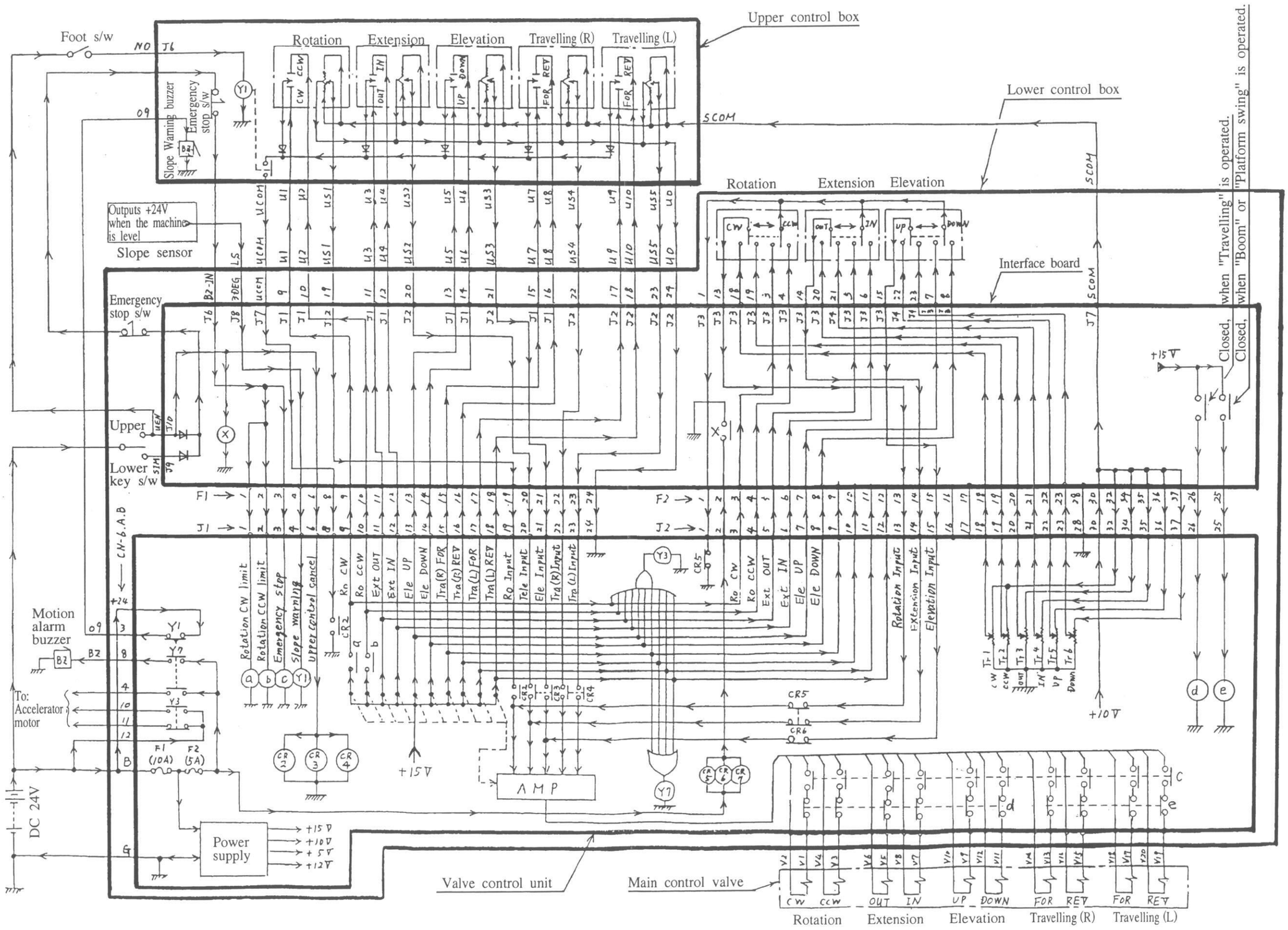
The LEDs and their functions installed on the Valve control unit are as shown in the table below.

	LED.NO.	Color	ON/OFF conditions & functions	Remarks
LEDs for Output	LD 1	Yellow	Output lines to Rotation solenoids } are { Normal → ON / Faulty → OFF	LEDs are turned off, in case the solenoids or electric lines to solenoids get short circuit.
	LD 2	Yellow	Output lines to Extension solenoids } are { Normal → ON / Faulty → OFF	
	LD 3	Yellow	Output lines to Elevation solenoids } are { Normal → ON / Faulty → OFF	
	LD 4	Yellow	Output lines to Travelling(Right) solenoids } are { Normal → ON / Faulty → OFF	
	LD 5	Yellow	Output lines to Travelling(Left) solenoids } are { Normal → ON / Faulty → OFF	
LEDs for Limitatin	LD 6	Yellow	OFF, when Emergency stop is operated.	
	LD 7	Green	OFF, when Rotation C.W. limitation is applied.	
	LD 8	Green	OFF, when Rotation C.C.W. limitation is applied.	
LEDs for "selector input signals"	LD 9	Red	ON, when Rotation C.W. selector input signal exists.	
	LD10	Red	ON, when Rotation C.C.W. selector input signal exists.	
	LD11	Red	ON, when Extension OUT selector input signal exists.	
	LD12	Red	ON, when Extension IN selector input signal exists.	
	LD13	Red	ON, when Elevation UP selector input signal exists.	
	LD14	Red	ON, when Elevation DOWN selector input signal exists.	
	LD15	Red	ON, when Travelling(Right) FWD selector input signal exists.	
	LD16	Red	ON, when Travelling(Right) REV selector input signal exists.	
	LD17	Red	ON, when Travelling(Left) FWD selector input signal exists.	
	LD18	Red	ON, when Travelling(Left) REV selector input signal exists.	

4. Note on function (NO.1)



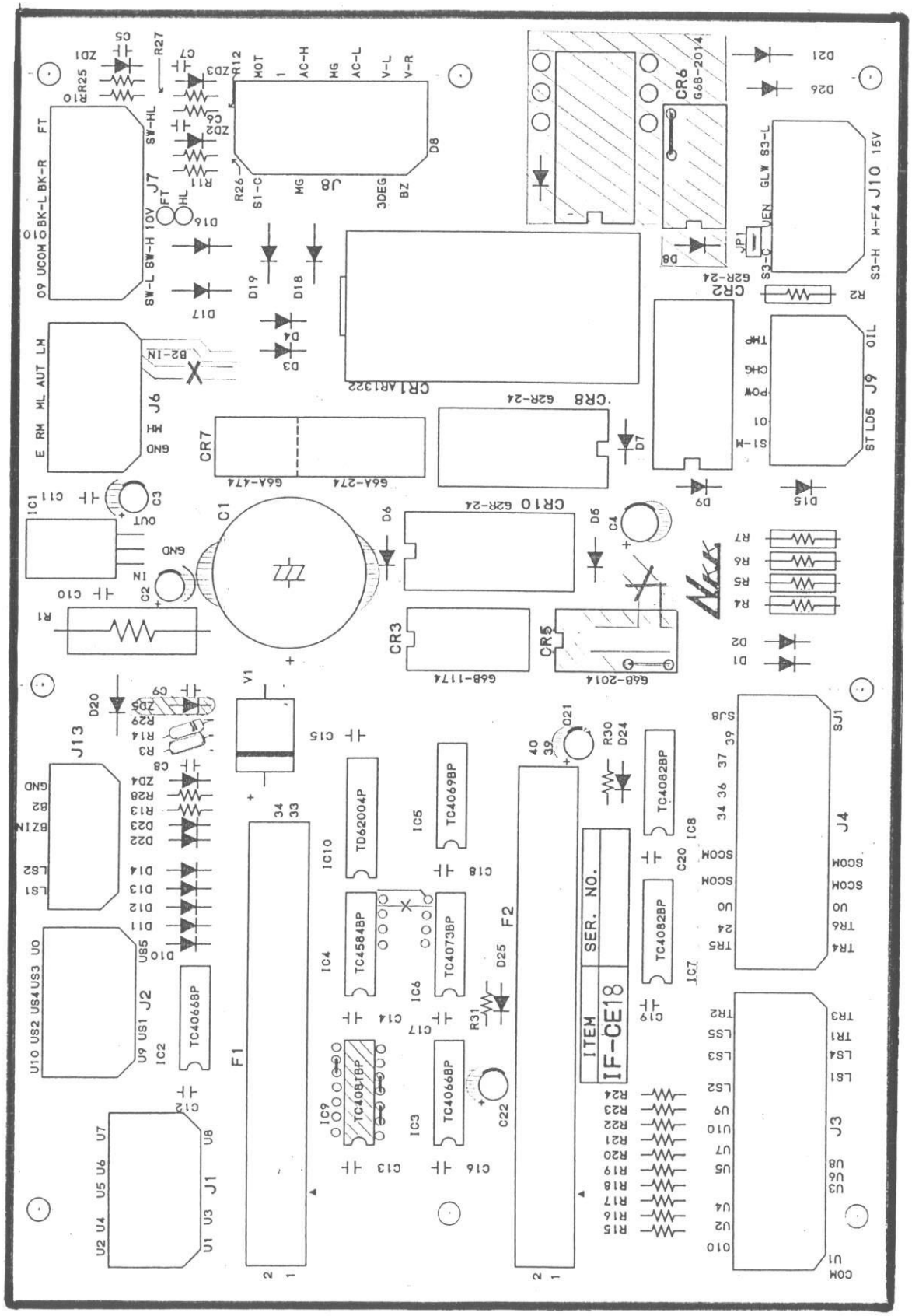
5. Note on function (NO.2)



INTERFACE BOARD

(witout CE/us selector switch)

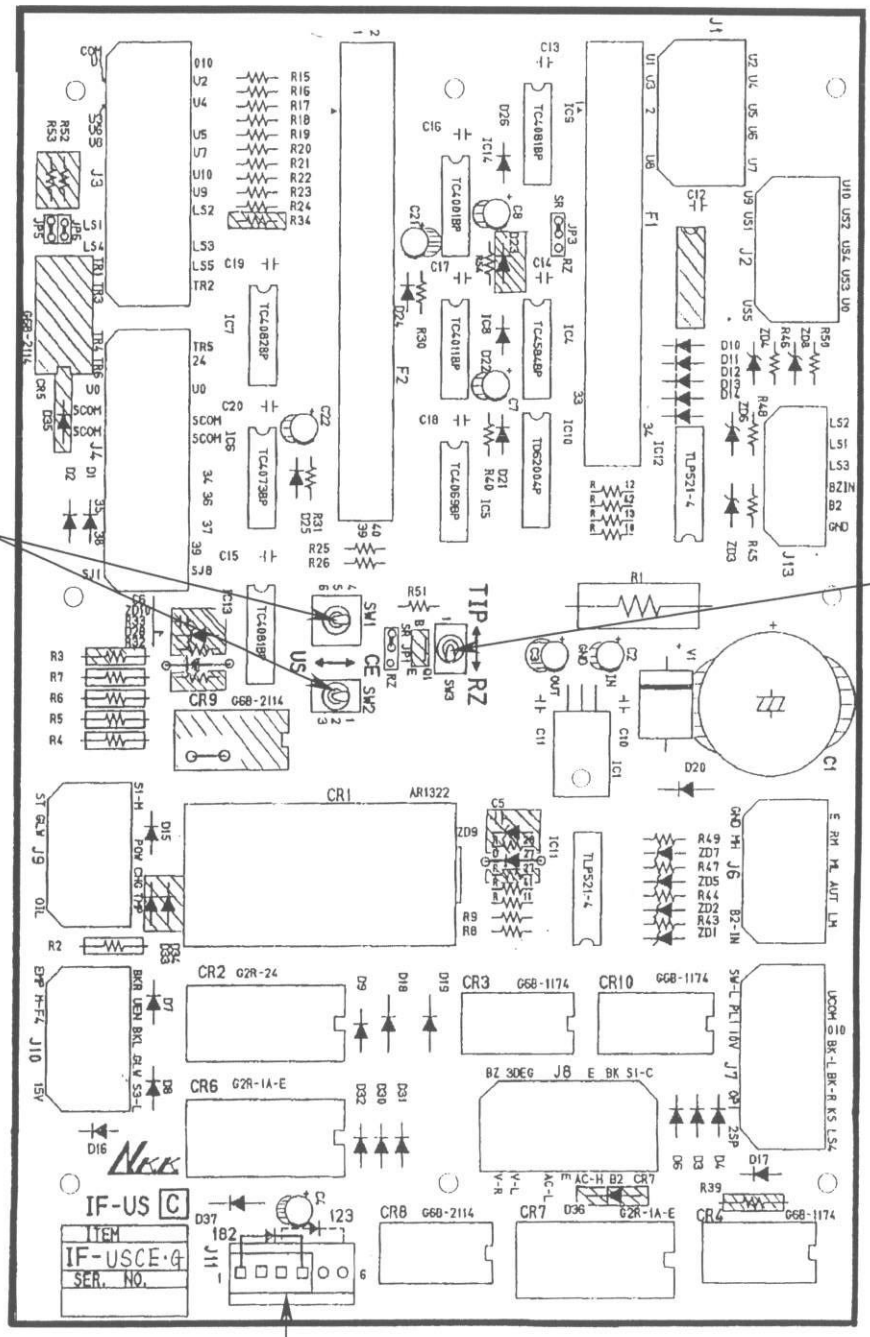
The interface board is located in the lower control box to control the electric system.



Interface Board

(with CE/US selector switches)

Set each switch and connector equipped on the board as shown in the figure below depending on the specifications of the machine.



Set these switches to the following positions depending on the Specification.

- CE Spec. —— CE position
- USA and Other Specs. —— US position

Set this switch to the following positions depending on the Model.

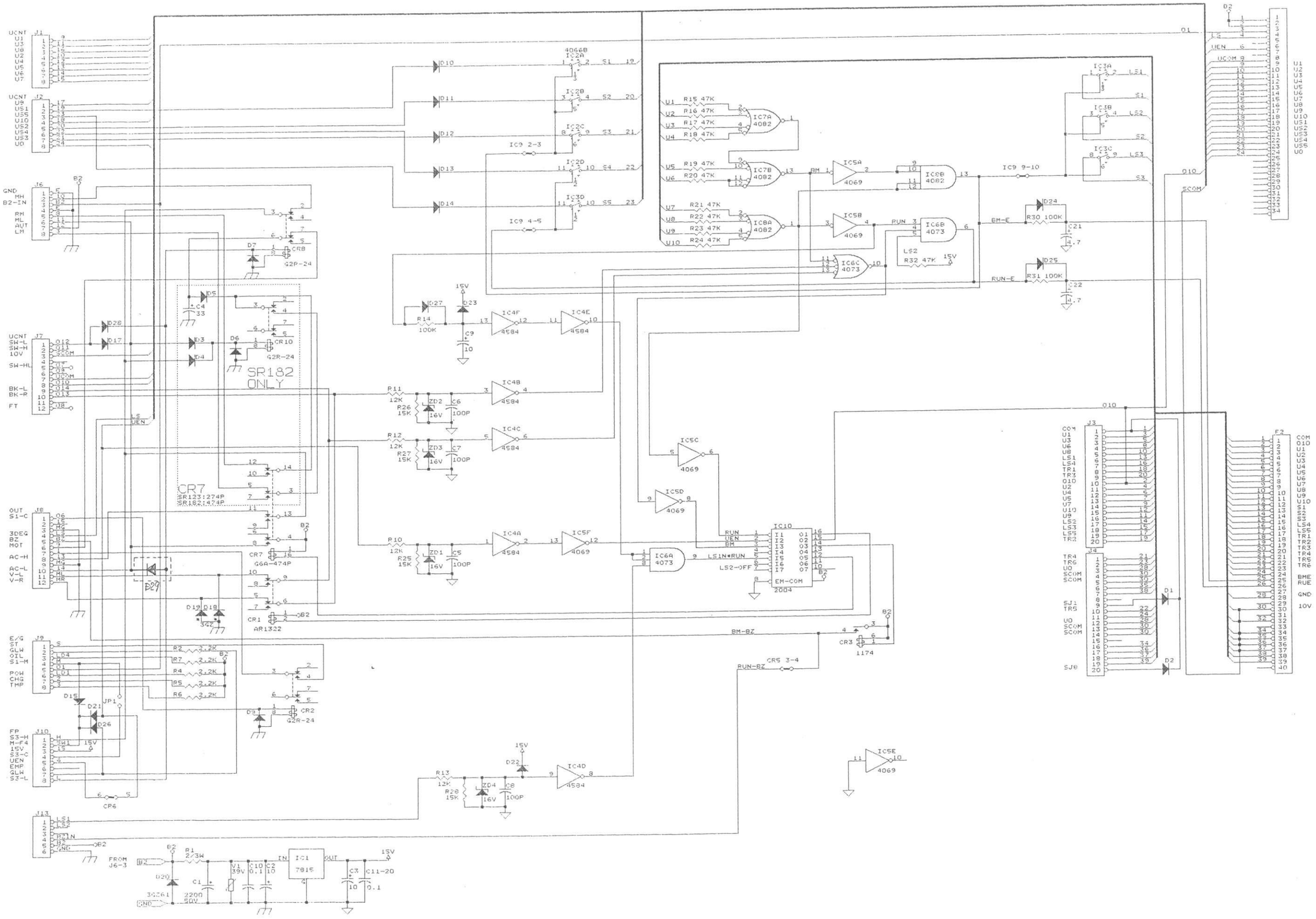
- SR123/ISR403 and SR182/ISR602 —— RZ position
- SR123J/ISR403J —— TIP position

Set this connector to the following positions depending on the Model.

- SR123/ISR403 and SR123J/ISR403J —— 123 position
- SR182/ISR602 —— 182 position

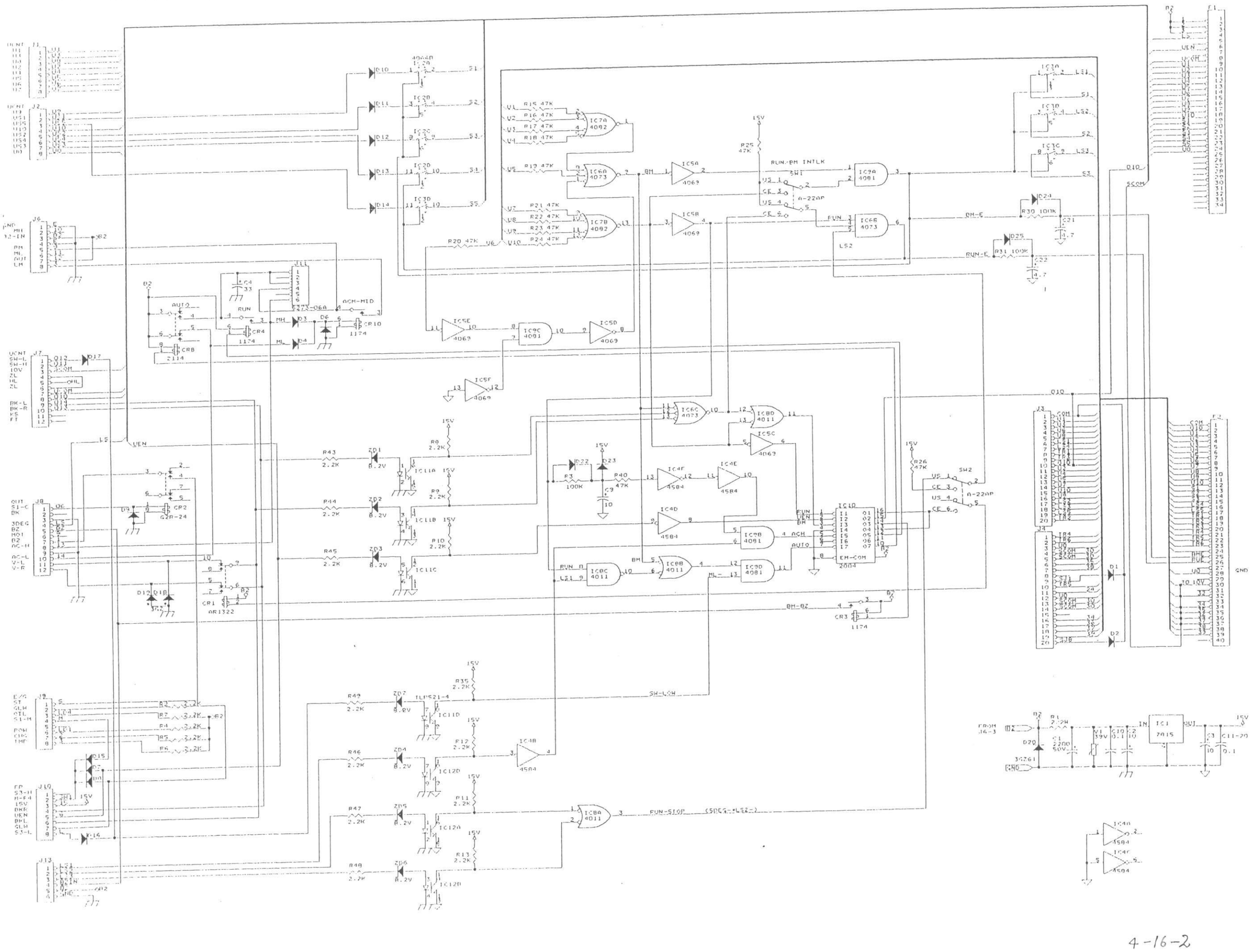
1. Electric circuit (for: without US/CE selector switch)

RCC-242C



614-06580

1. Electric circuit (for : with CE/US selector switch)

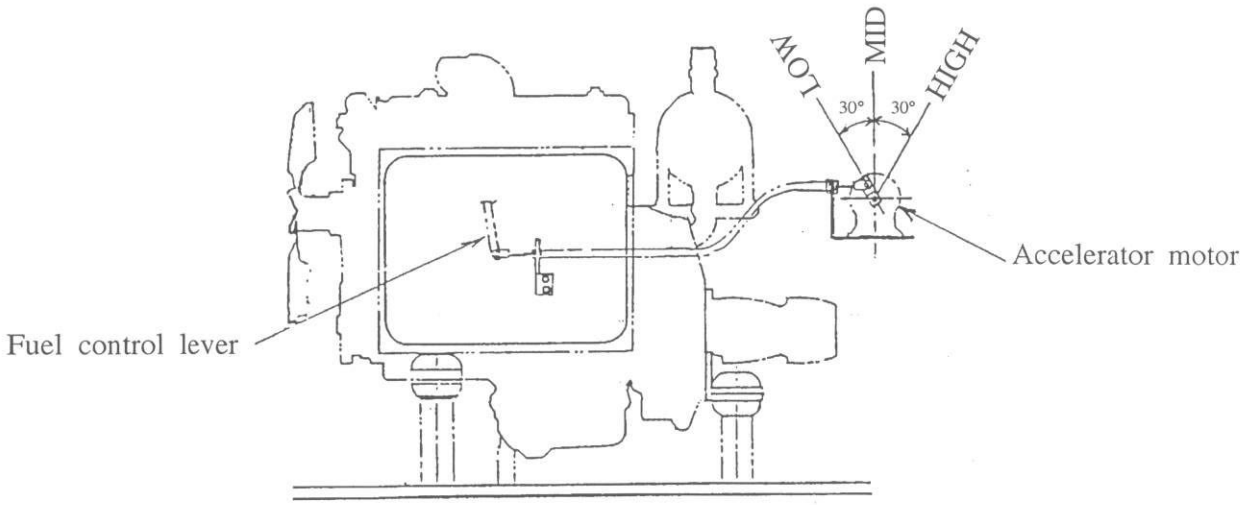


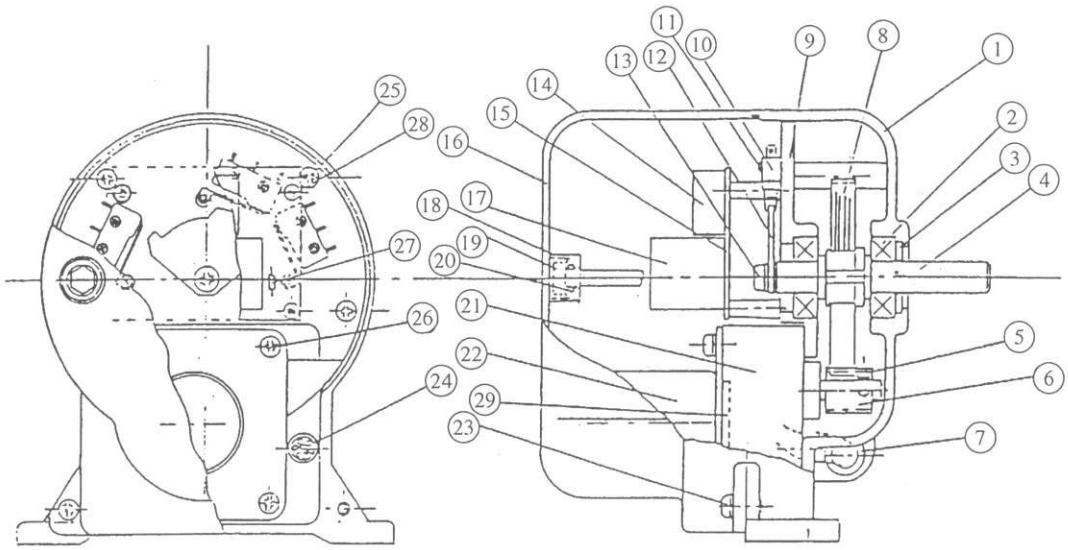
4-16-2

ACCELERATOR MOTOR

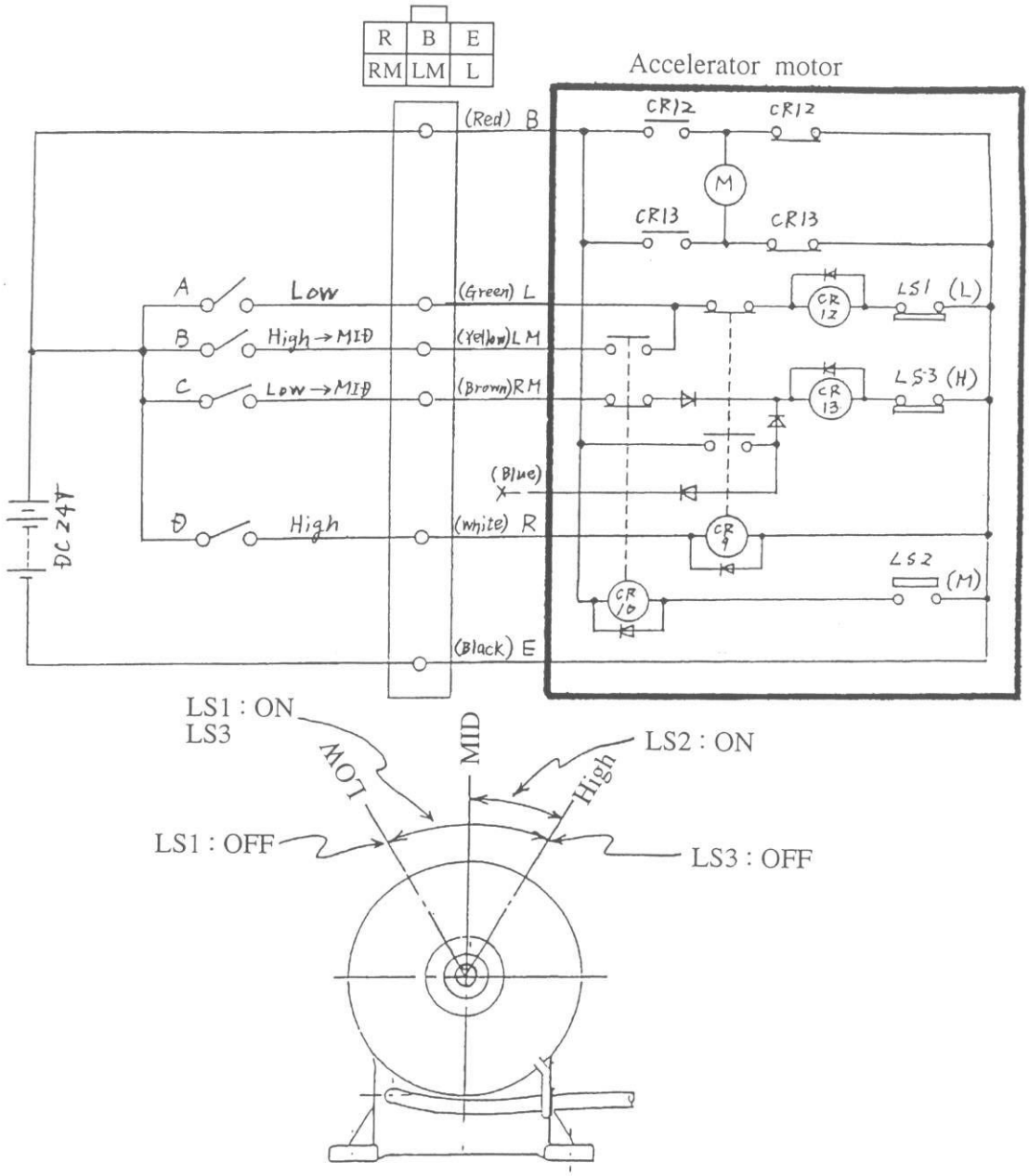
The output shaft of "Accelerator motor" is connected to the "Fuel control lever" of "Injection pump", and control the engine rpm into 3 speeds.

Low speed(Idling) —— 1.200rpm
Mid speed ———— 1.800rpm
High speed ———— 2.300rpm





1. Electric circuit



2. Inspection

Check the function of "Accelerator motor" as follows refering above chart.

No.	Inspection Procedures
1	Turn on "Switch D", and make sure the motor rotates clockwise, then stops at "High" position.
2	Turn on "Switch B", and make sure the motor rotates counter clockwise, then stops at "MID" position.
3	Turn on "Switch A", and make sure the motor rotates counter clockwise, then stops at "LOW" position.
4	Turn on "Switch C", and make sure the motor rotates clockwise, then stops at "MID" position.

SLOPE SENSOR

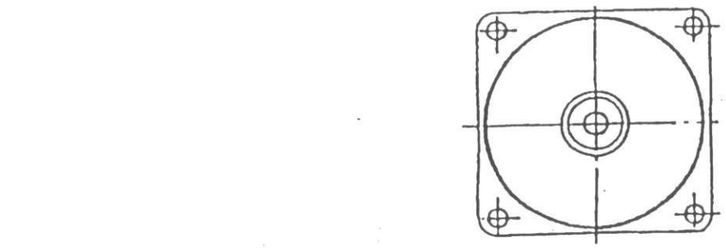
The sensor (installed on the turntable) detects the tilt angle of the machine caused by a slope.

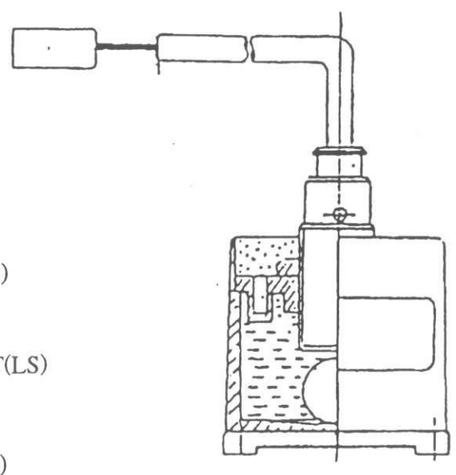
(for Spec : A3, A4)

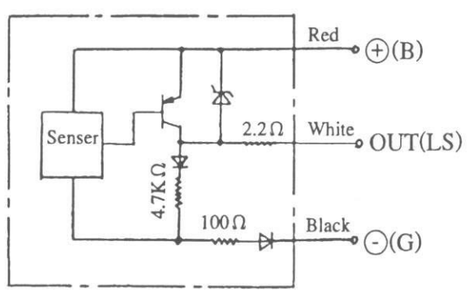
3 degree sensor

The sensor stops its out-put power (DC24V), and activates the slope warning buzzer, in case the machine is inclined 3° or more.

Rated voltage	DC24V(DC10~32V)
Preset angle	3°(2.5°~3.5°)
Output current	200mA







NOTE: The wire color of the slope sensor may be changed as follows.

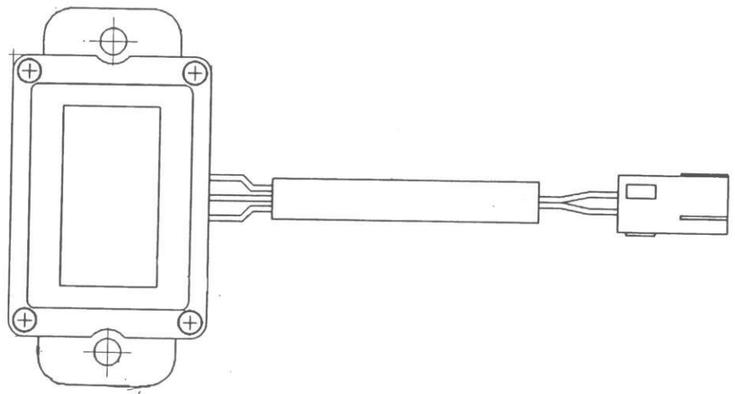
Red ⟶ Brown, White ⟶ Black, Black ⟶ Blue

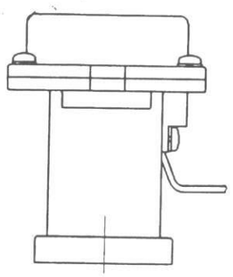
(for Spec : A6)

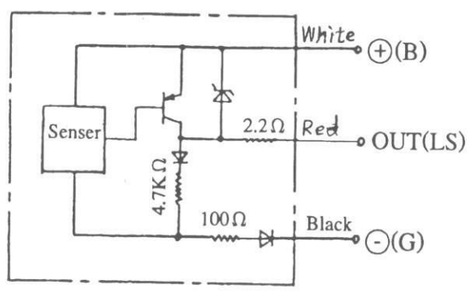
5 degree sensor

The sensor stops its out-put power (DC24V), and activates the slope warning buzzer, in case the machine is inclined 5° or more.

Rated voltage	DC24V(DC10~32V)
Preset angle	5.5°(5° ~ 6°)
Output current	100mA

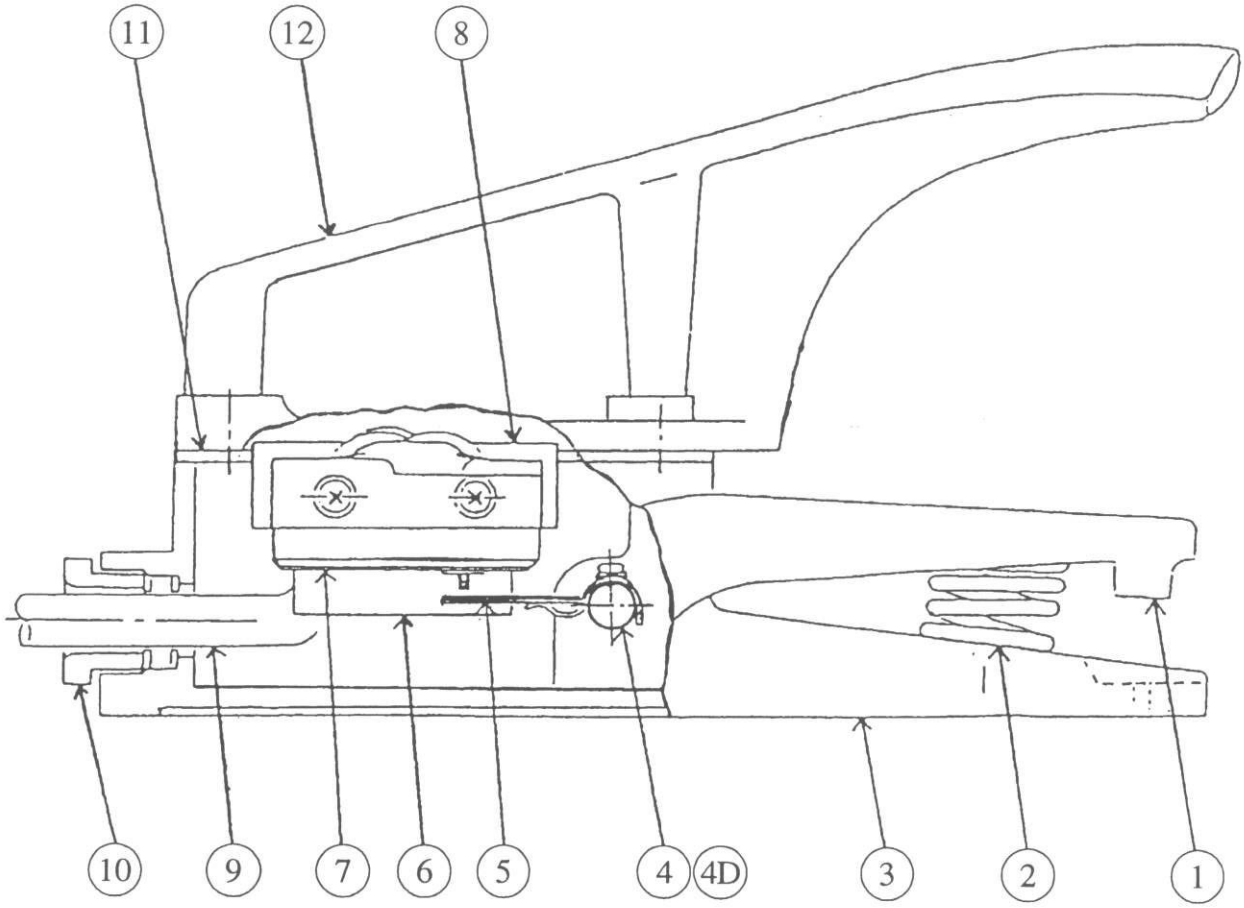


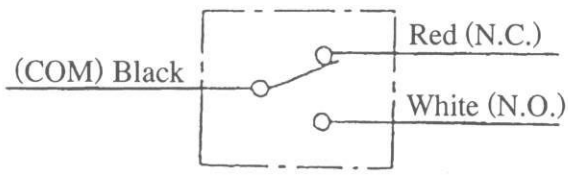




FOOT SWITCH

The foot switch is installed on the platform floor to stop the functions of Upper control levers and switches.
This will happen when the switch is not pressed down.

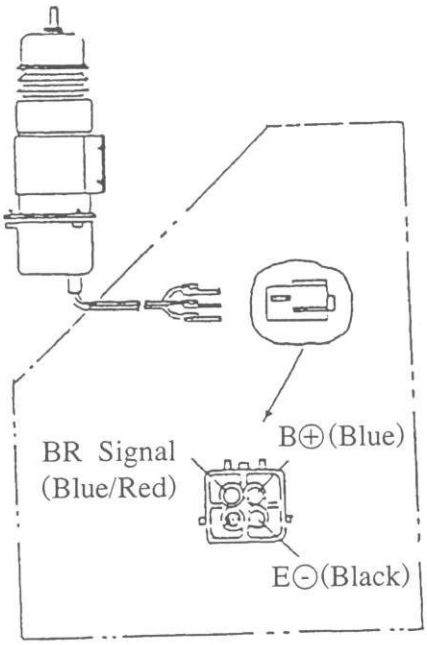




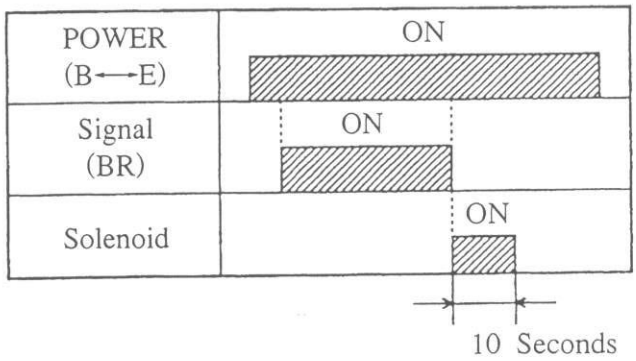
ELECTRIC COMPONENTS attached on ENGINE

1. Engine stop solenoid

Rated voltage	DC24V
Rated current	10A or less
Actuating time	10 seconds after switching off



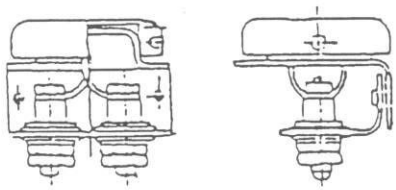
Function chart



The solenoid is switched on for about 10 seconds, when the power(+24V) applied on "Signal Line" is turned off, and switched off automatically after 10 seconds.

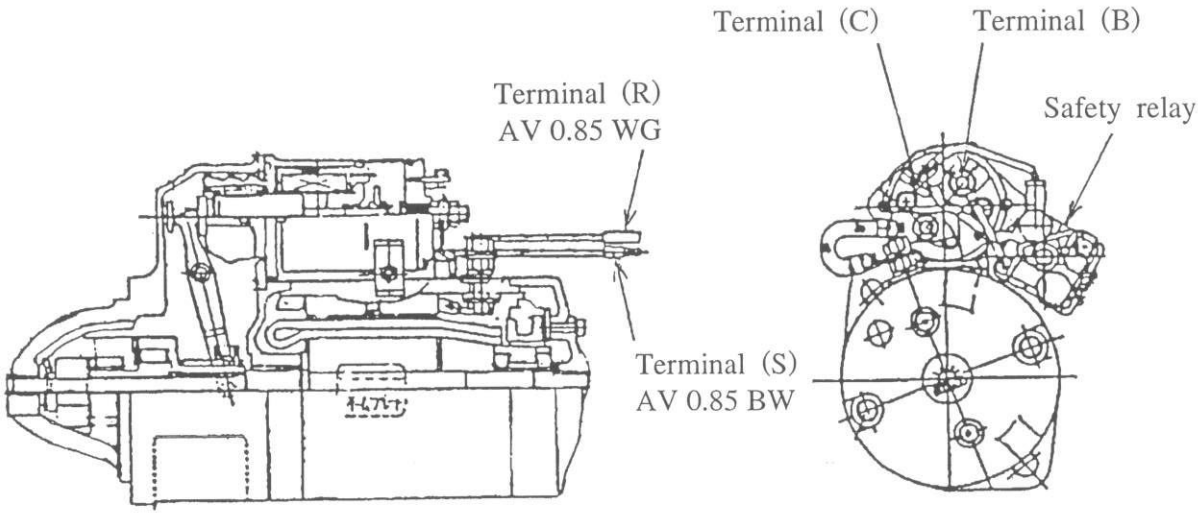
2. Glow indicator

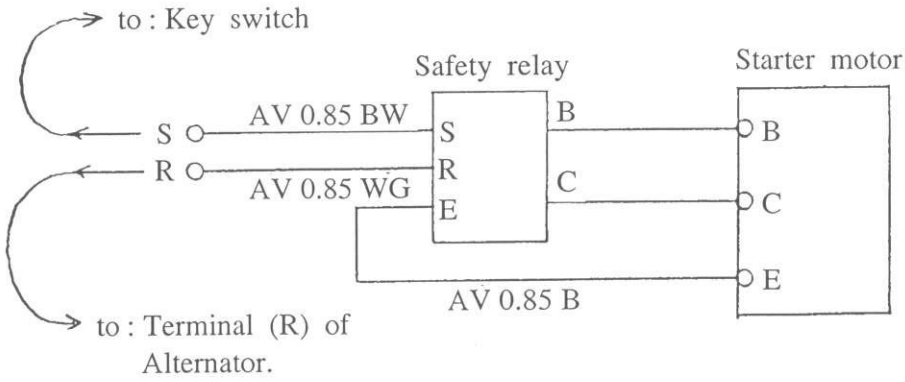
Rated voltage	DC24V
Rated current	16.4A
Resistance	0.054Ω
Time reaches to 800℃	20~25 seconds



3. Starter motor

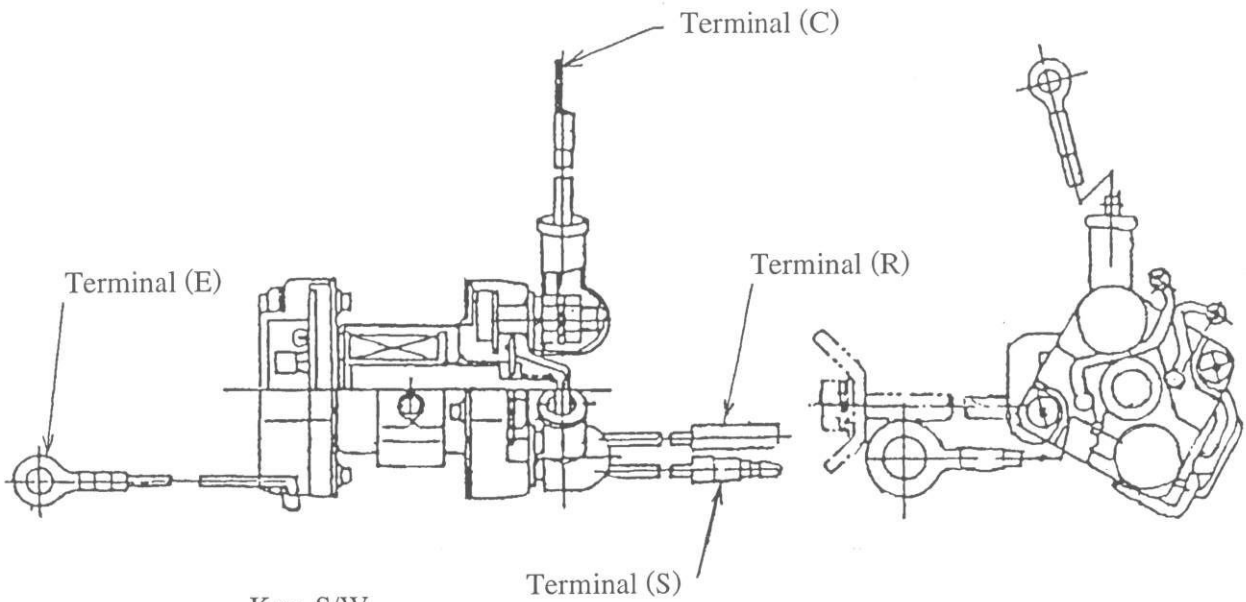
Rated voltage	DC24V
Rated output	3.5Kw

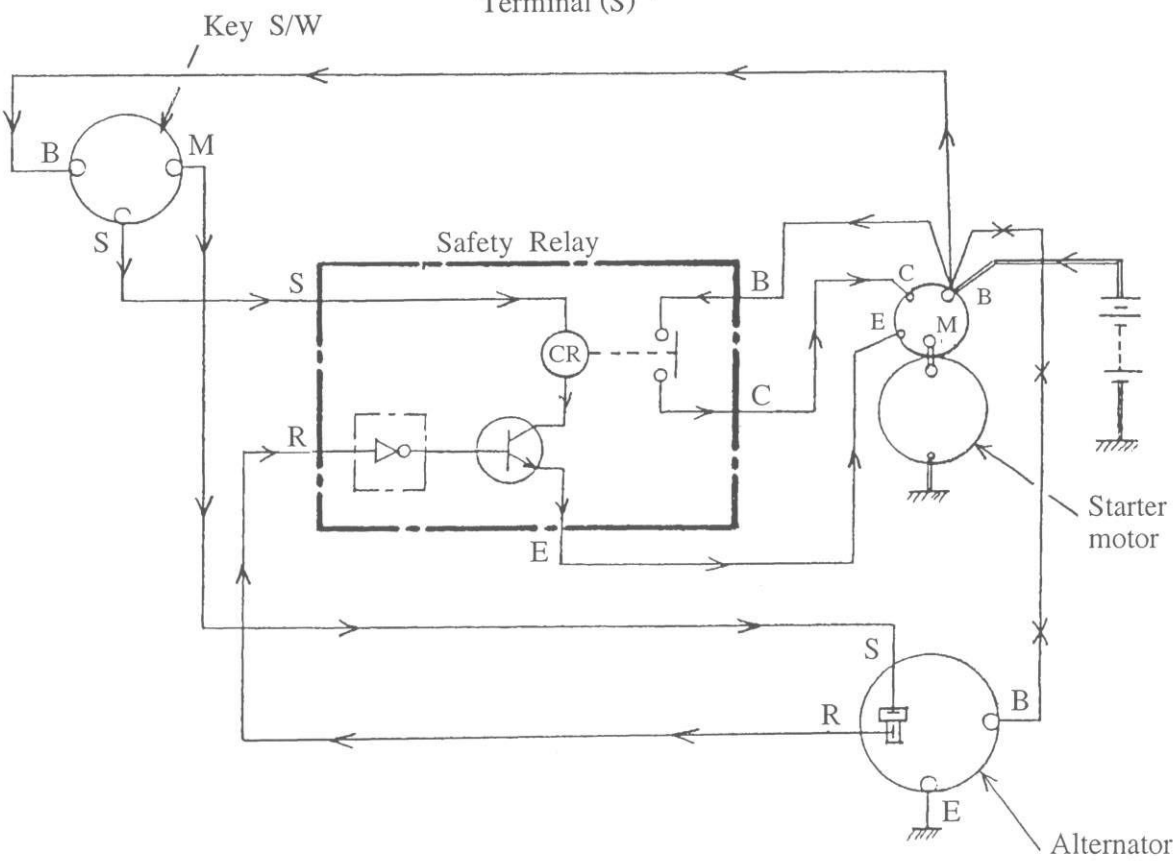




4. Safety relay

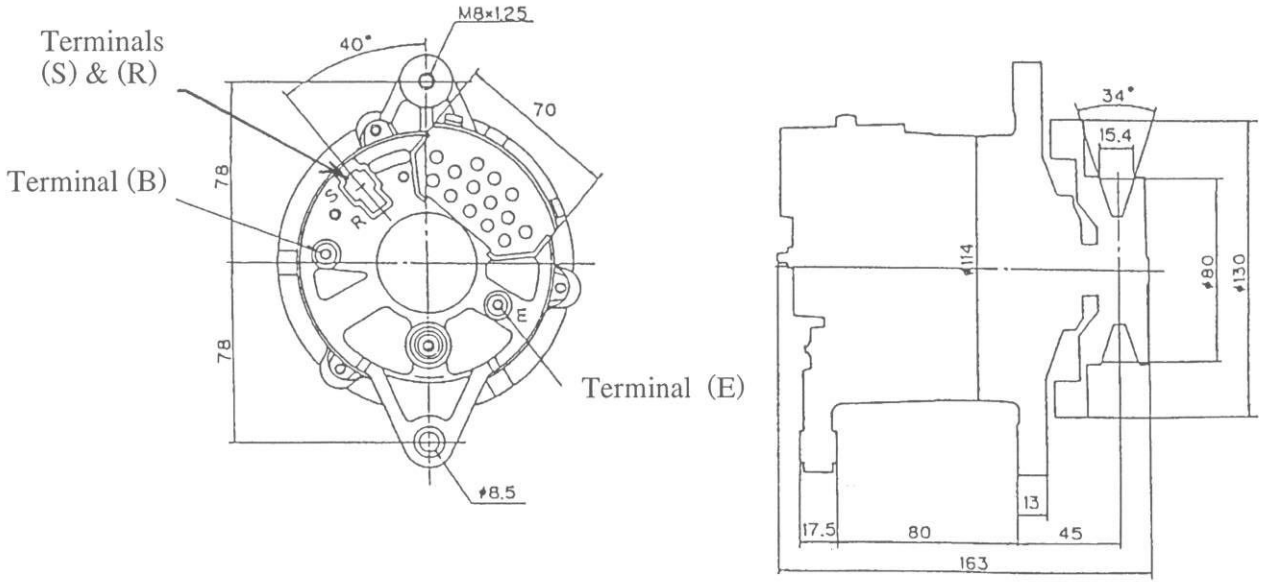
The relay is installed on the "Starter motor".

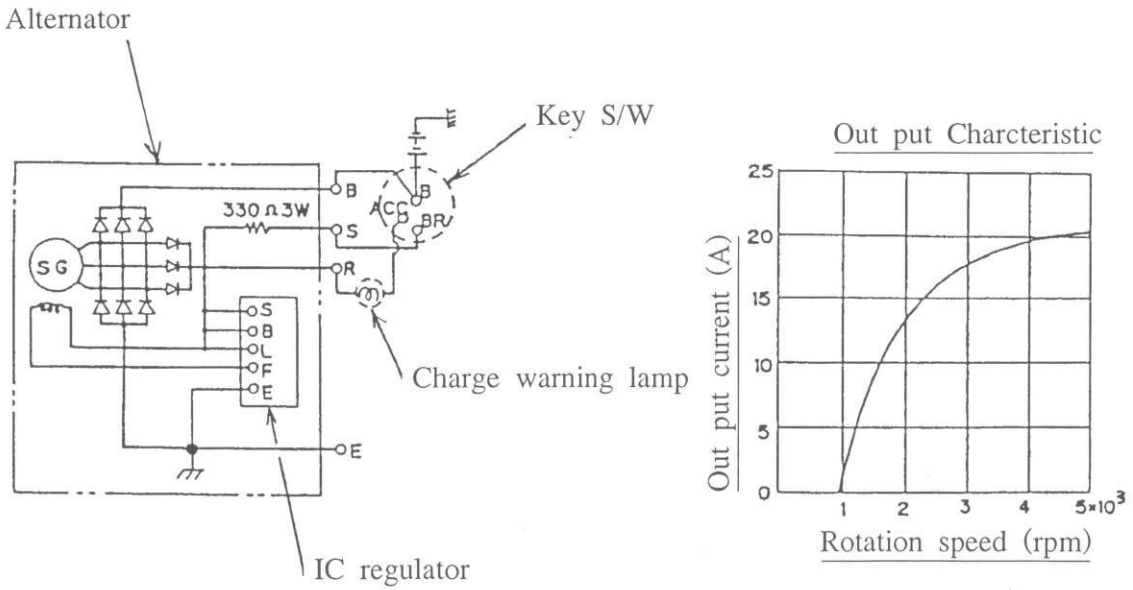




5. Alternator

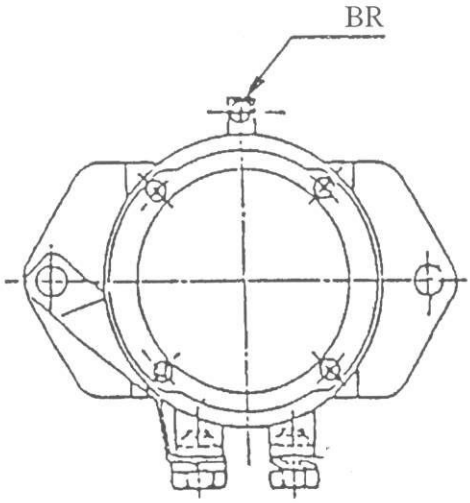
Rated voltage	DC24V
Out-put current	20A

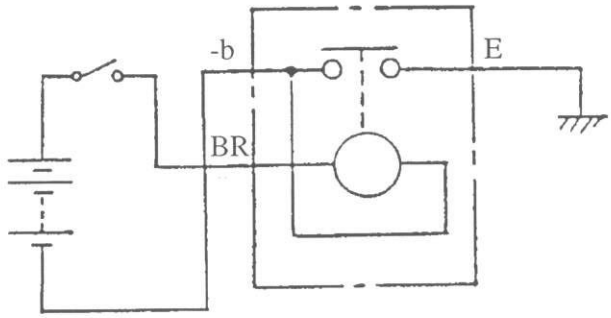


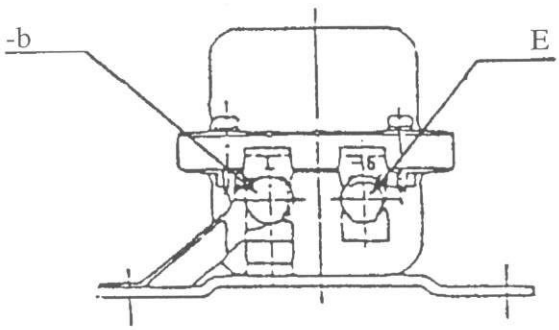


6. Battery relay

Rated voltage	DC24V
Rated current	100A(continuously), 1.000A(30 seconds)



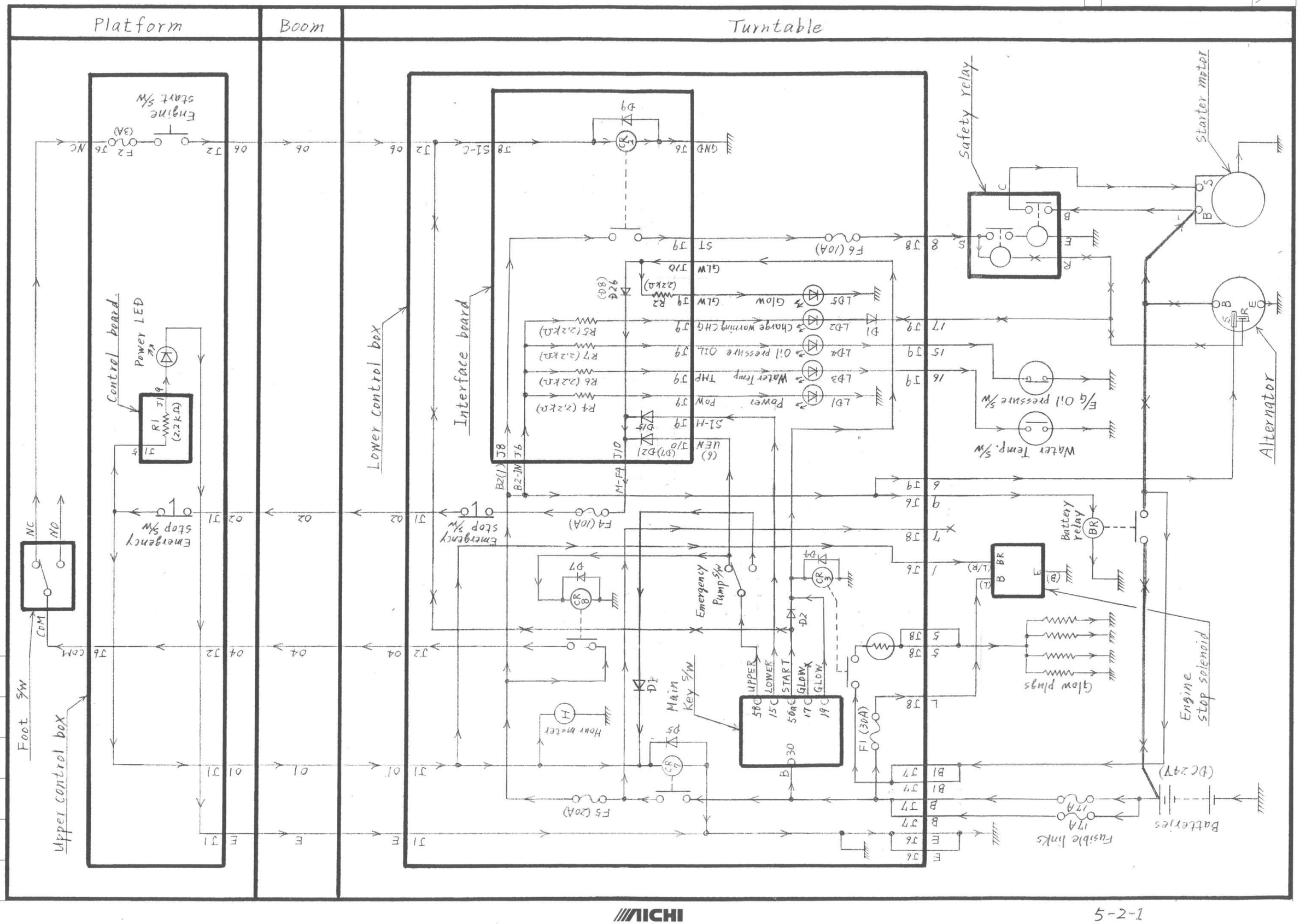




5
ELECTRIC CIRCUIT for INDIVIDUAL SYSTEM

ENGINE CONTROL SYSTEM

(for Spec : A3, A4,) (for Serial NO: ~655367)



ENGINE CONTROL SYSTEM

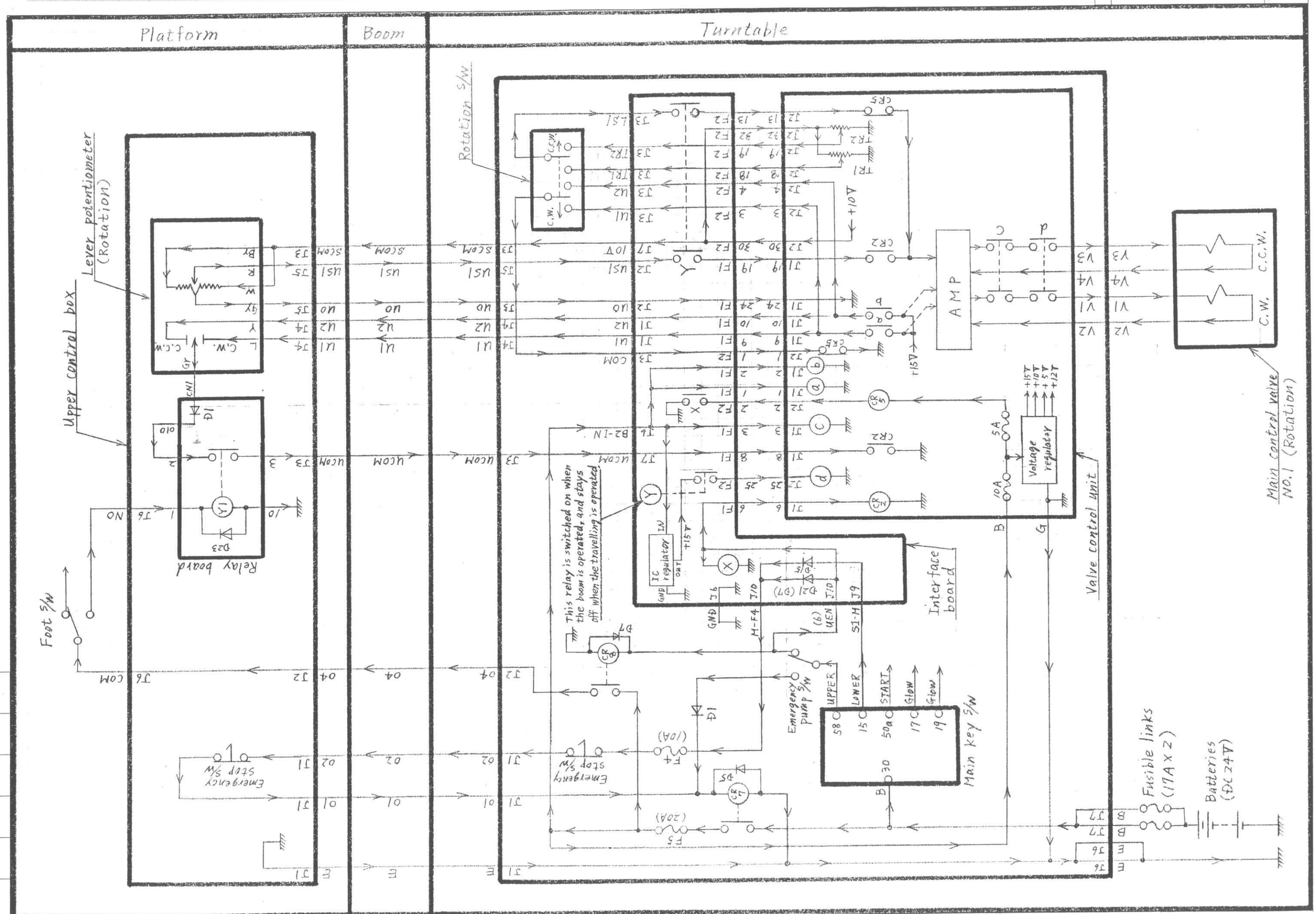
(for Spec : A4, A6) (for Serial NO: 655368 ~)

Platform | Boom | Turntable

Engine start S/W
(3A)
F2
Control board.
Power LED
R1 (2.2kΩ)
Emergency stop S/W
NC
NO
COM
Foot S/W
Upper control box
Lower control box
Interface board
F6 (10A)
R2 (2.2kΩ)
R3 (2.2kΩ)
R4 (2.2kΩ)
R5 (2.2kΩ)
R6 (2.2kΩ)
R7 (2.2kΩ)
Glow
Charge warning CHG
Oil pressure OIL
Water Temp
Power
LED1
LED2
LED3
LED4
LED5
D1
D2
D3
D4
D5
D6
D7
D8
D9
(6)
F4 (10A)
F5 (20A)
CR1
CR3
CR7
CR8
CR9
Hour meter
Emergency Pump S/W
Main key S/W
UPPER
LOWER
START
GLOW
GLOW
30
F1 (30A)
Safety relay
Starter motor
Alternator
E/G oil pressure S/W
Water Temp. S/W
Battery relay
Glow plugs
Engine stop solenoid
Batteries
(DC24V)
Fusible links
17A

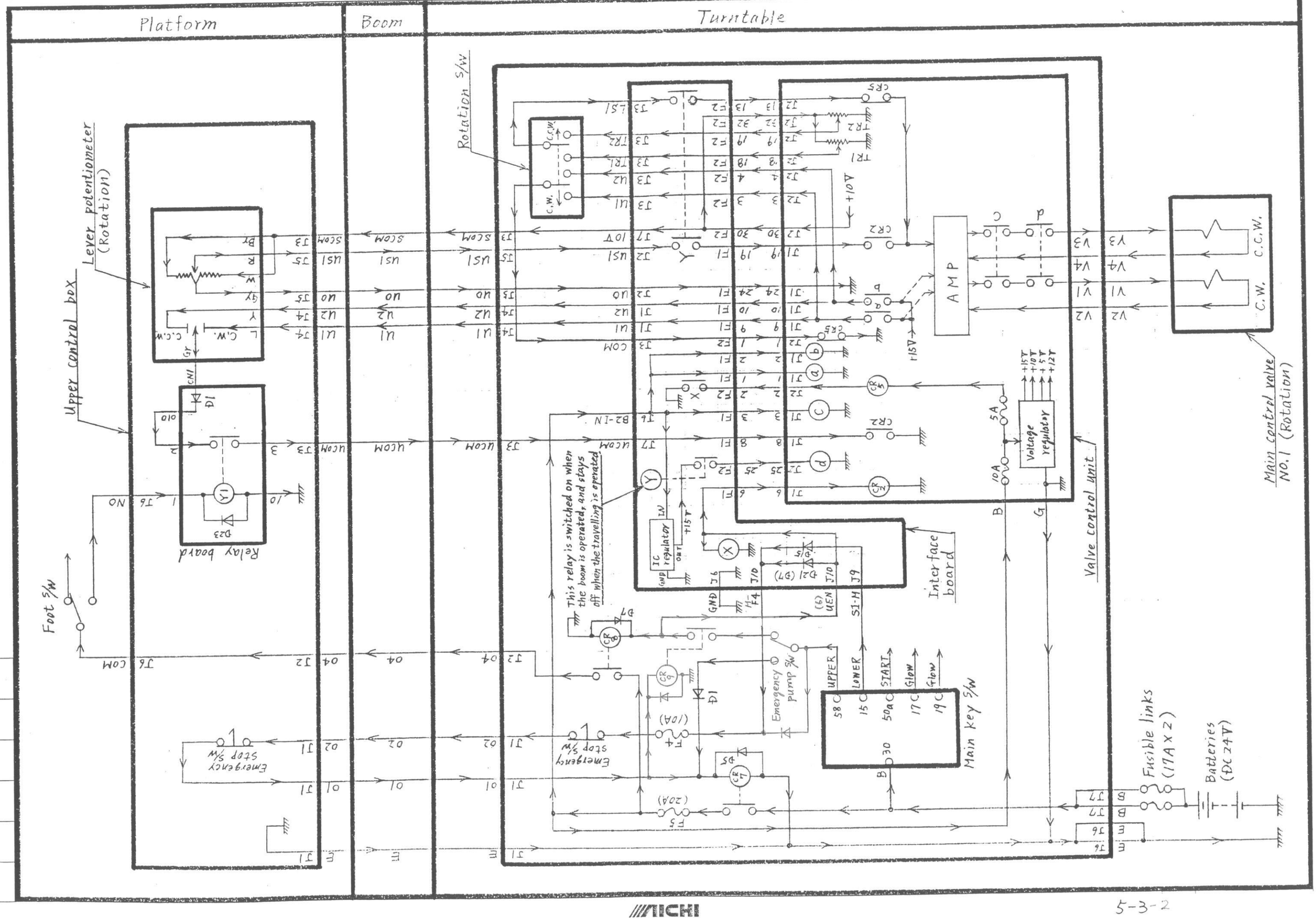
ROTATION SYSTEM

(for Spec : A3, A4) (for Serial NO: ～655367)



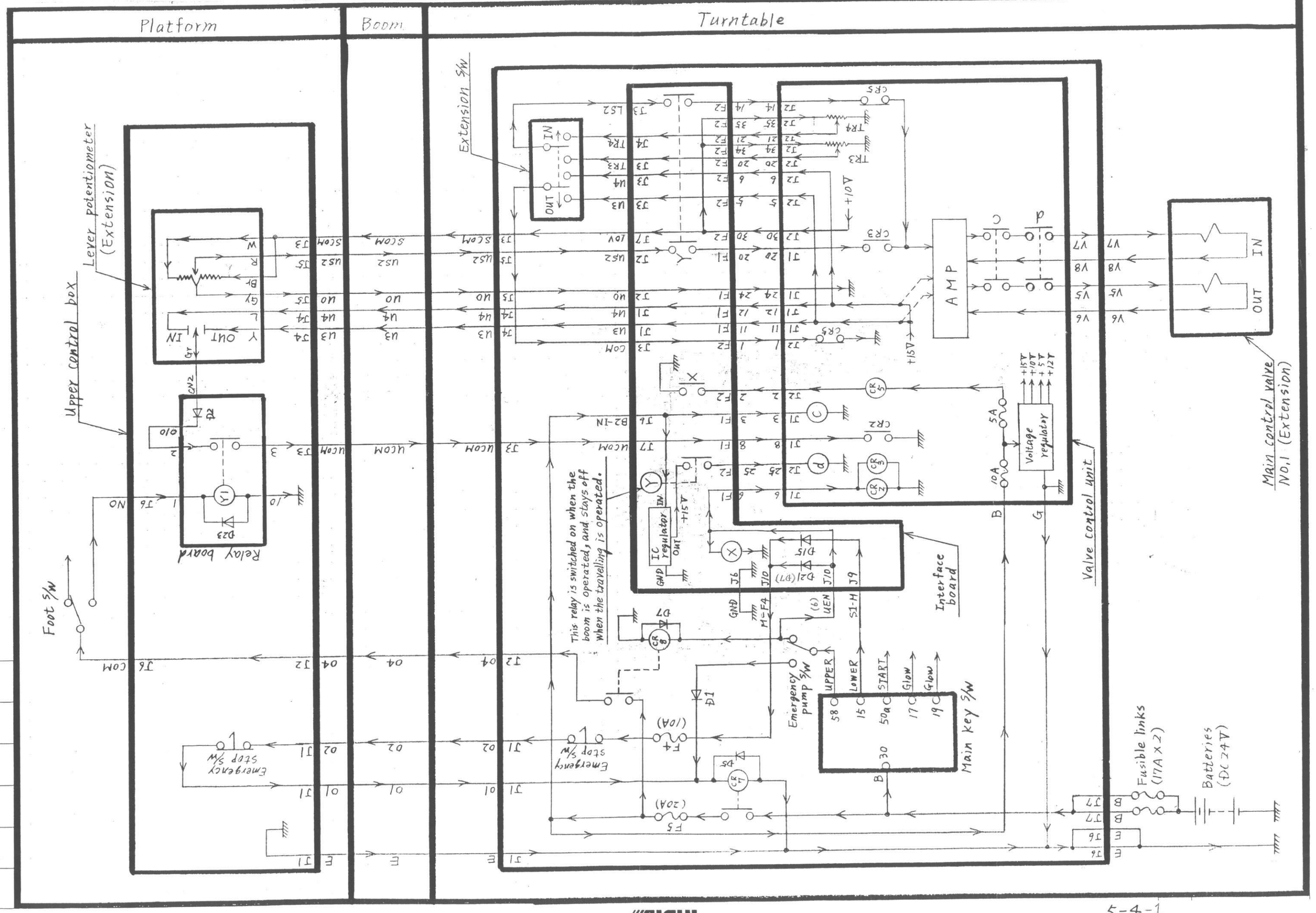
ROTATION SYSTEM

(for Spec : A4, A6) (for Serial NO: 655368 ~)



EXTENSION SYSTEM

(for Spec : A3, A4) (for Serial NO : ~655367)



EXTENSION SYSTEM

(for Spec : A4, A6) (Serial NO: 655368 ~)

Platform

Boom

Turntable

Lever potentiometer (Extension)

Upper control box

Relay board

Foot S/W

Emergency stop S/W

Extension S/W

This relay is switched on when the boom is operated, and stays off when the travelling is operated.

Interface board

AMP

Valve control unit

Main control valve (Extension) NO.1

Main key S/W

Emergency pump S/W

Fusible links (17A x 2)

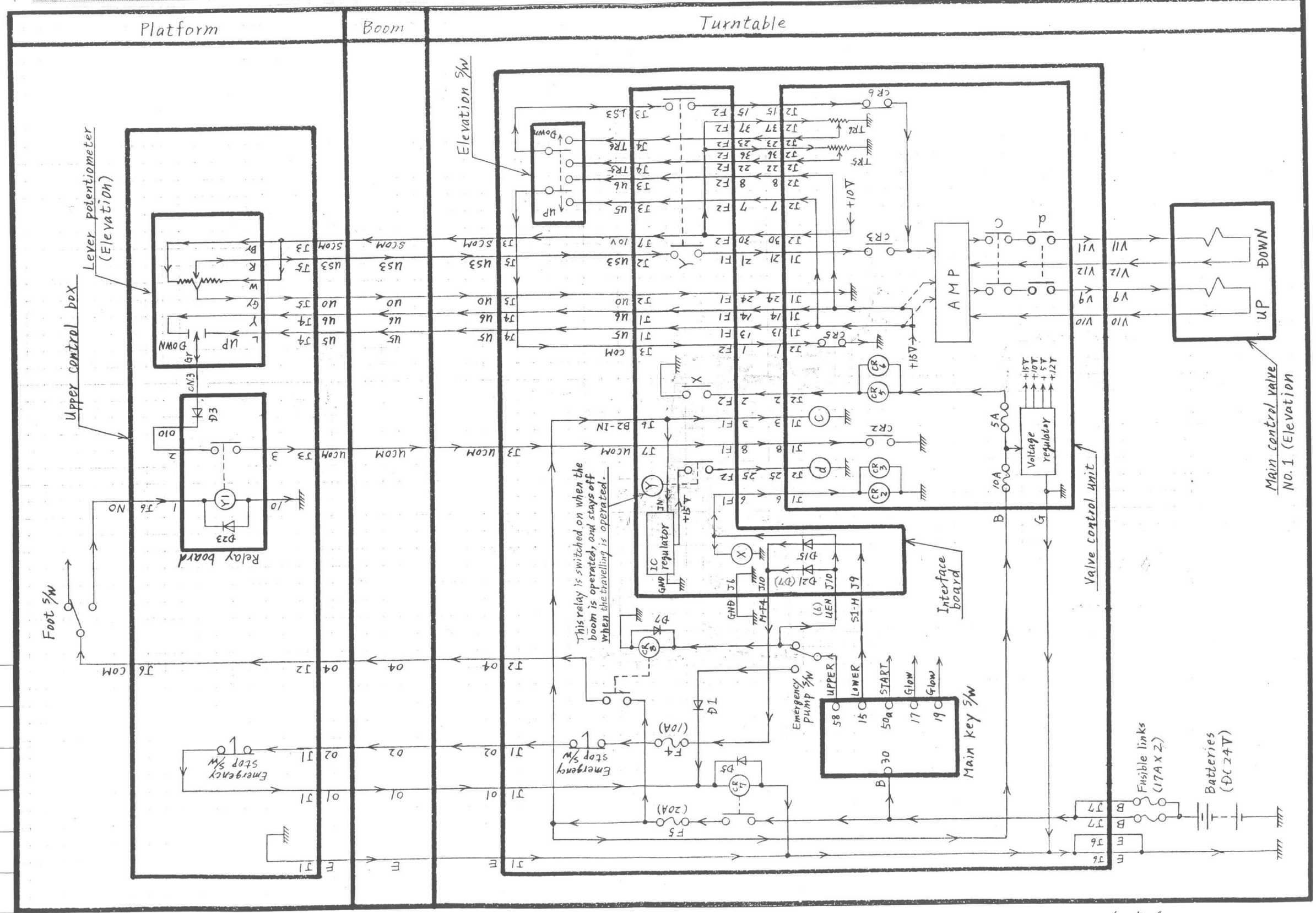
Batteries (DC 24V)

Voltage regulator

IC regulator

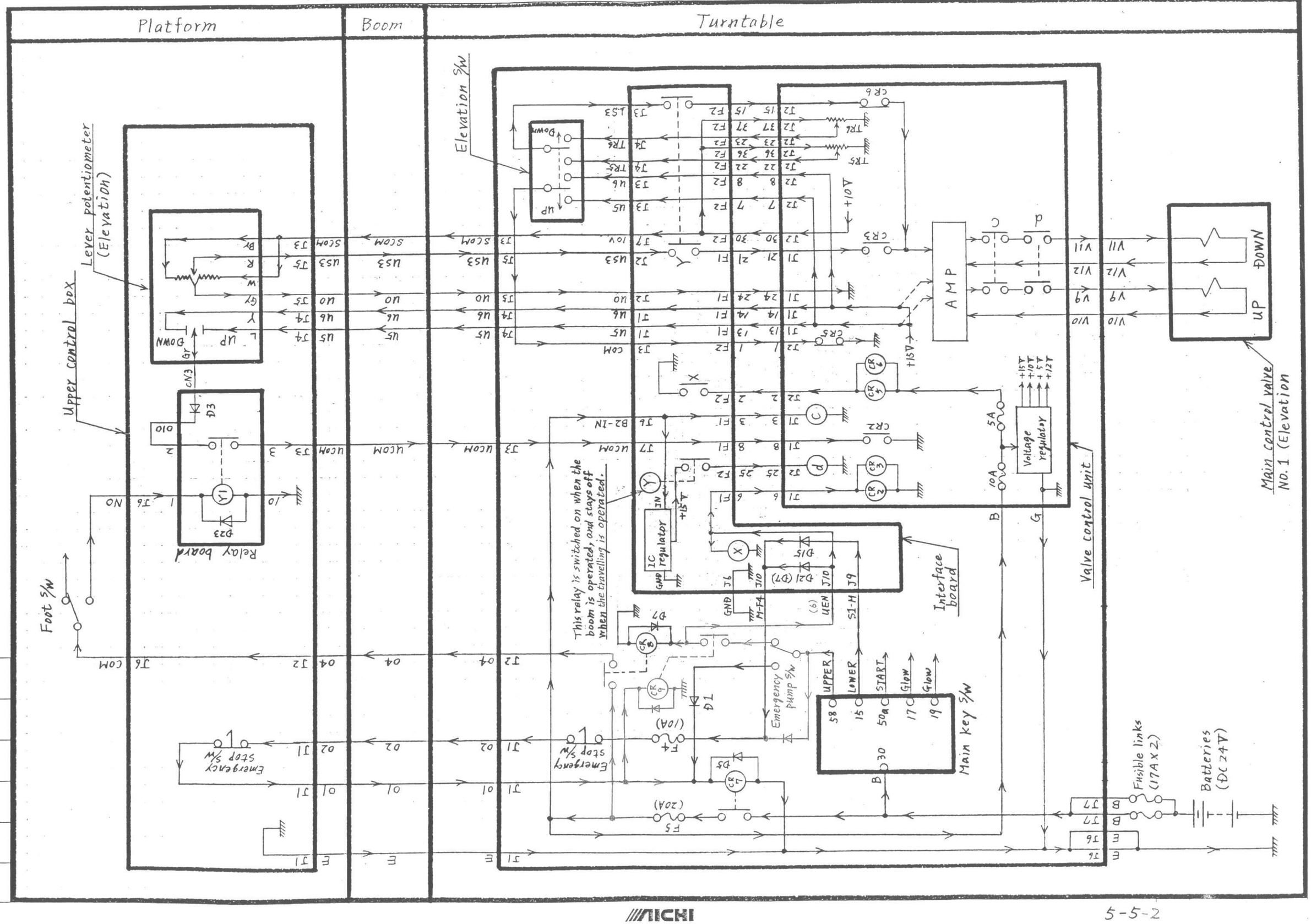
ELEVATION SYSTEM

(for Spec : A3, A4) (for Serial NO : ~655367)



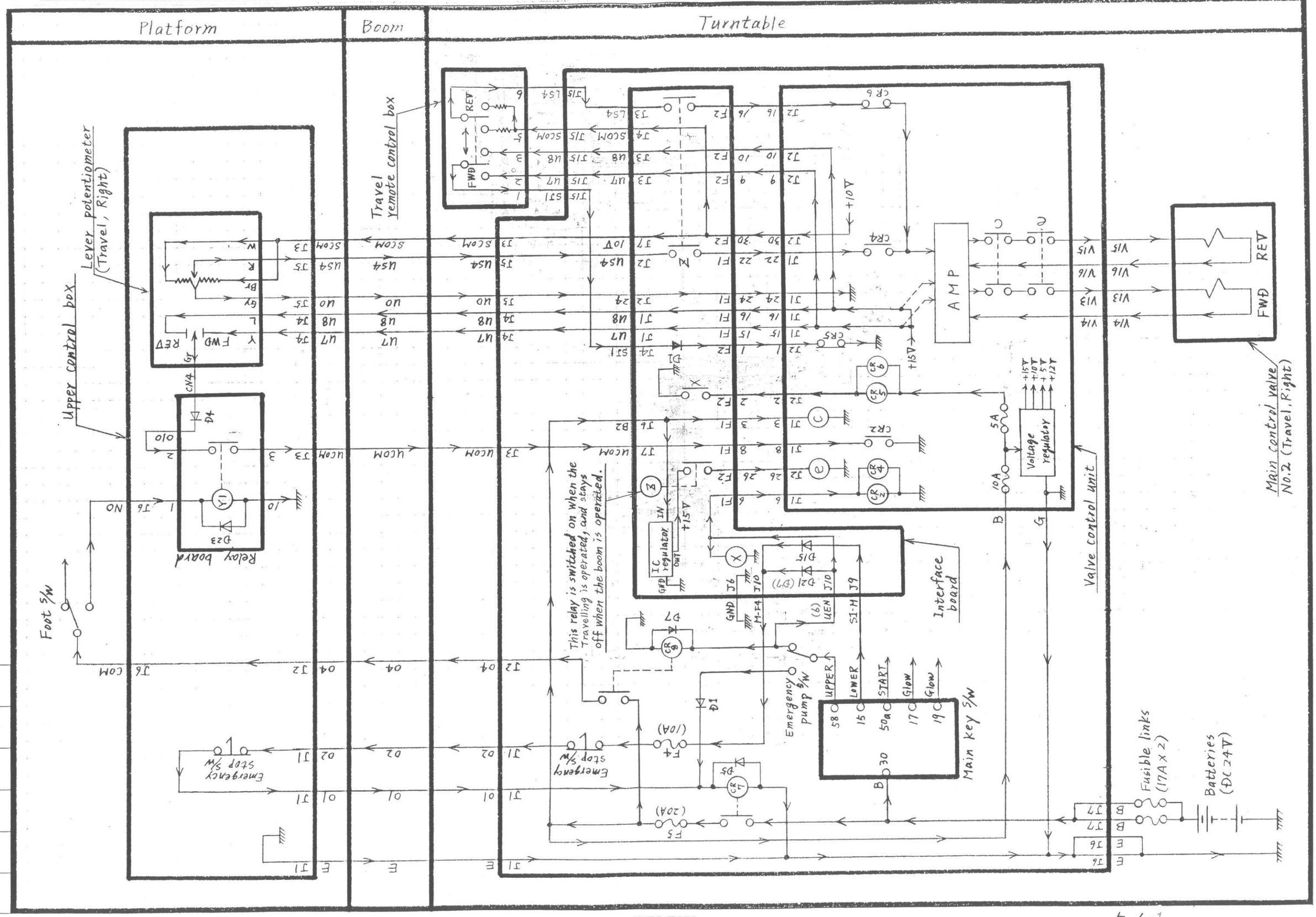
ELEVATION SYSTEM

(for Spec : A4, A6) (for Serial NO : 655368 ~)



TRAVEL (RIGHT) SYSTEM

(for Spec: A3, A4) (for Serial NO: ~655367)



TRAVEL (RIGHT) SYSTEM

(for Spec: A4, A6) (for Serial NO: 655368~)

Platform | Boom | Turntable

Lever potentiometer (Travel, Right)

Upper control box

Travel remote control box

Relay board

Foot S/W

Emergency stop S/W

Emergency stop S/W

This relay is switched on when the Travelling is operated, and stays off when the boom is operated.

Interface board

Emergency pump S/W

Main key S/W

Valve control unit

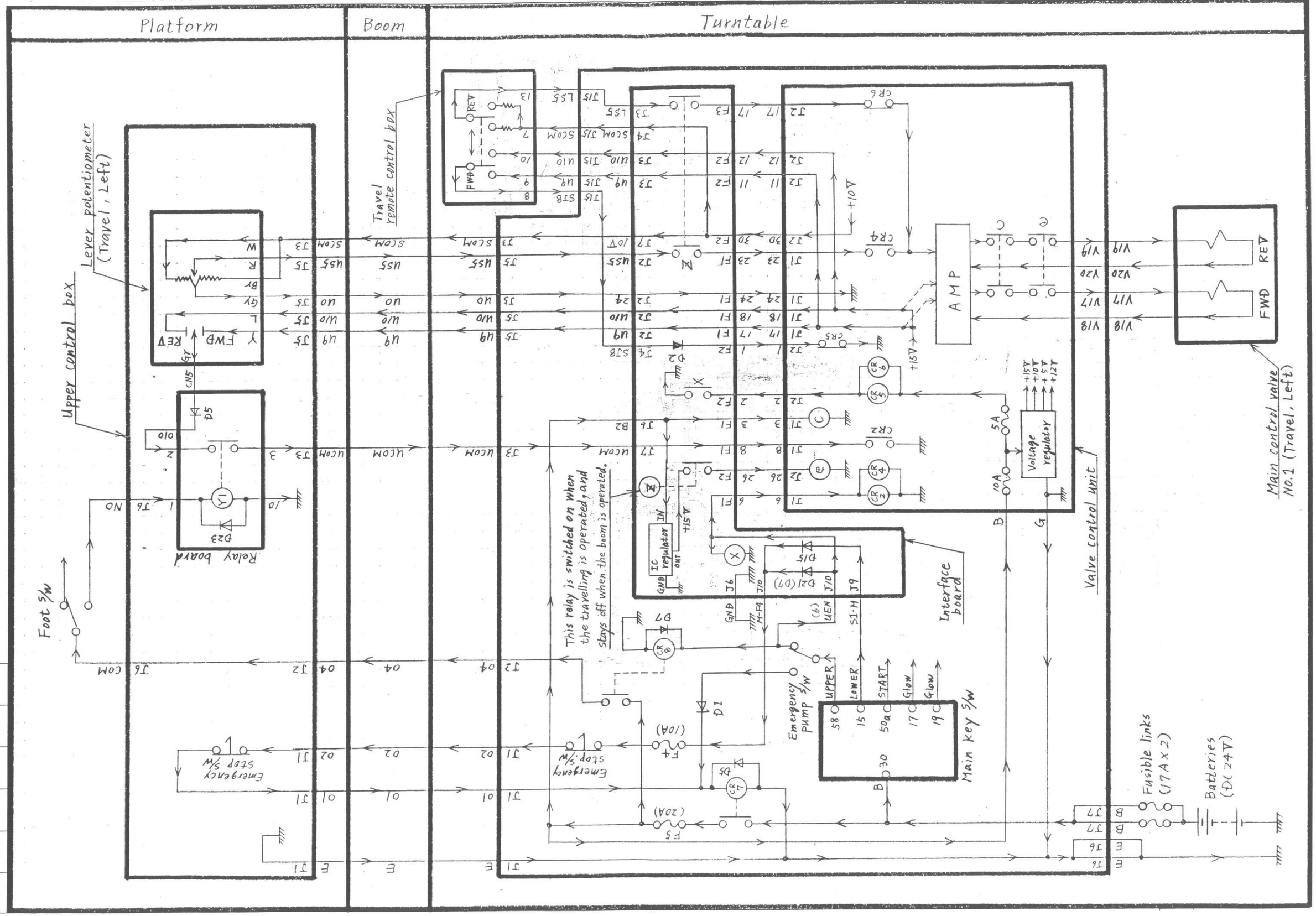
Main control valve No.2 (Travel, Right)

Fusible links (17A x 2)

Batteries (DC 24V)

TRAVEL (LEFT) SYSTEM

(for Spec : A3, A4) (for Serial NO : ~655367)



TRAVEL (LEFT) SYSTEM

(for Spec : A4, A6) (for Serial NO: 655368~)

Platform | Boom | Turntable

Lever potentiometer (Travel, Left)

Upper control box

Travel remote control box

Relay board

Foot S/W

Emergency stop S/W

Emergency stop S/W

This relay is switched on when the travelling is operated, and stays off when the boom is operated.

Interface board

Emergency pump S/W

Main key S/W

AMP

FWD REV

Valve control unit

Main control valve No.1 (Travel, Left)

Fusible links (17A x 2)

Batteries (DC 24V)

ACCELERATOR SYSTEM

(for Spec: A3)

Platform | Boom | Turntable

Accelerator system functions as follows, when the accelerator switch is set at AUTO position.

① Engine speed is automatically brought up to "MID" (1,800rpm), when "Boom" is operated.

② Engine speed is automatically brought up to "High" (2,300rpm), when "Travel" is operated.

③ Engine speed stays at "Low" (1,200rpm) even when "Travel" is operated, if one or both of the conditions listed below are satisfactory.

- Ⓐ Boom angle is over the horizontal.
- Ⓑ Boom is not fully retracted.

Upper control box

Foot S/W

Emergency stop S/W

Emergency stop S/W

Accelerator S/W

Low / Auto

Closed, when the boom angle is below horizontal.

Closed, when the boom is fully retracted.

LS-1

LS-2

F4 (3A)

F4 (10A)

F3 (10A)

F5 (20A)

F2 (5A)

Emergency pump S/W

Main key S/W

UPPER / LOWER / START / Glow / Glow

Valve control unit

Interface board

The relay is switched on, when either the boom or travel is operated.

The relay is switched on, when "Travel" is operated under one or both of the conditions listed below are satisfactory.

- Boom angle is over the horizontal.
- Boom is not fully retracted.

The relay is switched on, when "Travel" is operated.

Lower control box

Accelerator motor

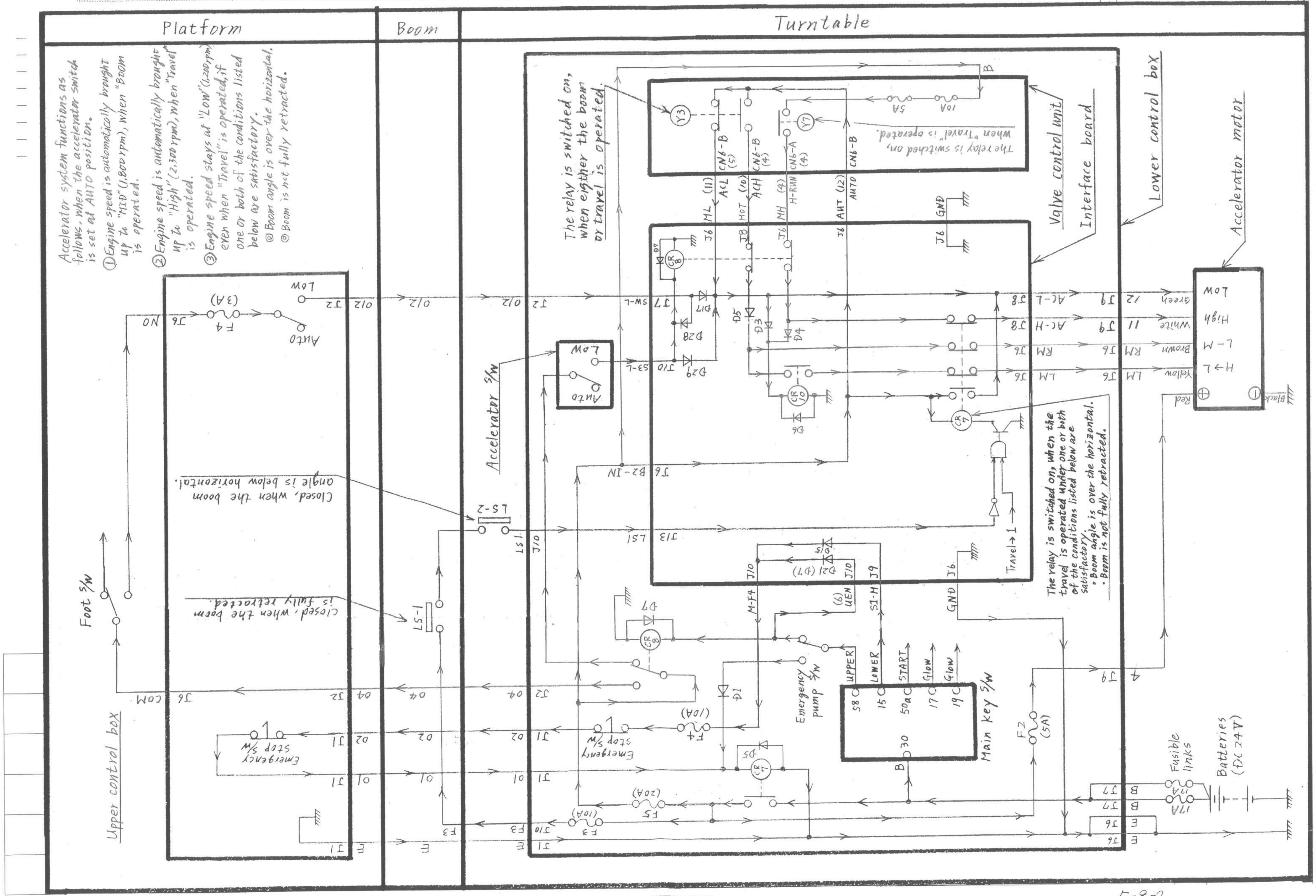
Low / High / L-M / H→L

Green / White / Brown / Yellow / Red / Black

Fusible links

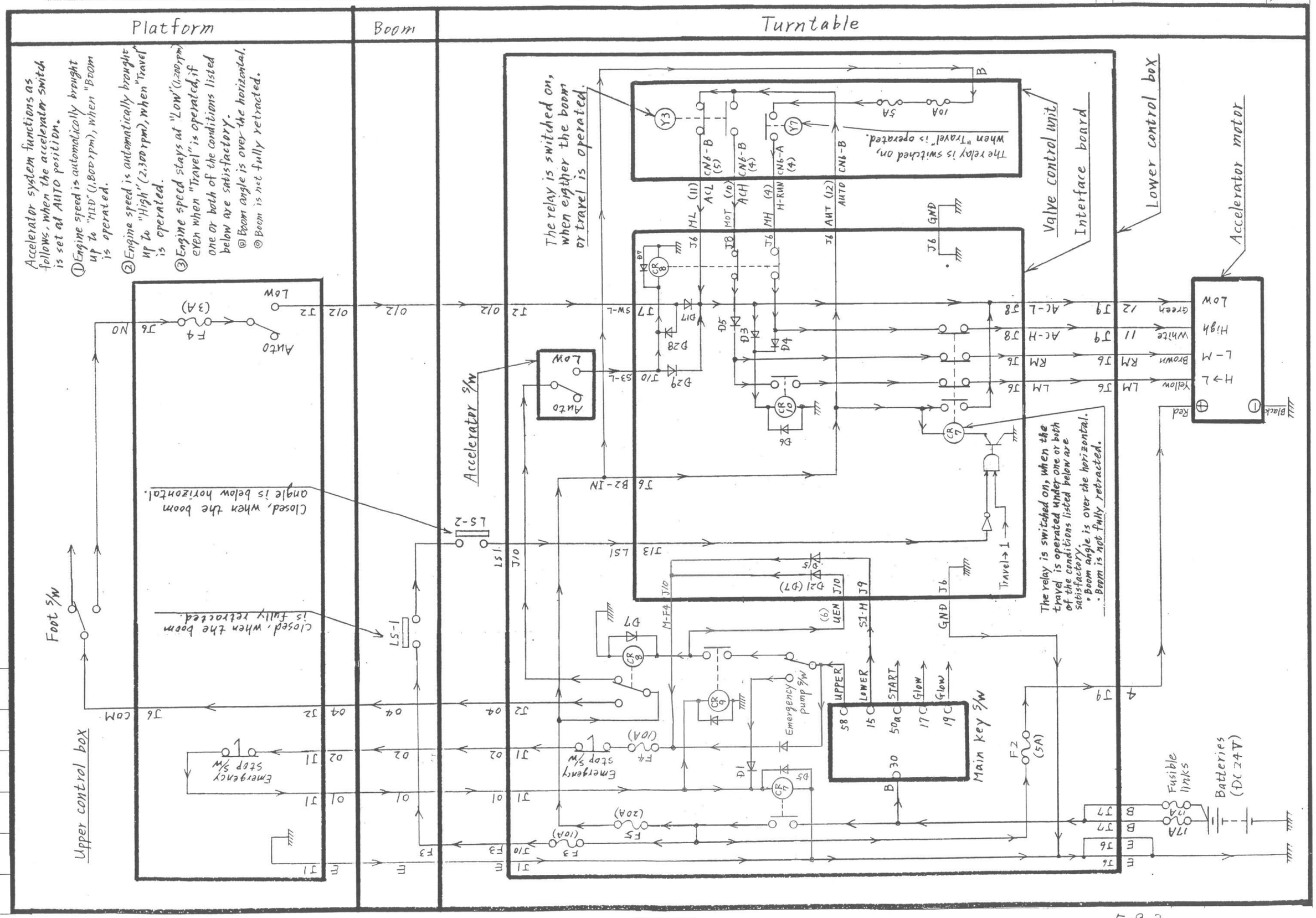
Batteries (DC 24V)

Travel→ I


Platform
Boom
Turntable
Accelerator system functions as follows, when the accelerator switch is set at AUTO position.
① Engine speed is automatically brought up to "MID" (1,800 rpm), when "Boom" is operated.
② Engine speed is automatically brought up to "High" (2,300 rpm), when "Travel" is operated.
③ Engine speed stays at "Low" (1,200 rpm) even when "Travel" is operated, if one or both of the conditions listed below are satisfactory.
◎ Boom angle is over the horizontal.
◎ Boom is not fully retracted.
The relay is switched on, when either the boom or travel is operated.
The relay is switched on, when "Travel" is operated.
The relay is switched on, when the travel is operated under one or both of the conditions listed below are satisfactory.
• Boom angle is over the horizontal.
• Boom is not fully retracted.
Closed, when the boom angle is below horizontal.
Closed, when the boom is fully retracted.
Valve control unit
Interface board
Lower control box
Accelerator motor
Upper control box
Accelerator S/W
Foot S/W
Emergency stop S/W
Emergency pump S/W
Main key S/W
Fusible links
Batteries (DC 24V)
LS-1
LS-2
Low
High
L-M
H-L
Auto
F4 (3A)
F4 (10A)
F5 (20A)
F3 (10A)
F2 (5A)
5A
10A
UPPER
LOWER
START
Glow
Travel→1

ACCELERATOR SYSTEM

(for Spec : A4) (for Serial NO : 655368 ~)

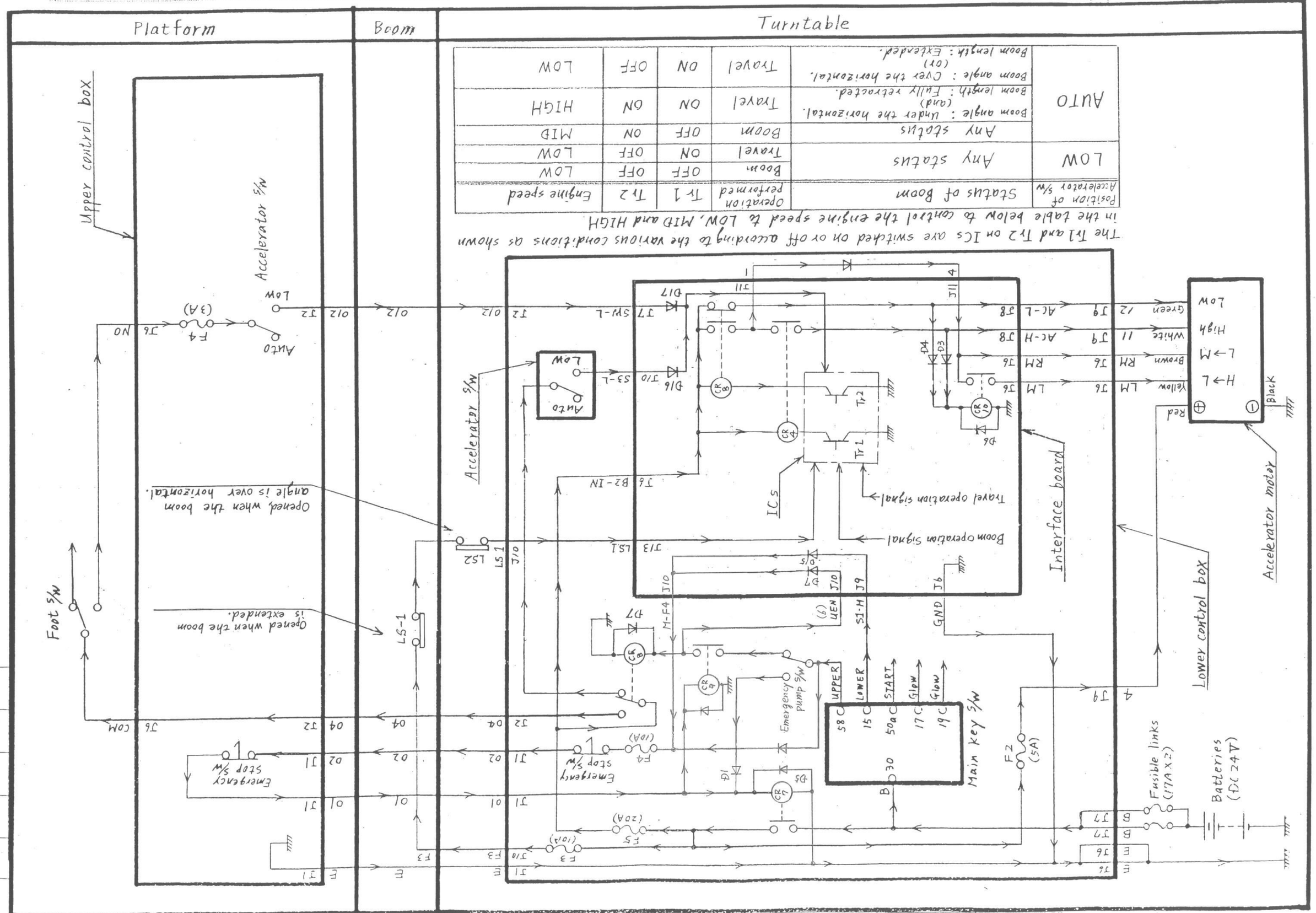


ACCELERATOR SYSTEM (for Spec : A6)

Platform | Boom | Turntable

The Tr1 and Tr2 on ICs are switched on or off according to the various conditions as shown in the table below to control the engine speed to LOW, MID and HIGH.

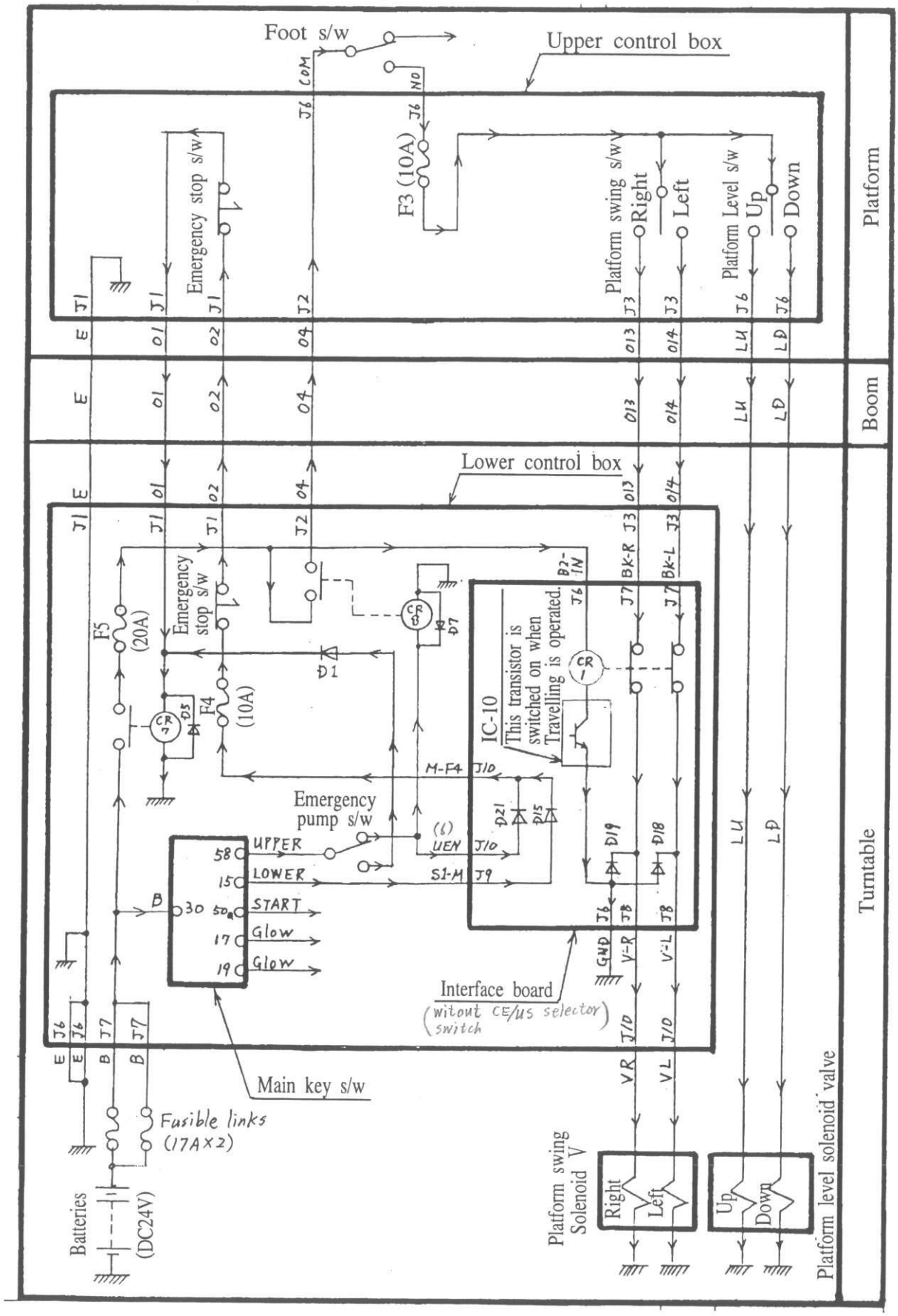
Position of Accelerator s/w	Status of Boom	Operation performed	Tr 1	Tr 2	Engine speed
LOW	Any status	Boom	OFF	OFF	LOW
		Travel	ON	OFF	LOW
AUTO	Any status	Boom	OFF	ON	MID
	Boom angle : Under the horizontal. (and) Boom length : Fully retracted.	Travel	ON	ON	HIGH
	Boom angle : Over the horizontal. (or) Boom length : Extended.	Travel	ON	OFF	LOW



(for Spec : A3, A4)

PLATFORM SWING, PLATFORM LEVEL SYSTEM

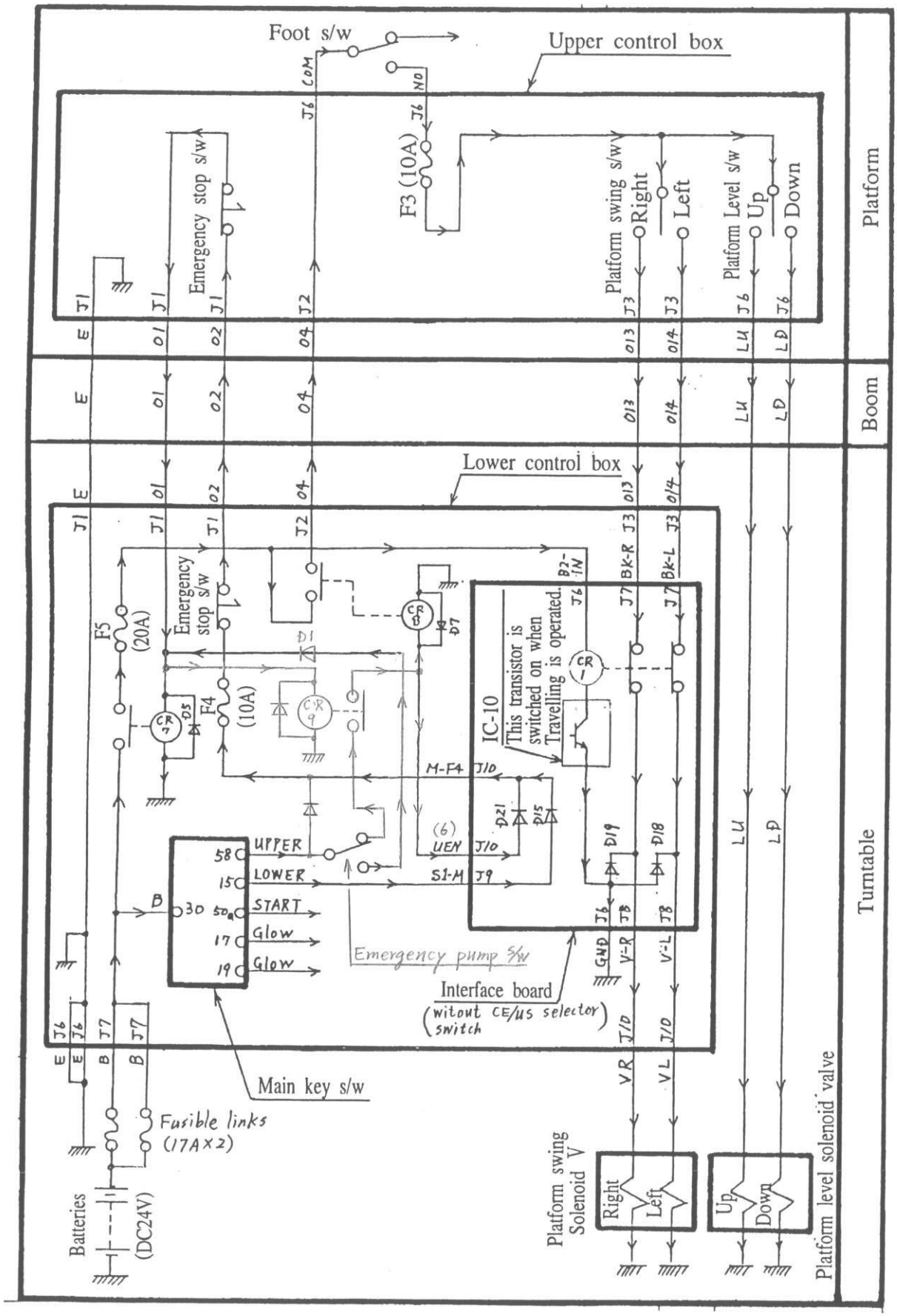
(for Interface boad without CE/us selector switch) (for Serial NO : ~655367)



(for Spec : A4, A6)

PLATFORM SWING, PLATFORM LEVEL SYSTEM

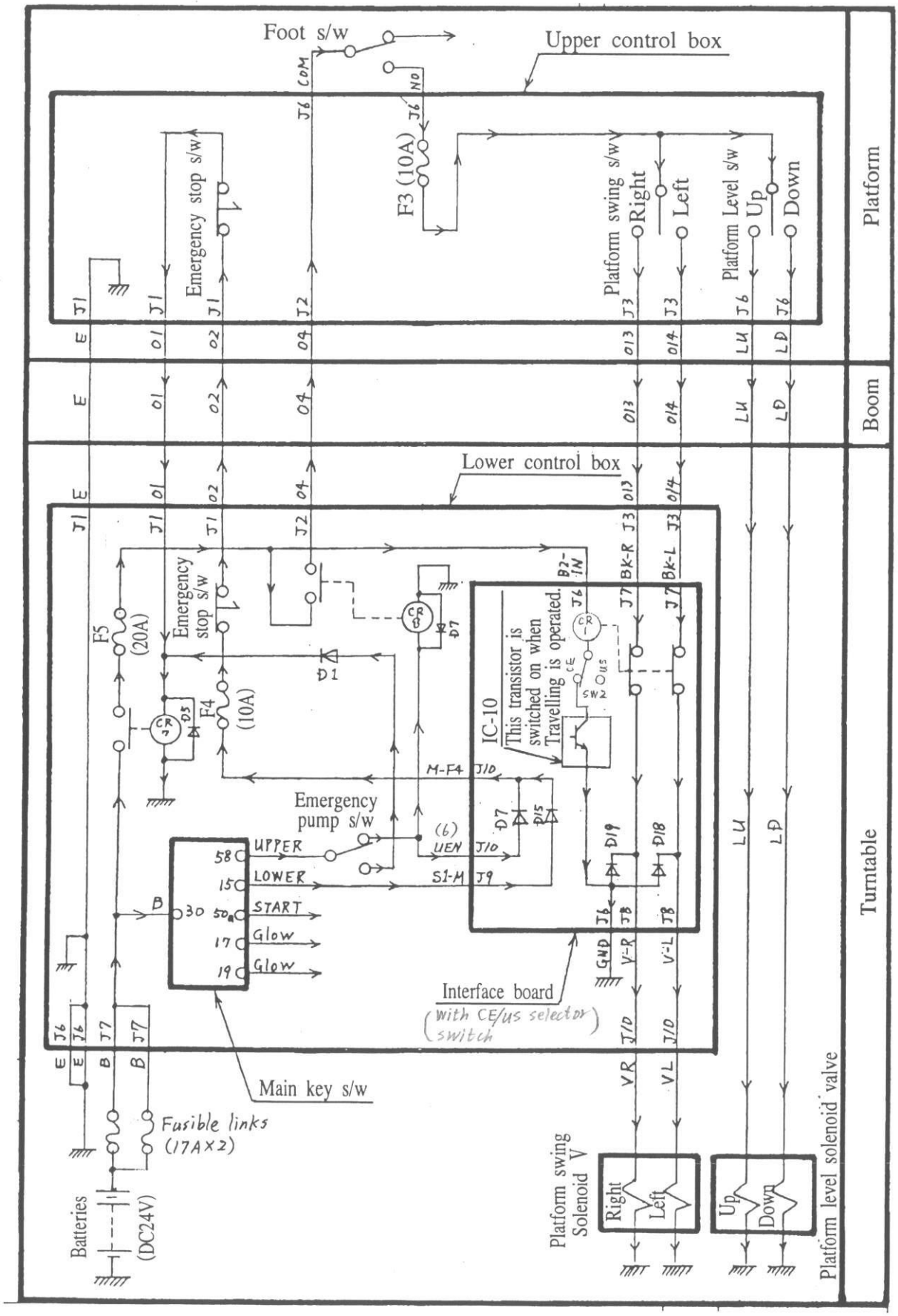
(for Interface boad without CE/us selector switch) (for Serial NO: 655368~)



(for Spec: A3, A4)

PLATFORM SWING, PLATFORM LEVEL SYSTEM

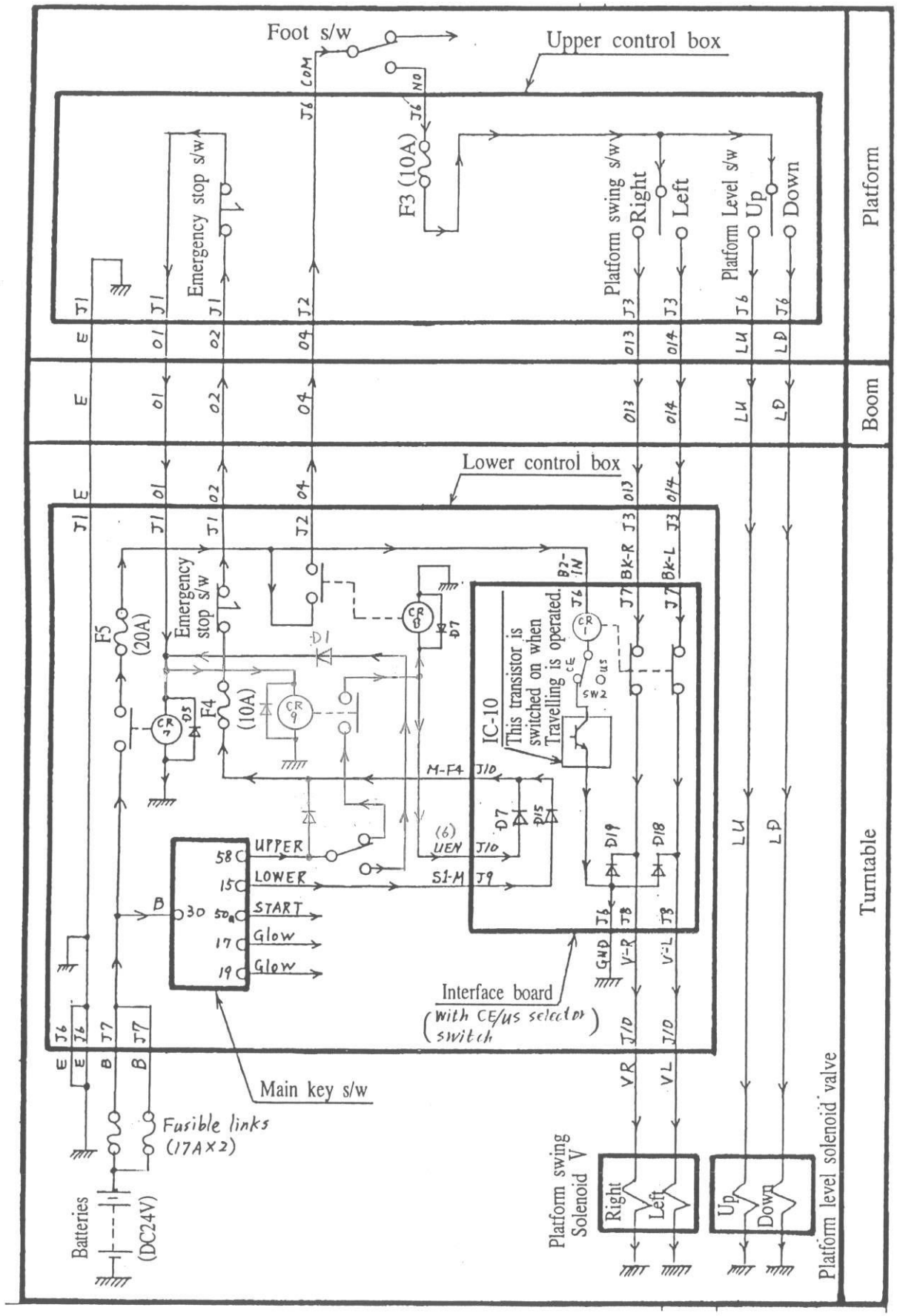
(for Inteface board CE/US selector switch) (for Serial NO: ~655367)



(for Spec: A4, A6)

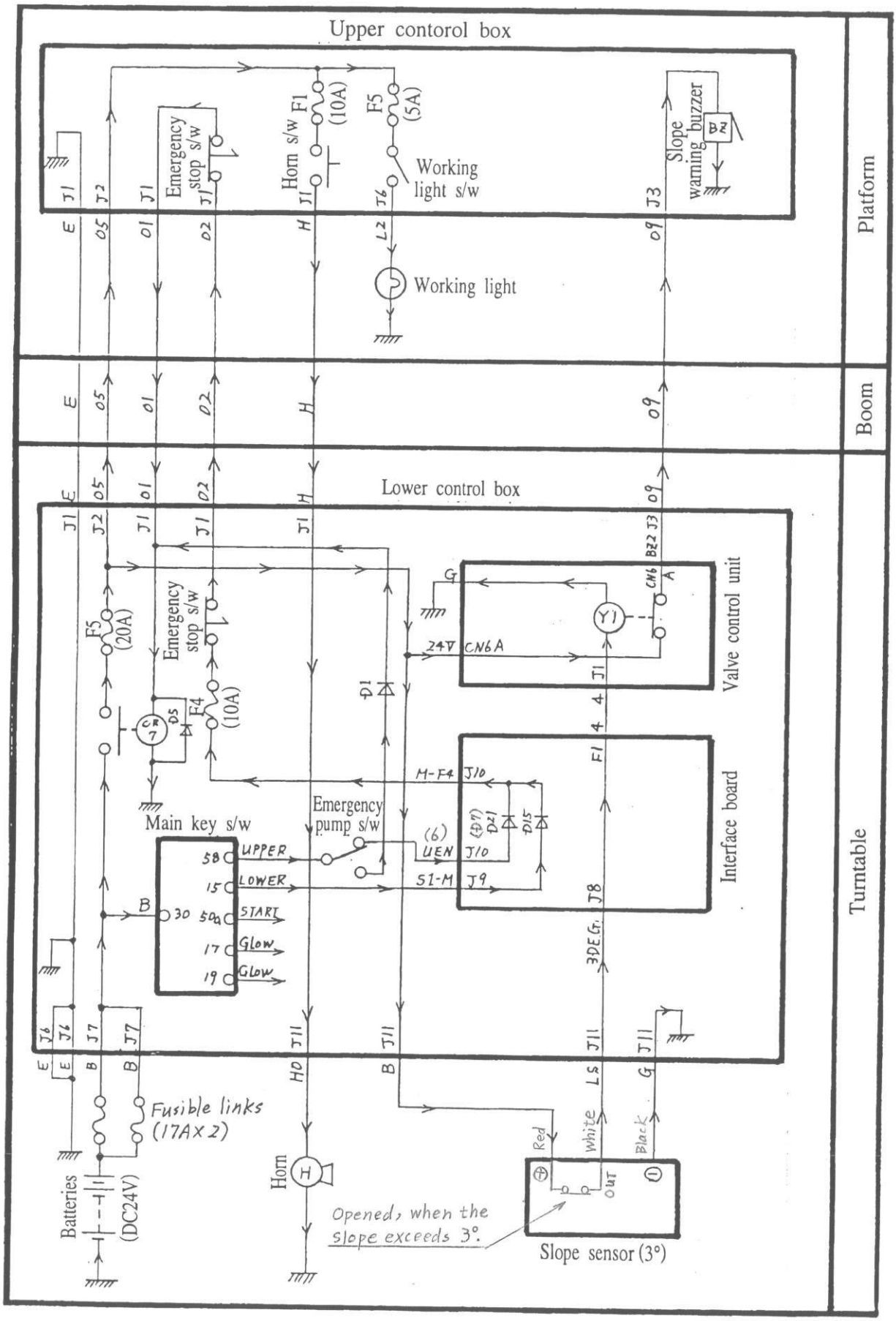
PLATFORM SWING, PLATFORM LEVEL SYSTEM

(for Inteface board CE/us selector switch) (for Serial NO: 655368~)



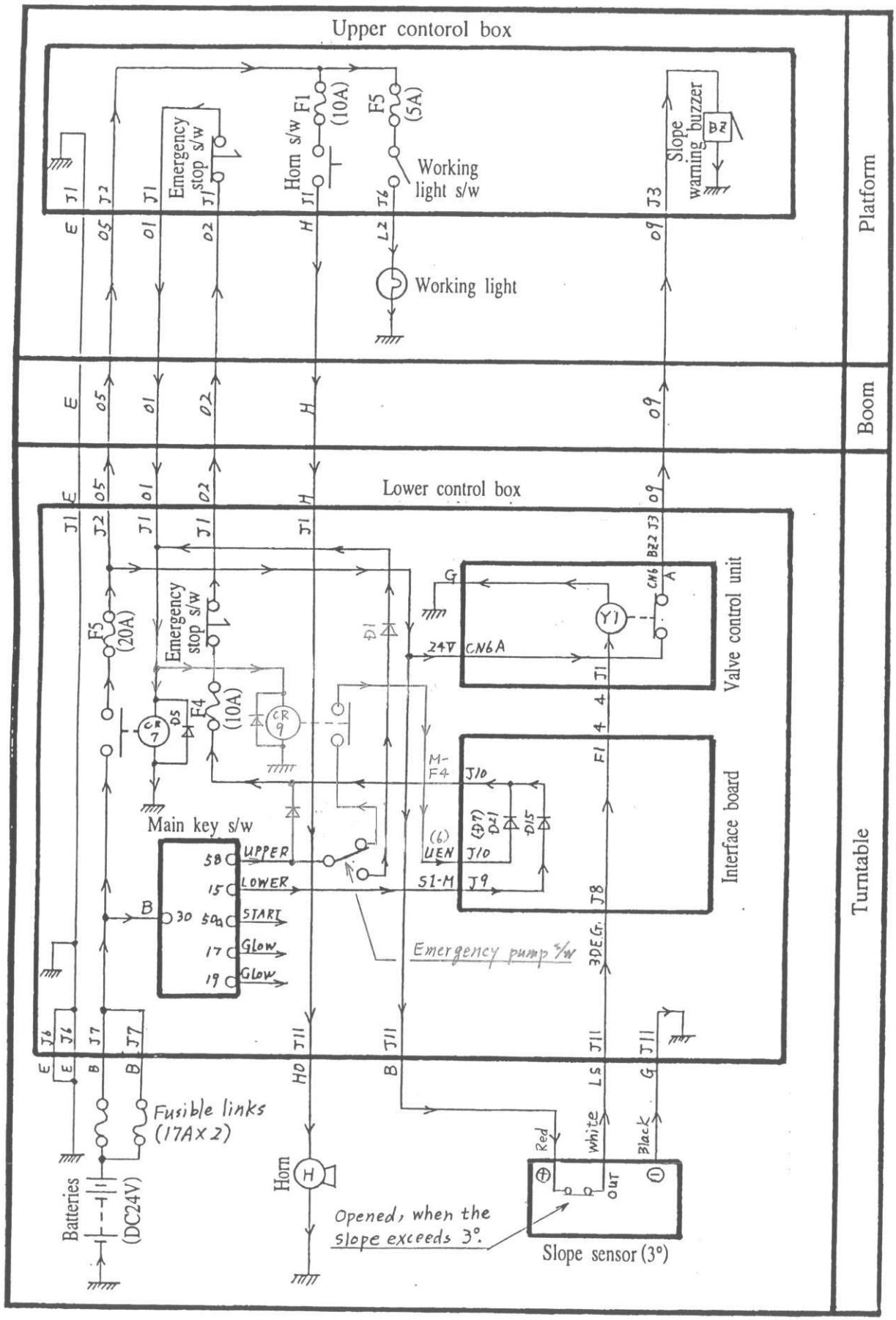
SLOPE WARNING, HORN and WORKING LIGHT SYSTEM

(for Spec : A3, A4.) (for Serial NO : ~ 655367)



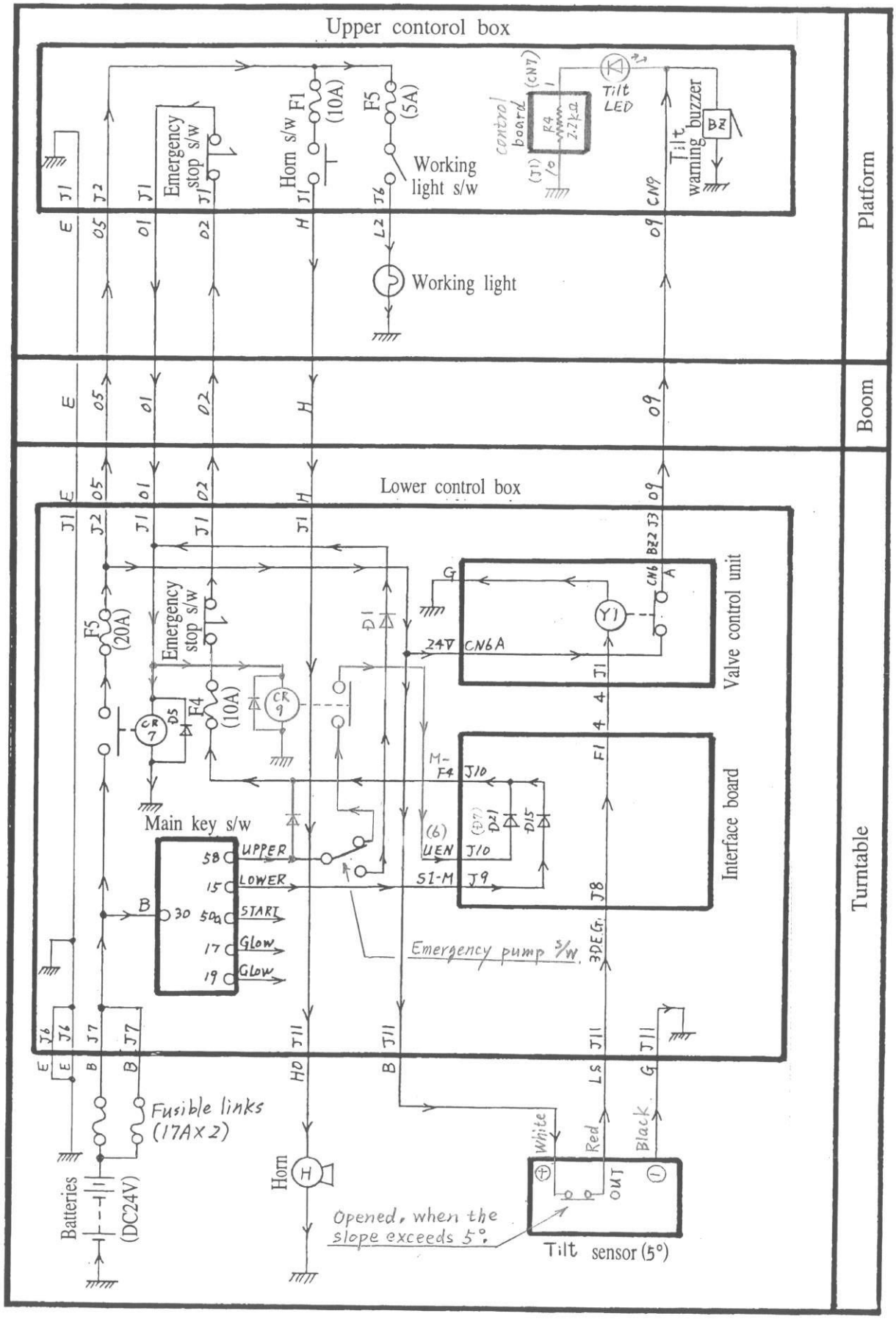
SLOPE WARNING, HORN and WORKING LIGHT SYSTEM

(for Spec : A3, A4.) (for Serial NO: 655368~)



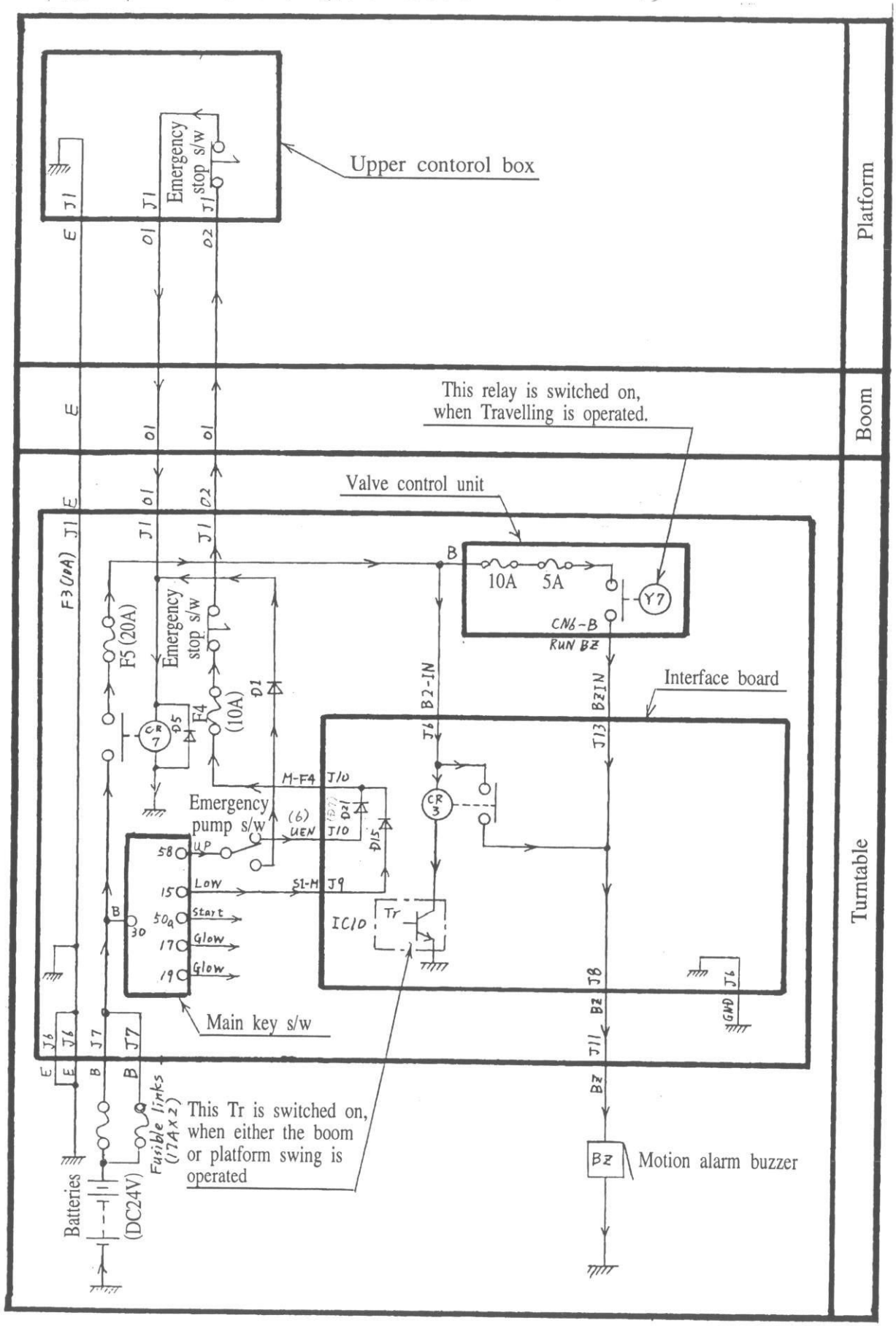
SLOPE WARNING, HORN and WORKING LIGHT SYSTEM

(for Spec : A6)



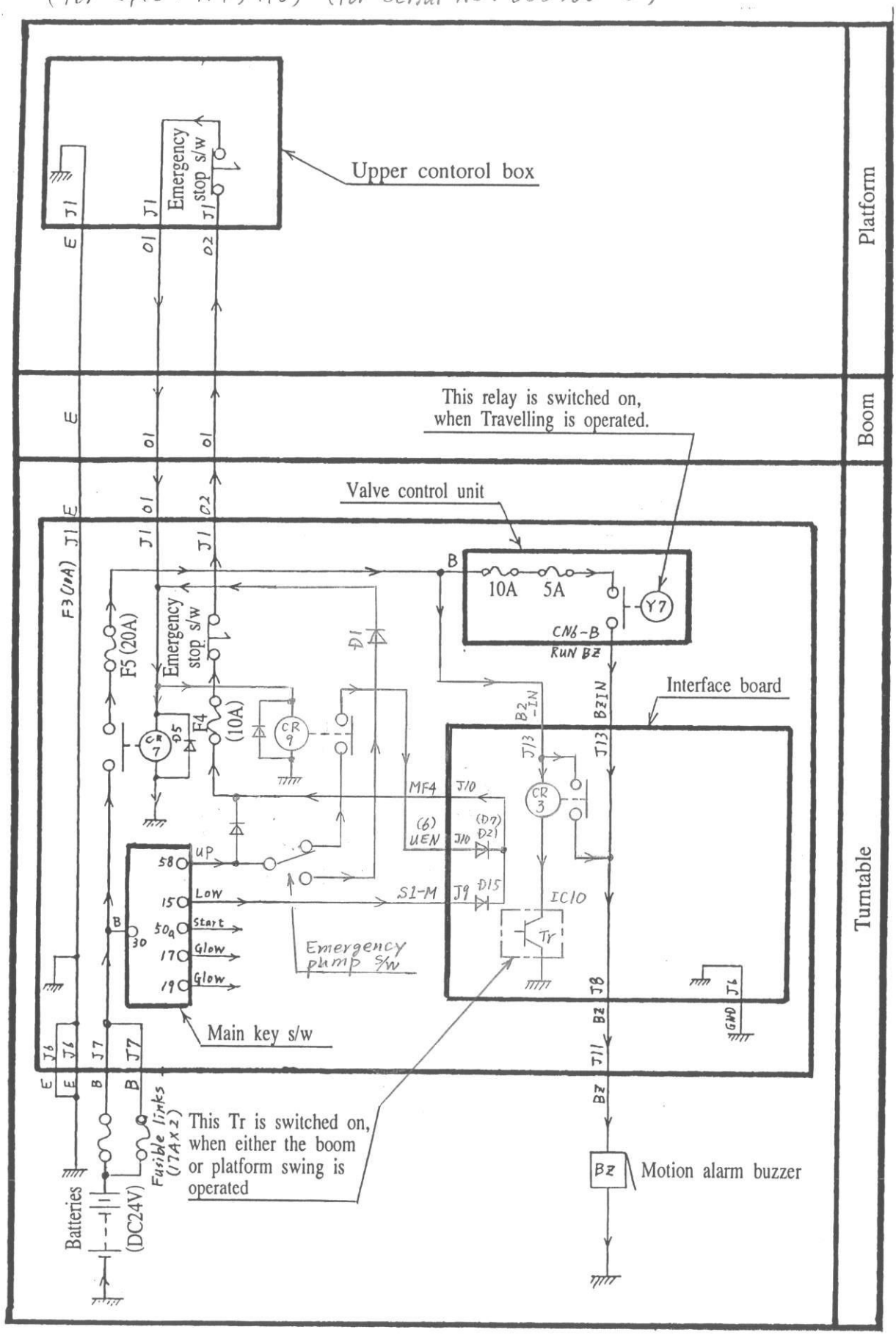
MOTION ALARM SYSTEM

(for Spec : A3, A4,) (for Serial NO : ~655367)



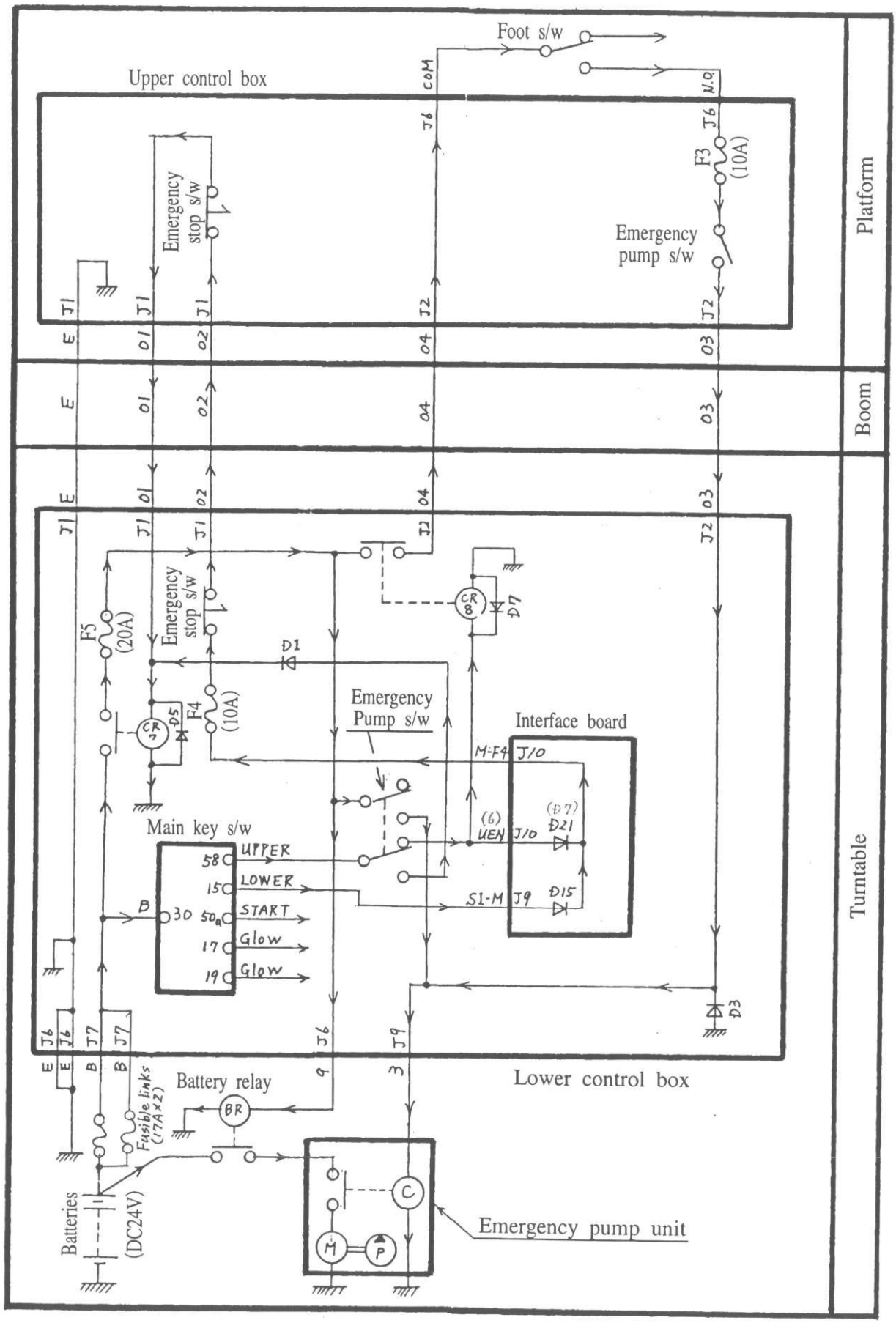
MOTION ALARM SYSTEM

(for Spec : A4, A6) (for Serial NO : 655368 ~)



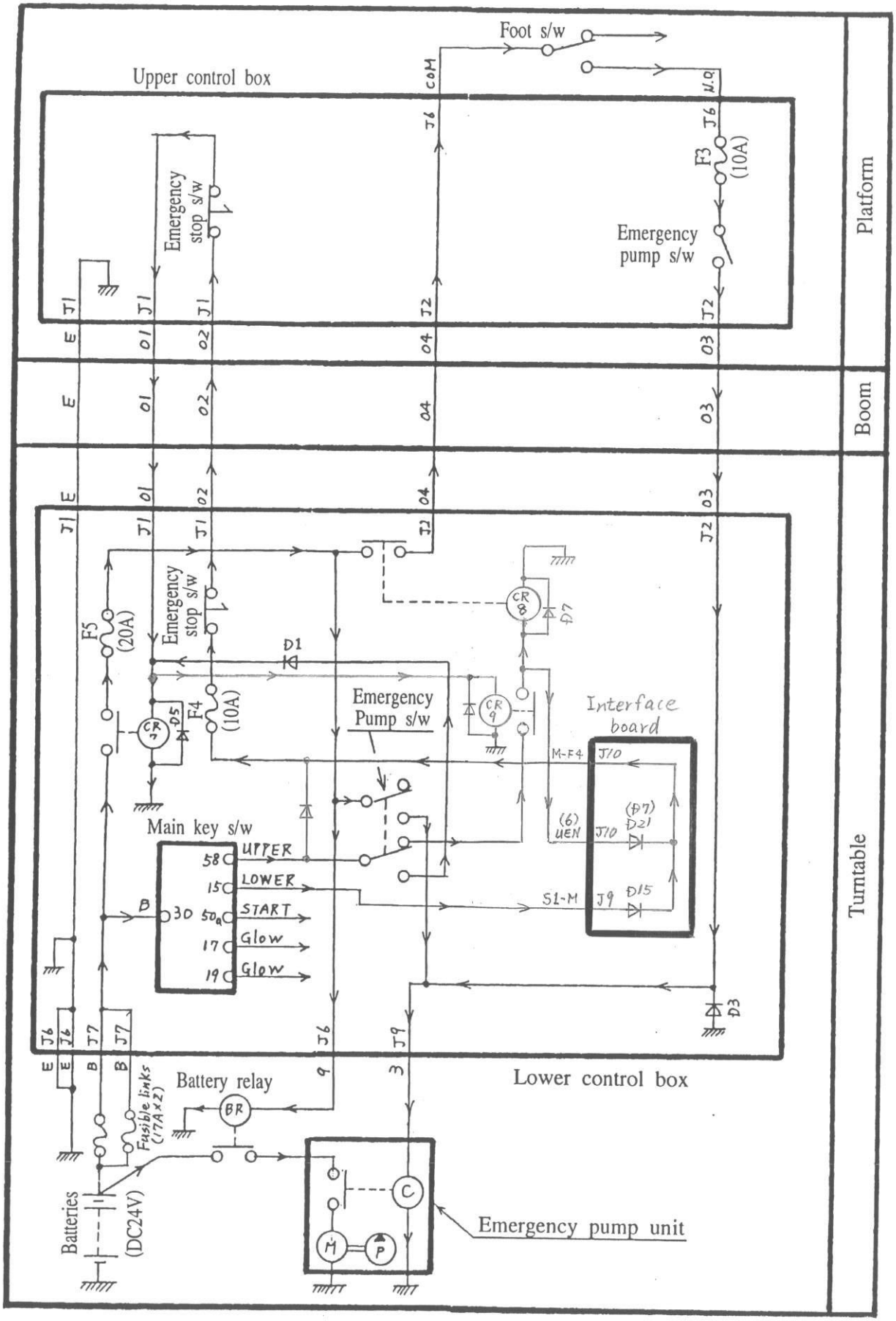
EMERGENCY PUMP SYSTEM

(for Spec : A3, A4,) (for Serial NO : ~ 655367)



EMERGENCY PUMP SYSTEM

(for Spec : A4, A6) (for Serial NO: 655368~)



6
ADJUSTMENT SECTION

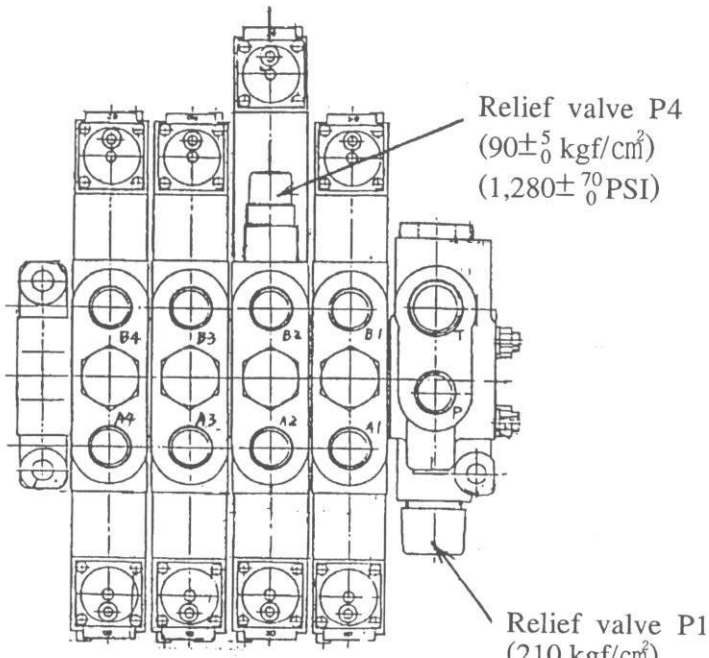
RELIEF VALVE P1 and P4

Adjust the "Preset pressure" of "Relief valves P1 and P4" installed on the "Main control valve No.1" as follws.

Preset pressure

Relief valve P1 ---------- $210 \pm {}^{5}_{0}$ kgf/cm² ($3{,}000 \pm {}^{70}_{0}$PSI)

Relief valve P4 ---------- $90 \pm {}^{5}_{0}$ kgf/cm² ($1{,}280 \pm {}^{70}_{0}$PSI)



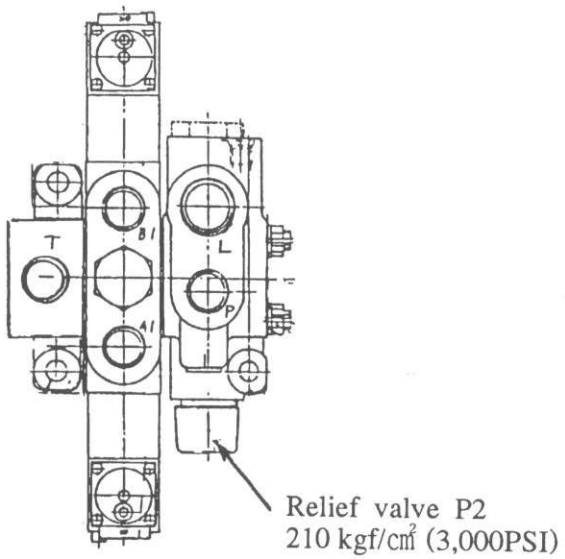
Main control valve NO.1

1. Remove the plug on "Pressure test port" installed on the out - let line of "Pump NO.1", and set a "Pressure gauge" onto the pressure test port.
2. Start engine, retract boom fully, and hold the "Extension switch" at "IN" to actuate "Relief valve P1".
3. Read the pressure gauge while "Relief valve P1" is active, and adjust the pressure to $210 \pm {}^{5}_{0}$kgf/cm² ($3{,}000 \pm {}^{70}_{0}$PSI) by turning "Adjust screw of "Relief valve P1".
4. Extend boom fully, and hold the "Extension switch" at "OUT" to actuate "Relief valve P4"
5. Read the pressure gauge while "Relief valve P4" is active, and adjust the pressure to $90 \pm {}^{5}_{0}$kgf/cm² ($1{,}280 \pm {}^{70}_{0}$PSI) by turning "Adjust screw of "Relief valve P4".

RELIEF VALVE P2

To adjust the "Preset pressure" of Relief valve P2 installed on the Main control valve No.2, take the following steps.

Preset pressure·····210^{+5}_{0} kgf/㎠ ($3,000^{+70}_{0}$ PSI)



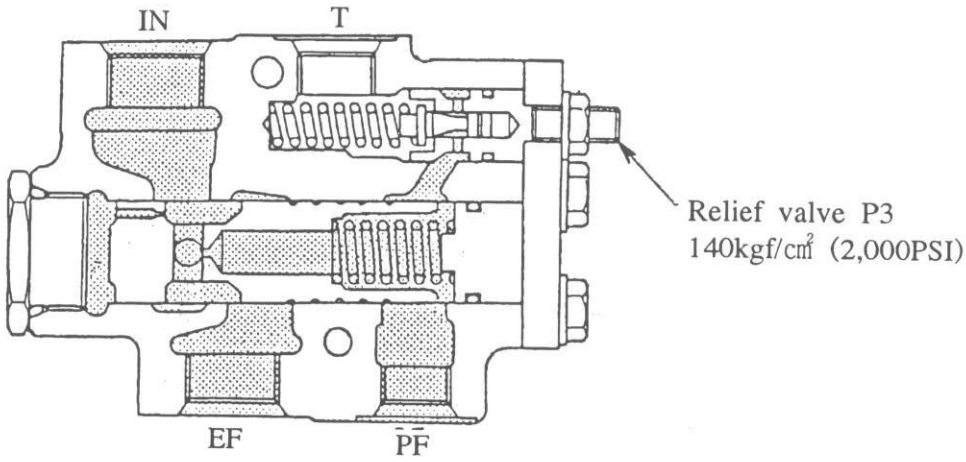
Main control valve NO.2

1. Remove the plug from the Pressure test port installed on the out - let line of Pump NO.2, and set a Pressure gauge onto the pressure test port.
2. Start engine, and insert something such as a Steel shaft between Drive sproket and the Track links on the right side travel motor to stop the rotation of travel motor.
3. Perform Travelling (Right) operation and actuate the Relief valve P2.
4. Read the pressure gauge while the Relief valve P2 is active, and adjust the pressure to 210^{+5}_{0} kgf/㎠ ($3,000^{+70}_{0}$ PSI) by turning the adjustment screw of Relief valve P2.

RELIEF VALVE P3

To adjust the Preset pressure of Relief valve P3 installed on the Priority valve, take the following steps.

Preset pressure·····140^{+5}_{0} kgf/cm² ($2,000^{+70}_{0}$ PSI)



Priority valve

1. Remove the plug from the Pressure test port installed on the out - let line of Pump NO.2, and set a Pressure gauge onto the pressure test port.
2. Start engine, swing the Platform fully to the "Right", and hold the Platform swing switch at "Right" to actuate the Relief valve P3.
3. Read the Pressure gauge while Relief valve P3 is active, and adjust the pressure to 140^{+5}_{0} kgf/cm² ($2,000^{+70}_{0}$ PSI) by turning the Adjustment screw of Relief valve P3.

OPERATIONAL SPEED

The following conditions must be strictly kept, when measuring or adjusting the operational speed.

* Hydraulic pump speed :	2,300 rpm. (Without load)
* Maximum hydraulic pressure.	
for Main control system :	210 kg/cm². (3,000 PSI)
for Sub control system :	140 kg/cm². (2,000 PSI)
* Pump discharge volume :	More than 22 liters/min(5.8 gals/min). (At pump speed : 1,000 rpm)
* Hydraulic oil temperature :	40°~ 60°C.
* Platform	No load condition.

1. Measurement procedures of "Maximum operational speed"

Take the following items into consideration, when measuring each Maximum operational speed.

*Measure each operational speed at least 3 times for the purpose of obtaining accurate data.

*Operate the control levers fully up to the stroke ends, when measuring the operational speed by functioning the upper control.

1. Elevation. (Boom raising "Up"/ lowering "DOWN" speed)
   Raise / lower the boom to its full stroke with the minimum boom length, and measure the boom raising "UP" and lowering "DOWN" speeds (seconds / stroke).
2. Extension (Boom extending "OUT" / retracting "IN" speed)
   Extend / retract the boom to its full stroke with the maximum boom angle, and measure the the boom extention "OUT" and retraction "IN" speeds (seconds / stroke).
3. Rotation. (Turn-table rotation speed)
   Rotate the Turn-table with the "minimum boom length" and the "maximum boom angle", and measure the turn-table rotation speed (seconds / rev).
4. Travelling. (Travelling speed straight)
   Travel the machine exactly 10 meters (10 yards) "Forward" and "REVERSE" on firm level ground, and measure the travelling speed (seconds / 10 meters, seconds / 10yards).
   NOTE : Travel the machine with the minimum boom length and with a boom angle which is less than horizontal.

5. Travelling Pivot turn speed.
   Perform "Pivot turn" to both Right and Left, and measure the "Pivot turn speed" (seconds/90°)
6. Travelling Spin turn speed.
   Perform "Spin turn" operation C.W. and C.C.W, and measure the "Spin turn speed" (seconds/90°)

2. Specific "Maximum operational speed"

Function		Direction	Upper control	Lower control
Elevation		UP	70 ± 5 sec/stroke	70 ± 5 sec/stroke
		DOWN	70 ± 5 sec/stroke	70 ± 5 sec/stroke
Extension		OUT	35 ± 5 sec/stroke	35 ± 5 sec/stroke
		IN	30 ± 5 sec/stroke	30 ± 5 sec/stroke
Rotation		C.W.	150 ± 10 sec/rev.	150 ± 10 sec/rev.
		C.C.W.	150 ± 10 sec/rev.	150 ± 10 sec/rev.
Travelling	Straight	FWD	32 ± 4 sec/10 meters (29 ± 3.5 sec/10 yards)	
		REV	32 ± 4 sec/10 meters (29 ± 3.5 sec/10 yards)	
	Pivot turn	Right	17 ± 3 sec/ 90°	
		Left	17 ± 3 sec/ 90°	
	Spin turn	C.W.	17 ± 3 sec/ 90°	
		C.C.W.	17 ± 3 sec/ 90°	

3. Adjustment procedures of Operational speed

Each operational speed for "Elevation", "Extension", "Rotation" and "Travelling" is adjusted by each "Trimmer" on the Valve control unit as follows.

NOTE : The locations of each "Trimmer" on the Valve control unit is shown in the clause of : Trimmer identification on valve control unit.

Adjustment is to be carried out in the following order

1. Minimum Operational speed.
2. Maximum Operational speed.
3. Adjustment of "Tr" trimmers
4. Adjustment of "Delay" trimmers
5. Adjustment of "Pivot" turn speed
6. Adjustment of "Spin" turn speed

1. Minimum operational speed

NOTE : The "Minimum" operational speed is obtained, when each Control lever is actuated slightly at the Upper control.

1. Start the machine and lower the platform close to the ground.
2. Stop engine and open the Lower control box.
   Then, set the Main key switch to the "UPPER" position.
3. Set a "Digital voltmeter" between each "PIN"⊕ on Valve control unit (listed below) and "Body earth" ⊖.

Function	Direction	Pin NO.
Elevation	UP	V10
	DOWN	V12
Extension	OUT	V6
	IN	V8
Rotation	C.W.	V2
	C.C.W.	V4
Travelling (Left)	FWD	V18
	REV	V20
Travelling (Right)	FWD	V14
	REV	V16

4. Move the Control lever slightly untill the "LED" indicator (Red) (on Valve control unit) turns on, and take the reading from the voltmeter.

NOTE : *The reading on the Digital voltmeter is the "NULL" voltage.
*Higher "NULL" voltage causes increased Minimum operational speed.
*The reference value for each "NULL" voltage is as shwon in the table below.

Function	Direction	NULL trimmer	"NULL voltage"
Elevation	UP	P9	0.32V
	DOWN	P11	0.32V
Extension	OUT	P5	0.32V
	IN	P7	0.32V
Rotation	C.W.	P1	0.32V
	C.C.W.	P3	0.32V
Travelling (Left)	FWD	P17	0.32V
	REV	P19	0.32V
Travelling (Right)	FWD	P13	0.32V
	REV	P15	0.32V

Caution : When checking or adjusting "NULL" voltage for Travelling, operate both of the Travel control levers "Right" and "Left" slightly in the same direction.

5. Adjust each "NULL" trimmer (listed above), so that each hydraulic actuator is about to move, when each Control lever is actuated slightly.
   NOTE : To increase the "NULL" voltage or "Minimum" operational speed, turn each "NULL" trimmer clockwise.

2. Maximum operational speed

NOTE : The "Maximum" operational speed is obtained, when each Control lever is actuated fully at the Upper control.

1. Start the machine and lower the platform close to the ground.
2. Stop the engine, and open the Lower control box.
   Then, set the Main key switch to the "UPPER" position.
3. Set a "Digital voltmeter" between each "PIN"⊕ on Valve control unit (listed below) and "Body earth"⊖.

Function	Direction	"Pin" NO.
Elevation	UP	V10
	DOWN	V12
Extension	OUT	V6
	IN	V8
Rotation	C.W.	V2
	C.C.W.	V4
Travelling (Left)	FWD	V18
	REV	V20
Travelling (Right)	FWD	V14
	REV	V16

4. Operate the Control lever fully and take the reading from the voltmeter.
   NOTE : * The reading on the Digital voltmeter is the "GAIN" voltage.
   * Higher "GAIN voltage" causes increased Maximum operational speed.
   * The reference value for each "GAIN" voltage is as shown in the table below.

Function	Direction	"GAIN trimmer"	"GAIN voltage"
Elevation	UP	P10	0.50V
	DOWN	P12	0.52V
Extension	OUT	P6	0.59V
	IN	P8	0.57V
Rotation	C.W.	P2	0.43V
	C.C.W.	P4	0.45V
Travelling (Left)	FWD	P18	0.60V
	REV	P20	0.60V
Travelling (Right)	FWD	P14	0.60V
	REV	P16	0.60V

   Caution : When checking or adjusting "GAIN" voltage for Travelling, operate both of the Travel control levers fully in the same direction.

5. Adjust each "GAIN" trimmer (listed in the table above), so that the each "Maximum" operational speed becomes a Specific value.
   NOTE : * To increase the "GAIN" voltage or "Maximum" operational speed, turn each "GAIN" trimmer clockwise.

3. Adjustment of "Tr trimmers"

The "Tr" trimmers are adjusted to vary the "Maximum" operational speed which is obtained by actuating the "Control switches" at Lower control. Follow the descriptions below to adjust the speed.

1. Stop engine, and open the Lower control box.
   Then, set the Main key switch to the "LOWER" position.
2. Set a "Digital voltmeter" between each "Pin⊕" on valve control unit (listed below) and Body earth ⊖.

Function	Direction	"Pin" NO.
Elevation	UP	V10
	DOWN	V12
Extension	OUT	V6
	IN	V8
Rotation	C.W.	V2
	C.C.W.	V4

3. Operate the each Control switch at Lower control box, and take the reading from the voltmeter.
   NOTE : The reading on the Digital voltmeter is the "Out put" voltage of valve control unit.
4. Turn the each "Tr" trimmer (listed in the table below) to adjust the speed.
   NOTE : *An increase to the output voltage causes an increase to the speed.
   *To increase the Out put voltage, turn each "Tr" trimmer clockwise.

Function	Direction	Tr trimmer NO.	Output voltage
Elevation	UP	Tr 5	0.50V
	DOWN	Tr 6	0.52V
Extension	OUT	Tr 3	0.59V
	IN	Tr 4	0.57V
Rotation	C.W.	Tr 1	0.43V
	C.C.W.	Tr 2	0.45V

4. Adjustment of "DELAY trimmers".

The "DELAY" trimmers can be adjusted to start or stop each operation more gradually, or quickly.

Function		Delay trimmer	
Elevation	UP	UP	VR 13
		DOWN	VR 14
	DOWN	UP	VR 16
		DOWN	VR 17
Extension	OUT	UP	VR 7
		DOWN	VR 8
	IN	UP	VR 10
		DOWN	VR 11
Rotation	C.W.	UP	VR 1
		DOWN	VR 2
	C.C.W.	UP	VR 4
		DOWN	VR 5
Travelling (Left)	FWD	UP	VR 25
		DOWN	VR 26
	REV	UP	VR 28
		DOWN	VR 29
Travelling (Right)	FWD	UP	VR 19
		DOWN	VR 20
	REV	UP	VR 22
		DOWN	VR 23

NOTE :

* To start each function more gradually, turn the each Delay trimmer "UP" clockwise.

* To stop each function more gradually, turn the each Delay trimmer "DOWN" clockwise.

Adjustment of DITHER trimmers.

The "DITHER" trimmers are adjusted to give the correct "Vibration" to the "Output power" of Valve control unit.

NOTE : Do not adjust the "Dither" trimmers, as they have been precisely adjusted by the manufacturer.

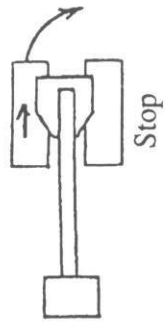
Function	Dither trimmer
Elevation	VR - 33
Extension	VR - 32
Rotation	VR - 31
Travelling (Left)	VR - 35
Travelling (Right)	VR - 34

5. Adjustment of "Pivot turn" speed

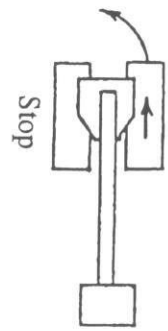
The "Pivot turn" speed is adjusted by the trimmers installed on the Valve control unit as follows.

Caution : The Pivot turn speed should be adjusted after having adjusted "Straight travelling speed".
The main key switch is to be set at its "UPPER" position, when adjusting the pivot turn speed.

1. Pivot Turn (Right)

NO.	Adjustment procedures	Remarks
1.	Set a Digital volt-meter between the "Check pin (TP - D)"⊕ on Valve control unit and "GND"⊖.	 Pivot turn (Right)
2.	Operate the "Travel lever (Left)" fully to "FWD", and read the voltmeter. Voltage (reference) 7.0V	
3.	Adjust the voltage by Trimmer (VR37). (The higher voltage causes the faster pivot turn speed.) Specific pivot turn speed ..... 17 ± 3 sec/90°	

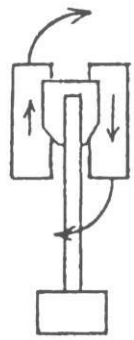
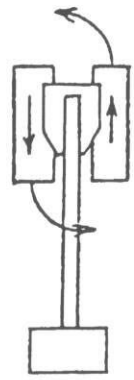
2. Pivot Turn (Left)

NO.	Adjustment procedures	Remarks
1.	Set a Digital volt-meter between the "Check pin (TP - C)"⊕ on Valve control unit and "GND"⊖.	 Pivot turn (Left)
2.	Operate the "Travel lever (Right)" fully to "FWD", and read the voltmeter. Voltage (reference) 7.0V	
3.	Adjust the voltage by Trimmer (VR36). (The higher voltage causes the faster pivot turn speed.) Specific pivot turn speed ..... 17 ± 3 sec/90°	

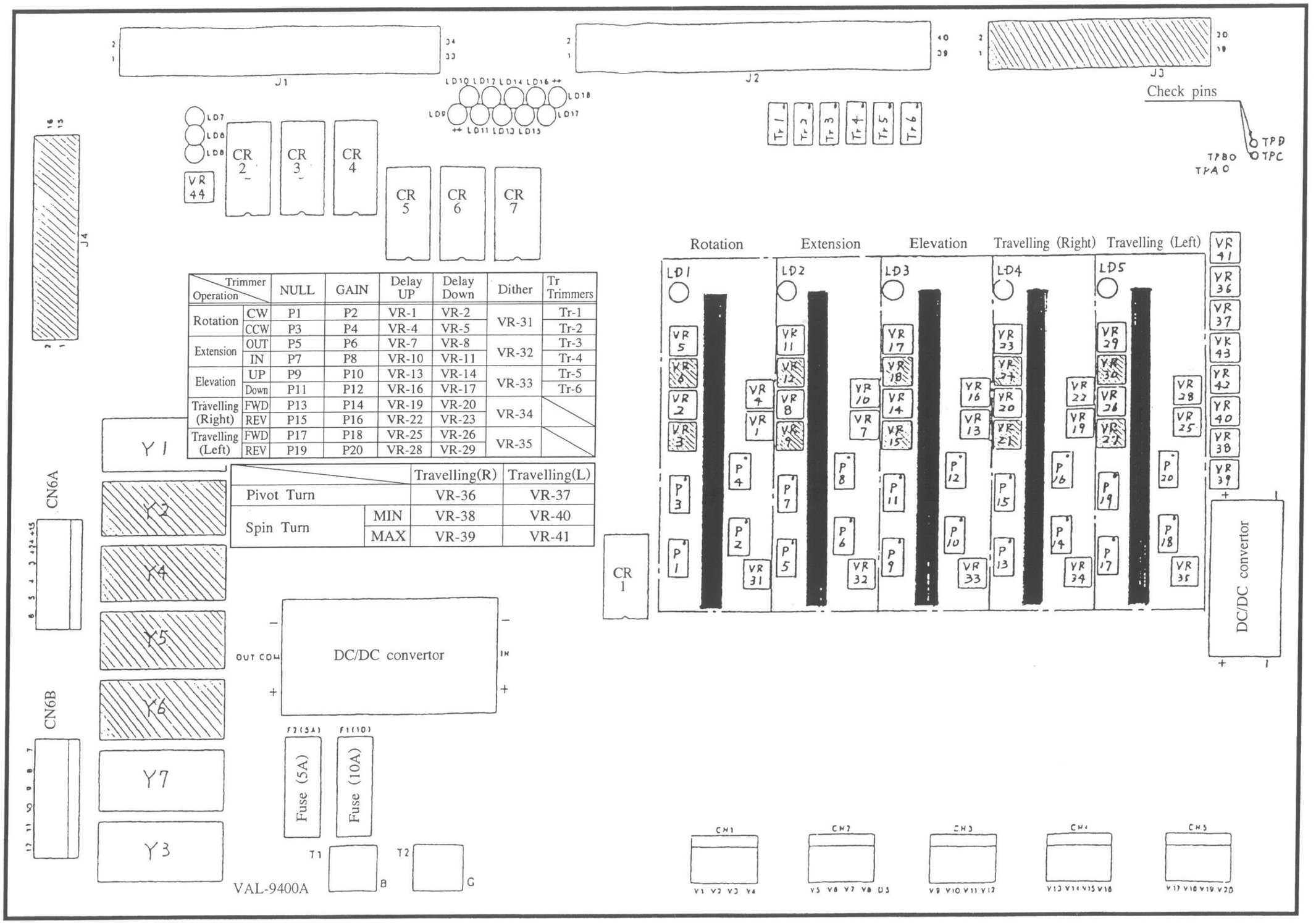
6. Adjustment of "Spin turn" speed.

The "Spin turn" speed is adjusted by the trimmers installed on the Valve control unit as follows.

Caution : The Spin turn speed should be adjusted after having adjusted "Straight travelling speed".
The main key switch is to be set at its "UPPER" position, when adjusting the spin turn speed.

NO.	Adjustment procedures	Remarks
1.	Set a Digital volt meter between the "Check pin (TP - C)"⊕ on Valve control unit and "GND"⊖.	
2.	Operate "Travel (Left) lever" to "REV" slightly, and "Travel (Right) lever" to "FWD" fully.	
3.	Hold the Travel levers at the above positions, and adjust the voltage (V_1) to 7.0V by Trimmer (VR - 38).	
4.	Operate "Travel (Left) lever" to "REV" fully, and "Travel (Right) lever" to "FWD" fully.	
5.	Hold the Travel levers at the above positions, and adjust the voltage (V_2) to 5.5 V by Trimmer (VR - 39).	 Spin turn (C.W.)
6.	Set a Digital voltmeter between the "Check pin (TP - D)"⊕ on Valve control unit and "GND"⊖.	
7.	Operate "Travel (Right) lever" to "REV" slightly, and "Travel (Left) lever" to "FWD" fully.	
8.	Hold the Travel levers at the above positions, and adjust the voltage (V_3) to 7.0V by Trimmer (VR - 40).	
9.	Operate "Travel (Right) lever" to "REV" fully, and "Travel (Left) lever" to "FWD" fully.	 Spin turn (C.C.W.)
10.	Hold the Travel levers at the above positions, and adjust the voltage (V_4) to 5.5 V by Trimmer (VR - 41).	
11.	Adjust the Spin turn speed CW & CCW, by varing the voltage (V_2 & V_4). The higher voltage causes the faster Spin turn speed.	Specific spin turn speed: C.W.···17±3sec/90° C.C.W.···17±3sec/90°

4. Trimmer's Identification on "Valve control unit"



Operation \ Trimmer		NULL	GAIN	Delay UP	Delay Down	Dither	Tr Trimmers
Rotation	CW	P1	P2	VR-1	VR-2	VR-31	Tr-1
	CCW	P3	P4	VR-4	VR-5		Tr-2
Extension	OUT	P5	P6	VR-7	VR-8	VR-32	Tr-3
	IN	P7	P8	VR-10	VR-11		Tr-4
Elevation	UP	P9	P10	VR-13	VR-14	VR-33	Tr-5
	Down	P11	P12	VR-16	VR-17		Tr-6
Travelling (Right)	FWD	P13	P14	VR-19	VR-20	VR-34	
	REV	P15	P16	VR-22	VR-23		
Travelling (Left)	FWD	P17	P18	VR-25	VR-26	VR-35	
	REV	P19	P20	VR-28	VR-29		

		Travelling(R)	Travelling(L)
Pivot Turn		VR-36	VR-37
Spin Turn	MIN	VR-38	VR-40
	MAX	VR-39	VR-41

ADJUSTMENT DATA SHEET

Date : Serial NO :

Function			Elevation		Extension		Rotation		Travel (Left)		Travel (Right)	
Direction			UP	DOWN	OUT	IN	CW	CCW	FOR	REV	FOR	REV
Pin No.			V 10	V12	V 6	V 8	V 2	V 4	V 18	V 20	V 14	V 16
NULL trimmer			P 9	P11	P 5	P 7	P 1	P 3	P 17	P 19	P 13	P 15
NULL voltage	Before adjustment		(0.33V)	(0.33V)	(0.33V)	(0.33V)	(0.33V)	(0.33V)	(0.33V)	(0.33V)	(0.33V)	(0.33V)
	After adjustment											
GAIN trimmer			P 10	P 12	P 6	P 8	P 2	P 4	P 18	P 20	P 14	P 16
GAIN voltage	Before adjustment		(0.50V)	(0.52V)	(0.59V)	(0.57V)	(0.43V)	(0.45V)	(0.60V)	(0.60V)	(0.60V)	(0.60V)
	After adjustment											
DELAY trimmer		UP	VR 13	VR 16	VR 7	VR 10	VR 1	VR 4	VR 25	VR 28	VR 19	VR 22
		DOWN	VR 14	VR 17	VR 8	VR 11	VR 2	VR 5	VR 26	VR 29	VR 20	VR 23
Tr trimmer			Tr 5	Tr 6	Tr 3	Tr 4	Tr 1	Tr 2				
DITHER trimmer			VR 33		VR 32		VR 31		VR 35		VR 34	
Spec., speed	UPPER control		70±5 sec	70±5 sec	35±5 sec	30±5 sec	150±10 sec/1turn		32±4 sec/10m 29 ±3,5 sec/10 yds		32±4 sec/10m 29 ±3,5 sec/10 yds	
	LOWER control		70±5 sec	70±5 sec	35 ±5sec	30 ±5sec	150±10 sec/1turn					

7
APPENDIX

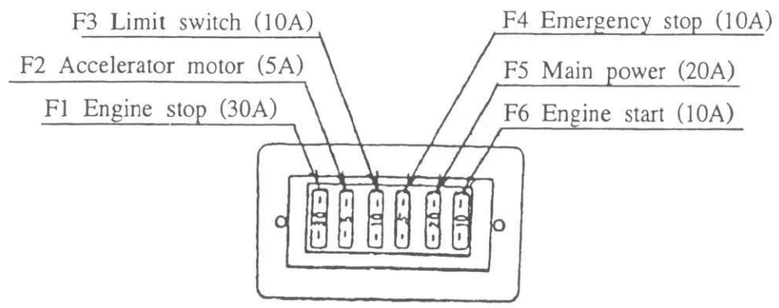
TROUBLE SHOOTING

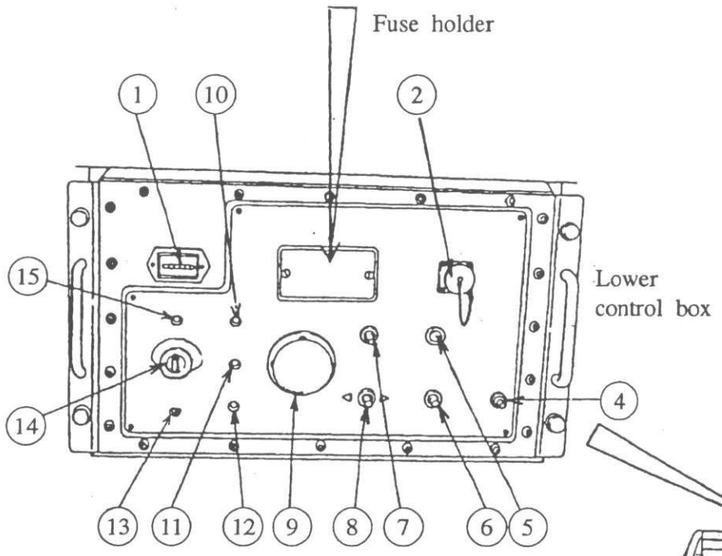
NO.	Problem	Cause	Remedy
1.	"Starter motor" does not run on either Upper or Lower control.	1)"Emergency stop s/w" on Lower or Upper control box is pressed. (Both Power lamps on "Lower" and "Upper" controls turn off.)	Pull the Emergency stop s/w to turn on Power lamps.
		2)"Emergency stop fuse F4 (10A) " in Lower contorol box has blown. (Power lamps turn off.)	Replace the fuse.
		3)"Main fuse F5 (20A) " in Lower contorol box has blown. (Power lamps turn off.)	Replace the fuse.
		4)"Engine start fuse F6 (10A) " in Lower contorol box has blown. (Power lamps turn on.)	Replace the fuse.
		5)"Fusible link" (30A) has blown.	Release the fusible link.
2.	"Starter motor" does not run at Upper control.	1)"Foot S/W" is pressed.	Release the foot switch and press the "Engine start switch".
		2)"Engine start fuse F2 (3A)" in Upper control box has blown.	Replace the fuse.
3.	"Starter motor" runs, but engine does not start.	1) Fuel tank is empty.	Fill fuel, bleed air, and start engine.
		2) Engine is cool.	Preheat "Glow plugs", and start engine.
4.	Engine does not stop.	1)"Engine stop fuse F1 (30A)" in Lower control box has blown.	Replace the fuse.
5.	Engine stopped naturally, and does not start again.	2) Fuel tank is empty.	Fill fuel, bleed air, and start engine.

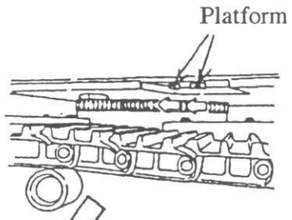
TROUBLE SHOOTING

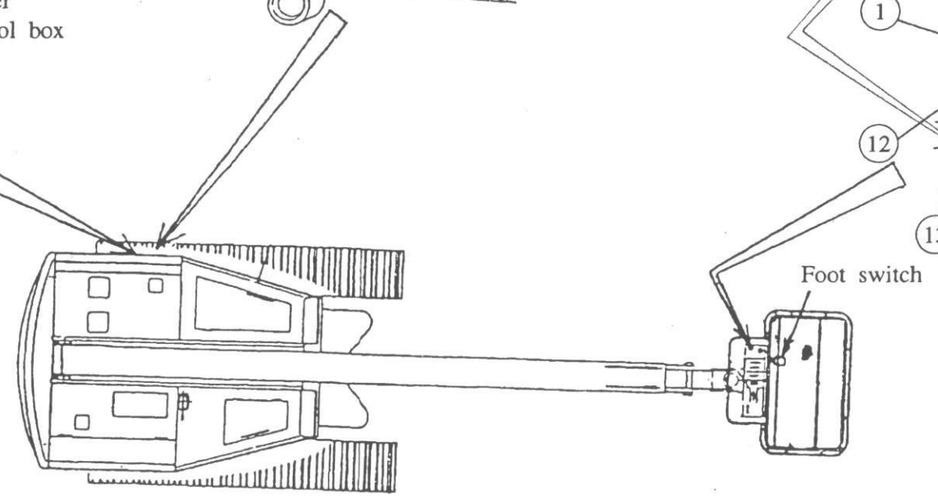
NO.	Problem	Cause	Remedy
6.	The upper control is non-operational, except for the "Horn" and "Working light".	1)"Foot switch" is not pressed.	Press Foot switch, and operate.
		2)"Main key switch" is set at "Lower" position.	Set the key switch to the "Upper" position.
7.	"Elevation", "Extension", "Rotation" and "Travel" operations are not functioning either "Lower" or "Upper" control.	"Fuse" on Valve control unit installed in Lower control box has blown.	Replace the fuse.
8.	Platform swing, level, and Emergency pump operation on Upper control are not functioning.	"Platform swing, level, & Emergency pump fuse F3 (10A)" in Upper control box has blown.	Replace the fuse.
9.	"Accelerator motor" does not work from either the "Upper" or "Lower" control.	"Accelerator motor Fuse F2 (5A)" in Lower control box has blown.	Replace the fuse.
10.	"Accelerator s/w" on Upper control does not work.	"Accelerator fuse F4 (3A)" in Upper control box has blown.	Replace the fuse.
11.	"Horn" does not work.	"Horn fuse F1 (10A)" has blown in Upper control box.	Replace the fuse.
11.	"Working light" does not work.	"Working light fuse F5 (5A)" in Upper control box has blow.	Replace the fuse.
12.	"Buzzer" sounds at Upper control.	Machine is inclined 3° or more due to slope.	Lower the platform, and set the machine on level ground.
13.	Platform loses level quite often.	"Platform level adjustment valves" are not closed firmly.	Close the valves firmly.

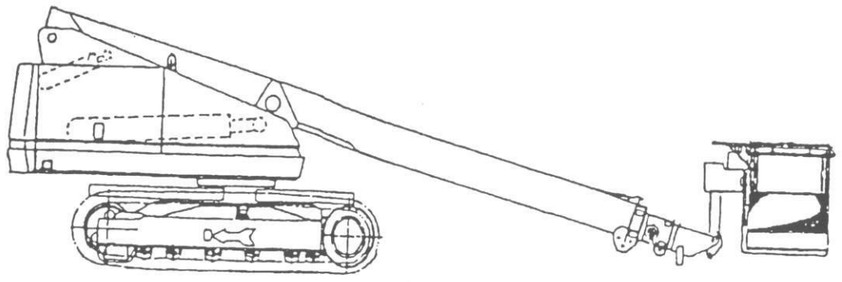
Identifications of "Control devices" and "Fuses"

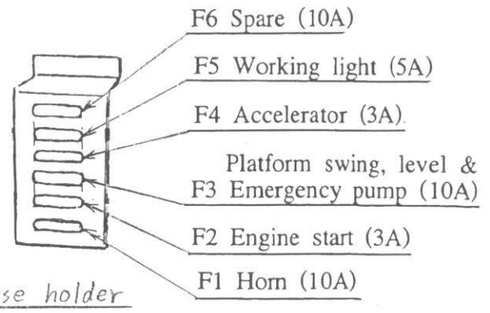


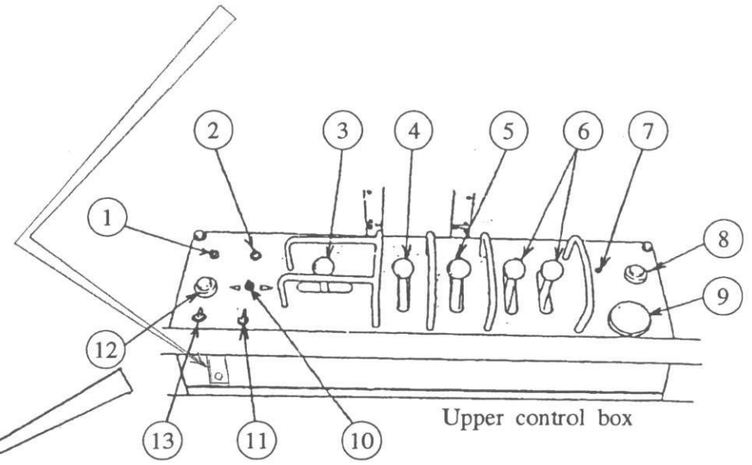








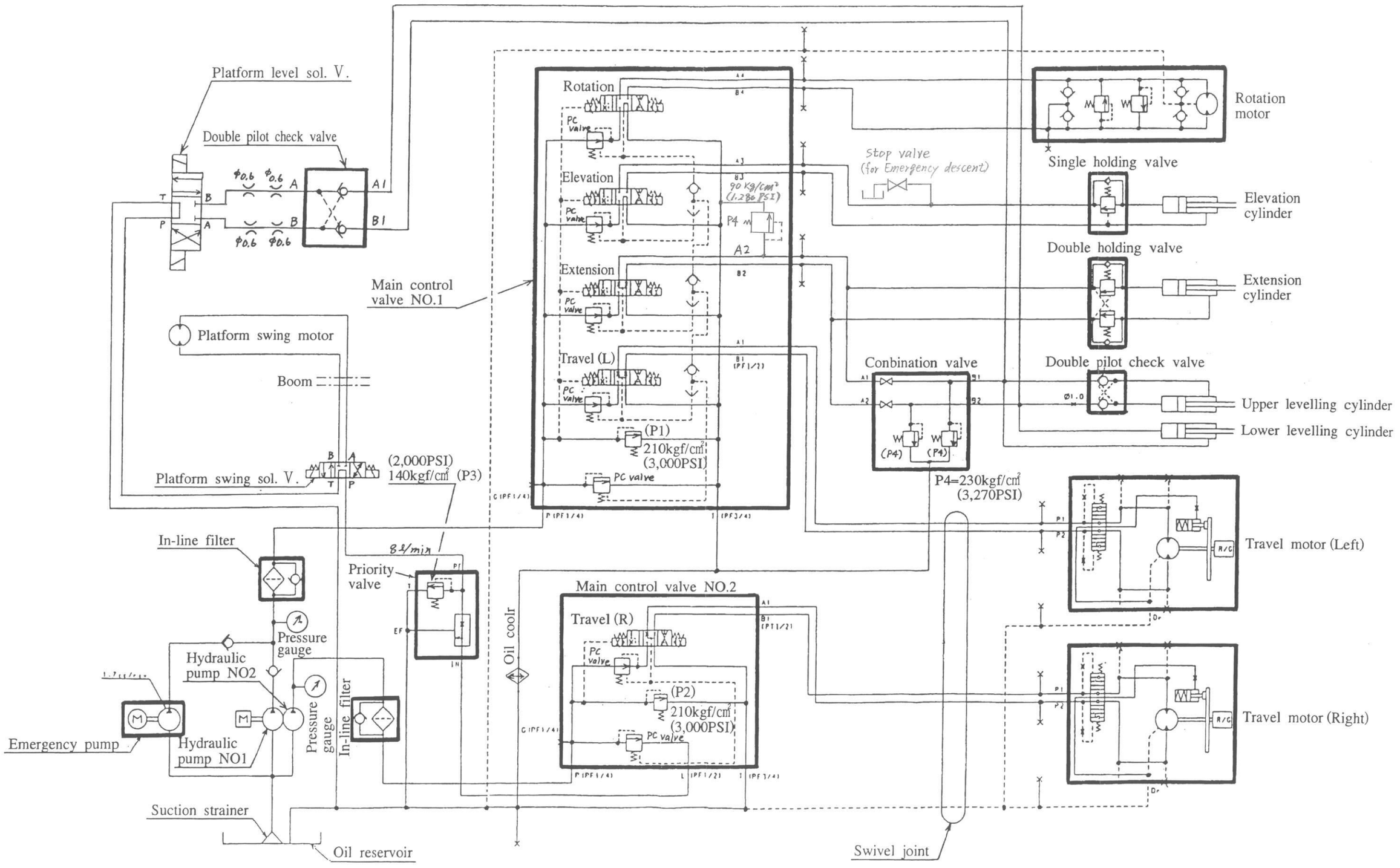


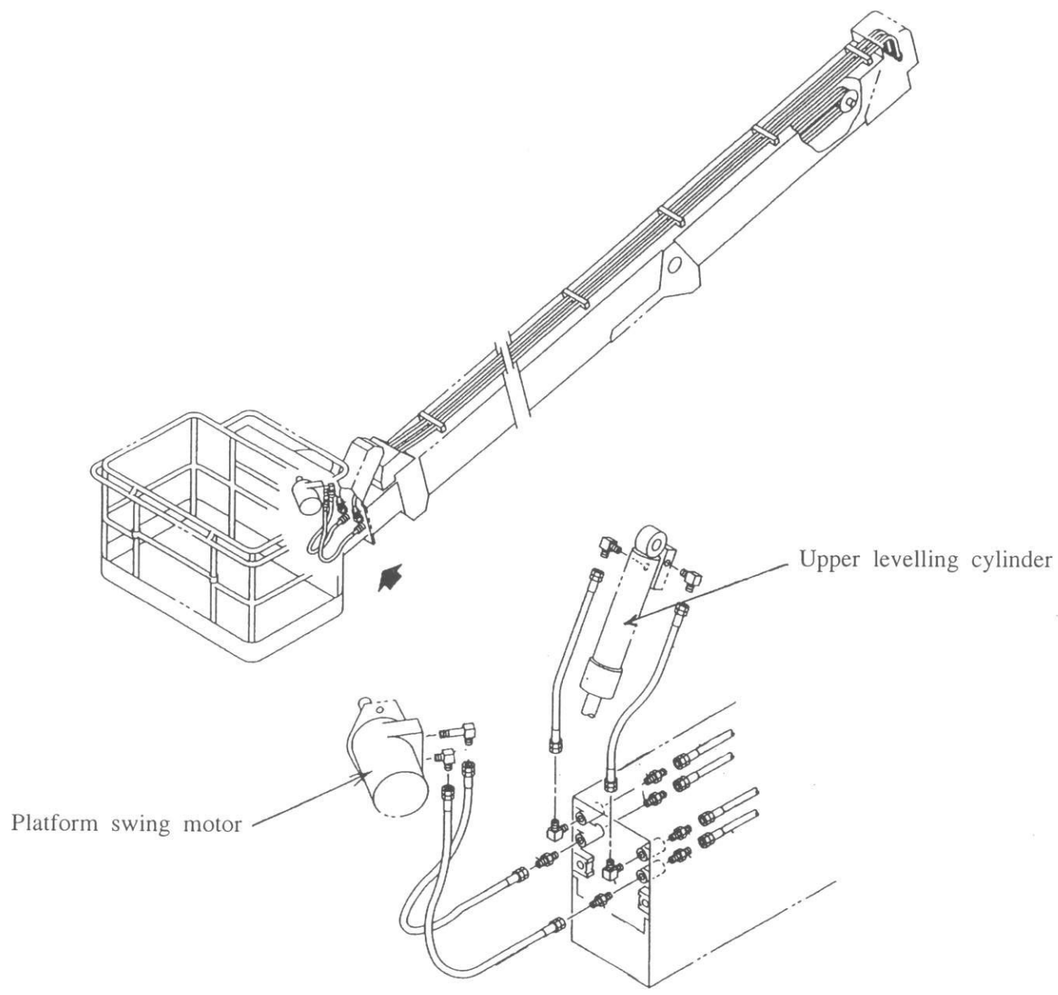


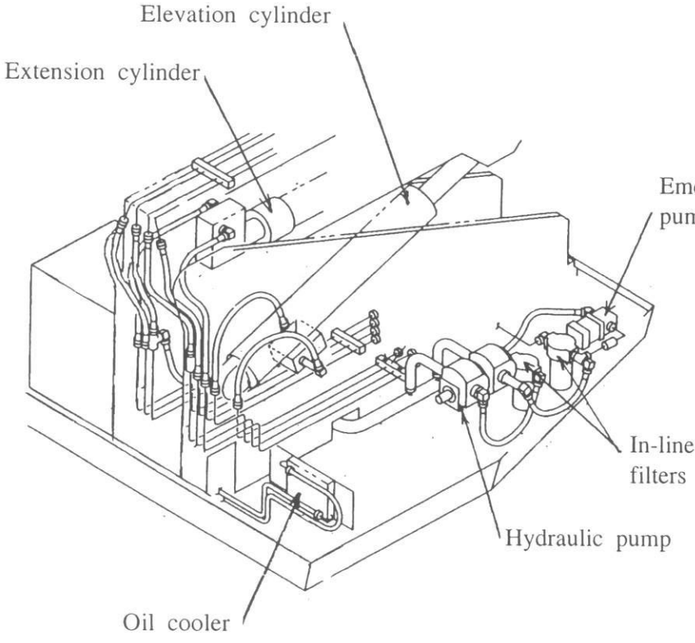
1	Hour meter
2	Metal connector(for Optional Remote control)
3	————
4	Elevation switch
5	Emergency pump switch
6	Extension switch
7	Accelerator switch
8	Rotation switch
9	Emergency stop switch
10	Charge warning lamp
11	Engine water temp lamp
12	Engine oil pressure lamp
13	Glow indicator lamp
14	Main key switch
15	Power lamp

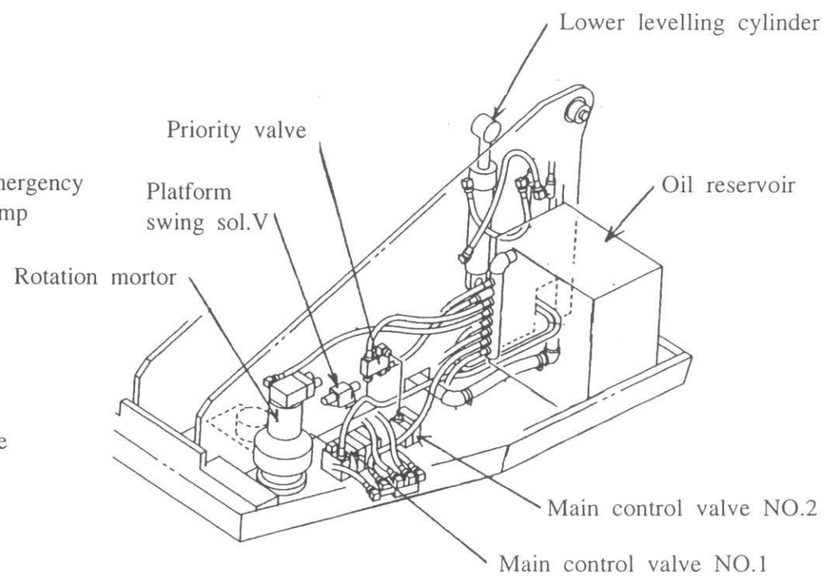
1	Working light switch
2	Accelerator switch
3	Rotation control lever
4	Extension control lever
5	Elevation control lever
6	Travel control lever
7	Power lamp
8	Engine start switch
9	Emergency stop switch
10	Platform swing switch
11	Emergency pump switch
12	Horn switch
13	Platform level switch

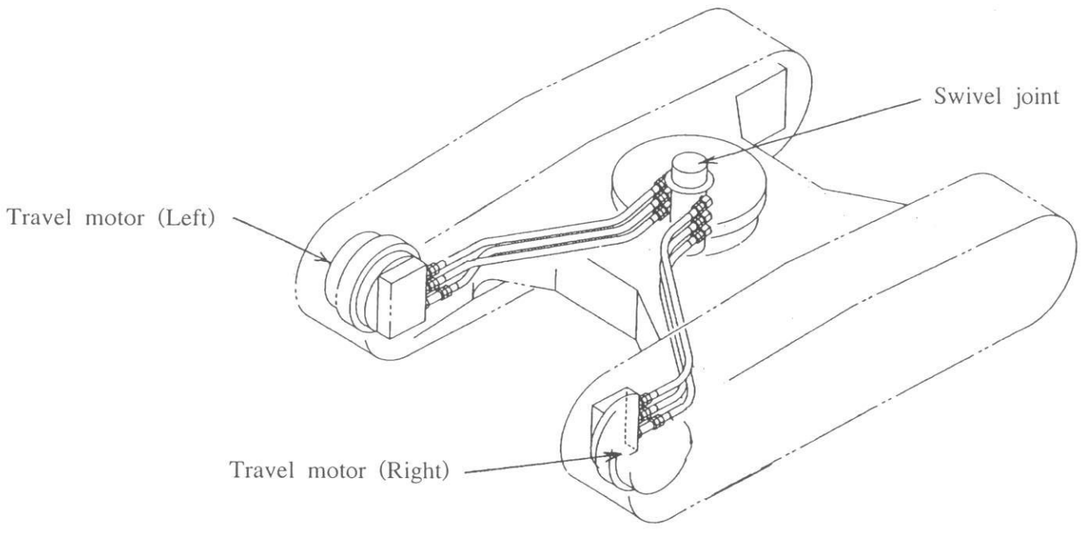
HYDRAULIC CIRCUIT DIAGRAM




Upper levelling cylinder
Platform swing motor


Elevation cylinder
Extension cylinder
Emergency pump
In-line filters
Hydraulic pump
Oil cooler


Lower levelling cylinder
Priority valve
Platform swing sol.V
Oil reservoir
Rotation mortor
Main control valve NO.2
Main control valve NO.1


Swivel joint
Travel motor (Left)
Travel motor (Right)

ELECTRIC CIRCUIT DIAGRAM (for Spec : A3, A4)

(for Serial NO : ~655367)

(SK-182)

UPPER CONTROL BOX

Rotation

Extension

Elevation

Travel (Right)

Travel (Left)

Relay board

U-REL

U-REL.SCH

UPPER CNT.SCH

Remote control box (for Travel)

LOWER CONTROL BOX

IF-CE12.SCH

Interface board (IF)

Valve control unit (VAL-9400)

VAL94.SCH

Main control valve NO.1

C.C.W. Travel L. Rev

Brwn IN

C.W. Travel L. For UP OUT

Travel R. Rev

Travel R. For

Main control valve NO.2

FOOT SWITCH

WORKING LIGHT

LS1 Boom length

LS2 Boom angle

SLOPE (3°) SENSOR

ENGINE

GLOW TEMP OIL

STOP SOLE.

ALTER-NATOR

STARTER

SAFETY RELAY

EMG.PUMP

BAT REL.

FUSIBLE LINK FL1 175×2

BT1:2

BT1: BATTERY

SW1 STOP

SW2 HORN

SW3 Light

SW4 EG.START

SW5 EM.PUMP

SW6 P.SWING

SW7 ACCL

SW8 LEVELING

BZ1 3DEG

BZ Slope warning buzzer

POWER CNT

EM. PUMP

ACCL

MAIN

KEY SW

GLW

STOP

HORN

Motion alarm buzzer

PLATFORM SWING SOL

ACCELERATOR MOTOR

PLATFORM LEVEL SOL

LD1 POWER

LD5 GLW

LD2 CHG

LD3 TEMP

LD4 OIL

IC1 3300

KEY SWITCH

	45A 30	13A 15/54	33A 19	33A 17	9A 50a	9A 58
UP	○					○
OFF						
LOW	○	○				
GLW	○		○			
STR	○			○	○	

ELECTRIC CIRCUIT DIAGRAM (for Spec : A3, A4)

(for Serial NO : 655368 ~)

(SR-1&2)

UPPER CONTROL BOX

Rotation

Extension

Elevation

Travel (Right)

Travel (Left)

Relay board

U-REL

U-REL.SCH

UPPER CNT.SCH

Remote control box (for Travel)

FOOT SWITCH

WORKING LIGHT

Light

Slope warning buzzer

EM.PUMP

EG.START

ACCL

LEVELING

HORN

STOP

P.SWNG

POWER

LOWER CONTROL BOX

LOWER CNT.SCH

Interface board (IF)

IF-CE12.SCH

STOP

POWER CNT

MAIN

KEY SW

RES GLOW

GLW

ACCL

CPB

UEN

EMP

HM

ACCL

Valve control unit (VAL-9400)

VAL9400

VAL94.SCH

Main control valve NO.1

C.C.W. Travel L. Rev

Sw.In IN

C.W. Travel L. For UP OUT

Travel R. Rev

Travel R. For

Main control valve NO.2

LS1 Boom length

LS2 Boom angle

SLOPE (3°) SENSOR

Motor alarm buzzer

HORN

PLATFORM SWING SOL

PLATFORM LEVEL SOL

ACCLERATOR MOTOR

ENGINE

GLOW TEMP OIL

STOP SOLE.

ALTER-NATOR

STARTER

SAFETY RELAY

EMG.PUMP

BAT REL.

FUSIBLE LINK FL

17A*2

BT1: BATTERY

KEY SWITCH

	45A	13A	33A	33A	9A	9A
	30	15/54	19	17	50a	58
UP	●					●
OFF						
LOW	●	○				
GLW	●		○			
STR	●			○	○	

7-7-2

ELECTRIC CIRCUIT DIAGRAM

(for Spec : A6)

602-14132

Remote control box for Travel (Option)

UPPER CONTROL BOX
R18-N5041
614-06560

LOWER CONTROL BOX
R12-N5119
614-06580

R12-N5012
R12-N5118
614-06579

Main control valve NO.1

Main control valve NO.2

Valve control unit (VAL-9400)

Interface board (IF-H5)

Rotation CCW
Travel (L) Rev
Elevation D
Extension(IN)

Rotation CW
Travel (L) FWD
Elevation (U)
Extension(out)

Travel (R) Rev
Travel (R) FWD

Rotation
Elevation
Travel (Right)
Travel (Left)

CA1
CA2
CA3
CA4
CA5
CA6
CA7
CA8

U-REL
U-REL.SCH
UPPER CNT.SCH
IF-CE12.SCH
VAL94.SCH

Slope warning buzzer
Motion alarm buzzer
HORN
PLATFORM SWING SOL
PLATFORM LEVEL SOL
Accelerator motor

FOOT SWITCH
WORKING LIGHT
LAMP
LEVELING
EG.START
ACCL
EM.PUMP
STOP
HORN
P.SWNG
POWER CNT
KEY SW
MAIN
GLW
RES GLOW
STOP
ACCL
ROT
EXT
ELEV
UEN
25AW
EM. PUMP
HM
POWER
GLW
CHG
TEMP
OIL

LS1 Boom length 1/5
LS2 Boom angle 1/5
SLOPE SENSOR 5 DEG
LS6 Boom wire rope (option)

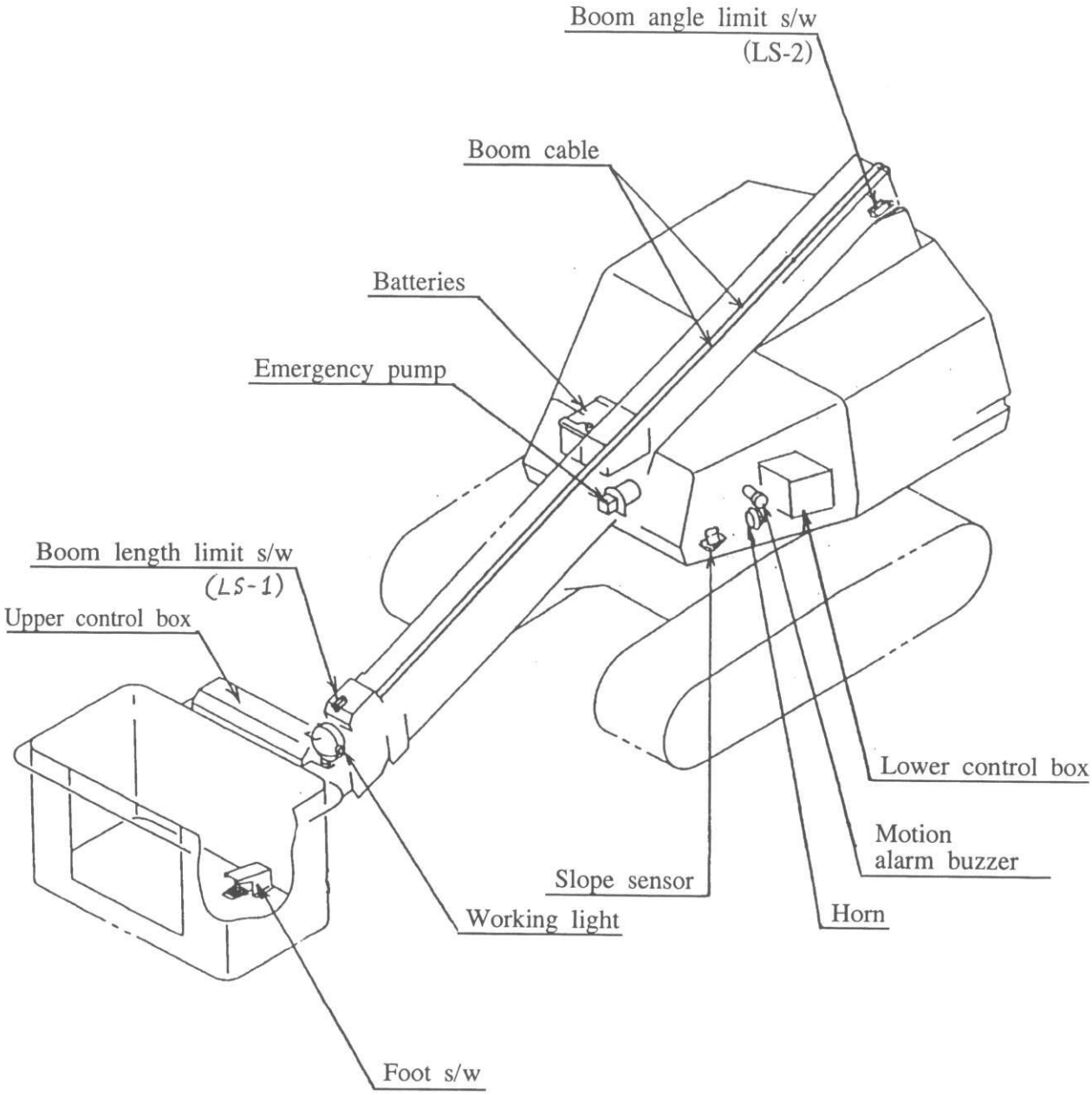
ENGINE
GLOW
TEMP
OIL
STOP SOLE.
ALT
Alternator
STARTER
SAFETY RELAY
EMG. PUMP
BAT REL.
FUSIBLE LINK FL1
17A*2
BT12
BT11 BATTERY

KEY SWITCH

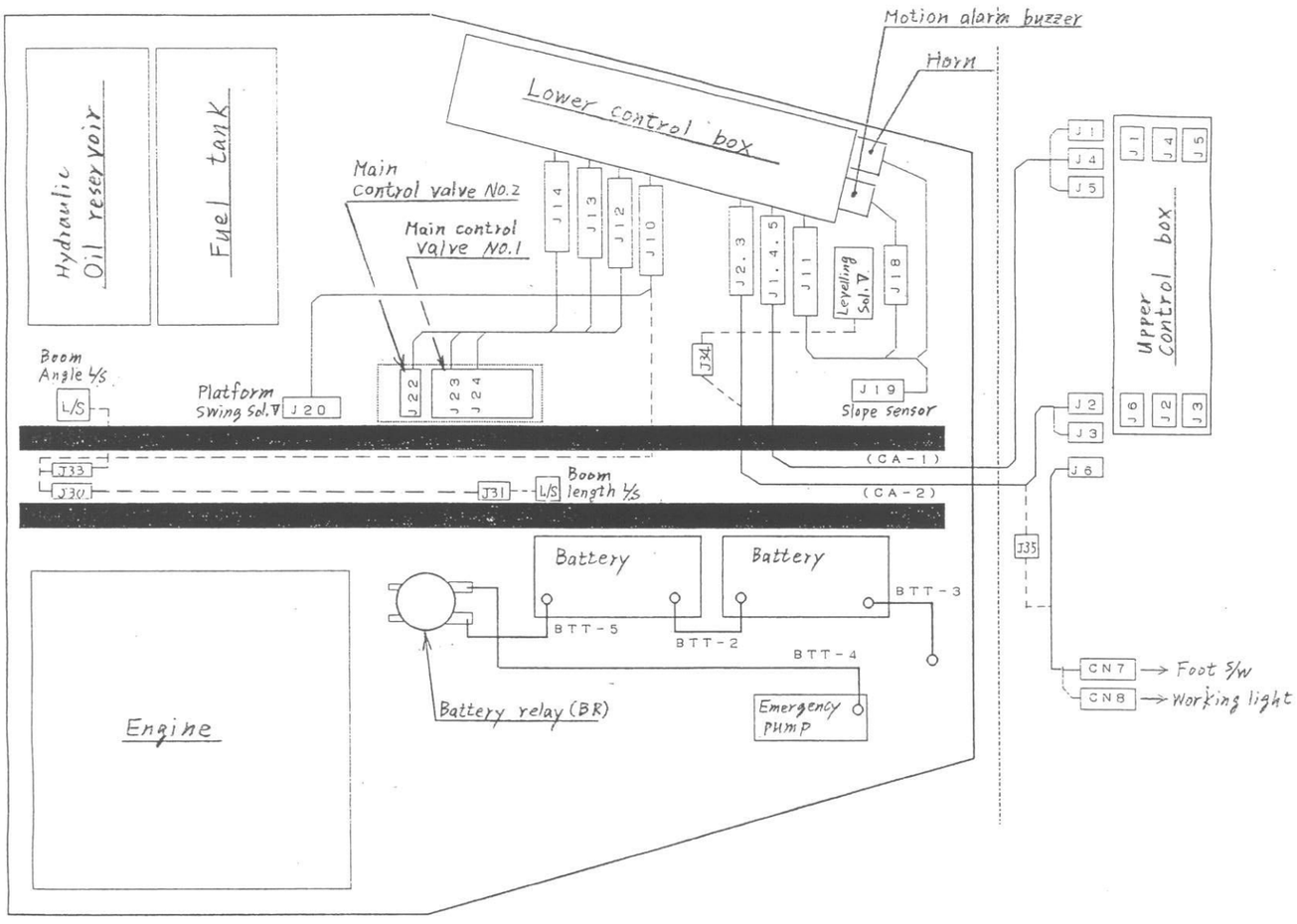
	45A	15A	33A	33A	9A	9A
	30	15/54	19	17	50 a	58
UP	○					○
OFF						
LOW	○	○				
GLW	○		○			
STR	○			○	○	

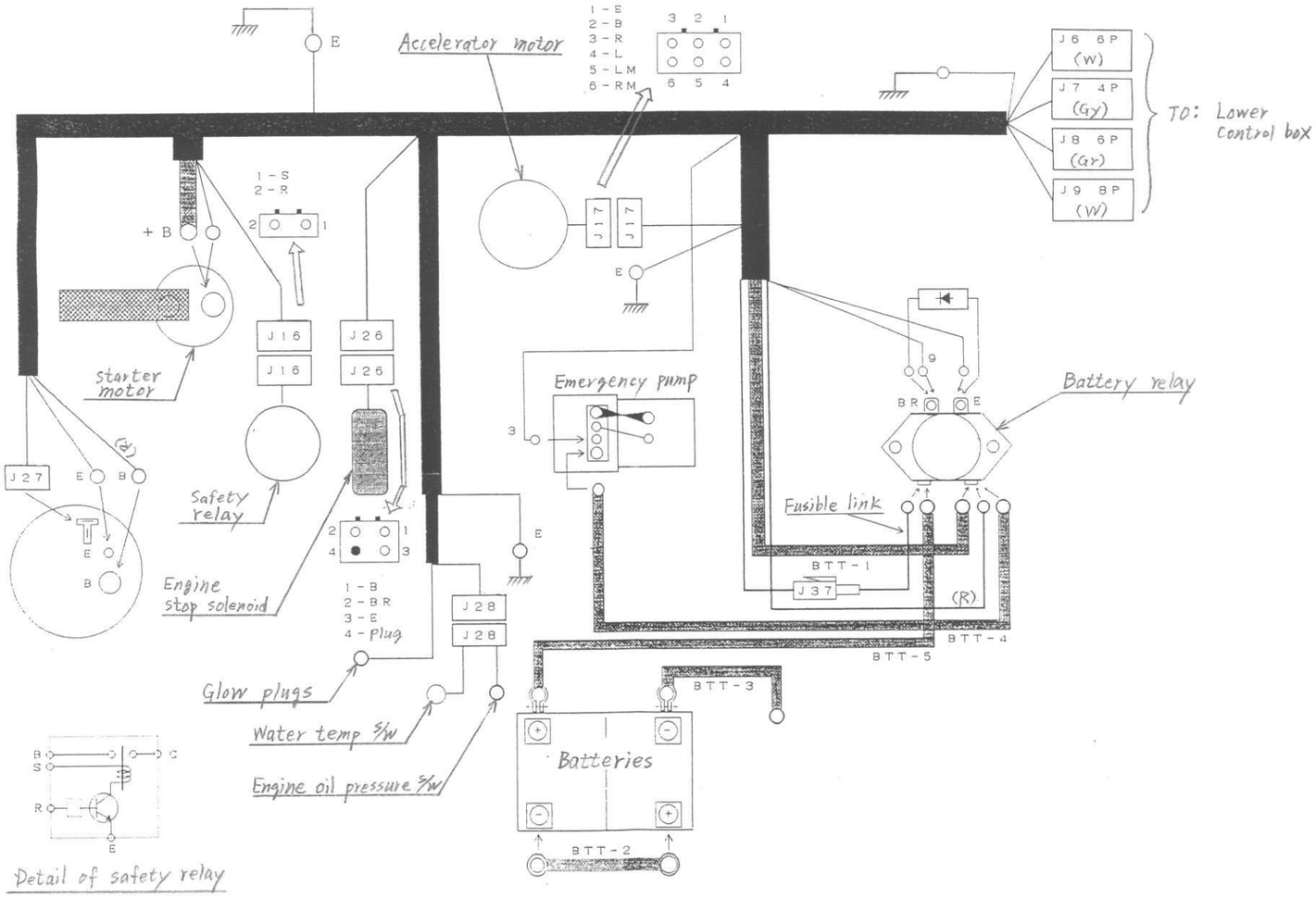
7-7-3

IDENTIFICATIONS OF ELECTRIC COMPONENTS

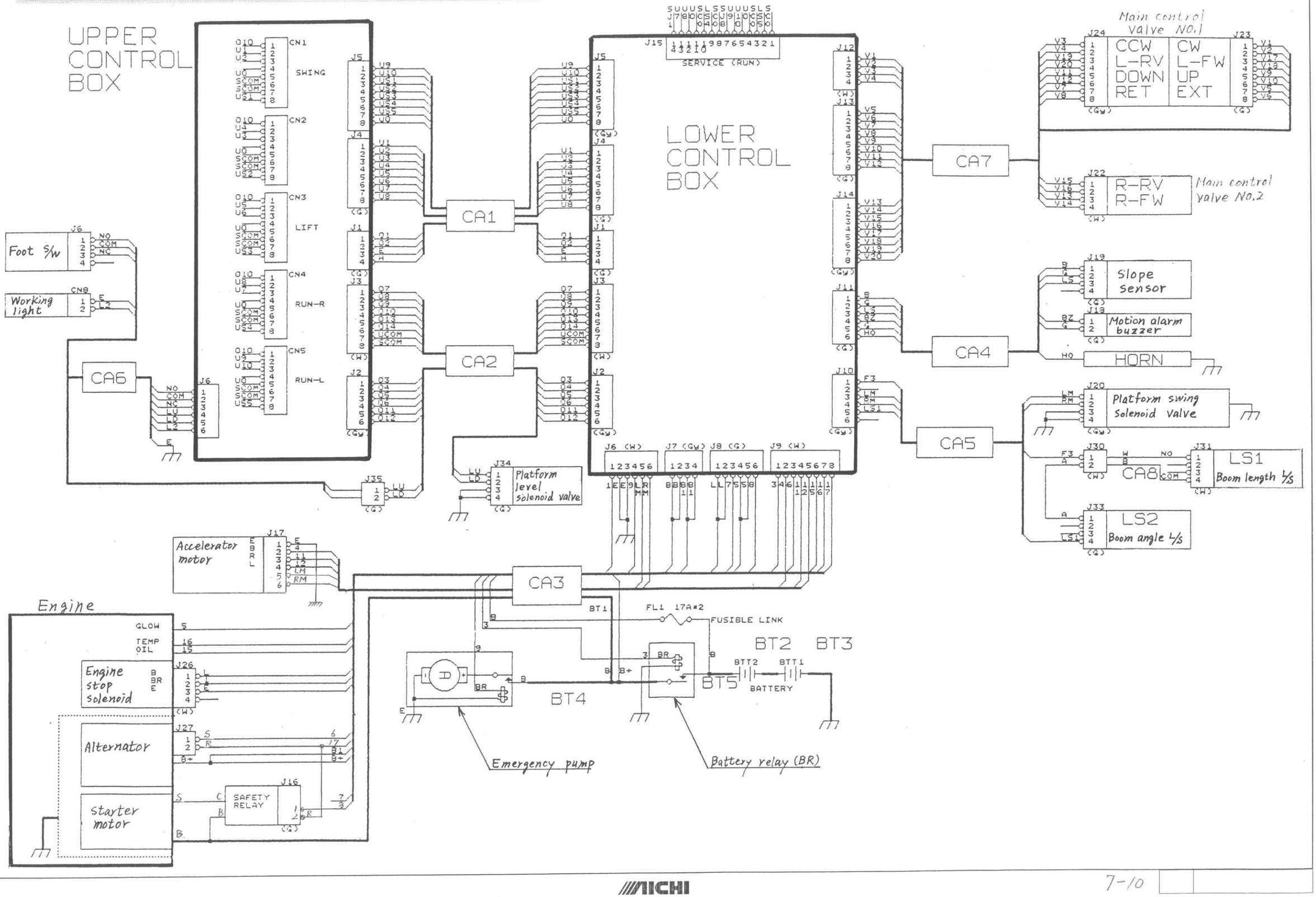


ELECTRIC WIRE HARNESS





ELECTRIC WIRING CHART



TIGHTENING TORQUE STANDARD

1) Hexagon Bolts and Nuts (8.8T)
Material : S45C

Tensile strength : 80 kgf/㎟
Yield point : 64 kgf/㎟
Brinell hardness : 225 ~ 300

Size mm	Pitch mm	Tightening torque	
		kgf - m	ft - lb
6	1.0	0.68 ~ 0.92	5 ~ 7
8	1.25	1.63 ~ 2.21	12 ~ 16
10	1.5	3.22 ~ 4.36	23 ~ 32
12	1.75	5.60 ~ 7.57	41 ~ 55
14	2.0	8.92 ~ 12.1	65 ~ 88
16	2.0	13.7 ~ 18.5	99 ~ 134
18	2.5	18.1 ~ 24.5	131 ~ 177
20	2.5	25.3 ~ 34.2	183 ~ 247
22	2.5	34.2 ~ 46.2	247 ~ 334
24	3.0	43.7 ~ 59.2	316 ~ 428
27	3.0	63.4 ~ 85.8	459 ~ 621
30	3.5	86.3 ~ 116.8	624 ~ 845
33	3.5	116.5 ~ 157.6	843 ~ 1140
36	4.0	150.2 ~ 203.3	1086 ~ 1471
39	4.0	193.1 ~ 261.2	1397 ~ 1889
42	4.5	214.5 ~ 290.2	1552 ~ 2099
45	4.5	266.2 ~ 360.2	1926 ~ 2605
48	5.0	321.4 ~ 434.8	2325 ~ 3145
52	5.0	412.7 ~ 558.4	2985 ~ 4039

2) Hexagon Socket Head Cap Screws (10.9T)
Material : SCM435

Tensile strength : 100 kgf/㎟
Yield point : 90 kgf/㎟
Brinell hardness : 280 ~ 365
Color : Black

Size mm	Pitch mm	Tightening torque	
		kgf - m	ft - lb
6	1.0	1.22 ~ 1.65	9 ~ 12
8	1.25	2.94 ~ 3.98	21 ~ 29
10	1.5	5.80 ~ 7.84	42 ~ 57
12	1.75	10.1 ~ 13.6	73 ~ 98
14	2.0	16.1 ~ 21.7	116 ~ 157
16	2.0	24.6 ~ 33.2	178 ~ 240
18	2.5	32.6 ~ 44.1	236 ~ 319
20	2.5	45.6 ~ 61.6	330 ~ 445
22	2.5	61.5 ~ 83.2	445 ~ 602
24	3.0	78.7 ~ 106.5	569 ~ 770
27	3.0	114.1 ~ 154.4	825 ~ 1116
30	3.5	155.4 ~ 210.2	1124 ~ 1570
33	3.5	209.6 ~ 283.6	1515 ~ 2050
36	4.0	270.4 ~ 365.9	1955 ~ 2645
39	4.0	347.5 ~ 470.2	2512 ~ 3340
42	4.5	386.1 ~ 522.4	2792 ~ 3777
45	4.5	479.2 ~ 648.3	3465 ~ 4687
48	5.0	578.5 ~ 782.7	4183 ~ 5659
52	5.0	742.6 ~ 1011	5369 ~ 7310

SME-906

INSPECTION MANUAL

SELF PROPELLED AERIAL PLATFORM

SP,SR SERIES

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

I N D E X

DAILY INSPECTION PROCEDURES

The inspection is to be carried out on firm level ground.

POWER UNIT

UNIT	ITEM	DESCRIPTION
Radiater.	Cooling water level.	Remove radiator cap and check the cooling water level.
Battery.	Electrolyte level.	Remove filler cap and check the electrolyte level.
Oil pan.	Engine oil level.	Check oil level.
Fuel tank.	Fuel level.	Check fuel level.
Hydraulic oil reservoir.	Hydraulic oil level.	Lower platform to its lowest position, retract jacks fully, and check oil level.

CARRIER

Tyre.	Excessive wear, cuts	Check tyres for excessive wear and cuts.
Wheel nuts.	Looseness.	Check wheel nuts for looseness.
Steering linkages.	Deformation, cracks.	Check steering linkages for deformation and cracks.
Travel motor unit.	Oil leakage.	Check the unit for oil leakage.
Carrier frame.	Deformation, cracks.	Check carrier frame for deformation and cracks.
Crawler.	Track link, shoes. (Excessive wear, tension.)	Check track link and shoes for excessive wear and abnormal tension.

OUTRIGGERS

Outrigger arm jack post.	Cracks, deformation.	Extend all of the outriggers and jacks fully, and check for cracks, deformation.
Jack cylinder.	Oil leakage.	Check each jack cylinder for oil leakage.
	Natural descent.	1. Extend all jacks and ground them. 2. Check each jack cylinder if it is retracted due to the weight of machine.

CONTROL SYSTEM

Control levers, switches.	Function.	Operate all of the control levers, switches and check that their functions are operating correctly.
	Excessive free play.	Operate all of the control levers, switches and check for excessive free play.

PLATFORM

UNIT	ITEM	DESCRIPTION
Platform leveling system.	Function.	Operate the boom by the lower control, and check that the platform always keeps its level position.
Platform Swing device	Deformation, cracks, wear.	Check platform swing device for deformation, cracks, and wear.

SAFETY DEVICE

Engine start stop system.	Function.	Test the engine start/stop switches at upper control and check they function correctly.
Emergency pump.	Function.	Stop engine, operate boom by emergency pump and check it functions correctly.
Foot switch.	Function.	Operate the machine using the upper control, release foot switch, and check if all of the function stops immediately.
Slope warning buzzer.	Function.	Turn on main key switch and make sure the slope warning buzzer sounds for a second just after turning on.
Alarm horn.	Function.	Press horn switch at upper control, and check it functions correctly.
Motion alarm buzzer	Function.	Operate the control levers, and switches then check that the motion alarm buzzer sounds.
Safety switch	Function.	Operate the safety switch, and check that the engine stops and that the power lamps turn off.
Working range controller. Moment limitter.	Function.	Operate the boom using the lower control, and check that it functions correctly.

DAILY INSPECTION CHECK SHEET

POWER UNIT

UNIT	ITEM	RESULTS
(DATE) ⟶		
Radiater.	Cooling water level.	
Battery.	Electrolyte level.	
Oil pan.	Engine oil level.	
Fuel tank.	Fuel level.	
Hydraulic oil reservoir.	Hydraulic oil level.	

CARRIER

Tyre.	Excessive wear, cuts	
Wheel nuts.	Looseness.	
Steering linkages.	Deformation, cracks.	
Travel motor unit.	Oil leakage.	
Carrier frame.	Deformation, cracks.	
Crawler.	Track link, shoes. (Wear, tension.)	

TURNTABLE

Rotation gear box.	Function.	

CONTROL SYSTEM

Control levers, switches.	Function.	
	Free play.	

BOOM

Boom.	Deformation, cracks.	
Boom pivot pin.	Any damage.	
Extension, Elevation cylinder.	Oil leakage.	
	Natural descent.	

PLATFORM

Platform leveling system.	Function.	
Platform & swing device.	Deformation, cracks, wear.	

SAFETY DEVICE

UNIT	ITEM	RESULTS
(DATE) ⟶		
Engine start, stop system.	Function.	
Emergency pump.	Function.	
Foot switch.	Function.	
Slope warning buzzer.	Function.	
Alarm horn.	Function.	
Motion alarm buzzer.	Function.	
Safety switch.	Function.	
Working range controller, Moment limitter.	Function.	

PERIODICAL INSPECTION PROCEDURES

Carry out both of the descriptions for Monthly and Annual inspections when conducting Annual inspection.

		DESCRIPTION	
UNIT	ITEM	MONTHLY INSPECTION	ANNUAL INSPECTION
Engine	Water, oil leakage.	Check for water and oil leakage thoroughly.	←
	Radiator.	Check for water level, contamination and replenish or change the water if necessary.	←
		Check the function of radiator cap and for any damage to the radiator thoroughly.	
	Air filter.	Check air filter and clean or replace the element, if necessary.	←
	Water separator.	Drain water from water separator.	Disassemble and clean thoroughly. (Cleaning interval ; Every 6 months.)
	Fuel filter.	Check filter for fuel leakage.	Replace the element. (Replacement interval ; Every 600 hours.)
	Battery.	Check for the electrolyte level and clean battery terminals.	←
	Fan belt.	Check for wear and tension.	←
	Alternator, starter.	Check the function.	←
	Valve clearance.		Remove tappet cover and adjust valve clearance. (Adjustment interval ; Every 1,200 hours.)
	Engine oil.	Check oil level and contamination.	Change engine oil. (Replacement interval ; Every 200 hours.)
	Oil filter.	Check filter for oil leakage.	Replace the element. (Replacement interval ; Every 400 hours.)
	Fuel tank.	Check filter for oil leakage.	Drain fuel and clean the tank.
Hydraulic oil reservoir	Oil leakage.	Check for oil leakage.	←
	Anchor bolts.	Check the bolts for looseness.	←
	Stop valve.	Check stop valves for oil leakage and any other damage.	←
	Oil level, contamination, viscosity, water content, oxidation.	Check oil level.	Stir oil in the reservoir, take out sample(60cc) and check the following items.

UNIT	ITEM	MONTHLY INSPECTION	ANNUAL INSPECTION
Hydraulic oil reservoir			–Contamination ; Within NAS class 12. –Viscosity ; Within 10% ± Standard. –Water content ; Less than 0.5%. –Oxidation ; Less than 0.4mgKOR/g. (Oil change interval ; 1,200 hours orAnnually)
Hydraulic filter.	Oil leakage, any other damage.	Check filters for oil leakage.	←
	Replacement of filter element.		Replace the element. (Replacement interval ; 1200 hours or Annualy)
Hydraulic pump.	Abnormal noise, excessive heat.	Run the pump and check for the items.	←
	Oil leakage.	Run the pump with max-imum pressure and check for oil leakage.	←
	Pump bracket, anchor bolts.	Check pump bracket for cracks, deformation, and anchor bolts for looseness.	
Wheels (SP series)	Tyre.	Check for excessive wear and cuts.	←
	Wheel nuts.	Check for looseness. Tightening torque ; 25-30kg-m.(180～220ft-lb)	←
Crawler. (SR series)	Track shoe, link.	Check for tension, and wear.	←
	Drive sprocket, Idle wheel.	Check for excessive wear and cracks.	←
	Track roller, carrier roller.	Check for wear and oil leakage.	←
Travel motor unit	Oil leakage, external damages.	Check for the items.	←
	Gear oil.	Check oil level.	Change gear oil. (Oil change interval; 1,200 hours or Annualy)
	Abnormal noise, excessive heat.	Run the motor and check the motor, gear box for the items.	←
	Bolts, nuts.	Check for looseness.	←

UNIT	ITEM	MONTHLY INSPECTION	ANNUAL INSPECTION
Steering mechanism. (SP serise)	Linkages.	Check for deformation, cracks.	←
	Wheel bearings.		Jack up the machine and check the wheel bearings for excessive free play and any other damage.
	Steering cylinder.	Operate the cylinder and check for oil leakage, abnormal function.	←
	Lubrication.	Supply grease to each grease fitting.	←
Travel speed limit system.	Travel speed.	Perform travelling operation with extended boom or setting boom over the horizontal and make sure the travelling speed is LOW.	←
	Flow divider valve.	Check the valves for oil leakage.	←
	Travel speed select solenoid valve.	Check the solenoid valve for oil leakage.	←
	Limit switch.	Check the limit switches for any damage.	←
Carrier, frame	Deformation, cracks.	Check the frame for the items.	←
Turntable.	Deformation, cracks.	Check turntable for the items.	←
	Anchor bolts.		Check anchor bolts for looseness.
T.T.B. (Turn Table Bearing)	Ring gear.	Check ring gear for excessive wear, cracks.	←
	Bearings.	Rotate T.T.B. and check for abnormal noise and any other fault.	Check the T.T.B. for free play. serviceable limit ; 3 mm(0.12 in)
	Anchor bolts.	Check bolts for looseness.	←
	Lubrication.	Supply grease to each grease fitting.	←
Rotation motor, gear box.	Oil leakage.	Check gear box and motor for oil leakage.	←
	Abnormal noise, excessive heat.	Run the motor and check for the items.	←
	Bolts, nuts.	Check bolts, and nuts for looseness.	←

UNIT	ITEM	MONTHLY INSPECTION	ANNUAL INSPECTION
Rotation motor, gear box.	Pinion gear.	Check pinion gear for wear, and cracks.	←
	Back-lash between pinion & T.T.B.		Check the back-lash between the pinion and ring gear of T.T.B. (Standard back-lash ; 0.6 mm (0.02in) or less)
	Gear oil.	Check oil level.	Change gear oil. (Oil change interval ; 1,200 hours or Annually)
Swivel joint.	Oil leakage.	Apply the maximum pressure, and check for oil leakage.	←
	Anchor bolts, stopper.	Check for looseness.	←
	Slip rings, carbon brushes.		Remove the cover or carbon brush holder and check for excessive wear, corrosion.
	Lubrication.	Supply grease to grease fitting.	←
Control system.	Control levers, switches, cables, linkages.	Test all of the control levers, switches and check the correct function, and any excessive free play.	←
	Instruments.	Check for the function.	←
	Relief valve.	Actuate relief valve, and check for abnormal noise, oil leakage.	Set a pressure gauge, measure the preset pressure of relief valve.
	Control valves.	Operate control valves, and check for oil leakage, any other fault.	←
	Name plates, Decals.	Check for legibility and any damage.	←
	Accelerator.	Operate accelerator switch either at lower or upper control and check for the function.	Check accelerator motor, limit switches, cams, wires for any damage.
Boom.	Bend, distortion, dent, crack, scratch.	Extend boom fully and check for the items. (The limit of bend ; −Vertically− 0.15% of the boom length. −Horizontally− 0.1% of the boom length.)	←
	Pivot pin.	Check boom pivot pin for excessive wear and any other damage. (The limit of clearance between pin and bushing ; 0.6 mm (0.024in))	←