CRAWLER CRANE

SHOP
MANUAL

model **CK1200**
CKE1100

KOBELCO

BOOK CODE : S5GK00004ZE01

Applicable Model	Applicable Machine	Date of issue	Remarks
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SAFETY

This section explains "Explanation of Warning Description", "Warning Labels" and "General safety"

EXPLANATION OF WARNING DESCRIPTION

This manual indicates the contents of warnings concerned in safety with the following three stages according to the degree of personal harm and material damage.
Since the very important matters for safety are described, understand the contents sufficiently and observe them without fail.

⚠ DANGER Warning to avoid dangerous condition resulting in instantaneous death or serious personal injury.

⚠ WARNING Warning to avoid dangerous condition which has possibility of death or serious personal injury.

⚠ CAUTION Warning to avoid dangerous condition which has possibility to cause slight or medium injury or damage of the machine and equipments.

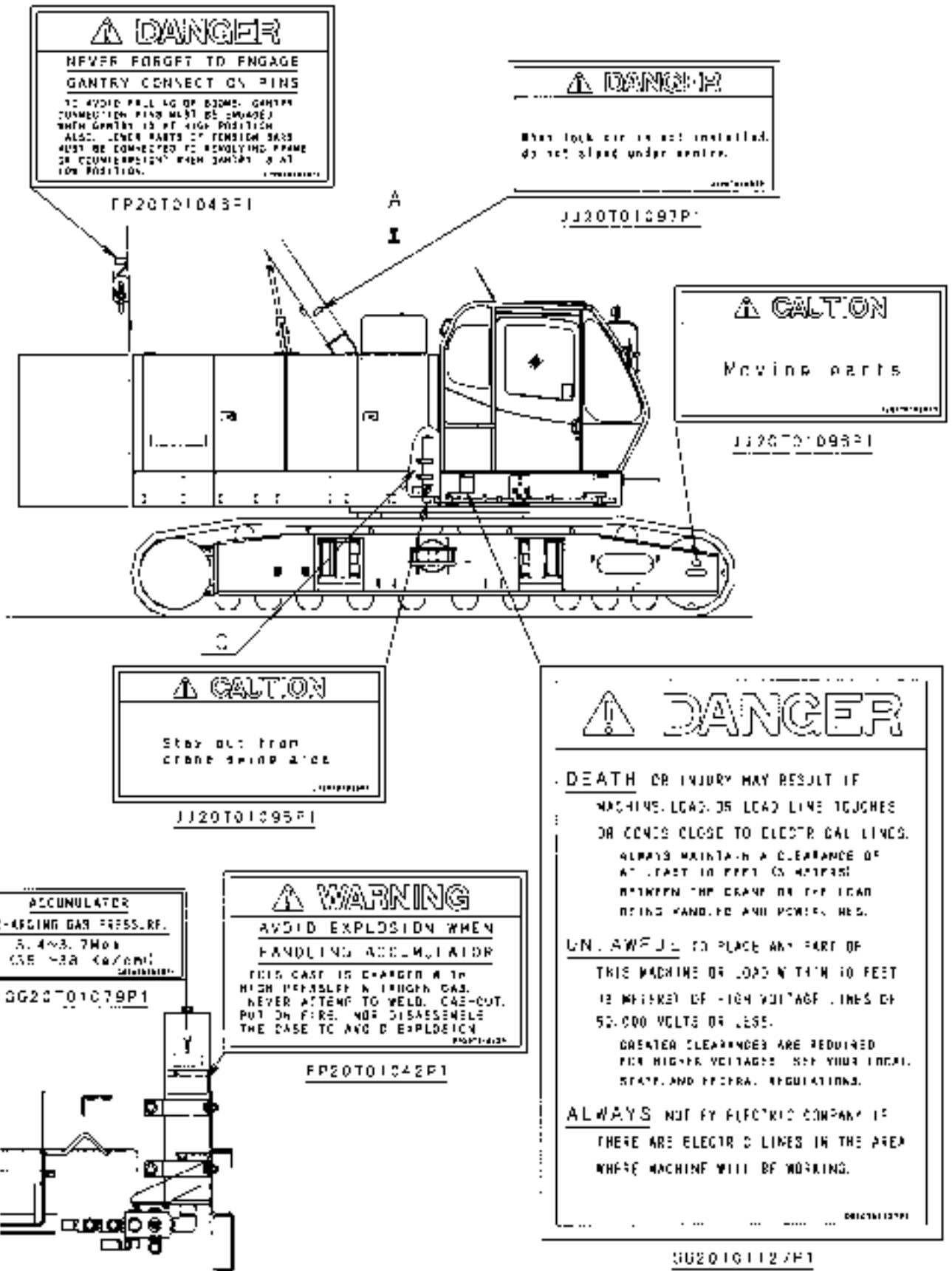
This manual describes safety warnings sufficiently, but dangerous conditions which are impossible to be anticipated are considered.
Therefore, take measures for safety not only regarding the machine, but also including the working environment

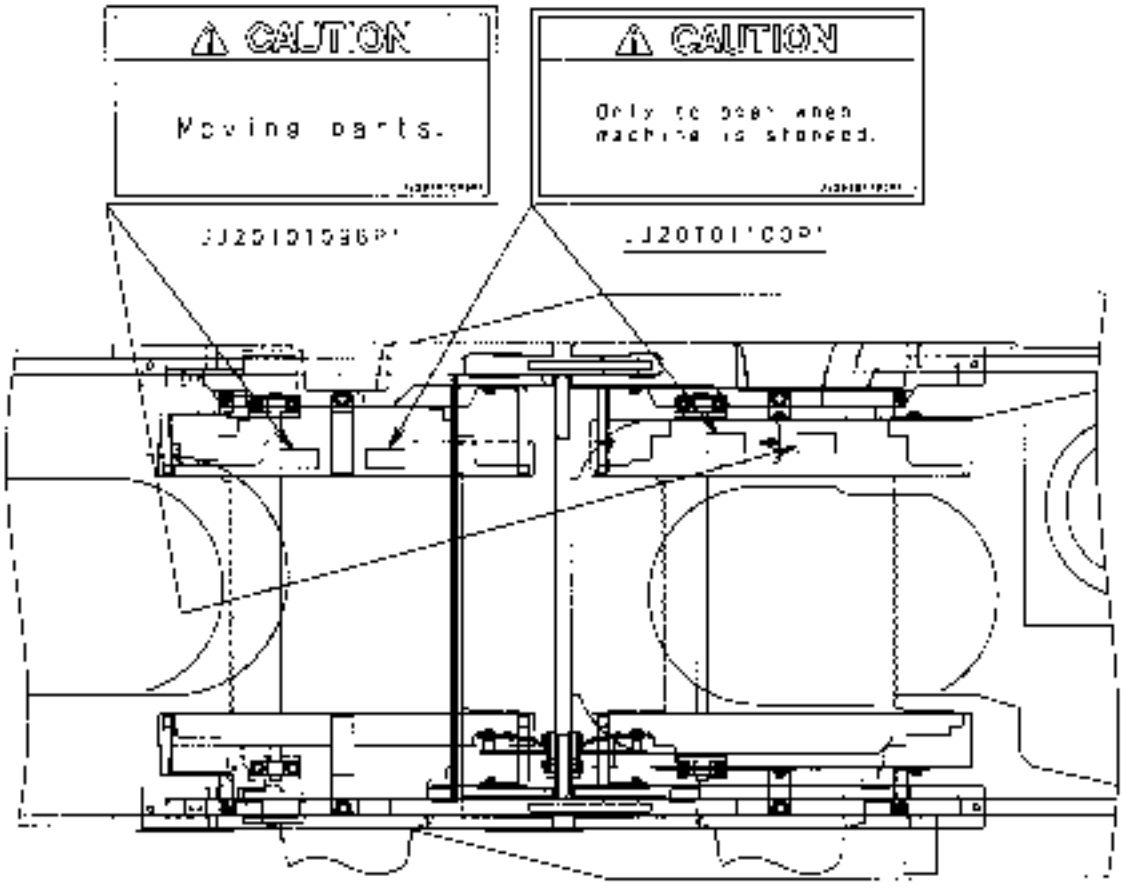
EXPLANATION OF WARNING LABELS

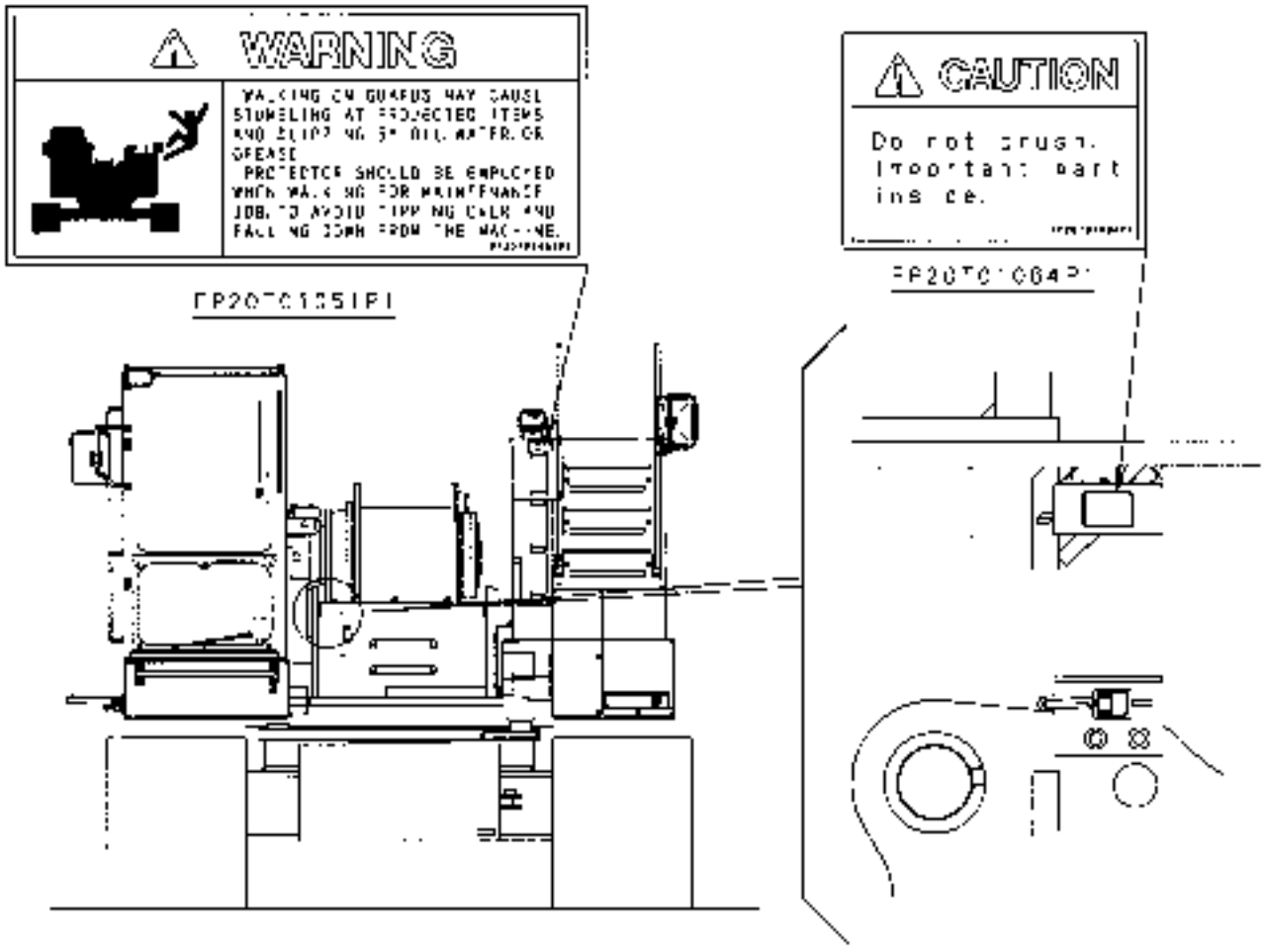
Since the warning labels are installed in the machine and indicated with the three stages in the same way as the warning description, confirm the positions and contents all warning labels first.
Put them to the practical use to secure safety when operating, checking and performing maintenance.

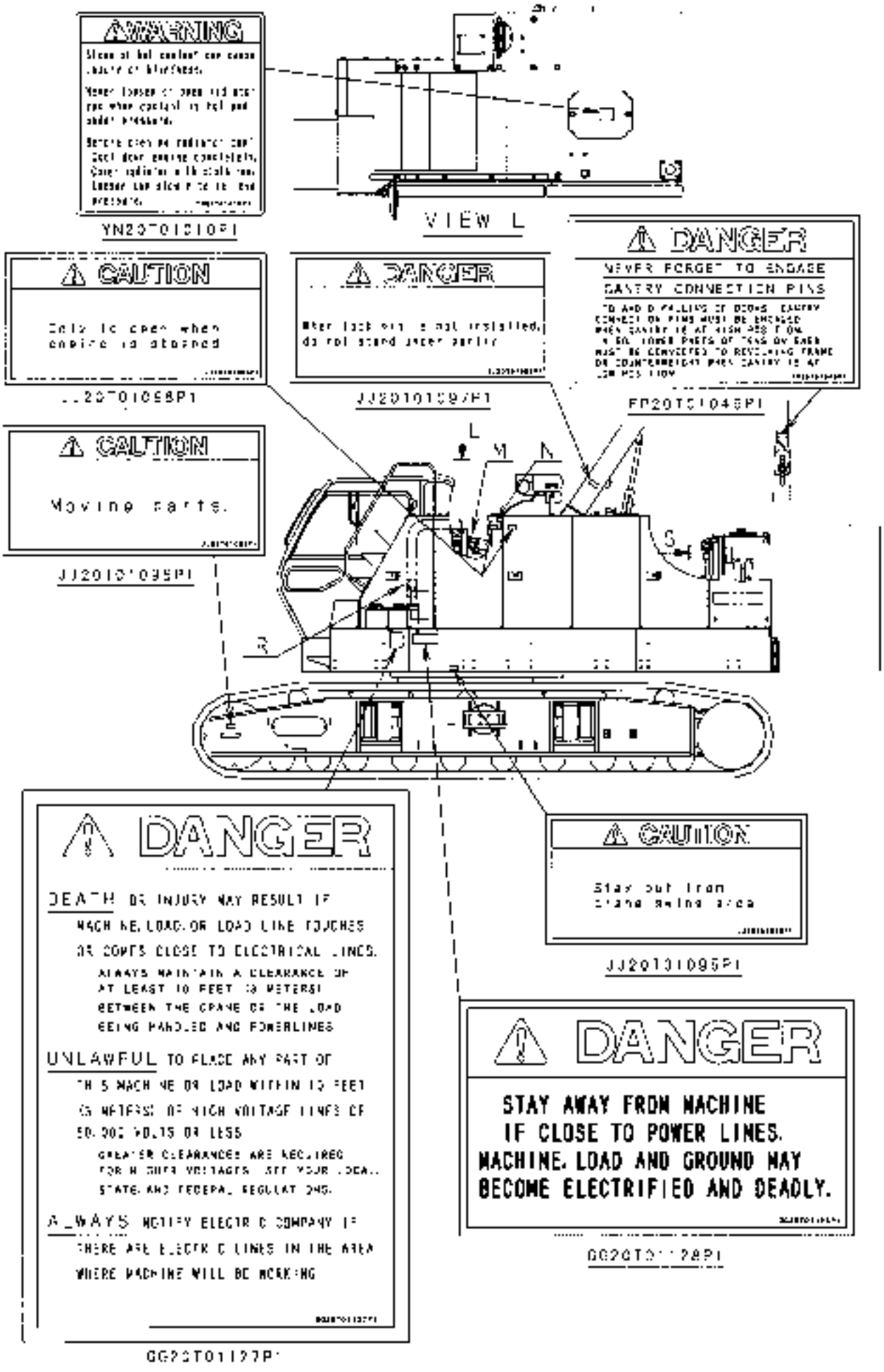
- HANDLING OF WARNING LABELS

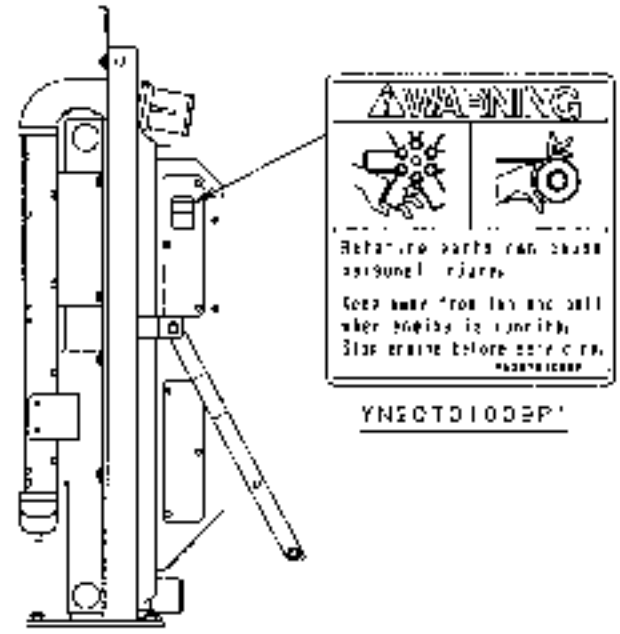
1. When the warning label is damaged or stained, order it to the designated service shop.
2. Do not remove the warning labels.
3. When the surface of the warning label is soiled and difficult to be seen, wipe it cleanly.



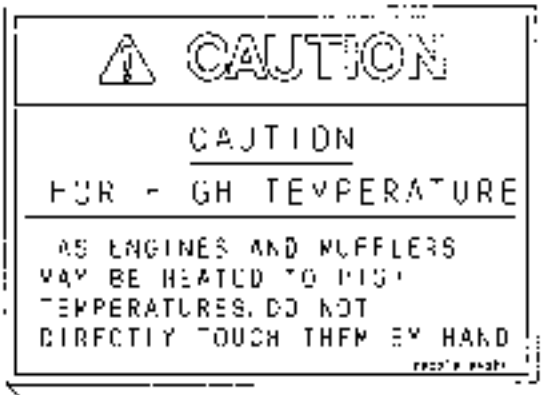


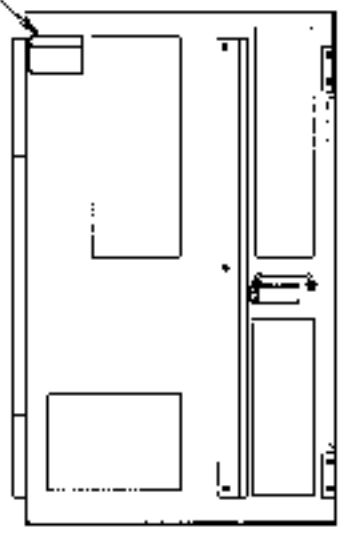




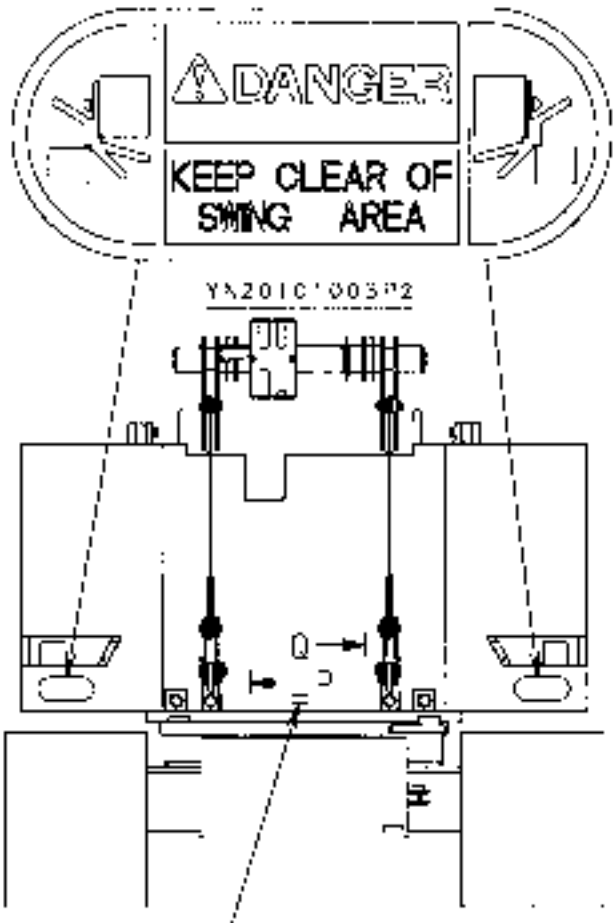


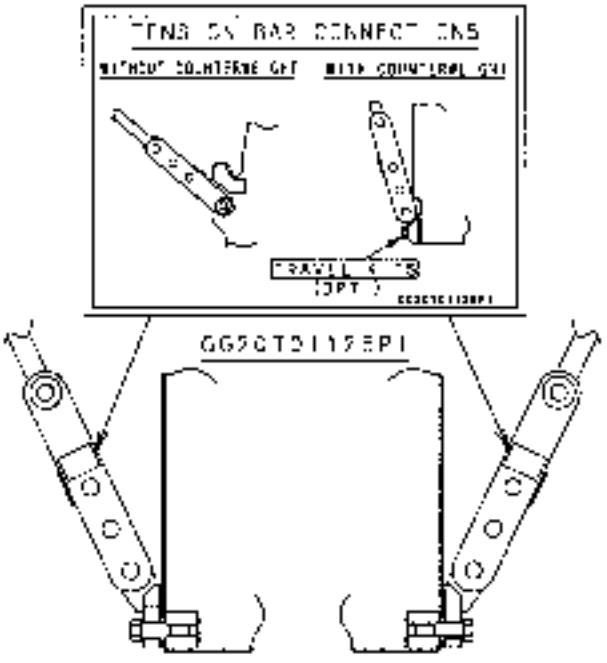
DETAIL M





DETAIL N
(VIEW FROM INNER OF DOOR)



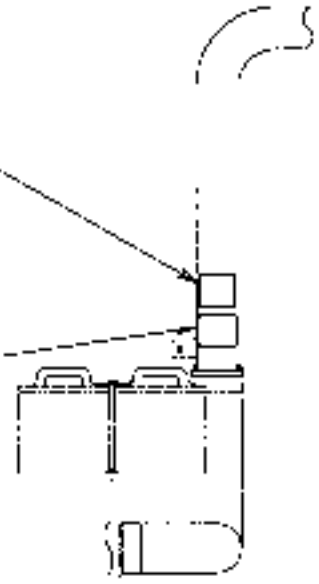


VIEW B

VIEW D

YN20T01017P1

YN20T01001P1

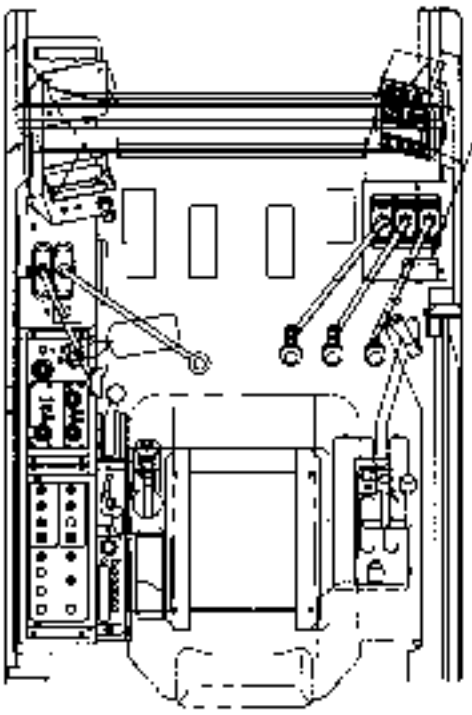


DETAIL R

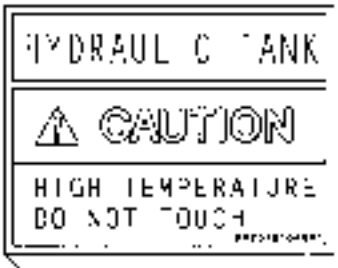
FP20T01050P1

FUEL TANK

FP20T01045P1



SECTION U-U



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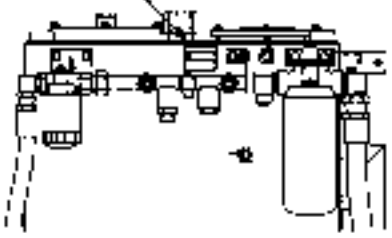
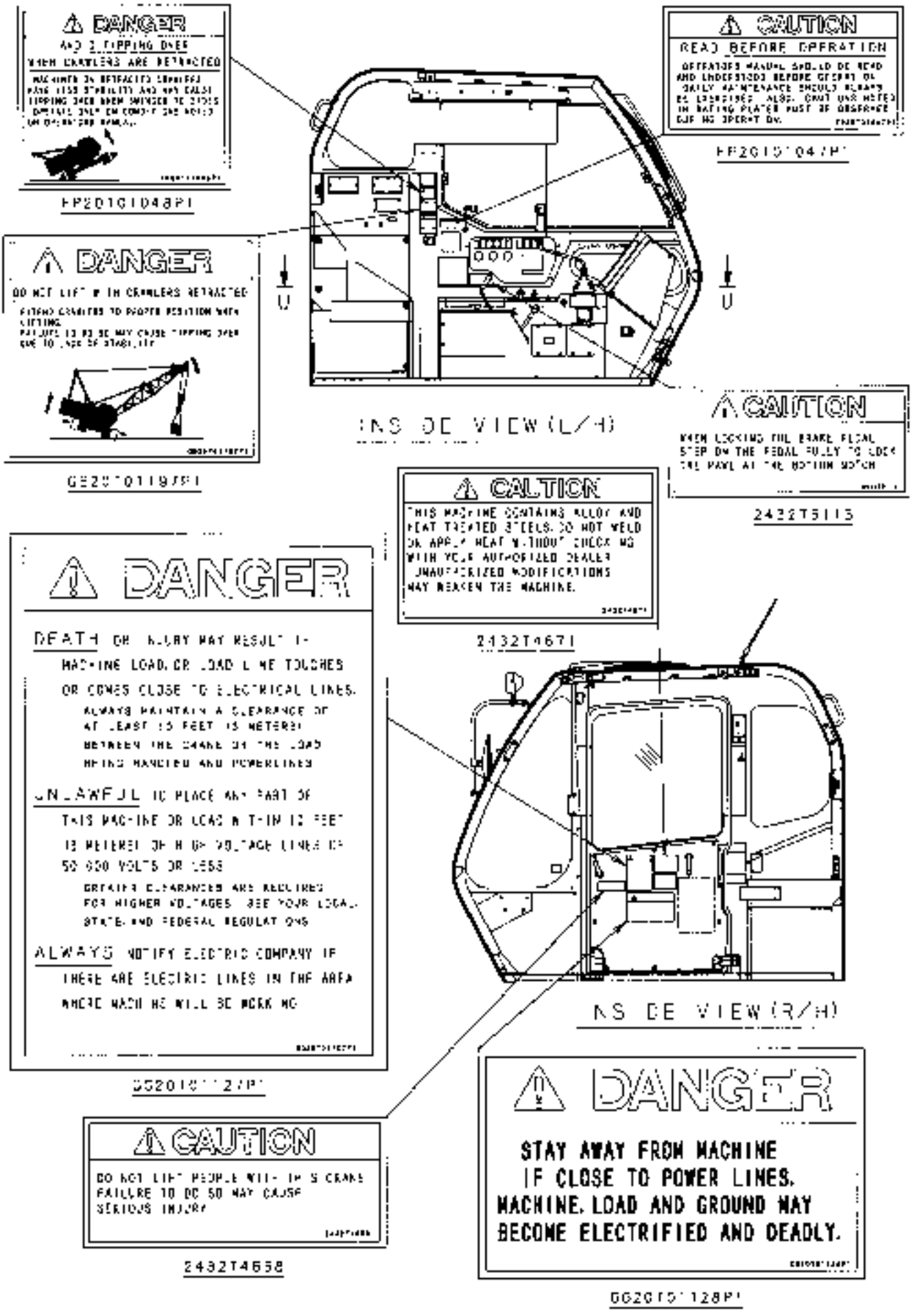
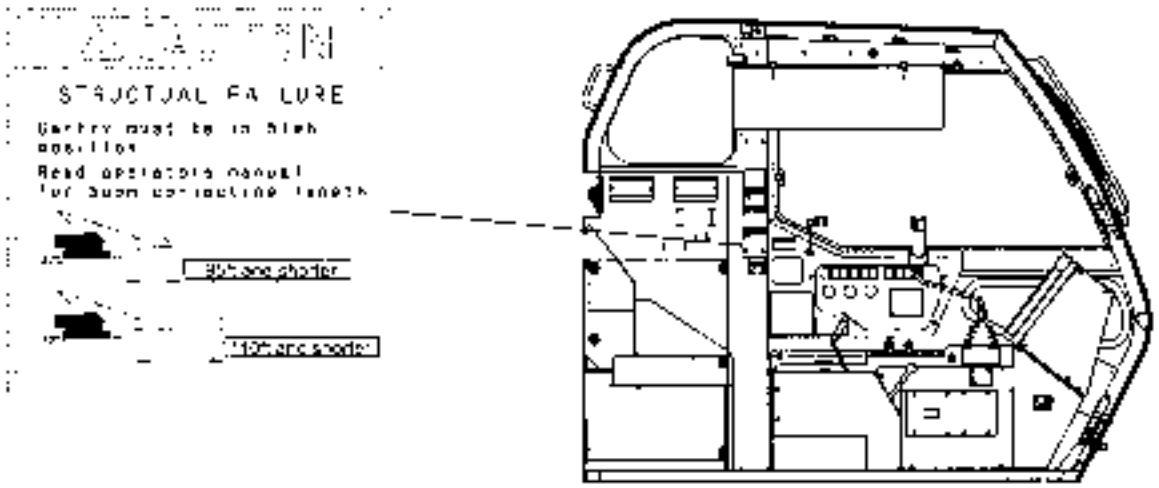
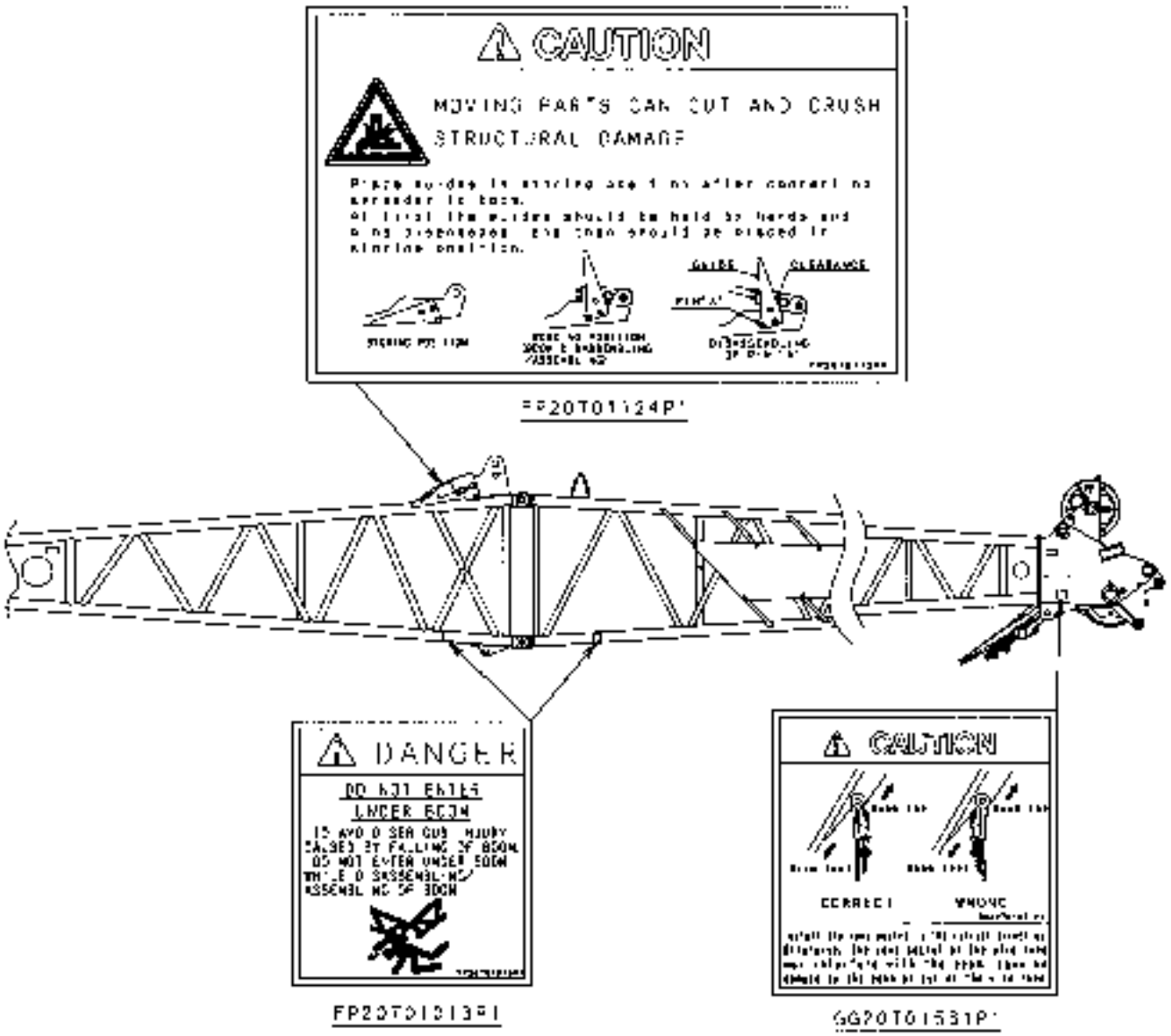


VIEW S
(HYD. OIL TANK)







FP20T01124P1

FP20T01313P1

GG20T01531P1

PRECAUTIONS FOR INSPECTION AND MAINTENANCE

1. Service and maintenance must be performed only by authorized personnel who are qualified in compliance with a relevant law or regulation.
2. Regular maintenance or inspection should be quickly performed after shutting down the machine and ensuring safety to personnel and equipment.
   Post an "INSPECTION IN PROGRESS. DO NOT START." warning sign on a readily visible location.

GENERAL SAFETY PRECAUTIONS

1. Wear safety shoes, helmets and clothing suitable for the job. Also use protective goggles, mask, gloves, etc., as required.
2. To ensure safe and correct maintenance, carefully study this SHOP MANUAL and get fully familiar with the instructions in it.
3. Place the machine in a safe place. Always maintain safe clearance around the machine.
4. Before starting crane operation, hold a safety meeting. Also, make agreement on standardized hand signals.
5. When inspecting or handling the battery or oil, do not use exposed flame nearby.
   To avoid fire accident, only use explosion-proof lighting equipment.
6. Start an inspection or maintenance work only after shutting down the engine.
7. Certain machine components remain hot immediately after the engine is shut down. Do not touch them.
8. Before removing the radiator cap, wait until the coolant water gets sufficiently cool. Next, carefully loosen the cap and release radiator pressure, and then remove the cap.
9. Before inspecting or maintaining an electrical system on the machine, power off the machine by, for example, disconnecting the battery cables.
10. When working at a high lift area, always wear a safety belt.
11. When leaving the operator's cab for an inspection or maintenance work, post an "INSPECTION IN PROGRESS. DO NOT START." warning sign on a readily visible location. Also, lock the cab for security.
12. Before starting a cleaning or lubrication work on the machine, always shut down the engine.
13. While adjusting tire pressure, be absolutely careful about rupture of a tire, flying of wheel part.
14. Use genuine KOBELCO replacement parts and oils only.
15. Always keep the oil containers clean. Protect them against ingress of dust or moisture. Also, fill clean, fresh oils only.
16. Once a maintenance work is complete, clean the machine.
    Protect grease nipples, breathers, and oil level gages against ingress of dust.
17. Always keep the subjects of regular inspection clean to allow problems such as oil leakage, crack, looseness, etc., to be readily detected.
18. During car washing, do not allow high pressure steam to be directly applied to electrical components and connectors.
19. After removing O-rings, oil seals, gaskets, etc., clean the mounting seats. Then, install fresh O-rings, oil seals, gaskets, etc. Also, remember to thinly apply oil to the seal faces of these parts before installation.
20. Before disconnecting pressurized piping, release the inside pressure.
21. CAUTIONs for repair work with welding: Turn OFF the key switch, disconnect the negative terminal on battery to power off the electrical circuit; provide grounding within 1 meter from a weld area; in advance, remove electronic components (for example, controller) to prevent possible damage.
22. Dispose industrial wastes according to a relevant law or regulation.
23. Extremely careful during an inspection or maintenance work under the carrier. Remember the possibility of being crushed.
    When jacking up the machine for an inspection or maintenance work, place blocks below it to prevent accidental falling.
24. Provide positive ventilation when refilling oils or fuel, rinsing parts, or starting the engine.

25 To remove a heavy component (20 kg or heavier), use a crane, etc. Always keep safety in mind

26 Illegal or unauthorized, or otherwise nonconforming modification is strictly inhibited

27. Do not allow oil or dust to deposit around the engine. Otherwise, fire accident can result.

28. Store removed attachments and components safely so that they do not drop or fall down.

29. Always use correct tools that have been well maintained.

30 To prevent personnel from being caught by a running fan, belt, shaft or the like, shut down the engine before starting an inspection or maintenance work.

31 Battery liquid and oils are harmful to human health. If touching any of these materials, immediately wash it away.

32 Make sure to use the light oil for fuel

1. SPECIFICATION

1.1 SPECIFICATION

1.1.1 PERFORMANCE

CK1200

Type		Crawler mounted, fully revolving
Max. lifting capacity	Standard boom	108,860 kg x 3.65 m (240,000 lbs x 12 feet)
Max. boom length	Standard boom	70.1 m (230 ft)
Max. boom + Jib length		61.0 m boom + 21.3 m jib (200 ft boom + 70 ft jib)
Basic boom length	Standard boom	15.2 m (50 ft)
Working weight (Including upper and lower machine, counter-weights, carbody weights, 50 ft standard boom, hook block)		Approximately 99,000 kg (218,000 lbs)
Average ground pressure		Approximately 92.9 kPa (13.5 psi)
Gradeability (tan θ)		30%
Engine		Hino P11C-UN 247 kw/2000 min⁻¹
Hoist line speed (front and rear drum)		120 m/min. (393 ft/min.)
Lowering line speed (front and rear drum)		120 m/min. (393 ft/min.)
Boom raising rope speed		48 m/min. (157 ft/min.)
Boom lowering rope speed		48 m/min. (157 ft/min.)
Swing speed		3.2 min⁻¹ (3.2 rpm)
Propel speed		1.4/1.0 km/h (0.87/0.62 miles/hour)

CKE1100

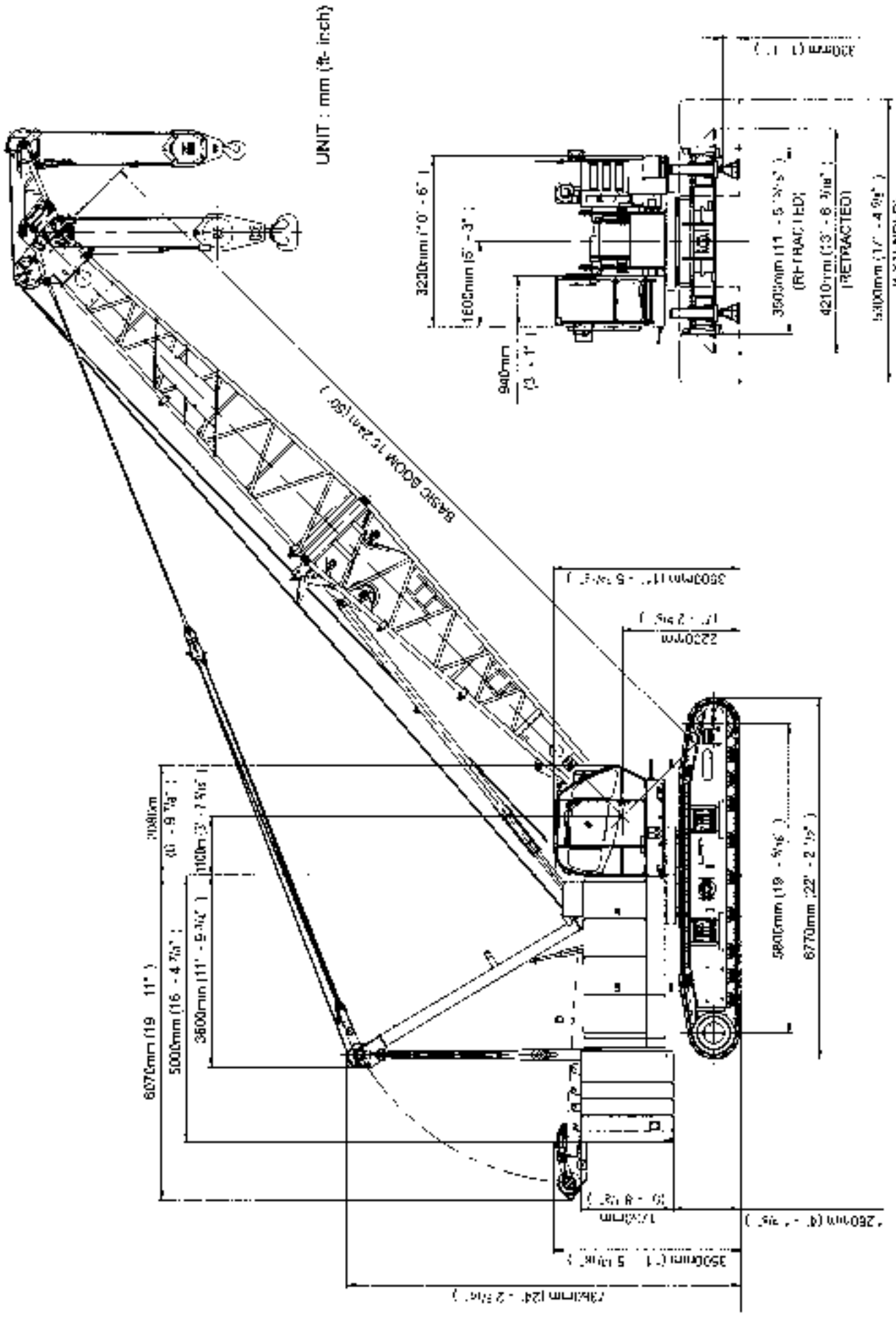
Type		Crawler mounted, fully revolving
Max. lifting capacity	Standard boom	110 000 kg x 3.6 m (242,504 lbs x 12 feet)
Max. boom length	Standard boom	70.1 m (230 ft)
Max. boom + Jib length		61.0 m boom + 21.3 m jib (200 ft boom + 70 ft jib)
Basic boom length	Standard boom	15.2 m (50 ft)
Working weight (Including upper and lower machine, counter-weights, carbody weights, 50 ft standard boom, hook block)		Approximately 99 000 kg (218 000 lbs)
Average ground pressure		Approximately 92.9 kPa (13.5 psi)
Gradeability (tan θ)		30%
Engine		Hino P11C-UN 247 kw/2000 min.⁻¹
Hoist line speed (front and rear drum)		120 m/min. (393 ft/min.)
Lowering line speed (front and rear drum)		120 m/min. (393 ft/min.)
Boom raising rope speed		48 m/min. (157 ft/min.)
Boom lowering rope speed		48 m/min. (157 ft/min.)
Swing speed		3.2 min⁻¹ (3.2 rpm)
Propel speed		1.4/1.0 km/h (0.87/0.62 miles/hour)

1 The main lifting/ lowering rope speed, the auxiliary hoisting/ lowering rope speed, and the propel speed vary depending on the load.

2 The rope speed is of the first layer on the drum.

1.1.2 OUTSIDE DIMENSIONS

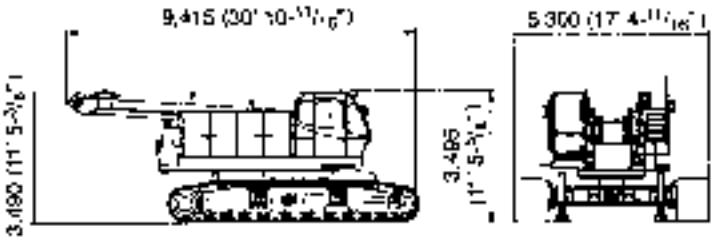
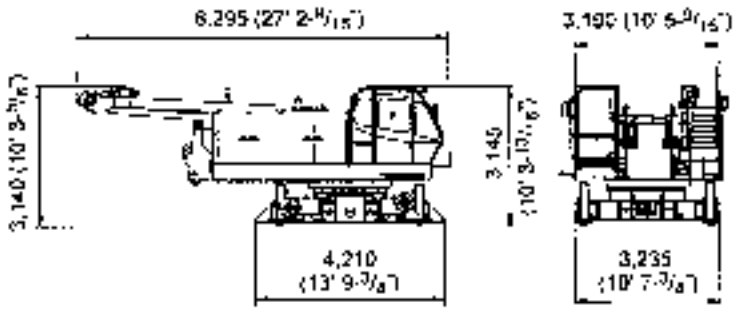
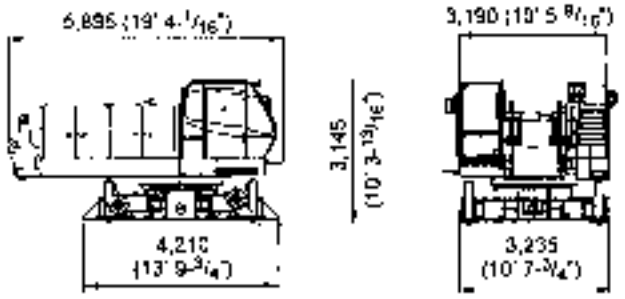
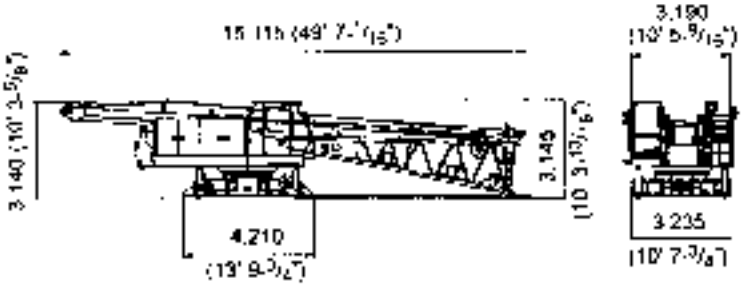
Height above ground of cab	3,500 mm (11'5-13/16")
Width of upper machine with operator's cab	3,200 mm (10' 6")
Radious of rear end (with counterweight)	5,000 mm (16' 4-7/8")
Counterweight ground clearance	1,260 mm (4' 1-5/8")
Center of rotation to boom foot pin	1,100 mm (3' 7-5/16")
Height above ground of boom foot pin	2,200 mm (7' 2-5/8")
Height to top of gantry (working position)	7,380 mm (24' 2-9/16")
Overall length of crawlers	6,770 mm (22' 2-1/2")
Distance between centers of tumblers	5,800 mm (19' 0-5/16")
Overall width of crawlers (extended)	5,300 mm (17' 4-5/8")
Overall of crawler shoe (retracted)	4,210 mm (13' 6-3/16")
Width of crawler shoe	900 mm (2' 11-7/16")
Ground clearance of carbody	330 mm (1' 1")

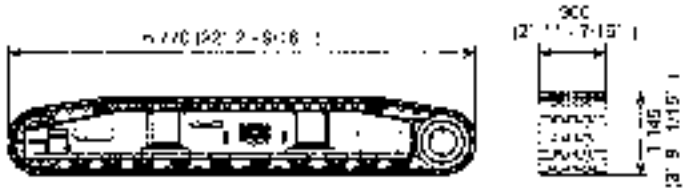
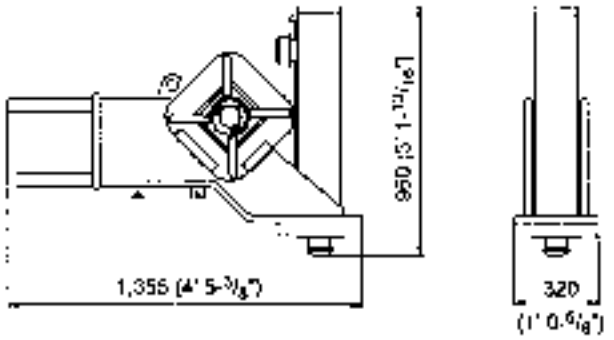


1.1.3 DIMENSIONS AND WEIGHT OF EACH PARTS

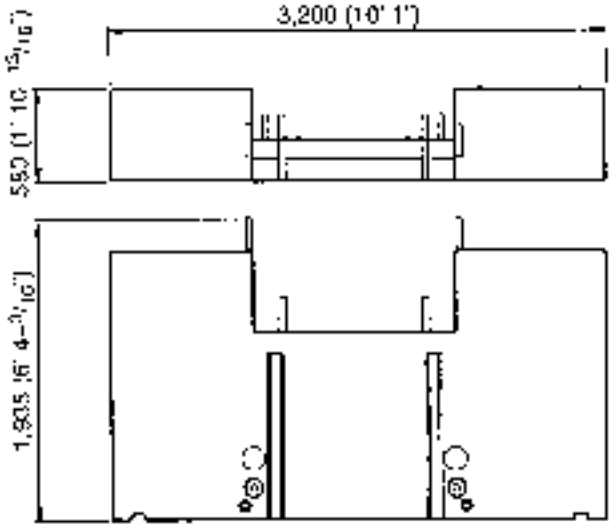
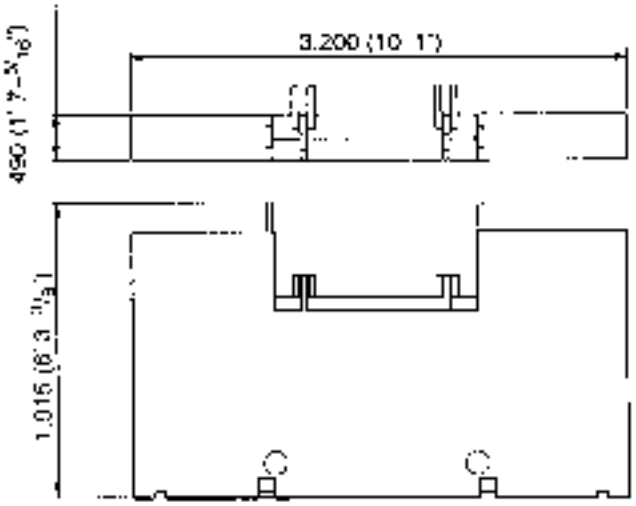
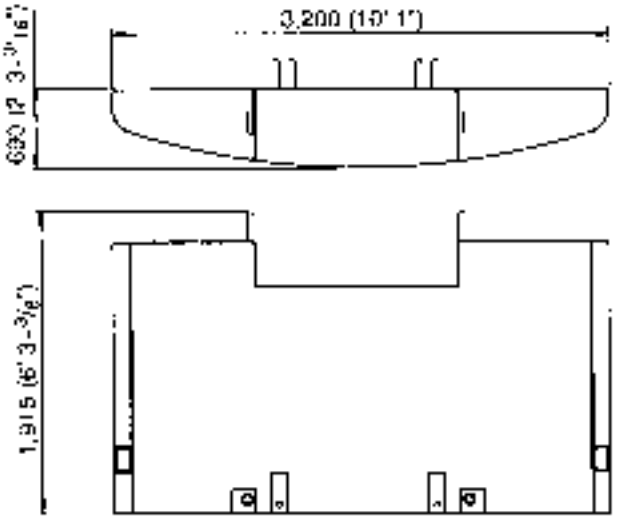
For your reference, the chart below shows the dimensions and weight of each parts.

1 BASE MACHINE

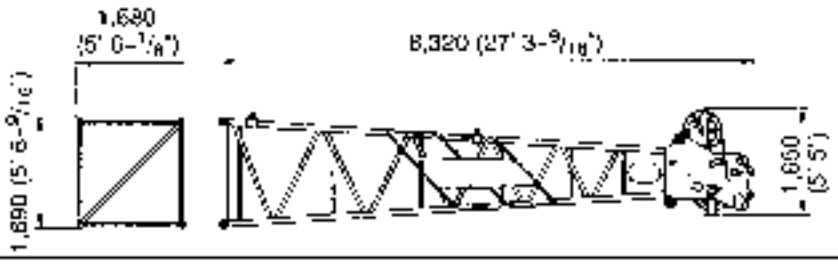
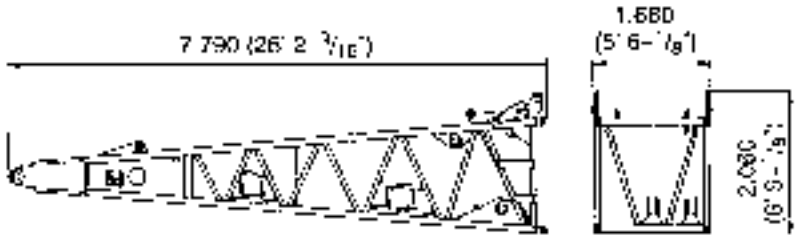
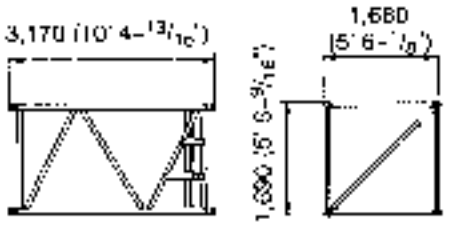
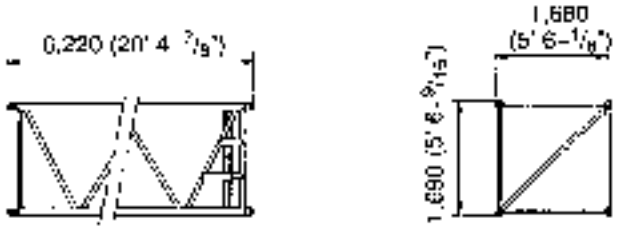
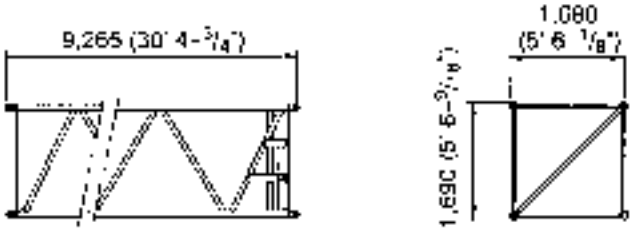
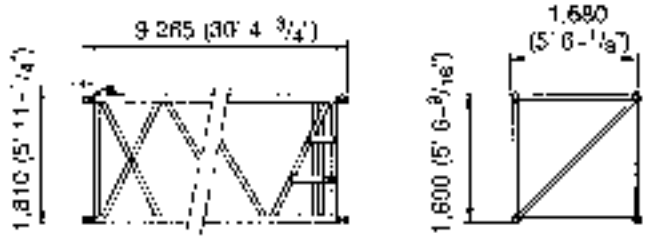
Name	Dimension mm (inch)	Weight kg (lbs)
Base Machine • With free fall drum • With wire ropes		60,070 (132,430)
Base Machine • Without Crawler • With wire ropes		36,210 (79,830)
Base Machine • Without Crawler • Without gantry • Without boom drum rope • With Fr & Re drum ropes		33,880 (74,690)
Base Machine • With boom base • With wire ropes • Without crawler		406,700 (89,665)

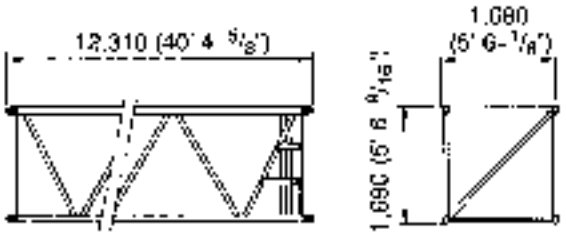
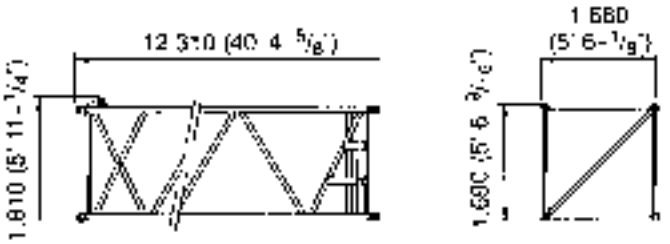
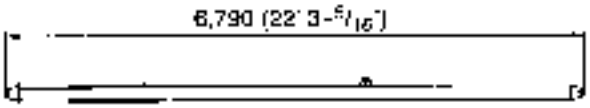
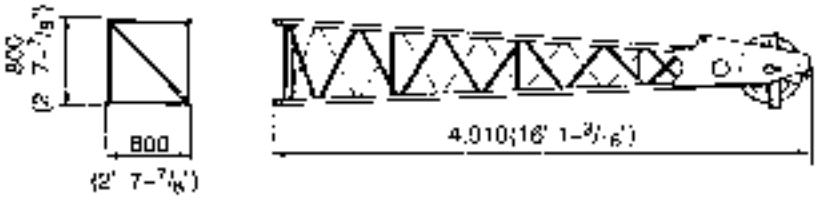
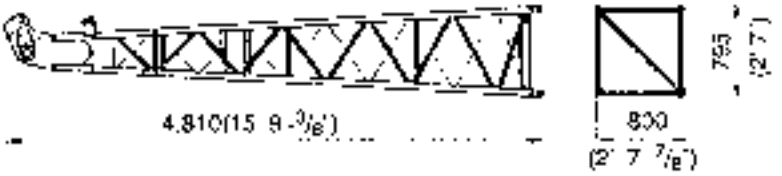
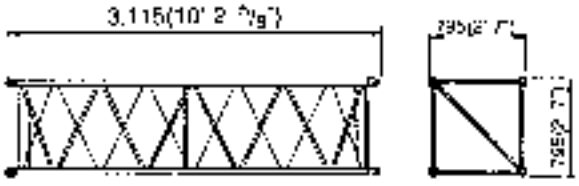
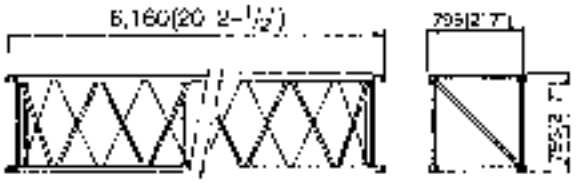
Name	Dimension mm (inch)	Weight kg (lbs)
Crawler		11 930 (26,300)
Translifter (with float)		430 (950) / 1 Piece

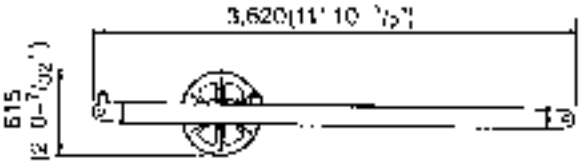
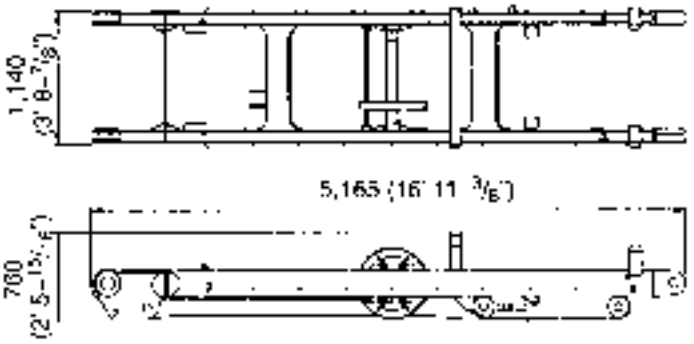
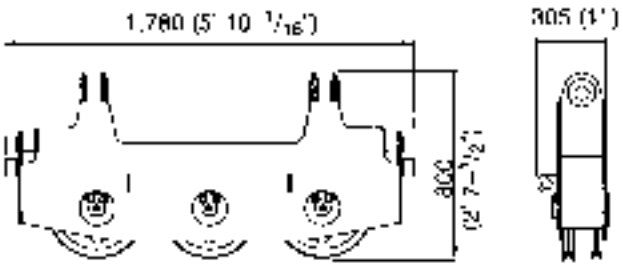
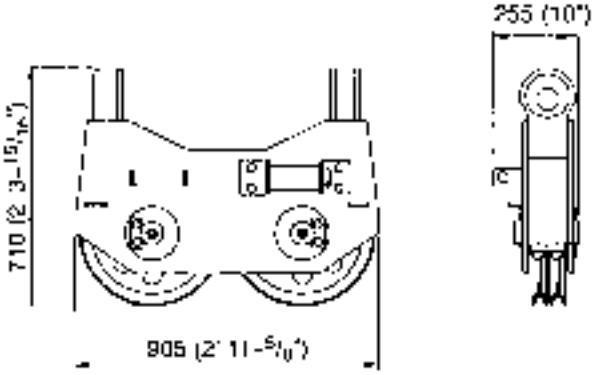
2 COUNTERWEIGHT

Name	Dimension mm (inch)	Weight kg (lbs)
Counterweight (1)		10,000 (22,050)
Counterweight (2) (3)		7,000 (15,435)
Counterweight (4)		10,000 (22,050)

3. ATTACHMENT

Name	Dimension mm (inch)	Weight kg (lbs)
Upper boom		1,525 (3,362)
Lower boom		2,110 (4,652)
3.0m (10') Insert boom		380 (838)
6.1m (20') Insert boom		655 (1,445)
9.1m (30') Insert boom		925 (2,040)
9.1m (30') Insert boom With lug		960 (2,117)

Name	Dimension mm (ft-in)	Weight kg (lbs)
12.2m (40') Insert boom		1,195 (2,635)
12.2m (40') Insert boom (With lug)		1,220 (2,690)
Backslop		500/each (1,100/each)
Jib tip		260 (617)
Jib base		200 (440)
3.0m (10') Insert jib		100 (220)
6.1m (20') Insert jib		180 (395)

Name	Dimension mm (ft-in)	Weight kg (lbs)
Strut		250 (550)
Gantry		1,760 (3,970)
Uoper spreader		300 (660)
Lower spreader		200 (440)

1.1.4 STABILITY IN SWINGING AND TRAVELING

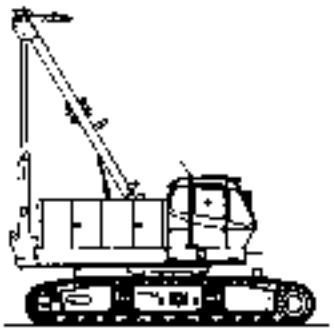
1 Without boom base

Gantry position	Counter weight (t)	All-round swing		Propelling	
		(A) With crawler	When jacked up Without crawler	Forwarding	Backwarding
Low gantry position	None	O	O	O	O
High gantry position	None	O	O	O	O
Low gantry position	10.0 t	O	X	O	O
High gantry position	10.0 t	O	X	O	O
Low gantry position	17.0 t	O	X	O	O
High gantry position	17.0 t	O	X	O	O
Low gantry position	24.0 t	O	X	O	O
High gantry position	24.0 t	O	X	O	O
Low gantry position	34.0 t	X	X	X	X
High gantry position	34.0 t	X	X	X	X

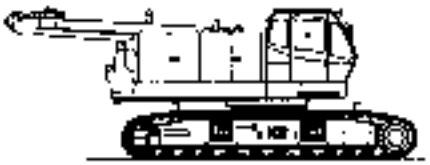
O : Operation is available
X : Operation is unavailable

(A) With crawler

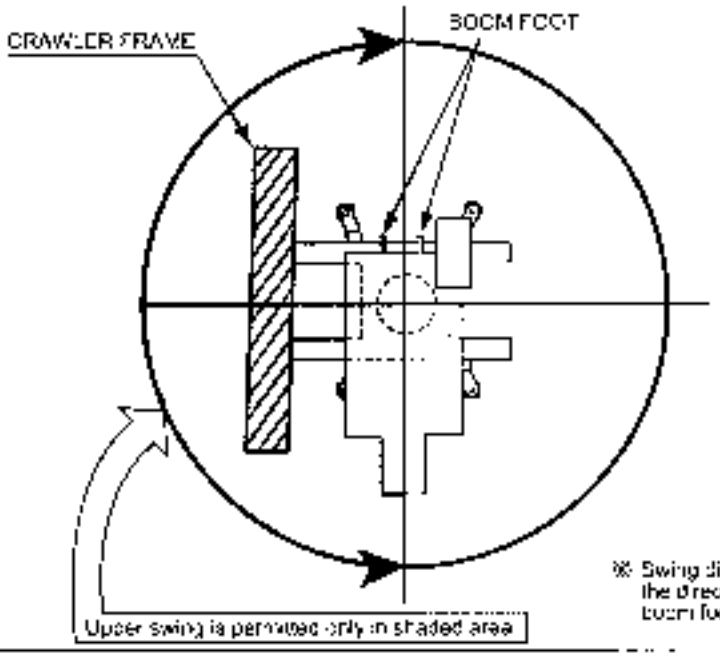
High gantry position



Low gantry position



Jacked up with one crawler

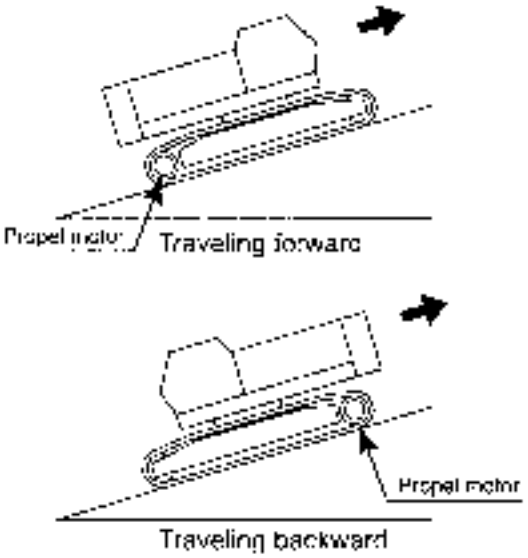


(1) The table on the previous page above shows the values for operation on a firm ground. On a weak ground, operate with care after curing the ground.

(2) As a principle, swinging on a trailer is prohibited.

(3) Maximum slope angle is 16.7 degrees (30%).

(4) Traveling forward means the case, where the counterweight is at the lower slope and the traveling backward, where it is at the upper slope.

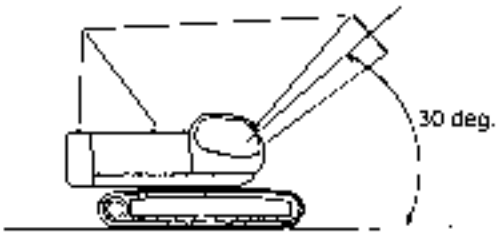


2. With boom base

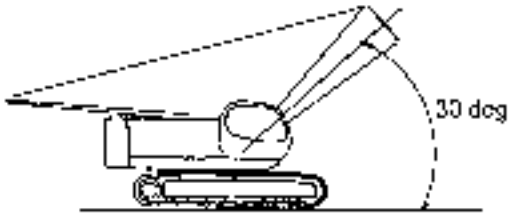
Gantry position	Boom angle	Counter-weight (t)	ALL-round swing		Propelling	
			With crawler	When jacke up Without crawler	Forwarding	Backwarding
Low gantry position	0 deg. to 30 deg	None	O	O	O	O
High gantry position		None	O	O	O	O
Low gantry position		10.0 t	O	X	O	O
High gantry position		10.0 t	O	X	O	O
Low gantry position		17.0 t	O	X	O	O
High gantry position		17.0 t	O	X	O	O
Low gantry position		24.0 t	O	X	O	O
High gantry position		24.0 t	O	X	O	O
Low gantry position		34.0 t	X	X	X	X
High gantry position		34.0 t	X	X	X	X

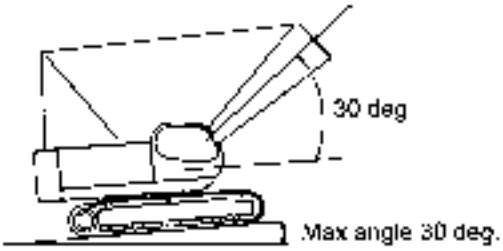
O : Operation is available
X : Operation is unavailable

High gantry position



Low gantry position



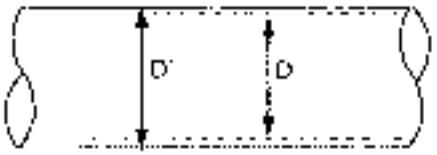


2. MAINTENANCE STANDARDS TEST PROCEDURES

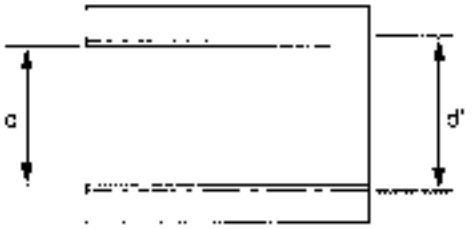
2.1 MAINTENANCE STANDARD

2.1.1 PIN, BUSHING, SPRING, LINING AND SHEAVE

1. Pin, Bushing



Pin

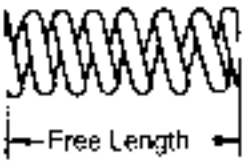


Bushing

Unit : mm (inch)

Name	Location	Item	Part number	Std. dimension D	Std. dimension d	Usable limit D'	Usable limit d'	Remedy	See figure
Pin	Pawl : Fr.& Re.Drum	2	GK82W01014P1	44.0 (1.732)		43.62 (1.725)		Replace	Fig.4-1 (P.2-5)
	Pawl : Boom Drum	2	GB82W01008P1	45.0 (1.772)		44.82 (1.764)			Fig.4-3 (P.2-6)
	Brake pedal	7	2419T6012	38.1 (1.50)		37.92 (1.493)		Replace	Fig.4-5 (P.2-7)
		8, 9	2419T2337D9	13.0 (0.512)		12.85 (0.506)			
		10	2419T2337D4	13.0 (0.512)		12.85 (0.506)			
		11	ZP45X10040	10.0 (0.394)		9.96 (0.392)			
		12	ZP45X10040	10.0 (0.394)		9.96 (0.392)			
	Boom Foot	2	GK03A01068P1	114.7 $^{+0.25}$ (4.516)		114.04 (4.490)		Replace	Fig.4-6 (P.2-8)
Bushing	Pawl (Front, Rear)	3	2405T1151		44.0 (1.732)		44.26 (1.743)	Replace	Fig.4-1 (P.2-5)
	Pawl (Boom)	3	2405U101D4540		45.0 (1.772)		45.27 (1.783)	Replace	Fig.4-3 (P.2-6)
	Boom Foot	3	GK52F01057P1		115.0 (4.528)		115.35 (4.541)	Replace	Fig.4-6 (P.2-8)

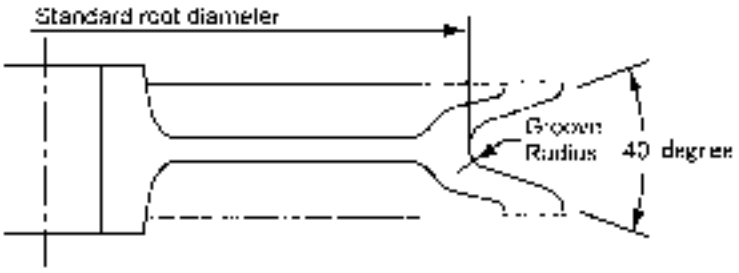
2. Spring



Unit : mm (inch)

Location	Item	Part number	Std. Free length	Usable limit of free length	Remedy	See figure
Fr & Re Drum pawl	5-1	HP26C15002G1	72 (2.835) (Compression)	68.4 (2.693)	Replace	Fig.4-1 (P.2-5)
Boom drum pawl	5	HP26C15002G1	72 (2.835) (Compression)	68.4 (2.693)		Fig.4-3 (P.2-6)
Brake pedal	15	17H286	61.5 (2.421) (Tension)	63.9 (2.516)		Fig.4-5 (P.2-7)

3.Sheave



Unit : mm (inch)

Equipment	Item	Part number	Std. root diameter	Use limit	Remedy	Groove radius	See figure
Boom point	8	JL06A01004P1	494 (19.45)	491 (19.34)	Replace or Build-up	15.5 (0.61)	Fig 4-6 (P 2-8)
Idler	9	2407P612	549 (21.61)	546 (21.50)		15.5 (0.61)	
Auxiliary sheave	10	JL06A01004P1	494 (19.45)	491 (19.34)		15.5 (0.61)	
Upper spreader	11	GN64A01002P2	381 (15.00)	379.5 (14.94)		11.0 (0.43)	
Lower spreader	5	GN64A01002P2	381 (15.00)	379.5 (14.94)		11.0 (0.43)	Fig 4-8 (P 2-9)
Jib point	12	2407P725	549 (21.61)	546 (21.50)		14.0 (0.55)	Fig 4-7 (P 2-8)
Jib strut	13						
Gantry peak	6	GK62F01011P1	381 (15.00)	379.5 (14.94)		11.5 (0.45)	Fig.4-8 (P.2-9)

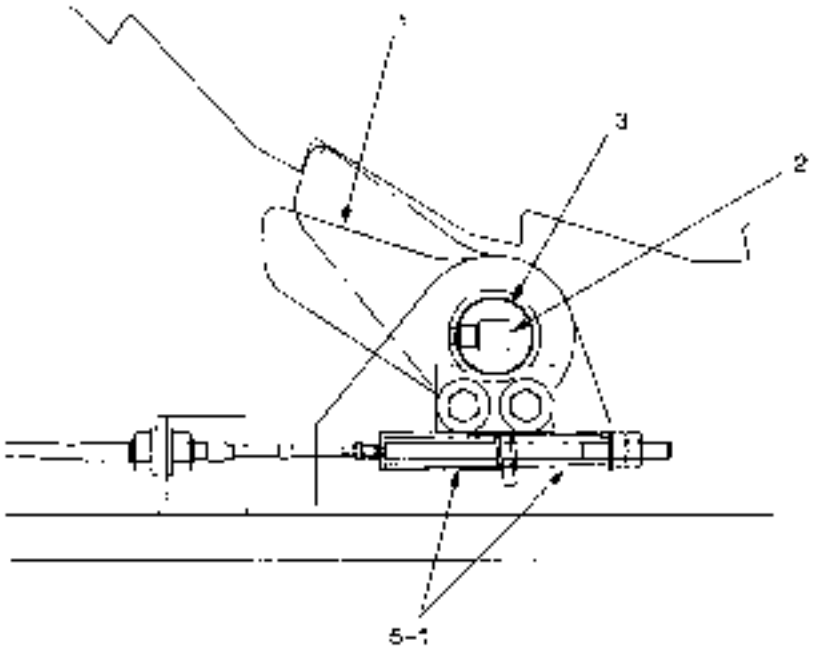


Fig.2-1 Front and Rear Dum Lock

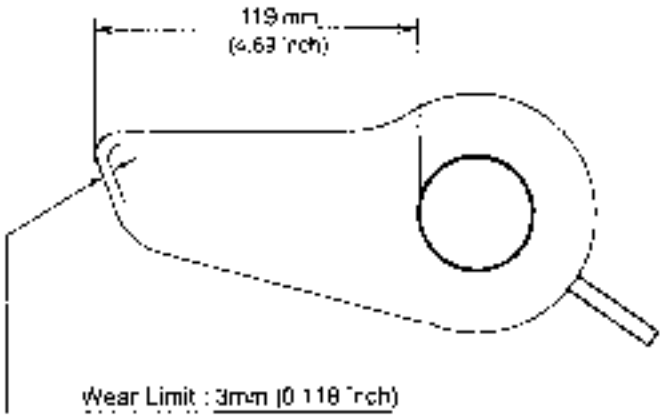


Fig.2-2 Pawl (GG82W01005P1)

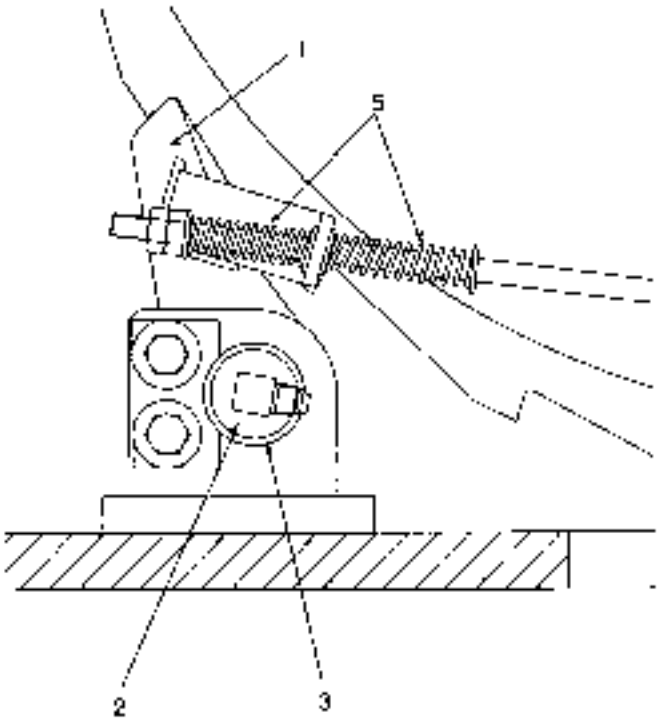
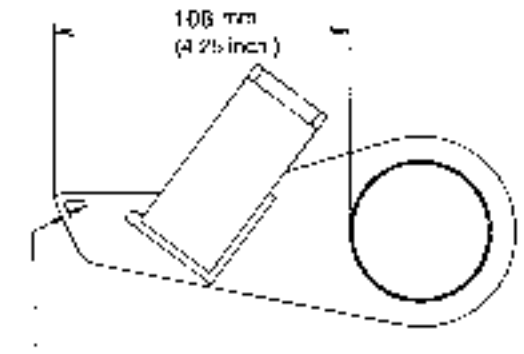


Fig.2-3 Boom Drum Lock



Wear Limit : 3mm (0.118 inch)

Fig.2-4 Pawl (GG82W01008P1)

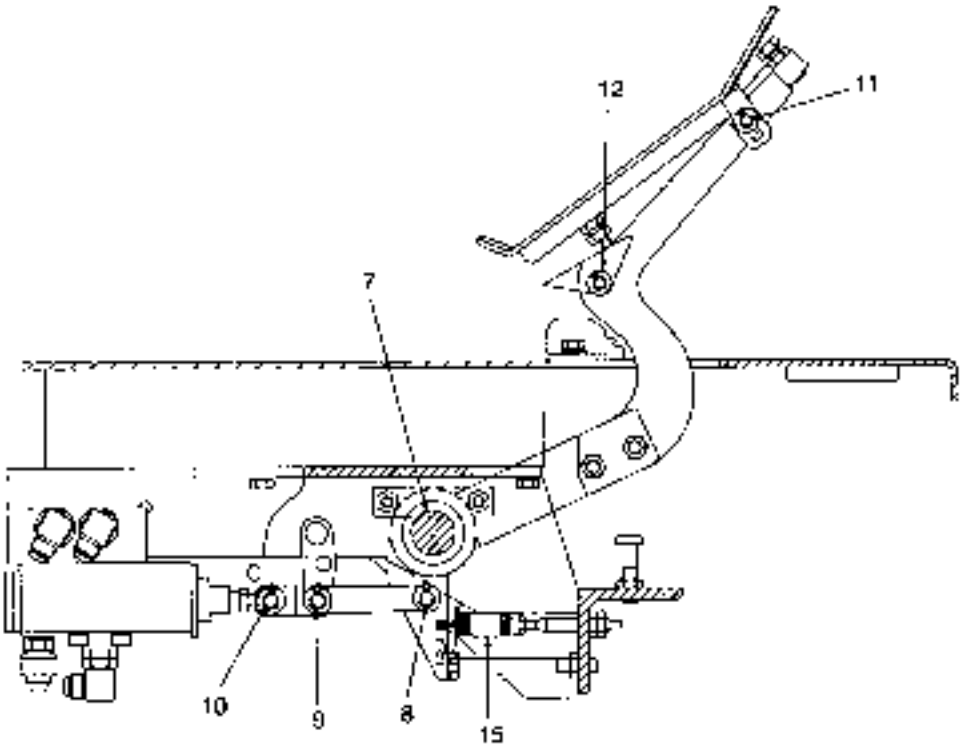


Fig.2-5 Brake Pedal

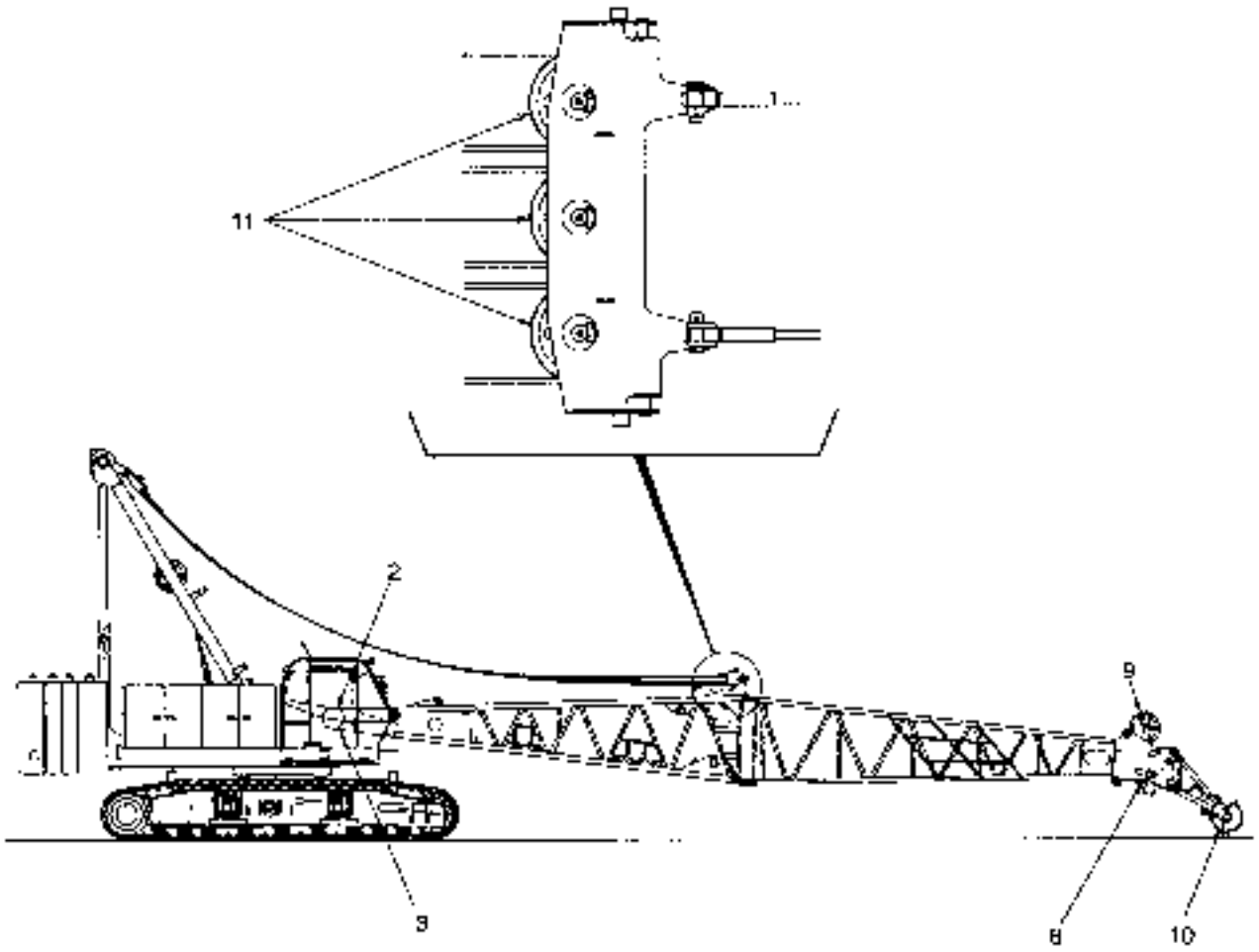


Fig.2-6 Crane Boom

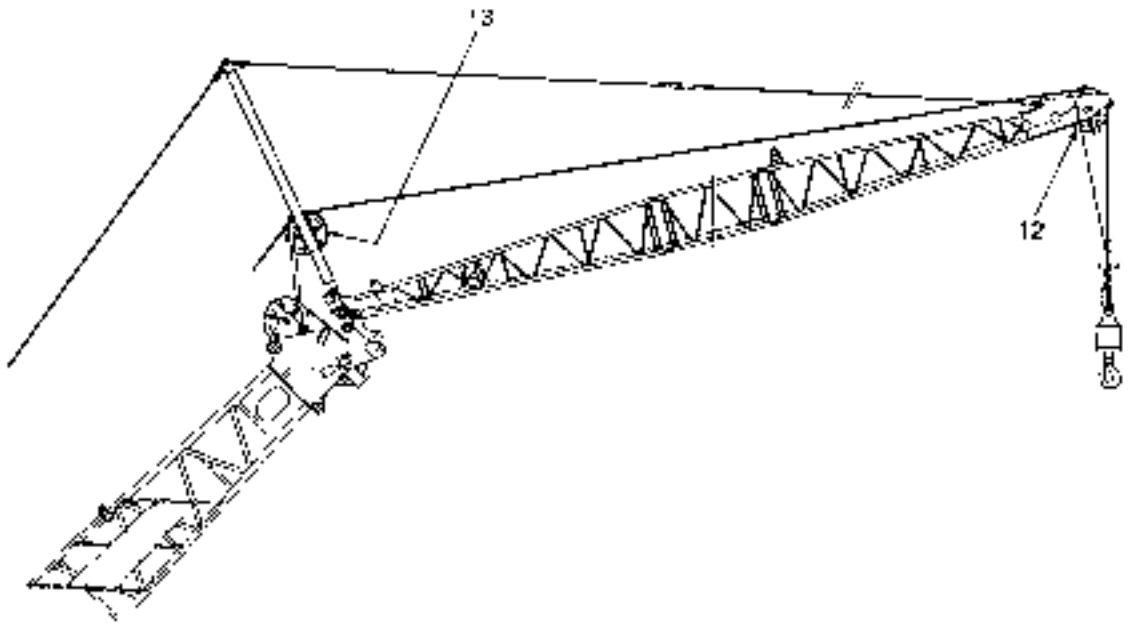


Fig.2-7 Crane Jib

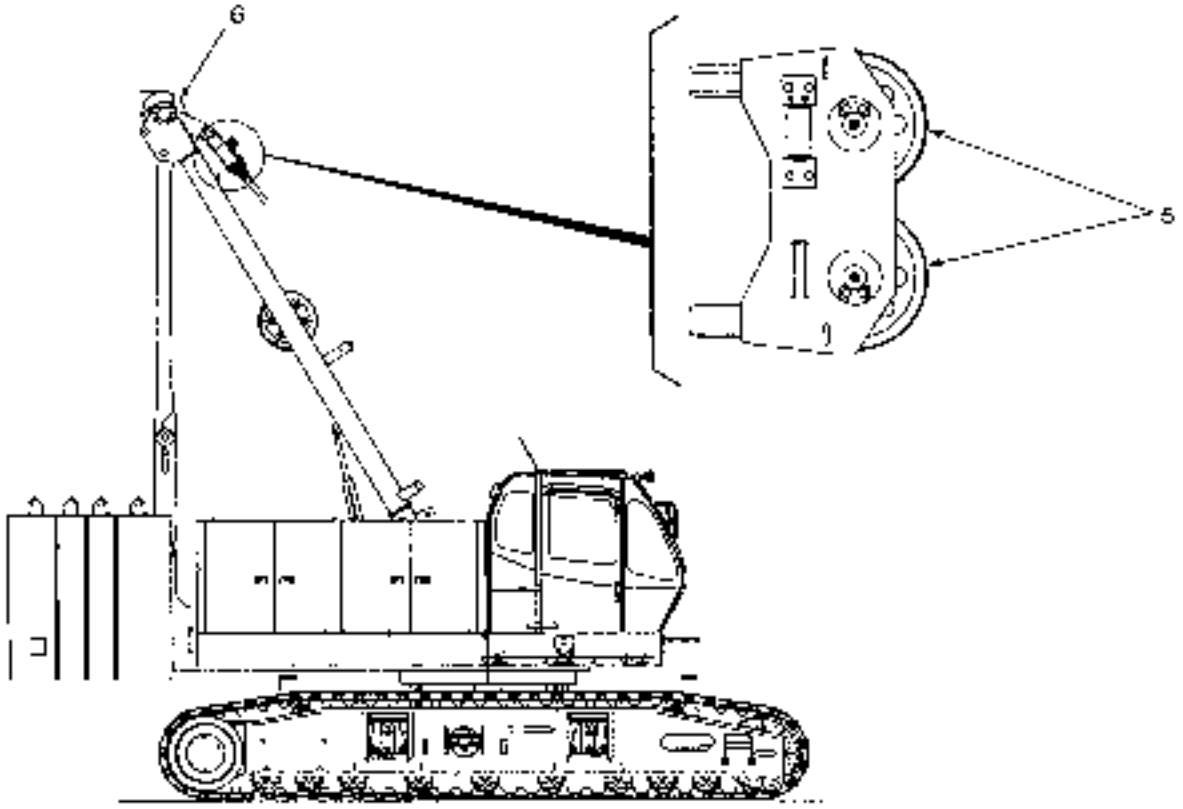
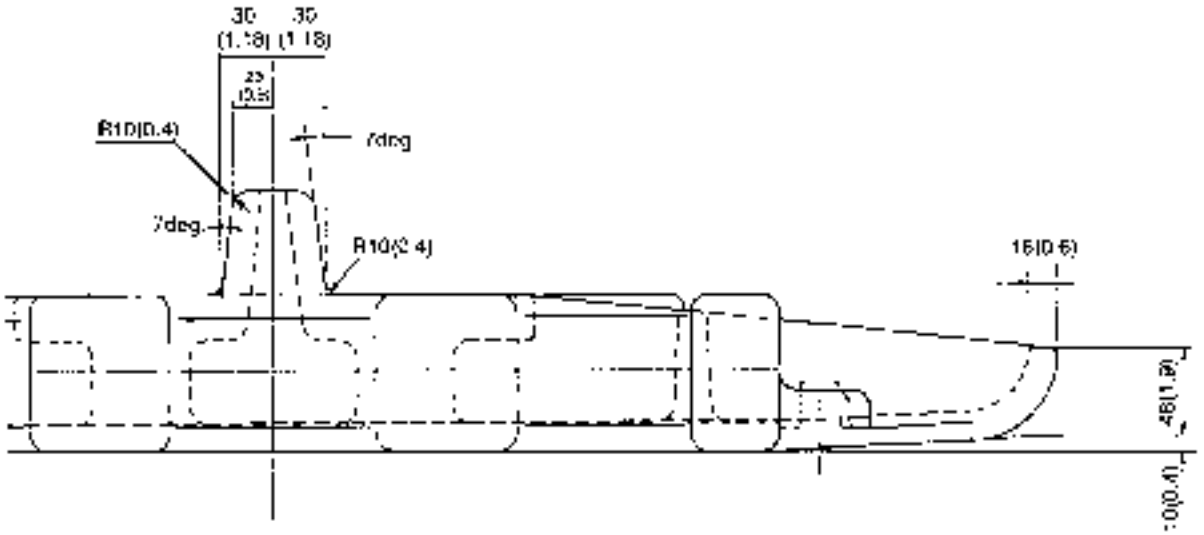


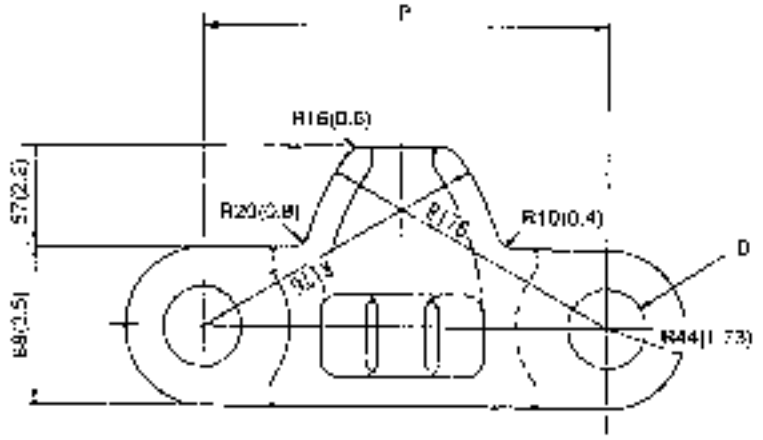
Fig.2-8 Gantry

2.1.2 PROPEL DEVICE

1. Crawler shoe

GN60D00004P3





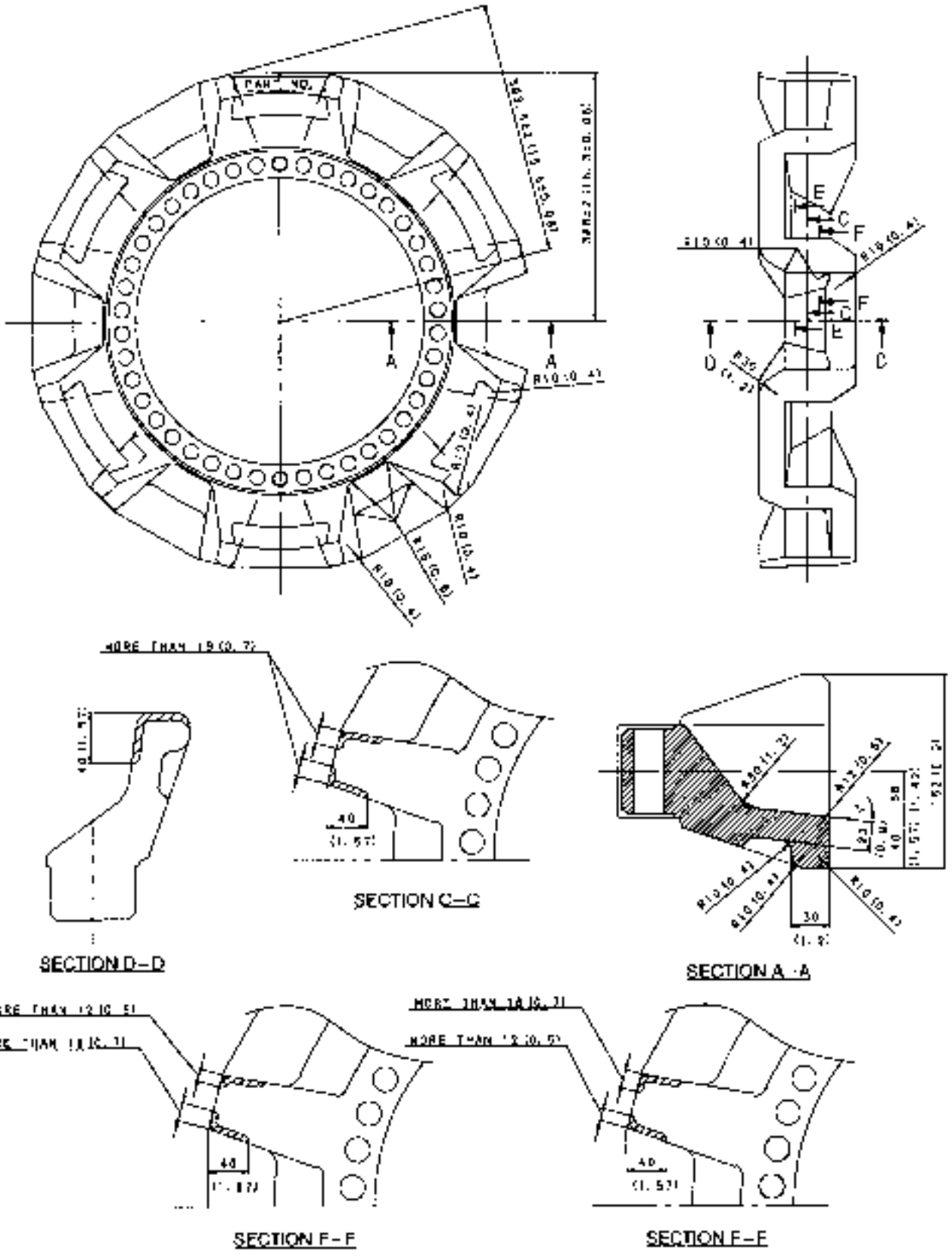
Unit : mm (inch)
Wear limit : 2 mm (0.079 inch)
Remedy : Build up or replace

Unit : mm(inch)

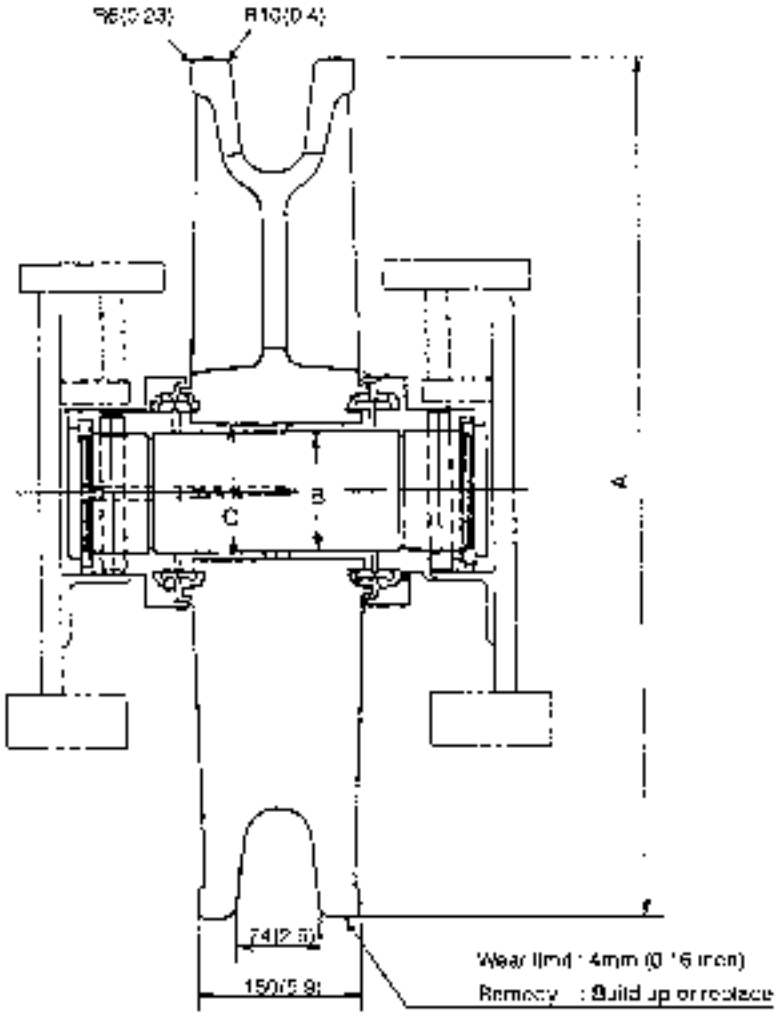
	Std. Dimension	Usable limit	Remedy
Pin hole (D)	Φ45.0 (1.77)	Φ46.0 (1.81)	Build-up or Replace
Pin	Φ44.45 (1.75)	Φ4.25 (1.67)	
Pitch (P)	228 (8.98)	234.6 (9.24)	

When 6 pcs shoes are connected by shoe pin and hang vertically, distance between pins should be 1378.0 mm (54.3 inch)

2. Drive tumbler



3. Idler

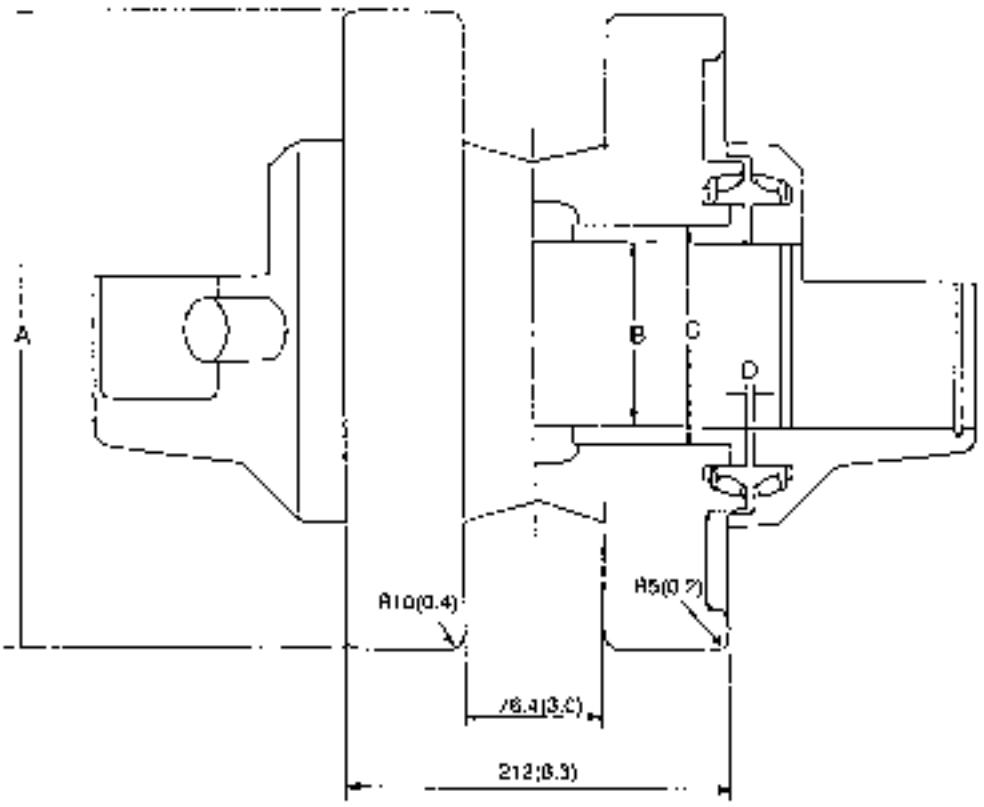


Unit : mm(inch)
Wear limit : 2mm (0.079 inch)
Remedy : Build up or replace

Unit : mm (inch)

Symbol	Item	Std. Dimension			Usable limit	Remedy
A	Outer diameter	Φ785 (30.9)			Φ777 (30.6)	Build-up or Replace
B	Gap between of shaft and bushing	Std. Dimension: Φ110 (4.33)	Shaft	-0.036 (0.001) / -0.071 (0.003)	Gap 0.175 (0.007) to 0.232 (0.009)	Gap 1.0 (0.04)	Replace-ment of bushing
			Hole	+0.161 (0.006) / +0.139 (0.005)		
C	Tightening tolerance of sprocket and bushing	Φ125 (4.92)	Shaft	+0.117 (0.005) / +0.092 (0.004)	Tightening tolerance 0.057 (0.002) to 0.117 (0.005)	Tightening tolerance 0	
			Hole	+0.047 (0.002) / +0 (0)		

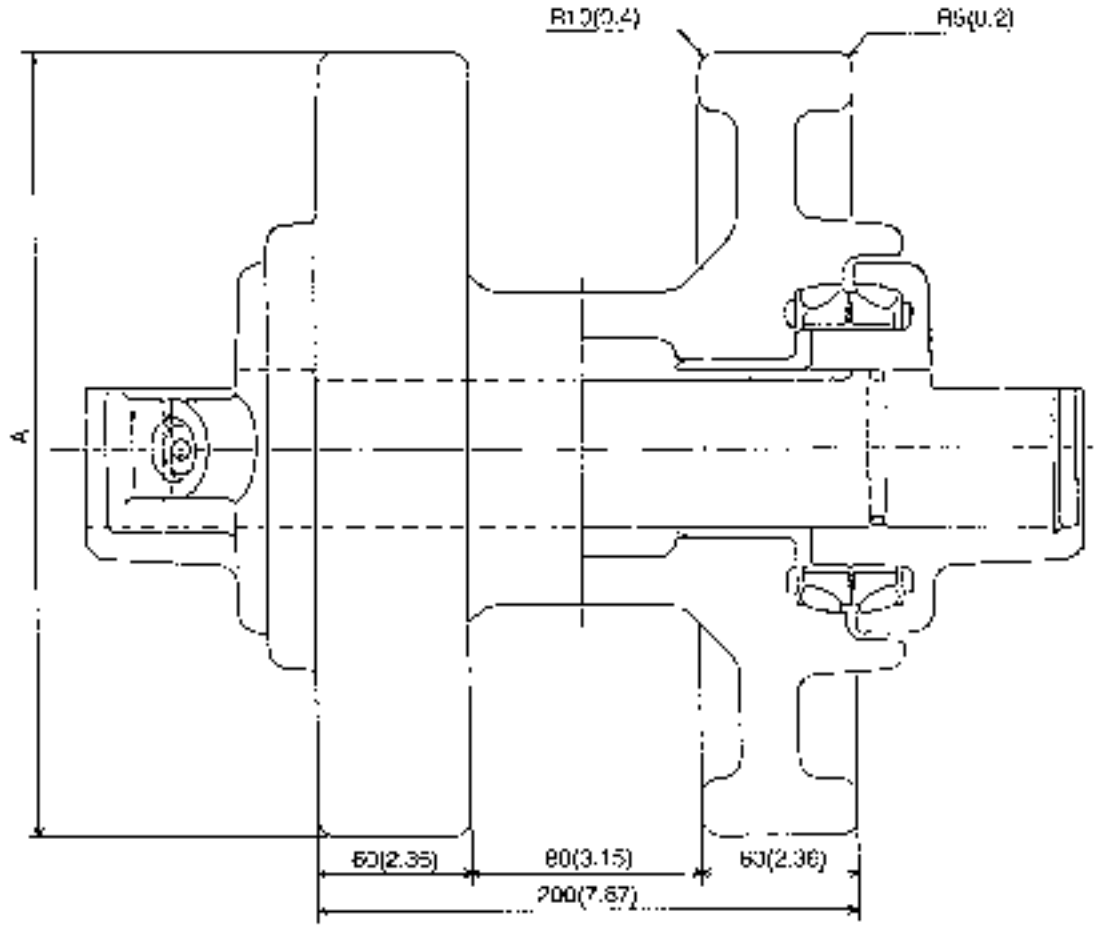
4 Track roller



Unit : mm (inch)

Symbol	Item	Std. Dimension				Usable limit	Remedy
A	Outer diameter	Φ290 ± 2 (11.4 ± 0.08)				Φ282 (11.1)	Build-up or Replace
B	Gap between of shaft and bushing	Std.Dimension	Tolerance		Standard	Allowable	Replace-ment of bushing
		Φ90 (3.54)	Shaft	-0.036 (0.001) -0.090 (0.004)	Gap 0.266 (0.01) to 0.37 (0.014)	Gap 0.8 (0.03)	
			Hole	+0.28 (0.011) +0.23 (0.009)			
C	Tightening tolerance of roller and bushing	Φ105 (4.13)	Shaft	+0.12 (0.005) +0.11 (0.004)	Tightening tolerance 0.075 (0.003) to 0.12 (0.005)	Tightening tolerance 0	Replace
			Hole	+0.035 (0.001) +0			

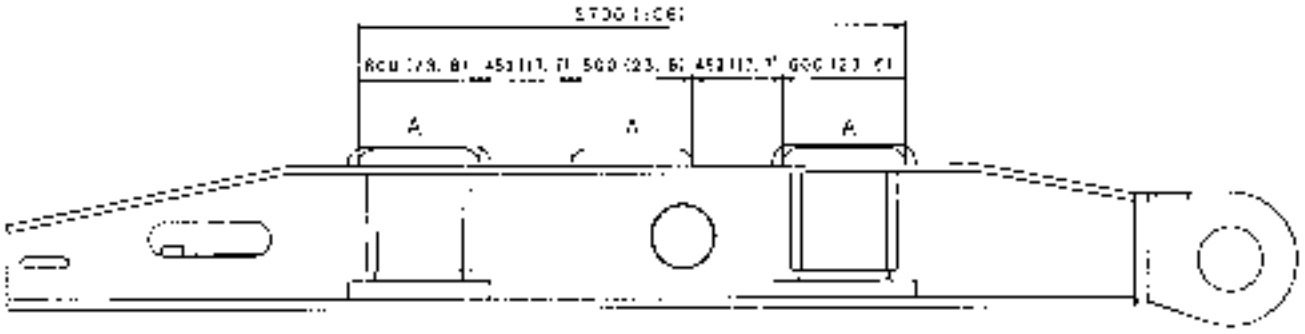
5. Guide roller

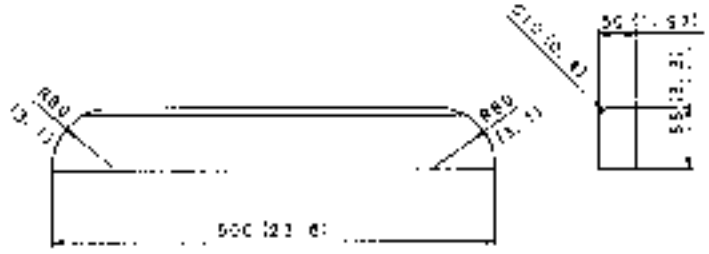


Unit : mm (inch)

Symbol	Item	Std. Dimension	Usable limit	Remedy
A	Outer diameter	Φ230 (9.1)	Φ222 (8.7)	Build-up or Replace

6. Guide bar



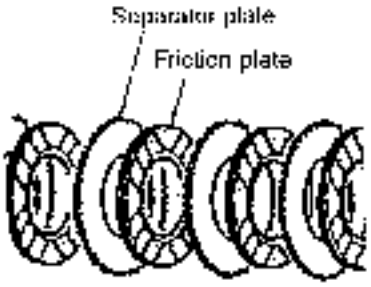


DETAIL A

Unit : mm (inch)

Symbol	Item	Std. Dimension	Usable limit	Remedy
A	Height of Guide Bar	85 (3.35)	65 (2.56)	Build-up or Replace

2.1.3 PROPEL BRAKE PLATE



Unit : mm (inch)

Name of plate	Number	Std. Dimension (Total)	Wear limit (Total)	Std. Brake torque
Friction plate	4	22.7 (0.89)	21.2 (0.83) Amount of wear : 1.5 (0.059)	528 to 712 N-m (389 to 525 ft-lbs)
Separator plate	5			

2.2 PERFORMANCE STANDARD AND TEST PROCEDURE

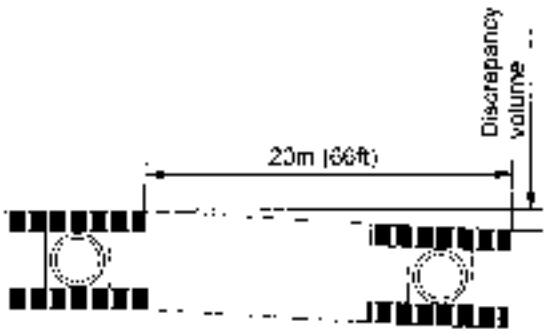
1. TERMINOLOGY

Standard value Standard of assembling new machine.
When the value exceeds the standard, repair or replace the part as required to maintain machine performance and or safety.

Temperature of oil ; It means temperature of hydraulic oil.

2 As to the items of which limit of use is not shown, referring to standard value as the guidance, repair or replace the part as required.

2.2.1 OPERATING SPEED

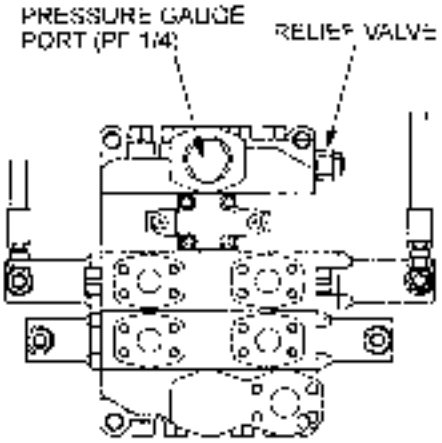
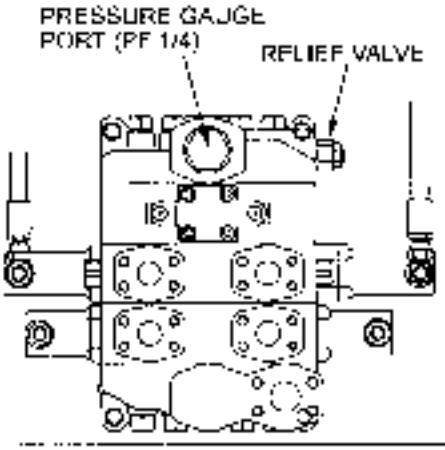
No.	Item	Test Condision	Test Procedure	Standard Value
1	Boom Hoisting and Lowering wire rope Speed	• Engine min⁻¹ : High idling • Temperature of Hyd. oil : 50°C (113 to 131°F) • Boom Length : Std. Boom	Measure the time taken to rotate drum 10 times. (Start measuring when the rotation of the drum becomes stable) Take average of 3 times measuring.	17.8 to 20.8 sec.
2	Main and Aux. hoisting wire rope	• Engine min⁻¹ : High idling • Temperature of Hyd. oil : 50°C (113 to 131°F) • Loading : No load	Measure the time taken to rotate drum 10 times. (Start measuring when the rotation of the drum becomes stable) Take average of 3 times measuring	8.7 to 10.3 sec
3	Swing Speed	• Engine min⁻¹ : High idling • Temperature of Hyd. oil : 50°C (113 to 131°F) • Boom Length : Standard Boom • Loading : No load • Swing Mode : Free High	Measure the time taken to rotate machine one time. Measure the time for 2nd rotation after 1st preliminary rotation. Take average of 3 times measuring.	17.8 to 21.2 sec.
4	Propel Speed	• Engine min⁻¹ : High idling • Temperature of Hyd. oil : 50°C (113 to 131°F) • Boom Length : Std. Boom	Measure the time taken to propel machine the distance of 20 m (65.6ft). Propel machine first preliminary more than 2 m (6.6 ft) before starting the measuring. Take average of 3 times measuring.	L = 69 to 82 sec. H = 47 to 56 sec.
5	Propelling Discrepancy	• Engine min⁻¹ : High idling • Temperature of Hyd. oil : 50°C (113 to 131°F) • Boom Length : Std. Boom	Measure the discrepancy volume resulted from propelling the distance of 20 m (65.6 ft). Propel machine first preliminary more than 2 m (6.6 ft) before starting the measuring. Take average of 3 times measuring. 	600 mm (23.62 inch)

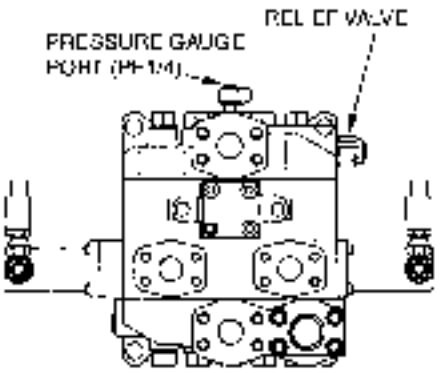
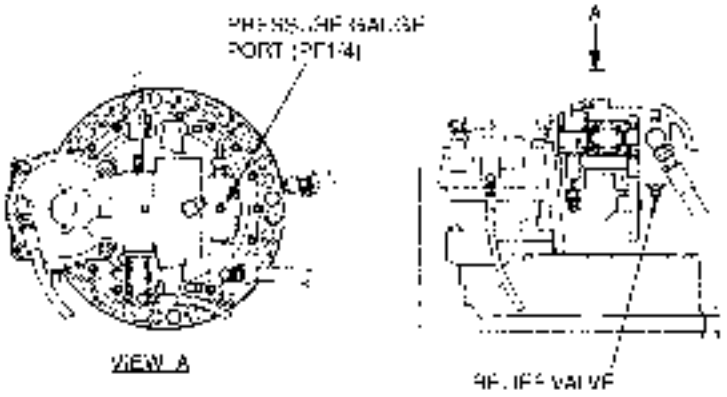
2.2.2 POINT AND METHOD OF MEASURING PRESSURE

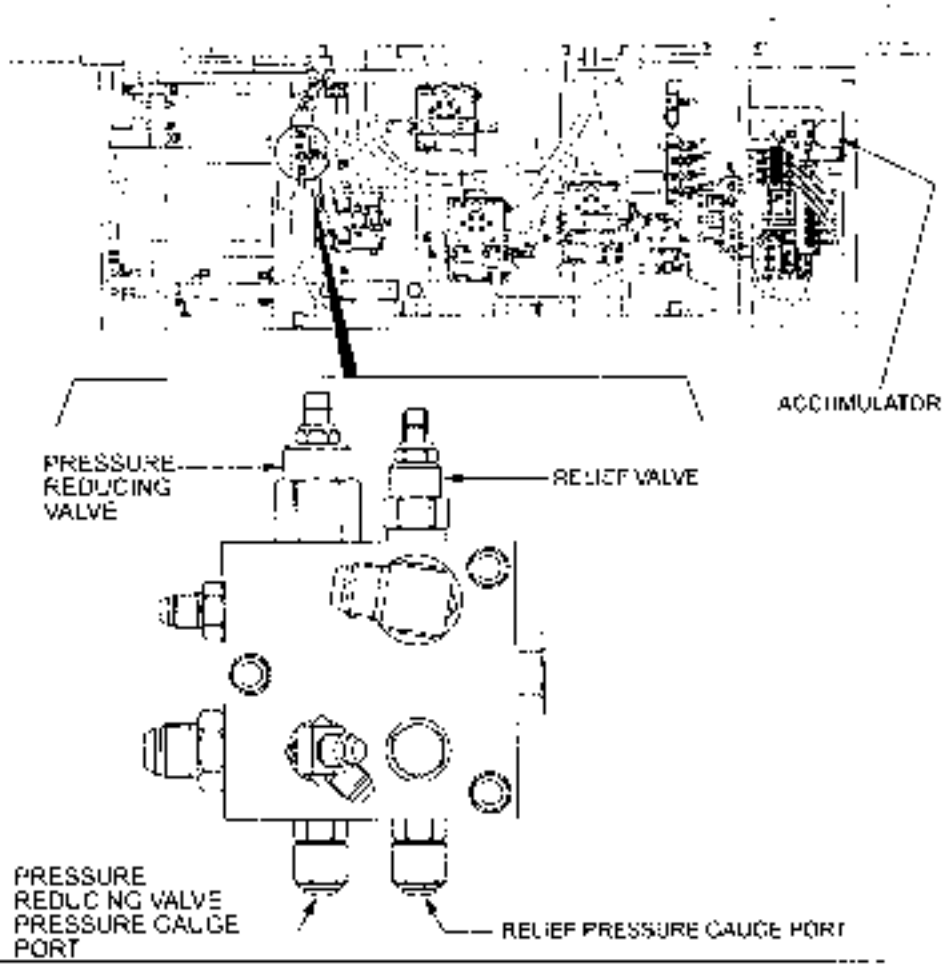
Use a pressure gauge which has a surplus of more than 10 MPa (1450 psi) for pressures to be measured and which has passed the inspection.

Prior to pressure measurement, clean the port for pressure measurement so as to be free from oil and dust.

Connector and hose for measuring pressure.
Connector : GB03H01085P1
Hose : GG03H01068D1

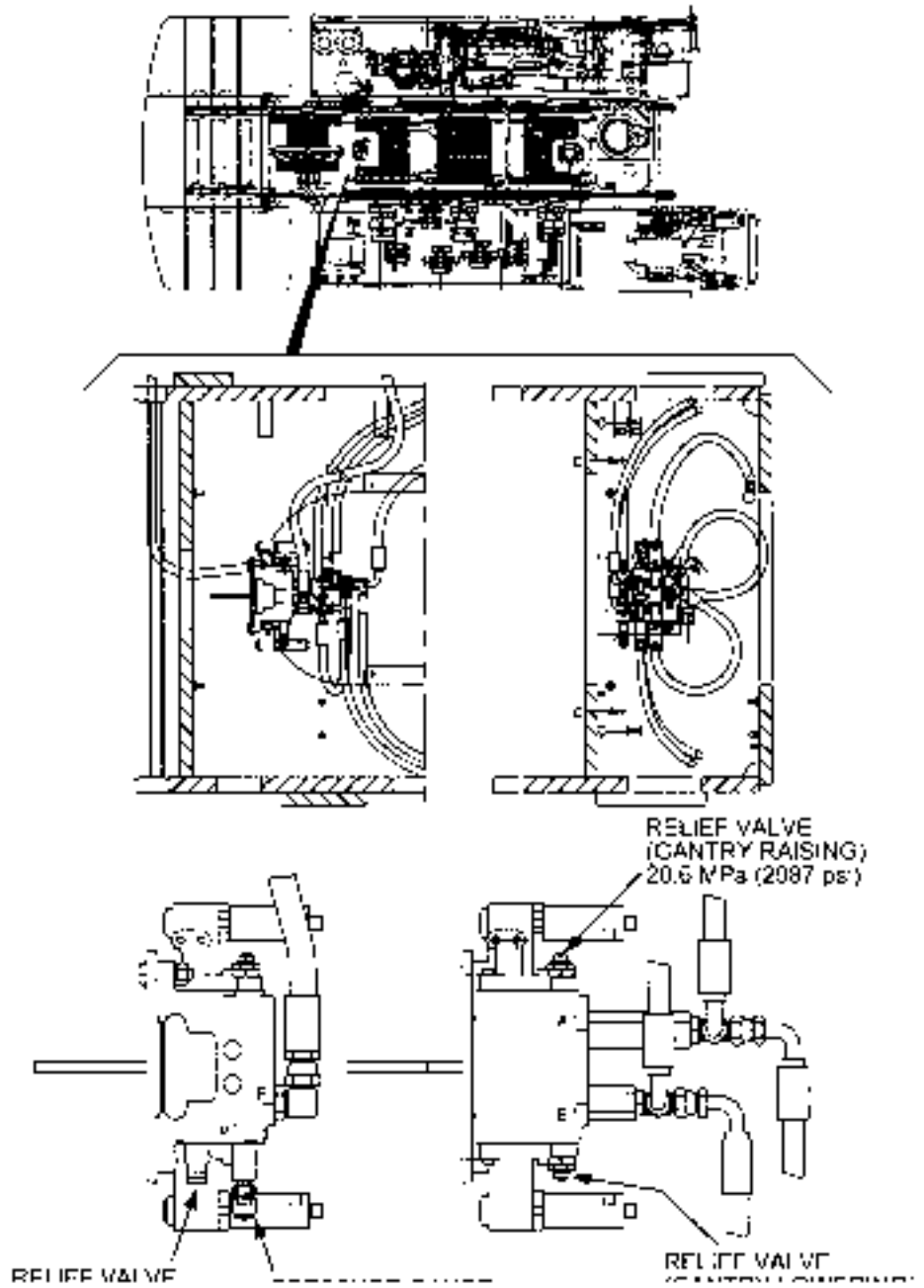
No.	Item	Test Condition	Test Procedure	Standard Value
1	Main • Propel Right • Rear Drum	• Engine revolution (min⁻¹): High idling • Temperature of Hydraulic oil : 45 to 55°C (113 to 131°F)	1. Lower the boom onto the ground 2. Lock the rear winch drum. 3 Make the valve relieve by rear winch drum lowering operation 	31.9 MPa (4622 psi)
2	Main • Propel Left • Front Drum	• Engine revolution (min⁻¹): High idling • Temperature of Hydraulic oil : 45 to 55°C (113 to 131°F)	1. Lower the main hook onto the ground. 2. Lock the main winch drum 3 Make the valve relieve by main winch lowering operation. 	31.9 MPa (4622 psi)

No.	Item	Test Condition	Test Procedure	Standard Value
3	Boom	• Engine revolution (r/min) : High idling • Temperature of Hydraulic oil : 45 to 55°C (113 to 131°F)	1. Lower the boom onto the ground. 2. Lock the boom drum. 3. Make the valve relieve by boom lowering operation.	31.9 MPa (4622.5 psi)
				
4	Swing	• Engine revolution (r/min) : High idling • Temperature of Hydraulic oil : 45 to 55°C (113 to 131°F) • Swing mode : Free high	1. Lock the upper not to turn with the swing lock pin and parking brake. 2. Make the valve relieve by swing operation.	27.5 MPa (3982.5 psi)
				

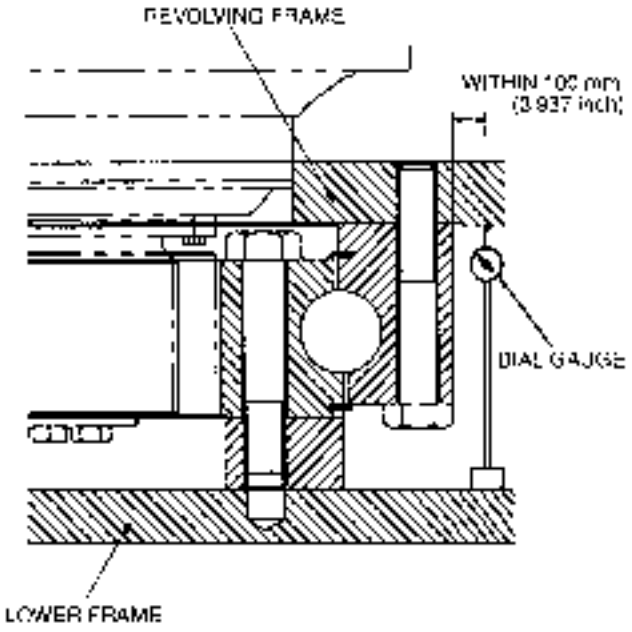
No	Item	Test Condition	Test Procedure	Standard Value
5	Control Circuit (Primary pressure)	• Temperature of Hydraulic oil : 50°C ± 5°C(122°F ± 9°F)		Relief Valve 7.0 MPa(1010psi) (High idling) Reduction Valve 5.4 MPa (782 psi) (Low idling)

6	Control Circuit (Secondary pressure)	• Engine revolution (min⁻¹) Low idling • Temperature of Hydraulic oil : 50°C ± 5°C (122°F ± 9°F)	1. Operate the control lever for the section to be measured (Operate the speed adjusting knod to the Max position) Take pressure out from the quick coupler of the control valve spool end Standard value 1st.speed Boom…… 2.50 to 2.79 MPa (362 to 405 psi) Propel…… 1.42 to 1.62 MPa (206 to 235 psi) Swing…… 1.62 to 1.81 MPa (235 to 263 psi) Front & Rear Drum . . 2.65 to 2.94 MPa (384 to 427 psi) 3rd. (Jib)(Op.)…… 2.75 to 3.24 MPa (398 to 469 psi)	

No.	Item	Test Condition	Test Procedure	Standard Value
7	• Gantry raising/ lowering • Lower circuit	• Engine revolution (min⁻¹): High idling • Temperature of hydraulic oil : 50°C ± 5°C (122°F ± 9°F)	1. Relief by raising the gantry cylinder. 2. Relief by lowering the gantry cylinder. 3. Relief by operating crawler fixing pin cylinder.	Raise : 20.6 MPa (2987 psi) Lower : 4.9 MPa (711 psi) Lower Circuit : 20.6 MPa (2986 psi)



2.2.3 SLEWING RING



COUNTERWEIGHT : 34 t Counterweight

Measuring Condition	Amount of play
Boom length : 15.2 m (50 ft) Radiuce : 9.14 m (30 ft) Load : 36.8 t (82500 lbs)	Less than 3 mm (0.21 inch)

3. GENERAL WORK STANDARD

3.1 TIGHTENING TORQUE OF CAPSCREWS AND NUTS

Unless otherwise specified, torque all screws and nuts on this machine to the values shown in the following tables.

3.1.1 METRIC COARSE THREADS

Unit : kg-m (ft-lbs)

Nominal size	Classification					
	Metric Coarse Threads					
	4T		7T		10T	
	Dry	Lubricated	Dry	Lubricated	Dry	Lubricated
M 6	0.45 (3.25)	0.38 (2.75)	0.9 (6.51)	0.8 (5.79)	1.7 (12.3)	1.5 (10.9)
M 8	1.09 (7.88)	0.9 (6.51)	2.4 (17.4)	2.0 (14.5)	4.3 (31.1)	3.6 (26.0)
M10	2.2 (15.9)	1.8 (13.0)	4.7 (34.0)	4.0 (28.9)	8.5 (61.5)	7.2 (52.1)
M12	3.7 (26.8)	3.2 (23.2)	8.1 (58.6)	6.8 (49.2)	14.6 (106)	12.3 (89.0)
M14	5.9 (42.7)	5.0 (36.2)	12.8 (92.6)	10.8 (78.1)	23.0 (166)	19.5 (141)
M16	9.0 (65.1)	7.6 (55.0)	19.5 (141)	16.4 (119)	35.0 (253)	29.0 (210)
M18	12.4 (89.7)	10.5 (76.0)	27.0 (195)	23.0 (166)	49.0 (354)	41.0 (297)
M20	17.5 (127)	14.7 (106)	38.0 (275)	32.0 (232)	68.0 (492)	57.0 (412)
M22	23.0 (166)	19.6 (142)	51.0 (369)	43.0 (311)	92.0 (665)	77.0 (557)
M24	30.0 (217)	24.0 (174)	65.0 (470)	53.0 (383)	118.0 (854)	96.0 (964)
M27	44.0 (318)	36.0 (260)	96.0 (694)	78.0 (564)	173.0 (1251)	140.0 (1012)
M30	60.0 (434)	50.0 (362)	131.0 (948)	110.0 (796)	-	
M33	81.0 (586)	68.0 (492)	176.0 (1273)	148.0 (1070)	-	
M36	105.0 (760)	88.0 (637)	-	-	-	-

3.1.2 METRIC FINE THREADS

Unit : kg-m (ft-lbs)

Nominal size	Classification					
	Fine Threads					
	4T		7T		10T	
	Dry	Lubricated	Dry	Lubricated	Dry	Lubricated
M 6	1.1 (7.96)	0.4 (2.89)	2.5 (15.2)	2.1 (15.2)	4.5 (32.6)	3.8 (27.5)
M10	2.3 (16.6)	1.9 (13.7)	4.9 (35.4)	4.2 (30.4)	8.9 (64.4)	7.5 (54.3)
M12	4.0 (28.9)	3.4 (24.6)	8.7 (62.9)	7.3 (52.8)	15.7 (114)	13.2 (95.5)
M16	9.0 (65.1)	7.3 (52.8)	20.0 (145)	17.2 (124)	37.0 (268)	31.0 (224)
M20	19.0 (137)	15.8 (114)	41.0 (297)	34.0 (246)	74.0 (536)	62.0 (448)
M24	32.0 (232)	27.0 (195)	70.0 (506)	58.0 (405)	126.0 (911)	105.0 (760)
M30	65.0 (470)	54.0 (391)	142.0 (1027)	118.0 (854)	-	-
M36	108.0 (788)	91.0 (658)	-	-	-	-

3.1.3 COARSE THREDS UNC

Unit : kg-m (ft-lbs)

Nominal size	Classification: Coarse Threads UNC					
	Grade 2		Grade 5		Grade 8	
	Dry	Lubricated	Dry	Lubricated	Dry	Lubricated
1/4	0.8 (5.79)	0.7 (5.06)	1.3 (9.40)	1.1 (7.96)	1.8 (13.0)	1.5 (10.8)
5/16	1.6 (11.6)	1.4 (10.1)	2.6 (18.8)	2.2 (15.9)	3.6 (26.0)	3.1 (22.4)
3/8	2.9 (21.0)	2.4 (17.4)	4.5 (32.6)	3.8 (27.5)	6.3 (45.6)	5.3 (38.3)
7/16	4.5 (32.5)	3.8 (27.5)	7.0 (50.6)	5.9 (42.7)	9.9 (71.6)	8.3 (60.0)
1/2	7.0 (50.6)	5.9 (42.7)	10.8 (78.1)	9.1 (65.8)	15.2 (110)	12.8 (92.6)
9/16	10.0 (72.3)	8.4 (60.8)	15.5 (112)	13.0 (94.0)	22.0 (159)	18.4 (133)
5/8	14.0 (101)	11.8 (85.3)	22.0 (159)	18.2 (132)	31.0 (224)	26.0 (188)
3/4	25.0 (181)	21.0 (152)	38.0 (275)	32.0 (232)	54.0 (391)	45.0 (325)
7/8	29.0 (210)	25.0 (181)	61.0 (441)	51.0 (369)	86.0 (622)	72.0 (521)
1	35.0 (253)	30.0 (217)	91.0 (658)	76.0 (550)	128.0 (926)	108.0 (781)
1 1/8	51.0 (369)	43.0 (311)	114.0 (825)	95.0 (687)	184.0 (1331)	154.0 (1114)
1 1/4	71.0 (514)	59.0 (427)	159.0 (1150)	133.0 (962)	257.0 (1859)	216.0 (1562)
1 3/8	93.0 (673)	78.0 (564)	209.0 (1512)	175.0 (1266)	338.0 (2445)	284.0 (2054)
1 1/2	124.0 (897)	104.0 (752)	277.0 (2004)	232.0 (1678)	449.0 (3248)	376.0 (2720)

3.1.4 FINE THREADS UNF

Unit : kg-m (ft-lbs)

Nominal size	Classification: Fine Threads UNF					
	Grade 2		Grade 5		Grade 8	
	Dry	Lubricated	Dry	Lubricated	Dry	Lubricated
1/4	0.9 (6.51)	0.8 (5.79)	1.4 (10.1)	1.2 (8.68)	2.1 (15.2)	1.7 (12.3)
5/16	1.8 (13.2)	1.5 (10.8)	2.8 (20.3)	2.4 (17.4)	4.0 (28.9)	3.4 (24.6)
3/8	3.2 (23.1)	2.7 (19.5)	4.9 (35.4)	4.1 (29.7)	7.0 (50.6)	5.8 (42.0)
7/16	5.0 (36.2)	4.2 (30.4)	7.7 (55.7)	6.4 (46.3)	10.8 (78.1)	9.1 (65.8)
1/2	7.7 (55.7)	6.4 (46.3)	11.9 (86.1)	9.9 (71.6)	16.8 (122)	14.0 (101)
9/16	10.9 (78.8)	9.2 (66.5)	16.9 (122)	14.1 (102)	24.0 (174)	19.9 (144)
5/8	15.5 (112)	12.9 (93.3)	24.0 (174)	20.0 (145)	34.0 (246)	28.0 (203)
3/4	27.0 (195)	22.0 (159)	42.0 (304)	35.0 (253)	58.0 (420)	49.0 (354)
7/8	31.0 (224)	25.0 (181)	66.0 (477)	55.0 (398)	93.0 (673)	77.0 (557)
1	38.0 (275)	31.0 (224)	98.0 (709)	82.0 (593)	138.0 (998)	115.0 (832)
1 1/8	56.0 (405)	46.0 (333)	124.0 (897)	104.0 (752)	201.0 (1454)	168.0 (1215)
1 1/4	77.0 (557)	64.0 (463)	153.0 (1107)	143.0 (1034)	279.0 (2018)	232.0 (1678)
1 3/8	103.0 (745)	86.0 (622)	231.0 (1671)	192.0 (1389)	374.0 (2705)	311.0 (2249)
1 1/2	136.0 (984)	113.0 (817)	304.0 (2199)	253.0 (1830)	493.0 (3566)	410.0 (2966)

3.1.5 TIGHTENING TORQUE OF HYDRAULIC FITTINGS

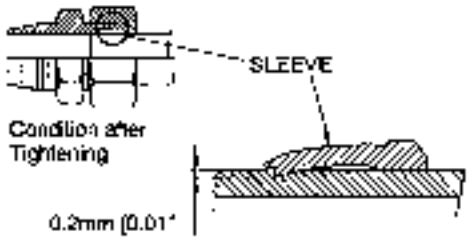
Excessive or insufficient tighten ng of hose or tube fittings can cause oil teak and deformation or damage to the metal fitt ngs.

Therefore, to secure and obtain good fix ng and performance of fittings it is necessary to tighten to the proper torque. The follows are the recommended torques.

1. BITE TYPE TUBE FITTINGS.

Size in mm (nch) (Outside diameter X thicknes	Tighten ng torque in kg-m (ft-lbs)
10 (0.364) X 1.5 (0.059)	5 to 7 (36 to 51)
15 (0.591) X 2.0 (0.079)	13 to 16 (94 to 116)
18 (0.709) X 2.5 (0.098)	16 to 17 (116 to 123)
22 (0.866) X 3.0 (0.118)	20 to 22 (145 to 159)
28 (1.102) X 4.0 (0.157)	25 to 29 (181 to 210)
35 (1.378) X 5.0 (0.197)	33 to 36 (239 to 260)

Remarks

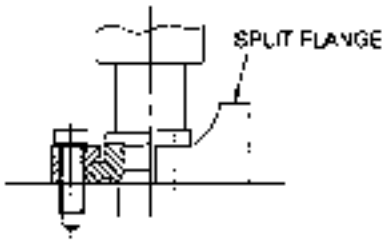


2 SPI IT FIANGES

(From SAE Standard)

Size	Tightening torque in kg-m (ft-lbs)	
	3000 psi (210 kg/cm²)	6000 psi (420 kg/cm²)
1/2"	2 to 2.6 (14.5 to 19)	-
3/4"	2.9 to 4.0 (21 to 29)	3 45 to 4.6 (25 to 33)
1"	3 75 to 4.9 (27 to 35)	5 75 to 6.9 (42 to 50)
1 1/4"	4 9 to 6.3 (35 to 45)	8 6 to 10.3 (62 to 74)
1 1/2"	6 3 to 8 0 (45 to 58)	16 1 to 18 4 (116 to 133)
2"	7.5 to 9.5 (54 to 69)	27.6 to 30 0 (200 to 217)

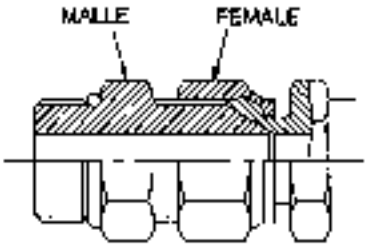
Remarks



3. FLARE TYPE TUBE FITTINGS (30°FLARE, PF THREADS)

Size	Tightening torque in kg-m (ft-lbs)
1/4"	2 5 to 3 5 (18 to 25)
3/8"	5 to 7 (36 to 51)
1/2"	6 to 8 (43 to 58)
3/4"	12 to 16 (87 to 116)
1"	15 to 19 (108 to 137)
1 1/4"	17 to 23 (123 to 166)
1 1/2"	22 to 28 (159 to 202)
2"	26 to 34 (188 to 246)

Remarks



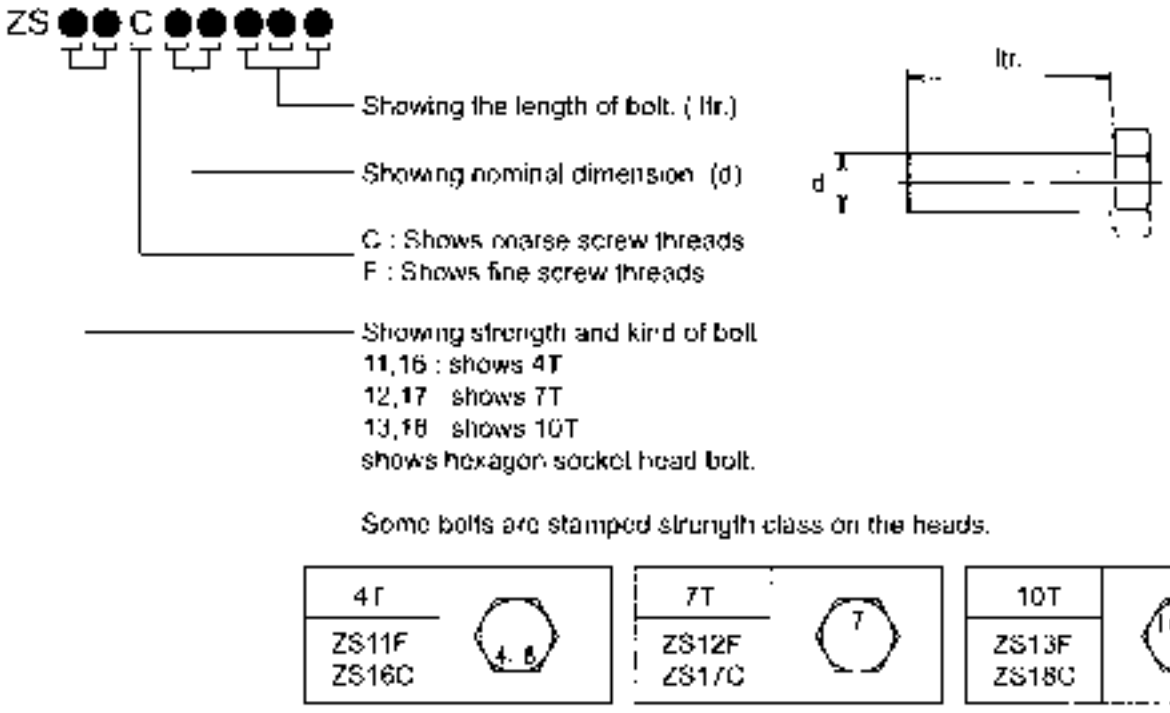
4. Jubilee Clip (Low Pressure and Suction)

Nominal cord	Diameter		Recommended torque		Working pressure range	
BS5315	inches	mm	kg-cm	in-lbs	kg/cm²	psi
12	3/8" - 1/2"	9.5 - 12	34.5	29.9	56.0	796
16	1/2" - 5/8"	11 - 16	34.5	29.9	56.0	796
20	1/2" - 3/4"	13 - 20	34.5	29.9	56.0	796
22	5/8" - 7/8"	16 - 22	45.7	39.7	56.0	796
25	3/4" - 1"	18 - 25	45.7	39.7	56.0	796
30	7/8" - 1 1/8"	22 - 30	45.7	39.7	56.0	796
35	1" - 1 3/8"	25 - 35	45.7	39.7	56.0	796
40	1 1/8" - 1 5/8"	27 - 40	45.7	39.7	35.0	498
50	1 1/4" - 1 7/8"	35 - 50	45.7	39.7	35.0	498
55	1 1/2" - 2 1/8"	40 - 55	60.4	52.4	21.0	299
60	1 3/4" - 2 3/8"	45 - 60	60.4	52.4	21.0	299
70	2" - 2 3/4"	55 - 70	60.4	52.4	16.8	239
80	2 3/8" - 3 1/8"	60 - 80	60.4	52.4	16.8	239
90	2 3/4" - 3 1/2"	70 - 90	69.0	59.9	16.8	239
100	3 1/4" - 4"	85 - 100	69.0	59.9	16.8	239
120	3 3/4" - 4 1/2"	90 - 120	69.0	59.9	10.5	149
140	4 1/8" - 5 1/2"	110 - 140	69.0	59.9	10.5	149
150	5" - 5 3/4"	130 - 150	69.0	59.9	10.5	149
165	5 1/4" - 6 1/2"	135 - 165	69.0	59.9	9.8	139
190	6 1/4" - 7 1/2"	160 - 190	69.0	59.9	9.8	139
215	7 1/4" - 8 1/2"	185 - 215	78.0	67.7	9.0	128
240	8 1/4" - 9 1/2"	205 - 240	78.0	67.7	9.0	128
270	9 1/4" - 10 1/2"	235 - 270	78.0	67.7	9.0	128
290	10 1/4" - 11 1/2"	255 - 290	78.0	67.7	9.0	128
320	11 1/4" - 12 1/2"	285 - 320	78.0	67.7	9.0	128

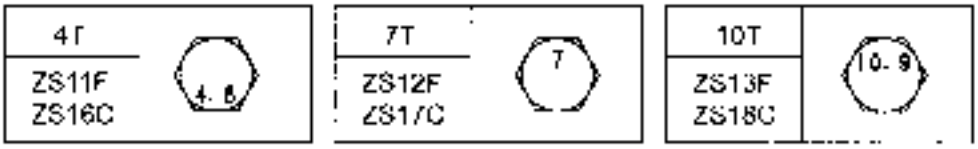
3.2 STANDARD PARTS

3.2.1 BOLT

Size and kind of bolt can be identifid as shown below.



Some bolts are stamped strength class on the heads.



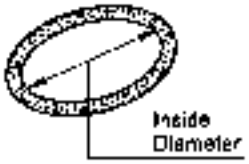
3.2.2 O-RING

Size and kind of O-Ring are identified as shown below.

ZD●●P●●●0 0

Showing inside diameter.

Classifing thickness of the ring.
P : Shows for the use of moving part
G : For the use of stationary part.



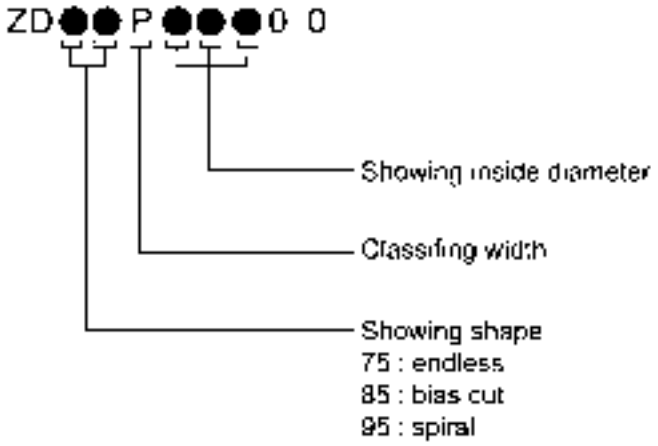
Classifing quality of rubber.
Not figures but points of blue, red, green and of yellow colours are put on
Colour and quantity of points classify as follows
11 : 1 point of blue colour mean Hs70.
12 : 2 point of blue colour mean Hs90.

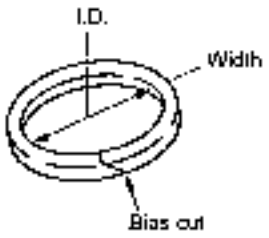
Colour of point shows
- Both blue and red to be of nitril rubber and blue to be used in the range of temperature of minus 25℃ to120℃(77°F to 248°F)
  Red for gasoline proof not to be used normally.
- Green to be of fluorine rubber and used in the range of temperature of minus 15℃to 200℃(59°F to 392°F)

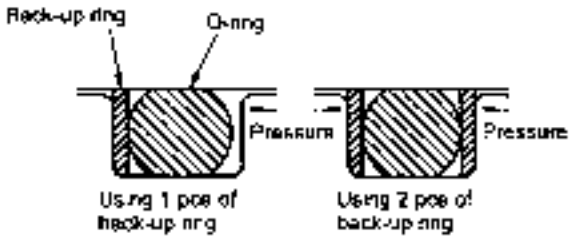
1 point of blue : ZD11	nitril rubber Hs70
2 point of blue : ZD12	nitril rubber Hs90
1 point of red :	nitril rubber Hs70
1 point of yellow :	styrol rubber Hs70
1 point of green :	fluorince rubber Hs70

3.2.3 BACK-UP RING

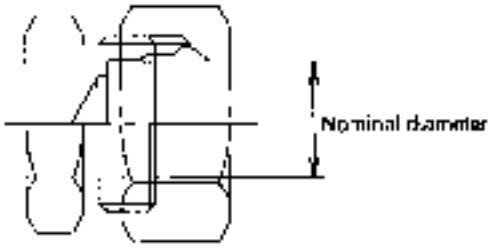
Size and kind of back-up ring are identified as shown below.



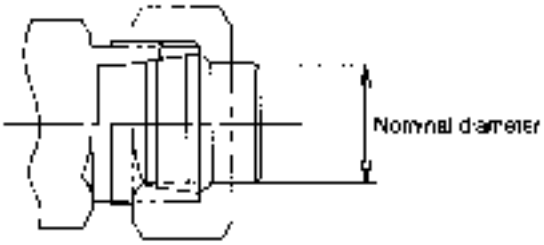




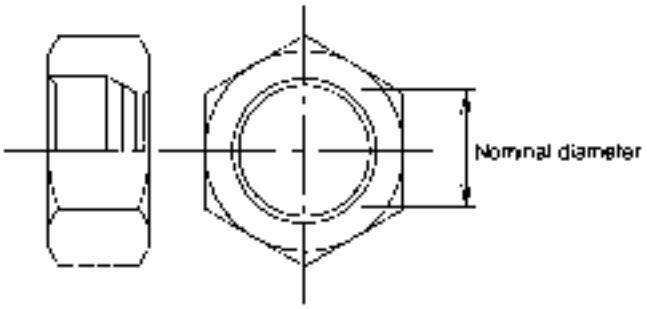
3.2.4 BITE FITTING



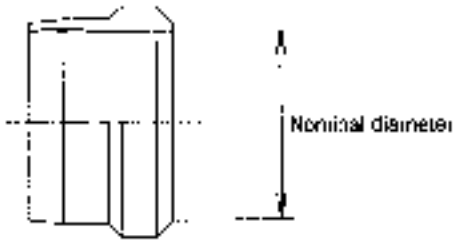
Nominal Diameter	Made by IHARA KOHATSU (ZF)	Made by NIHON AMC (ZA)	Made by NIHON AMC (ZK)
10	ZF83H10000	ZA82P10000	ZK82P10000
15	ZF83H15000	ZA82P15000	ZK82P15000
18	ZF83H18000	ZA82P18000	ZK82P18000
22	ZF83H22000	ZA82P22000	ZK82P22000
28	ZF83H28000	ZA82P28000	ZK82P28000
35	ZF83H35000	ZA82P35000	ZK82P35000



Nominal Diameter	Made by IHARA KOHATSU (ZF)	Made by NIHON AMC (ZA)	Made by NIHON AMC (ZK)
10	ZF83P10000	ZA83P10000	ZK83P10000
15	ZF83P15000	ZA83P15000	ZK83P15000
18	ZF83P18000	ZA83P18000	ZK83P18000
22	ZF83P22000	ZA83P22000	ZK83P22000
28	ZF83P28000	ZA83P28000	ZK83P28000
35	ZF83P35000	ZA83P35000	ZK83P35000



Nominal Diameter	Made by IHARA KOHATSU (ZF)	Made by NITTON AMC (ZA)	Made by NITTON AMC (ZK)
10	ZF93N10000	ZA93N10000	ZK93N10000
15	ZF93N15000	ZA93N15000	ZK93N15000
18	ZF93N18000	ZA93N18000	ZK93N18000
22	ZF93N22000	ZA93N22000	ZK93N22000
28	ZF93N28000	ZA93N28000	ZK93N28000
35	ZF93N35000	ZA93N35000	ZK93N35000



Nominal Diameter	Made by IHARA KOHATSU (ZF)	Made by NIHON AMC (ZA)	Made by NIHON AMC (ZK)
10	ZF93S10000	ZA93S10000	ZK93S10000
15	ZF93S15000	ZA93S15000	ZK93S15000
18	ZF93S18000	ZA93S18000	ZK93S18000
22	ZF93S22000	ZA93S22000	ZK93S22000
28	ZF93S28000	ZA93S28000	ZK93S28000
35	ZF93S35000	ZA93S35000	ZK93S35000

Tightening torque ZE • ZA Type

Nominal Diameter	10	15	18	22	28	35
Tightening Torque kg-m (ft-lbs)	6 ± 1 (43 ± 7)	15 ± 2 (108 ± 14)	18 ± 2 (130 ± 14)	22 ± 2 (160 ± 14)	28 ± 3 (200 ± 20)	35 ± 3 (253 ± 20)

Tightening torque ZK Type

Nominal Diameter	10	15	18	22	28	35
Tightening Torque kg-m (ft-lbs)	6 ± 1 (43 ± 7)	9 ± 1 (65 ± 7)	12 ± 2 (87 ± 14)	17 ± 2 (123 ± 14)	22 ± 2 (160 ± 14)	28 ± 3 (200 ± 20)

3.3 CONVERSION TABLE

3.3.1 UNIT CONVERSION

[Remarks] Figures in ( ) show number of zero down a decimal point
Example 0.(2)1 = 0.001

1 Length

Unit	mm	cm	m	km	in	ft	yd	mile
mm	1	0.1	0.001	0.00001	0.03937	0.0032808	0.0010936	0.(6)6214
cm	10	1	0.01	0.0001	0.3937	0.032808	0.010936	0.(5)6214
m	1000	100	1	0.001	39.37	3.28083	1.0936	0.(3)6214
km	...	100000	1000	1	39370	3280.83	1093.61	0.62137
in	25.40	2.540	0.0254	0.(4)254	1	0.0833	0.02778	0.(4)1578
ft	304.8	30.48	0.3048	0.(3)3048	12	1	0.3333	0.(3)1894
yd	914.4	91.44	0.9144	0.(3)9144	36	3	1	0.(3)5682
mile	1609347.0	160934.70	1609.35	1.60935	63360	5280	1760	1

2. Capacity

Unit	cm³	m³	ltr.	klt.	in³	ft³	yd³	gal
cm³	1	0.(5)1	0.001	0.(5)1	0.06102	0.(4)3531	0.(5)1308	0.(3)2642
m³	1000000	1	1000	1	61020	35.31	1.308	264.2
ltr.	1000	0.001	1	0.001	61.02	0.03531	0.001308	0.2642
klt.	1000000	1	1000	1	61020	35.31	1.308	264.2
in³	16.39	0.(4)1639	0.01639	0.(4)1639	1	0.(3)5787	0.(4)2143	0.004429
ft³	28320	0.02832	28.32	0.02832	1728	1	0.03704	7.48055
yd³	764500	0.7645	764.5	0.7645	46660	27	1	201.974
gal	3785	0.003785	3.785	0.003785	231	0.1337	0.004951	1

3 Weight

Unit	kg	oz	lb	(2000 lbs) nt	(2240 lbs) gt	mt
kg	1	35.2740	2.20462	0.001102	0.(3)9842	0.001
oz	0.02835	1	0.06250	0.(4)3125	0.(4)2790	0.(4)2835
lb	0.45359	16	1	0.00050	0.(3)4460	0.(3)4536
nt	907.185	32000	2000	1	0.89286	0.90719
gt	1016.05	35840	2240	1.12	1	1.01605
mt	1000	35274	2204.6	1.10231	0.98421	1

[Remakes] mt : ton (Metric) nt : ton (U.s.unit) gt : (British Unit)

3.3.2 MILLIMETER : INCH CONVERSION TABLE

1. 1mm to 99mm

mm	0	1	2	3	4	5	6	7	8	9
						in				
0	0.0000	0.0394	0.0787	0.1181	0.1575	0.1969	0.2362	0.2756	0.3150	0.3543
10	0.3937	0.4331	0.4724	0.5118	0.5512	0.5906	0.6299	0.6693	0.7087	0.7480
20	0.7874	0.8268	0.8661	0.9055	0.9449	0.9843	1.0236	1.0630	1.1024	1.1417
30	1.1811	1.2205	1.2598	1.2992	1.3386	1.3780	1.4173	1.4567	1.4961	1.5354
40	1.5748	1.6142	1.6535	1.6929	1.7323	1.7717	1.8110	1.8504	1.8898	1.9291
50	1.9685	2.0079	2.0472	2.0866	2.1260	2.1654	2.2047	2.2441	2.2835	2.3228
60	2.3622	2.4016	2.4409	2.4803	2.5197	2.5591	2.5984	2.6378	2.6772	2.7165
70	2.7559	2.7953	2.8346	2.8740	2.9134	2.9528	2.9921	3.0315	3.0709	3.1102
80	3.1496	3.1890	3.2283	3.2677	3.3071	3.3465	3.3858	3.4252	3.4646	3.5039
90	3.5433	3.5827	3.6220	3.6614	3.7008	3.7402	3.7795	3.8189	3.8583	3.8976

25.4mm = 1 in

2. Inch Fraction-Milimeter

in	0	1	2	3	4	5	6	7	8	9
	mm									
0	0.000	25.400	50.800	76.200	101.600	127.000	152.400	177.800	203.200	228.600
1/64	0.397	25.797	51.197	76.597	101.997	127.397	152.797	178.197	203.597	228.997
1/32	0.794	26.194	51.594	76.994	102.394	127.794	153.194	178.594	203.994	229.394
1/16	1.588	26.988	52.388	77.788	103.188	128.588	153.988	179.388	204.788	230.188
3/32	2.381	27.781	53.181	78.581	103.981	129.381	154.781	180.181	205.581	230.981
1/8	3.175	28.575	53.975	79.375	104.775	130.175	155.575	180.975	206.375	231.775
5/32	3.969	29.369	54.769	80.169	105.569	130.969	156.369	181.769	207.169	232.569
3/16	4.763	30.163	55.563	80.963	106.363	131.763	157.163	182.563	207.963	233.363
7/32	5.556	30.956	56.356	81.756	107.156	132.556	157.956	183.356	208.756	234.156
1/4	6.350	31.750	57.150	82.550	107.950	133.350	158.750	184.150	209.550	234.950
9/32	7.144	32.544	57.944	83.344	108.744	134.144	159.544	184.944	210.344	235.744
5/16	7.938	33.338	58.738	84.138	109.538	134.938	160.338	185.738	211.138	236.538
11/32	8.731	34.131	59.531	84.931	110.331	135.731	161.131	186.531	211.931	237.331
3/8	9.525	34.925	60.325	85.725	111.125	136.525	161.925	187.325	212.725	238.125
13/32	10.319	35.719	61.119	86.519	111.919	137.319	162.719	188.119	213.519	238.919
7/16	11.113	36.513	61.913	87.313	112.713	138.113	163.513	188.913	214.313	239.713
15/32	11.906	37.306	62.706	88.106	113.506	138.906	164.306	189.706	215.106	240.506
1/2	12.700	38.100	63.500	88.900	114.300	139.700	165.100	190.500	215.900	241.300
17/32	13.494	38.894	64.294	89.694	115.094	140.494	165.894	191.294	216.694	242.094
9/16	14.288	39.688	65.088	90.488	115.888	141.288	166.688	192.088	217.488	242.888
19/32	15.081	40.481	65.881	91.281	116.681	142.081	167.481	192.881	218.281	243.681
5/8	15.875	41.275	66.675	92.075	117.475	142.875	168.275	193.675	219.075	244.475
21/32	16.669	42.069	67.469	92.869	118.269	143.669	169.069	194.469	219.869	245.269
11/16	17.463	42.863	68.263	93.663	119.063	144.463	169.863	195.263	220.663	246.063
23/32	18.256	43.656	69.056	94.456	119.856	145.256	170.656	196.056	221.456	246.856
3/4	19.050	44.450	69.850	95.250	120.650	146.050	171.450	196.850	222.250	247.650
25/32	19.844	45.244	70.644	96.044	121.444	146.844	172.244	197.644	223.044	248.444
13/16	20.638	46.038	71.438	96.838	122.238	147.638	173.038	198.438	223.838	249.238
27/32	21.431	46.831	72.231	97.631	123.031	148.431	173.831	199.231	224.631	250.031
7/8	22.225	47.625	73.025	98.425	123.825	149.225	174.625	200.025	225.425	250.825
29/32	23.019	48.419	73.819	99.219	124.619	150.019	175.419	200.819	226.219	251.619
15/16	23.813	49.213	74.613	100.013	125.413	150.813	176.213	201.613	227.013	252.413
31/32	24.606	50.006	75.406	100.806	126.206	151.606	177.006	202.406	227.806	253.206

3.3.3 METER-FOOT CONVERSION TABLE

Foot	Meter	Foot	Meter	Foot	Meter
5	1.52	155	47.24	355	108.20
10	3.05	160	48.77	360	109.73
15	4.57	165	50.29	365	111.25
20	6.10	170	51.82	370	112.78
25	7.62	175	53.34	375	114.30
30	9.14	180	54.86	380	115.82
35	10.67	185	56.39	385	117.35
40	12.19	190	57.91	390	118.87
45	13.72	195	59.44	395	120.40
50	15.24	200	60.96	400	121.92
55	16.76	205	62.48	405	123.44
60	18.29	210	64.01	410	124.97
65	19.81	215	65.53	415	126.49
70	21.34	220	67.06	420	128.02
75	22.86	225	68.58	425	129.54
80	24.38	230	70.10	430	131.06
85	25.91	235	71.63	435	132.59
90	27.43	240	73.15	440	134.11
95	28.96	245	74.68	445	135.64
100	30.48	250	76.20	450	137.16
105	32.00	255	77.72	455	138.68
110	33.53	260	79.25	460	140.21
115	35.05	265	80.77	465	141.73
120	36.58	270	82.30	470	143.26
125	38.10	275	83.82	475	144.78
130	39.62	280	85.34	480	146.30
135	41.15	285	86.87	485	147.83
140	42.67	290	88.39	490	149.35
145	44.20	295	89.92	495	150.88
150	45.72	300	91.44	500	152.40

3.3.4 GRADIENT CONVERSION TABLE

Degree	Percent	Degree	Percent	Degree	Percent
1	1.8	16	28.7	31	60.1
2	3.5	17	30.6	32	62.5
3	5.2	18	32.5	33	64.9
4	7.0	19	34.4	34	67.5
5	8.8	20	36.4	35	70.0
6	10.5	21	38.4	36	72.7
7	12.3	22	40.4	37	75.4
8	14.1	23	42.5	38	78.1
9	15.8	24	44.5	39	81.0
10	17.6	25	46.6	40	83.9
11	19.4	26	48.8	41	86.9
12	21.3	27	51.0	42	90.0
13	23.1	28	53.2	43	93.3
14	24.9	29	55.4	44	96.6
15	26.8	30	57.7	45	100.0

3.4 TABLE OF UNIT WEIGHT

Material	Weight per Cub. Meter (t)	Material	Weight per Cub. Meter (t)
Lead	11.4	Sand	1.9
Copper	8.9	Coal cold	0.8
Steel	7.8	Coal powder	1.0
Cast iron	7.2	Coke	0.5
Aluminum	2.7	Oak	0.9
Concrete	2.3	Cedar	0.4
Soil	2.0	Cypress	0.4
Gravel	1.9	Paulownia	0.3

Note

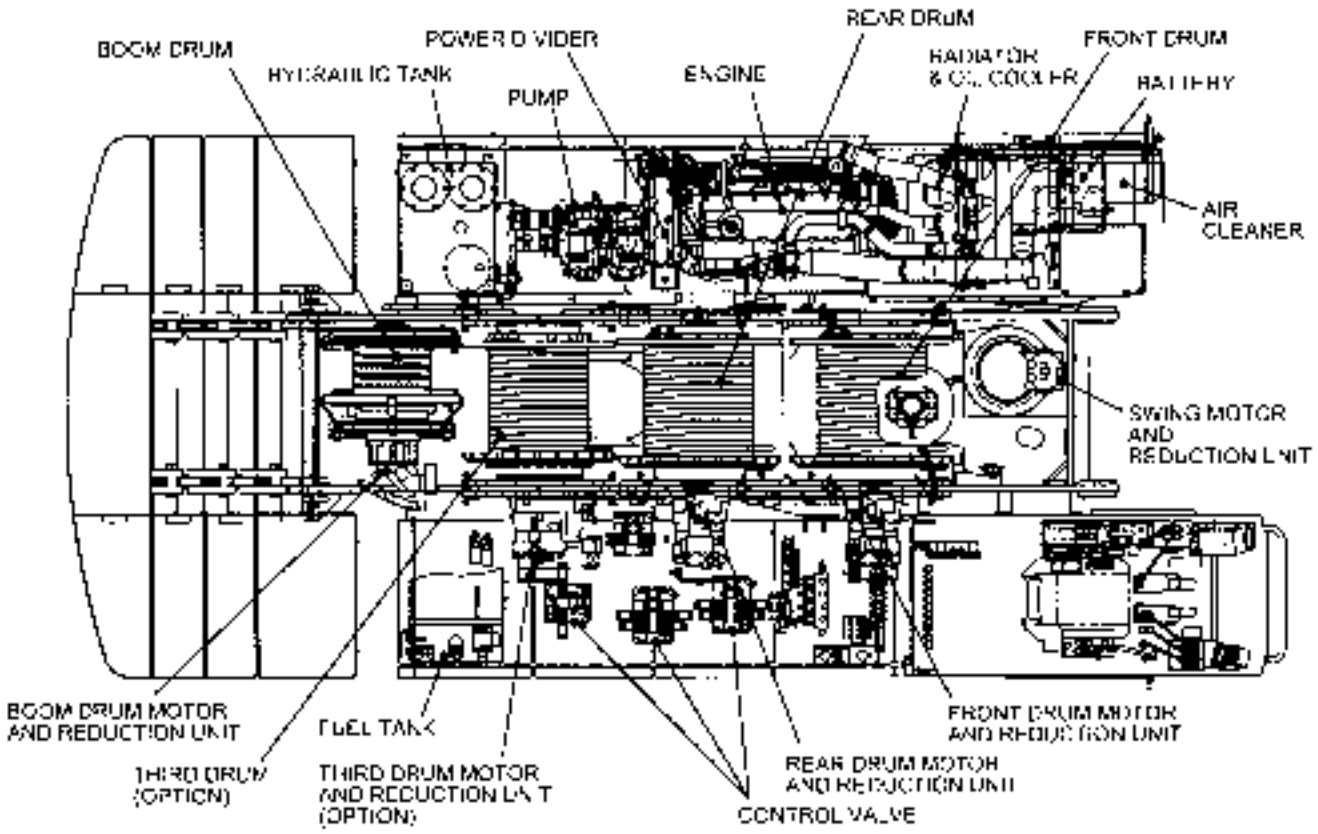
1. Weight of wood is that of the dried.
2. Value sworn in the table may well be taken for specific gravity.

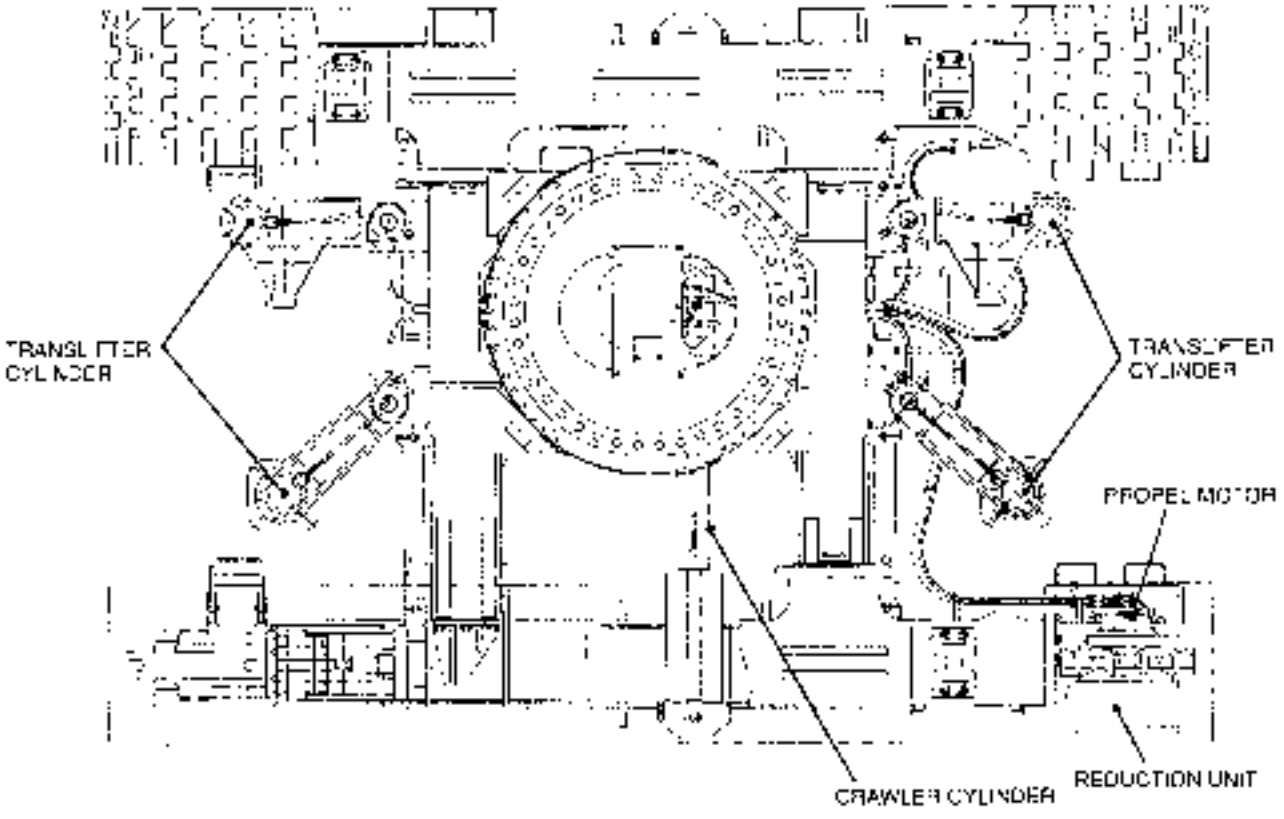
4. POWER TRAIN

4.1 INTRODUCTION

This is a fully hydraulic crawler crane.
The crane's engine drives two pairs of tandem-plunger-type double pump and tandem gear double pump connected to each plunger-type pump through the power divider
Both of the tandem plunger type double pump are variable
One plunger type double pump is the main pump.
The main pump powers the front and rear drum motors and the right and left drive motors through the two control valves
For another plunger type double pump, the inner pump powers the swing motor, and the outer pump powers the boom drum motor, respectively
The tandem gear double pump connected to the swing and boom pump feed oil to the free fall brake cooling line of front and rear drums. The inner pump of tandem gear double pump connected to the main pump feed pressurized oil to control line, and the other pump feed it to the auxiliary actuator (gantry cylinder / counterweight self removal cylinder / translifter cylinder).

Fig.1-1 Component Locations





4.2 ENGINE

4.2.1 INTRODUCTION

This chapter explains how to remove and re-install the engine. Refer to the manual provided by the engine manufacturer for maintenance and repair details.

4.2.2 REMOVAL

Proceed as follows when removing the engine from the machine.

Note

Remove the pump drive assembly with the engine.

1. Lower the boom to the ground, pin the upper spreader to the lower boom.
   Store the gantry in its travel position.
2. Remove the grounding cable of the battery.
3. Remove the muffler.
4. Remove the air inlet hose from the engine and air cleaner
5. Remove the air inter cooler hose from the engine and air inter cooler
6. When removing the engine and pump drive assembly, it is necessary to first remove the guard.
7. Drain the engine oil, hydraulic oil and coolant water.

⚠WARNING

Do not drain the oil and water when it is hot.
The hot oil and water may spout out which could result in personal injury. After the oil and water has cooled, drain the oil and water.
Failure to observe this precaution may result in serious injury or death.

8. Remove the cap screws that hold the fanguard to the radiator and take off the radiator assembly.

9. Label and then remove the hydraulic hoses from the hydraulic pumps.
   All the ports and hoses should be plugged to prevent soil from getting into them.

10. Label and then remove the fuel line and electric harness from engine.
    Cap all the fuel lines to prevent soil from getting into them

11 Recheck to be sure that no electrical lines, mechanical connections and fuel pipes are remaining to interfere with the removal of the engine.

12. Use a sufficiently strong engine lift. (The engine/power divider combined weight is approximately 1500 kg (3307 lbs)) . Note the three designated lifting points on the engine assembly.

13. Remove the nuts, washers and bolts from the rubber mounts of the engine and power divider.

14 Slowly lift to remove as a single unit the engine and pump drive assembly.

15 Check the rubber mounts and replace them if necessary.

4.2.3 REPAIR AND MAINTENANCE

Regarding the repair and maintenance of the engine, refer to the manual provided by the manufacturer.

The engine manufacturer :	HINO MOTORS, LTD.
The engine model :	CK1200 CKE1100 ; P11C-UN

4.2.4 RE-INSTALLATION

Proceed as follows when re-installing the engine. (See page 4-8, 4-9)

1. Check to make sure that no fuel lines, coolant water hoses, mechanical connection parts or other items are left to interfer with the re-installation.
2. If the rubber mounts were removed, replace them.
3. Using a sufficiently strong engine lift, lift the engine and place it onto the mount pads.
4. Use Loctite #271 on the rubber mount holding bolts and tighten them to 559 ± 59N-m (412 ± 44 ft-lbs) torque.
5. Install the radiator assembly and fan guard. The space between the fan shroud and fan should be even all around.
   Use Loctite #271 on the bolts of the radiator assembly and tighten them with 314 ± 31 N-m (232 ± 23 ft-lbs) torque.
6. Connect all the electric lines that were disconnected when the engine was removed.
7. Install all the fuel lines that were removed when the engine was removed.
8. Install the guard, and connect the battery cable.
9. Install the air inter cooler hose that were removed when the engine was removed.

⚠WARNING

- **Do not bring a flame or spark close to the batteries.**
- **Since the battery electrolyte is dilute sulfuricacid, avoid battery acid contact with the skin, eyes, or clothing.**
  If accidentally contacted, immediately flush the area with water and consult a doctor immediately.
- **Wear eye glasses to protect eyes when working with electrolyte.**

Failure to observe this precaution may result in serious injury or death.

10. Install the air inlet hose and muffler.
11. Install hydraulic hoses to the hydraulic pumps.
12. Refill the engine with coolant water and engine oil to the required levels.

13. Remove the air from the fuel lines.
14. Start the engine and set it to low idle. Check for water and fuel leaks, and any strange noises.

⚠CAUTION

Before starting the engine, re-check all electrical, fuel, water and hydraulic connections as well as mechanical connections.
Be prepared to stop the engine immediately if something unusual develops.

Fig.2-1 Engine (1/2)

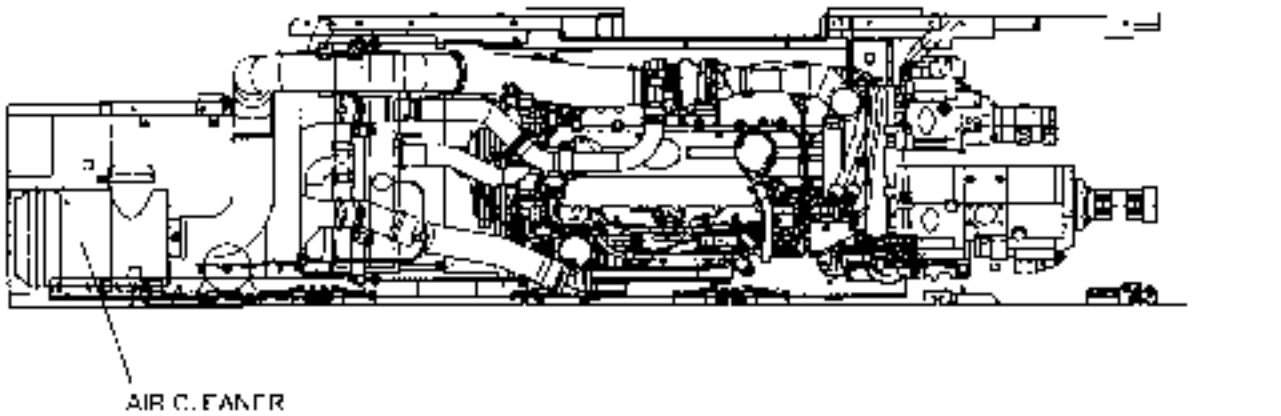
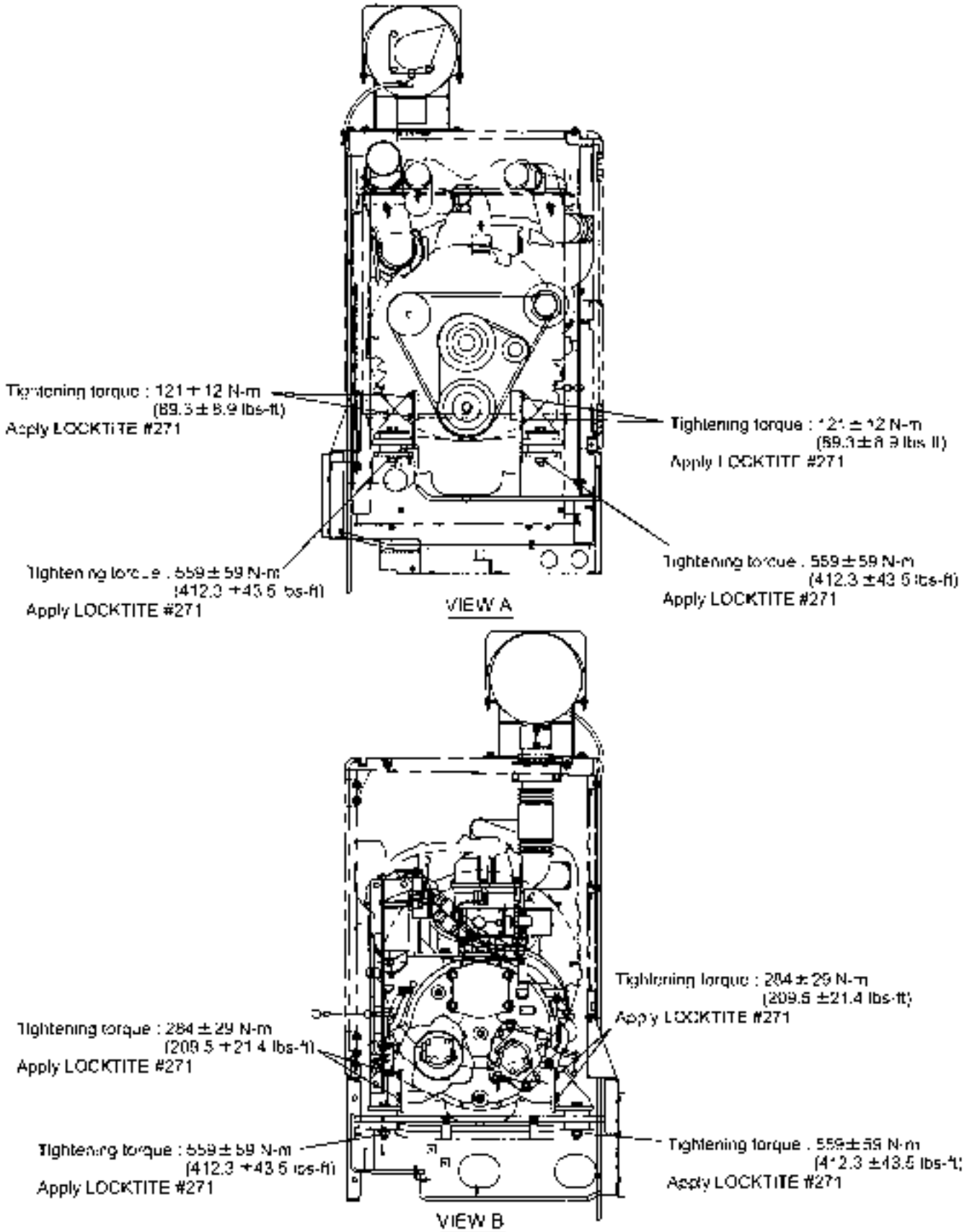


Fig.2-1 Engine (2-2)



4.3 PUMP DRIVE ASSEMBLY

4.3.1 INTRODUCTION

This chapter explains how to remove, inspect, repair and re-install the pump drive assembly.
The pump drive assembly is mounted directly onto the back of the engine. It consists of a coupling, a power divider, tandem-mounted main pump (hoist, propel), swing/boom hoist pump and two tandem gear double pumps connected to each tandem pump.
The power of the engine is transfered from a flywheel through the coupling to the center core of the power divider. Three pairs of gears divide this power between the main pump shaft and the swing/boom pump shaft and option pump shaft. (See page 4-11)

4.3.2 REMOVAL

Proceed as follows when removing the pump drive assembly (See page 4-11)

⚠CAUTION

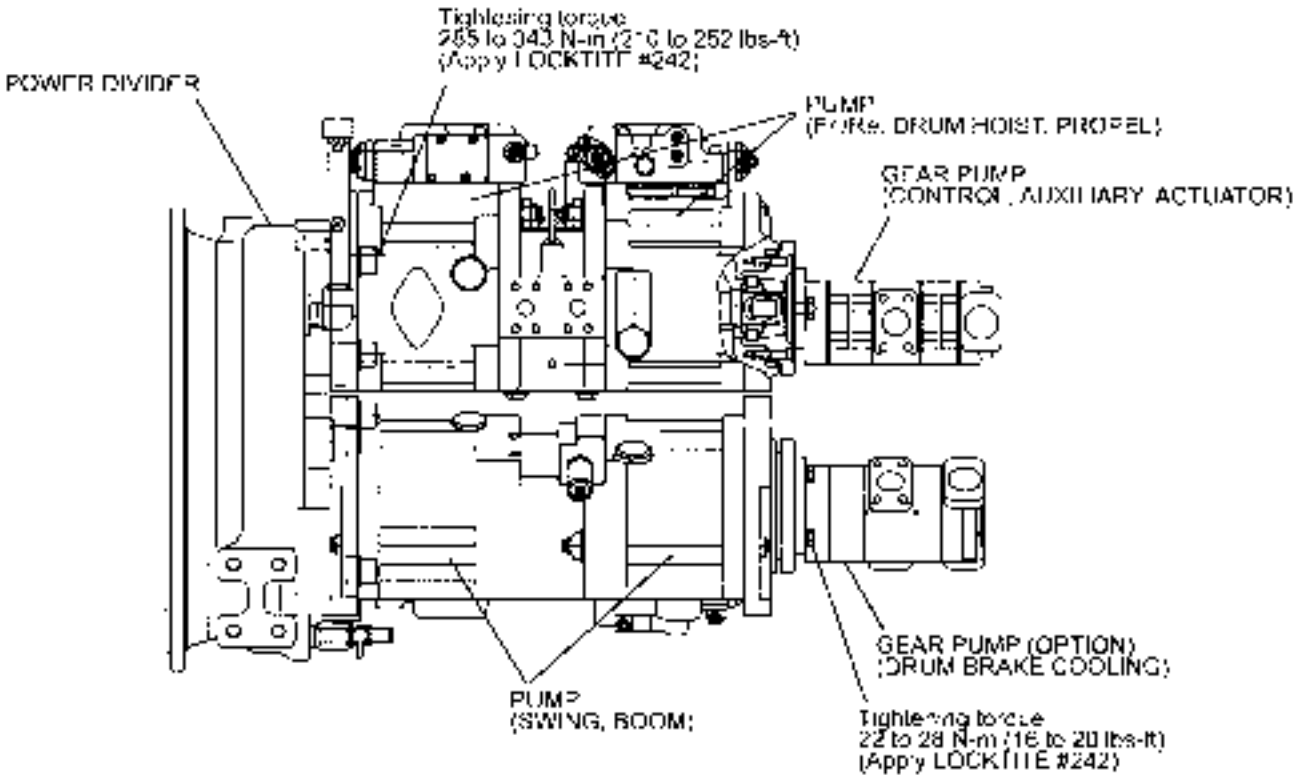
Pump drive assembly should be removed from the engine according to the following procedure only after the engine has been removed from the machine as described in Section 4.2.

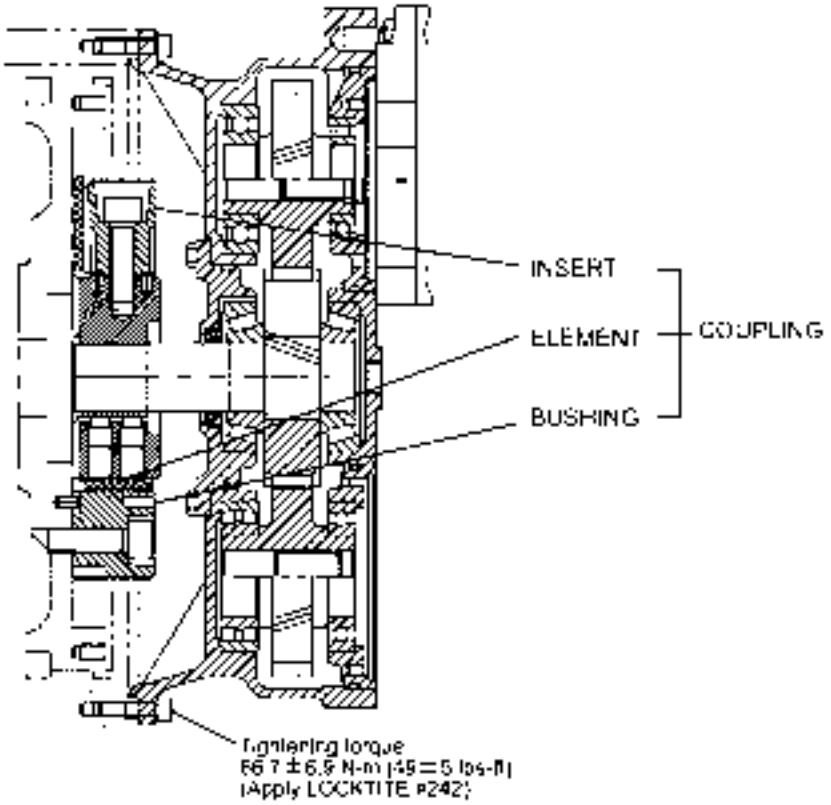
1. Drain the oil in the power divider through the port on the lower part of the power divider.
2. Remove the main pump, swing/boom pump and gear pump.

Main pump	124kg (273 lbs)
Swing/Boom pump	124kg (273 lbs)
Gear pump (Control)	7.4kg (16.3 lbs)
Gear pump (Cooling)	8.4kg (18.5 lbs) (OPTION)

3. Using a sufficiently strong lift device (the approximate weight of the power divider is 130 kg (287 lbs)), attach the lift riggings to suspension screws provided on the power divider. (screw holes : M16)
   Remove the cap screws set in the fly wheel housing of the engine and move the power divider slowly toward the back of the engine.
   Remove the coupling and disconnect the power divider.
4. The main part of this coupling will be removed with the power divider connected to its core.

Fig.3-1 Pump Drive Assembly





4.3.3 DISASSEMBLING THE POWER DIVIDER

Proceed as follows when disassembling the power divider (See page 4-16,4-17,4-18,4-19,4-20)

1. Set the power divider on a block with the pump side facing up.
2. Use the screw holes (M8) provided when removing support (3) with a puller. Remove the O-ring (15).
3. Remove the gear (6) and remove the bearings (11, 13) on both sides if necessary.
4. Use the screw holes (M8) provided when removing support (30) with a puller. Remove the O-ring (15).
5. Remove gear (33) and remove the bearings (31, 32) on both sides if necessary.
6. Now, turn the assembly over and set the power divider on a block with the fly wheel side facing up.
7. Remove the capscrew (23), insert the capscrew (M10) into the screw hole for removing the support (2) and remove support (2).
8. Remove the shaft (8) and gear (5).
9. Remove the oil seal (17), O-ring (15) and outer race of the bearing (10) from the support (2). Remove the outer race of the bearing (10) from the housing (1)
   Retain and keep all the shims (27, 28, 29) together.
10. If necessary, remove the inner race of the tapered roller bearing (10) from the shaft (8).

4.3.4 CHECK AND REPAIR OF THE POWER DIVIDER

Check all parts prior to reassembling the power divider. All questionable parts should be replaced to maximize the re-assembled power divider's service life and to avoid further break downs. Checking should proceed in the following order

1. Clean all the parts with fresh cleaning oil and blow them dry.
2. Check bearing balls, rollers, inner and outer races to see that they are free of pitching and scratches. Replace any defective ones.
3. Bearings with no pitching or scratches should be lightly lubricated, but replace any bearings that develop rattles due to excessive clearances toward the shaft or toward the external side should be replaced
4. Check the bearings' outer and inner races. Replace any that show indications of slipping and/or rolling.
5. Check the teeth of all the gears and replace any that show pitching, scratch, signs of friction wear, peeling or cracking.
6. Check the shafts and replace any with signs of cracking, deformation, wear at contact surfaces or bearing slippage.
7. Check the splines of the shafts and gears. Replace or fix any that show cracking, signs of wear or impact damage.
8. Check the bearing casings and replace any that show slip wear or other deformations
9. Check the gear casings and replace or fix any that show cracks, deformation or scratches.
10. All the O-rings and oil seals should be replaced with new ones.
11. Check cap screw threadings and screw hole threadings and replace or repair any that show signs of cross-threading and or strippage.

4.3.5 ASSEMBLING THE POWER DIVIDER

Assembling the power divider takes place in the reverse order for disassembly. Be particularly cautious with the following factors. (See page 4-16,4-17,4-18,4-19,4-20)

1. Apply clean oil to each part before assembling.
2. When assembling the shaft (8), drive gear (5), tapered roller bearing (10) and support (2), adjust with the shims (27, 28, 29) to 0 mm to 0.15 mm (0 inch to 0.006 inch) clearance at point "S"
3. Install the support (2) to the housing (1) so that the oil hole is positioned
4. Apply Loctite #242 to the assembling bolts (23) for the support (2) before tightening them to 70 ± 7 N-m (52 ± 5 ft-lbs) torque.
5. Install the bearing (11), insert the gear (6) and install the support (3) in which the bearing (13) is inserted.
6. Install the bearing (31), insert the gear (33) and install the support (30) in which the bearing (32) is inserted.
7. After assembly is completed, make sure the input shaft can be turned easily by hand, and no noise is emitted.

4.3.5 RE-INSTALLATION

Assemble the pump drive as follows.
(See page 4-20)

1. Grease the spline of the input shaft (9) and insert the coupling hub (2) to the until it comes in contact with the shaft shoulder section.
   Torque the clamping screws (7) to 206 ± 9.8 N-m (152 ± 7 ft- lbs).
2. Assemble the coupling in the following order ; first put spring pins (8) into the coupling hub (2) , then the elements (1) and then inserts (R) (4).
3. Torque the cap screws (6) to 451 ± 29 N-m (332 ± 21 ft-lbs).
4. On the side of the fly wheel(11), put spring pins (12) into the fly wheel (11), install inserts (A)(3) and then torque the cap screws (5) to 451 ± 29 N-.m (332 ± 21 ft-lbs).
5. Fit the hook of a hoisting device with suitable capacity to the eyebolt of the power divider ; insert the element at the coupling side of the power divider into the bushing at the flywheel and thus set the power divider assembly to the flywheel housing.
6. Apply Loctite #242 to the capscrews (10) and tighten to 66.7 ± 6.9 N-m (49 ± 5.1 ft-lbs).
7. Apply Loctite #242 to the respective cap screws, and tighten them to the two tandem-type pumps (main and swing/boom) with a tightening torque from 314 ± 29.4 N-m (231 ± 21.4 ft-lbs) and the tandem-type gear pumps from 25 ± 3 N-m (18 ± 2 ft-lbs). Ensure that the installation positions of the main pump and swing/boom pump are correct (refer to page 4-11).
8. Supply the specified #90 gear oil to the power divider to the specified level [about 3.5 ltr. (0.92 gals) is needed]
9. Attach power divider to the engine, and install the engine assembly to base machine
10. Start the engine, and check that there is no abnormal noise, oil leakage, etc

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Note

If the pump is not installed to the power div der, the support (3). (30) may come off.

Fig. 3-2 Power Divider (1/4)

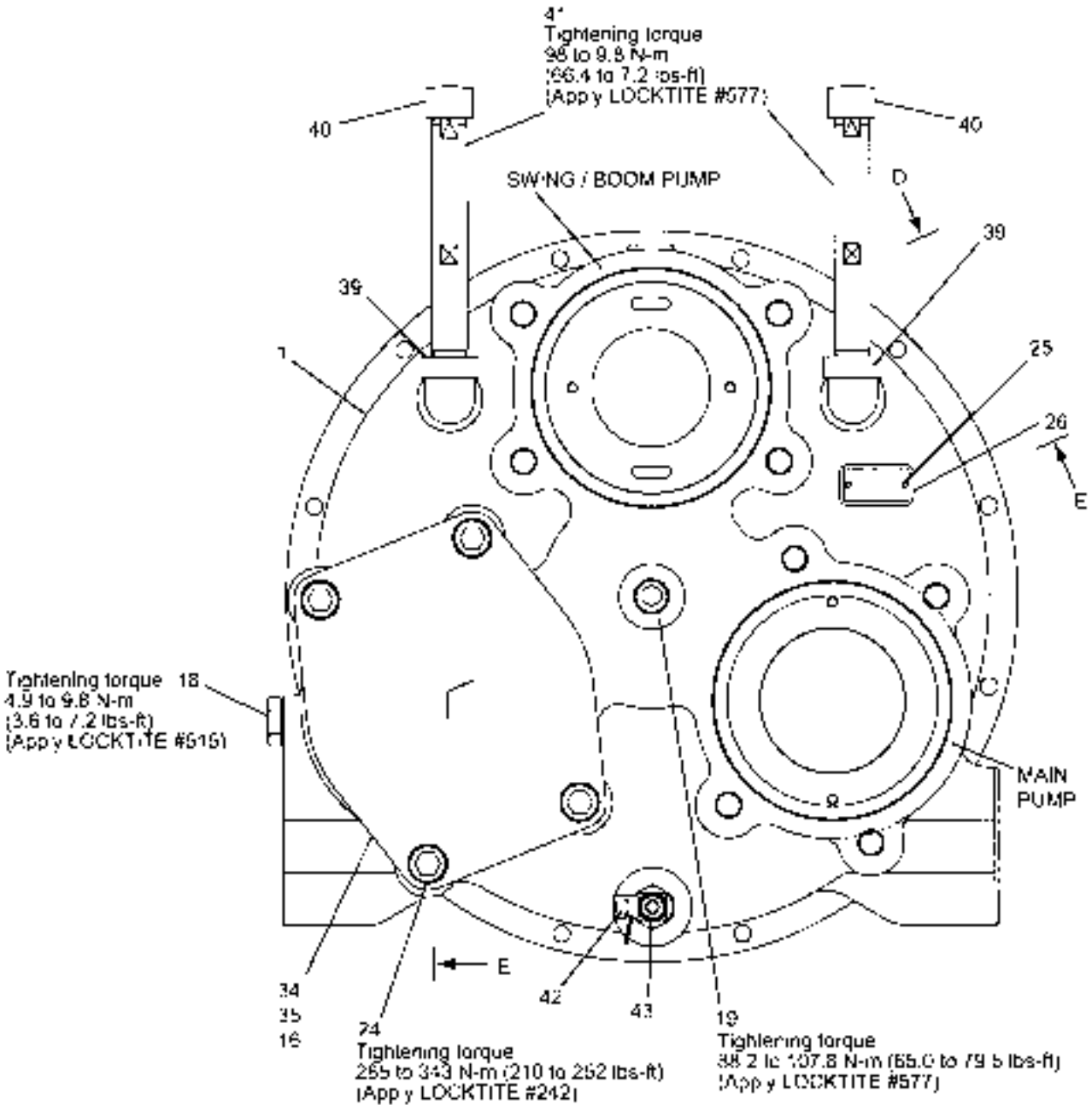
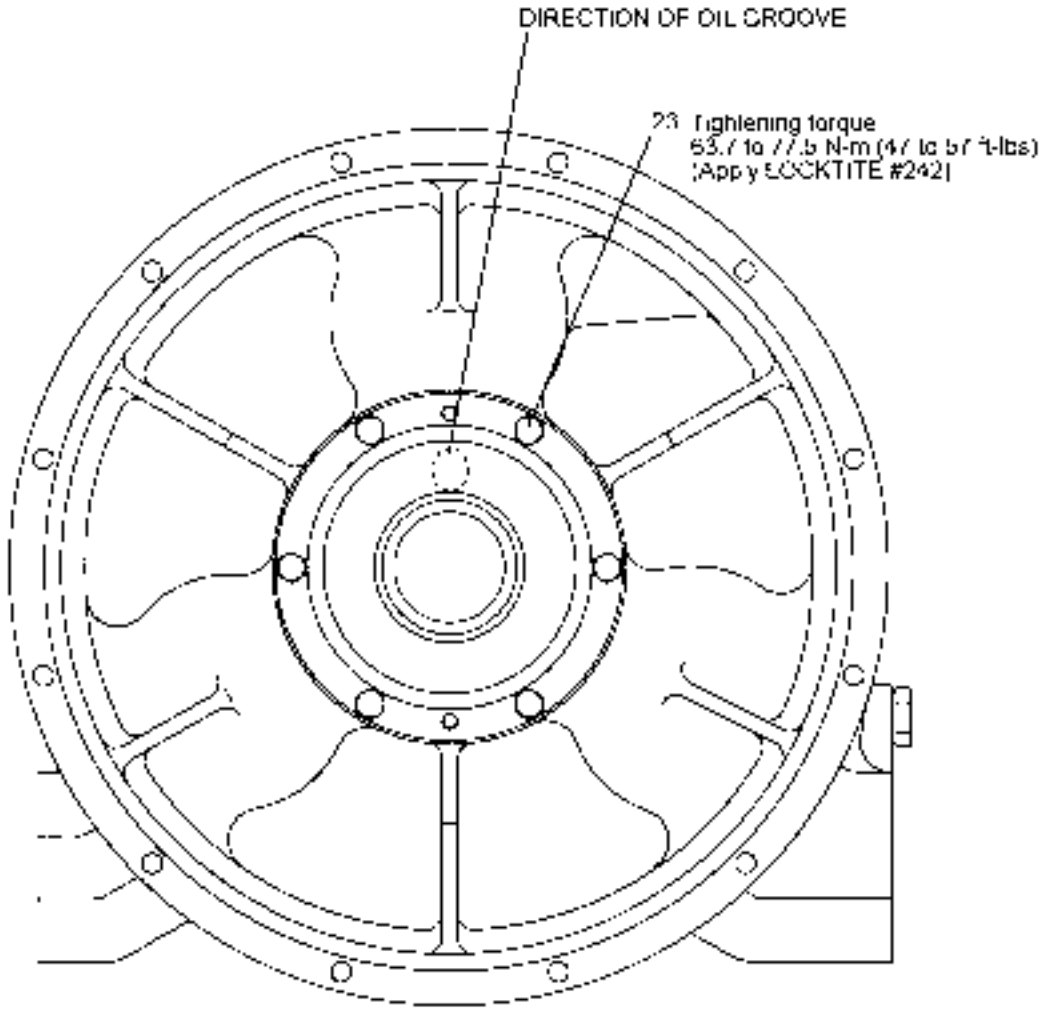


Fig. 3-2 Power Divider (2/4)



1. Housing	10. Bearing	18. Oil level gaugu	27. Shim	33 Gear	40. Cap
2. Support	11. Bearing	19. Plug	28. Shim	34. Cover	41. Tube
3. Support	13. Bearing	23. Capscrew	29. Shim	35. Cover	42. Drain cock
5. Gear	15. O-ring	24. Capscrew	30. Support	37. Breather "B"	43. Connector
6. Gear	16. O-ring	25. Plate	31. Ball bearing	38. Tube	
8. Shaft	17. Oil seal	26. Rivet	32. Ball bearing	39. Elbow	

Fig. 3-2 Power Divider (3/4)

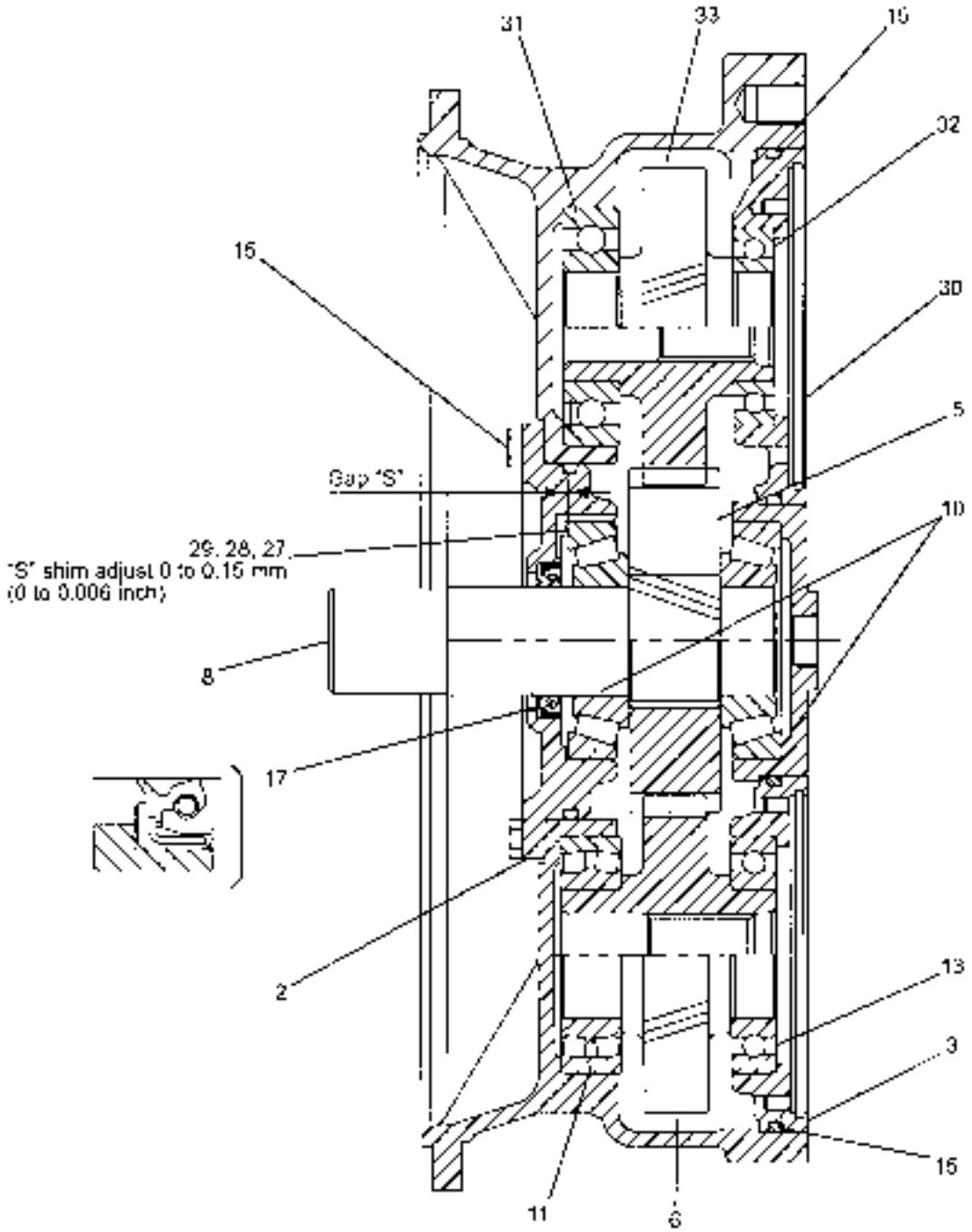
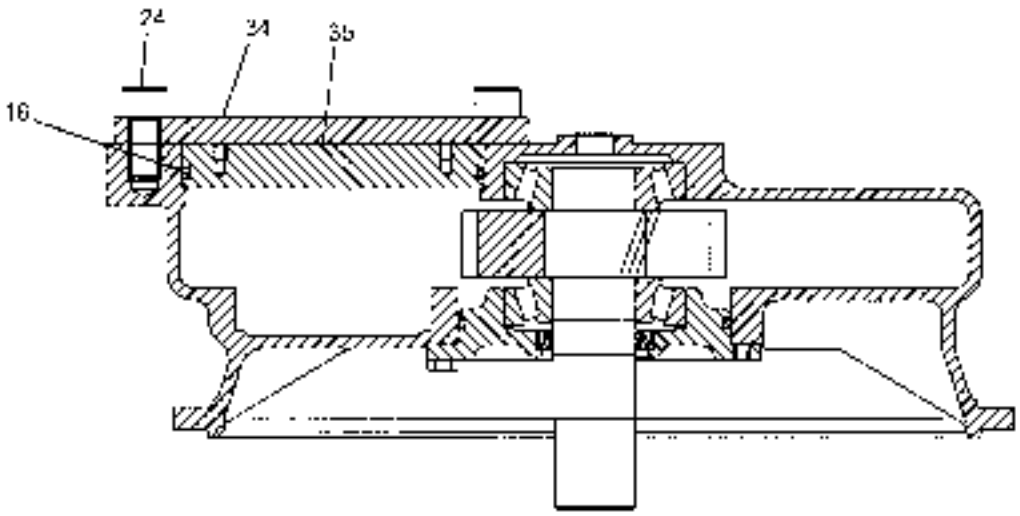


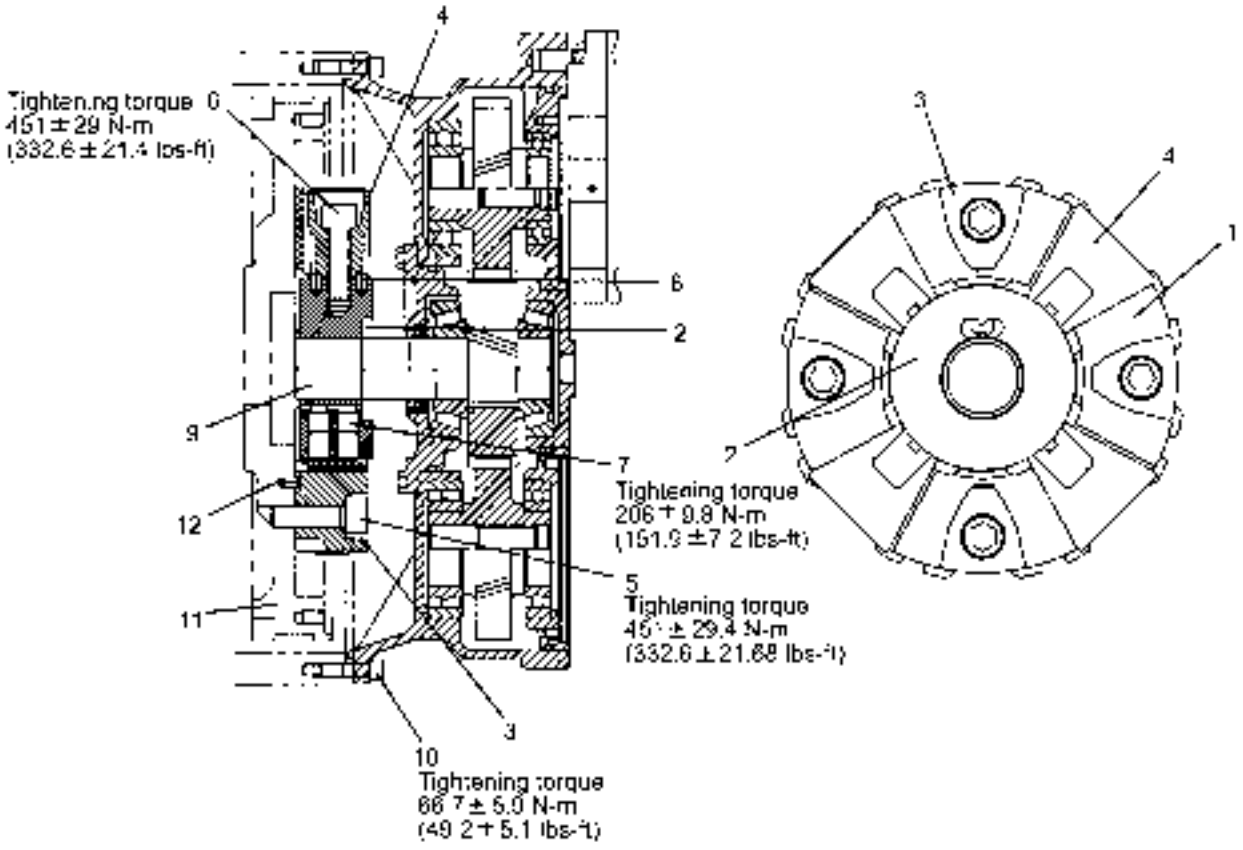
Fig. 3-2 Power Divider (4/4)



SECTION E-E

1. Housing	10. Bearing	18 Oil level gauge	27. Shim	33. Gear	40. Cap
2. Support	11 Bearing	19 Plug	28. Shim	34. Cover	41. Tube
3. Support	13 Bearing	23 Capscrew	29. Shim	35. Cover	42. Drain cock
5. Gear	15 O ring	24 Capscrew	30. Support	37. Breather "B"	43. Connector
6. Gear	16 O-ring	25 Plate	31. Ball bearing	38. Tube	
8. Shaft	17 Oil seal	26 Rivet	32. Ball bearing	39. Elbow	

Fig. 3-3 Coupling

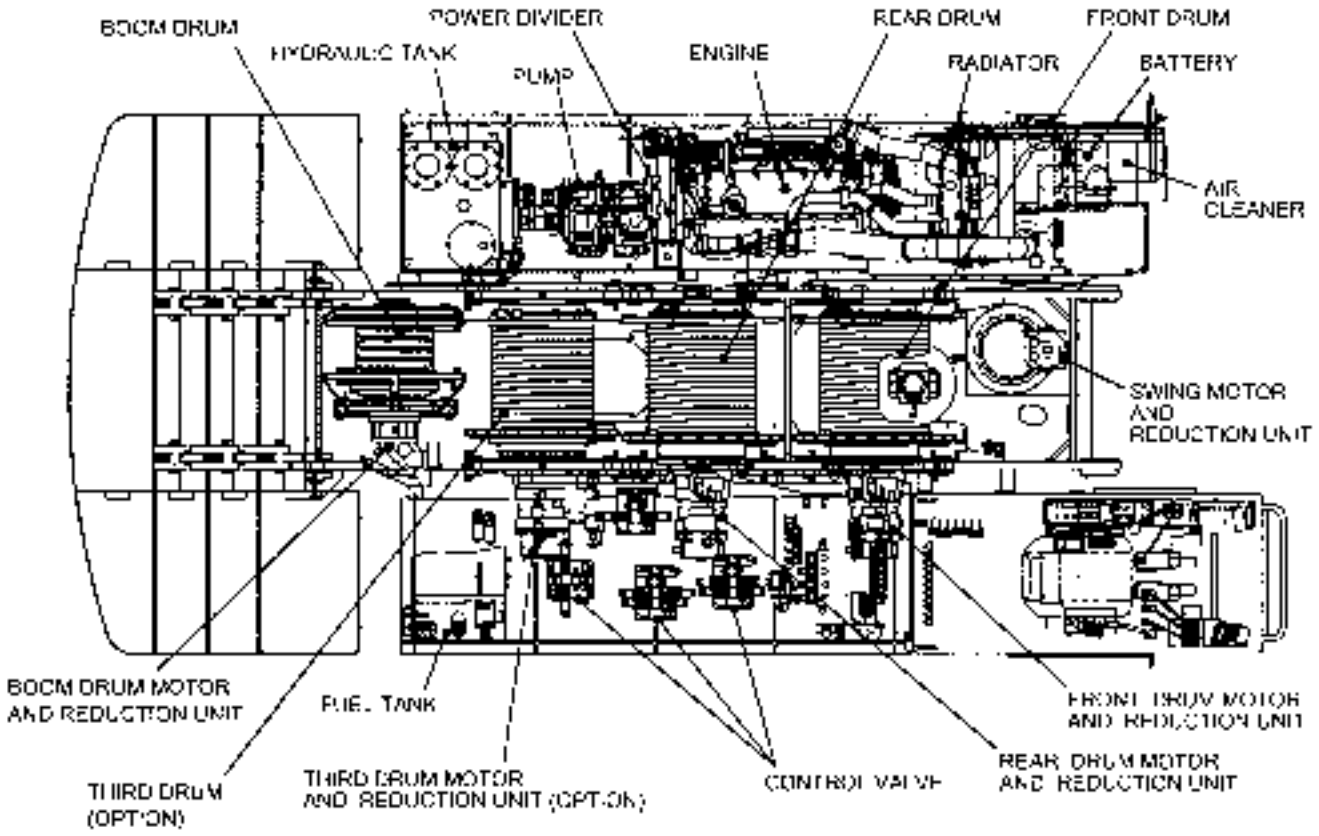


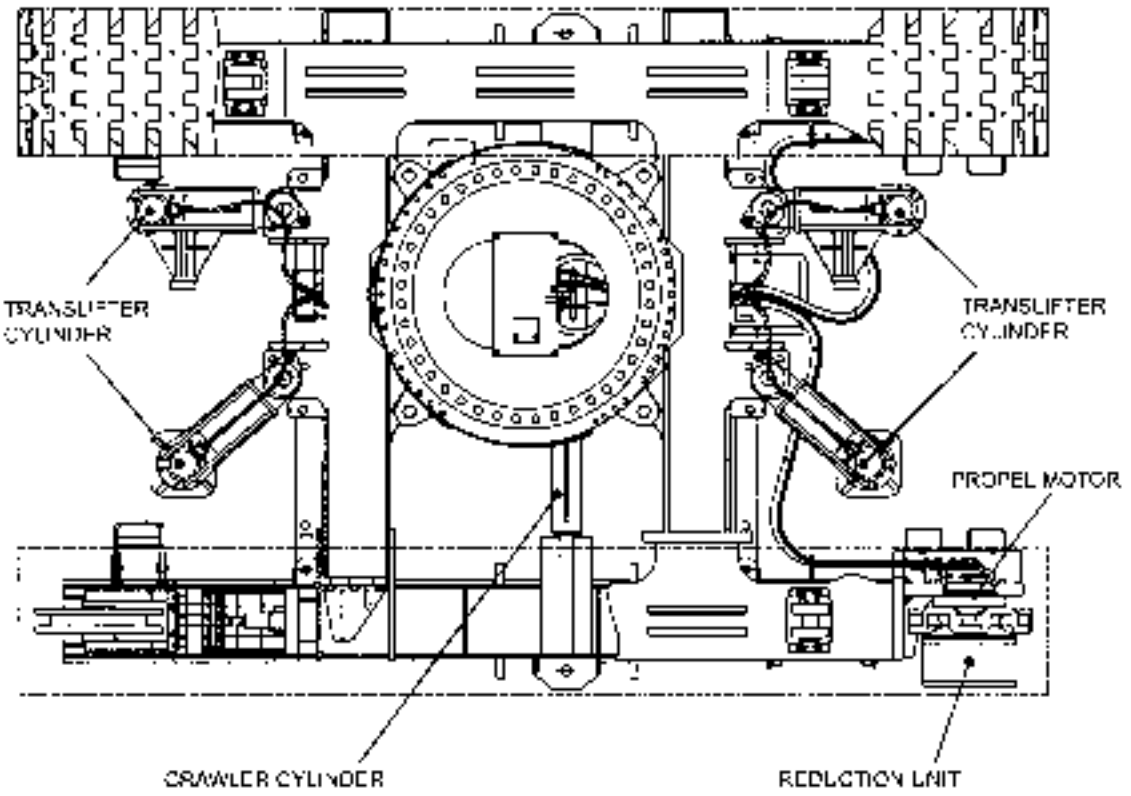
1. Element
2. Hub
3. Insert (A)
4. Insert (R)
5. Capscrew (M20 X 65)
6. Capscrew (M20 X 65)
7. Clamping screw (M20 X 25)
8. Spring pin
9. Shaft
10. Capscrew
11. Flywheel
12. Spring pin

5. HYDRAULIC SYSTEM

5.1 LOCATION OF MAIN HYDRAULIC COMPONENTS

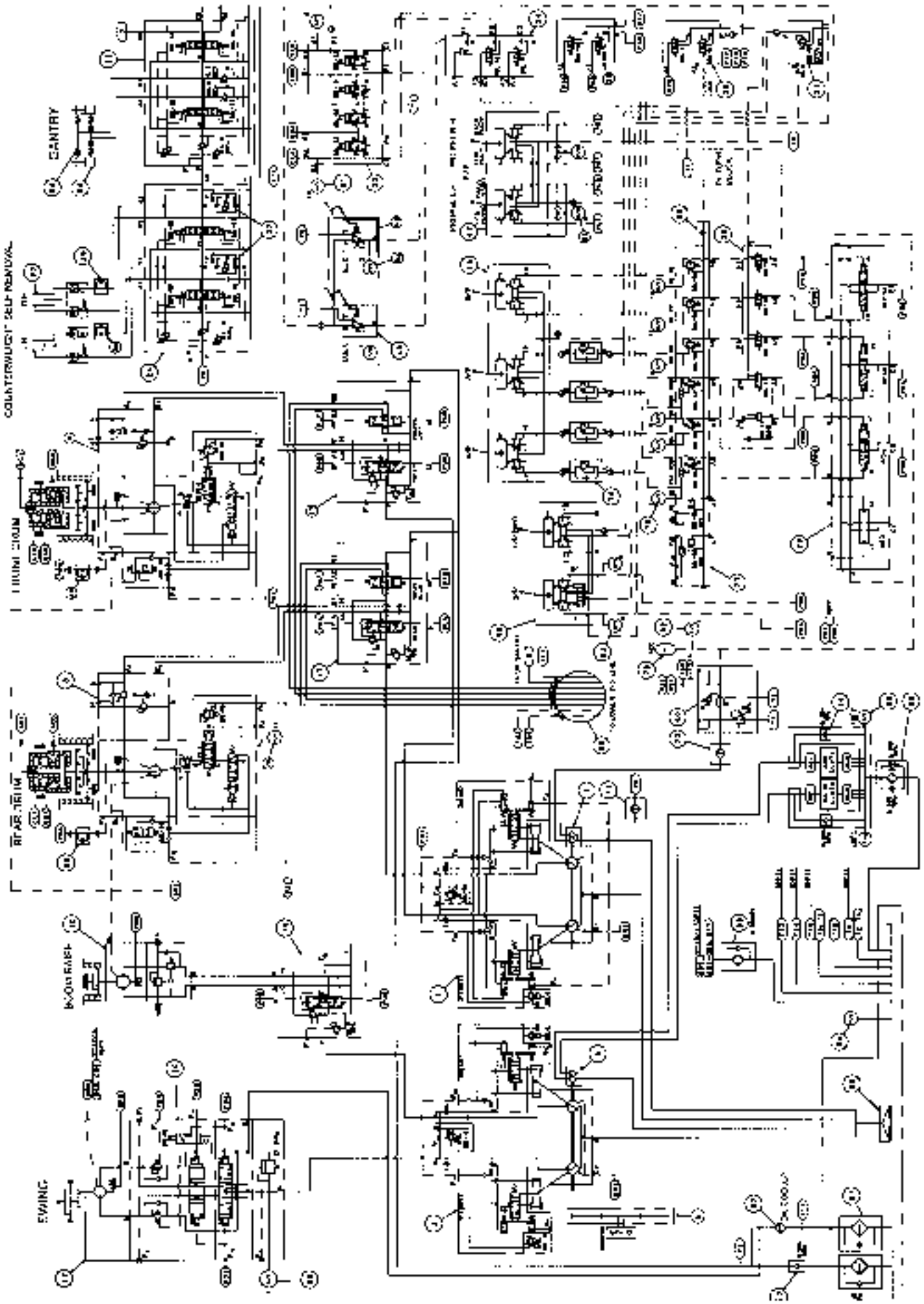
Location of Main Component

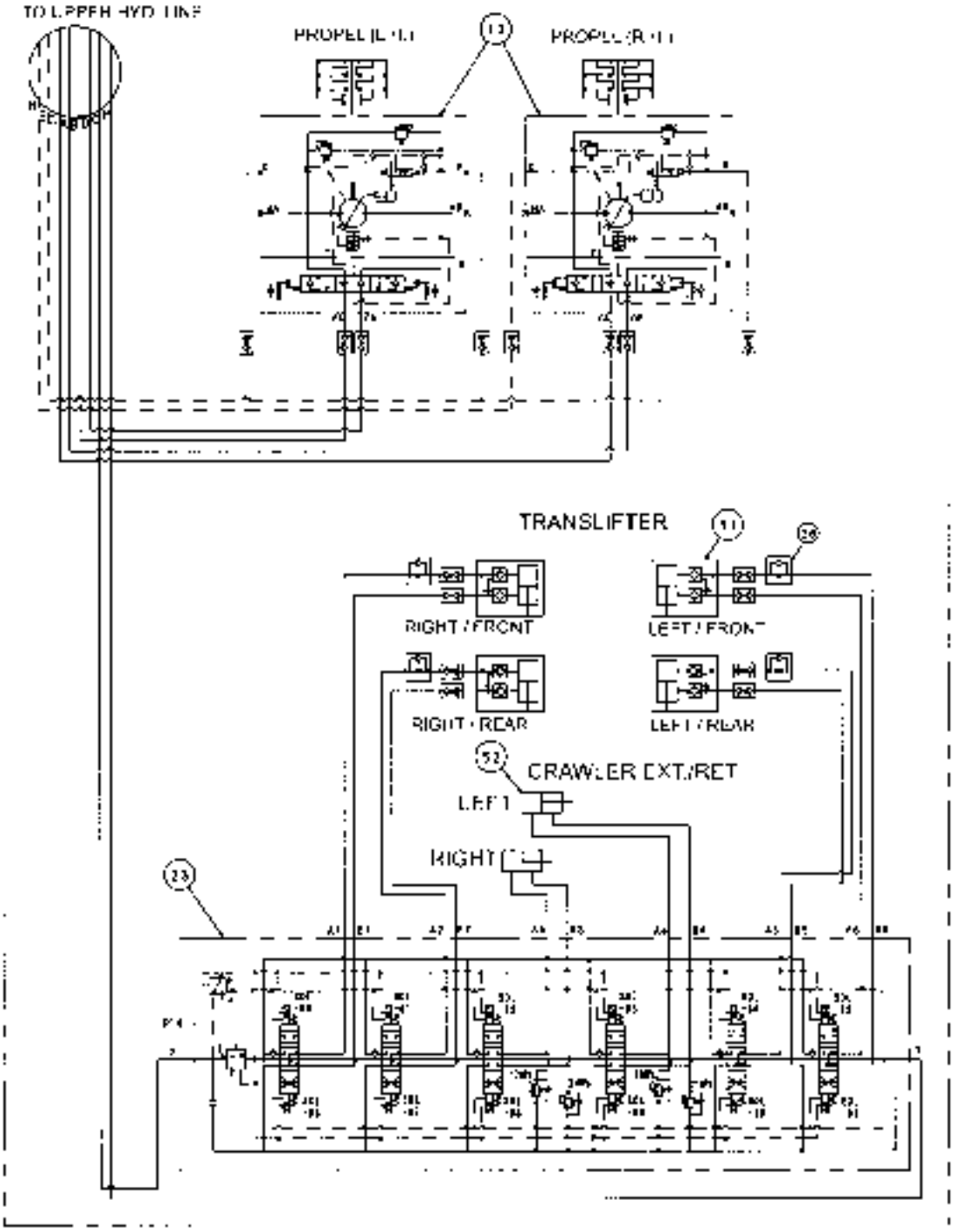


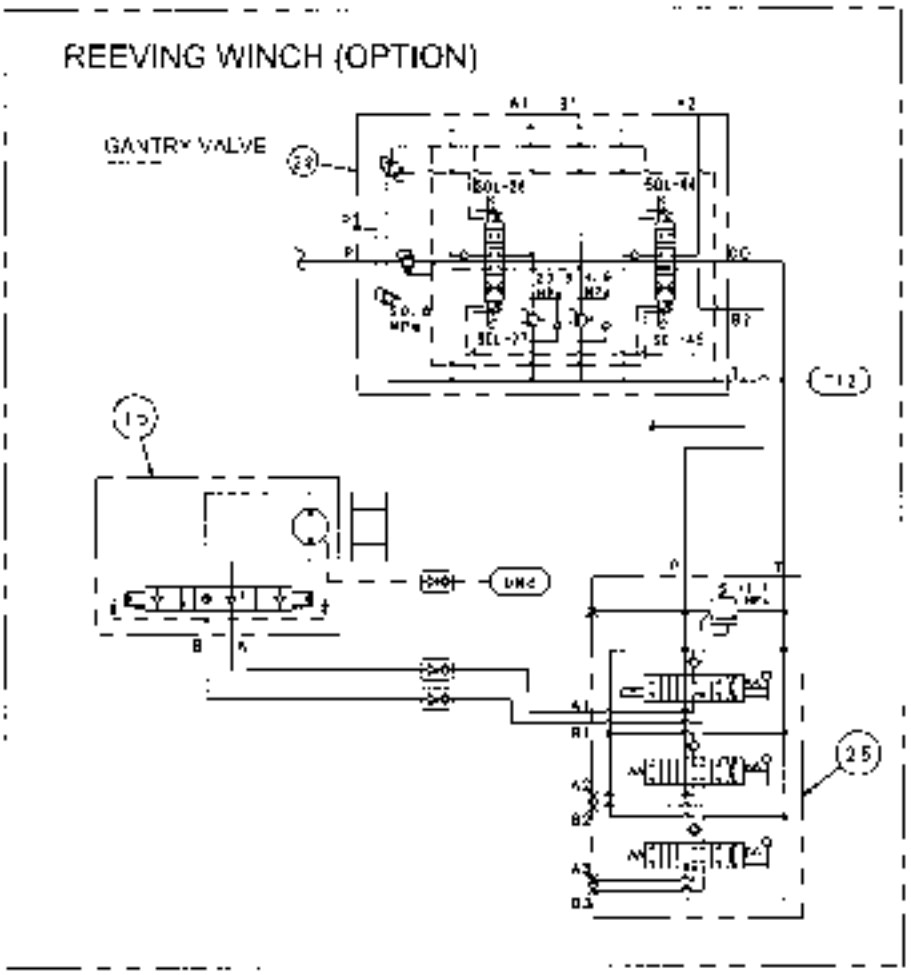


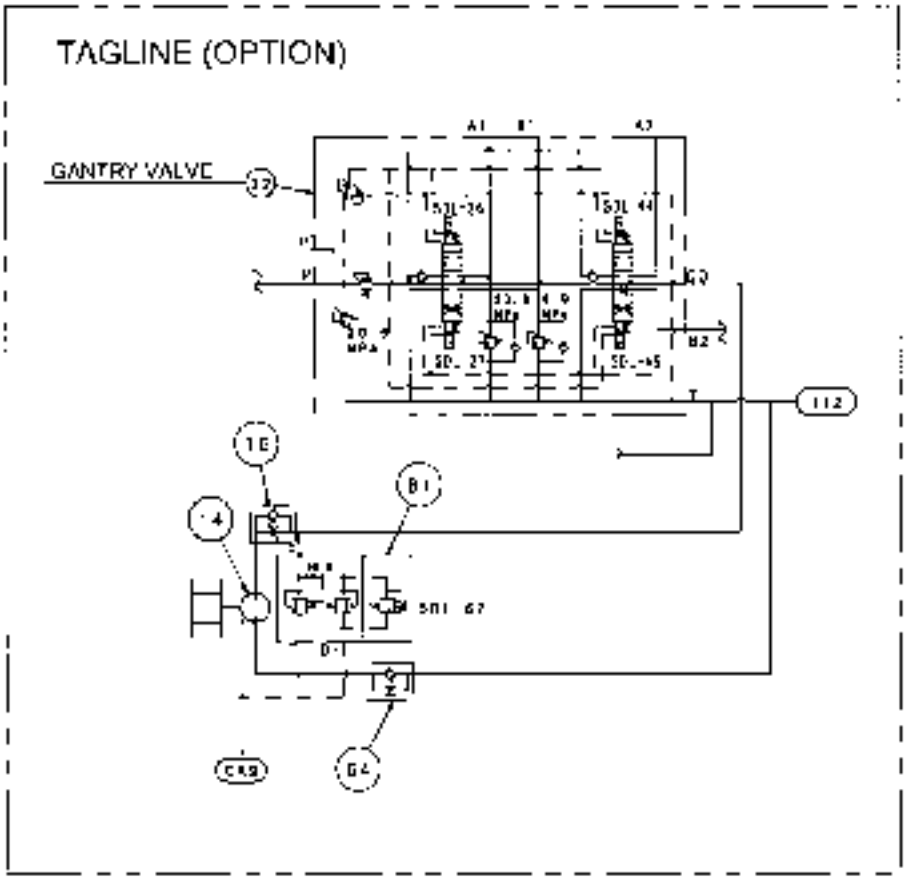
5.2 HYDRAULIC CIRCUITS AND COMPONENTS

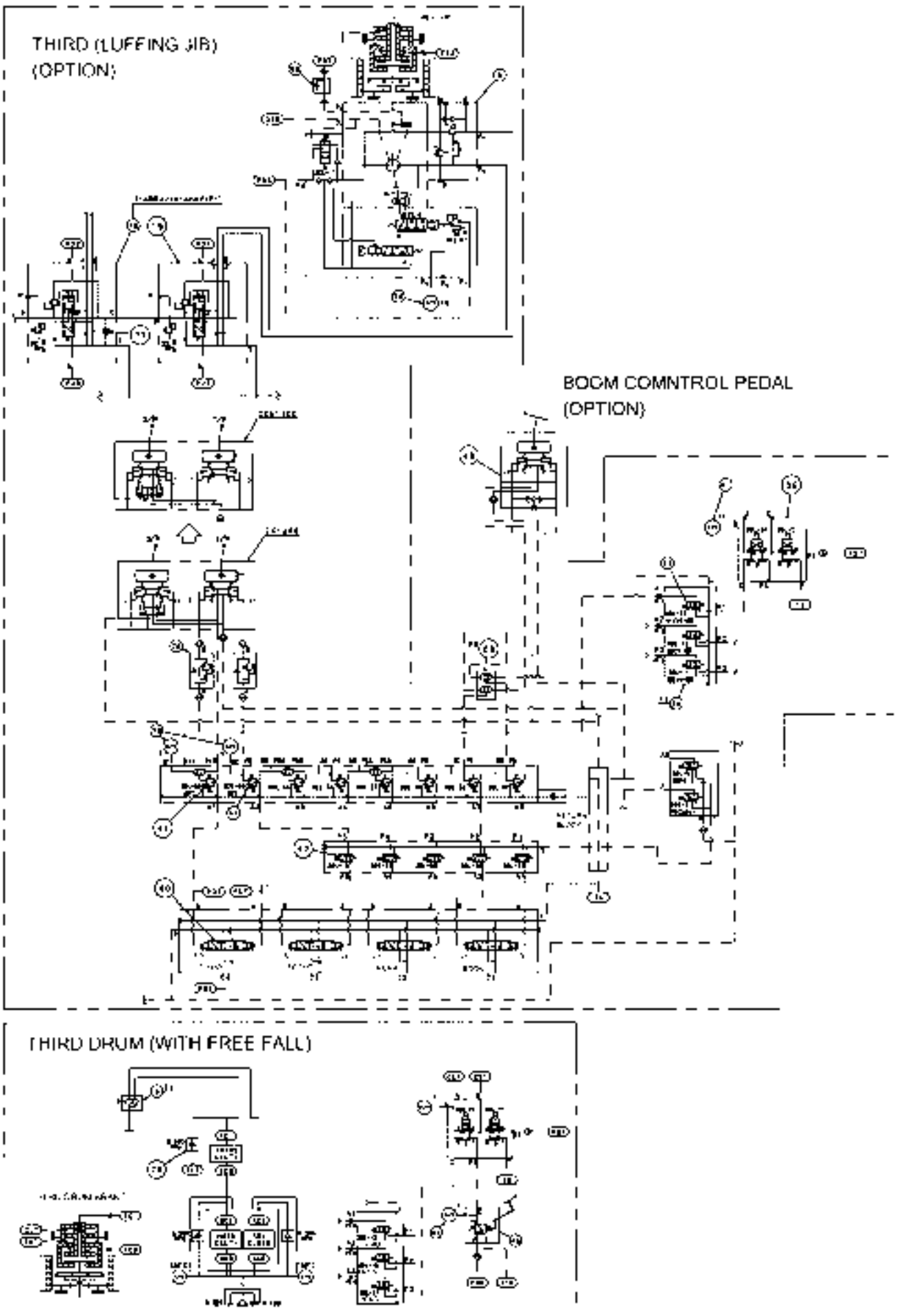
5.2.1 HYDRAULIC CIRCUIT











5.2.2 COMPONENT SPECIFICATIONS

Item	Name of Component	Specification		
1	Pump (Front & Rear Drum, Propel) [K3V112DT]	Swash Plate Type, Variable Capacity Max. Delivery : 252 ltr./min X 2 Max. Working Pressure : 31.9 MPa		
3	Pump (Swing / Boom) [K3V112DT]	Swash Plate Type, Variable Capacity		
			Swing	Boom
		Max. Delivery	175 ltr./min	252 ltr./min
		Max. Working Pressure	27.5 MPa	32.0 MPa
4	Gear Pump (Control / Aux. Actuator) [SD1A2718F2H1]		Control	Aux. Actuator
		Max. Delivery :	61 ltr./min	40 ltr./min
		Max. Working Pressure :	7.0 MPa	21.0 MPa
5	Gear Pump (Drum Brake Cooling) [SD1A3232F2H1] (OPTION)	Max. Delivery : 73 ltr./min X 2 Max. Working pressure : -		
8	Motor (Front & Rear Drum & Third or Jib) [M3B80BC]	Swash Plate Type, Variable Capacity Max. Oil Flow : 252 ltr./min Max. Working Pressure : 31.9 MPa		
10	Motor (Boom) [A2F250]	Bent Axis Type, Fixed Capacity Max. Oil Flow : 252 ltr./min Max. Working Pressure : 32.0 MPa		
12	Motor (Swing) [M2X210]	Swash Plate Type, Fixed Capacity Max. Oil Flow : 175 ltr./min Max. Working Pressure: 27.5 MPa		
13	Motor (Propel) [M3V260]	Swash Plate Type, Variable Capacity (2-Speed Type) Max. Oil Flow : 252 ltr./min Max. Working Pressure : 31.9 MPa		
14	Motor (Tagline) [2-080AF2-L] (OPTION)	Internal Trochoid Gear Type, Fixed Capacity Max. Oil Flow : 40 ltr./min Max. Working Pressure : 13.7 MPa		
15	Motor (Reeving) [TRCF44C] (OPTION)	Radial Plunger Type, Fixed Capacity Max. Oil Flow : 40 ltr./min Max. Working pressure : 12.7 MPa		
16	Flow Control Valve (Tagline) [FDCB] (OPTION)	Max. Oil Flow : 40 ltr./min		
17	Control Valve (Front & Rear Drum, Propel) [MWP225]	Max. Oil Flow : 252 ltr./min Set Pressure : 31.9 MPa		
18	Control Valve (Boom) [MWP125]	Max. Oil Flow : 252 ltr./min Set Pressure : 32.0 MPa		
19	Control Valve (Third or Jib) [MWP125] (OPTION)	Max. Oil Flow : 252 ltr./min Set Pressure : 32.0 MPa		
20	Control Valve (Swing) [KSC19L]	Max. Oil Flow : 175 ltr./min Set Pressure : 27.5 MPa		

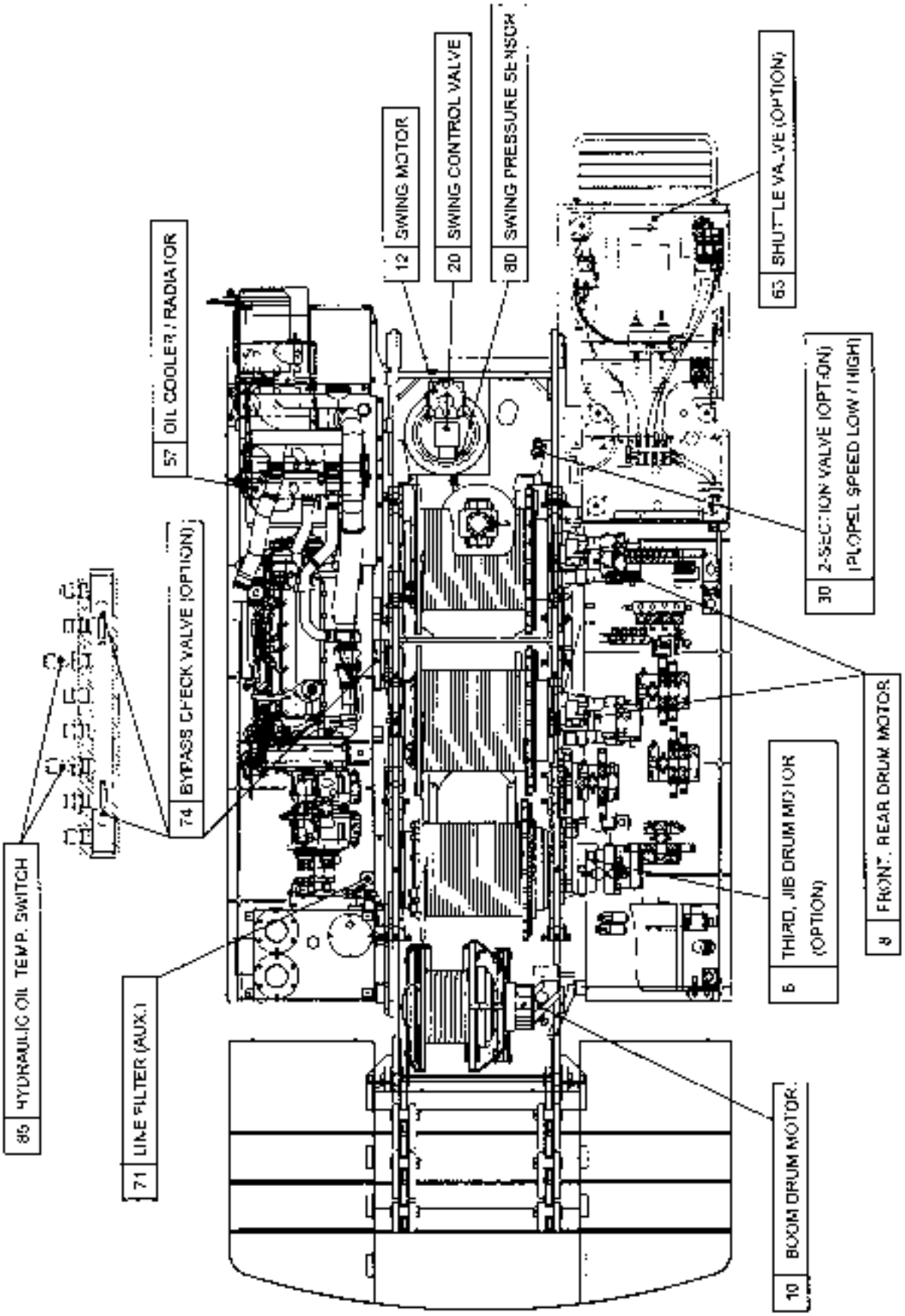
Item	Name of Component	Specification
22	Control Valve (Gantry & Circuit-change) [KMC10-2]	Max. Oil Flow : 40 ltr./min Set Pressure : 20.6 MPa
23	Control Valve (Translifter) [KMC10-6]	Max. Oil Flow : 40 ltr./min Set Pressure : 20.6 MPa
24	Control Valve (Counter-Weight Removal) [KMC10-2]	Max. Oil Flow : 40 ltr./min Set Pressure : 21.0 MPa
25	Control Valve (Boom Foot Pin & Reeving) [SC3A-3] (OPTION)	Max. Oil Flow : 40 ltr./min Set Pressure : 12.7 MPa
27	8-Section Valve (Automatic Stop & Speed Adjusting)	3rd.(Jib) Drum Lower Control Press. Reduce (OPT.) 3rd.(Jib) Drum Hoist Control Press. Reduce (OPT.) Fr. Drum Lower Control Press. Reduce Fr. Drum Hoist Control Press. Reduce Re. Drum Lower Control Press. Reduce Re. Drum Hoist Control Press. Reduce Boom Lower Control Press. Reduce Boom Raise Control Press. Reduce
28	5- Section Valve (Limit Stop)	Boom Raise Stop (No.2) Boom Lower Stop (No.2) Re. Drum Hoist Stop (No 2) Fr. Drum Hoist Stop (No 2) 3rd(Jib) Drum Hoist Stop (No.2) [OPT.]
29	4 Section Valve (Motor Negative Brake)	Fr. Drum Motor Parking Brake Re. Drum Motor Parking Brake Boom Drum Motor Parking Brake 3rd.(Jib) Drum Motor Parking Brake [OPT.]
30	2 Section Valve	Function Lock / Swing Parking Brake Swing Pressure Changeover / Propel Speed Changeover
31	1-Section Valve	Swing Reaction
33	4-Section Valve (Free Fall Changeover) (OPTION)	Re. Drum Clutch On/Off Re. Drum Emergency Stop Fr. Drum Emergency Stop Re. Drum Clutch On/Off
34	3-Section Valve (Free Fall Acceleration) (OPTION)	Fr. Drum Free Fall Acceleration Re. Drum Free Fall Acceleration 3rd. Drum Free Fall Acceleration
37	Port Relief valve	-
38	Slow Return Check Valve	-
39	2-Section Valve (Free Fall Changeover) (OPTION)	3rd. Drum Clutch On/Off 3rd. Drum Emergency Stop
40	Pilot Valve (3rd. Motor Negative Brake) (OPTION)	3rd.(Jib) Drum Motor Parking Brake
41	Solenoid Valve (3rd. Automatic Stop & Speed Adjusting) (OPTION)	3rd.(Jib) Drum Lower Control Press. Reduce 3rd.(Jib) Drum Hoist Control Press. Reduce
42	Solenoid Valve (3rd. Limit Stop) (OPTION)	3rd.(Jib) Drum Hoist Stop (No.2)

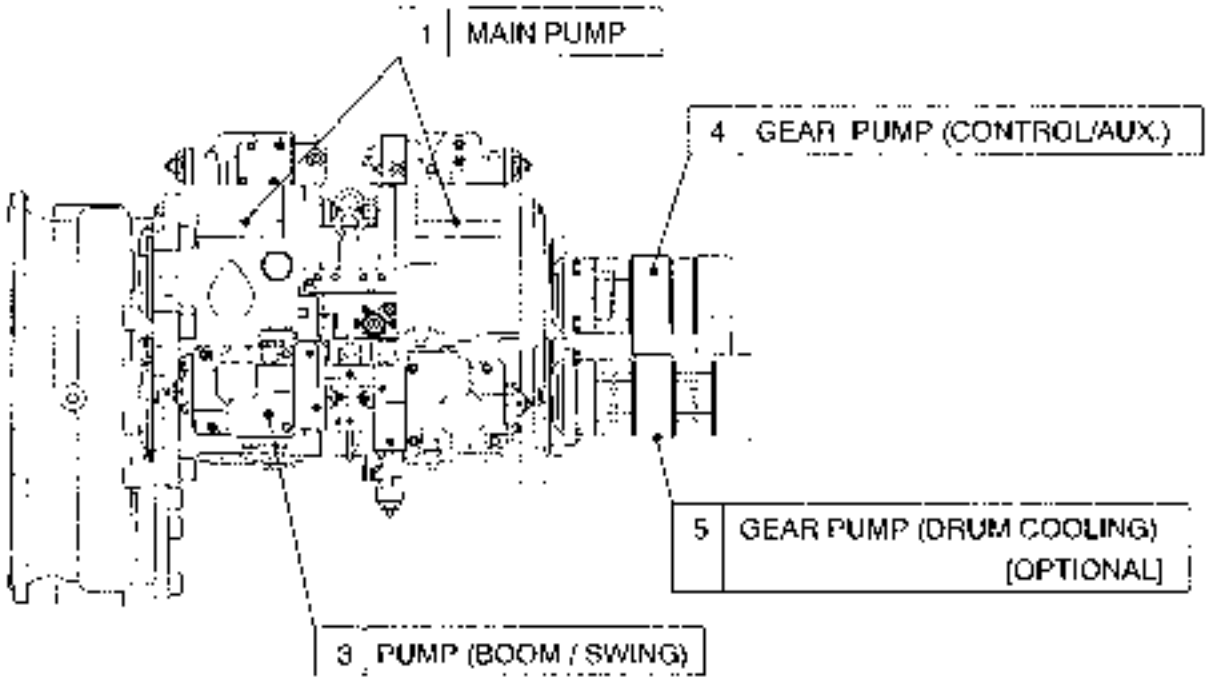
Item	Name of Component	Specification
45	Remote Control Valve	Fr Drum Re Drum Boom
46	Remote Control Valve	Swing 3rd Drum (Jib) [OPT]
47	Remote Control Valve	Propel
48	Brake Master Valve (OPTION)	Foot Brake
49	Remote Control Valve (OPTION)	Boom Control Pedal
51	Cylinder (Translifter)	Φ 140 / Φ 110 X 700 Pressure : 20.6 MPa
52	Cylinder (Crawler Removal)	Φ 160 / Φ 75 X 1246 Pressure : 17 MPa / 20.6 MPa
53	Cylinder (Counter-Weight Removal)	Φ 90 / Φ 45 X 631 Pressure : 21.0 MPa / 10.0 MPa
54	Cylinder (Gantry)	Φ 100 / Φ 50 X 480 Pressure 20.6 MPa / 4.9 MPa
57	Oil Cooler / Radiator	-
58	Swivel Joint (Gantry Cylinder)	1 Port G3/8 (PF 3/8)
59	Swivel Joint	8 Port A : Propel (R.H.) Backward B : Propel (L.H.) Backward C : Propel (R.H.) Forward D : Propel (L.H.) Forward F : Propel Speed F : Return (To Tank) G : Aux. Actuator H : Drain
60	Valve Block (Relief Valve & Reduction Valve)	Control Relief Pressure : 7.0 MPa Reducing Pressure : 5.4 MPa
61	Relief Valve (Tagline) (OPTION)	Tagline Inversely Proportional Solenoid Operated
63	Shuttle Valve (OPTION)	2-Section Boom (or Jib) remote control
64	Slow Return Check Valve (OPTION)	Tagline (OPT) Back Pressure Valve
65	Slow Return Check Valve	Drum Motor Parking Brake Control
66	Suction Strainer	80 Mesh 6,720 cm³
67	Return Filter	ϕ10 ± 8 15,000 cm³
68	Return Filter (Drum Cooling Circuit) (OPTION)	10 μ (Norminal) 7,230 cm³
69	Drain Filter	10 μ (Norminal) 2,000 cm³
70	Line Filter (Control)	149 μ (Norminal) [100 Mesh] 370 cm³
71	Line Filter (Aux. Actuator)	149 μ (Norminal) [100 Mesh] 380 cm³
73	Check Valve (Oil Cooler)	Bypass Valve Bypass Pressure : 0.294 MPa

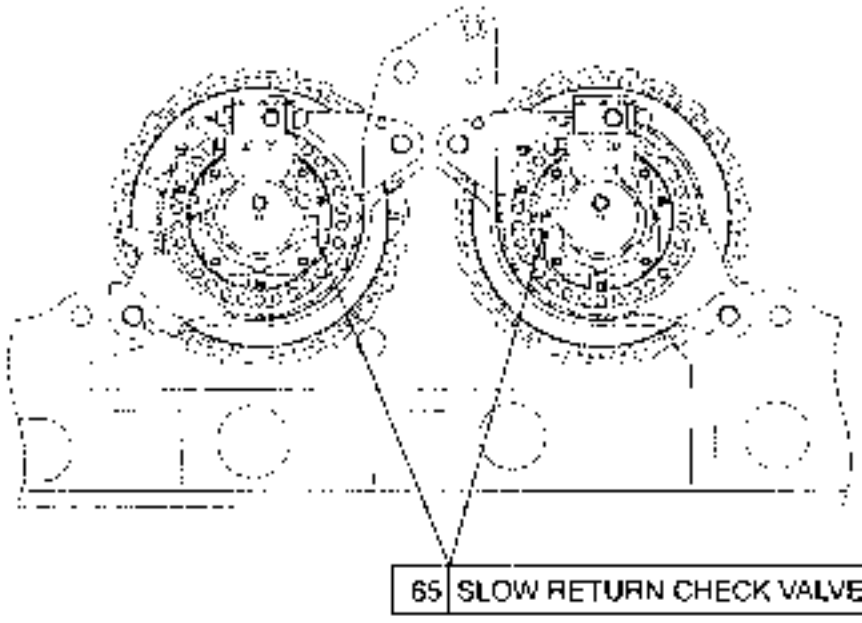
Item	Name of Component	Specification
74	Check Valve (Fr. & Re. Drum Cooling Circuit) (OPTION)	Bypass Valve Bypass Pressure : 0.294 MPa
75	Check Valve (3rd. Drum Cooling Circuit) (OPTION)	Bypass Valve Bypass Pressure : 0.49 MPa
76	Accumulator	Gas : N_2 Gas capasity : 2900 cc Gas Set Pressure : 3.4 to 3.7 MPa
77	Plug (OPTION)	For Carry Over
78	Flow Control Valve (Remote Contrl.)	Remote Control Circuit
79	Pressure Sensor	Remote Control Pressure Detect
80	Pressure Sensor	Swing Pressure Detect
81	Pressure Sensor (OPTION)	Winch Clutch Pressure Detect
82	Pressure Switch	Control Pressure Foot Brake Pressure [OPT.]
83	Pressure Switch	Remote Control Pressure Swing Propel
84	Hyd. Oil Temperature Switch (For Hyd. Oil Tank)	90°C
85	Hyd. Oil Temperature Switch (For Drum Cooling Circuit) (OPTION)	130°C
86	Check Valve	Control Return Line Protect From Back-Pressure-Serge

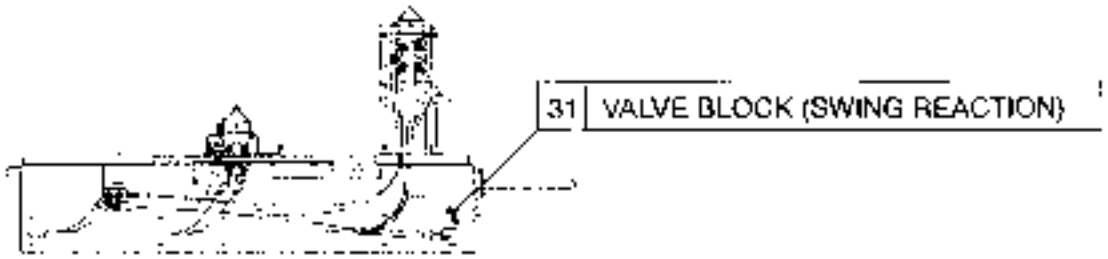
5.2.3 LOCATION OF HYDRAULIC COMPONENTS

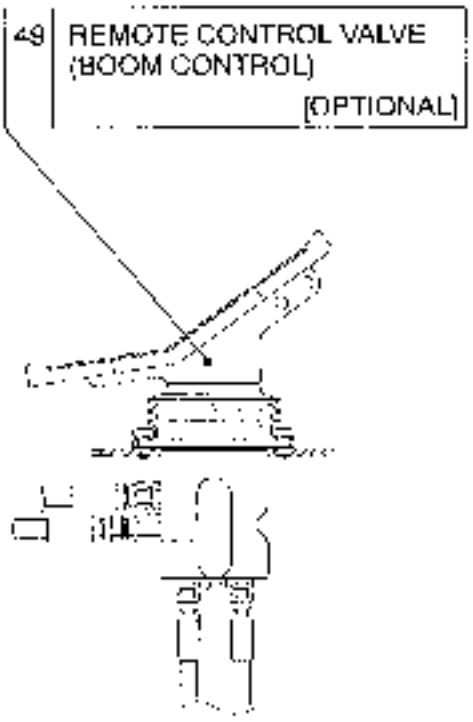
The item numbers in figure are linked with the item number in the hydraulic circuit diagrams and 5.2.2 COMPONENT SPECIFICATIONS



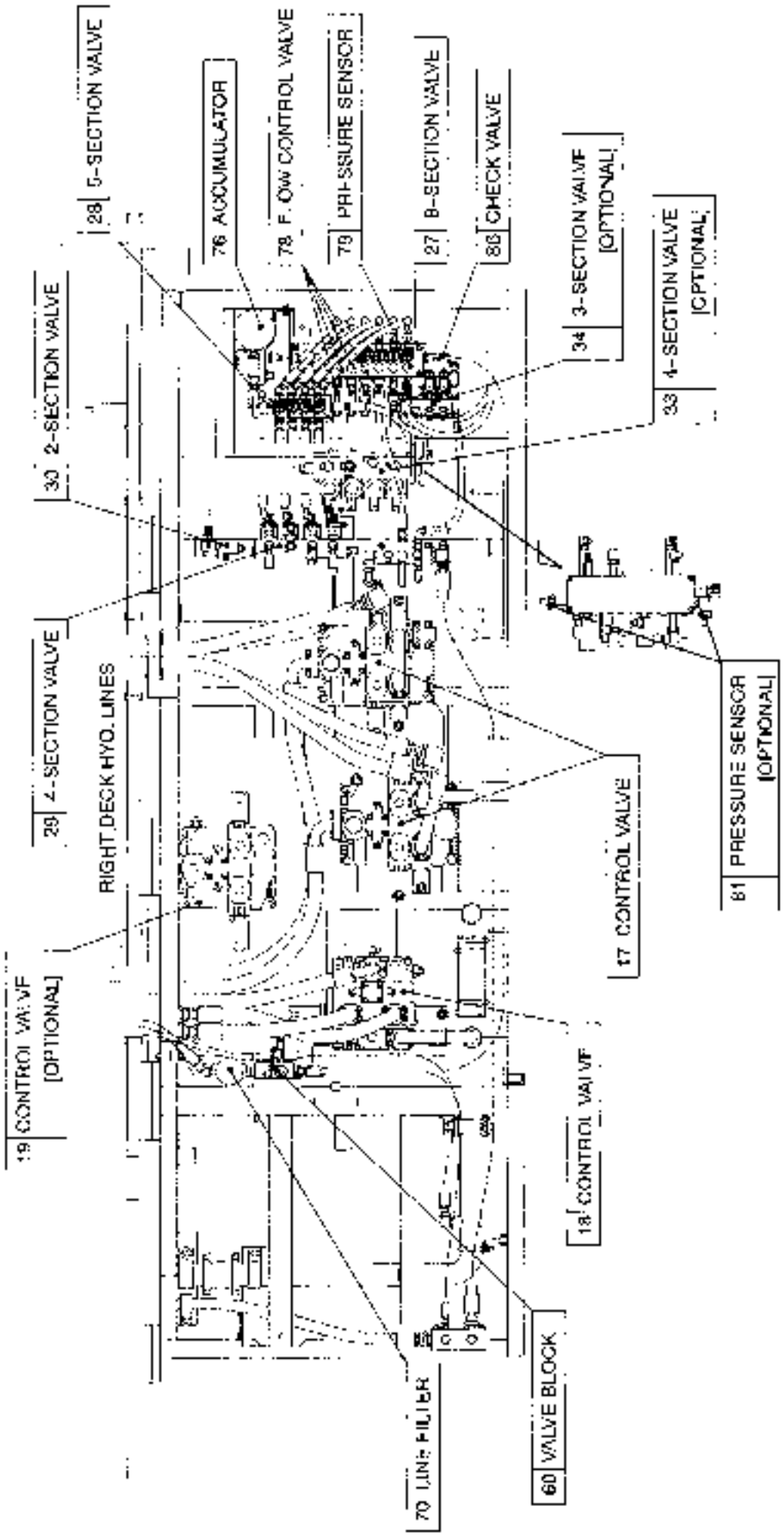


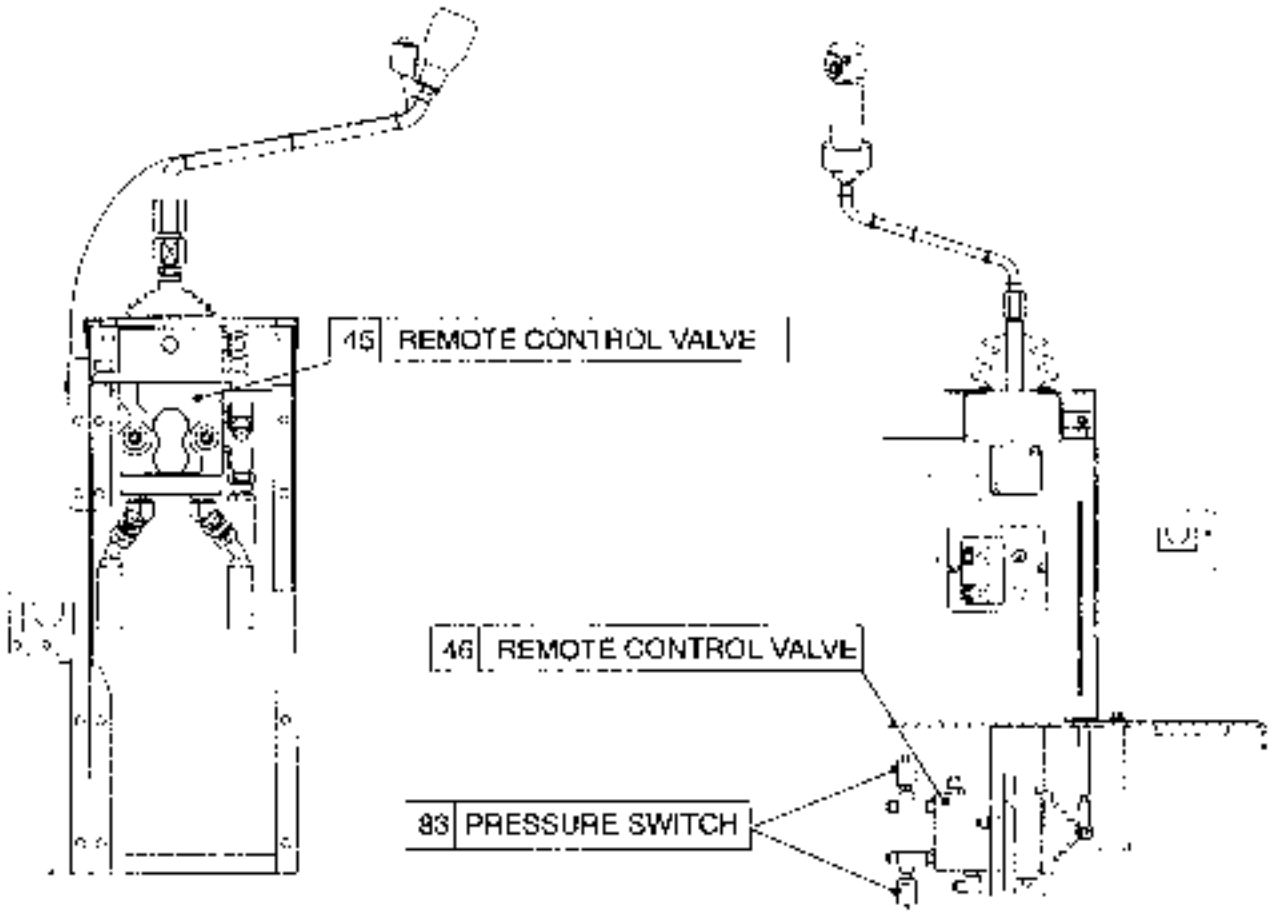






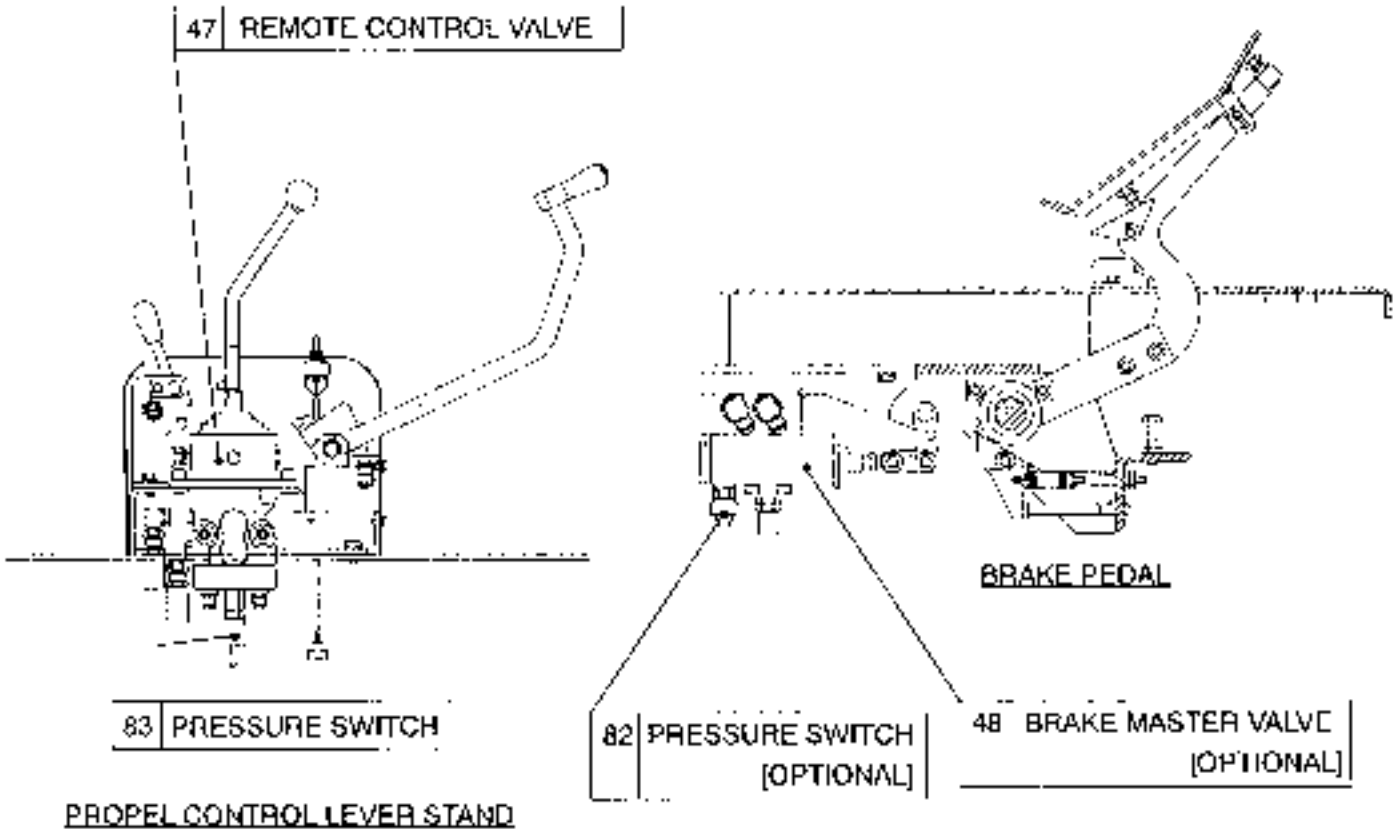
BOOM CONTROL PEDAL





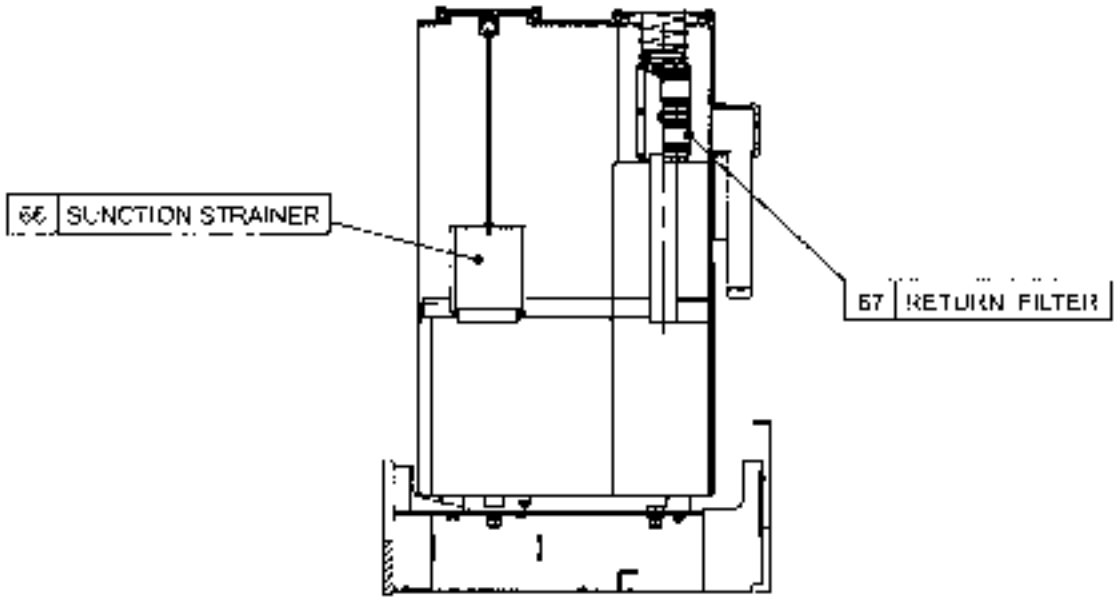
RIGHT SIDE LEVER STAND

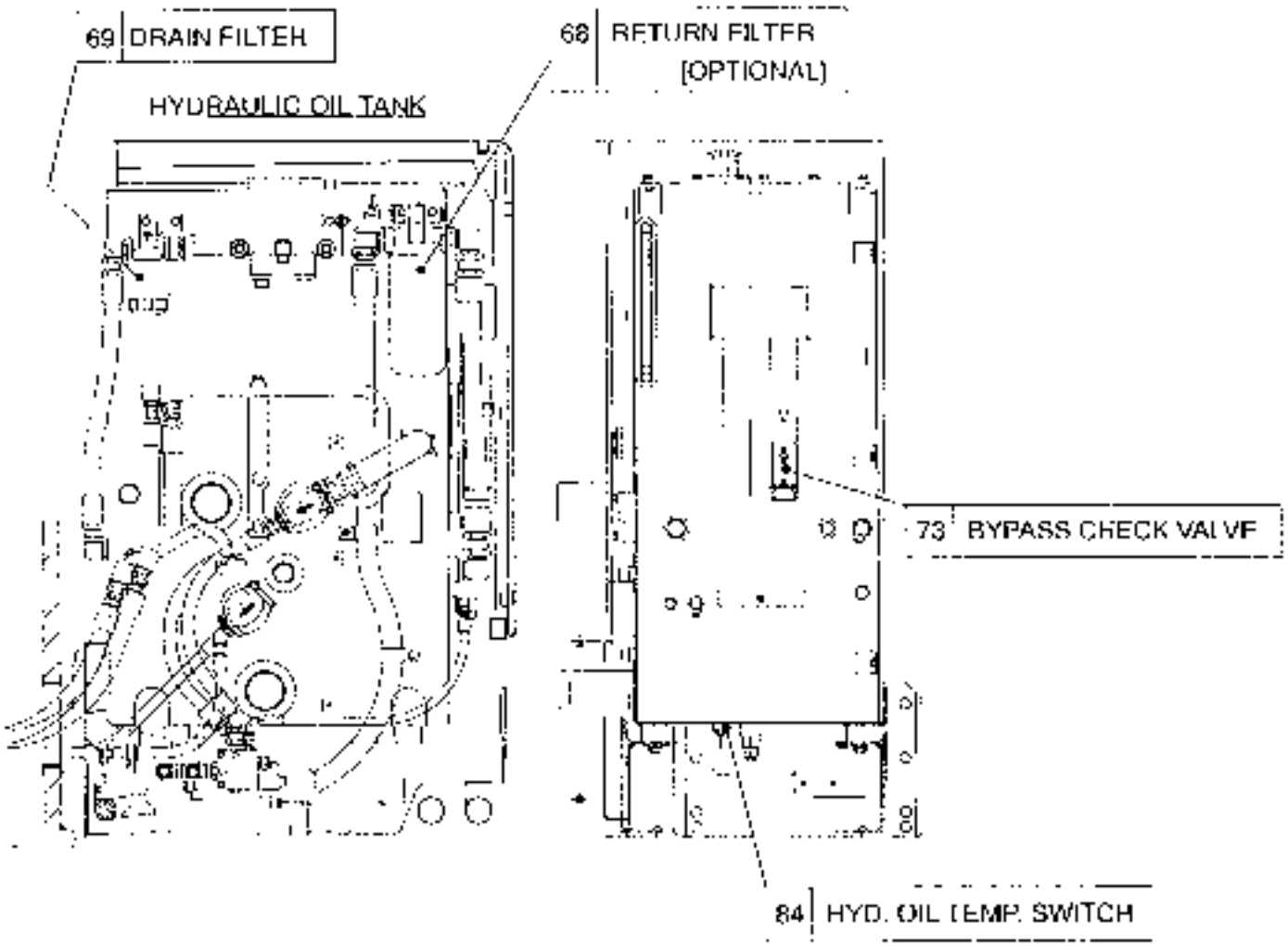
LEFT SIDE LEVER STAND

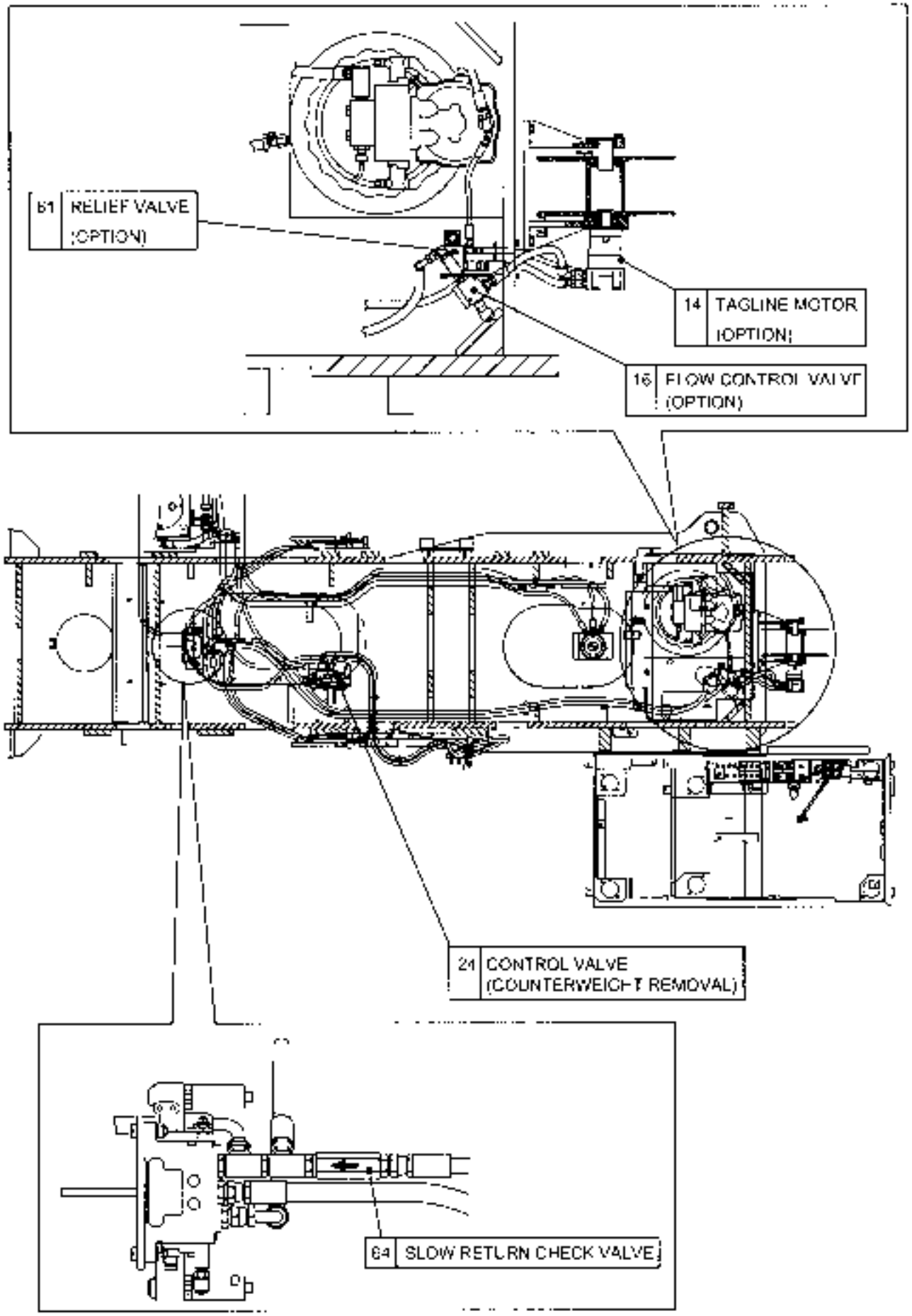


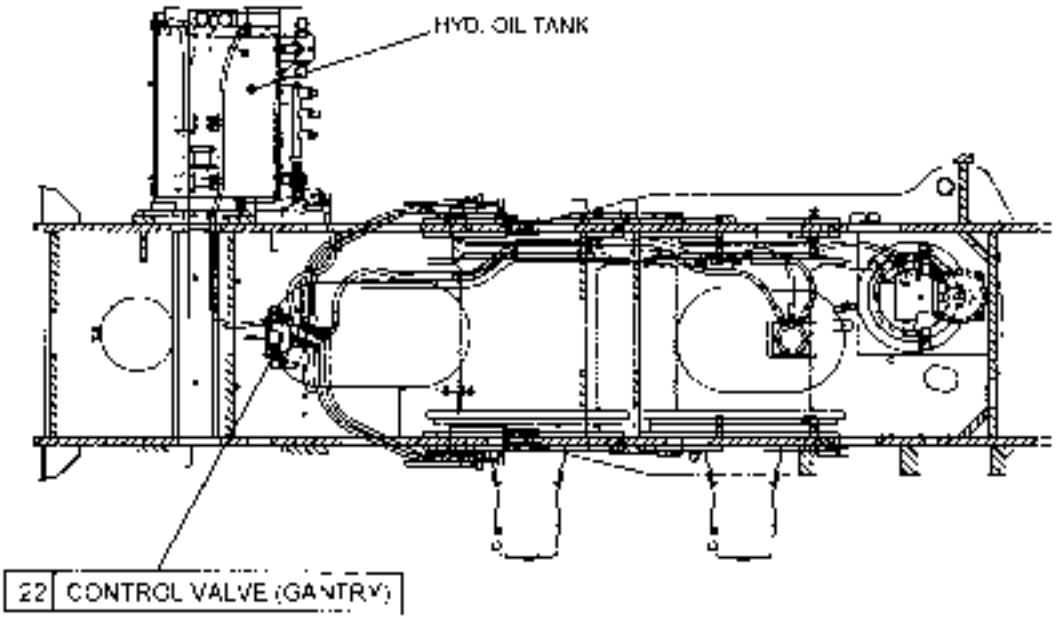
PROPEL CONTROL LEVER STAND

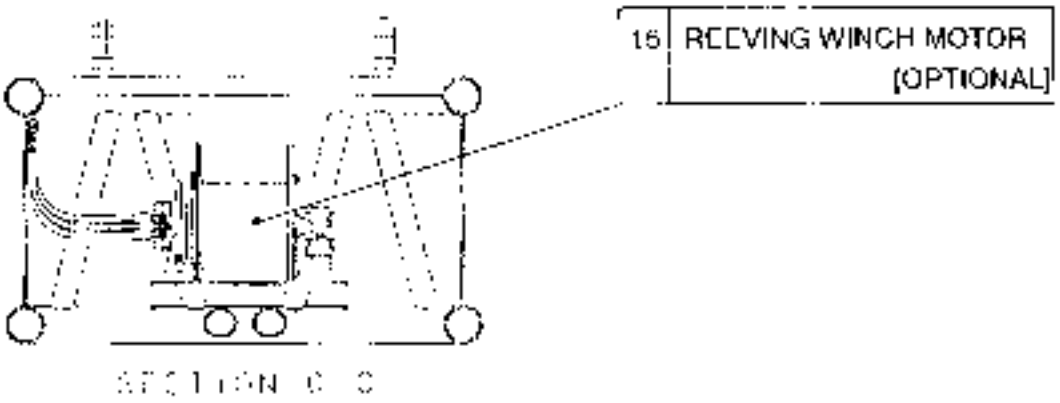
BRAKE PEDAL

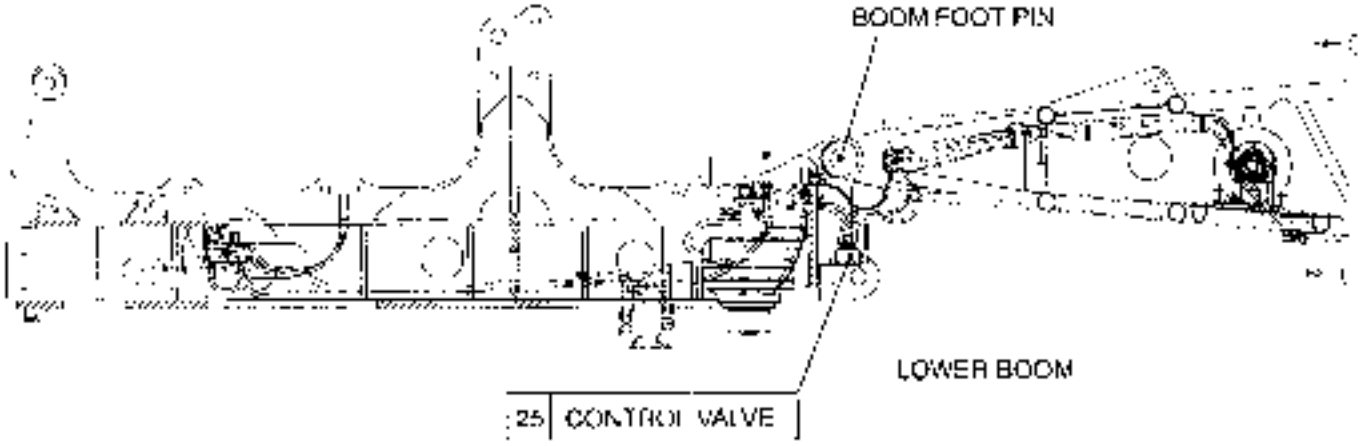


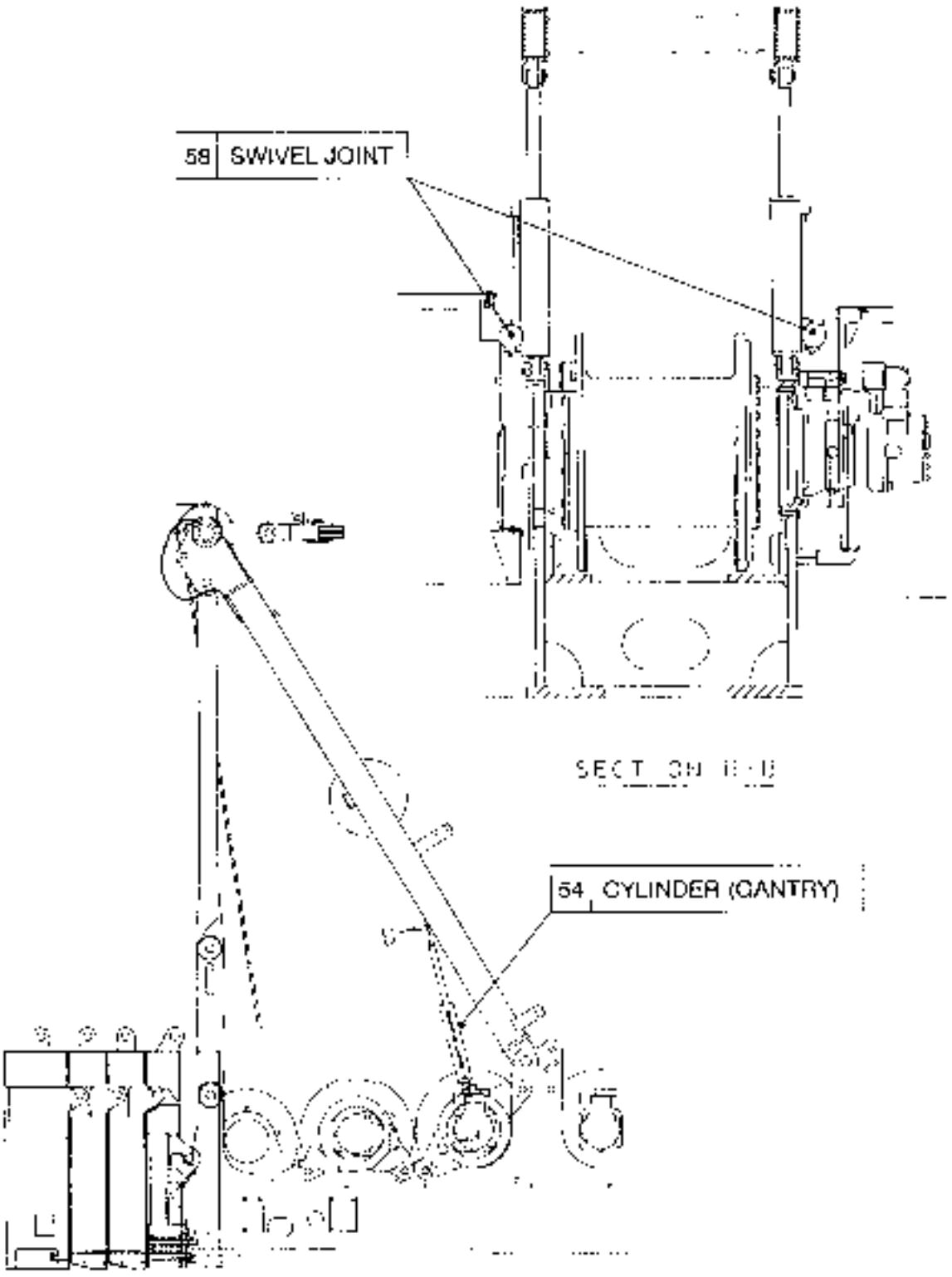


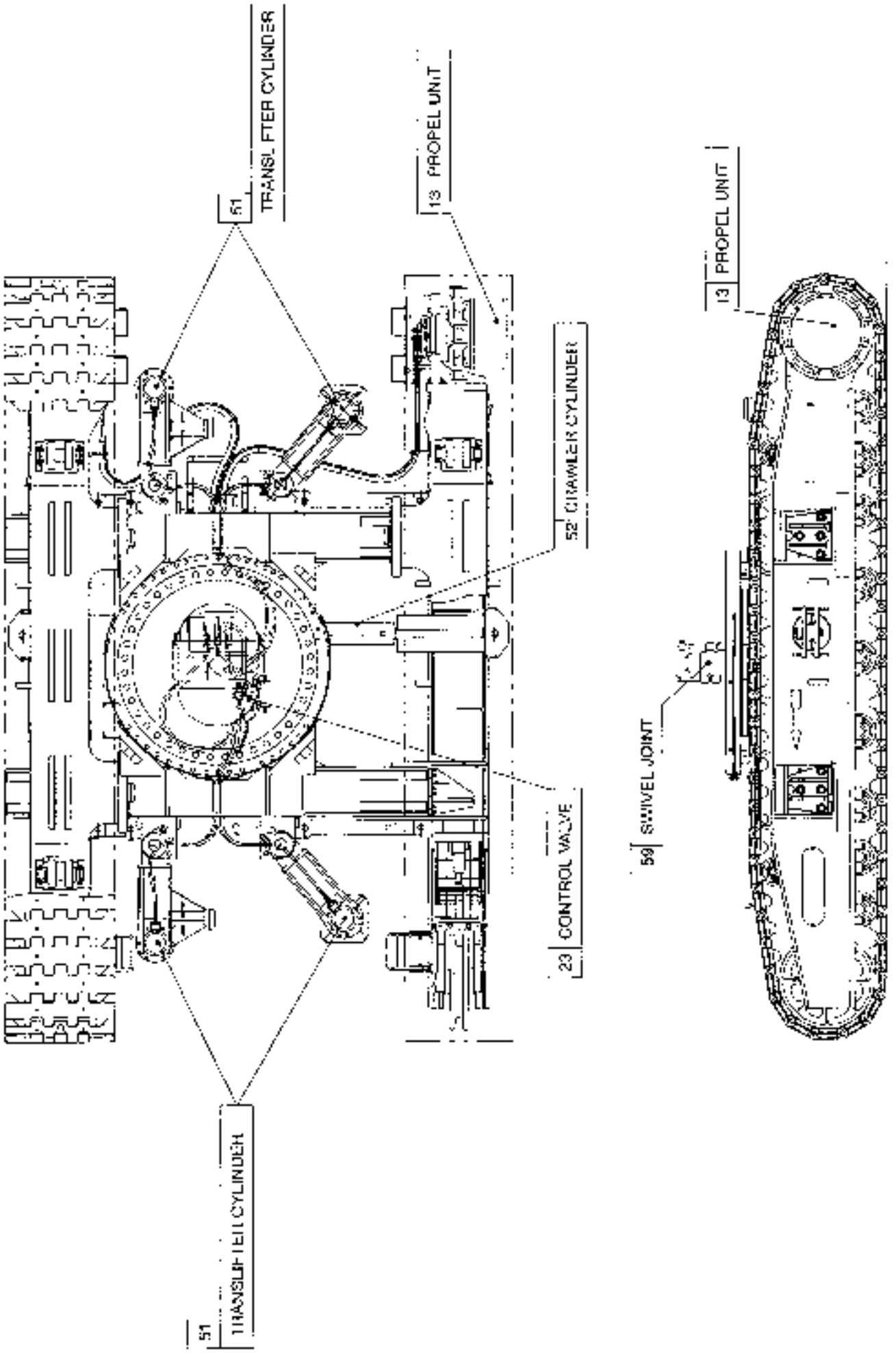












5.3 HYDRAULIC SYSTEM

5.3.1 PREFACE

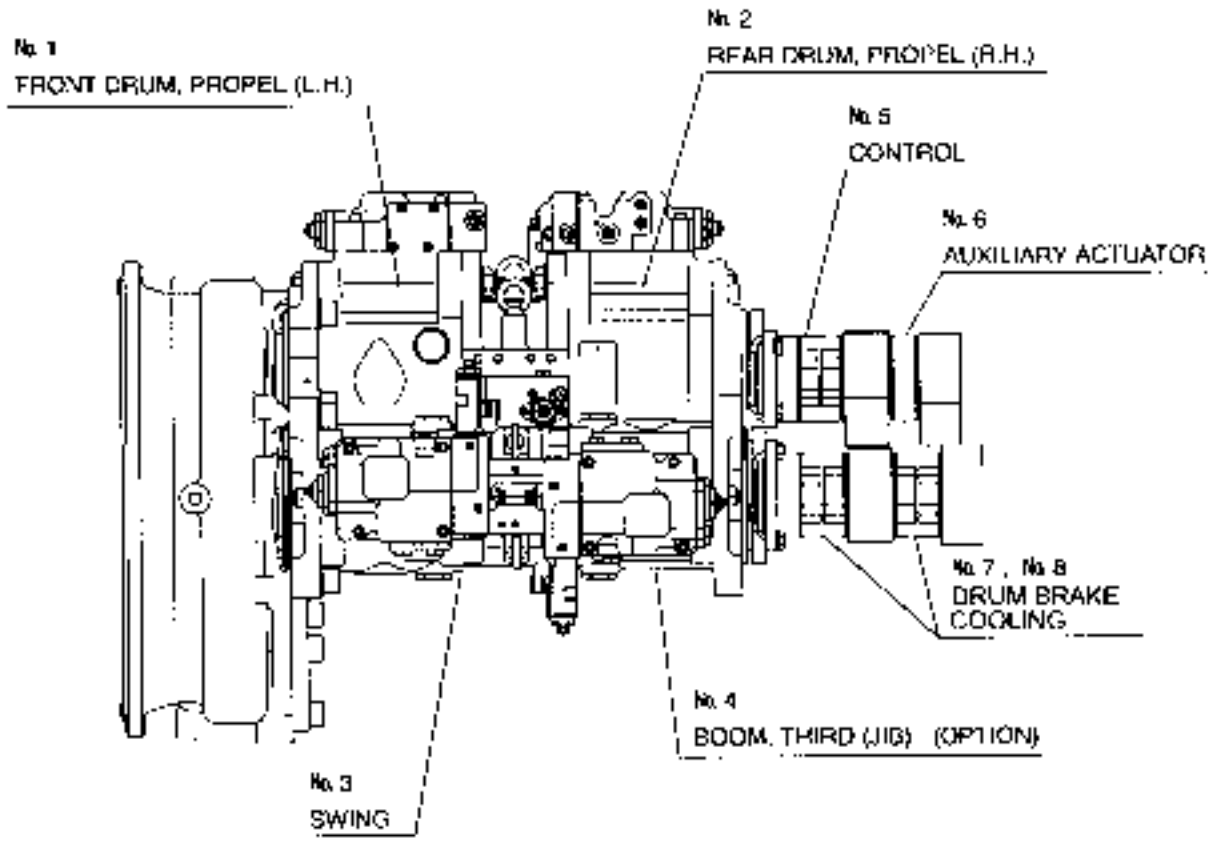
This chapter provides a general outline of the overall hydraulic system. For more detailed explanations of each circuit, please refer to the specific sections relating to each systems.

5.3.2 OUTLINE

The pressurized hydraulic oil flowing through these circuits is supplied by eight pumps (four variable displacement, four fixed gear) installed on the power divider mounted directly on the engine. The tandem-mounted variable displacement double pump (main pump) power the front and rear drums, and the propel system. The other variable displacement double pump, power the swing system and the boom drum.
The gear pumps directly connected to the tandem pluger type pumps are provided for control, auxiliary actuator and drum brake cooling system.

Note

The gear pump for drum cooler is optional (with option with free fall).



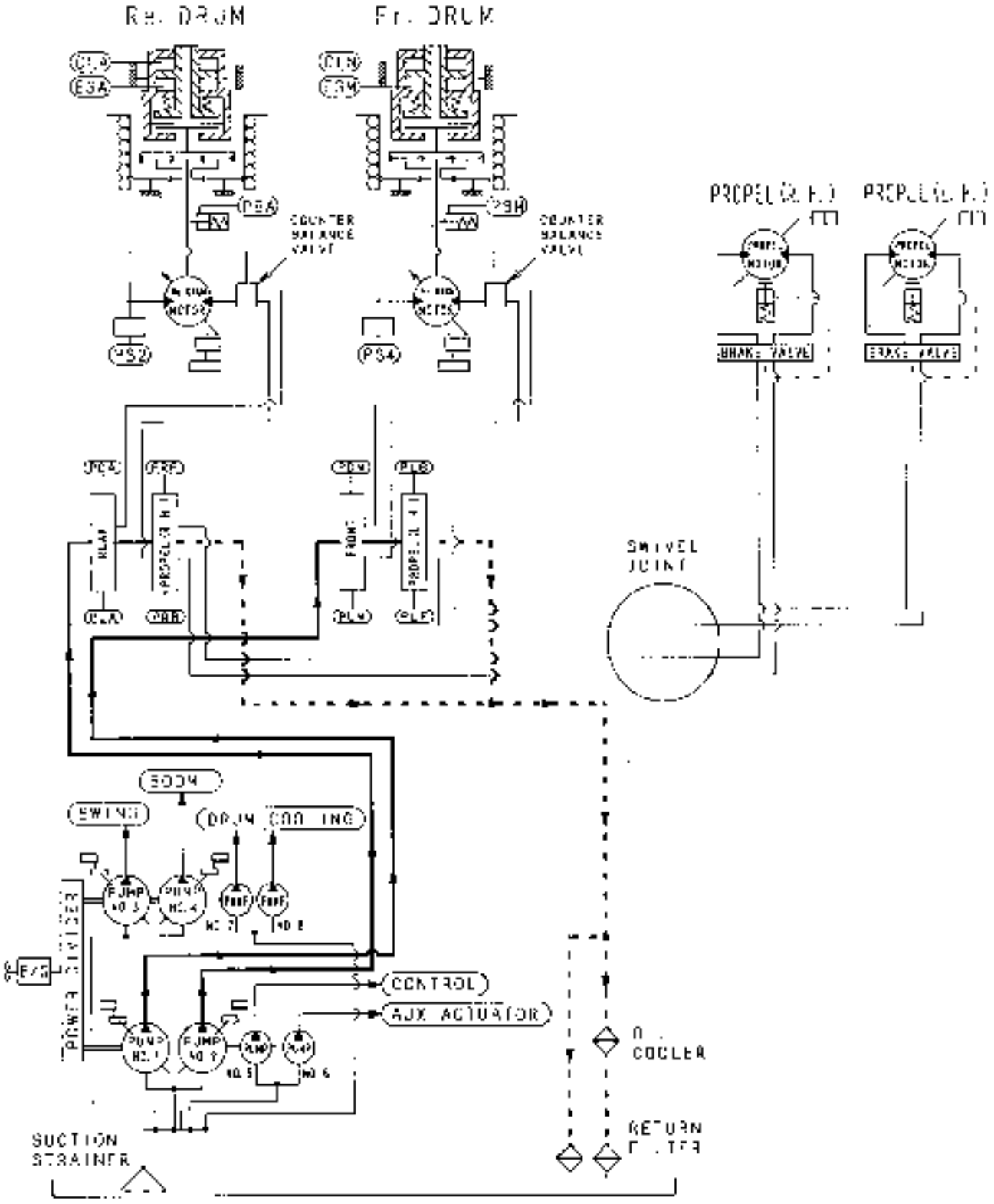
5.3.3 OIL FLOW FROM No.1 and No. 2 PUMPS

These are tandem mounted, variable capacity pumps.

The pressurized oil from the No 1 pump flows through the 2-sectioned control valve for the L. H. propel, front drum circuits, while the oil from the No.2 pump flows through the 2-sectioned control valve for R. H. propel, rear drum circuits. In neutral, the flow from each pump passes through its respective control valve and returns freely to the oil tank However, when one of the control valve spools is moved by oil pressure from its remote control valve, then the oil flow from the pump is directed toward the targetted actuator.

When the "Inching Speed" switch installed to the boom control lever in the operator's cab is used, this activates the inching speed solenoid on the pump's regulator which minimizes the discharge rate of oil from that pump

Oil Flow From No.1 and No.2 Pumps



5.3.4 OIL FLOW FROM No.3 AND No.4 PUMPS

This is also a variable capacity pump

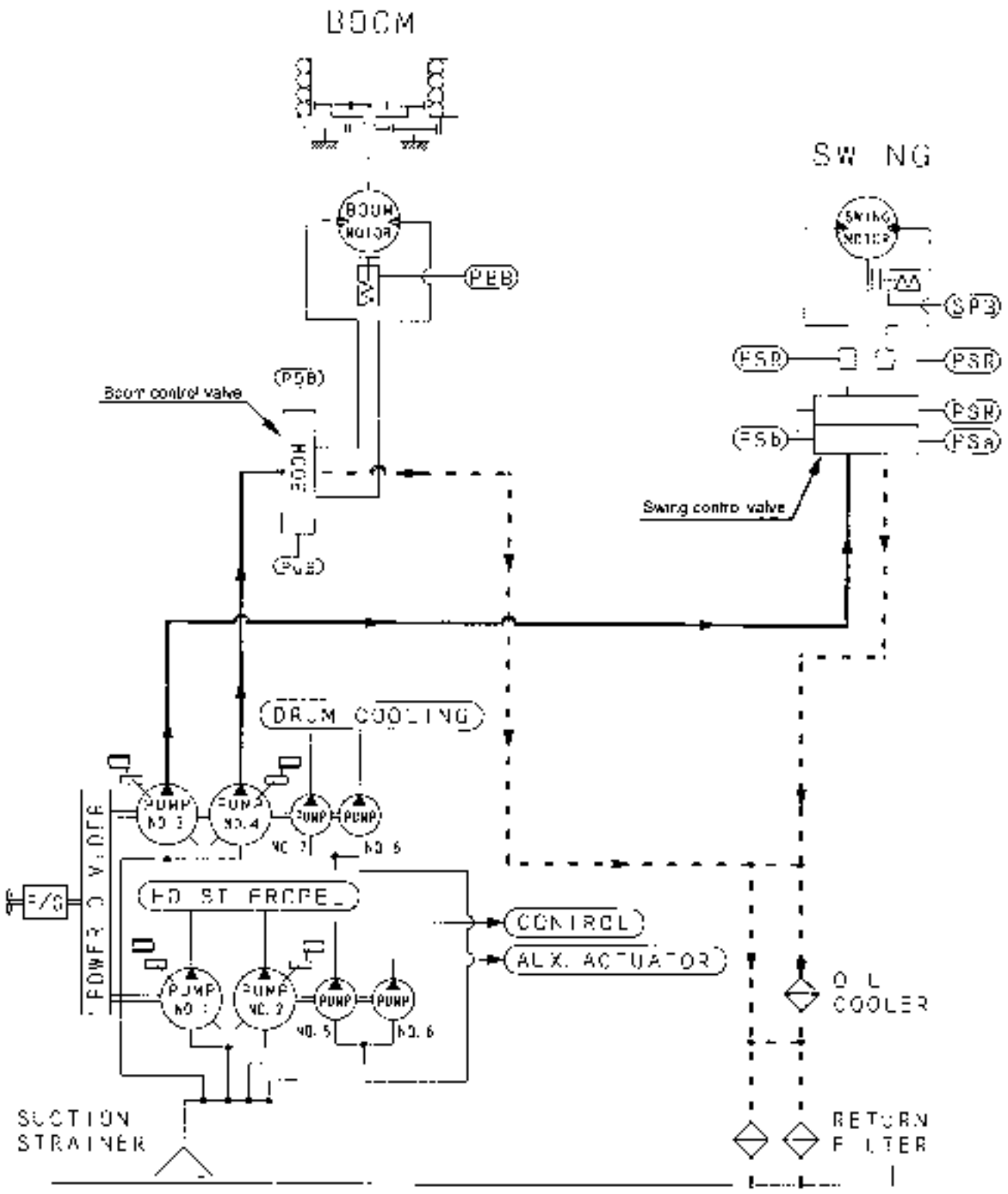
The oil flow from the No 3 pump flows through the control valve for the swing system. In neutral, the flow from No 3 pump passes through the control valve and return freely to the oil tank

When the swing valve spool is moved by oil pressure directed from the swing remote control valve, the oil flow from the No 3 pump powers the swing motor to rotate the crane's upper body.

On the other hand, the pressurized oil flow from the No 4 pump flows into the boom control valve, and returns to the tank with no load.

When the control valve spool is moved by the pressurized oil from the remote control valve, the main pressurized oil is led to the boom motor to actuate the boom.

Oil Flow From No.3 and No.4 Pumps



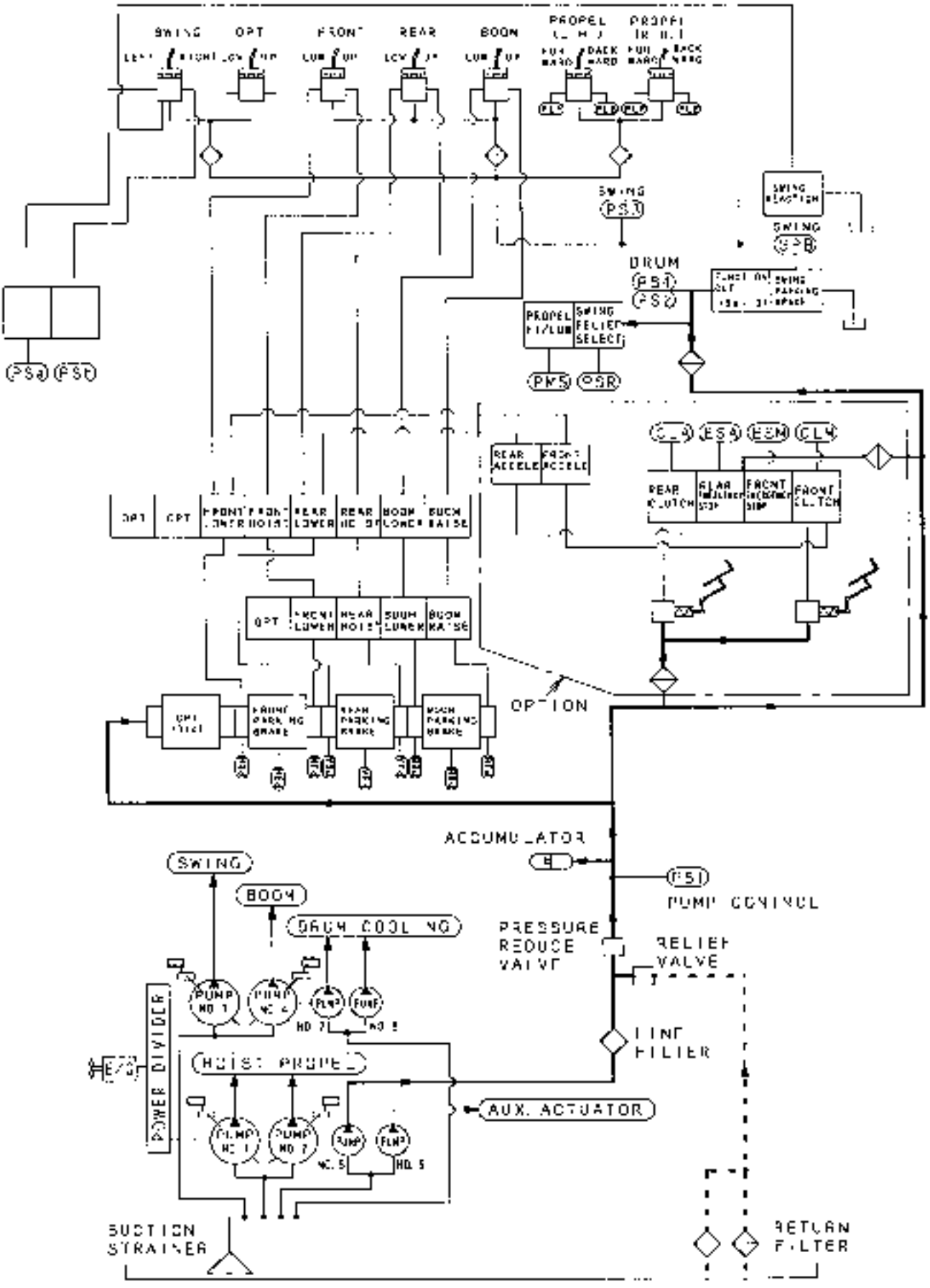
5.3.5 OIL FLOW FROM No.5 PUMPS (Control Pumps)

The pressurized oil discharged from this fixed capacity gear pump flows through a line filter, by an accumulator, and through a relief valve and a pressure reducing valve that reduces line pressure to 5.4 MPa (782 psi). The pressurized oil is now available to the foot brake valves as it flows toward the 4-section valve and it flows two 2-section valve and 4-section valve

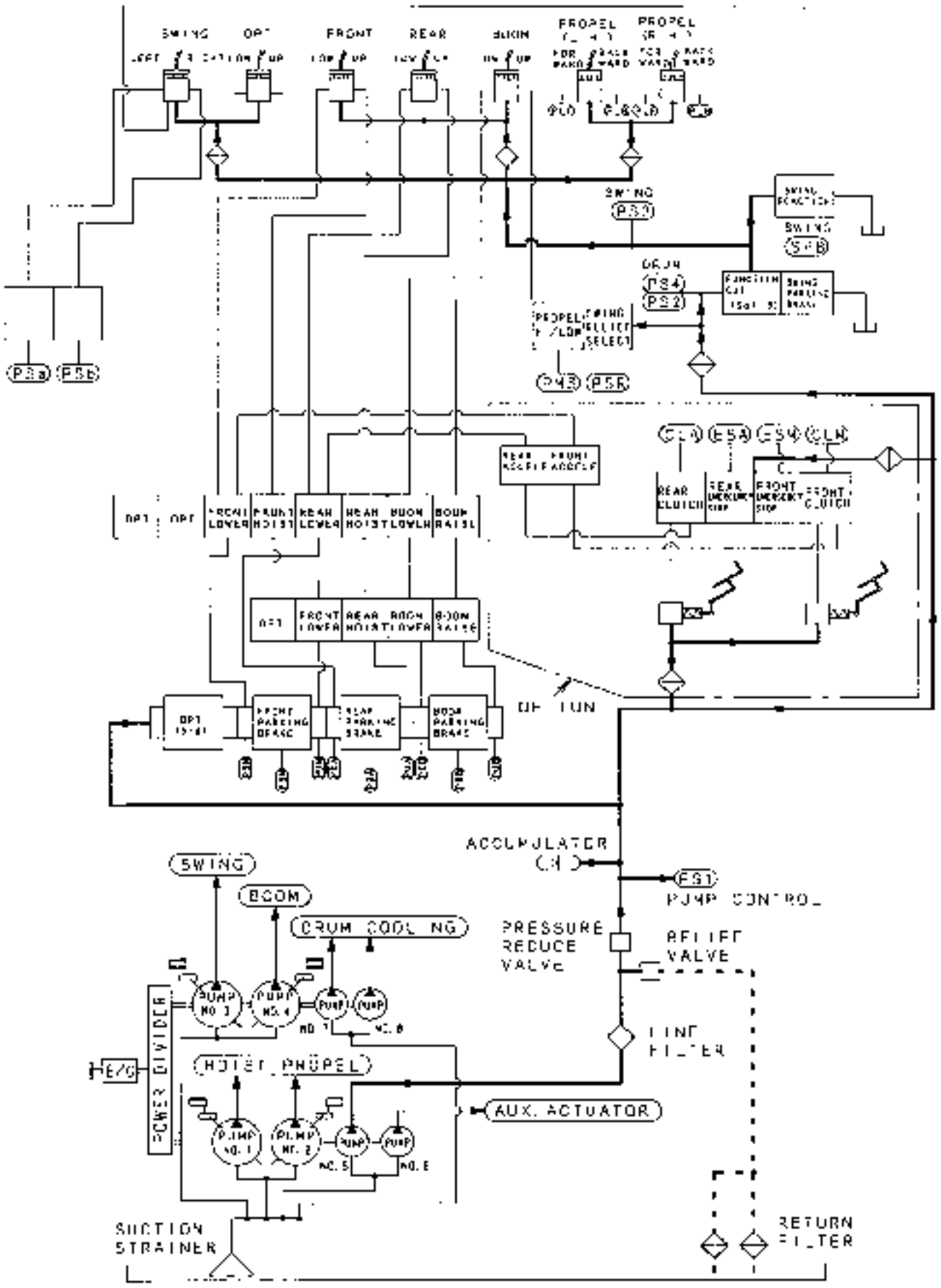
When the Function Lock lever is in the "Shut Down" position, the solenoid valve (Sol 3) that is part of the 2-section valve disallows delivery of oil to the remote control valves. As there is no control pressure, the machine will not move even if the its control levers are operated

When the Function Lock lever is in the "Work" position, however, then solenoid valve (Sol 3) allows pressurized oil to be directed from the remote control valves to the main control valves. Thus operating the control levers will cause the machine to move.

Oil Flow From No.5 Pump (When the function lock lever is "Shut Down" position)



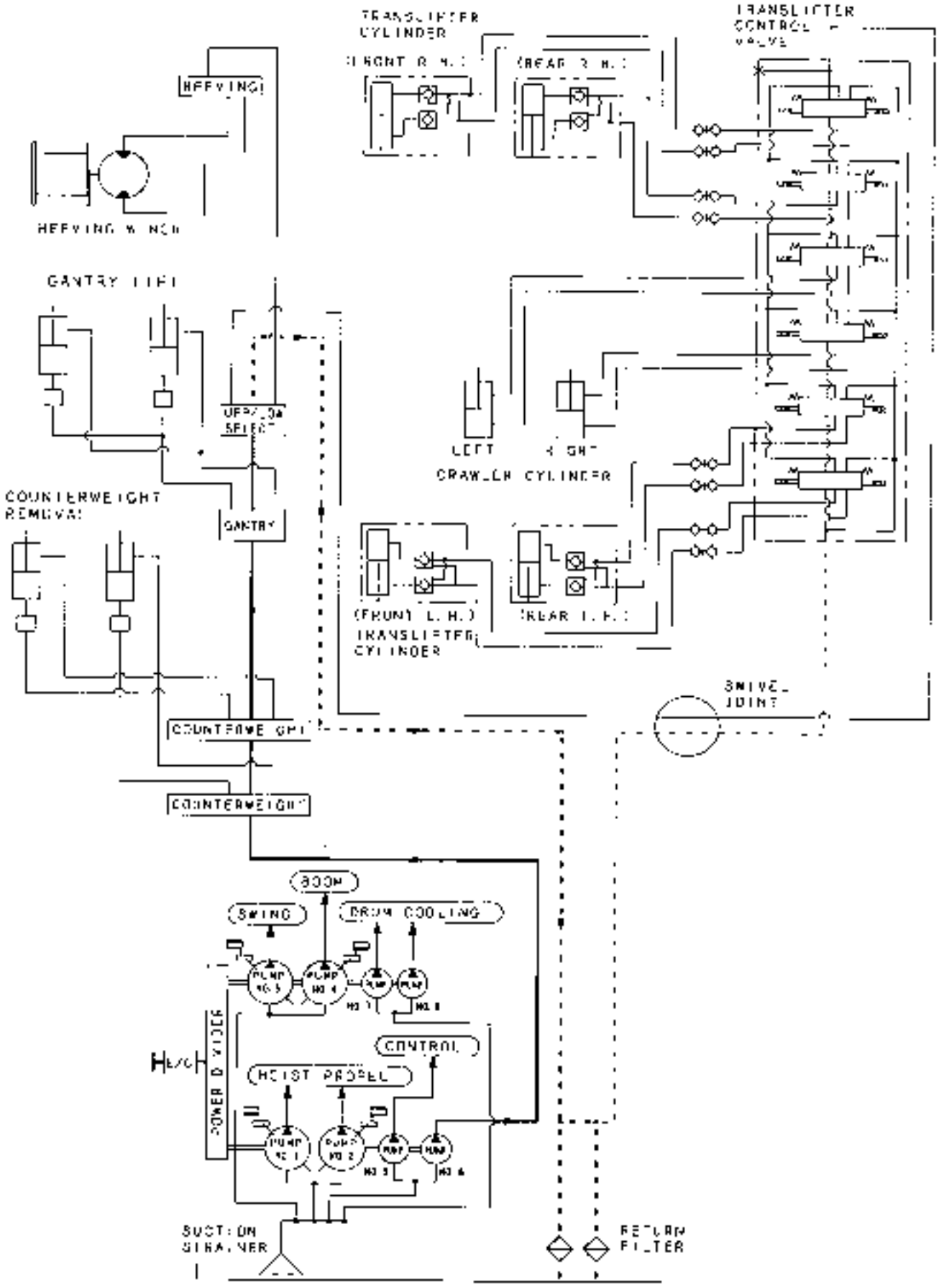
Oil Flow From No.5 Pump (When the function lock lever is "Work" position)



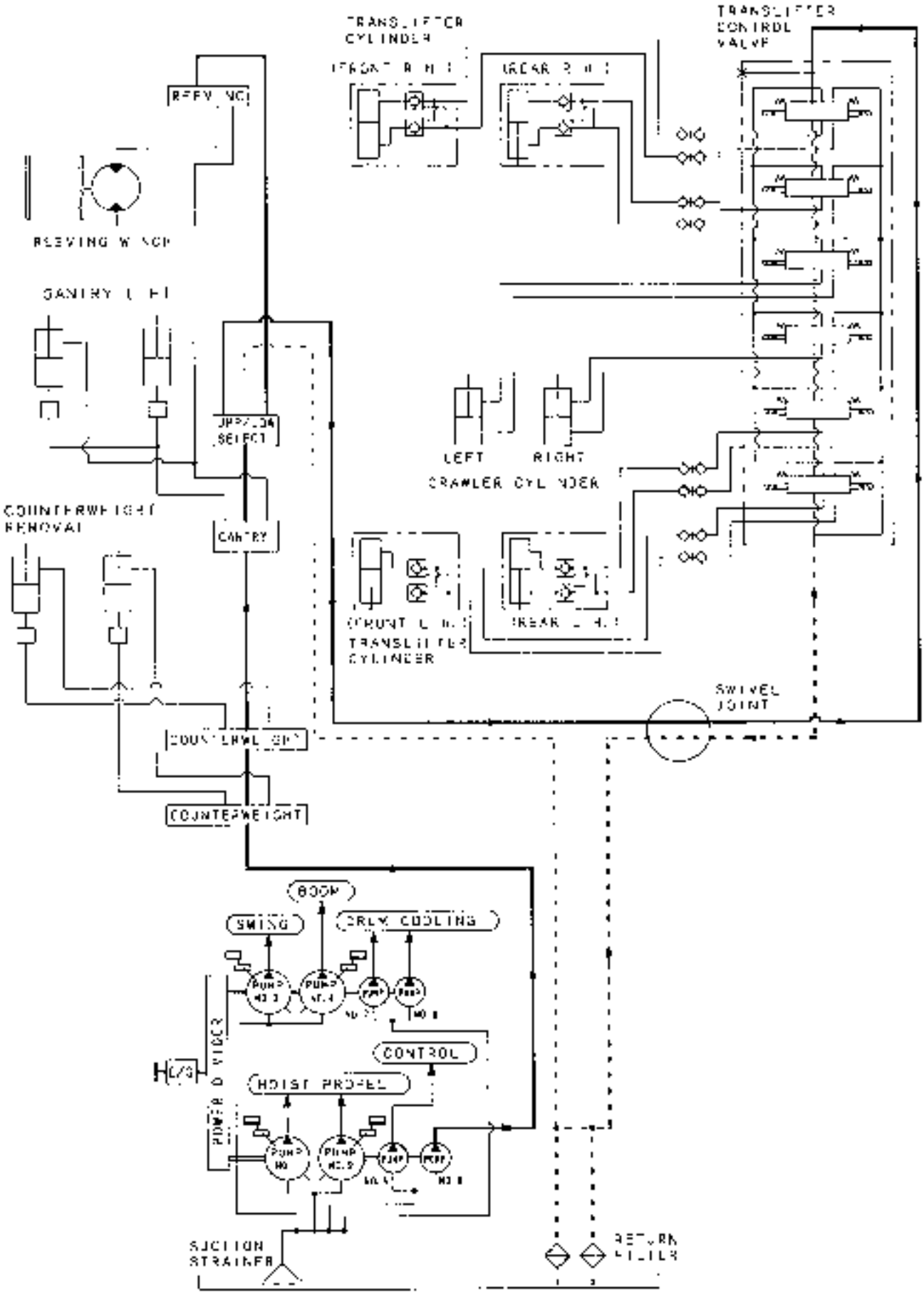
5.3.6 OIL FLOW FROM No.6 PUMP (For Auxiliary Actuator Circuit)

The No. 6 pump is fixed capacity gear pump. It is used to the gantry cylinder, reeving winch, boom foot pin cylinder, counterweight removal cylinder and translifter. The pressurized oil flow from pump No. 6 flows through the counterweight removal cylinder control valve. If the counterweight removal control valve, gantry control valve and hydraulic selector valve are in its neutral position, the oil flow returns freely to the reservoir. Pressurized oil can be supplied to the reeving winch, boom foot pin, or translifter with the hydraulic selector switch (sol. 45).

Oil Flow From No.6 Pump (When the hydraulic switch is neutral)

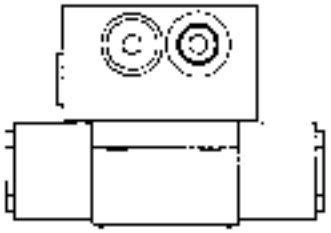


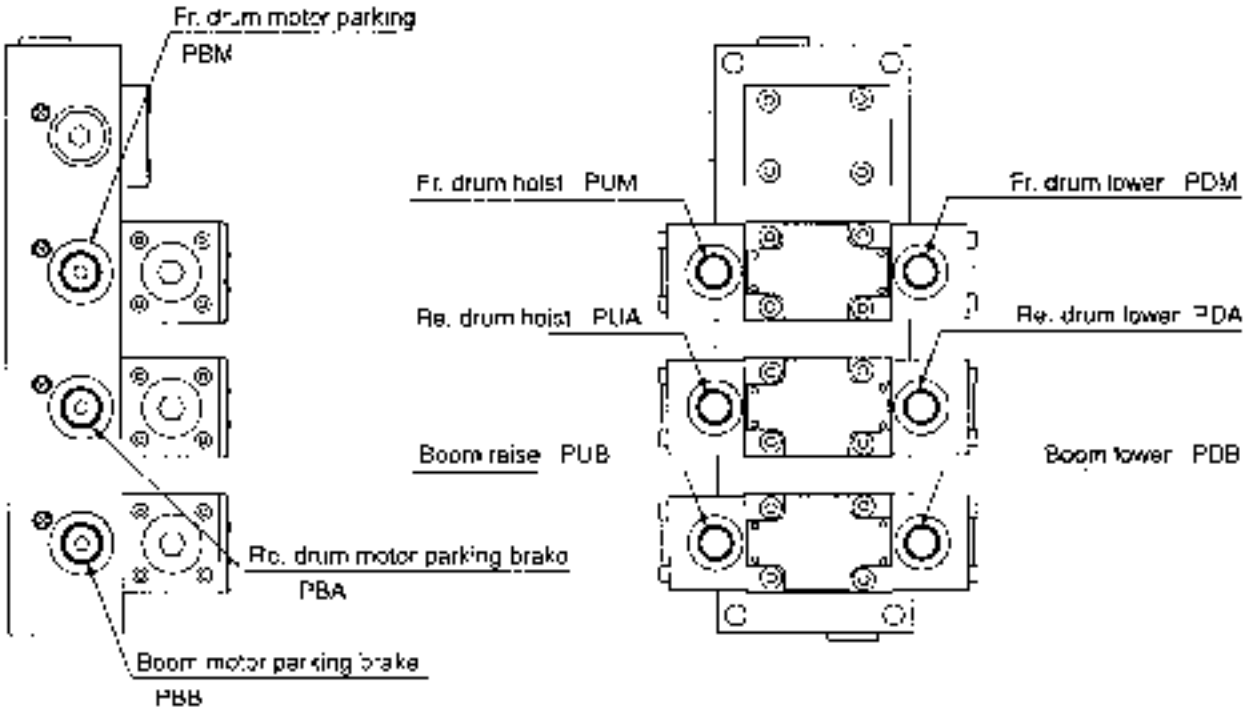
Oil Flow From No.6 Pump (When the hydraulic switch is shifted)

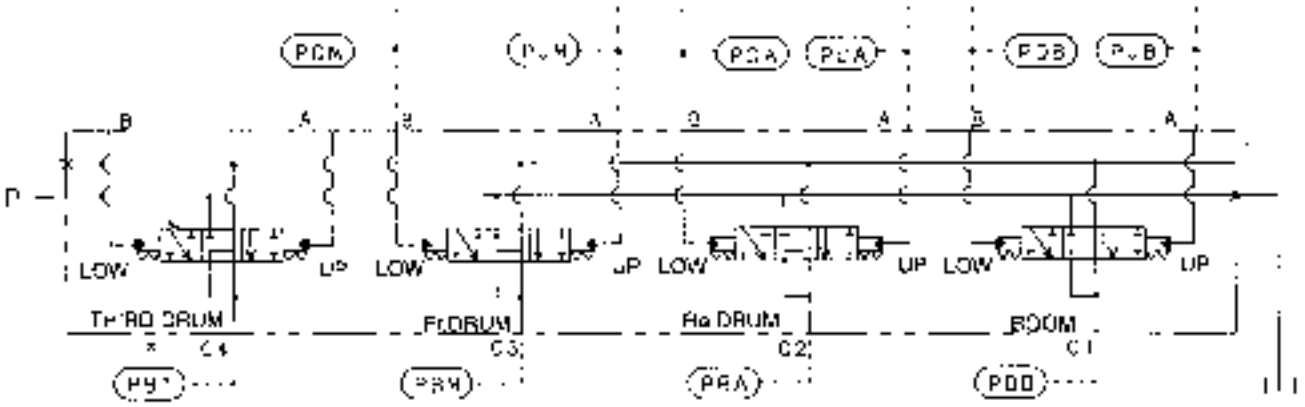


5.4 VALVES

4-Section Valve (GN20V00004F1)

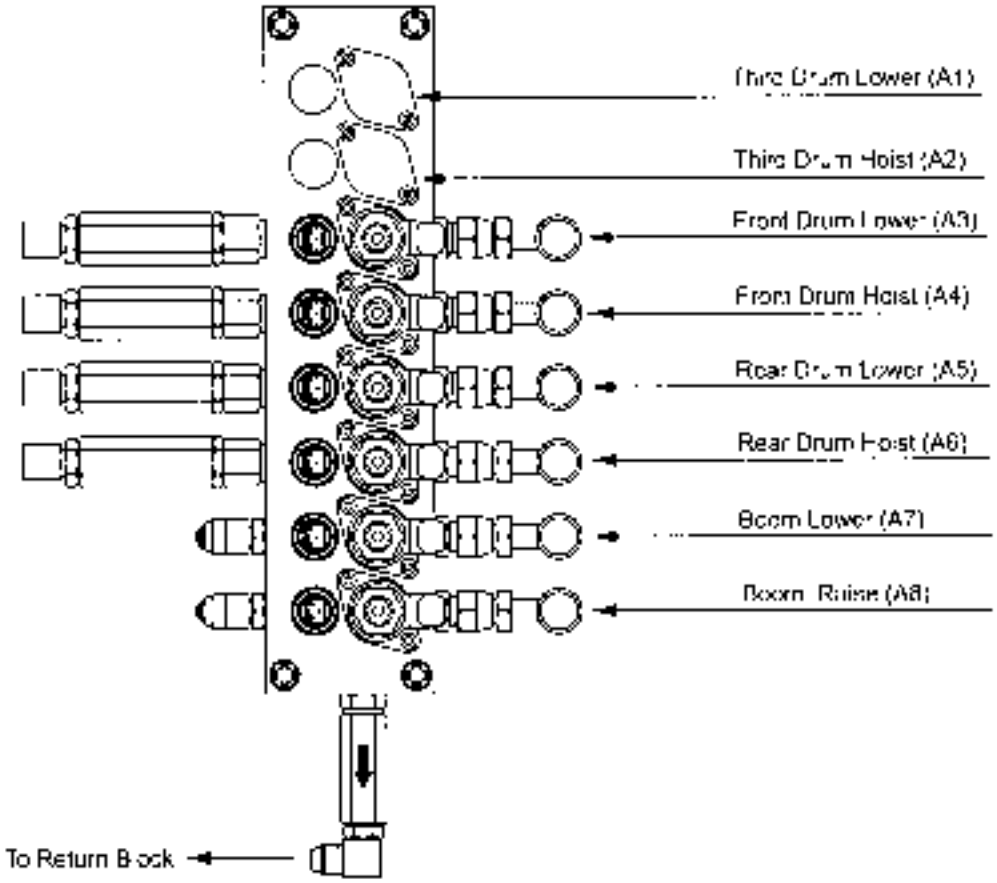


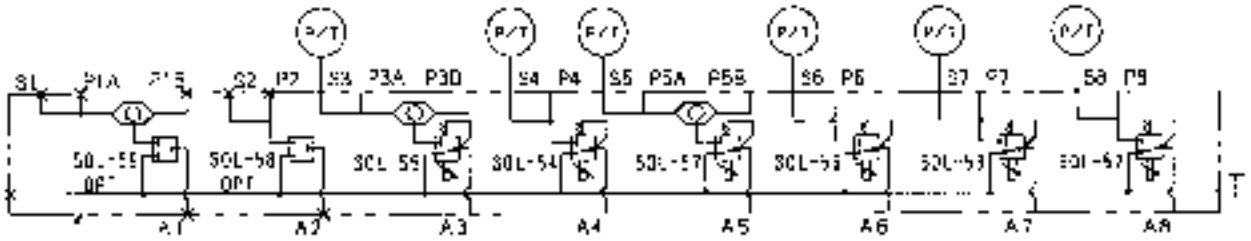




4-Section Valve Hydraulic Schematic

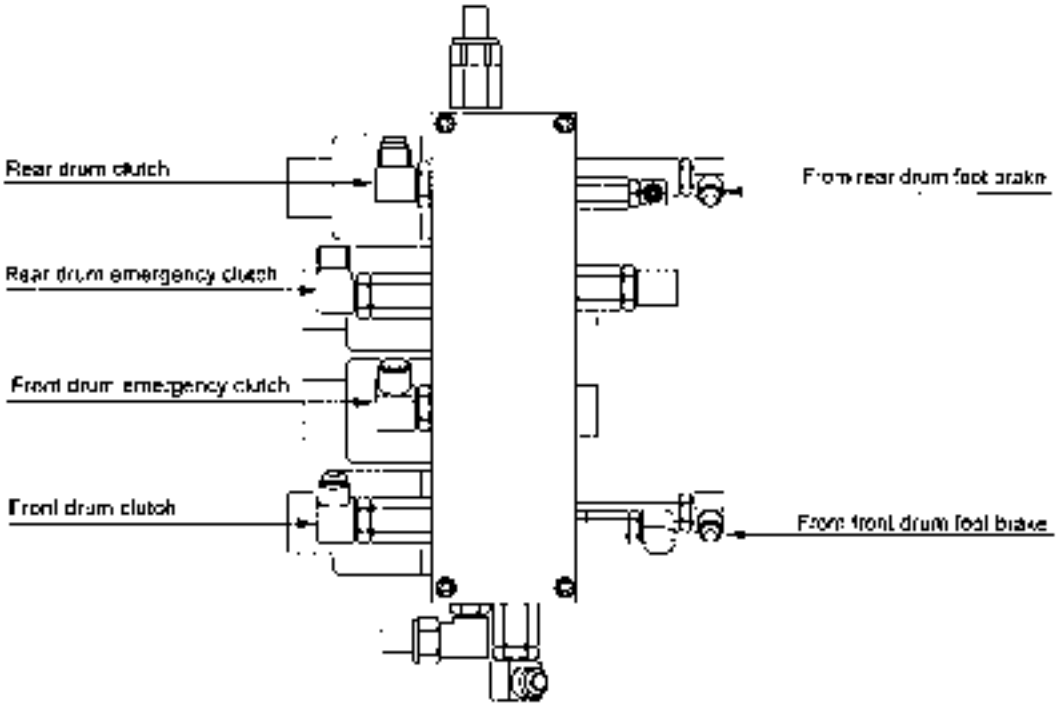
8-Section Valve (With shuttle valve) (GG20V00017F2)

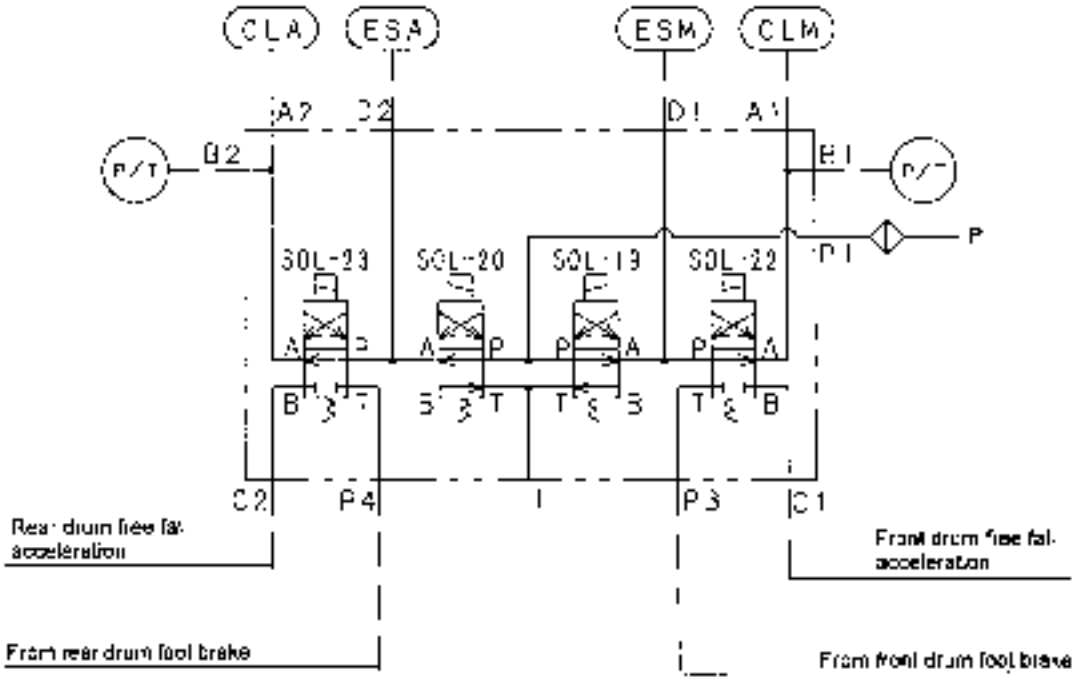




8-Section Valve Hydraulic Schematic

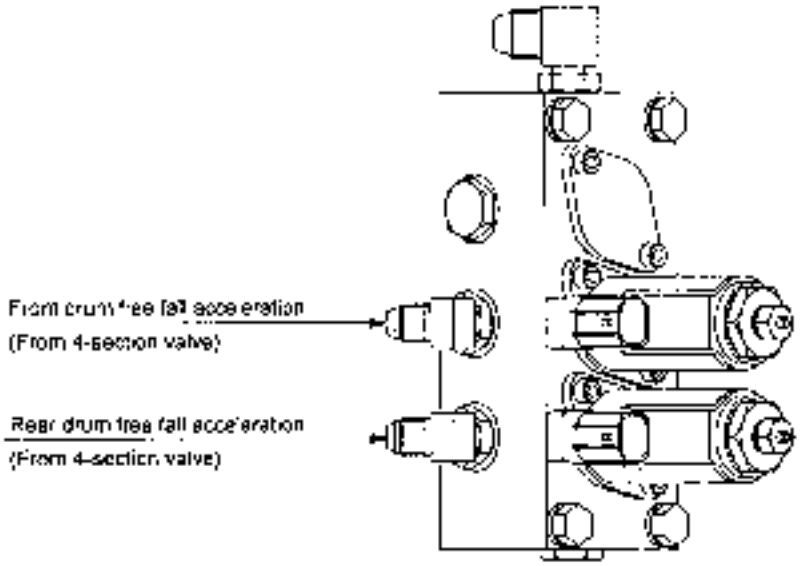
4-Section Valve (JJ35V00006F1)

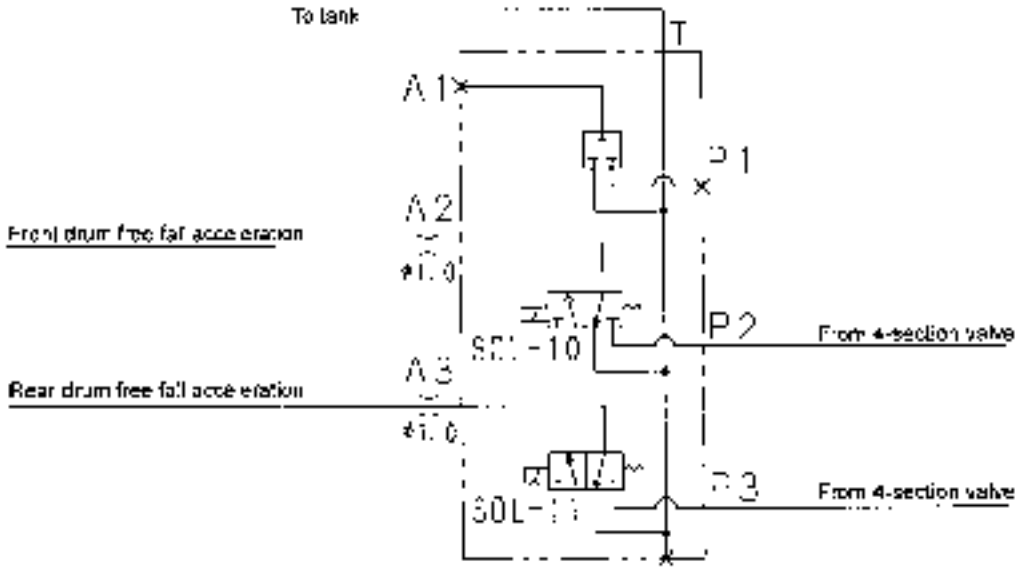




4-Section Valve Hydraulic Schematic

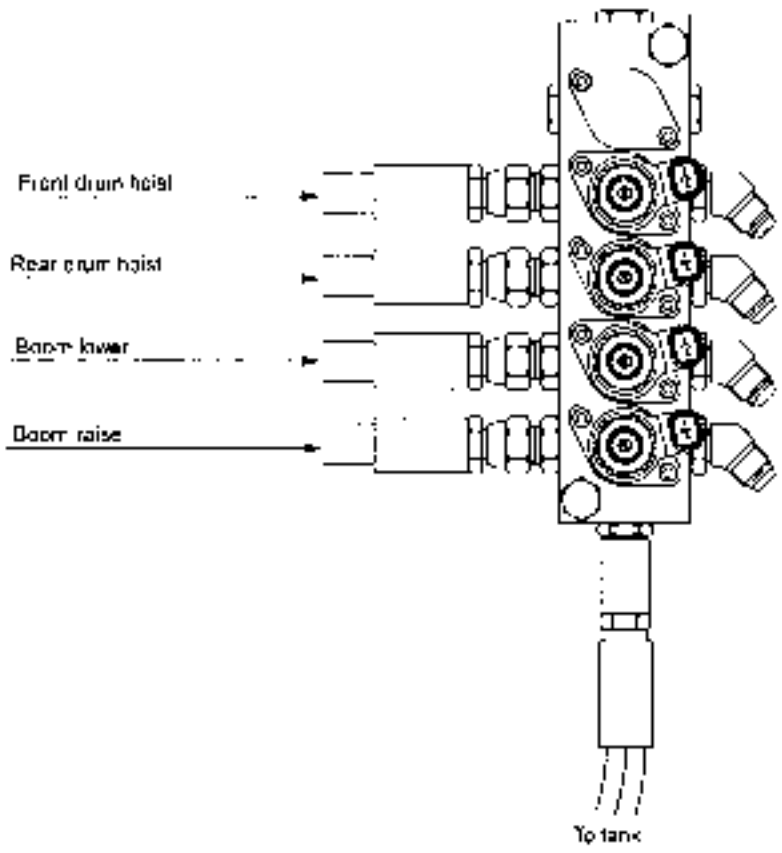
3-Section Valve (JJ35V00010F1)

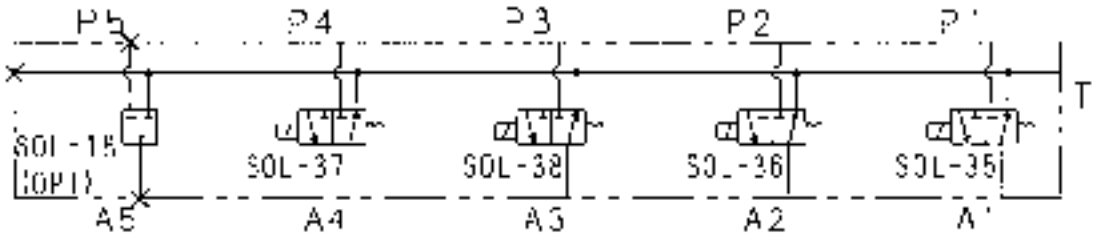




3-Section Valve Hydraulic Schematic

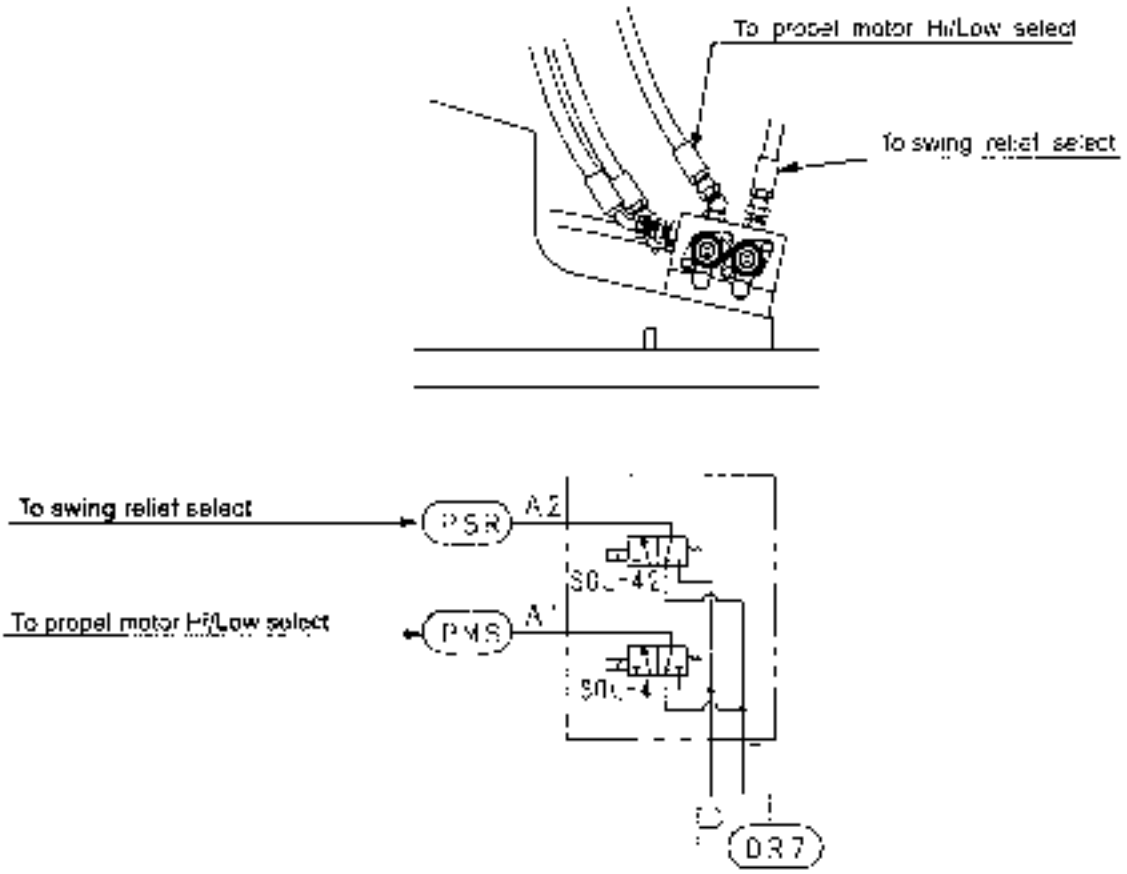
5-Section Valve (JJ35V00009F1)



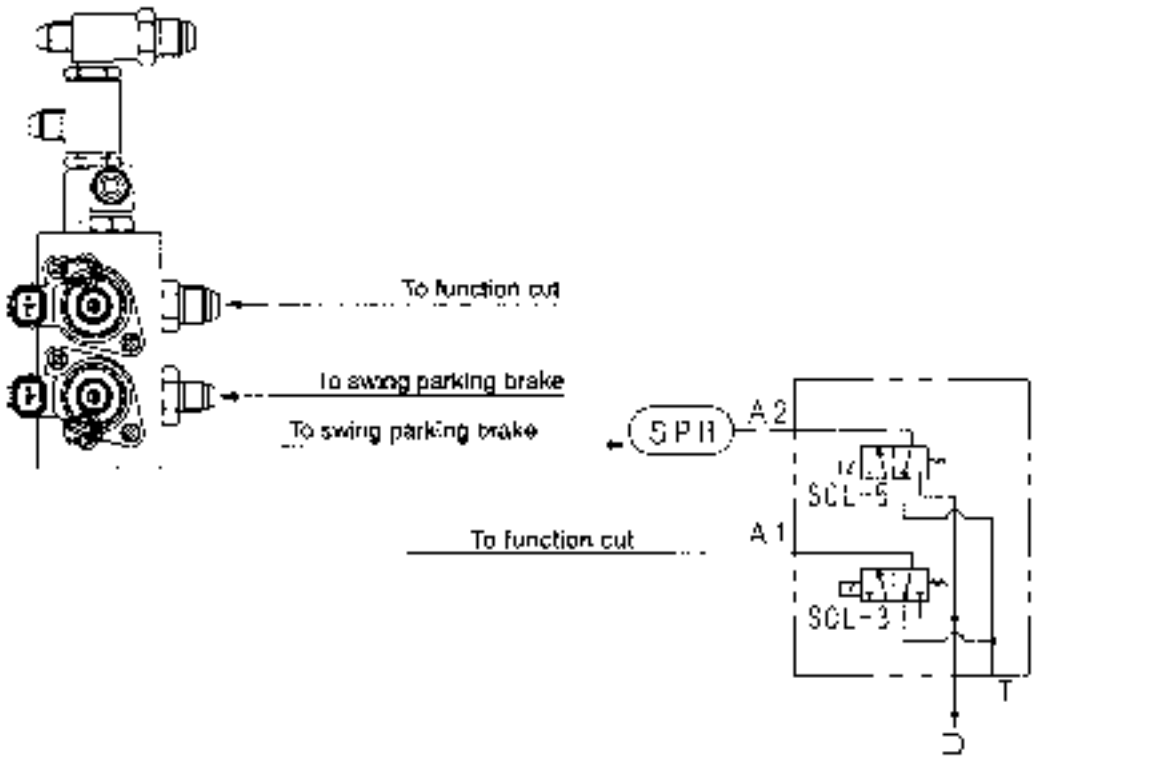


5-Section Valve Hydraulic Schematic

2-Section Valve (YN35V00027F1)

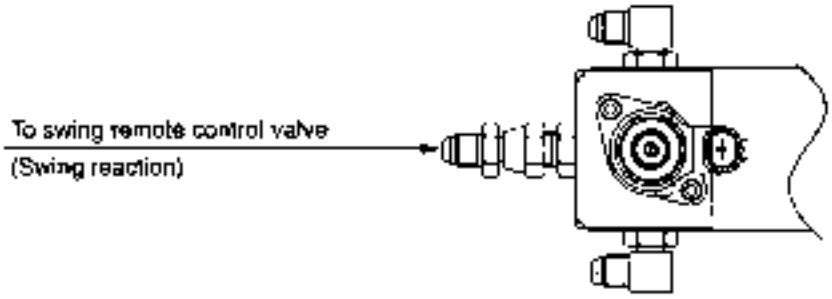


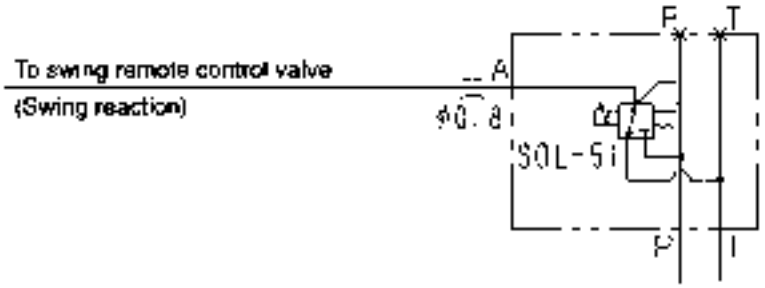
2-Section Valve Hydraulic Schematic



2-Section Valve Hydraulic Schematic

1-Section Valve (YN35V00001F1)

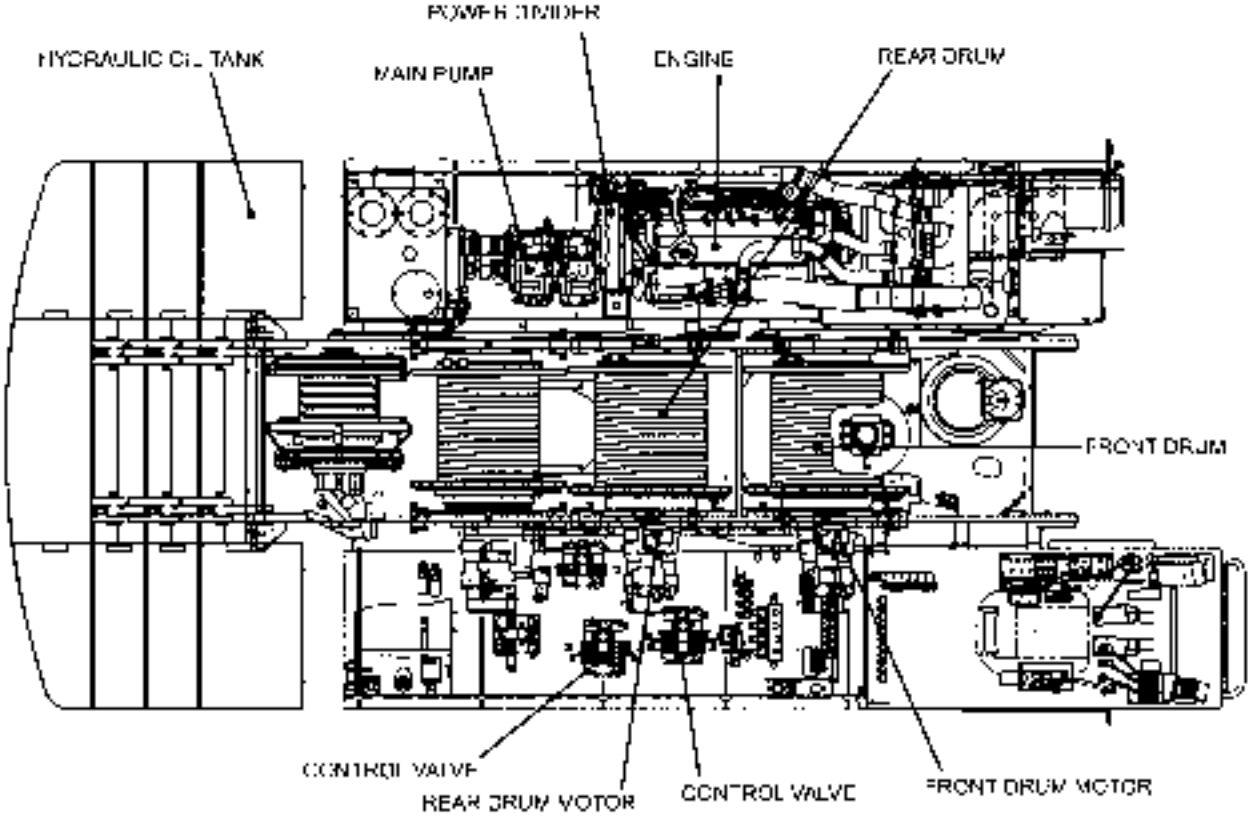


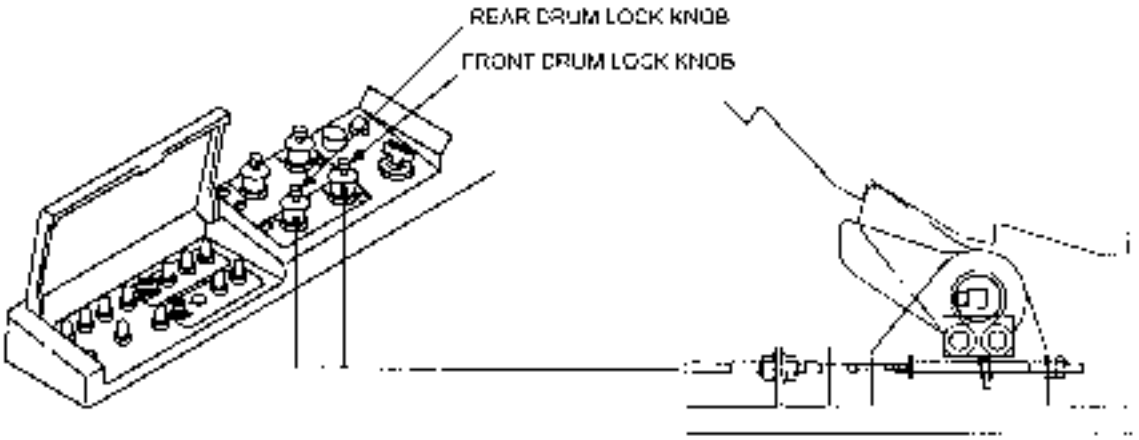


6. HOIST SYSTEM

6.1 APPARATUS AND LOCATION OF COMPONENTS

The hoist system consists of the main pumps, the control valves, and the front and rear drum assemblies. Both of the drum assemblies consist of a hoist motor (with a built-in mechanical brake) and reduction unit as well as a clutch and drum lock.
The No.1 and No.2 main pumps supply the pressurized oil for the hoist system by way of control valves.



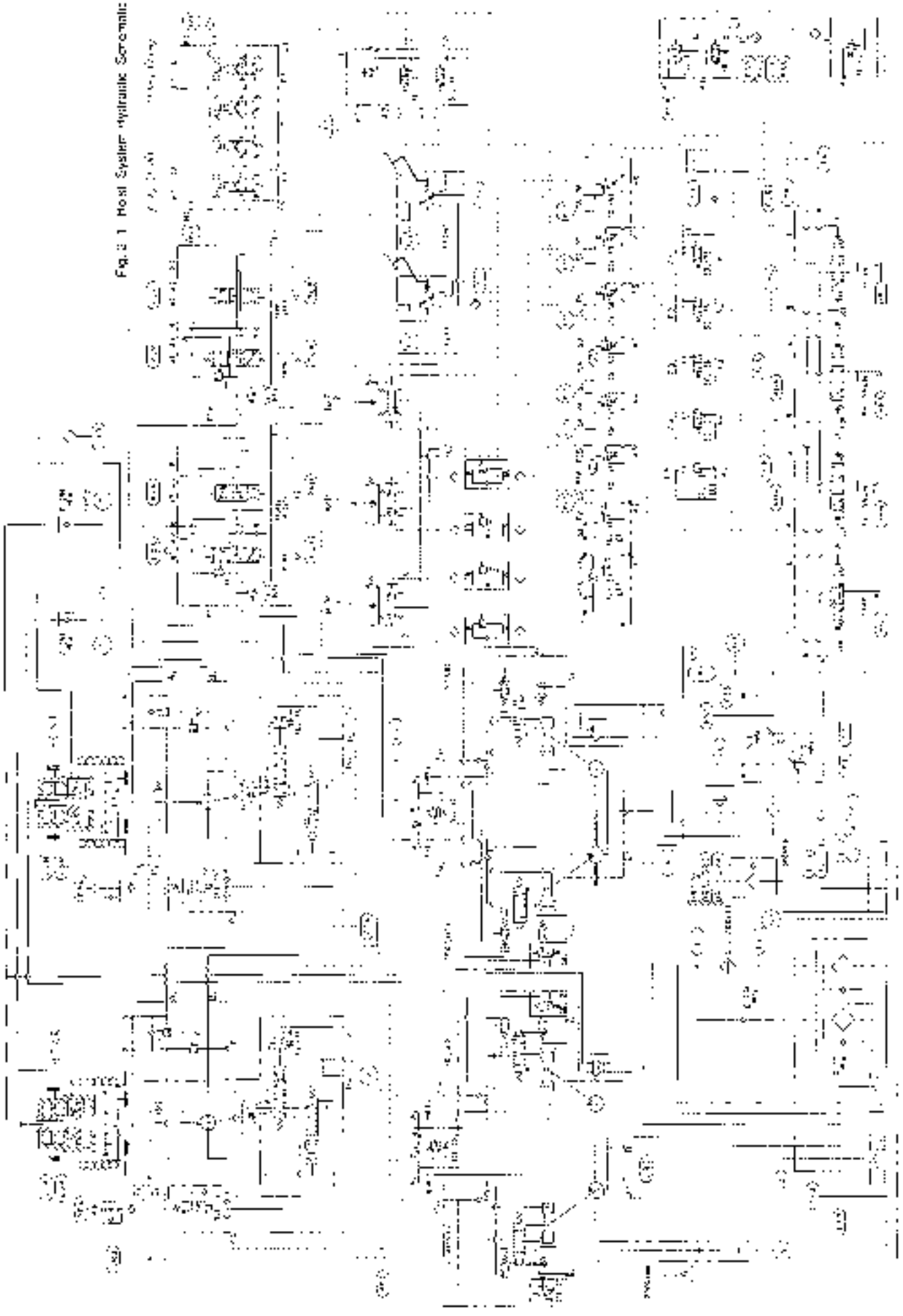


6.2 CONSTRUCTION AND FUNCTION

6.2.1 HYDRAULIC SCHEMATIC

This drawing includes the free fall circuit (Optional)

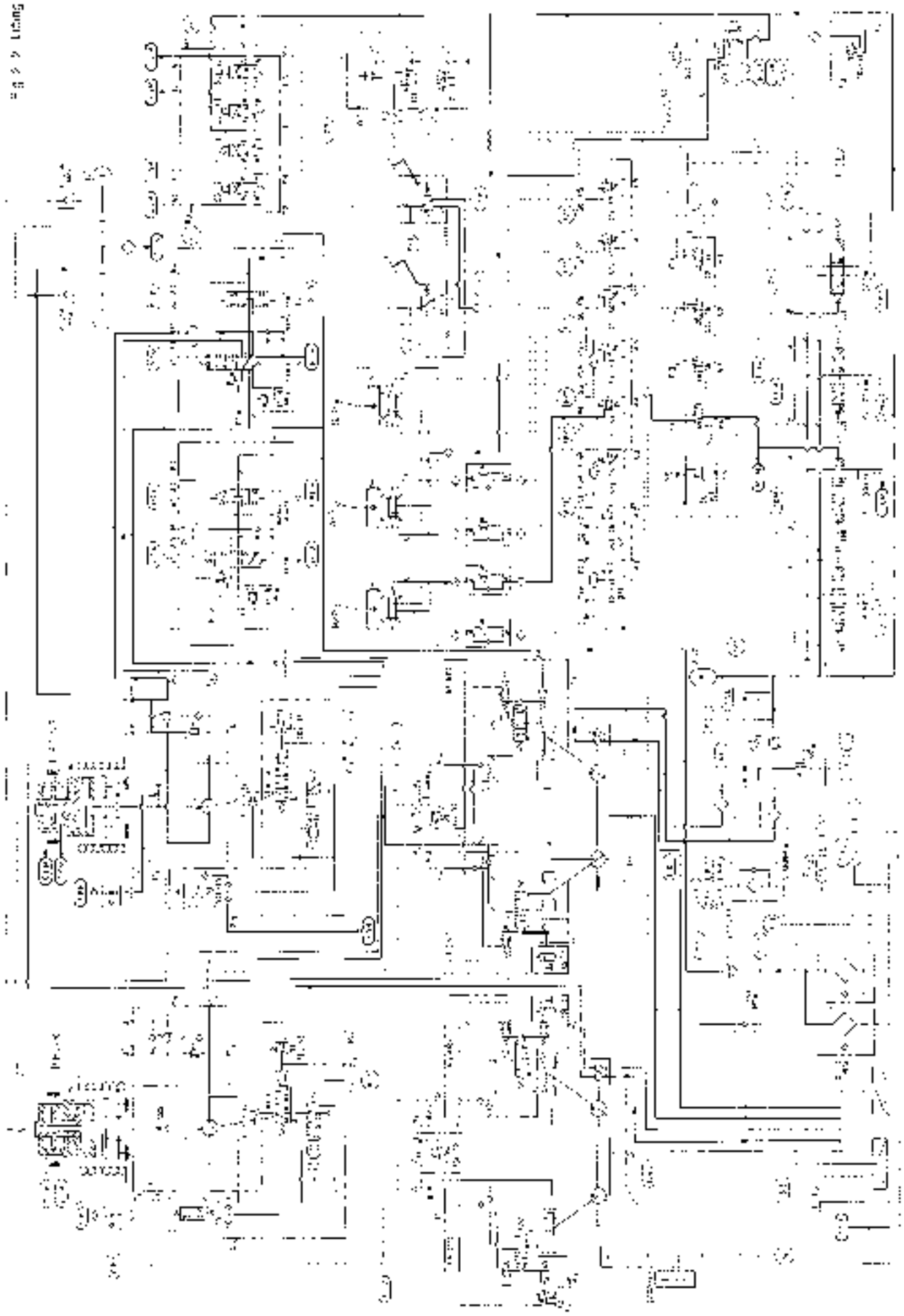
Fig. 6-1 Hoist System Hydraulic Schematic



The front and rear drums are mechanically identical so the following explanation uses the front drum for illustration purposes.

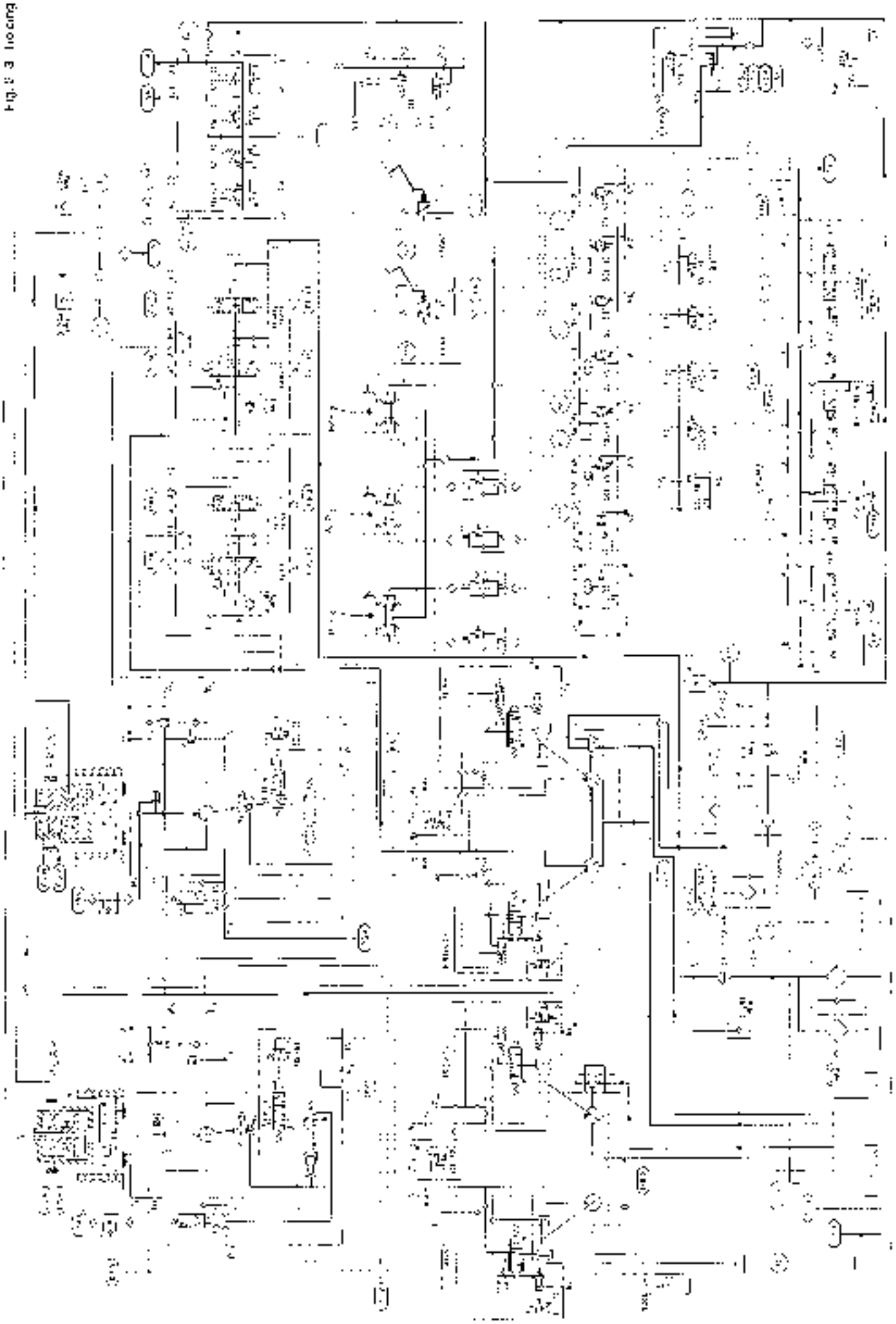
6.2.2 LIFTING A LOAD

Pressurized oil from the main pump flows through two main control valves to power the hoist system. While the function lock lever is in the "Operation" position (Sol. 3:On position), oil pressure from the control system pump flows past the accumulator and into the brake valve block, the clutch valve block, the clutch valve block, and it flows through the valve block (2-section solenoid valves) and into the remote control valve. The pressurized oil is fed to the both sides oil chambers of the clutch cylinder (CI M, FSM) via the valve block (4 section solenoid valves). Since the cylinder thrust force by the pressurized oil is not generated, the clutch is connected with the spring.
When the Hoist Control lever is operated in the "hoist load" direction, it directs control pressure oil through the remote control valve and into the port of the main control valve where it moves the spools.
At the same time, the control pressurized oil flows into the port of the brake cylinder built in the winch motor via the valve block (4-section pilot operated valves) and the motor brake is released.
As directed by the position of the spools, the main pump oil flowing into the control valve is sent to the lift side of the hoist motor to drive the hoist drum and thereby hoist the load.



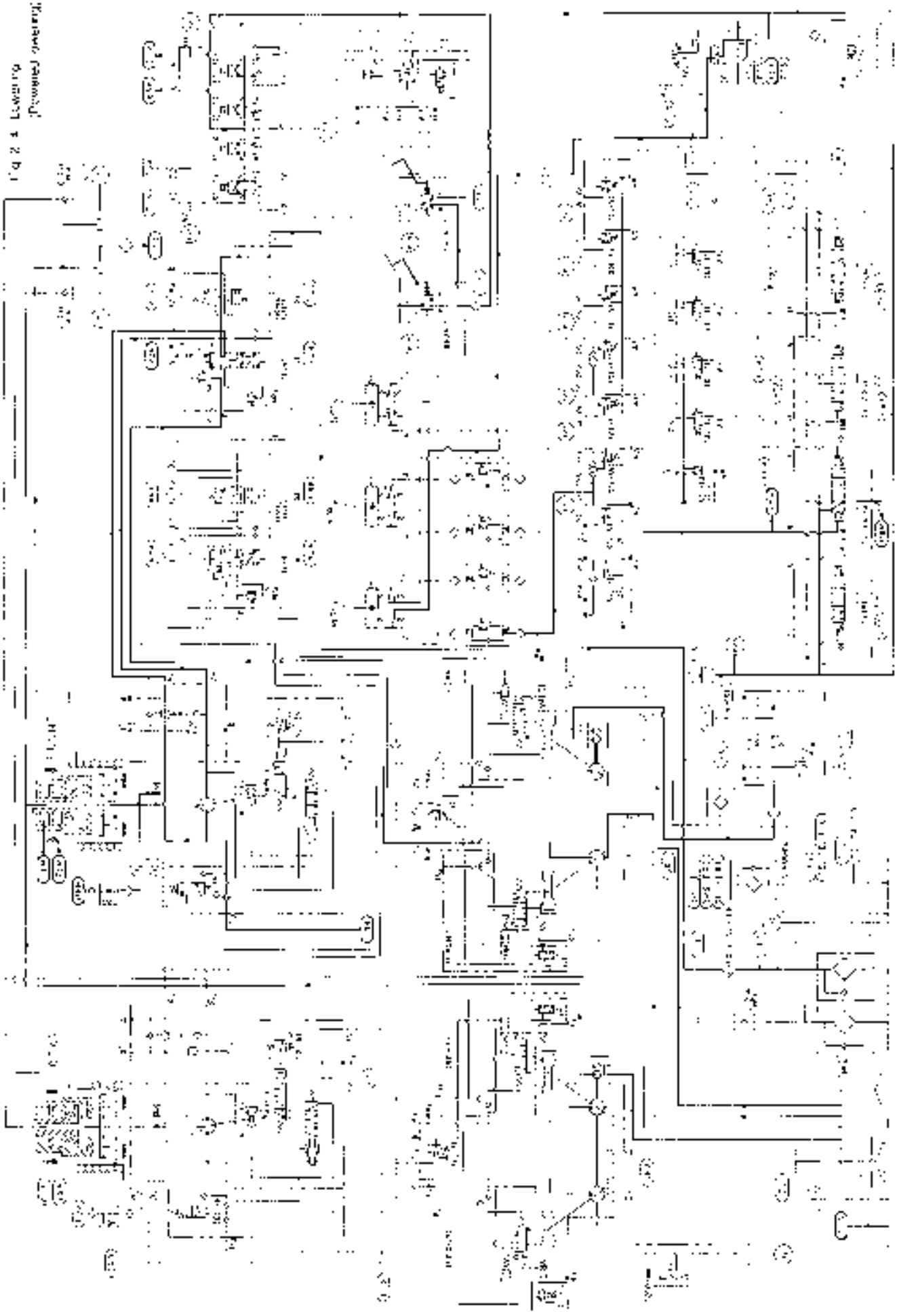
6.2.3 HOLDING A RAISED LOAD

With the Hoist Control lever back in its neutral position, the control pressure coming from the remote control valve is cut, and then the spool in the main control valve returns to its neutral position
When the spool returns to neutral, the pressurized oil to the motor is cut off and the motor stops
Now, although the weight of the suspended load continues to pull on the drum, further rotation of the drum is prevented by a motor counterbalance valve that disallows any motor rotation by blocking the return of oil to the reservoir.
At the same time, the control oil pressure in the motor brake cylinder is directed back to the reservoir and the motor brake resets itself.
The pressurized oil is fed to the both sides oil chambers of the clutch cylinder (CLM, ESM), and the cylinder thrust force by the pressurized oil is not generated. Therefore, the clutch remains connected with the spring.
The load is now held in suspension by the combined effects of the motor counterbalance valve, and the motor brake and the clutch.



6.2.4 LOWERING A LOAD (POWERED LOWERING)

Pressurized oil from the main Pump flows through the main control valves to power the hoist system.
When the function lock lever is in the "Operation" position (Sol. 3 On position) oil pressure from the control pump flows past the accumulator and it flows the brake valve block, the clutch valve block, valve block (2-section solenoid valves) and into the remote control valve
The pressurized oil is fec to the both sides oil chambers of the clutch cylinder (CLM, ESM) via the valve block (4-suction solenoid valves). Since the cylinder thrust force by the pressurized oil is not generated, the clutch is connected with the spring.
When the Hoist Control lever is operated in the "lower oad" direction, this control oil pressure is directed by the remote control valve to flow through into ports of the main control valve where it moves the spool
At the same time, control pressure is also directed to the port of the motor brake cy inders where it causes the motor brake to disengage.
Now the main pump oil flowing into the control valve, as directed by the pos tion of the spools, activates the hoist motor to drive the drum and thereby lower the load. The counterbalance valve is opened by pilot pressure from the "running in" side to allow the motor to rotate.



6.2.5 FREE FALL OPERATION

When the brake selector switch is set to the "FREE FALL" mode, the solenoid valve (Sol. 22) in the valve block (4-section solenoid valves) is switched.

When the solenoid valve is switched and the foot brake is released, the pressurized oil in the CLM side oil chamber of the clutch cylinder returns to the tank, and the cylinder thrust force is generated against the spring to release the clutch.

As a result, the load falls freely (free fall), and the brake can be applied with the foot brake.

When the brake pedal is operated, the control pressurized oil flows into the CLM side oil chamber of the clutch cylinder through the brake valve, and the cylinder thrust force is decreased to actuate the brake (braking with the clutch).

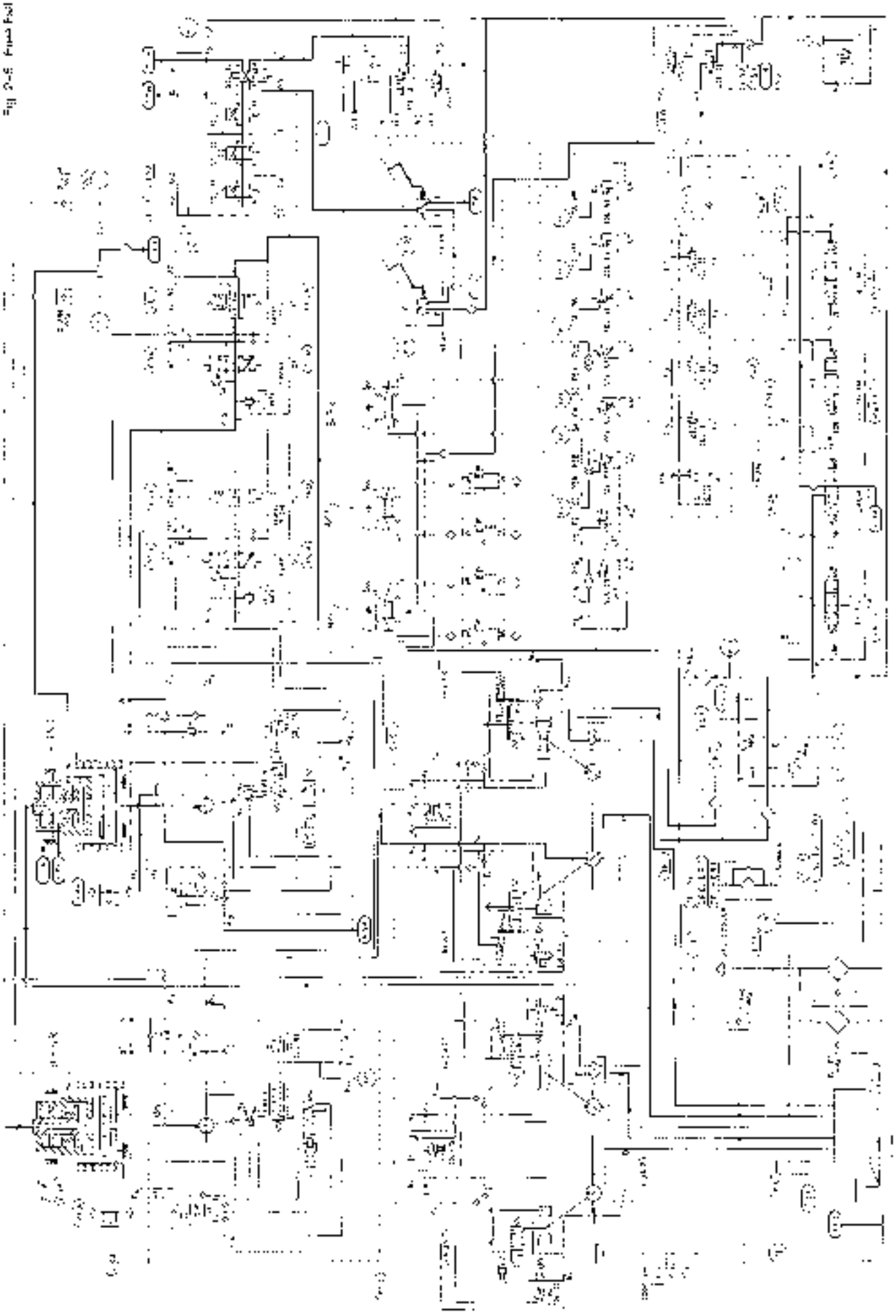
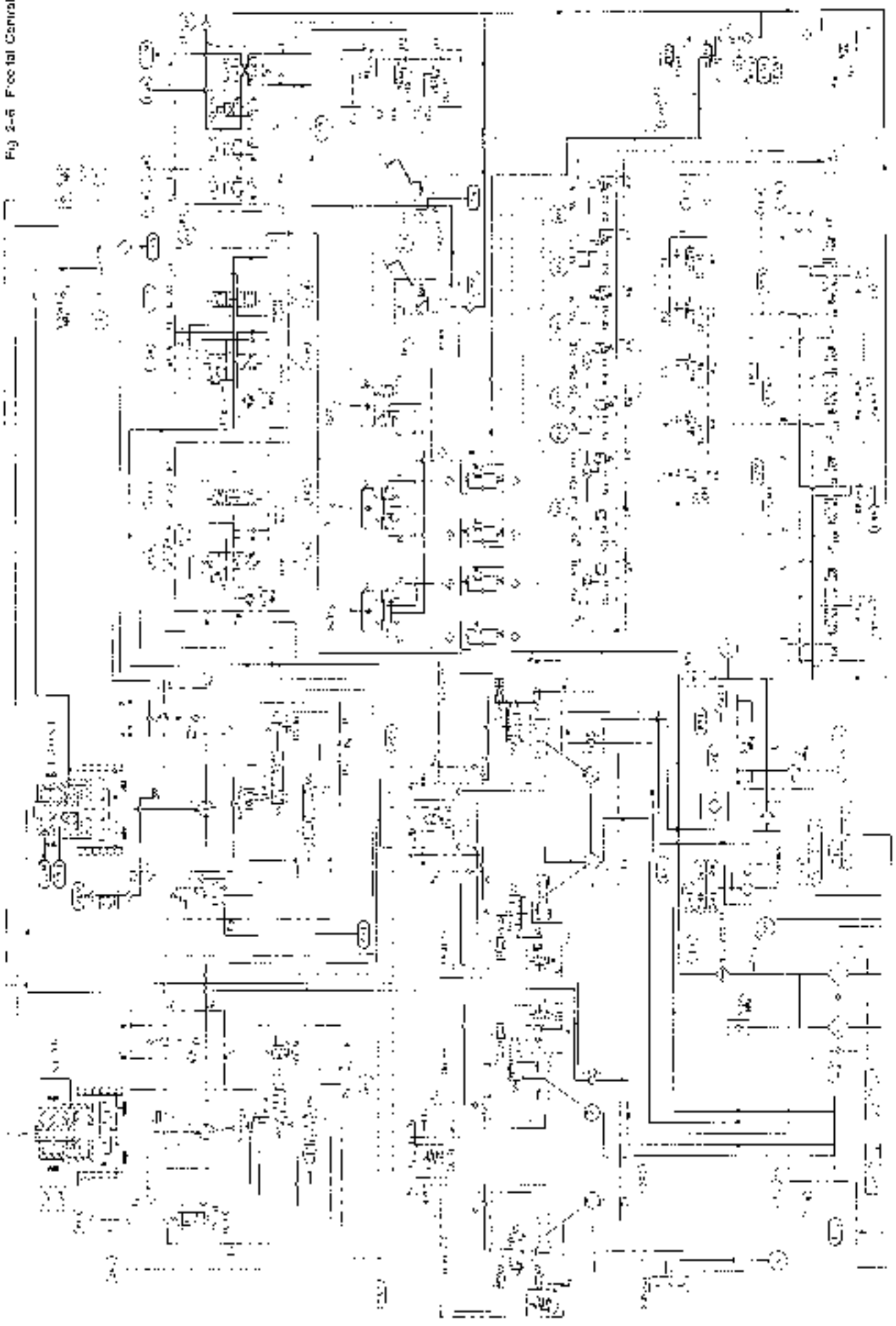


Fig 6-5 Frontal Control



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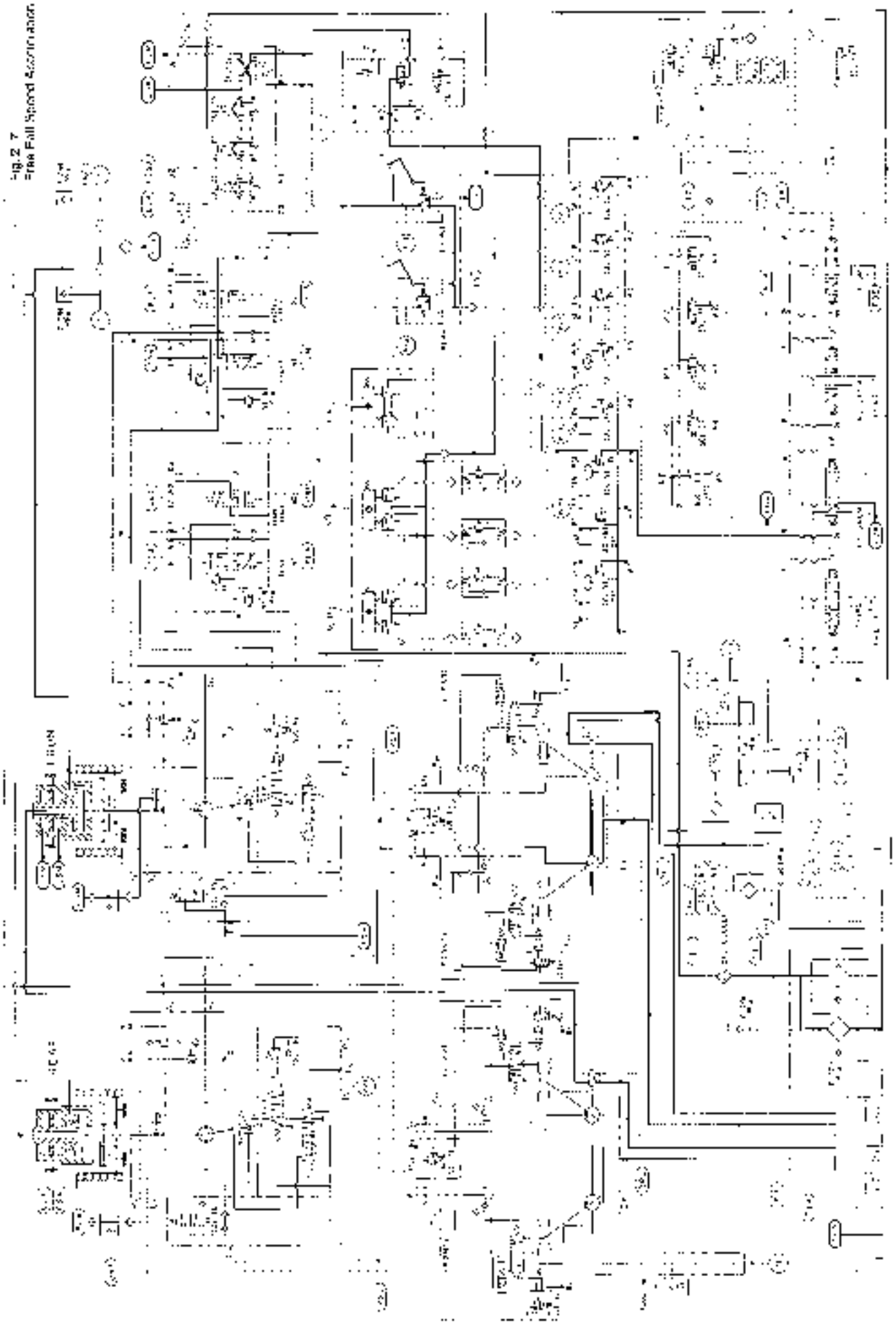
6.2.6 FREE FALL ACCELERATION

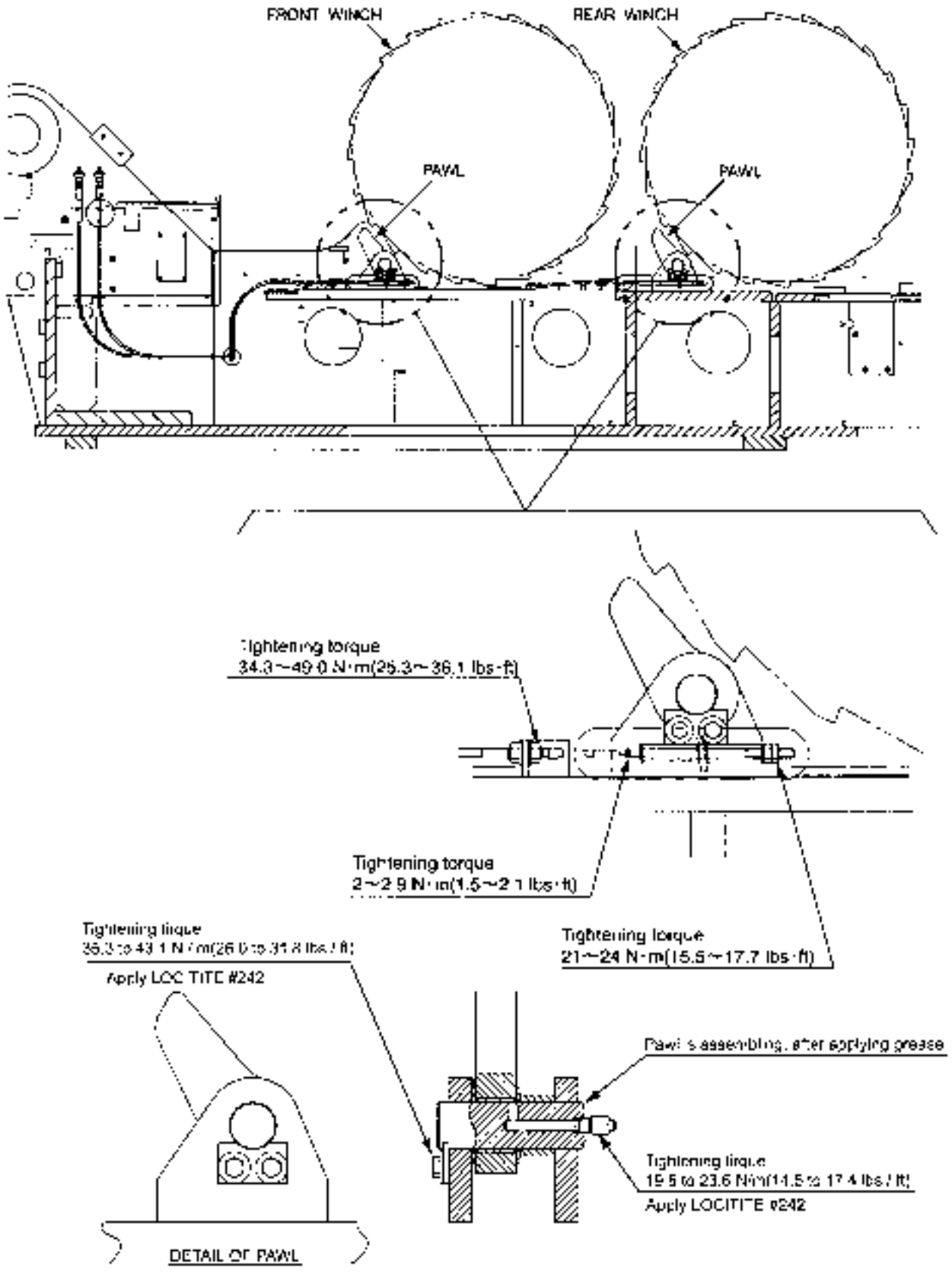
Free fall with the "FREE FALL SPEED INCREASED SELECTOR SWITCH" on the side panel set to the "HIGH" position

- When the brake pedal is released, the solenoid valve (SOL-10) is switched, and pressurized oil flows into the [PDM] port of the main control valve through the solenoid valve (SOL-10) in the 3-section solenoid valve block and shuttle valve and solenoid proportional valve (SOL-55) to move the spool. Simultaneously, the oil also goes into the brake cylinder [PBM] port of the winch motor through the valve block (4-section pilot operated valve) to release the motor brake. Then, the motor rotates to the lowering direction.
  Though the clutch is released while the "FREE FALL" mode is selected the rotation of the winch motor is transmitted to the drum and the free fall speed is increased by the power lowering, because the rotation resistance of the clutch is larger than that of the drum In this status, the drum rotates without any load
- When the brake pedal is depressed, pressurized oil is fed to the [CLM] side of the clutch cylinder through the brake valve. Then, the cylinder thrust is decreased to slow down the free fall, and the control pressure from the solenoid valve [SOL-10] in the 3-section valve block is also decreased by proportional valve (sol-55) and solenoid valve (sol-10) to return the main control valve spool to the neutral position.
  When the spool is returned to the neutral position. pressurized oil to the motor is shut off, and the motor stops rotating.



6.3 DRUM LOCK

6.3.1 ASEEMBLY DRAWING



6.3.2 ADJUSTMENT OF DRUM LOCK

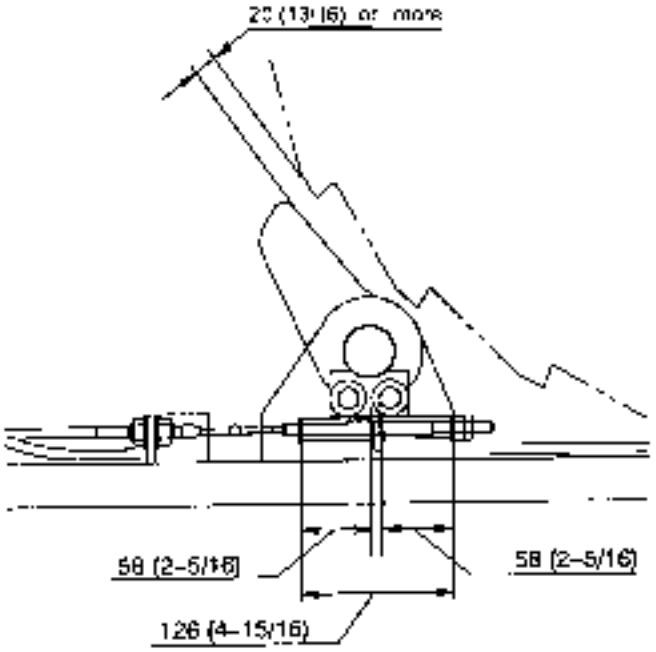
WARNING

Do not adjust the drum locks until the boom, hook block, and load have been lowered to the ground. Failure to observe this precaution may result in serious injury or loss of life.

(1) Pull the drum lock knob in the LOCK position and check to see that the pawl is engaged in the bottom of the drum ratchet.
If the pawl is not engaged in the bottom of the ratchet, adjust the spring length to allow the pawl to be engaged in the bottom.

(2) With the condition of step 1, adjust the respective dimension as shown in the figure.

(3) Push the drum lock knob in the RELEASE position and check to see that the pawl is clear of the ratchet by at least 20 mm (13/16).
Operate the knob to the LOCK position and to the RELEASE position and confirm that the pawl moves smoothly.

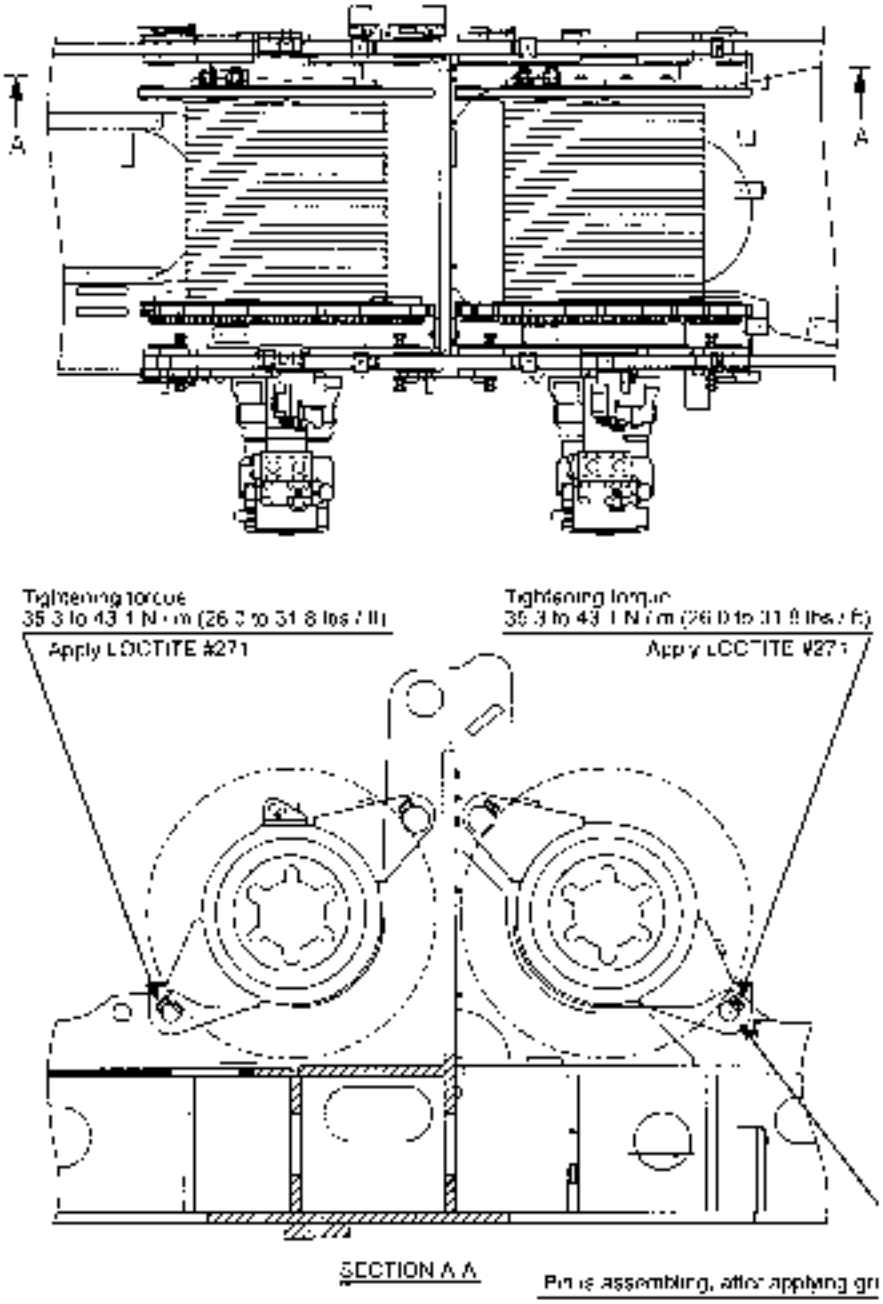


Unit: mm (inch)

FRONT AND REAR DRUM LOCK

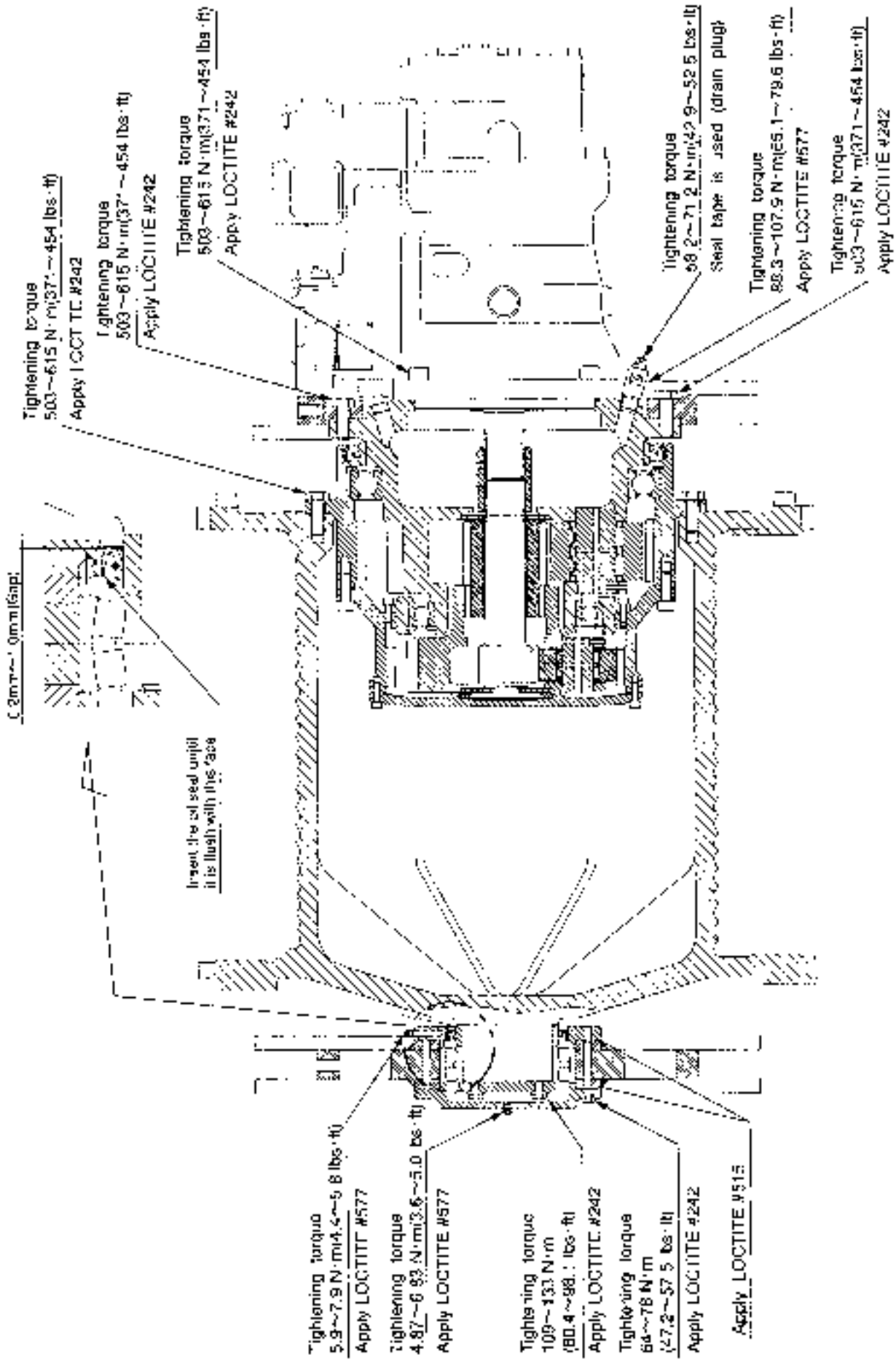
6.4 WINCH ASSEMBLY

6.4.1 WINCH INSTAL

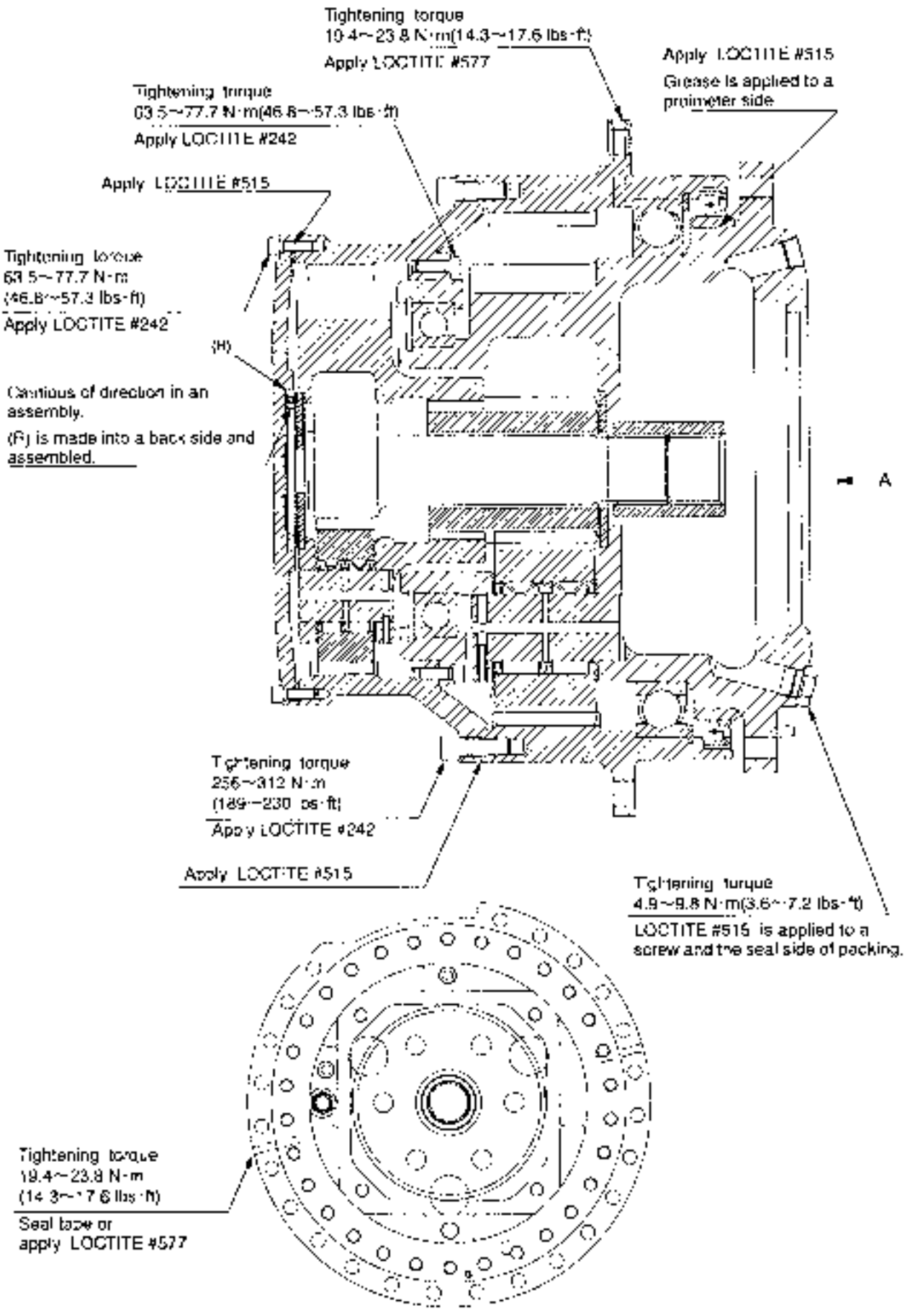


6.4.2 WINCH ASSEMBLY / REDUCTION UNIT WITHOUT FREE FALL (STD.)

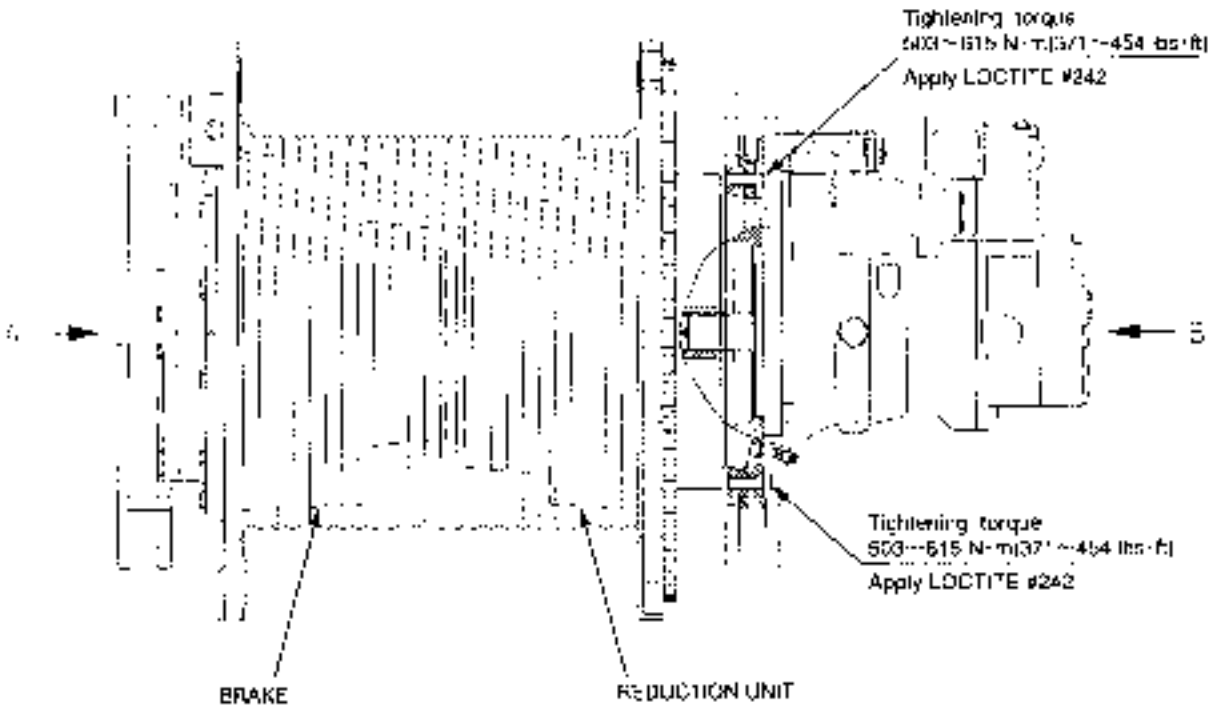
WINCH ASSY

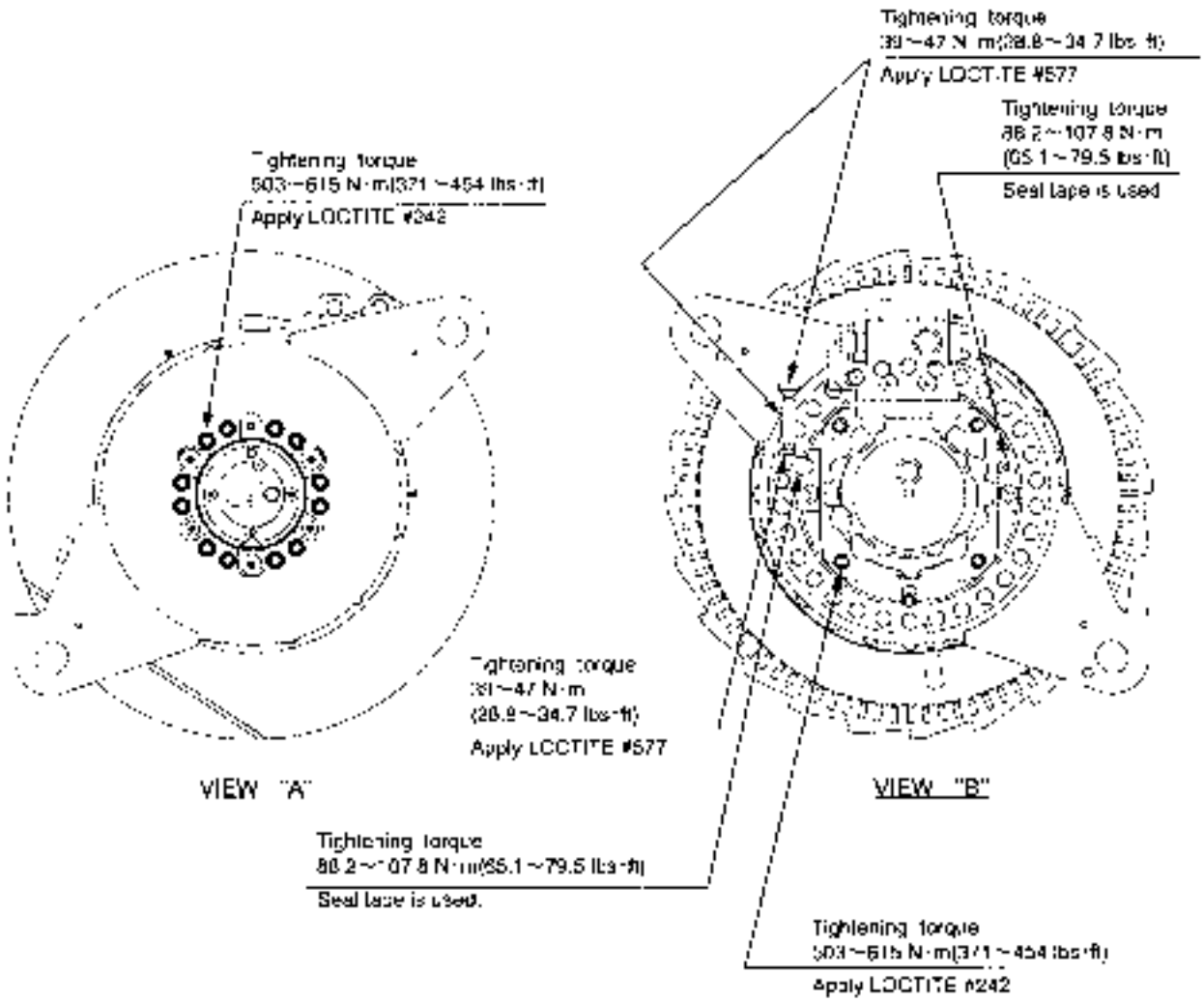


REDUCTION UNIT ASSY



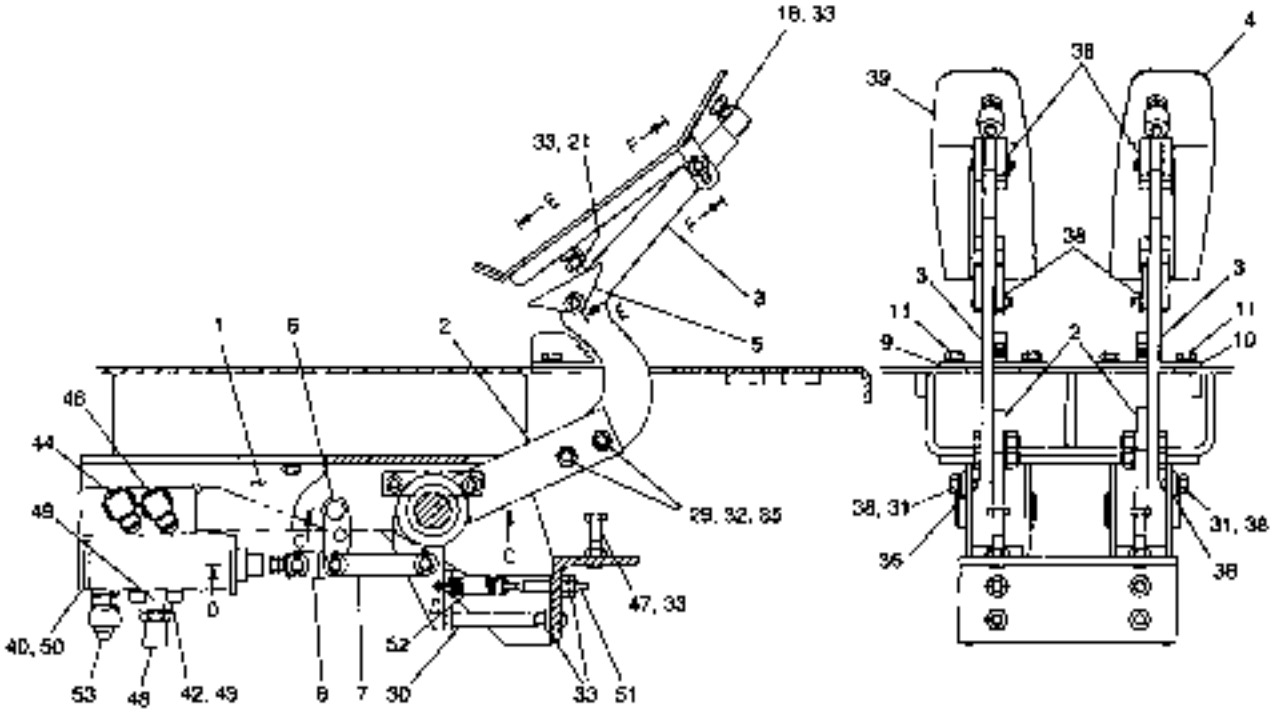
6.4.3 WINCH ASSEMBLY WITH FREE FALL (OPT.)

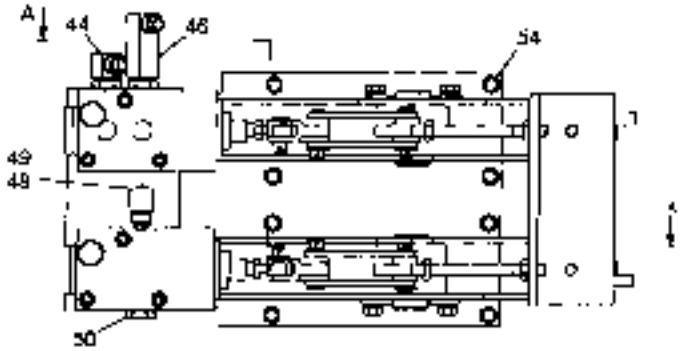


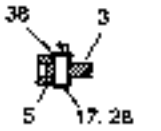


6.5 BRAKE PEDAL

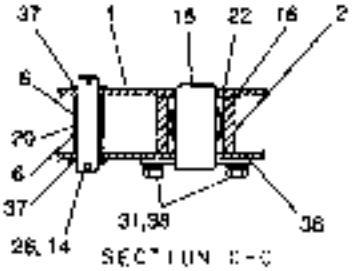
6.5.1 ASSEMBLY DRAWING



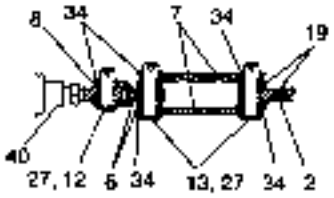




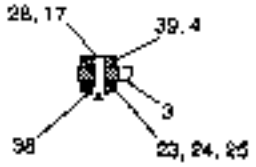
SECTION E-E



SECTION C-C



SECTION D-D



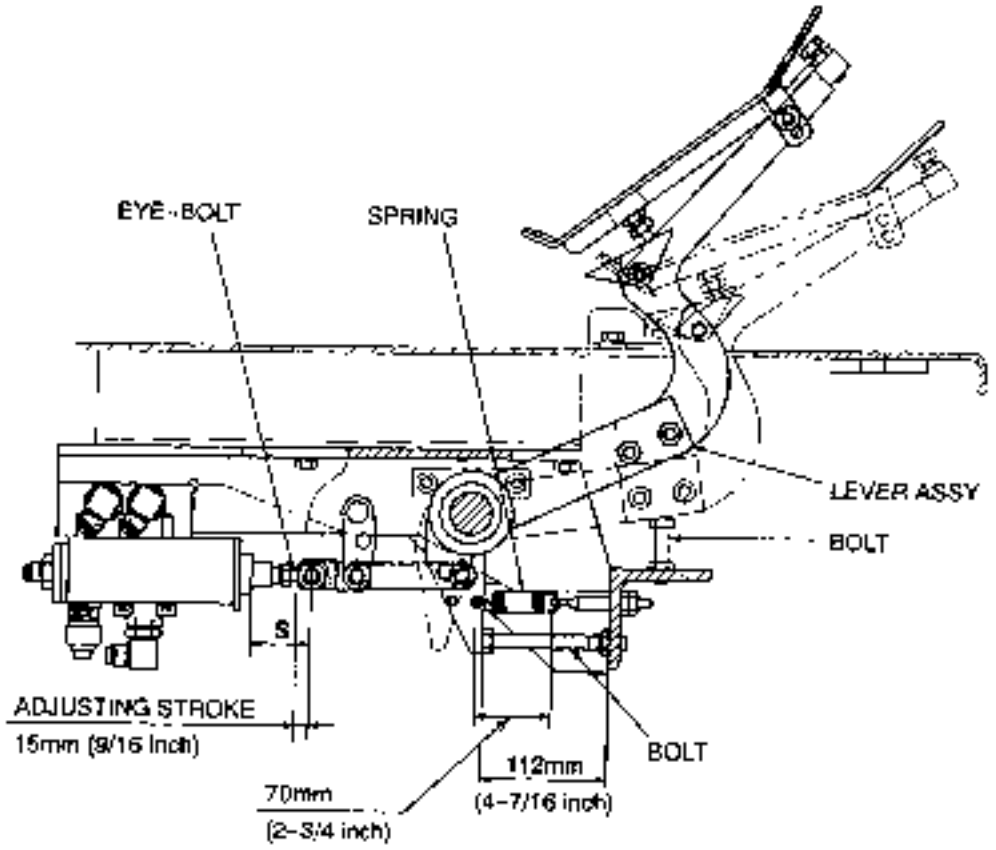
SECTION F-F

1. Bracket
2. Lever assembly
3. Link
4. Pedal
5. Pawl
6. Link
7. Link
8. Link
12. Pin
13. Pin
14. Pin
15. Pin
16. Bearing
17. Pin
18. Bolt
19. Spacer
20. Spacer
21. Bolt
22. Spacer
23. Shim (0.4)
24. Shim (0.6)
25. Shim (0.9)
26. Cotter pin
27. Cotter pin
28. Cotter pin
29. Bolt
30. Bolt
31. Sems bolt
32. Nut
33. Nut
34. Washer
35. Lock washer
36. Plate
37. Washer
38. Washer
39. Pedal
40. Brake valve
42. Capscrew
43. Lock washer
44. Elbow
45. 90° Elbow
46. 90° Elbow
47. Capscrew
48. 90° Elbow
49. Connector
50. Plug
51. Eye bolt
52. Spring
53. Pressure switch
54. Sems bolt

Item	Name	Size	Tightening torque N-m (ft-lbs)
29	Bolt	M12 X 40	41.19 ± 3.92 (30.3 ± 3)
42	Capscrew	M10 X 70	34.32 ± 3.92 (25.3 ± 3)
53	Pressure Switch	PF3/8	29.41 ± 2.94 (21.7 ± 2)

- Prior to the installation of the bearing (No.16), sufficiently pack grease
- Apply Moly coat to the rotating sections.

6.5.2 ADJUSTING THE BRAKE PEDAL



Adjustment

1 Adjust the eye bolt until the dimension S is 53 mm (2-3/32)

2 Depress the brake pedal until the valve spool reaches the stroke end {dimension S = 37.5 mm (1-15/32)}.

3. Bring the bolt (No.47) into contact with the lever (No.2) in the status described in the 2 above, and loosen 3/4 turn (protrude upward) to adjust the dimension S until it is 38.0 mm to 38.3 mm (1.496 to 1.508 inch). Then, tighten the nut.

4. Raise the lever (No 2) up, and return the valve spool to the neutral position {dimension S = 53 mm (2-3/32)}. Bring the cap screw (No.30) into contact with the lever (No.2), and loosen 3/4 turn (protrude left). Then, tighten the nut.
{dimension S = 52.3 mm to 52.5 mm (2.06 to 2.07 inch)}

5. Adjust the spring (No.52) until the dimension **L** is 70 mm (2-3/4) in the status described in the 4 above

6. Ensure that the effective stroke of the valve (No 40) from the time when the pedal is depressed to the time it is released is 15 mm (19/32).

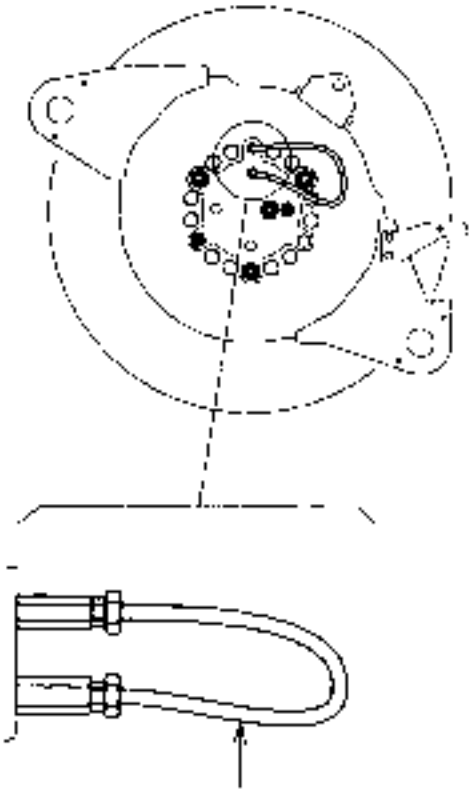
6.6 BLEEDING AIR FROM BRAKE CIRCUIT

If air remains in the piping from the brake valve to the cylinder built in the winch, the brake response becomes poor.
After the brake valve and piping are removed, bleed air by the following sequences shown below.

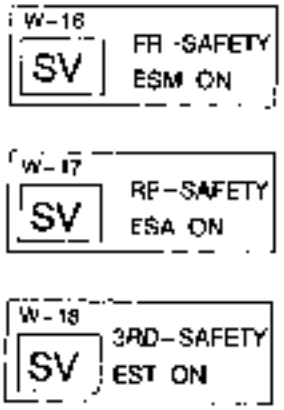
⚠ DANGER

Be sure to lower the hook onto the ground, and select the "Neutral free" mode. Then, ensure that the drum does not rotate even when you release your foot from the brake pedal.

1. Bypass the quick coupler of the winch brake section with a hose, while the engine is stopped.
   Hose used: GG20H01033D1
2. Start the engine, and increase the engine revolution to the high idling. (*)
3. Fully depress the brake pedal, and press the brake selector switch to enter the "Free fall mode".
   * The free fall indicator lamp lights up.
4. Release your foot from the brake pedal, and wait for approx. a minute.
   At this time, air is bled.
5. Return to the "Neutral brake mode", and stop the engine.
   After the engine is stopped, wait until the control pressure is lost (approx. a minute), and then, remove the bypass hose.

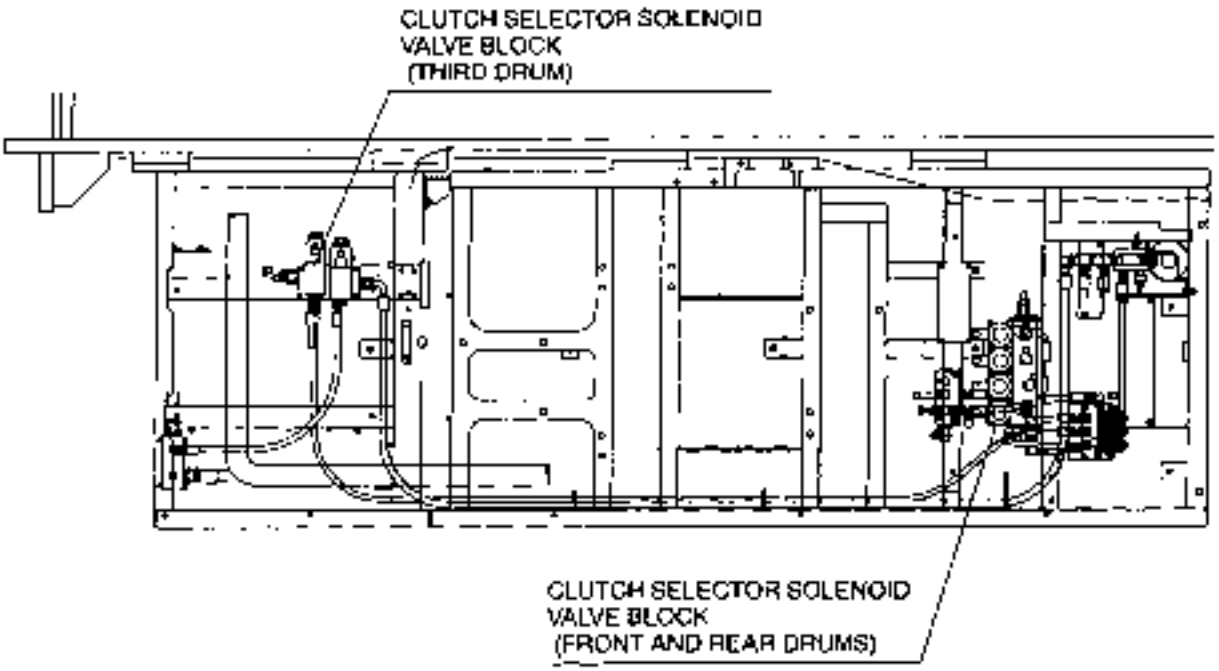


BYPASS HOSE
PART No. : GG20H01033D1



* If the error message shown in the drawing on the right side appears on the cluster gauge of the operator's cabin at the startup of the engine, provide the procedures below.

(1) Stop the engine
(2) Remove the electrical harness connector of the basic machine from the clutch selector solenoid valve block
(3) Start the engine.
(4) Reconnect the connector that was removed in the step (2).

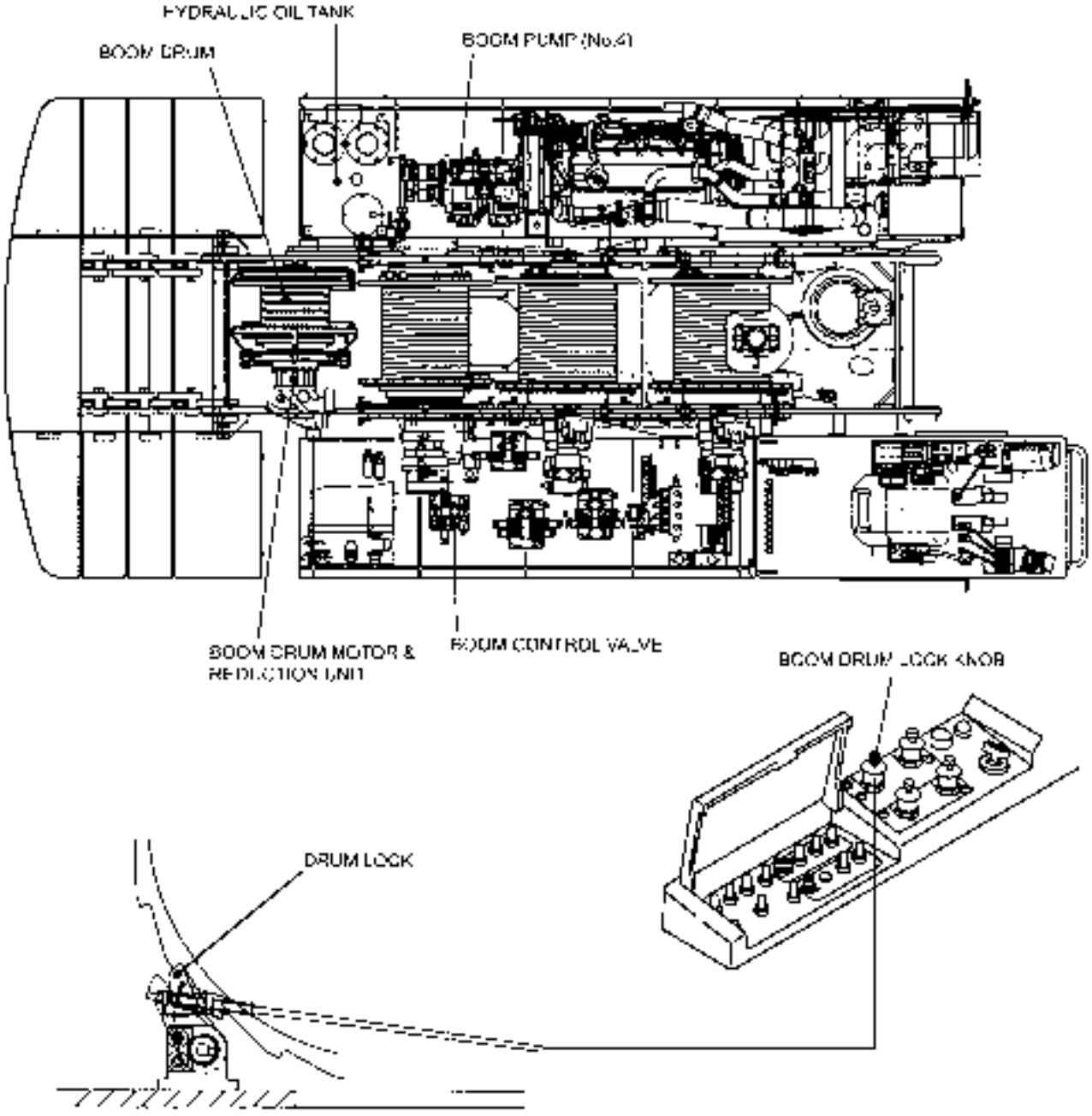


7. BOOM HOIST SYSTEM

7.1 APPARATUS AND LOCATION OF COMPONENTS

The boom hoist system consists of the boom pump, the boom control valve, the boom drum motor, a reduction unit, the boom drum itself and the drum lock mechanism.

The pressurized oil for the boom hoist system is supplied by the No.4 pump installed on the engine's power divider. From this pump, the oil flows through the control valve to power the motor for the boom drum.



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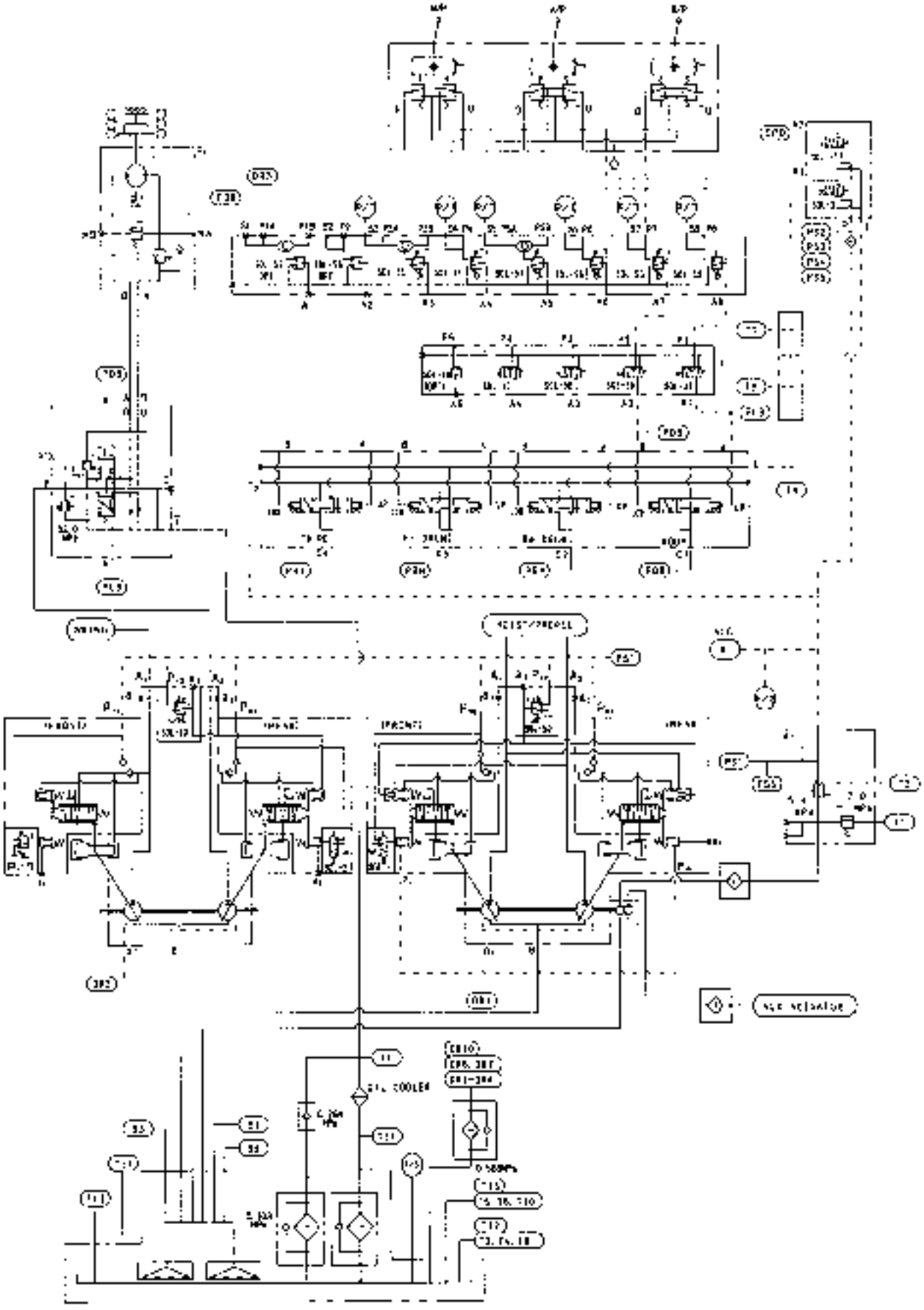
7.2 CONSTRUCTION AND FUNCTION

7.2.1 HYDRAULIC SCHEMATIC

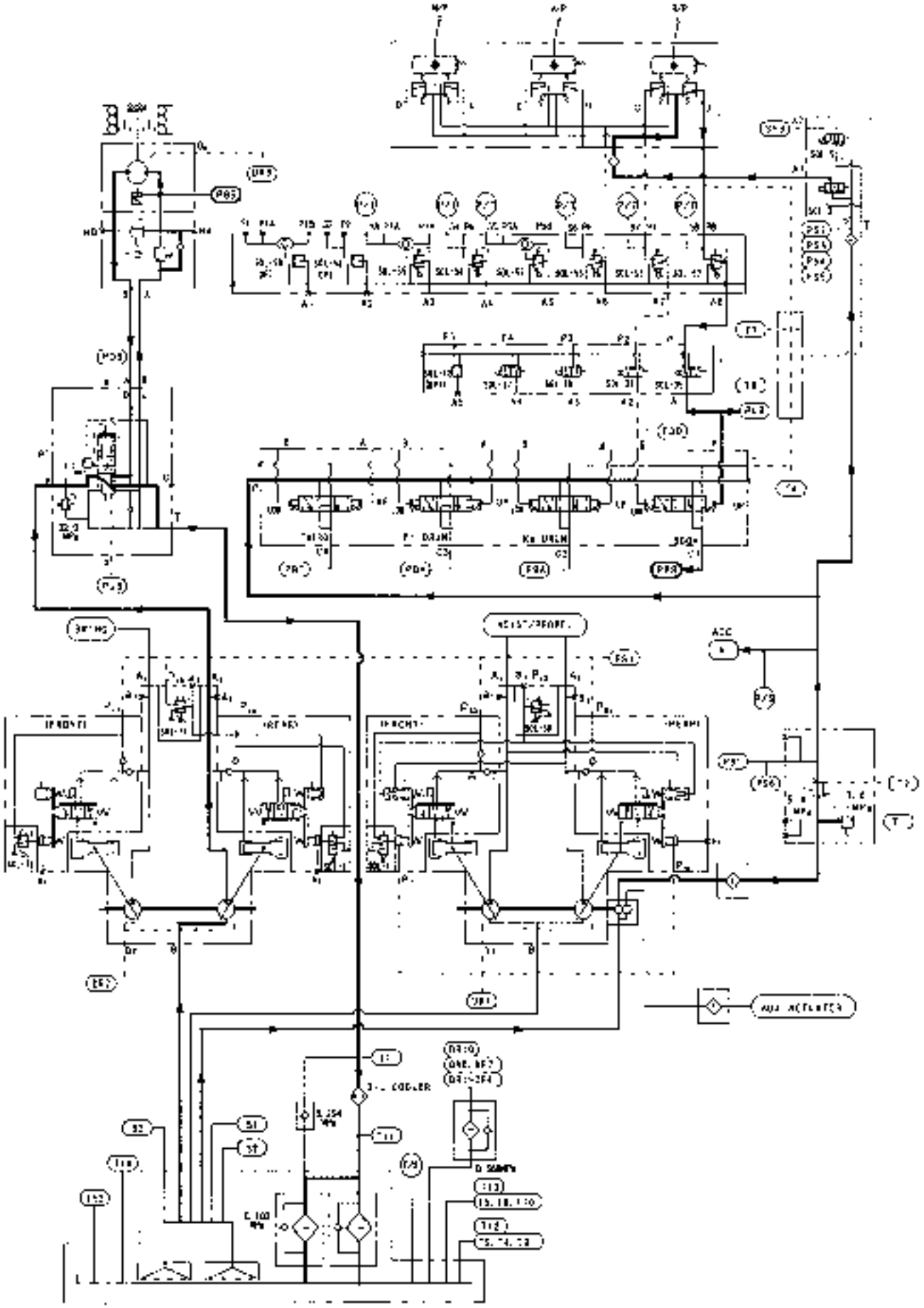
Boom Hoist Hydraulic Schematic



7.2.2 RAISING THE BOOM

Pressurized hydraulic oil from the No 4 pump flows continuously through the control valve.
While the Function lock lever is in the "Operation" position (SOL-3.ON POSITION), pressurized oil is also flowing from the control pump, past the accumulator and then through the valve block and into the remote control valve.
Shifting the Boom Hoist control lever to "Raise" directs control system oil through the remote control valve and valve block and into the [PUB] port of the control valve This pressure shifts the spool. At the same time, the control pressurized oil flows into the port [PBB] of the brake cylinder built in the boom motor via the valve block (4-sect on pilot operated valves), and then control pressure is applied to release the negative brake mechanisms. This allows the oil pressure from the No.4 pump to activate the boom hoist motor and drive the drum to raise the boom.

Raising the Boom



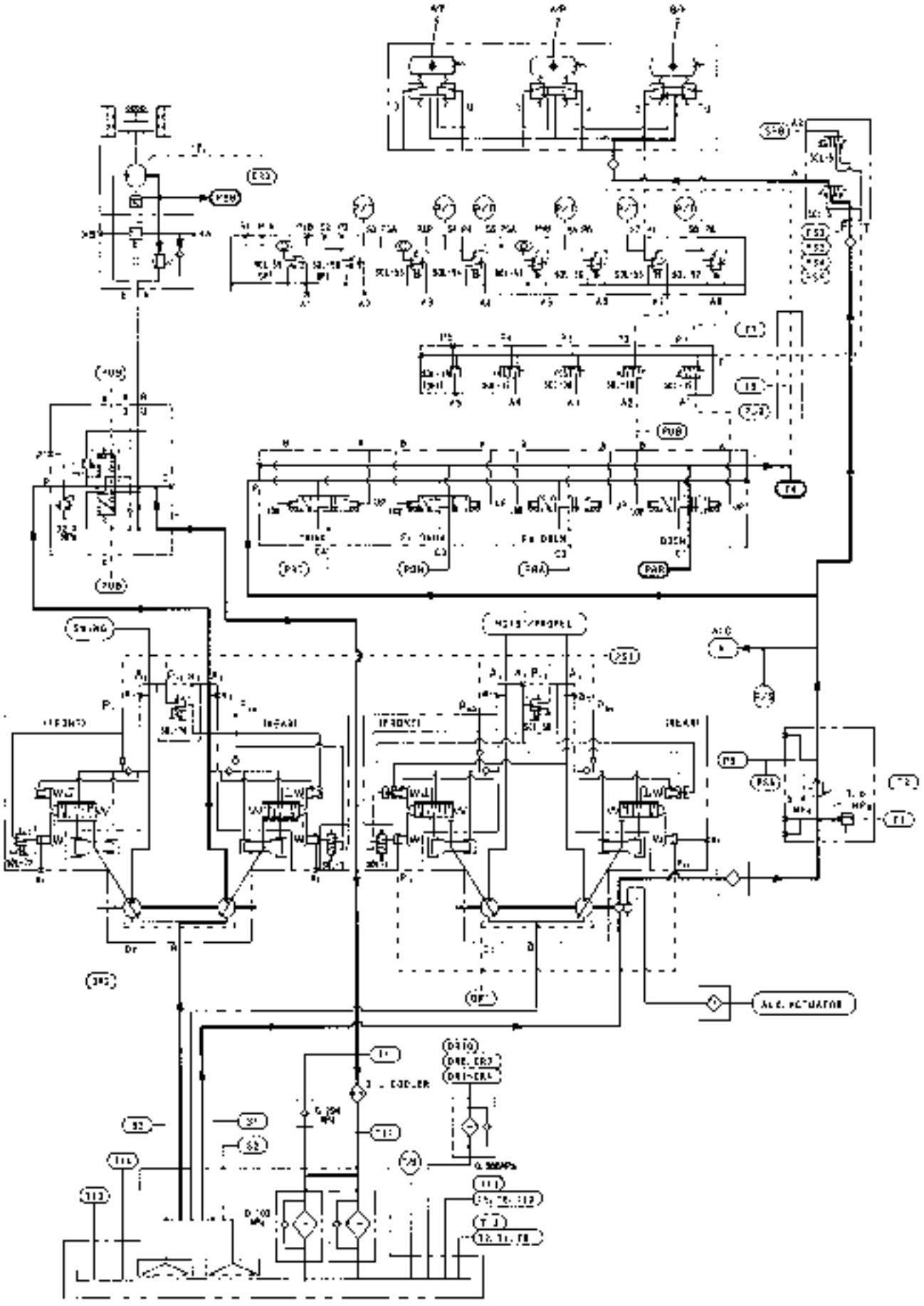
7.2.3 NEUTRAL (MAINTAINING THE BOOM POSITION)

With the Boom Hoist control lever returned to its neutra position, the control pressure is cut off, and the oil flow from the No 4 pump is again allowed to pass through the control valve and flow freely back to the oil reservoir.

Now, although the weight of the suspended load and the boom continues to pull on the drum, further rotation of the drum is prevented by a motor counterbalance valve that disallows any motor rotation by blocking the return of oil to the reservoir.

At the same time, the oil pressure to the boom drum motor negative brake is also released back to the reservoir. Both braking mechanisms then re-engage to hold the boom hoist drum in position

Neutral The Boom (Maintaining Boom Position)



7.2.4 LOWERING THE BOOM

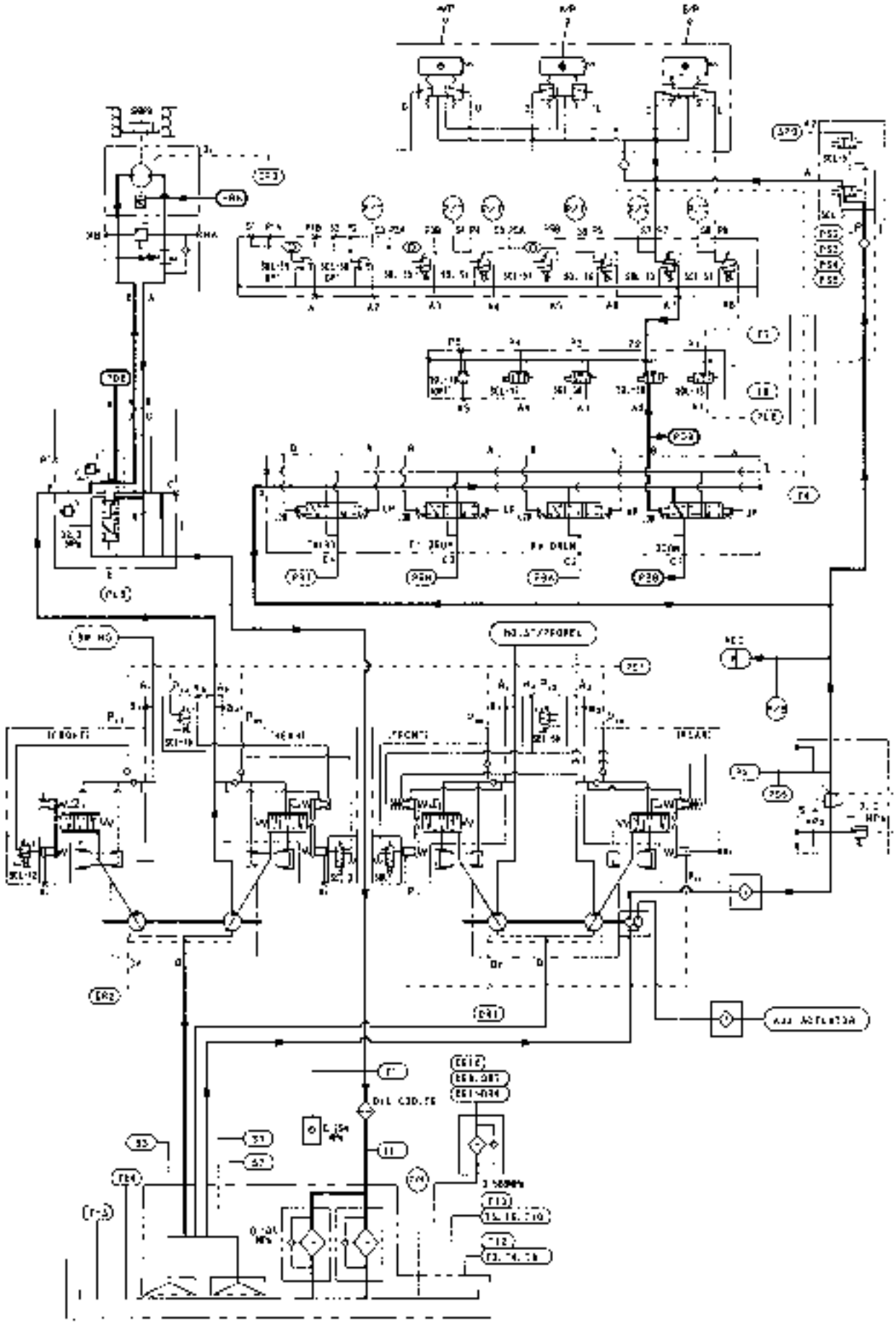
Pressurized hydraulic oil from the No.4 pump flows through the control valve while oil from the control pump flows past the accumulator and into the valve block and the remote control valve. (The function lock lever remains in the "Operation" position.(SOL-3:ON POSITION))

Shifting the Boom Hoist control lever to "Lower" directs control system oil through the remote control valve and through the valve block and into the [PDB] port of the control valve to shift the spool.

At the same time, the control pressurized oil flows into the port [PBB] of the brake cylinder built in the boom motor via the valve block (4-section pilot operated valves), and then control pressure is applied to release the motor parking brake.

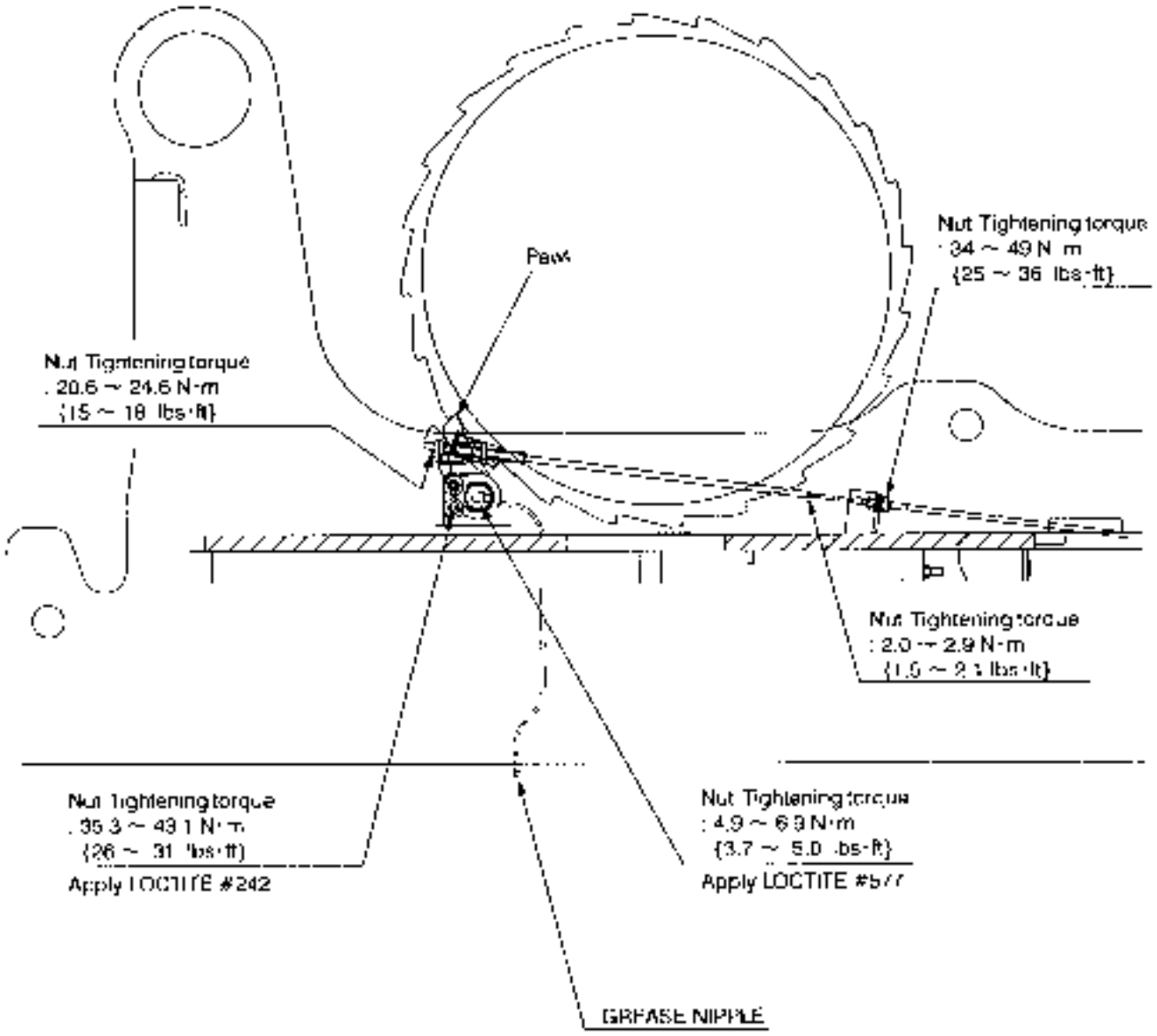
The pressurized oil from the No.4 pump is sent to the lowering side of the boom hoist motor. This line pressure opens the counterbalance valve and drives the boom hoist motor so that the boom drum lowers the boom

Lowering the Boom



7.3 BOOM DRUM LOCK

7.3.1 ASSEMBLY DRAWING



- When the assembly is complete, fill grease until it is squeezed out from the clearances of the pawl.

7.3.2 ADJUSTING THE BOOM DRUM LOCK

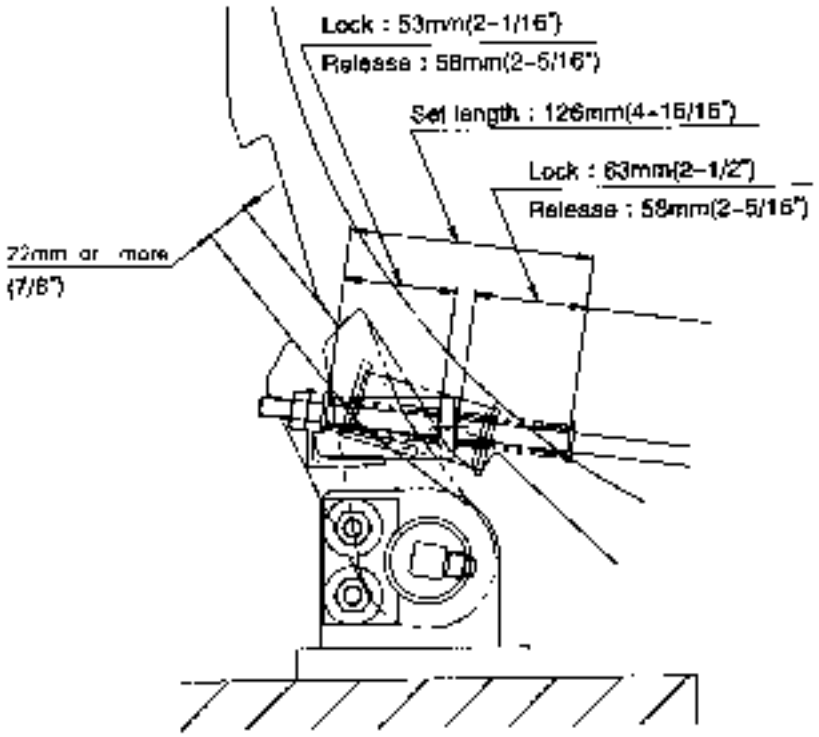
⚠WARNING

Do not adjust the boom hoist drum locks until the boom has been lowered to the ground.
Failure to observe this precaution may result in serious injury or loss of life.

1. Pull the drum lock knob in the LOCK position and check to see that the pawl is engaged in the bottom of the drum ratchet with the drum lock condition. If the pawl is not engaged in the bottom of the ratchet, adjust the spring dimension to allow the pawl to be engaged in the bottom.
2. With the condition of step1, adjust the respective dimension as shown in the figure.
3. Push the drum lock knob in the RELEASE position and check to see that the pawl is clear of the ratchet by at least 22mm (7/8 inch).
   Operate the knob to the LOCK position and to the RELEASE position and confirm that the pawl moves smoothly.

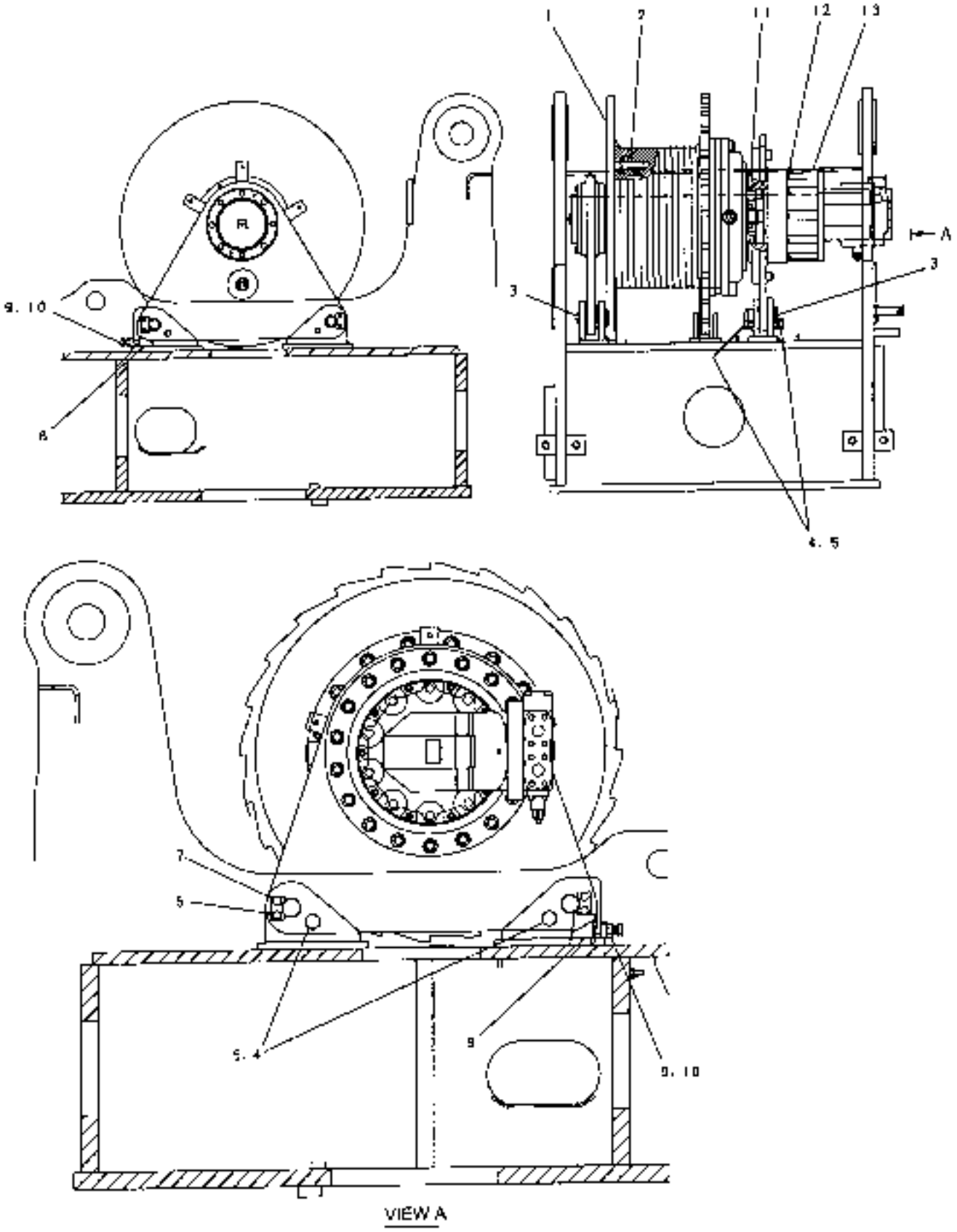
⚠WARNING

Keep hands and clothing clear of the rotating drum.
Failure to observe this precaution may result in serious injury or loss of life.



7.4 DRUM AND REDUCTION UNIT

7.4.1 BOOM WINCH ASSEMBLY

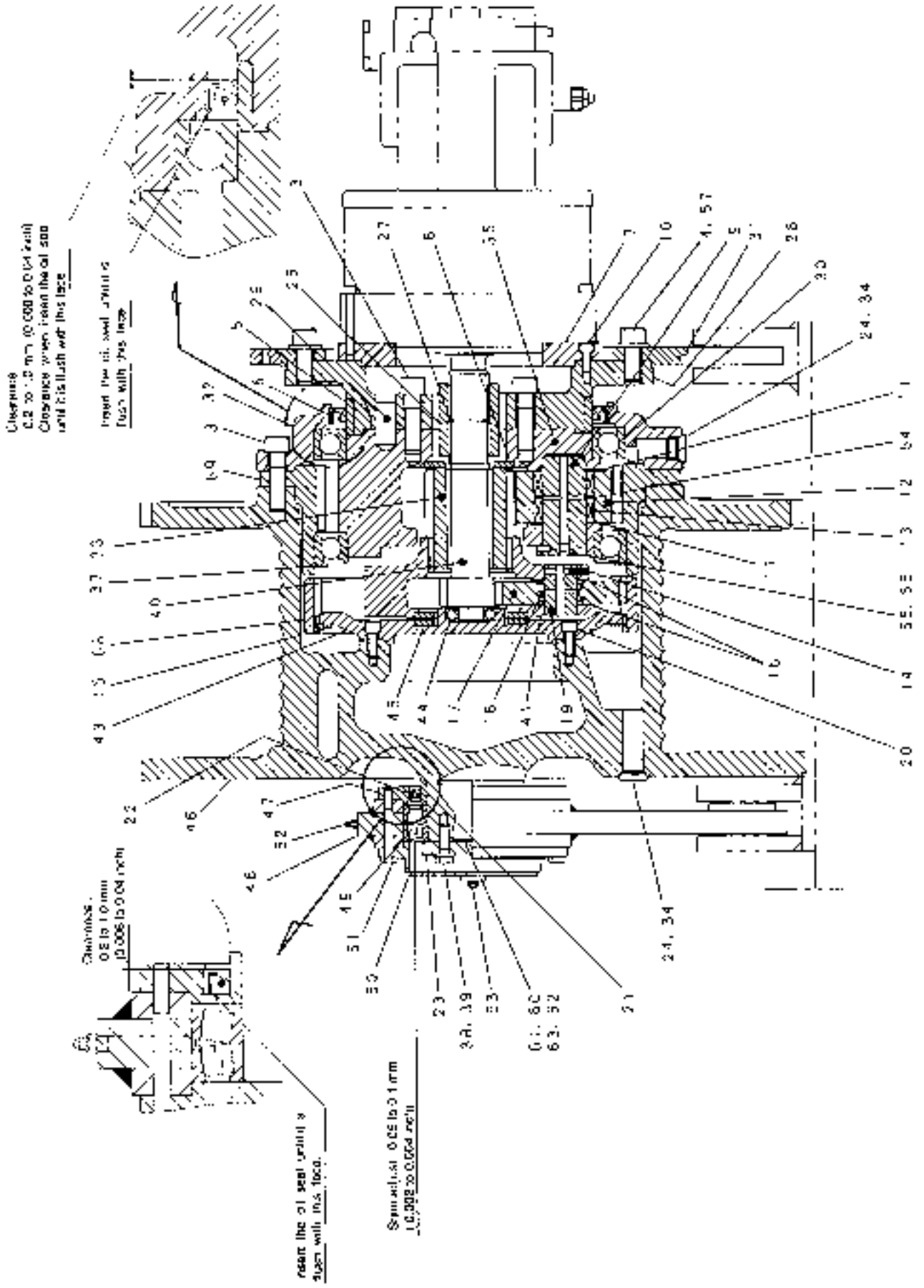


1. Winch Assy
2. Rope Wedge
3. Pin
4. Capscrew
5. Nut
6. Keeper Plate
7. Capscrew
8. Block
9. Capscrew
10. Nut
11. O-Ring
12. Capscrew
13. Hydraulic Motor Assy

Tightening torque

Item	Name	Size	Tightening Torque N-m (ft-bs)	
5	Nut	M20	336 to 410 (246 to 303)	Lightly press the code No.4 cap screw against the winch, and tighten it.
7	Capscrew	M10 X 20	35.3 to 43.1 (26 to 31)	Apply Loctite #271
10	Nut	M16	171 to 211 (126 to 156)	Screw in the code No.9 cap screw so that the code No.8 block is stable, and then, tighten it.
12	Capscrew	M10 X 75	64.7 to 77.5 (48 to 57)	Apply Loctite #242

7.4.2 BOOM DRUM AND REDUCTION UNIT ASSEMBLY



3 Capscrew
4 Capscrew
5 Sleeve
6 Oil seal
7 Retainer
8 Spacer
9 Pin
10 Capscrew
11 Thrust washer
12 Pinion
13 Needle Bearing
14. Spring pin
15. Retaining ring
16 Thrust washer
17. Pinion
18. Needle Bearing
19. Pin
20. Capscrew
21. Collar
22. Oil seal
23. Plate
24. O-Ring
26. Collar
27. Retaining ring
28. Retainer
29. Pin
30. Ball Bearing
31. Plate
32. Retainer
33. Sun gear
34. Plug
35. Spider
37. Retaining ring
38. Capscrew
39. Washer
40. Sun gear
41. Spider
43. Cover
44. Ball Bearing
45. Spacer
46 Winch Drum
47 Retainer
48 Plate
49 Bearing
50 Retainer
51 Capscrew
52 Grease Nipple
53 Breather
54 Thrust Washer
55. Keeper Plate
56. Capscrew
57. Washer
60. Shim
61. Shim
62. Shim
63. Shim
68. Ring Gear
69. Ring Gear

Tightening torque

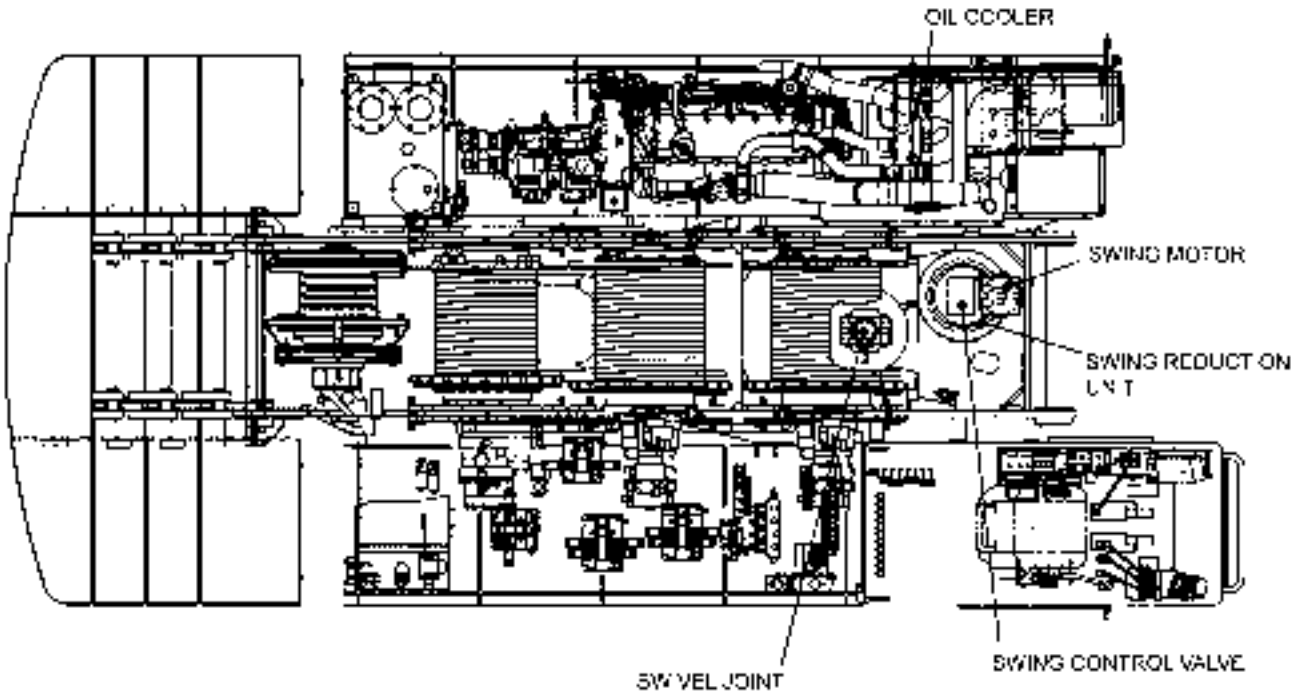
Item	Name	Size	Tightening Torque N-m (ft-lbs)	
3	Capscrew	M20 X 70	500 to 618 (368 to 455)	Apply Loctite #242
4	Capscrew	M10 X 45	500 to 618 (368 to 455)	Apply Loctite #242
10	Capscrew	M10 X 25	63.7 to 77.5 (45 to 57)	Apply Loctite #242
34	Plug	PF3/4	113 to 123 (83 to 90)	-
38	Capscrew	M12 X 40	82 to 100 (61 to 72)	Apply Loctite #242
51	Capscrew	M10 X 85	35.3 to 43.1 (26 to 31)	Apply Loctite #242

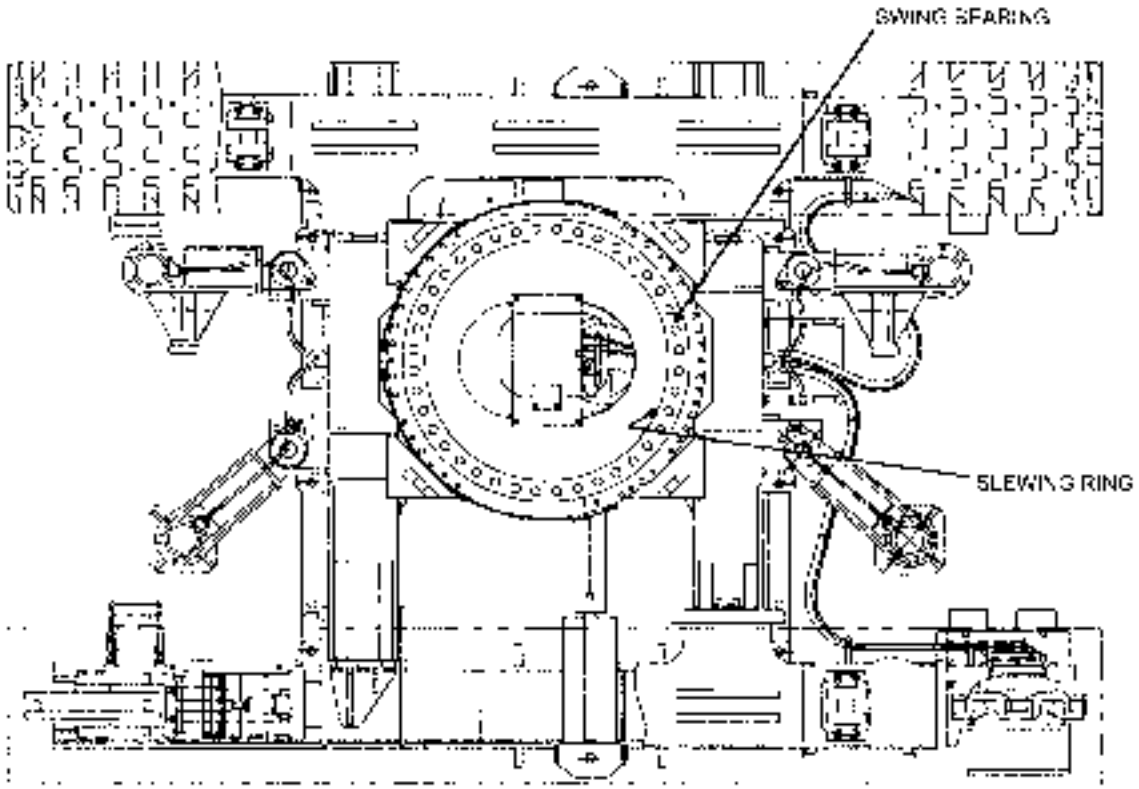
8. SWING SYSTEM

8.1 APPARATUS AND LOCATION OF COMPONENTS

The swing system consists of the swing motor which includes an internal brake, the swing control valve, the reduction unit, the swing bearing ring, the swivel joint, the swing gear and the swing lock.
To swing the machine's upper body, pressurized oil from the swing pump mounted on the power divider is sent to the swing motor by way of the control valve which is directly mounted on the swing motor.

Main Component Locations

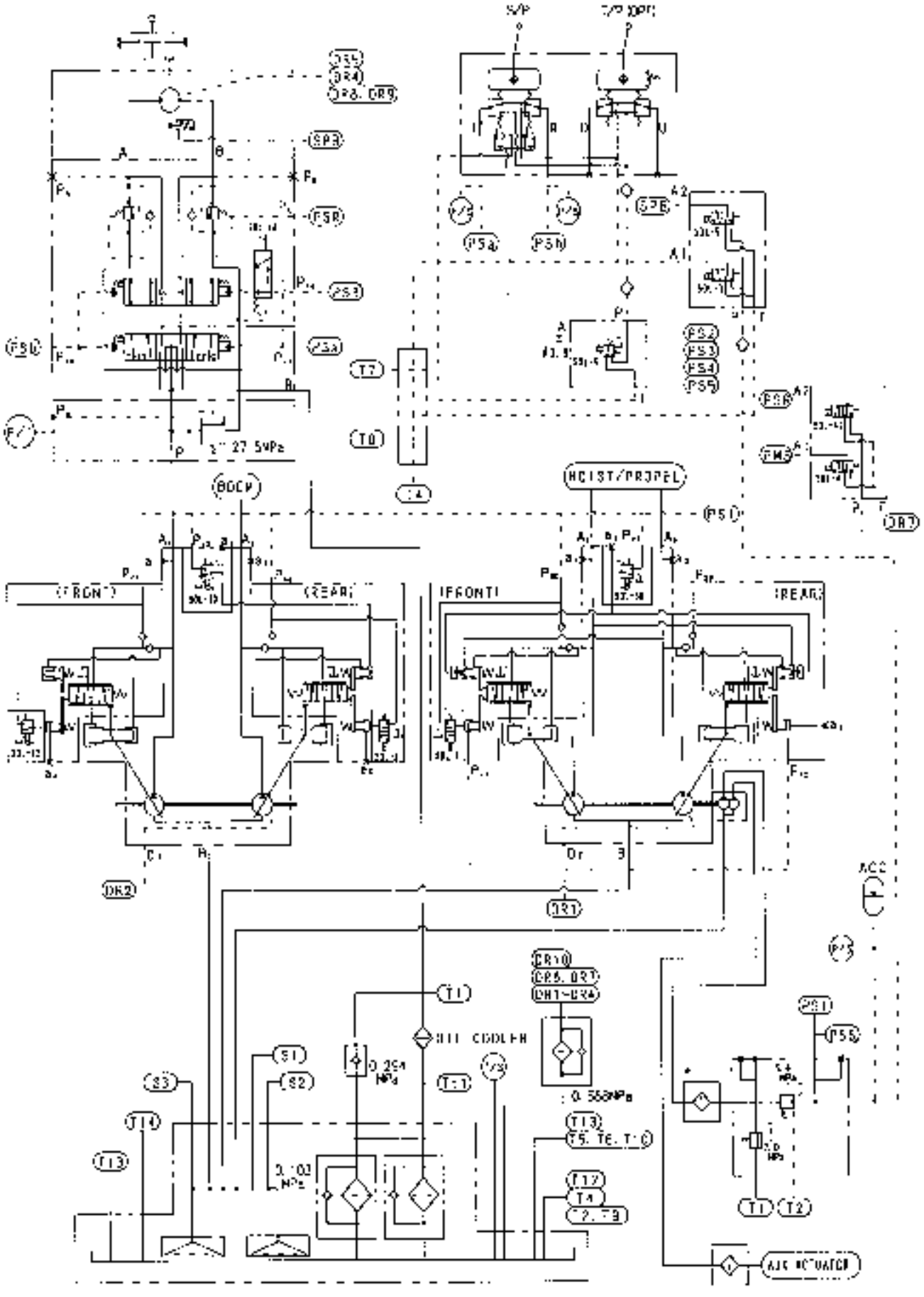




8.2 CONSTRUCTION AND FUNCTION

8.2.1 HYDRAULIC SCHEMATIC

Swing hydraulic schematic



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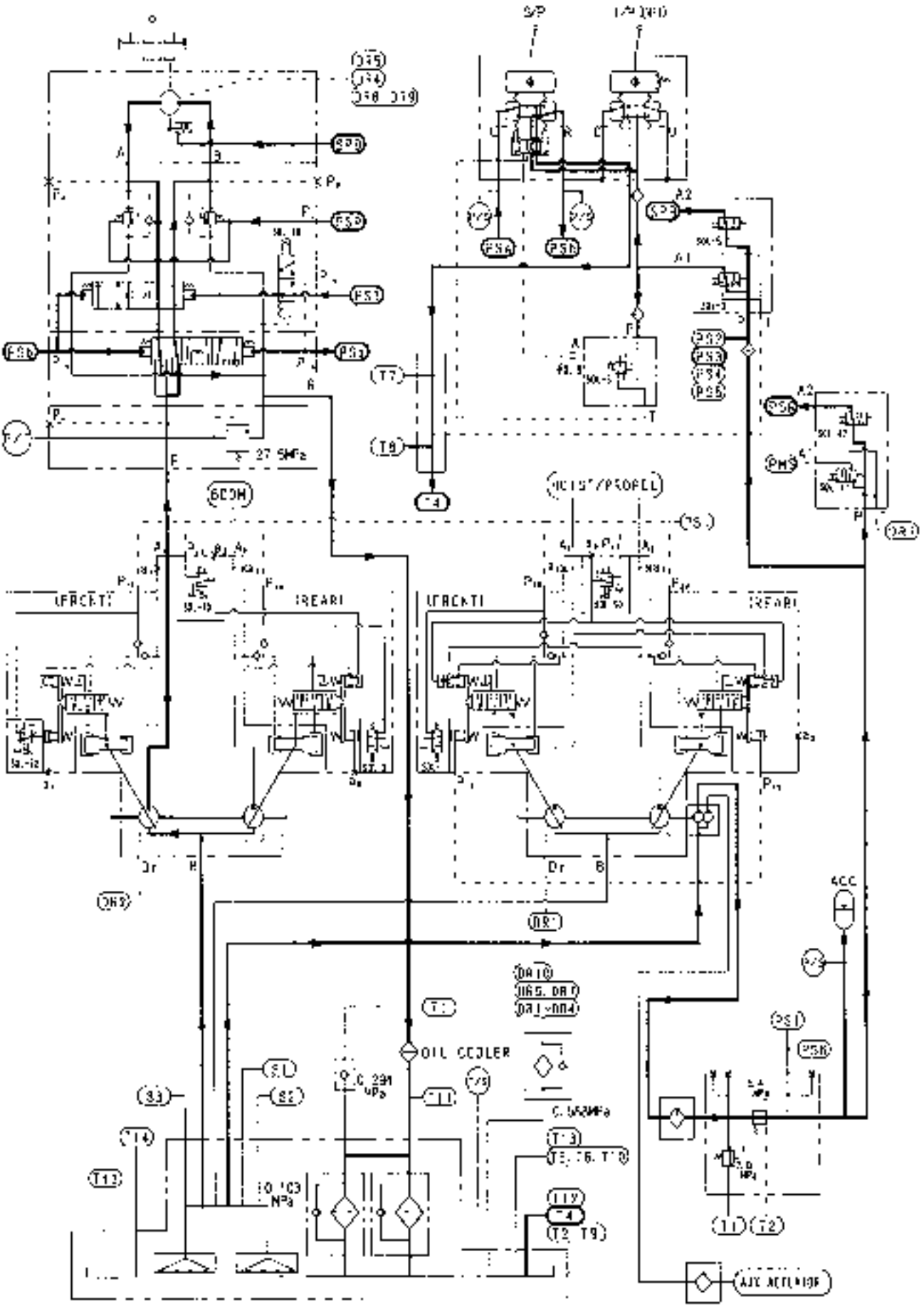
8.2.2 SWING

The working principle of the rightward swing, identical to that of the leftward swing, is shown below. [The swing brake is released (SPB SOL5 is actuated).]
The pressurized oil from the swing pump is led to the swing control valve. On the other hand, the control pressurized oil from the control pump flows into the valve block, swing remote control valve, and brake mode select solenoid valve (SOL48) built in the swing control valve through the accumulator.
[The function lock lever is at the "working position" (SOL3 is actuated).]

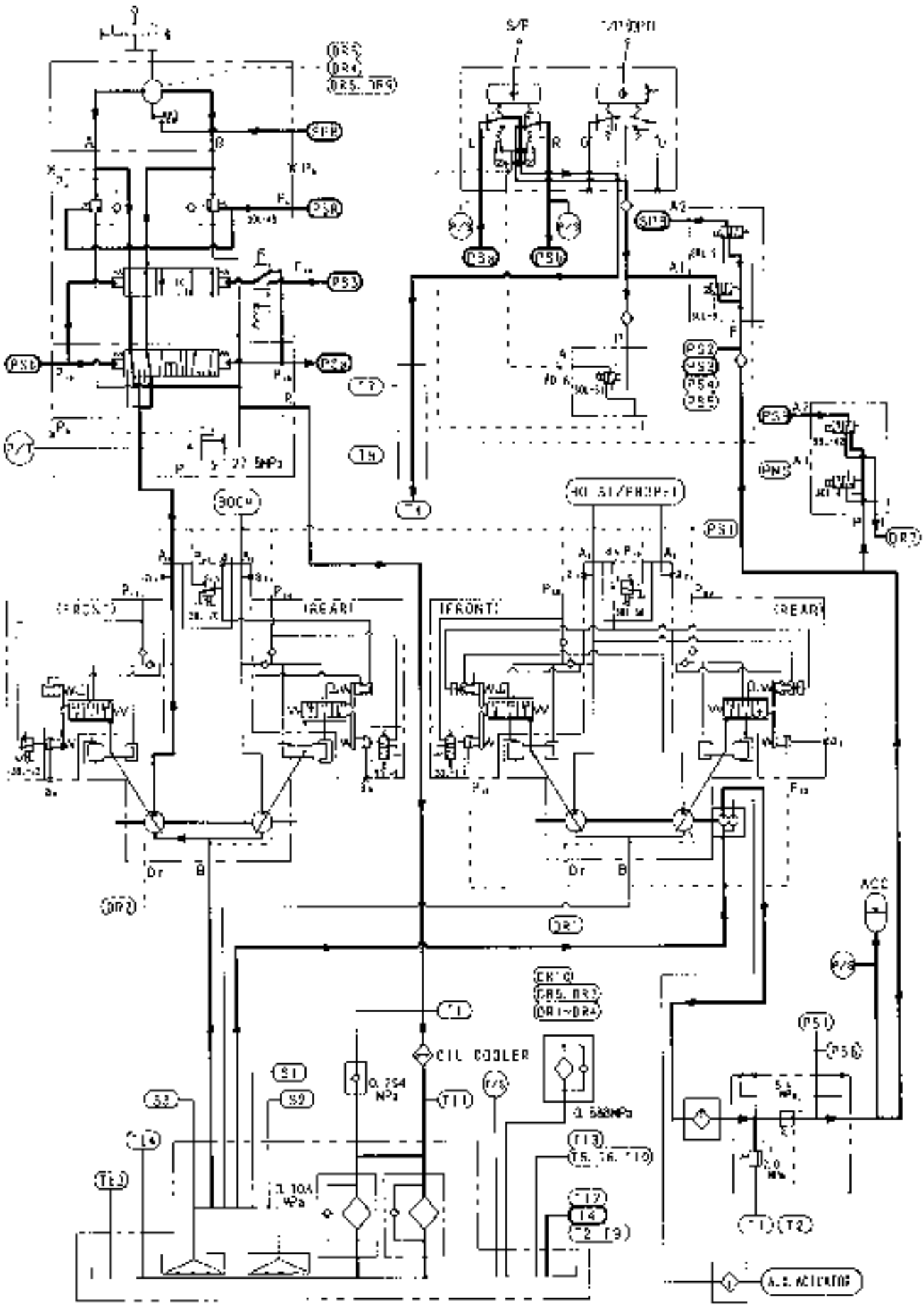
(1) Neutral free mode
When the swing mode selector switch on the side stand panel in the operator's cab is set to the "free" side, the control pressurized oil flows through the solenoid valve (SOL 48) to move the spool "B" of the swing control valve to the full stroke.
In this status, when the swing control lever is swung down to the right swing side (back ward), the control oil flows through the remote control valve, and is led to the [PSb] port of the control valve to move the spool "A".
The main pressurized oil controlled by the control valve is fed to the swing motor to run the motor.

(2) Neutral brake mode
When the swing mode selector switch on the side stand panel in the operator's cab is set to the "brake" side, the solenoid valve (SOL 48) is actuated to connect the both pilot ports, the swing control valve spool "A" and "B".
In this status, when the swing control lever is swung down to the right swing side (back ward), the control oil flows is led to the [PSb] port of the control valve to move the spools "A" and "B" at the same time.
The main pressurized oil controlled by the control valve is fed to the swing motor to run the motor.

Swing (Neutral Free Mode)



Swing (Neutral Brake Mode)



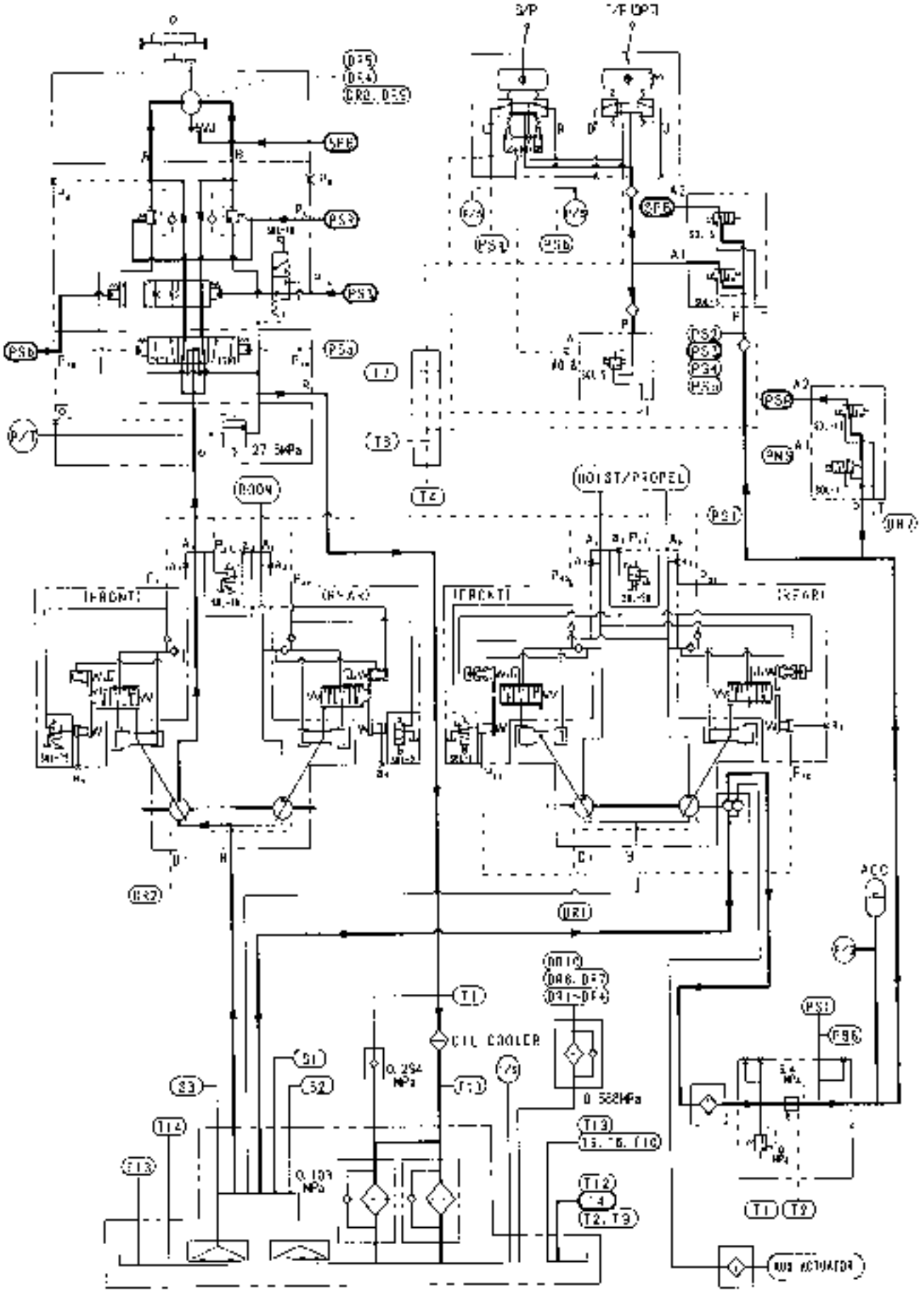
8.2.3 STOPPING

When the swing control lever is returned from the swing mode to the neutral mode, the control pressure from the remote control valve is lost and the control valve spool "A" returns to neutral. Thus, the main pressurized oil returns to the tank with no load.

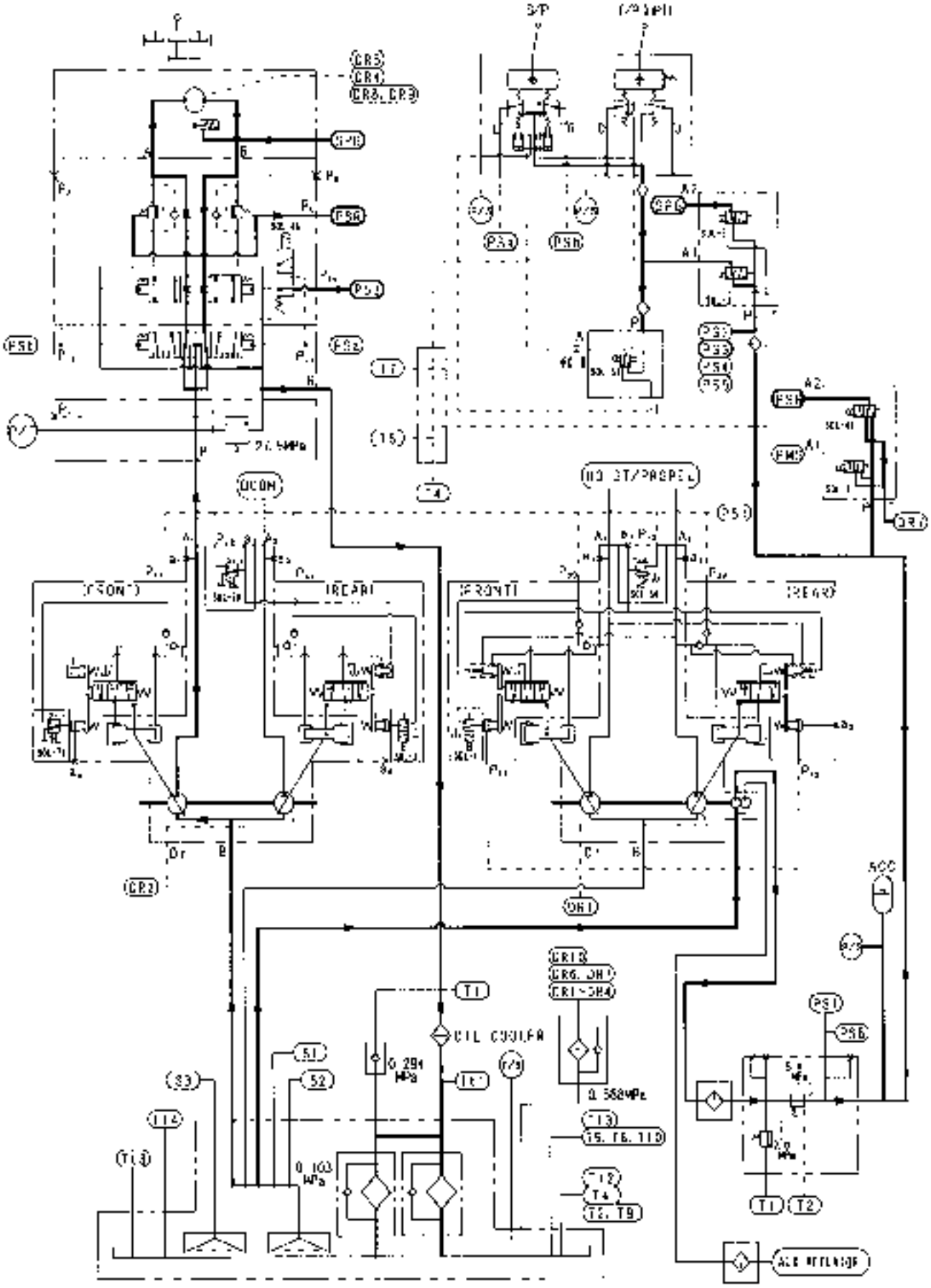
(1) Neutral free mode
Although the pressurized oil flow to the swing motor is shut down, the returned oil circulates in the motor and valves, since the spool "B" has been moved to the full stroke by the pilot pressure. Thus, the motor continues rotating by inertia. (The swing brake is released.) To stop the swing motion, carefully swing down the swing control lever to the opposite side.

(2) Neutral brake mode
The brake mode select solenoid valve (SOL 48) is actuated, and the spool "B" returns to neutral.
The brake pressure is generated at the exit port of the swing motor by the oil returned from the swing motor passing the restrictor section of the control valve spool "B". The swing motor is decelerated by the brake pressure until the motor is stopped smoothly. (The swing brake is released.)
The main pressurized oil returned from the swing motor is interrupted by the orifice of the spool "B", then the swing stops. If an unusually high pressure occurs, the overload valve is actuated to protect the circuit from damage. (At the neutral brake mode, the overload valve relief set is Low side.) However remember that the motor will not be stopped completely when external forces are always applied, including the operation on a slope or on windy days.

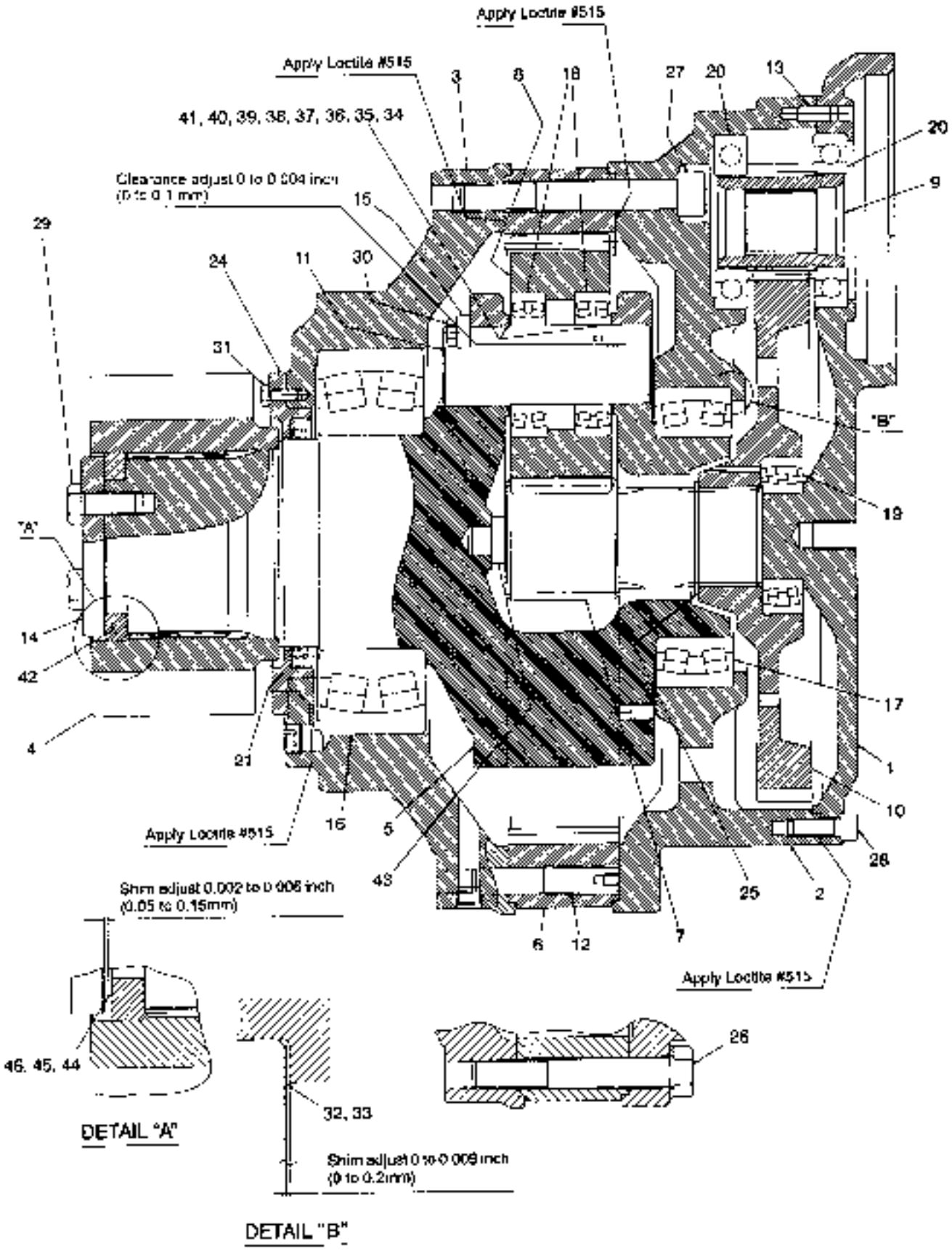
Stop (Neutral Free Mode)



Stop (Neutral Brake Mode)



8.3 SWING REDUCTION UNIT



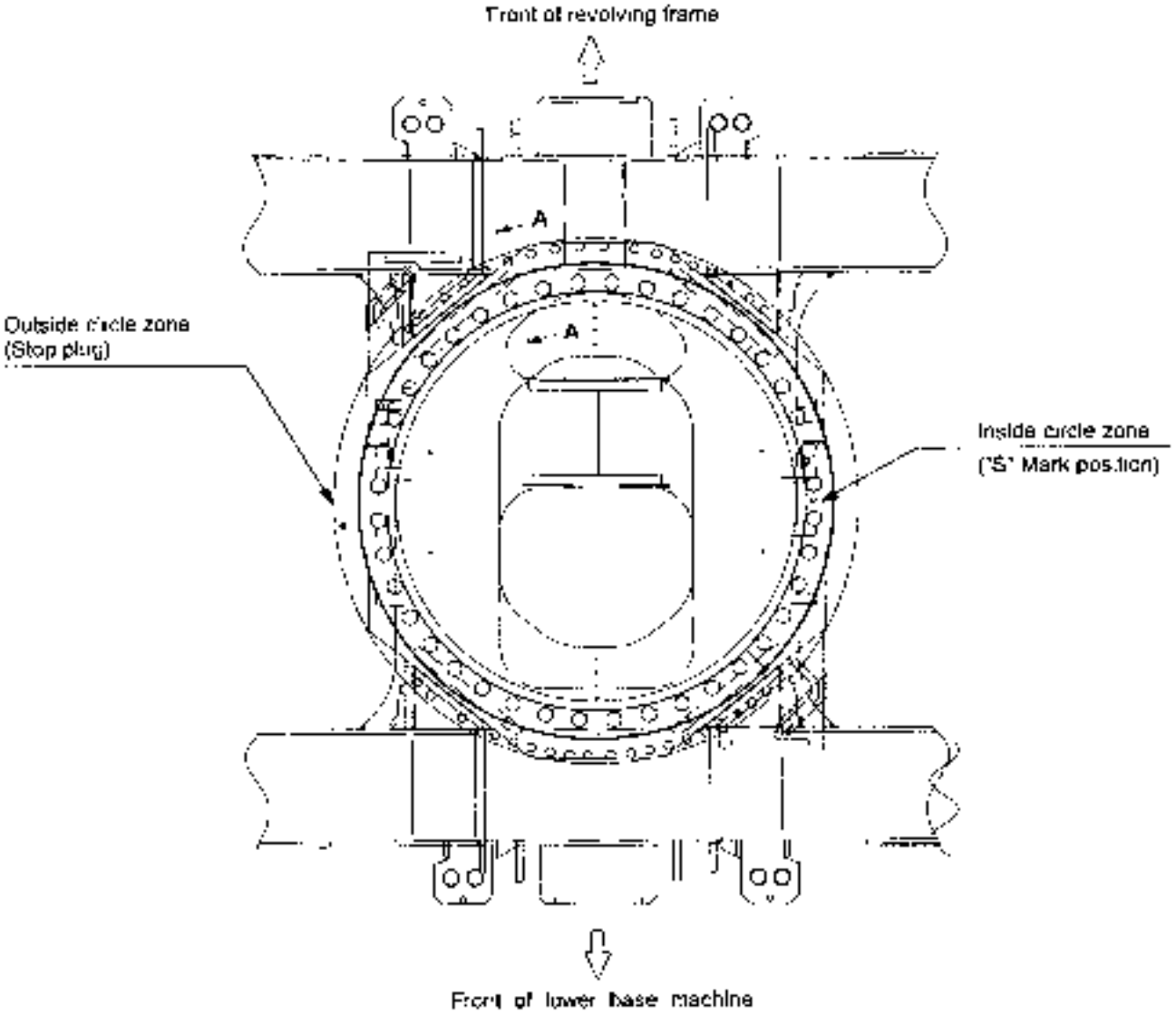
1. Housing
2. Housing
3. Housing
4. Pinion
5. Shaft
6. Ring gear
7. Sun gear
8. Pinion
9. Pinion
10. Gear
11. Pin
12. Pin
13. Pin
14. Plate
15. Keeper plate
16. Bearing
17. Bearing
18. Bearing
19. Bearing
20. Bearing
21. Oil seal
22. Plug
23. Plug
24. Retainer
25. Retaining ring
26. Capscrew
27. Capscrew
28. Capscrew
29. Capscrew
30. Capscrew
31. Capscrew
32. Shim (0.2) mm
33. Shim (0.5) mm
34. Shim (1.1) mm
35. Shim (1.2) mm
36. Shim (1.3) mm
37. Shim (1.4) mm
38. Shim (1.5) mm
39. Shim (1.6) mm
40. Shim (1.7) mm
41. Shim (1.8) mm
42. Spacer
43. Thrust button
44. Shim (0.1) mm
45. Shim (0.2) mm
46. Shim (0.3) mm

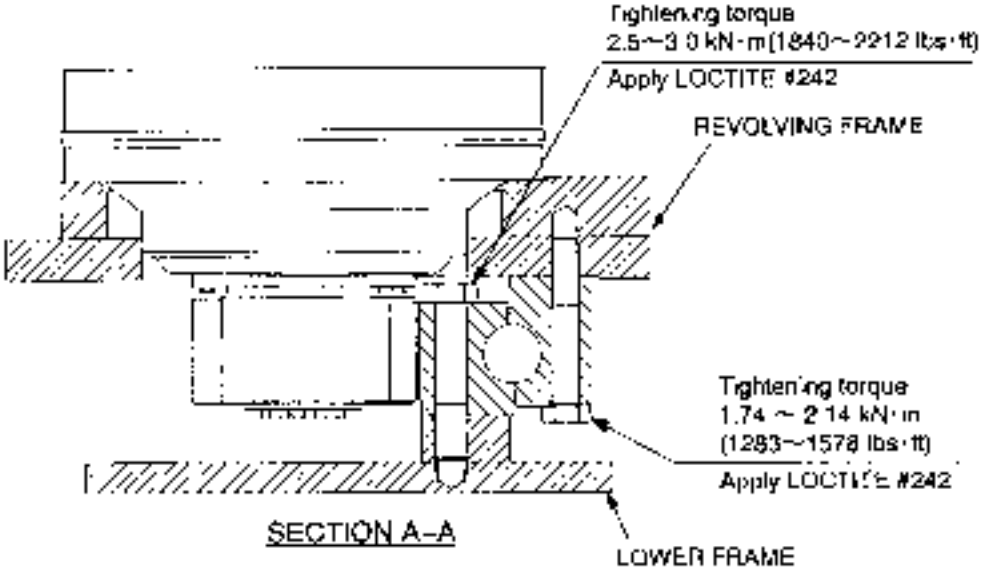
Tightening torque

Item	Name of Part	Size	Tightening Torque N-m (ft-lbs)	Remedy
22	Plug	PT1/2	57.9 to 71.6 (43 to 53)	Apply seal tape
23	Plug	PT3/4	88.2 to 107.8 (65 to 79.5)	Apply seal tape
26	Capscrew	M20 X 140	500 to 618 (369 to 455)	Apply locktite #242
27	Capscrew	M20 X 150	500 to 618 (369 to 455)	Apply locktite #242
28	Capscrew	M12 X 35	109 to 133 (80 to 98)	Apply locktite #242
29	Capscrew	M16 X 40	255 to 313 (188 to 230)	Apply locktite #242
30	Capscrew	M10 X 25	63.7 to 77.5 (47 to 57)	Apply locktite #242
31	Capscrew	M8 X 20	31.4 to 39.2 (23 to 28)	Apply locktite #242

- Apply Loctite #515 to the circumference of oil seal No.21
- Apply Loctite #242 to capscrew.
- Assembly weight : Approx. 400 kg (882 lbs)

8.4 SWING BEARING

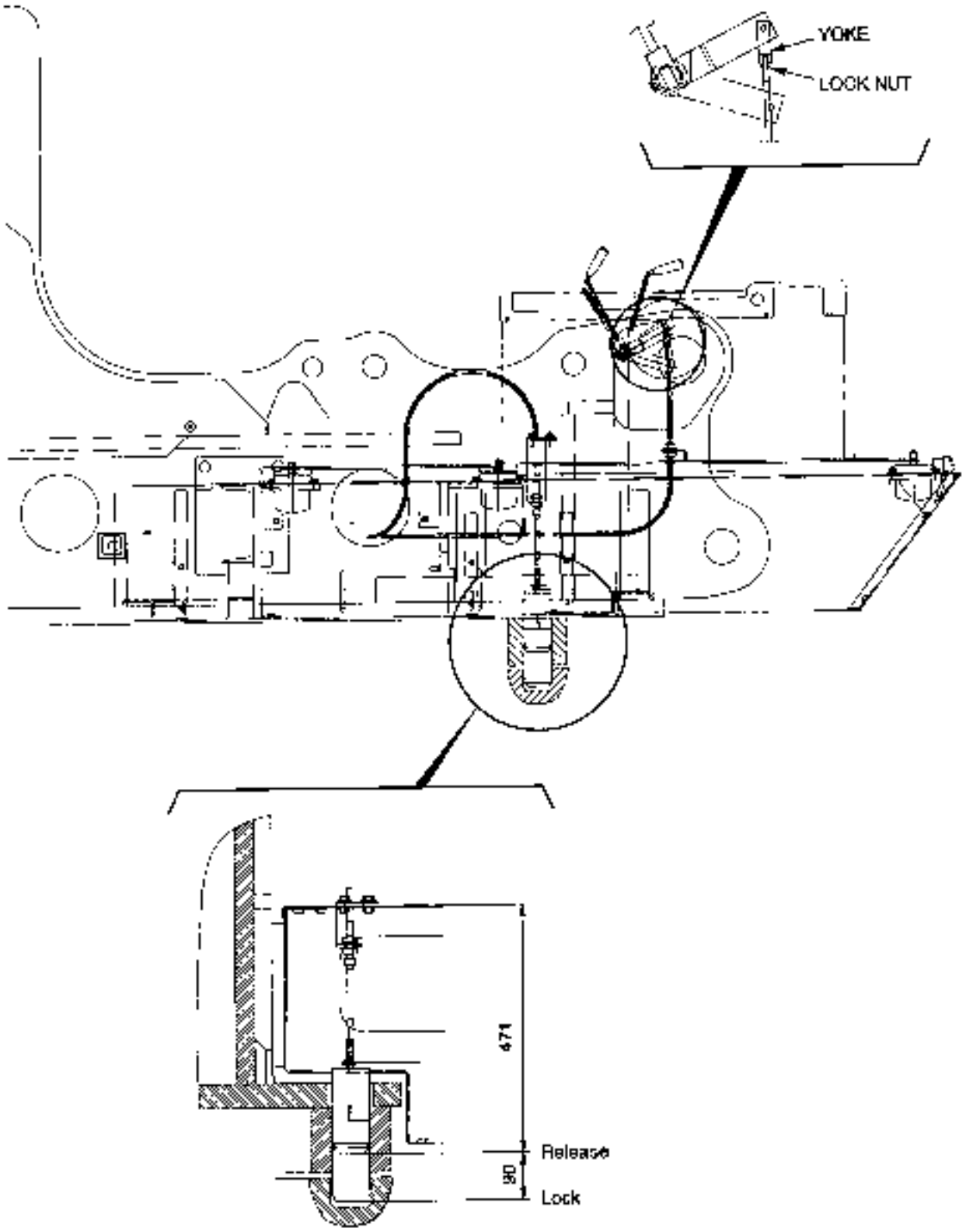




Method of bolt tightening

1. The soft zone of the bearing inner ring (S-marked area) against the lower unit must be positioned as shown in the figure.
2. Apply LOCKTITE #242 to screw of bolt and apply / molybdenum disulfidegrease to seat of bolt
3. Temporary tighten two axisymmetrically bolts positioned in the carbody with a tightening torque of 147 N/m (15 kgf/m)
4. Temporary tighten two bolts, which are positioned 90 degree appart from the bolts tightened in step (1). with a tightening torque of 147 N/m {15 kgf / m}.
5. Similarly, tighten all the bolts, in parts. in parts of axisymmetrically located two, with a tightening torque of 147 N/m {15 kgf / m}.
6. Fully tighten all the bolts with a tightening torque of 2.51 to 3.07 kN/m {256 to 313 kgf/m}.
7. After all the bolts are tighten to the car body, fully apply molybdenum disulfide grease to the gear tooth faces.
8. Place the upper unit with the roll pins inserted in the front and rear sides fitting to the bearing.
9. Tighten the four bolts which are located on the front both ends and rear both ends of the swing frame side with a tightening torque of 147 N/m {15 kgf / m}.
10. Tighten the bolts axisymetrically one after another with a tightening torque of 147 N / m {15 kgf N / m}.
11. Tighten all the bolts with a tightening torque of 2.51 to 3.07 kN / m {256 to 313 kgf / m}.

8.5 SWING LOCK



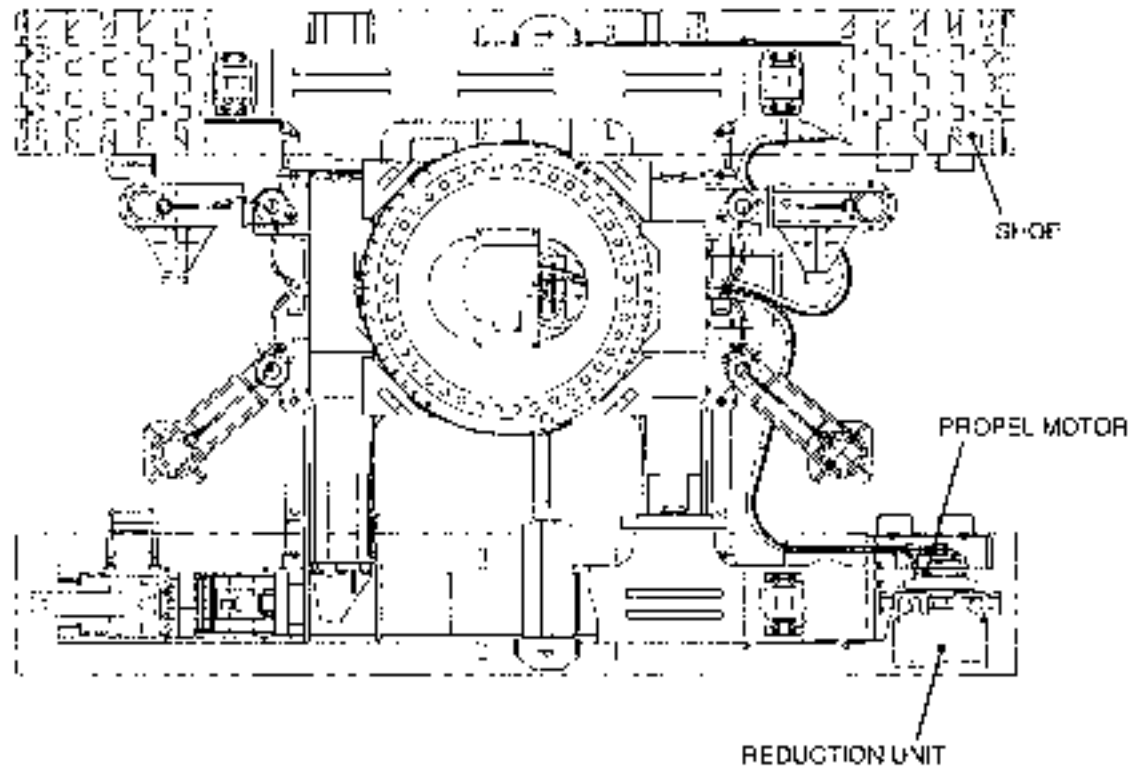
9. PROPEL SYSTEM

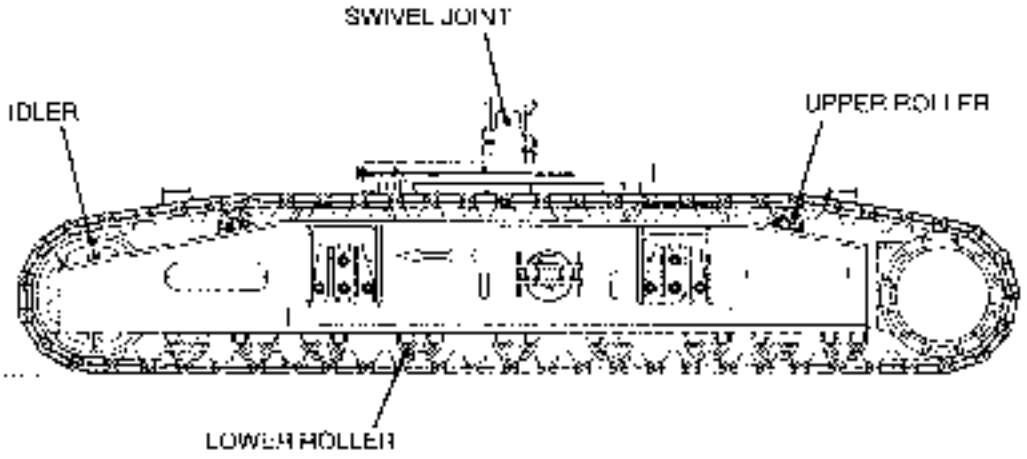
9.1 LOCATION OF THE MAJOR COMPONENTS

The Propel system consists of the main pump, the main control valve, the propel motors, the propel reduction units, the upper/lower rollers, the drive tumblers, idlers and shoes

Pressurized oil from the main pumps (No.1 and No.2 installed on the power divider) is controlled through the main control valve. This stream of pressurized oil flows through the swivel joint and then on to the left and right propel motors to run their respective motors.

A spring set/hydraulic release disk brake is installed on each of the two propel motors (built-in type)

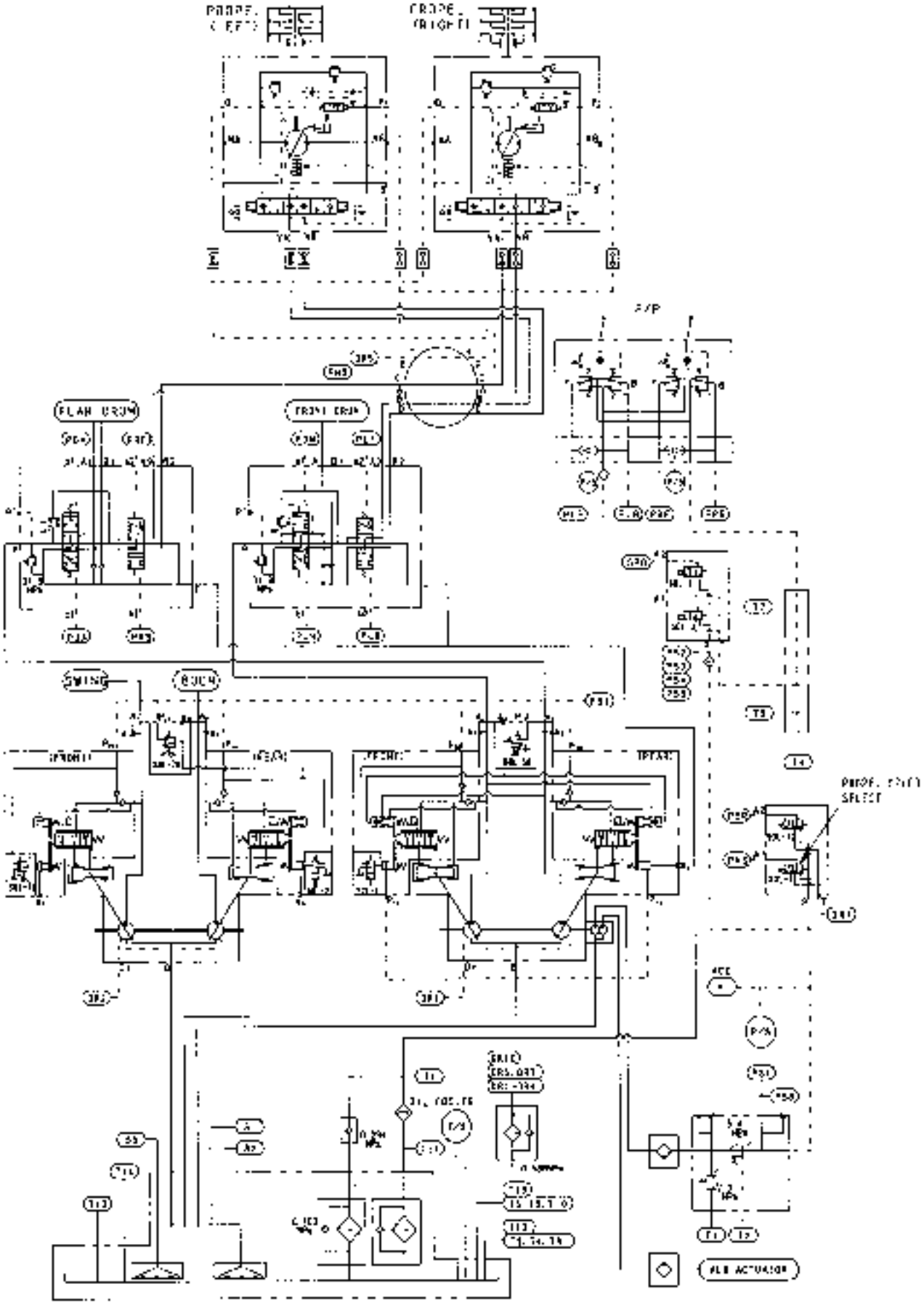




9.2 CONSTRUCTION AND FUNCTION

9.2.1 HYDRAULIC SCHEMATIC

Propel hydraulic schematic



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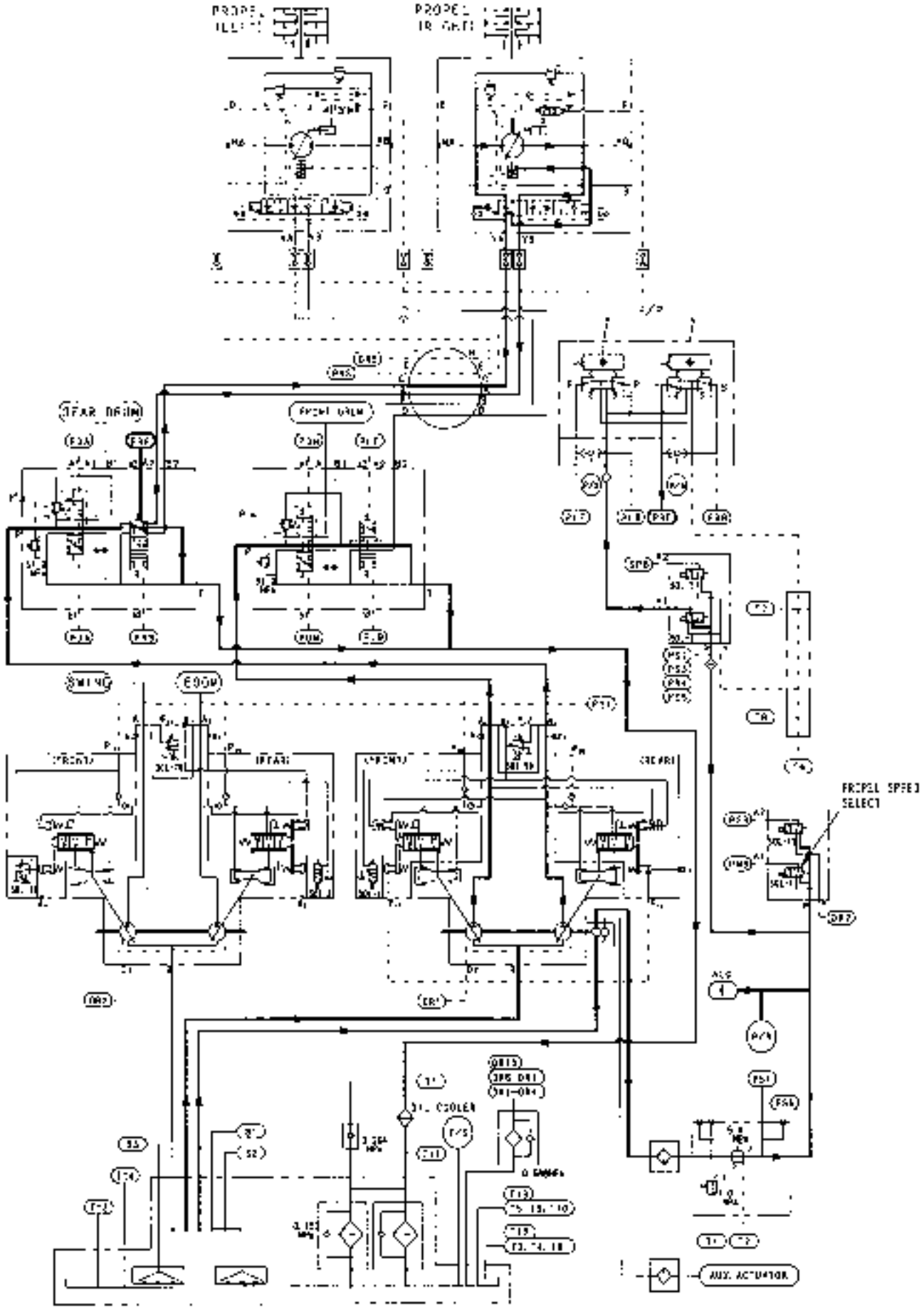
9.2.2 PROPELLING (RIGHT SIDE FORWARD)

Propeling the right and/or left sides and to the forward and reverse are basica ly the same operation.
We will use a rightside forward operation as the example here.
Pressu rised oil from the main pump (No. 2) is directed into the control valve.
The oil from the control pump goes throu.gh the accumulator and into the prope circuit's remote control valve
(The machine's function lock lever remains in the "Operation" position)
When the right propel control lever is shifted to "forward" the control oil runs through the remote control va ve to the control valve's [PRF | port to shift the spool of the prope section
The pressurized oil directed by the control valve then goes through the swivel joint and run into the propel motor. At the same time, this oil runs into the pilot of the brake va've and the brake cylinder.
The oil in this cylinder releases the brake, and the o l in the brake valve pilot moves the spool, so that the pressurized oil releases the mechanical and hydraulic brake.
The pressurized oil that activated the propel motor then is free to return to the reservoir.

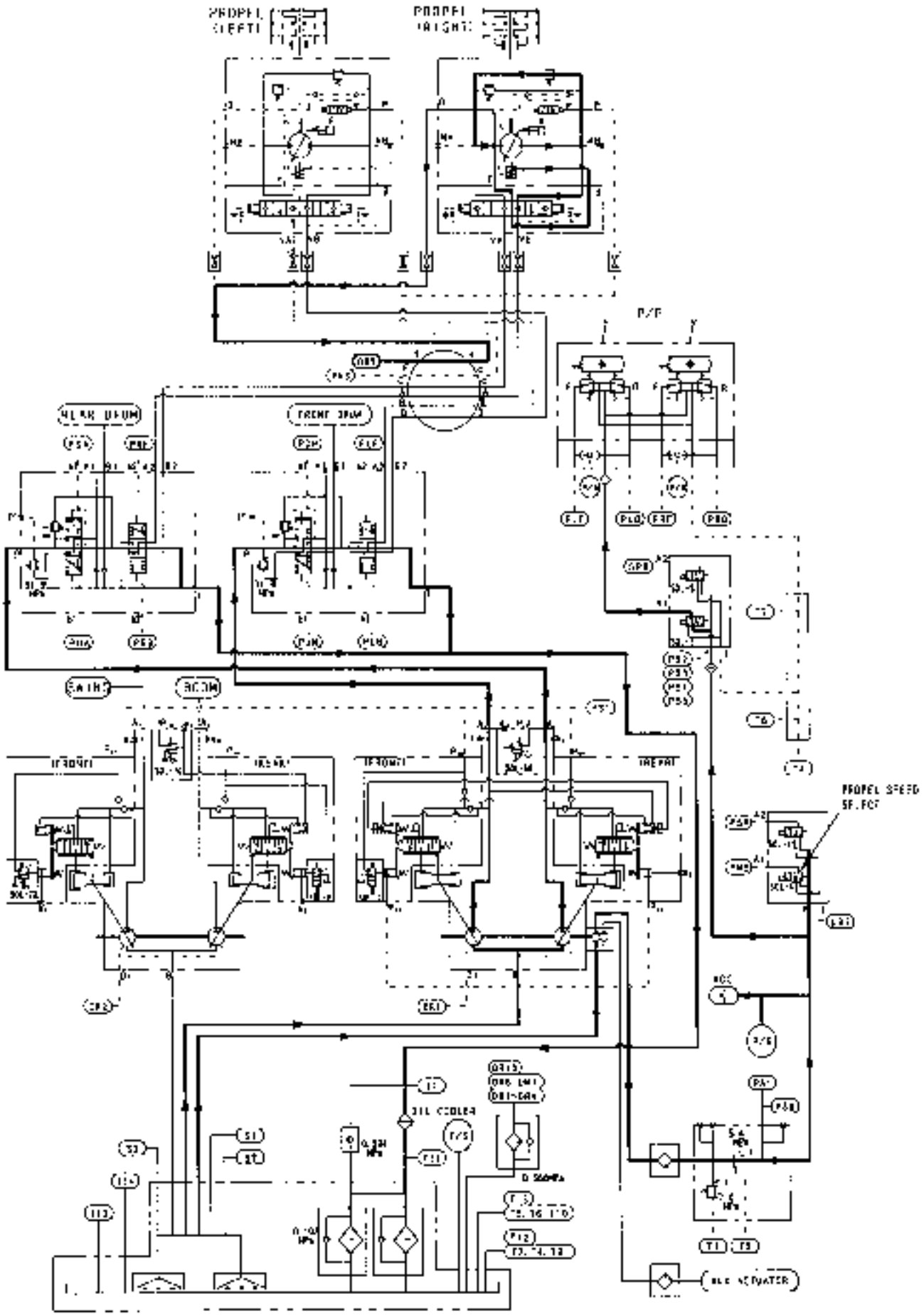
Propel R.H.(forward) hydraulic schematic



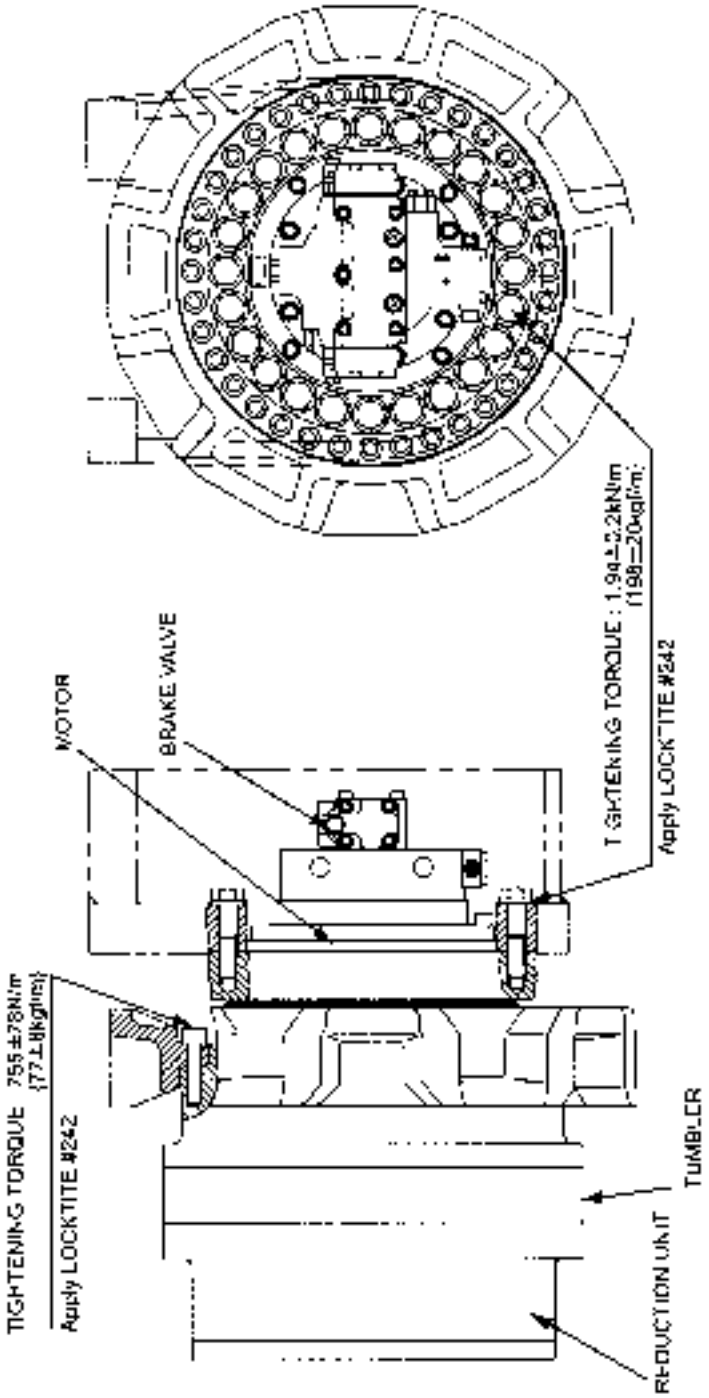
9.2.3 STOPPING

When the propel control lever is shifted back to neutral from propel position, the flow from the remote control valve is cut and the spool of the control valve repositions itself. At the same time, the pilot pressure on the propel brake valve is discontinued, and the spool in the brake valve also repositions itself.
Inertia may continue momentarily to rotate the propel motor. This creates negative pressure on the supply side and high pressure on the return side. Therefore, the supply side is connected to the reservoir in neutral. If extreme pressure developes on the return side, an overload relief valve will open to protect the circuit. At the same time, the pressurized oil in the brake cylinder is returned to the reservoir, and the parking brake engages slowly.

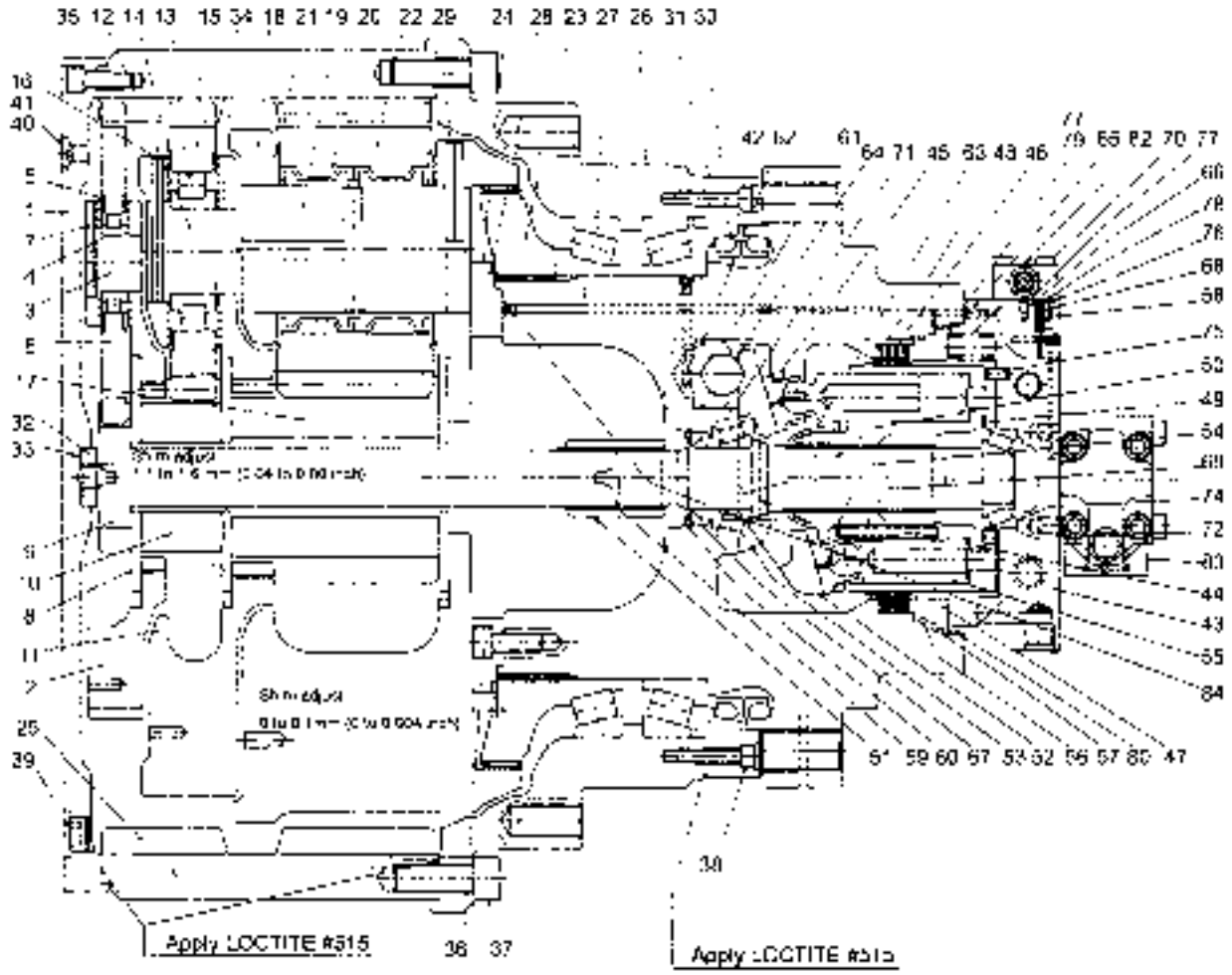
Stopping hydraulic schematic

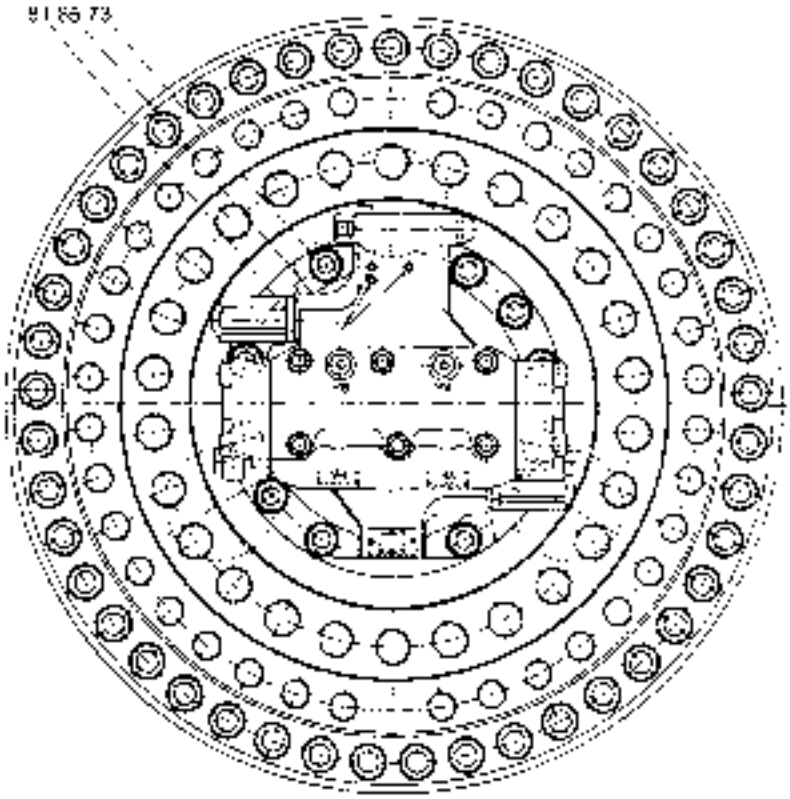


9.3 PROPEL REDUCTION UNIT



9.3.1 MOTOR AND REDUCTION UNIT





1 Cover
2 Carrier
3 Carrier pin
4 Bearing
5 Thrust washer
6 Planetary gear
7. Spring pin
8. Spacer
9. Sun gear
10. Sun gear
11. Carrier
12. Carrier p n
13. Bearing
14. Thrust washer
15. Planetary gear
16. Spring pin
17. Sun gear
18. Carrier
19 Carrier pin
20 Needle bearing
21 Thrust washer
22 Planetary gear
23 Coupling
24 Holder
25 Ring gear
26 Housing
27. Bearing
28. Shim
29. Spring pin
30. Floating Seal
31. Seal cover
32. Thrust ring
33. Shim
34. Bearing spacer
35. Capscrew
36. Capscrew
37. Capscrew
38. Capscrew
39. Plug
40. Plug
41. O-ring
42. Casing
43. Rear Cover
44. Cylinder brock
45. Shoe retainer
46. Friction plate
47. Brake piston
48. Separated plate
49. Valve plate
50. Shaft
51. Coupling
52. Swash p'ate
53. Pivot
54. Spring holder
55. Piston Assembly
56. D-Ring
57. D-Ring
58. Check valve
59 Retaining ring
60. Retaining ring
61. Shifter piston
62 Piston seal
63 Ball joint
64. Ball
65. Orifice
66. Orifice
67. Oil seal
68. Spring
69. Spring
70. Brake Spring
71. Bearing
72. Bearing
73. Capscrew
74. Shim
75. Parallel pin
76. O-ring
77. O-ring
78. O-ring
79. O-ring
80. O-ring
81. Over load relief valve
82. Pilot valve
83. Brake valve
84. Plug
85. Plug

Item	Name	Size	Tightening Torque N-m (ft-lbs)	
35	Capscrew	M12 X 35	106 to 130 (78.2 to 95.8)	Apply Loctite #242
36	Capscrew	M12 X 30	106 to 130 (78.2 to 95.8)	Apply Loctite #242
37	Capscrew	M18 X 55	363 to 441 (267.7 to 325.3)	Apply Loctite #242
38	Capscrew	M10 X 30	61.8 to 75.4 (45.6 to 55.6)	Apply Loctite #242
39	Plug	PT 3/4	88.3 to 107.9 (65.1 to 79.6)	Wrap a seal tape
40	Plug	PF 1/4	26.5 to 32.3 (19.6 to 23.8)	-
73	Capscrew	M18 X 50	291 to 356 (140.9 to 262.5)	-
81	Over load relief valve	-	98.1 to 117.7 (72.4 to 86.8)	-

Assembly weight about 950 kg (2094 lbs)

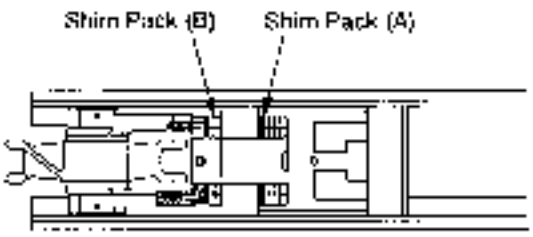
9.4 ADJUSTMENT

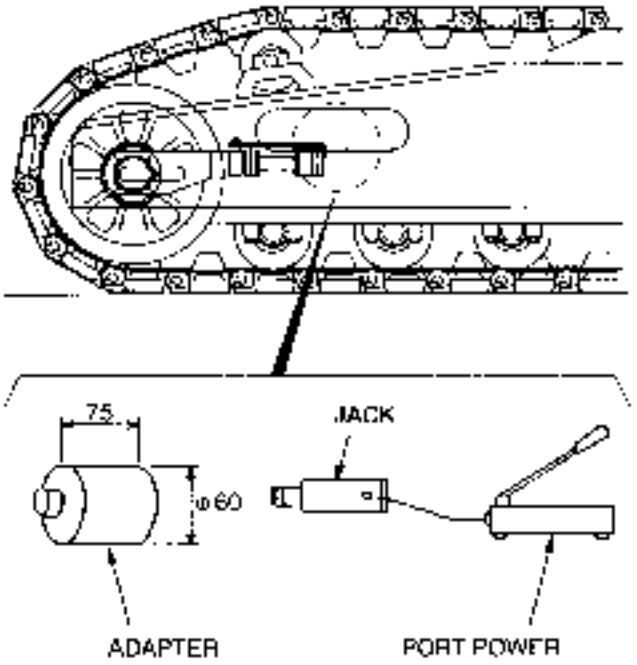
If the crawler shoes are too tight, the shoes wear quickly and a connection between two shoes could break. On the other hand, if the shoes are too loose, the shoes may ride off the drive sprocket and idler wheel during the travel operation. To prevent these occurrence from happening, it is required to adjust shoe tension. To adjust shoe tension, proceed as follows:

1. Move the machine forward about the crawler length so that the slackening of the crawler shoes appear on the upper side of the crawler.
2. Remove all the shims from shim pack (A).
3. Set the hydraulic jack in the position between the bracket and block of the side frame.
   Operate the jack to push the idler wheel, and remove the slackening of the shoes.
4. Insert the shims removed from pack (A) in step2 into the vacant room of pack (B). Insert the remaining shims into pack (A).
5. Remove the hydraulic jack. Store spare shims in the shim pack (A).

Note

Equalize the tension in right and left crawler tracks.





10. ELECTRIC SYSTEM

⚠CAUTION

1. Before unplugging or plugging in the connector, be sure to shut off the power supply (set the starter switch to the OFF position).
2. When unplugging the connector, hold it with both hands and draw it straight, while pressing down the catch. DO NOT pull on the cable. Otherwise, the inner conductors can be damaged. NEVER twist or pry the connector. Otherwise, its internal female terminal will be expanded, leading to disconnection.
3. When plugging in the connector, fully insert it until the catch is engaged (clicks into position). Otherwise, disconnection can occur later.
4. When performing a continuity test or voltage measurement on the connector, follow the procedure below.

- Square connector
  For easy measurement, place the measurement probes of the multitester onto the pins of male side connector. NEVER insert the probe of the multitester into the socket of the female side connector. Otherwise, disconnection can occur later.
- Round waterproof connector
  The male side connector has waterproof construction, and the measurement probe of the multitester cannot touch its pins. Therefore, place the measurement probes onto the terminals on the female side connector. NEVER forcibly insert the measurement probe. Otherwise, disconnection can occur later. Short-circuiting across terminals inside a connector can damage electronic components. Be absolutely careful to prevent short-circuit.

Harness line Color

Base single color

Color Sign	Color Name	
B	Black	
W	White	
R	Red	
G	Green	
Y	Yellow	
Br	Brown	
L	bLue	
Gr	Gray	
O	Orange	
Sb	Skyblue	
P	Pink	
Lg	Lite green	

Multi color

Color Sign	Base Color	Line Color
WB	White	Black
RB	Red	Black
GB	Green	Black
YB	Yellow	Black
BrB	Brown	Black
LB	bLue	Black
GrB	Gray	Black
OB	Orange	Black
SbB	Skyblue	Black
PB	Pink	Black
LgB	Light bLue	Black
BW	Black	White
RW	Red	White
GW	Green	White
YW	Yellow	White
LW	bLue	White
WL	White	bLue
YL	Yellow	bLue
GrL	Gray	bLue
SbL	Skyblue	bLue
PL	Pink	bLue
LgL	Light green	bLue
WR	White	Red

Color Sign	Base Color	Line Color
YR	Yellow	Red
GrR	Gray	Red
SbR	Skyblue	Red
PR	Pink	Red
LgR	Lite green	Red
BY	Black	Yellow
BR	Black	Red
WY	White	Yellow
WG	White	Green
RY	Red	Yellow
RG	Red	Green
RL	Red	bLue
GR	Green	Red
GY	Green	Yellow
GL	Green	bLue
YG	Yellow	Green
BrW	Brown	White
BrR	Brown	Red
BrY	Brown	Yellow
LR	bLue	Red
LY	bLue	Yellow
LgY	Lite green	Yellow
LgW	Lite green	White

10.1 ELECTRICAL WIRING SCHEMATIC

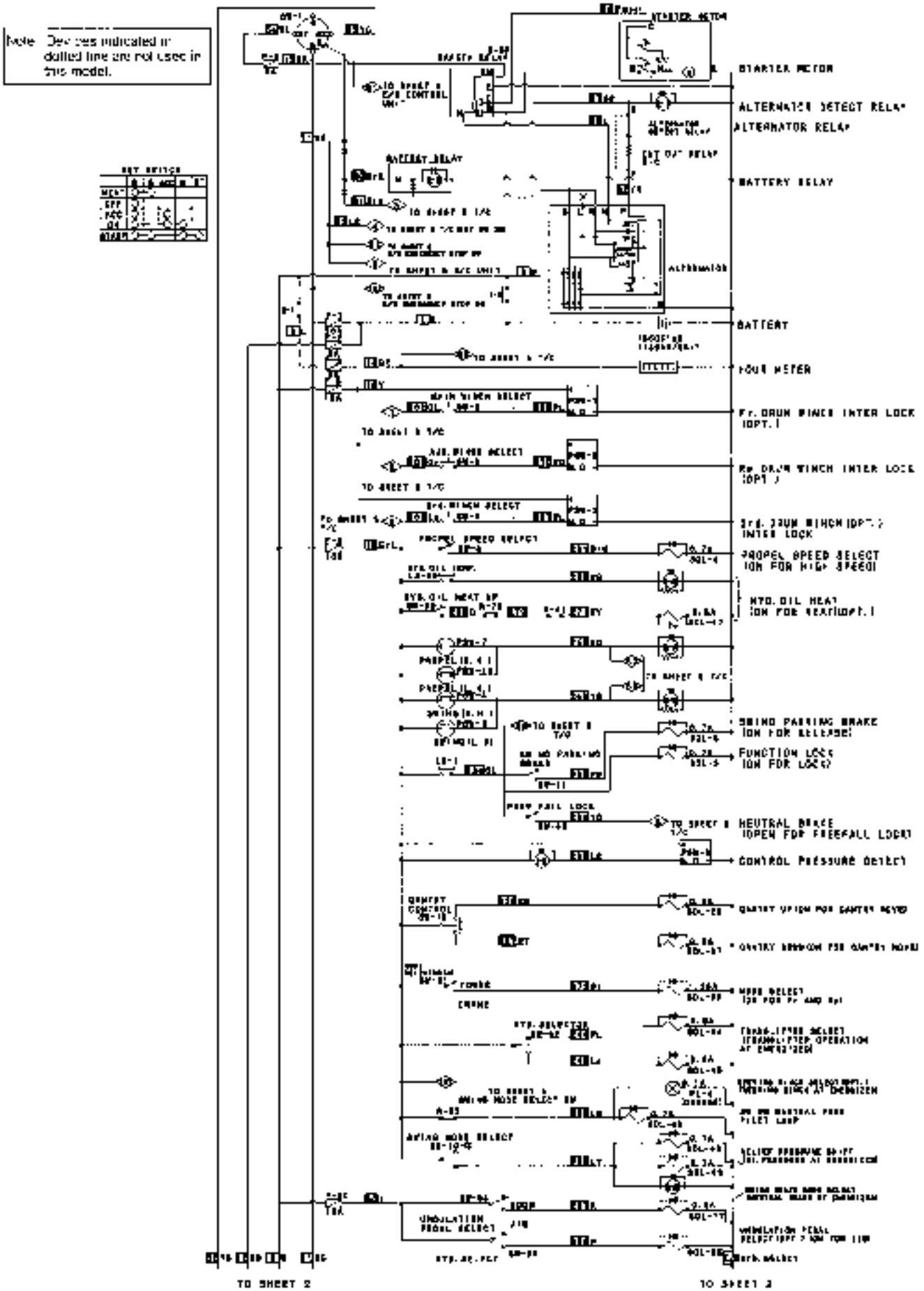


Fig.10-1 GK03Z00008P1 (1/11)

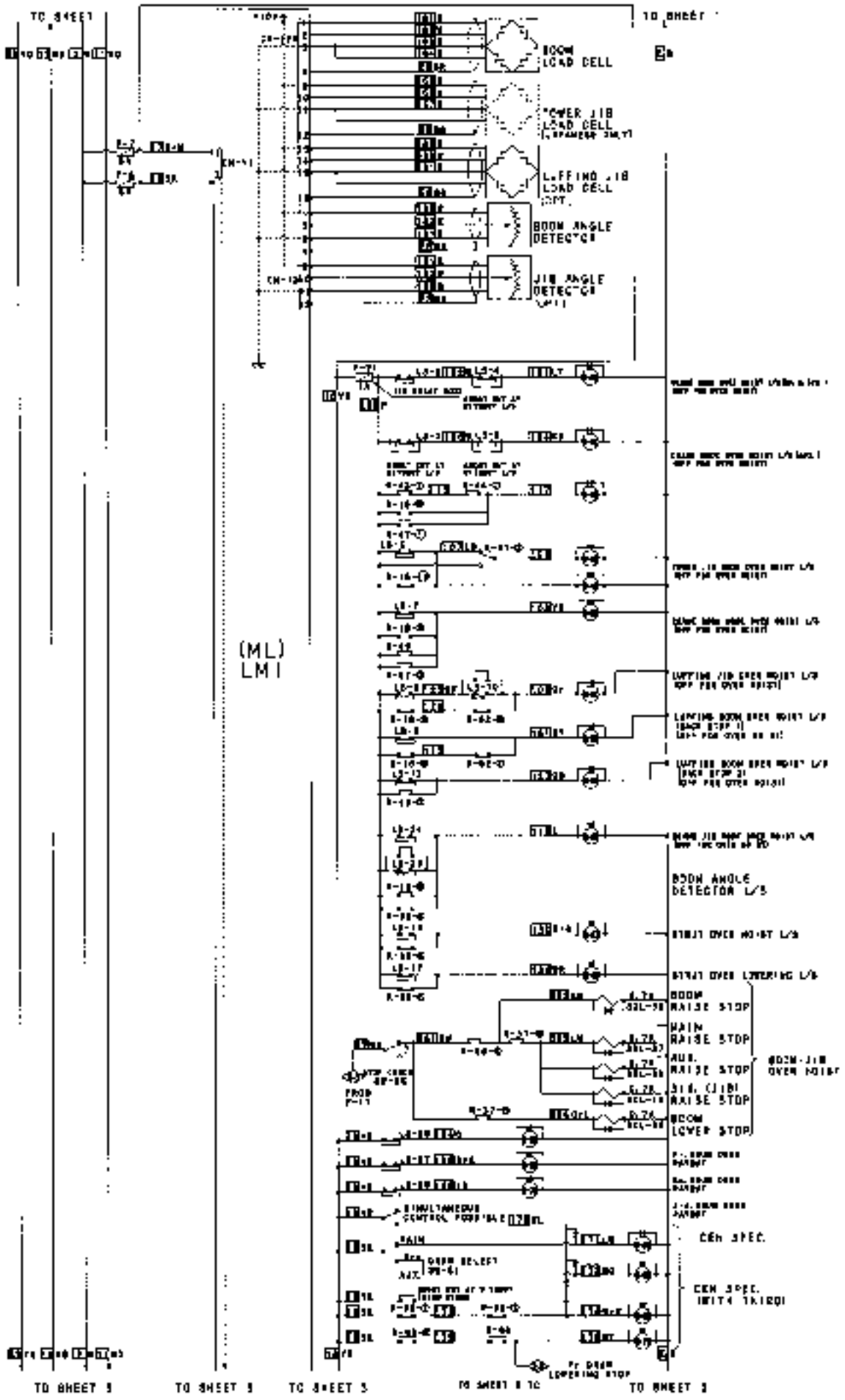


Fig.10-2 GK03Z00008P1 (2/11)

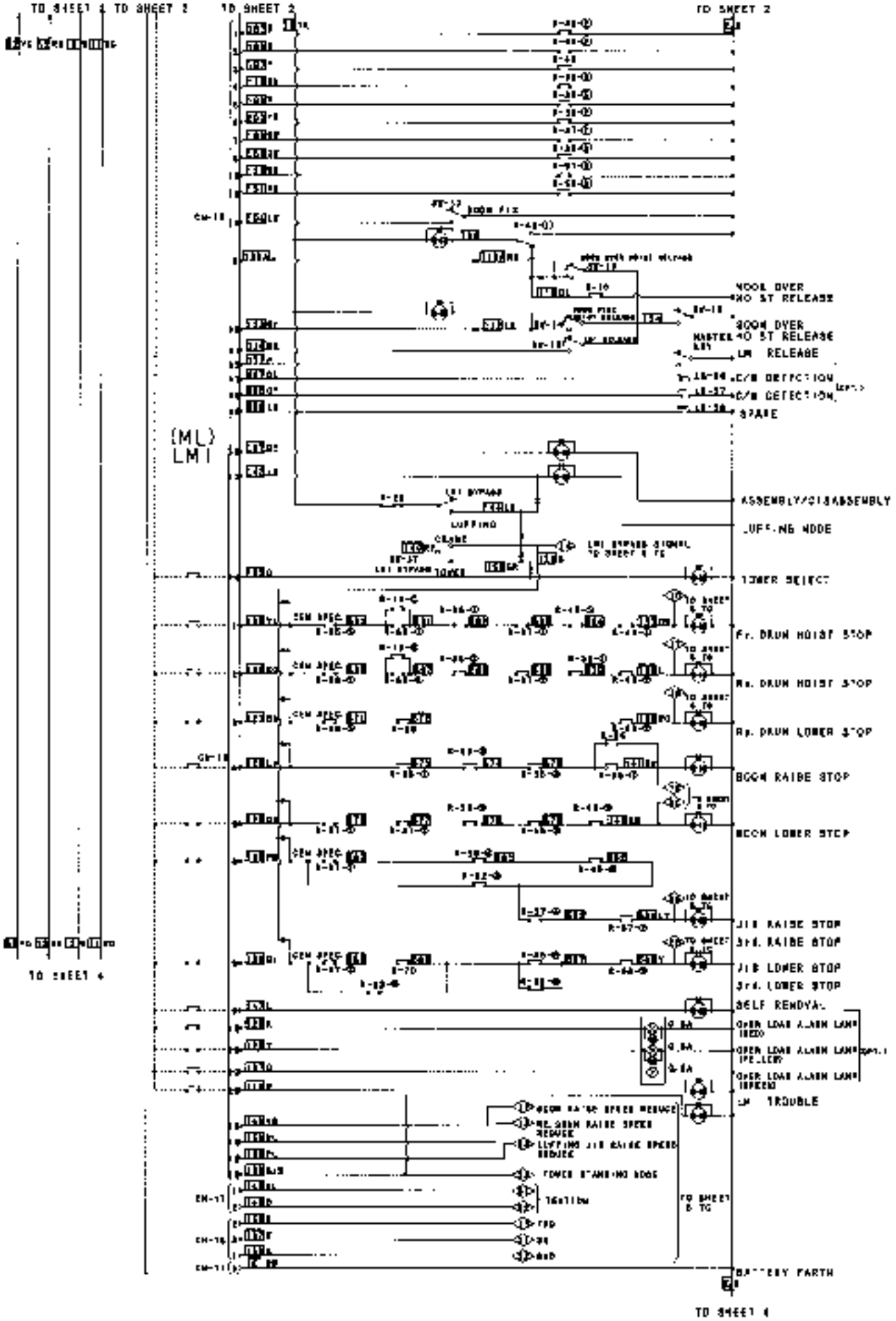


Fig.10-3 GK03Z00008P1 (3/11)

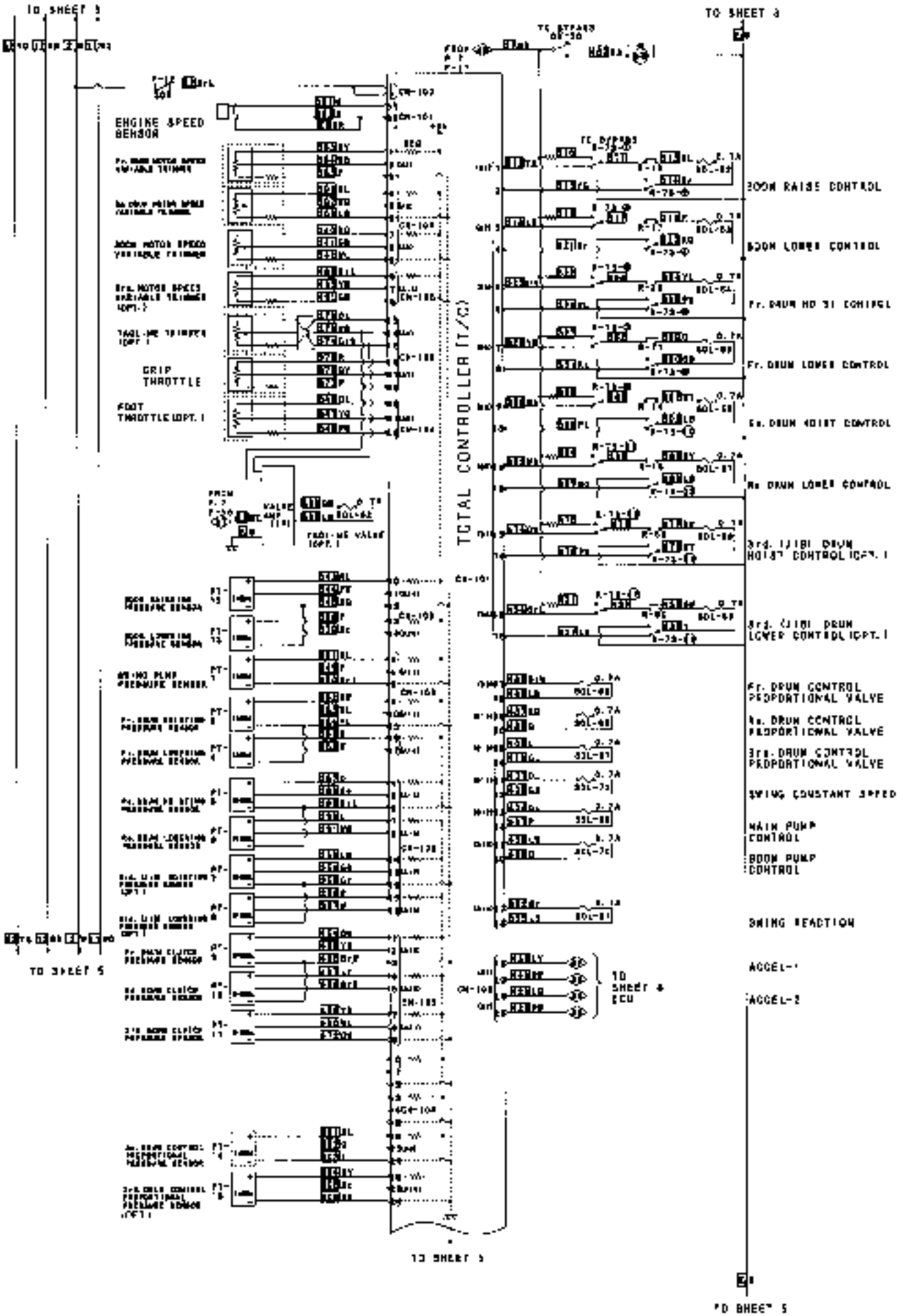


Fig.10-4 GK03Z00008P1 (4/11)

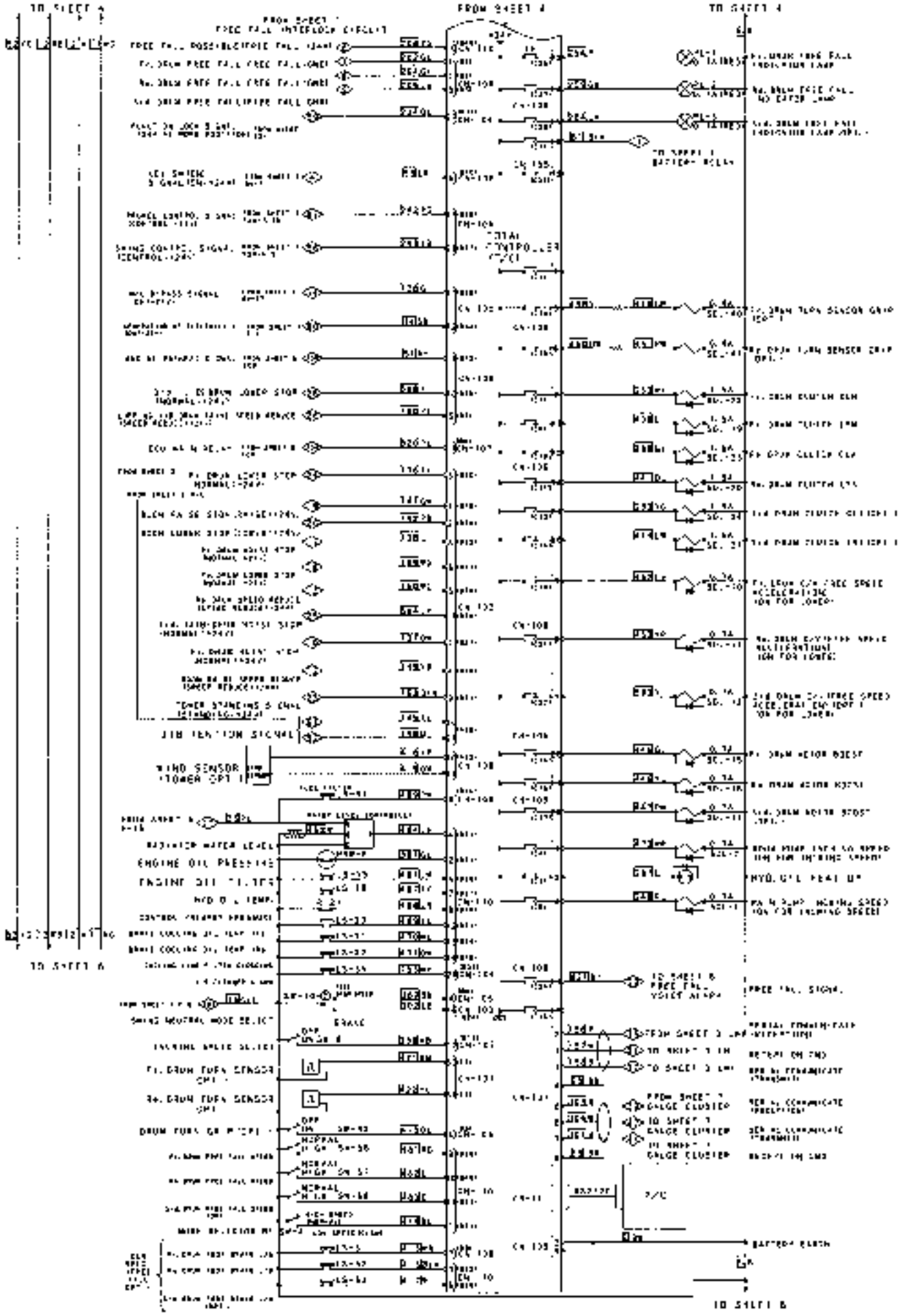


Fig.10-5 GK03Z00008P1 (5/11)

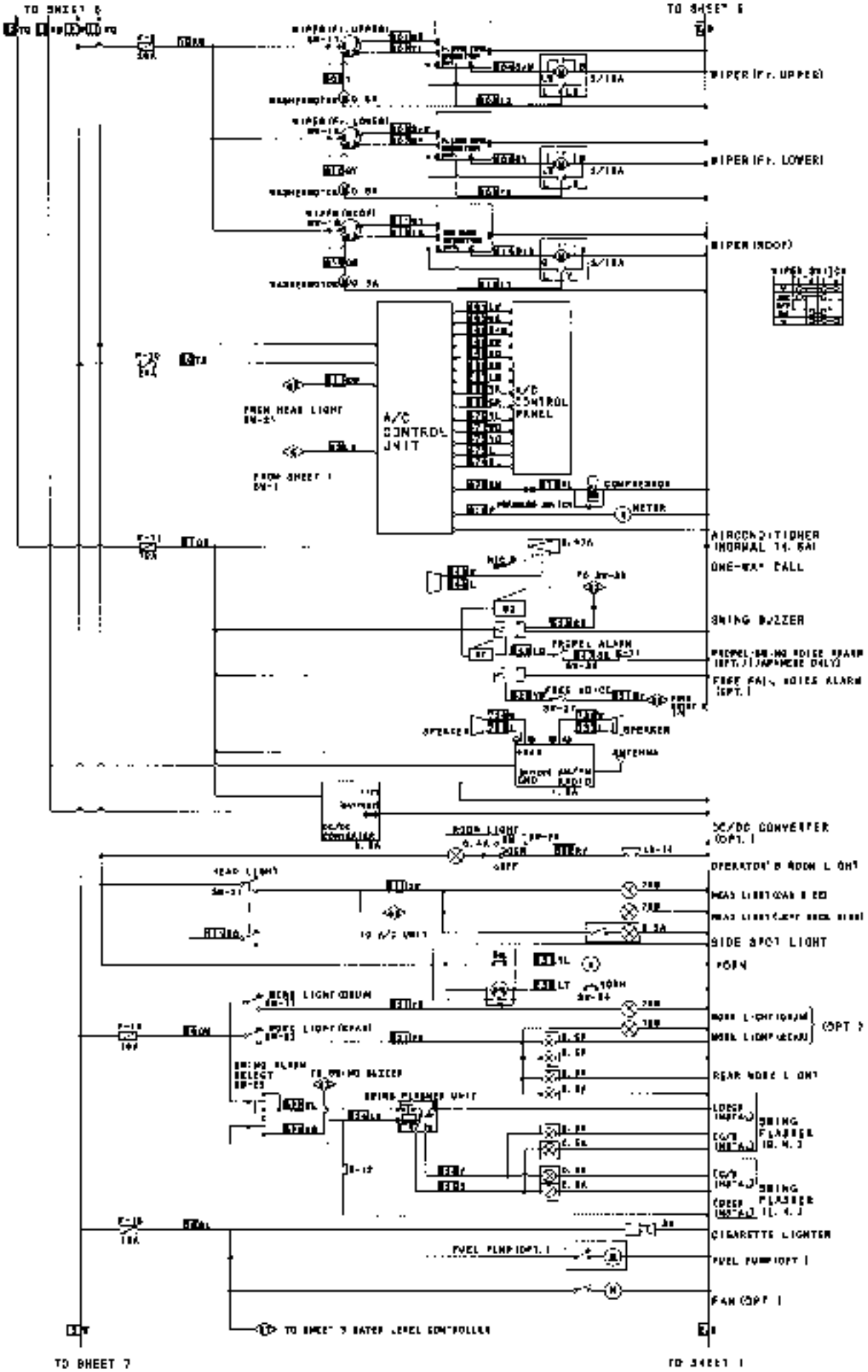


Fig.10-6 GK03Z00008P1 (6/11)

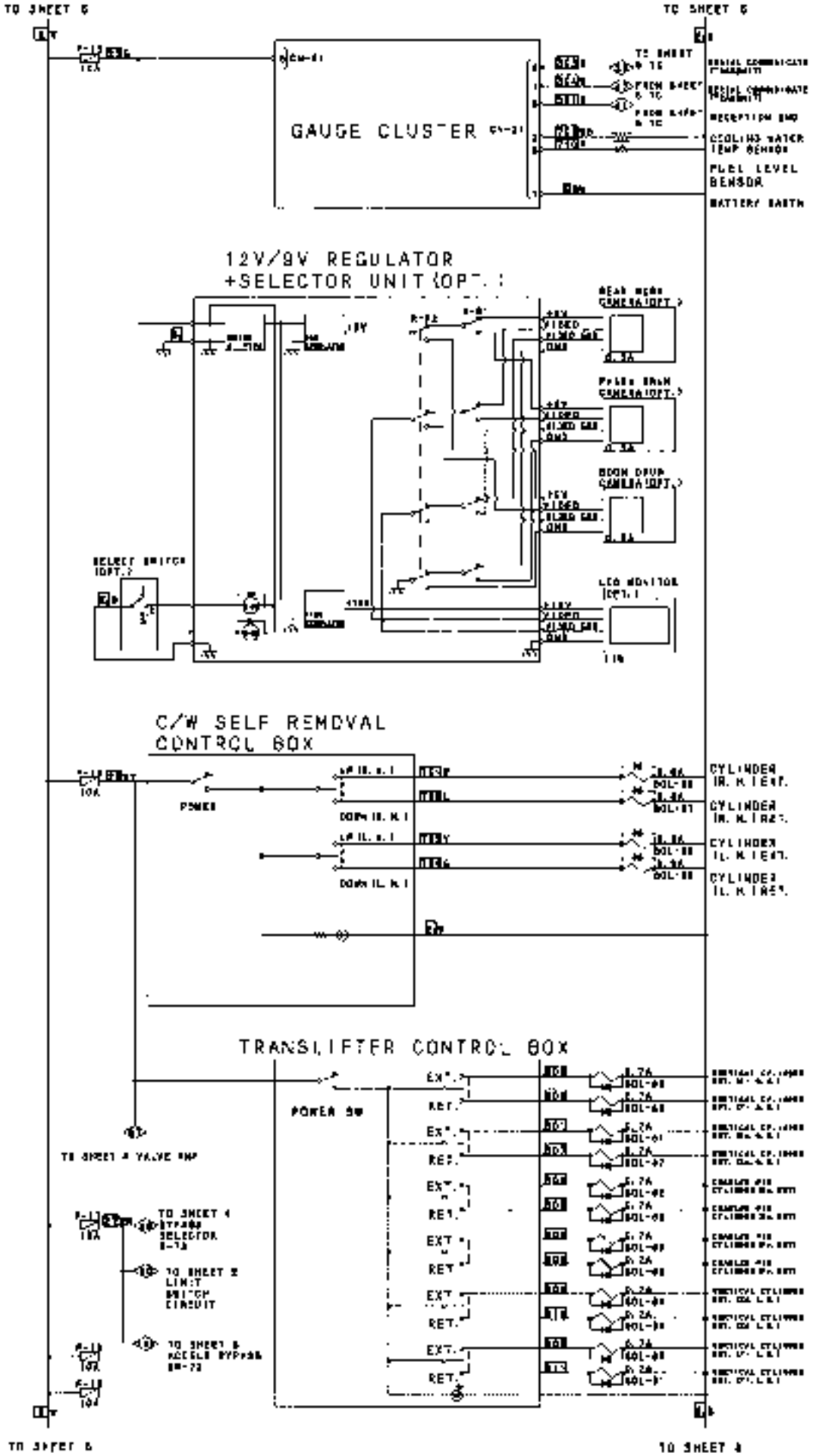


Fig.10-7 **GK03Z00008P1 (7/11)**

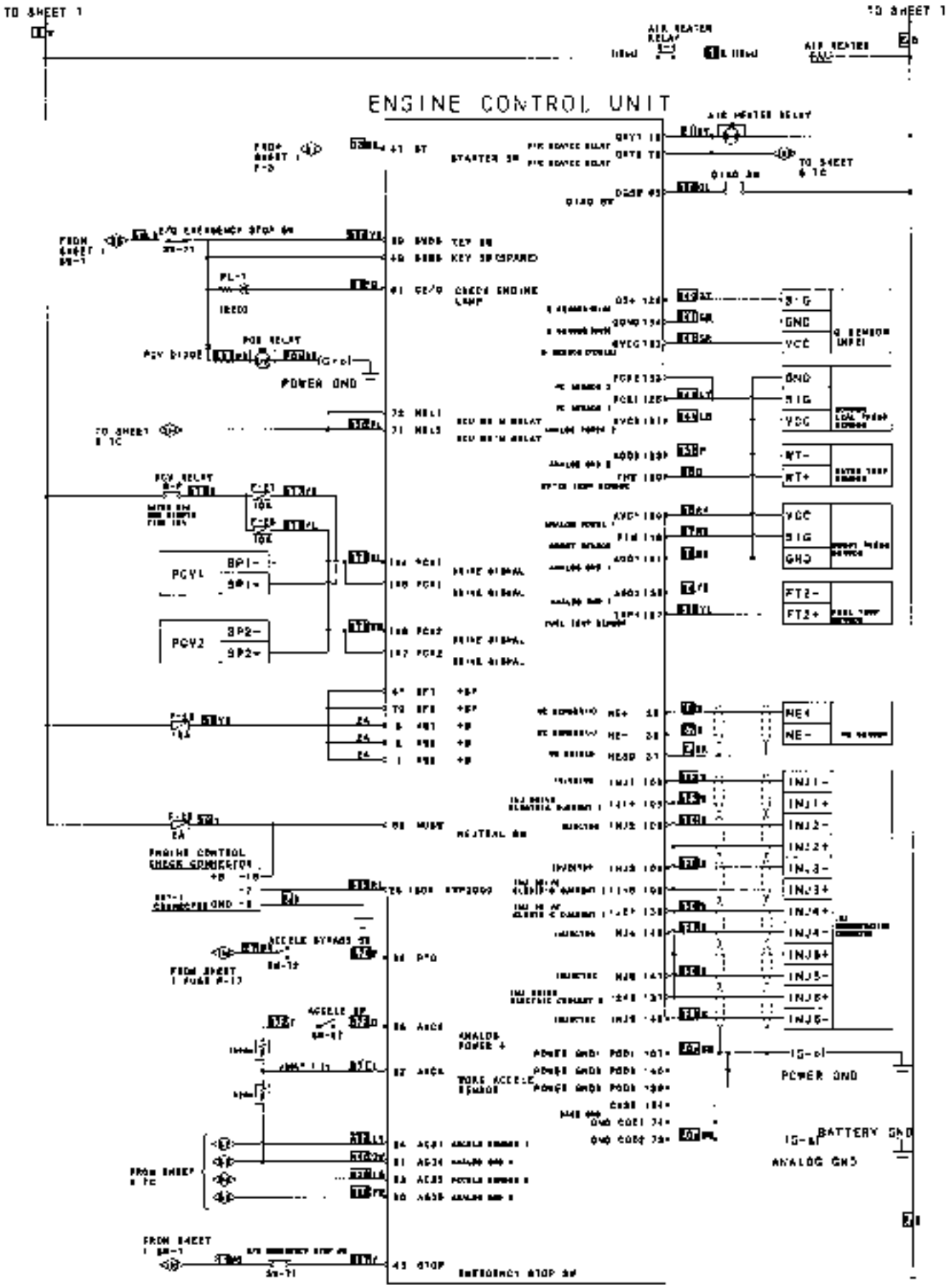


Fig.10-8 GK03Z00008P1 (8/11)

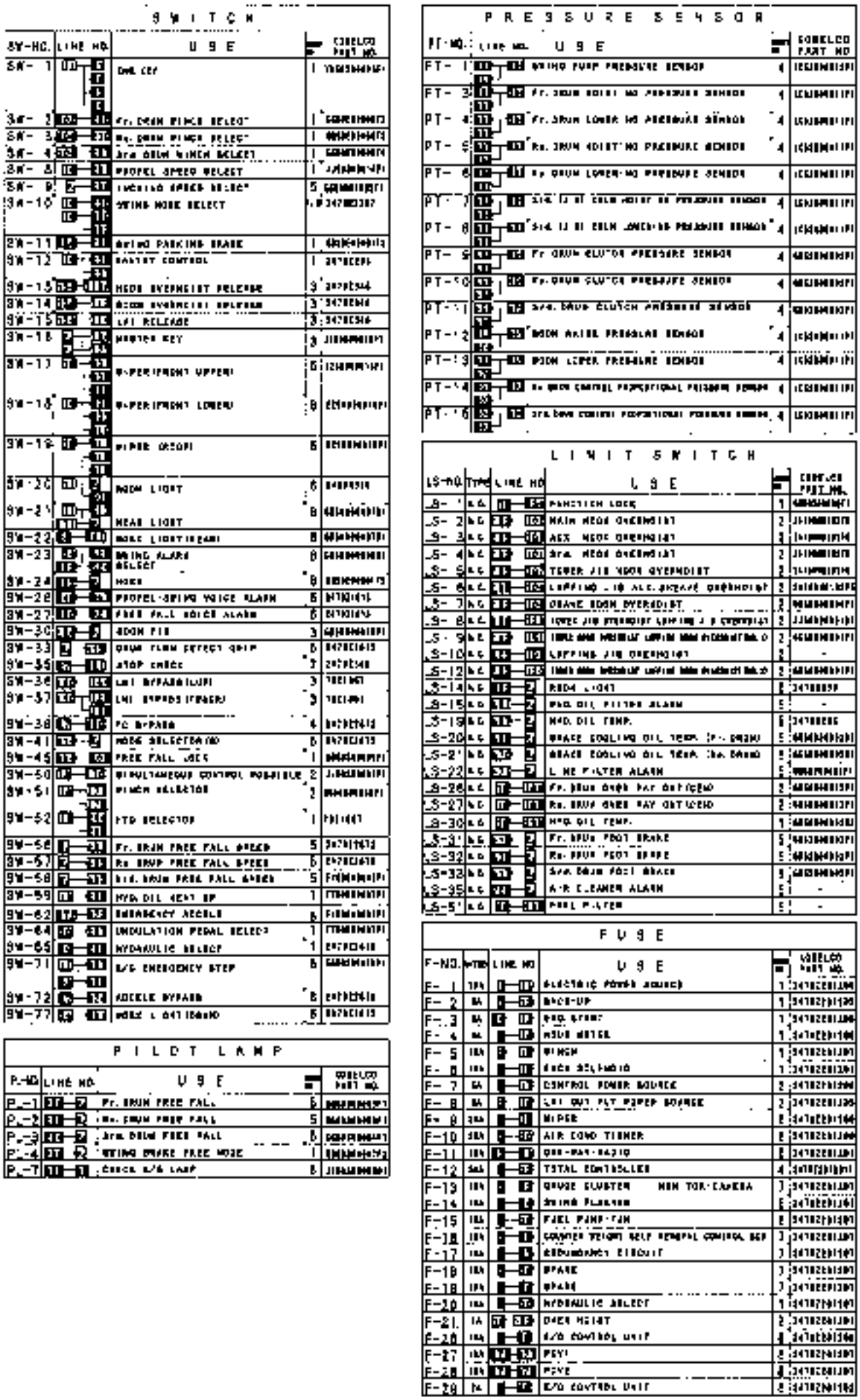


Fig.10-9 GK03Z00008P1 (9/11)

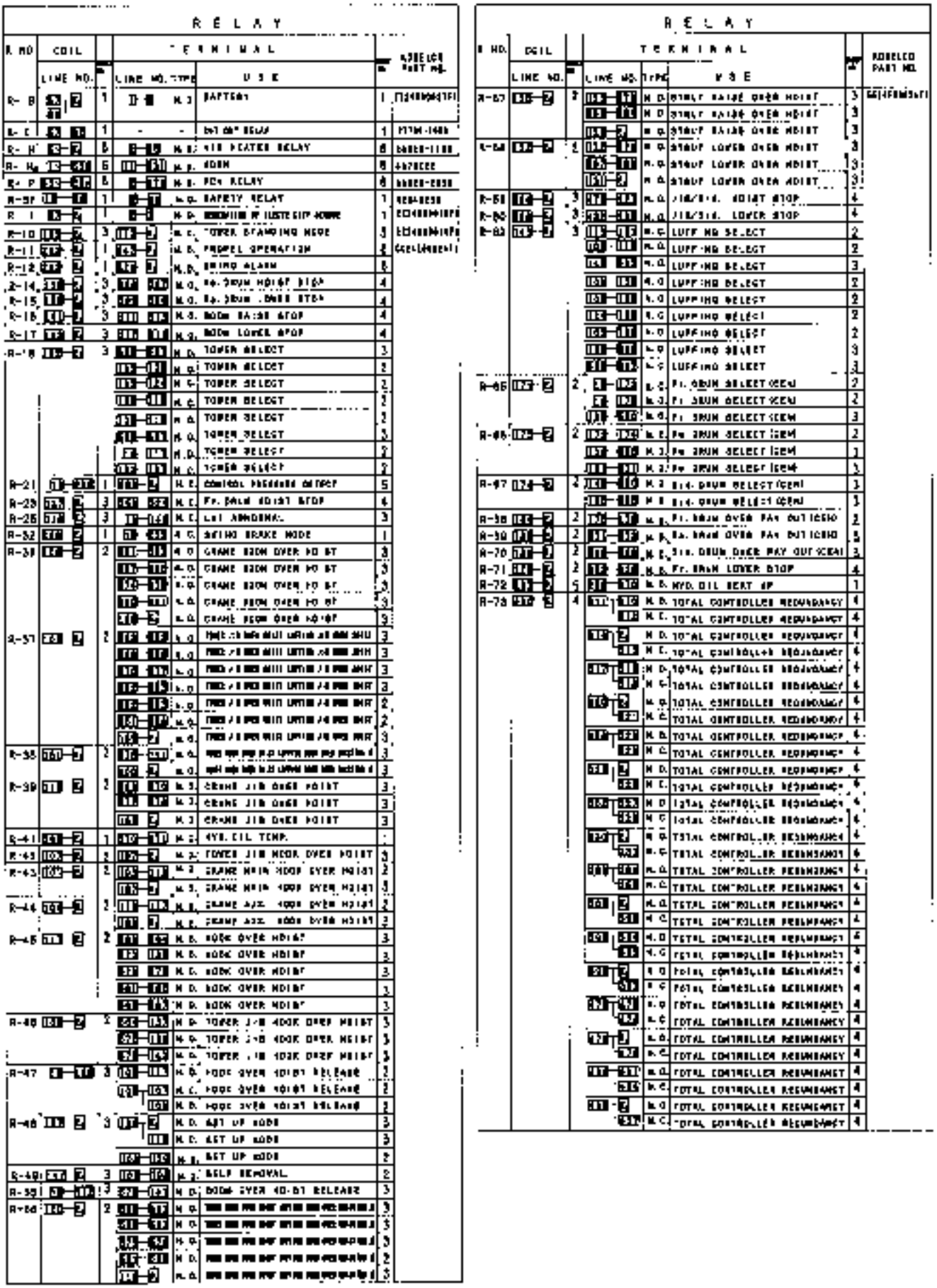


Fig.10-10 GK03Z00008P1 (10/11)

PRESSURE SWITCH

PSW-NO.	RATED	LINE NO.	USE	SHEET NO.	KOBELCO PART NO.
PSW-1	N.O.	16-E, 208	Fr. DRUM FOOT BRAKE PRESSURE SW.	1	GG53300021F1?
PSW-2	N.O.	16-E, 210	Re. DRUM FOOT BRAKE PRESSURE SW.	1	GG53300031F1?
PSW-3	N.O.	16-E, 211	3rd. DRUM FOOT BRAKE PRESSURE SW.	1	GG50300031F1?
PSW-4	N.O.	16-243	SWING CONTROL DETECT SW. (R.H.)	1	GG50500037F1?
PSW-5	N.O.	16-243	SWING CONTROL DETECT SW. (L.H.)	1	GG50500037F1?
PSW-6	N.O.	16-E, 244	CONTROL PRIMARY PRESSURE DETECT SW.	1	GG50300031F1?
PSW-7	N.O.	16-243	PROPEL CONTROL DETECT SW. (R.H.)	1	GG50800037F1?
PSW-8	N.C.	111-E	ENGINE OIL PRESSURE SW.	5	-
PSW-10	N.O.	16-243	PROPEL CONTROL DETECT SW. (L.H.)	1	GG50500037F1?

SOLENOID VALVE

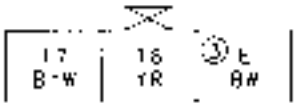
SOL NO.	LINE NO.	USE	SHEET NO.	KOBELCO PART NO.
SOL-1	246-E	MAIN PUMP INCHING SPEED	5	YN35V00020F1?
SOL-2	423-E	BOOM PUMP INCHING SPEED	5	YN35V00020F1?
SOL-3	234-E	FUNCTION LOCK	1	YN35V00020F1?
SOL-4	211-E	PROPEL SPEED SELECT	1	YN35V00020F1?
SOL-5	235-E	SWING PARKING	1	YN35V00020F1?
SOL-10	452-E	Fr. DRUM C/V	5	YN36V00020F1?
SOL-11	[illegible]-E	Re. DRUM C/V	5	YN35V00020F1?
SOL-12	517-E	3rd. DRUM C/V	5	YN35V00020F1?
SOL-15	445-E	Fr. DRUM MOTOR BOOST	5	YN35V00050F1?
SOL-16	446-E	Re. DRUM MOTOR BOOST	5	YN35V00050F1?
SOL-17	447-E	3rd DRUM MOTOR BOOST	5	YN35V00050F1?
SOL-18	[illegible]-E	3rd HOIST STOP (NO. 2)	2	YN35V00050F1?
SOL-19	438-E	Fr. DRUM CLUTCH ESM	5	GG35000001F1?
SOL-20	441-E	Re. DRUM CLUTCH ESA	5	GG35000001F1?
SOL-21	444-E	3rd. DRUM CLUTCH EST	5	GG35000001F1?
SOL-22	453-E	Fr. DRUM CLUTCH CLM	5	JJ35000011F1?
SOL-23	456-E	Re. DRUM CLUTCH CLA	5	JJ35000011F1?
SOL-24	[illegible]-E	3rd. DRUM CLUTCH CLT	5	JJ35000011F1?
SOL-25	490-E	HYDRAULIC SELECT	1	-
SOL-26	236-E	GANTRY UP	1	GG30V00019F1?
SOL-27	237-E	GANTRY DOWN	1	GG30V00019F1?
SOL-35	552-E	BOOM RAISE STOP (NO. 2)	2	YN35V00038F1?
SOL-36	554-E	BOOM LOWER STOP (NO. 2)	2	YN36V00038F1?
SOL-37	653-E	Fr. DRUM HOIST STOP (NO. 2)	2	YN35V00038F1?
SOL-38	555-E	Re. DRUM HOIST STOP (NO. 2)	2	YN35V00038F1?
SOL-40	448-E	Fr. DRUM TURN DETECT GRIP	5	GB50V01003F1?
SOL-41	451-E	Re. DRUM TURN DETECT GRIP	5	GB50V01003F1?
SOL-42	433-E	PRESS. RELIEF SHIFT	1	YN36V00038F1?
SOL-44	240-E	TRANSLIFTER SELECT	1	JJ30V00003F1?
SOL-45	245-E	REEVING WINCH SELECT	1	JJ30V00005F1?
SOL-47	271-E	HYD. OIL HEAT	1	GG27V00001F1?
SOL-48	238-E	SWING NEUTRAL MODE SELECT	1	GB35V00002F1?
SOL-49	236-E	SWING NEUTRAL MODE SELECT	1	GB35V00002F2?
SOL-50	404-403	MAIN PUMP CONTROL	4	YN35V00018F2?

SOLENOID VALVE

SOL NO.	LINE NO.	USE	SHEET NO.	KOBELCO PART NO.
SOL-51	332 323	SWING REACTION	4	YN35V00019F1?
SOL-52	313-314	BOOM RAISE CONTROL	4	YN35V00018F1?
SOL-53	317-320	BOOM LOWER CONTROL	4	YN35V00018F1?
SOL-54	324-326	Fr. DRUM HOIST CONTROL	4	YN35V00018F1?
SOL-55	51?-530	Fr. DRUM LOWER CONTROL	4	YN35V00018F1?
SOL-56	367-368	Re. DRUM HOIST CONTROL	4	YN35V00018F1?
SOL-57	[illegible]-518	Re. DRUM LOWER CONTROL	4	YN35V00018F1?
SOL-58	47?-4??	3rd. DRUM HOIST CONTROL	4	YN35V00018F1?
SOL-59	435 436	3rd DRUM LOWER CONTROL	4	YN35V00018F1?
SOL-62	[illegible]-416	TAGLINE	4	GB22V00007F1?
SOL-65	4??-4??	Fr. DRUM CONTROL PROPORTIONAL VALVE	4	YN35V00018F2?
SOL-66	457 4??	Re. DRUM CONTROL PROPORTIONAL VALVE	4	YN35V00018F2?
SOL-67	409 410	3rd. DRUM CONTROL PROPORTIONAL VALVE	4	YN35V00018F2?
SOL-70	430-433	BOOM PUMP CONTROL	4	YN35V00018F2?
SOL-72	401 403	SWING CONSTANT SPEED	4	YN35V00018F2?
SOL-77	257-E	BOOM/JIB PEDAL SELECT	1	YN35V00036F1?
SOL-80	800-E	VERTICAL EXT. (Fr. R.H.)	7	GB35V00025B01?
SOL-81	801-E	VERTICAL EXT. (Re. R.H.)	7	GB35V00025B01?
SOL-82	802-E	CRAWLER FIXING PIN (Re. EXT)	7	GB35V00025B01?
SOL-83	803-E	CRAWLER FIXING PIN (Fr. EXT)	7	GB35V00025B01?
SOL-84	804-E	VERTICAL EXT. (Re. L.H.)	7	GB35V00025B01?
SOL-85	805-E	VERTICAL EXT. (Fr. L.H.)	7	GB35V00025B01?
SOL-86	806-E	VERTICAL RET. (Fr. R.H.)	7	GB35V00025B01?
SOL-87	807-E	VERTICAL RET. (Re. R.H.)	7	GB35V00025B01?
SOL-88	808-E	CRAWLER FIXING PIN (Re. RET)	7	GB35V00025B01?
SOL-89	809-E	CRAWLER FIXING PIN (Fr. RET)	7	GB35V00025B01?
SOL-90	810-E	VERTICAL RET. (Re. L.H.)	7	GB35V00025B01?
SOL-91	811-E	VERTICAL RET. (Fr. L.H.)	7	GB35V00025B01?
SOL-95	T54-E	LEFT CYLINDER RET.	7	GB30V00019F1?
SOL-96	T53-E	LEFT CYLINDER EXT.	7	GB30V00019F1?
SOL-97	T52-E	RIGHT CYLINDER RET.	7	GB30V00019F1?
SOL-98	T51-E	RIGHT CYLINDER EXT.	7	GB30V00019F1?

Fig.10-11 GK03Z00008P1 (11/11)

10.2 CONNECTOR LIST



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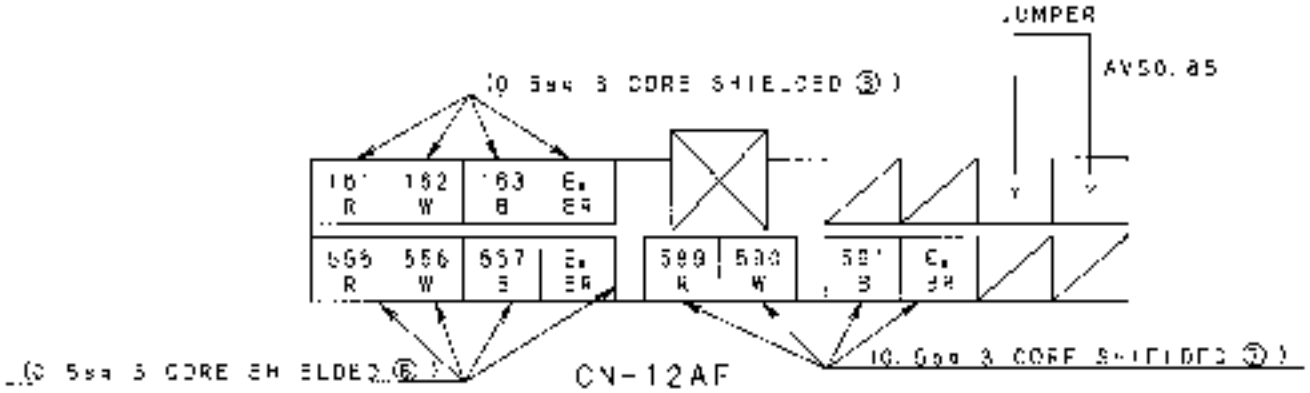

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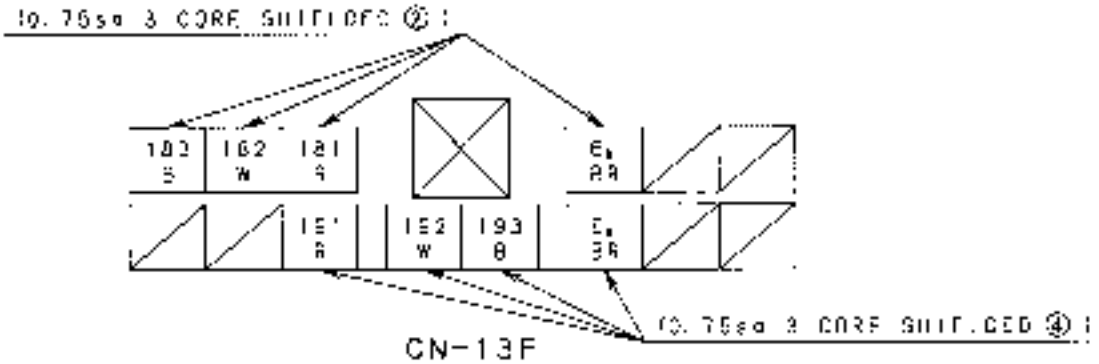

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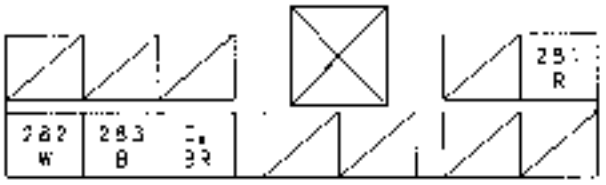
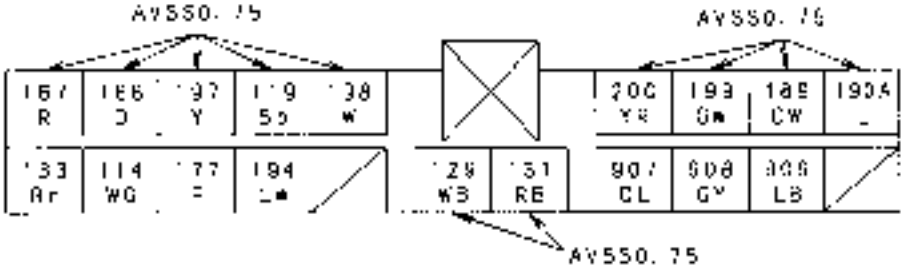


CN-14F

(0.75sq 3 CORE SHIELDED ⑤)



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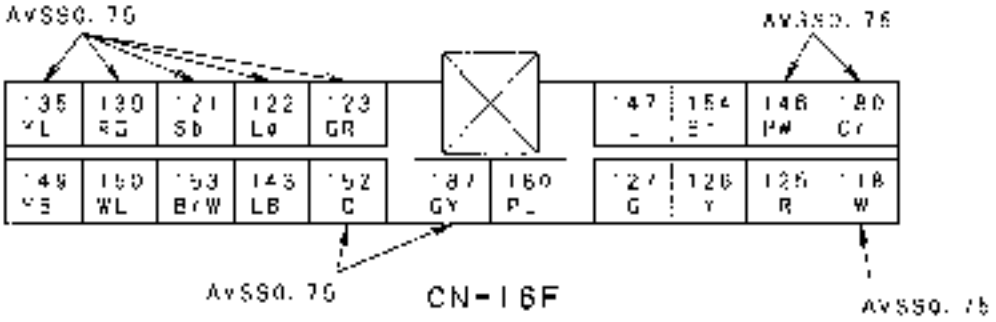

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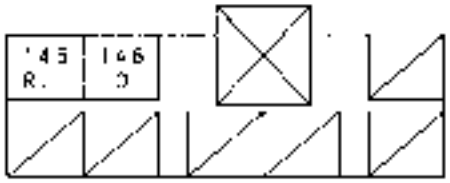

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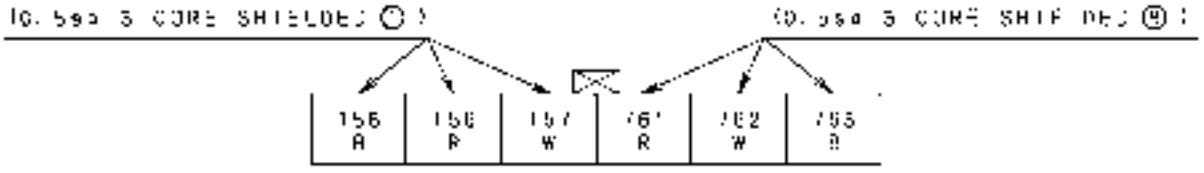

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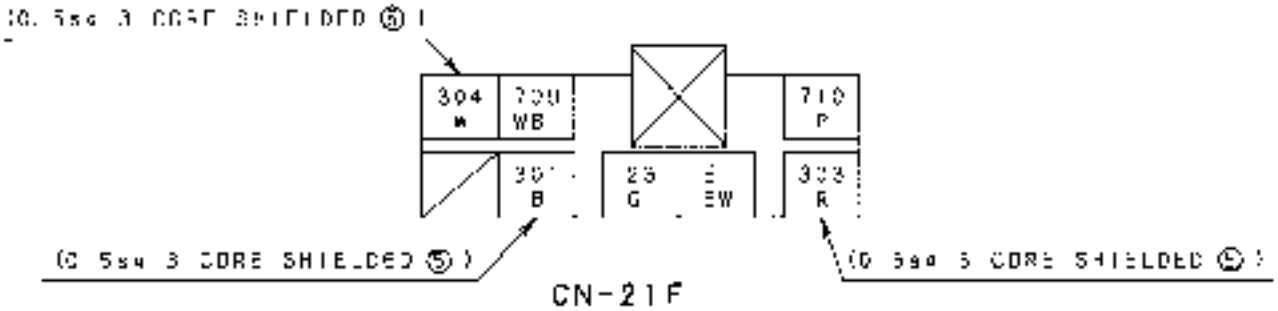

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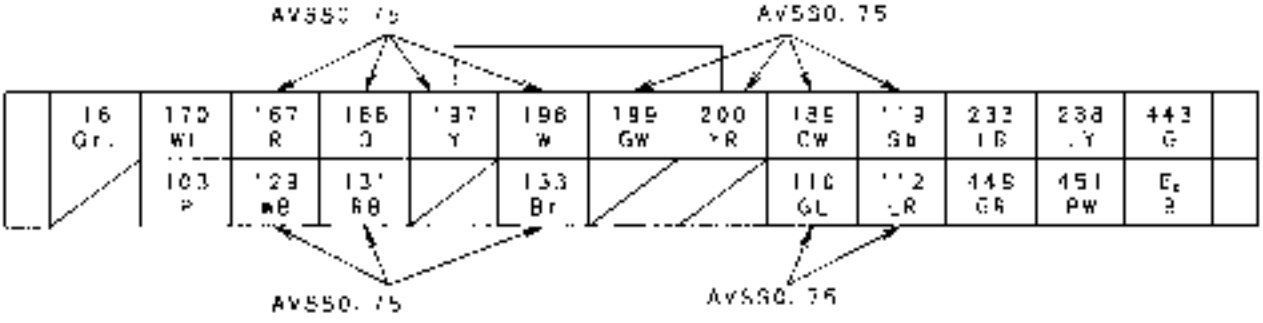

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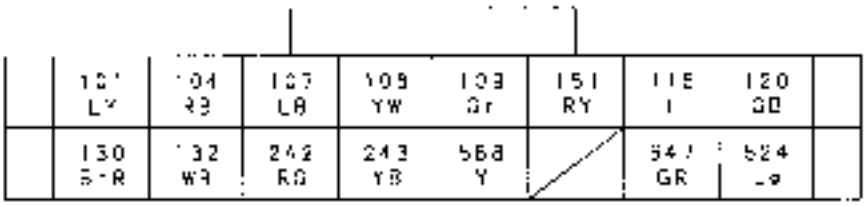
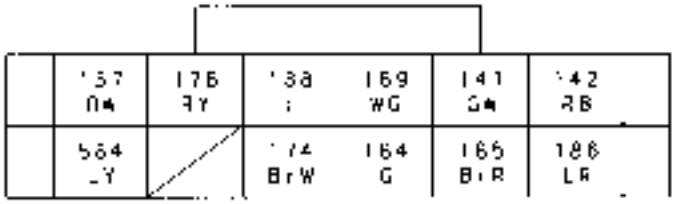


CN 32F (AVSS0. 75)



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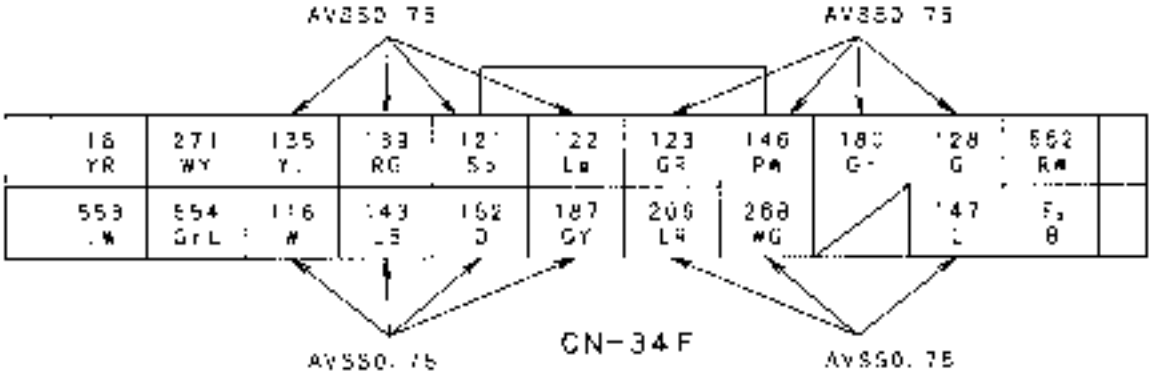

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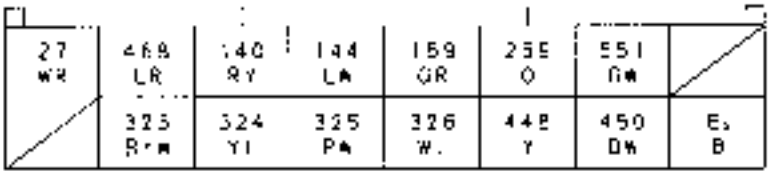

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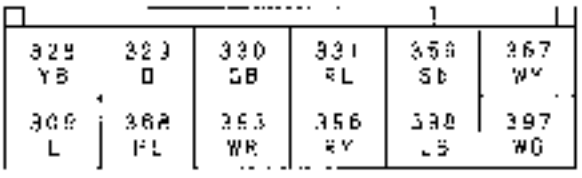
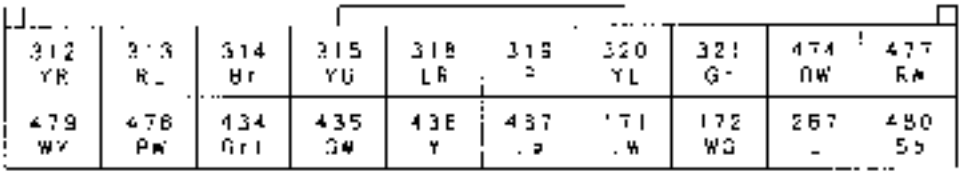
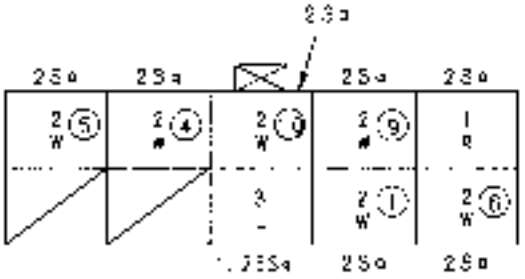


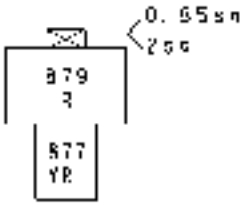
CN-36F (AVSS0. 75)



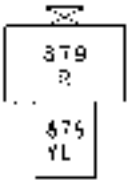
CN-37F (AVSS0. 75)



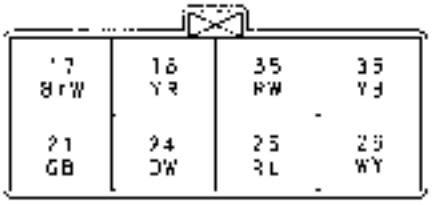
CN-41F



CN-43AF

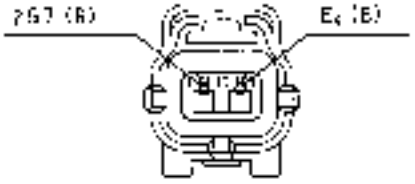


CN-43BF



CN-42M

CN-46M



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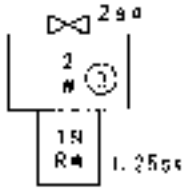

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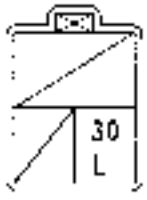

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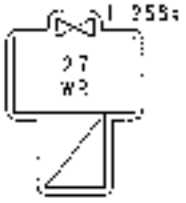

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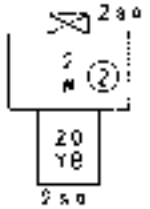

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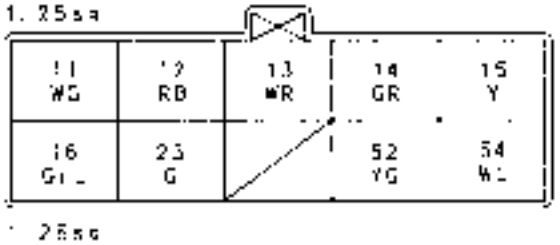

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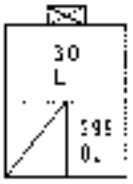

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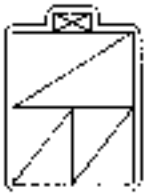

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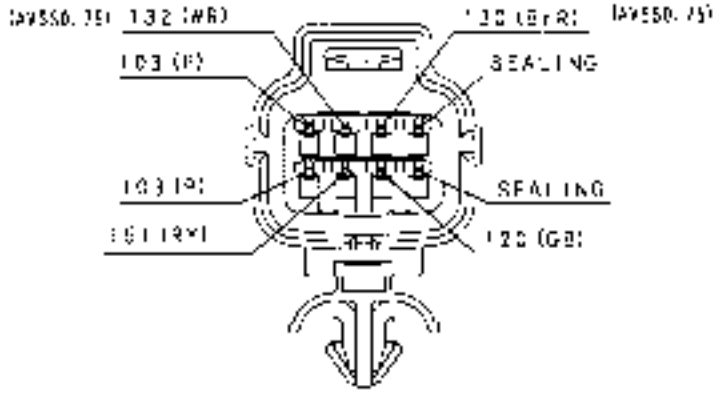

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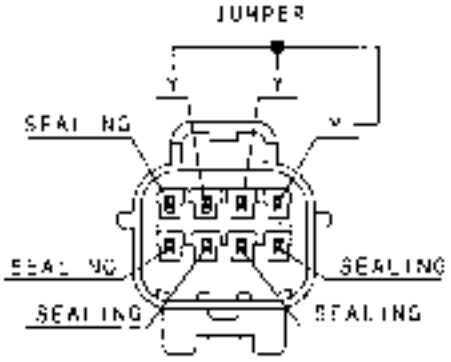

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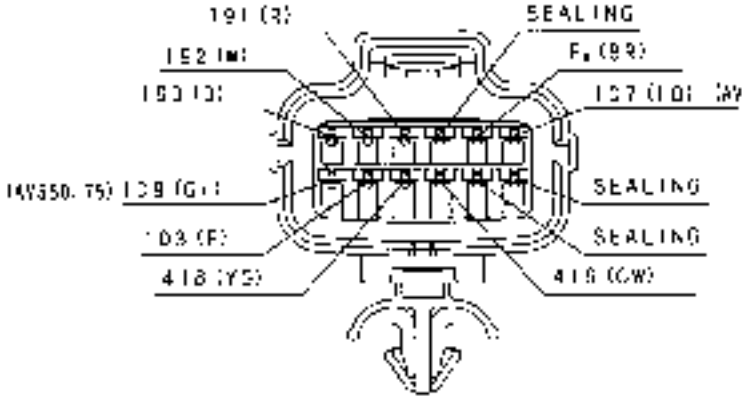

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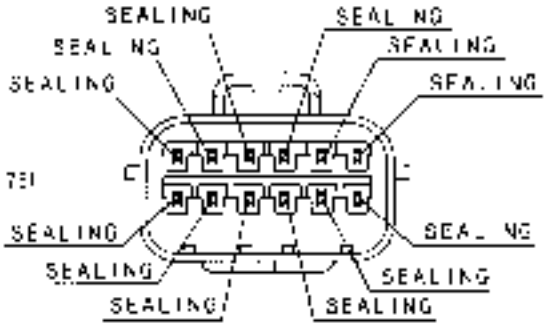

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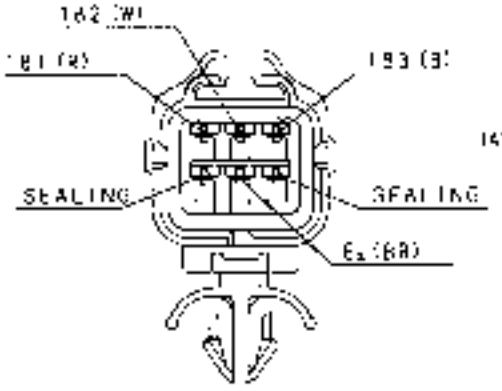

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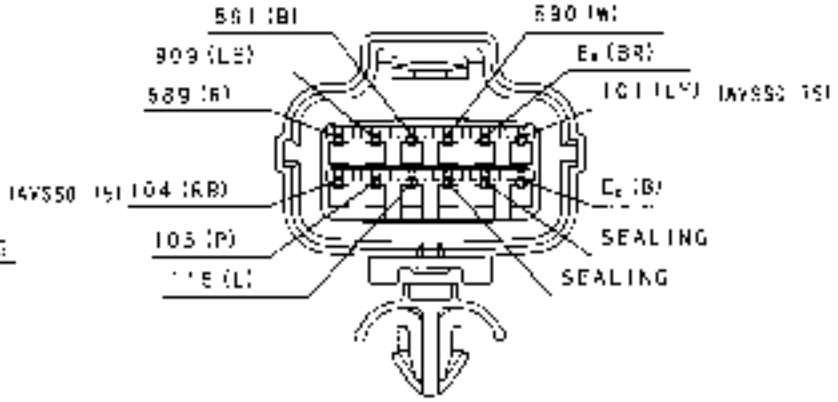

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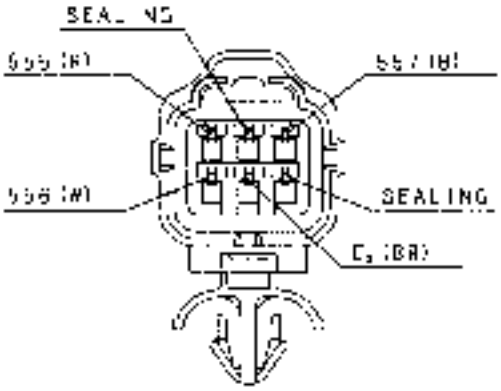

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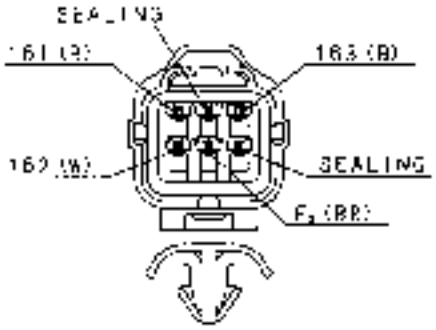

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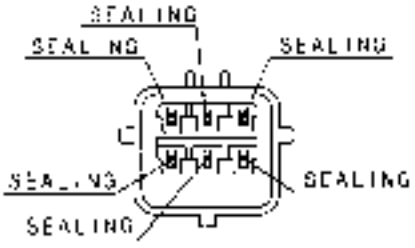

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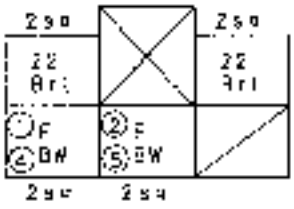

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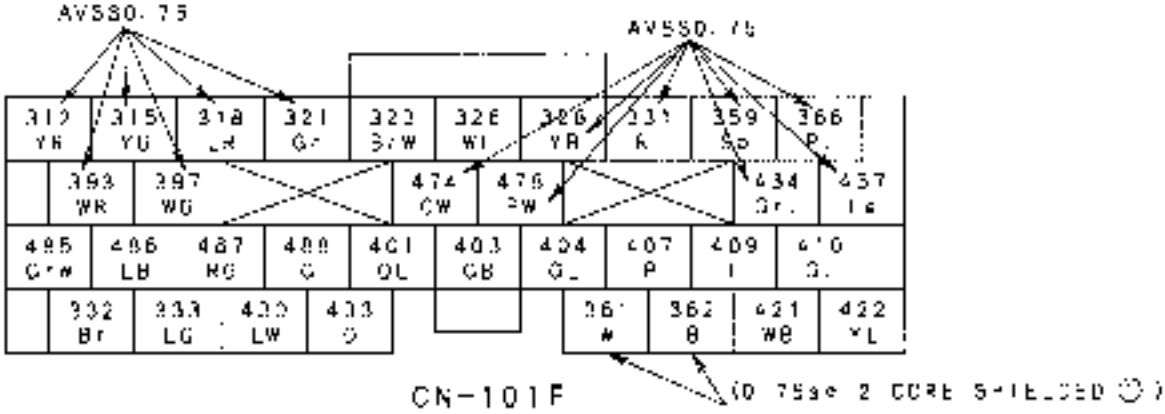

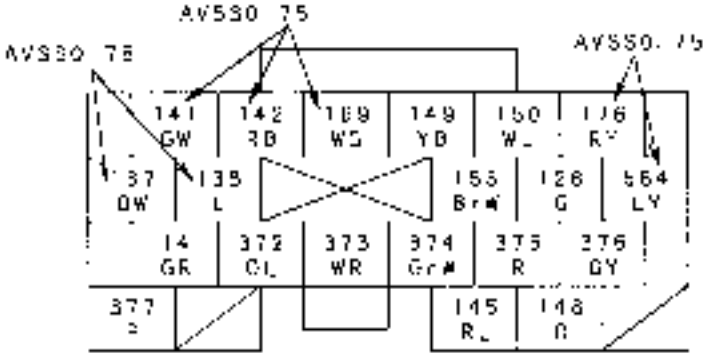

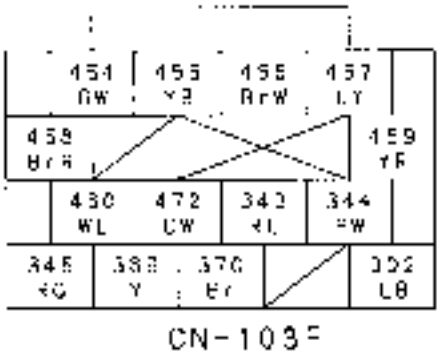

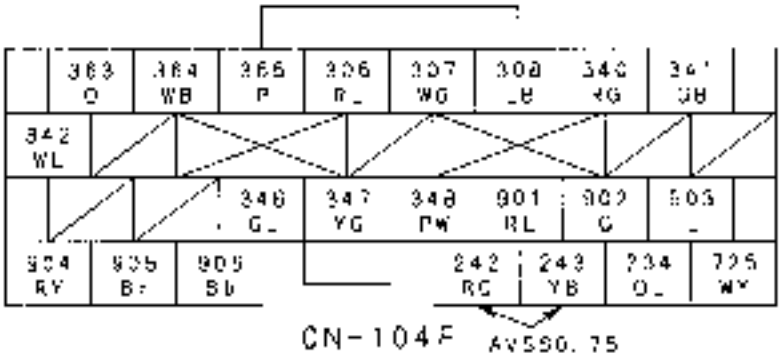

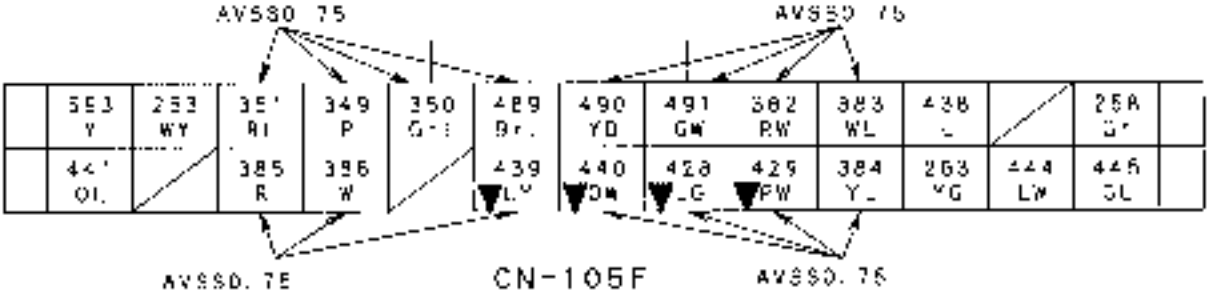

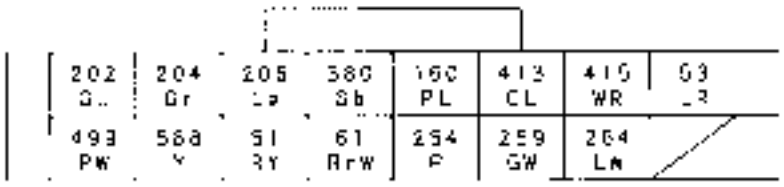

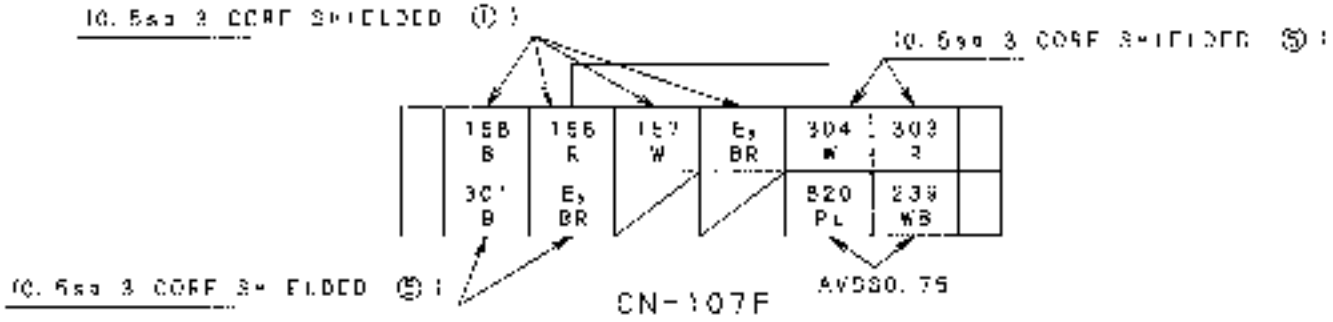

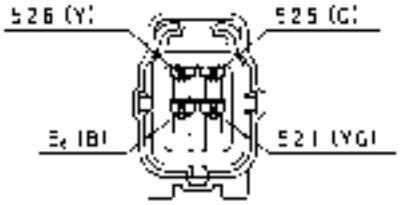

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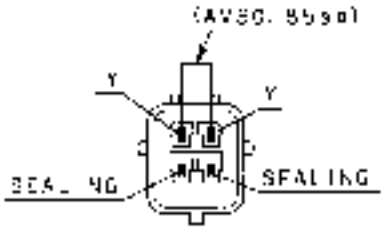
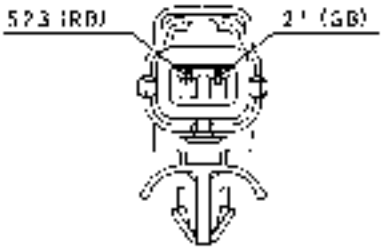
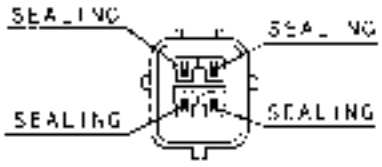


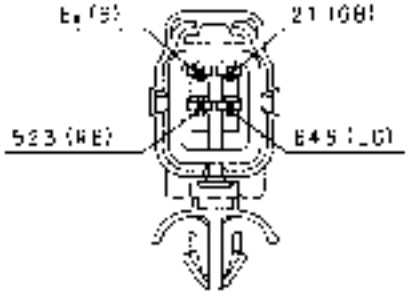
CN-113AM



CN-115F

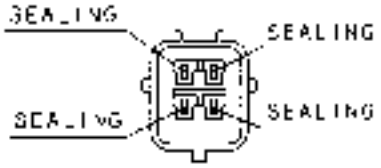


CN-113M



CN-114F

CN-115M



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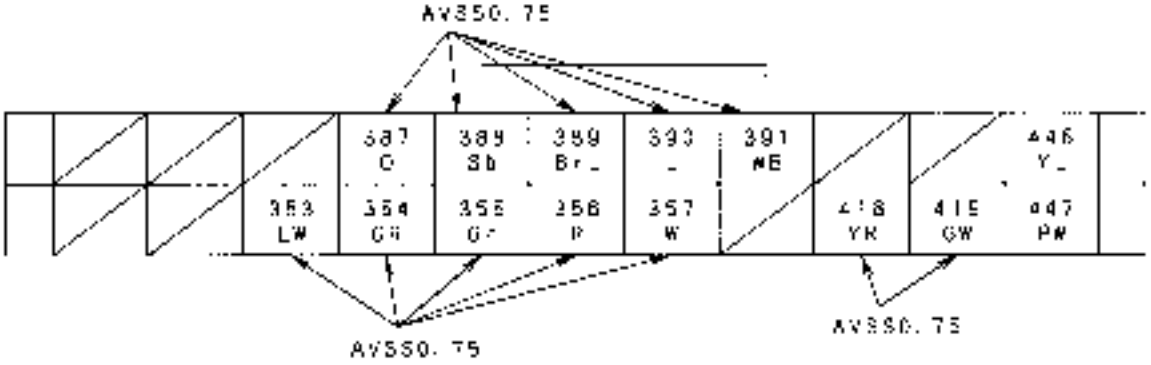

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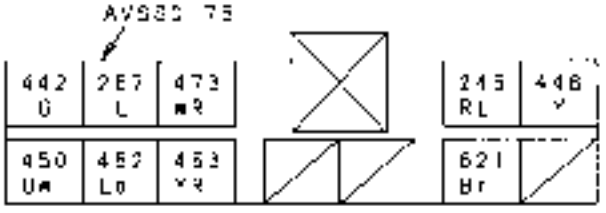

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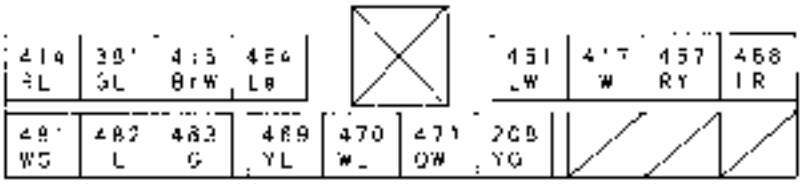

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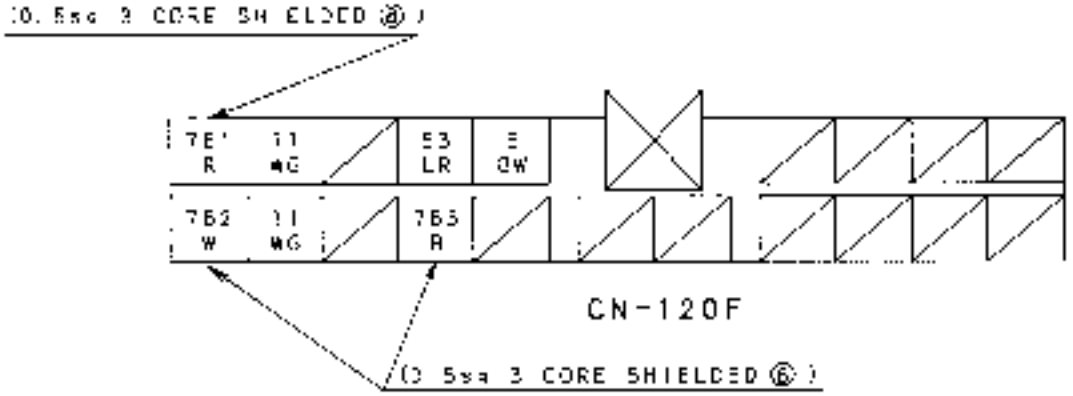
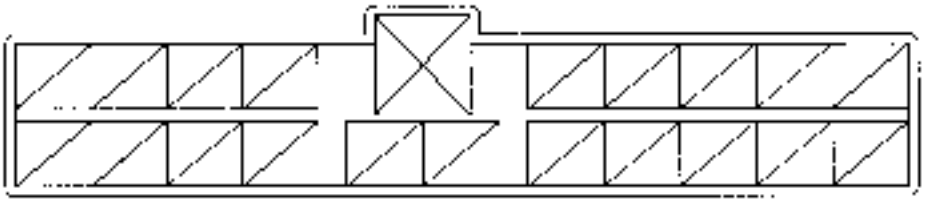
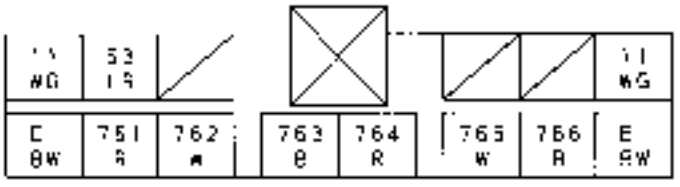




CN-120M



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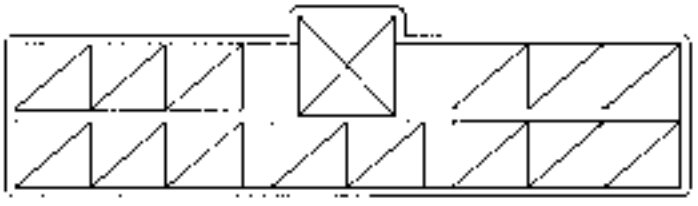

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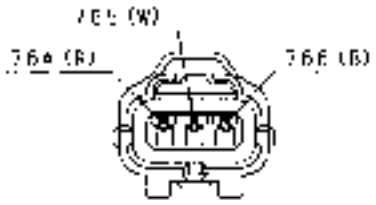

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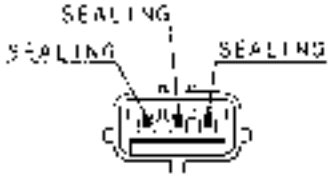
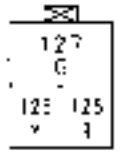


CN-122M

CN-134F

CN-134M



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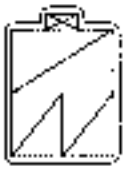

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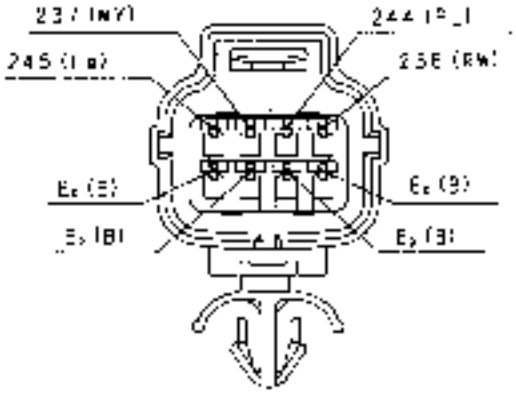

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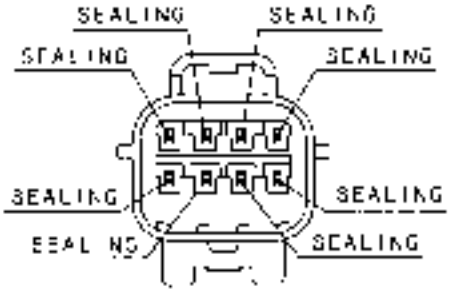

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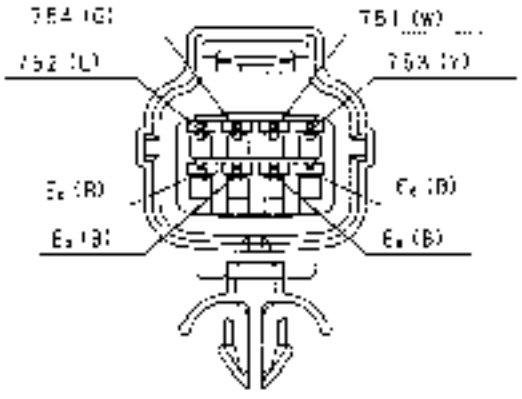

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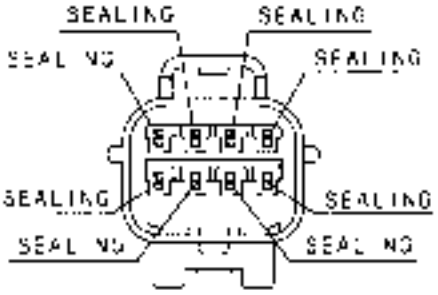
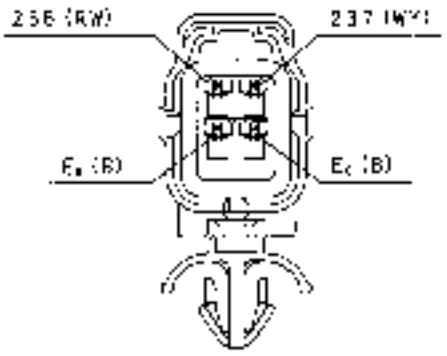
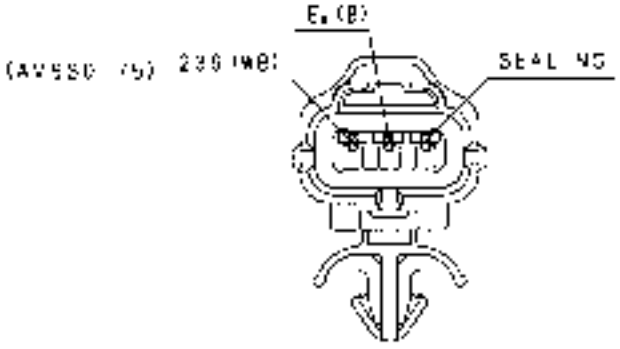


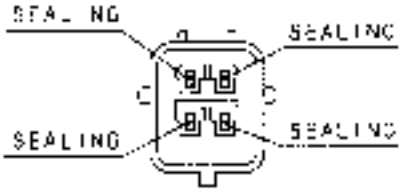
CN-137M



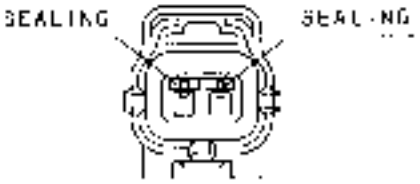
CN-140F



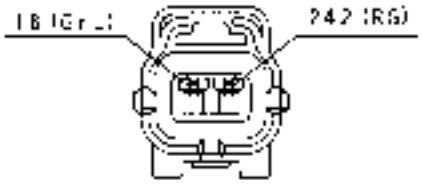
CN-156F



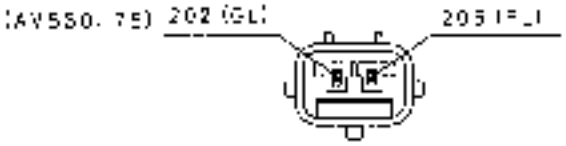
CN-140M



CN-157F



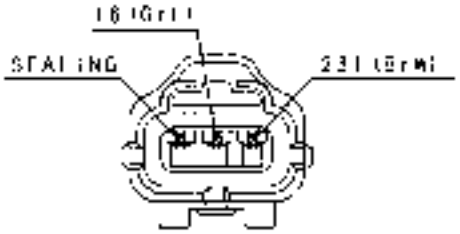
CN-143F



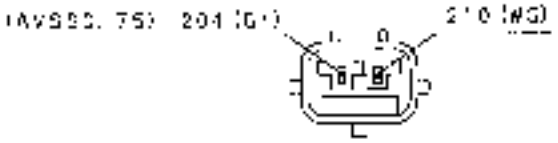
CN-157M

CN-144F

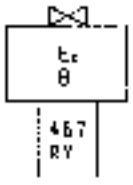
CN-158F



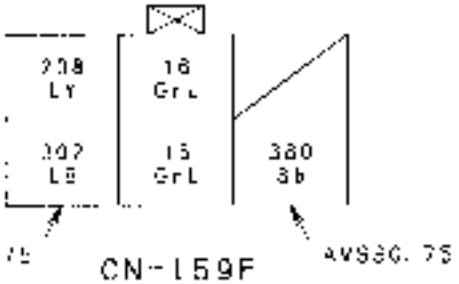
CN-145F



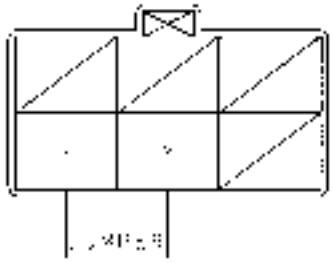
CN-158M



CN-147F

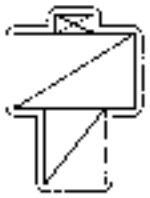


CN-159F

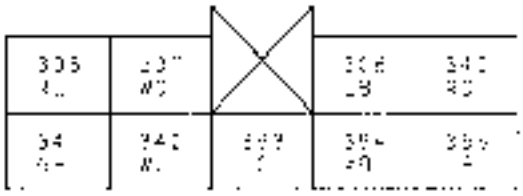


CN-159M

CN-150F



CN-162M



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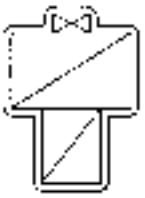

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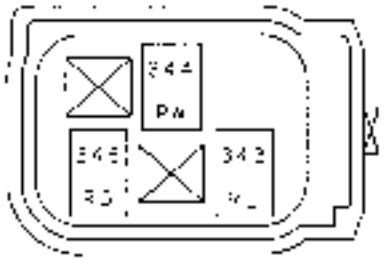
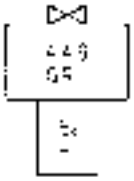
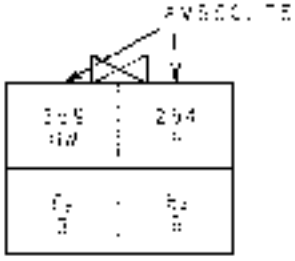


CN-163F
(AVSS0. 75)



CN-154F



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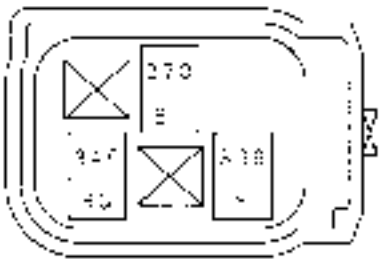
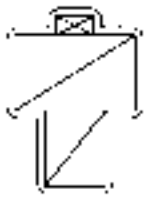


CN-164F
(AVSS0. 75)



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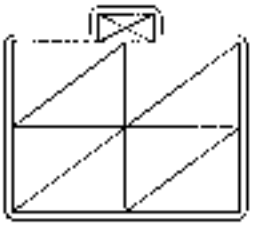

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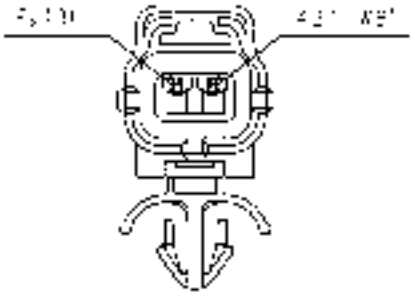

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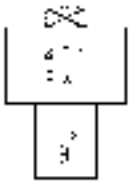

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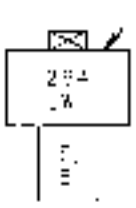

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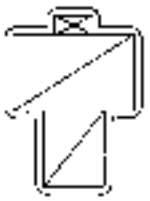
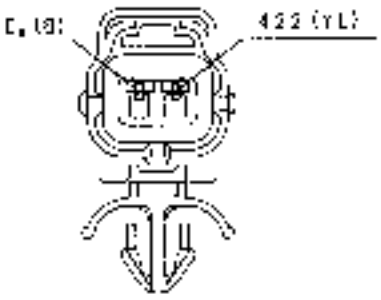


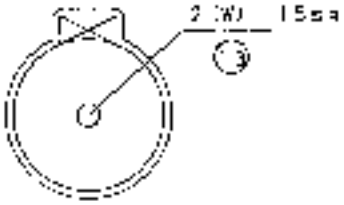
CN-155M

CN-173M

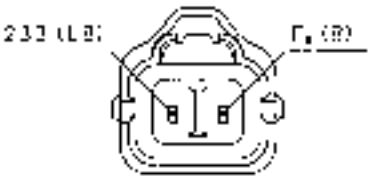


CN-174F

CN-177M



CN-181M



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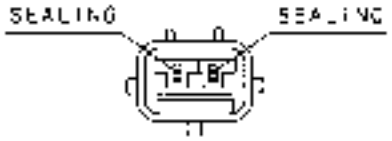
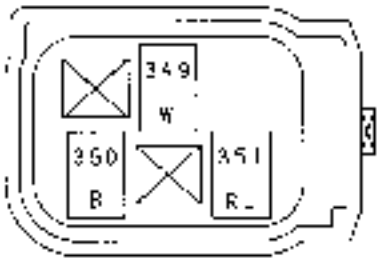
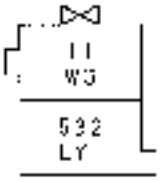


CN-174M

CN-178M



CN-176F
(AVSS0.75)



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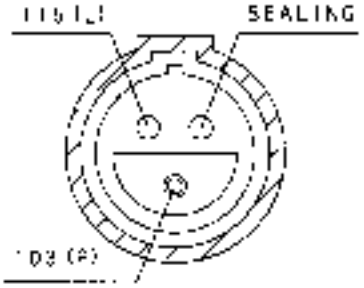
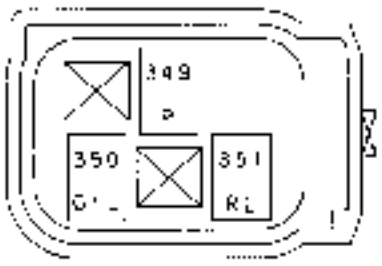
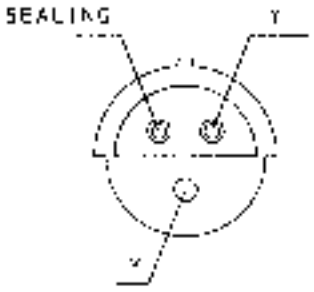


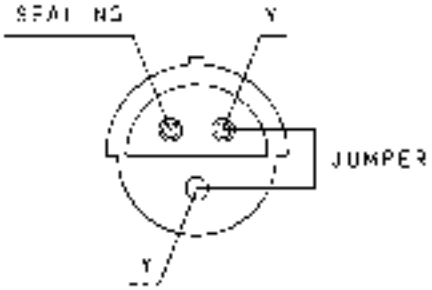
CN-187F



CN-176F
(AVSS0.75)



CN-186M



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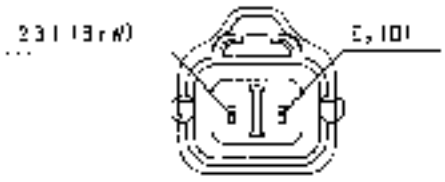

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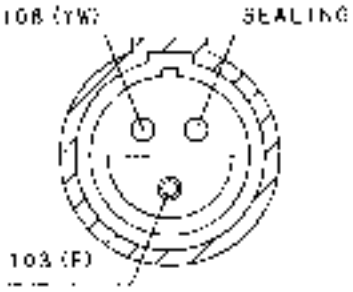

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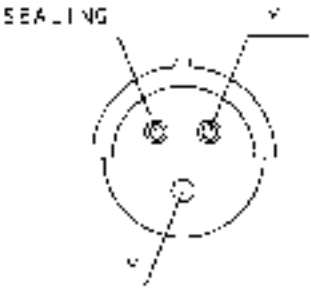
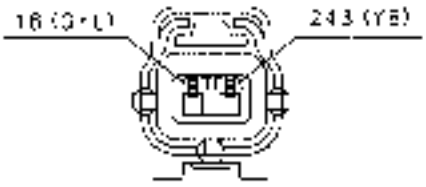


CN-187M

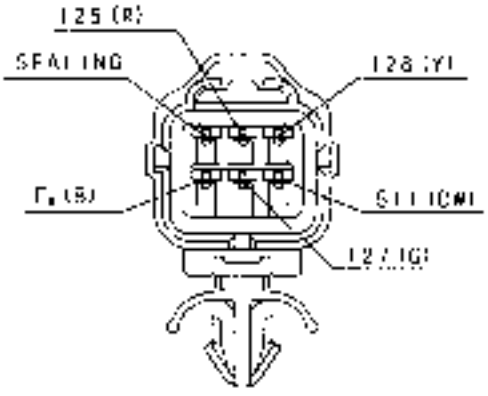
CN-193F



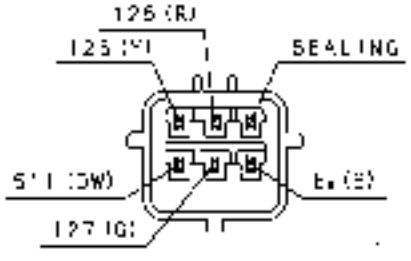
CN-194F

CN-202F

CN-202M



CN-206F



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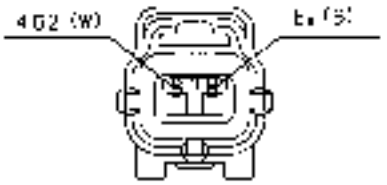

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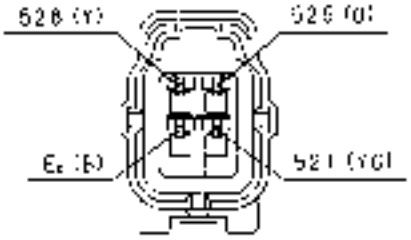
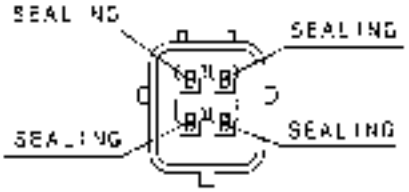


CN-214F



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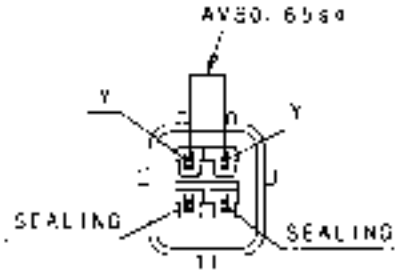

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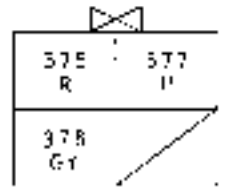
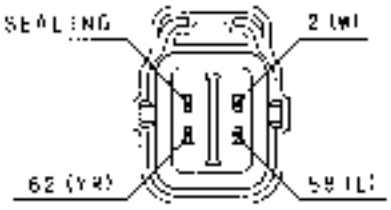
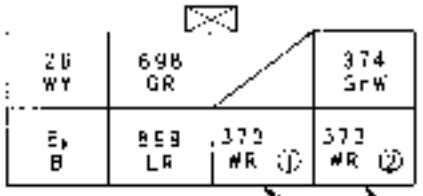


CN-235F



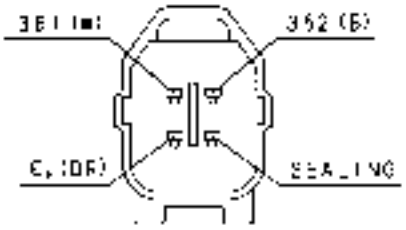
CN-216F



CN-237F

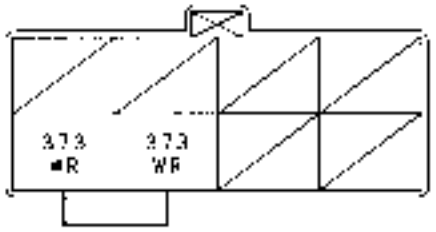
TO CN-560F

TO CN-377M



CN-217F

0.75sq 2 CORE SHIELDED ①



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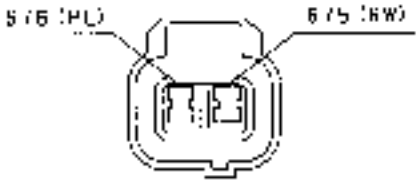
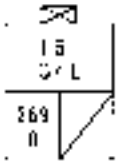
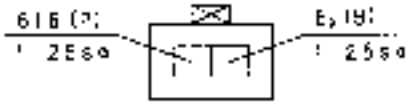


CN-223F

CN-239F



CN-240F



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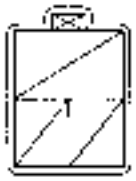
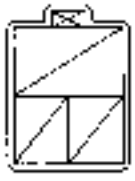


CN-239M



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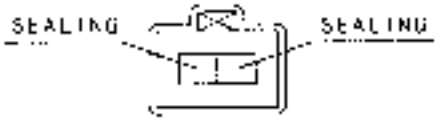

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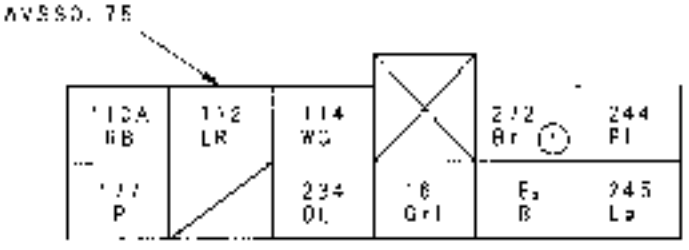
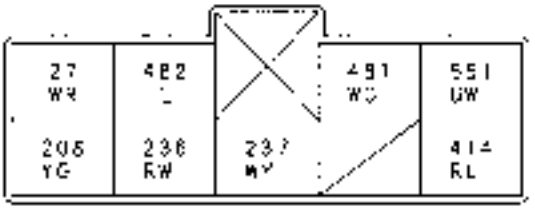
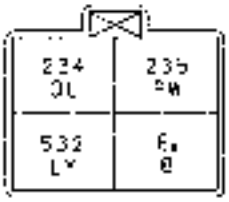


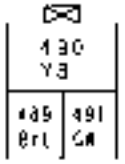
CN-241F



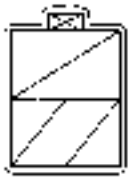
CN-243M



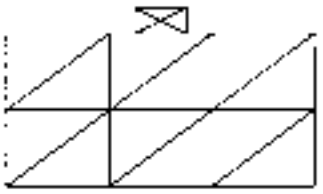
CN-249M



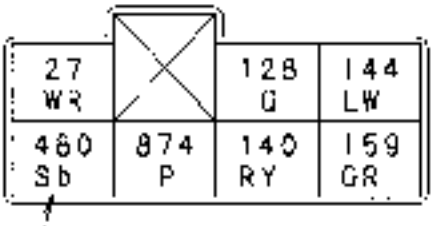
CN-244F (AVSS0.75)



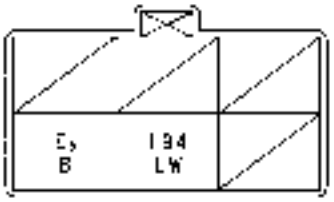
CN-244M



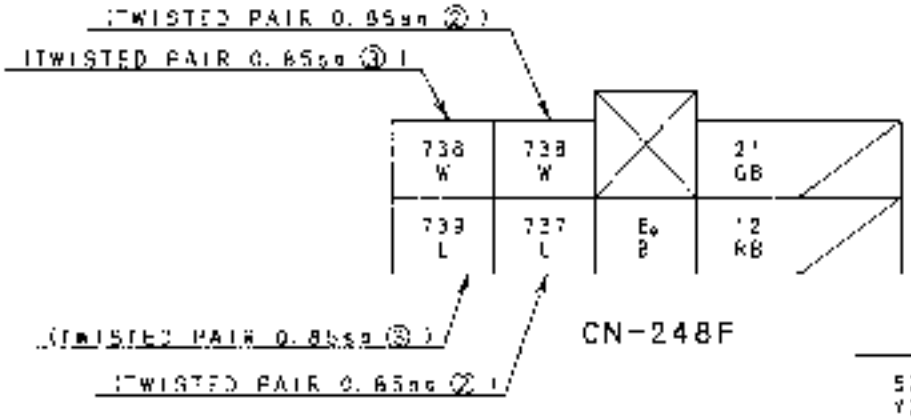
CN-251F



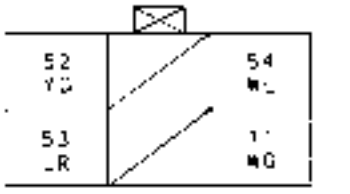
AVSS0.75 CN-246M



CN-251M



CN-248F



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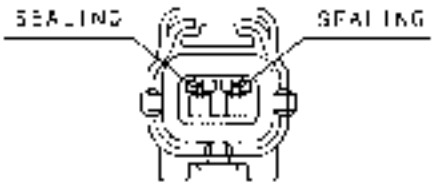
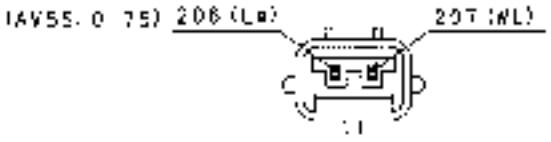
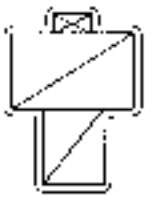
CN-259F



CN-260F

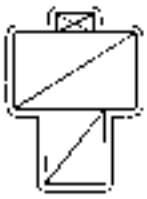


CN-260M

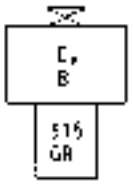


CN-261M

CN-261F



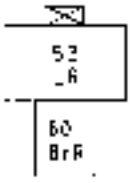
CN-294M



CN-294F

CN-298M

CN-298F



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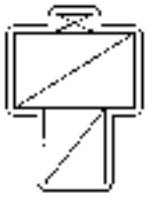

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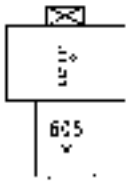

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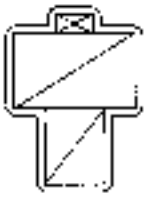
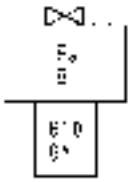
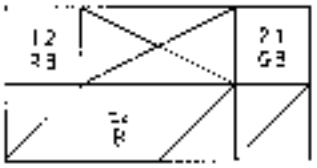


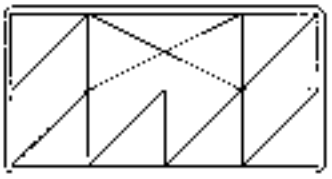
CN-296M



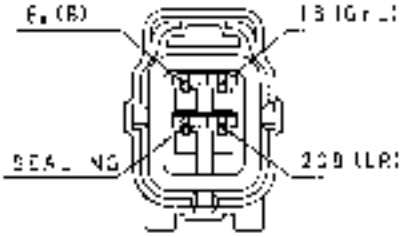
CN-296F



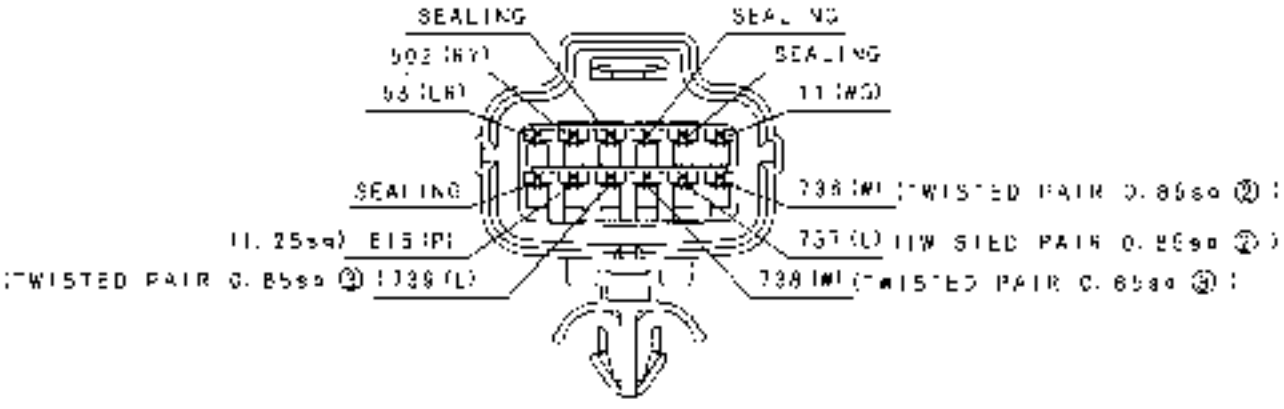
CN-263F



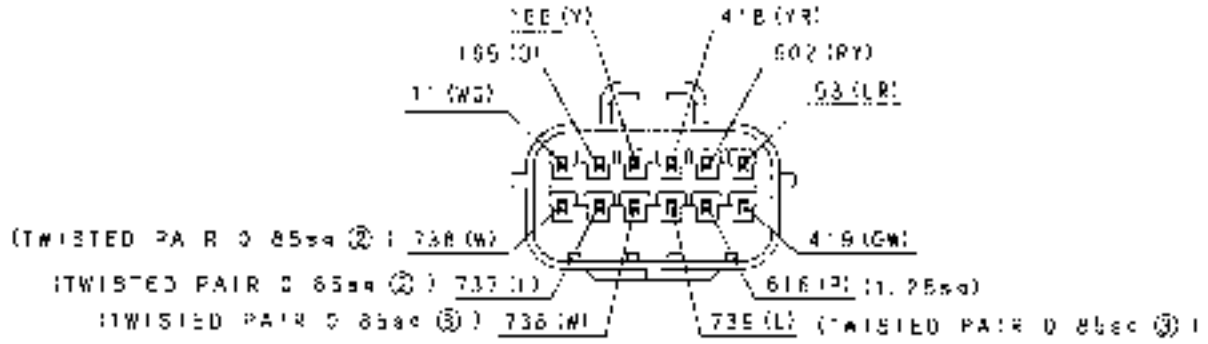
CN-263M



CN-298F



CN-311F



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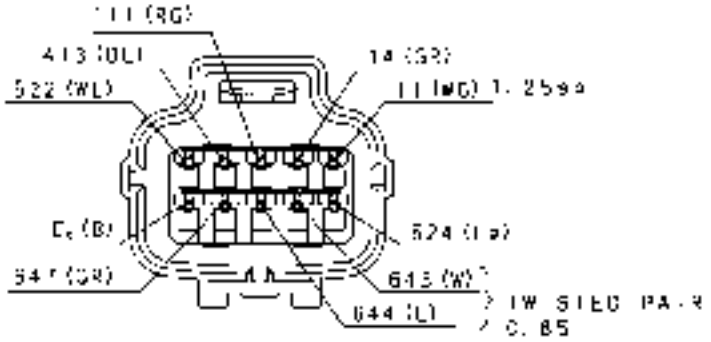

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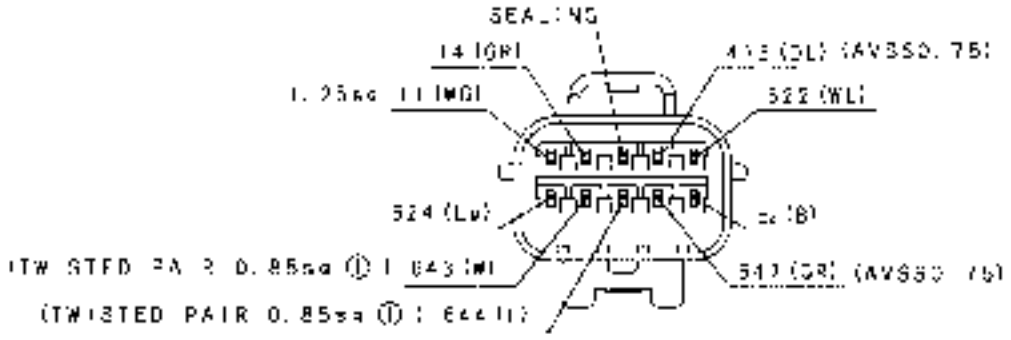

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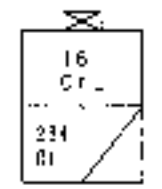
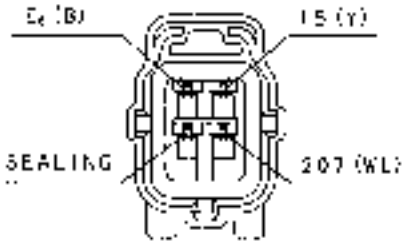


CN-314F



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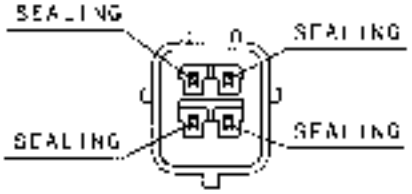

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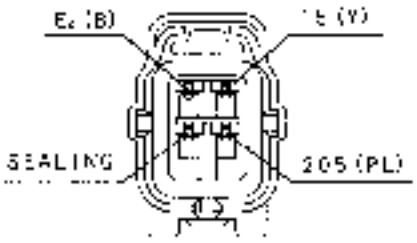

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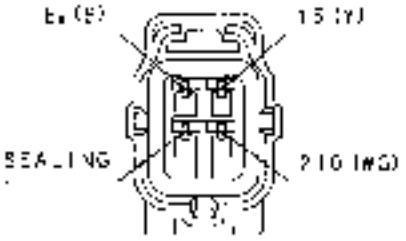

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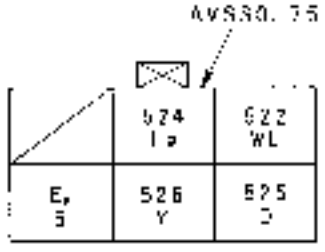

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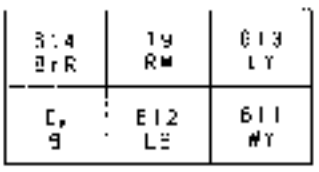

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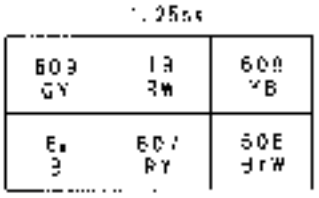

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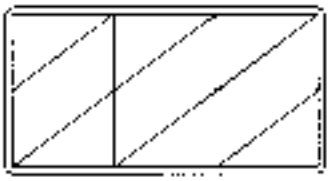

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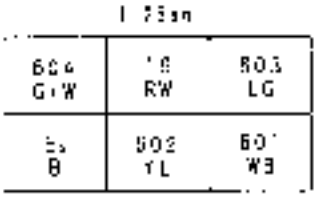

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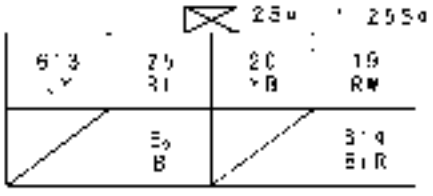

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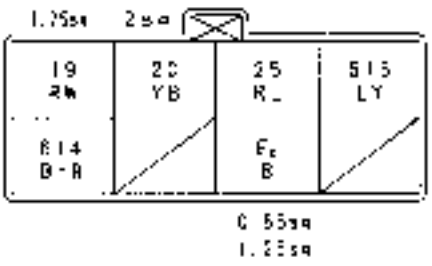

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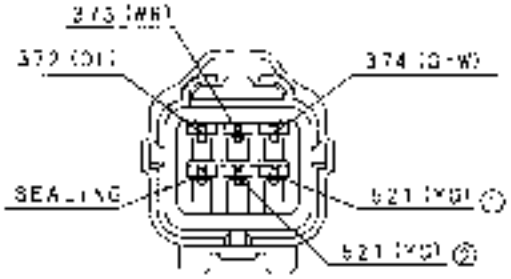

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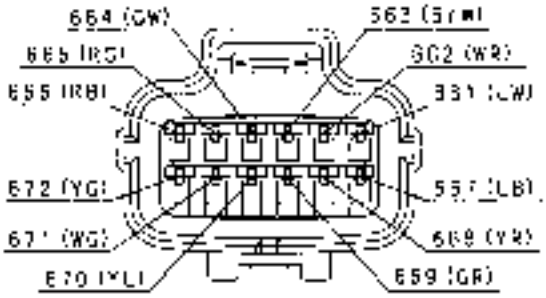

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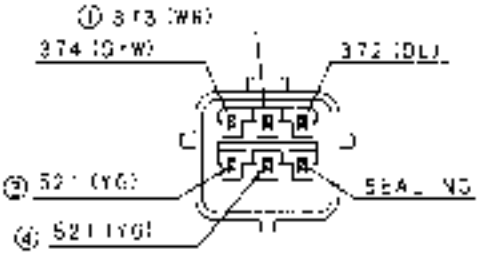

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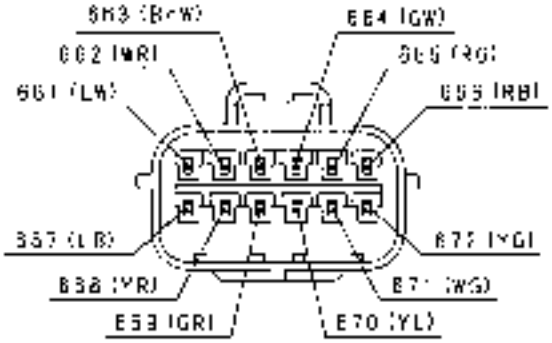

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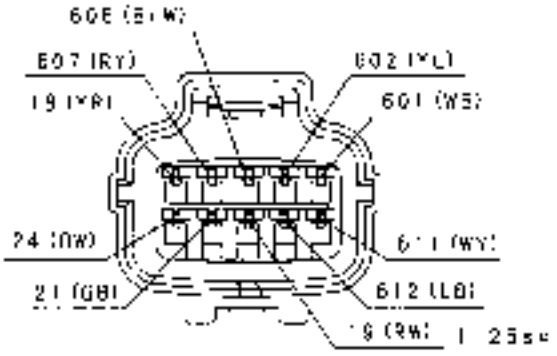

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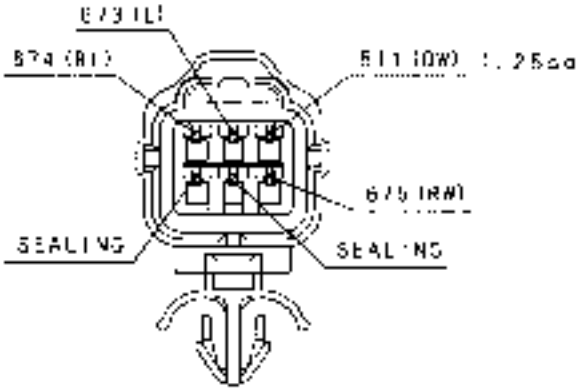

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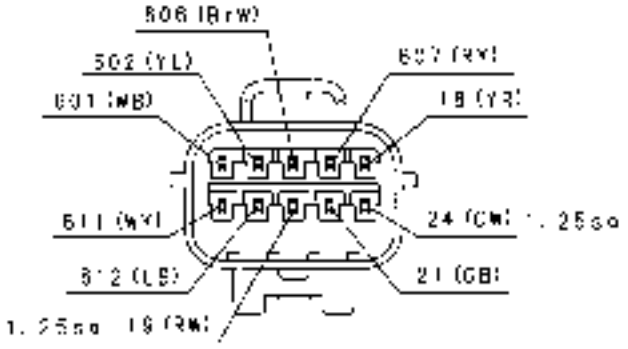

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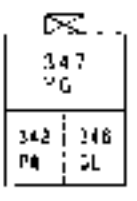

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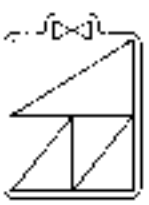

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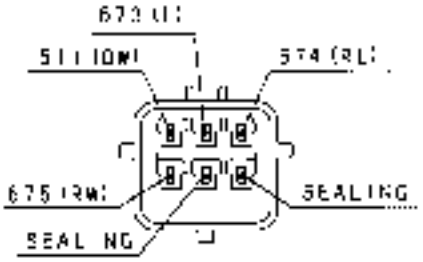

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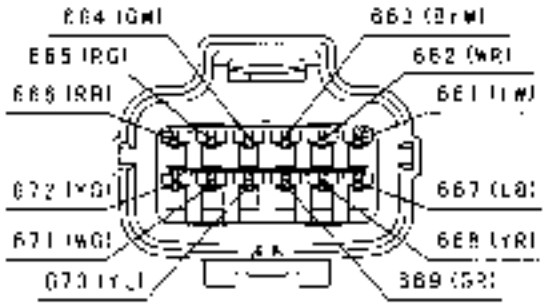

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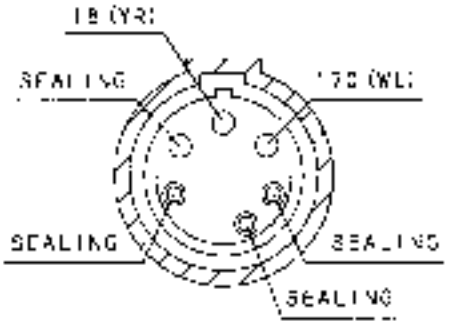

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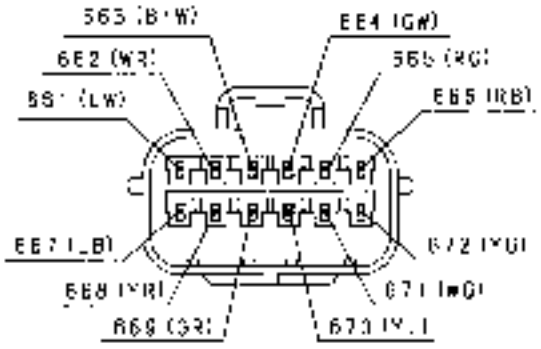
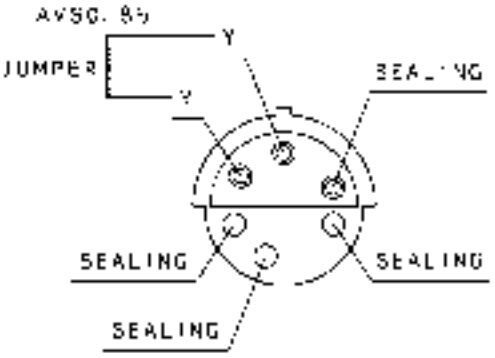
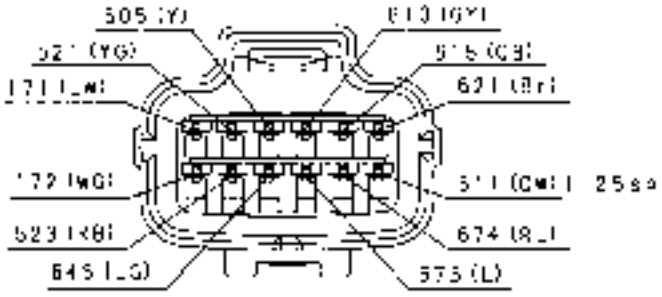


CN-334M



CN-341M



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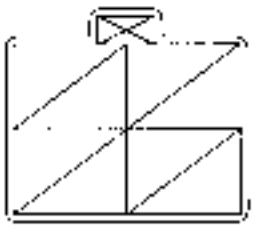
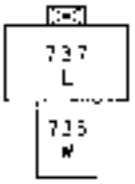
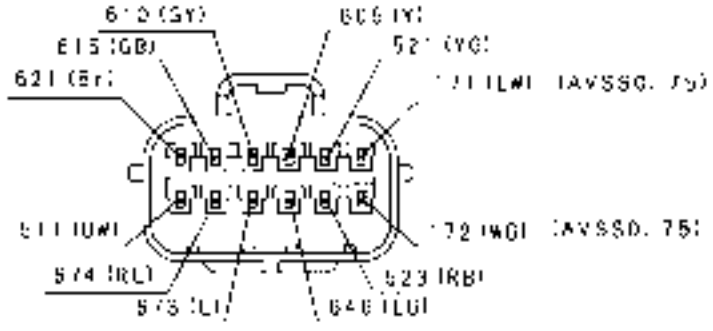


CN-352M

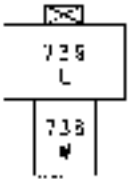


CN-361F

(TWISTED PAIR 0.65sq ②)

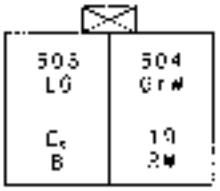


CN-335M

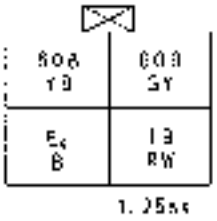


CN-362F

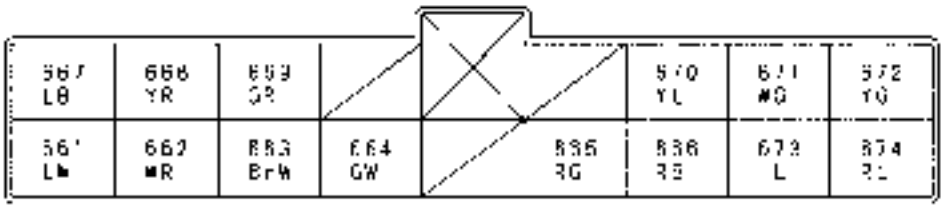
(TWISTED PAIR 0.85sq ③)



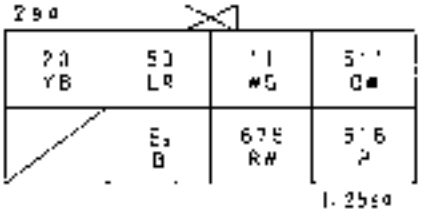
CN-351F



CN-352F

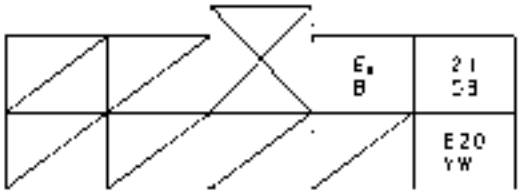


CN-363M

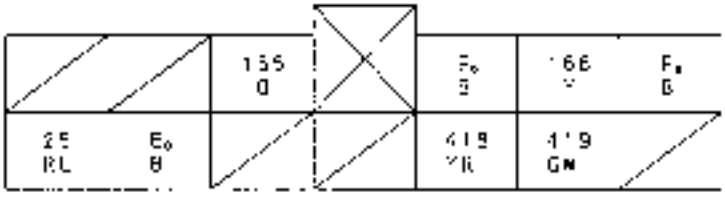


CN-364F

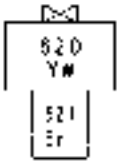
FAN SW



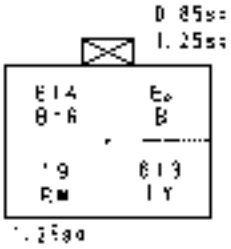
CN-378F



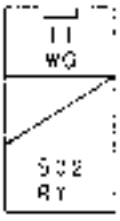
CN-369F



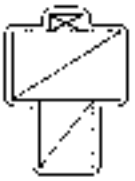
CN-379F



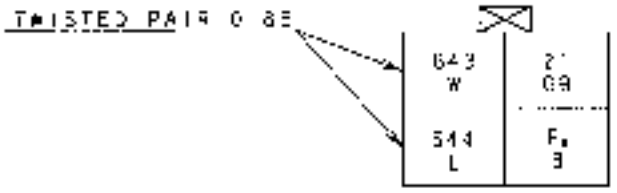
CN-370F



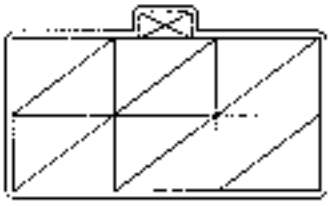
CN-371F



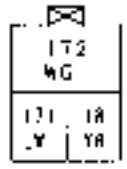
CN-379M



CN-381F



CN-386M



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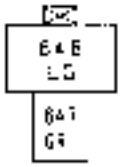

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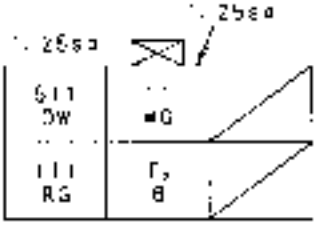

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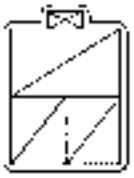

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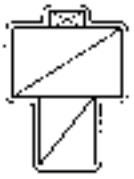

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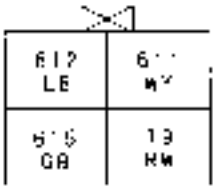

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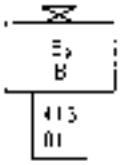

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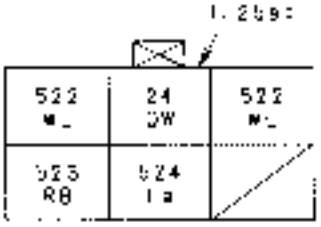

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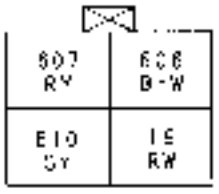

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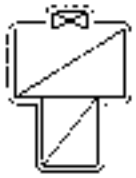

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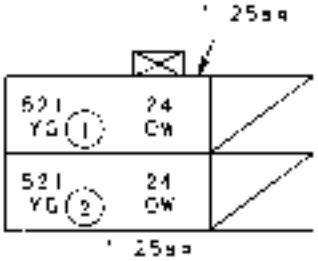

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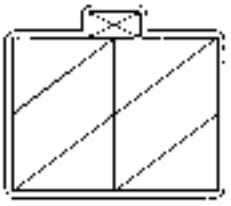

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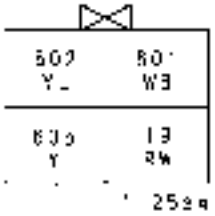

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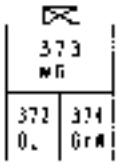

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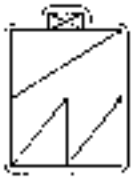

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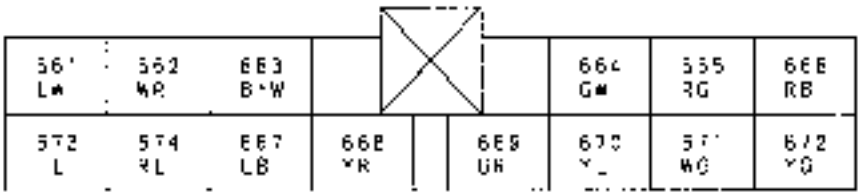

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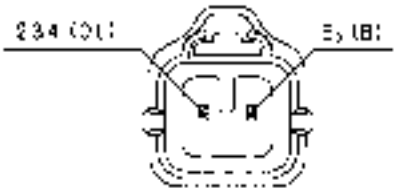

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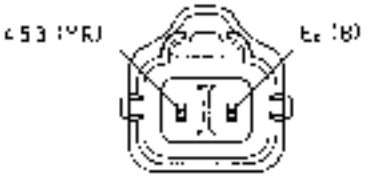

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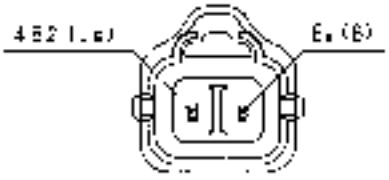
CN-402F

CN-404M



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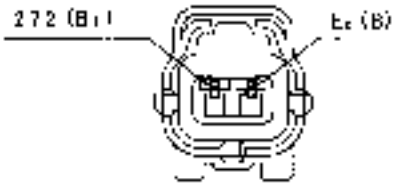

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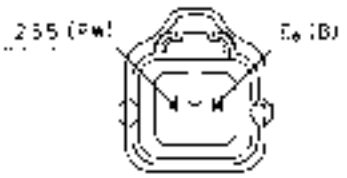

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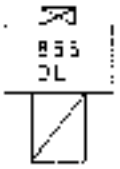

CN-446F
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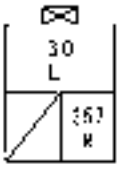

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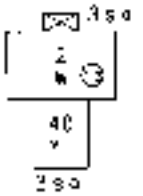

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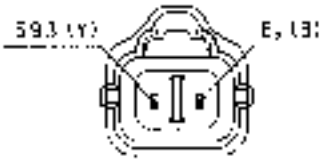

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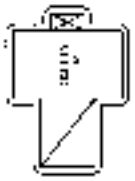

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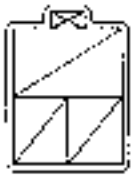

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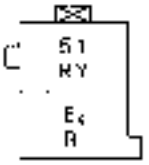

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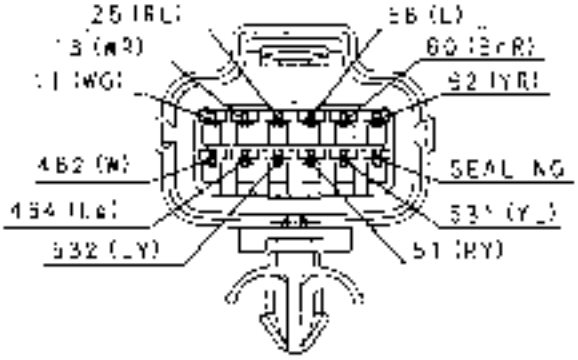

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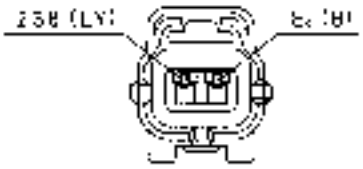

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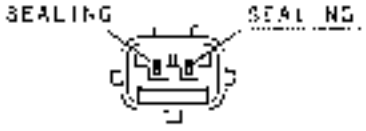

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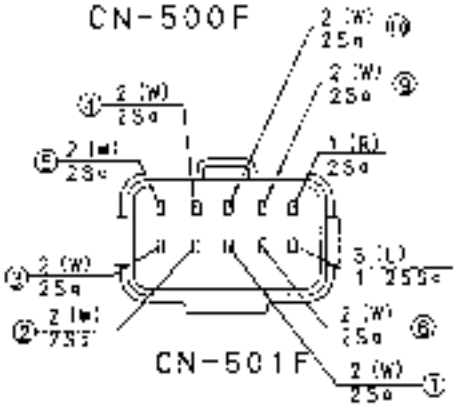

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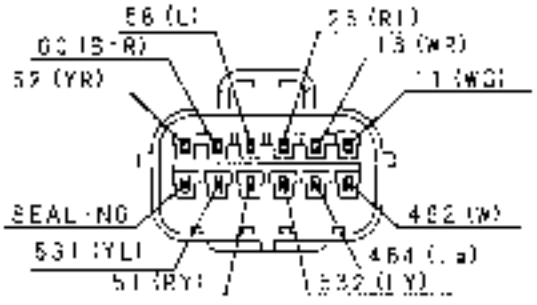

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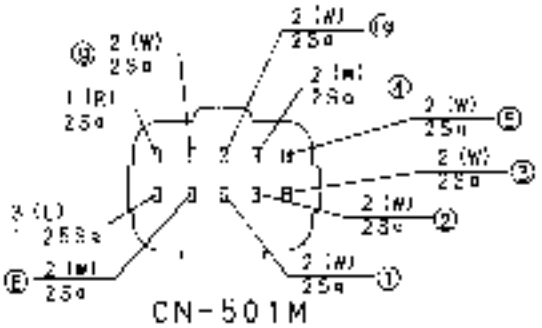

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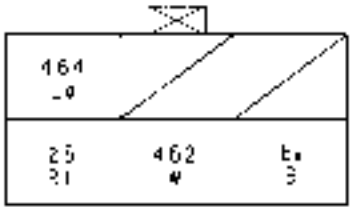

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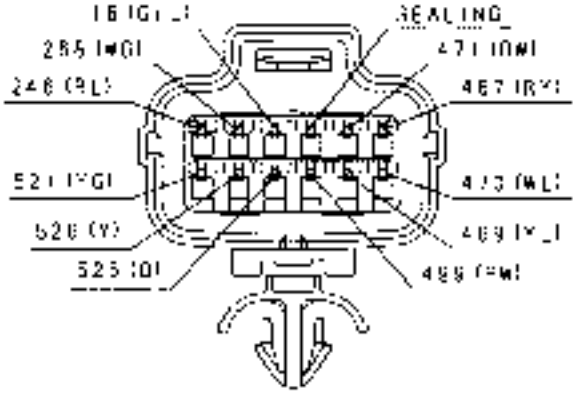

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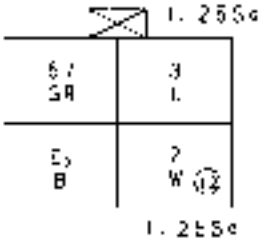

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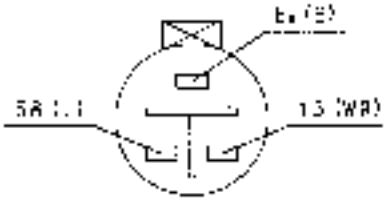

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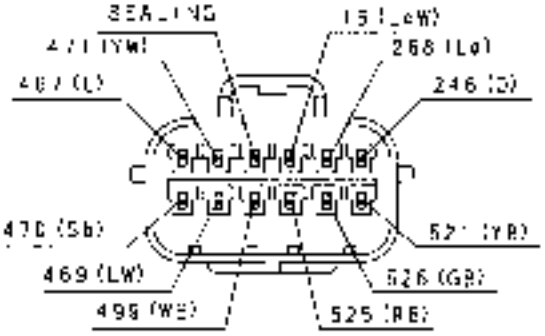

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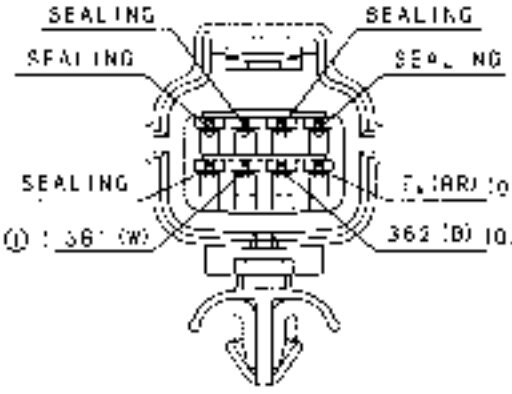

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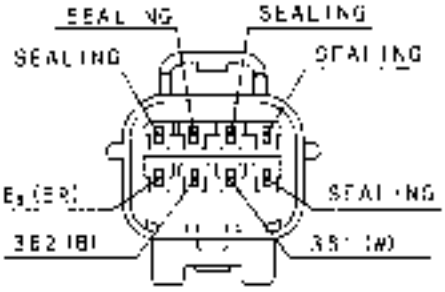

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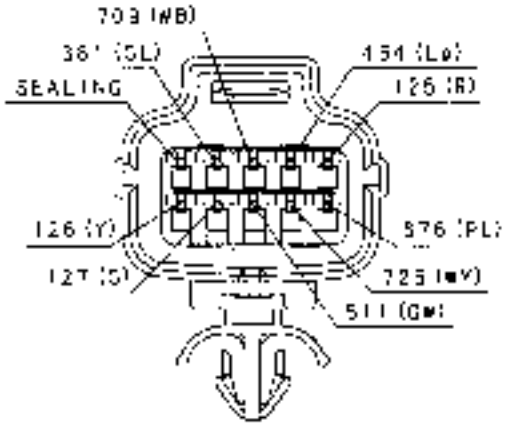

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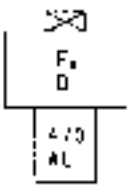

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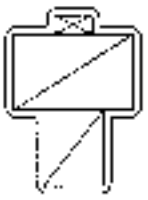

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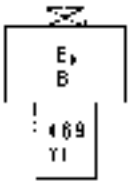

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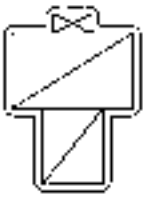

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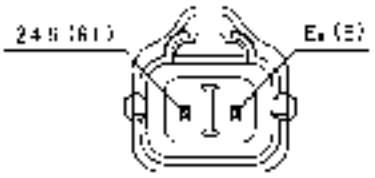

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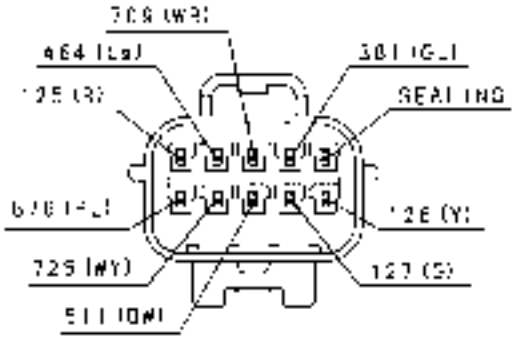

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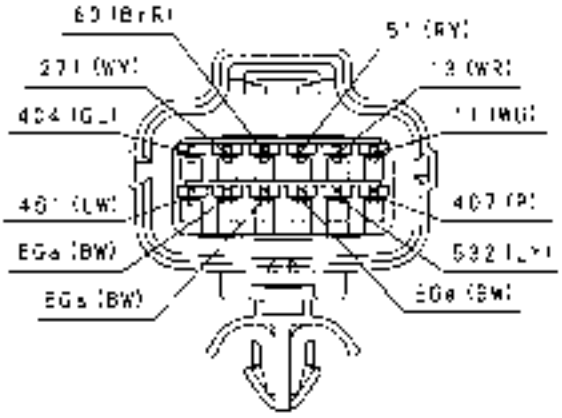

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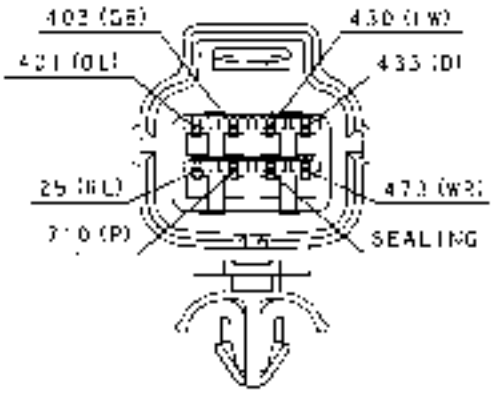

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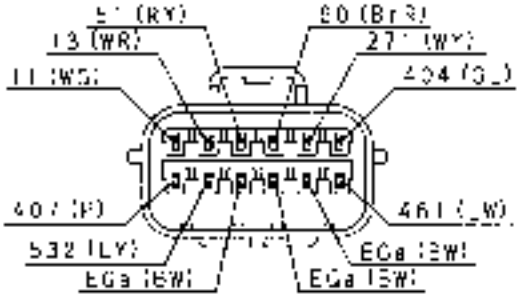

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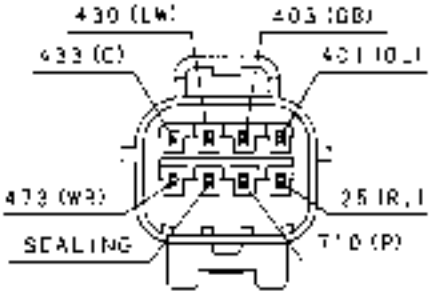

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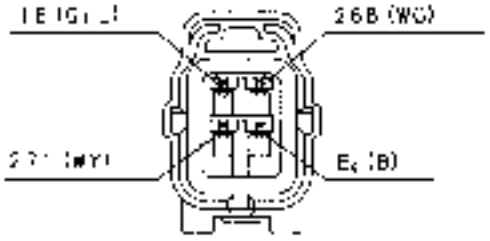

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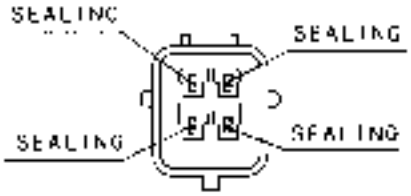

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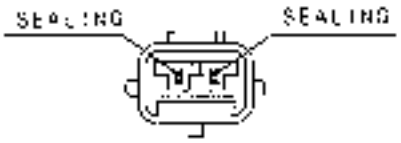

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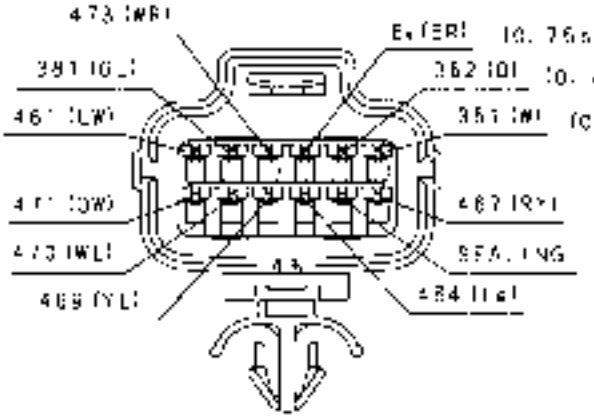

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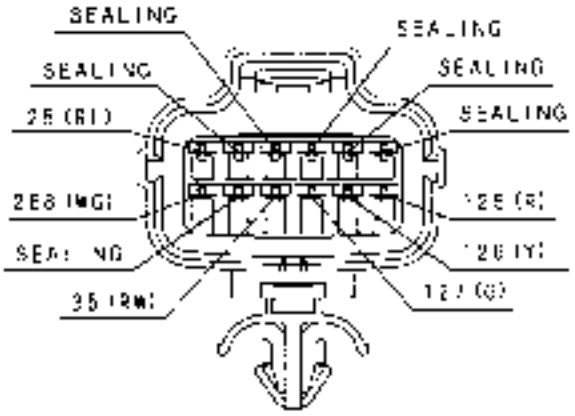

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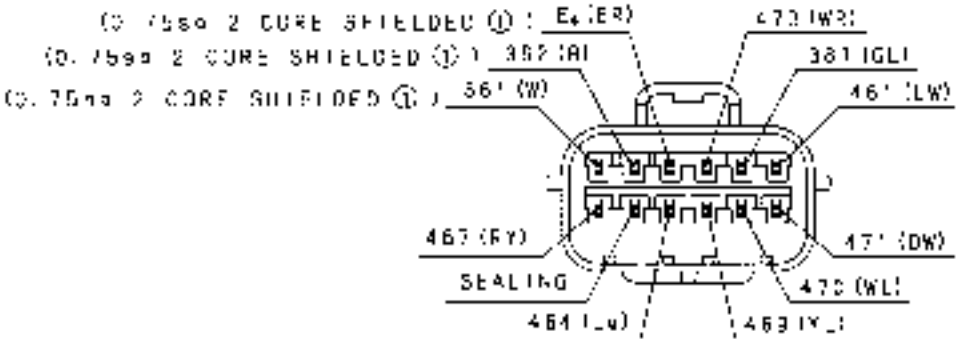
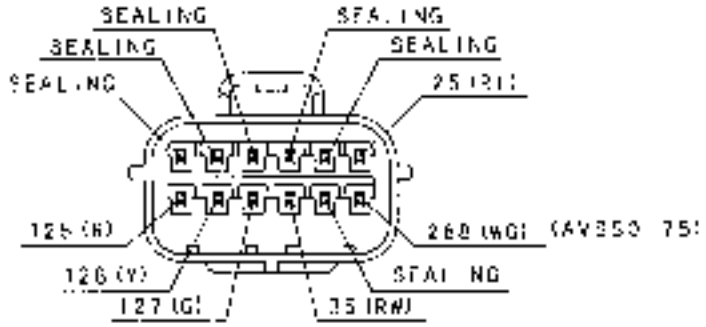


CN-516M



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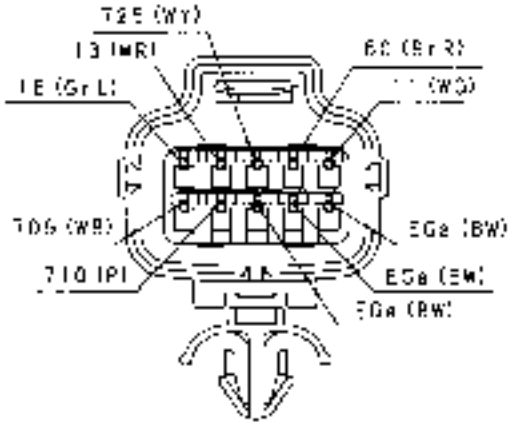

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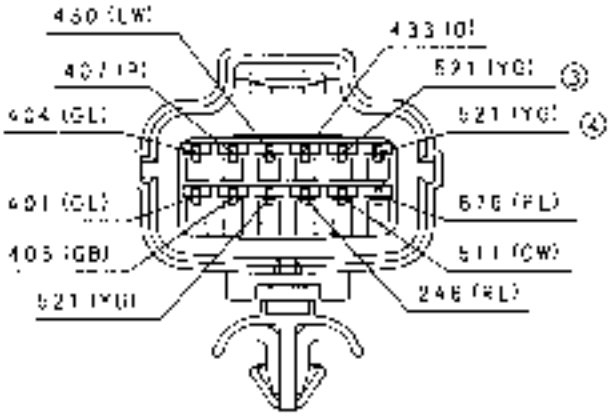

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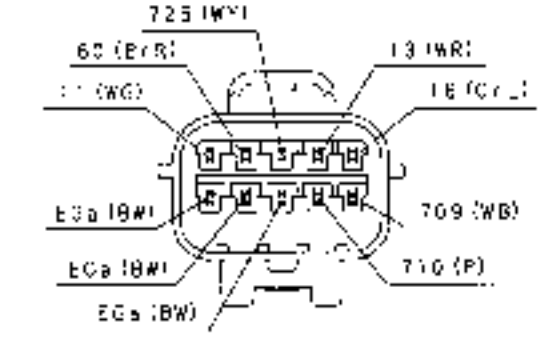

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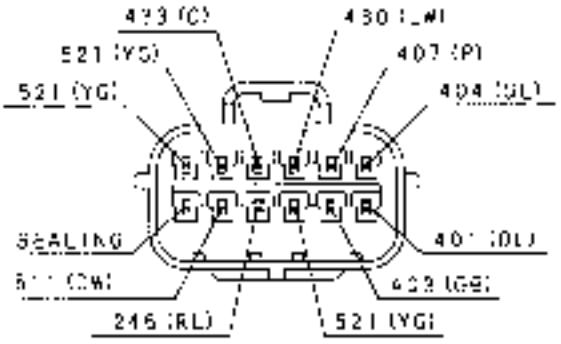

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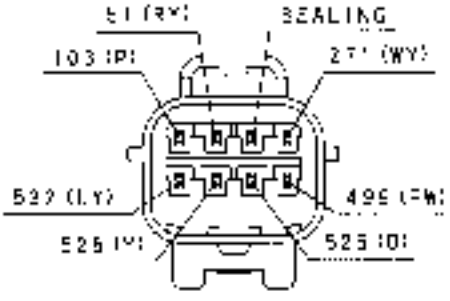

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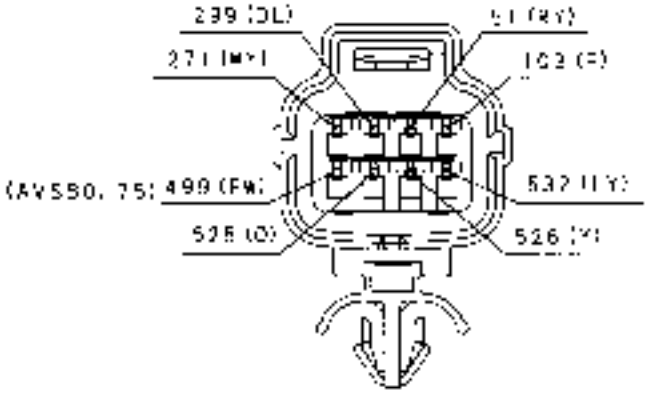

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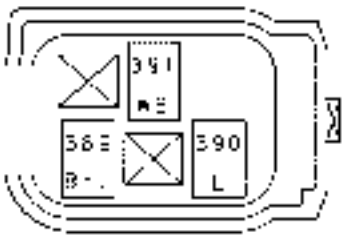
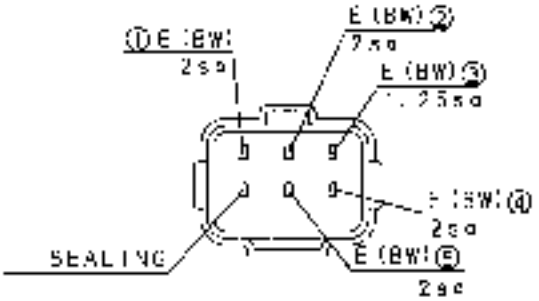


CN-523F
(AVSS0. 75)



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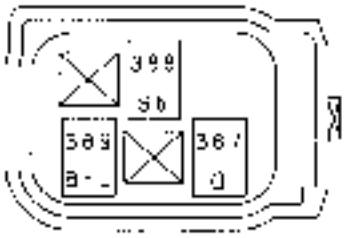

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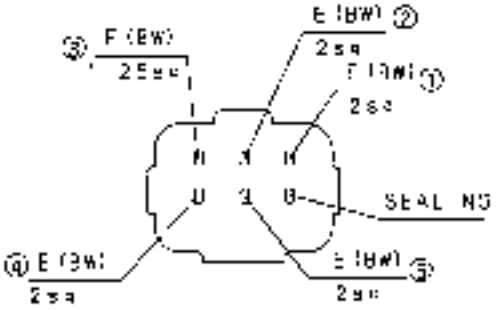

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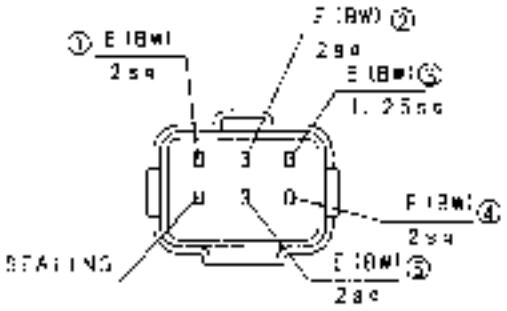

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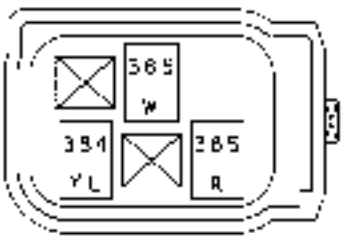

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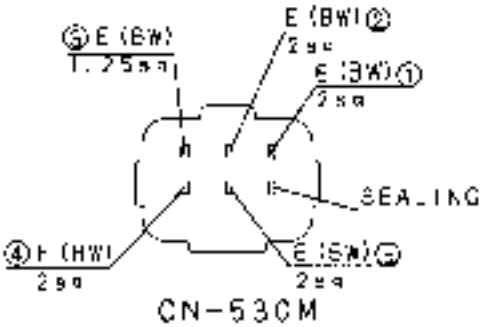

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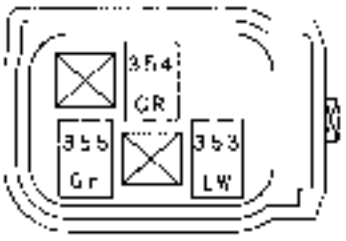

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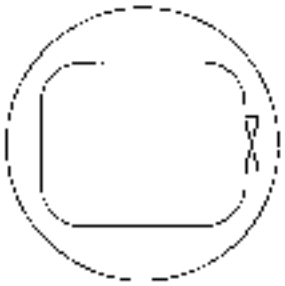

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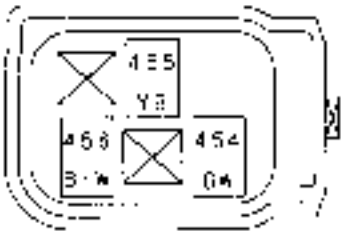
CN-541F



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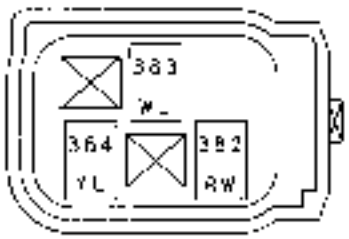

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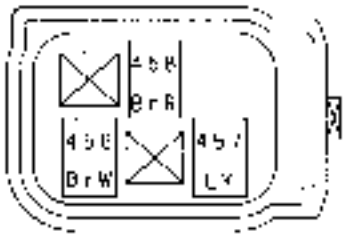
(AVSS0 75)



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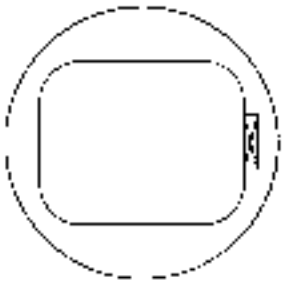

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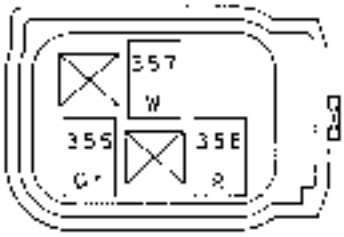

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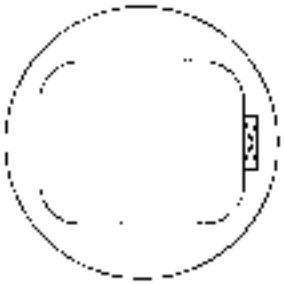

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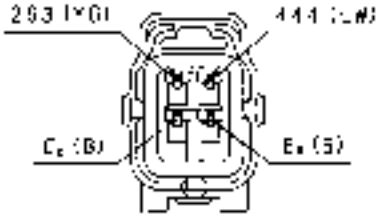

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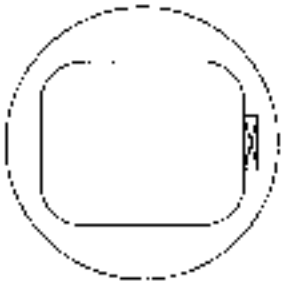

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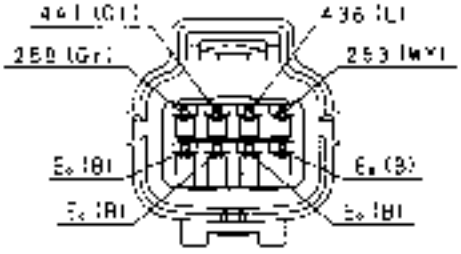

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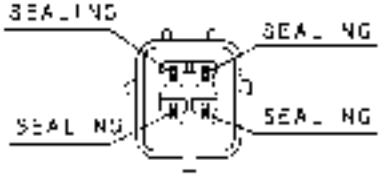

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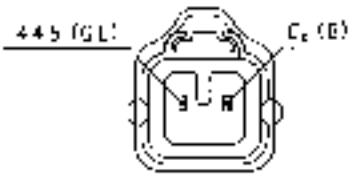

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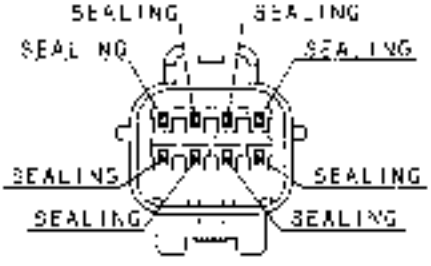

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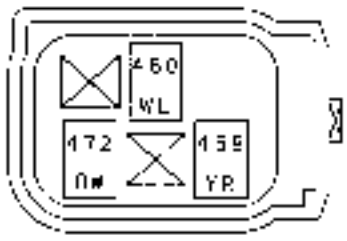

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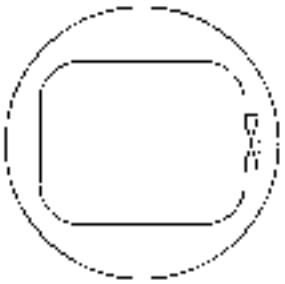

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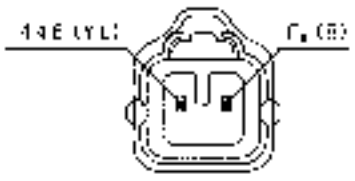

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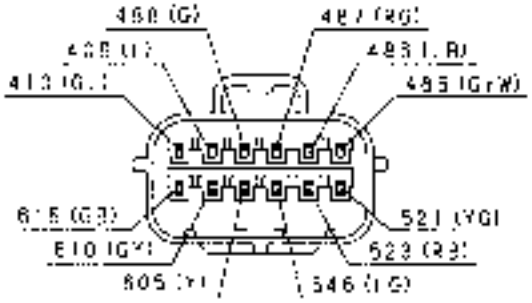

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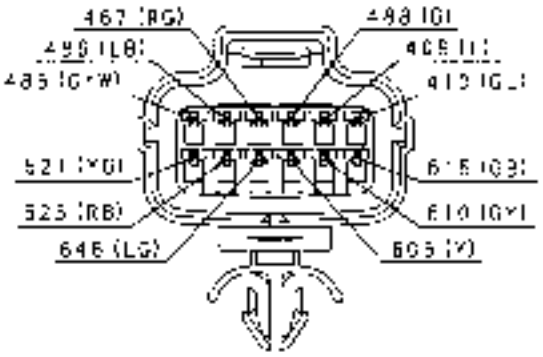

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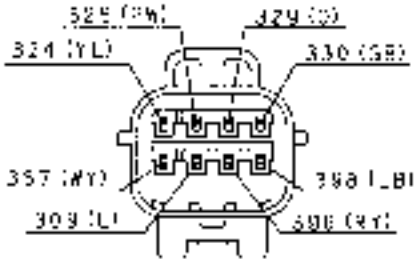

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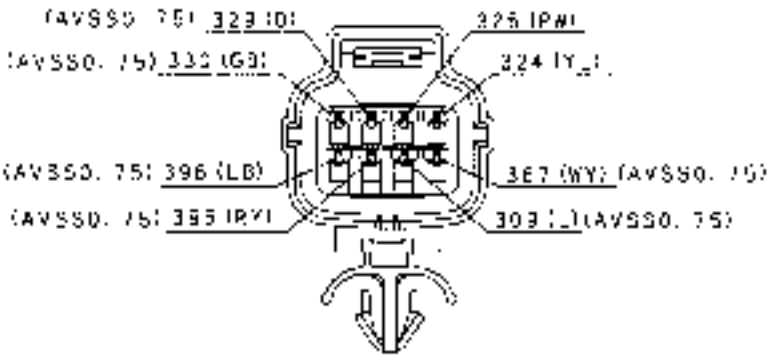

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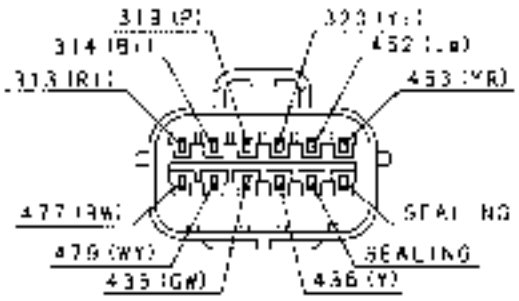

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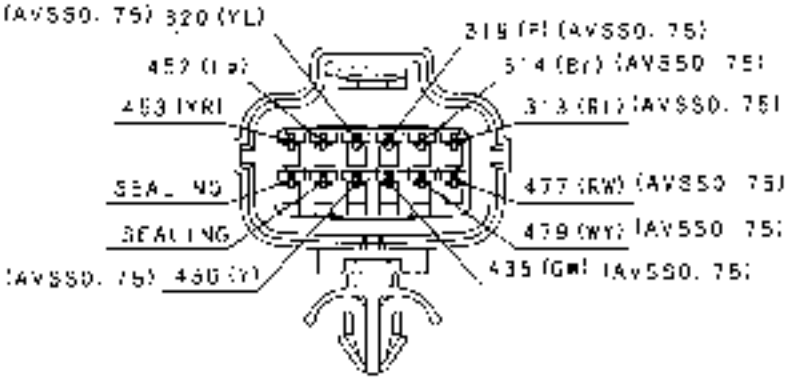

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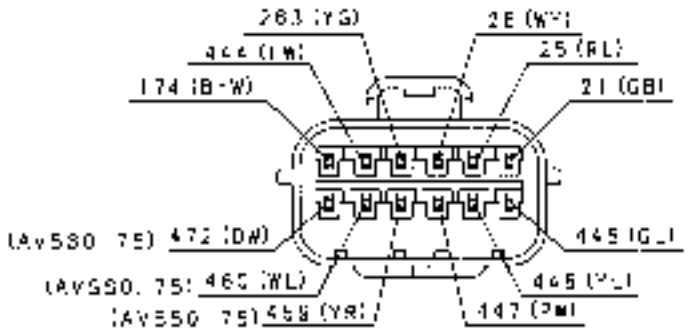

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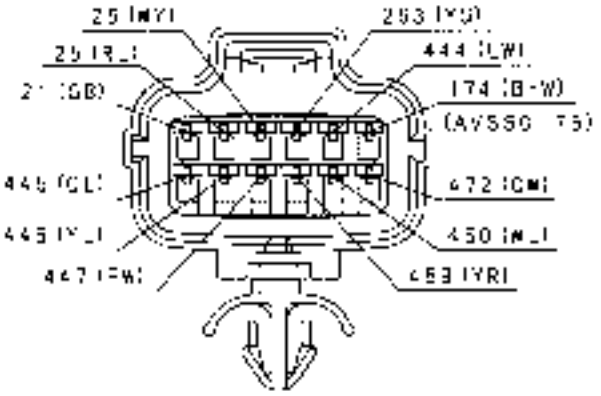

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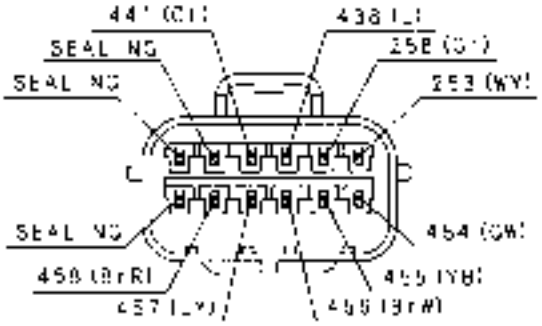

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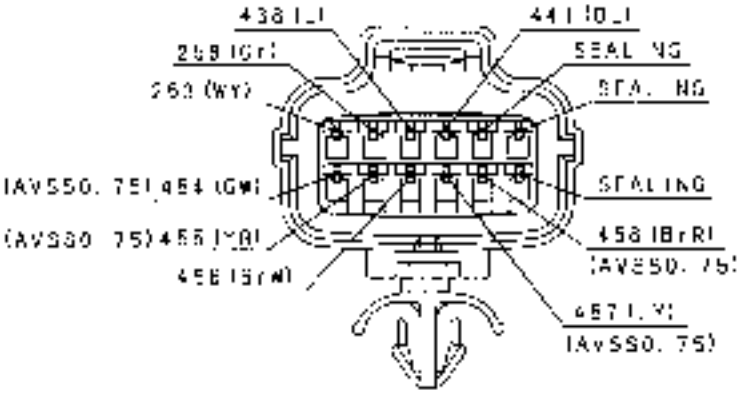

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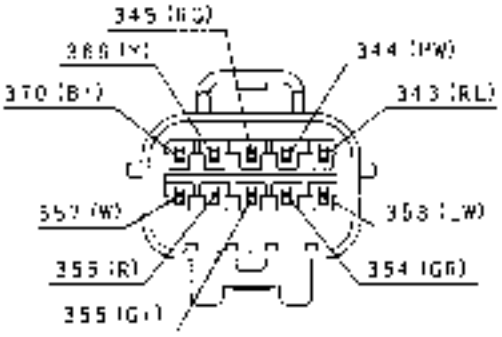

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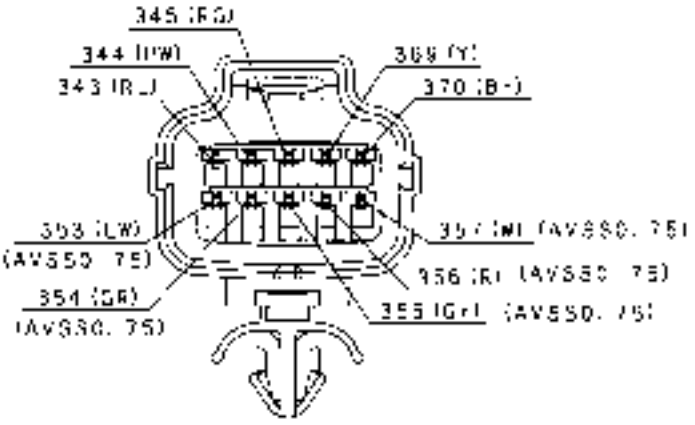

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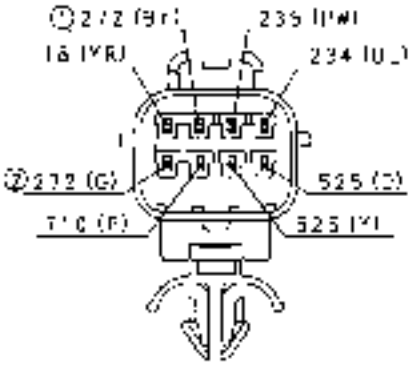

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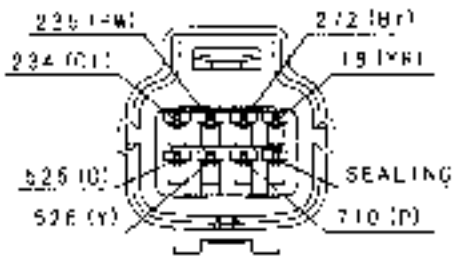

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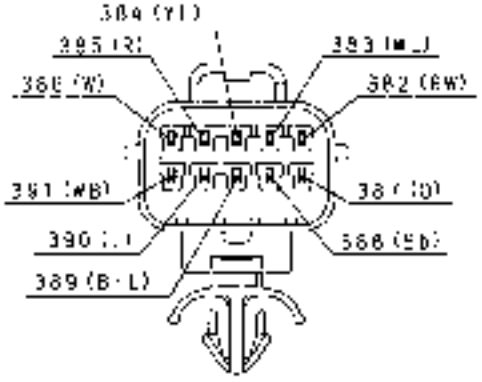
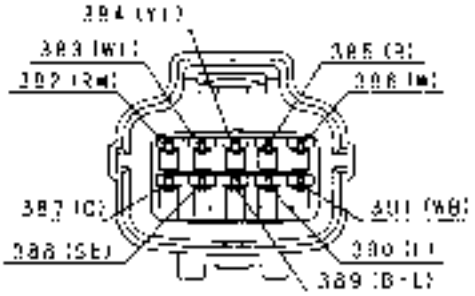


CN-555M (AVSS0. 75)



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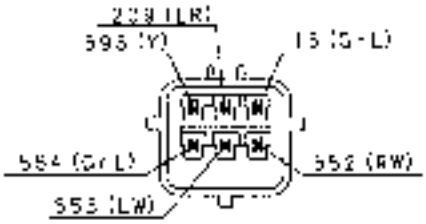
(AVSS0. 75)



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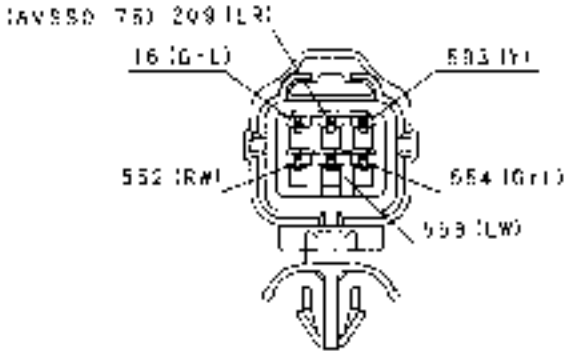

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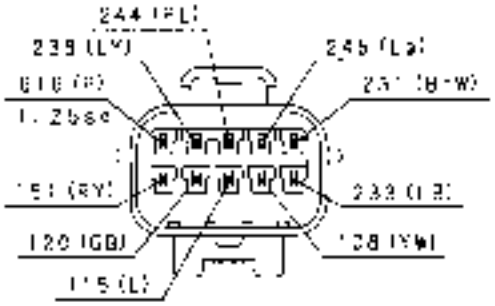

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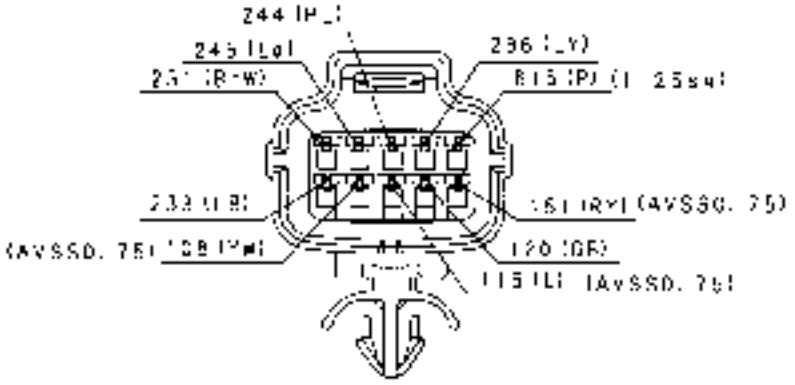

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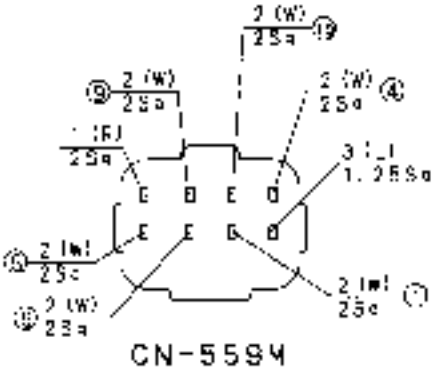

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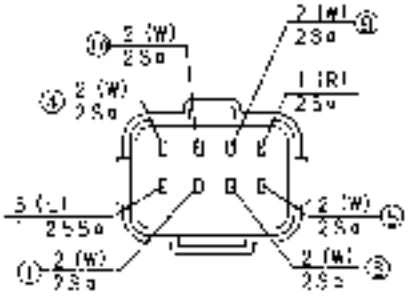

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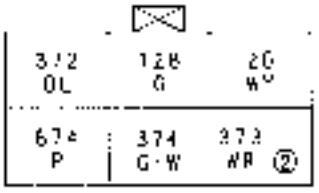

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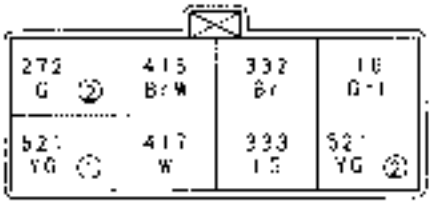

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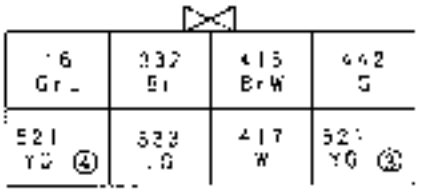

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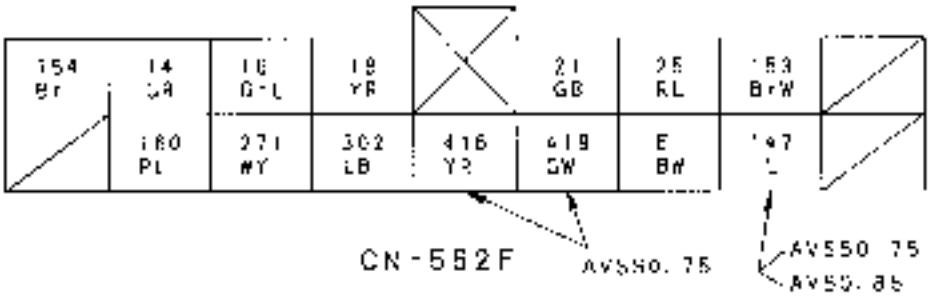
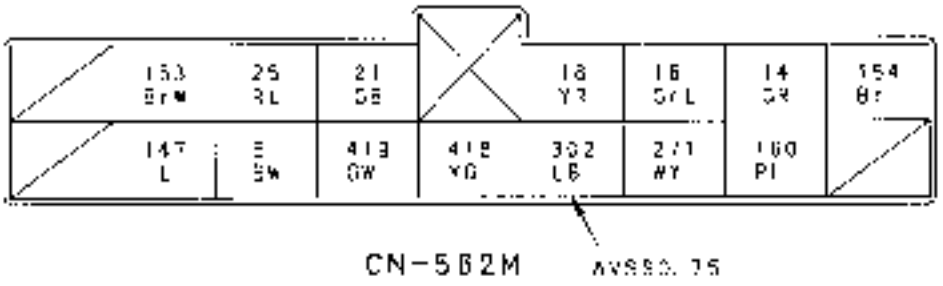


CN-562F



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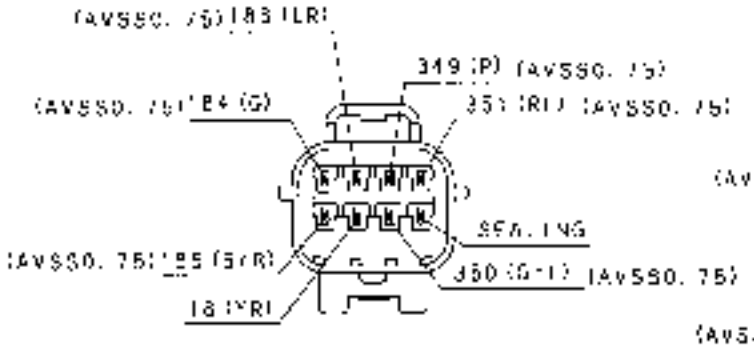

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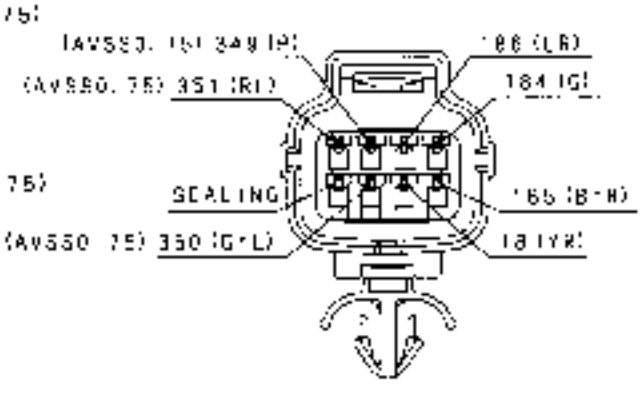

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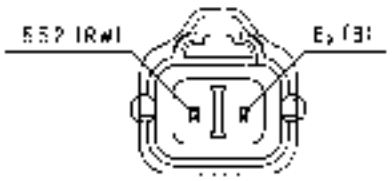

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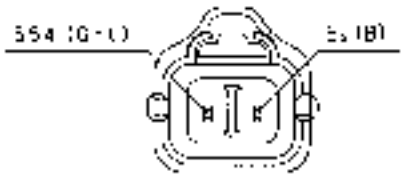

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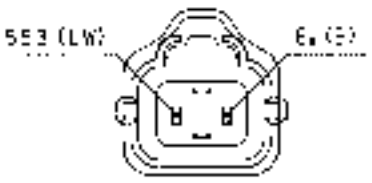

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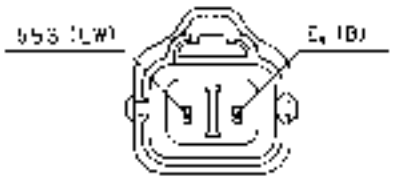

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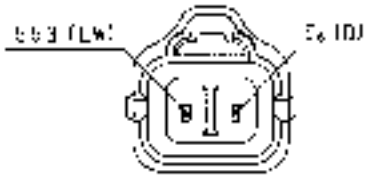

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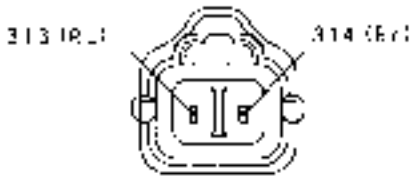

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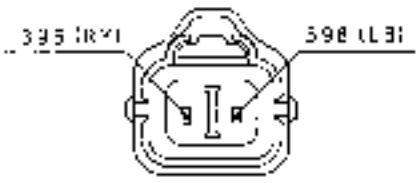

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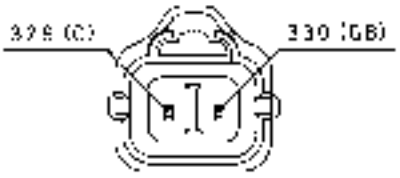

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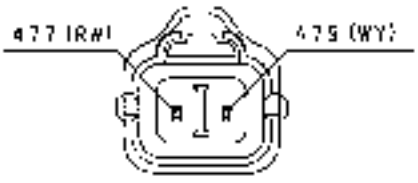

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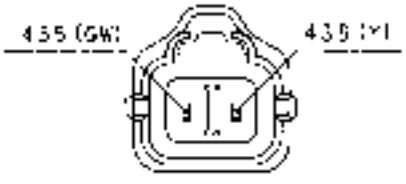

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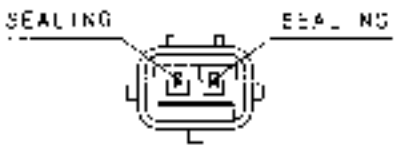

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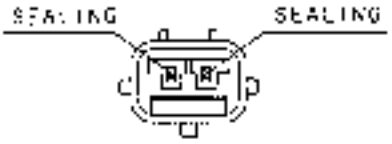

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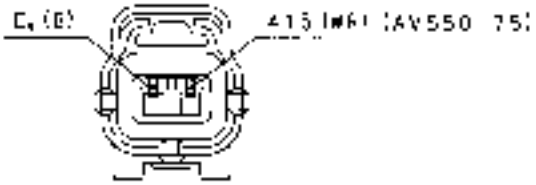

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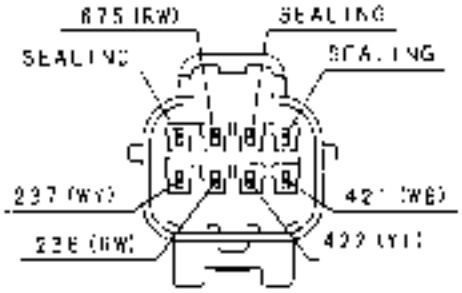

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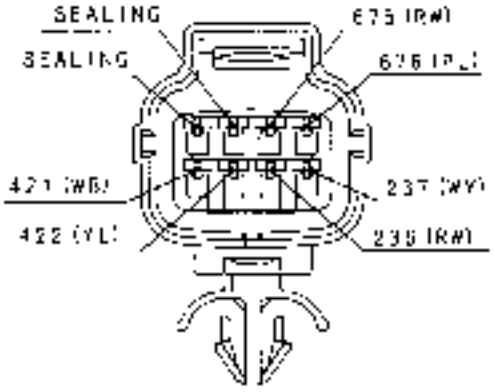

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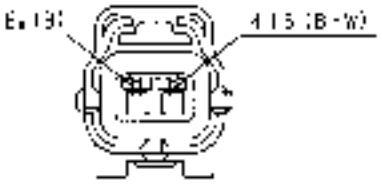

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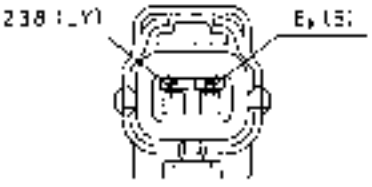

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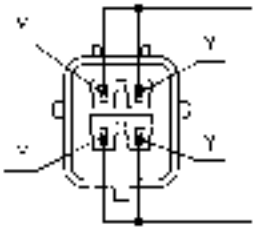

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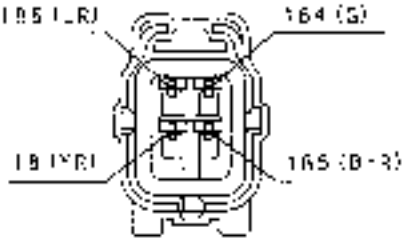

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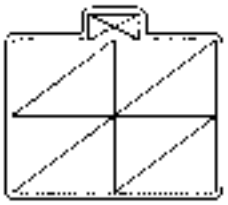

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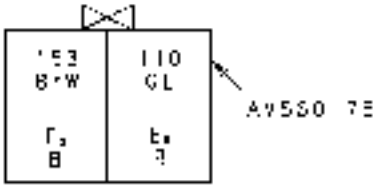

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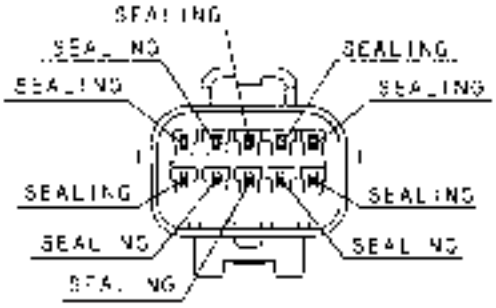

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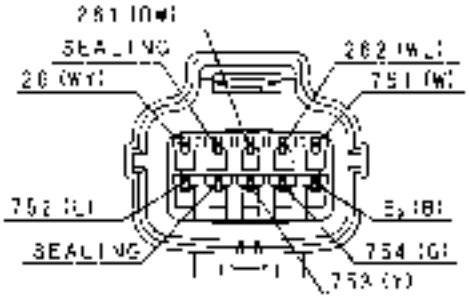

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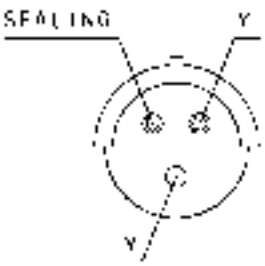

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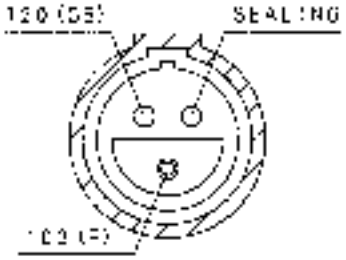

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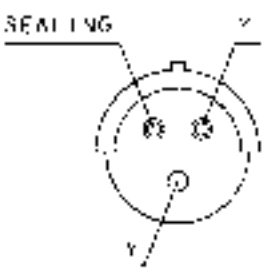

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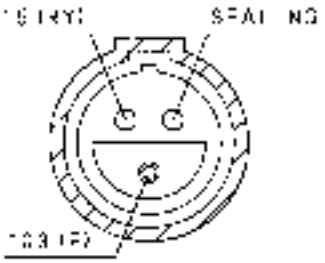

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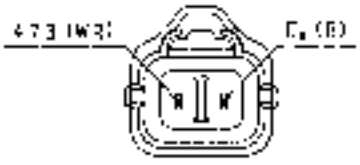

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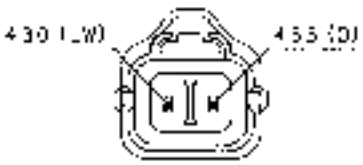

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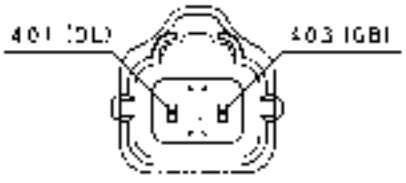

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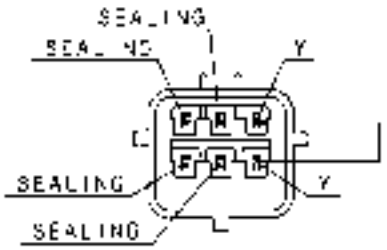

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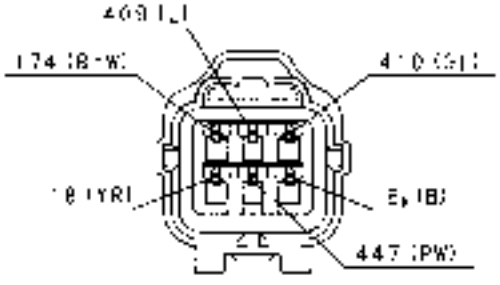

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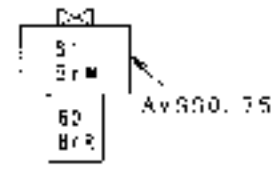
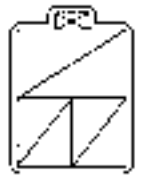
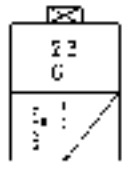
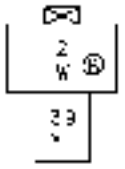
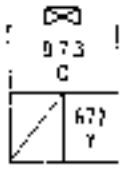
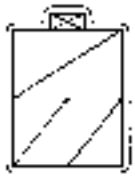


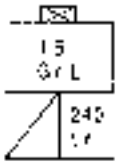


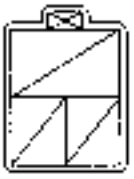


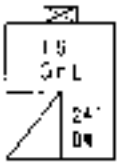


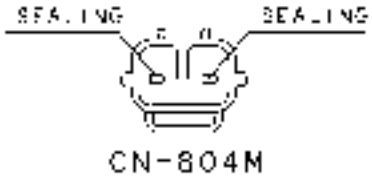


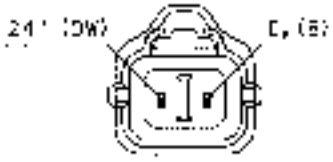


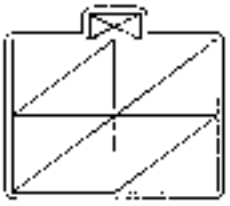


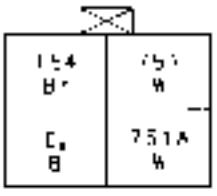


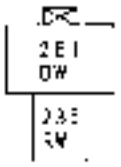


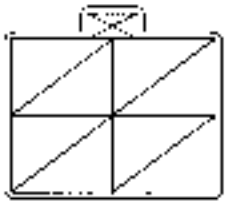


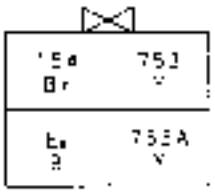


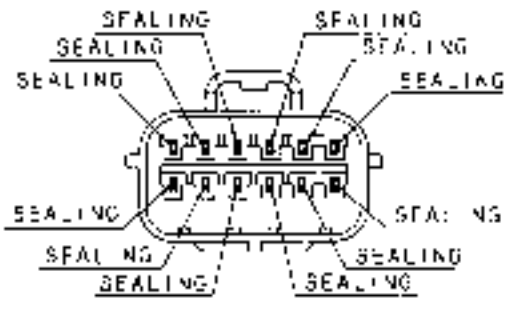


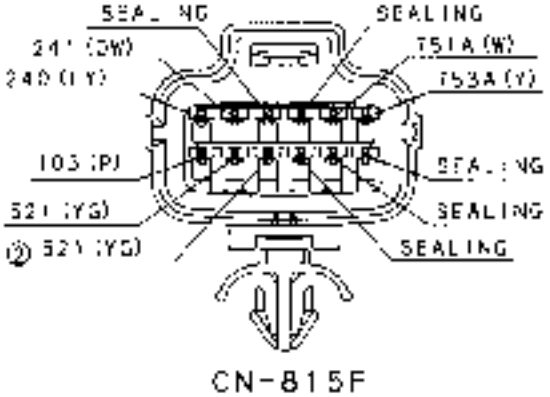


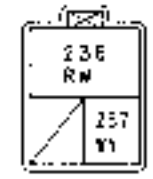




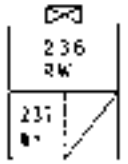








CN-816M



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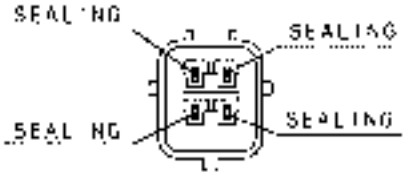

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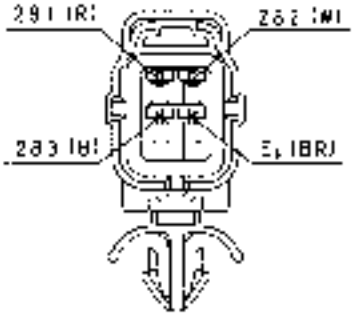

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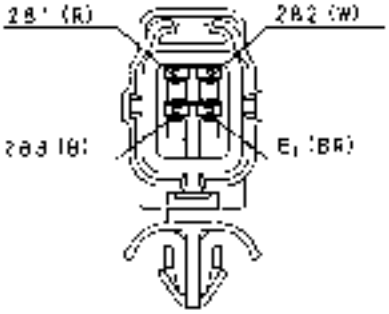

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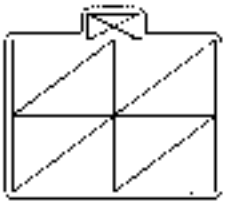
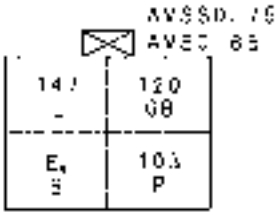
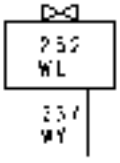


CN-823M



CN-823F



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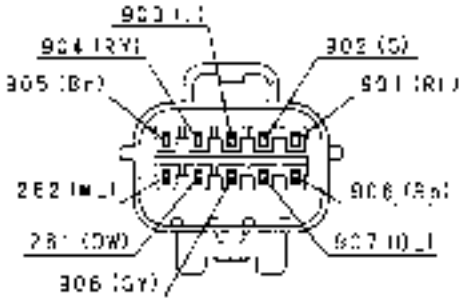

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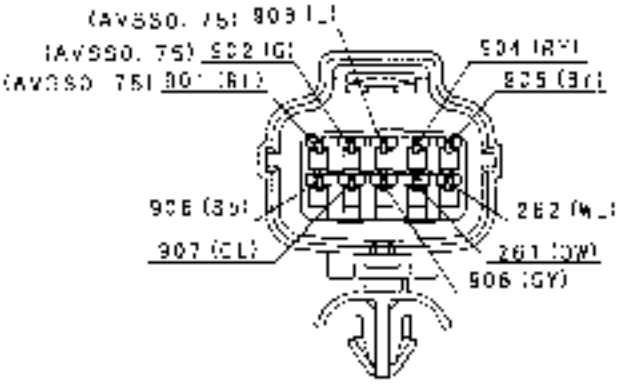

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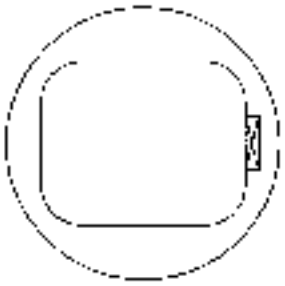

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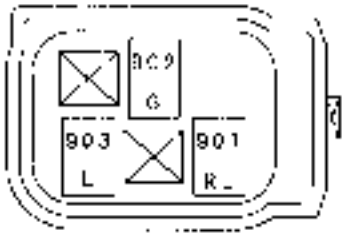
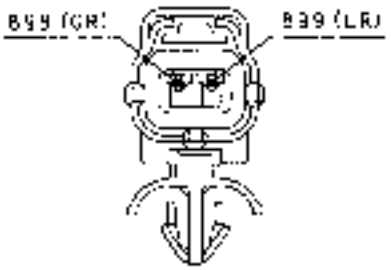


CN-851F
(AVSS0. 75)



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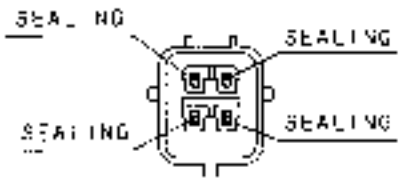

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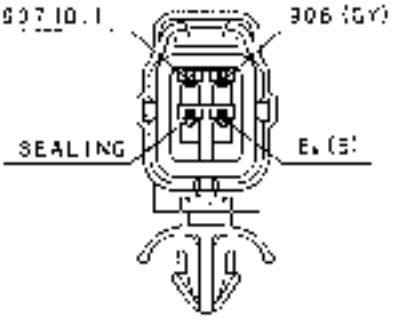

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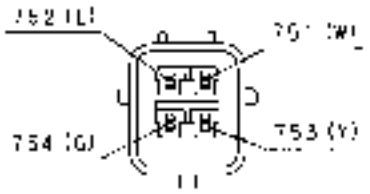

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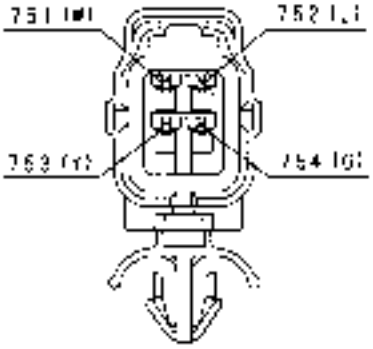

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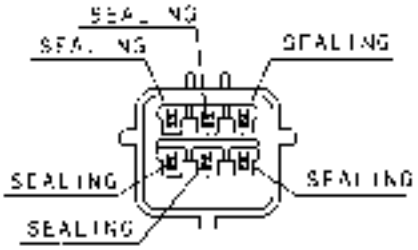

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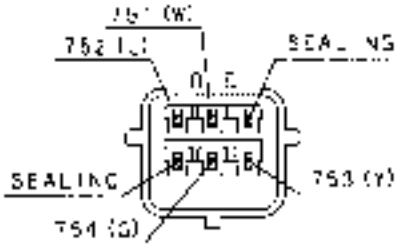

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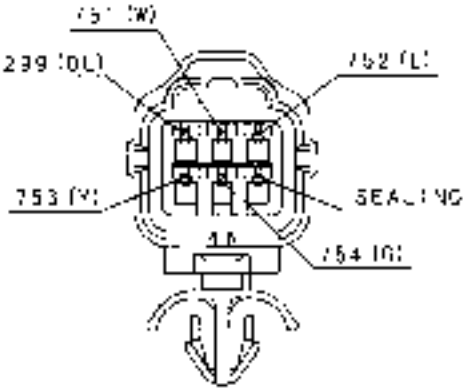

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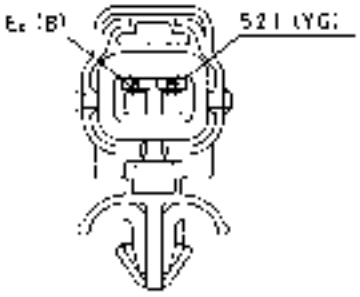

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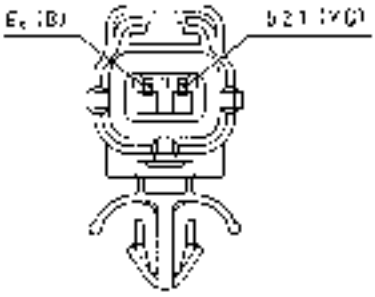

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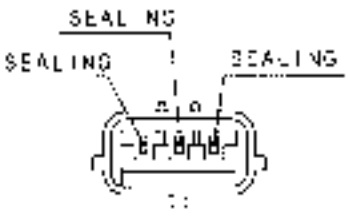

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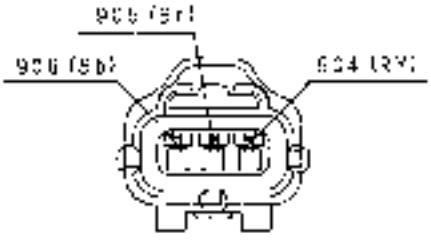

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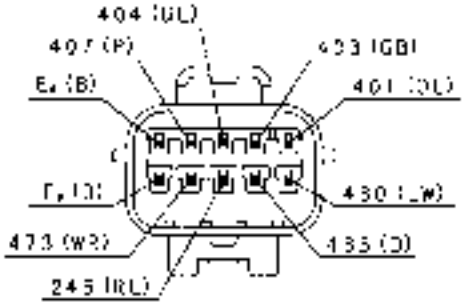

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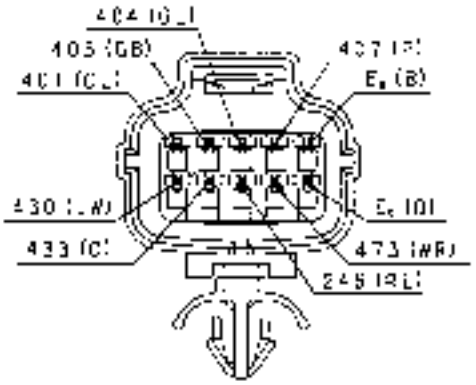

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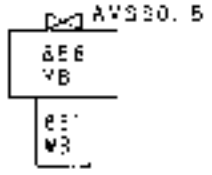
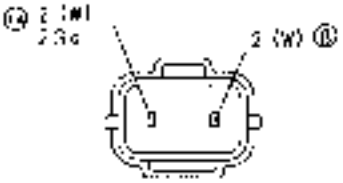


CN-930F

CN-926M

CN-926F

CN-927M



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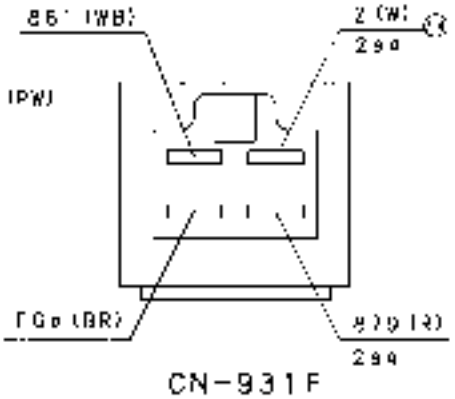
CN-932F



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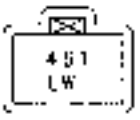
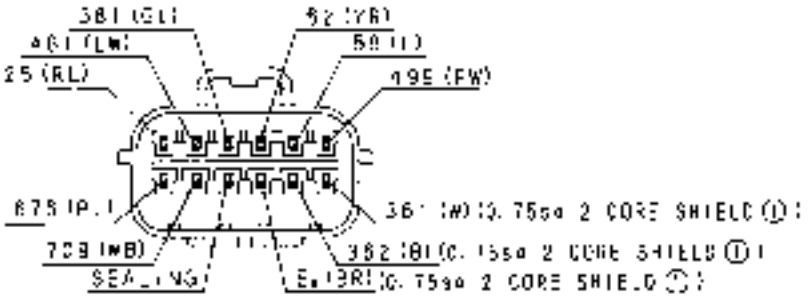


CN-933M

CN-933F



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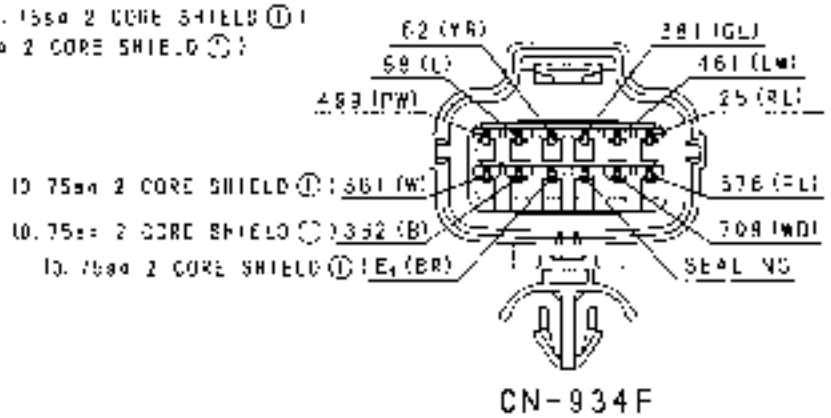

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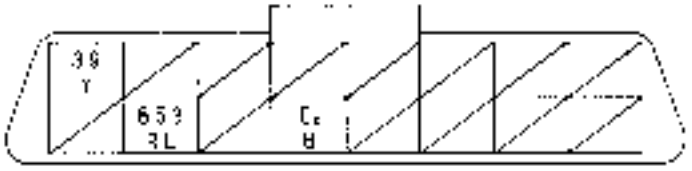

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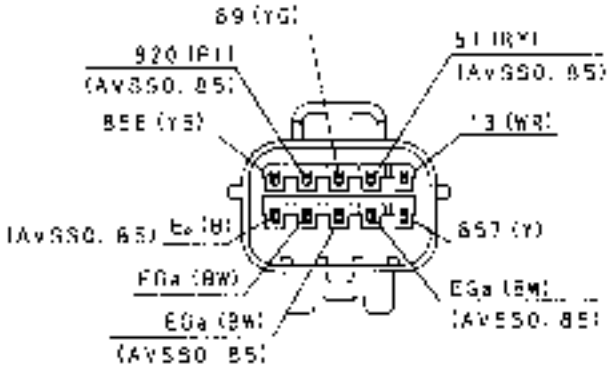
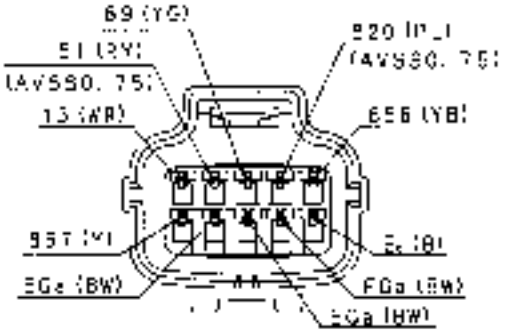


CN-937M
(AVSS0. 5)



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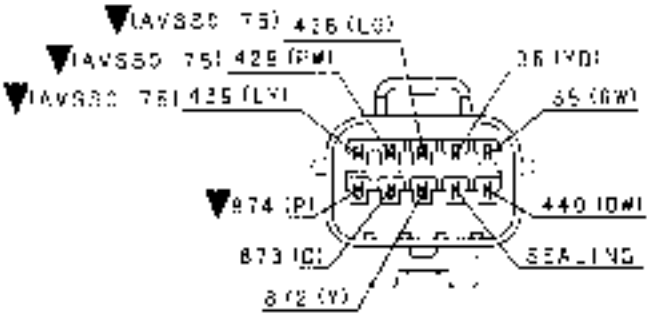

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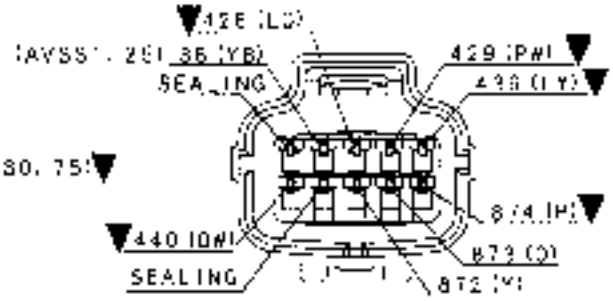
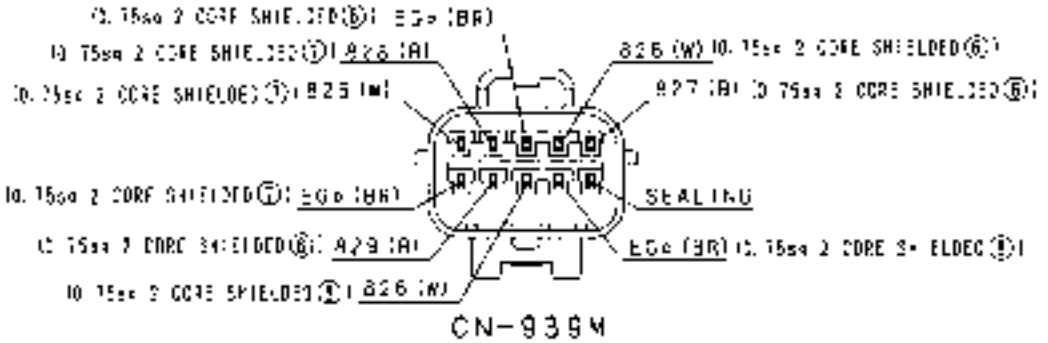


CN-938F
(AVSS0. 5)



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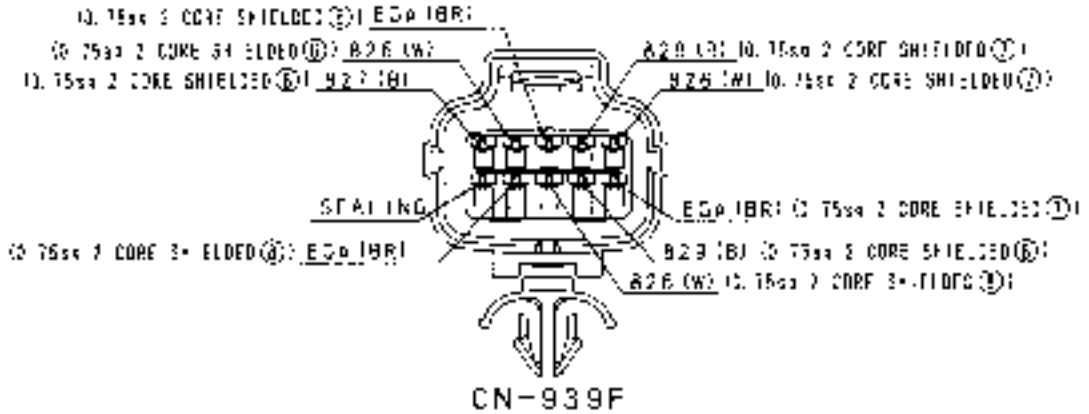

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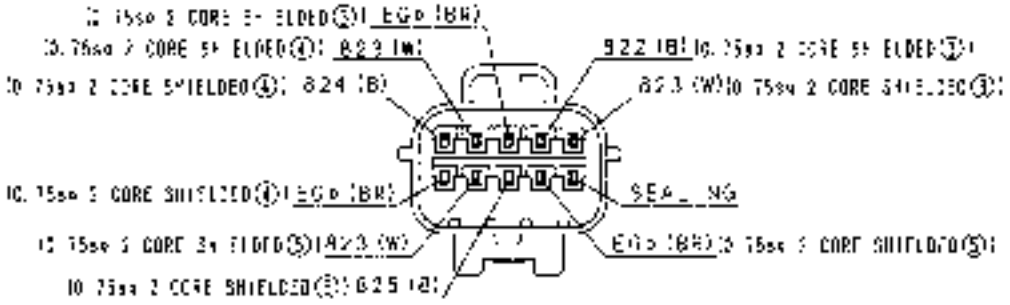
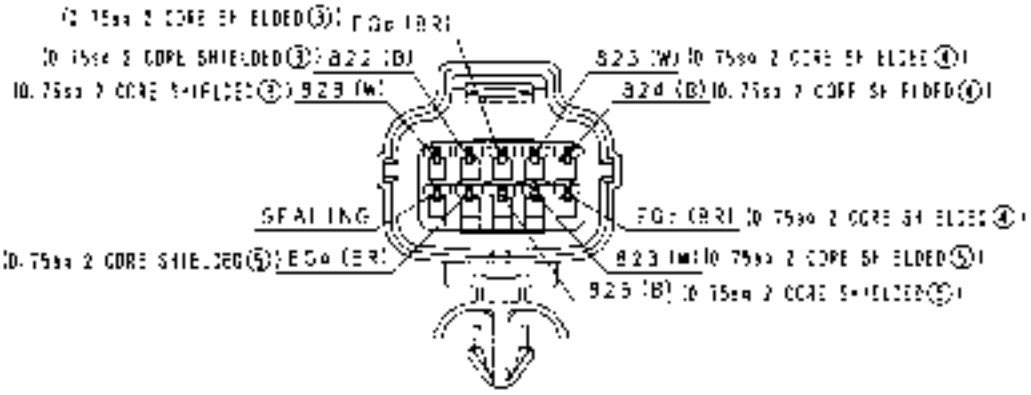
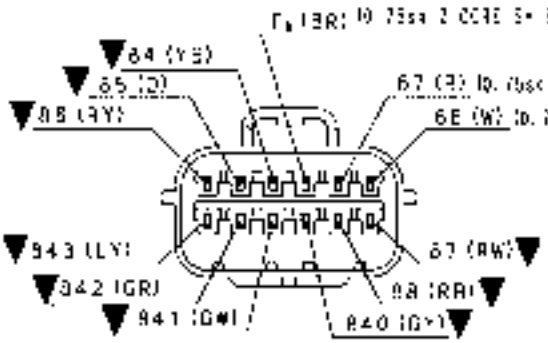
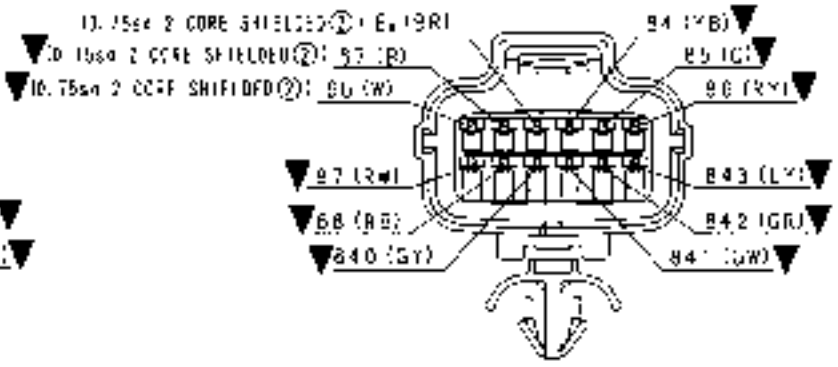
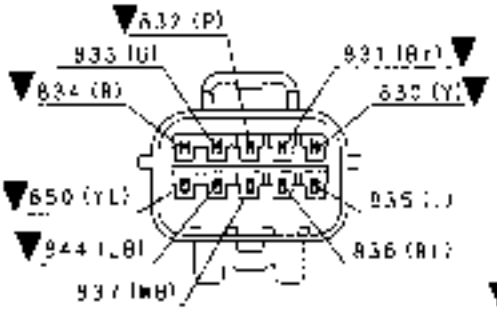
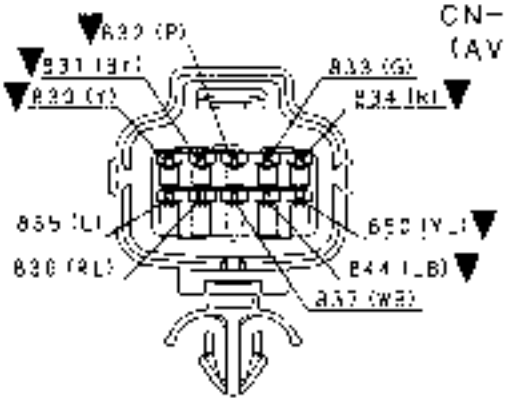


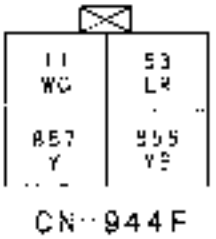






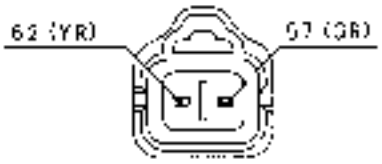






CN-945M

CN-945F



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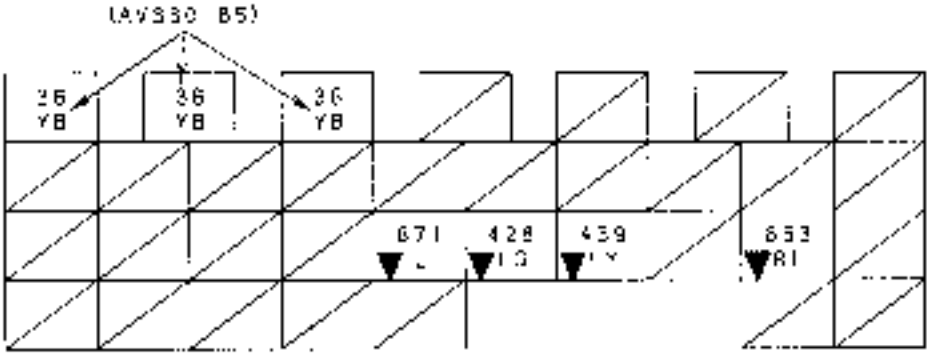
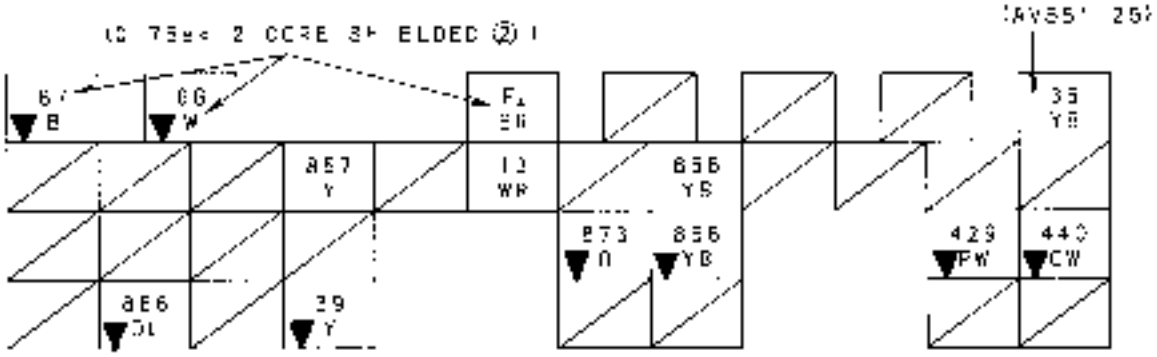


CN-953F A26
(AV550. 5)



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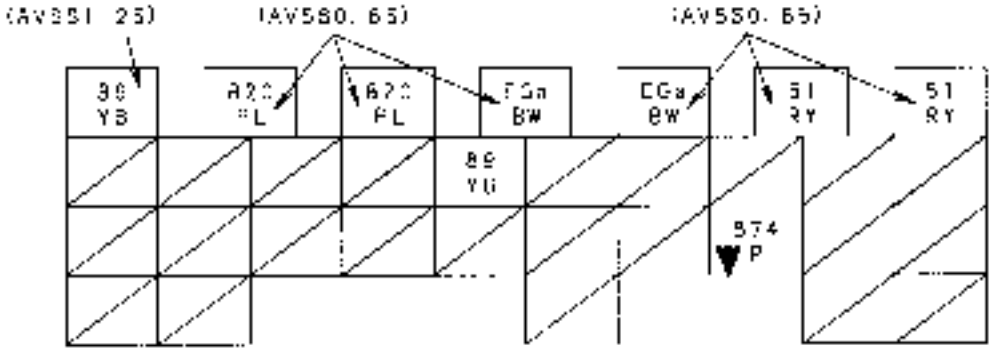
(AV550. 5) A27



CN-955F A28
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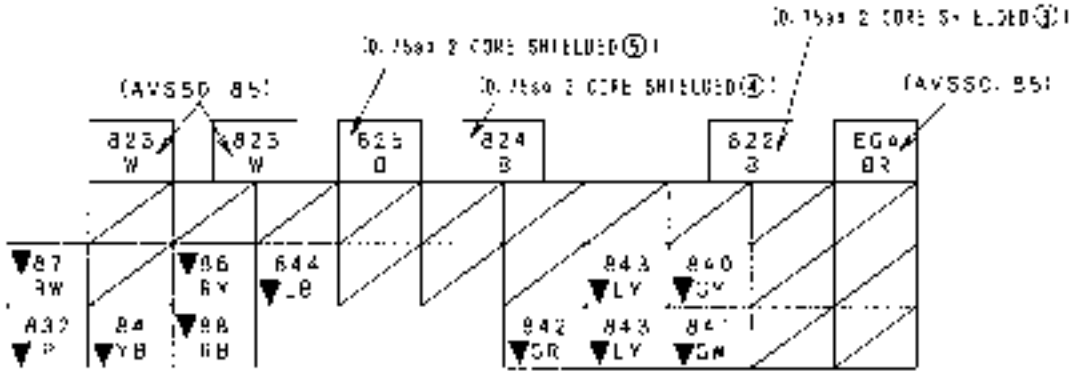

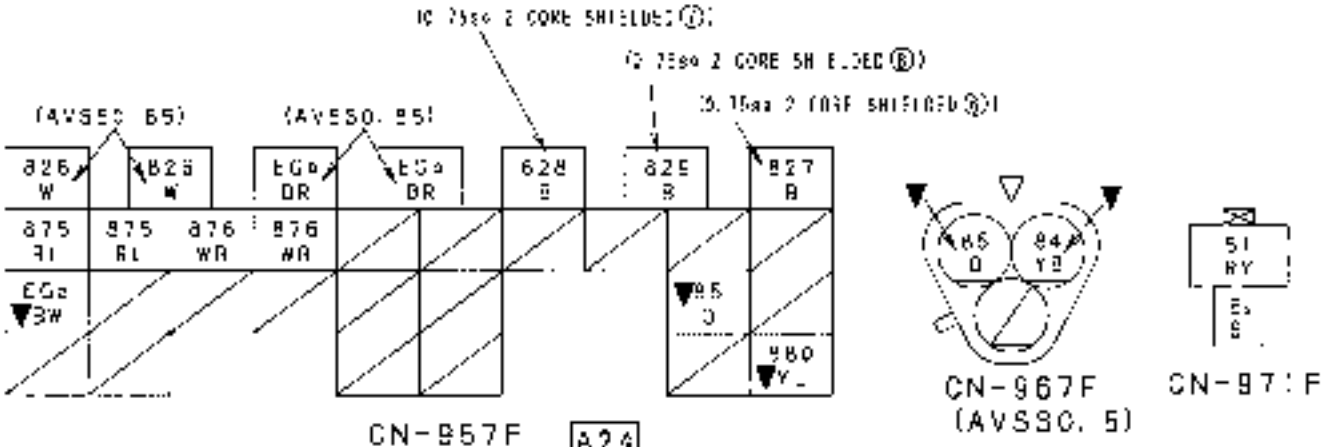

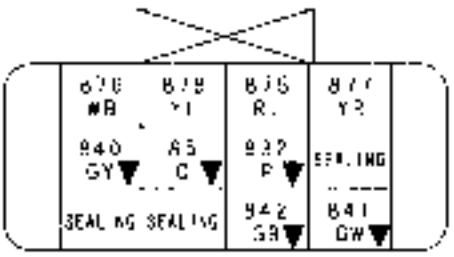

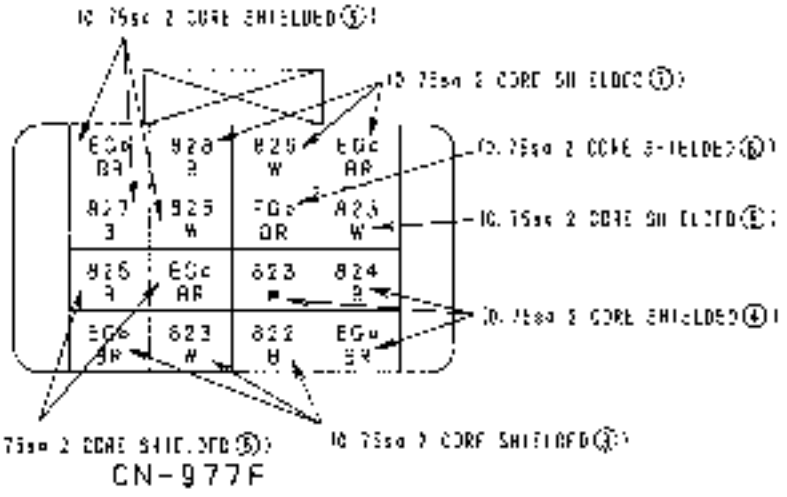

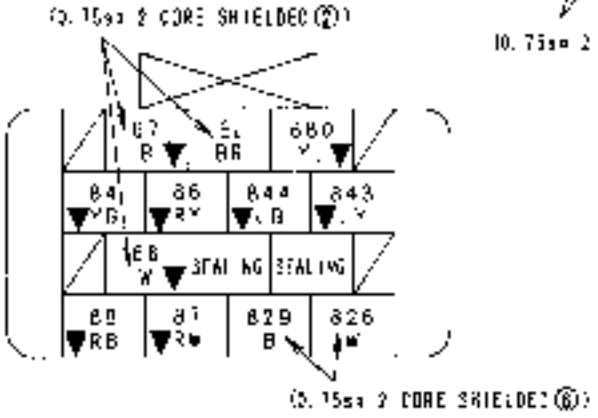

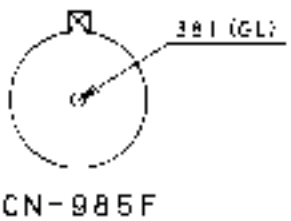

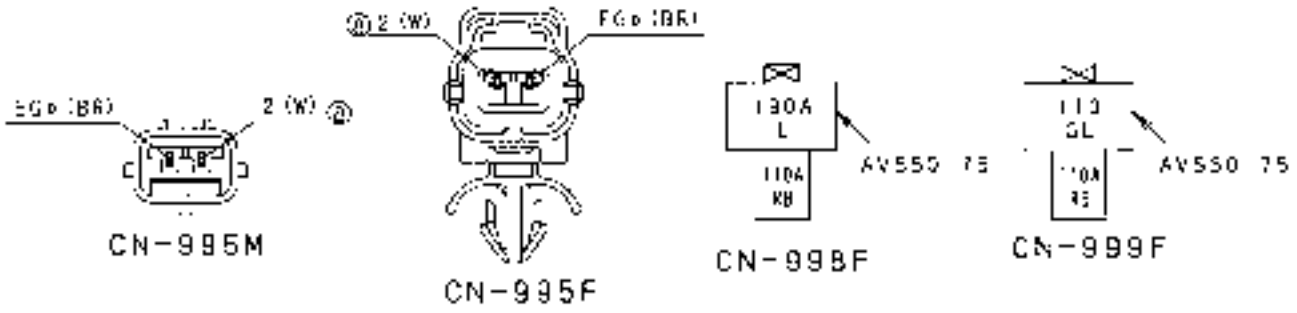

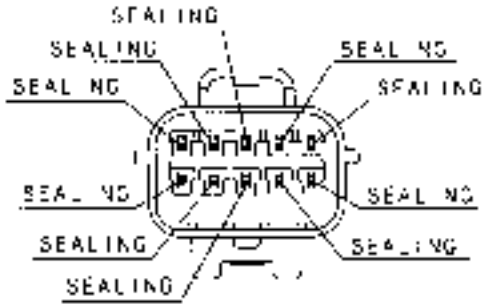

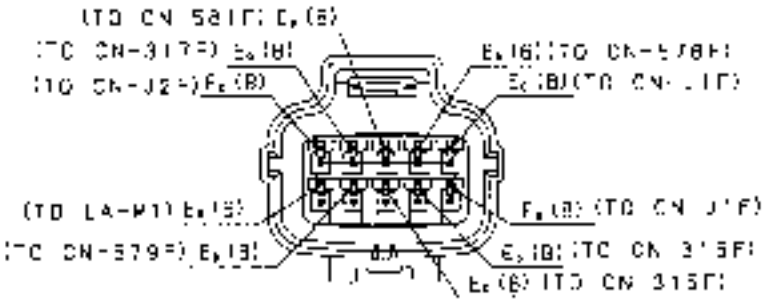

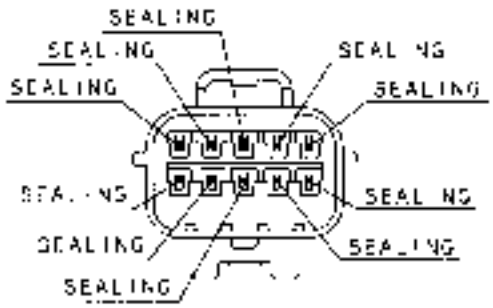

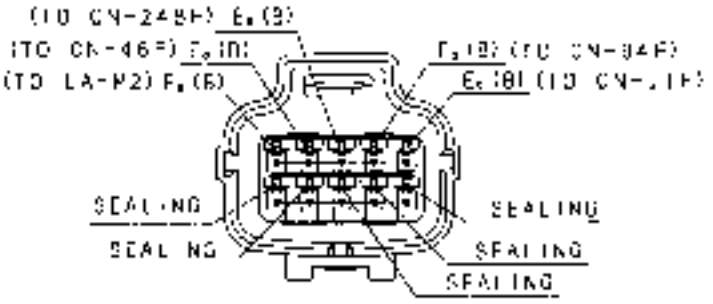

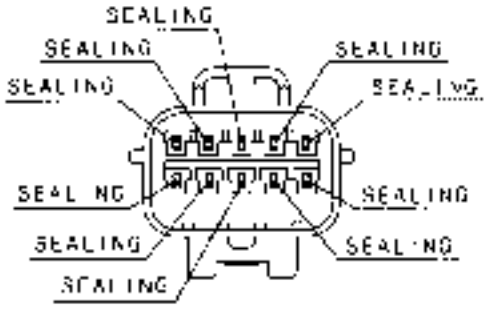

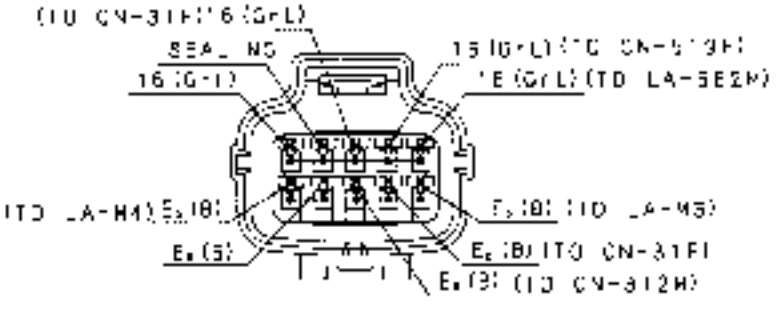

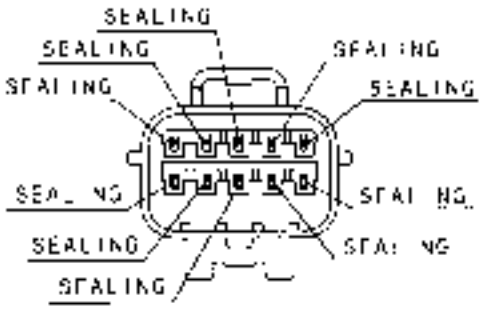

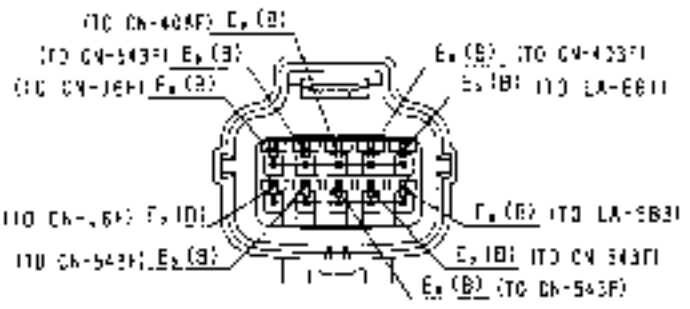

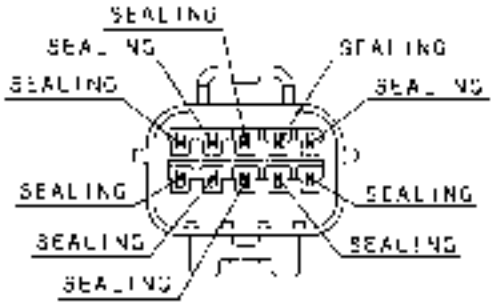

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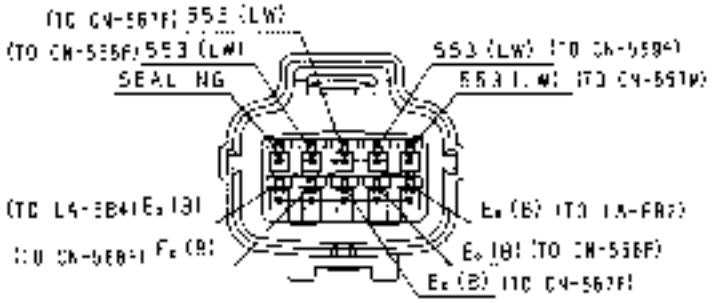

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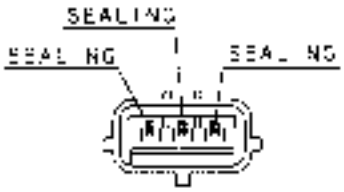

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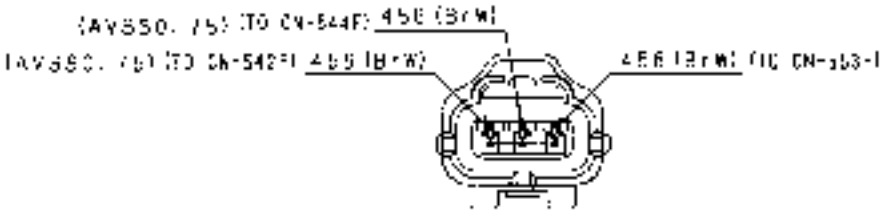

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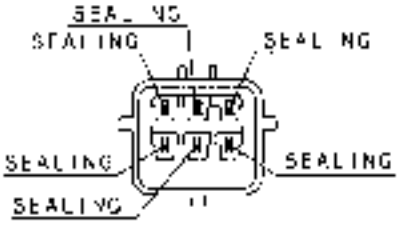

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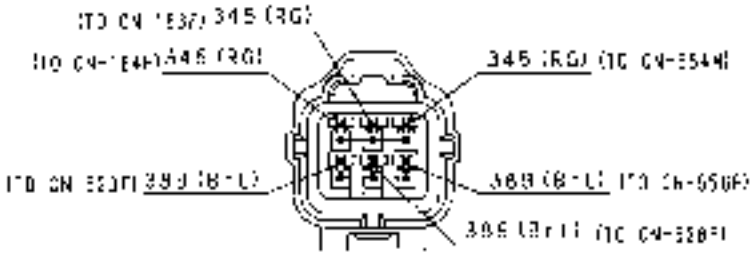

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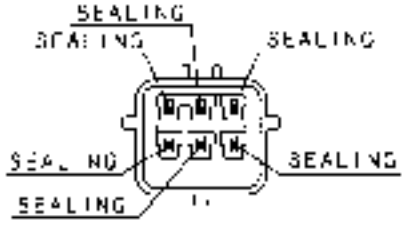

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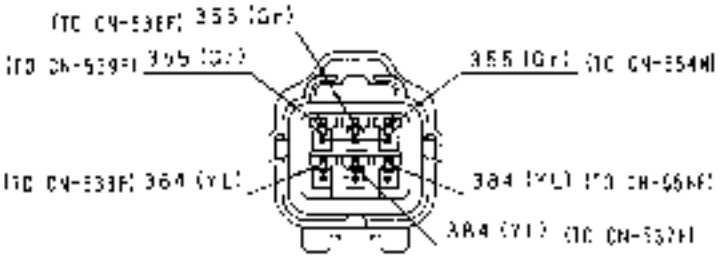

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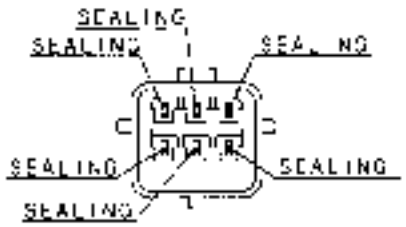

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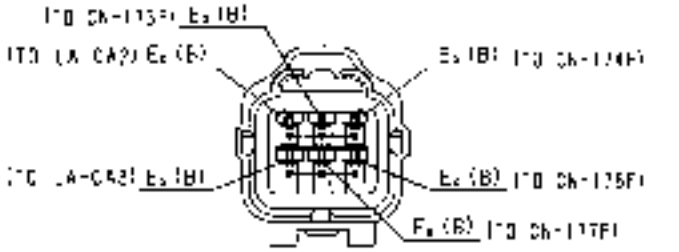

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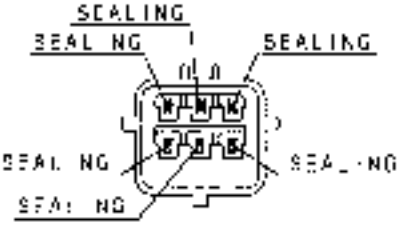

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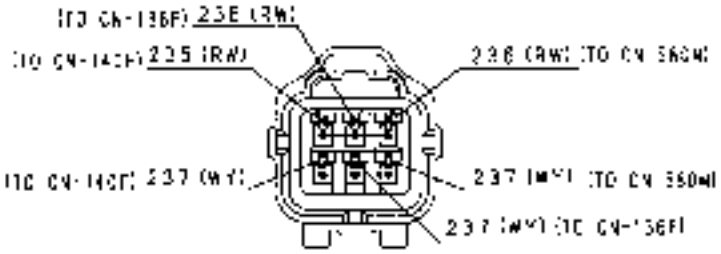

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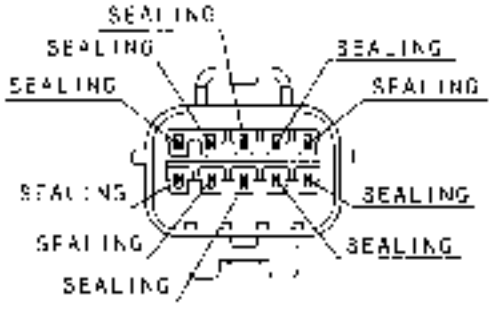

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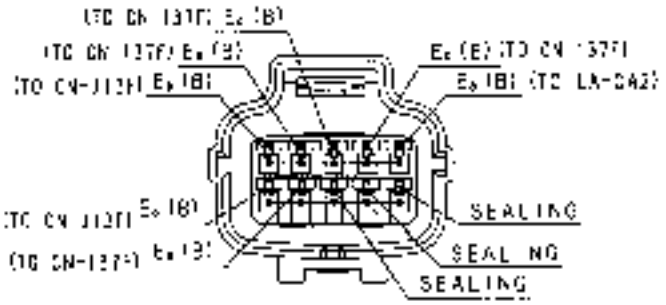

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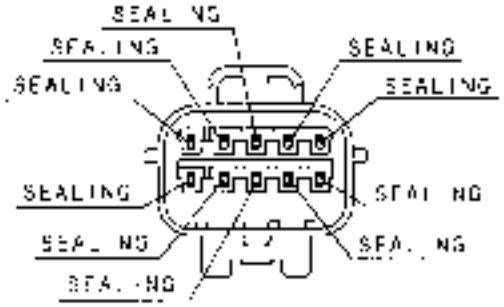

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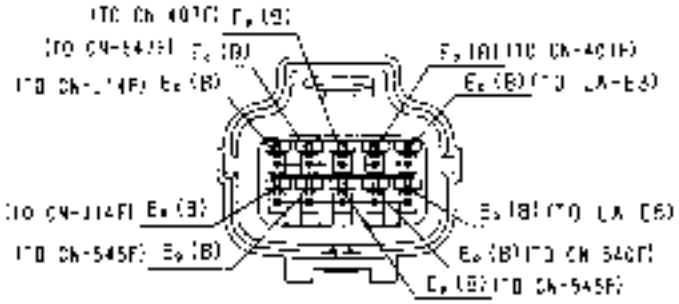

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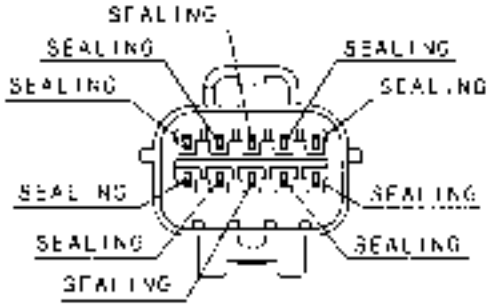

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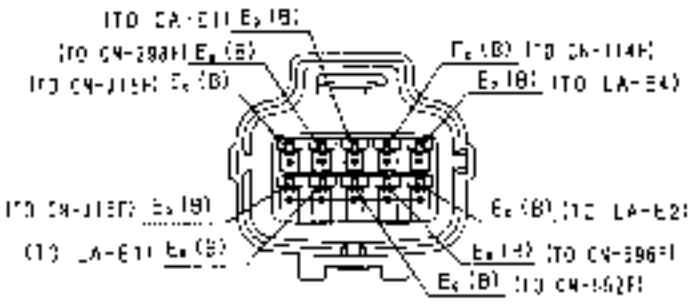

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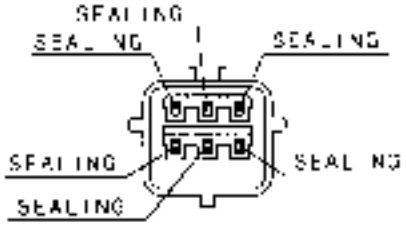

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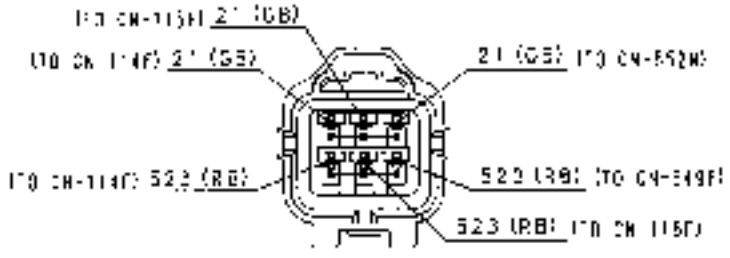

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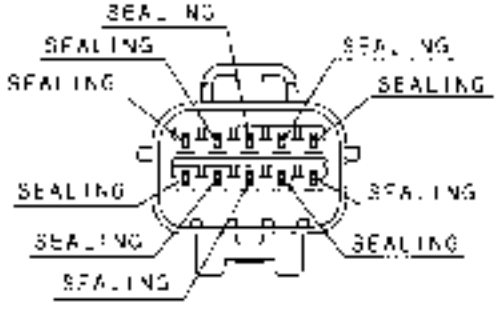

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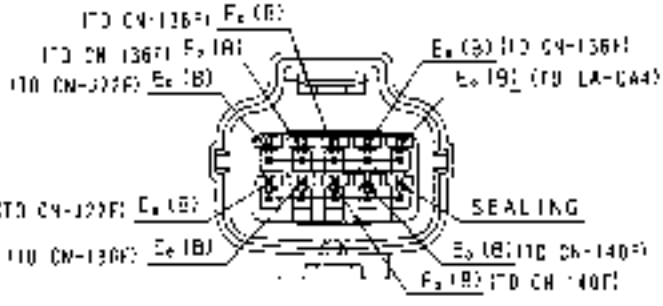

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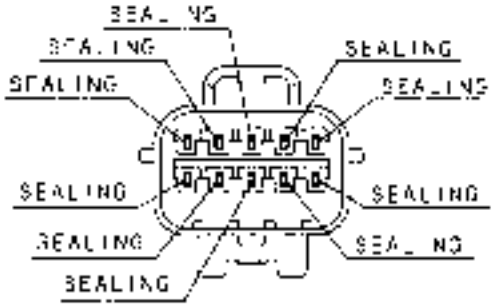

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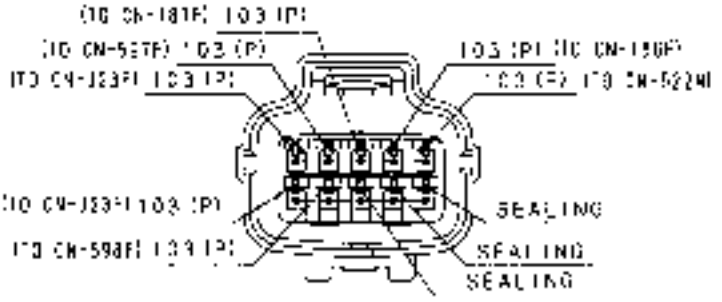

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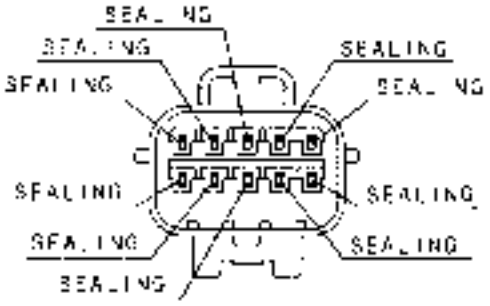

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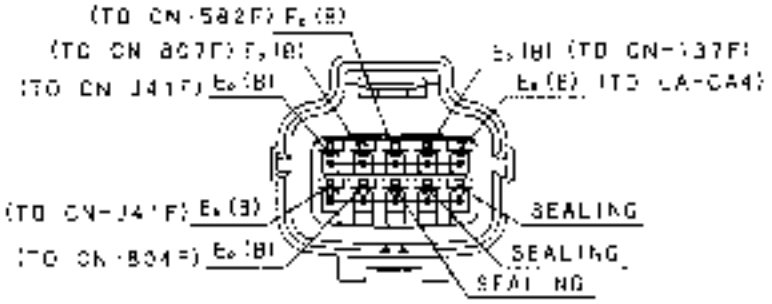

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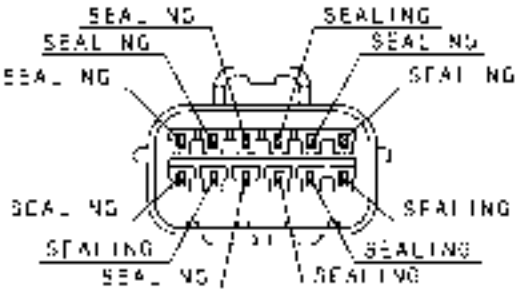

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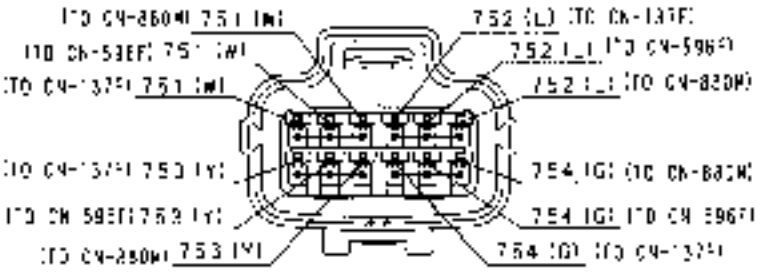

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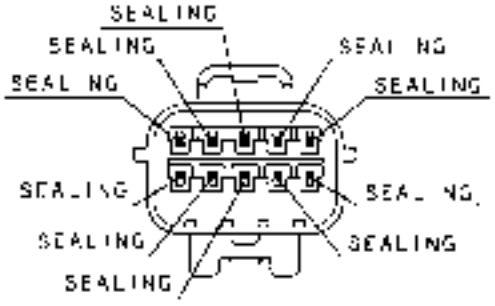

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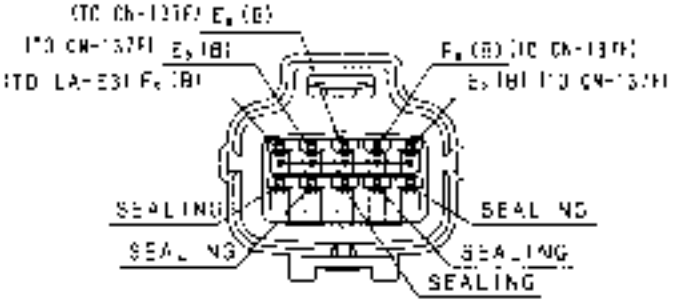

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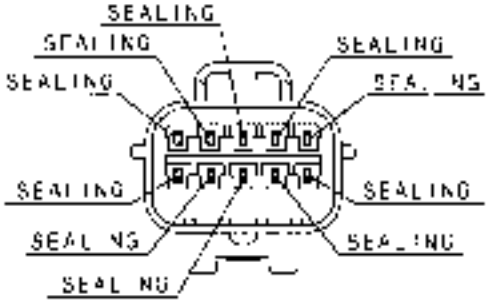

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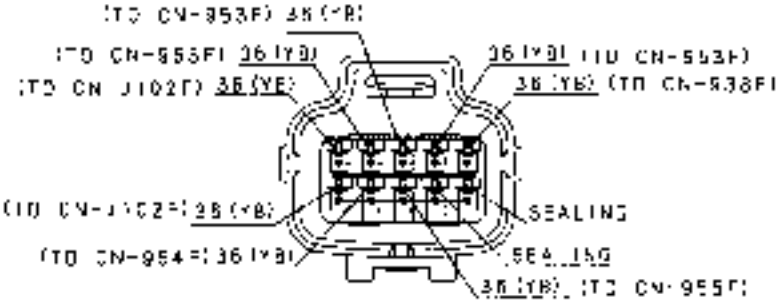

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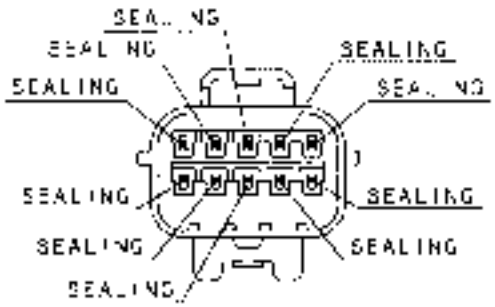

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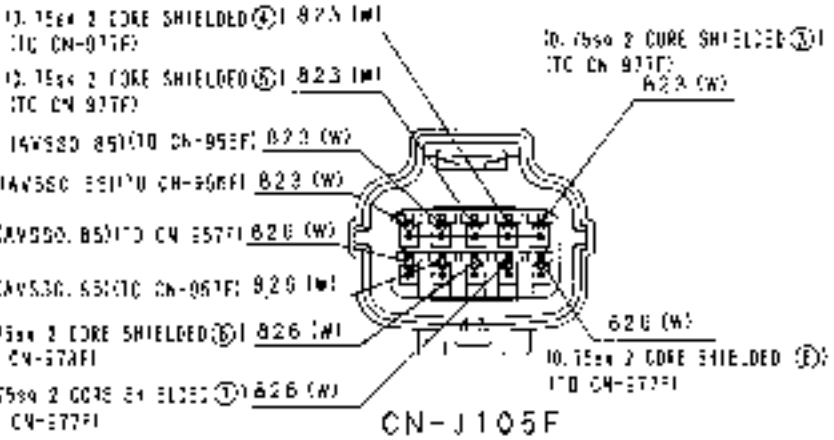

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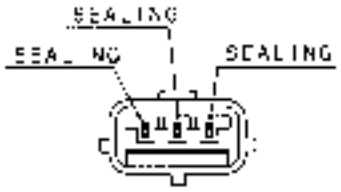

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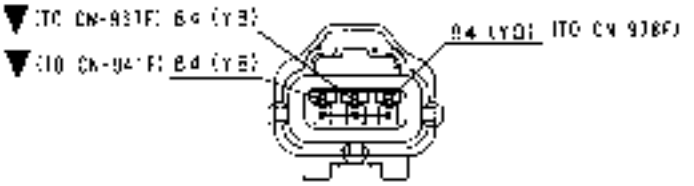

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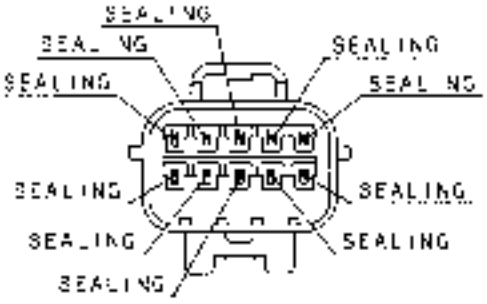

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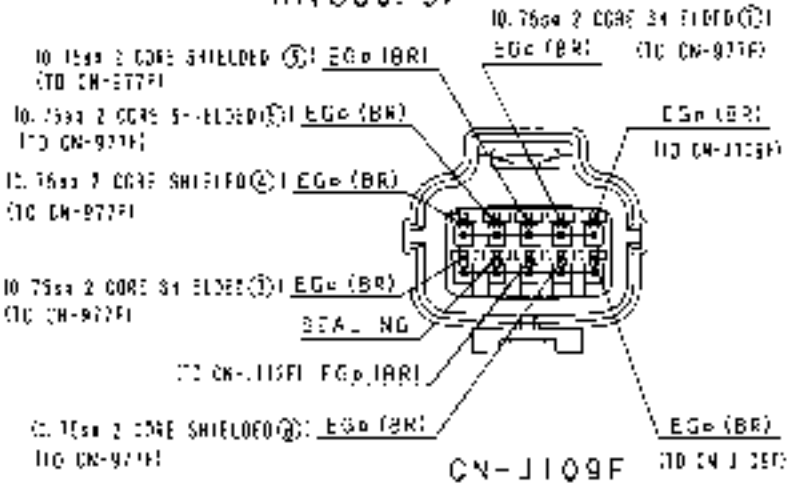

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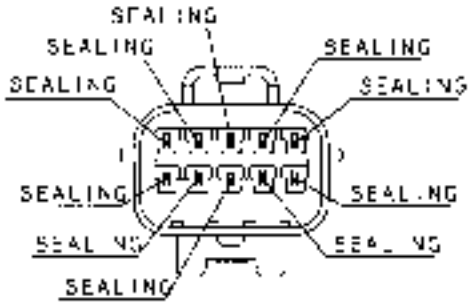

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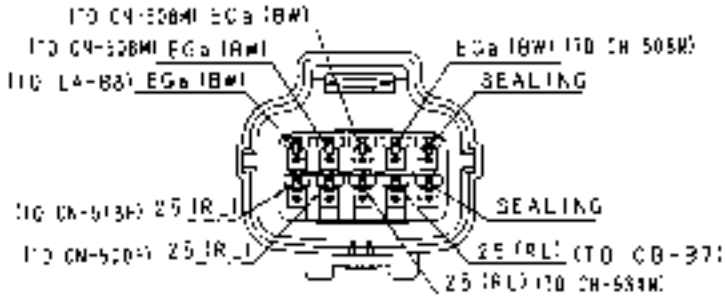

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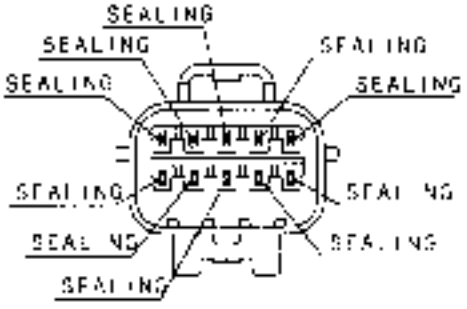

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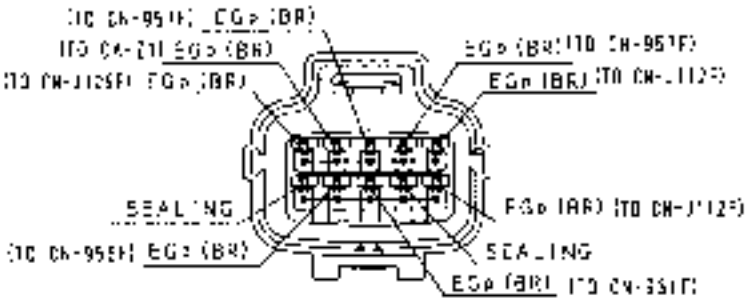
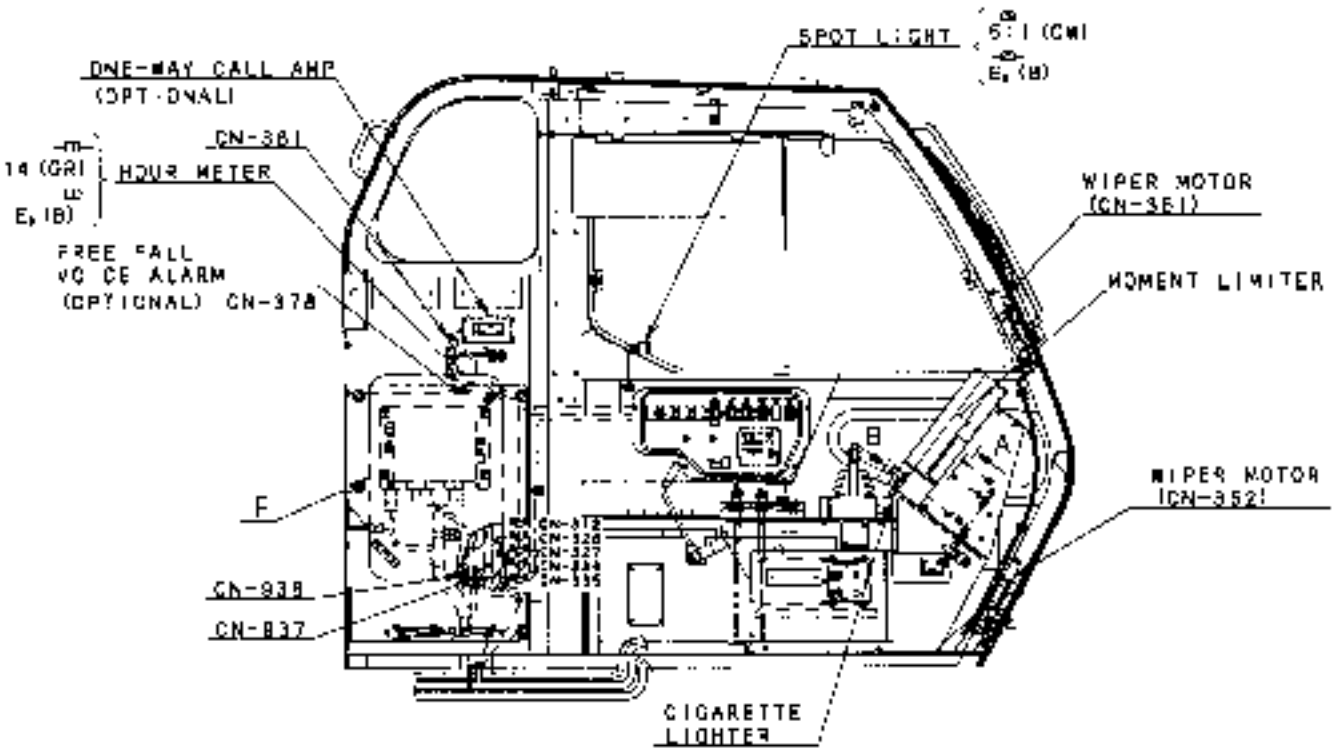
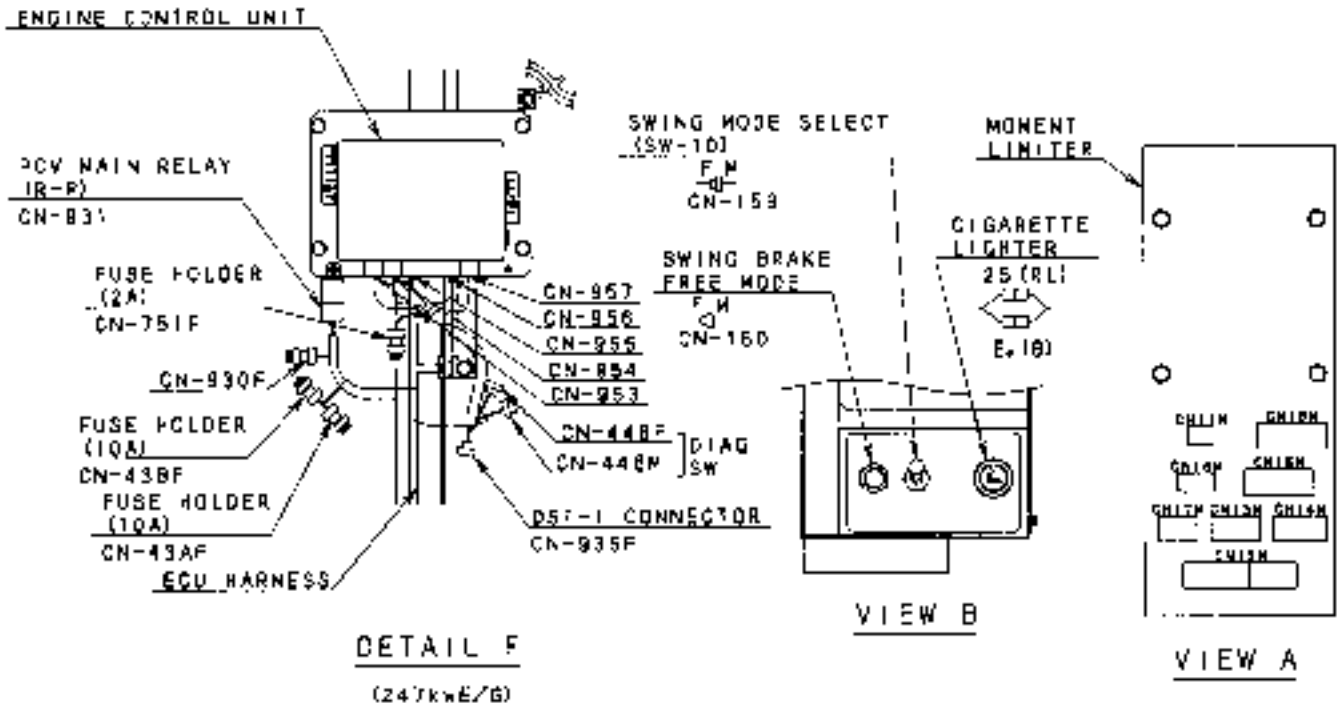


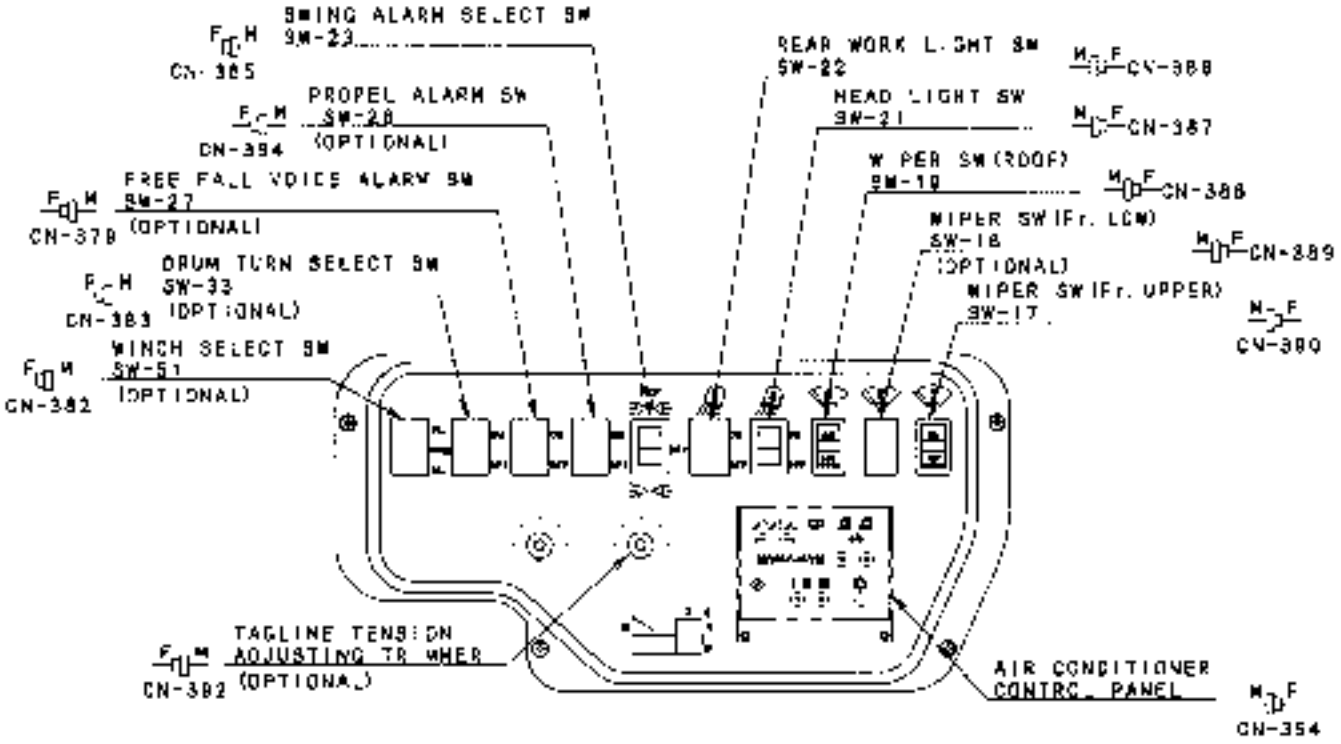
CN-J112F

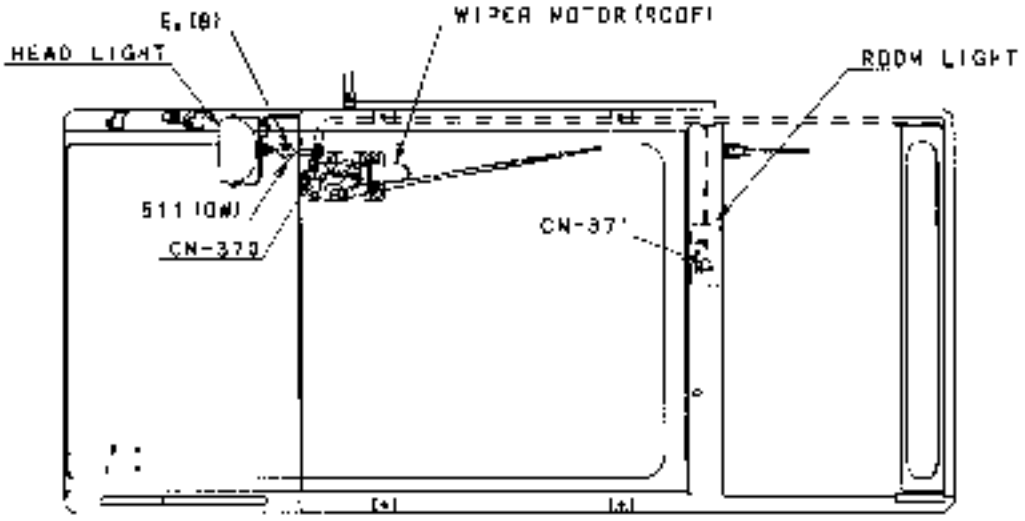
10.3 ARRANGEMENT OF ELECTRICAL PART

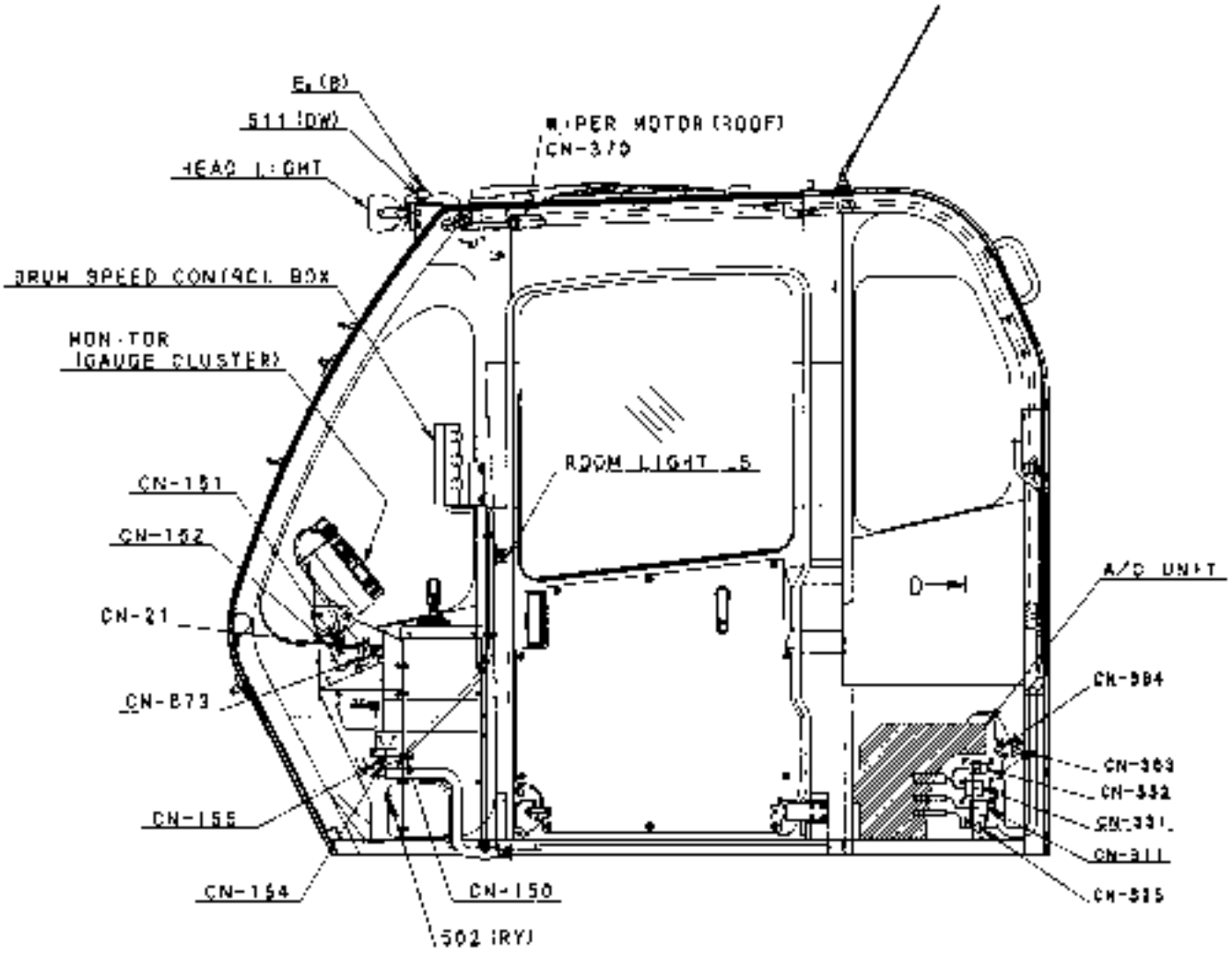
10.3.1 ELECTRICAL PART OF CAB

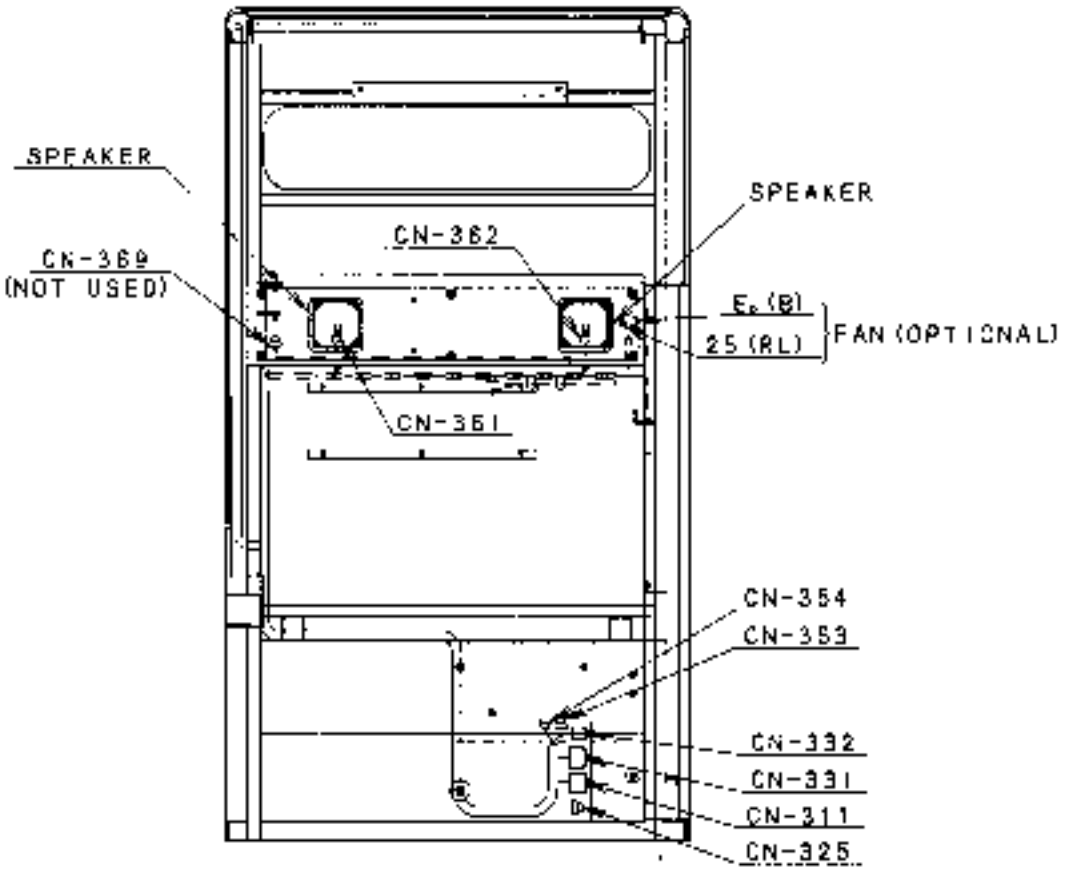












VIEW D

10.3.2 ELECTRICAL PART OF RIGHT DECK

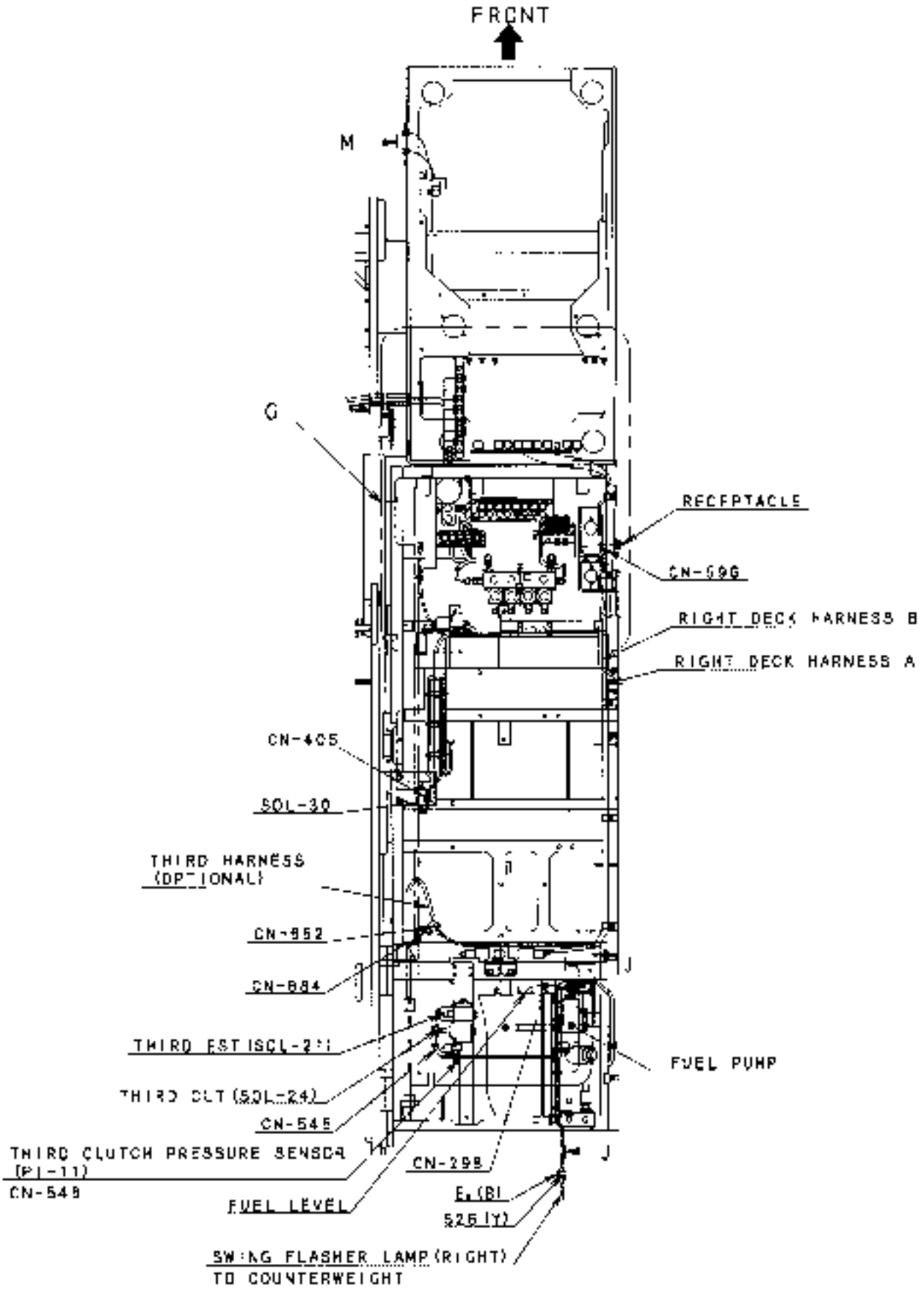


Fig.10-12 GG01E00071 (1/8)

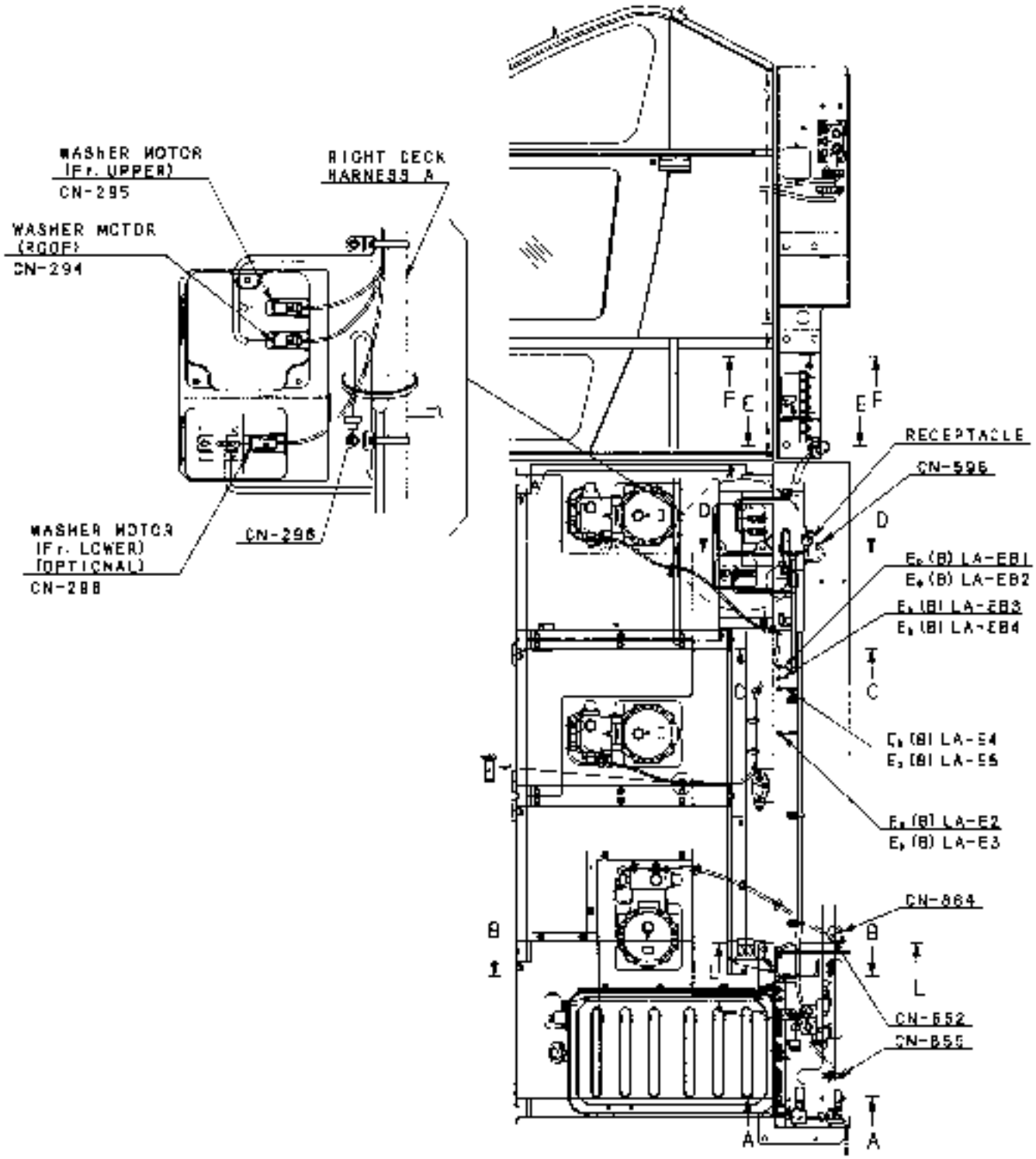


Fig.10-13 GG01E00071 (2/8)

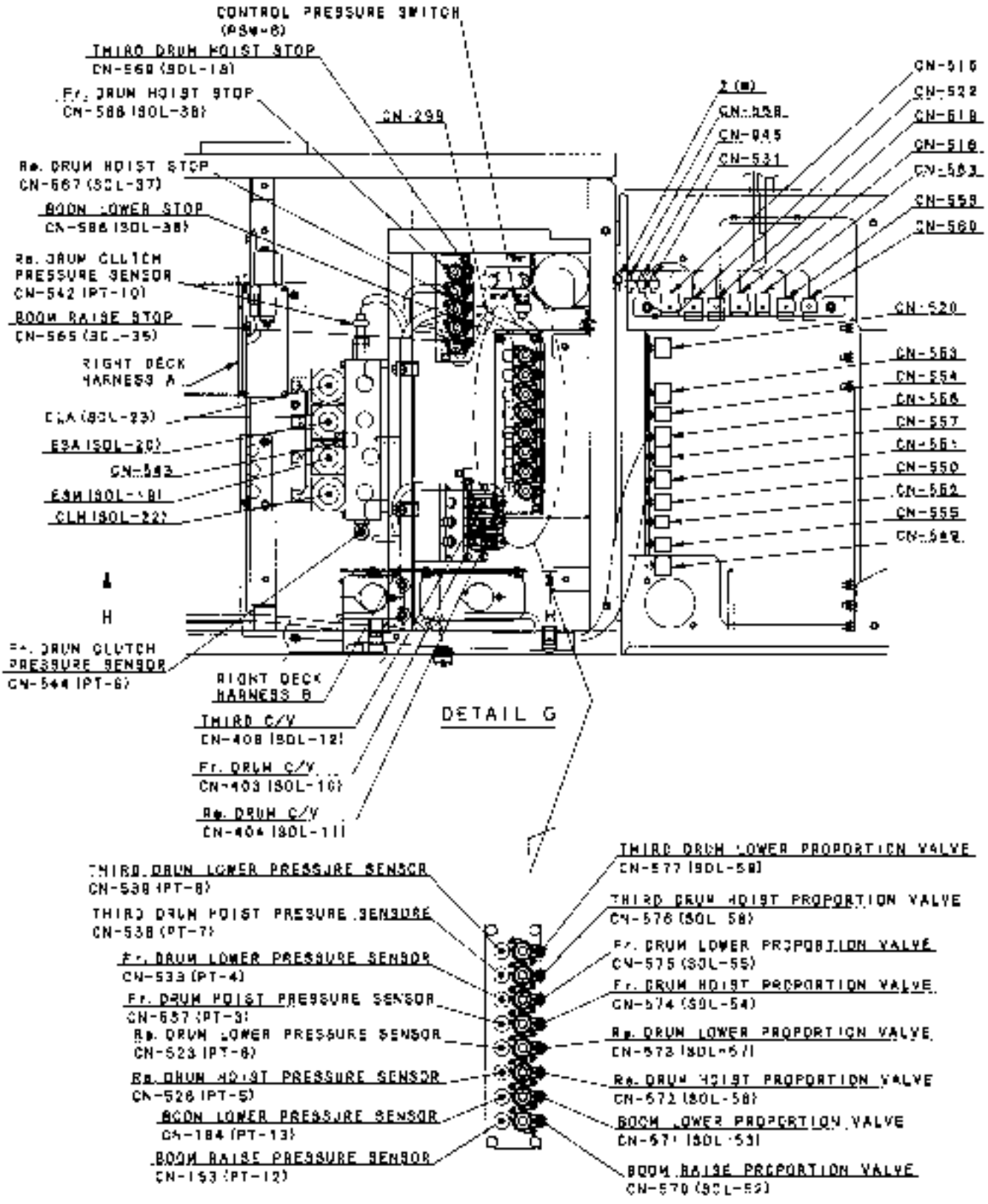
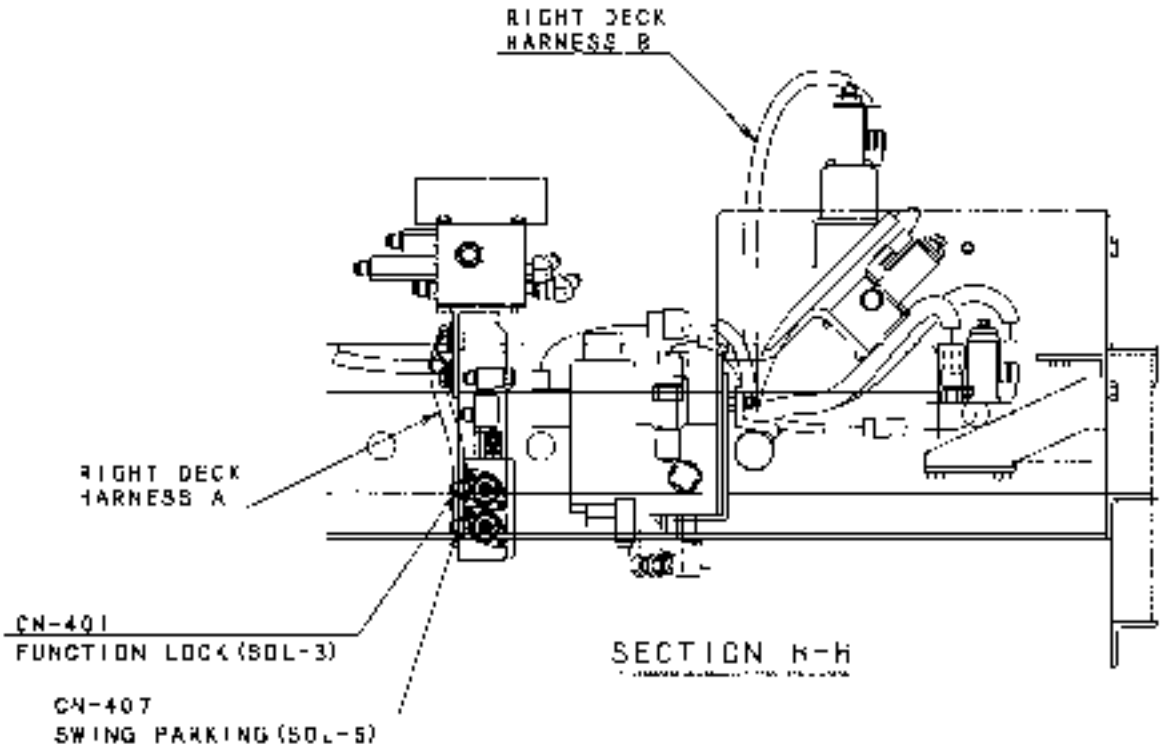


Fig.10-14 GG01E00071 (3/8)



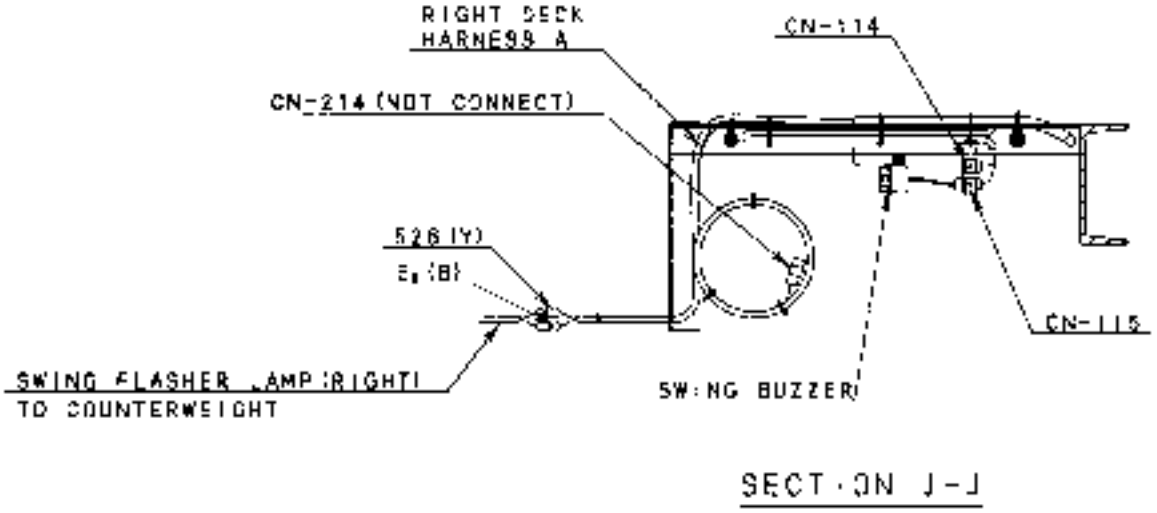
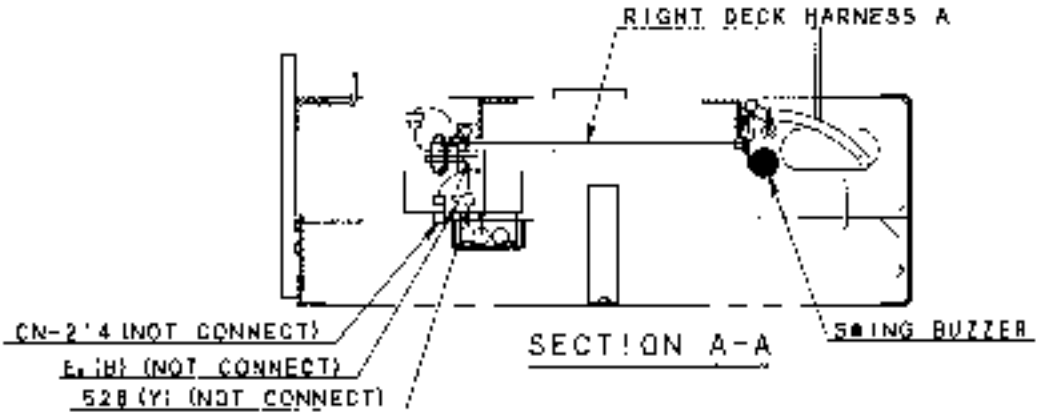
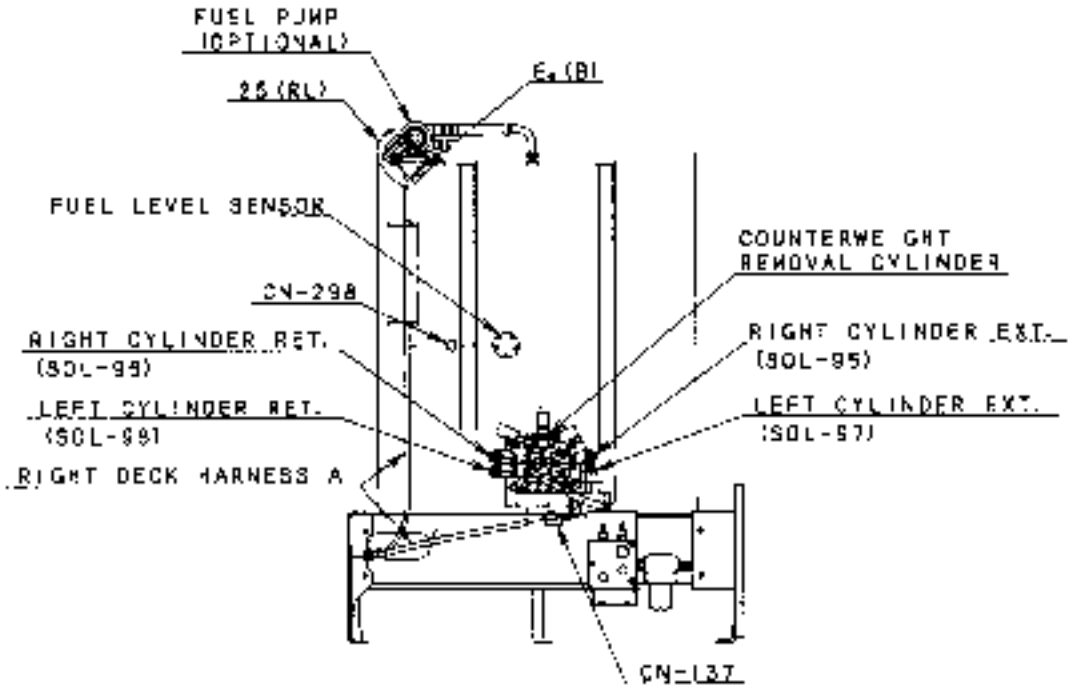


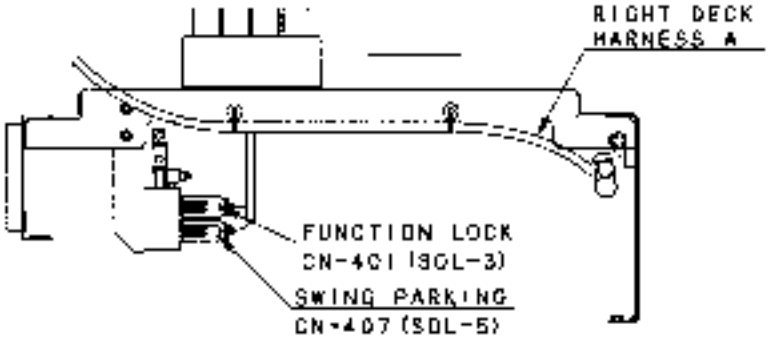
Fig.10-15 GG01E00071 (4/8)



SECTION A-A

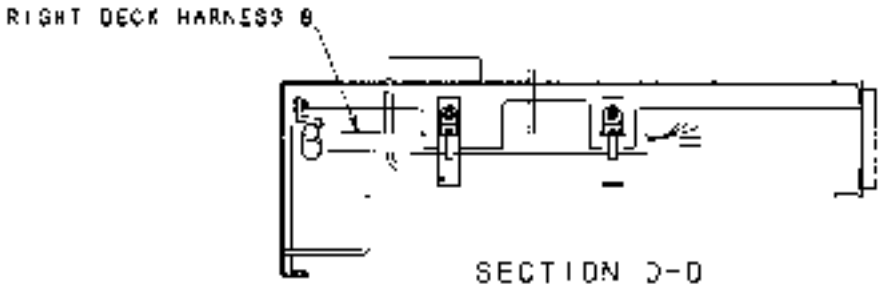


SECTION B-B

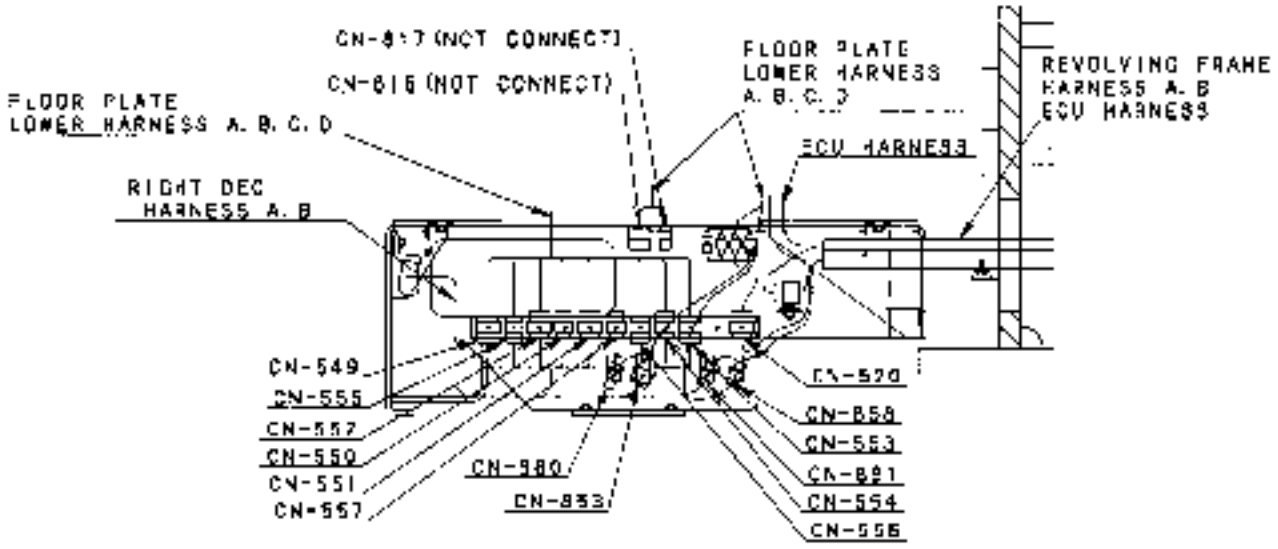


SECTION C-C

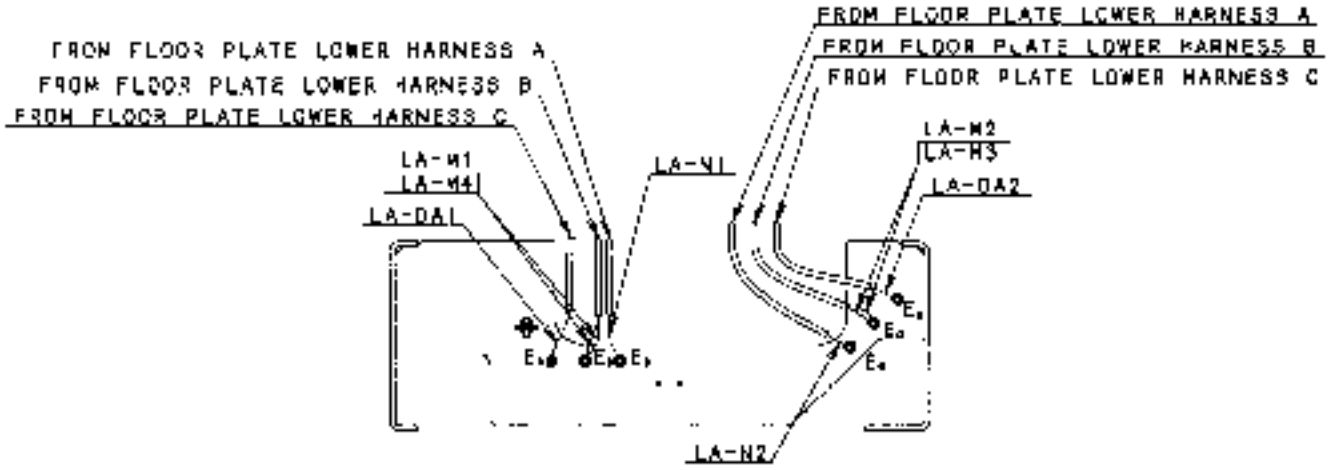
Fig.10-16 GG01E00071 (5/8)



SECTION D-D

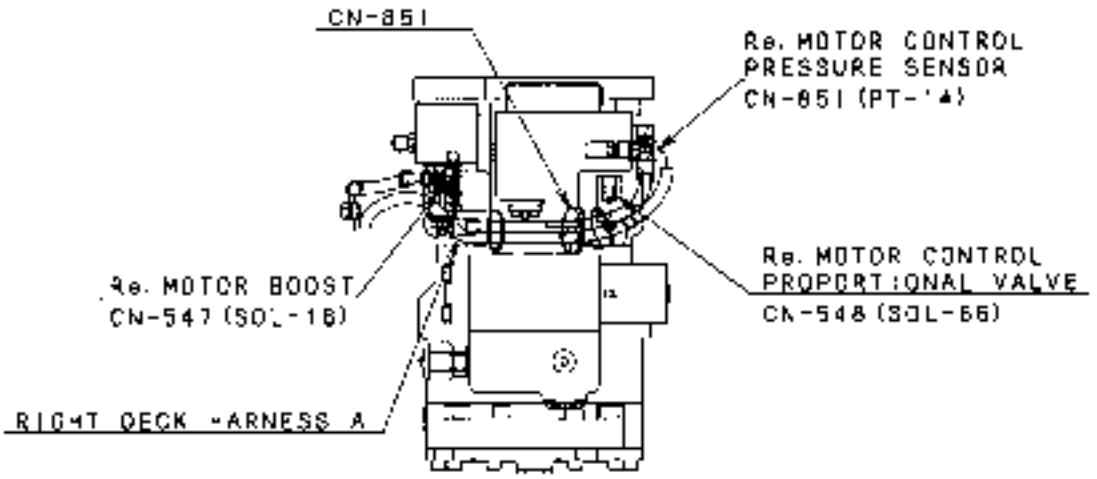


SECTION E-E

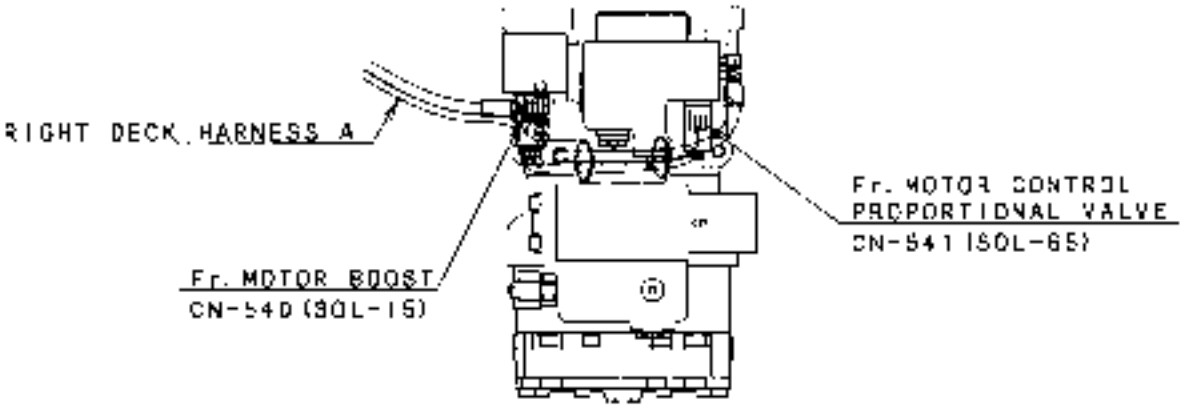


SECTION F-F

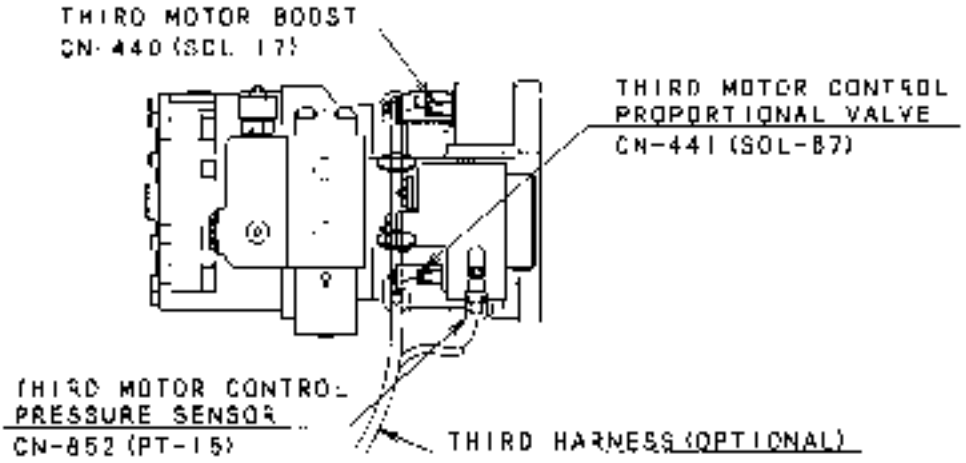
Fig.10-17 GG01ED0071 (6/8)



Re. WINCH

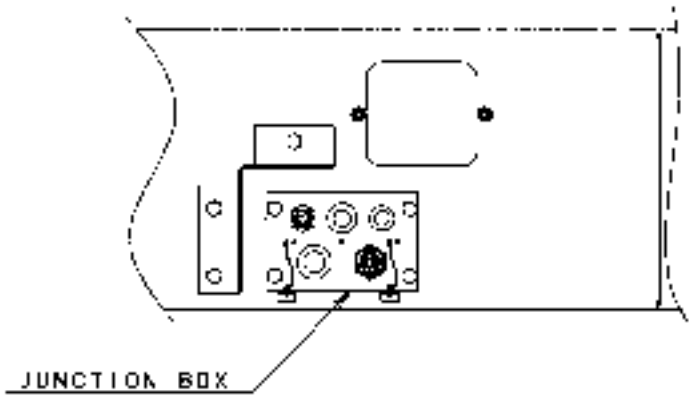


Fr. WINCH

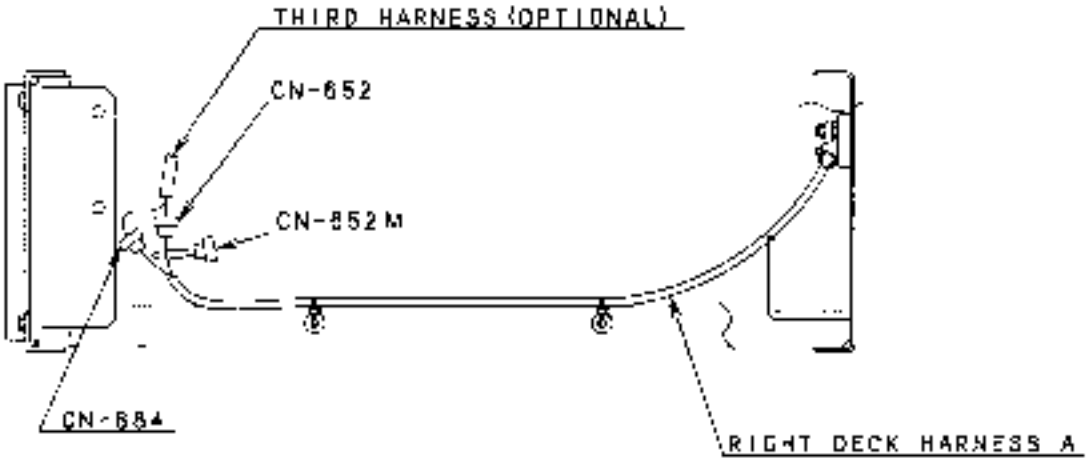


THIRD WINCH
(OPTIONAL)

Fig.10-18 GG01E00071 (7/8)



VIEW M



SECTION L-L

Fig.10-19 GG01E00071 (6/8)

10.3.3 ELECTRICAL PART OF FLOOR PLATE & LEFT SIDE STAND PANEL

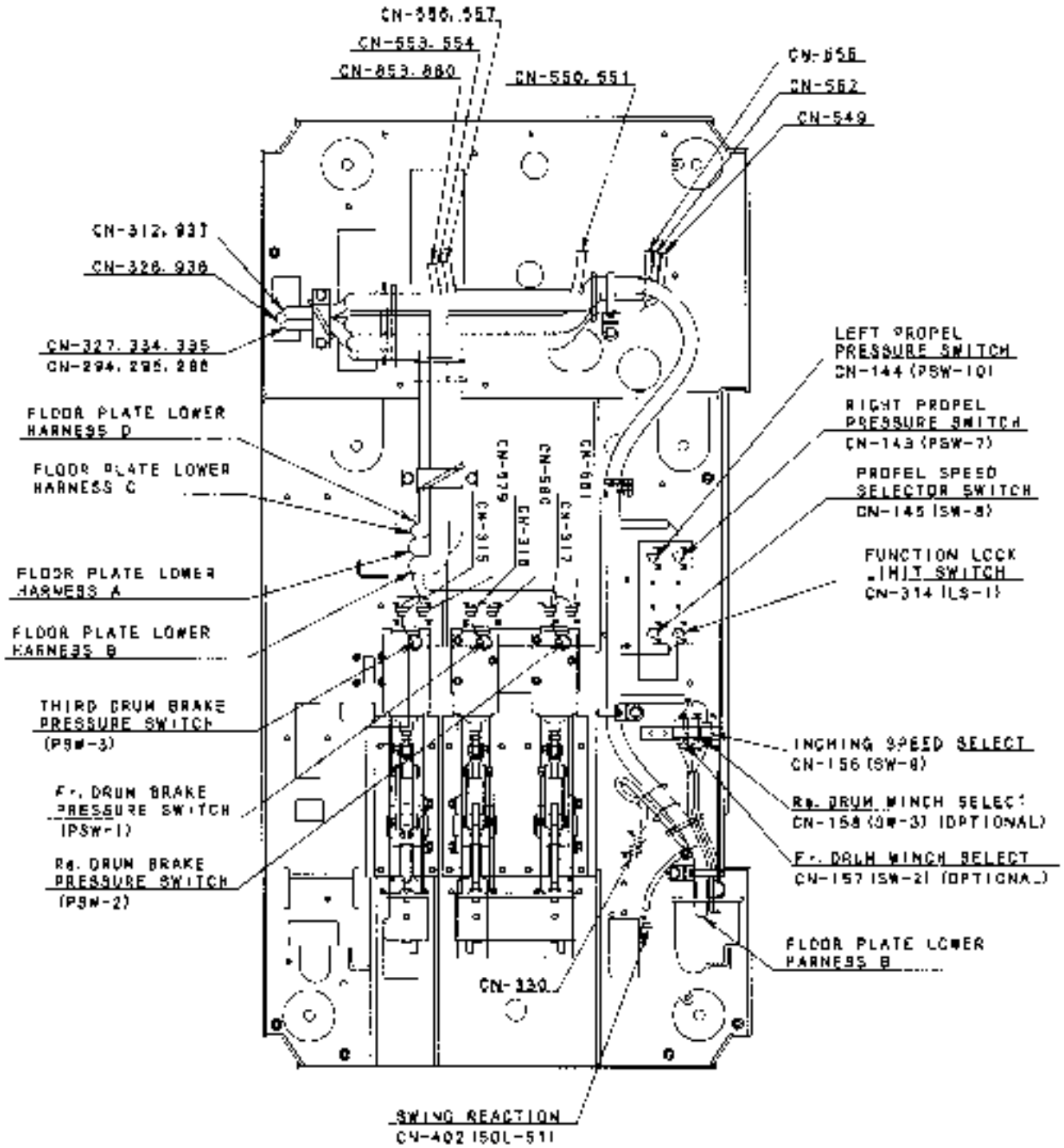


Fig.10-20 GG01E00068 (1/5)

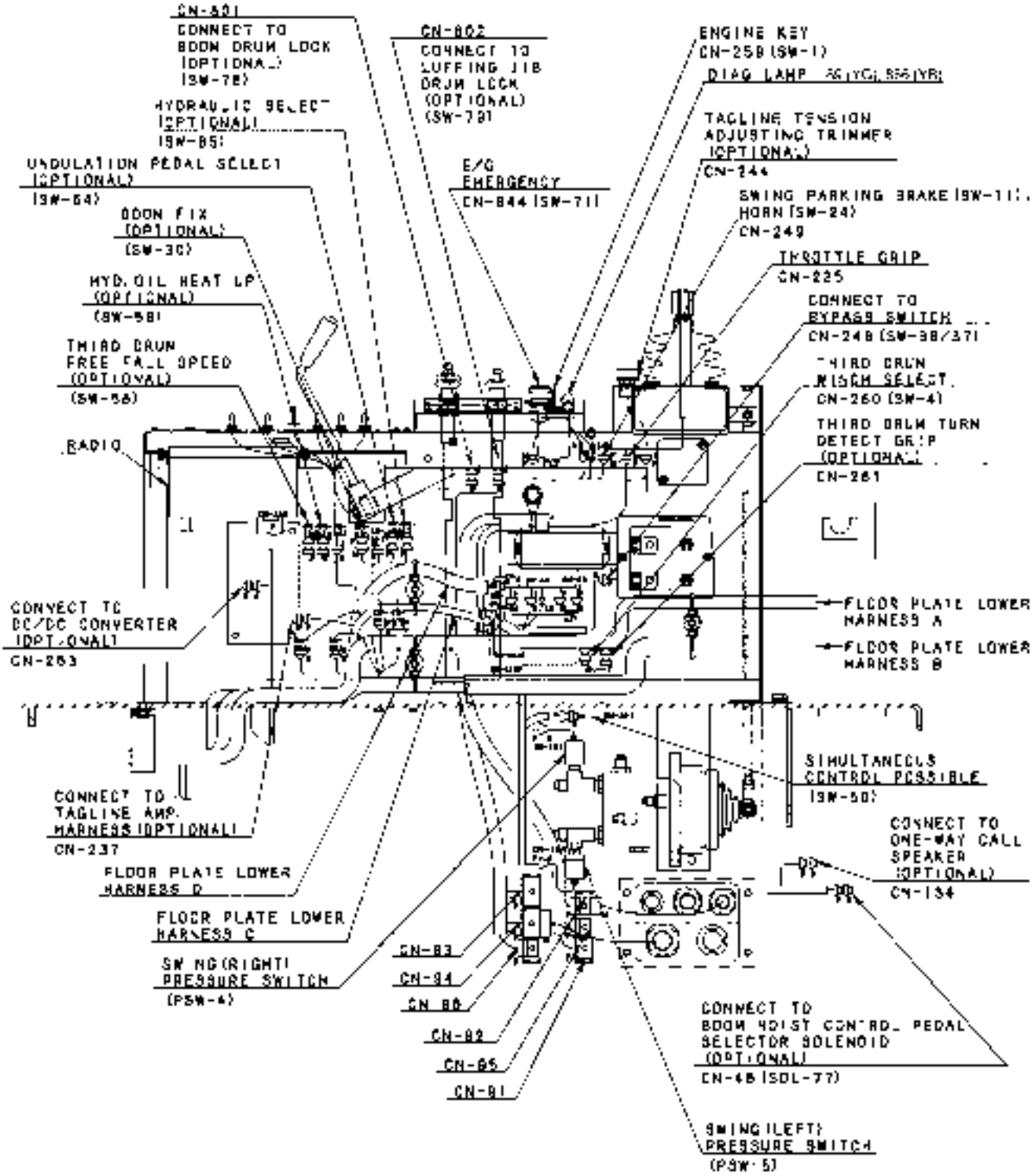


Fig.10-21 GG01E00068 (2/5)

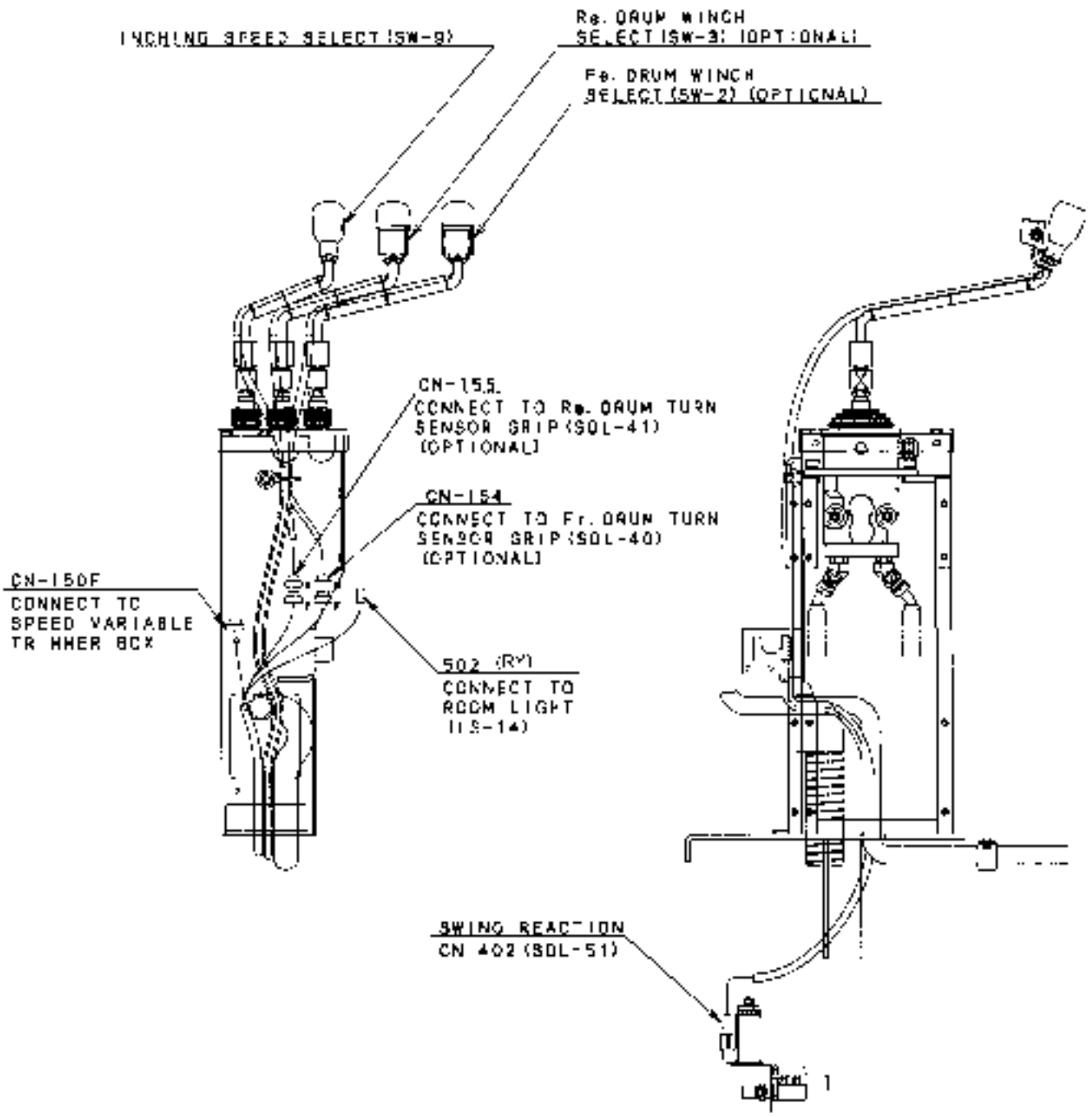
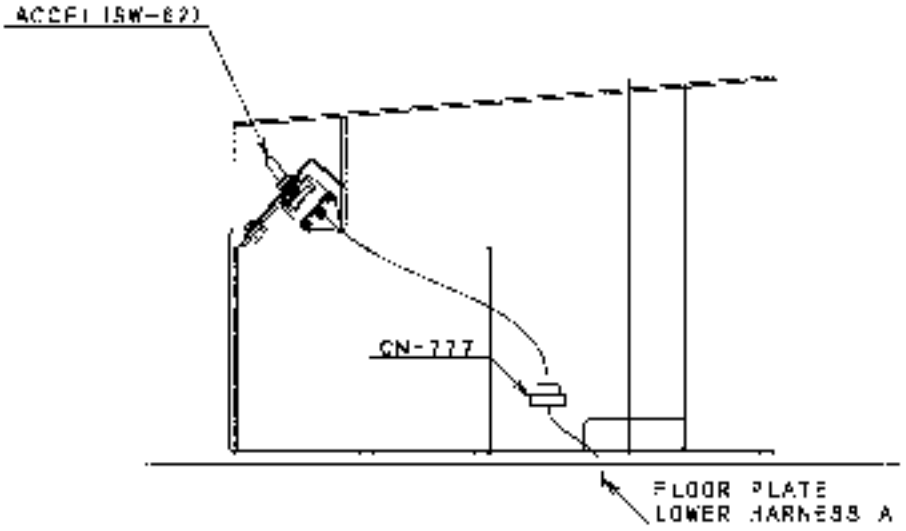
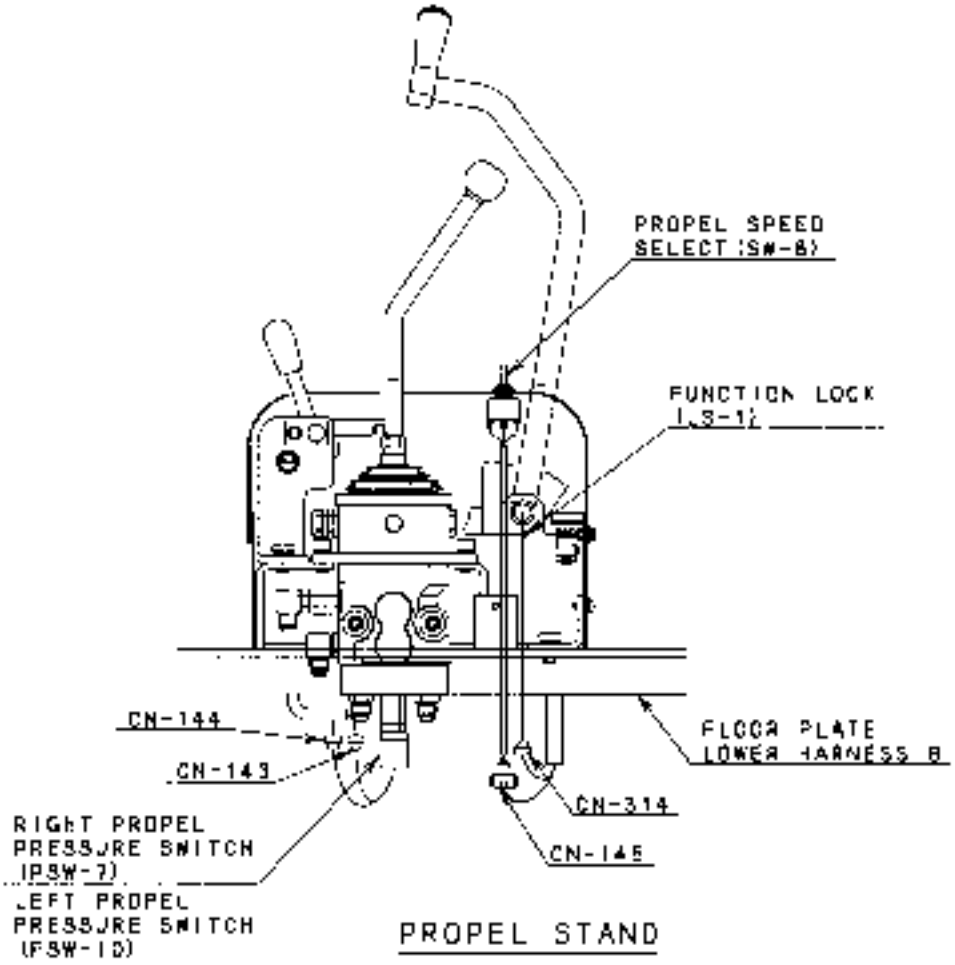


Fig.10-22 GG01E00068 (3/5)



DETAIL OF SEAT STAND



PROPEL STAND

Fig.10-23 GG01E00068 (4/5)

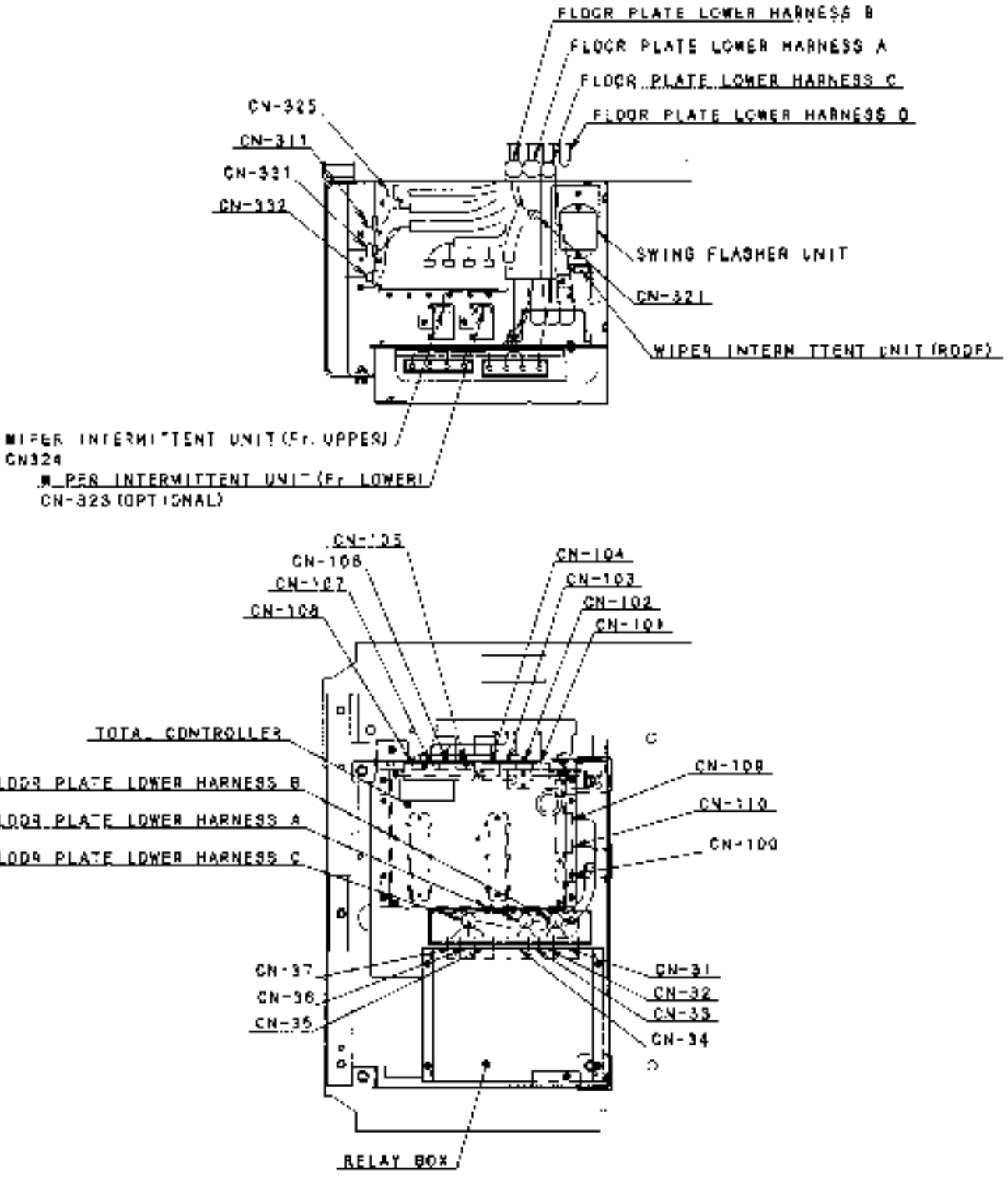
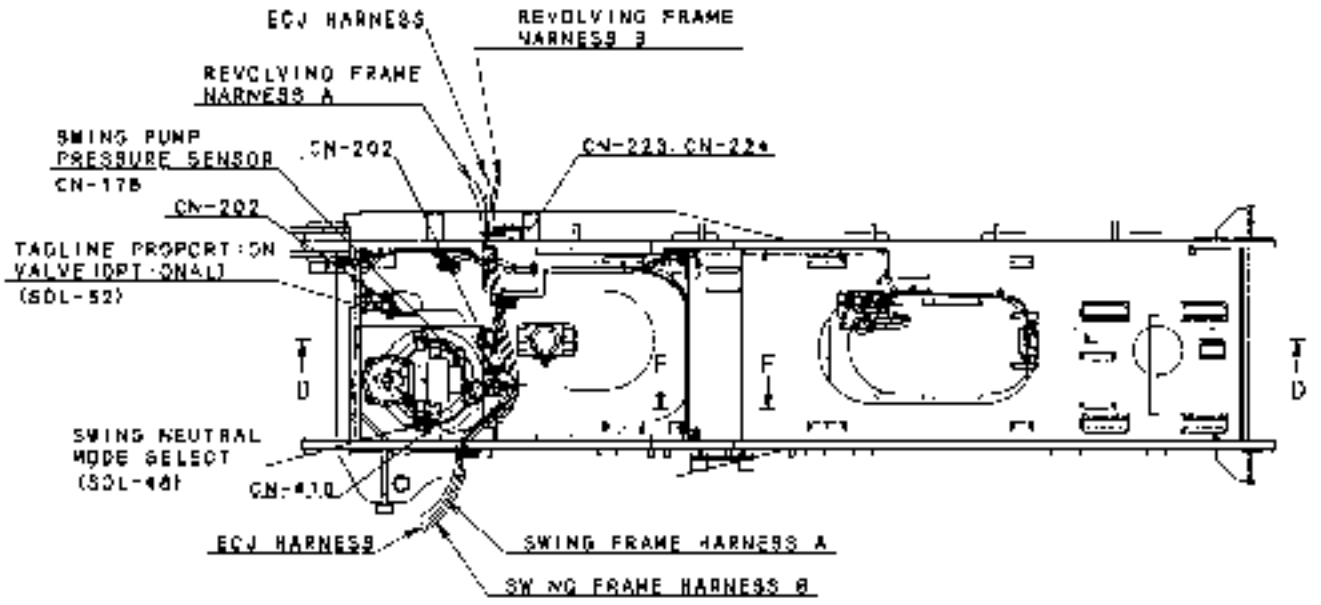
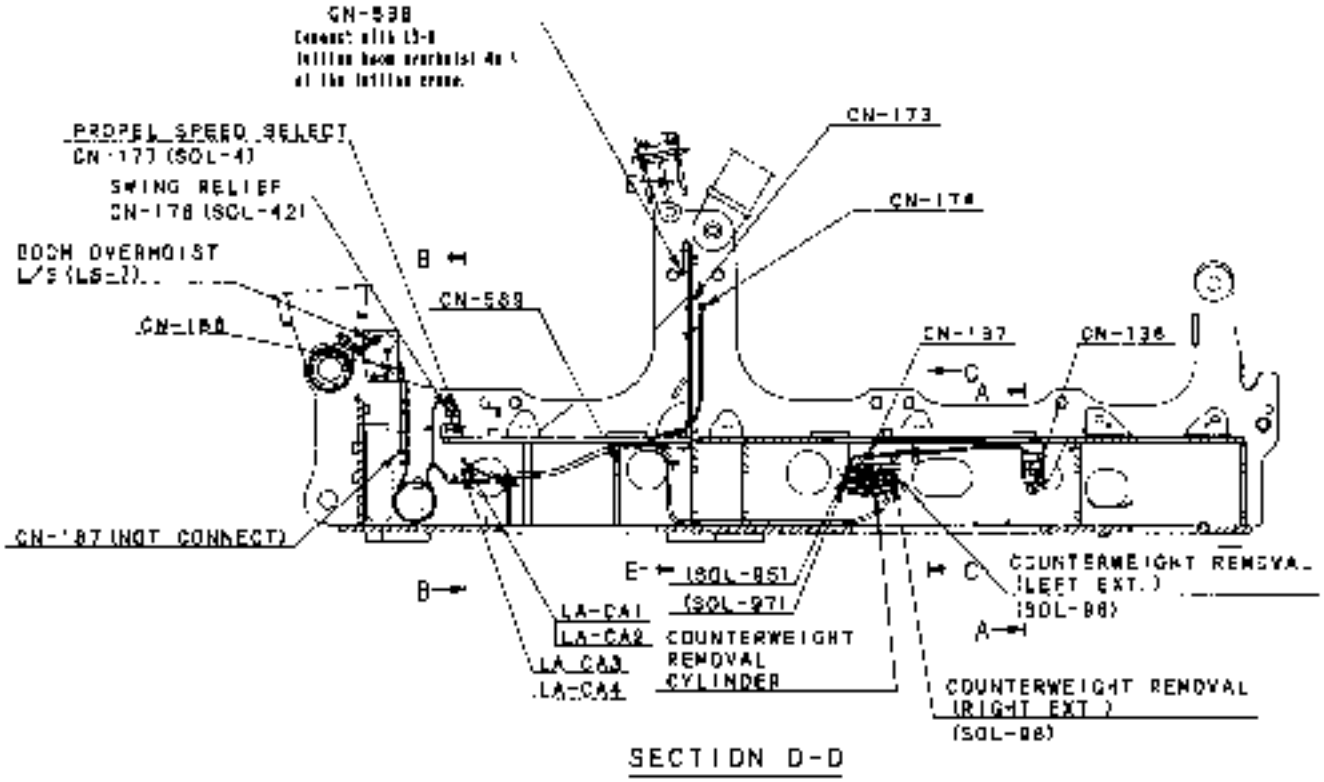


Fig.10-24 GG01E00068 (5/5)

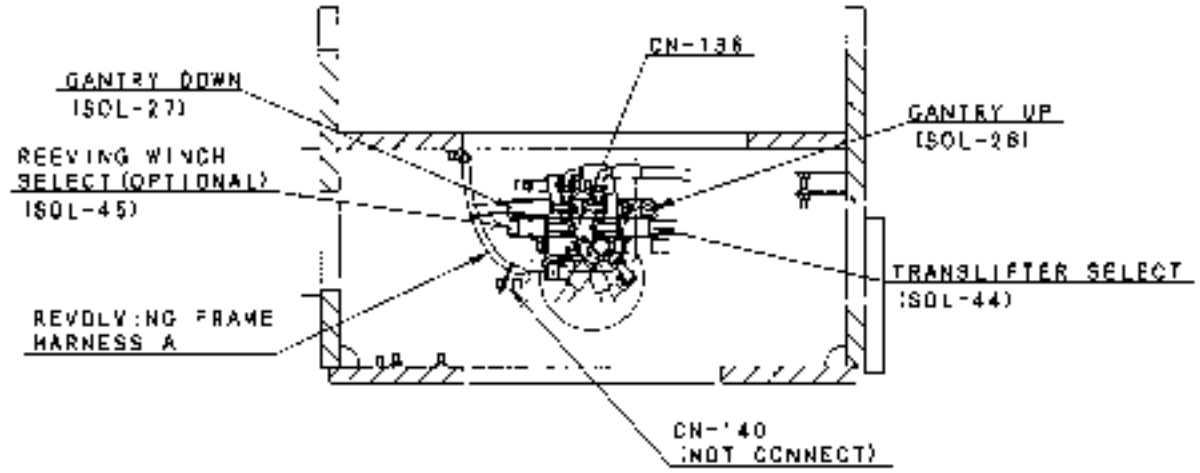
10.3.4 ELECTRICAL PART OF REVOLVING FRAME



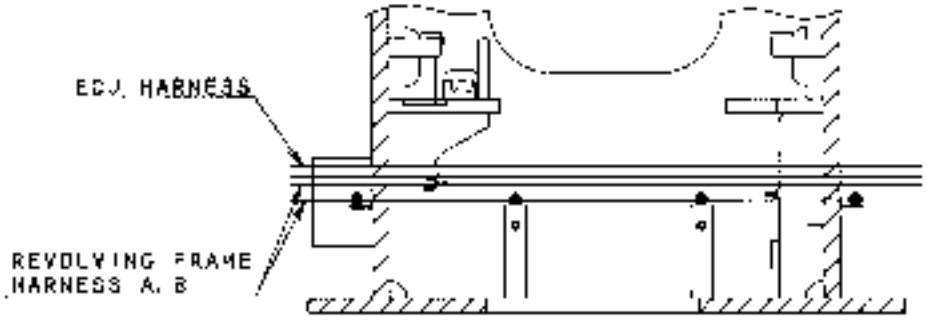


SECTION D-D

Fig.10-25 GK01E00029 (1/3)



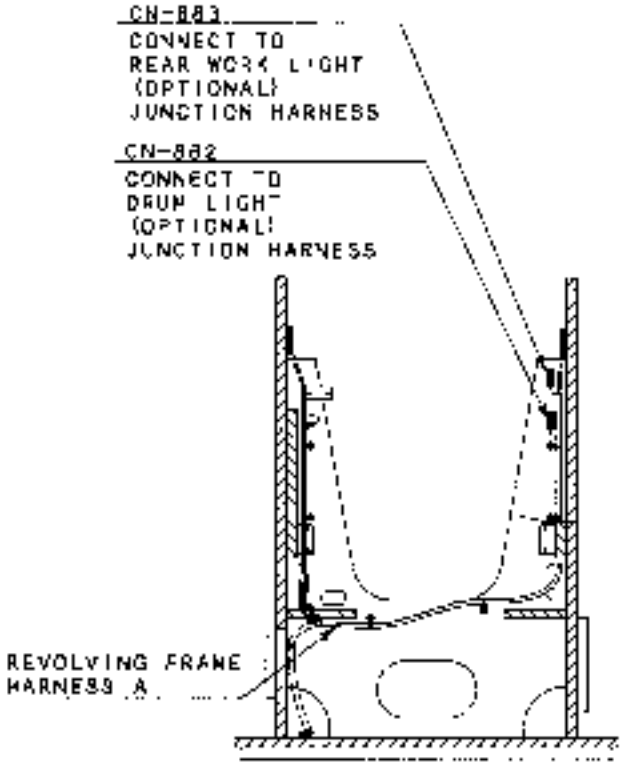
SECTION A-A



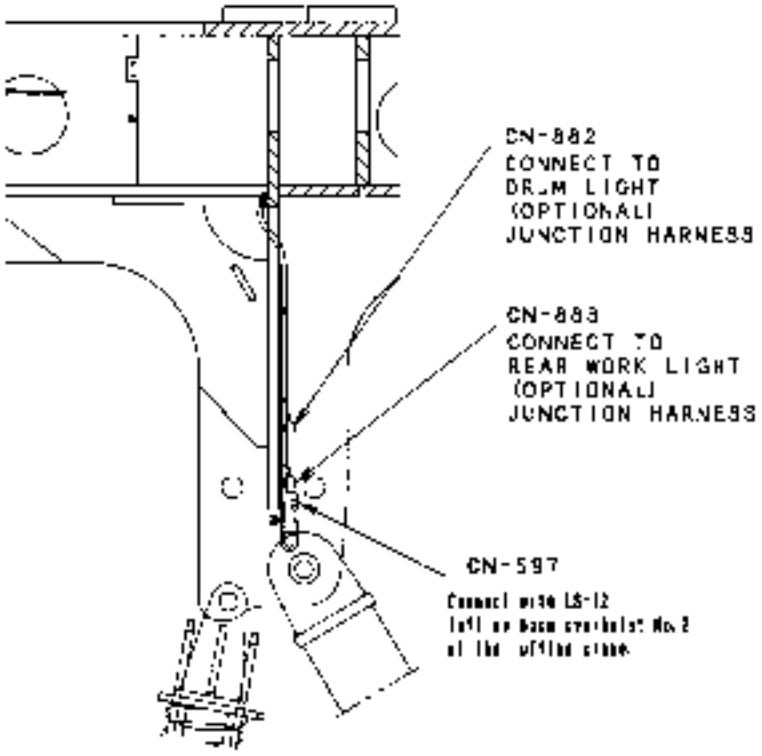
SECTION B-B

SECTION C-C

Fig.10-26 GK01E00029 (2/3)



SECTION E-E



SECTION F-F

Fig.10-27 GK01E00028 (3/3)

10.3.5 ELECTRICAL PART OF LEFT DECK

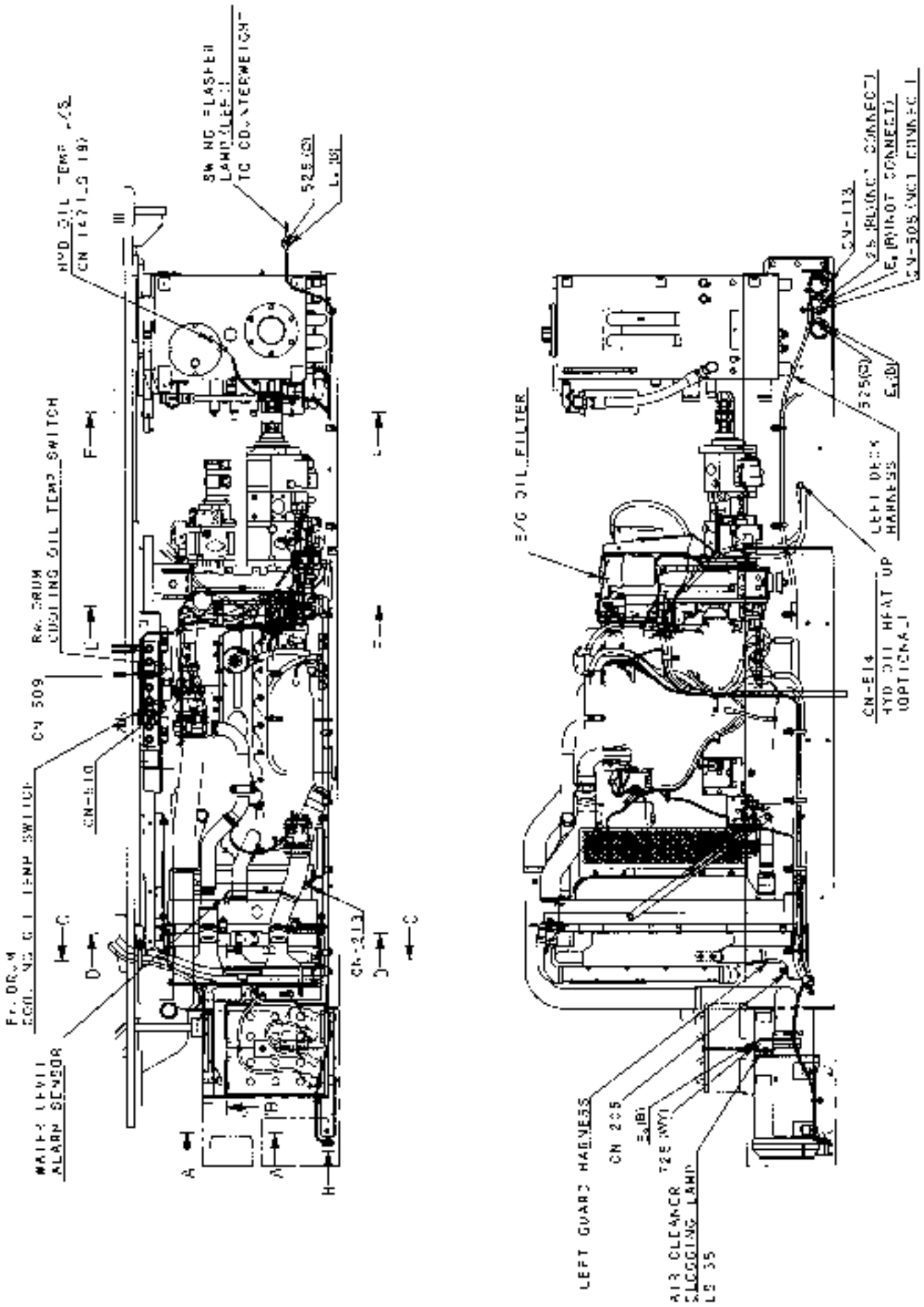
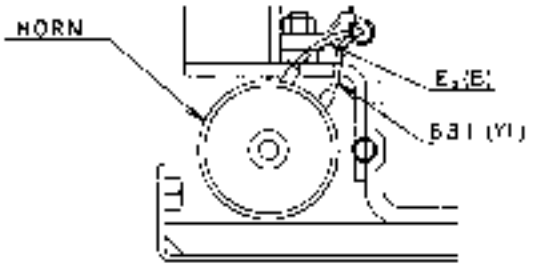
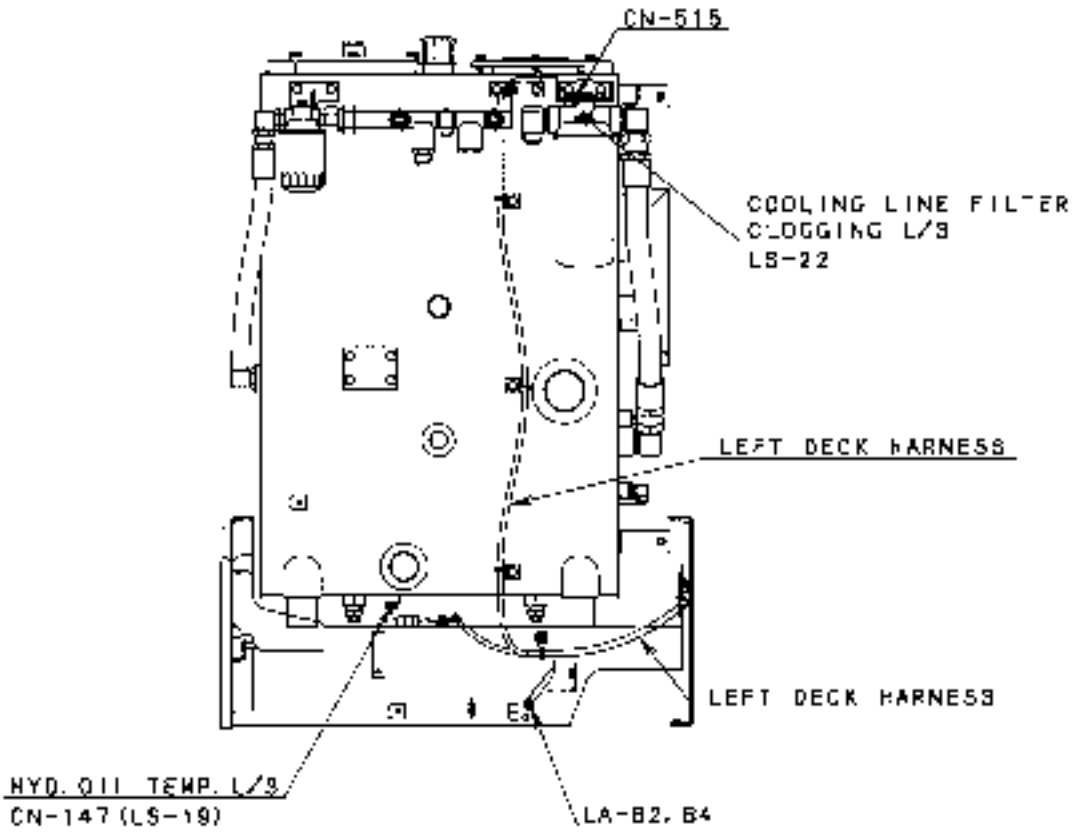


Fig.10-28 GH01E00001 (1/7)

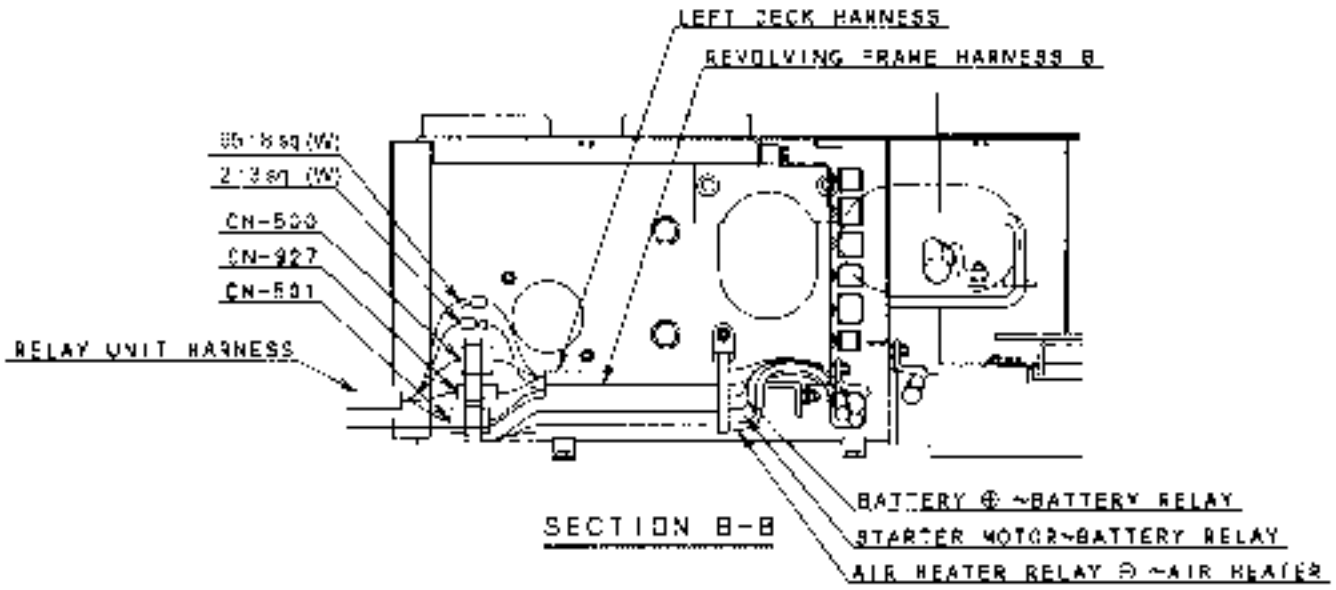


VIEW H



SECTION F-F

Fig.10-29 GH01E00001 (2/7)



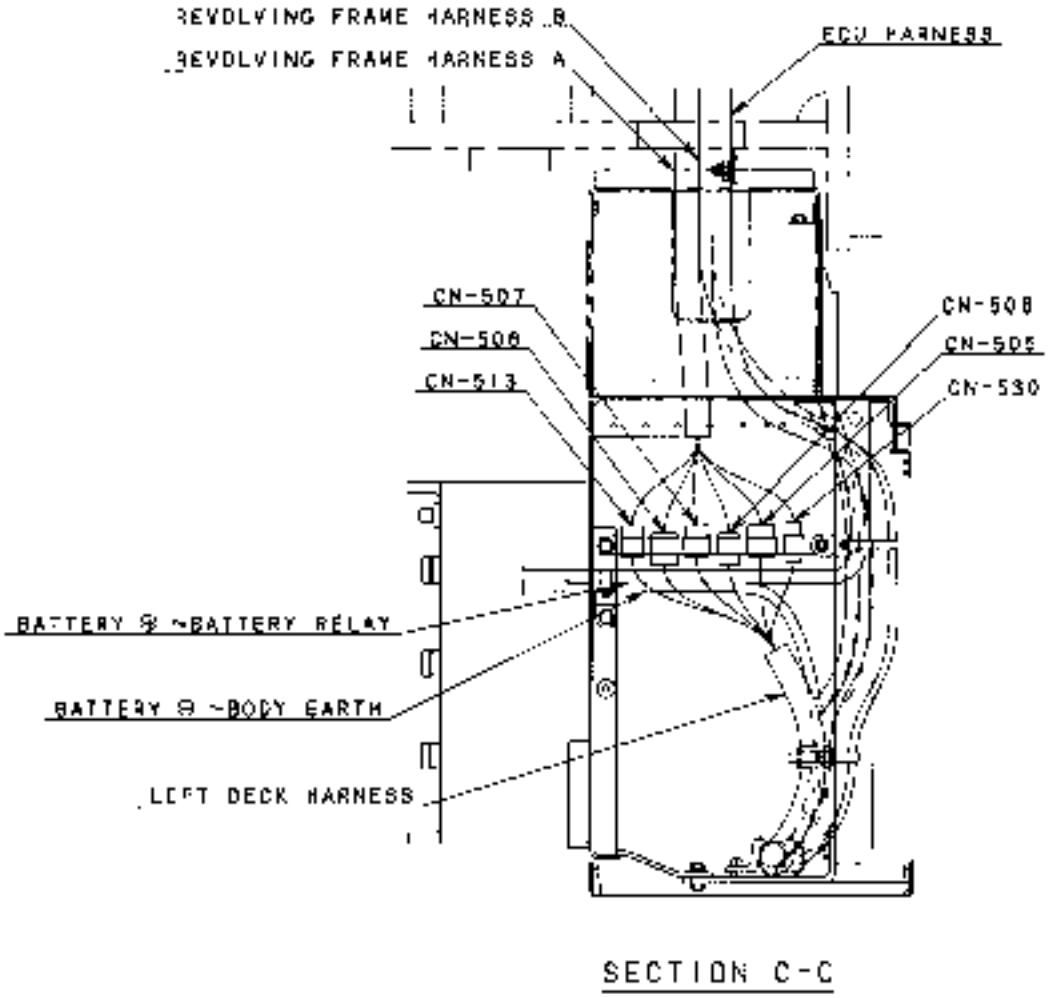
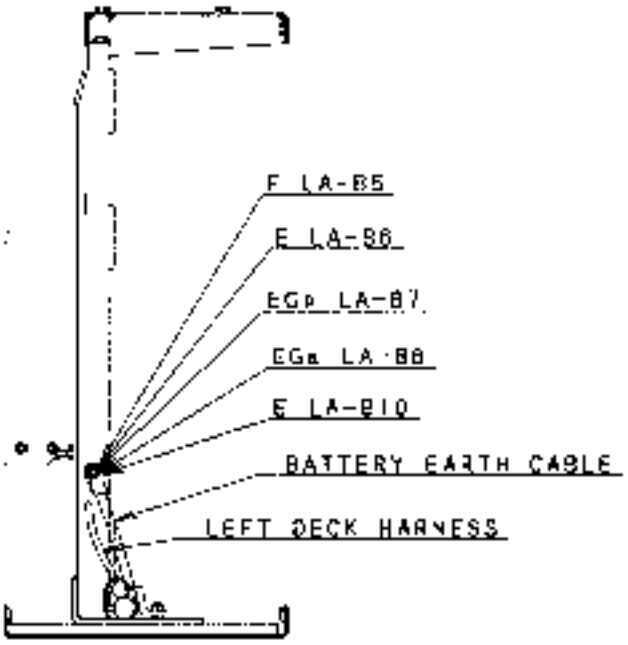
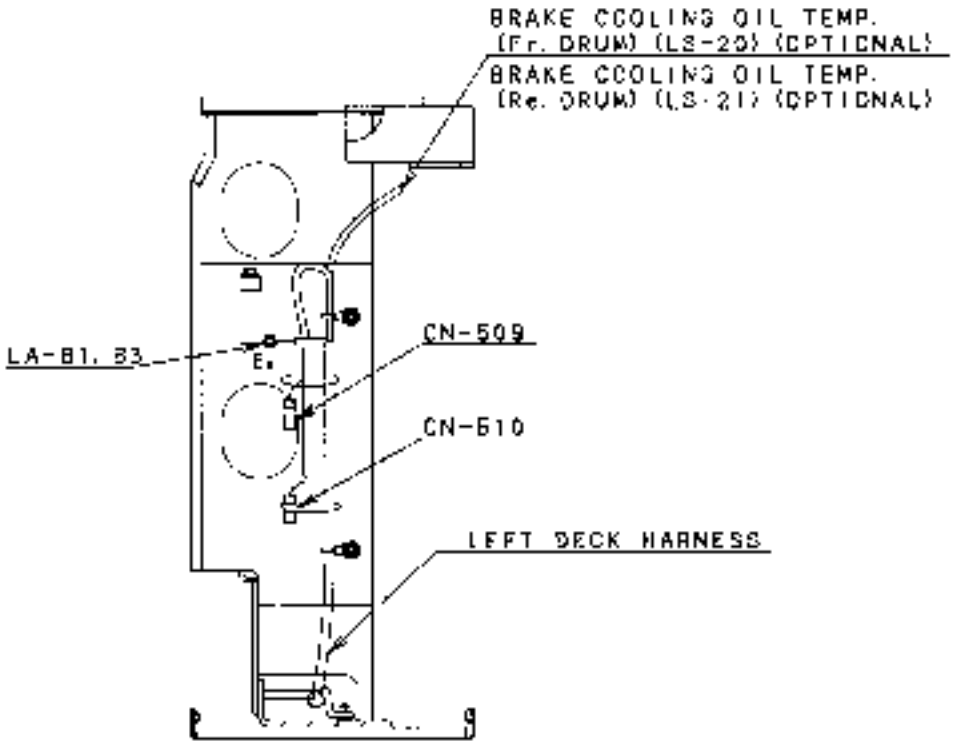


Fig.10-30 GH01E00001 (3/7)



SECTION D-D



SECTION E-E

Fig.10-31 GH01E00001 (4/7)

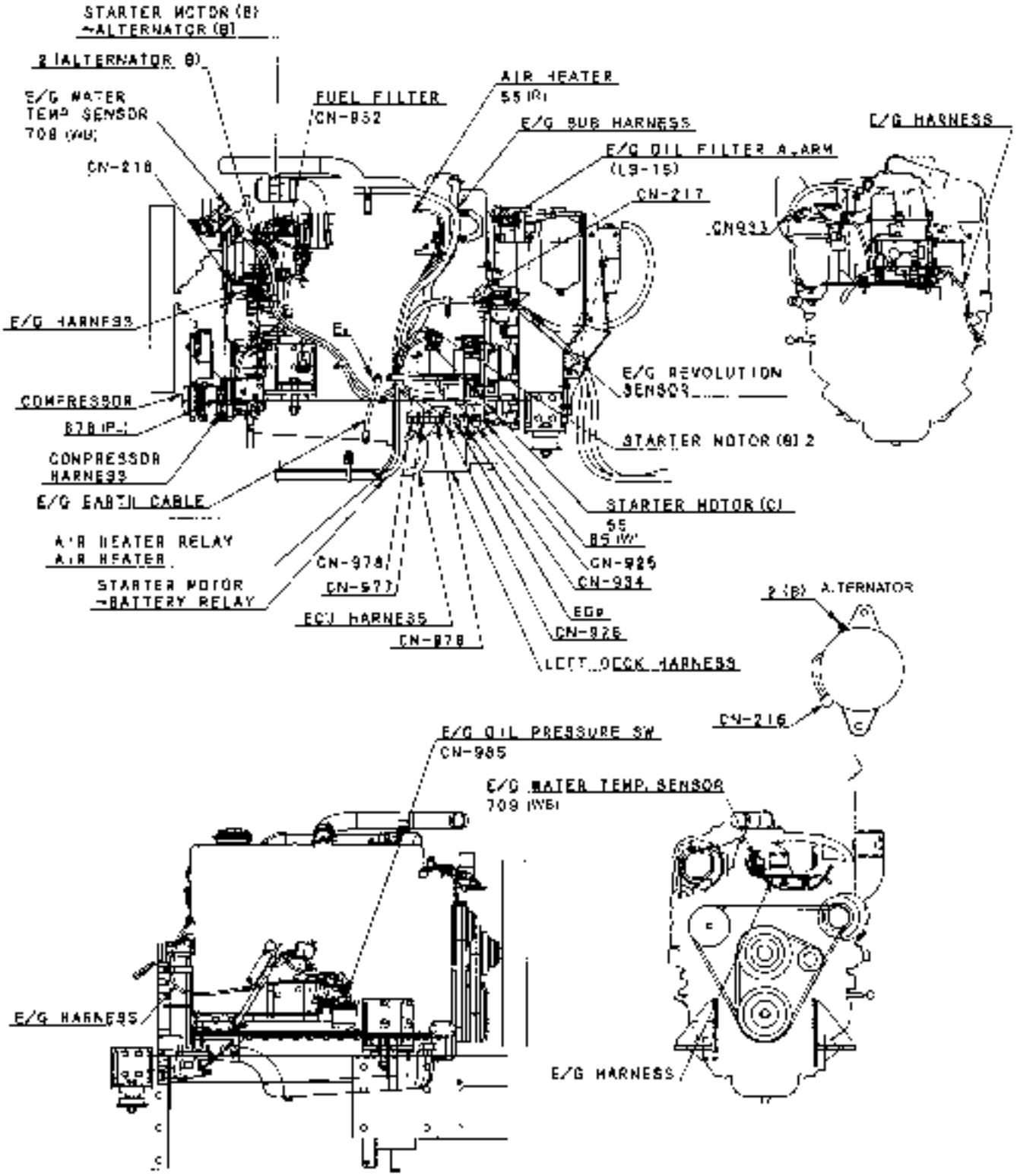


Fig.10-32 GH01E00001 (5/7)

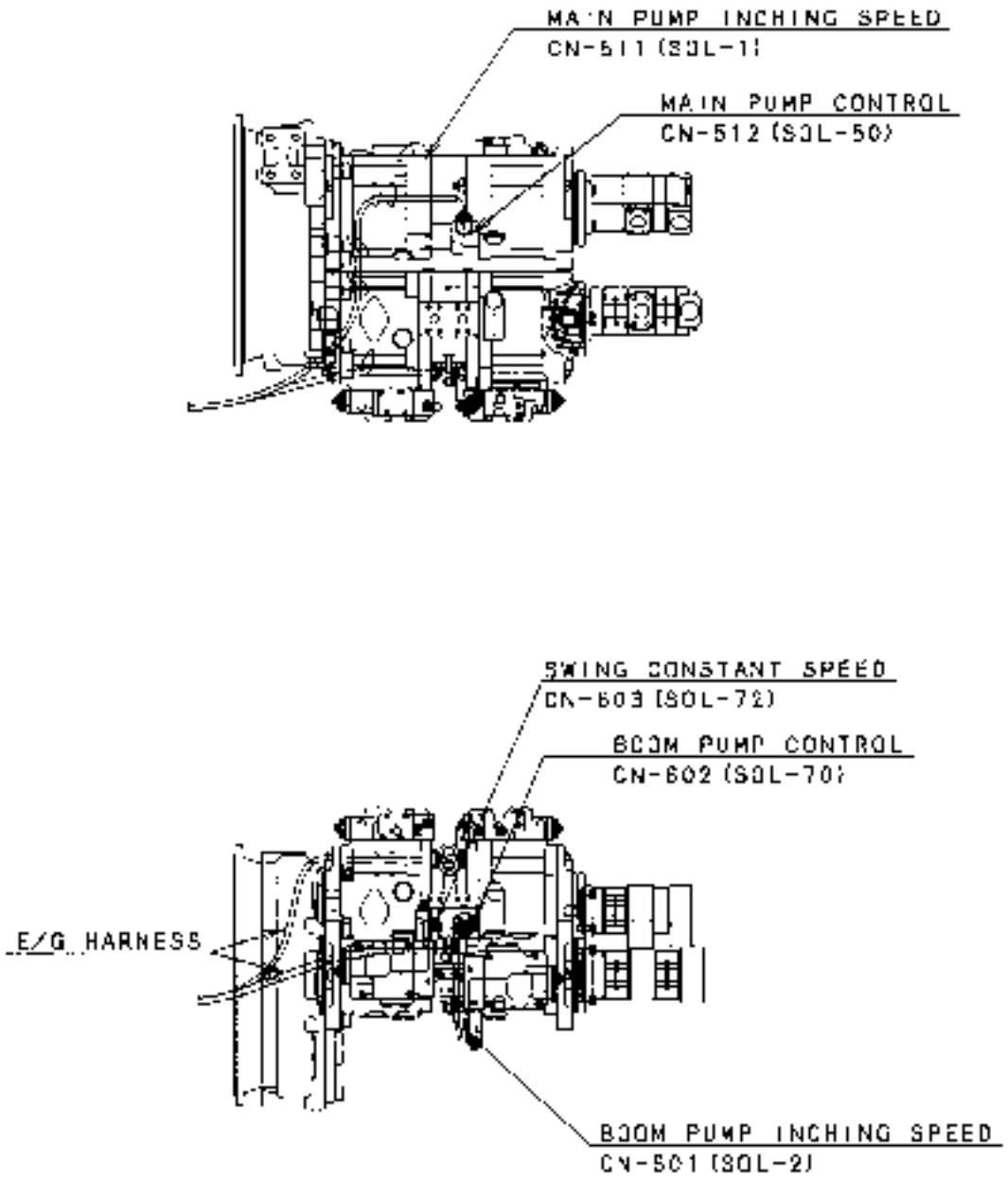
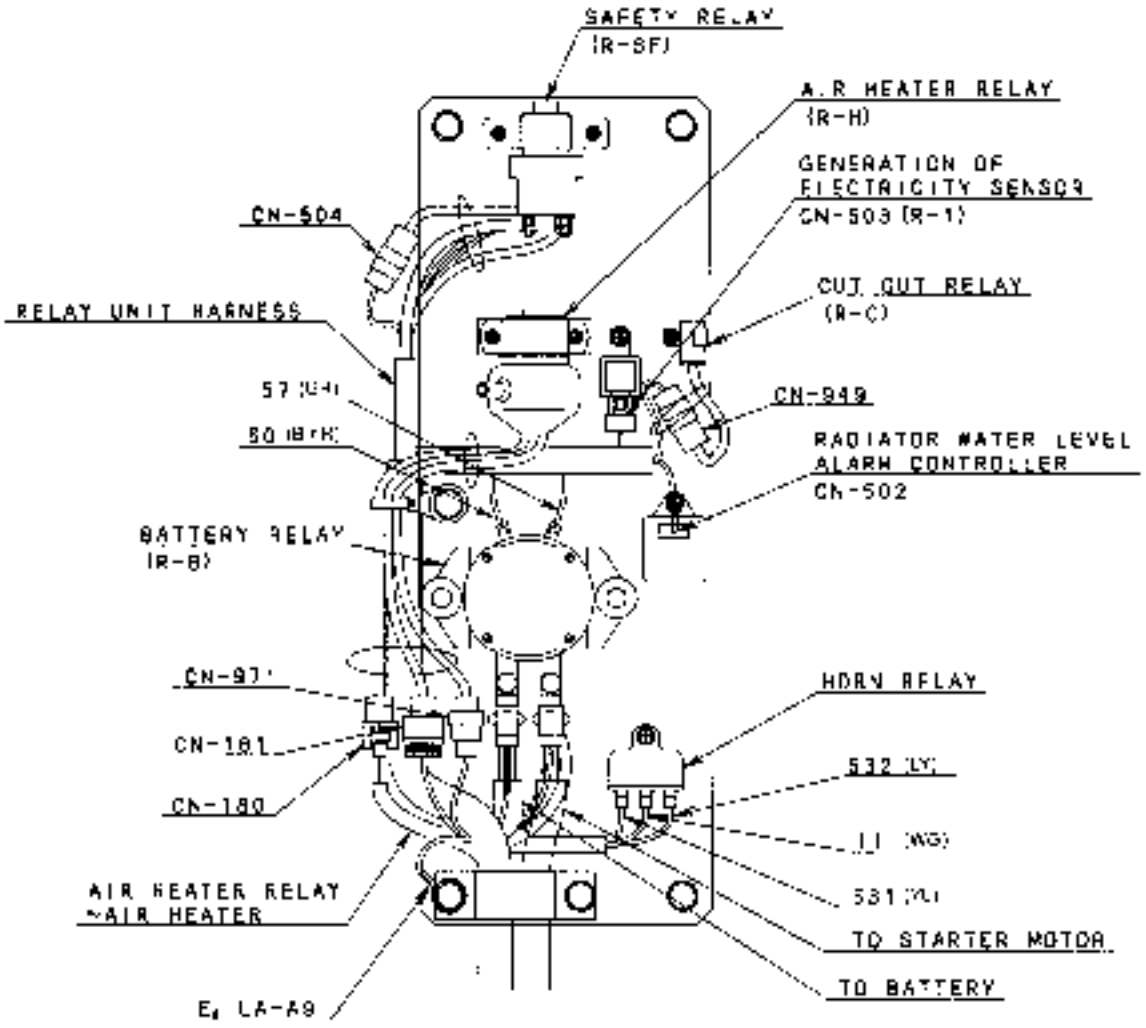


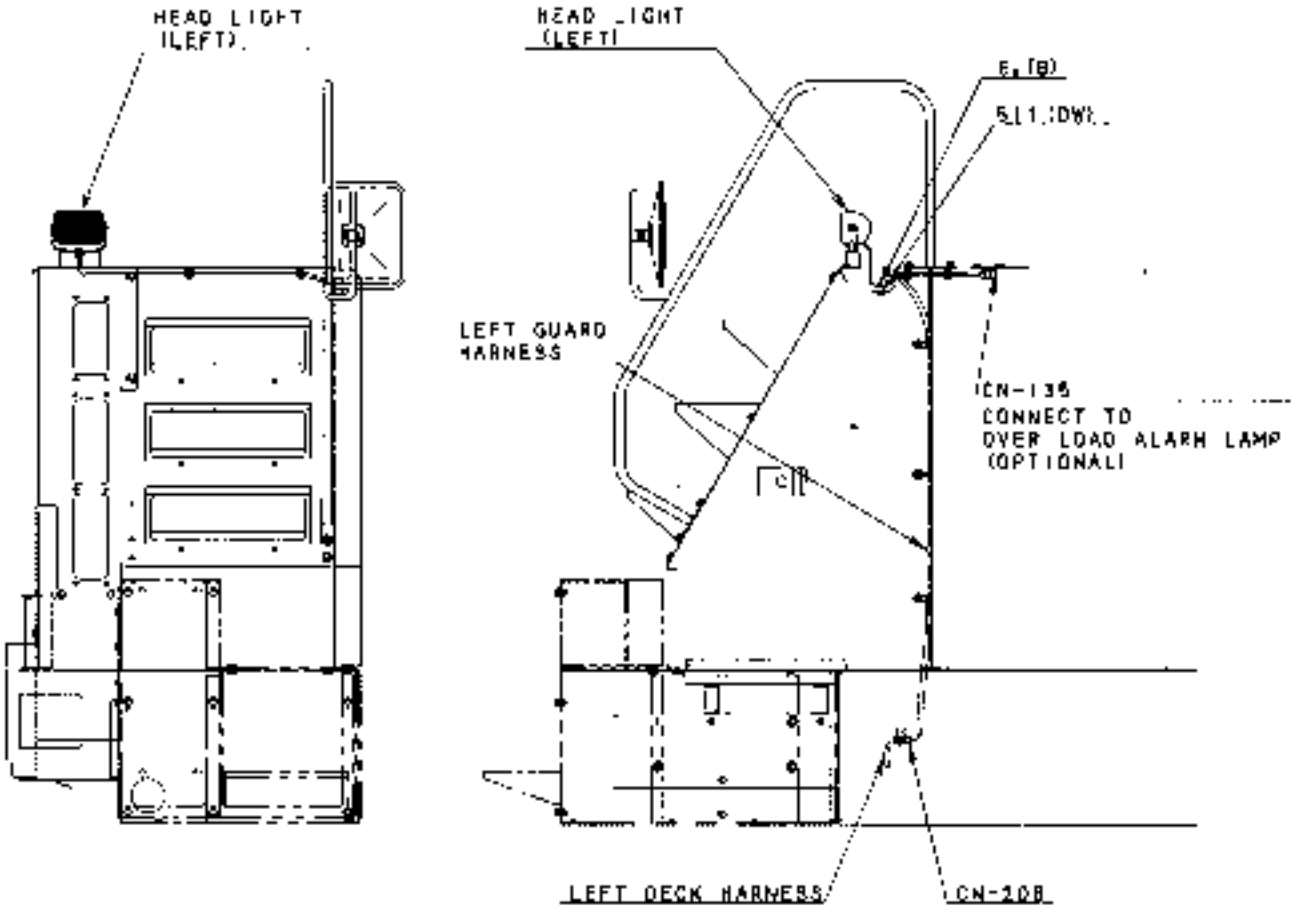
Fig.10-33 GH01E00001 (5/7)



SECTION A-A

Fig.10-34 GH01E00001 (7/7)

10.3.6 ELECTRICAL PART OF LEFT GUARD



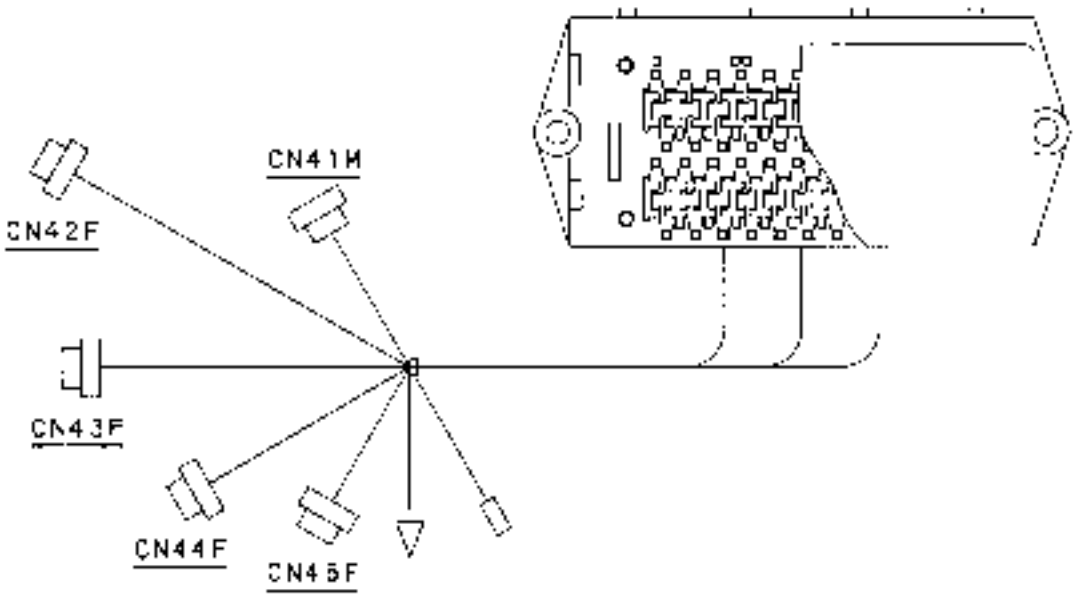
LEFT GUARD

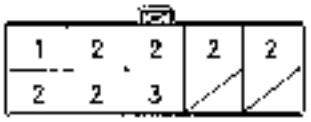
10.4 ELECTRICAL PART

10.4.1 FUSE BOX (GG73E00004F1)

⚠ DANGER

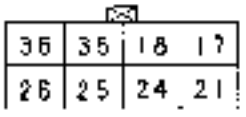
1. **In the case that a same fuse is frequently burnt out, it is considered that burning out of the fuse may be due to some fault in the electric circuit and it is not yet repaired. In such case, absolutely do not replace the burnt fuse simply with a fuse over the specified capacity. This could cause damage to the wiring and electrical apparatus.**
2. **In the above case, or when installing a new optional apparatus, be sure to consult the service shop of our representative. They will make a proper treatment or give a proper instruction.**
3. **When replacing the fuse with a new one, be sure to turn the key switch off.**





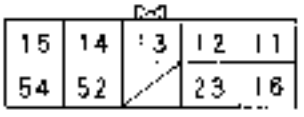
CN41M

Connector No. 7122-2137
(YAZAKI)



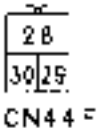
CN42F

Connector No. 7123-2186
(YAZAKI)



CN43F

Connector No. 7123-2107
(YAZAKI)

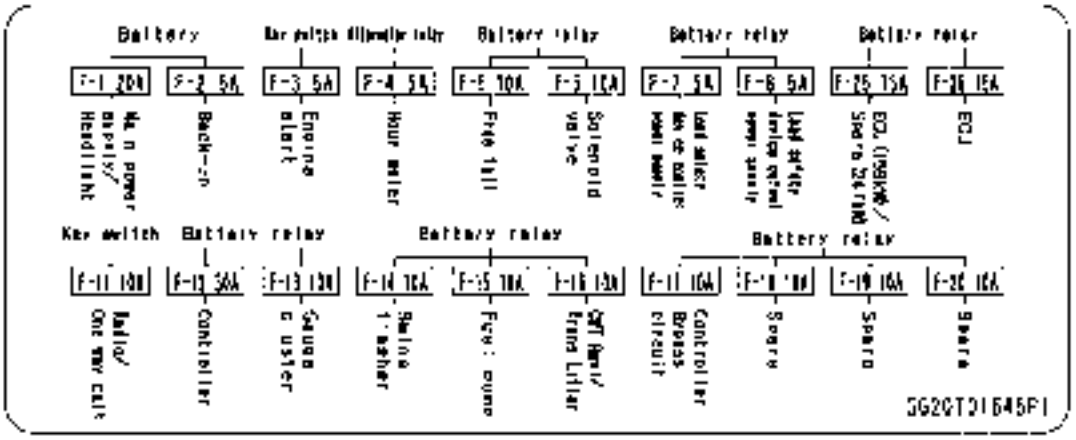


CN44F

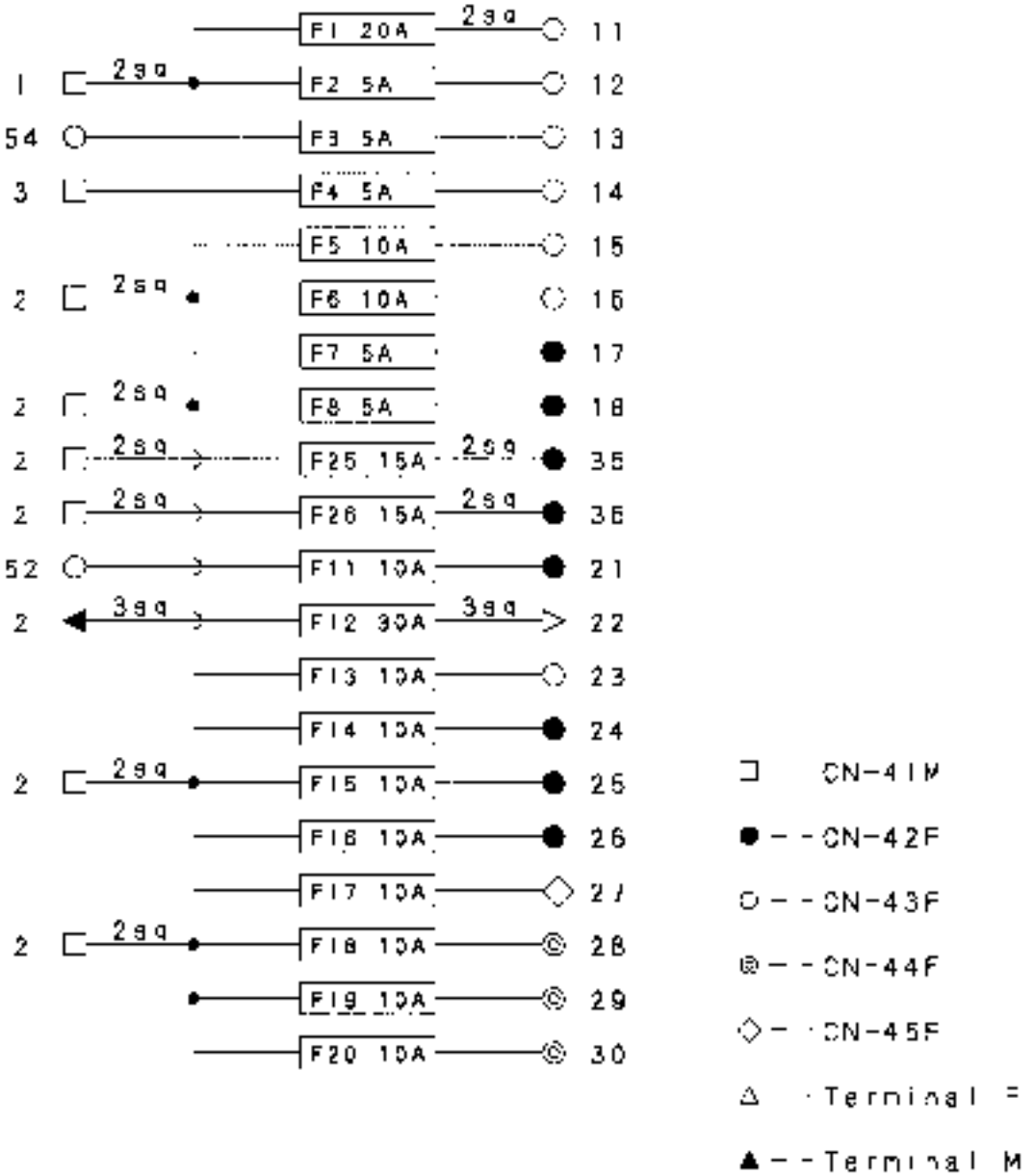
Connector No. 7123-2237
(YAZAKI)

CN45F

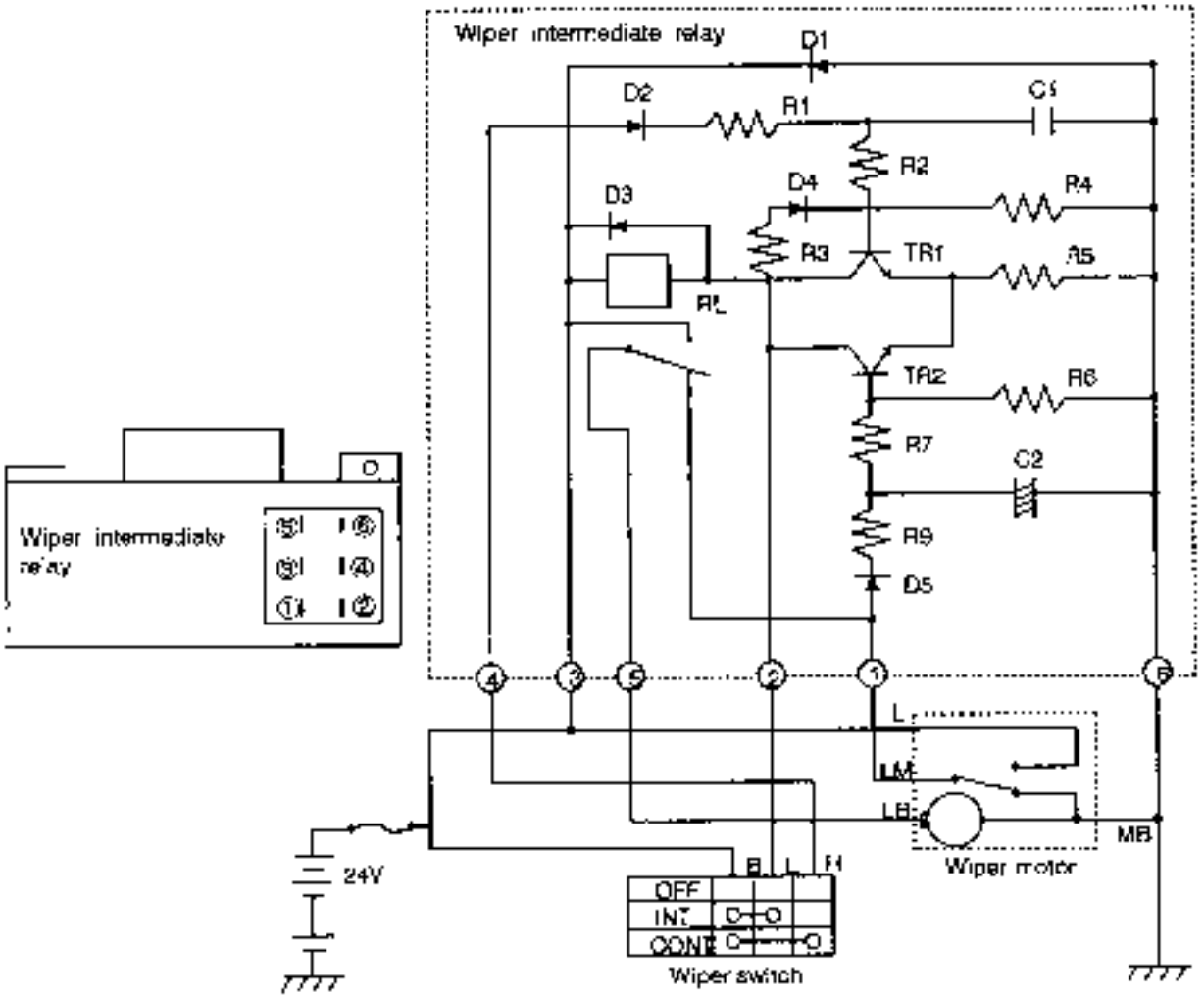
Connector No. 7123-2228
(YAZAKI)



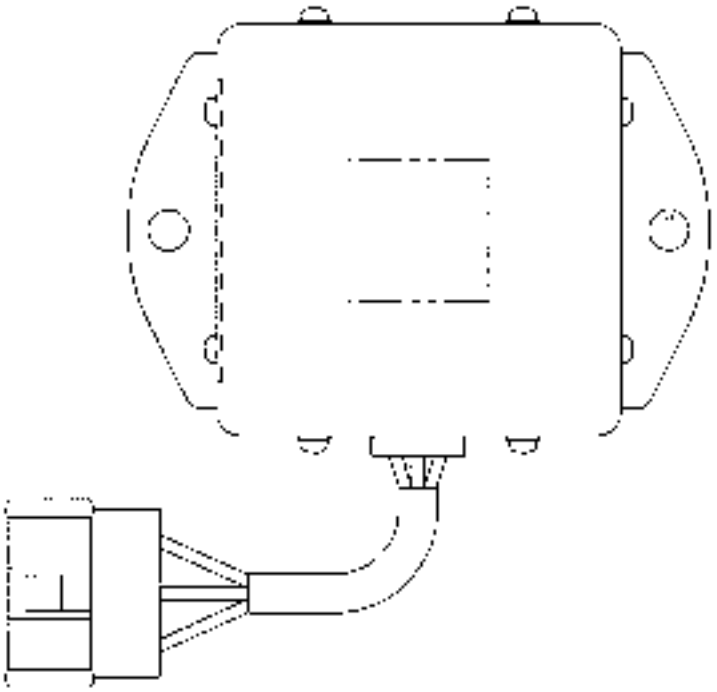
Fuse Connection Schematic

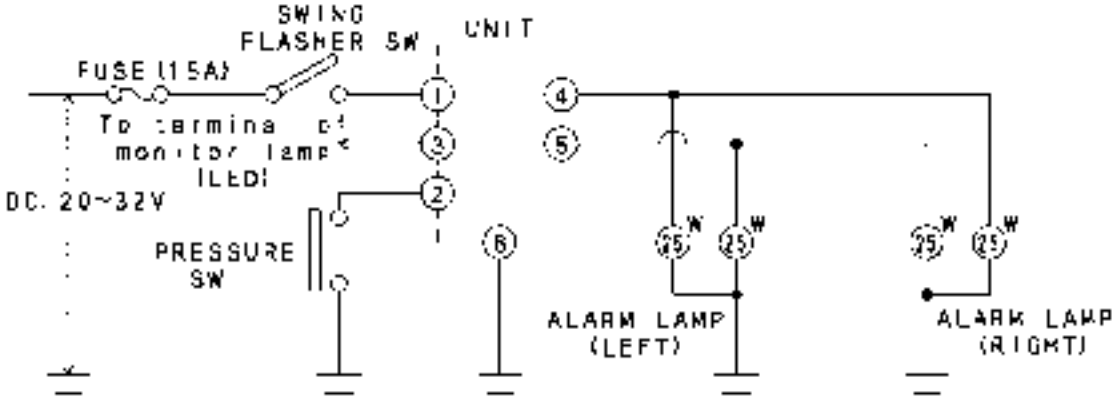


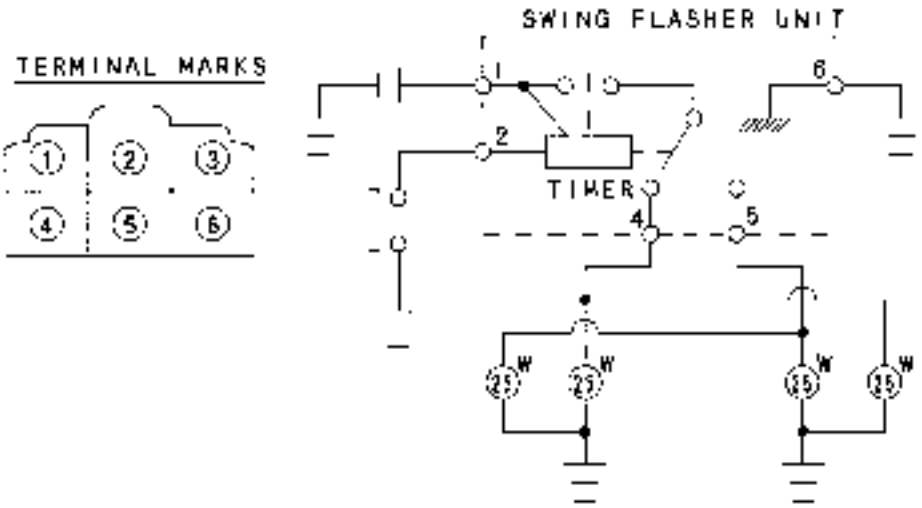
10.4.2 WIPER CONTROL UNIT (2480U306)



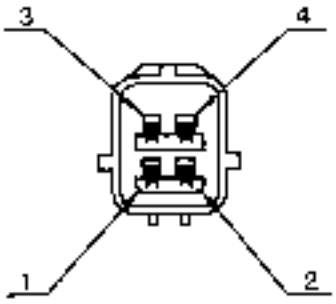
10.4.3 SWING FLASHER UNIT (2480U306)







10.4.4 PRESSURE SWITCH (CONTROL PRESSURE CUT & FREE FALL) (GG52S00006P1)

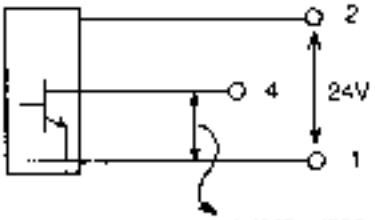


1 — W — COMMON

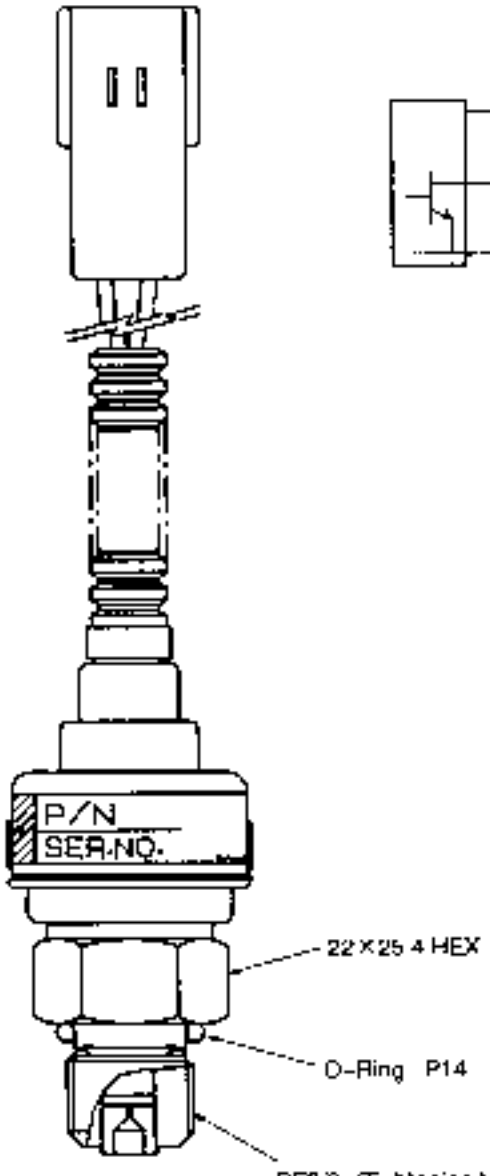
2 — R — POWER (+)

3 — NC

4 — G — Open collector (−)



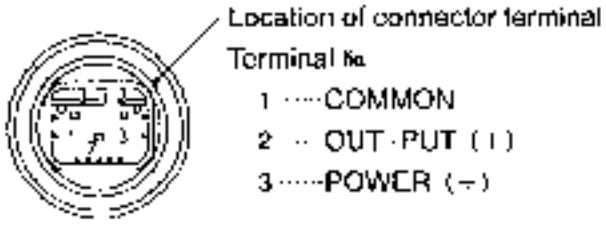
4.4MPa (638psi) : ON
3.6MPa (522psi) : OFF

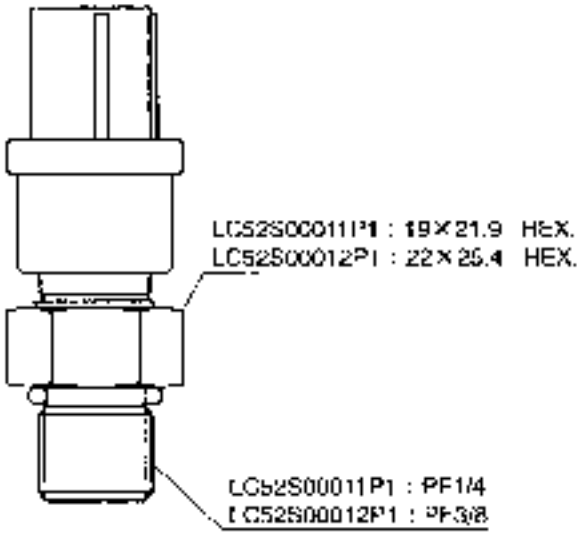


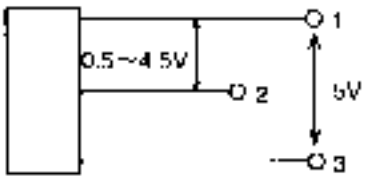
Use	Part number	(ON) Pressure MPa (Psi)	(ON) Pressure MPa (Psi)	Pressure Range MPa (Psi)
Foot Pedal (Front•Rear•3rd) Control Pressure	GG50S00006P1 (N.O.Type)	4.4 (640)	3.6 (522)	0 to 19.6 (0 to 2843)

10.4.5 PRESSURE SENSOR

(LC52S00011P1 - LC52S00012P1)





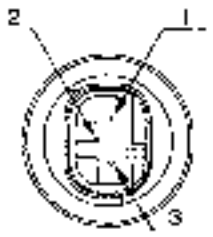


Use	Part number	Pressure raqnge MPa (psi)	Power (V)	Out-put (V)
• Remote control pressure (Front•Rear•3rd•Boom) • Control pressure (Rear•3rd)	LC52S00011P1	0 to 3.5 (0 to 507)	5	0.5 to 4.5
Swing pump pressure	LC52S00012P1	0 to 50 (0 to 7252)	5	0.5 to 4.5

[NOTE]

LC52S00011P1	LC52S00012P1
• Pressure range : 0 to 3.0 MPa	• Pressure range : 0 to 49 MPa
• Voltage Vcc : 5.0 ± 0.5 V DC	• Voltage Vcc : 5.0 ± 0.5 V DC
• Out-put : 1/10 Vcc to 9/10 Vcc = 0.5 V to 4.5 V	• Out-put : 1/10 Vcc to 9/10 Vcc = 0.5 V to 4.5 V
• Tightening torque : 36.3 N-m max (26.7 ft-lbs)	• Tightening torque : 73.5 N-m max (54.2 ft-lbs)

GN52S00002P1



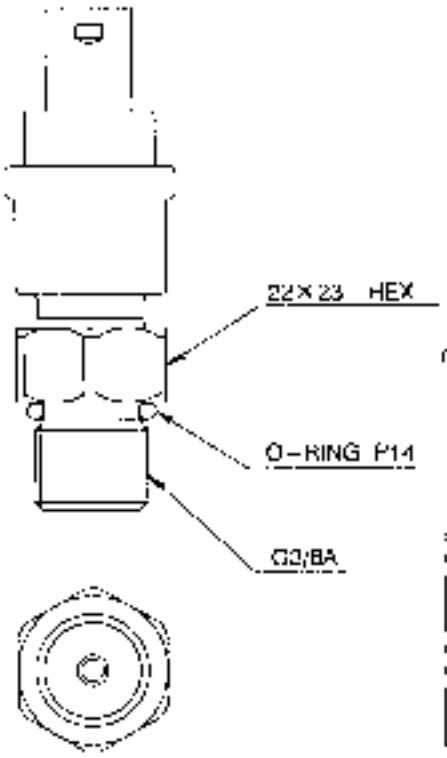
Location of connector terminal

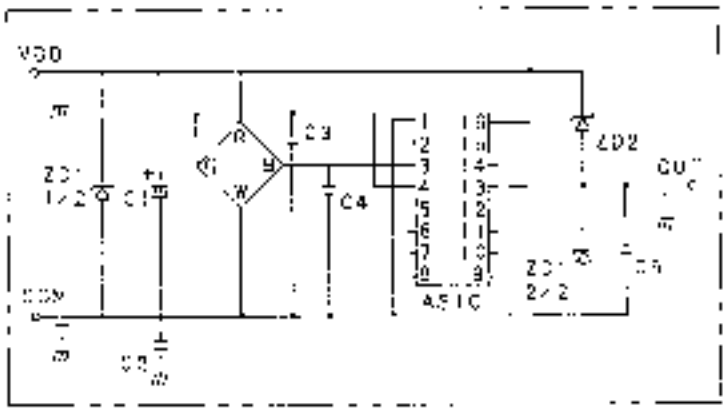
Terminal No.

1 · · · COMMON

2 ····· OUT-PUT (+)

3 · · · POWER (+)





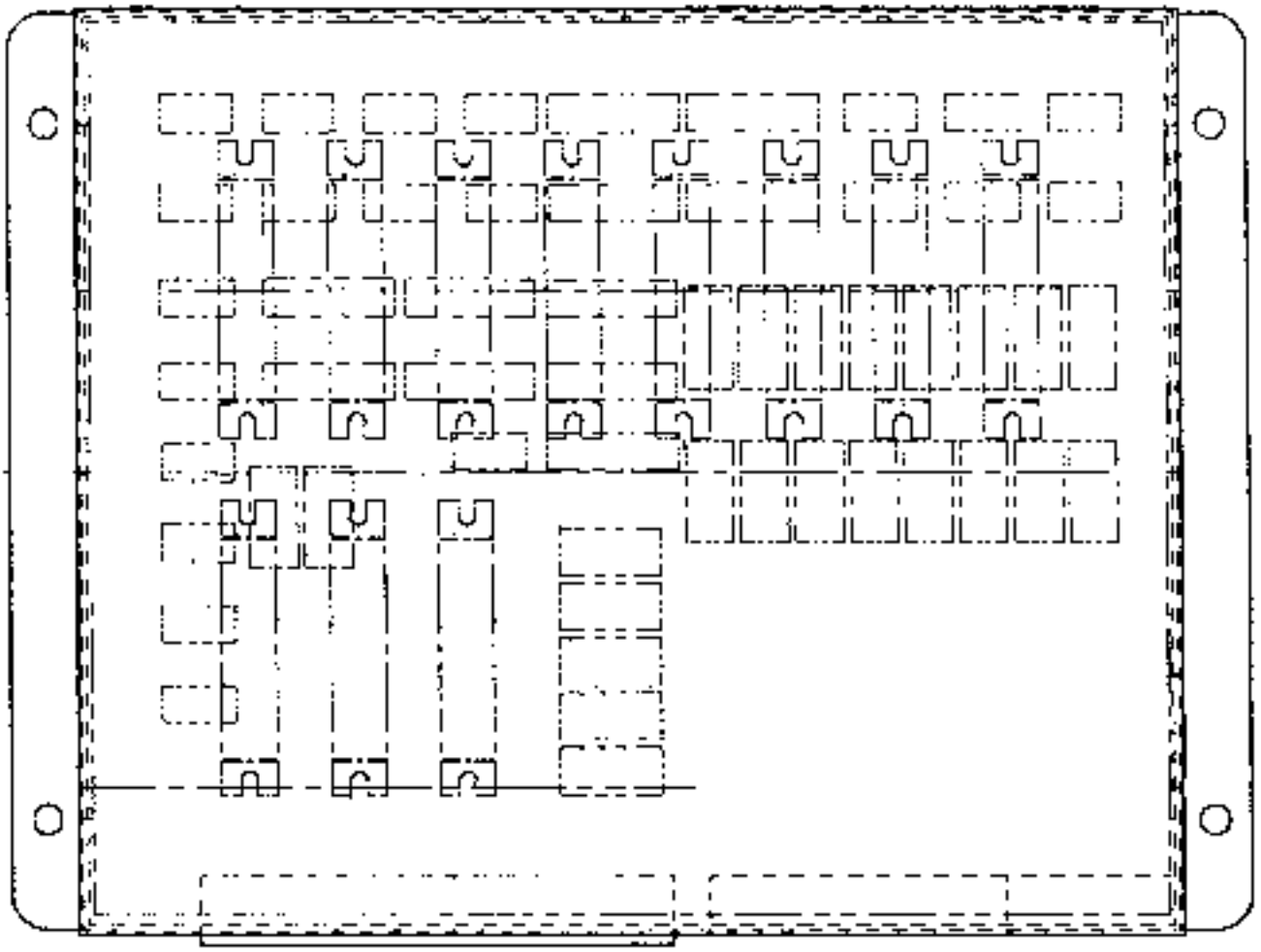
Use	Part number	Pressure range MPa (psi)	Power (V)	Out-put (V)
Clutch pressure (Front·Rear·3rd)	GN52S00002P1	0 to 19.6 (0 to 2842)	5	0.5 to 4.5

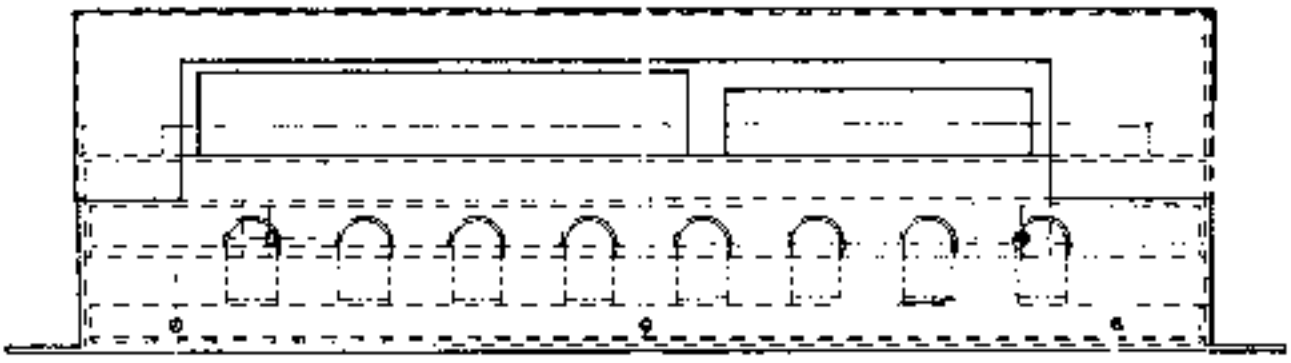
[NOTE]

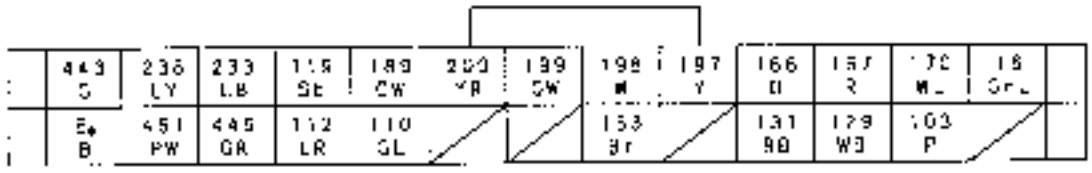
GN52S00002P1
• Tightening torque : 73.5 N·m

10.4.6 RELAY BOX (GG24E00024F1)

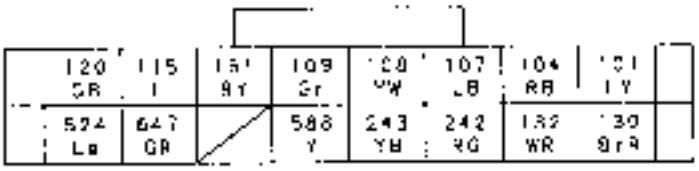
10.4.6.1 ARRANGEMENT OF CONNECTOR



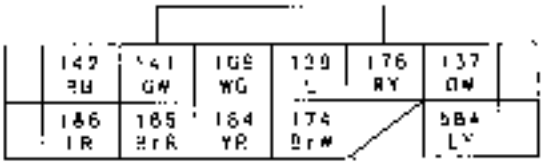




CN-31



CN-32



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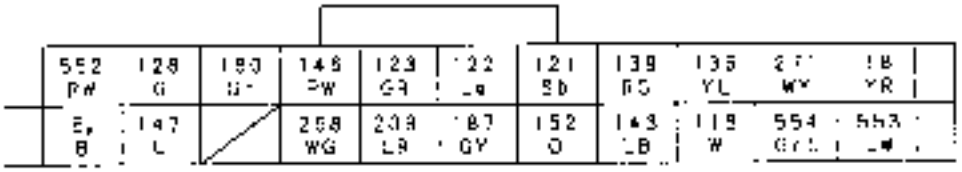
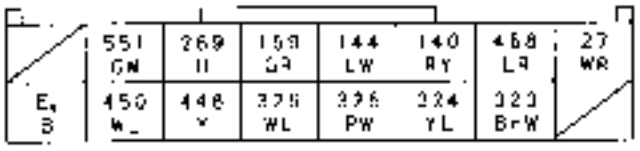
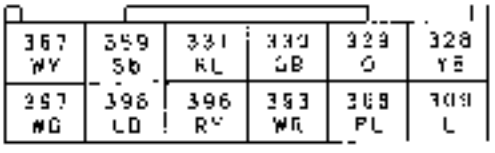


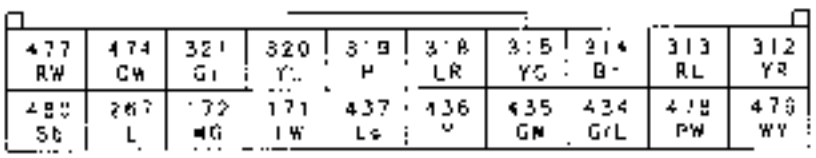
CN-34



CN-35

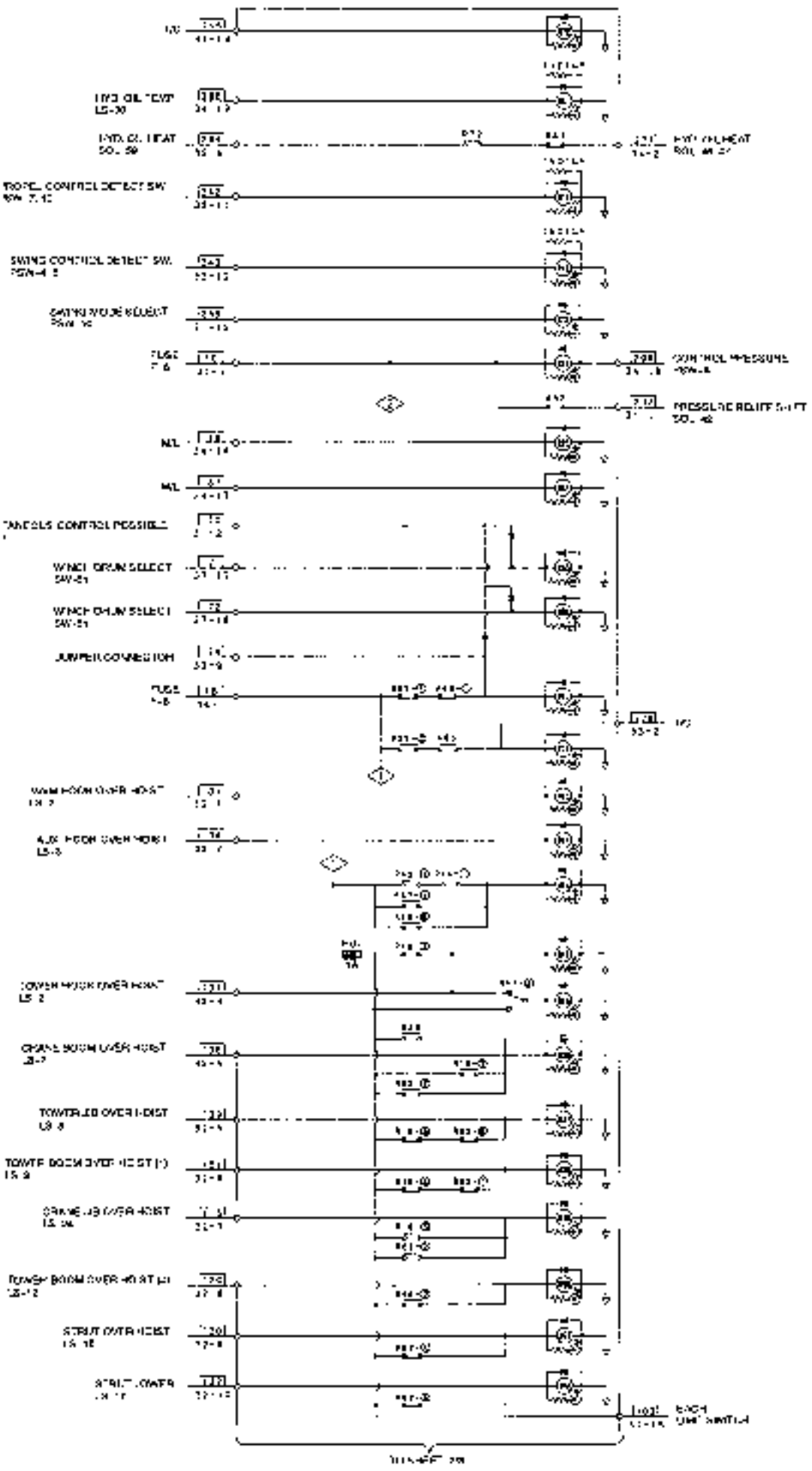


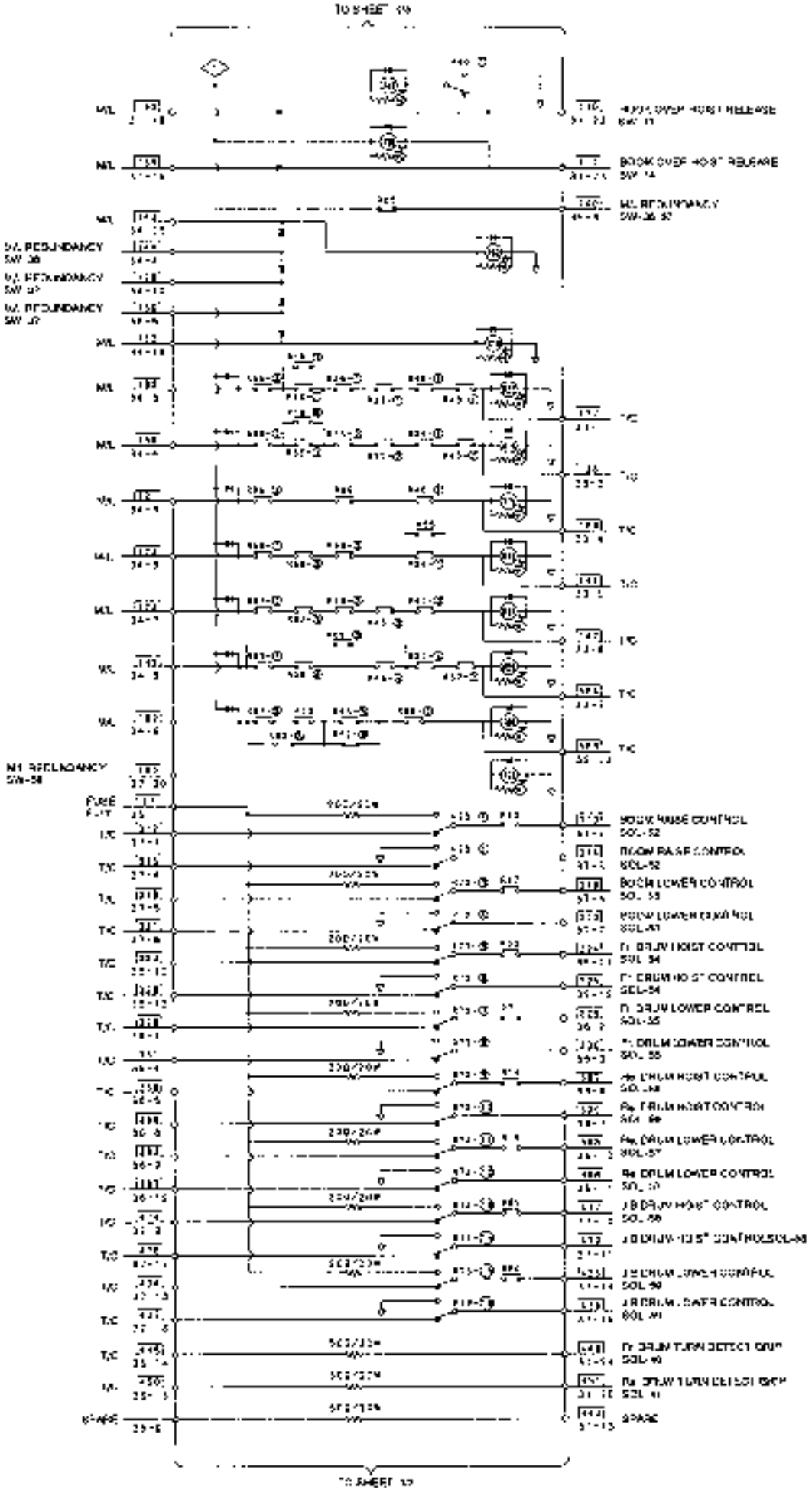
CN-36

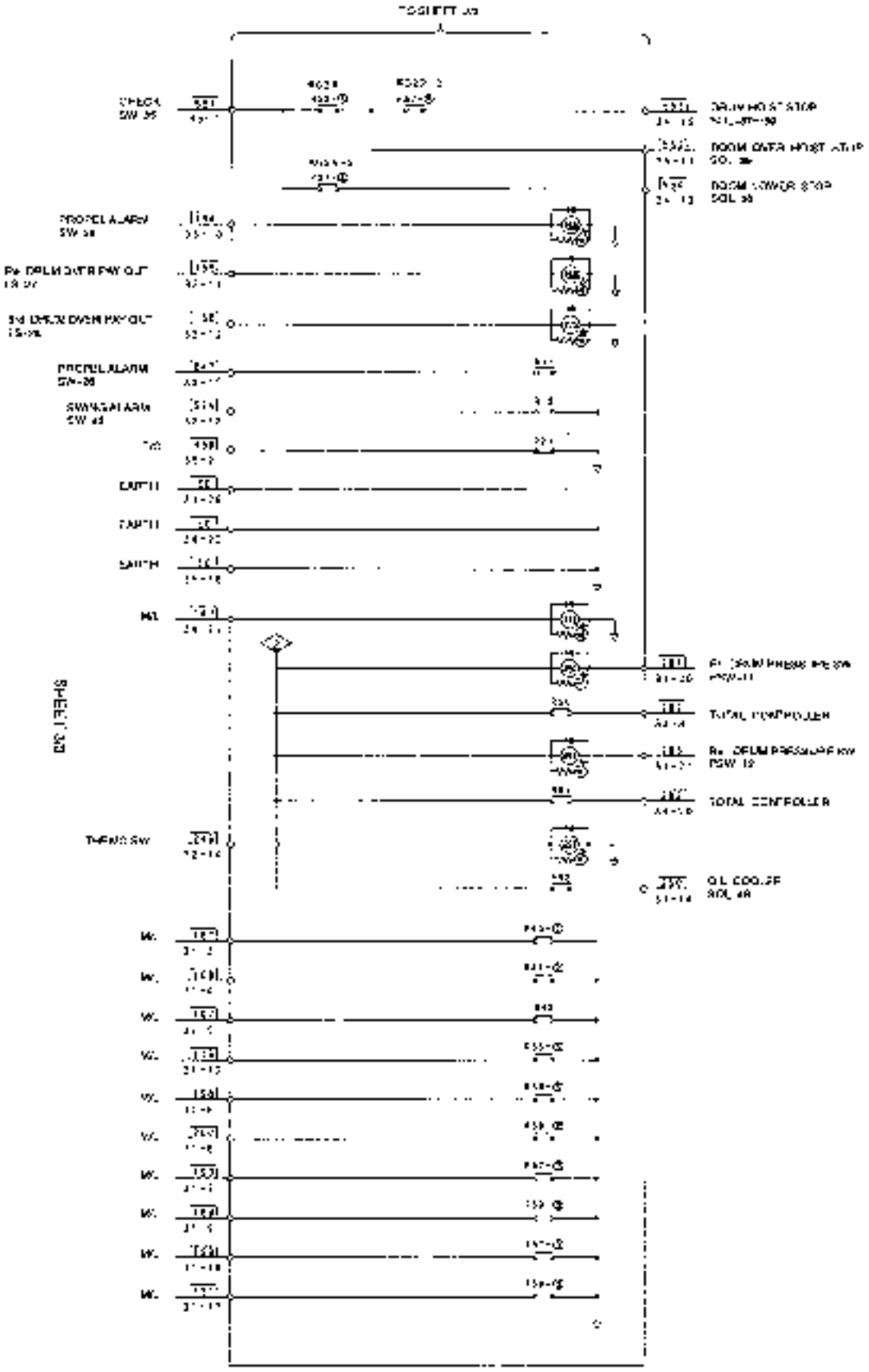


CN-37

10.4.6.2 RELAY BOX SCHEMATIC



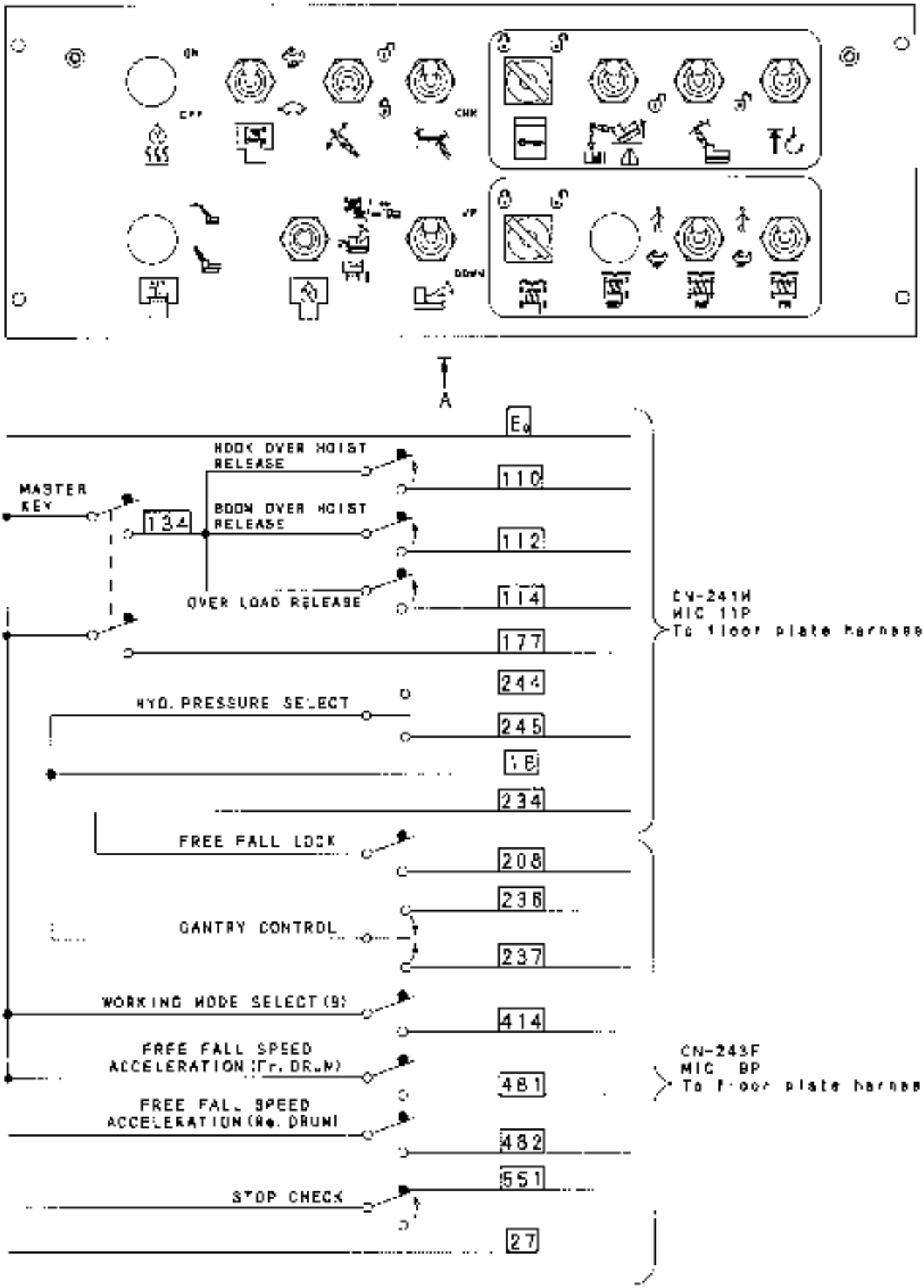




10.4.7 LEFT SIDE STAND PANEL

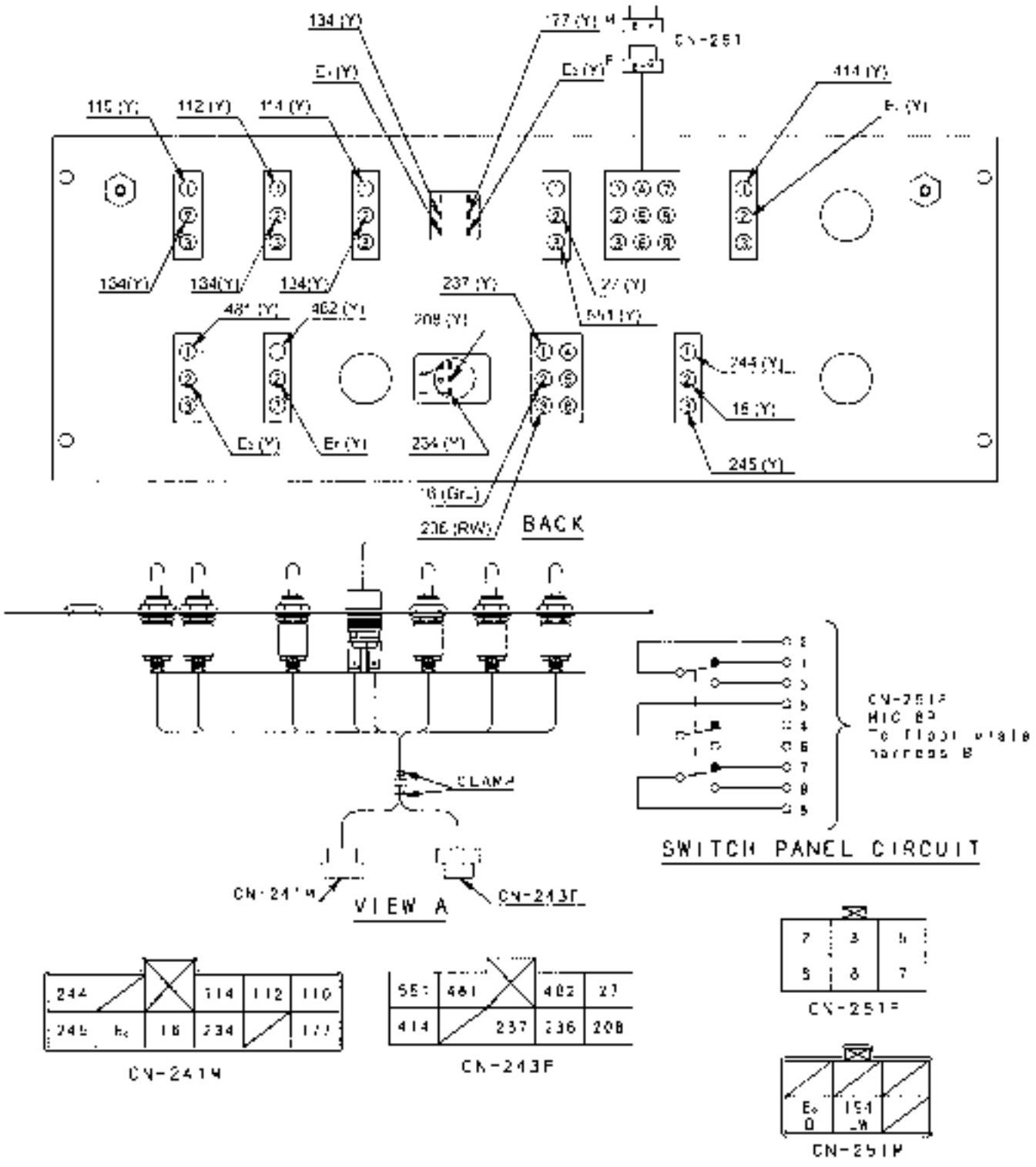
GG17M01050F4 (Free-fall spec.)

CKE1100

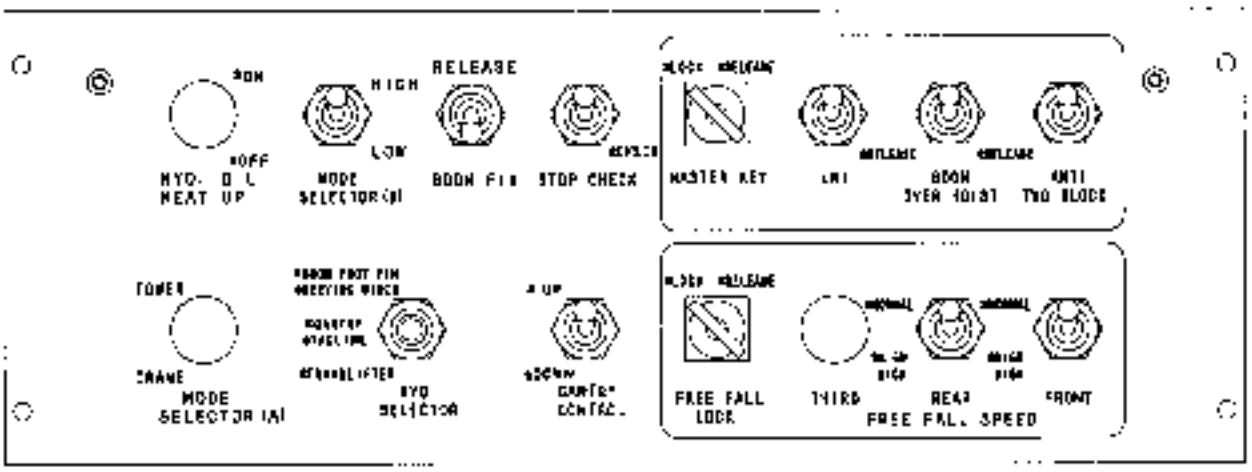


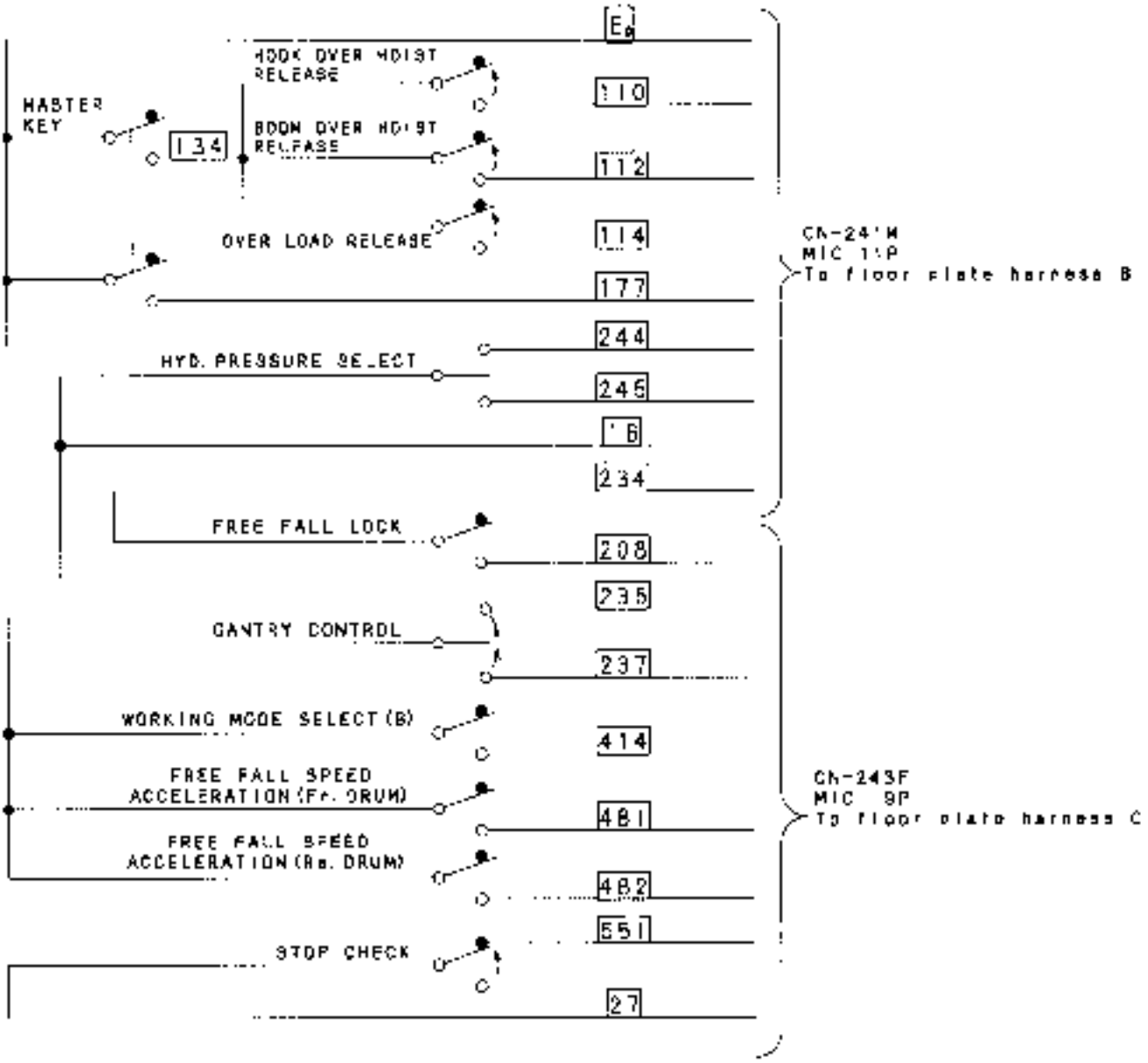
SWITCH PANEL CIRCUIT

CKE1100



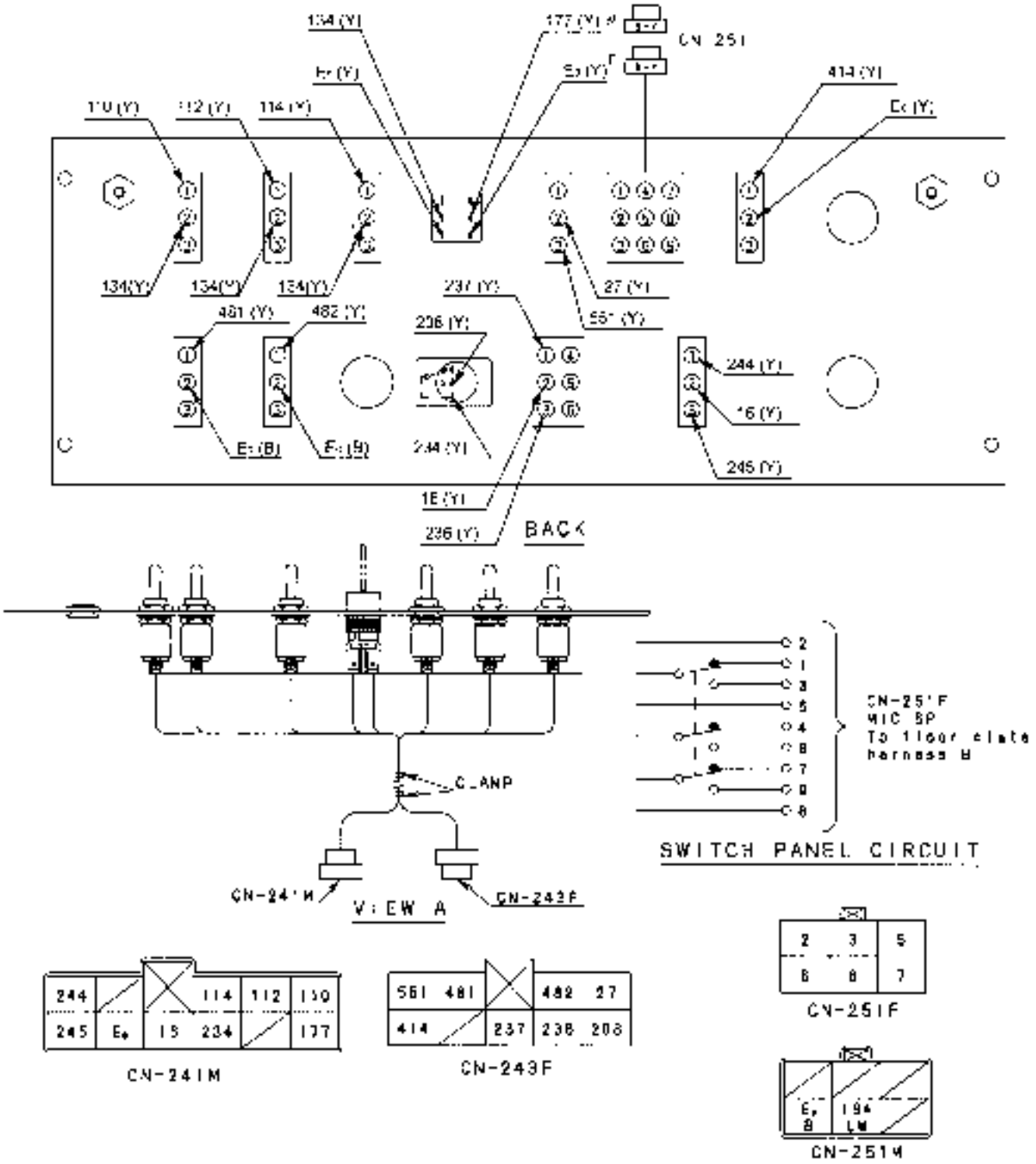
CK1200





SWITCH PANEL CIRCUIT

CK1200



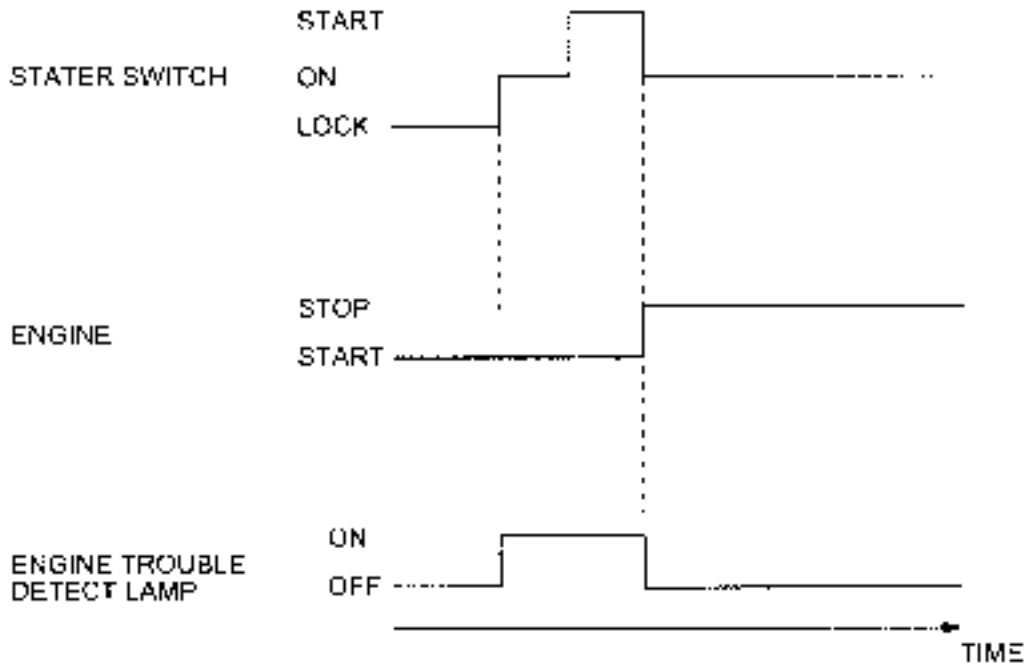
10.5 TROUBLESHOOTING OF EXHAUST GAS THIRD REGULATION ENGINE

10.5.1 FAILURE DIAGNOSIS FUNCTION

ECU always diagnoses whether or not the sensors malfunction while the key switch (M) is turned ON, and it lights on the diagnosis lamp when the sensor is judged as being malfunctioned and restores the place of failure at the same time to inform the operator of abnormality and ECU restricts the injection amount of fuel depending on the failure content.
It is possible to check the place of failure by using the diagnosis lamp or the diagnosis tool via the DST-1 connector.

- Diagnosis lamp status while the key is turned ON
  The lamp lights on when the key is ON (M) and engine is stopped as shown in the following chart.
  When the lamp does not go off even if the engine has been started, promptly stop the engine after avoiding danger because the system may have abnormality.

How to turn off the engine trouble detect lamp

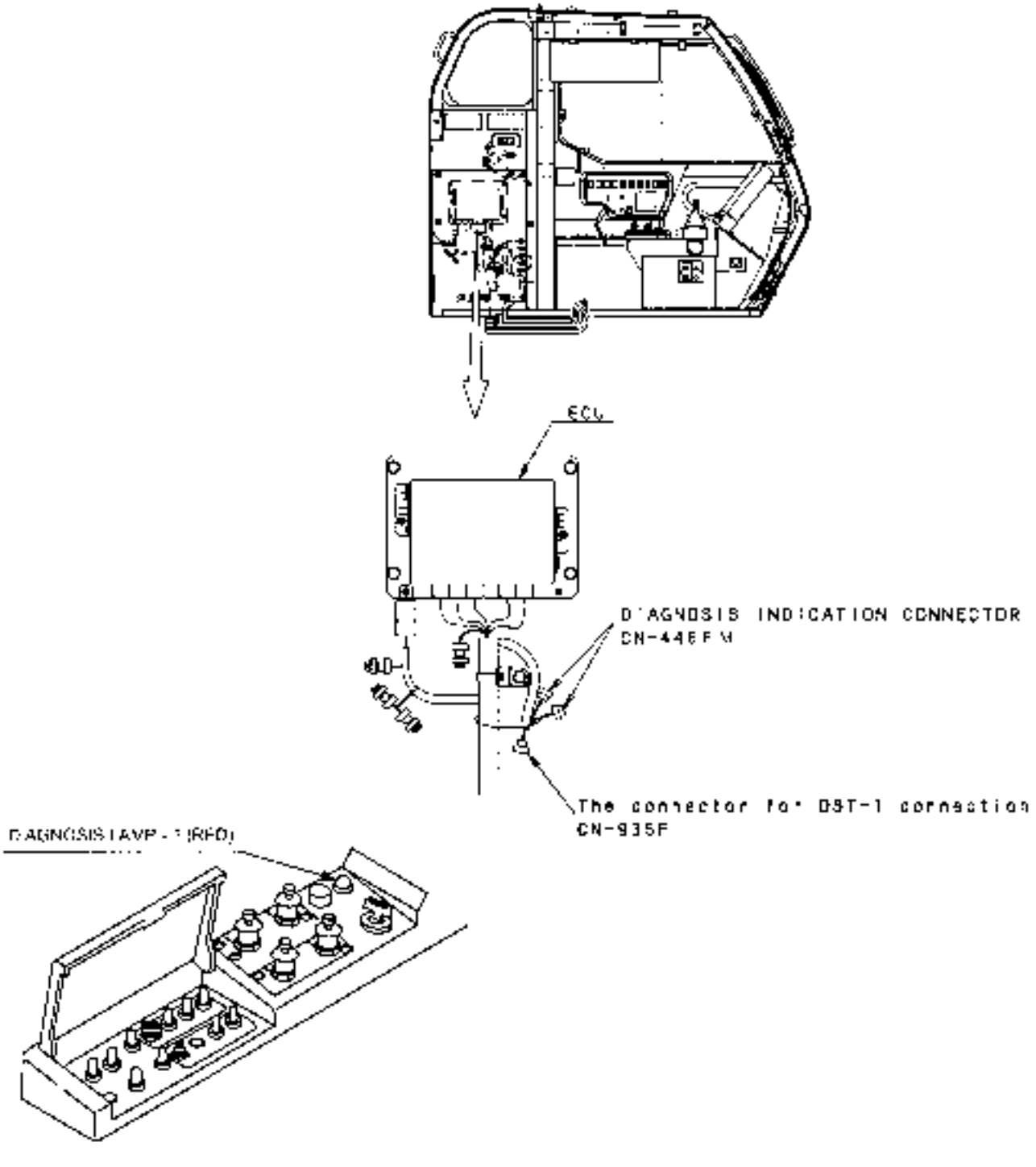


10.5.2 HOW TO CHECK THE FAILURE CONTENTS

When the abnormality is detected by the diagnosis lamp, the diagnosis code can be checked by connecting the diagnosis switch.

(1) Position of the equipment related to the diagnosis

- Position of ECU
- Position of the diagnosis lamp
- Position of the diagnosis switch
- Position of the DST-1 connector



(2) Table of Diagnosis codes

SAE code	System	Diagnosis code	Function	Check lamp ○	Failure criteria	Recovery timing	Injection amount restriction	Action to engine		Remarks
P0217	Sensor systems and their relevant dialogs	5	Overheat	–	Water temperature 115°	Water temperature 107°	Controlled to 75%	Do not stop		
P2228	Sensor systems and their relevant dialogs	15	Atmosphere pressure sensor failure (Lo)	○	Altitude 5000m or higher (less than 50 kPa)	Immediate	Controlled to 75%	Do not stop		
P2229			Atmosphere pressure sensor failure (Hi)	○		Immediate	Controlled to 75%	Do not stop		
P0192	Sensor systems and their relevant dialogs	67	Common rail pressure sensor failure (Lo)	○	< 0.70 V	After IG-OFF	Controlled to 75%	Do not stop		
P0193			Common rail pressure sensor failure (Hi)	○	> 4.70 V	After IG-OFF	Controlled to 75%	Do not stop		
P0191	Sensor systems and their relevant dialogs	67	Common rail pressure sensor failure	○		After IG-OFF	Controlled to 75%	Do not stop		
P0237	Sensor systems and their relevant dialogs	37	Intake pressure (boost pressure) sensor failure (Lo)	○	< 0.20 V	After IG-OFF	Controlled to 75%	Do not stop		
P0108			Intake pressure (boost pressure) sensor failure (Hi)	○	> 4.80 V	After IG-OFF	Controlled to 75%	Do not stop		
P0117	Sensor systems and their relevant dialogs	11	Water temperature sensor failure (Lo)	○	< 0.05 V	Immediate	Controlled to 75%	Do not stop		
P0118			Water temperature sensor failure (Hi)	○	> 4.80 V	Immediate	Controlled to 75%	Do not stop		
P0182	Sensor systems and their relevant dialogs	14	Fuel temperature sensor failure (Lo)	○	< 0.15 V	Immediate	No limitation	Do not stop		
P0183			Fuel temperature sensor failure (Hi)	○	> 4.85 V	Immediate	No limitation	Do not stop		
P2120	Accelerator sensor system	22	Both accelerator sensors failure	○	When 1 and 2 sensors malfunction	After IG OFF	No limitation	Do not stop		Backup function is activated when both sensors malfunction
P2122			Accelerator sensor 1 failure (Lo)	○	< 0.30 V	After IG OFF	No limitation	Do not stop		
P2123			Accelerator sensor 1 failure (Hi)	○	> 4.85 V	After IG OFF	No limitation	Do not stop		
P2127			Accelerator sensor 2 failure (Lo)	○	< 0.30 V	After IG-OFF	No limitation	Do not stop		
P2128			Accelerator sensor 2 failure (Hi)	○	> 4.85 V	After IG-OFF	No limitation	Do not stop		
P2121			Accelerator sensor 1 failure	○		Immediate	No limitation	Do not stop		
P2126			Accelerator sensor 2 failure	○		Immediate	No limitation	Do not stop		
P1130		23	Accelerator sensor by-wire (Hi)	–		After IG OFF	No limitation	Do not stop		
P0335	Rotation sensor system	13	Main rotation sensor failure, both rotation sensors failure	○		Immediate	Controlled to 75%	Do not stop		
P0336			Main rotation sensor pulse error	–		Immediate	No limitation	Do not stop		Controlled to 60 MPa
P0340		12	Sub rotation sensor failure	○		Immediate	No limitation	Do not stop		
P0341			Sub rotation sensor pulse error	–		Immediate	No limitation	Do not stop		
P1266	Supply pump system	77	Supply pump pressure transfer defective	○		After IG-OFF	Controlled to 75%	Do not stop		Output limits the cylinders' accuracy operation which reduces injection to the rail number and large motor fluctuation
P1225		76	Supply pump excessive pressure transfer	○		Immediate	Controlled to 75%	Do not stop		
P0089		56	Common rail excessive high pressure (1st stage)	○		After IG-OFF	Controlled to 75%	Do not stop		
P0088		59	Common rail excessive high pressure (2nd stage)	○		After IG-OFF	Controlled to 75%	Do not stop		
P0629		71	Supply pump solenoid valve 1 failure	○		After IG-OFF	Controlled to 50%	Do not stop		
P0628			Supply pump solenoid valve 1 failure	○		After IG-OFF	Controlled to 50%	Do not stop		
P2634		72	Supply pump solenoid valve 2 failure	○		After IG-OFF	Controlled to 75%	Do not stop		
P2633			Supply pump solenoid valve 2 failure	○		After IG-OFF	Controlled to 75%	Do not stop		

SAE code	System	Diagnosis code	Function	Check lamp On	Failure criteria	Recovery timing	Injection amount restriction	Action of engine		Remarks
P1211	Injector system	57	Injector common 1 failure (GND short circuit)	○		After IG-OFF	No limitation	Do not stop		
P1214		58	Injector common 2 failure (GND short circuit)	○		After IG-OFF	No limitation	Do not stop		
P1212		57	Injector common 1 failure (VB short circuit)	○		Immediate	No limitation	Do not stop		
P1215		58	Injector common 2 failure (VB short circuit)	○		Immediate	No limitation	Do not stop		
P1213		57	Injector common 1 failure (open)	○		Immediate	No limitation	Do not stop		
P1216		58	Injector common 2 failure (open)	○		Immediate	No limitation	Do not stop		
P0201	Injector system	51	Injector 1 disconnection	○		After IG-OFF	No limitation	Do not stop		Output limit is 0% Output limits by the amount which one cylinder does not inject.
P0202		52	Injector 2 disconnection	○		After IG-OFF	No limitation	Do not stop		
P0203		53	Injector 3 disconnection	○		After IG-OFF	No limitation	Do not stop		
P0204		54	Injector 4 disconnection	○		After IG-OFF	No limitation	Do not stop		
P0205		55	Injector 5 disconnection	○		After IG-OFF	No limitation	Do not stop		
P0206		56	Injector 6 disconnection	○		After IG-OFF	No limitation	Do not stop		
P0263	Injector system	61	Correction error #1 between cylinders	–		After IG-OFF	No limitation	Do not stop		
P0266		62	Correction error #2 between cylinders	–		After IG-OFF	No limitation	Do not stop		
P0269		63	Correction error #3 between cylinders	–		After IG-OFF	No limitation	Do not stop		
P0272		64	Correction error #4 between cylinders	–		After IG-OFF	No limitation	Do not stop		
P0275		65	Correction error #5 between cylinders	–		After IG-OFF	No limitation	Do not stop		
P0278		66	Correction error #6 between cylinders	–		After IG-OFF	No limitation	Do not stop		
P0234	Turbo	36	Turbo over boost	○		Immediate	Controlled to 50%	Do not stop		
P0611	ECU main unit system	55	ECU charge circuit defective (Lo)	○		After IG-OFF	Controlled to 50%	Do not stop		
P0200			ECU charge circuit defective (Hi)	○		After IG-OFF	Controlled to 50%	Do not stop		
P0605		3	Flash ROM abnormality	○		Immediate	Controlled to 75%	Do not stop		
P0606			CPU failure (by hardware detection)	○		Immediate	Forced shut down	Stop		
P0607			IC abnormality for monitoring the CPU	○		Immediate	Controlled to 75%	Do not stop		
P1601		2	QR code failure	○		Immediate	No limitation	Do not stop		
P0540	Vehicle system	25	Preheating unit failure	○		Immediate	No limitation	Do not stop		
P0685	Vehicle system	5	Main relay failure	○		Immediate	No limitation	Do not stop		
P0219	Vehicle system	7	Engine overrunning	○	At 100% rating	Immediate	No limitation	Do not stop		
P0617	Vehicle system	45	Starter switch failure	○		Immediate	No limitation	Do not stop		

SAE code	System	Diagnosis code	Function	Check lamp On	Failure criteria	Recovery timing	Injection amount restriction	Action to engine	EGR control	Remarks
P0540	Vehicle system	25	Preheating unit failure	○		Immediate	No limitation	Do not stop	Continue	
P0685	Vehicle system	5	Main relay failure	○		Immediate	No limitation	Do not stop	Continue	
P0219	Vehicle system	7	Engine overrunning	○	At 1500 r/min	Immediate	No limitation	Do not stop	Continue	
P0617	Vehicle system	45	Starter switch failure	○		Immediate	No limitation	Do not stop	Continue	

* How to output the diagnosis codes

1. SAE code : The code is output when the failure is checked by the failure diagnosis. Failure code is displayed for present and past cases. Past failures can be deleted only with the failure diagnosis tool.
2. Diagnosis code ; Blinking times of the engine check lamp is checked. Only the present error is displayed.(Past failures cannot be viewed.)

Note.
When the diagnosis switch is turned OFF (User mode) to check the lighting status of the engine check lamp, the check lamp lights on when the "diagnosis output" failure as mentioned above took place.When the diagnosis switch is turned ON the 2-digit code is displayed by the check lamp's blinking condition.In this case, if no error is generated, the lamp blinks continuously to show that the status is normal.

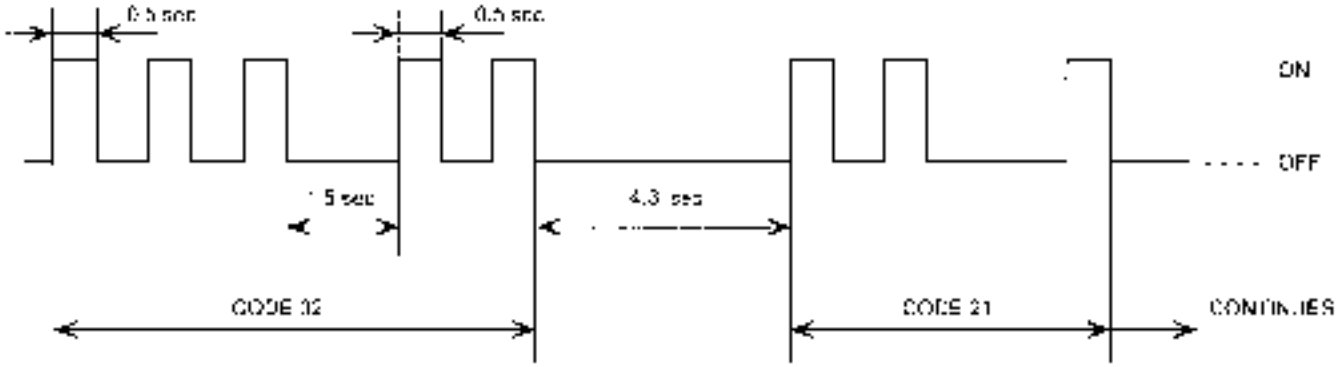
(3) Indication of diagnosis codes

(A) For example, the following chart shows the case when the diagnosis codes 32 and 21 are displayed. The display method is based on the blinking intervals of the lamp. First, the first code makes the lamp light on the figure "3" at the 10's place for 0.5 seconds 3 times and lights on 2 times after 1.5 seconds. Next code display makes the lamp light on 2 + 1 times having 4.3 seconds intervals in the same way as the first code, and afterward this sequence will be repeated.

(B) Usually, the lamp does not light on or blink when the system has no abnormality. At this time, if the diagnosis indication connector is connected, the lamp repeats blinking with 0.3 seconds of light-on duration.

[Example] Display of diagnosis codes

example 1) When codes 32 and 21 are displayed



example 2) Normality displayed

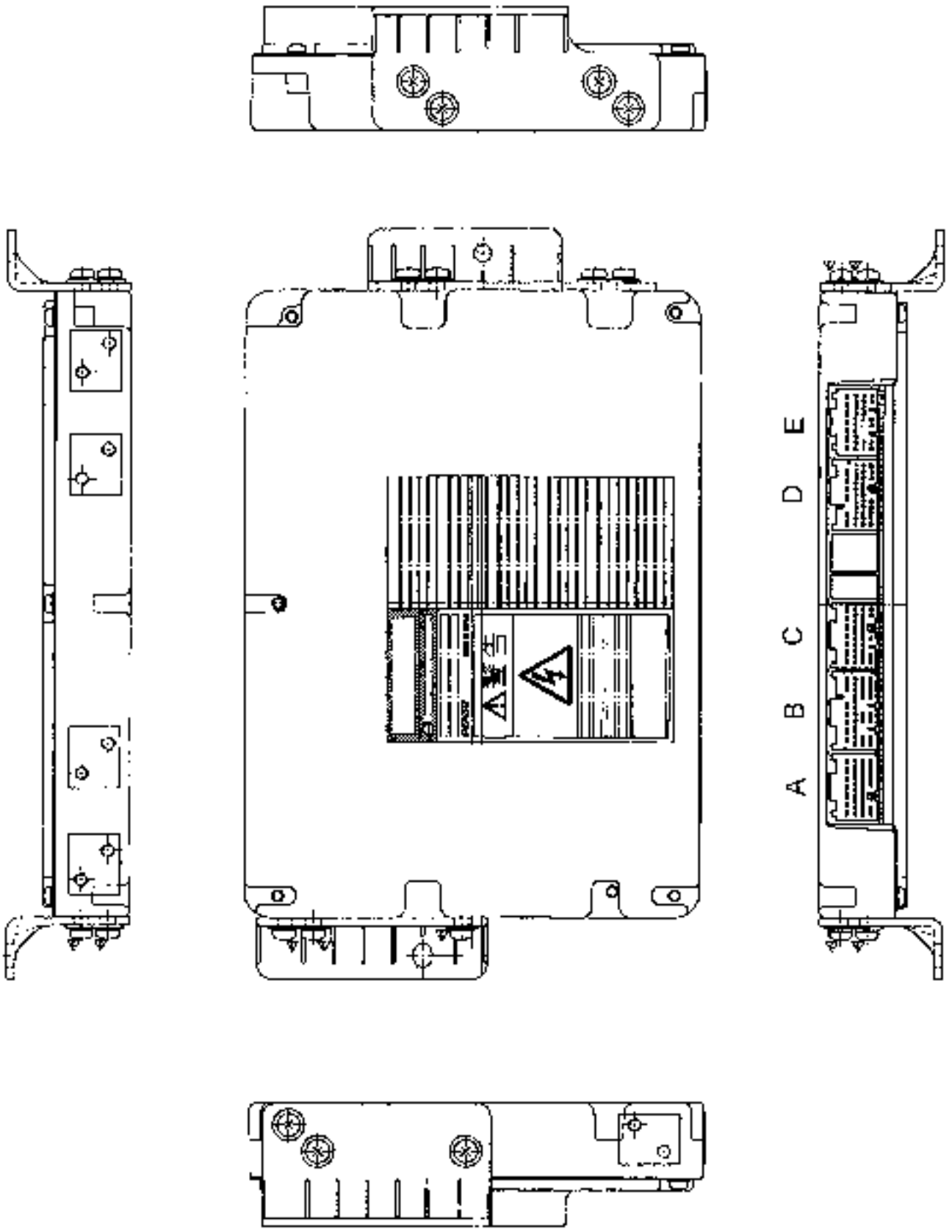
10.5.3 CHECKING BLOWN-OFF DIAGNOSIS LAMPS

The diagnosis lamp is lit up when all the conditions shown below are satisfied

[Requirements for checking blown-off diagnosis lamps]

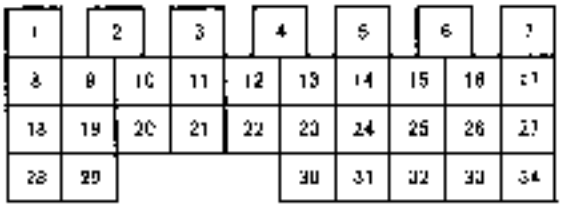
- Engine speed : 0 min⁻¹
- Starter switch : ON
- Diagnosis indication connector (CN-446) : Open
- There should be no fault causing either of the diagnosis lamps to be lit up.

10.5.4 ENGINE ECU

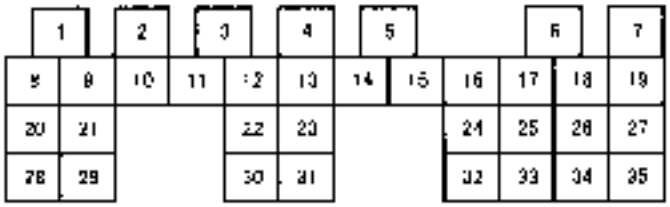


ECU TERMINAL NUMBER

(A)



(B)



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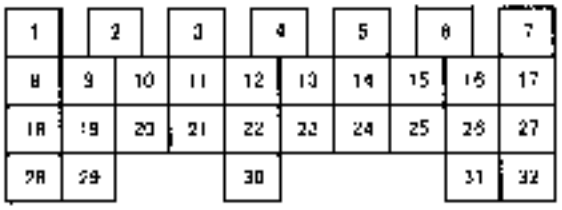
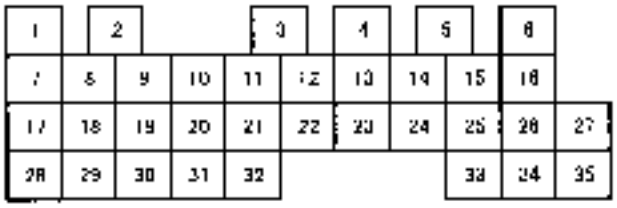
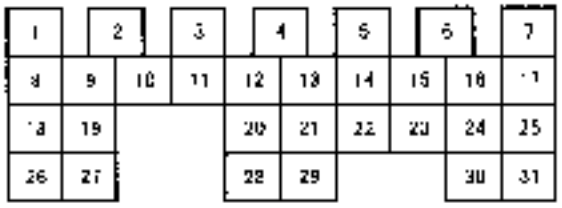


(D)



(E)



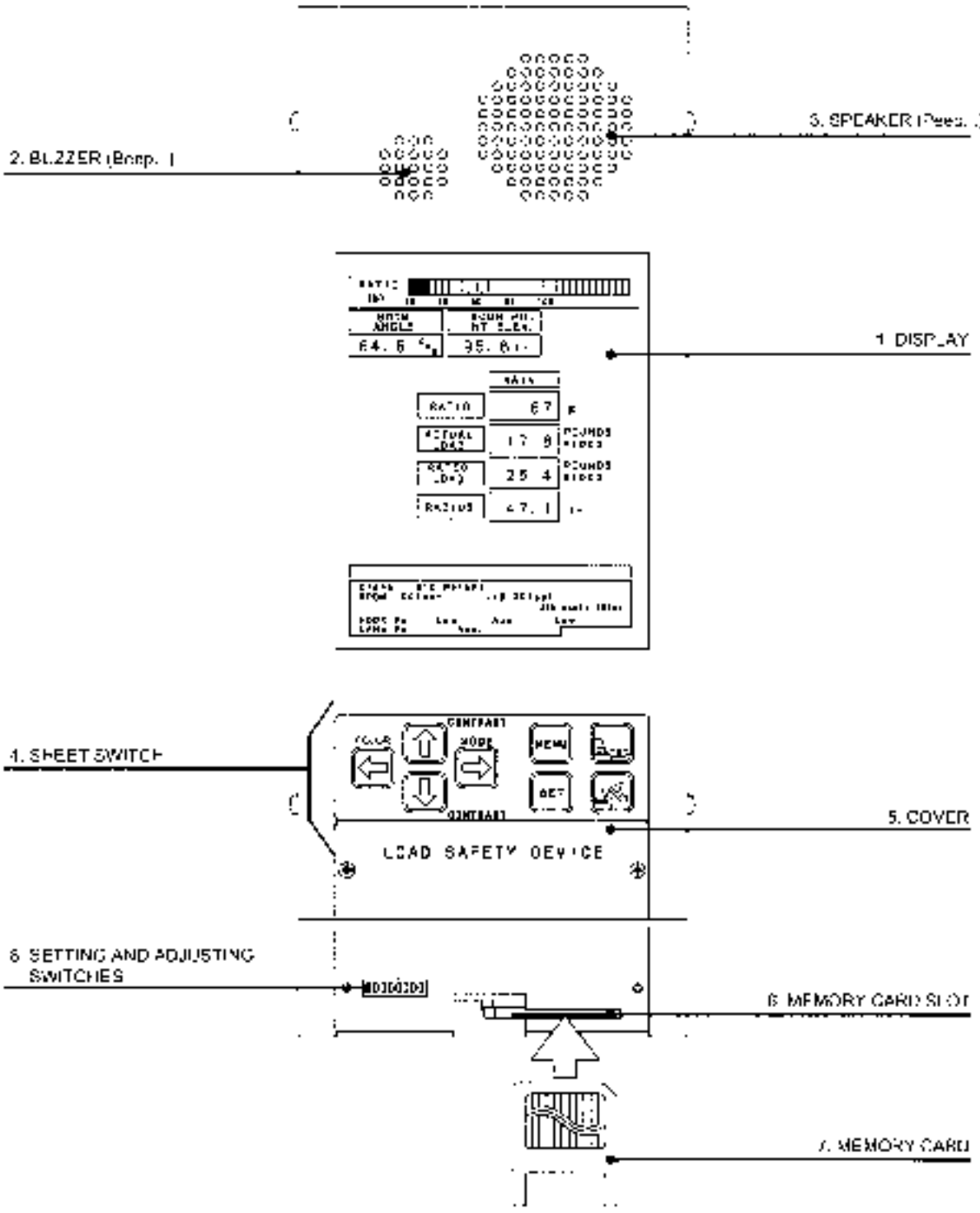
INPUT AND OUTPUT TABLE

Connector A			Connector B			Connector C			Connector D			Connector E		
Terminal number	Terminal code	Description	Terminal number	Terminal code	Description	Terminal number	Terminal code	Description	Terminal number	Terminal code	Description	Terminal number	Terminal code	Description
1	–	–	1	+BF2	+B fly back	1	HRY 1	Heater Relay	1	PGD1	Power system GND1	1	IN#4	Injector
2	–	–	2	–		2	HRY 2	Heater Relay	2	IN#1	Injector	2	IN#6	Injector
3	–	–	3	–	–	3	OGD1	Analog system GND	3	IN#2	Injector	3	IN#5	Injector
4			4	–	–	4	OGD2	Analog system GND	4	IN#3	Injector	4	PGD2	Power system GND2
5	+B	Power supply	5	NESD	Ground for a shielded cable	5	MRL1	ECU main relay	5	I1+	Injector drive power supply 1	5	PGD3	Power system GND3
6	+B	Power supply	6	NE+	NE sensor	6	MRL2	ECU main relay	6	I1+S	Injector drive power supply 1	6	I2+	Injector drive power supply 2
7	+B	Power supply	7	NE-	NE sensor	7	+BF1	+B fly back	7	–	–	7	I2+S	Injector drive power supply 2
8	–	–	8	–	–	8	–	–	8	–	–	8	–	–
9	–	–	9	–	–	9	–	–	9	–	–	9	–	–
10			10			10	–	–	10	–	–	10		
11	–	–	11	–	–	11	–	–	11	–	–	11	–	–
12	–	–	12	SSWS	Key switch	12	–	–	12	–	–	12	–	–
13			13			13	DIAG	Check engine lamp	13	–	–	13	–	–
14	–	–	14	ST	Starter switch	14			14	–	–	14	PCV2	Drive power supply 2
15	–	–	15	–	–	15	–	–	15	–	–	15	PCV2	Drive power supply 2
16			16	STOP	Engine stop switch	16	–	–	16	–	–	16	PCV1	Drive power supply 1
17	–	–	17	–	–	17			17			17	PCV1	Drive power supply 1
18	–	–	18	–	–	18	–	–	18	–	–	18	–	
19	ISOK	DST-1	19	–	–	19	–	–	19	G1+	G sensor	19	THW	Water temperature sensor
20	–	–	20	ACD4	Analog GND4	20	PTO	PTO switch	20	PCR1	Common rail pressure sensor 1	20		
21	ACS1	Accelerator sensor 1	21	ACD5	Analog GND5	21	–	–	21	–	–	21	–	–
22	ACS2	Accelerator sensor 2	22	SWSS	Key switch	22	–	–	22			22	–	–
23	ASOS	Accelerator sensor for operation	23	AVC2	Sensor power supply 2	23	–	–	23	–	–	23	–	–
24	–	–	24	–		24			24	AVC4	Sensor power supply 4	24	–	–
25	–	–	25	–	–	25	–	–	25	AVC1	Sensor power supply 1	25	CASE	Case GND
26			26	–	–	26	–	–	26	–	–	26	THF	Fuel temperature sensor
27	–	–	27			27			27	PIM	Boost sensor	27		–
28	–	–	28	–	–	28	–	–	28	–	–	28	–	–
29			29	–	–	29	–	–	29	–	–	29	–	–
30	–		30			30			30	GGND	G sensor GND	30	–	–
31	–	–	31	–	–	31	–	–	31	PCR2	Common rail pressure sensor 2	31	–	–
32	–	–	32	NUSW	Neutral switch	32	–	–	32	GVCC	G sensor power supply			
33	–	–	33	–	–				33	AGD1	GND for ADC system			
34	–	–	34	DGSW	Diagnosis switch				34	AGD2	GND for ADC system			
			35						35	AGD3	GND for ADC system			

11. LOAD SAFETY DEVICE

11.1 PART NAMES AND FUNCTIONS

11.1.1 FRONT VIEW



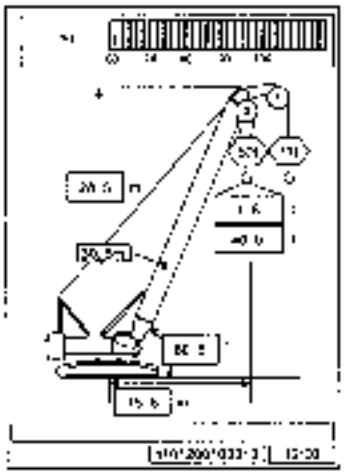
Note

- All numeric values and units in the display in this manual are just examples.
- Units on the display can be changed.
  For details of change procedures, refer to "11.5.7 CHOICE OF LANGUAGE (CKE SERIES ONLY)".

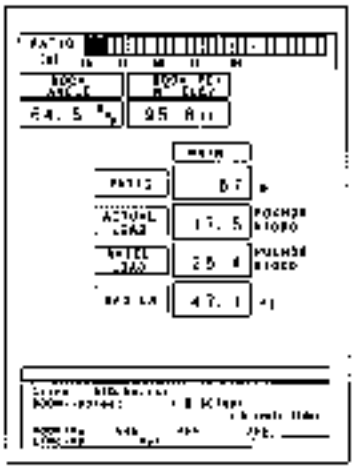
1. DISPLAY

Current status of the crane is displayed

(CKE series)



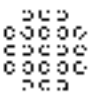
(CK series)



2. BUZZER (beep--)

Warning buzzers mainly related to overload (including load limit warning) are issued. When the moment ratio is 90% or more, intermittent buzzers are issued, and continuous buzzers are issued when it is 100%.

Intervals of intermittent buzzers are divided into three types. As the moment ratio is greater, the intervals of buzzers become shorter.



Buzzer types	Buzzers
Intermittent	beep. beep, beep, ...
Continuous	beep------

3. SPEAKER (peep,peep,peep--)

Overhoist and working area limit warning buzzers are issued. When the boom exceeds the working area limit prenotice point, intermittent buzzers are issued.

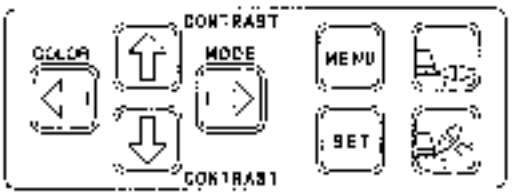
When the boom reaches the working area limit stop point or the hook blocks or boom is overhoisted, continuous buzzers are issued. Intervals of intermittent buzzers are divided into three types. As the boom is closer to the stop point, the intervals of buzzers become shorter.

Buzzer types	Buzzers
Intermittent	peep, peep, peep,.
Continuous	peep------

Note

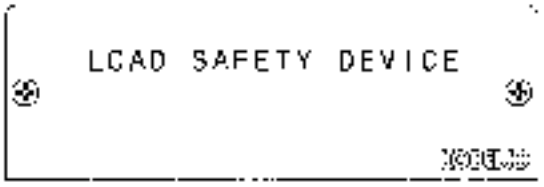
1. Buzzers warning overhoist
   Buzzers warning boom overhoist are issued when the limit switch is actuated. Buzzers warning hook overhoist are issued when the limit switch is actuated to stop the hook blocks, and the winch lever is set to the "WINCH" position or the boom lever is set to the "LOWER" position.
   (No warning buzzer is issued while the levers are set to the "NEUTRAL" positions.)
2. Buzzers warning working area limit
   Unless the prenotice point is set, warning buzzers are issued when the boom reaches the position 5 degree before or 1 feet or 1 m before the stop point.

4. SHEET SWITCH



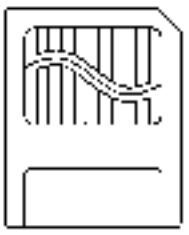
	Use this switch to change the display colors or decrease figures. * To change the colors, depress and hold this switch for three seconds or longer.
	Use this switch to alternate between the MAIN and AUX. modes or increase figures. * To change the current mode, depress and hold this switch for three seconds or longer.
	Use this switch to display the screen (to darken) or select any intended item * To adjust the contrast, depress and hold this switch for three seconds or longer. Then, the brightness of the screen is changed a little every three seconds. To change the brightness extremely, depress and hold it for several tens of seconds.
	Use this switch to display the screen (to brighten) or select any intended item. * To adjust the contrast, depress and hold this switch for three seconds or longer. Then, the brightness of the screen is changed a little every three seconds. To change the brightness extremely, depress and hold it for several tens of seconds.
	Use this switch to display or cancel the list of selected items.
	Use this switch to decide or execute the selected item
	Use this switch to alternate between the assembly/disassembly or operation modes. * To change the current mode, depress and hold this switch for three seconds or longer.
	Use this switch when it is necessary to lower the boom onto the ground at out of angle position (lower limit angle/no rated load) without a load. * Depress and hold this switch for three seconds or longer for cancellation.

5. COVER
DO NOT open unless you need to load the memory card or operate the setting and adjusting switches

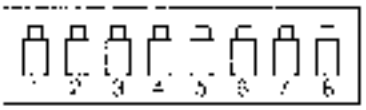


6 MEMORY CARD SLOT
Insert the data memory card here.

7 MEMORY CARD
This card contains the data related to the crane capacity
Insert this card into the data card slot unless otherwise specified



8 SETTING AND ADJUSTING SWITCHES
This switches are used for upgrading of programs or adjustment only
DO NOT touch them unless otherwise absolutely necessary.

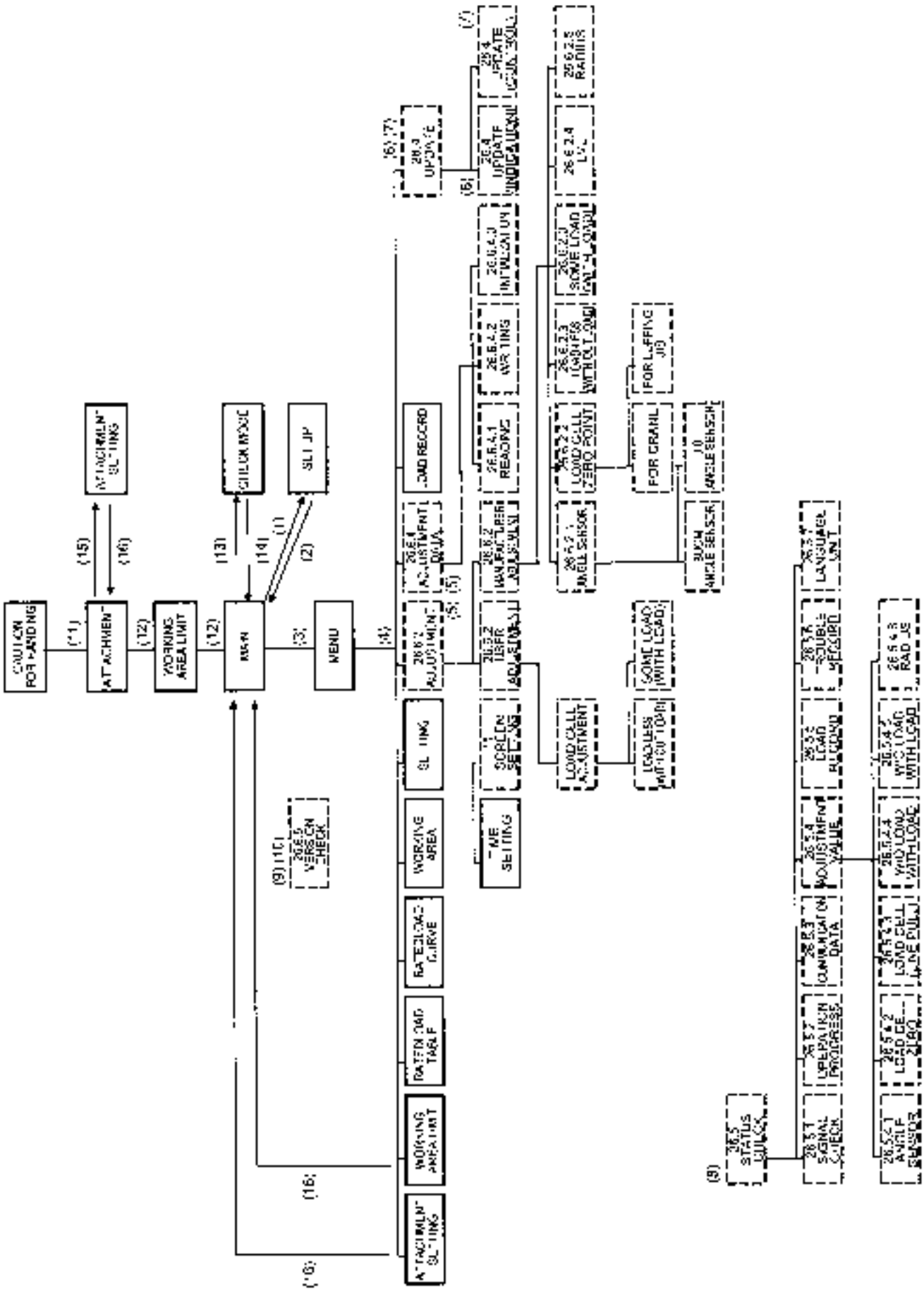


The dip switches are used to make adjustments. The following chart explains the dip switch functions.

Dip switches

Dip switches No.								Function
1	2	3	4	5	6	7	8	
ON	-	-	-	-	-	-	-	Permission of upgrading indication program
-	ON	-	-	-	-	-	-	Permission of upgrading control program
-	-	ON	-	-	-	-	-	Permission of writing adjustment value
-	-	-	ON	-	-	-	-	Display of maintenance screen
-	-	-	-	ON	-	-	-	Making LVL function available
-	-	-	-	-	-	ON	-	None
-	-	-	-	-	ON	-	-	Initialization of load and trouble records

11.1.2 CONFIGURATION OF SCREENS



[Procedures and conditions required for change of screens]

1. When the conditions required for the setup mode are satisfied, press and hold the setup switch for three seconds or longer.

Note

1. The boom angle is 15 deg. or less (in the crane mode)
2. The boom angle is 30 deg. or less (in the luffing crane mode)
3. The boom angle detector is not connected, and the guy line tension is less than regulation value (about 5 t (11,023 lbs)).
4. Neither the boom angle detector nor load detector is connected.

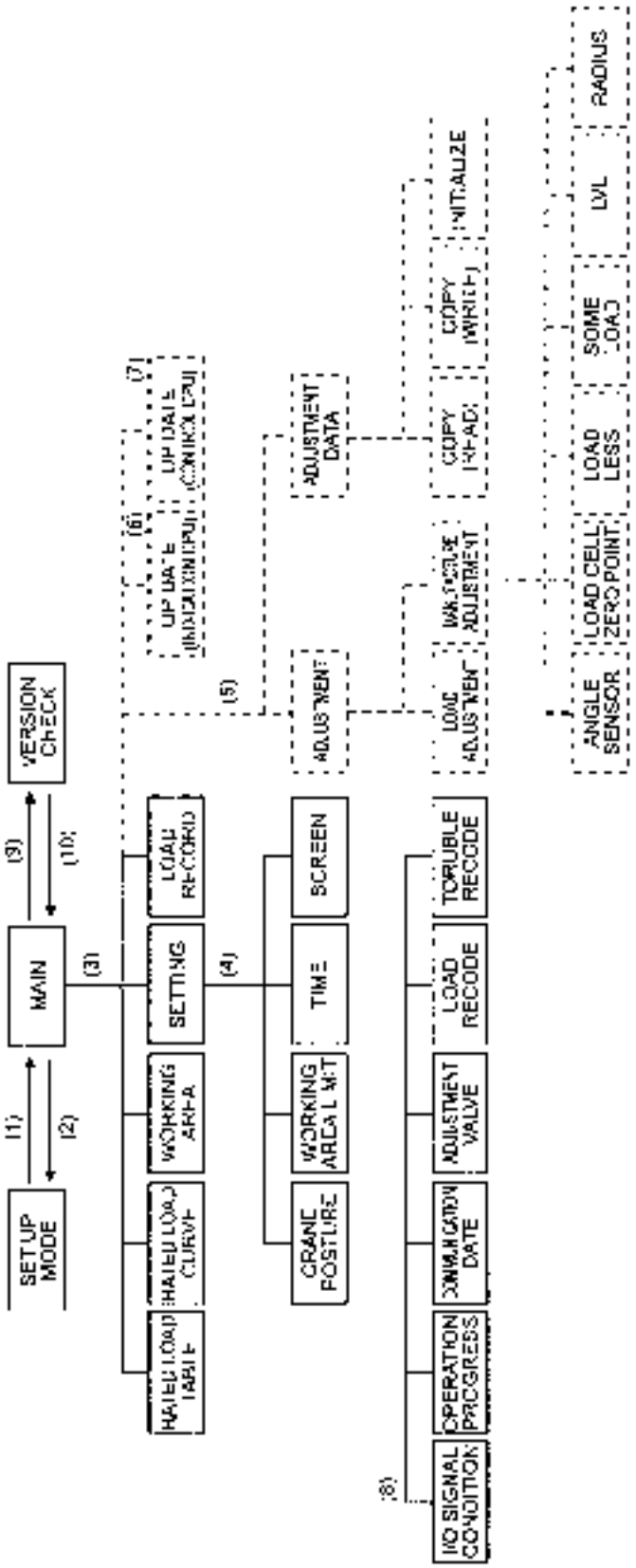
---

2. Press and hold the setup switch for three seconds or longer, or shut down the power supply. Or, fail to satisfy any of the conditions required for the setup mode.
3. When the [SET] switch is pressed, the items are displayed. When any of them is selected with the [SET] switch, screens in the lower category appear.

   When the [SET] switch is pressed again, those in the upper category appear.
4. When any of the items is selected with the [SET] switch, screens in the lower category appear, and those in the upper category appear when the [SET] switch is pressed.
5. When the dip switch No.3 is turned on, they are displayed.
6. When the dip switch No.1 is turned on, they are displayed.
7. When the dip switch No.2 is turned on, they are displayed.
8. When the dip switch No.4 is turned on, they are displayed.
9. Press the [△] and [▽] switches at a time, and hold them for three seconds or longer.
10. In the status (9) above, release the switches.

11. When the SET switch is pressed, the next screen appears.
12. When the OK mark on the screen is selected and the SET switch is pressed, the next screen appears.
13. Only while the SET switch is pressed and held the next screen appears.
14. When the SET switch is released, the next screen appears.
15. When the mark on the screen is selected and the SET switch is pressed, the next screen appears.
16. When the setting is completed, the next screen appears.

[CK series]



[Procedures and conditions required for change of screens]

1. When the conditions required for the setup mode are satisfied, press and hold the setup switch for three seconds or longer.

2. Press and hold the setup switch for three seconds or longer or shut down the power supply. Or, fail to satisfy any of the conditions required for the setup mode.

3. When the [ESC] switch is pressed, the items are displayed. When any of them is selected with the [SET] switch, screens in the lower category appear.

   When the [ESC] switch is pressed again, those in the upper category appear.

4. When any of the items is selected with the [SET] switch, screens in the lower category appear, and those in the upper category appear when the [ESC] switch is pressed.

5. When the dip switch No.3 is turned on, they are displayed.

6. When the dip switch No.1 is turned on, they are displayed.

7. When the dip switch No.2 is turned on, they are displayed.

8. When the dip switch No.4 is turned on, they are displayed.

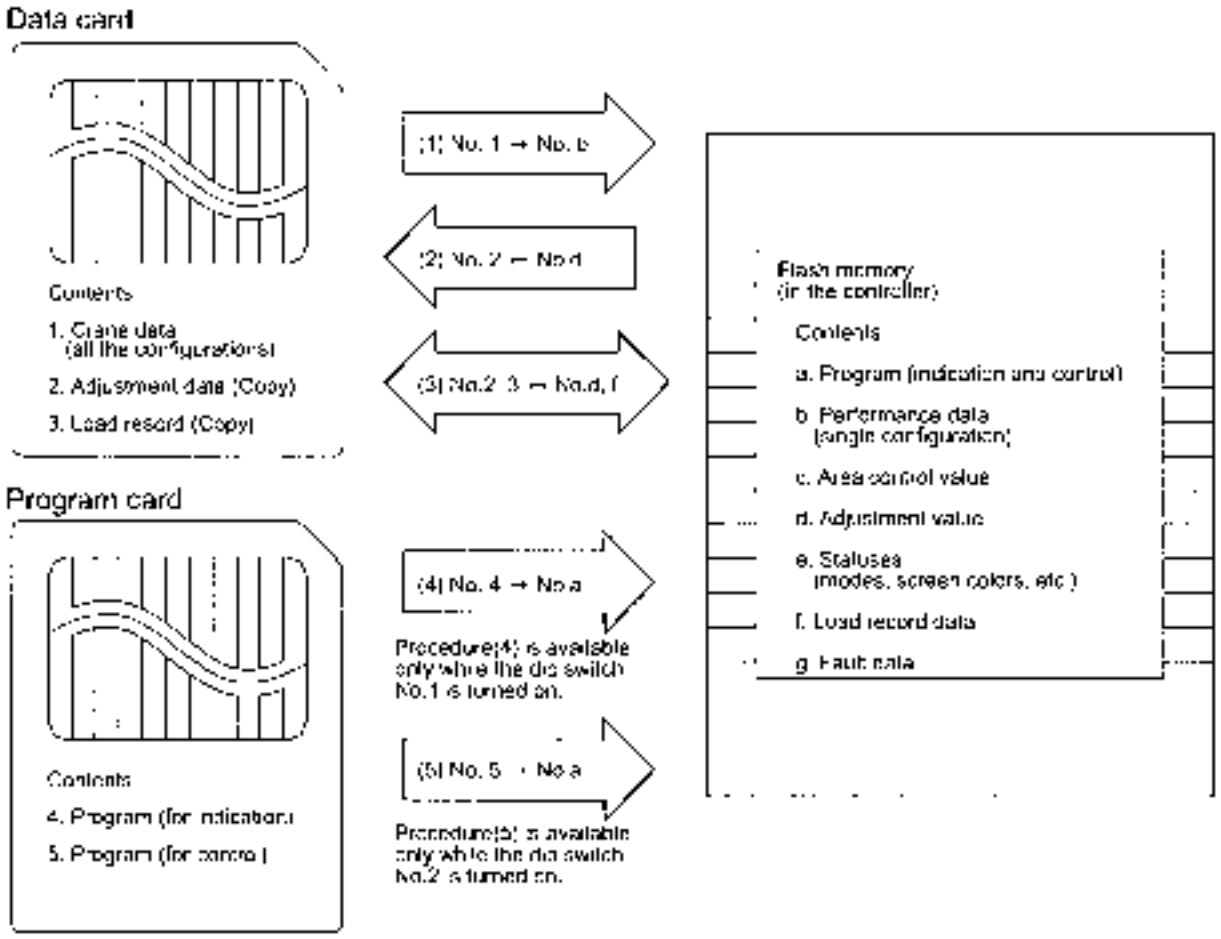
9. Press the [△] and [▽] switches at a time, and hold them for three seconds or longer.

10. In the status (9) above, release the switches.

Note

1. The boom angle is 15 deg. or less (in the crane mode)
2. The boom angle is 30 deg. or less (in the luffing crane mode)
3. The boom angle detector is not connected, and the guy line tension is less than regulation value (about 4.5 t (10,000 lbs)).
4. Neither the boom angle detector nor load detector is connected.

11.1.3 DATA TRANSMISSION BETWEEN CONTROLLER AND CARDS



The data card is loaded in the load safety device normally, and data are transmitted as shown below.

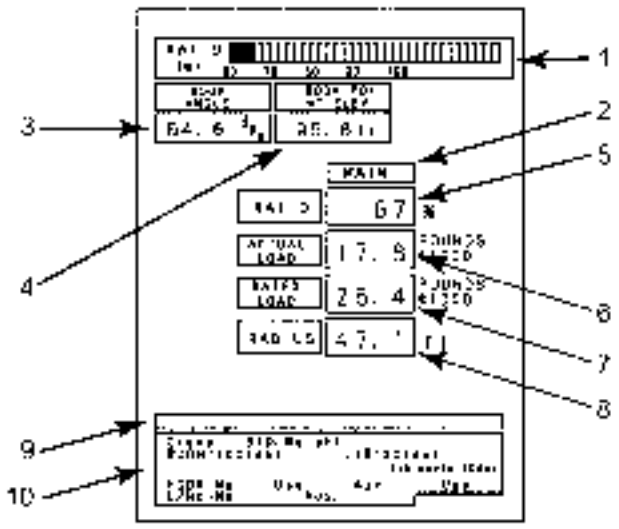
1. Copying crane data
   Crane data for the installed attachment are copied into the flash memory from the data card by carrying out the "crane configuration setup" after the attachment is changed
   (After that, removal of the card will not give any influence on the motion of the machine, since data copied in the flash memory are used for operation.)
2. Copying adjustment value (automatic backup)
   Whenever adjustment is carried out, adjustment values are stored into the flash memory, and used for operation. However, if the controller is malfunctioned and is replaced with a new one, the conventional adjustment values become unavailable, since the flash memory is fixed on the PCB by soldering. Thus, whenever adjustment is performed, data are automatically copied into the data card. If the data card is not loaded, no data is copied, and no display warning it will be provided.

3. Copying adjustment value and history data
   Adjustment values copied during adjustment shown in the step (2) above can be written into the controller by executing out the command. Conventional adjustment values can be used by transferring the copy data that are stored in the data card used into the controller. Arbitrary copying of adjustment values of the controller into the data card and return of adjustment values in the controller to the initial statuses are also available (refer to 11 6.5 VERSION CHECK)
4. Upgrading program for display
   Program for display can be upgraded by turning on the dip switch No.1 and executing the command.
5. Upgrading program for control
   Program for control can be upgraded by turning on the dip switch No.2 and executing the command.

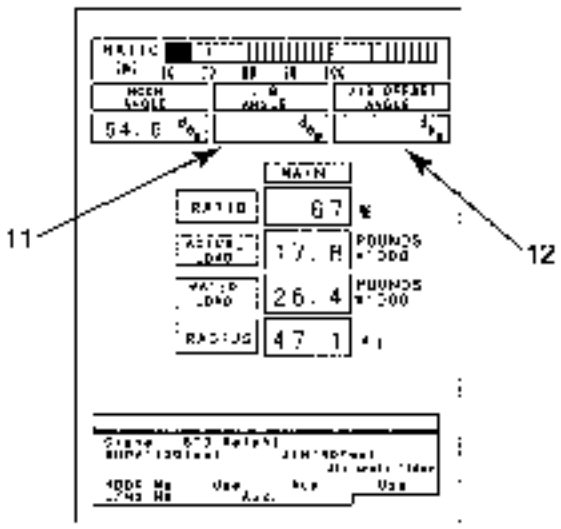
11.1.4 DETAILS OF INDICATORS ON MAIN DISPLAY SCREEN

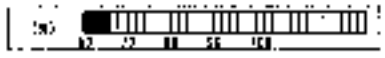
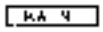
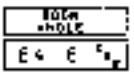
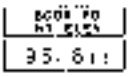
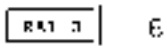
(IN CASE OF CK series)

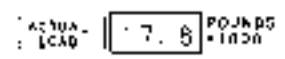
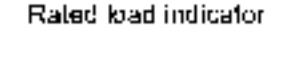
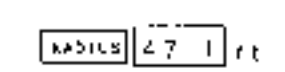
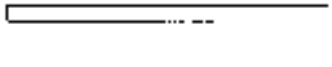
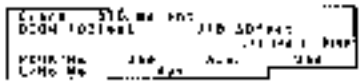
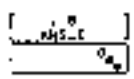
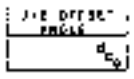
CRANE TYPE



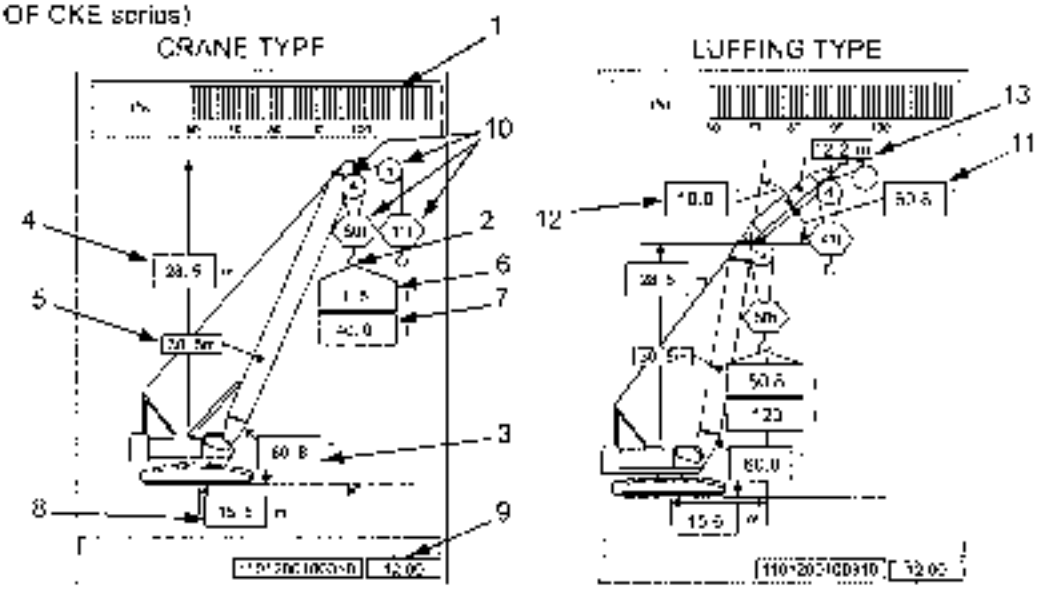
LUFFING TYPE



No	Indicator	Details
1	Moment ratio indicator (bar indicator) 	Moment ratio is indicated from 60 to 126% by the 2% When moment ratio is less than 90%, it is indicated in green color. When it is 90% or more and less than 100%, it is indicated in yellow When it is 100% or more, it is indicated in red.
2	Mode indicator 	After the ⇨ switch is pressed and the "MAIN" or the "AUX" mode is selected, the selected mode is indicated.
3	Boom angle indicator 	Current boom angle is indicated When it is in the range from 0 to 9.9 to 99.9 deg., it is indicated by the 0.1 deg. When it is in the range from -150 to -10 deg., it is indicated by the 1 deg.
4	Point height indicator 	Boom point elevation or jib point elevation is indicated. When it is in the range from -9.9 to 99.9 m, it is indicated by the 0.1 feet When it is in the range from 100 to 999 feet or in the range from -99 to 10 m, it is indicated by the 1.0 feet You can choose whether this item should be displayed or not (Refer to "3.5.1 SETTING SCREEN" of the operation manual)
5	Moment ratio indicator (digital indicator) 	Moment ratio is indicated from 0 to 200% by the 1 %

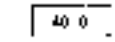
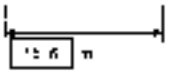
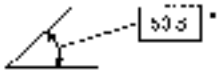
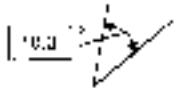
No.	Indicator	Details
6	Actual load indicator 	Actual load is indicated. When it is out of the working area, "—" is indicated When it is 0 pounds X 1000, "0.0" is indicated. When it is in the range from 0 to 100 pounds X 1000, it is indicated in 0.1 pounds X 1000. When it is in the range from 100 to 999 pounds X 1000, it is indicated in 1.0 pounds X 1000
7	Rated load indicator 	Rated load is indicated. When it is out of the working area, "0.0" is indicated When it is in the range from 0 to 100 pounds X 1000, it is indicated in 0.1 pounds X 1000. When it is in the range from 100 to 999 pounds X 1000, it is indicated in 1.0 pounds X 1000.
8	Working radius indicator 	Working radius is indicated. When it is in the range from 0 to 100 feet, it is indicated in 0.1 feet. When it is in the range from 100 to 999 feet, it is indicated in 1.0 feet
9	Message indicator 	Messages for hazardous or faulty statuses are indicated For the types and details of the messages, refer to "3.11 INDICATION OF MESSAGE AND ALARM" of the operation manual.
10	Crane configuration indicator 	The detailed settings of the crane configuration are displayed. For the settings, refer to "3.6.2 SETTING OF THE CRANE CONFIGURATION" of the operation manual
11	Jib angle indicator 	Luffing jib angle is indicated. When it is in the range from -9.9 to 99 deg., it is indicated by the 0.1 deg. When it is in the range from -150 to 10 deg., it is indicated by the 1.0 deg.
12	Jib offset angle indicator 	Jib offset angle is indicaged. When it is in the range from -9.9 to 99 deg., it is indicated by the 0.1 deg. When it is in the range from -99 to -10 deg., it is indicated by the 1.0 deg. * This indicator cannot be displayed together with the point height indicator at a time.

(IN CASE OF CKE series)



* The indicating units depend on the choice done in the steps described in "11.5.7 CHOICE OF LANGUAGE (CKE SERIES ONLY)".

No.	Indicator	Details
1	Moment ratio indicator (bar indicator) 	Moment ratio is indicated from 60 to 126% by the 2%. When moment ratio is less than 90%, it is indicated in green color. When it is 90% or more and less than 100%, it is indicated in yellow. When it is 100% or more, it is indicated in red.
2	Mode indicator 	When the switch is pressed, the mode changes. The actual load and rated load of the hook at the selected side are displayed.
3	Boom angle indicator 	Current boom angle is indicated. When it is in the range from 0 to 9.9 to 99.9 deg., it is indicated by the 0.1 deg. When it is in the range from -150 to -10 deg., it is indicated by the 1 deg.
4	Point height indicator 	Boom point elevation or jib point elevation is indicated. When it is in the range from -9.9 to 99.9 m, it is indicated by the 0.1 m. When it is in the range from 100 to 999 m or in the range from -99 to 10 m, it is indicated by the 1.0 m.
5	Boom length indicator 	The selected boom length is displayed.

No.	Indicator	Details
6	Actual load indicator 	Actual load is indicated. When it is out of the working area, "---" is indicated When it is 0 t, "0.0" is indicated. When it is in the range from 0 to 100 t, it is indicated in 0.1 t. When it is in the range from 100 to 999 t, it is indicated in 1.0 t.
7	Rated load indicator 	Rated load is indicated. When it is out of the working area, "0.0" is indicated. When it is in the range from 0 to 100 t, it is indicated in 0.1 t. When it is in the range from 100 to 999 t, it is indicated in 1.0 t.
8	Working radius indicator 	Working radius is indicated. When it is in the range from 0 to 100 m, it is indicated in 0.1 m. When it is in the range from 100 to 999 m, it is indicated in 1.0 m
9	Message indicator	Messages for hazardous or faulty statuses are indicated For the types and details of the messages, refer to "3.11 INDICATION OF MESSAGE AND ALARM" of the operation manual
10	Hook, number of part lines 	The selected type and number of part lines of the hook are displayed.
11	Jib angle indicator 	Luffing jib angle is indicated. When it is in the range from -9.9 to 99 deg., it is indicated by the 0.1 deg. When it is in the range from -150 to 10 deg., it is indicated by the 1.0 deg.
12	Jib offset angle indicator 	Jib offset angle is indicated. When it is in the range from -9.9 to 99 deg., it is indicated by the 0.1 deg. When it is in the range from -99 to -10 deg., it is indicated by the 1.0 deg. * This indicator cannot be displayed together with the point height indicator at a time.
13	Jib length 	The selected jib length is displayed

11.1.5 REAR VIEW

1. Controller instal ation holes
   Use 0.59 inch (15 mm) screws (M6) for mounting.
2. CN11M . Power input connector
3. CN12AM : Load Detector (1 to 4) input connector
   Load Detector output .s between 1 and 5 volts.
4. CN12BM : Load Detector (5 to 7) input connector
5. CN13M : Angle Detector (1 to 3) input connector
6. CN14M : Angle Detector (4 to 5) input connector
7. CN15M : Digital input connector
8. CN16M : Digital output connector
9. CN17M ; Analogue output connector
10. CN18M : Communication connector

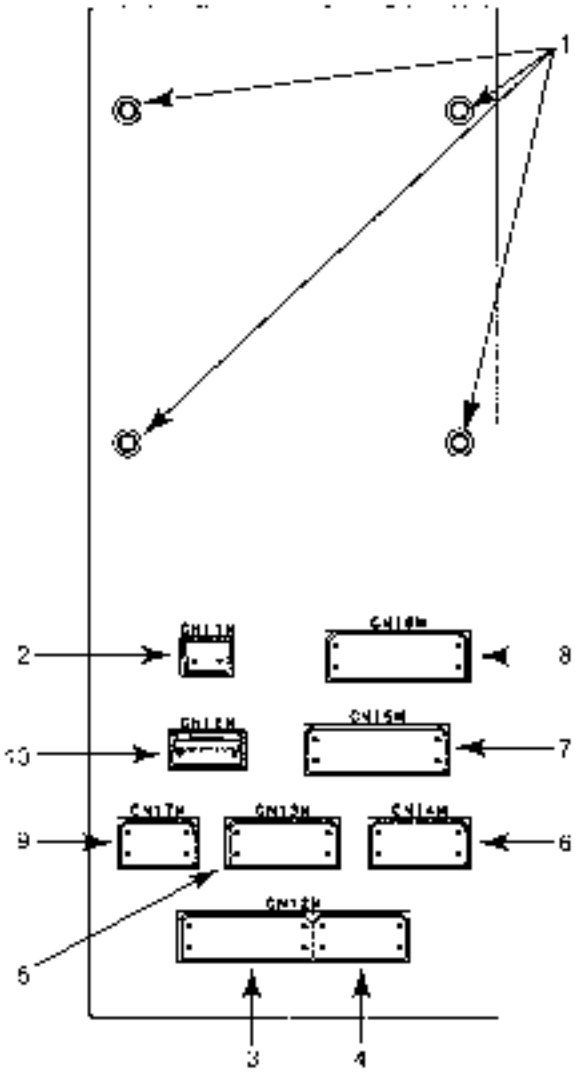


Chart1. System Input/Output, Connector Designations

Connector No.	Pin No	Signals	Functions	
CN1*M	1	Power supply	Power supply (+24 V)	Power supply
	2		Power supply for output signal (+24 V)	
	3		Grounding	
CN12AM (18 poles)	1	Load detector 1	Power supply (+10 V)	Boom raising load detector
	2		Signal (+)	
	3		Power supply grounding & signal grounding	
	4		Shield grounding	
	5	Load detector 2	Power supply (+10 V)	Spare load detector 1
	6		Signal (+)	
	7		Power supply grounding & signal grounding	
	8		Shield grounding	
	9	Load detector 3	Power supply (+10 V)	Spare load detector 2
	10		Signal (+)	
	11		Power supply grounding & signal grounding	
	12		Shield grounding	
	13	Load detector 4	Power supply (+10 V)	Luffing jib load detector (Luffing only)
	14		Signal (+)	
	15		Power supply grounding & signal grounding	
	16		Shield grounding	
	17	Vacant		
	18			
CN13M (12 poles)	1	Load detector 5	Power supply (+10 V)	Spare load detector 3
	2		Signal (+)	
	3		Power supply grounding & signal grounding	
	4		Shield grounding	
	5	Load detector 6	Power supply (+10 V)	Spare load detector 4
	6		Signal (+)	
	7		Power supply grounding & signal grounding	
	8		Shield grounding	
	9	Load detector 7	Power supply (+10 V)	Spare load detector 5
	10		Signal (+)	
	11		Power supply grounding & signal grounding	
	12		Shield grounding	
CN13M	1	Angle detector 1	Power supply (+10 V)	Boom angle detector
	2		Signal (+)	
	3		Power supply grounding & signal grounding	
	4		Shield grounding	
	5	Angle detector 2	Power supply (+10 V)	Spare angle detector 1
	6		Signal (+)	
	7		Power supply grounding & signal grounding	
	8		Shield grounding	
	9	Angle detector 3	Power supply (+10 V)	Luffing jib angle detector (Luffing only)
	10		Signal (+)	
	11		Power supply grounding & signal grounding	
	12		Shield grounding	
	13	Vacant		
	14			
CN14M	1	Angle detector 4	Power supply (+10 V)	Spare angle detector 2
	2		Signal (+)	
	3		Power supply grounding & signal grounding	
	4		Shield grounding	
	5	Angle detector 5	Power supply (+10 V)	Spare angle detector 3
	6		Signal (+)	
	7		Power supply grounding & signal grounding	
	8		Shield grounding	

Chart2. System Input/Output, Connector Designations

Connector No.	Pin No.	Signals	Functions	
CN15M	1	Contact point input	Final switch signal	Main hook overhoist
	2			Aux. hook overhoist
	3			Tower hook overhoist (Not used)
	4			Boom overhoist (Backstop 1) (Luffing only)
	5			Boom overhoist (Crane)
	6			Boom overhoist (Backstop 2)
	7			Luffing jib overhoist (Luffing only)
	8			Fixed jib overhoist (Not used)
	9		Release switch signal Reset switch signal Others	Hook overhoist stop release
	10			Boom and jib stop release
	11			Overload stop release
	12			Release switch master key
	13			Boom tilt (Luffing only)
	14			Gantry tilt detect (Not used)
	15			Strut overhoist (Not used)
	16			Strut overlowering (Not used)
	17			Counterweight detect 1 (Option)
	18			Counterweight detect 2 (Option)
	19			Spare
	20			Gantry cylinder detect (Not used)
CN16M	1	Contact point output	Drum also output	Front drum winch up
	2			Rear drum winch up
	3			Rear drum winch down
	4			Boom drum winch up
	5			Boom drum winch down
	6			Self removal mode
	7			Spare
	8			Third (Jib) drum winch up
	9			Third (Jib) drum winch down
	10		Others	Boom raising deceleration
	11			Tower jib raising deceleration (Not used)
	12			Tower standby mode (Not used)
	13			Luffing mode (Luffing only)
	14			Tower mode (Not used)
	15			Set up mode
	16			Luffing jib raising deceleration (Luffing only)
	17		External indication output	External indication (Green)
	18			External indication (Yellow)
	19			External indication (Red)
	20		CPU fault signal output	CPU fault
CN17M	1	Analogue output	Tension	Tension (+) (Not used)
	2			Tension (-) (Not used)
	3		Boom angle	Boom angle (+) (Not used)
	4			Boom angle (-) (Not used)
	5		Jib offset angle	Jib offset angle (+) (Not used)
	6			Jib offset angle (-) (Not used)
	7	Vacant	-	-
	8		-	-
CN18M	1	RS232C	RXD (1)	Communication with total controller
	2		TXD (1)	
	3		GND (1)	
	4		RXD (2)	Spare
	5		TXD (2)	
	6		GND (2)	

Chart3. System Input/Output (Digital Input)

Signals	Operations		
1) Main hook overhoist	Grounded	→	Normal
	Open	→	Hook overhoisted (Anti two block)
2) Aux. hook overhoist	Grounded	→	Normal
	Open	→	Hook overhoisted (Anti two block)
3) Tower hook overhoist (Not used)	Grounded	→	Normal
	Open	→	Hook overhoisted (Anti two block)
4) Boom overhoist (Selection for lifting only)	Grounded	→	Normal
	Open	→	Boom overhoisted
5) Boom overhoist (Crane)	Grounded	→	Normal
	Open	→	Boom overhoisted
6) Boom overhoist (Backstop 2)	Grounded	→	Normal
	Open	→	Boom overhoisted
7) Luffing jib overhoist (Luffing only)	Grounded	→	Normal
	Open	→	Jib overhoisted
8) Fixed jib overhoist (Not used)	Grounded	→	Normal
	Open	→	Jib overhoisted
9) Hook overhoist stop release	Grounded	→	Release of automatic stop caused by hook overhoist
	Open	→	Non-release
10) Boom and jib stop release	Grounded	→	Release of automatic stop caused by boom overhoist
	Open	→	Non-release
11) Overload stop release	Grounded	→	Release of automatic stop caused by overload
	Open	→	Non-release
12) Release switch master key	Grounded	→	Releasable
	Open	→	Unreleasable
13) Boom tilt (Luffing only)	Grounded	→	Fixed
	Open	→	Released
14) Gantry tilt lock detect (Not used)	Grounded	→	Gantry fixed tilt is not connected
	Open	→	Gantry fixed tilt is connected
15) Strut overhoist (Not used)	Grounded	→	Normal
	Open	→	Strut overhoisted
16) Strut overlowering (Not used)	Grounded	→	Normal
	Open	→	Strut overhoisted
17) Counterweight detect 1 (Option)	Grounded	→	With weights
	Open	→	Without weight
18) Counterweight detect 2 (Option)	Grounded	→	With weights
	Open	→	Without weight
19) Spare			
20) Gantry cylinder detect (Not used)	Grounded	→	Cylinder is contacted gantry
	Open	→	Cylinder is not contacted gantry

Chart4. System Input/Output (Digital Output)

	Signals	Operations			Remarks
1)	Front drum winch up				
2)	Rear drum winch up	Power is turned	→	Open	
3)	Rear drum winch down	Safety area	→	Output	
4)	Boom drum winch up	Hazardous area	→	Open	
5)	Boom drum winch down				
6)	Self removal mode	Self removal mode	→	Output	
		Others	→	Open	
7)	Spare				
8)	Third crane winch up	Power is turned OFF	→	Open	
9)	Third crane winch down	Safety area	→	Output	
		Hazardous area	→	Open	Contact capacity
10)	Boom swing deceleration	Deceleration area	→	Output	2.5 A 30 VDC
11)	Tower jib raising deceleration (Not used)	Other area	→	Open	(Allowable inrush current: 5 A)
12)	Tower self-standing mode (Not used)	Tower raising posture	→	Output	
		Others	→	Open	
13)	Luffing mode (Luffing only)	Luffing attachment	→	Output	
		Others	→	Open	
14)	Tower mode (Not used)	Tower attachment	→	Output	
		Others	→	Open	
15)	Set up mode	Set up mode	→	Output	
		Other	→	Open	
16)	Luffing jib raising deceleration (Luffing only)	Deceleration area	→	Output	
		Area	→	Open	
17)	External indication (green) less than 90%	Power is turned OFF	→	Open	Contact capacity
18)	External indication (yellow) 90% or more	Conditions are not satisfied	→	Open	2.5 A 30 VDC
19)	External indication (red) 100% or more	Conditions are satisfied	→	Output	(Allowable inrush current: 10 A)
20)	CPU fail	CPU is normal	→	Output	As per remarks of 1) to 16)
		CPU is faulty	→	Open	

Chart5. Output Spares

Signals	Operations	Remarks
Guy line tension (Not used)	0 to MAX / 0 to 5V	Output resistance is less than 100 Ω
Boom angle output (Not used)	0 to +90 deg / 0 to 5V	
Jib offset angle output (Not used)	-90 to +90 deg / 0 to 5V	

11.1.6 ITEMS REQUIRED TO BE EXECUTED FOR REPLACEMENT OF CONTROLLER OR DATA CARD AND INSTRUCTIONS

(In a similar manner to upgrade of program)

	Items to be executed and pages including detailed explanations								
	Reprogramming	Adjustment (from 11-37 to 11-90)					Backup of adjusting data (from controller to card)	Copying of adjusting data (from card to controller)	Re-input of attachment
		Angle detector	Load override position	No load	Load	Working radius			
	P.11-27 to P.11-33	P.11-61 to P.11-64	P.11-65 to P.11-72			P.11-76 P.11-77	P.11-84	P.11-82	Operator's Manual
Both controller and data card replaced	△ (Controller program is old)	○	○	△ (Load radius is appropriate)			×	×	○
Only controller replaced (Existing data card to be used)	△ (Controller program is old)	× (Basically unnecessary if adjusting data has been copied)					×	○	○
Data card replaced (Existing controller to be used)	×	×	×	×	×	×	○	× (Strictly prohibited)	○
Program upgrade	○	×	×	×	×	×	×	×	×

○ To be implemented necessarily

△ To be implemented if necessarily

× Unnecessary

11.2 PREPARATION FOR USE

Prior to installation, be sure to correctly identify and verify all the connecting lines. Then connect them to the CN11M to CN18M connectors, on the back of the unit. (The CN-12BM and CN-14M are not connected.)

11.3 TURN THE POWER ON

After checking all connections for accuracy. Then turn the power on.
A t no misconnection may cause errors and/or cause an alarm to sound. In this case, shut the power off and re-check wiring and the detectors (load detector, angle detector). For further information on handling errors, see "11.7 ERROR CODE (ABNORMALITY DETECTION) AND COUNTERMEASURES".

11.4 UPGRADING PROGRAMS

When upgrading the programs in the controller, use the program memory card.
Two types of programs, comprising "indication programs" and "control programs", are stored in the controller. The program memory card for upgrading always contains these two types of programs.

11.4.1 PROCEDURES

Open the cover, and press the push button located on the left side of the loading port to partially eject the data memory card. Then, remove the card from the loading port with your fingers.
Check the version on the label attached to the program memory card, and fully insert the card into the loading port.

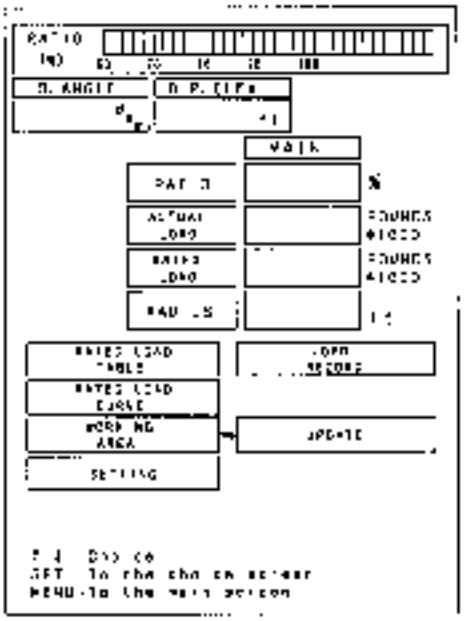
Use the dip switch located on the left side of the card loading port to enable the upgrading of programs.
Turn the dip switch No.1 ON to upgrade indication programs, and turn the dip switch No.2 ON to upgrade control programs.

⚠CAUTION

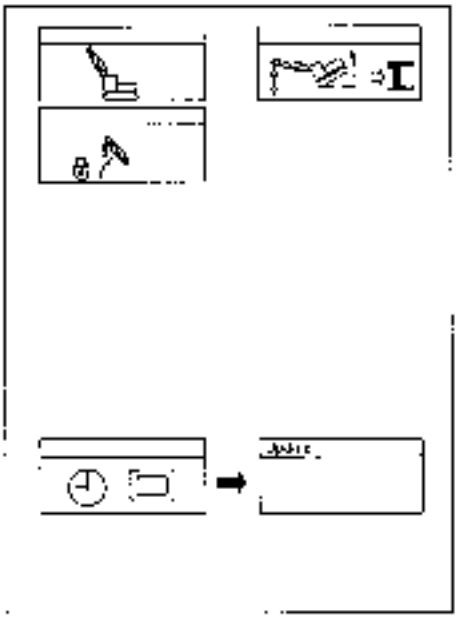
When upgrading both of display programs and control programs, be sure to upgrade the display programs first, and then, upgrade the control programs.

Insertion and removal of card
The card can be removed or inserted even when power supply to the controller is turned on, except for the time that the controller accesses the card. Messages including "Reading" or "Transferring" appear during the access. In such a status, DO NOT remove the card.

1. Turn ON the dip switch No.1 or 2 located in the cover. Then, [UP DATE] is displayed on the menu screen. Move the cursor ⇨ onto the [UP DATE], and press the [SET] switch.



CK SERIES

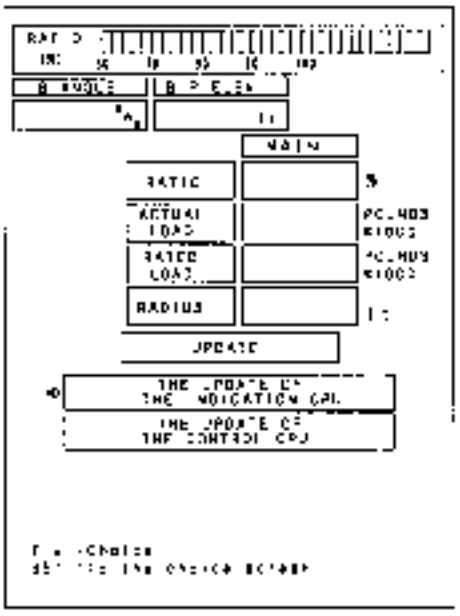


CKE SERIES

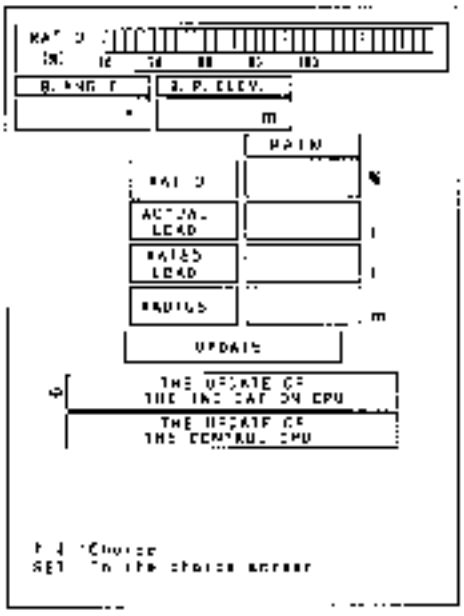
2. "THE UPDATE OF THE INDICATION CPU" is displayed if the dip switch No.1 has been turned ON, and "THE UPDATE OF THE CONTROL CPU" is displayed if the dip switch No.2 has been turned ON.

* Both of the messages above are displayed in the example of the screen shown below, since both of the dip switches No.1 and 2 are turned ON in this case.

Move the cursor ⇨ onto "THE UPDATE OF THE INDICATION CPU", and press the SET switch. Then, the indication programs can be upgraded. To upgrade the control programs, move the cursor ⇨ onto "THE UPDATE OF THE CONTROL CPU", and press the SET switch.



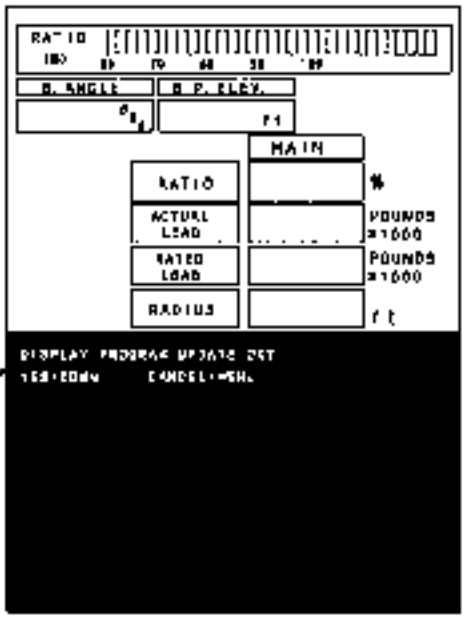
CK SERIES



CKE SERIES

11.4.2 UPGRADING OF INDICATION PROGRAMS

1 Select "THE UPDATE OF THE INDICATION CPU".
Then, the screen shown below is displayed.



DISPLAY PROGRAM UPDATE OK?
YES : DOWN CANCEL : MENU

When upgrading the program, press the [⇩] switch.

When canceling, press the [ESC] switch.

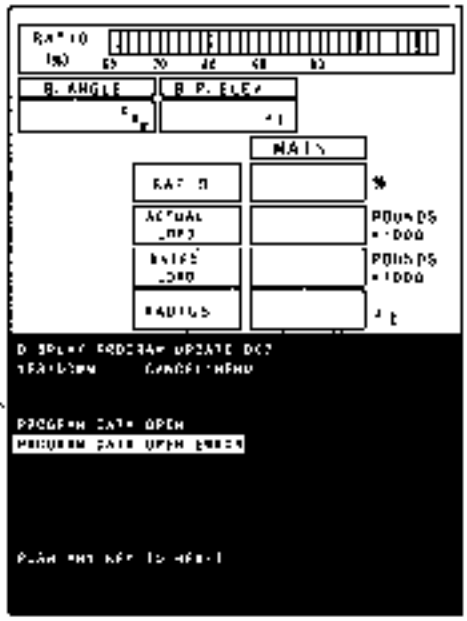
The previous screen appears when the [ESC] switch is pressed.

2. When error messages appear on the screen just after the [⇩] switch is pressed, the data memory card may be left inserted. In such a case, check the data memory card.

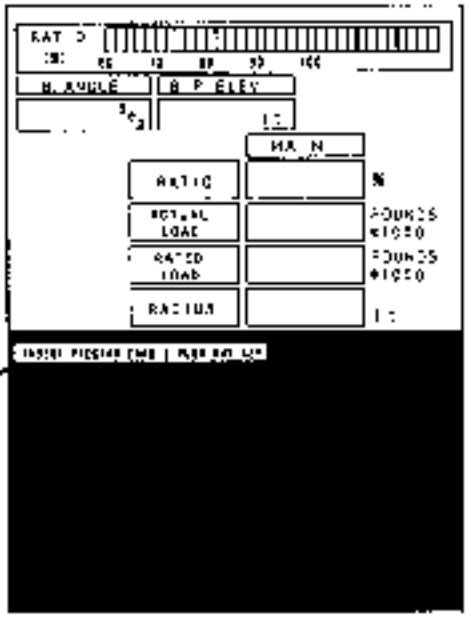
DISPLAY PROGRAM UPDATE OK?
YES : DOWN CANCEL : MENU

PROGRAM DATA OPEN
PROGRAM DATA OPEN ERROR

PUSH ANY KEY TO RESET



3. If the data memory card is not inserted, the error message of "INSERT PROGRAM CARD & PUSH ANY KEY" appears on the screen just after "THE UPDATE OF THE INDICATION CPU" is selected.



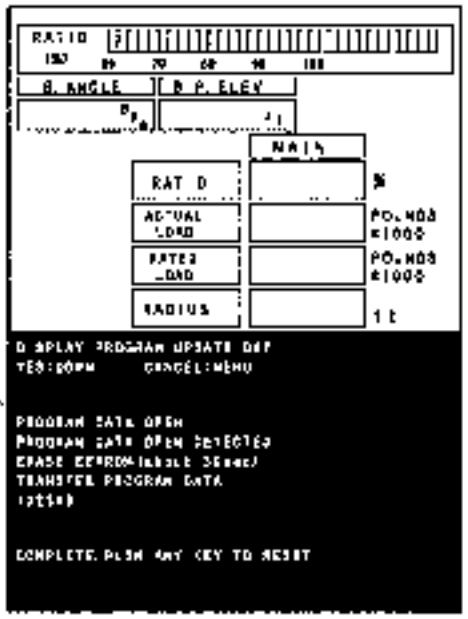
INSERT PROGRAM CARD & PUSH ANY KEY

If the error message above appears even though the data memory card is inserted, imperfect contact may occur. In such a case, remove the data memory card, and re-insert it.

* When inserting or removing the card, it is unnecessary to shut the power down. After re-inserting it, press any switch. If the error still cannot be corrected, the controller or the card may be faulty. In such a case, it must be replaced.

4. After the programs in the controller are erased (it takes approx. 30 sec.), new programs in the card are written onto the controller.
   When the indicated 0 KB is increased to 1023 KB, upgrading is complete. If upgrading is successfully completed, the screen shown below appears.

```
DISPLAY PROGRAM UPDATE OK?
YES:DOWN      CANCEL:MENU

PROGRAM DATA OPEN
PROGRAM DATA OPEN DETECTED
ERASE EEPROM(about 30sec)
TRANSFER PROGRAM DATA
1023KB

COMPLETE, PUSH ANY KEY TO RESET
```



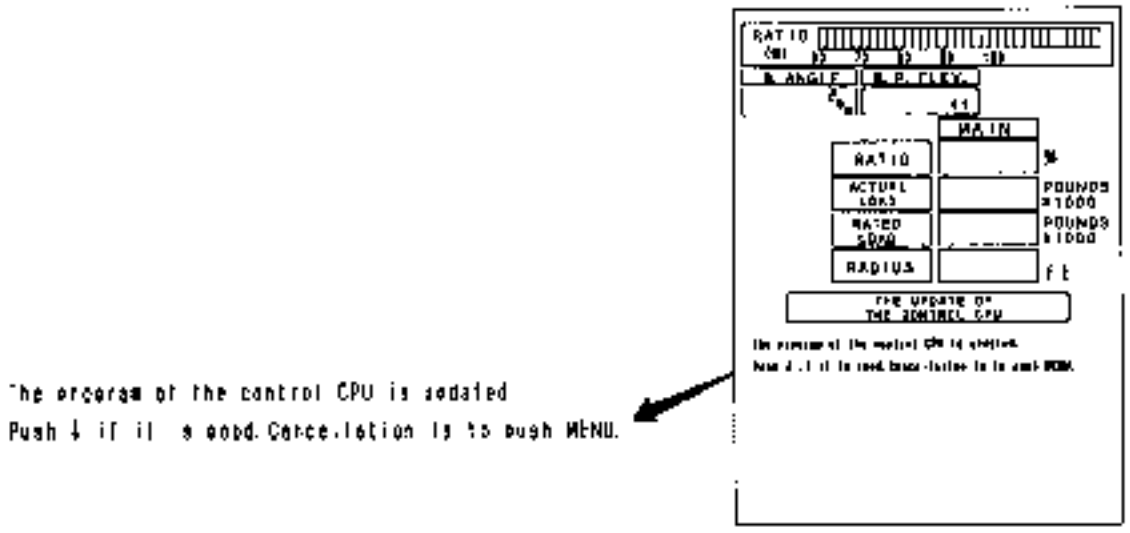
When either switch is pressed, the power supply is reset, and the controller is rebooted.
Then, upgrading of the indication programs is completed.

⚠CAUTION

DO NOT remove or insert the data memory card while programs in the card are written onto the controller. Otherwise, malfunction will occur.

11.4.3 UPGRADING OF CONTROL PROGRAMS

1. Select "THE UPDATE OF THE CONTROL CPU".
   Then, the screen shown below is displayed.

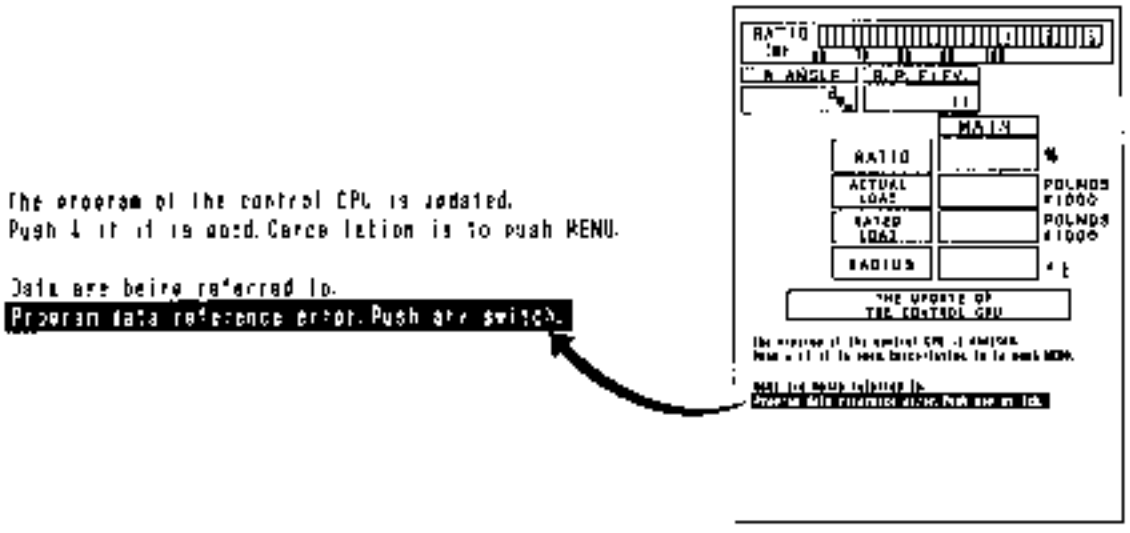


When upgrading the program, press the ↓ switch.

When canceling, press the MENU switch.

The previous screen appears when the MENU switch is pressed

2. When error messages appear on the screen just after the ↓ switch is pressed, the data memory card may not be inserted at all, or may be inserted partially or left inserted. In such a case, check the data memory card.

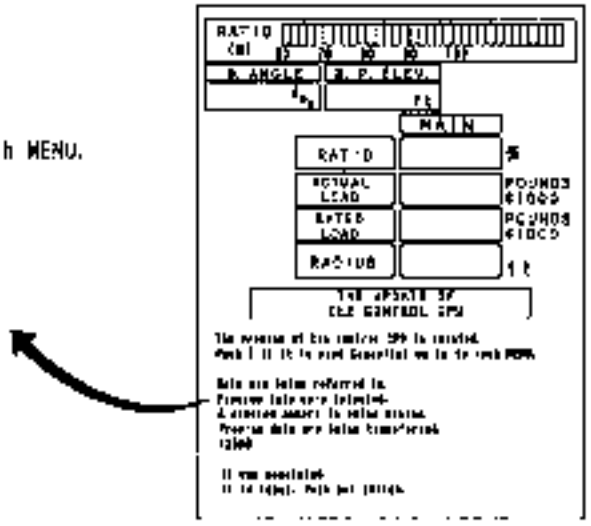


Other errors

- Memory clim nation error
  Program area in the flash memory in the controller cannot be deleted.
  → Replace the controller.
- Memory card read error
  Program cannot be read out from the card
  ▸ Recheck the card insertion status or replace the card.
- Writing error
  Program cannot be written into the flash memory in the controller.
  → Replace the controller.

3 If the intended programs are found in the controller after the switch s pressed, they are erased first (it takes several seconds for erasure) Then, new programs in the card are written onto the controller When the indicated 0 KB is increased to 1023 KB, upgrading is complete. If upgrading is successfu.ly comp eted, the screen shown below appears.

```
The program of the control CPU is updated.
Push ↓ if it  a good.Cancellation is to push MENU.

Data are being referred to.
Program data were deleted.
A program memory is being erased.
Program data are be ne transferred.
128KB

It was comp eted.
It is reset. Push any switch.
```



When either switch is pressed, the power supply is reset, and the controller is rebooted.
Then, upgrading of the control programs is completed.

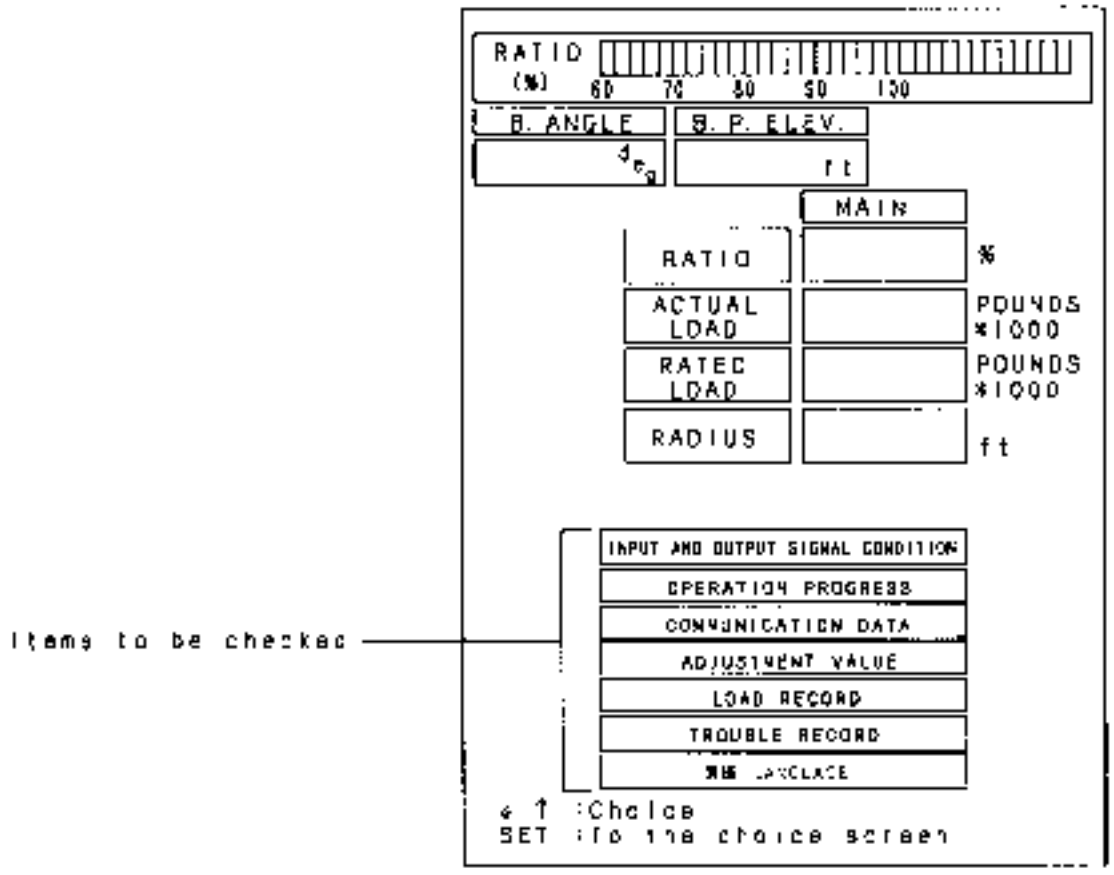
⚠CAUTION

DO NOT remove or insert the data memory card while programs in the card are written onto the controller. Otherwise, malfunction will occur.

11.5 STATUS CHECK

This controller features various status check functions for easier diagnosis of malfunctions.

Turn ON the dip switch No.4 in the cover. Then, the items to be checked are displayed in the lower half part of the screen as shown below.



11.5.1 SIGNAL CHECK

Statuses of signals input from the sensors and limit switches or those of automatic stop signal output can be checked.

On the "STATUS CHECK" screen, move the cursor ⇨ onto the "INPUT AND OUTPUT SIGNAL CONDITION", and press the SET switch. Then, the screen shown below appears.

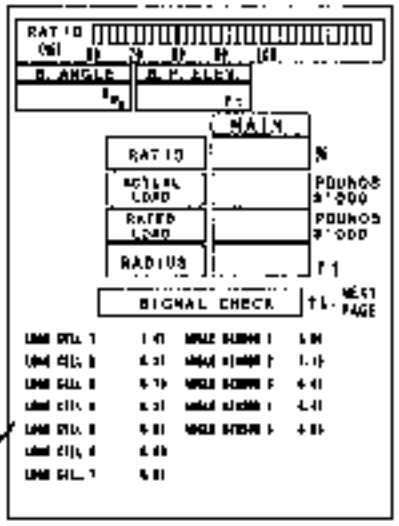
Statuses of analogue signals from the load cells and angle detectors are displayed on this first displayed screen.

Up to seven load cells and up to five angle detectors can be connected to this controller.

Refer to "Chart1. System Input/Output, Connector Designations" page11-20 for details of connection.

For the cells and sensors that are not connected to the controller, values close to 0.4 are displayed

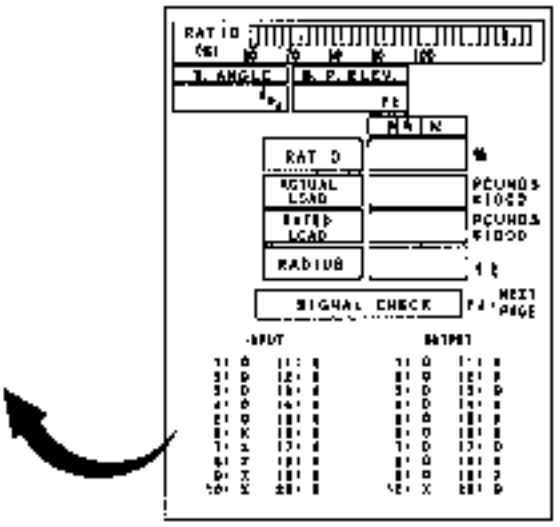
LOAD CELL 1	1.47	ANGLE SENSOR 1	6.34
LOAD CELL 2	0.37	ANGLE SENSOR 2	1.10
LOAD CELL 3	0.79	ANGLE SENSOR 3	0.41
LOAD CELL 4	0.37	ANGLE SENSOR 4	0.41
LOAD CELL 5	0.37	ANGLE SENSOR 5	4.28
LOAD CELL 6	0.59		
LOAD CELL 7	5.81		



Press the ⇩ or ⇧ switch once.
Then, the screen shown below appears.
Statuses of input and output of digital signals can be displayed on this screen.
For the designations and functions of signals, refer to "Chart3. System Input/Output (Digital Input)","Chart4 System Input/Output (Digital Output)" page 11-22.11-23.
For input digital signals, a "O" mark indicates the grounded status, and a "X" mark indicates the open status.
For output digital signals, a "O" mark indicates the output status, and a "X" mark indicates the non-output status.

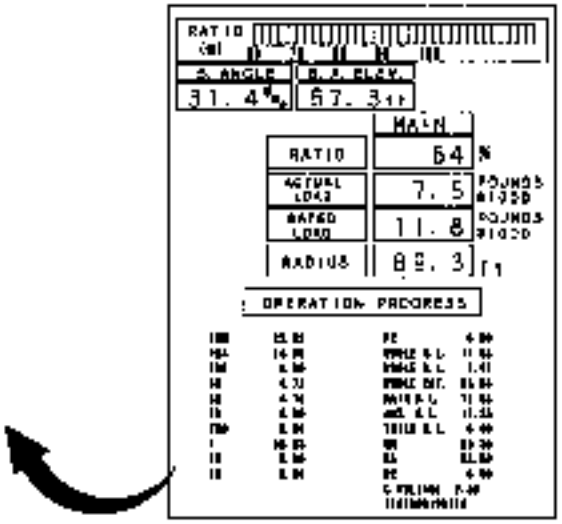
* Displayed output signal statuses are decided as a result of software processing only.
  If the hardware is faulty, the output may not be as shown below

INPUT				OUTPUT			
1 :	O	11 :	X	1 :	O	11 :	X
2 :	O	12 :	X	2 :	O	12 :	X
3 :	O	13 :	X	3 :	O	13 :	O
4 :	O	14 :	X	4 :	O	14 :	X
5 :	O	15 :	X	5 :	O	15 :	X
6 :	X	16 :	X	6 :	O	16 :	X
7 :	X	17 :	X	7 :	O	17 :	O
8 :	X	18 :	X	8 :	O	18 :	X
9 :	X	19 :	X	9 :	O	19 :	X
10 :	X	20 :	X	10 :	X	20 :	O



11.5.2 OPERATION PROGRESS

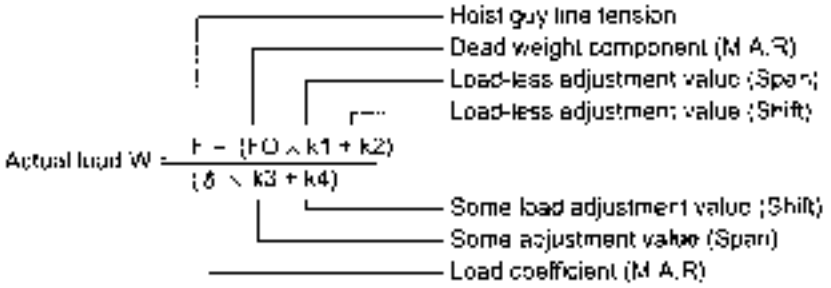
On the "STATUS CHECK" screen, move the cursor ⇨ onto the "OPERATION PROGRESS", and press the SET switch. Then, the screen shown below appears.



Symbols	Details
FOM	Tare weight component during main winch lifting with current radius
FOA	Tare weight component during aux. winch lifting with current radius
FOR	Tare weight component during third winch lifting with current radius
δM	Load coefficient during main winch lifting with current radius
δA	Load coefficient during aux. winch lifting with current radius
δR	Load coefficient during third winch lifting with current radius
FOO	Tare weight component other than weight of hook block with current radius (during simultaneous lifting only) (Not used)
F	Raising guy line tension
FM	Main winch wire rope tension (w/ main winch load cell) (Not used)
FA	Aux. winch wire rope tension (w/ aux. winch load cell) (Not used)
FR	Third winch wire rope tension (w/ third winch load cell) (Not used)
WHOLE R.L.	Whole rated load (rated load during selected mode other than simultaneous lifting mode)
WHOLE A.L.	Whole actual load (actual load during selected mode other than simultaneous lifting mode)
WHOLE RAT.	Whole moment ratio (value indicated in bar graph)
MAIN R.L.	Main winch rated load with current radius on the basis of data
AUX. R.L.	Aux. winch rated load with current radius on the basis of data
THIRD R.L.	Third winch rated load with current radius on the basis of data
RM	Calculated main winch operating radius before correction by radius adjustment
RA	Calculated aux. winch operating radius before correction by radius adjustment
RR	Calculated third winch operating radius before correction by radius adjustment
C. VOLTAGE	Control voltage of liquid crystal
13-digits number	Data judgment code

Example of using operation screen

The actual load W can be indicatec by the formula shown bullow.



Suppose the values above are ind cated shuwn below anc the indicated actual load is 2 t, when a load weighing 5 t is lifted with the main winch.

F = 4.97

FOM = 2.28

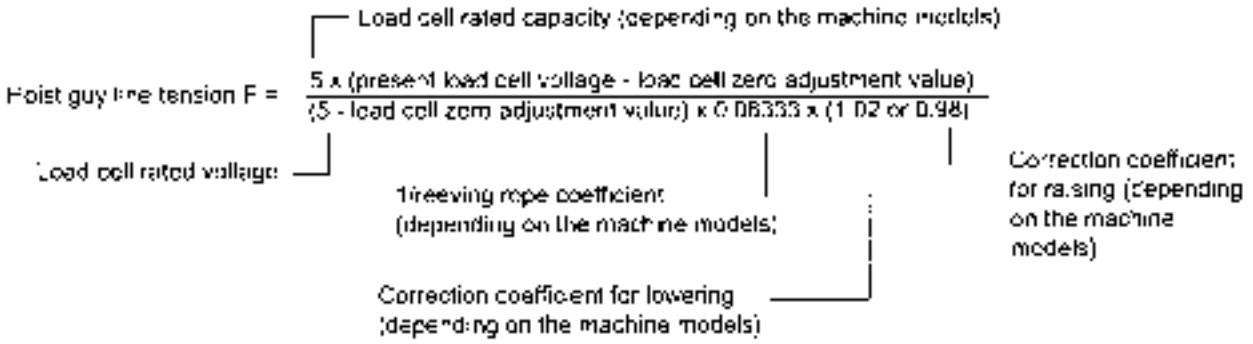
δ=1.33

If neither load-less adjustment nor some load adjustment is carried out, and factors from k1 to k4 are ignored, the theoretical F required for the actual load of 5 t can be found by the using the formula above, as shown below

F = 5 X 1.33 + 2.28 = 8.93

Where, the actual F is obvious y smaller than the theoretical F.

Next, the F can be found by the formula shown below.

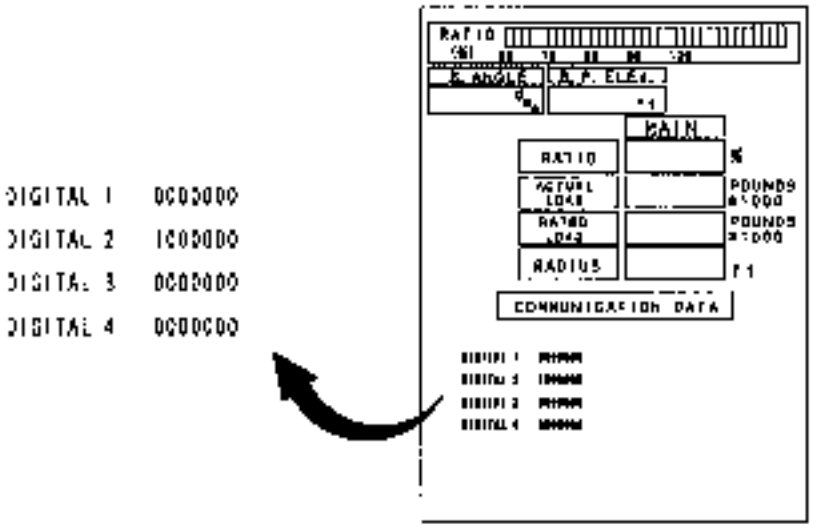


If the load cell zero point adjustment has not been carried out, adjustment value is 1, and the coefficient is 1.02, if lowering is stopped. In such a status, if the load cell voltage is calculated with using the formula above and the values when the F is 4.97, the present load cell voltage is 1.34 V.
In a similar manner, the load cell voltage is 1.61 V, when the theoretical tension F is 8.93.
Then, check the load cell voltage on the signal check screen (page 11-35).
If it is close to 1.34 V above, the detected load cell voltage is smaller than the theoretical value. In this case, the load cell may be faulty.

11.5.3 COMMUNICATION DATA

Details of data transmitted from other controllers can be displayed.
Meanings of the numbers in communication data are shown below.

On the "STATUS CHECK" screen, move the cursor ⇨ onto the "COMMUNICATION DATA", and press the SET switch. Then, the screen shown below appears.
Control signals of control levers are used for the output of buzzer sounds or correction of load. Thus, check the communication status if any fault is found in them.



DIGITAL 1 0000000

0 : No operation	1 : Main winch up
0 : No operation	1 : Main winch down
0 : No operation	1 : Aux. winch up
0 : No operation	1 : Aux. winch down
0 : No operation	1 : Third winch up
0 : No operation	1 : Third winch down
Spare . Fixed to 0	

DIGITAL 2 1000000

0 : No operation	1 : Boom raising
0 : No operation	1 : Boom lowering
0 . No operation	1 : Jib raising
0 No operation	1 : Jib lowering
0 · Fixed to 0	
0 · Fixed to 0	
0 . Receive normal	1 : Reciever error

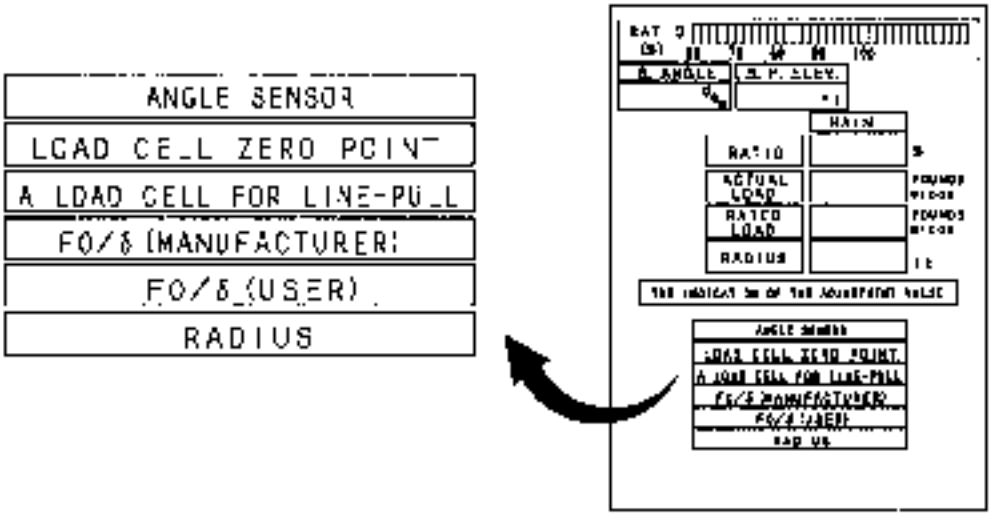
Both digital 3 and digital 4 are spare, and fixed to zero.

If "1" appears in the indicator corresponding to the operated lever, the status is normal. The response may be delayed by approximately a second, depending on the communication status. If only one operation is faulty and the others are normal, check the signals between the pressure sensors and the total controller.

11.5.4 INDICATION OF ADJUSTMENT VALUE

Results of adjustments can be checked

On the "STATUS CHECK" screen, move the cursor (▷ onto the "ADJUSTMENT VALUE", and press the F1 switch. Then the screen shown below appears (menu screen).



11.5.4.1 ANGLE SENSOR ADJUSTMENT VALUE

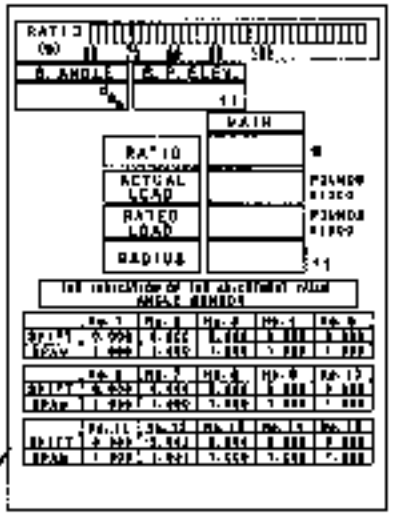
On the "ADJUSTMENT VALUE" screen, move the cursor ⇨ onto the "ANGLE SENSOR", and press the [NT] switch. Then, the table showing angle sensor adjustment values appears on the screen

THE INDICATION OF THE ADJUSTMENT VALUE
ANGLE SENSOR

	No. 1	No. 2	No. 3	No. 4	No. 5
SHIFT	0. 000	0. 000	0. 000	0. 000	0. 000
SPAN	1. 000	1. 000	1. 000	1. 000	1. 000

	No. 6	No. 7	No. 8	No. 9	No. 10
SHIFT	0. 000	0. 000	0. 000	0. 000	0. 000
SPAN	1. 000	1. 000	1. 000	1. 000	1. 000

	No. 11	No. 12	No. 13	No. 14	No. 15
SHIFT	0. 000	-2. 003	0. 000	0. 000	0. 000
SPAN	1. 000	1. 061	1. 000	1. 000	1. 000



In this machine No.2 is used as the boom angle detector and No.1 is used as the jib angle detector
While adjustment is not provided, "0.000 (in the lines of SHIFT)" and "1.000 (in the lines of SPAN)" are indicated.

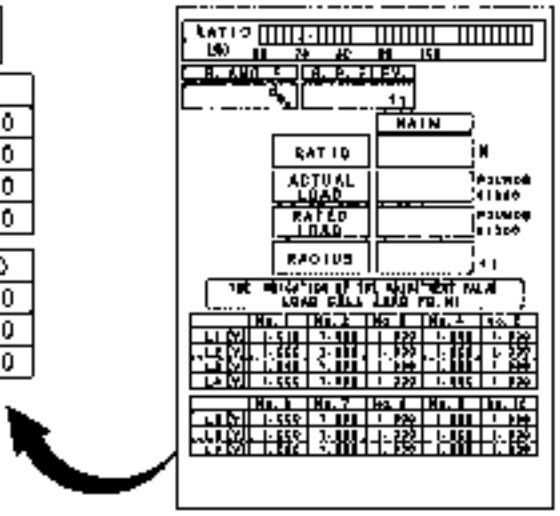
11.5.4.2 LOAD CELL ZERO POINT ADJUSTMENT VALUE

On the "ADJUSTMENT VALUE" screen, move the cursor ⇨ onto the "LOAD CELL ZERO POINT", and press the SET switch. Then, the table showing the load call zero point adjustment values appears.

THE INDICATION OF THE ADJUSTMENT VALUE
LOAD CELL ZERO POINT

	No. 1	No. 2	No. 3	No. 4	No. 5
iL1 [V]	1.015	1.000	1.000	1.000	1.000
iL2 [V]	1.000	1.000	1.000	1.000	1.000
iL3 [V]	1.000	1.000	1.000	1.000	1.000
iL4 [V]	1.000	1.000	1.000	1.000	1.000

	No. 6	No. 7	No. 8	No. 9	No. 10
iL5 [V]	1.000	1.000	1.000	1.000	1.000
iL6 [V]	1.000	1.000	1.000	1.000	1.000
iL7 [V]	1.000	1.000	1.000	1.000	1.000



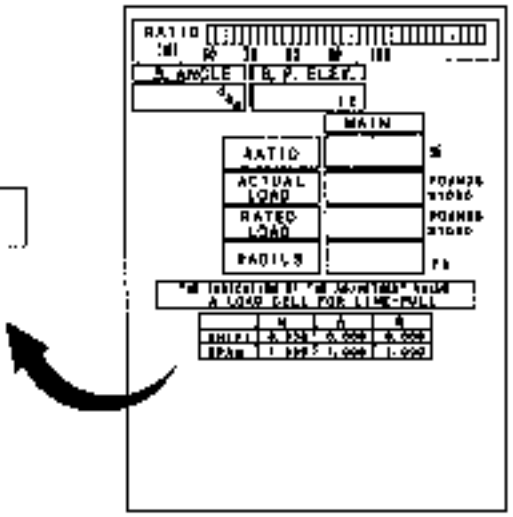
In this machine No.1 of the iL1 is used as the boom load cell and No.4 of the iL1 is used as the jib load cell. While adjustment is not provided, "1.000" is indicated.

11.5.4.3 ADJUSTMENT VALUE OF LOAD CELL FOR LINE-PULL

On the "ADJUSTMENT VALUE" screen, move the cursor ⇨ onto the "A LOAD CELL FOR LINE-PULL", and press the [SET] switch. Then, the table showing the adjustment values of load cell for line-pull appears.

THE INDICATION OF THE ADJUSTMENT VALUE
A LOAD CELL FOR LINE-PULL

	M	A	R
SHIFT	0.000	0.000	0.000
SPAN	1.000	1.000	1.000



M = MAIN, A = AUX., R = THIRD
While adjustment is not provided, "0.000 (in the line of SHIFT)" and "1.000 (in the line of SPAN)" are indicated.

Since this machine is not equipped with this load cell, it can be ignored.

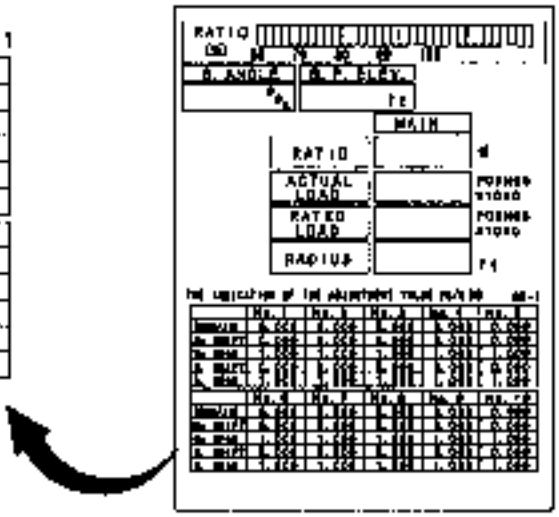
11.5.4.4 RESULT OF MANUFACTURE ADJUSTMENTS "NO LOAD" AND "SOME LOAD"

On the "ADJUSTMENT VALUE" screen, move the cursor ⇨ onto the "Fo/δ (MANUFACTURER)", and press the SET switch. Then, the table showing the results of manufacturers adjustments, "NO LOAD" and "SOME LOAD", appears on the screen.

(Fo = NO LOAD, δ = SOME LOAD)

THE INDICATION OF THE ADJUSTMENT VALUE Fo/δ (M) GR-1

	No. 1	No. 2	No. 3	No. 4	No. 5
BOOM/JIB	0.000	0.000	0.000	0.000	0.000
No SHIFT	0.000	0.000	0.000	0.000	0.000
No SPAN	1.000	1.000	1.000	1.000	1.000
S. SHIFT	0.000	0.000	0.000	0.000	0.000
S. SPAN	1.000	1.000	1.000	1.000	1.000
	No. 6	No. 7	No. 8	No. 9	No. 10
BOOM/JIB	0.000	0.000	0.000	0.000	0.000
No SHIFT	0.000	0.000	0.000	0.000	0.000
No SPAN	1.000	1.000	1.000	1.000	1.000
S. SHIFT	0.000	0.000	0.000	0.000	0.000
S. SPAN	1.000	1.000	1.000	1.000	1.000



For group No. 1 to 30, adjustment with a load or without load for ten types of boom lengths is possible.

First, the table of group No. 1 is displayed. ("GR-1" can be seen in the upper right side of the screen.) Whenever the ⇨ switch is pressed, the screen changes from GR-1 to GR-30.

Whenever the ⇦ switch is pressed, screens appear in the following orders: GR-1, GR-30, GR-29, ...

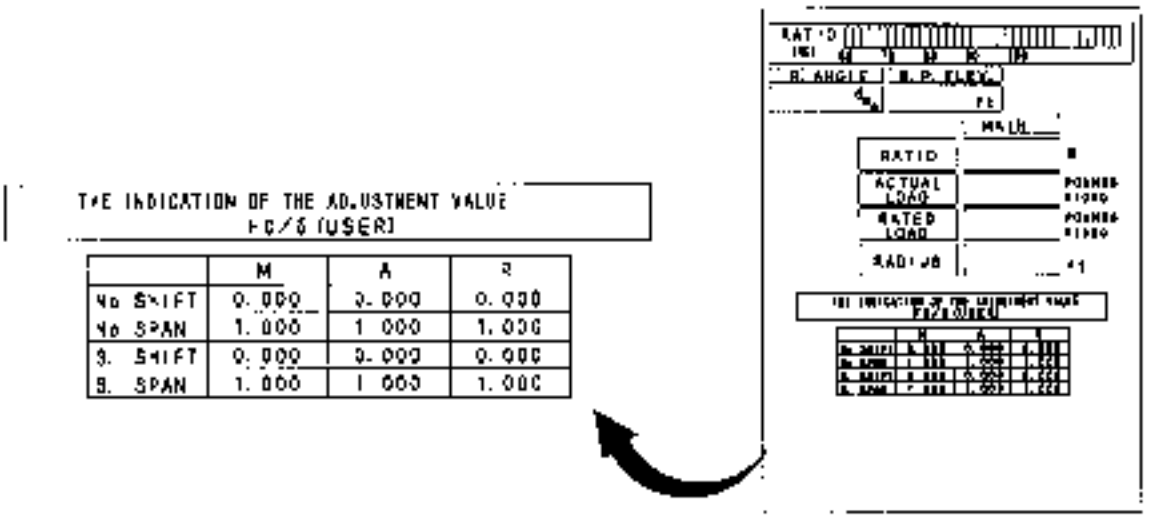
In respect of No.1 to 10, boom length or Jib length (BOOM/JIB) on which adjustment is conducted, shift and span of adjustment without load (No SHIFT, No SPAN), and shift and span of adjustment with a load (S. SHIFT, S. SPAN) are indicated.

While adjustment is not provided, "0.000 (in the lines of BOOM/JIB, No SHIFT, S. SHIFT)" and "1.000 (in the lines of No SPAN, S. SPAN)" are indicated.

If the lengths of the two or more booms have been already adjusted and the length of the boom that has not been adjusted yet is used, the adjusted two lengths that are closest to it are corrected, and the adjusted length of the boom that has not been adjusted yet is calculated, accordingly.

11.5.4.5 RESULT OF LOAD ADJUSTMENTS "NO LOAD" AND "SOME LOAD"

On the "ADJUSTMENT VALUE" screen, move the cursor ⇨ onto the "Fwd (USER)", and press the SET switch.
Then, the table showing the results of user adjustments, "NO LOAD" and "SOME LOAD", for the selected mode appears on the screen.



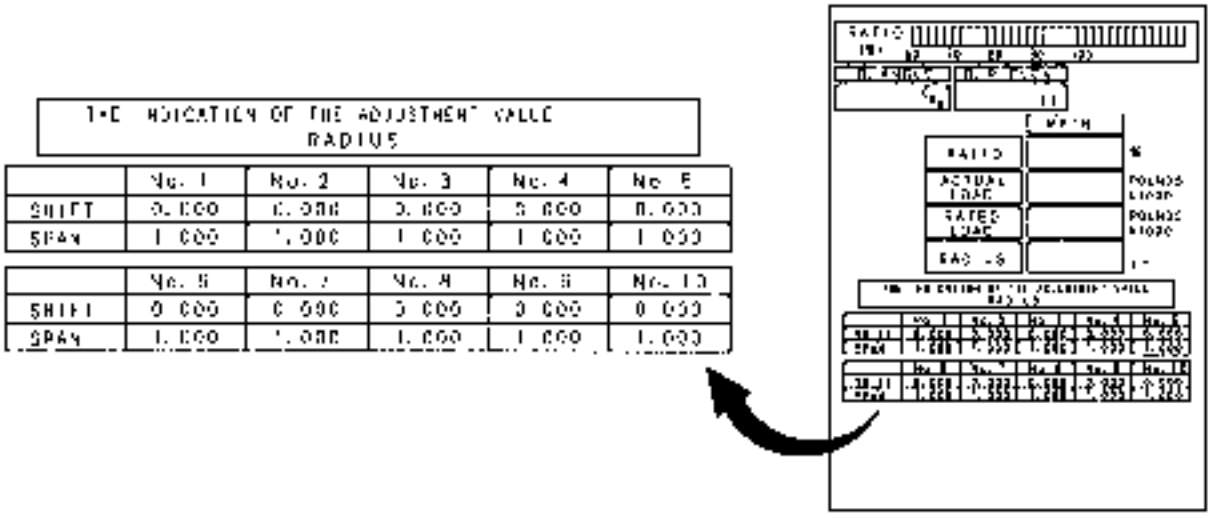
M = MAIN, A = AUX., R = THIRD
While adjustment is not provided, "0.000 (in the lines of SHIFT)" and "1.000 (in the lines of SPAN)" are indicated.

11.5.4.6 ADJUSTMENT VALUE OF WORKING RADIUS

On the "ADJUSTMENT VALUE" screen, move the cursor ⇨ onto the "RADIUS", and press the [SET] switch. Then, the table showing the adjustment value of working radius appears on the screen.

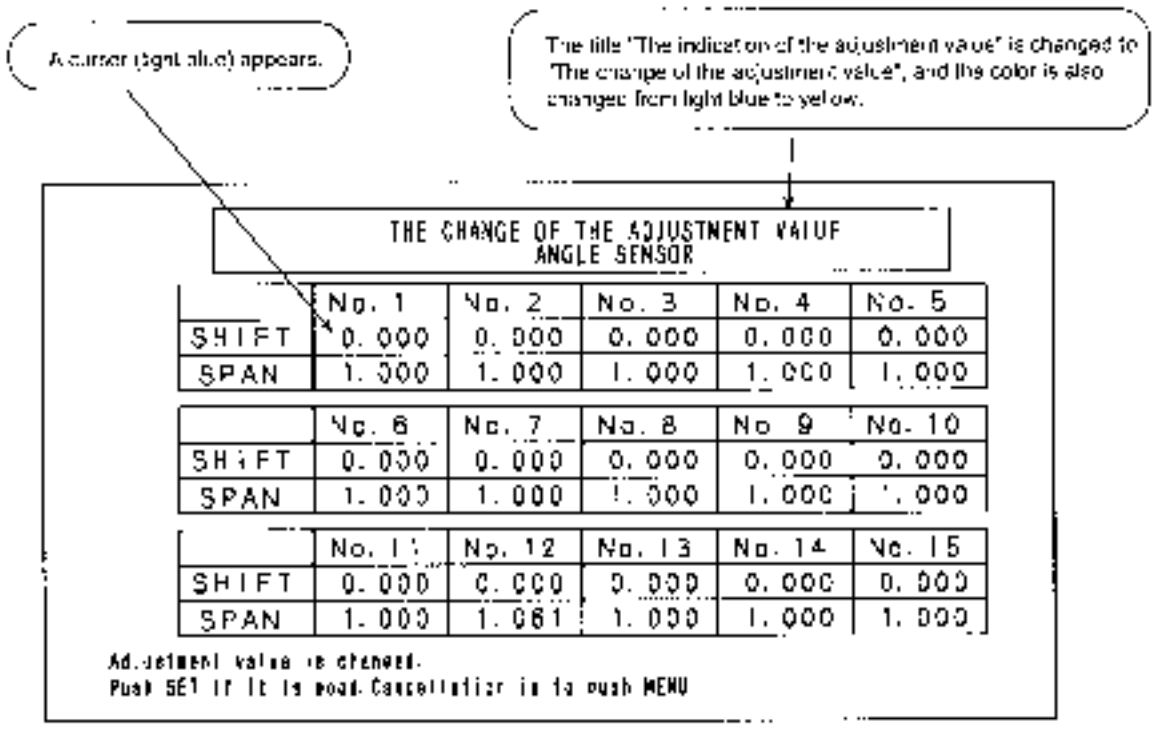
Adjustment values of group No. 1 to 30 can be displayed on this screen, and the table of group No. 1 to 10 is displayed first. To display the table of groups No. 11 to 20, press the [⇩] switch.

While adjustment is not provided, "0.000 (in the lines of SHIFT)" and "1.000 (in the lines of SPAN)" are indicated.



11.5.4.7 ALTERATION OF ADJUSTED VALUE

When the DIP switch No.3 is turned on while the adjusted values are displayed, alteration of them becomes enabled.



Move the cursor onto the item to be altered with the ⇩ and ⇧ switches. To increase the value, use the SET switch.

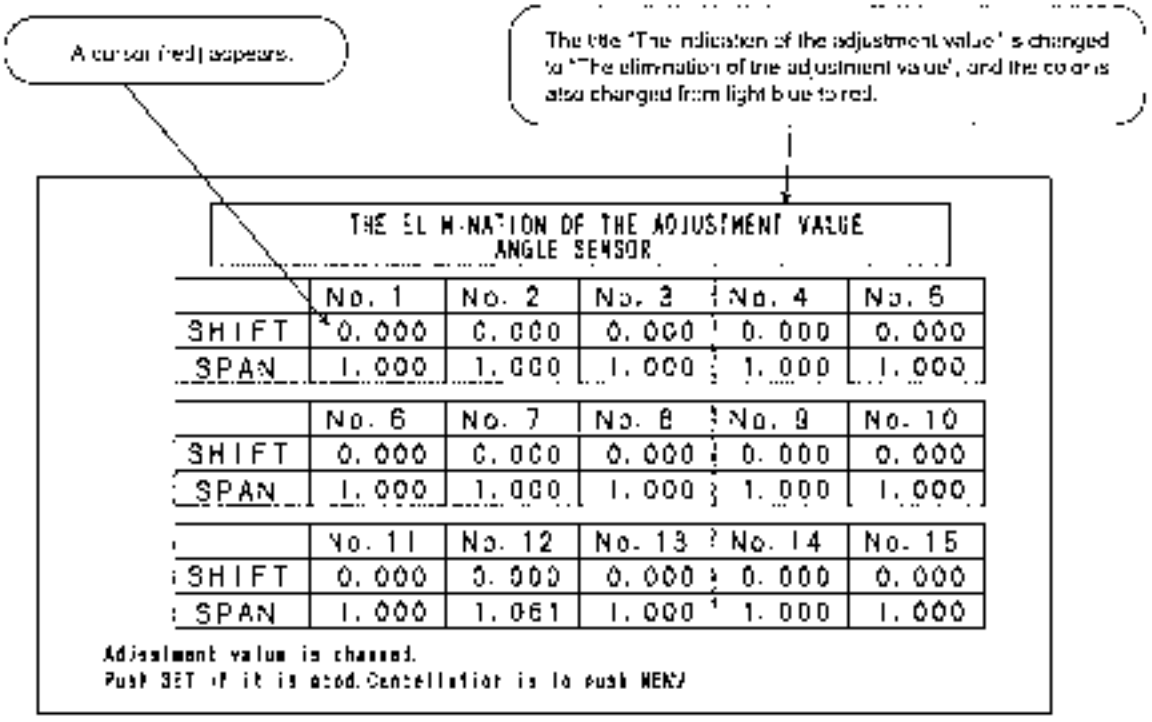
To decrease it, use the ⇦ switch. Then, press the SET switch. To cancel the alteration, press the MENU switch before pressing the SET switch.

When the SET switch is pressed, the message "Alteration of adjustec value is completed." appears.

When the MENU switch is pressed, the message "Alteration is cancelled." appears.

11.5.4.8 DELETION OF ADJUSTED VALUE

When the DIP switches No.3 and No.6 are turned on while the adjusted values are displayed, deletion of them becomes enabled.



Move the cursor onto the item to be altered with the ▽ and △ switches, and press the SET switch. To execute the deletion, press the SET switch again.

To cancel the deletion, press the ESC switch.

When the SET switch is pressed, the message "Deletion of adjusted value is completed." appears.

When the ESC switch is pressed, the message "Deletion is cancelled." appears.

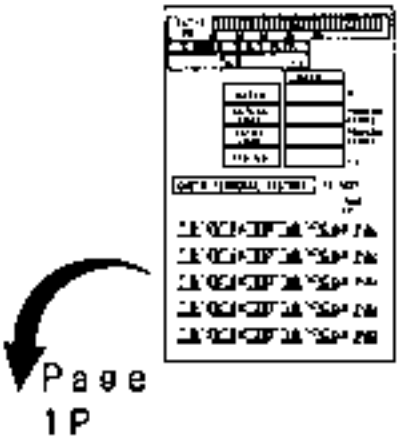
11.5.5 LOAD RECORD

This controller features the function to record the data of hazardous statuses for easier investigation of causes of troubles (load record).

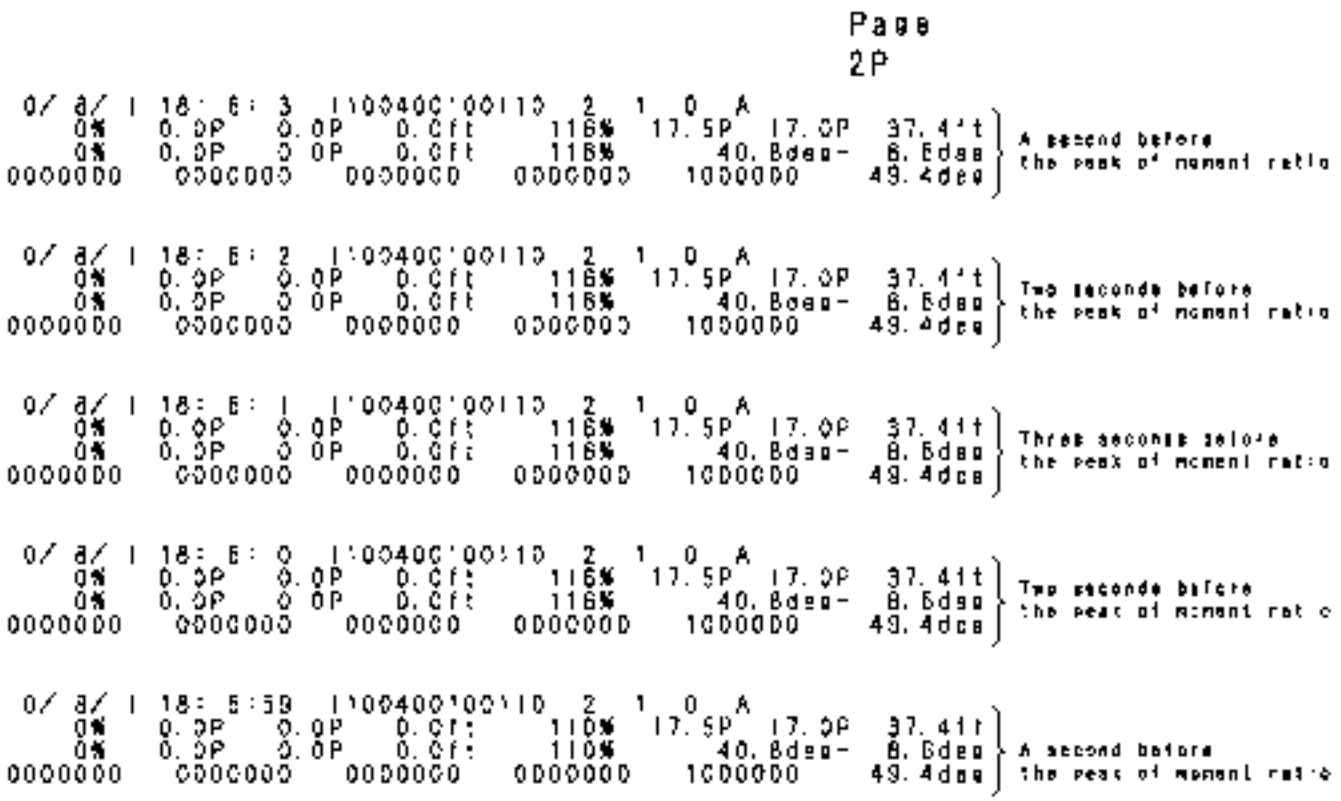
The recording is started when the moment ratio or boom angle exceeds the upper or lower limit values, and data are recorded for ten seconds in total, from the time five seconds before the peak to the time four seconds after the peak every second.

On the "ADJUSTMENT VALUE" screen, move the cursor ⇨ onto the "LOAD RECORD", and press the SET switch. Then, the load records can be checked.

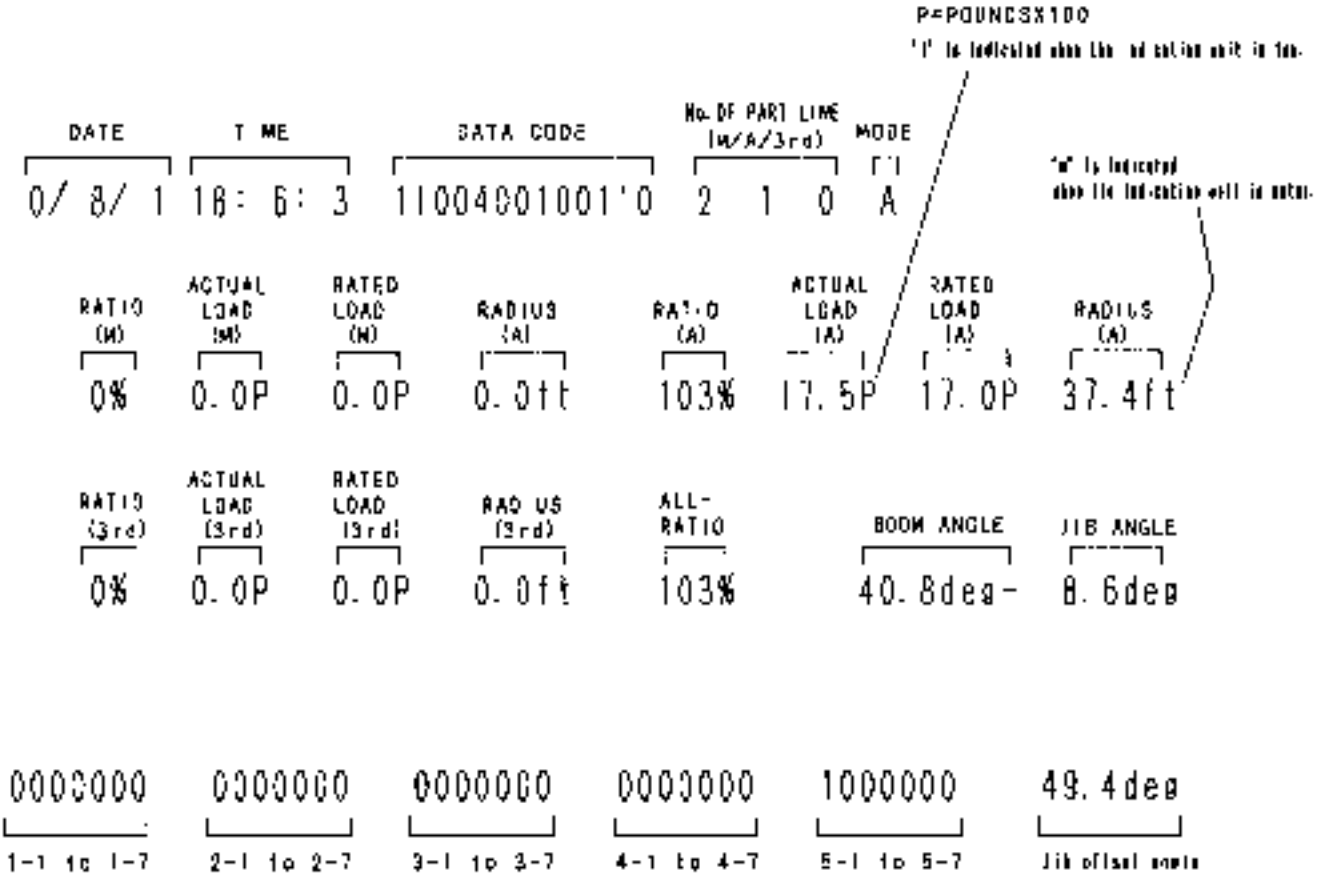
Unit record (records for 10 seconds) is displayed in two pages. To scroll down the page, press the ⇩ key, and press the ⇧ key to scroll up the page.
Up to 200 units of records (400 pages) are available.




```
 0/ 8/ 1  18: 6: 8  1100400100110   2   1   0   A
    0%   0.0P   0.0P    0.0ft      103%   17.5P   17.0P   37.4ft  } Four seconds after
    0%   0.0P   0.0P    0.0ft      103%     40.8deg-   8.6deg  } the peak of moment ratio
0000000   0000000   0000000   0000000   1000000     49.4deg  }

 0/ 8/ 1  18: 6: 7  1100400100110   2   1   0   A
    0%   0.0P   0.0P    0.0ft      106%   17.5P   17.0P   37.4ft  } Three seconds after
    0%   0.0P   0.0P    0.0ft      106%     40.8deg-   8.6deg  } the peak of moment ratio
0000000   0000000   0000000   0000000   1000000     49.4deg  }

 0/ 8/ 1  18: 6: 6  1100400100110   2   1   0   A
    0%   0.0P   0.0P    0.0ft      106%   17.5P   17.0P   37.4ft  } Two seconds after
    0%   0.0P   0.0P    0.0ft      106%     40.8deg-   8.6deg  } the peak of moment ratio
0000000   0000000   0000000   0000000   1000000                   }

 0/ 8/ 1  18: 6: 5  1100400100110   2   1   0   A
    0%   0.0P   0.0P    0.0ft      112%   17.5P   17.0P   37.4ft  } A second after
    0%   0.0P   0.0P    0.0ft      112%     40.8deg-   8.6deg  } the peak of moment ratio
0000000   0000000   0000000   0000000   1000000     49.4deg  }

 0/ 8/ 1  18: 6: 4  1100400100110   2   1   0   A
    0%   0.0P   0.0P    0.0ft      116%   17.5P   17.0P   37.4ft  } Peak of moment ratio
0000000   0000000   0000000   0000000   1000000     49.4deg  }
```



Meanings of numerals

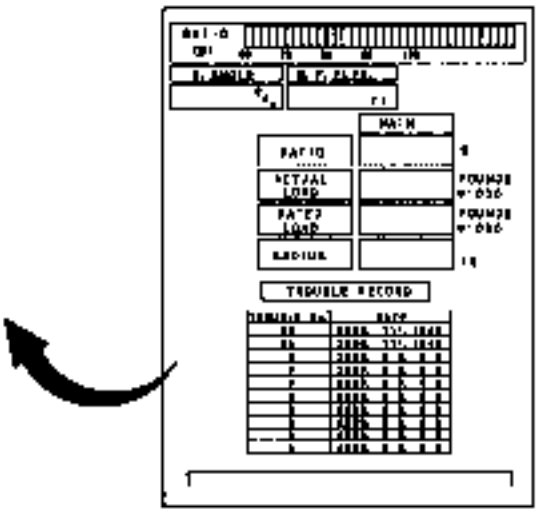


No.		Signal	Signal level
1-1	Limit switch	Luffing jib LS	0 : Normal 1 : Overhoist
1-2		Boom backstop LS (1)	
1-3		Boom overhoist LS (Crane)	
1-4		Boom backstop LS (2)	
1-5		Anti-two block LS (tower)	
1-6		Anti-two block LS (aux.)	
1-7		Anti-two block LS (main)	
2-1		Gantry fix lock LS (Not used)	0 : Un-connection 1 : Connection
2-2	Release switch	Boom fix SW	1 : Fix position 0 : Normal position
2-3		Master key SW	1 : Release position 0 : Normal position
2-4		Over load release SW	
2-5		Boom overhoist release SW	
2-6		Anti-two block release SW	
2-7	Limit switch	Fixed jib overhoist LS (Not used)	0 : Normal 1 Overhoist
3-1		Not used	
3-2		Gantry cylinder LS (Not used)	1 : Contact 0 : Un-contact
3-3		Not used	
3-4		Counterweight detect 2 (Option)	1 : Detect 0 : Not detect
3-5		Counterweight detect 1 (Option)	
3-6		Strut overlowering LS (Not used)	0 : Normal
3-7		Strut overhoist LS (Not used)	1 : Overhoist (Overlowering)
4-1		Third drum lower	
4-2	Operation	Third drum lower	1 Operation 0 Neutral
4-3		Rear drum hoist	
4-4		Rear drum hoist	
4-5		Front drum lower	
4-6		Front drum hoist	
4-7		Communication	
5-1		Not used	1 : Trouble 0 : Normal
5-2	Operation	Not used	1 : Operation 0 : Neutral
5-3		Jib drum lower	
5-4		Jib drum hoist	
5-5		Boom drum lower	
5-6		Boom drum hoist	
5-7			

11.5.6 TROUBLE RECORD

On the "STATUS CHECK" screen, move the cursor [ ] onto the "TROUBLE RECORD", and press the [SET] switch.
Then, the screen shown below appears
Past ten trouble records (trouble No. and dates of trouble occurrence) are displayed on this screen.
Trouble No. means message No. For details, refer to the message list of page 11-88.
When the number of trouble records exceeds ten, the oldest data is erased.

TROUBLE No.	DATE
36	2000. 7/1- 16:43
44	2000. 7/1- 16:42
0	2000. 0. 0. 0: 0
0	2000. 0. 0. 0: 0
0	2000. 0. 0. 0: 0
0	2000. 0. 0. 0: 0
0	2000. 0. 0. 0: 0
0	2000. 0. 0. 0: 0
0	2000. 0. 0. 0: 0
0	2000. 0. 0. 0: 0

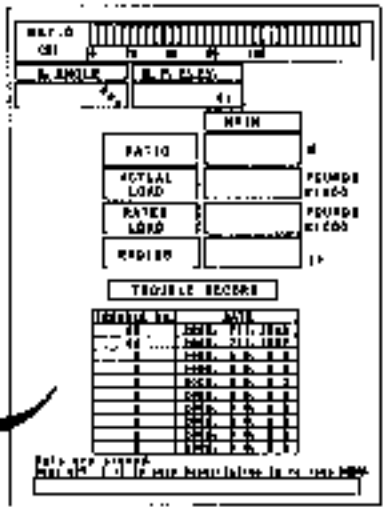


ERASING TROUBLE RECORDS

Previous trouble records can be erased prior to use of the controller together with other machines
While trouble records are disolayed, turn the dip switch No.6 ON.
Then, the messages shown below appear To erase the records, press the SET switch To cancel erasing, press the MENU switch.

TROUBLE No.	DATE
36	2000. 711. 1843
44	2000. 711. 1842
D	2000. 0 0. 0 0
D	2000. 0 0. 0 0
D	2000. 0 0. 0 0
D	2000. 0 0. 0 0
D	2000. 0 0. 0 0
0	2000. 0 0. 0 0
0	2000. 0 0. 0 0
0	2000. 0 0. 0 0

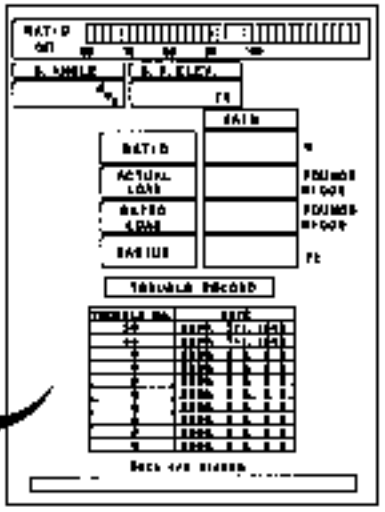
Data are erased.
Push SET if it is good. Cancellation is to push MENU.



Press the SET switch. Then, all the trouble records are erased, and the screen returns to the initial status.

TROUBLE No.	DATE
0	2000. 0 0. 0 0
0	2000. 0 0. 0 0
0	2000. 0 0. 0 0
0	2000. 0 0. 0 0
0	2000. 0 0. 0 0
0	2000. 0 0. 0 0
0	2000. 0 0. 0 0
0	2000. 0 0. 0 0
0	2000. 0 0. 0 0
0	2000. 0 0. 0 0

Data are erased.



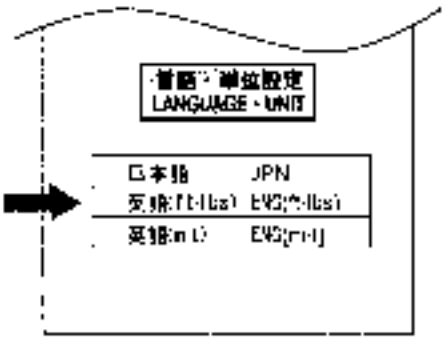
After erasing, turn off the dip switch No.6.

11.5.7 CHOICE OF LANGUAGE (CKE SERIES ONLY)

On the "STATUS CHECK" screen, move the cursor ⇨ onto "言語/LANGUAGE", and press the SET switch. Then, the screen shown below appears.

For CK series Model, move the cursor onto the "ENG (ft-lbs)" and press the SET switch.

For CKE series Model, move the cursor onto the "ENG (m-t)" and press the SET switch



11.5.8 LOAD RECORD (LOAD RECORD IN THE MAIN MENU)

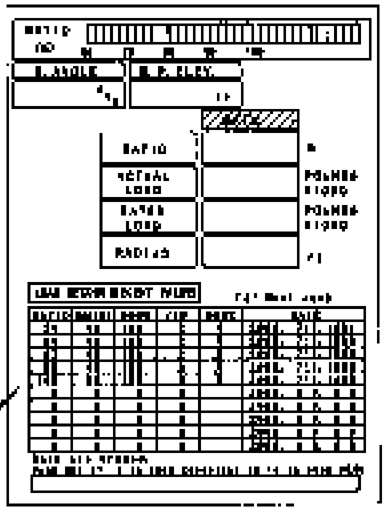
Erasing load records

Previous load records can be erased prior to use of the controller together with other machines.
While load records are displayed (both of records displayed in the order of moment ratio and those displayed in the order of date are acceptable), turn the dip switch No.6 ON.
Then, the messages shown below appear. To erase the records, press the SET switch. To cancel erasing, press the MENU switch.

LOAD RECORD (RECENT VALUE)　　↑↓: Next page

RATIO	RADIUS	BOOM	JIB	MODE	DATE
24	43	100	2	M	2000. 711. 1631
34	43	100	2	M	2000. 711. 1523
97	43	100	2	M	2000. 711. 1523
58	43	100	2	M	2000. 711. 1623
148	95	100	2	M	2000. 711. 1429
0	0	0	0		2000. 0 0. 0 0
0	0	0	0		2000. 0 0. 0 0
0	0	0	0		2000. 0 0. 0 0
0	0	0	0		2000. 0 0. 0 0
0	0	0	0		2000. 0 0. 0 0

Data are erased.
Push SET if it is good. Cancellation is to push MENU.

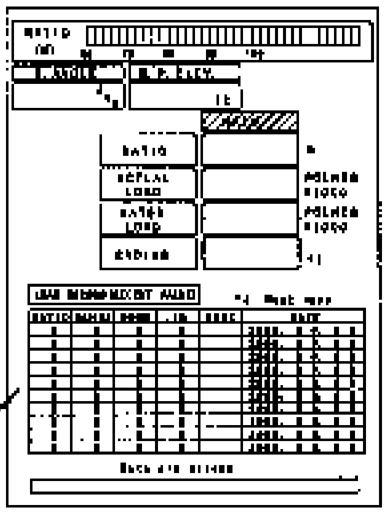


Press the SET switch. Then, the records are erased and the screen is reset as shown below.

LOAD RECORD (MAX. VALUE)　　↑↓: Next page

RATIO	RADIUS	BOOM	JIB	MODE	DATE
0	0	0	0		2000. 0 0. 0 0
0	0	0	0		2000. 0 0. 0 0
0	0	0	0		2000. 0 0. 0 0
0	0	0	0		2000. 0 0. 0 0
0	0	0	0		2000. 0 0. 0 0
0	0	0	0		2000. 0 0. 0 0
0	0	0	0		2000. 0 0. 0 0
0	0	0	0		2000. 0 0. 0 0
0	0	0	0		2000. 0 0. 0 0
0	0	0	0		2000. 0 0. 0 0

Data are erased.



After erasing, turn off the dip switch No.6.

11.6 ADJUSTMENTS

WARNING

Prior to adjustment, be sure to check the items below.

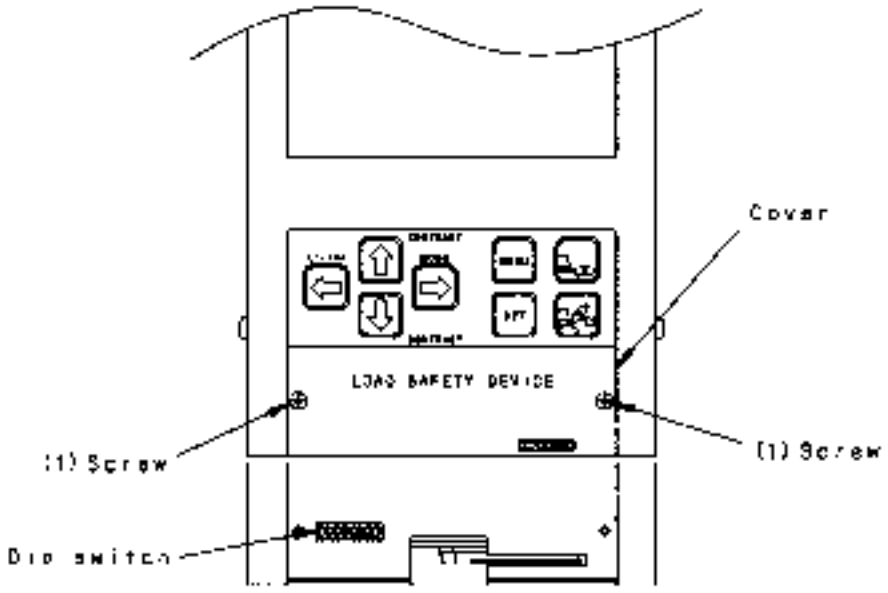
1. Input crane configuration

2. Main/jib lifting selection

In this section, the adjustment of sensors installed to the crane and various coefficients, and other functions are described.

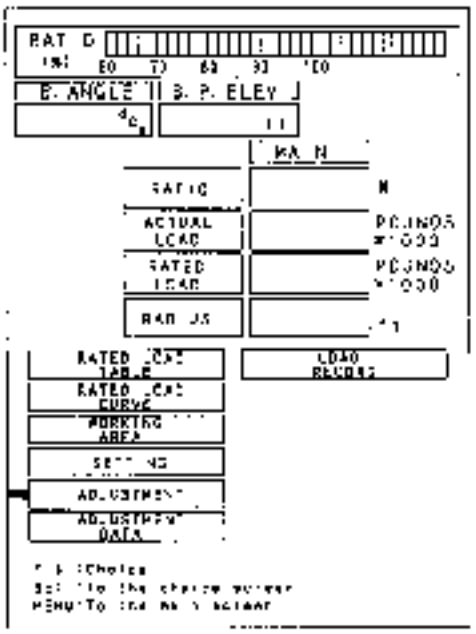
11.6.1 REMOVING THE INNER PANEL

The dip switches that are needed for adjustment are located when you remove cover.
Take off 2 (1) screws shown below to remove the cover.
Do not lose the cover or the screws.

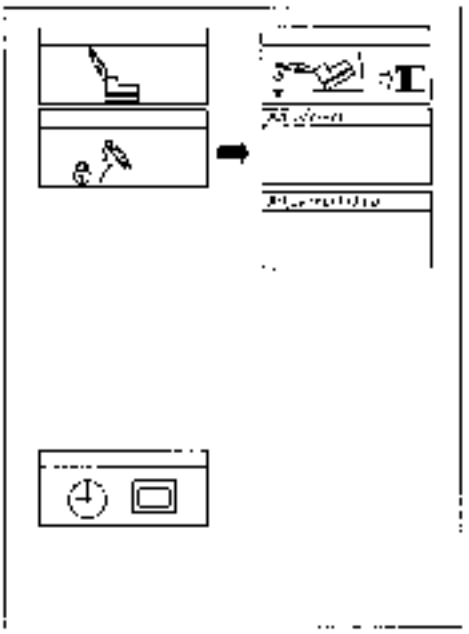


11.6.2 ADJUSTMENT

Wh le the menu screen is displayed, turn ON the dip switch No.3 of the controller.
Then, the "ADJUSTMENT" screen is displayed.

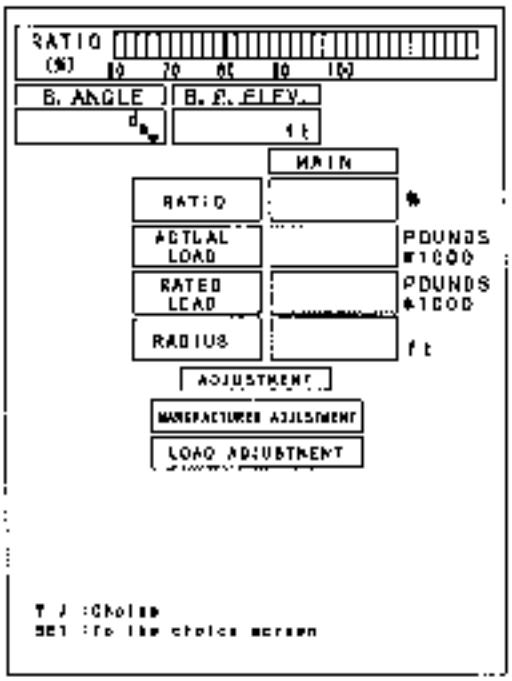


CK SERIES



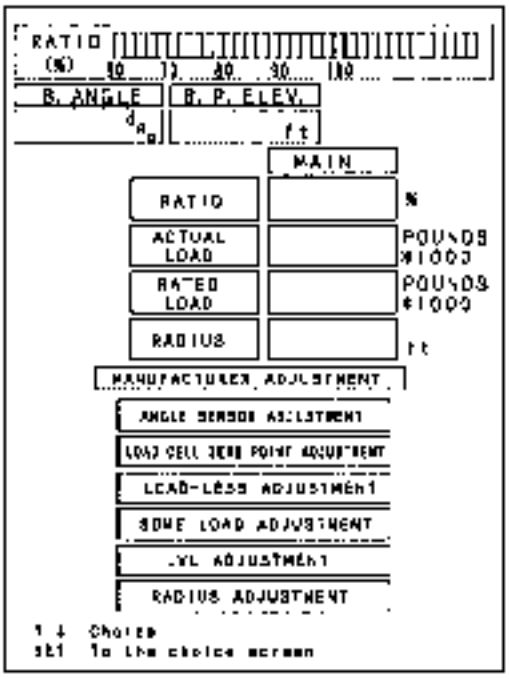
CKE SERIES

Move the cursor ⇨ ontu the "ADJUSTMENT", and press the SET switch. Then, the screen shown bc ow appears.



Move the cursor ⇨ onto the "MANUFACTURER AD-

JUSTMENT", and press the SEL switch.
Then, the screen shown below appears.



MANUFACTURE ADJUSTMENT

ANGLE SENSOR ADJUSTMENT	This adjustment should be performed when the indicated angle is different from the actual angle or the angle detector is replaced. (Adjustment should be performed within the specified range. If the adjusted value is out of the range, the adjustment is invalid.)
LOAD CELL ZERO POINT ADJUSTMENT	This adjustment should be performed if the output voltage is deviated when no load is applied to the load cell. (Adjustment should be performed within the specified range. If the adjusted value is out of the range, the adjustment is invalid.)
LOAD LESS ADJUSTMENT	This adjustment should be performed if the indicated actual load is excessively deviated when a light load such as a hook is lifted. (Adjustment should be performed within the specified range. If the adjusted value is out of the range, the adjustment is invalid.)
SOME LOAD ADJUSTMENT	This adjustment should be performed if the indicated actual load is excessively deviated when a load is lifted after the load-less adjustment is carried out. (Adjustment should be performed within the specified range. If the adjusted value is out of the range, the adjustment is invalid.)
LVL ADJUSTMENT	Automatic stop points (alarm points) can be changed
RADIUS ADJUSTMENT	This adjustment should be performed if the indicated working radius is excessively different from the actual working radius (Adjustment should be performed within the specified range. If the adjusted value is out of the range, the adjustment is invalid.)

Since limitations are provided for these adjustments, they cannot be completed when the adjusted values are excessively deviated. In such a case, ensure that the sensors are free from any fault, crane configuration is input correctly, and adjustment procedures are appropriate.

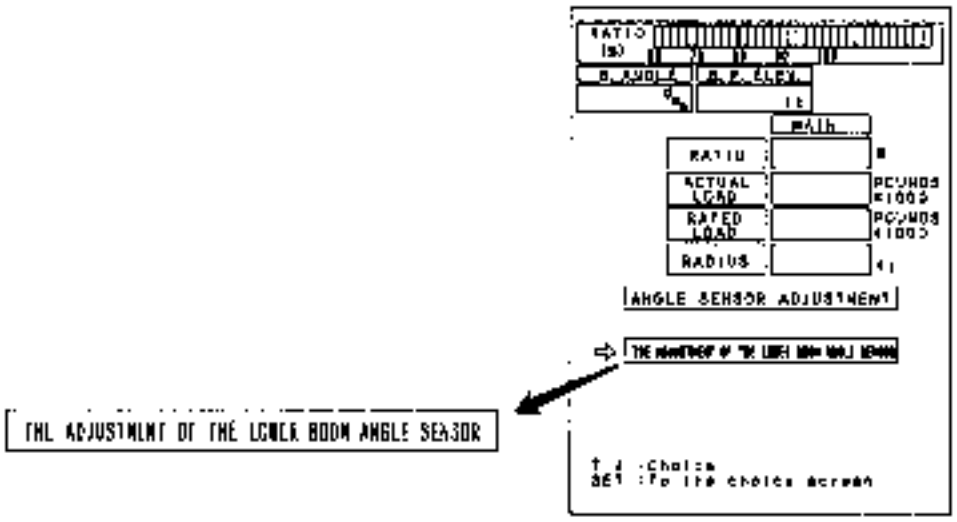
LOAD ADJUSTMENT

This adjustment is intended for emergency, and there is no limitation of adjustment values. It is valid for adjusted attachments only. After the attachments are changed, it is invalid.

LOAD-LESS ADJUSTMENT	This adjustment should be performed when "LOAD-LESS ADJUSTMENT" of MANUFACTURE ADJUSTMENT is rejected. It is valid for adjusted attachments only.
LOAD-LESS ADJUSTMENT	This adjustment should be performed when "SOME LOAD ADJUSTMENT" of MANUFACTURE ADJUSTMENT is rejected. It is valid for adjusted attachments only.

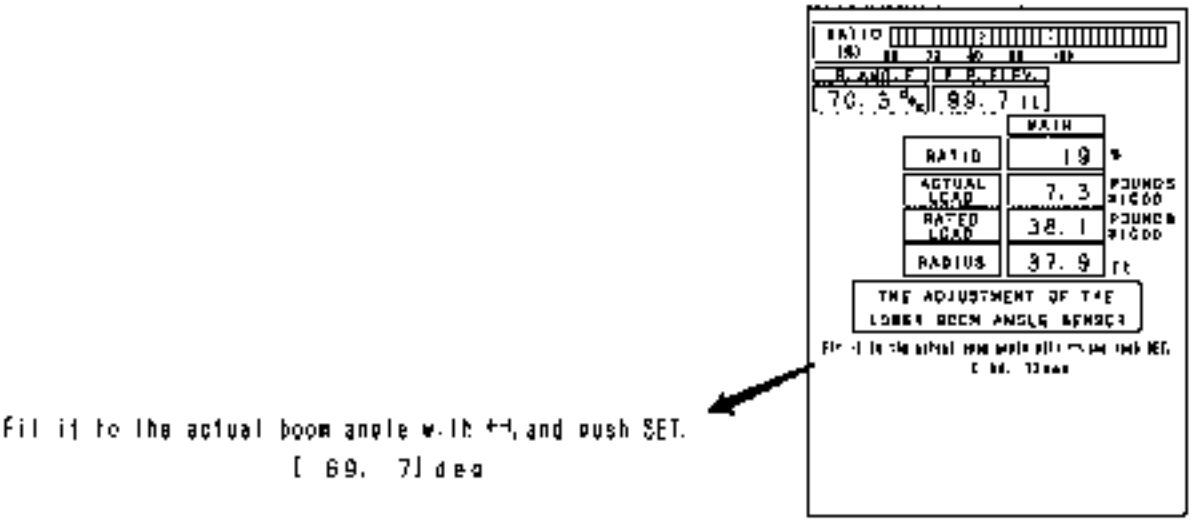
11.6.2.1 ANGLE SENSOR ADJUSTMENT

Move the cursor ⇨ onto the "ANGLE SENSOR ADJUSTMENT", and press the SET switch.
Then, the screen shown below appears.

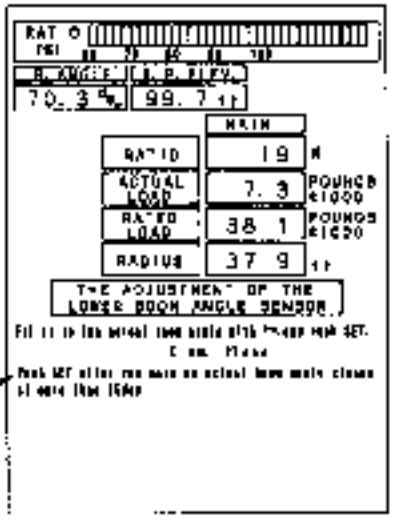


If the boom and the jig are equipped with the angle sensors, several choices are displayed

1. Move the cursor ⇨ onto the intended angle sensor (angle sensor to be adjusted), raise the boom close to the upper limit, and press the SET switch. Then, the screen shown below appears.



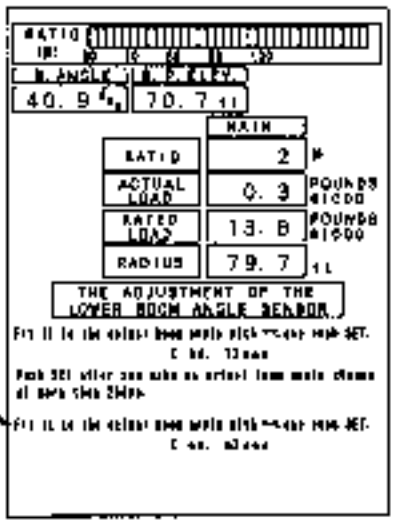
2. Measure the actual boom angle with a level or an angle gauge, enter the measured boom angle in the [ ] on the screen, and press the SET switch. Then, the screen shown below appears.



3. After lowering the boom by 25 deg. or more, stop it and press the SET switch. Then, the screen shown below appears.

Note

Angle of 25 deg. is just a guideline for lowering the boom, and this guideline should not be necessarily observed. However, remember that the adjustment is effective if the boom is lowered with an angle as large as possible.

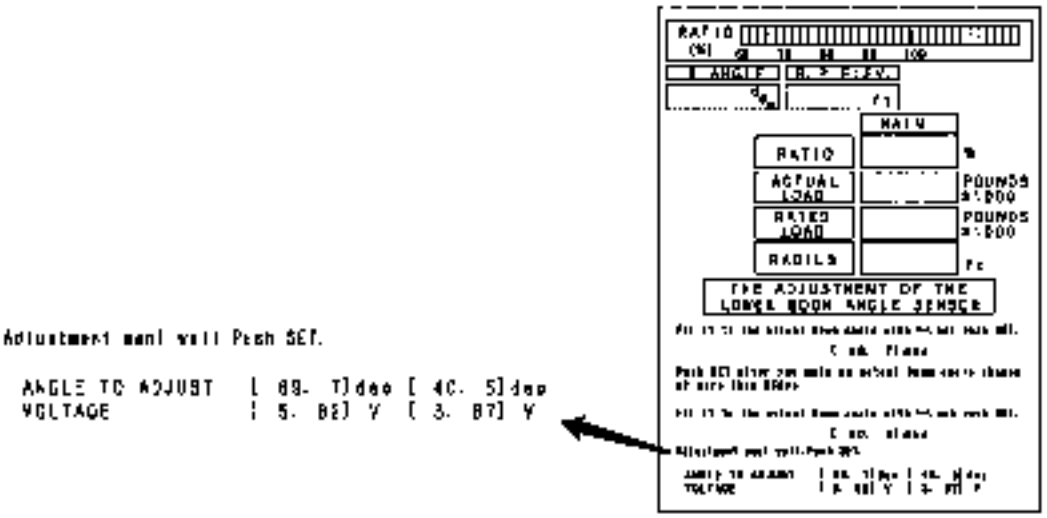


4. Measure the actual boom angle with a level or an angle gauge. enter the measured boom angle in the [ ] on the screen, and press the [SET] switch

   In this case, the maximum angle is adjusted first and the minimum angle is adjusted next
   Of course. the reverse order is also acceptable.

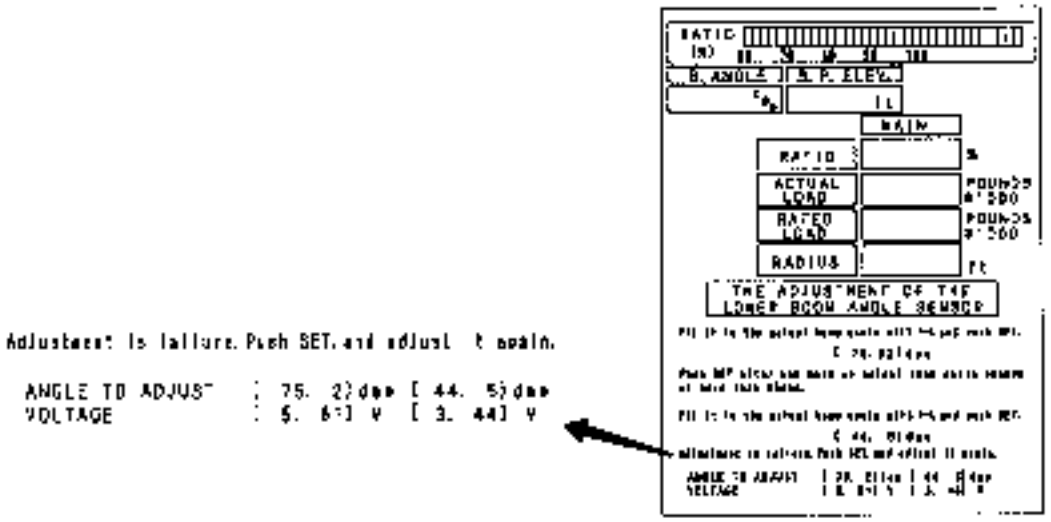
5. When the adjustment is successfully completed, messages shown below are displayed (numerals in [ ] are changed whenever adjustment is complete).

   Press the [SET] switch. Then, the screen returns to that before the adjustment is performed.



6. When the adjustment is not successfully completed, messages shown below are displayed (numerals in [ ] are changed whenever adjustment is completed).

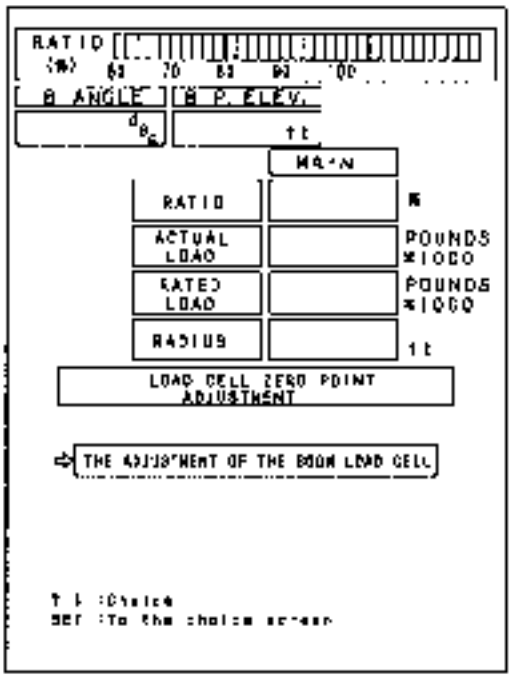
   Press the SET switch. Then, the screen returns to that before the adjustment is performed. Re-perform the adjustment correctly.



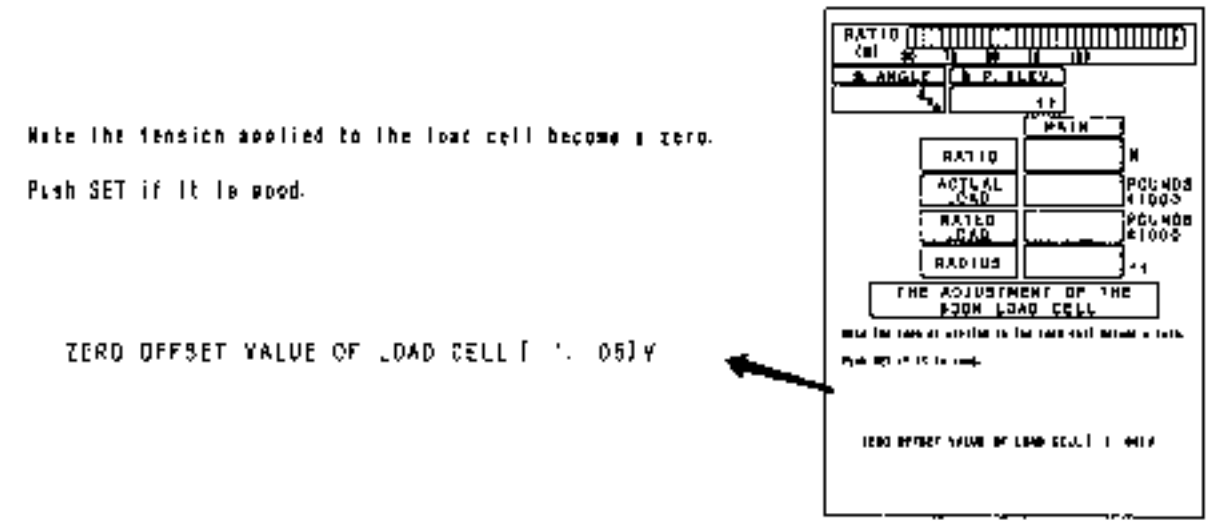
11.6.2.2 LOAD CELL ZERO POINT ADJUSTMENT

Errors in output voltage (1.0 V) when no load is applied to the load cell can be adjusted.

1 Move the cursor ⇨ onto the "LOAD CELL ZERO POINT ADJUSTMENT", and press the SET switch. Then, the screen shown below appears.



2 For the crane with several load cells, number of load cells is displayed on this screen. Move the cursor ⇨ onto the load cell item you intend to adjust, and press the SET switch. Then, the screen shown below appears.



3. Decrease the tension applied to the load cell by removing the load cell completely or loosening the wire rope as far as possible. When this step is complete, press the [SET] switch.

- When the displayed load cell voltage is not in the rage from 0.8 to 1.2 V, the load cell is judged to be faulty and the adjustment is rejected. In such a case, replace the load cell.

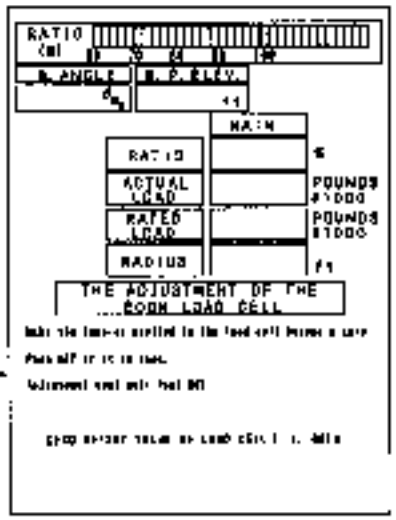
4. When the adjustment is successfully completed, the screen shown below appears. Press the [SET] switch is to return to the previous screen.

Make the tension applied to the load cell become a zero.

Push SET if it is good.

Adjustment went well. Push SET

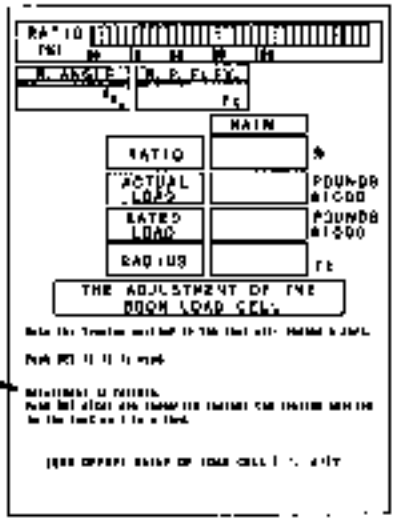
ZERO OFFSET VALUE OF LOAD CELL [1. 05] V



5. When the adjustment is not successfully comp eted, the screen shown below appears.
Ensure that no tension is applied to the load cell, and re-perform the adjustment.

Adjustment is failure.
Push SET after you reconfirm whether the tension applied to the load cell is a zero.

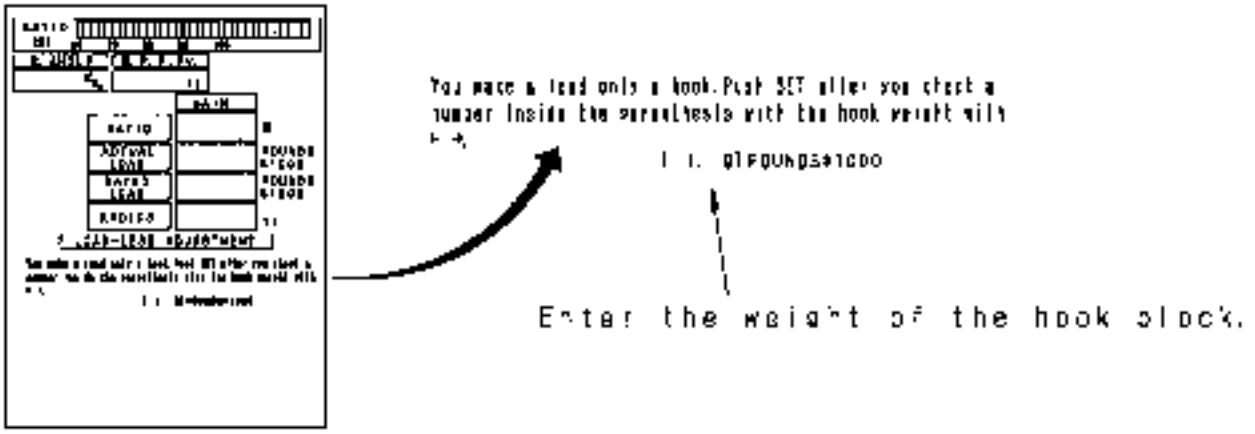
ZERO OFFSET VALUE OF LOAD CELL [1. 47] V



11.6.2.3 LOAD-LESS ADJUSTMENT & SOME LOAD ADJUSTMENT

LOAD-LESS ADJUSTMENT.....	When this item is selected, tare weight component, including boom weight can be adjusted. Select this item if the actual load is not identical to the displayed load when a light load weighing as same as the hook block is lifted.
SOME LOAD ADJUSTMENT.....	When this item is selected, load component can be adjusted. Select this item, if error that occurs when a heavy load is lifted is greater than that occurs when a light load weighing as same as the hook block is lifted.

When "LOAD LESS ADJUSTMENT" is selected, the following screen appears.



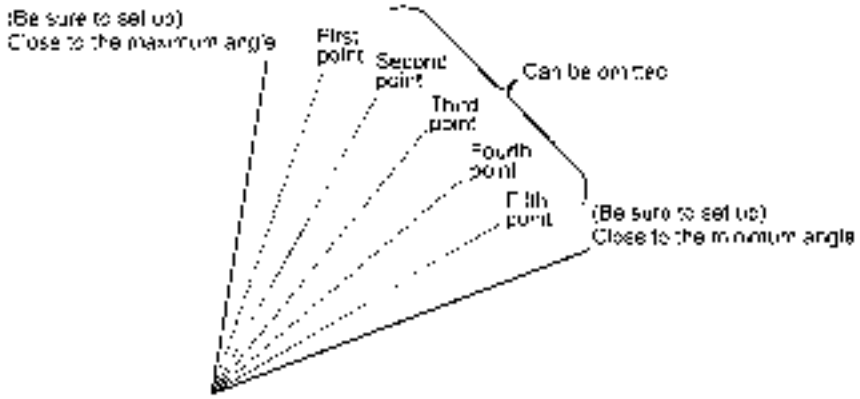
The current lifted load must be the load of the hook block only.
Adjust the value in [ ] to the weight of hook block. The entered value is decreased with the ◁ switch, and increased with the ▷ switch.

After the adjustment, press the SET switch. Then, the next screen appears.

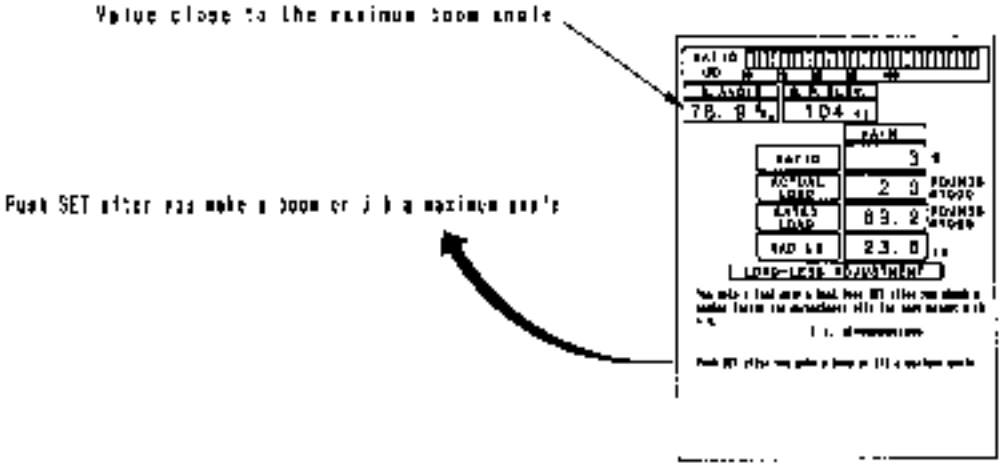
- If the two hooks are used, enter the sum of their weights.

Adjust the load at the maximum boom angle point, minimum boom angle point, and arbitrary five points between them. To start the adjustment, stop the boom at an arbitrary point, and press the SET switch.

Input point

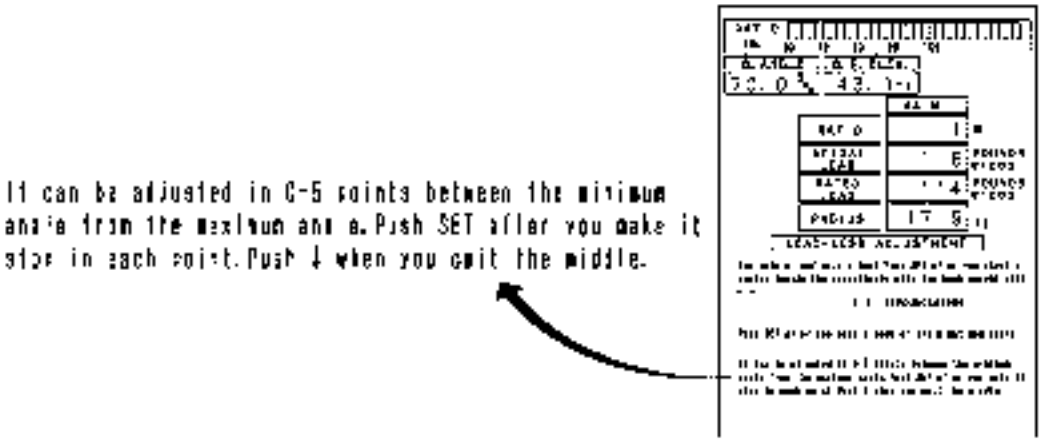


1 First, raise the boom to the point near the maximum boom angle (75 deg. to 80 deg.), and press the SET switch.



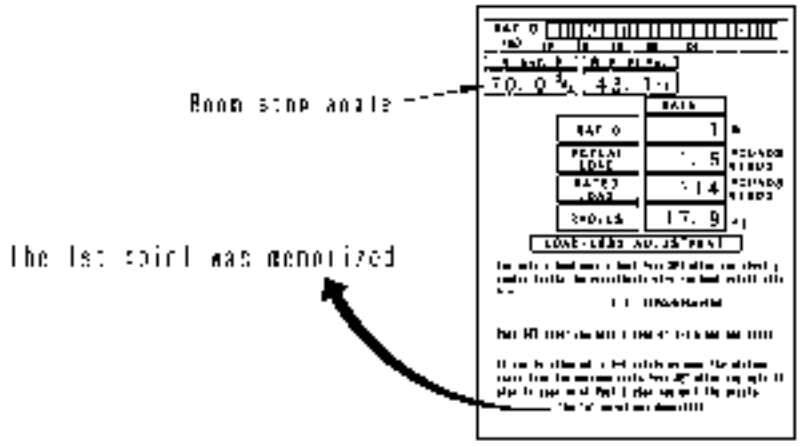
2. Then, the load can be adjustec at zero to five points to the minimum boom angle point.
   Lower the boom to arbitrary points, stop it, and press the [SET] switch.
   The maximum and min mum boon angle points are absolutely necessary for this adjustment, and five points between them can be set arbitrarily or omitted (there is no rule of the number of points, and intervals of points).
   However, note that fine adjustment is possible when many points are set in the boom angle range as wide as possible.

   To omit the points set arbitrarily, press the [▽] switch. Then, the message instructing to lower the boom to the minimum boom angle is displayed.

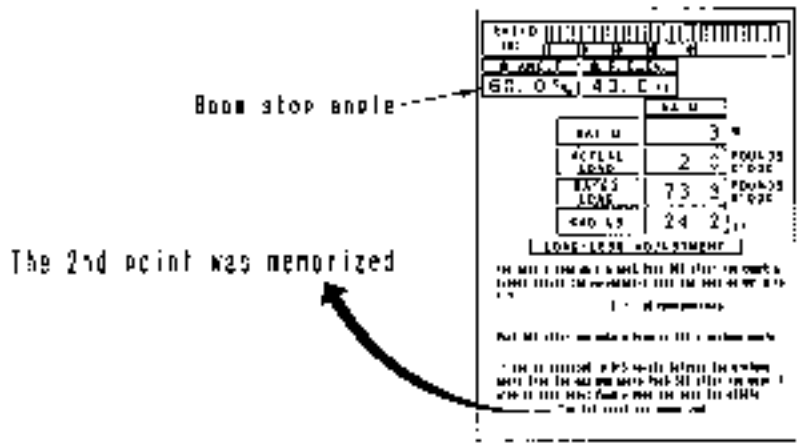


For example,

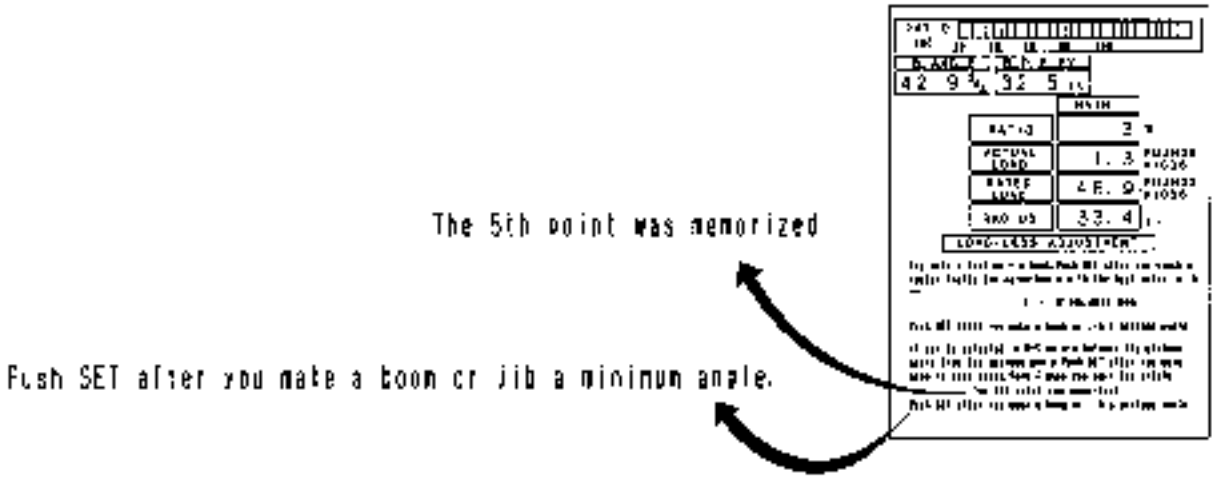
- When the boom is lowered to 70 deg. and stopped as the first arbitrary point, and the [SET] switch is pressed, the message informing that the first point is recorded appears.



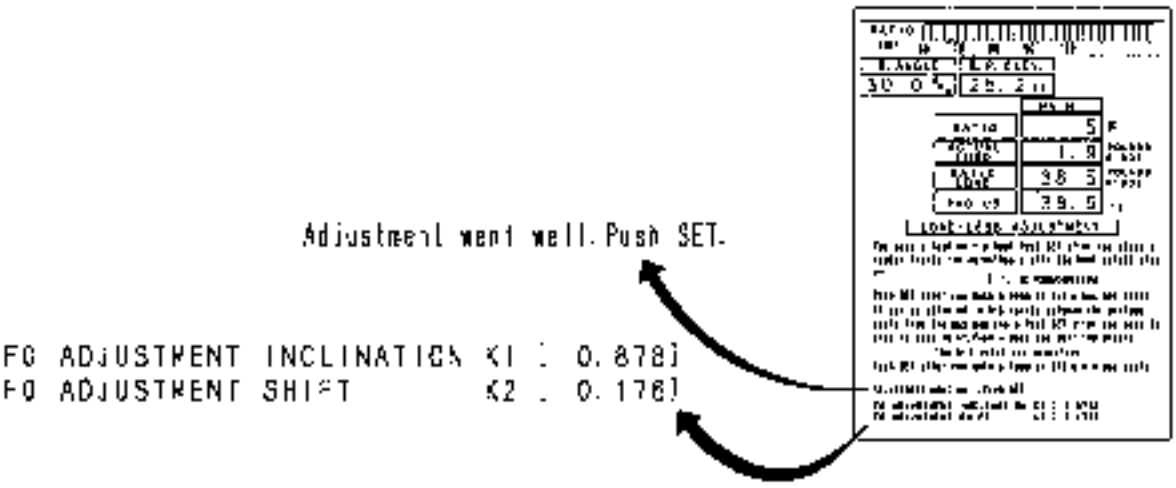
- Next, when the boom is lowered to 60 deg. and stopped as the second arbitrary point, and the SET switch is pressed, the message informing that the second point is recorded appears



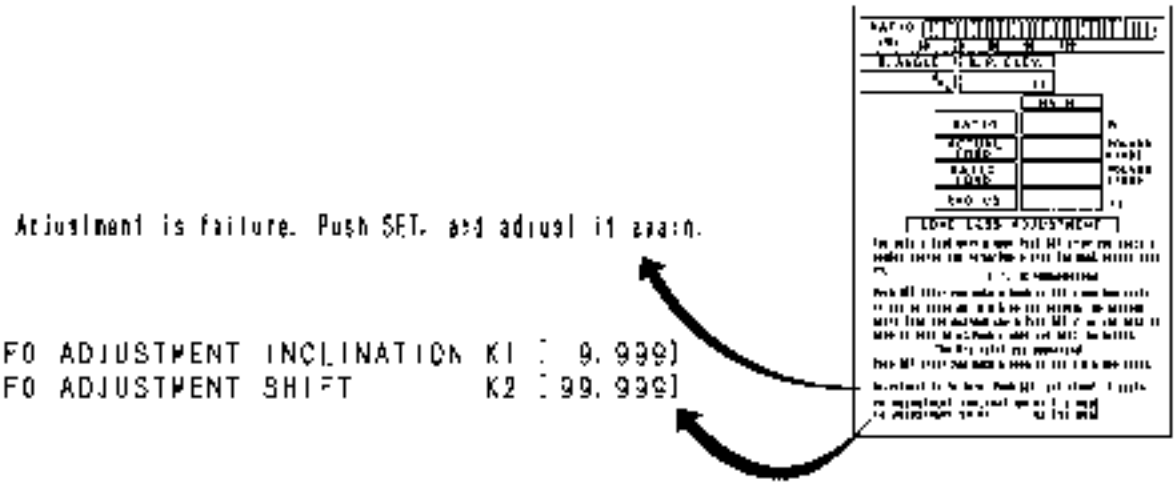
- When the fifth points are recorded after other arbitrary points are set in similar manners, the message instructing to adjust the boom angle to the minimum and press the SET switch. The same message appears even when the switch is pressed to omit arbitrary points.



- When the SET switch is pressed after the boom is lowered to the point near the min mum angle, adjustment results are displayed
  The message shown below appears if the adjustment is normally completed.
  However, figures in [ ] may be changed according to situations



- If the adjustment is not normally completed, the message instructing of re-adjustment is displayed as shown below
  The displayed adjustment results are cancelled if this message appears

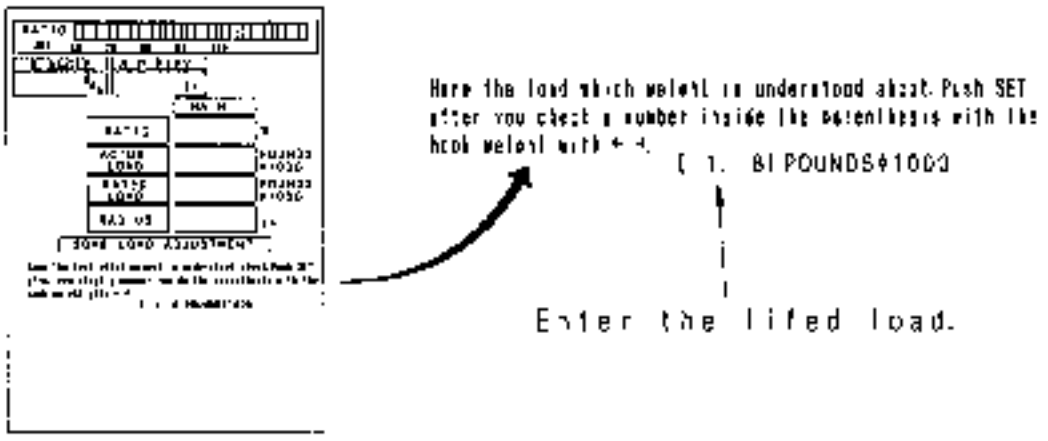


If the lengths of the two or more booms have been already adjusted and the length of the boom that has not been adjusted yet is used, the adjusted two lengths that are closest to it are corrected, and the adjusted length of the boom that has not been adjusted yet is calculated, accordingly.

When "SOME LOAD ADJUSTMENT" is selected

Only the first procedure and the adjustment result of the "SOME LOAD ADJUSTMENT" are different from those of the "LOAD-LESS ADJUSTMENT". Other procedures and displays are identical.

- First, lift a load of which weight is already known, and adjust the displayed value in [ ] to the lifted load (lifted load includes the weights of hook block and wire rope).



- Adjustment procedures are identical to those of the "LOAD LESS ADJUSTMENT".

- The adjustment results are displayed on the bottom of the screen as shown below.

  & ADJUSTMENT INCLINATION K3 [ ]
  & ADJUSTMENT SHIFT K4 [ ]

- Adjustment for luffing crane
  For main lifting, adjust in a similar manner shown 11.6.2.3 LOAD-LESS ADJUSTMENT & SOME LOAD ADJUSTMENT.
  For jib lifting, fix the boom angle, and adjust by modifying the jib angle in a similar manner shown 11.6.2.3 LOAD-LESS ADJUSTMENT & SOME LOAD ADJUSTMENT.

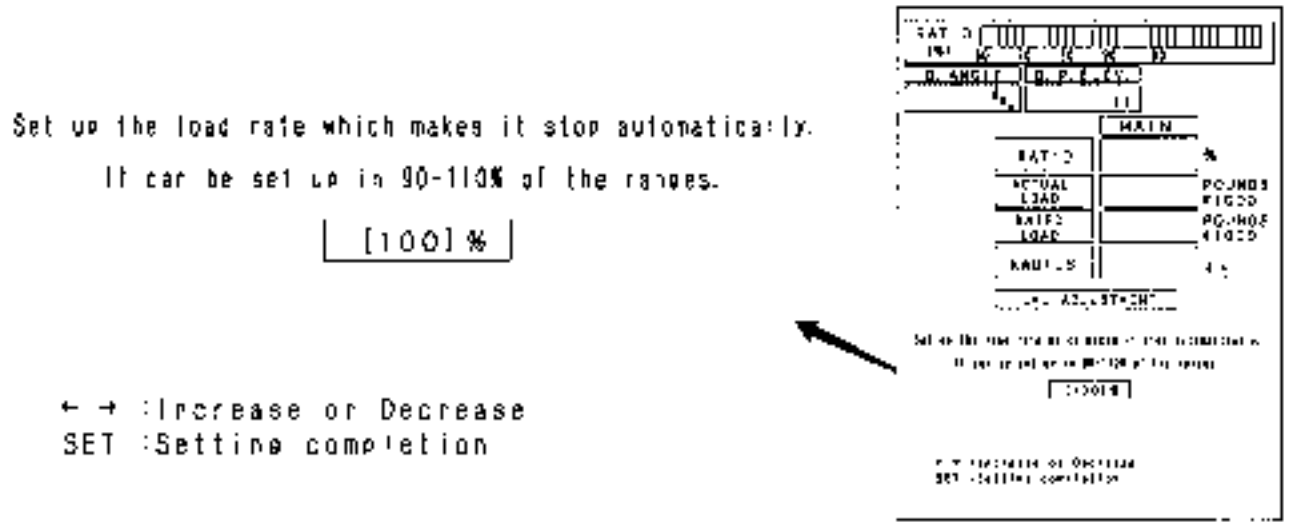
11.6.2.4 LVL ADJUSTMENT (LVL SETTING)

LVL means the level of moment ratio that the machine is automatically stopped and the alarm is issued. It is usually set at 100%, and can be altered in the range from 90 to 110%.

- Increase or decrease the LVL with the ⇦ or ⇨ switch to the intended value, and press the SET switch

Note

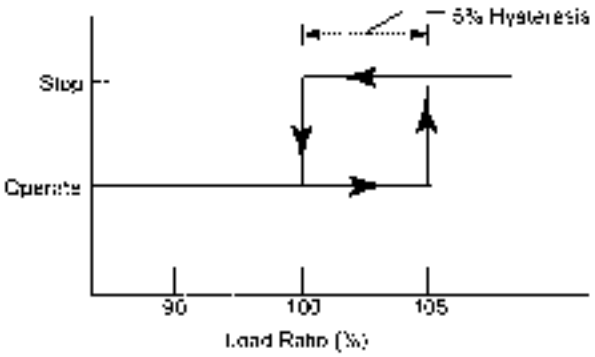
LVL adjustment is available only while the dip switch No 5 is in the "ON" status. When it is in the "OFF" status, the moment ratio level that the machine is automatically stopped and the alarm is issued is set to 105% as usual



LVL Function

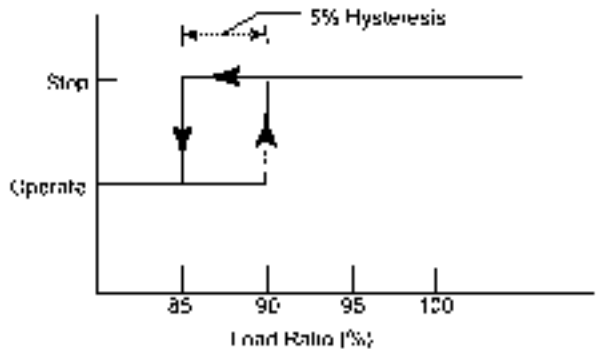
The following drawings are some examples of LVL function.

1 When the LVL function is OFF.



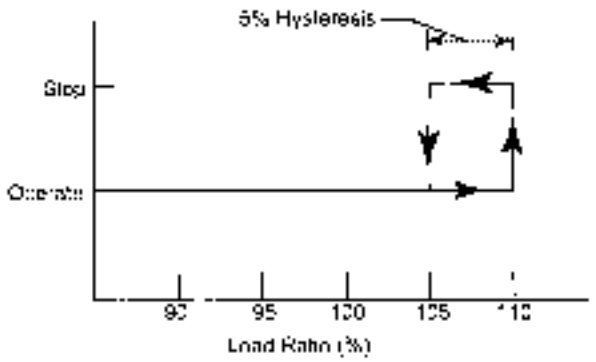
If the loading ratio is 105% or more while the LVL function is not actuated, operation toward the hazardous side is automatically stopped. Note that hysteresis of 5% must be considered for restoration from the automatic stop status. When the loading ratio is returned to 100%, the automatic stop status is cancelled.
When the loading ratio is 90% or more, intermittent alarm sounds are emitted. Continuous alarm sounds are emitted when the loading ratio is 100% or more.

2. When the LVL function is ON and set to 90%.



If the loading ratio is 90% or more, operation toward the hazardous side is automatically stopped. The machine is restored from the automatic stop status when the loading ratio is less than 85%. When the loading ratio is 90%, continuous alarm sounds are emitted. No forecasting sound (intermittent sound) will be emitted.

3. When the LVL function is ON and set to 110%.



When LVL is set at 110%, the figure above applies. Please note the following points.

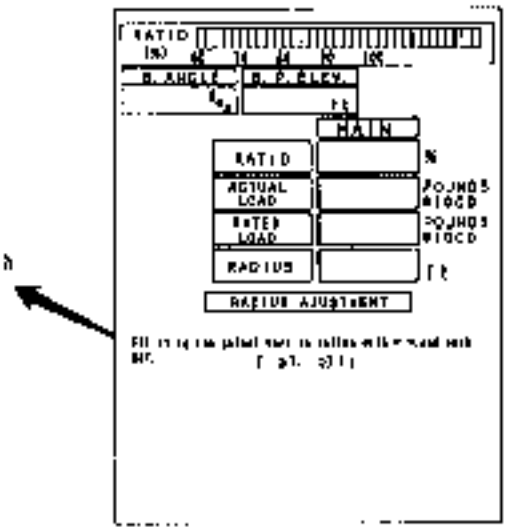
- LVL is also affected by the work area limit parameters. It operates by referencing the smaller value set by the Load Setting switch in "Setting the Work Area Limit Values"
- The LVL operational lag (hysterics) is -5%.
- The load ratio is not affected by LVL function.
- When the loading ratio is 90%, forecasting sounds (intermittent sounds) are emitted. Alarm sounds (continuous sounds) are emitted when the loading ratio is 100% (not affected by the LVL function).

11.6.2.5 RADIUS ADJUSTMENT

When the deflection of the boom causes the difference between the indicated radius and the actual radius, perform this adjustment.

1. Adjust the boom angle close to the maximum angle.

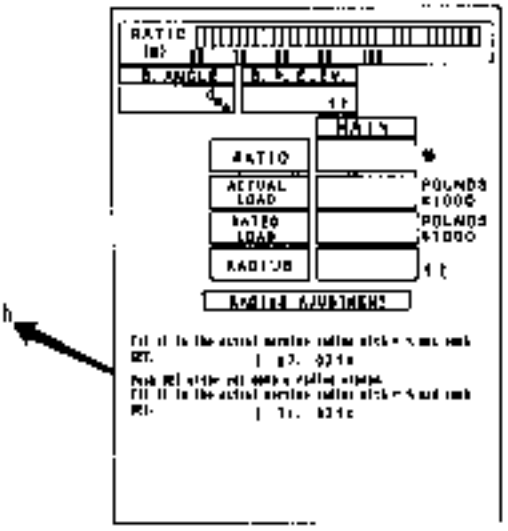
   Move the cursor ⇨ onto the "RADIUS ADJUSTMENT", and press the SET switch. Then, the screen shown below appears.



Fit [ ] to the actual working radius with ← →, and push SET. [37. 0] ft

Measure the actual radius with a measuring tape, and enter it in the [ ] on the screen, and press the SET switch.

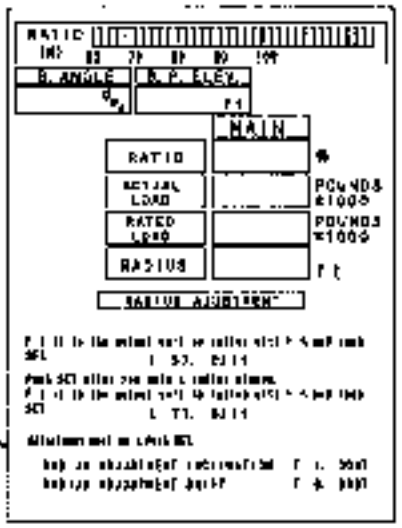
2. Adjust the boom angle close to the minimum angle and press the SET switch. Then, the screen shown below appears.



Push SET after you make a radius change.
Fit [ ] to the actual working radius with ← →, and push SET. [71. 9] ft

Measure the actual radius with a measuring tape, and enter it in the [ ] on the screen, and press the SET switch.

3. When the adjustment is successfully completed, the screen shown below appears. To return to the previous screen, press the SET switch.




```
Adjustment went wel . Push SET.
 RADIUS ADJUSTMENT INCLINATION   [  1.  003]
 RADIUS ADJUSTMENT SHIFT         [  0.  696]
```

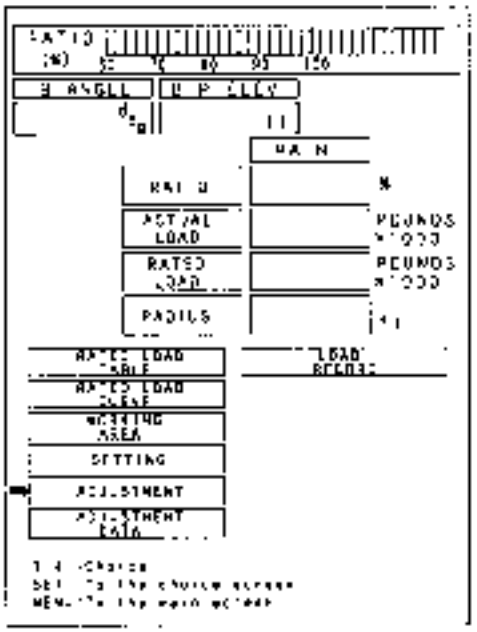
4. If the adjustment is failed, the messages shown below appear. In such a case, retry it.

```
Adjustment is failure.  Push SET, and adjust again.
RADIUS ADJUSTMENT INCLINATION    [1.003]
RADIUS ADJUSTMENT SHIFT          [-9.999]
```

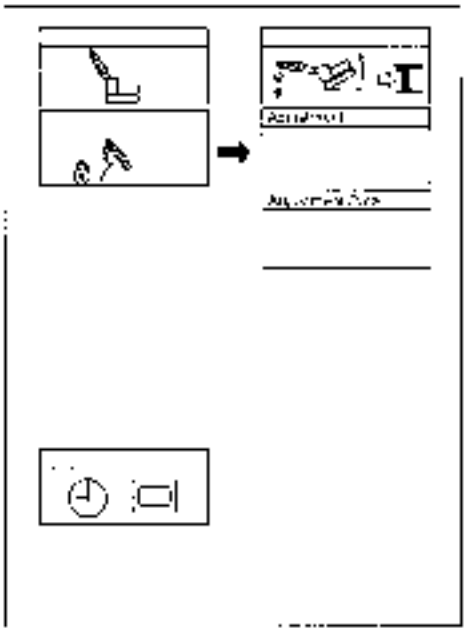
11.6.3 LOAD ADJUSTMENT

Perform the user adjustment only when the load detector should be temporarily adjusted if it is faulty and the indicated load differs from the actual load. In this adjustment, no limitation is provided for the adjustment values. If the setup of the crane status is altered, the adjustment values are deleted, and they are returned to operation based on the adjustment values provided by manufactures. This adjustment should be used as the temporary measure for emergency.

1. When the dip switch No.3 of the controller is turned on, selection items for the "Adjustment" appear on the screen

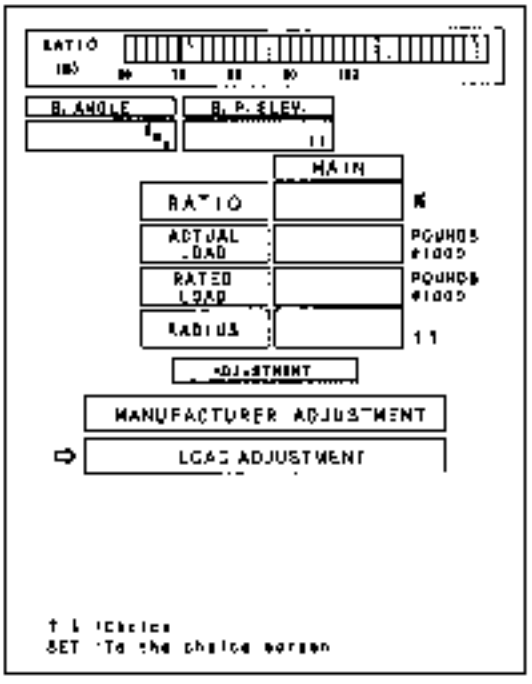


CK SERIES

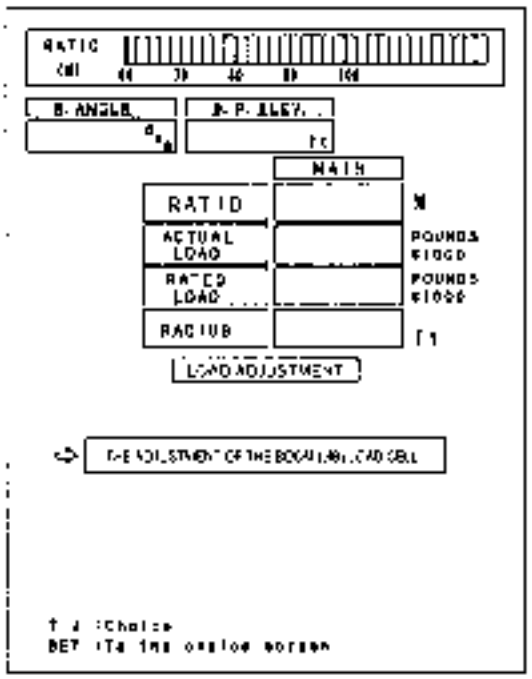


CKE SERIES

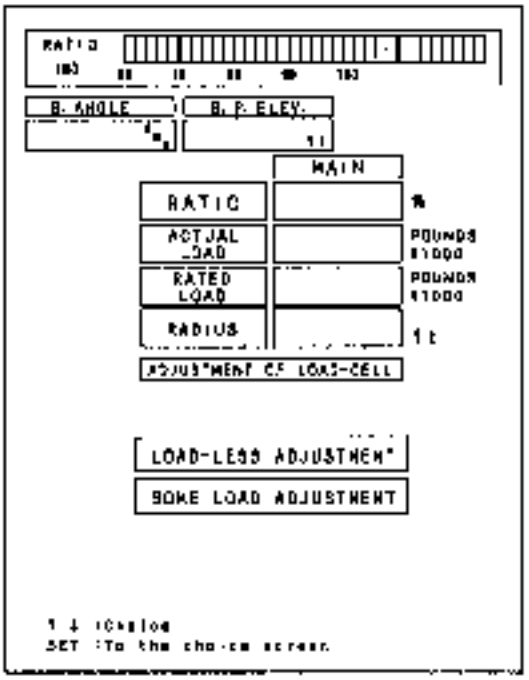
2. When the cursor is moved onto the "Adjustment" and the SET switch is pressed, the screen shown below appears



3. When the cursor is moved onto the "Load adjustment" and the SET switch is pressed, the screen shown below appears.



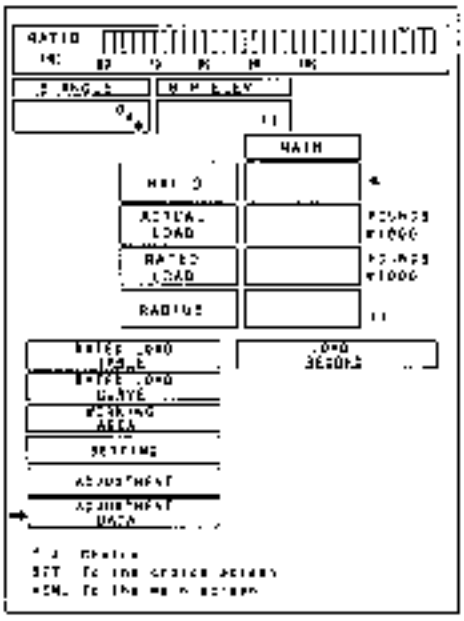
4. When the SET switch is pressed next, the screen shown below appears.
Procedures of "LOAD-LESS ADJUSTMENT" and "SOME LOAD ADJUSTMENT" are the same as those of the "Manufacturers adjustment".



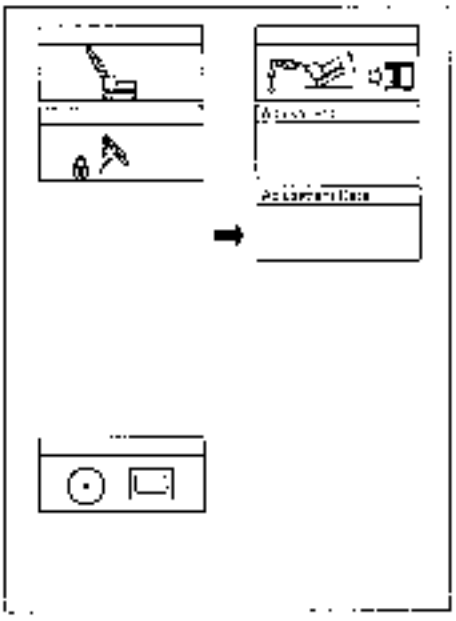
11.6.4 ADJUSTMENT DATA COPY (INITIALIZATION)

The manufacture adjustment values are stored in the flash memory in the controller, and used for actual operation. They can be copied down into the data card in case of disorder of the controller.
Even if a controller is replaced with a new controller, readjustment is unnecessary if the copied data of adjustment values in the used data card are written on the new controller.

1 Turn the dip switch No.3 ON. Then, the "ADJUSTMENT DATA" is added to the menus and displayed.

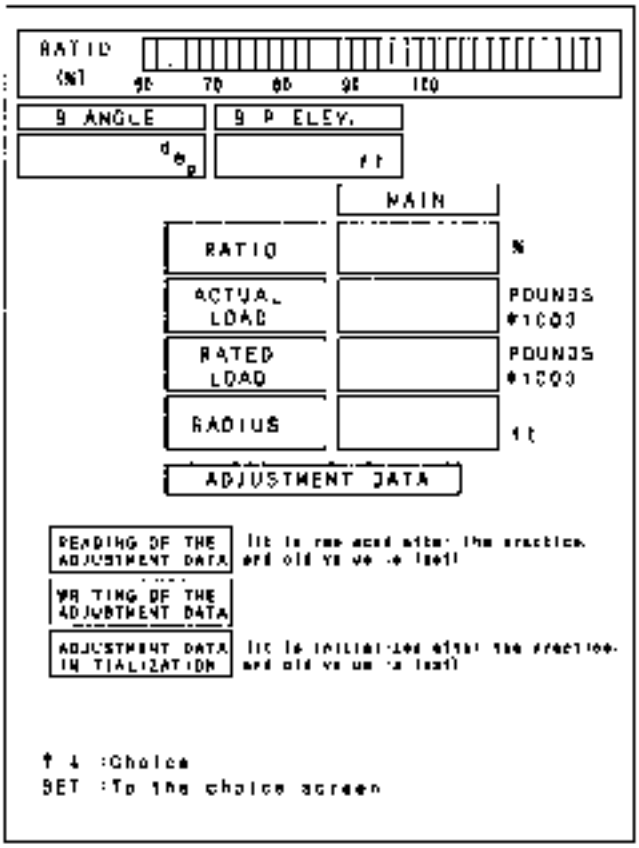


CK SERIES



CKE SERIES

Move the cursor ⇨ onto the "ADJUSTMENT DATA", and press the SET switch. Then, the screen shown below appears.

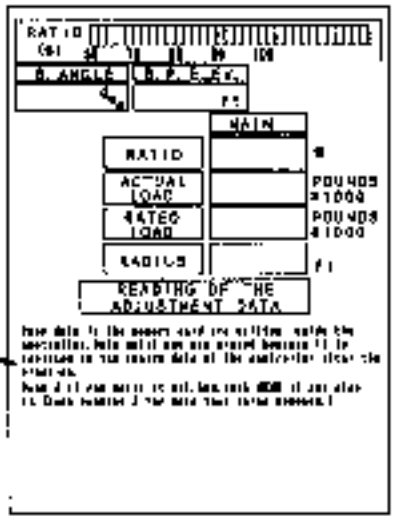


Following three functions are available :

READING OF THE ADJUSTMENT DATA	This command allows transmission of all the adjustment values in the original data card after the controller is replaced with a new one. Copied data in the data card can be read out and written into the flash memory in the controller. When this item is selected, data of adjustment values stored in the flash memory are erased and replaced with new data. Ensure that the stored data may be replaced with new data before selecting this item.
WRITING OF THE ADJUSTMENT DATA	This command allows backup of all the adjustment values in the controller into a new data card after the old data card is replaced with a new one. Data of adjustment values in the flash memory can be copied in the data card. They usually are copied automatically when any adjustment is performed. Select this item when you need to copy them in other cases.
ADJUSTMENT DATA INITIALIZATION	Data of adjustment values in the flash memory can be initialized.

11.6.4.1 READING OF THE ADJUSTMENT DATA

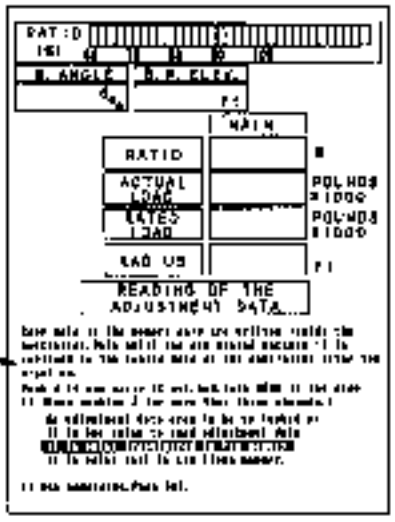
Move the cursor (▷) onto the "READING OF THE ADJUSTMENT DATA", and press the [SET] switch. Then, the screen shown below appears.




```
Copy data in the memory card are written inside the
controller. Data until now are erased because it is
replaced in the inside data of the controller after the
practice.
Push ↓ if you carry it out. And, push MENU if you stop
it. (Keep pushing ↓ for more than three seconds.)
```

To execute this job, press and hold the [↓] switch for three seconds or longer. To cancel it, press the [ESC] switch.
When this job is successfully completed, the screen shown below appears.

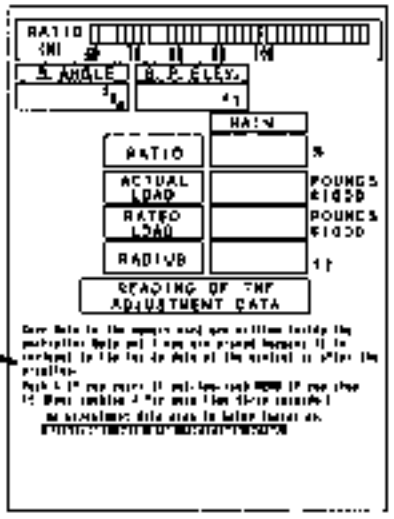
To return to the previous screen, press the [SET] switch.




```
Copy data in the memory card are written inside the
controller. Data until now are erased because it is
replaced in the inside data of the controller after the
practice.
Push ↓ if you carry it out. And, push MENU if you stop
it. (Keep pushing ↓ for more than three seconds.)
    An adjustment data area is being looked up.
    It is beginning to read adjustment data.
    It is being transferred to the memory.
    It is being kept in the flash memory.

It was completed. Push SET.
```

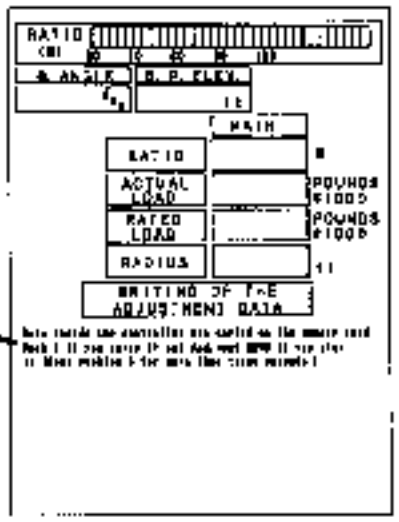
If error messages shown below appear on the screen after the execution of this job, the data card may not be fully inserted. In such a case, make sure that the card is securely inserted, and then, retry the execution.

Copy data in the memory card are written inside the controller. Data until now are erased because it is replaced in the inside data of the controller after the practice.
Push ↓ if you carry it out And, push MENU if you stop it. (Keep pushing ↓ for more than three seconds.)
An adjustment data area is being locked up.
Adjustment data area reference error.



11.6.4.2 WRITING OF ADJUSTMENT DATA

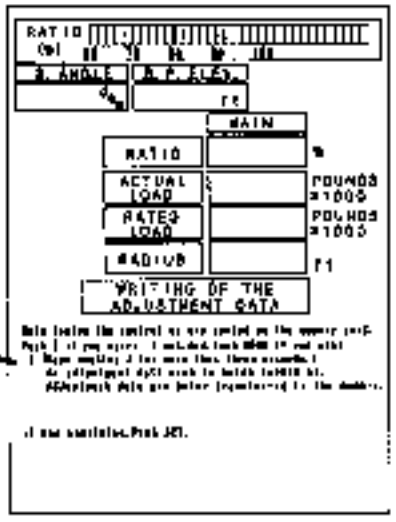
Move the cursor (▷) onto the "WRITING OF THE ADJUSTMENT DATA", and press the [SET] switch. Then, the screen shown below appears.



To execute this job, press and hold the [↓] switch for three seconds or longer. To cancel it, press the [MENU] switch. The previous screen appears.

When this job is successfully completed, the screen shown below appears.

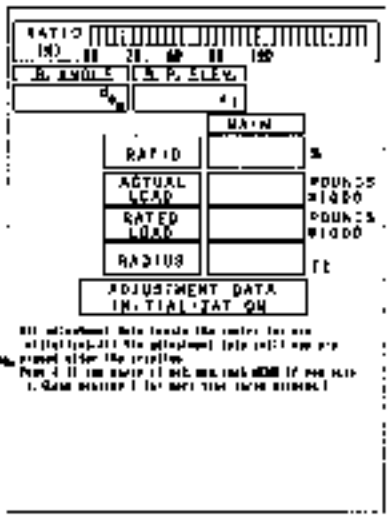
To return to the previous screen, press the [SET] switch.



If error messages similar to those on the screen of the "WRITING OF THE ADJUSTMENT DATA", make sure that the card is securely inserted, and then, retry the execution.

11.6.4.3 INITIALIZATION OF ADJUSTMENT DATA

Move the cursor (▷) onto the "ADJUSTMENT DATA INITIALIZATION", and press the [SET] switch. Then the screen shown below appears.

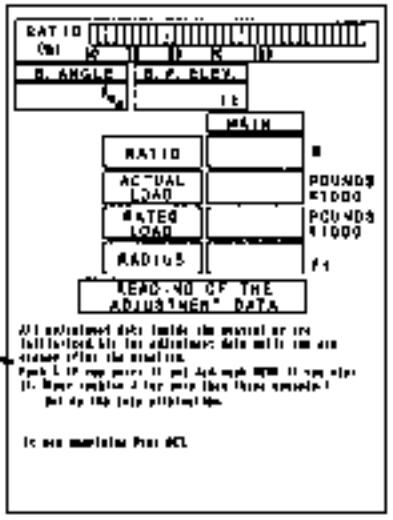


All adjustment data inside the controller are initialized. All the adjustment data until now are erased after the practice.
Push ↓ if you carry it out. And, push MENU if you stop it. (Keep pushing ↓ for more than three seconds.)

To execute this job, press and hold the [▽] switch for three seconds or longer. To cancel it, press the [ESC] switch. The previous screen appears.

When this job is successfully completed, the screen shown below appears.

To return to the previous screen, press the [SET] switch.



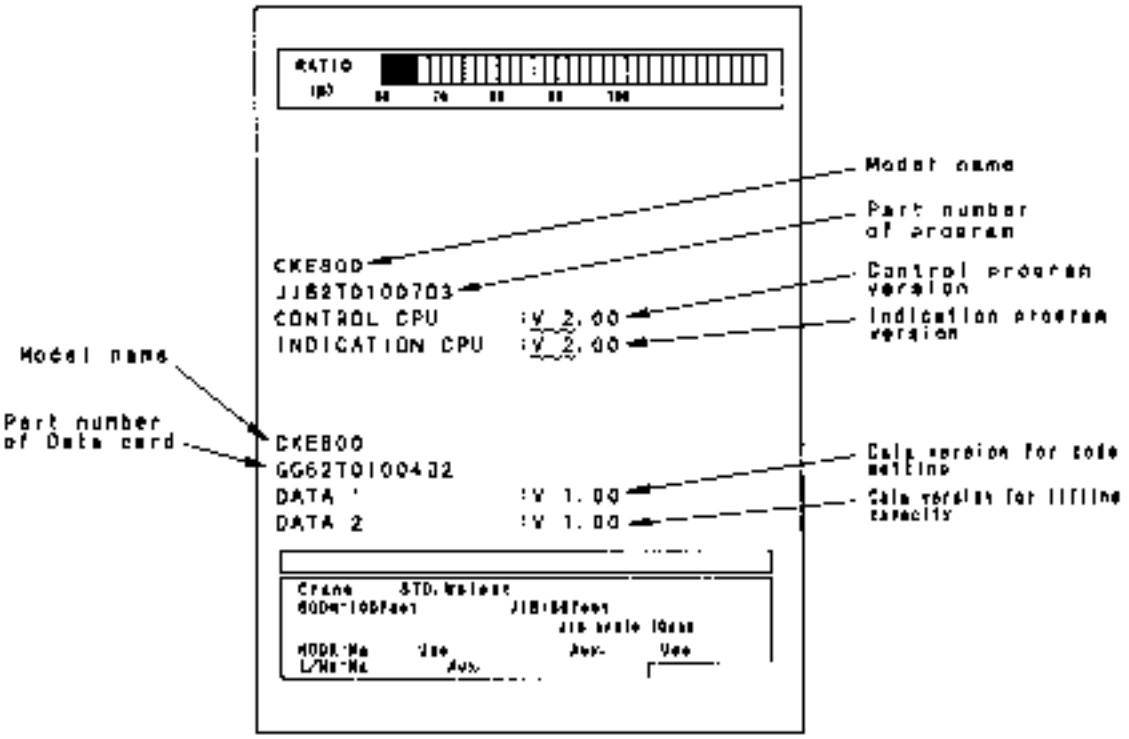
All adjustment data inside the controller are initialized. All the adjustment data until now are erased after the practice.
Push ↓ if you carry it out. And, push MENU if you stop it. (Keep pushing ↓ for more than three seconds.)
During the data elimination.

It was completed. Push SET

11.6.5 VERSION CHECK

Versions of "indication program" "control program", and "data" can be displayed by the step shown below.

When both the [HOME] and [CLEAR] switches are pressed for three seconds or longer at a time, display of versions is started.
The previous screen reappears when they are released.
(Version screen can be accessed from any screen.)



* Versions and P/No. shown in the all figure are some example. Actually displayed versions may differ from them.

11.7 ERROR CODE (ABNORMALITY DETECTION) AND COUNTERMEASURES

When an abnormality is detected, error messages are displayed in the message display window. Some abnormalities may cause lamp displays too. The machine will stop and a steady alarm sound comes on. The auto-stop mechanism can be bypassed by using the Overhoist Release switch, but the alarm sound will continue

- Status display (1/2)

Message (CK series)	CODE (CKE series)	Buzzer	Display conditions (mach ne statuses)
(1) Out of angle.	(J001)	Peep	Out of capacity set range
(2) Stop by the hook overhoist is canceled	(J002)	-	The hook overhoist automatic stop release switch is actuated.
(3) Stop by the boom/jib overhoist is canceled.	(J003)		Input from the boom/jib raising stop cancel switch is detected.
(4) Stop by the overload is canceled.	(J004)		Overload status is canceled.
(5) Overload condition	(J005)	Beep	The loading ratio exceeds the specified level.
(6) Head wind is strong.	(J006)	-	The head wind load alarm is issued
(7) Boom is lowered too much.	(J007)	Beep	The boom is out of the maximum working radius area
(8) Boom is raised too much.	(J008)	Peep	The boom is out of the minimum working radius area
(9) Jib is lowered too much.	(J009)	Beep	The jib is out of the maximum working radius range.
(10) Jib is raised too much.	(J010)	Peep	The jib is within the minimum working radius range.
(11) Boom is lowered too much.	(J011)	Beep	The main boom angle is smaller than the lower limit.
(12) Boom is raised too much.	(J012)	Peep	The main boom angle exceeds the upper limit.
(13) Jib is lowered too much.	(J013)	Beep	The jib offset angle exceeds the upper limit.
(14) Jib is raised too much.	(J014)	Peep	The jib offset angle is smaller than the lower limit.
(17) Hook overhoist.	(J017)	Peep	The main hook overhoist limit switch is actuated.
(18) Hook overhoist.	(J018)	Peep	The aux. hook overhoist limit switch is actuated.
(21) Boom overhoist.	(J021)	Peep	The boom overhoist limit switch (boom foot, backstop No. 1) is actuated.
(22) Jib overhoist	(J022)	Peep	The jib overhoist limit switch is activated.
(24) Overload forecast.	(J024)	Beep, Beep	Loading ratio is 90% or more, and lower than the specified level.
(25) Reached the setup value of the load limitation.	(J025)	Beep	Lifting load exceeds the lifting load limit value set by operator
(26) Reached 90% of the load limitation value.	(J026)	Beep, Beep	Lifting load exceeds 90% of the lifting load limit value set by operator.
(27) Boom angle reached upper limitation value.	(J027)	Peep	The boom reaches the boom angle upper limit point (stop point) set by operator
(28) Boom angle reached lower limitation value.	(J028)	Peep	The boom reaches the boom angle lower limit point (stop point) set by operator
(29) Jib angle reached upper limitation value	(J029)	Peep	The jib reaches the jib angle upper limit point (stop point) set by operator

• Status display (2/2)

Message (CK Series)	CODE (CKE series)	Buzzer	Display conditions (machine statuses)
(30) Jib angle reached lower limitation value.	(J030)	Peep-	The jib reaches the jib angle lower limit point (stop point) set by operator.
(31) Working radius reached limitation value.	(J031)	Peep-	The boom reaches the working radius limit point (stop point) set by operator
(32) Boom point elevation reached limitation value.	(J032)	Peep-	The boom reaches the boom height limit point (stop point) set by operator.
(33) Jib point elevation reached limitation value.	(J033)	Peep-	The jib height reaches the limit value (stop point) preset by the operator.
(56) Check mode (Overload condition)	(J056)	Beep-	In the overload check mode
(60) Boom overhoist	(J060)	Peep-	The boom overhoist limit switch (second backstop) is activated.

When any fault occurs, the corresponding error message is displayed on the message display. If any error code for the load detector and the boom angle detector is issued, the machine is automatically stopped, and the buzzer sounds are emitted. Note that cancellation by using the release switch of the load safety device is enabled.

• Error message

Detected fault	Required condition of detection	Message contents (CK series)	CODE (CKE series)	Alarm sound
No corresponding data is present in the M/L data storage area in the controller		(34) Wrong code number setup	(E034)	Beep
Faulty load detector for crane	0.45 V or less, or 6.20 V or more	(36) Faulty boom hoist load detector	(E036)	Beep
Faulty load detector for tower	0.45 V or less, or 6.20 V or more	(38) Faulty jib hoist load detector	(E038)	Beep
Faulty boom angle detector	0.5 V or less	(44) Faulty lower boom angle detector	(E044)	Beep
Faulty jib angle detector	0.5 V or less	(47) Faulty lower jib angle detector	(E047)	Beep
Communication data cannot be received from the total controller	1. It takes for five seconds or more from the receipt of STX to that of the next STX. 2. BCC faults occur for ten times continuously.	(57) Faulty communication	(E057)	-

11.8 CONTROL OUTPUT

1. Controller output signal (Type No.01)

STD type crane (main boom only, with aux. sheave and fixed jib) - (3-drums type)

				Digital indication											
				Boom angle (3-digits)	Point elevation (3-digits)	Jib angle (3-digits)	Moment ratio (3-digits) * CK series only.		Actual load (3-digits)		Rated load (3-digits)		Working radius (4-digits)	
							Main	Aux.	Main	Aux	Main	Aux	Main	Aux.
Power OFF			–	Not indicated	Not indicated	—	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated
Allowable working area			01	Indicated	Indicated		Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Load	Main/Aux. single mode	Overload prenotice	11	Indicated	Indicated	—	Indicated in yellow		Indicated		Indicated		Indicated	Indicated
		Overload	12	Indicated	Indicated		Indicated in red		Indicated		Indicated		Indicated	Indicated
	Main hook max. load set point (area limitation)		19	Indicated	Indicated	—	Indicated in red	Indicated	Indicated	Indicated	Indicated in green	Indicated	Indicated	Indicated
	Aux. hook max. load set point (area limitation)		20	Indicated	Indicated	--	Indicated	Indicated in red	Indicated	Indicated	Indicated	Indicated in green	Indicated	Indicated
Radius	Boom over-lowering		31	Indicated in red	Indicated	—	---	---	---	---	3.0	0.0	Indicated in red	Indicated in red
	Boom over-raising		32	Indicated in red	Indicated	—	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Main hook radius excess (area limitation prenotice)		33	Indicated	Indicated	—	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in yellow	Indicated
	Main hook radius excess (area limitation alarm)		34	Indicated	Indicated	—	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in yellow	Indicated
	Aux. hook radius excess (area limitation prenotice)		35	Indicated	Indicated	—	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in yellow
	Aux. hook radius excess (area limitation alarm)		36	Indicated	Indicated	—	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in yellow
Angle	Boom over-lowering (area limitation prenotice)		41	Indicated in yellow	Indicated	—	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Boom over-lowering (area limitation alarm)		42	Indicated in yellow	Indicated	—	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Boom over-raising (area limitation prenotice)		43	Indicated in yellow	Indicated	—	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Boom over-raising (area limitation alarm)		44	Indicated in yellow	Indicated	—	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Elevation	Point elevation (area limitation prenotice)		61	Indicated in yellow	Indicated in yellow	—	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Point elevation (area limitation alarm)		62	Indicated in yellow	Indicated in yellow	—	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Limit switch	Main hook overhoist		71	Indicated	Indicated	—	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Aux. hook overhoist		72	Indicated	Indicated	—	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Boom overhoist		74	Indicated in red	Indicated	—	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in red	Indicated in red
	Jib overhoist		75	Indicated	Indicated	—	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in red	Indicated in red
Others	Head wind alarm		81	Indicated	Indicated	—	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Attachment self-standing and stowing		91	Indicated	Indicated	--	—	—	—	—	3.0	0.0	Indicated	Indicated
	Attachment assembly and disassembly		92	Indicated	Indicated	—	–							

				Whole moment ratio (bar indicator) (3-digits)	Mode indication		Alarm output					
							Alarm output					
							Alarm sounds					
					Main	Aux.	Overload (Boom)	Overhoist Prev.	Messages	Voice alarms	Alarm output conditions	Alarm cancel conditions
Power OFF			—	Not indicated	Not indicated	Not indicated	Not issued	Not issued	—	—	—	—
Allowable working area			01	Indicated	Indicated	Indicated	Not issued	Not issued	—	—	—	—
Load	Main/Aux. single mode	Overload preno tice	11	Indicated in yellow	Indicated	Indicated	Intermittent	—	(24)	11	K	B
		Overload	12	Indicated in red	Indicated	Indicated	Continuous	—	(5)	2	L	C
	Main hook max. load set point (area limitation)		19	Indicated	Indicated	Indicated	Intermittent	—	(5)	2	L	C
	Aux. hook max. load set point (area limitation)		20	Indicated	Indicated	Indicated	Intermittent	—	(5)	2	L	C
Radius	Boom over-lowering		31	Entirely indicated in red	Indicated	Indicated	Continuous	—	(7)	4	N	D
	Boom over-raising		32	Indicated	Indicated	Indicated	—	Continuous	(8)	5	M	D
	Main hook radius excess (area limitation prenotice)		33	Indicated	Indicated	Indicated	—	Intermittent	—	—	M	J
	Main hook radius excess (area limitation alarm)		34	Indicated	Indicated	Indicated	—	Continuous	(31)	14	M	J
	Aux. hook radius excess (area limitation prenotice)		35	Indicated	Indicated	Indicated	—	Intermittent	—		M	J
	Aux. hook radius excess (area limitation alarm)		36	Indicated	Indicated	Indicated		Continuous	(31)	14	M	J
Angle	Boom over-lowering (area limitation prenotice)		41	Indicated	Indicated	Indicated	—	Intermittent	—		M	D
	Boom over-lowering (area limitation alarm)		42	Indicated	Indicated	Indicated	—	Continuous	(28)	13	M	D
	Boom over-raising (area limitation prenotice)		43	Indicated	Indicated	Indicated	—	Intermittent	—	—	M	D
	Boom over-raising (area limitation alarm)		44	Indicated	Indicated	Indicated	-	Continuous	(27)	13	M	D
Elevation	Point elevation (area limitation prenotice)		61	Indicated	Indicated	Indicated	—	Intermittent	—	—	M	J
	Point elevation (area limitation alarm)		62	Indicated	Indicated	Indicated	—	Continuous	(32)	15	M	J
Limit switch	Main hook overhoist		71	Indicated	Indicated in red	Indicated in red	—	Continuous	(17)	10	P	A
	Aux. hook overhoist		72	Indicated	Indicated in red	Indicated in red	—	Continuous	(18)	10	P	A
	Boom overhoist		74	Indicated	Indicated	Indicated	—	Continuous	(21)	5	Q	A
	Jib overhoist		75	Indicated	Indicated	Indicated	—	Continuous	(23)	10	Q	A
Others	Head wind alarm		81	Indicated	Indicated	Indicated	—	—	(6)	3		—
	Attachment self-standing and slewing		91	Entirely indicated in red	Indicated	Indicated	—	—	(1)	—	—	
	Attachment assembly and disassembly		92	—			Not issued	Not issued	—	—	—	—

				Crane control output								External indication output		
				Automatic stop						Conditions required for restoration from automatic stop		<90%	90%≤ <LVL	LVL ≤
				Winch 1	Winch 2		Winch 3	Raising 1						
				Main winch	Aux. winch		Third winch	Boom raising		Restoration	Compulsory cancellation	Green	Yellow	Red
				Up	Up	Down	Up	Up	Down					
Power OFF			—	OFF	OFF	OFF	OFF	OFF	OFF	—	—	OFF	OFF	OFF
Allowable working area			01	ON	ON	ON	ON	ON	ON	—	—	ON	OFF	OFF
Load	Main/Aux. single mode	Overload prenotice	11	—	—	—	—	—	—			OFF	ON	OFF
		Overload	12	OFF	OFF	ON	OFF	ON	OFF	F	Z	OFF	OFF	ON
	Main hook max. load set point (area limitation)		19	OFF	OFF	ON	OFF	ON	OFF	F	Z	OFF	OFF	ON
	Aux. hook max. load set point (area limitation)		20	OFF	OFF	ON	OFF	ON	OFF	F	Z	OFF	OFF	ON
Radius	Boom over-lowering		31	OFF	OFF	ON	OFF	ON	OFF	D	Z	—	—	
	Boom over-raising		32	—	—	—	—	OFF	ON	D	T	—		—
	Main hook radius excess (area limitation prenotice)		33	—	—	—	—	—	—	—	—	—	—	—
	Main hook radius excess (area limitation alarm)		34	—	—	—	—	—	OFF	J	Z	—		—
	Aux. hook radius excess (area limitation prenotice)		35	—	—	—	—	—	—	—	—	—	—	—
	Aux. hook radius excess (area limitation alarm)		36	—	—	—	—	—	OFF	J	Z	—		—
Angle	Boom over-lowering (area limitation prenotice)		41	—	—	—	—	—	—	—	—	—	—	
	Boom over-lowering (area limitation alarm)		42	—	—	—	—	—	OFF	D	Z			—
	Boom over-raising (area limitation prenotice)		43	—	—	—	—	—	—	—	—	—	—	—
	Boom over-raising (area limitation alarm)		44	—	—	—	—	OFF	—	D	Z	—	—	—
Elevation	Point elevation (area limitation prenotice)		61	—	—	—	—	—	—	—	—	—	—	—
	Point elevation (area limitation alarm)		62	—	—	—	—	OFF		J	Z		—	—
Limit switch	Main hook hook overhoist		71	OFF	OFF	ON	OFF	ON	OFF	A	S	—	—	—
	Aux. hook hook overhoist		72	OFF	OFF	ON	OFF	ON	OFF	A	S	—	—	—
	Boom overhoist		74	OFF	OFF	ON	OFF	OFF	ON	A	R	—	—	—
	Jib overhoist		75	ON	OFF	ON	ON	ON	OFF	A	R	—	—	—
Others	Head wind alarm		81	—	—	—	—	—	—	—	—	ON	OFF	OFF
	Attachment self-standing and stowing		91	(ON)	(ON)	ON	(ON)	ON	ON	A	S	OFF	OFF	ON
	Attachment assembly and disassembly		92	ON	ON	ON	ON	ON	ON	—	—	OFF	OFF	ON

Notes

(1) Symbols "-" shown on the columns of alarm sounds, crane control output, and external indication output in the table above indicate that the corresponding items are not the subjects of control.

(2) In the columns of the crane control output (automatic stop) and external indication output, "OFF" indicates the stop status, and "ON" indicates the operable status.

(3) In respect of automatic stop, priority is given in the following order : condition No.92, 71 to 75, 91, 01 to 62 (except for 81).

(4) Point elevation is indicated only when the indication is requested on the setting screen

Details of alarm and automatic stop condition symbols

(a) When the status is cancelled, the machine immediately restores automatically.

(b) When the moment ratio is decreased to 89.5%, the status is cancelled (automatically restored)

(c) When the moment ratio is decreased by 0.5% from the overload automatic start point, the status is cancelled (automatically restored).

(d) When the boom is returned to the safety side by 0.4 deg. or more from the limit angle, the status is cancelled (automatically restored).

(e) When the boom is returned to the safety side by 2.0 deg. or more from the limit angle, the status is cancelled (automatically restored).

(f) When the moment ratio is decreased by 5.0% from the overload automatic stop point, the status is cancelled (automatically restored).

(g) Blank

(h) Blank

(i) Blank

(j) When the radius or elevation is returned by 0.1 m (0.1 feet) to the safety side from the prenotice set radius or height, the status is cancelled (automatically restored).

(k) Alarm is issued when the moment ratio is 90% or more.

(l) Alarm is issued when the moment ratio exceeds the LVL.

(m) Alarm is issued when the set values are exceeded and the machine is operated in hazardous directions.

(n) Alarm is issued when the boom angle exceeds the limit angle.

(o) Blank

(p) Alarm is issued when overhoist occurs and the machine is operated in hazardous directions

(q) Alarm is issued when overhoist occurs

(r) The status cannot be cancelled whatever cancel switch is operated.

(s) Automatic stop is cancelled only while the hook overhoist cancel switch is operated.

(t) Automatic stop is cancelled only while the boom overhoist cancel switch is operated.

(u) Blank

(v) Blank

(w) Blank

(x) Blank

(y) Blank

(z) Automatic stop is cancelled only while the overload cancel switch is operated.

2. Controller output signal (Type No 03)

Luffing crane (main, auxiliary, boom, lufing jib) - (4-drums type)

				Digital indication						
				Boom angle (3-digits)	Boom elevation (3-digits)	Jib offset angle (3-digits)	Jib angle (3-digits)	Moment ratio (3-digits) *CK series only: Main	Jib	Aux
Power OFF			—	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated
Allowable working area			01	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Load	Main/Aux./Jib single mode	Overload prevention	11	Indicated	Indicated	Indicated	Indicated	Indicated in yellow		
Load	Main/Aux./Jib single mode	Overload	12	Indicated	Indicated	Indicated	Indicated	Indicated in red		
Load	Main winch max. load set point (area limitation prevention)		21	Indicated	Indicated	Indicated	Indicated	Indicated in yellow	Indicated	Indicated
Load	Main winch max. load set point (area limitation alarm)		22	Indicated	Indicated	Indicated	Indicated	Indicated in red	Indicated	Indicated
Load	Aux. winch max. load set point (area limitation prevention)		23	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in yellow	Indicated
Load	Aux. winch max. load set point (area limitation alarm)		24	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in red	Indicated
Load	Jib max. load set point (area limitation prevention)		25	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in yellow
Load	Jib max. load set point (area limitation alarm)		26	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in red
Radius	Boom over-lowering (only for crane fitting)		31	Indicated in red	Indicated	Indicated	Indicated	-	---	-
Radius	Boom over-raising (only for main fitting)		32	Indicated in red	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Radius	Jib over-lowering (only for jib fitting)		33	Indicated	Indicated	Indicated in red	Indicated in red	---	---	
Radius	Jib over-raising (only for jib fitting)		34	Indicated	Indicated	Indicated in red	Indicated in red	Indicated	Indicated	Indicated
Radius	Main winch radius excess (area limitation prevention)		35	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Radius	Main winch radius excess (area limitation alarm)		36	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Radius	Aux. winch radius excess (area limitation prevention)		37	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Radius	Aux. winch radius excess (area limitation alarm)		38	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Radius	Luffing jib radius excess (area limitation prevention)		39	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Radius	Luffing jib radius excess (area limitation alarm)		40	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Angle	Boom over-lowering (area limitation prevention)		41	Indicated in yellow	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Angle	Boom over-lowering (area limitation alarm)		42	Indicated in yellow	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Angle	Boom over-raising (area limitation prevention)		43	Indicated in yellow	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Angle	Boom over-raising (area limitation alarm)		44	Indicated in yellow	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Angle	Jib over-lowering (area limitation prevention)		45	Indicated	Indicated	Indicated in yellow	Indicated in yellow	Indicated	Indicated	Indicated
Angle	Jib over-lowering (area limitation alarm)		46	Indicated	Indicated	Indicated in yellow	Indicated in yellow	Indicated	Indicated	Indicated
Angle	Jib over-raising (area limitation prevention)		47	Indicated	Indicated	Indicated in yellow	Indicated in yellow	Indicated	Indicated	Indicated
Angle	Jib over-raising (area limitation alarm)		48	Indicated	Indicated	Indicated in yellow	Indicated in yellow	Indicated	Indicated	Indicated
Angle	Boom low limit angle (only for jib fitting)		49	Indicated	Indicated	Indicated	Indicated			
Angle	Boom upper limit angle (only for jib fitting)		50	Indicated in red	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Angle	Jib offset low limit angle (only for main fitting)		51	Indicated	Indicated	Indicated in red	Indicated in red	Indicated	Indicated	Indicated
Angle	Jib offset upper limit angle (only for main fitting)		52	Indicated	Indicated	Indicated in red	Indicated in red	-	---	---
Elevation	Point elevation (area limitation prevention)		61	Indicated in yellow	Indicated in yellow	Indicated	Indicated in yellow	Indicated	Indicated	Indicated
Elevation	Point elevation (area limitation alarm)		62	Indicated in yellow	Indicated in yellow	Indicated	Indicated in yellow	Indicated	Indicated	Indicated
Limit switch	Main winch hook overhoist		71	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Limit switch	Aux. winch hook overhoist		72	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Limit switch	Boom overhoist (1st)		73	Indicated in red	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Limit switch	Boom overhoist (2nd)		74	Indicated in red	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Limit switch	Jib overhoist		76	Indicated	Indicated	Indicated in red	Indicated in red	Indicated	Indicated	Indicated
Limit switch	Strut over-raising		77	Indicated in red	Indicated	Indicated	Indicated in red	Indicated	Indicated	Indicated
Limit switch	Strut over-lowering		78	Indicated in red	Indicated	Indicated	Indicated in red	Indicated	Indicated	Indicated
Others	[illegible]		81	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Others	Attachment self-standing and lowering		91	Indicated	Indicated	Indicated	Indicated	---	---	---
Others	Attachment assembly and disassembly		92	Indicated	Indicated	Indicated	Indicated			

				Digital indication								
				Actual load (3 digits)			Rated load (3 digits)			Working radius (3 digits)		
				Main	Jib	Aux	Main	Jib	Aux	Main	Jib	Aux
	Power OFF		—	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated	Not indicated
	Allowable working area		01	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Load	Main/Aux. hook single mode	Overload precursor	11	Indicated			Indicated			Indicated	Indicated	Indicated
		Overload	12	Indicated			Indicated			Indicated	Indicated	Indicated
	Main hook max. load set point (area limitation precursor)		21	Indicated	Indicated	Indicated	Indicated in green	Indicated	Indicated	Indicated	Indicated	Indicated
	Main hook max. load set point (area limitation alarm)		22	Indicated	Indicated	Indicated	Indicated in green	Indicated	Indicated	Indicated	Indicated	Indicated
	Jib hook max. load set point (area limitation precursor)		23	Indicated	Indicated	Indicated	Indicated	Indicated in green	Indicated	Indicated	Indicated	Indicated
	Jib hook max. load set point (area limitation alarm)		24	Indicated	Indicated	Indicated	Indicated	Indicated in green	Indicated	Indicated	Indicated	Indicated
	Aux. hook load set point (area limitation precursor)		25	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in green	Indicated	Indicated	Indicated
	Aux. hook load set point (area limitation alarm)		26	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in green	Indicated	Indicated	Indicated
Radius	Boom over-lowering (only for main lifting)		31	—	—	—	0.0	0.0	0.0	Indicated in red	Indicated in red	Indicated in red
	Boom over-raising (only for main lifting)		32	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Jib over-lowering (only for jib lifting)		33	—	—	—	0.0	0.0	0.0	Indicated in red	Indicated in red	Indicated in red
	Jib over-raising (only for jib lifting)		34	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Main hook radius excess (area limitation precursor)		35	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in yellow	Indicated	Indicated
	Main hook radius excess (area limitation alarm)		36	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in yellow	Indicated	Indicated
	Jib hook radius excess (area limitation precursor)		37	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in yellow	Indicated
	Jib hook radius excess (area limitation alarm)		38	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in yellow	Indicated
	Aux. hook radius excess (area limitation precursor)		39	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in yellow
	Aux. hook radius excess (area limitation alarm)		40	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in yellow
Angle	Boom over-lowering (area limitation precursor)		41	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Boom over-lowering (area limitation alarm)		42	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Boom over-raising (area limitation precursor)		43	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Boom over-raising (area limitation alarm)		44	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Jib over-lowering (area limitation precursor)		45	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Jib over-lowering (area limitation alarm)		46	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Jib over-raising (area limitation precursor)		47	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Jib over-raising (area limitation alarm)		48	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Boom low limit angle (only for jib lifting)		49	Indicated	Indicated	Indicated	0.0	0.0	0.0	Indicated	Indicated	Indicated
	Boom upper limit angle (only for jib lifting)		50	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Jib offset low limit angle (only for main lifting)		51	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Jib offset upper limit angle (only for main lifting)		52	Indicated	Indicated	Indicated	0.0	0.0	0.0	Indicated	Indicated	Indicated
Elevation	Point elevation (area limitation precursor)		61	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Point elevation (area limitation alarm)		62	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Limit switch	Main hook overhoist		71	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Jib hook/Aux. hook overhoist		72	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Boom overhoist (Jib)		73	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in red	Indicated in red	Indicated in red
	Boom overhoist (Crane)		74	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in red	Indicated in red	Indicated in red
	Jib overhoist		76	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated in red	Indicated in red	Indicated in red
	Strut over-raising		77	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Strut over-lowering		78	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
Others	Head wind alarm		81	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated	Indicated
	Attachment self-erecting and stowing		91				0.0	0.0	0.0	Indicated	Indicated	Indicated
	Attachment assembly and disassembly		92	—								

			Whole moment ratio (bar indicator) (3 digits)	Mode indication			Alarm output			
							Alarm sounds		Messages	Voice alarms
				Main	Jib	Aux	Over load stop	Over-limit		
Power OFF		—	Not indicated	Not indicated	Not indicated	Not indicated	Not issued	Not issued		—
Allowable working area		01	Indicated	Indicated	Indicated	Indicated	Not issued	Not issued	—	—
Load	Main/Aux/Jib single mode — Overload precaution	11	Indicated in yellow	Indicated	Indicated	Indicated	Intermittent	—	(24)	11
	Main/Aux/Jib single mode — Overload	12	Indicated in red	Indicated	Indicated	Indicated	Continuous	—	(7)	2
	Main hook max. load set point (area limitation precaution)	21	Indicated	Indicated	Indicated	Indicated	Intermittent		(24)	11
	Main hook max. load set point (area limitation alarm)	22	Indicated	Indicated	Indicated	Indicated	Continuous	—	(5)	2
	Jib hook max. load set point (area limitation precaution)	23	Indicated	Indicated	Indicated	Indicated	Intermittent	—	(24)	11
	Jib hook max. load set point (area limitation alarm)	24	Indicated	Indicated	Indicated	Indicated	Continuous	—	(5)	2
	Aux. hook load set point (area limitation precaution)	25	Indicated	Indicated	Indicated	Indicated	Intermittent	—	(24)	11
	Aux. hook load set point (area limitation alarm)	26	Indicated	Indicated	Indicated	Indicated	Continuous	—	(5)	2
Radius	Boom over-lowering (only for main lifting)	31	Entirely indicated in red	Indicated	Indicated	Indicated	Continuous		(7)	4
	Boom over-raising (only for main lifting)	32	Indicated	Indicated	Indicated	Indicated	—	Continuous	(8)	5
	Jib over-lowering (only for jib lifting)	33	Entirely indicated in red	Indicated	Indicated	Indicated	Continuous	—	(11)	5
	Jib over-raising (only for jib lifting)	34	Indicated	Indicated	Indicated	Indicated	—	Continuous	(14)	7
	Main hook radius excess (area limitation precaution)	35	Indicated	Indicated	Indicated	Indicated	—	Intermittent	—	
	Main hook radius excess (area limitation alarm)	36	Indicated	Indicated	Indicated	Indicated	—	Continuous	(31)	14
	Jib hook radius excess (area limitation precaution)	37	Indicated	Indicated	Indicated	Indicated		Intermittent	—	
	Jib hook radius excess (area limitation alarm)	38	Indicated	Indicated	Indicated	Indicated	—	Continuous	(31)	14
	Aux. hook radius excess (area limitation precaution)	39	Indicated	Indicated	Indicated	Indicated	—	Intermittent	—	
	Aux. hook radius excess (area limitation alarm)	40	Indicated	Indicated	Indicated	Indicated	—	Continuous	(31)	14
	Boom over-lowering (area limitation precaution)	41	Indicated	Indicated	Indicated	Indicated	—	Intermittent	—	
Angle	Boom over-lowering (area limitation alarm)	42	Indicated	Indicated	Indicated	Indicated		Continuous	(26)	15
	Boom over-raising (area limitation precaution)	43	Indicated	Indicated	Indicated	Indicated	—	Intermittent	—	—
	Boom over-raising (area limitation alarm)	44	Indicated	Indicated	Indicated	Indicated	—	Continuous	(27)	13
	Jib over-lowering (area limitation precaution)	45	Indicated	Indicated	Indicated	Indicated		Intermittent		
	Jib over-lowering (area limitation alarm)	46	Indicated	Indicated	Indicated	Indicated	—	Continuous	(30)	13
	Jib over-raising (area limitation precaution)	47	Indicated	Indicated	Indicated	Indicated	—	Intermittent		—
	Jib over-raising (area limitation alarm)	48	Indicated	Indicated	Indicated	Indicated		Continuous	(29)	13
	Boom low limit angle (only for jib lifting)	49	Entirely indicated in red	Indicated	Indicated	Indicated	Continuous	—	(11)	4
	Boom upper limit angle (only for jib lifting)	50	Indicated	Indicated	Indicated	Indicated	—	Continuous	(12)	5
	Jib offset low limit angle (only for main lifting)	51	Indicated	Indicated	Indicated	Indicated		Continuous	(14)	7
	Jib offset upper limit angle (only for main lifting)	52	Entirely indicated in red	Indicated	Indicated	Indicated	Continuous	—	(13)	6
Elevation	Point elevation (area limitation precaution)	61	Indicated	Indicated	Indicated	Indicated		Intermittent	—	—
	Point elevation (area limitation alarm)	62	Indicated	Indicated	Indicated	Indicated	—	Continuous	(32)	15
Anti-two-block / Limit switch	Main hook overhoist	71	Indicated	Indicated in red	Indicated	Indicated	—	Continuous	(17)	10
	Aux. hook overhoist	72	Indicated	Indicated	Indicated in red	Indicated in red		Continuous	(18)	10
	Boom overhoist (1st)	73	Indicated	Indicated	Indicated	Indicated	—	Continuous	(21)	7
	Boom overhoist (2nd)	74	Indicated	Indicated	Indicated	Indicated		Continuous	(60)	5
	Three-sheave	76	Indicated	Indicated	Indicated	Indicated	—	Continuous	(22)	7
	Strut over-raising	77	Indicated	Indicated	Indicated	Indicated	—	Continuous	(63)	—
	Strut over-lowering	78	Indicated	Indicated	Indicated	Indicated	—	Continuous	(66)	
Others	Head wind alarm	81	Indicated	Indicated	Indicated	Indicated		—	(6)	3
	Attachment self-standing and lowering	91	Entirely indicated in red	Indicated	Indicated	Indicated		—	(1)	—
	Attachment assembly and disassembly	92	—				Not issued	Not issued	—	—

			Alarm output		Crane control output						
					Automatic stop						
					Winch 1	Winch 2		Raise/lower 1		Raise/lower 2	
			Alarm output control lamp	Alarm output condition	Main winch	Aux. winch		Boom		Jib	
					Up	Up	Down	Up	Down	Up	Down
Power OFF			—	—	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Allowable working area		01		—	ON	ON	ON	ON	ON	ON	ON
Load	Main/Aux. Jib single mode – Cautious (precaution)	11	A	B	—	—	—	—	—	—	—
Load	Main/Aux. Jib single mode – Overload	12	L	C	OFF	OFF	ON	ON	OFF	ON	OFF
Load	Main hook max. load set point (area limitation precaution)	21	K	B	—	—	—	—	—	—	—
Load	Main hook max. load set point (area limitation alarm)	22		C	OFF	OFF	ON	ON	OFF	ON	OFF
Load	Jib hook max. load set point (area limitation precaution)	23	K	B	—	—	—	—	—	—	—
Load	Jib hook max. load set point (area limitation alarm)	24	L	C	OFF	OFF	ON	ON	OFF	ON	OFF
Load	Aux. hook load set point (area limitation precaution)	25	K	B	—	—	—	—	—	—	
Load	Aux. hook load set point (area limitation alarm)	26	L	C	OFF	OFF	ON	ON	OFF	ON	OFF
Radius	Boom over-lowering (only for main lifting)	31	M	D	OFF	OFF	ON	ON	OFF	ON	OFF
Radius	Boom over-raising (only for main lifting)	32	M	D	ON	ON	ON	OFF	ON	ON	ON
Radius	Jib over-lowering (only for jib lifting)	33	M	D	OFF	OFF	ON	ON	OFF	ON	OFF
Radius	Jib over-raising (only for jib lifting)	34	M	D	ON	ON	ON	ON	ON	OFF	ON
Radius	Main hook radius excess (area limitation precaution)	35	M	J							
Radius	Main hook radius excess (area limitation alarm)	36	M	J	—	—	—	—	OFF	—	OFF
Radius	Jib hook radius excess (area limitation precaution)	37	M	J	—	—	—	—	—	—	—
Radius	Jib hook radius excess (area limitation alarm)	38	M	J	—				OFF		OFF
Radius	Aux. hook radius excess (area limitation precaution)	39	M	J	—	—	—	—	—	—	—
Radius	Aux. hook radius excess (area limitation alarm)	40	M	J	—	—	—	—	OFF	—	OFF
Angle	Boom over-lowering (area limitation precaution)	41	M	D							
Angle	Boom over-lowering (area limitation alarm)	42	M	D	—	—	—	—	OFF	—	—
Angle	Boom over-raising (area limitation precaution)	43	M	D							
Angle	Boom over-raising (area limitation alarm)	44	M	D	—	—	—	OFF	—	—	—
Angle	Jib over-lowering (area limitation precaution)	45	M	D				—	—		
Angle	Jib over-lowering (area limitation alarm)	46	M	D							OFF
Angle	Jib over-raising (area limitation precaution)	47	M	D	—	—	—	—	—	—	—
Angle	Jib over-raising (area limitation alarm)	48	M	D	—	—	—	—	—	OFF	—
Angle	Boom low limit angle (only for jib lifting)	49	M	D	OFF	OFF	ON	ON	OFF		—
Angle	Boom upper limit angle (only for jib lifting)	50	M	D	ON	ON	ON	OFF	ON	—	
Angle	Jib offset low limit angle (only for main lifting)	51	M	D	—			ON	OFF	OFF	ON
Angle	Jib offset upper limit angle (only for main lifting)	52	M	D	OFF	OFF	ON	OFF	ON	ON	OFF
Elevation	Point elevation (area limitation precaution)	61	M	J		—	—	—	—	—	
Elevation	Point elevation (area limitation alarm)	62	M	J	—	—	—	OFF		OFF	—
Limit switch	Main winch hook overhoist	71	P	A	OFF	OFF	ON	ON	OFF	ON	OFF
Limit switch	Aux. winch hook overhoist	72	P	A	OFF	OFF	ON	ON	OFF	ON	OFF
Limit switch	Boom overhoist (Full)	73	Q	A	ON	ON	ON	OFF	ON	ON	ON
Limit switch	Boom overhoist (2nd)	74	Q	A	OFF	OFF	ON	OFF	ON	ON	ON
Limit switch	Jib overhoist	76	Q	A	OFF	OFF	ON	ON	OFF	OFF	ON
Limit switch	Strut overraising	77	Q	A	ON	ON	ON	ON	OFF	OFF	ON
Limit switch	Strut over-lowering	78	Q	A	ON	ON	ON	OFF	ON	ON	OFF
Others	[illegible] wind alarm	81	—	—	—	—	—	—	—	—	—
Others	Attachment self-standing and slewing	91			(ON)	(ON)	ON	(ON)	(ON)	(ON)	(ON)
Others	Attachment disassembly and reassembly	92	[illegible]		ON	ON	ON	ON	ON	ON	ON

				Condition required for restoration from automatic stop		External indication output		
				Restoration	Command restoration	Green	Yellow	Red
Power ON						OFF	OFF	ON
All available working area			01		–	ON	OFF	OFF
Load	Main/Aux. hook (single reeving)	Overload (pre-caution)	11	–	–	OFF	ON	OFF
		Overload	12	R	Z	OFF	OFF	ON
	Main hook max. load working point (area limitation pre-caution)		21	–	–	OFF	ON	OFF
	Main hook max. load working point (area limitation alarm)		22	R	Z	OFF	OFF	ON
	Jib max. load working point (area limitation pre-caution)		23	–	–	OFF	ON	OFF
	Jib max. load working point (area limitation alarm)		24	R	Z	OFF	OFF	ON
	Aux. hook max. load working point (area limitation pre-caution)		25	–	–	OFF	ON	OFF
	Aux. hook max. load working point (area limitation alarm)		26	R	Z	OFF	OFF	ON
Radius	Boom over-lowering (only for main hook)		31	U	Z	OFF	OFF	ON
	Boom over-lowering (only for single reeving)		32	O	T	–	–	–
	Jib over-lowering (only for single reeving)		33	O	Z	OFF	OFF	ON
	Jib over-raising (only for single reeving)		34	O	T	–	–	–
	Main hook radius pre-caution (area limitation pre-caution)		35	–				
	Main hook radius alarm (area limitation alarm)		36	U	Z	–	–	–
	Jib hook radius pre-caution (area limitation pre-caution)		37	–	–	–	–	–
	Jib hook radius alarm (area limitation alarm)		38	U	Z		–	–
	Aux. hook radius pre-caution (area limitation pre-caution)		39	–	–		–	–
	Aux. hook radius alarm (area limitation alarm)		40	U	Z	–	–	–
Angle	Boom over-lowering (area limitation pre-caution)		41					
	Boom over-lowering (area limitation alarm)		42	D	Z	–	–	
	Boom over-raising (area limitation pre-caution)		43					–
	Boom over-raising (area limitation alarm)		44	D	Z	–	–	–
	Jib over-lowering (area limitation pre-caution)		45	–	–	–	–	–
	Jib over-lowering (area limitation alarm)		46	D	Z			
	Jib over-raising (area limitation pre-caution)		47		–	–	–	–
	Jib over-raising (area limitation alarm)		48	D	Z	–	–	–
	Boom up limit angle (only for single reeving)		49	D	Z	OFF	OFF	ON
	Boom up limit angle (only for single reeving)		50	D	–	–	–	–
	Jib down/Aux. hook up limit angle (only for single reeving)		51	D	–			
	Jib down/Aux. hook up limit angle (only for single reeving)		52	U	Z	OFF	OFF	ON
Elevation	Point elevation (area limitation pre-caution)		61	–				
	Point elevation (area limitation alarm)		62	–	Z			
Anti-two-block (ATB) Limit switch	Main hook overhoist		71	A	S	–	–	–
	Aux. hook overhoist		72	A	S	–	–	–
	Boom up limit (ATB)		73	A	T	–	–	–
	Boom overwind (ATB)		74	A	H			
	Jib overhoist		75	A	R	–	–	–
	Jib over-lowering		77	A	R	–	–	–
	Jib over-raising		78	A	R	–	–	–
Others	Head wind alarm		91	–	–	ON	OFF	OFF
	Attachment assembly/ disassembly		92	–	–	OFF	OFF	ON

Notes

(1) Symbols "-" shown on the columns of alarm sounds and, crane control output, in the table above indicate that the corresponding items are not the subjects of control.

(2) In the columns of the crane control output (automatic stop), "OFF" indicates the stop status, and "ON" indicates the operable status.

(3) From No. 01 to 76 shown in the table above, priority is given to OFF of conditions other than the drum control output over ON.

(4) Priority is given in the following order : condition No.92, 71 to 78, 91, 11 to 62

Details of alarm and automatic stop condition symbols

(a) When the status is cancelled, the machine immediately restores automatically.

(b) When the moment ratio is decreased to 89.5%, the status is cancelled (automatically restored).

(c) When the moment ratio is decreased by 0.5% from the overload automatic start point, the status is cancelled (automatically restored).

(d) When the boom is returned to the safety side by 0.4 deg. or more from the limit angle, the status is cancelled (automatically restored).

(e) When the boom is returned to the safety side by 2.0 deg. or more from the limit angle, the status is cancelled (automatically restored).

(f) When the moment ratio is decreased by 5.0% from the overload automatic stop point, the status is cancelled (automatically restored).

(g) Blank

(h) Blank

(i) Blank

(j) When the radius or elevation is returned by 0.1 m (0.1 feet) to the safety side from the prenotice set radius or height, the status is cancelled (automatically restored).

(k) Alarm is issued when the moment ratio is 90% or more.

(l) Alarm is issued when the moment ratio exceeds the LVL.

(m) Alarm is issued when the set values are exceeded and the machine is operated in hazardous directions.

(n) Alarm is issued when the boom angle exceeds the limit angle.

(o) Blank

(p) Alarm is issued when overhoist occurs and the machine is operated in hazardous directions.

(q) Alarm is issued when overhoist occurs.

(r) The status cannot be cancelled whatever cancel switch is operated.

(s) Automatic stop is cancelled only while the hook overhoist cancel switch is operated.

(t) Automatic stop is cancelled only while the boom overhoist cancel switch is operated.

(u) Blank

(v) Blank

(w) Blank

(x) Blank

(y) Blank

(z) Automatic stop is cancelled only while the overload cancel switch is operated.

11.9 RELEASES

When an operation has been auto stopped, the release functions are as explained in the following chart.

11.9.1 RELEASE FUNCTION

11.9.1.1 CRANE RELEASE CHART

Set the master key to the "RELEASE" position.
If it is set to the "LOCK" position, any release is disabled.

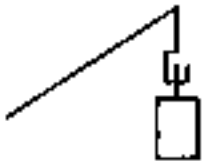
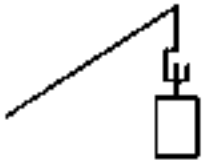
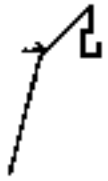
Standard Crane Release Chart

Stop Condition	Release Switch Operation	Boom		Hook Hoist Up		
		Raise	Down	Main	Auxiliary	Third
Hook Overhoist (Main)	No Operation	O	X	X	X	X
	Hook overhoist	O	O	O	O	O
	Boom overhoist	O	X	X	X	X
	Overload	O	X	X	X	X
	Hook & Boom	O	O	O	O	O
	Hook & Overload	O	O	O	O	O
	Boom & Overload	O	X	X	X	X
	All three	O	O	O	O	O
Hook Overhoist (Aux.)	No Operation	O	X	X	X	X
	Hook overhoist	O	O	O	O	O
	Boom overhoist	O	X	X	X	X
	Overload	O	X	X	X	X
	Hook & Boom	O	O	O	O	O
	Hook & Overload	O	O	O	O	O
	Boom & Overload	O	X	X	X	X
	All three	O	O	O	O	O
Overload Boom Low.Limit Angle (Stop type)	No Operation	O	X	X	X	X
	Hook overhoist	O	X	X	X	X
	Boom overhoist	O	X	X	X	X
	Overload	O	O	O	O	O
	Hook & Boom	O	X	X	X	X
	Hook & Overload	O	O	O	O	O
	Boom & Overload	O	O	O	O	O
	All three	O	O	O	O	O

* The hook lowering is always possible.

O : Can move X: Cannot move

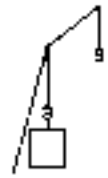
Standard Crane Release Chart

Stop Condition	Release Switch Operation	Boom		Hook Hoist Up		
		Raise	Down	Main	Auxiliary	Third
Overload Boom low. limit angle (Alarm type) 	No Operation	O	O	O	O	O
	Hook overhoist	O	O	O	O	O
	Boom overhoist	O	O	O	O	O
	Overload	O	O	O	O	O
	Hook & Boom	O	O	O	O	O
	Hook & Overload	O	O	O	O	O
	Boom & Overload	O	O	O	O	O
	All three	O	O	O	O	O
Boom up. limit angle (Controlled by LMI) 	No Operation	X	O	O	O	O
	Hook overhoist	X	O	O	O	O
	Boom overhoist	O	O	O	O	O
	Overload	X	O	O	O	O
	Hook & Boom	O	O	O	O	O
	Hook & Overload	X	O	O	O	O
	Boom & Overload	O	O	O	O	O
	All three	O	O	O	O	O
Boom overhoist (Limit switch) 	No Operation	X	O	X	X	X
	Hook overhoist	X	O	X	X	X
	Boom overhoist	X	O	X	X	X
	Overload	X	O	X	X	X
	Hook & Boom	X	O	X	X	X
	Hook & Overload	X	O	X	X	X
	Boom & Overload	X	O	X	X	X
	All three	X	O	X	X	X
Overload (200%) 	No Operation	O	X	X	X	X
	Hook overhoist	O	X	X	X	X
	Boom overhoist	O	X	X	X	X
	Overload	O	X	X	X	X
	Hook & Boom	O	X	X	X	X
	Hook & Overload	O	X	X	X	X
	Boom & Overload	O	X	X	X	X
	All three	O	X	X	X	X
Crane jib overhoist (Option) 	No Operation	O	X	O	X	O
	Hook overhoist	O	X	O	X	O
	Boom overhoist	O	X	O	X	O
	Overload	O	X	O	X	O
	Hook & Boom	O	X	O	X	O
	Hook & Overload	O	X	O	X	O
	Boom & Overload	O	X	O	X	O
	All three	O	X	O	X	O

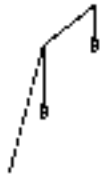
* The hook lowering is always possible.

O : Can move X : Cannot move

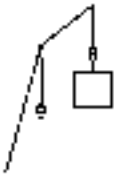
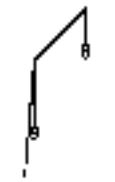
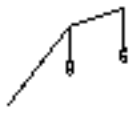
Lifting Crane Release Chart (Main 1/2)

Stop Condition	Release Switch Operation	Boom		Jib		Hook Hoist Up	
		Raise	Down	Raise	Down	Main	Auxiliary
Hook overhoist (Main) 	No Operation	O	X	O	X	X	X
	Hook overhoist	O	O	O	O	O	O
	Boom overhoist	O	X	O	X	X	X
	Overload	O	X	O	X	X	X
Hook overhoist (Auxiliary) 	No Operation	O	X	O	X	X	X
	Hook overhoist	O	O	O	O	O	O
	Boom overhoist	O	X	O	X	X	X
	Overload	O	X	O	X	X	X
Overload 	No Operation	O	X	O	X	X	X
	Hook overhoist	O	X	O	X	X	X
	Boom overhoist	O	X	O	X	X	X
	Overload	O	O	O	O	O	O
Boom up limit angle (Controlled by LMI) 	No Operation	X	O	O	O	O	O
	Hook overhoist	X	O	O	O	O	O
	Boom overhoist	O	O	O	O	O	O
	Overload	X	O	O	O	O	O
Boom low. limit angle (Controlled by LMI) 	No Operation	O	X	O	X	X	X
	Hook overhoist	O	X	O	X	X	X
	Boom overhoist	O	X	O	X	X	X
	Overload	O	O	O	O	O	O

Luffing Crane Release Chart (Main 2/2)

Stop Condition	Release Switch Operation	Boom		Jib		Hook Hoist Up	
		Raise	Down	Raise	Down	Main	Auxiliary
Boom overhoist (Backstop No.1 L/S) 	No Operation	X	O	O	O	O	O
	Hook overhoist	X	O	O	O	O	O
	Boom overhoist	O	O	O	O	O	O
	Overload	X	O	O	O	O	O
Boom overhoist (Backstop No.2 L/S) 	No Operation	X	O	X	O	X	X
	Hook overhoist	X	O	X	O	X	X
	Boom overhoist	X	O	X	O	X	X
	Overload	X	O	X	O	X	X
Jib up. limit angle (Small offset angle) 	No Operation	O	X	X	O	O	O
	Hook overhoist	O	X	X	O	O	O
	Boom overhoist	O	O	O	O	O	O
	Overload	O	X	X	O	O	O
Jib low. limit angle (Large offset angle) 	No Operation	X	O	O	X	X	X
	Hook overhoist	X	O	O	X	X	X
	Boom overhoist	X	O	O	X	X	X
	Overload	O	O	O	O	O	O
Jib overhoist L/S 	No Operation	O	X	X	O	X	X
	Hook overhoist	O	X	X	O	X	X
	Boom overhoist	O	X	X	O	X	X
	Overload	O	X	X	O	X	X

Luffing Crane Release Chart (Jib 1/2)

Stop Condition	Release Switch Operation	Boom		Jib		Hook Hoist Up	
		Raise	Down	Raise	Down	Main	Auxiliary
Hook overhoist (Main) 	No Operation	O	X	O	X	X	X
	Hook overhoist	O	O	O	O	O	O
	Boom overhoist	O	X	O	X	X	X
	Overload	O	X	O	X	X	X
Hook overhoist (Auxiliary) 	No Operation	O	X	O	X	X	X
	Hook overhoist	O	O	O	O	O	O
	Boom overhoist	O	X	O	X	X	X
	Overload	O	X	O	X	X	X
Overload 	No Operation	O	X	O	X	X	X
	Hook overhoist	O	X	O	X	X	X
	Boom overhoist	O	X	O	X	X	X
	Overload	O	O	O	O	O	O
Boom up. limit angle (Controlled by LMI) 	No Operation	X	O	O	O	O	O
	Hook overhoist	X	O	O	O	O	O
	Boom overhoist	O	O	O	O	O	O
	Overload	X	O	O	O	O	O
Boom low. limit angle (Controlled by LMI) 	No Operation	O	X	O	O	X	X
	Hook overhoist	O	X	O	O	X	X
	Boom overhoist	O	X	O	O	X	X
	Overload	O	O	O	O	O	O

Luffing Crane Release Chart (Jib 2/2)

Stop Condition	Release Switch Operation	Boom		Jib		Hook Hoist Up	
		Raise	Down	Raise	Down	Main	Auxiliary
Boom overhoist (Backstop No 1 L/S) 	No Operation	X	O	O	O	O	O
	Hook overhoist	X	O	O	O	O	O
	Boom overhoist	O	O	O	O	O	O
	Overload	X	O	O	O	O	O
Boom overhoist (Backstop No.2 L/S) 	No Operation	X	O	X	O	X	X
	Hook overhoist	X	O	X	O	X	X
	Boom overhoist	X	O	X	O	X	X
	Overload	X	O	X	O	X	X
Jib up. limit angle (Controlled by LMI) 	No Operation	O	O	X	O	O	O
	Hook overhoist	O	O	X	O	O	O
	Boom overhoist	O	O	O	O	O	O
	Overload	O	O	X	O	O	O
Jib low. limit angle (Controlled by LMI) 	No Operation	O	X	O	X	X	X
	Hook overhoist	O	X	O	X	X	X
	Boom overhoist	O	X	O	X	X	X
	Over oad	O	O	O	O	O	O
Jib overhoist L/S 	No Operation	O	X	X	O	X	X
	Hook overhoist	O	X	X	O	X	X
	Boom overhoist	O	X	X	O	X	X
	Overload	O	X	X	O	X	X

11.9.1.2 ALARM SOUND

1. Crane

O : emitted (Peep--) △ : emitted (Beep) X : not emitted

Condition	Operation							
	Main winch up	Main winch down	Aux. winch up	Aux. winch down	3rd winch up	3rd winch down	Boom raise	Boom lower
Hook overhoist (main)	O	X	O	X	O	X	X	O
Hook overhoist (Jib / aux.)	O	X	O	X	O	X	X	O
Boom upper limit angle	X	X	X	X	X	X	O	X
Boom overhoist (L/sw)	O : regardless of operation							
Overload	△ : regardless of operation							
Crane jib overhoist (Not used)	O : regardless of operation							

- When any hazardous condition occurs, and any circle is found in the line of the hazardous condition in the table above, alarm sounds are emitted.

2. Luffing

O : emitted (Peep--) △ : emitted (Beep-) X : not emitted

Condition	Operation							
	Main winch up	Main winch down	Aux. winch up	Aux. winch down	Boom raise	Boom lower	Jib raise	Jib lower
Hook overhoist (main)	O	X	O	X	X	O	X	O
Hook overhoist (Jib/aux.)	O	X	O	X	X	O	X	O
Boom upper limit angle	X	X	X	X	O	X	X	X
Jib upper limit angle	X	X	X	X	X	X	O	X
Boom overhoist (No.1 L/sw)	O : regardless of operation							
Boom overhoist (No 2 L/sw)	O : regardless of operation							
Jib overhoist (L/sw)	O : regardless of operation							
Boom low. limit angle	△ : regardless of operation							
Jib low. limit angle	△ : regardless of operation							
Overload	△ : regardless of operation							

- When any hazardous condition occurs and any circle is found in the line of the hazardous condition in the table above, alarm sounds are emitted.

11.9.1.3 EXTERNAL INDICATOR LAMPS IN RELEASE CONDITION

The overload external indicator lamps are forcibly lit to indicate the moment ratio of 100% or more by the release switch.

Release condition	External indicator		
	to 90% (green)	90% to 100% (yellow)	100% to (red)
Normal condition	O	X	X
Hook overhoist	X	X	O
Overload	X	X	O
Boom overhoist	X	X	O
Hook overhoist and overload	X	X	O
Hook overhoist and boom overhoist	X	X	O
Overload and boom overhoist	X	X	O
Hook overhoist, overload, and boom overhoist	X	X	O
Master key	X	X	O

Alarm sounds

1. For the hook overhoist, boom upper limit angle, and jib upper limit angle, alarm sounds are emitted only when the operation toward the hazardous side is performed while the machine is in the hazardous condition.
   Even when the machine is in the hazardous condition, the alarm sounds are not emitted when the operation toward the safe side is performed or the lever is at the neutral position.
2. For the overload, boom lower limit angle, jib lower limit angle, boom overhoist (limit switch), and jib overhoist (limit switch), the alarm sounds are emitted regardless of the lever operation when the machine is in the hazardous condition.
   The alarm sounds cannot be cancelled.

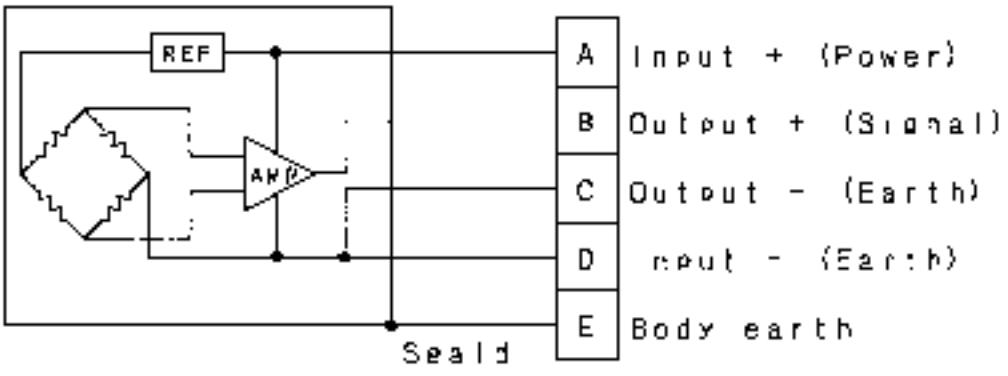
11.10 MECHANICAL SPECIFICATION

11.10.1 ENVIRONMENTAL PERFORMANCE PARAMETERS

Power :	DC24V battery (20 - 32V)	
Capable temperature :	-20 to 70 °C (However, since the LC display temperature limit is 0 to 40 deg., when the temperature is outside of this range, it may not be visible)	
Storage temp. :	-40 to 80 °C.	
Humidity :	95%	
Protective structure :	Outdoor elements	Water proofed, sealed structures
	Inside elements	Dust proofed (no sealed structures)
Vibration proof :	39 m/s² 33 Hz X, Y, Z (2 hours each)	
Shock proof :	196 m/s² 15 to 19 sec. X, Y, Z (3 times each)	
Electronic "Noise" Proofing :	No mechanical damage with DC 1000V 1µS added while the power is on. No mechanical malfunction with DC 700V 100nS added while the power is on.	
Item locations :	Outdoor	Detector link, angle changers, connecting cables, transit boxes etc. (outdoor elements)
	Oper. cab n	Controllers etc. (inside elements)

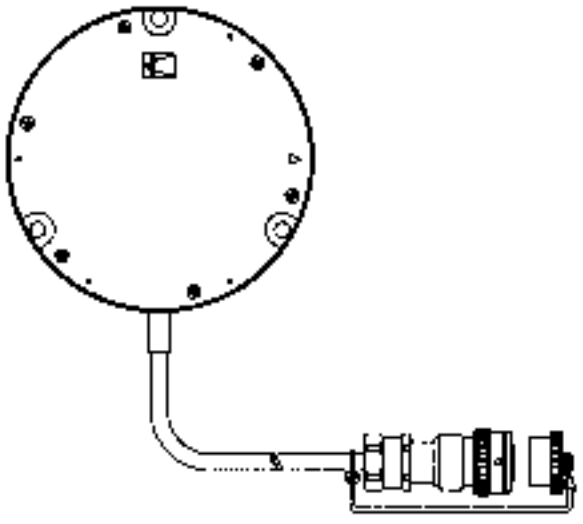
11.10.2 LOAD CELL (CRANE)

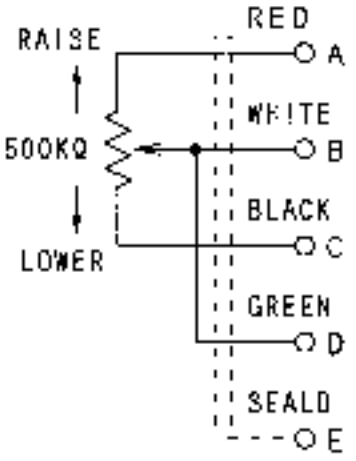
Model name :	LTP-S-10t-KNSA7
Detective capacity:	Guy-cable support power
Rated capacity :	10 ton (98.07KN)
Load capacity :	150%
Output voltage :	with no load 1V ± 0.01V (at shipping) with rated load 5V ± 0.040V
Power source :	DC9V ± 15V (under 30 mA)
Output resistance	Appr. under 100 Ω
Insulated resistance :	500MΩ / above 25VDC
Non-Linearity :	± 1% RO
Hysteresis :	± 1% RO
Temperature compensation range :	-30°C ~ 65°C
Temperature capacity :	-35°C to + 75°C
Temperature effect at zero point :	± 0.1% RO/C
Temperature effect at output :	± 0.1% RO/C
Output cable	None apex classification 5P water proof plug AE770L14-05P
Vibration proof :	69.6 m/s 33Hz up/down for 4 hours and left/right, front/back for 2 hours.
Shock proof :	245 m/s, 15mS X,Y, Z (3 times each)
Water proof :	Conforms to IP67 or equivalent (JIS C0920 non-seaping type)
Durability :	5 × 10⁵ times
Noise proof :	DC700V 100ns
Total integrity :	2.9% RO
Weight :	About 6 kg



11.10.3 ANGLE SENSOR

Model name :	MLA-901A-**C
Detection capacity	Boom angle against ground
Valid operating range	0 to ± 90 degree
Operation range :	360 deg. endless
Rated output sensitivity .	0.255V/V±0.5%
Input voltage :	10V
Input resistance :	50k Ω ± 5%
Output resistance :	(25000 + 141.6 X θ) Ω ± 5%
Detecting accuracy :	±1 deg.
Initial inbalance :	Set within±5deg.
Insulate resistance :	100MΩ / 50VDC
Output cable :	Cab tire crolobran cable 0.5mm² X 4
Cable analysis :	Bending radius : R100, Tensile strength : 8kg
Cable apex :	5P water proof plug AE776L14-05S+MT12-14+MS3180-14CAL
Control method :	Oil damper
Monitor :	With outside weight 0deg., 30deg., 60deg.. 90deg. Monitorable
Case material :	Plastic (Toshiba premix AP-902S)
Surface treatment :	Non, stripe (Black)
Temperature range :	-20 to 70°C
Store temp. :	-40 to 80°C
Weight :	appr. 1.2kg (main body), appr. 65g/m (cable)





A-C Resistance : 50KΩ
A-B Resistance (R) : 25000+141.6Xθ°

11.10.4 CONTROLLER

11.10.4.1 MODEL NAME

LSD-1500A

11.10.4.2 SYSTEM INPUT/OUTPUT

1. Load input 1 to 7

Corresponding transducer	Voltage output type load transducer
Input range	From 1 to 5 V (from 0 to rated load) Faulty when the load is 130% or more, or -10% or less of rating
Frequency characteristic	2 Hz
Detective resolution	0.03%RO
Detective precision	±0.1%RO
Input connector	CN12M 1-174961-1

2. Angle input 1 to 4

Corresponding transducer	Potentiometer type jib angle transducer
Input range	From 0.75 to 7.83 V (Error occurs when it is 8.08 V or more or 0.45 V or less)
Frequency characteristic	1 Hz
Detective resolution	0.07 deg.
Detective precision	±0.2 deg
Others	Disconnection detective function
Input connector	Input 1 to 3: CN13M 1-179019-1 Input 4 CN14M 1-174957-1 (Common to input 5)

3. Angle input 5

Input range	From 0.75 to 9.25 V (Error occurs when it is 9.5 V or more or 0.45 V or less)
Frequency characteristic	1 Hz
Detective resolution	0.08 deg.
Detective precision	± 0.3 deg
Others	Disconnection detective function
Input connector	CN14M 1-174957-1 (Common to input 4)

4. Digital input 1 to 20

Input type	No-voltage contact (ON : Grounded, OFF : Open)
Input judgment level	ON when the contact resistance is 500 Ω or less (when the power supply voltage is 24 V, and the contact current is 14 mA) ON when it is approximately 200 Ω or less under the power supply voltage of 20 V, or it is approximately 1 kΩ or less under the power supply voltage of 32 V.
Input connector	CN15M 1-174960-1

5. Digital output 1 to 20

Output type	Relay contact (ON : 24 V, OFF : Open)
Rated current capacity	2.5A
Allowable rush-in current	5 A or less. Output for indicator lamp is 10 A or less.
Others	Short-circuit protection
Input connector	CN16M 1-174960-1

6. Analogue output 1 to 3

Output range	1. Tension : From 0 to 5 V (from 0 ton to rating) 2. Boom angle : From 0 to 5 - (from 0 to 90 deg.) 3. Jib angle : From 0 to 5 V (from -90 to 90deg.)
Resolution	5 mV or less
Precision	± 0.5% from indicated value
Data upgrading time	0.2 sec. or shorter
Input connector	CN16M 1-174965-1

7. Serial communication 1

Application	Data communication with controller (for details of communication, refer to the separate sheet)
Interface	Conforms to RS-232C
Baud rate	9600BPS
Start bit	1
Data bit	8
Parity bit	1 (even number)
Stop bit	1
Communication connector	CN18M 1-174964 (Common to communication 2)

8. Serial communication 2

Application	Data transmission to PC (hysteresis data)
Interface	Conforms to RS-232C
Baud rate	19200BPS
Start bit	1
Data bit	8
Parity bit	1 (even number)
Stop bit	1
Communication connector	CN18M 1-174964 (Common to communication 1)

9. Sound output

Application	Overhoist alarm and voice a arm
Output sound pressure	75 dB (A) at 1m

10. Alarm output

Application	Overload alarm
Output sound pressure	75 dB (A) at 1m

11.10.4.3 MONITOR DISPLAY

Element used	7.2 type STN semipermeable colnr liquid crystal 640×480 dots vertically used

11.10.4.4 OPERATION SWITCH

Seat switch	8 key switches Upward, downward, leftward, and rightward arrow keys, MLNU key, SET key, assembly and disassembly key, and slowing mode key
Dip switch	8 switches Program upgrading permission, manulacturer's adjustment permission, and other spare switches

11.10.4.5 INTERNAL PROCESSING SYSTEM

CPU	H8/304B (CONTROL), H8/2633 (INDICATION)
Control frequency	200 mS or ess

11.10.4.6 MEMORY

Flash memory	Capacity : 2 MB Applicatio : Sturage of programs, adjustment values, set values, display data, load hysteresis, and selected capacity data
One-time PROM	Capacity : 128 KB Applicatio : Storage of sound data
S-RAM	Capacity : 512 Kbit Application : For operation

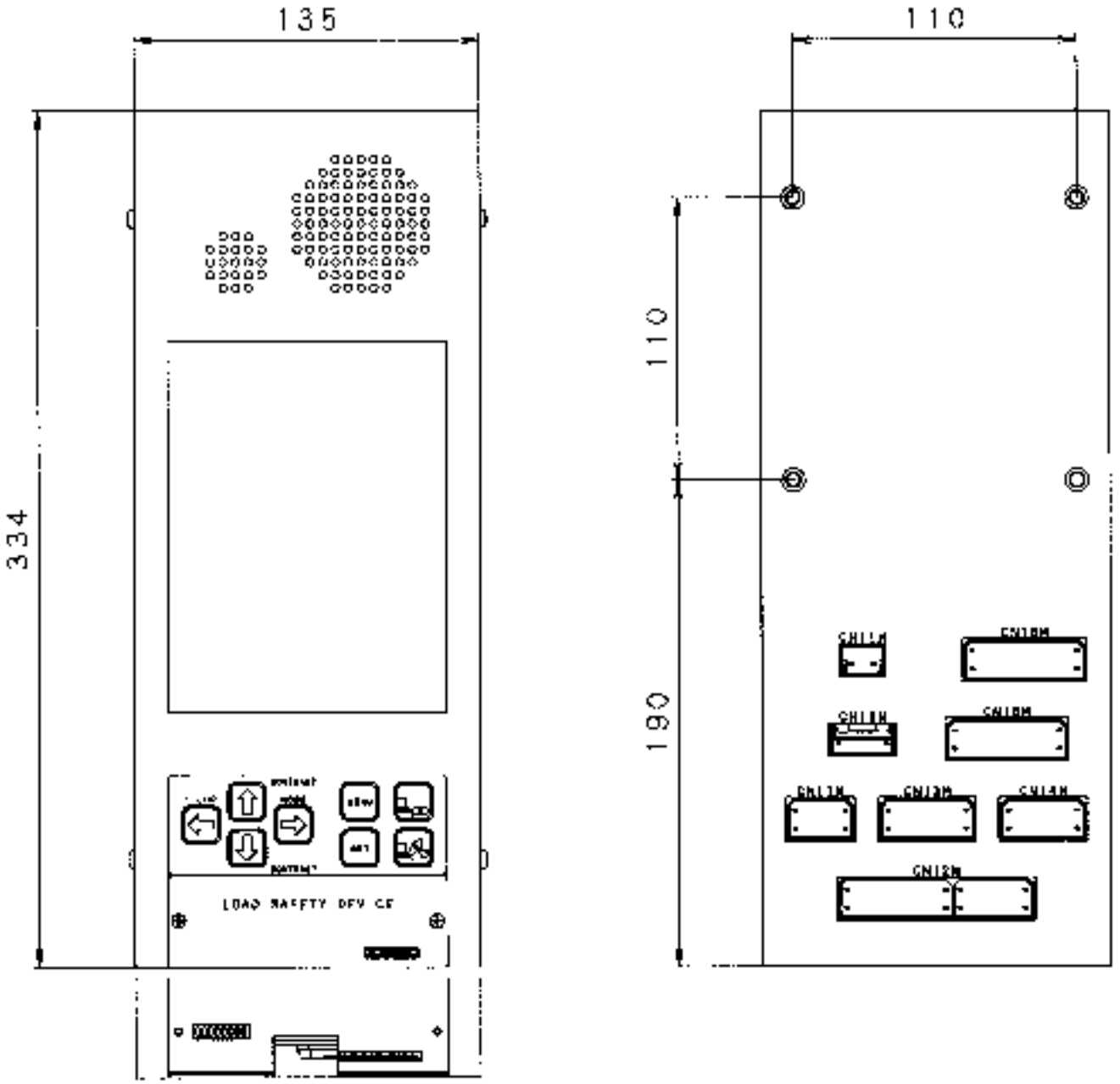
11.10.4.7 EXTERNAL STORAGE ELEMENT

Smart media	Capacity : 4MB or 8MB Application : Storage of capacity data, adjustment values, and set values Format : Only for this unit (Reading and writing with the PC is performed through the special adapter)

11.10.4.8 OTHERS

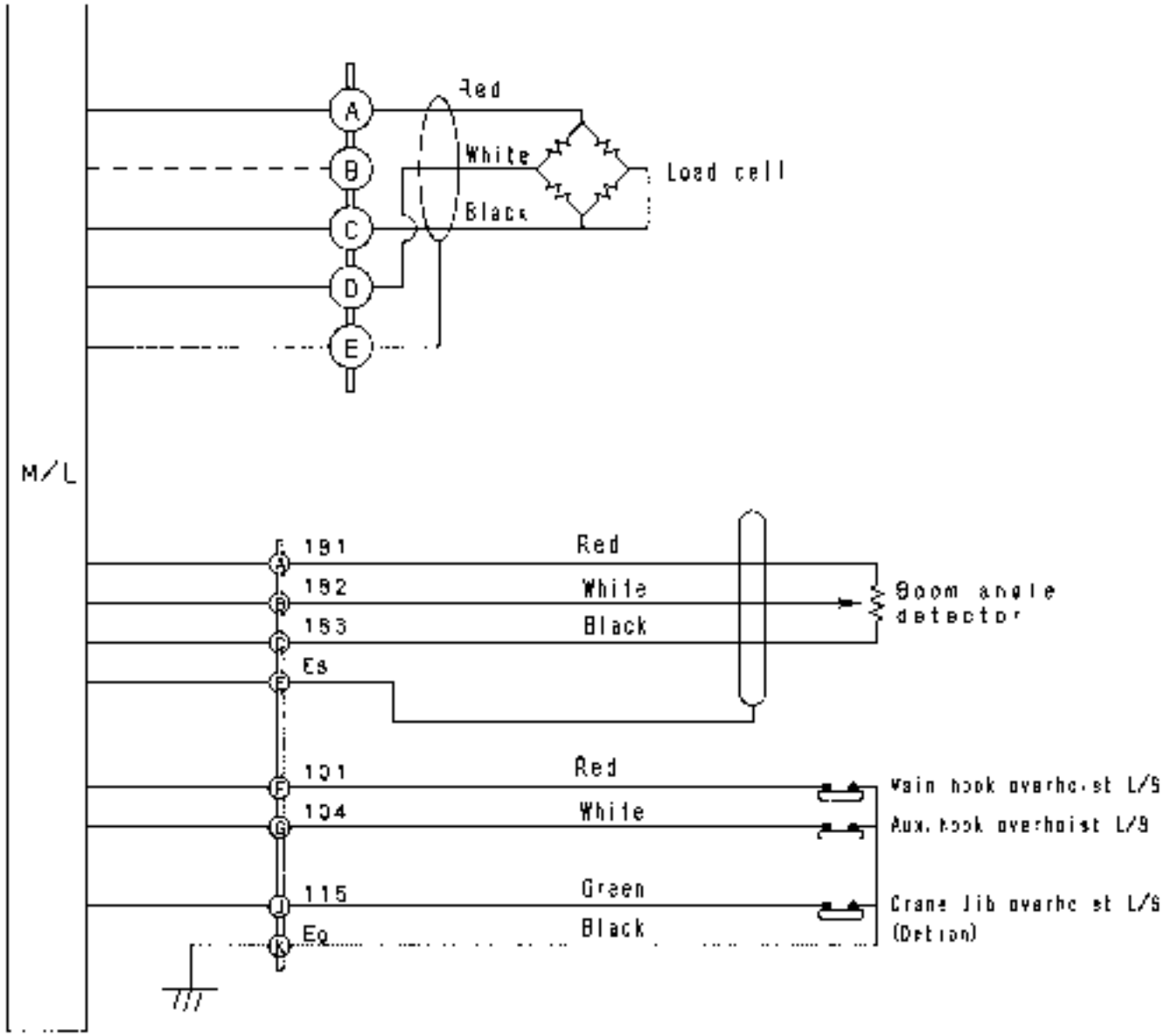
Clock and calendar functions	Back-up with the super capacitor Charged when the power is supplied. Buck-up for approx. one month is possible when fully charged.

11.11 EXTERNAL DIMENSIONS

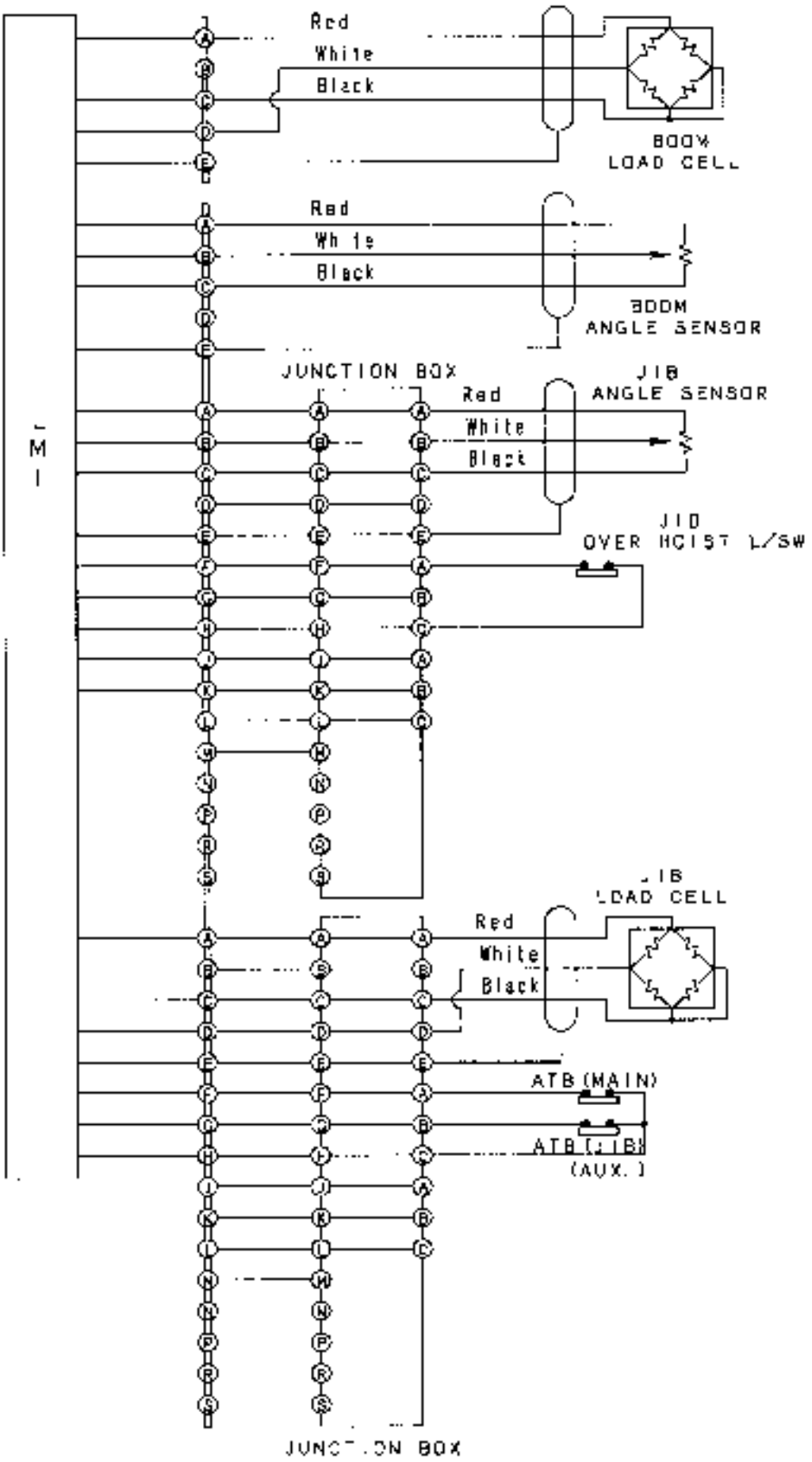


11.12 ELECTRIC SCHEMATIC DIAGRAM

11.12.1 CRANE TYPE



11.12.2 LUFFING TYPE

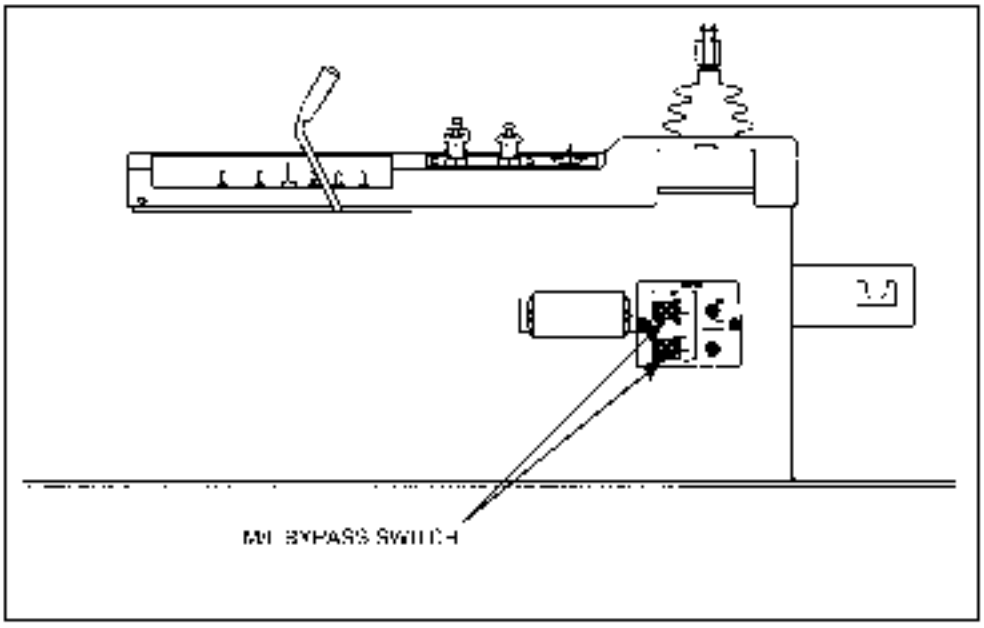


11.13 CONTROLLER MALFUNCTION EMERGENCY MEASURES

When the controller is malfunctioned, as an emergency measure, set the M/L bypass switch in the left side stand to the "crane bypass" or "luffing bypass" position depending on the attachment used.
Then, immediately repair the controller. Though all the operations become possible by performing the step above, the indication, warning, and stop functions (overhoist limit function is available) are still unavailable

⚠ DANGER

While the load safety device controller functions correctly, the bypass circuit is not actuated even when the M/L bypass switch is set to the "bypass" position.



11.14 LOAD SAFETY DEVICE CHECK PROCEDURES

1. Check of working radius indication

(1) Display the appropriate working radius within the working area in the boom lowering direction in the indicator.

(2) Measure the working radius with a measuring tape, and check that it is the same as the indicated working radius.

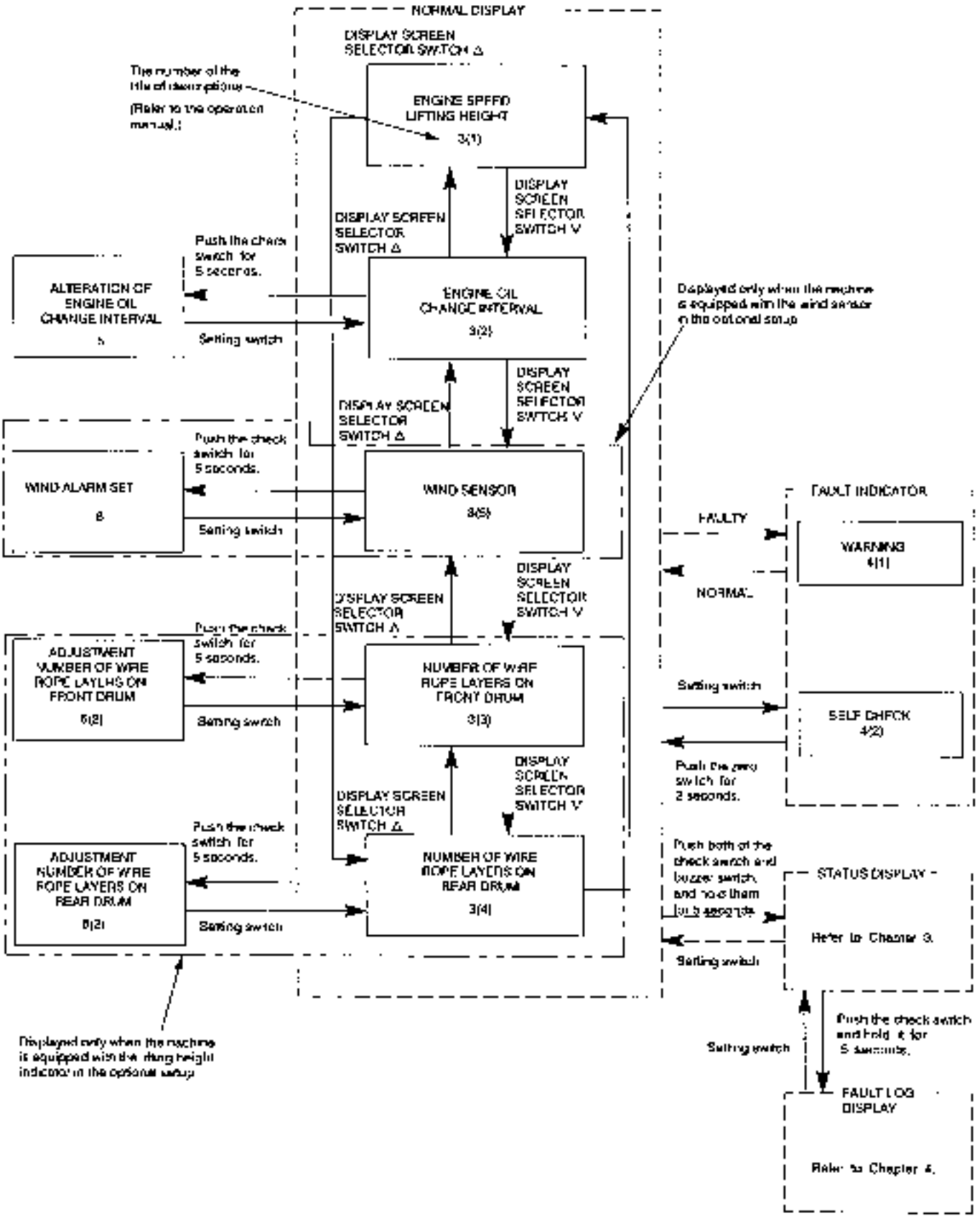
2. Check of load indication

(1) Lift a load of which correct weight is known.

(2) Check that the load (lifted load + hook weight + sling weight) is the same as the indicated actual load.

12. GAUGE CLUSTER

12.1 CONFIGURATION OF DISPLAY



12.2 PRIORITY

1 All the display items are divided into seven groups, A to G.
The priority is given to them in the alphabetical order, A (highest) to G (lowest).

2 While the items in higher priority groups are displayed on the screen of the gauge cluster, the items in lower priority groups are not displayed.
For example, while the "M/L stop release" (in the group A) is displayed on the screen, the "self check function" (in the ground E) is not displayed. The items in lower priority groups are displayed after the display of the items in higher priority groups is ended.

3. When some items in the same group are required to be displayed, they are displayed by turns.

4. The normal display is replaced by the display of the items in higher priority groups, since the normal display has the lowest priority. It can be forcibly displayed with flashing by pushing the zero switch, and holding it for 5 seconds or longer.

Priority	No.	Display items	Input signal for local controller *1		Detection condition		Input delay *2	Buzzer alarm *3
			Disappeared from screen	Displayed on screen	Standstill E/G	Running E/G		
	1	CPU MECHATRO FAILURE (H-1)	Normal communication	Faulty communication	○	○	-	○
A	2	M/L STOP RELEASE (H-2)	By communication with M/L			○	◎	△
	3	M/L BYPASS (W-21)	-	1	○	○	◎	△
B	4	ENGAGE THE DRUM LOCK (W-31)	-	1	○	○	-	○
	5	ENGINE PREHEAT (W-1)	-	1	○		-	
	6	FINISH PREHEAT (W-2)	-	1	○		-	
C	7	Fault log display						
	8	Mechatronic adjustment						
	9	Status display						
D	10	ENGINE OIL PRESS (W-5)	-	0		○	◎	◎
			0	-	○		◎	◎
	11	ENGINE WATER TEMP (W-6)	Water temperature is less than 105°C (221°F)	Water temperature is 105°C or more (221°F)	○	○	◎	○
	*12	FR-SAFETY ESM ON (W-16)	When the machine is in the neutral brake mode, clutch pressure is 570 psi or less		○	○	◎	○
	*13	RF-SAFETY ESM ON (W-17)			○	○	◎	○
	*14	3RD WINCH EST ON (W-18)			○	○	◎	○
	*15	ENGINE OIL FILTER (W-9)	-	0	○	○	◎	
	16	ENGINE AIR CLEANER (W-10)	-	0	○	○	-	-
E	17	Solenoid function						○
F	18	CHARGING PROBLEM (W-3)	1	-		○	◎	
				1	○		◎	
	19	LOW FUEL LEVEL (W-11)	Fuel gauge communication exceeds 05 hex	Fuel gauge communication is 05 hex or less	○	○	◎	
	20	RADIATOR WATER LVL (W-8)		0	○	○	◎	
	21	CONTROL MAIN PRESS (W-4)	-	0		○	◎	
			0		○		◎	
	22	HYD OIL TEMP (W-12)	-	0	○	○	◎	
	23	FR-WINCH OIL TEMP (W-13)	-	0	○	○	◎	○
	24	RE-WINCH OIL TEMP (W-14)	-	0	○	○	◎	○
	25	WINCH FILTER (W-15)	-	0		○	◎	○
	26	HOOK RAISE STOP REL. (W-19)	By communication with M/L			○	◎	△
	27	BOOM RAISE STOP REL (W-20)	By communication with M/L			○	◎	△
G	28	MOISTURE DETECTION OF THE FUEL FILTER (G-25) *4	-	1	○	○	-	-

*1. Input signal 1 : +24 V level 0 : GND level - : Open level

*2. Input delay ◎ : 5.0 sec. ○ : 1.5sec. - : No delay

*3. Buzzer alarm

◎ : Buzzer sounds emission intermittently continues for 0.2 sec. with intervals of 0.3 sec (it cannot be stopped with the buzzer stop switch).

○ : Buzzer sounds emission intermittently continues for 0.5 sec. with intervals of 0.5 sec (it can be stopped with the buzzer stop switch).

△ : Buzzer sounds emission intermittently continues for 0.2 sec. with intervals of 0.3 sec., and is stopped 5 sec. later.

Blank: None

*4. Normal display for other items except (G-25)

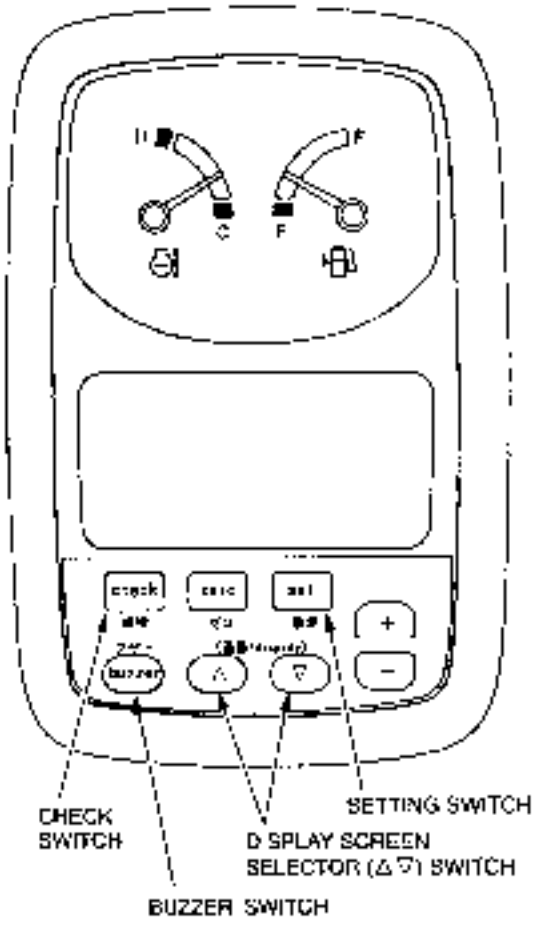
12.3 STATUS DISPLAY

The current machine statuses can be displayed on the liquic crystal display screen of the gauge cluster by using the data from the total contro ler. Fifty-two types of display screens are available (refer to CONTENTS OF STATUS DISPLAY).

No.1
MAIN CONT P/N
GK3CS00032D3
PROGRAM VER
VER 1.03

Procedures

1. Start the engine.
2. Push both of the check switch and buzzer switch at the same time, and hold them for 5 seconds or longer.
   First, the No.1 items, parts code of the tota controller and program version, are d splayed.
   - While the items in the group A or B are displayed, the machine does not enter the status display mode. Correct the conditions that lead to the display of the items in group A or B.
3. Whenever the display screen selector switch ▽ is pushed, the screen is scrolled up once, wh le it is scrolled down once whenever the display screen selector switch △ is pushed. When the display screen selector switch ▽ or △ is left pushed, the screen is scrolled continuously.
4. To end the status display mode, push the setting switch. Then, the screen returns to the normal display.
5. If the key switch is not set to the "OFF" position and the status display mode is actuated again, the screen which had been displayed just before the normal screen was returned appears.
   If the key switch is set to the "OFF" position, the No.1 screen appears.



CONTENTS OF STATUS DISPLAY

Display example	Use	Operation instruction	Range of indicated values		Remarks
NO. 1 MAIN CONT. P/N [illegible] PROGRAM VER VER 1.00					*The part number and version vary by model and specification
NO. 2 ENGINE SET 2005 MEAS 2001		The setting value is changed depending on the position of the hand throttle and foot throttle.	Low 700 to 780 rpm	High 2020 to 2100 rpm	
ENGINE PRS LIVE			With E/G oil pressure: LIVE No E/G oil pressure: DEAD		
No. 3 A/D GRIP VOLT 4.2V POS 100%		The values are changed depending on the hand throttle operation, low or high.	Low 0.5V 0%	High 5.0V 100%	The components are normal if the values of the POS are changed between 0 and 100%. When the E/G speed is changed between low and high, if they are not changed to 0 and 100%, adjust.
MOTOR STEP 250 POS 100%	NO USE				
No. 4 STEP MOTOR 1-1 COIL-A 1.0A 1-2 COIL-B 1.1A	COMMAND TO ECU	The set values are changed depending on the position of the throttle.	Low 1.0V	High 4.0V	Although the unit shown on the display is "A", the actual unit is "V".
LIMIT OFF	NO USE				
No. 5 DIGITAL OUTPUT 0-1 COMP OFF MEAS OFF	BATTERY RELAY		[illegible] set to the "ON" while the power is supplied.		
0-2 COMP - MEAS -	SPARE				*COMP: command value from controller
No. 6 DIGITAL OUTPUT 0-3 COMP OFF MEAS OFF	HYD. OIL HEAT RELAY	Status of the relay that switches the hydraulic oil heating circuit ON/OFF is displayed.			*MEAS: feed back value
		All the control levers are set to the neutral positions.	ON		
		Any of the control levers is being operated.	OFF		
0-4 COMP OFF MEAS OFF	BOOM PUMP INCHING SOL	The boom control lever is at the neutral position or the inching switch is turned on.	ON		The faulty connection is indicated by displaying the following codes. COMP:OFF MEAS:ON
		When the conditions other than the above are not satisfied.	OFF		
No. 7 DIGITAL OUTPUT 0-5 COMP OFF MEAS OFF	MAIN PUMP INCHING SOL	When the main, aux. and third winch control levers are at the neutral positions and the inching switch is turned on.	ON		Connector voltage ON: 24V OFF: 6 to 8V (disconnection)
		Conditions other than the above, or in the free fall mode.	OFF		
0-6 COMP - MEAS -					Check procedures 1) Measure the voltage at the connector. 2) Measure the resistance of the solenoid valves. 3) Replace with nearby solenoid valves and connectors.
No. 8 DIGITAL OUTPUT 0-7 COMP OFF MEAS OFF	MAIN WINCH (FRONT DRUM) CLUTCH CLM SOL	Status of the main winch (front drum) motor clutch solenoid valve (SOL 22) is displayed.			
		When the main winch is in the free fall mode and the lever is at the neutral position.	ON		
		Conditions other than the above	OFF		
0-8 COMP OFF MEAS OFF	MAIN WINCH (FRONT DRUM) CLUTCH ESM SOL	Status of the main winch (front drum) motor clutch emergency solenoid valve (SOL 15) is displayed.			
		The clutch pressure decreases although the main winch is in the brake mode.	ON		
		The clutch pressure decreases when the main winch is in the free fall mode and the lever is operated.	ON		
		Conditions other than the above	OFF		

Display example	Use	Operation instruction	Range of indicated values	Remarks
NO. 9 DIGITAL OUTPUT C-9 COMP MEAS				
C-10 COMP OFF MEAS OFF	AUX. WINCH (REAR DRUM) CLUTCH CLA SOL	Status of the aux. winch (rear drum) clutch solenoid valve (SOL-21) is displayed.		
		When the aux. winch is in the free fall mode and lever is in the neutral position	ON	
		Conditions other than the above	OFF	
NO. 10 DIGITAL OUTPUT C-11 COMP OFF MEAS OFF	AUX. WINCH (REAR DRUM) CLUTCH EM SOL	Status of the aux. winch (rear drum) clutch emergency solenoid valve (SOL-20) is displayed.		
		The clutch pressure decreases although the aux. winch is in the brake mode	ON	
		The clutch pressure decreases when the aux. winch is in the free fall mode and the lever is operated	ON	
		Conditions other than the above	OFF	
C-12 COMP. MEAS.				* COMP: command value from controller
NO. 11 DIGITAL OUTPUT C-13 COMP. OFF MEAS. OFF	THIRD WINCH (THIRD DRUM) CLUTCH CLT SOL	Status of the third winch (third drum) clutch solenoid valve (SOL-24) is displayed.		* MEAS: feed back value
		When the third winch is in the free fall mode and the lever is at the neutral position	ON	The input disconnection is indicated by displaying the following codes. COMP OFF MEAS ON
		Conditions other than the above	OFF	
C-14 COMP OFF MEAS. OFF	THIRD WINCH (THIRD DRUM) CLUTCH EM SOL	Status of the third winch (third drum) clutch emergency solenoid valve (SOL-21) is displayed.		
		The clutch pressure decreases although the third winch is in the brake mode	ON	Connection rating ON: 24 V OFF: [illegible] (at disconnection)
		The clutch pressure decreases when the third winch is in the free fall mode and the lever is operated	ON	
		Conditions other than the above	OFF	
NO. 12 DIGITAL OUTPUT C-15 COMP OFF MEAS OFF	MAIN WINCH (FRONT DRUM) MOTOR BOOST SOL	Status of the main winch (front drum) motor boost solenoid valve (SOL-15) is displayed.		Check procedure: 1) Measure the voltage at the connector. 2) Measure the resistance of the solenoid valves. 3) Replace with nearby solenoid valves and connectors.
		The main winch lever is at the neutral position	ON	
		The main winch lever is not at the neutral position	OFF	
		When the main winch lever is returned to the neutral position	The code is changed to the "ON" 1 sec. later. (If the lever is not at the neutral position within 1 sec., the "OFF" code remains displayed.)	
C-16 COMP OFF MEAS OFF	AUX. WINCH (REAR DRUM) MOTOR BOOST SOL	Status of the aux. winch (rear drum) motor boost solenoid valve (SOL-16) is displayed.		
		The aux. winch lever is at the neutral position	ON	
		The aux. winch lever is not at the neutral position	OFF	
		When the aux. winch lever is returned to the neutral position	The code is changed to the "ON" 1 sec. later. (If the lever is not at the neutral position within 1 sec., the "OFF" code remains displayed.)	
NO. 13 DIGITAL OUTPUT C-17 COMP. OFF MEAS. OFF	THIRD WINCH (THIRD DRUM) MOTOR BOOST SOL	Status of the third winch (third drum) motor boost solenoid valve (SOL-17) is displayed.		
		The third winch lever is at the neutral position	ON	
		The third winch lever is not at the neutral position	OFF	
		When the third winch lever is returned to the neutral position	The code is changed to the "ON" 1 sec. later. (If the lever is not at the neutral position within 1 sec., the "OFF" code remains displayed.)	
C-18 COMP OFF MEAS OFF	MAIN WINCH TURN GRIP	Motion of the main winch drum turn detection grip is displayed.	Display of the "ON" and "OFF" is repeated with the drum rotation. The repeating speed of the "ON" and "OFF" codes display is proportional to the drum rotation speed.	
		Turn on the drum turn switch, and raise or lower the main winch.		

Display example	Item	Operation instruction	Range of indicated values	Remarks
NO.14 DIGITAL OUTPUT C-19 COMP. OFF MEAS. OFF	AUX. WINCH TURN SIGN	Motion of the aux. winch drum turn detection amp is displayed. Turn on the drum turn switch, and raise or lower the aux. winch.	Display of the "ON" and "OFF" is repeated with the drum rotation. The repeating speed of the "ON" and "OFF" ordered display is proportional to the drum rotating speed.	
C-20 COMP. OFF MEAS. OFF	MAIN WINCH CW SOL	Status of the main winch drum CW solenoid valve (SOL-) is displayed.		
		Set the main winch free fall speed switch to the "HIGH" position when the main winch is in the free fall mode, the lever is at the neutral position, and the foot pedal is released.	ON	
		In the status shown above, set the switch to the "LOW" position, depress the pedal, or operate the lever.	OFF	
NO.15 DIGITAL OUTPUT C-21 COMP. OFF MEAS. OFF	AUX. WINCH CW SOL	Status of the aux. winch drum CW solenoid valve (SOL-) is displayed.		
		Set the aux. winch free fall speed switch to the "HIGH" position when the aux. winch is in the free fall mode, the lever is at the neutral position, and the foot pedal is released.	ON	
		In the status shown above, set the switch to the "LOW" position, depress the pedal, or operate the lever.	OFF	
C-22 COMP. OFF MEAS. OFF	THIRD WINCH CW SOL	Status of the third drum CW solenoid valve (SOL-) is displayed.		* COMP.: Command value from controller * MEAS.: Feedback value The fault (disconnection) is indicated by displaying the following codes: COMP OFF MEAS ON Connector voltage ON : 24 V OFF : 0 to 8V (disconnection) Check procedures: 1) Measure the voltage of the connector. 2) Measure the resistance of the solenoid valves. 3) Replace with new the solenoid valves and connectors.
		Set the third winch free fall speed switch to the "HIGH" position when the third winch is in the free fall mode, the lever is at the neutral position, and the foot pedal is released.	ON	
		In the status shown above, set the switch to the "LOW" position, depress the pedal, or operate the lever.	OFF	
NO.16 DIGITAL OUTPUT C-23 COMP. MEAS.	WIND SPEED ALARM OUTPUT	The wind speed is not less than the setup level that the warning is issued while the anemometer is optionally set up. When the conditions other than the above are not satisfied.		
C-24 COMP. MEAS.	SPARE			
NO.17 DIGITAL OUTPUT C-25 COMP. MEAS.	SPARE			
C-26 COMP. OFF	MAIN WINCH DRUM FREE FALL LAMP	Lower the interceptive lever for getting ON and OFF, and set the free fall lock switch to the release position. Then depress the main winch foot pedal while pressing the main winch free fall switch.	ON	
MEAS. OFF		In the status shown above, repeat the same operation. Or, raise the interceptive lever for getting ON and OFF, or set the free fall lock switch to the lock position.	OFF	
NO.18 DIGITAL OUTPUT C-27 COMP. OFF	AUX. WINCH DRUM FREE FALL LAMP	Lower the interceptive lever for getting ON and OFF, and set the free fall lock switch to the release position. Then depress the aux. winch foot pedal while pressing the aux. winch free fall switch.	ON	
MEAS. OFF		In the status shown above, repeat the same operation. Or, raise the interceptive lever for getting ON and OFF, or set the free fall lock switch to the lock position.	OFF	
C-28 COMP.	THIRD WINCH DRUM FREE FALL LAMP	Lower the interceptive lever for getting ON and OFF, and set the free fall lock switch to the release position. Then depress the third winch foot pedal while pressing the third winch free fall switch.	ON	
MEAS.		In the status shown above, repeat the same operation. Or, raise the interceptive lever for getting ON and OFF, or set the free fall lock switch to the lock position.	OFF	

Display example	Use	Operation situation	Range of adjusted values		Remarks
NO.19		The value is changed according to the speed adjusting trimmer value.	Trimmer min. value	Trimmer Max. value	
PROPO VALVE		It is not possible in the boom limit deceleration range.	E/G Low 345mA	625mA	
D-1	BOOM RAISE SPEED CONTROL		E/G High 415mA	625mA	
COMP 600mA 4.5MP		The value is changed when the boom raising is stopped (due to boom upper limit)	The current of the proportional valve is decreased to 200 mA depending on the boom angle		
MEAS 600mA 4.5MP		The value is changed when the lever interlock is actuated	At the stop 150mA		
NO.20			Trimmer min. value	Trimmer max. value	
PROPO VALVE		The value is changed according to the speed adjusting trimmer value.	E/G Low 345mA	625mA	
D-2	BOOM LOWER SPEED CONTROL		E/G High 415mA	625mA	
COMP 600mA 4.5MP		The value is changed when the boom lowering is slowly stopped (due to overload and boom lower limit)	The current of the proportional valve is decreased to 200 mA in approximately 1.5 sec		
MEAS 600mA 4.5MP		The value is changed when the lever interlock is actuated	At the stop 150mA		
NO.21			Trimmer voltage	Proportional valve current	
PROPO VALVE		The value is changed according to the speed adjusting trimmer value.	0V	145mA	
			1.5V	345mA	
	FRONT DRUM HOIST SPEED CONTROL		4.5V	570mA	
			5.0V	570mA	
D-3		When hook overhoist is released	When the hook overhoist is released 375 mA		
COMP 600mA 4.5MP		The value is changed when the main winch raising is stopped (due to overload)	At the stop 150mA		*COMP: Commanding value from controller
MEAS 600mA 4.5MP		The value is changed when the lever interlock is actuated	At the stop 150mA		
NO.22			Trimmer voltage	Proportional valve current	*MEAS: Feed back value
PROPO VALVE		The value is changed according to the speed adjusting trimmer value.	0V	345mA	
D-4			1.5V	345mA	
COMP 600mA 4.5MP	FRONT DRUM LOWER SPEED CONTROL		4.5V	570mA	The comparisons are normal if the values of the "MEAS" are increased according to the changes in the values of the "COMP".
MEAS 600mA 4.5MP			5.0V	620mA	
		The value is changed when the lever interlock is actuated	At the stop 150mA		
NO.23			Trimmer voltage	Proportional valve current	
PROPO VALVE		The value is changed according to the speed adjusting trimmer value.	0V	345mA	
D-5			1.5V	345mA	
COMP 600mA 4.5MP	REAR DRUM HOIST SPEED CONTROL		4.5V	570mA	Check procedures
MEAS 600mA 4.5MP			5.0V	620mA	1) Measure the current value at the connector. Comp with a meter.
		When hook overhoist is released	When the hook overhoist is released 375 mA		2) Measure the voltage at the controller inlet direction resistance
		The value is changed when the main winch raising is stopped (due to overload)	At the stop 150mA		3) Measure the proportional valve resistance
		The value is changed when the lever interlock is actuated	At the stop 150mA		4) Replace with nearby solenoid valves and components
NO.24			Trimmer voltage	Proportional valve current	
PROPO VALVE		The value is changed according to the speed adjusting trimmer value.	0V	345mA	
D-6	REAR DRUM LOWER SPEED CONTROL		1.5V	345mA	
COMP 600mA 4.5MP			4.5V	570mA	
MEAS 600mA 4.5MP			5.0V	620mA	
		The value is changed when the lever interlock is actuated	At the stop 150mA		
NO.25			Trimmer voltage	Proportional valve current	
PROPO VALVE		The value is changed according to the speed adjusting trimmer value.	0V	345mA	
D-7	THIRD DRUM HOIST SPEED CONTROL		1.5V	345mA	
COMP 600mA 4.5MP			4.5V	570mA	
MEAS 600mA 4.5MP			5.0V	570mA	
		The value is changed when the third winch raising is stopped	At the stop 150mA		
		The value is changed when the lever interlock is actuated	At the stop 150mA		
NO.26			Trimmer voltage	Proportional valve current	
PROPO VALVE		The value is changed according to the speed adjusting trimmer value.	0V	345mA	
D-8	THIRD DRUM LOWER SPEED CONTROL		1.5V	345mA	
COMP 600mA 4.5MP			4.5V	570mA	
MEAS 600mA 4.5MP			5.0V	620mA	
		The value is changed when the lever interlock is actuated	At the stop 150mA		

Display example	Use	Operation instruction	Range of indicated values		Remarks
NO.27 PROPO-VALVE D-9 COMP 600mA 4.5MP MEAS 600mA 4.5MP	FRONT MOTOR CONTROL		Trimmer voltage	Proportional valve current	
			0V	250mA	
			1.5V	250 to 750mA	
			4.5V	250 to 750mA	
		Inching switch is in the "OFF" status. When the conditions shown below are satisfied the output is fluctuated depending on the status of the speed adjustment trimmer, engine running, and the operation of lever.	250mA (constant)		
		Free fall acceleration	700mA (constant)		
NO.28 PROPO-VALVE D-10 COMP 600mA 4.5MP MEAS 600mA 4.5MP	REAR MOTOR CONTROL		Trimmer voltage	Proportional valve current	
			0V	250mA	
			1.5V	250-750mA	
			4.5V	250-750mA	
		Inching switch is in the "OFF" status. When the conditions shown below are satisfied the output is fluctuated depending on the status of the speed adjustment trimmer, engine running, and the operation of lever.	250mA (constant)		
		Free fall acceleration	250mA (constant)		
NO.29 PROPO-VALVE D-11 COMP 500mA 4.5MP MEAS 500mA 4.5MP	SWING SPEED CONTROL	The voltage of the proportional valve is changed by the swing brake mode switch	Free fall at high speed	Free fall at low speed or braking	
		Low E/G speed	250mA	350mA	
		High E/G speed	250mA	350mA	
		When the boom is not swing for 10 sec. or longer	250mA		Standard value shown in the table is effective during hoisting and lowering
NO.30 PROPO-VALVE D-12 COMP 500mA 4.5MP MEAS 500mA 4.5MP	MAIN PUMP CONTROL	The control lever is at the neutral position, and the E/G speed is low	Approx. 700mA		
		The same conditions as the above, but the E/G speed is high	Approx. 105mA		
		Main pump cut-off switch is off and the E/G speed is low	Approx. 700mA		
		The same conditions as the above, but the E/G speed is high	Approx. 405mA		
NO.31 PROPO-VALVE D-13 COMP 500mA 4.5MP MEAS 500mA 4.5MP	THIRD MOTOR CONTROL	The maximum current is fluctuated according to the E/G speed. (Hoisting and lowering)	Trimmer voltage	Proportional valve current	
			0V	170mA	
			1.5V	170-750mA	
			4.5V	170-750mA	
		Inching switch is in the "ON" status	250mA		
		Free fall acceleration	250mA		
NO.32 PROPO-VALVE D-14 COMP 500mA 4.5MP MEAS 500mA 4.5MP	SWING REACTION	The swing lever is at the neutral position.	Free	Brake	
			150mA	170mA	
		The swing lever is fully operated. (When operated, actuate the swing brake and insert the swing lock pin)	510mA	250mA	
NO.33 PROPO-VALVE D-15 COMP 500mA 4.5MP MEAS 500mA 4.5MP	BOOM PUMP CONTROL	Control lever is neutral position, low E/G speed	Approx. 200mA		
		Control lever is neutral position, high E/G speed	Approx. 100mA		
		Front, rear and boom winch relief, low E/G speed	Approx. 300mA		
		Front, rear and boom winch relief, high E/G speed	Approx. 100mA		

Display example	Use	Operation instruction	Range of indicated values		Remarks
NO.04 ANALOG INPUT					
A-1 0.5V	FRONT DRUM SPEED	The value is changed according to the front drum high/low speed adjusting trimmer value	Trimmer min. value 0.5V	Trimmer max. value 5V	Voltage measurement mode The corresponding normal line output is changed according to the changes in the potentiometer output
A-2 0.5V	REAR DRUM SPEED	The value is changed according to the rear drum high/low speed adjusting trimmer value	Trimmer min. value 0.5V	Trimmer max. value 5V	
A-3 0.5V	BLOW DRUM SPEED	The value is changed according to the blow drum high/low speed adjusting trimmer value	Trimmer min. value 0.5V	Trimmer max. value 5V	
A-4 0.5V	SPARE				
NO.05 ANALOG INPUT					
A-5 0.5V	SPARE				Check procedure 1) Measure the voltage of the connector
A-6 0.5V					
A-7 0.5V	GRIP THROTTLE	The value is changed depending on the main throttle status	Low 0.4 to 0.6V	High 4.5 to 5V	
A-8 0.5V	FOOT THROTTLE	The value is changed depending on the foot throttle status (Unstable when the optional component is not equipped)	Low 1V	High 3.5 to 4.0V	
NO.06 ANALOG INPUT					
A-9 0.5V	REAR DRUM DIRECTION CONTROL PRESSURE SENSOR		0.2 to 0.4MPa 0.5 to 4.5V		
A-10 0.5V	THIRD DRUM DIRECTION CONTROL PRESSURE SENSOR		0.2 to 0.4MPa 0.5 to 4.5V		
A-11 0.5V	SWING PUMP PRESSURE SENSOR	The swing lever is at the neutral position (Out of swing lever)	0.5V 3.5V		Similar to A-15 to A-16
A-12 0.5V	THIRD DRUM SPEED	The value is changed according to the third winch drum high/low speed adjusting trimmer value (Unstable when the optional component is not equipped)	Trimmer min. value 0.5V	Trimmer max. value 5V	Similar to A-1 to A-3

Display example	Use	Operation instruction	Range of indicated values	Remarks
NO.37 ANALOG INPUT				
A-13 3.5V	FRONT DRUM HOIST PRESS SENSOR	The lever is at the neutral position.	0.5V	
		The lever is fully operated	4.5V	
A-14 3.5V	FRONT DRUM LOWER PRESS SENSOR	The lever is at the neutral position.	0.5V	
		The lever is fully operated	4.5V	
A-15 3.5V	REAR DRUM HOIST PRESS SENSOR	The lever is at the neutral position.	0.5V	
		The lever is fully operated	4.5V	
A-16 3.5V	REAR DRUM LOWER PRESS SENSOR	The lever is at the neutral position.	0.5V	
		The lever is fully operated	4.5V	
NO.38 ANALOG INPUT				
A-17 3.5V	THIRD DRUM HOIST PRESS SENSOR	The lever is at the neutral position	0.5V	* The components are normal if the values are changed when the respective conditions are satisfied.
		The lever is fully operated	4.5V	
A-18 3.5V	THIRD DRUM LOWER PRESS SENSOR	The lever is at the neutral position.	0.5V	
		The lever is fully operated	4.5V	
A-19 1.5V	FRONT CLUTCH PRESS SENSOR	When the lever is operated while the machine is in the brake or free fall mode	1.6V	Check procedure: Replace with another sensor.
		When the machine is in the free fall mode and the foot pedal released	0.5V	
A-20 1.5V	REAR CLUTCH PRESS SENSOR	When the lever is operated while the machine is in the brake or free fall mode	1.6V	After the replacement: At if the indicated value is changed → the sensor is faulty.
		When the machine is in the free fall mode and the foot pedal released	0.5V	At if the indicated value is not changed → wire harness or controller is faulty.
NO.39 ANALOG INPUT				
A-21 3.5V	THIRD CLUTCH PRESS SENSOR	When the lever is operated while the machine is in the brake or free fall mode	1.6V	
		When the machine is in the free fall mode and the foot pedal released	0.5V	
A-22 3.5V	WIND SPEED SENSOR	0m	0V	
		50m	1.0~5.0V	
A-23 3.5V				
A-24 3.5V	BOOM RAISE PRESS SENSOR	The lever is at the neutral position	0.5V	
		The lever is fully operated	4.5V	
NO.40 ANALOG INPUT				
A-25 3.5V	BOOM LOWER PRESS SENSOR	The lever is at the neutral position	0.5V	
		The lever is fully operated	4.5V	
A-26 3.5V	SPARE			
NO.41 DIGITAL INPUT				
B-1 OFF	FRONT DRUM FREE FALL SIGNAL	When the free fall on/off switch is set to the "ON" position and the foot pedal is depressed	W/input: ON / W/O input: OFF	* The components are normal if the values are changed when the respective conditions are satisfied.
B-2 OFF	REAR DRUM FREE FALL SIGNAL	When the free fall on/off switch is set to the "ON" position and the foot pedal is depressed	W/input: ON / W/O input: OFF	
B-3 OFF	THIRD DRUM FREE FALL SIGNAL	When the free fall on/off switch is set to the "ON" position and the foot pedal is depressed	W/input: ON / W/O input: OFF	
B-4 OFF	ECU ON SIGNAL	ECU condition is displayed	ECU ON: ON / ECU OFF: OFF	

Display example	Use	Operation instruction	Range of indicated values		Remarks
NO.42 DIGITAL INPUT					
B 5 OFF					
B 6 OFF	SWING BRAKE MODE (2)	Position of the swing brake mode selector switch is displayed	Free fall at low speed ON	Free fall at high speed OFF	
B 7 OFF	LUFFING JIB RAISING DECELERATION	With deceleration signal : ON	Deceleration : ON	Normal : OFF	
B 8 OFF	DRUM TURN GRIP SWITCH	When drum detection grip ON/OFF switch	ON: ON	OFF: OFF	
NO.43 DIGITAL INPUT					
B 9 OFF	FRONT DRUM BRAKE PEDAL LIMIT SWITCH	Foot brake operating status display	Operation : ON	Not operation : OFF	
B 10 OFF	IGN. SWITCH	The displayed code is changed depending on the position of the ignition switch	IGNITION ON: ON	IGNITION OFF: OFF	
B 11 OFF	INCHING SPEED	Speed changes according to the position of the inching speed switch	Inching : ON	Normal : OFF	
B 12 OFF	SPARE				
NO.44 DIGITAL INPUT					
B 13 OFF	ENGINE OIL PRESSURE SWITCH	The displayed code is changed depending on the status of the engine	E/G is stopped: ON	E/G is running: OFF	
B 14 OFF	MOISTURE DETECTION OF THE FUEL FILTER	Moisture in the fuel filter is detected	Detection: ON	Usually: OFF	
B 15 OFF	BOOM RAISE STOP SIGNAL	When the boom is raised up to the upper limit height	Stop : ON	Usually: OFF	*: The compound values are normal if the values are changed when the respective conditions are satisfied.
B 16 OFF	BOOM LOWER STOP SIGNAL	When the machine is in the overload or ATB status, or the boom exceeds the working area limit	Stop : ON	Usually: OFF	
NO.45 DIGITAL INPUT					
B 17 OFF	REAR LOWER STOP SIGNAL	When the aux. winch drum wire rope over-unwinding prevention function is activated	Stop : ON	Usually : OFF	
B 18 OFF	BOOM RAISE SLOW DOWN SIGNAL	10 degrees to the boom upper limit	Deceleration : ON	Normal : OFF	
B 19 OFF	REAR RAISE SLOW DOWN SIGNAL	In the CK1200 normally the code "OFF" is displayed			
B 20 OFF	FRONT LOWER STOP SIGNAL	When the main winch drum wire rope over-unwinding prevention function is activated	Stop : ON	Usually: OFF	
NO.45 DIGITAL INPUT					
B 21 OFF	FRONT DRUM HOIST STOP SIGNAL	When the machine is in the overload or ATB status	Stop : ON	Usually: OFF	
B 22 OFF	REAR DRUM HOIST STOP SIGNAL	When the machine is in the overload or ATB status	Stop : ON	Usually: OFF	
B 23 OFF	TOWER RAISE MODE	In the CK1200 normally the code "OFF" is displayed			
B 24 OFF	SWING BRAKE MODE (1)	Position of the swing brake mode selector switch is displayed	Swing brake mode selected: ON	Swing free mode low speed select: OFF	
NO.47 DIGITAL INPUT					
B 25 OFF	TILTED JIB LOWER STOP SIGNAL	In the CK1200 normally the code "OFF" is displayed	Stop : ON	Usually : OFF	
B 26 OFF	TRAVEL SIGNAL	The displayed code is changed depending on the operation of the travel lever	Operation : ON	Normal: OFF	
B 27 OFF	SWING SIGNAL	The displayed code is changed depending on the operation of the swing lever	Operation : ON	Normal : OFF	
B 28 OFF	LMI BYPASS	The LMI bypass switch is effective	Effective: ON	Ineffective : OFF	*1

Display example	Use	Operation instruction	Range of indicated values		Remarks
NO.48 DIGITAL INPUT					
B-29 OFF	THIRD DRUM BRAKE STOP SIGNAL	When the machine is in the overload or ATB status (If used as the jib, when the jib is overhoisted)	Stop: ON	Usually: OFF	
B-30 OFF	FUNCTION LOCK	The value is changed when the function lock lever is operated	Release: ON	Lock: OFF	
B-31 OFF	CLOGGING OF ENG AIR CLEANER	Clogging of the ENG air cleaner is detected	Detection: ON	Usually: OFF	
B-32 OFF	REAR DRUM BRAKE PEDAL LIMIT SWITCH	Foot brake operating status display	Operation: ON	Not operated: OFF	
NO.49 DIGITAL INPUT					
B-33 OFF	RADIATOR LEVEL SENSOR	The displayed code is changed depending on the level of the remaining cooling water.	Specified level or lower: ON	Specified level or higher: OFF	
B-34 OFF	GENERATION SIGNAL	The displayed code is changed depending on the generation signal of the alternator.	ENG ON: ON	ENG OFF: OFF	
B-35 OFF	ENGINE OIL FILTER	The displayed code is changed depending on clogs of the engine oil filter.	Clog: ON	Normal: OFF	
B-36 OFF	THIRD DRUM BRAKE PEDAL LIMIT SWITCH	Foot brake operating status display	Operation: ON	Not operated: OFF	
NO.50 DIGITAL INPUT					
B-37 OFF	HYD. OIL TEMP	The displayed code is changed depending on the hydraulic oil temperature.	Specified level or higher: ON	Specified level or lower: OFF	* The components are normal if the values are changed when the respective conditions are satisfied.
B-38 OFF	CONTROL PRIMARY PRESSURE	The displayed code is changed depending on the primary pressure.	Specified level or higher: ON	Specified level or lower: OFF	
B-39 OFF	FRONT DRUM FREE FALL ACCELERATION	The displayed code is changed depending on the position of the front drum free fall acceleration switch.	High: ON	Normal: OFF	
B-40 OFF	REAR DRUM FREE FALL ACCELERATION	The displayed code is changed depending on the position of the front drum free fall acceleration switch.	High: ON	Normal: OFF	
NO.51 DIGITAL INPUT					
B-41 OFF	THIRD DRUM FREE FALL ACCELERATION	The displayed code is changed depending on the position of the third drum free fall acceleration switch.	High: ON	Normal: OFF	
B-42 OFF	ENGINE PREHEAT	The displayed code is changed depending on the position of the ignition switch.	Glow position: ON	Other positions: OFF	
B-43 OFF	FRONT DRUM BRAKE COOLING OIL TEMPERATURE	The displayed code is changed depending on the oil temperature in the front drum brake cooling line.	Specified level or higher: ON	Specified level or lower: OFF	
B-44 OFF	REAR DRUM BRAKE COOLING OIL TEMPERATURE	The displayed code is changed depending on the oil temperature in the rear drum brake cooling line.	Specified level or higher: ON	Specified level or lower: OFF	
NO.52 DIGITAL INPUT					
B-45 OFF	COOLING LINE FILTER CLOG	The displayed code is changed depending on clogs in the cooling line filter.	Clog: ON	Normal: OFF	
B-46 OFF	FREE FALL PERMISSION	The displayed code is changed depending on the position of the free fall lock switch.	Release: ON	Lock: OFF	

*1 The LMI bypass switch is effective (ON is displayed) only when it is set to the "Bypass" position and the LMI is malfunctioning, and it is ineffective even if it is set to the "ON" position when the LMI operates normally.

12.4 FAULT LOG DISPLAY

The logs of faults which have been found by the self check of the total controller are stored in the controller, and can be displayed on the display screen of the gauge cluster.
If faults do not re-appear on job sites, first, check the fault log display for the convenience of troubleshooting.

1. Display procedures

(1) Set the key switch to the "ON" position.

(2) Enter the fault finding mode.
(Push both of the check switch and buzzer switch at the same time and hold them for 5 sec. or longer.)

(3) Push the check switch and hold it for 5 sec. or longer while the machine is in the status display mode.
Then, the fault logs are displayed.

(Example)
If no fault has occurred in the past:

NO ERROR

If faults have occurred in the past:

5000 Hr
A-2 AM ERROR
C-7 C/O ERROR
F-1 S/M ERROR

(4) The displayed fault logs remain displayed on the screen for an hour. If there are four or more fault logs to be displayed at a time, the displayed fault logs are changed automatically.

(Example) (a)

5000	Hr
A-2	A/I ERROR
C-7	D/O ERROR
F-1	S/W ERROR

Displayed alternately

(b)

5000	Hr
D-2	PV ERR
D-3	PV ERR.

(5) To display the logs of faults occurred at other time (for example, logs of faults occurred at the time other than 5000 Hr), switch the display with the display screen selector switch △ or ▽
Former fault logs can be displayed by pushing the display screen selector switch △, and later logs can be displayed by pushing the display screen selector switch ▽.

(6) To end the fault log display, push the setting switch. Then, the status display mode returns.

2. Deletion of fault logs

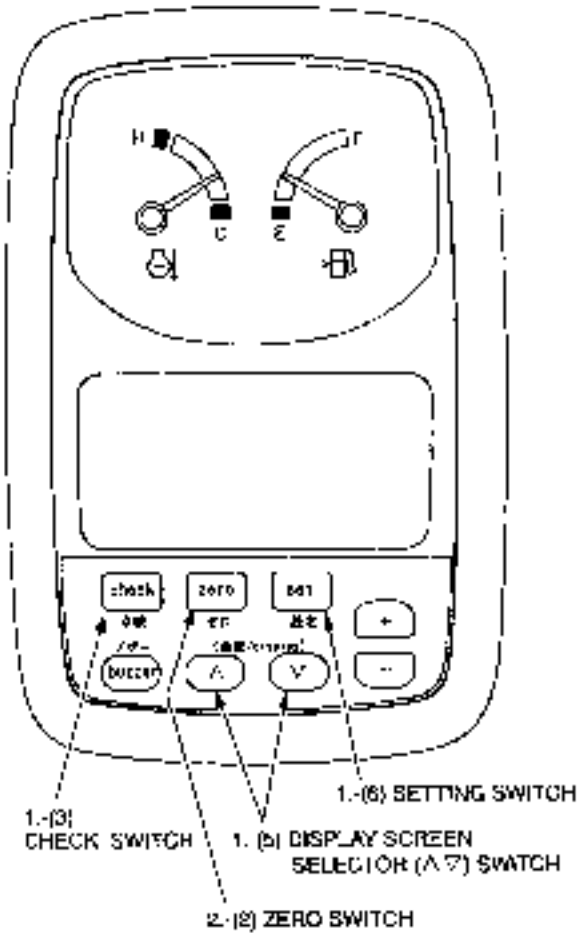
(1) Display the fault logs occurred.

(2) Push the zero switch and hold it for 5 sec. or longer. All the fault logs occurred are deleted.

(3) After the deletion is completed, the message "NO ERROR" appears on the display screen.

3. Notes on fault logs

- Even when a fault occurs, if the same type fault already occurred in the past, and the log of the fault has a ready been stored, a new log of the fault is not stored.
- The hour indicated in the hourmeter on the display is a reference (for the replacement of the controller), and indicates the total period of the controller operation. It is not related to the hourmeter on the carrier.



Owing to the facts above, be sure to delete fault logs after faults are corrected.
It is recommended to record the hourmeter value of the controller together with that of the hourmeter of the carrier.

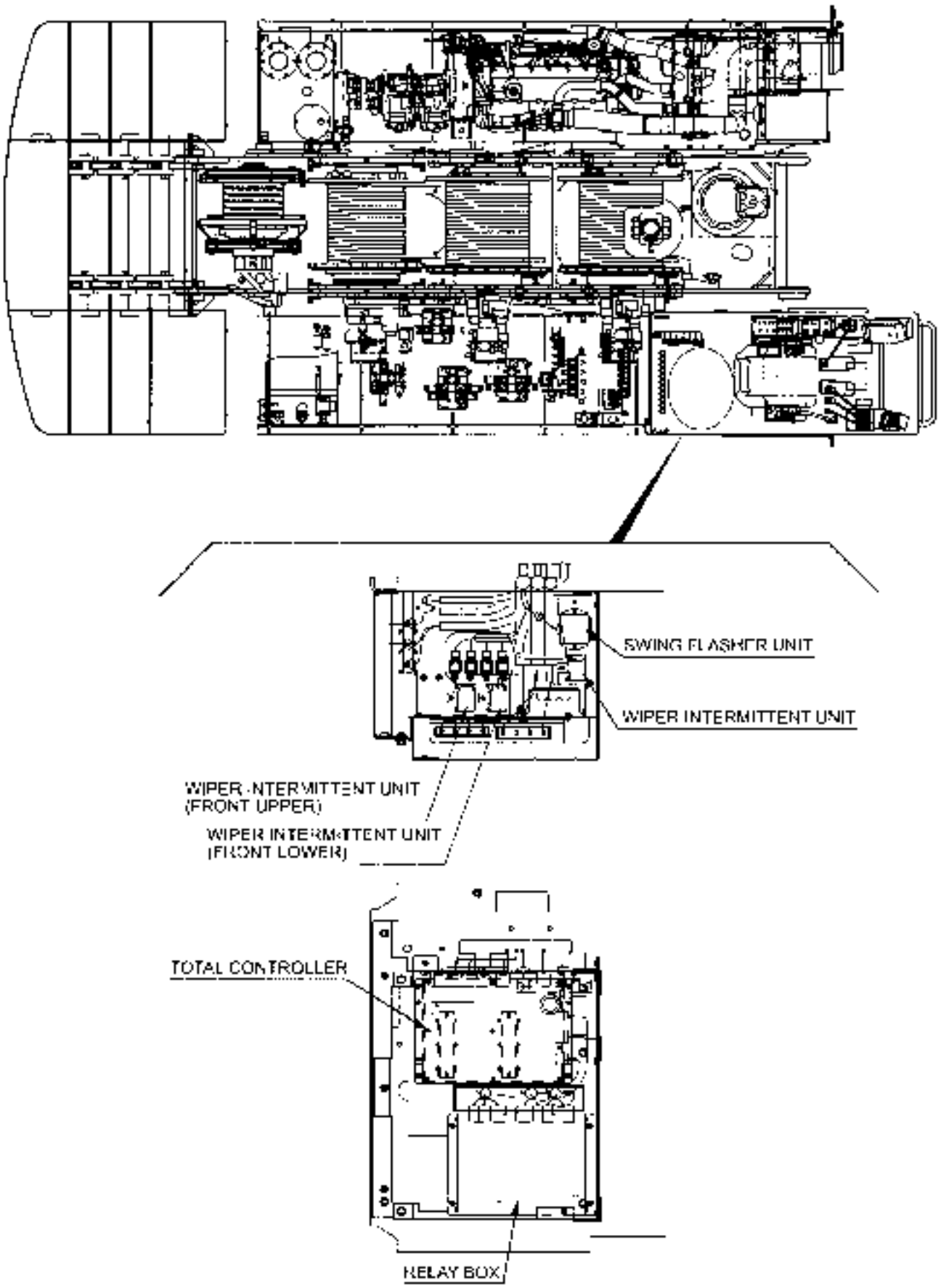
4. Contents of fault log display

CONTENTS OF DISPLAY	SELF CHECK	USE
A-1 A/I ERROR	(SELF CHECK 7) D1	Main winch (front drum) motor speed adjusting trimmer
A-2 A/I ERROR	(SELF CHECK 7) D2	Aux. winch (rear drum) motor speed adjusting trimmer
A-3 A/I ERROR	(SELF CHECK 7) D3	Boom winch motor speed adjusting trimmer
A-6 A/I ERROR	(SELF CHECK 7) D6	Tagline trimmer
A-7 A/I ERROR	(SELF CHECK 8) D0	Hand throttle
A-8 A/I ERROR	(SELF CHECK 8) D1	Foot throttle
A-9 A/I ERROR		Aux. winch (rear drum) motor pressure sensor
A-10 A/I ERROR		Third winch motor pressure sensor
A-11 A/I ERROR	(SELF CHECK 8) D4	Swing pump pressure sensor
A-12 A/I ERROR	(SELF CHECK 8) D5	Third (jib) motor speed adjusting trimmer
A-13 A/I ERROR	(SELF CHECK 8) D6	Main winch raising pressure sensor
A-14 A/I ERROR	(SELF CHECK 8) D7	Main winch lowering pressure sensor
A-15 A/I ERROR	(SELF CHECK 8) D8	Aux. winch raising pressure sensor
A-16 A/I ERROR	(SELF CHECK 9) D2	Aux. winch lowering pressure sensor
A-17 A/I ERROR	(SELF CHECK 9) D3	Third (jib) winch raising pressure sensor
A-18 A/I ERROR	(SELF CHECK 9) D4	Third (jib) winch lowering pressure sensor
A-19 A/I ERROR	(SELF CHECK 9) D5	Main winch clutch pressure sensor
A-20 A/I ERROR	(SELF CHECK 9) D6	Aux. winch clutch pressure sensor
A-21 A/I ERROR	(SELF CHECK 10) D0	Third winch clutch pressure sensor
A-24 A/I ERROR	(SELF CHECK 10) D3	Boom raising pressure sensor
A-25 A/I ERROR	(SELF CHECK 10) D4	Boom lowering pressure sensor
A-26 A/I ERROR		Jib fenlich
C-1 D/O ERR		Battery relay
C-3 D/O ERR		Hyd. oil heat relay
C-4 D/O ERR		Boom pump inching solenoid
C-5 D/O ERR	(SELF CHECK 3) D4	Main pump inching solenoid
C-7 D/O ERR	(SELF CHECK 4) D0	Main winch (front drum) clutch CLM solenoid
C-8 D/O ERR	(SELF CHECK 4) D1	Main winch (front drum) clutch ESM solenoid
C-10 D/O ERR	(SELF CHECK 4) D3	Aux. winch (rear drum) clutch CLA solenoid
C-11 D/O ERR	(SELF CHECK 4) D4	Aux. winch (rear drum) clutch ESA solenoid
C-13 D/O ERR	(SELF CHECK 4) D6	Third winch (third drum) clutch CLT solenoid
C-14 D/O ERR	(SELF CHECK 5) D0	Third winch (third drum) clutch EST solenoid
C-15 D/O ERR	(SELF CHECK 5) D1	Main winch (front drum) motor boost solenoid
C-16 D/O ERR	(SELF CHECK 5) D2	Aux. winch (rear drum) motor boost solenoid
C-17 D/O ERR	(SELF CHECK 5) D3	Third winch (third drum) motor boost solenoid
C-18 D/O ERR	(SELF CHECK 5) D4	Main winch drum turn detection grip
C-19 D/O ERR	(SELF CHECK 5) D5	Aux. winch drum turn detection grip
C-20 D/O ERR	(SELF CHECK 5) D6	Main winch C/V solenoid
C-21 D/O ERR	(SELF CHECK 6) D0	Aux. winch C/V solenoid
C-22 D/O ERR	(SELF CHECK 6) D1	Third winch C/V solenoid
C-23 D/O ERR		Wind alarm output
C-26 D/O ERR	(SELF CHECK 6) D5	Main winch free fall lamp
C-27 D/O ERR	(SELF CHECK 6) D6	Aux. winch free fall lamp
C-28 D/O ERR	(SELF CHECK 7) D0	Third winch free fall lamp

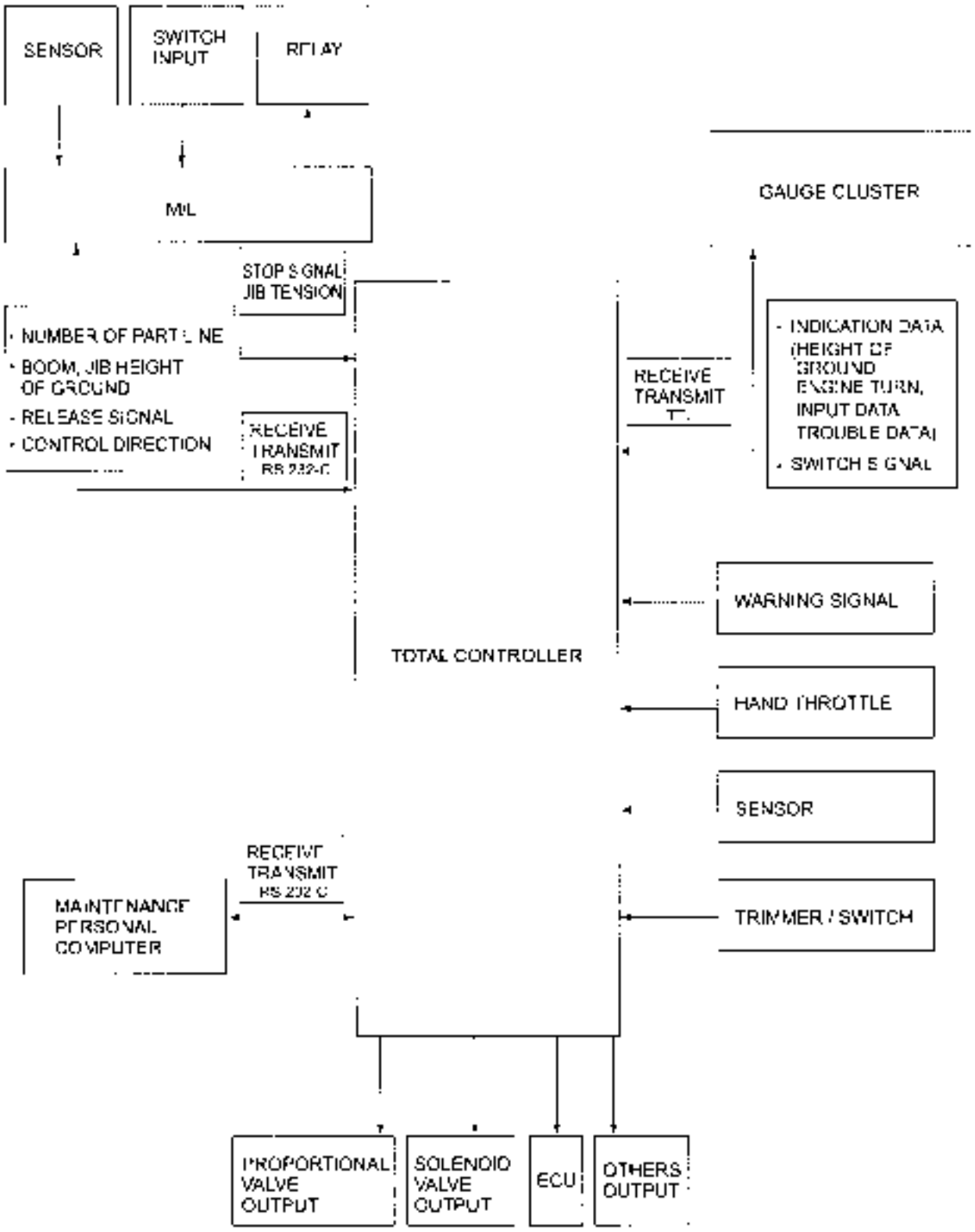
CONTENTS OF DISPLAY		SELF CHECK	USE
D-1	P/V ERR	(SELF CHECK 1) D0	Boom remote control raising pressure reducing proportional valve
D-2	P/V ERR	(SELF CHECK 1) D1	Boom remote control lowering pressure reducing proportional valve
D-3	P/V ERR	(SELF CHECK 1) D2	Main winch remote control raising pressure reducing proportional valve
D-4	P/V ERR	(SELF CHECK 1) D3	Main winch remote control lowering pressure reducing proportional valve
D-5	P/V ERR	(SELF CHECK 1) D4	Aux. winch remote control raising pressure reducing proportional valve
D-6	P/V ERR	(SELF CHECK 1) D5	Aux. winch remote control lowering pressure reducing proportional valve
D-7	P/V ERR	(SELF CHECK 1) D6	Third winch remote control raising pressure reducing proportional valve
D-8	P/V ERR	(SELF CHECK 2) D0	Third winch remote control lowering pressure reducing proportional valve
D-9	P/V ERR	(SELF CHECK 2) D1	Main winch (front drum) motor tilting angle proportional valve
D-10	P/V ERR	(SELF CHECK 2) D2	Aux. winch (rear drum) motor tilting angle proportional valve
D-11	P/V ERR	(SELF CHECK 2) D3	Swing constant speed proportional valve
D-12	P/V ERR	(SELF CHECK 2) D4	Main pump reducing horsepower proportional valve
D-13	P/V ERR	(SELF CHECK 2) D5	Third winch motor tilting angle proportional valve
D-14	P/V ERR	(SELF CHECK 2) D6	Swing reaction proportional valve
D-15	P/V ERR	(SELF CHECK 3) D0	Boom pump reducing horsepower proportional valve
H-3	ROM DATA	(SELF CHECK 11) D2	Abnormal total controller adjustment value
H-4	M/C SET	(SELF CHECK 11) D3	Wrong total controller adjustment
H-5	M/L RECEIVE	(SELF CHECK 11) D4	Faulty communication with LMI
H-6	M/C RECEIVE	(SELF CHECK 11) D5	Faulty communication with total controller
NO ERROR			

13. TOTAL CONTROLLER

13.1 ARRANGEMENT OF TOTAL CONTROLLER



13.2 COMPOSITION OF SYSTEM



13.2.1 OUTPUT RELATION TO CONTROLLER

Items	Input/Output	Signal types	Outline
Indicator (GAUGE CLUSTER)	Input/Output	Serial communication	The SW setting data are received from the indicator. The indication signals of the OK monitor, engine speed, lifting height, wind speed, faults, etc. are transmitted depending on the SW setting conditions.
M/L (LMI)	Input/Output	Serial communication + Digital input	The changes in lifting height during boom and jib hoisting, faults signals, and number of part lines are transmitted from the M/L. The operating direction of the winch operation lever is transmitted to the M/L. The signals referring to automatic stop are input from the M/L in digital form.
Maintenance personal computer	Input/Output	Serial communication	This PC is used for down-loading of programs.
Hand throttle	Input	Analogue 0 to 5 V	The grip signals from the engine throttle are input.
Sensor	Input		The values from the pressure sensor, engine turn sensor, wind speed sensor, etc. are input.
Cab inside switch/ trimmer	Input		The values from the switches and trimmers in the cab are input
Proportional valve	Output	24 V 100 to 700 mA	PWM output Constant current circuit (Max 1 A) Disconnection detection W/short-circuit protection
Solenoid valve	Output	24 V 1 A	Disconnection detection W/short-circuit protection

13.3 FUNCTION OF TOTAL CONTROLLER

The total controller features the following main three functions:
(1) Control of main body, (2) Cluster control, and (3) Adjustment
The function items and outline are shown below

(1) Control of main body

No.	Function items
1	Accelerator control & power off
2	Power control
3	Speed control of front and rear, third, boom drums
4	Swing reaction
5	Boom raising deceleration
6	Boom raising stop
7	Boom lowering slow stop
8	Jib raising deceleration / Jib raising stop
9	
10	Jib lowering slow stop
11	Front drum hoisting stop
12	Rear drum hoisting stop
13	
14	Lifting height gauge (option)
15	Winch control
16	Boost control
17	Motor control
18	Main pump control / Boom pump control
19	Drum turn detection grip control (option)
20	Tagline control (Not used)
21	Wind sensor (option)
22	Lever interlock control
23	Control of hoist deceleration when overhoist stop is canceled
24	Control of communication with LMI
25	Swing speed select, swing pump control
26	Hyd. oil heat

(2) Cluster control

No.	Function items
1	Indication control (refer to the pages relating to the cluster)
2	Communication control

(3) Adjustment function

No.	Function items	
1	Adjustment 3	Memory of high and low idle position and no-load speed
2	Adjustment 1	option setting
3	Adjustment 3	Throttle range setting

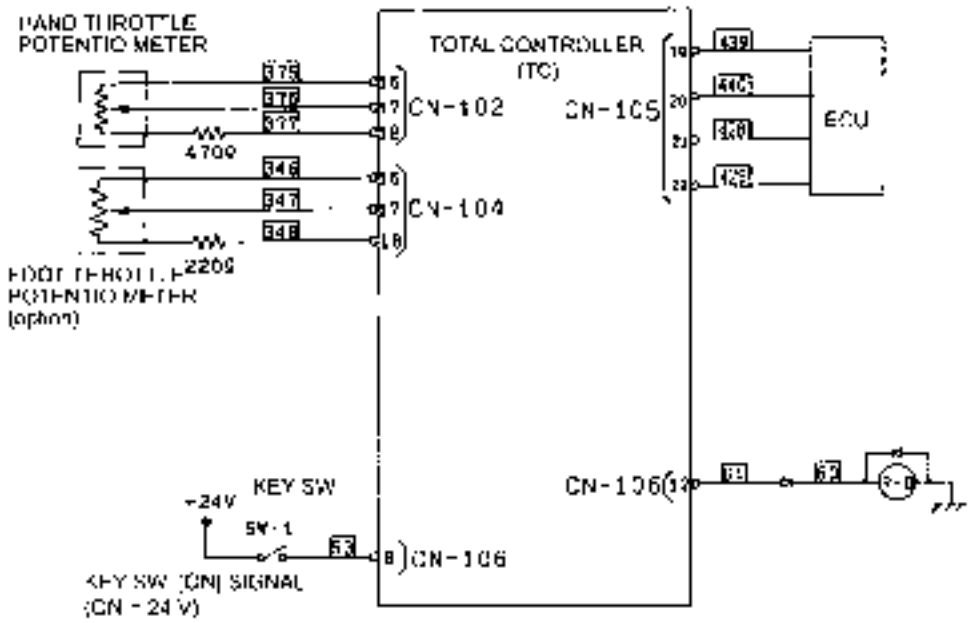
1. ACCELERATOR CONTROL & POWER OFF

(1) Accelerator control

Commands are sent to the ECU (Engine control unit) according to the input from the hand throttle or foot throttle. If the machine is equipped with both the throttles, priority is given to the throttle issuing more commands.

(2) Measures against engine stop

- Four seconds after the key switch is set to the OFF position, the battery relay is de-energized.

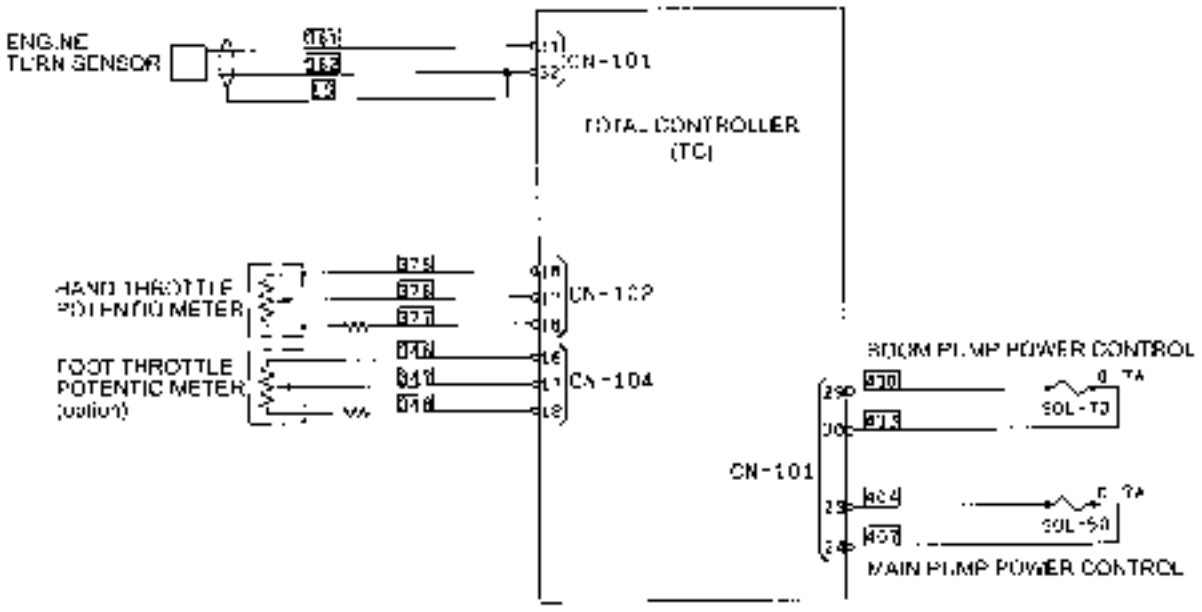


If wiring of both the hand throttle and foot throttle is disconnected, output voltage to the ECU is 0 V.
Low speed rotation and middle speed rotation can be switched by turning "ON" the auxiliary acceleration switch after turning "ON" the by-pass switch.

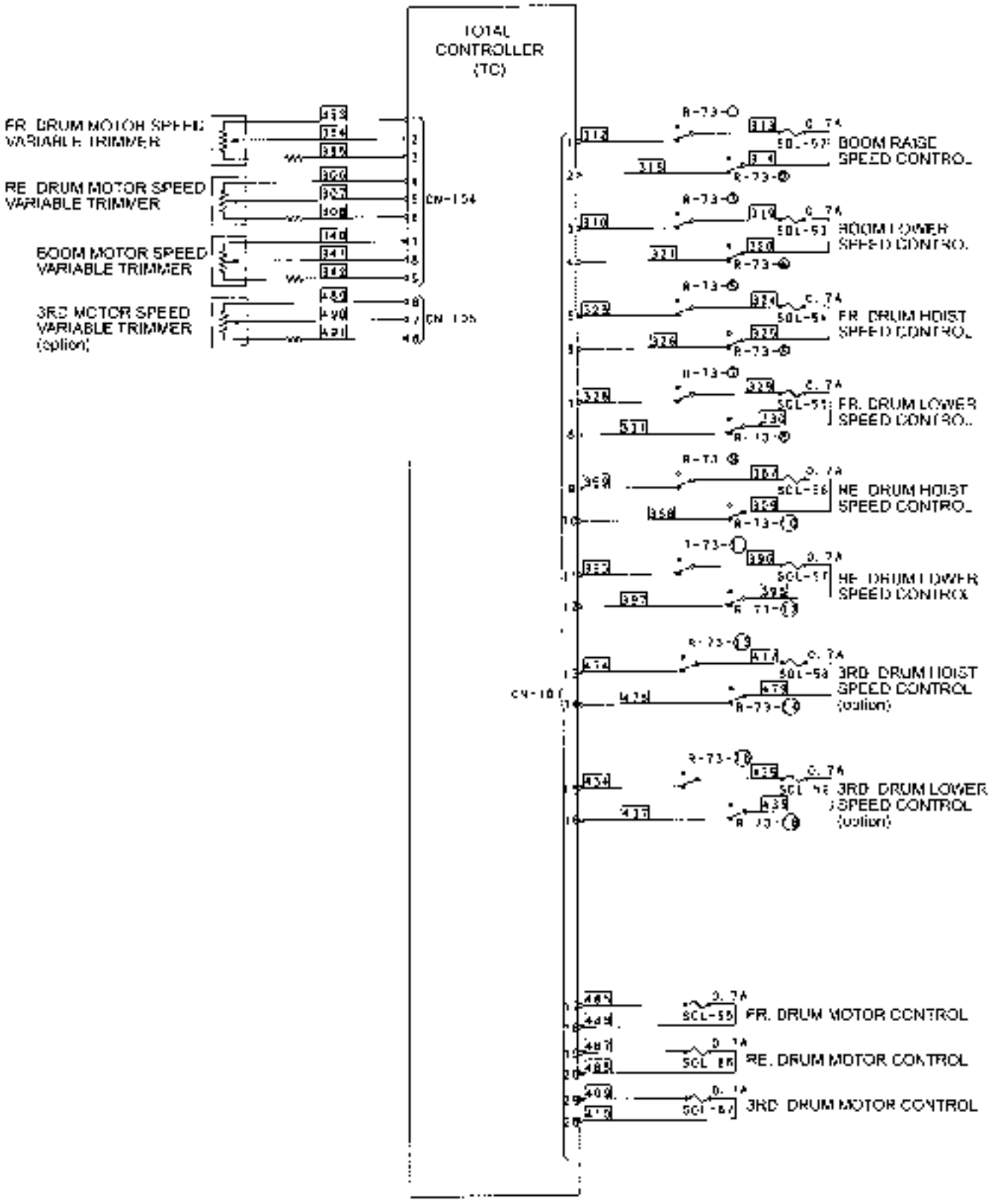
2. POWER CONTROL

The target speed is calculated by the hand throttle. Then, the tilting angle of the pump is controlled when the actual engine speed is slower than the target engine speed.

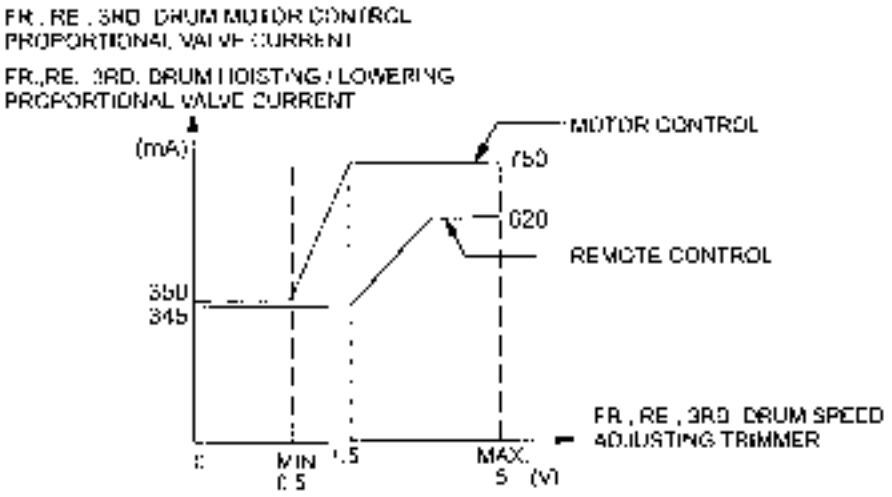
As the actual rotating speed is lower than the target rotating speed, the output current becomes greater. Note that the output current is great while the rotating speed is low, even when the speed difference is slight (for prevention of engine stall).



3. SPEED CONTROL OF FRONT, REAR, THIRD AND BOOM DRUMS



(1) FR, RE , 3RD DRUM SPEED VARIABLE



The maximum current values at the remote control proportional valve and motor control proportional valve are controlled as shown in the graph above.
The orders of operation priority are shown below

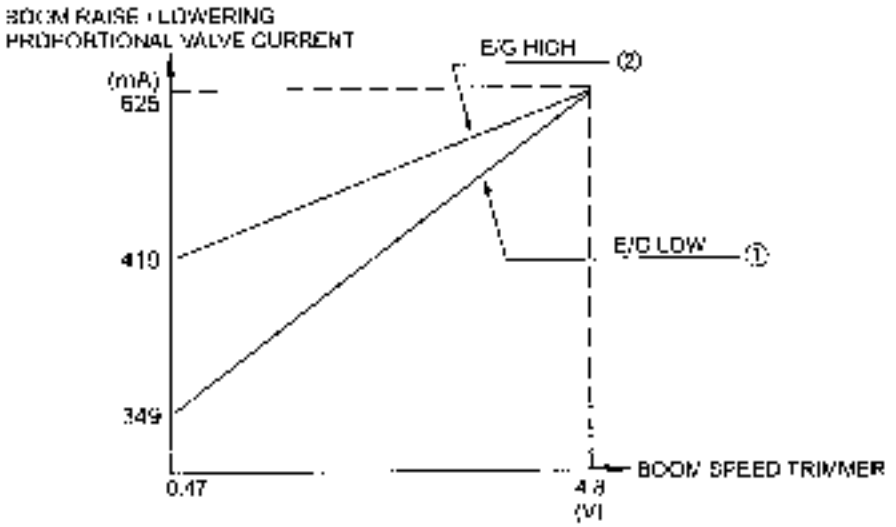
- Remote control proportional valve

Stop of front or rear drum Lever inter lock > Deceleration of front or rear drum > Free fall > Trimmer control

- Motor control proportional valve

Drum stop Lever inter lock > Free fall acceleration > Main pump inching speed > Trimmer control (control during power lowering) Motor control > Luffing mode speed control

(2) Boom Drum Speed Control

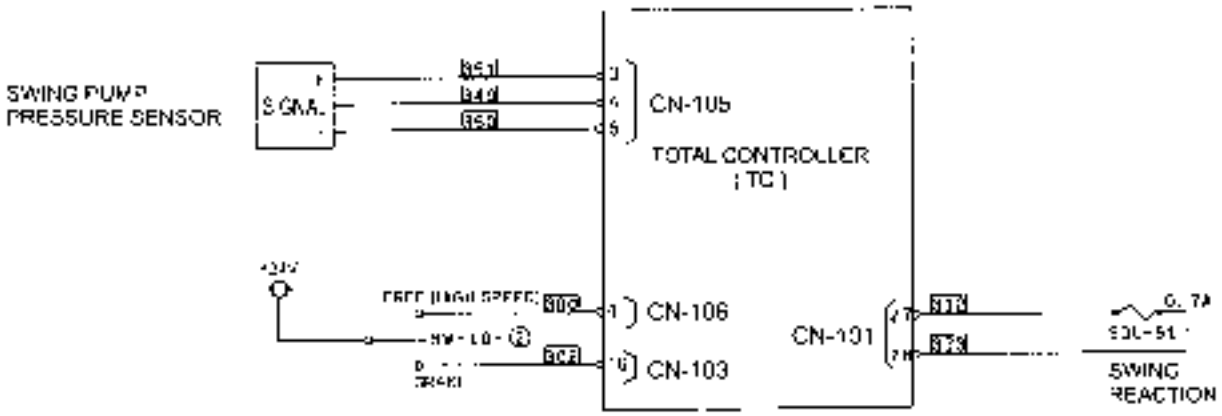


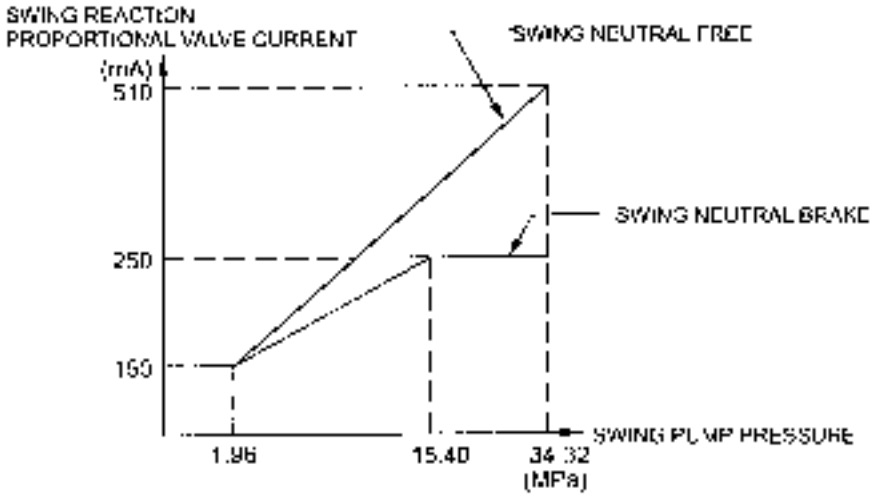
- If the engine speed is increased from low to high under the characteristic status (1), the current value is close to that of the characteristic status (2)

* When the trimmer is set to the maximum position, the proportional valve is fully opened, and the status becomes identical to that of no trimmer.

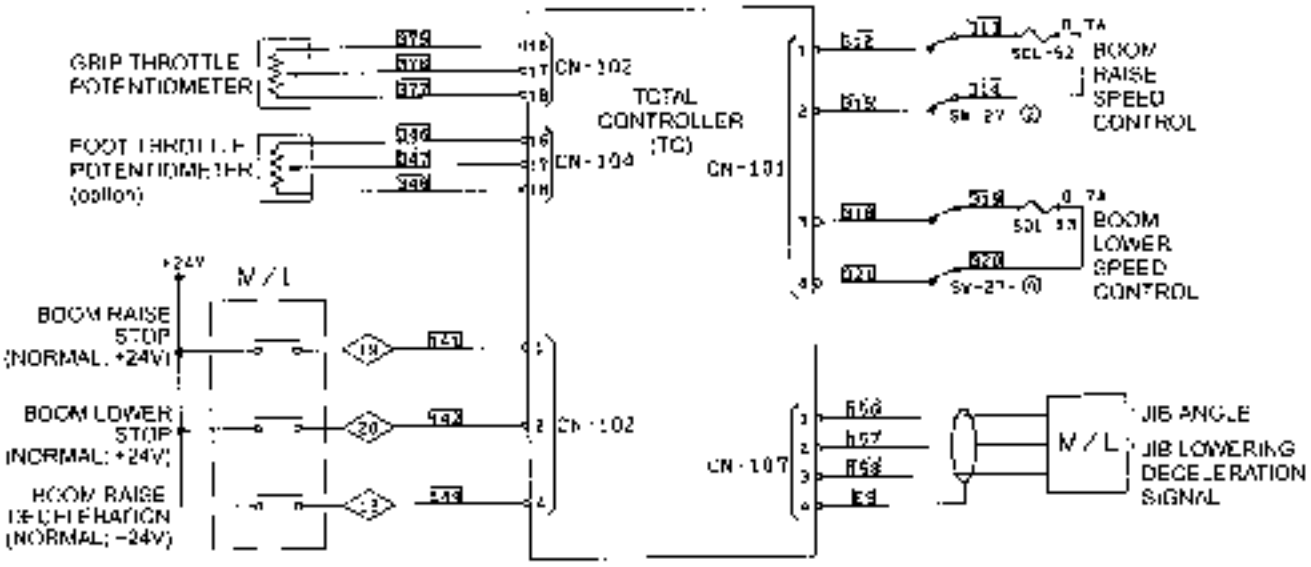
4. SWING REACTION

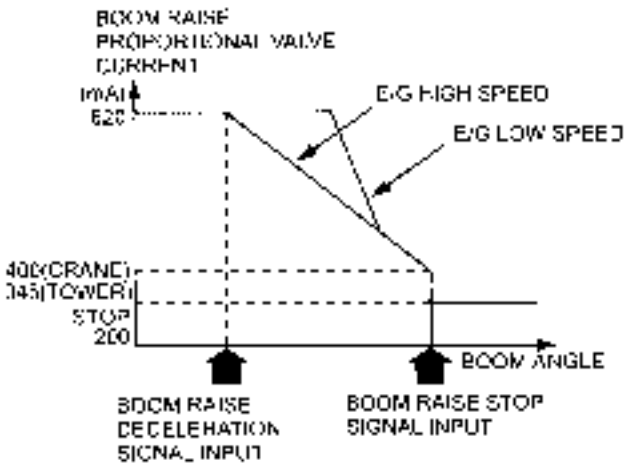
A reaction is applied to the lever depending on swing loads.

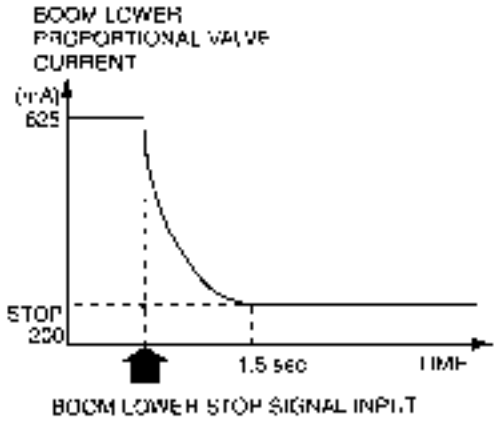




5. BOOM RAISING DECELERATION
6. BOOM RAISING STOP
7. BOOM LOWERING SLOW STOP







- When boom raise deceleration signals are input (input when the boom reaches the angle smaller than the boom upper limit angle by 10°), the boom raise remote control proportional valve is controlled and the boom raising speed is decelerated assording to the boom angle.

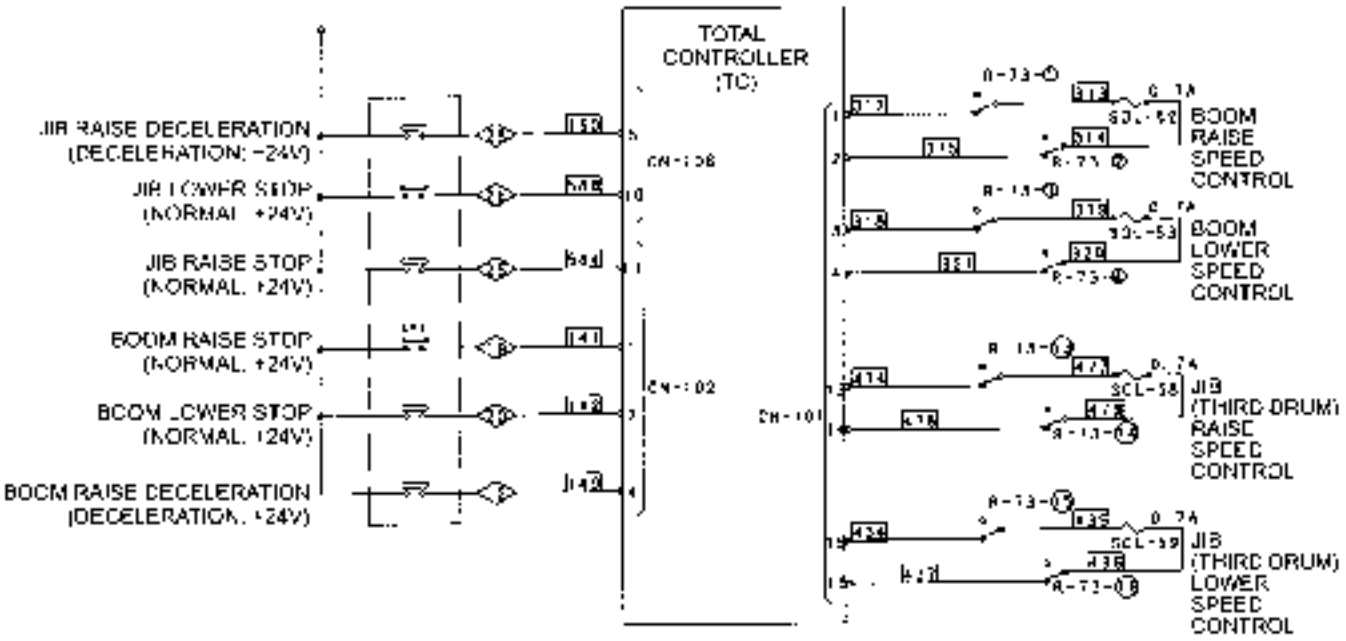
*1 If the communication with the ML is faulty, the deceleration is performed by decreasing the current at the proportional valve (to 400 mA in 5 sec.) regardless of fluctuations in the boom angle depending on the elapsed time after the raising deceleration signal is input.

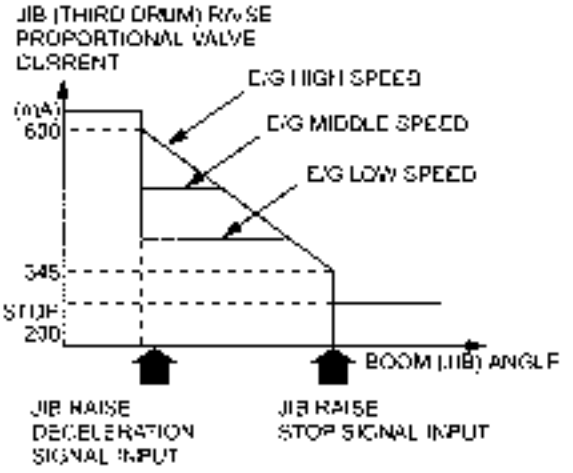
- When the boom lower stop signals are input, the current value at the boom lower proportional valve is minimized within 1.5 seconds, and the boom is slowly stopped.

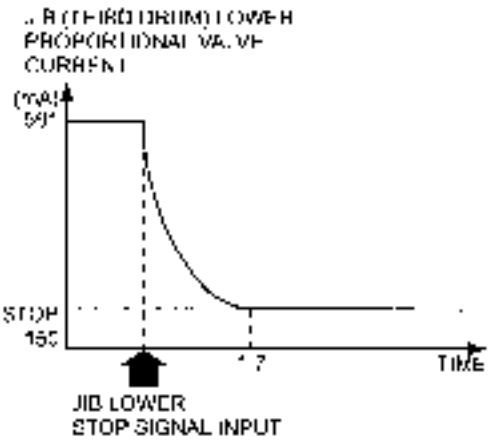
*2 (If current at the proportional valve is 625 mA or less at the startup of control (when the stop signal is input), control is started from the current value. [The period required for minimization of current at the proportional valve is shorter than 1.5 sec.])

IF THE JIB IS RAISED BY THIRD DRUM

8. JIB RAISING DECELERATION / JIB RAISING STOP
10. JIB LOWERING SLOW STOP







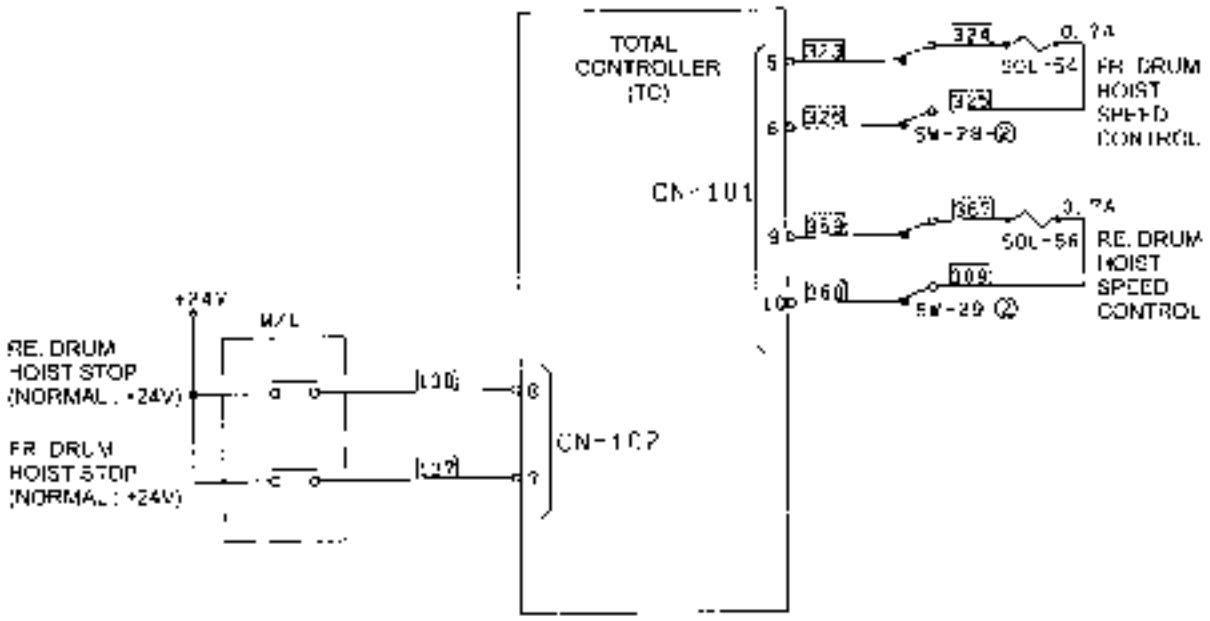
- When jib raise deceleration signals are input (input when the jib reaches the angle smaller than the jib upper limit angle by 10°), the jib raise remote control proportional valve is controlled and the jib raising speed is decelerated according to the jib angle.

*1 If the communication with the ML is faulty, the deceleration is performed by decreasing the current at the proportional valve (to 400 mA in 4 sec.) regardless of fluctuations in the boom angle depending on the elapsed time after the raising deceleration signal is input.

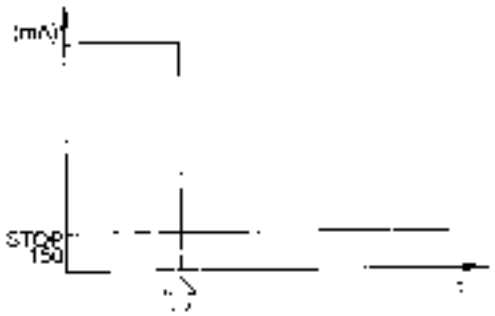
- When the jib lower stop signals are input, the current value at the jib lower proportional valve is minimized within 1.7 seconds, and the jib is slowly stopped.

*2 (If current at the proportional valve is 591 mA or less at the startup of control (when the stop signal is input), control is started from the current value.
[The period required for minimization of current at the proportional valve is shorter than 1.7 sec.])

11. FR. DRUM HOISTING STOP
12. RE. DRUM HOISTING STOP

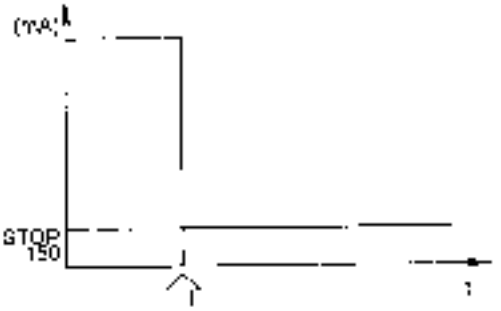


FR. DRUM HOIST PROPORTIONAL VALVE CURRENT



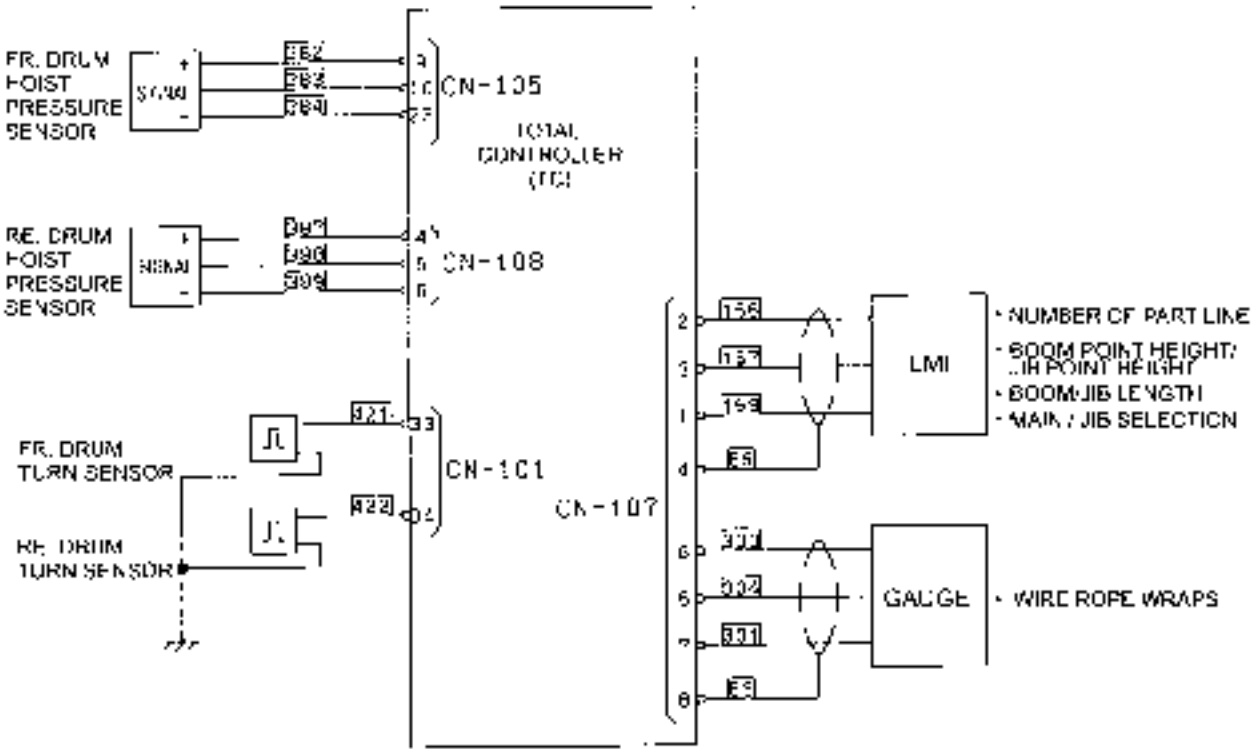
FRONT DRUM HOIST STOP
SIGNAL INPUT

RE. DRUM HOIST PROPORTIONAL VALVE CURRENT



REAR DRUM HOIST STOP
SIGNAL INPUT

14. LIFTING HEIGHT GAUGE (option)



(1) The number of drum rotation is detected with the drum turn sensor as the pulse count.

(2) When there is any winch pressure sensor input, the changes are regarded to occur to the hoisting side and the pulse count is increased. When in other cases, they are regarded to occur to the lowering side and the pulse count is decreased.

(3) The number of wire rope wraps on the rotating drum is calculated on the basis of the wire rope wraps adjusted with the cluster as a standard.

(4) The length of unwound wire rope is calculated from the coefficients and pulse numbers of the wire rope wraps.

(5) The lifting height by the winch is calculated by dividing by the number of part line.

(6) The boom point height data are received from the LMI.

(7) The difference between the height at the zero reset and current height is calculated to find the height lifted by the boom.

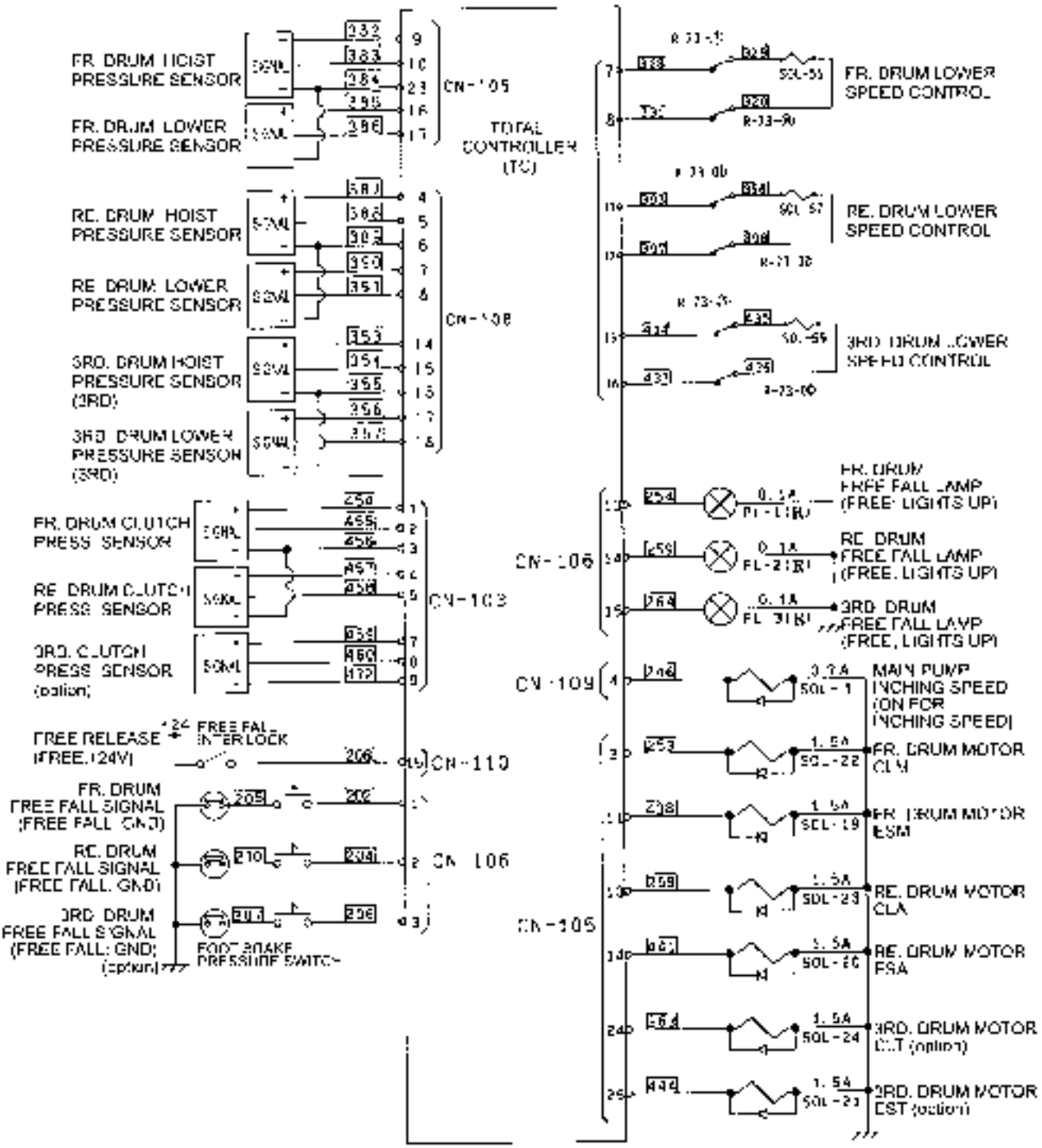
(8) Both of them are added to find the changes in actual lifting height, and the changes are indicated on the display screen of the cluster.

- Option setup is required to enable this control function (refer to 13.5.2.1 OPTION SETTING).

15. WINCH CONTROL (Valid only when the wet type free fall winch is optionly set up.)

(1) Control lever Neutral Mode Selection

(2) Winch Operation Solenoid Valve Control



1) When power is supplied
The machine always starts running in the neutral brake mode.

2) Switching from the brake mode to the free fall mode

Condition		Output
A. The free fall lock switch is set released. And function lock lever is neutral position.	..... ← Free release "ON"	• Select the free mode. • Light up the free fall indicator lamp. • Release the main pump control.
B. The foot brake is depressed (the pressure switch is set to the "ON" position). C The free selector switch is set to the "ON" position.	→ Each drum free fall signal "ON"	

3) Change from free fall mode to brake mode
Depress the foot brake again, and set the free fall mode selector switch to the ON position Or, when the free fall permiss on signal is in the "OFF" status

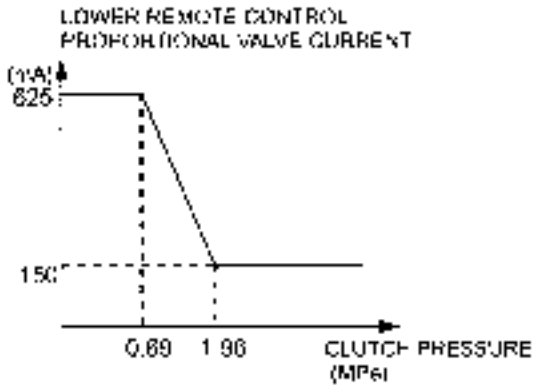
4) Control of sc enoid valve in free fall/brake mode
The front drum CLM (SOL 22) is controlled as shown in the table below.

Lever control	Mode	
	Neutral free	Neutral brake
Hoisting	X	X
Lowering	X	X
Neutral	O	X

O : Energized X : De-energized

- The ON/OFF status of the lever operation is judged by the value from the pressure sensor (Lever operation is judged to be ON if the pressure is 0.343 MPa or more It is judged to be OFF if the pressure is not more than 0.196 MPa or less)

The rear drum CLA (SOL-23) and the third drum CLT (SOL-24) are controlled in a similar manner. When the lever is at the neutral position while the free fall mode is selected, output from the front drum (rear drum and third drum) down remote control proportional valve should depend on the clutch pressure.



5) Emergency solenoid valve control
For the front drum, when either of the conditions below is satisfied, ESM (Sol-19) is unergized to prevent a drop of a lifted load.

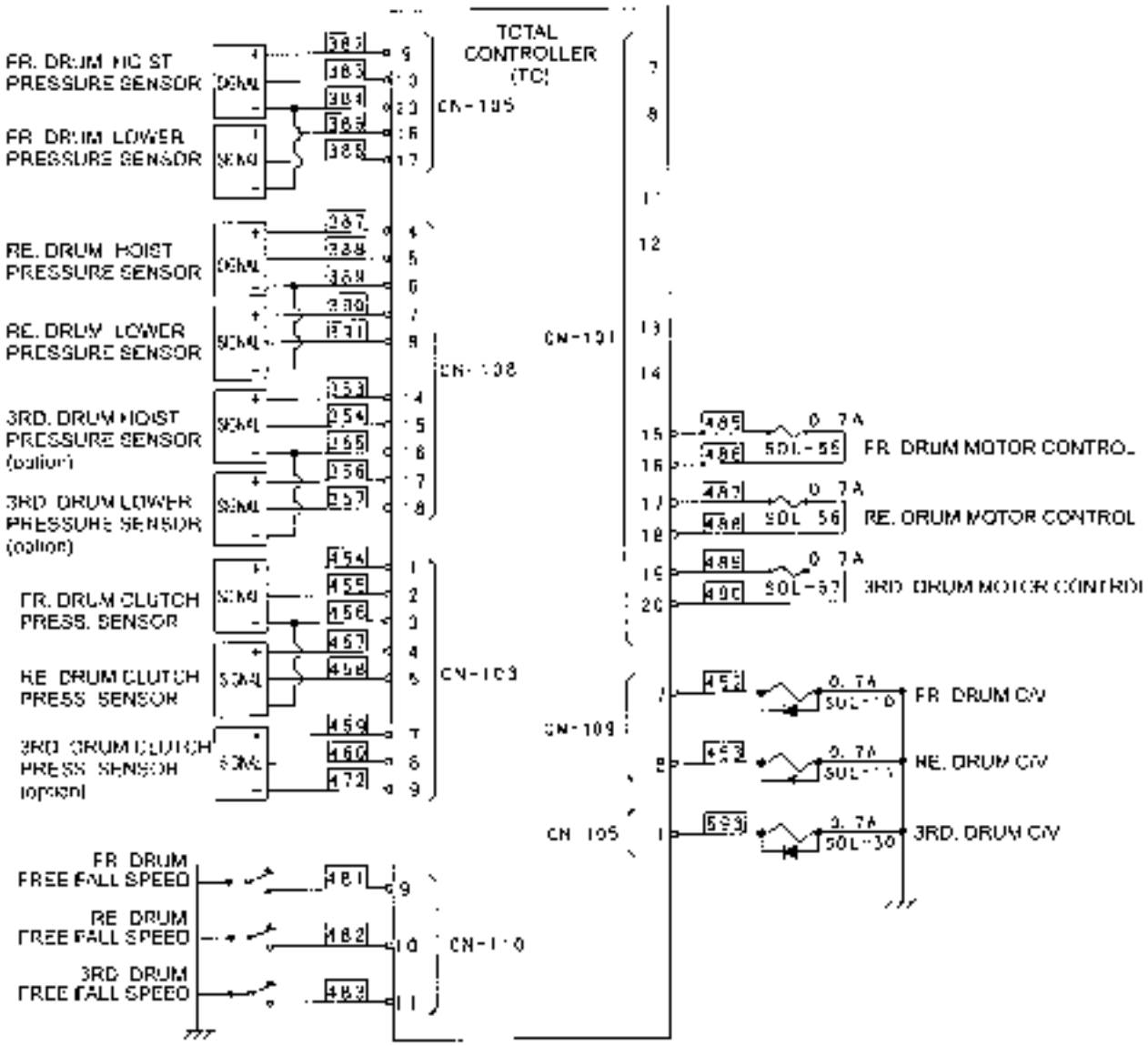
(A) The clutch pressure is reduced although the brake mode is selected.

(B) The clutch pressure is reduced although the lever is operated during the free fall mode.
For the rear drum and the third drum, the LSA (Sol-20) and EST (Sol-21) are controlled, respectively.

Note

Once the emergency solenoid valve is actuated, the current operation mode cannot be altered to the free fall mode unless power to the controller is shut down. Even after the main power supply is shut down while the emergency solenoid valve is being actuated, power supply to the controller remains alive for ninety seconds after the engine is stopped. In this period, the residual clutch pressure is removed.

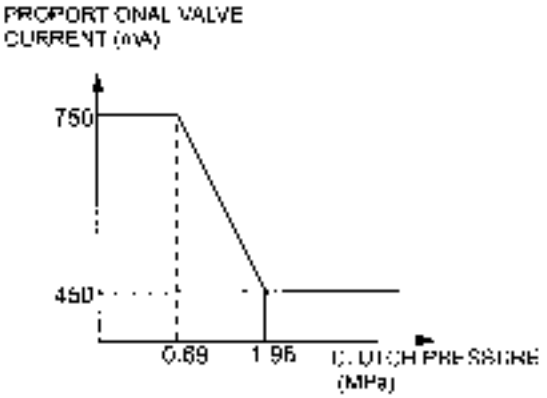
(3) FREE FALL ACCELERATION



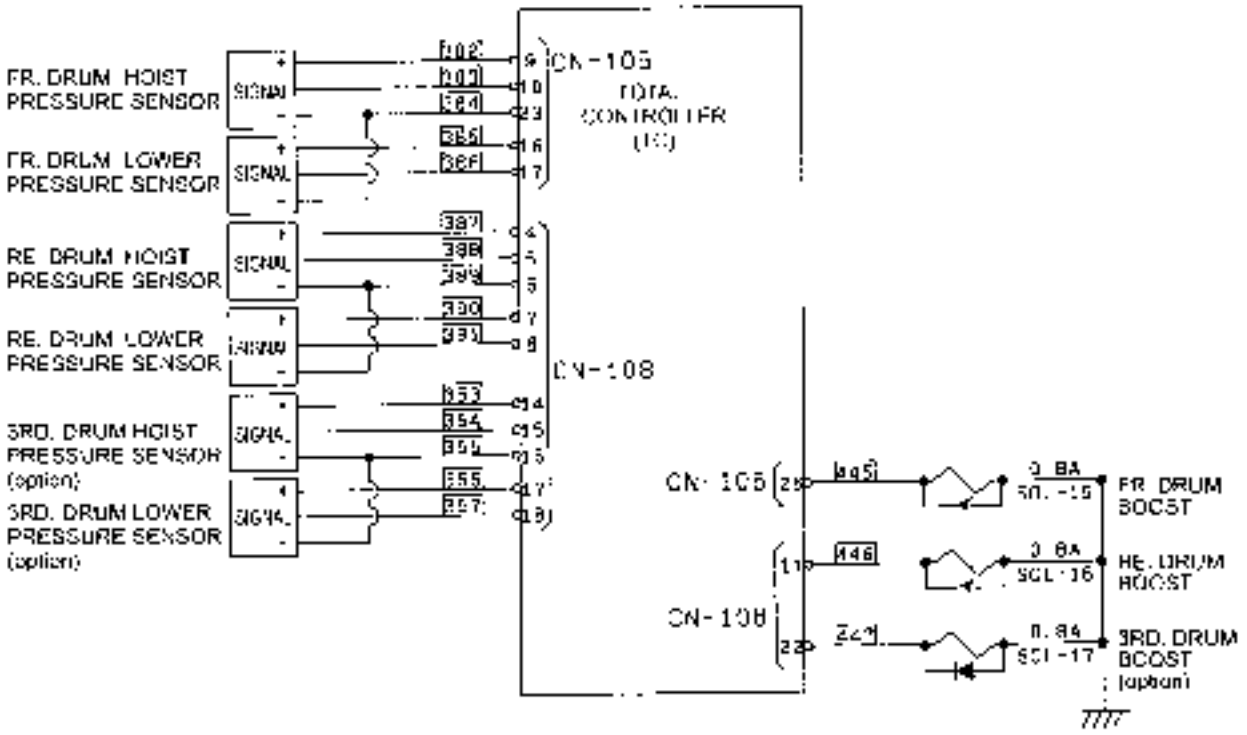
The falling speed can be increased by idling the motor during the free fall.
The speed is controlled as shown in the table below.

Conditions	Procedures
1. Free fall mode is selected 2. The control lever is at the neutral position 3. The "FREE FALL SPEED SWITCH" on the left panel is in the "High" status 4. The foot brake is not depressed. (Clutch pressure ≤ 1.0 MPa when free fall mode)	• C/V solenoid is energized • Current at the drum control proportional valve is maintained at 750 mA (The motor keeps running at a high speed)
Any of conditions shown above is not satisfied	• L/V Solenoid is de-energized • Other conditions are restored to those of the normal control

The drum motor control proportional valve is controlled according to the depression of the foot pedal (clutch pressure)



16. BOOST CONTROL



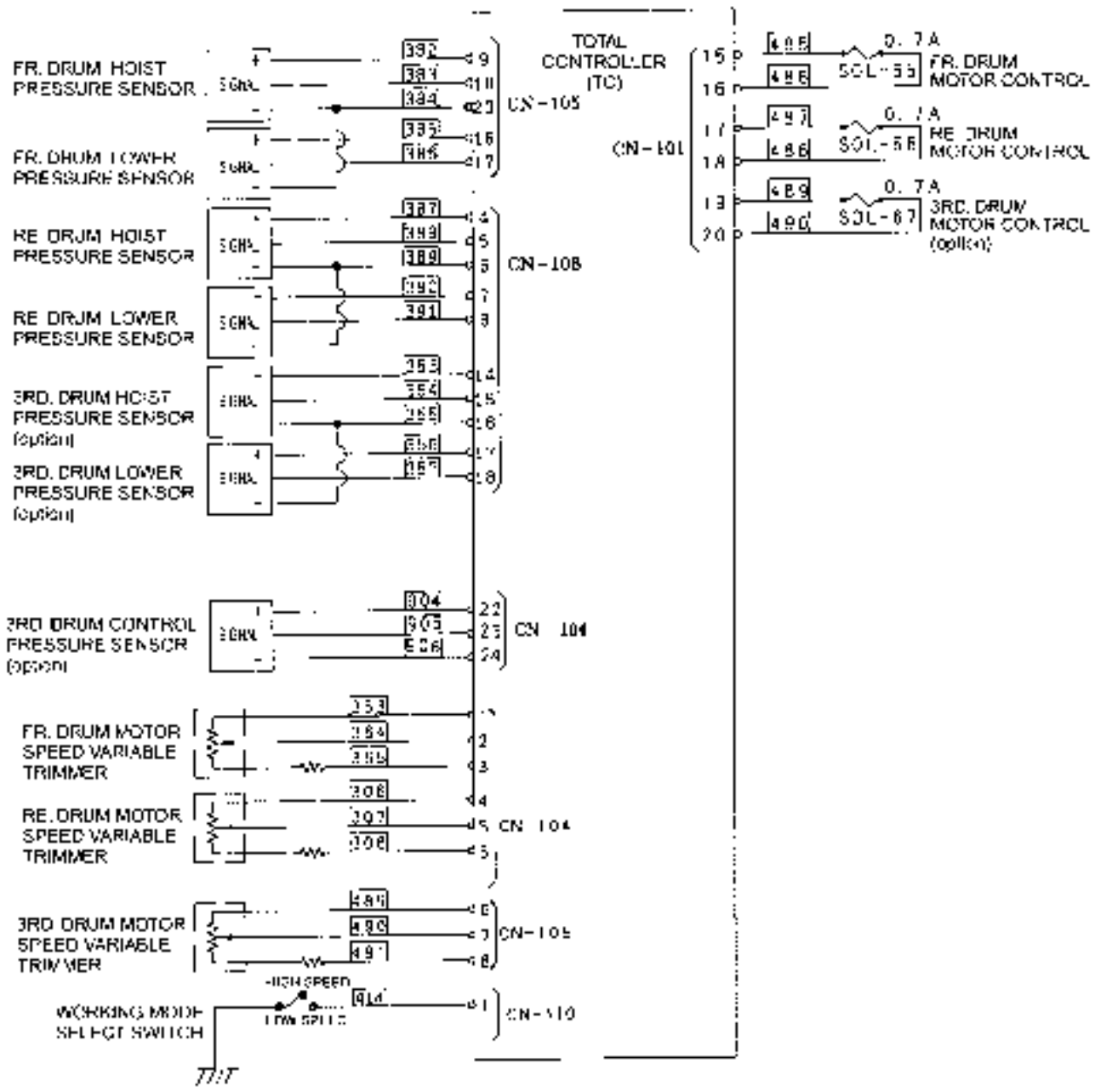
To prevent a momentary drop of a lifted load, apply a constant boost to the motor while the lever is in the neutral position.
The boost solenoid valve is controlled as shown in the table below.

Lever	Boost solenoid valve
Neutral	Energized
Neutral → Hoisting, lowering	Immediately de-energized
Hoisting, lowering → Neutral	Energized a second after the lever is returned to the neutral position Remained de-energized if the lever is operated within a second after the lever is returned to the neutral position

When the front drum or rear drum is stopped, the boost solenoid valve is controlled as shown in the table below.

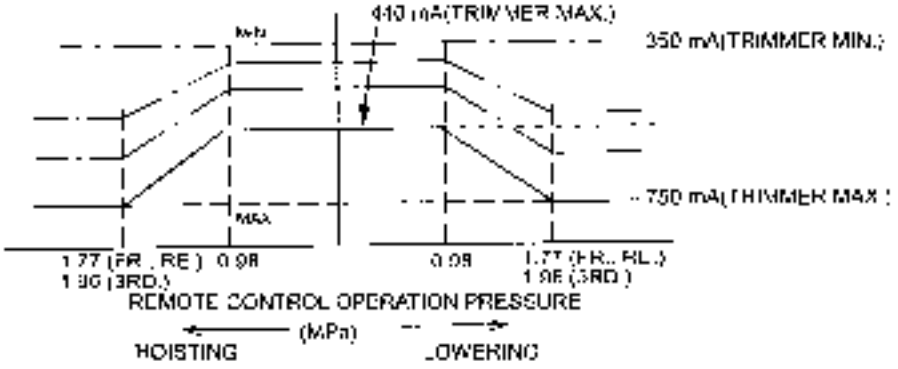
Stop signal	Boost solenoid valve
Front drum hoisting stop	Front drum boost solenoid is immediately de-energized
Rear drum hoisting stop	Rear drum boost solenoid is immediately de-energized
Third drum hoisting stop	Third drum boost solenoid is immediately de-energized

17. MOTOR CONTROL

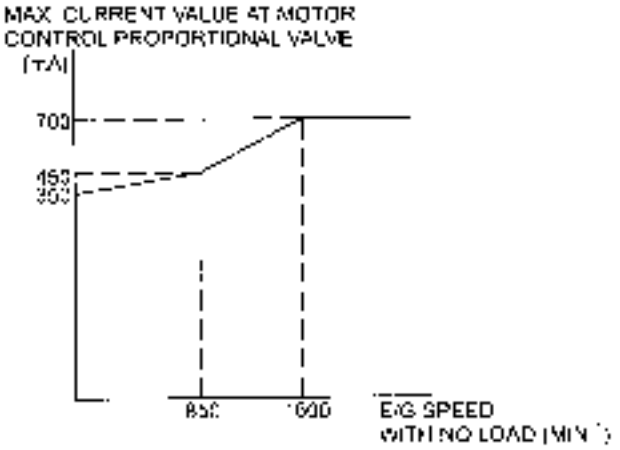


(1) When hoisting or lowering the drums during the brake mode or free fall mode, current at the drum control proportional valve is controlled as shown in the graph below.

(A) Current at the drum control proportional valve is fluctuated according to the operation of the lever.



(B) Maximum current value at the drum control proportional valve is controlled according to the E/G speed with no-load.



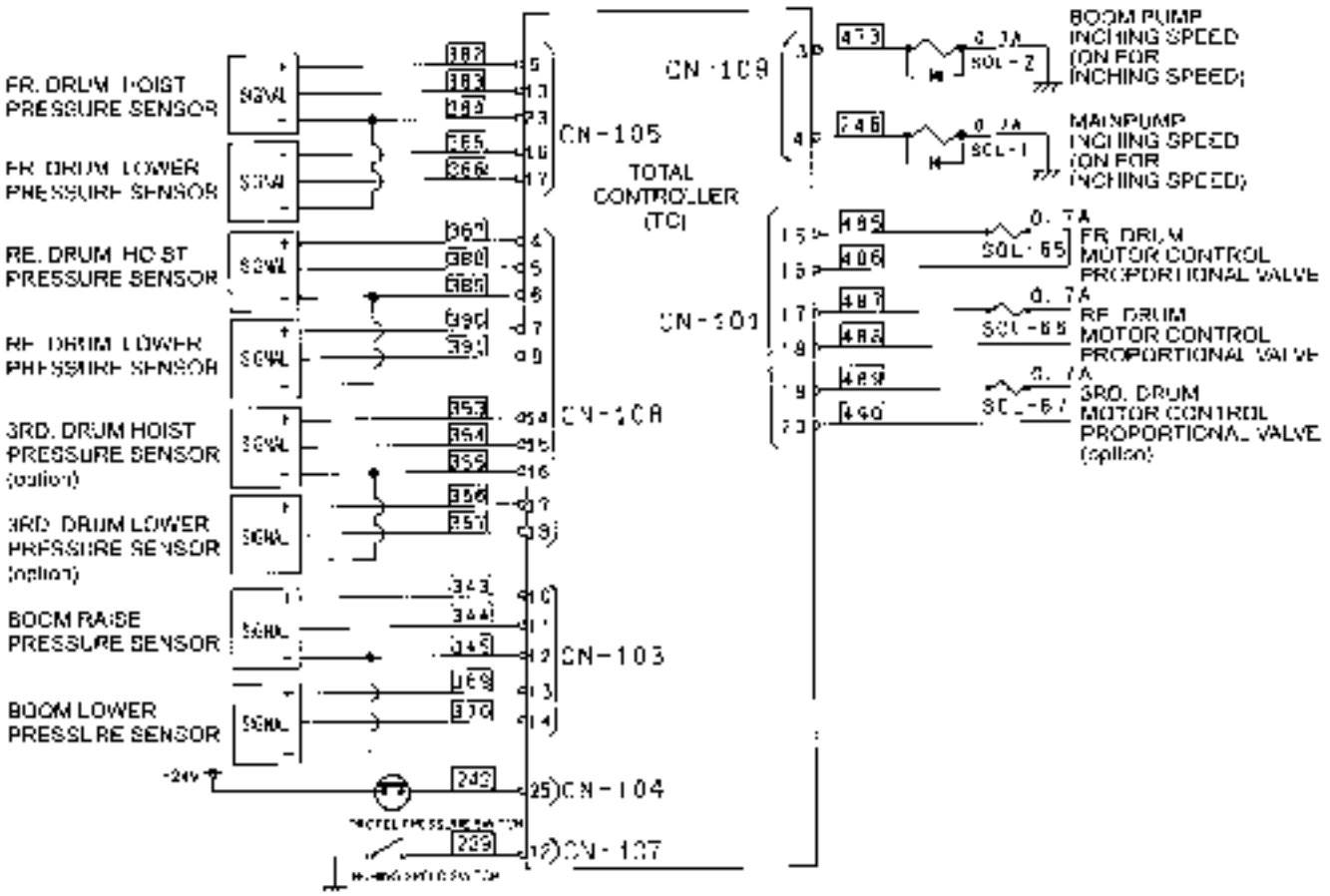
(2) If the winches are in the automatic stop statuses and the control lever is not being operated to ward the safe side, output to the corresponding motor control proportional valve shall be the minimum (350mA).

(3) Luffing mode speed control
While the luffing mode is selected with the ML (to be selected by communication from the ML), speed of the third drum motor is limited to the certain level by control of the output from the third drum motor control proportional valve.
Current at the proportional valve should be limited to the certain level so that the third drum motor control pressure is 2.11 MPa (=3.37 V) or less.

(4) Clamshell mode
While the working mode switch is turned on (– low speed is selected (heavy load clamshell)), control of the front drum motor and the rear drum motor should be fixed to a low speed (current at the proportional valve should be fixed to 300 mA).
(As for the tower type, this step can be ignored.)

(5) The order of operation priority is shown below.
Motor control (2) / Lever interlock > Free fall acceleration > Main pump inching speed > Motor control (1) A, (1) B. (Whichever smaller one between the value controlled by A, controlled by B is selected as the maximum value) > Luffing mode speed control (3)

8 MAIN PUMP CONTROL / BOOM PUMP CONTROL

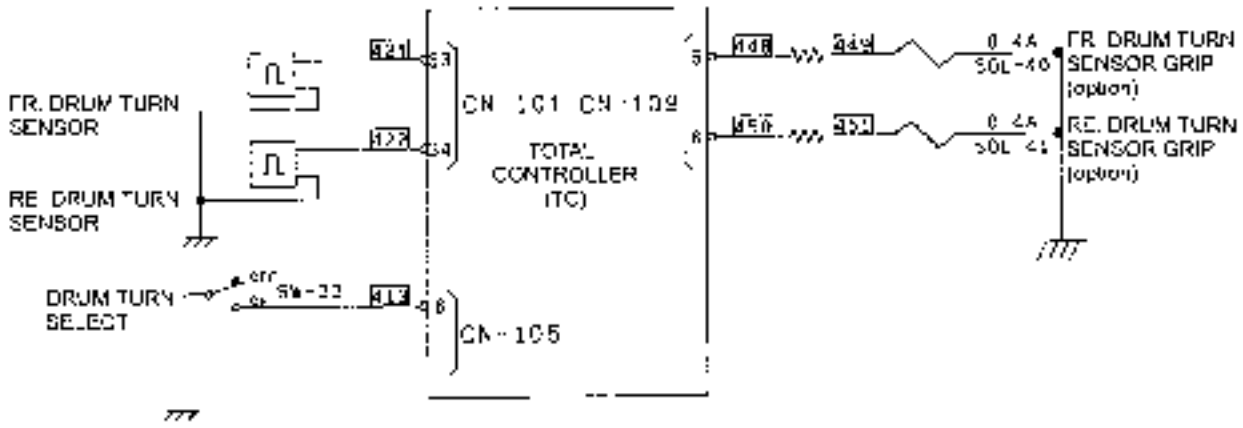


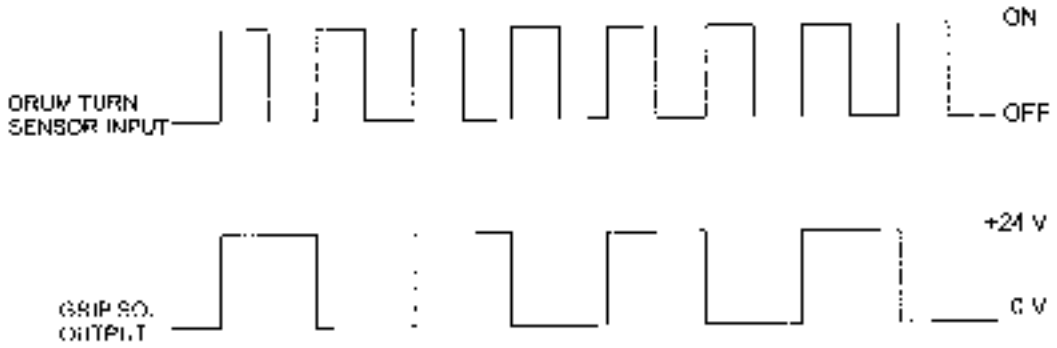
The pump control solenoid valve is controlled under the conditions shown in the table below.

Conditions	Pump control solenoid	Statuses
1. The inching switch is turned off. No input from the front, rear, and the third pressure sensors is detected, and the travel signal is in the "OFF" status.	Pump control solenoid Main pump inching solenoid Energized	Main pump at the minimum flow rate
2. The inching switch is turned off, and no input from the boom pressure sensor is detected.	Boom pump inching solenoid Energized	Boom pump at the minimum flow rate
3. The inching switch is turned off, and input from any of the front, rear, and the third pressure sensors is detected, or the travel signal is in the "ON" status.	Main pump inching solenoid De-energized	Main pump at a normal flow rate
4. The inching switch is turned off, and input from the boom pressure sensors is detected.	Boom pump inching solenoid De-energized	Boom pump at a normal flow rate
5. The inching switch is turned on (inching).	Main pump inching solenoid Boom pump inching solenoid Energized Motor control is fixed to a low speed. (Current: 350 mA)	Main pump at the minimum flow rate Boom pump at the minimum flow rate

Priority is given as shown below.
Free fall control > Inching control [5. in the table above] > Inching control (feathering) [from 1. to 4.]

19. DRUM TURN DETECTION GRIP CONTROL
(option)
The grip solenoic valve is controlled according to the input to the drum turn sensor.

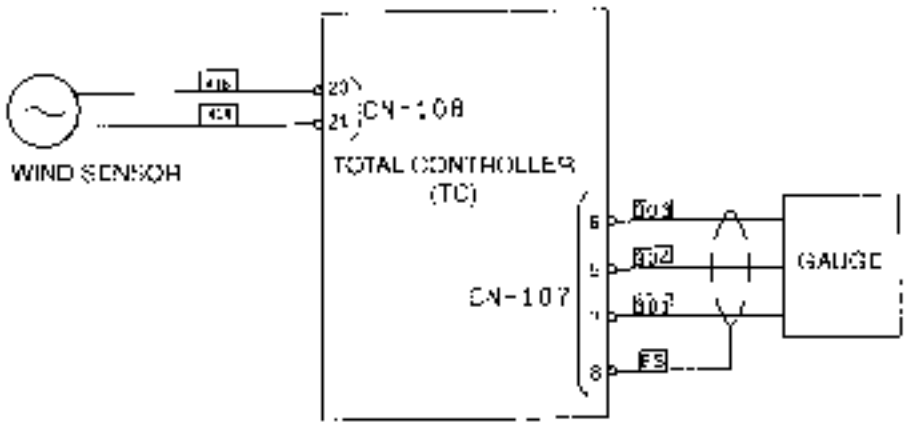




- The grip solenoid output is turned to "OFF" when the drum speed is faster than the specified speed.
  Specified speed = Drum rotating speed approx. 61.5 m n = 4 pulses or more per 50 msec
- Option setup is required in order to enable this control.

20. TAGLINE CONTROL (option)
In this machine, tagline output is carried out by the separate proportional valve AMP, and no output from the total controller is detected.

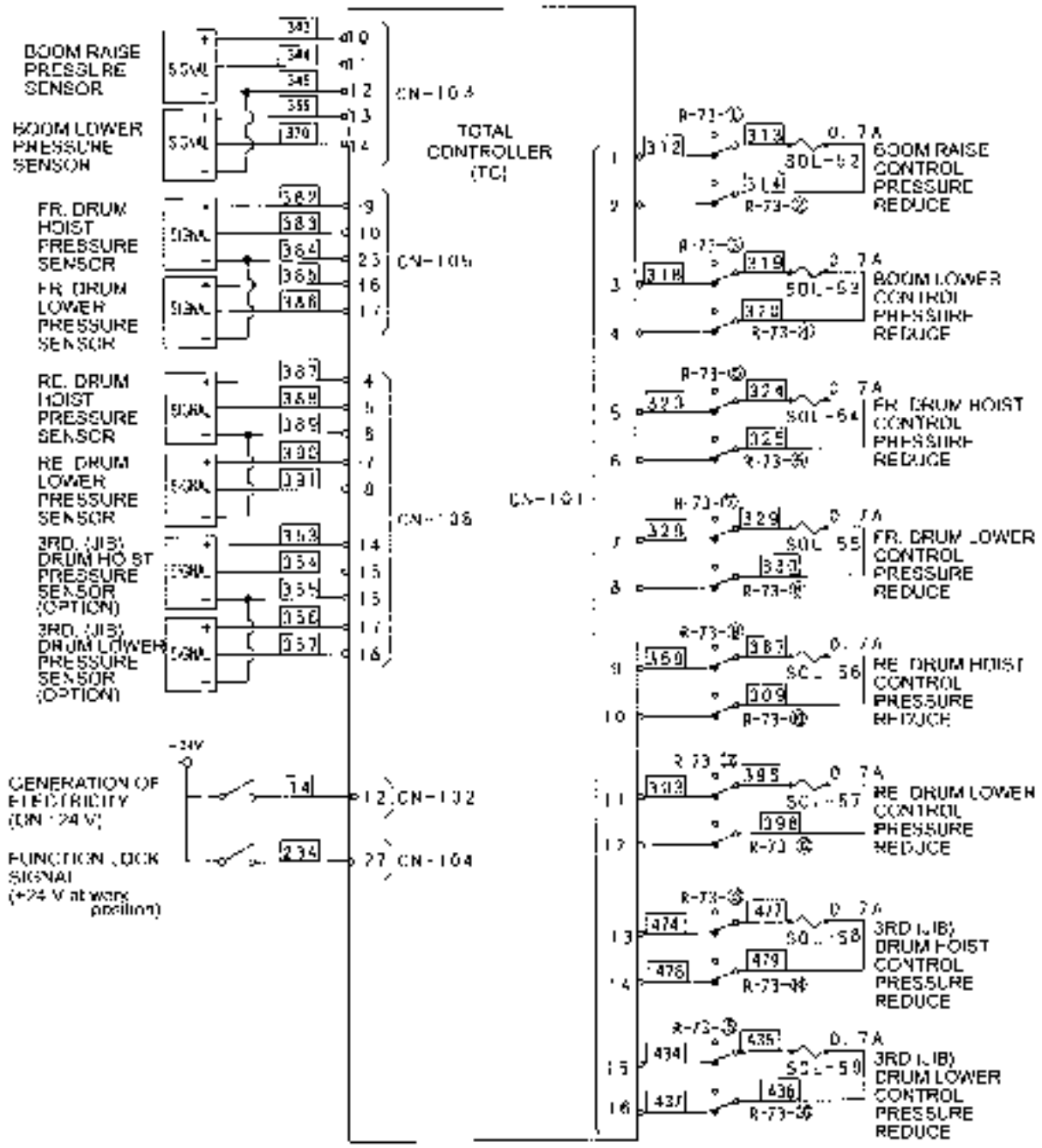
21. WIND SENSOR (option)



Wind velocity is calculated with the input voltage from the wind velocity sensor, and displayed on the cluster gauge.

- Option setup is required to enable the display function.

22. LEVER INTERLOCK CONTROL



The machine is stopped when the engine is started or the function lock lever is set to the working position with the lever set to the detent.

(1) Before the engine is started
Current value at the proportional valves is regarded as the minimum value (150 mA).

(2) After the engine is started
Function lock signals are checked after electricity generation signals are input.

(3) When the function lock signals are in the "ON" status
Input at the pressure sensors is checked, and the minimum value when the lever is set to the "ON" position is maintained. Once the lever is set to the neutral position, the proportional valve is normally controlled. When the lever is at the neutral position, the proportional valve is normally controlled.

(4) When the function lock signals are in the "OFF" status
When the function lock signals are set to the "ON" status, the procedures shown in the 3) above are performed.

(5) This interlock is actuated whenever electricity generation signals or function lock signals are set to the "OFF" status.

23. CONTROL OF HOIST DECELERATION WHEN OVERHOIST STOP IS CANCELED

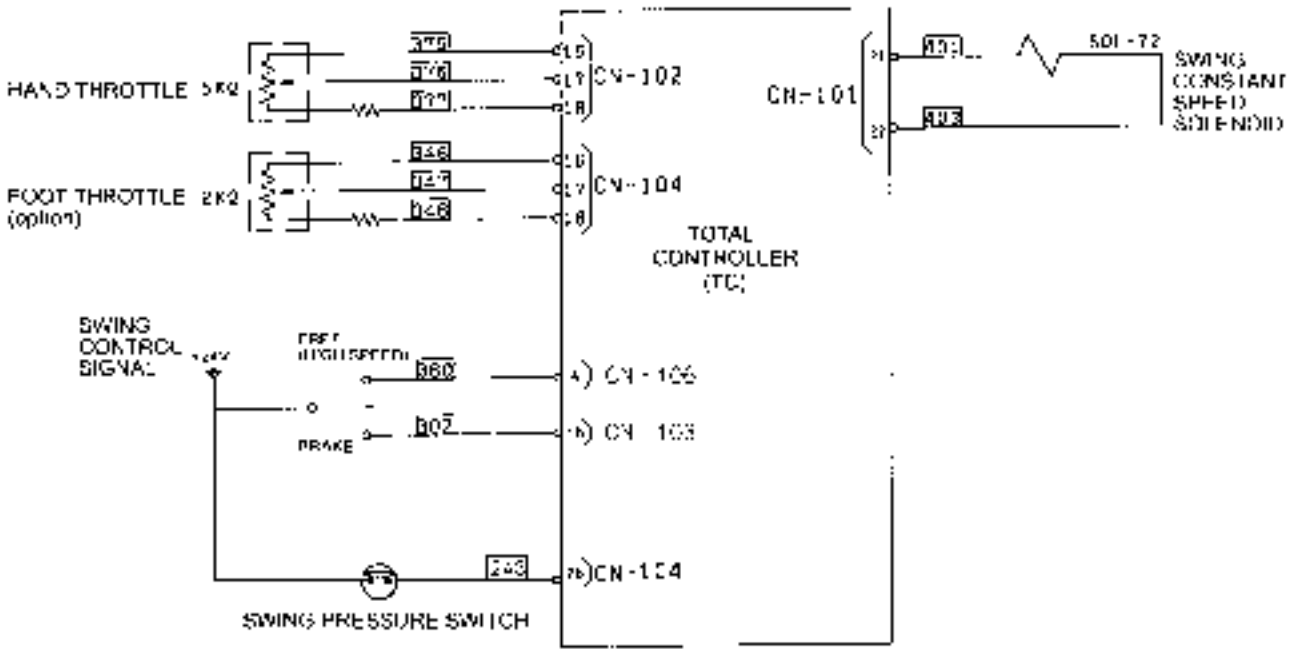
When overhoist is canceled (judged by M/L communication data), current at the remote control proportional valves for hoisting the front drum and rear drum is adjustec to that of the inching speed control (375 mA : constant).
Output current at the drum motor control proportional valve should be adjusted to 350 mA (constant)(only while the lever is being operated).

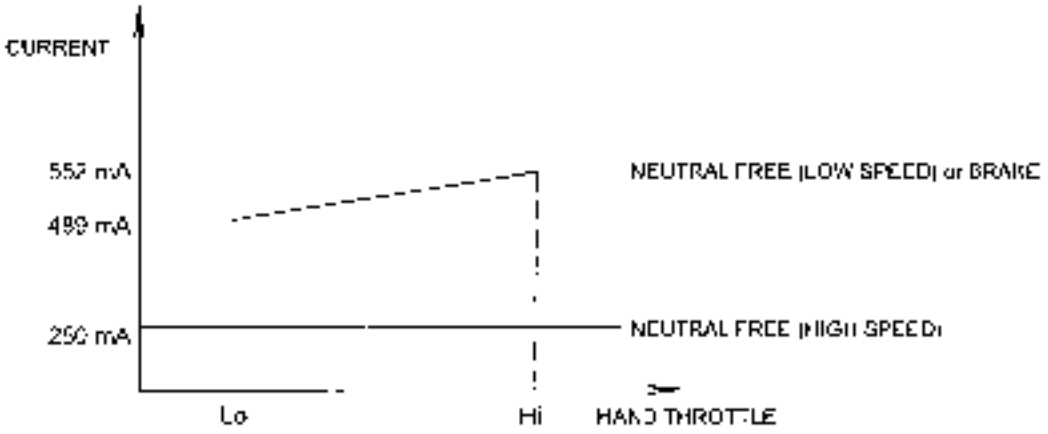
24. CONTROL OF COMMUNICATION WITH M/L

Communications

M/L→TC		TC→M/L
Main/jib	Number of part lines on main winch	Main winch raising ON/OFF
Crane/luffing	Number of part lines on aux. winch	Aux. winch raising ON/OFF
	Boom point height	Aux. winch lowering ON/OFF
	Jib point height	Third winch raising ON/OFF
Hook overhoist release ON/OFF	Boom angle	Boom raising ON/OFF
Boom overhoist release ON/OFF	Jib angle	Boom lowering ON/OFF
Overload and overhoist release ON/OFF	Boom length	
Main hook overhoist ON/OFF	Jib length	
Aux. hook overhoist ON/OFF		Third winch lowering ON/OFF
Crane boom overhoist ON/OFF	Working mode/working range outside mode	Main winch lowering ON/OFF
	Working mode/set up mode	
Luffing jib overhoist ON/OFF		
Luffing boom overhoist ON/OFF		
Crane jib overhoist ON/OFF	English / Japanese	

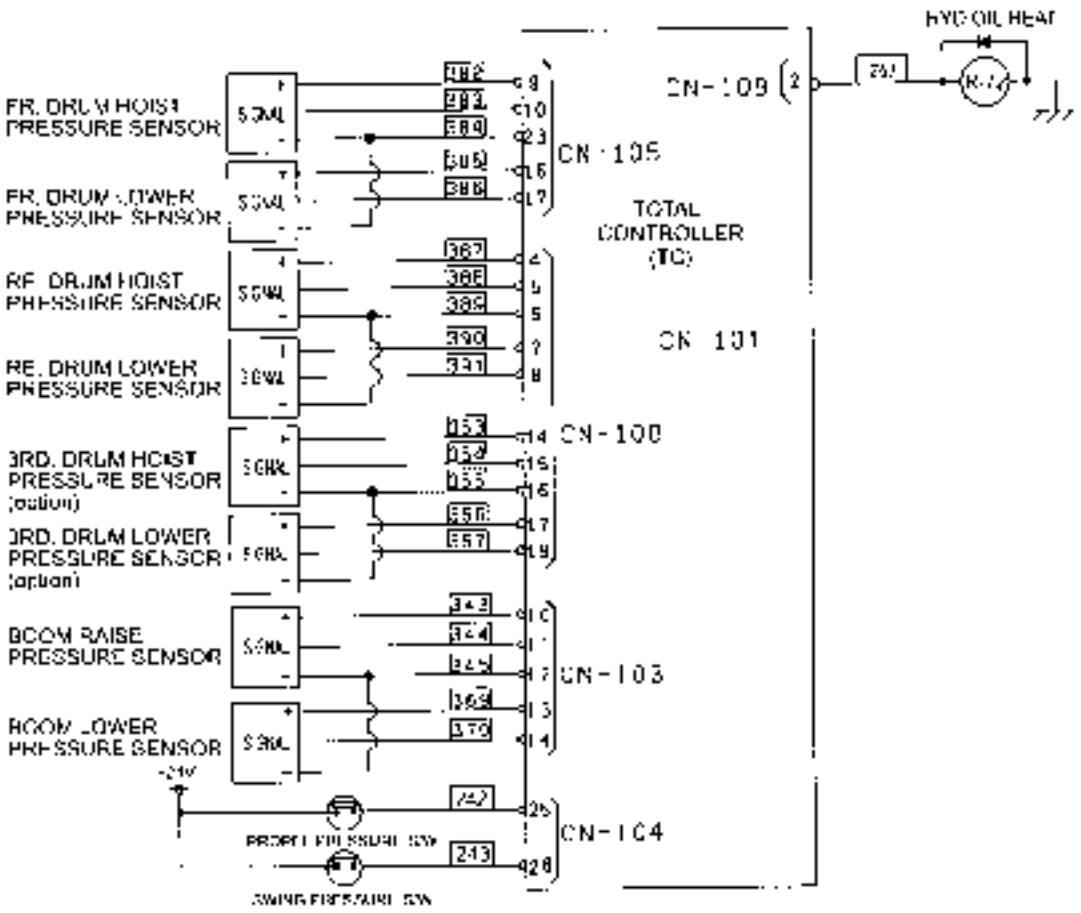
25. SWING SPEED SELECT • SWING PUMP CONTROL





- When the swing control signal in the "OFF" status for ten seconds or longer, current value is maximized (700 mA)
  (Characteristics shown above can be controlled as soon as the swing control signal is set to the "ON" status.)

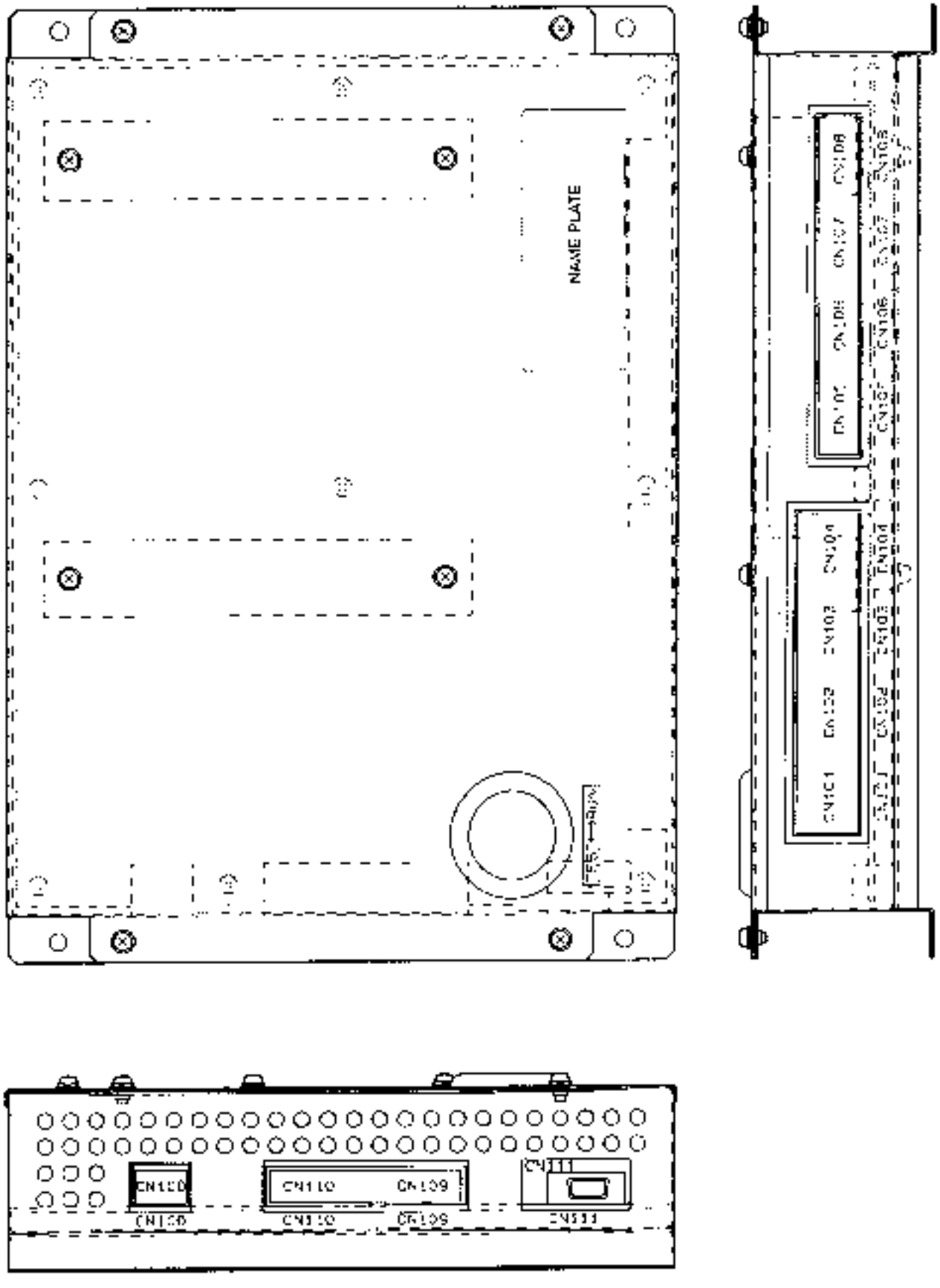
26. HYD. OIL HEAT



Control	Relay
All the levers are set to the neutral positions	Energized
Any of the levers is operated	De-energized

13.4 TOTAL CONTROLLER (HARDWARE)

13.4.1 OUTLINE



13.4.2 SPECIFICATIONS OF TOTAL CONTROLLER OUTPUT

1. ANALOGUE INPUT [A]

Item	Name	Range	Input voltage	Trouble judgment	Note
1	Fr. drum motor speed adjusting trimmer	0 to FULL	0.43 to 5 V	Less than 0.2 V	Broken down wire resistance 470 Ω All resistance 5 KΩ
2	Re. drum motor speed adjusting trimmer	↑	↑	↑	↑
3	Boom motor speed adjusting trimmer	↑	↑	↑	↑
4	Spare A/D	-	-	-	
5	Spare A/D	-	-	-	
6	Tagline trimmer (Not used)	-	-	-	
7	Hand throttle potentiometer	LOW to HIGH	0.7 to 5V	↑	Broken down wire resistance 470 Ω All resistance 5k Ω
8	Foot throttle potentiometer (option)	↑	1.0V to 4.4V	↑	Broken down wire resistance 220 Ω All resistance 2 KΩ
9	Rear drum control pressure Sensor (Not used)	0 to 427 psi (0 to 2.94 MPa)	0 to 4.5 V	0.1V or less or 4.9V or more. Or, 3V or more remains input for 3 sec. or longer after power ON.	
10	Third drum control pressure sensor	↑	↑	↑	
11	Swing pump pressure sensor	0 to 7110 psi (0 to 49 MPa)	↑	↑	
12	Jib (third) motor speed adjusting trimmer (option)	0 to FULL	0.43 to 5V	Less than 0.2 V	Broken down wire resistance 470 Ω All resistance 5 KΩ
13	Fr. drum hoisting pressure sensor	0 to 427 psi (0 to 2.94 MPa)	0.5V to 4.5V	0.1V or less or 4.9V or more. Or, 3V or more remains input for 3 sec. or longer after power ON	
14	Fr. drum lowering pressure sensor	↑	↑	↑	
15	Re. drum hoisting pressure sensor	↑	↑	↑	
16	Re. drum lowering pressure sensor	↑	↑	↑	
17	3rd. drum hoisting pressure sensor (option)	↑	↑	↑	
18	3rd. drum lowering pressure sensor (option)	↑	↑	↑	
19	Fr. drum clutch pressure sensor	0 to 2844psi (0 to 19.6MPa)	↑	↑	
20	Re. drum clutch pressure sensor	↑	↑	↑	
21	3rd. drum clutch pressure sensor (option)	↑	↑	↑	
22	Wind velocity sensor (option)	2m/s to 90m/s	AC0.67 to 44.3V	-	AC Input
23	Vacancy	-	-	-	
24	Boom raise pressure sensor	0 to 427 psi (0 to 2.94 MPa)	0.5 to 4.5 V	0.1V or less or 4.9V or more. Or, 3V or more remains input for 3 sec. or longer after power ON.	
25	Boom lower pressure sensor	↑	↑	↑	
26	Tension signal (Not used)	0 to 264,550 lbs (0 to 120 t)	0 to 5V	-	

2. PULSE INPUT (INTERRUPT)[E]

Item	Name	Status	Signal level	Trouble judgment	Note
1	Eng. revolution sensor	0 to 2500 min⁻¹	Vp-p3.0 to 45 V	NO	Electromagnetic pick-up 137pulses/min⁻¹ 6 kHz
2	Fr. drum turn sensor	0 to 500 min⁻¹	GND/OPEN	↑	Proximity sensor 78 pulses/min⁻¹ 650 Hz
3	Re. drum turn sensor	↑	↑	↑	↑
4	Interrupt input spare	-	↑	↑	Proximity sensor

3. Digital Input [B]

Item	Name	Status	Signal level	Note
1	Fr. drum free fall	Free/Brake	GND/OPEN	No
2	Re. drum free fall	Free/Brake	GND/OPEN	↑
3	3rd. drum free fall (option)	Free/Brake	GND/OPEN	↑
4	ECU on signal	ON/OFF	GND/OPEN	↑
5	Vacancy	-	-	↑
6	Swing neutral mode selection (Free high speed)	Free high mode/Not free high mode	+24V/OPEN	↑
7	Jib (third) raising deceleration	Deceleration/Normal	+24V/OPEN	↑
8	Drum turn selection (option)	ON/OFF	GND/OPEN	↑
9	Fr. drum brake detect sensor (CEN)	Brake ON/OFF	GND/OPEN	↑
10	Key switch "ON"	Key switch ON/OFF	+24V/OPEN	↑
11	Inching selection switch	Inching/Normal	GND/OPEN	↑
12	Mode section	Low/high	GND/OPEN	↑
13	E/G PSW	E/G Stop/Work	GND/OPEN	↑
14	Moisture detection of the fuel filter	Detection/Usually	+24V/OPEN	↑
15	Boom raise stop	Stop/Normal	OPEN/-24V	↑
16	Boom lowering stop	Stop/Normal	OPEN/-24V	↑
17	Re. drum lower stop	Stop/Normal	+24V/OPEN	↑
18	Boom raise deceleration	Deceleration/Normal	+24V/OPEN	↑
19	Re. drum hoist deceleration (Not used)	Deceleration/Normal	+24V/OPEN	↑
20	Fr. drum lowering stop	Normal/stop	+24V/OPEN	↑
21	Fr. drum hoisting stop	Stop/Normal	OPEN/-24V	↑
22	Re. drum hoisting stop	Stop/Normal	OPEN/-24V	↑
23	Tower raise signal (Not used)	Raise/Normal	+24V/OPEN	↑
24	Swing neutral mode selection (Brake)	Brake mode/Not Brake mode	+24V/OPEN	↑
25	Jib (3rd) drum lowering stop	Normal/stop	+24V/OPEN	↑
26	Propel control	Control/Neutral	+24V/OPEN	↑
27	Swing control	Control/Neutral	+24V/OPEN	↑
28	M/L redundancy	Redundancy/Normal	+24V/OPEN	↑
29	3rd (Jib) drum hoisting stop	Normal/stop	+24V/OPEN	↑
30	Function lock	Work/stop	+24V/OPEN	↑
31	Clogging of E/G air cleaner	Clogging/Normal	GND/OPEN	↑
32	Re. drum brake detect sensor (CEN)	Brake ON/OFF	GND/OPEN	↑
33	Water level	Low level/Normal	GND/OPEN	↑
34	Charge signal	With power generation/Without power generation	+24V/OPEN	↑
35	E/G oil filter clog	Clog/Normal	GND/OPEN	↑
36	3rd. drum brake detect sensor (CEN)	Brake ON/OFF	GND/OPEN	↑
37	Hydraulic oil temperature switch	Higher temperature/Normal	GND/OPEN	↑
38	Control primary pressure	Lower pressure/Normal	GND/OPEN	↑

Item	Name	Status	Signal level	Note
39	Fr. drum free fall speed switch	High/Normal	GND/OPEN	No
40	Re. drum free fall speed switch	High/Normal	GND/OPEN	↑
41	3rd. drum free fall speed switch	High/Normal	GND/OPEN	↑
42	E/G preheat	Preheat/Normal	+24V/OPEN	↑
43	Fr. drum brake cooling oil temperature	Higher temperature/Normal	GND/OPEN	↑
44	Re. drum brake cooling oil temperature	Higher temperature/Normal	GND/OPEN	↑
45	Cooling line filter	Clog/Normal	GND/OPEN	↑
46	Free fall release	Release/Lock	+24V Pull Up	↑

4 ANALOGUE OUTPUT [H]

Item	Name	Status	Signal level	Trouble judgment
1	Accelerator signal 1	Low to High	1.0 to 4.0V	NO
2	Accelerator signal 2	Low to High	1.0 to 4.0V	↑

- Provide the external protection against short-circuit (resistance insertion).

5. PROPORTIONAL VALVE OUTPUT [D]

Item	Name	Output current	Dither	Trouble judgment
1	Boom raising speed control	200 to 625mA	200mA-p 100Hz	The indicated value is 100 mA or lower and the feed back is 50 mA or lower
2	Boom lowering speed control	↑	↑	↑
3	Fr. drum hoisting speed control	150 to 625mA	↑	↑
4	Fr. drum lowering speed control	↑	↑	↑
5	Re. drum hoisting speed control	↑	↑	↑
6	Re. drum lowering speed control	↑	↑	↑
7	3rd. drum hoisting speed control	↑	↑	↑
8	3rd drum lowering speed control	↑	↑	↑
9	Fr. drum motor control	300 to 750mA	↑	↑
10	Re. drum motor control	↑	↑	↑
11	Swing speed control	250 to 700mA	↑	↑
12	Main pump power reduction	200 to 700mA	↑	↑
13	3rd drum motor control	300 to 750mA	↑	↑
14	Swing reaction	150 to 510mA	↑	↑
15	Boom pump power reduction	200 to 700mA	↑	↑

6. DIGITAL OUTPUT [C]

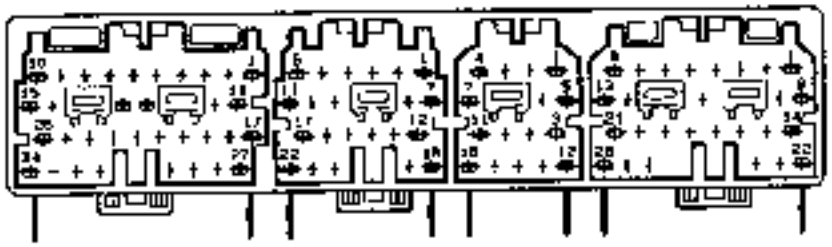
Item	Name	Status	Signal level	Trouble judgment
1	Battery relay energizing	Energized/De-energized	+24V/OPEN	Broken down wire
2	Spare	-	+24V/OPEN	↑
3	Hyd. oil heat	Energized/De-energized	+24V/OPEN	↑
4	Drum pump inching speed	Inching/Normal	+24V/OPEN	↑
5	Main pump inching speed	Inching/Normal	+24V/OPEN	↑
6	-			
7	Fr. drum clutch CLM	Energized/De-energized	+24V/OPEN	↑
8	Fr. drum clutch FSM	Energized/De-energized	+24V/OPEN	↑
9	-			
10	Re. drum clutch CLA	Energized/De-energized	+24V/OPEN	↑
11	Re. drum clutch FSA	Energized/De-energized	+24V/OPEN	↑
12	-			
13	3rd. drum clutch CLT (option)	Energized/De-energized	+24V/OPEN	↑
14	3rd. drum clutch FST (option)	Energized/De-energized	+24V/OPEN	↑
15	Fr. drum motor boost	Boost/Normal	+24V/OPEN	↑
16	Re. drum motor boost	Boost/Normal	+24V/OPEN	↑
17	3rd. drum motor boost (option)	Boost/Normal	+24V/OPEN	↑
18	Fr. drum turn detecting grip (option)	凸/凹	+24V/OPEN	↑
19	Re. drum turn detection grip (option)	凸/凹	+24V/OPEN	↑
20	Fr. drum C/V	Energized / De-energized	+24V/OPEN	↑
21	Re. drum C/V	Energized / De-energized	+24V/OPEN	↑
22	3rd. drum C/V (option)	Energized / De-energized	+24V/OPEN	↑
23	Wind alarm output (custom)	Energized / De-energized	+24V/OPEN	↑
24	Free fall voice alarm (not use)	Free fall/Normal	GND/OPEN	↑
25	Spare	-	GND/OPEN	↑
26	Fr. drum free fall indication lamp	Lit up/Unlit	+24V/OPEN	↑
27	Re. drum motor free fall indication lamp	Lit up/Unlit	+24V/OPEN	↑
28	3rd. drum free fall indication lamp (option)	Lit up/Unlit	+24V/OPEN	↑

7. COMMUNICATION

Item	Communication counterpart	Communication system	Communication speed
1	Indicator	TTL	4800 bps
2	M/L	RS232C	9600 bps
3	PC (for handy checker)	RS232C	4800 bps

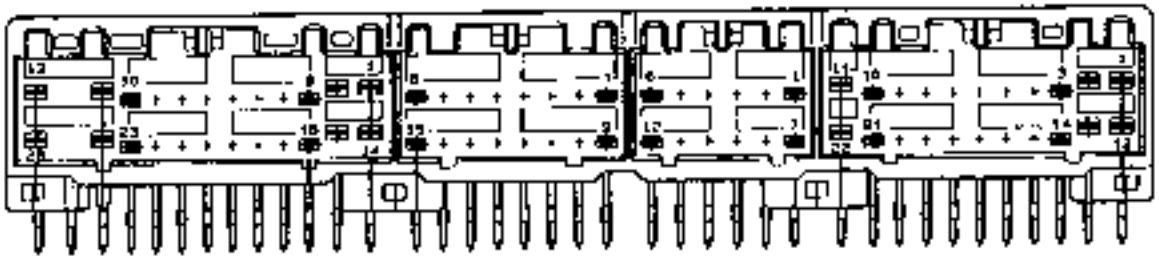
The channel can be used for No.2 and 3 by switching operation.

13.4.3 DETAILS OF TOTAL CONTROLLER CONNECTOR



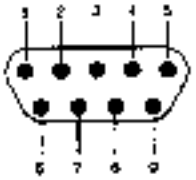
CN101 CN102 CN103 CN104

AMP 1-178203-6 (100P)



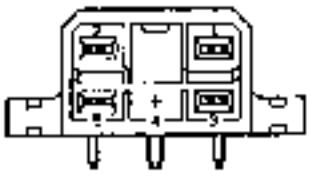
CN105 CN106 CN107 CN108

AMP 3-178780-6 (76P)



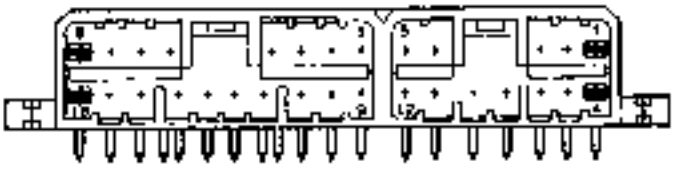
CN111

D-SUB9P CONNECTOR



CN100

AMP172040-1 (5P)



CN110 CN109

AMP 2-173866-1 (30P)

13.4.4 ARRANGEMENT OF TOTAL CONTROLLER CONNECTOR PIN

Connector No.	Pin No.	Port name	Specifications
CN100	1	+24V	Power supply
	2	+24V	
	3	GND	Grounding
	4	GND	
	5		Vacancy

Connector No.	Pin No.	Port name	Specifications
CN101	1	D1+	Boom raising speed control proportinnal valve
	2	D1-	
	3	D2+	Boom lowering speed control proportional valve
	4	D2-	
	5	D3+	Fr. drum hoisting speed control proportiona valve
	6	D3-	
	7	D4+	Fr. drum lowering speed control proportional valve
	8	D4-	
	9	D5+	Re. drum hoisting speed control proportional valve
	10	D5	
	11	D6+	Re. drum lowering speed control proportional valve
	12	D6-	
	13	D7+	3rd. drum ho sting speed control proportional valve (option)
	14	D7-	
	15	D8+	3rd. drum lowering speed control proportional valve (option)
	16	D8-	
	17	D9+	Fr. drum motor control proportional valve
	18	D9-	
	19	D10+	Re. drum motor control proportional valve
	20	D10-	
	21	D11+	Swing speed control
	22	D11-	
	23	D12+	Main pump control proport onal valve
	24	D12-	
	25	D13+	3rd. drum motor control proportional valve (option)
	26	D13-	
	27	D14+	Swing reaction proportional valve
	28	D14-	
	29	D15+	Boom pump control proportional valve
	30	D15-	
	31	E1+	Engine turn sensor
	32	E1-	
	33	E2	Fr. drum turn sensor
	34	E3	Re. drum turn sensor

Connector No.	Pin No.	Port name	Specifications
CN102	1	B15	Boom raising stop
	2	B16	Boom lowering stop
	3	B17	Re. drum lowering stop
	4	B18	Boom raise deceleration
	5	B19	Re. drum hoisting deceleration
	6	B20	Fr. drum lowering stop
	7	B21	Fr. drum hoisting stop
	8	B22	Re. drum hoisting stop
	9	B23	Tower raise signal (Not used)
	10	B28	M/I. redundancy
	11	B29	3rd. (Jib) drum hoisting stop
	12	B34	Charge signal
	13	+5V	Tagline trimmer (Not used)
	14	A6	
	15	G	
	16	+5V	Hand throttle POT
	17	A7	
	18	G	
	19	+5V	Tension signal (Not used)
	20	A26	
	21	G	
	22	E4	Spare interrupt

Connector No.	Pin No.	Port name	Specifications
CN103	1	+5V	Fr. clutch pressure sensor
	2	A19	
	3	G	
	4	+5V	Re. clutch pressure sensor
	5	A20	
	6	G	
	7	+5V	3rd. clutch pressure sensor (option)
	8	A21	
	9	G	
	10	+5V	Boom raise pressure sensor
	11	A24	
	12	G	
	13	+5V	Boom lower pressure sensor
	14	A25	
	15	G	
	16	B24	Swing neutral mode selection (Brake)

Connector No.	Pin No.	Port name	Specifications
CN104	1	+5V	
	2	A1	Fr. drum speed adjusting trimmer
	3	G	
	4	+5V	
	5	A2	Re. drum speed adjusting trimmer
	6	G	
	7	+5V	
	8	A3	Boom drum speed adjusting trimmer
	9	G	
	10	+5V	
	11	A4	Spare A/D
	12	G	
	13	+5V	
	14	A5	Spare A/D
	15	G	
	16	+5V	
	17	A8	Foot throttle POT (option)
	18	G	
	19	+5V	Rear drum control pressure sensor (Not used)
	20	A9	
	21	G	
	22	+5V	Third drum control pressure sensor
	23	A10	
	24	G	
	25	B26	Propel control
	26	B27	Swing control
	27	B30	Function lock
	28	B31	Clogging of E/G air cleaner

Connector No.	Pin No.	Port name	Specifications
CN105	1	C22	3rd. C/V solenoid valve
	2*	C7	Fr. clutch CLM solenoid valve
	3	+5V	
	4	A11	Swing pump pressure sensor
	5	G	
	6	+5V	
	7	A12	3rd. motor speed adjusting trimmer
	8	G	
	9	+5V	Fr. drum hoisting pressure sensor
	10	A13	
	11*	C8	Fr. clutch ESM solenoid valve
	12*	C23	Wind alarm output (Custom)
	13*	C10	Re. clutch CLA solenoid valve
	14*	C11	Re. clutch ESA solenoid valve
	15*		Vacancy
	16	+5V	
	17	A14	Fr. drum lowering pressure sensor
	18	G	
	19	H1+	ECU command (1)
	20	H1-	
	21	H2+	ECU command (2)
	22	H2-	
	23	G	Fr. drum hoisting pressure sensor
	24*	C13	3rd. clutch CLT solenoid valve (option)
	25*	C14	3rd. clutch EST solenoid valve (option)
	26*	C15	Fr. drum motor boost solenoid valve

Connector No.	Pin No.	Port name	Specifications
CN106	1	B1	Fr. drum free fall select
	2	B2	Re. drum free fall select
	3	B3	3rd. drum free fall select (option)
	4	B6	Swing neutral mode selection (free high speed)
	5	B7	Jib (third) raising deceleration
	6	B8	Drum turn selection
	7	B9	Fr. drum brake detect sensor (for CEN)
	8	B10	Key switch "ON"
	9	B14	Moisture detection of the fuel filter
	10	B25	Third drum lowering stop
	11	B42	E/G preheat signal
	12	C1	Battery relay energizing
	13	C26	Fr. drum free fall indication lamp
	14	C27	Re. drum free fall indication lamp
	15	C28	3rd drum free fall indication lamp (option)
	16		Vacancy

Connector No.	Pin No.	Port name	Specifications
CN107	1	TxD1	M/L communication (RS232C)
	2	RxD1	
	3	GND1	
	4	SHG1	
	5	TxD2	Monitor communication (TTL)
	6	RxD2	
	7	GND2	
	8	SHG2	
	9		Vacancy
	10		
	11	B4	ECU ON signal
	12	B11	Inching selection

Connector No.	Pin No.	Port name	Specifications
CN108	1*	F1+	Spare
	2*	F1-	
	3	SHG	Spare
	4	+5V	Re. drum hoisting pressure sensor
	5	A15	
	6	G	
	7	+5V	Re. drum lowering pressure sensor
	8	A16	
	9	G	
	10	+5V	Vacancy
	11*	C16	Re. drum motor boost
	12*	F2+	Spare
	13*	F2-	
	14	+5V	3rd drum hoisting pressure sensor (option)
	15	A17	
	16	G	
	17	+5V	3rd drum lowering pressure sensor (option)
	18	A18	
	19	G	
	20	A22	Wind sensor (option)
	21	G	
	22*	C17	3rd. motor boost solenoid valve (option)

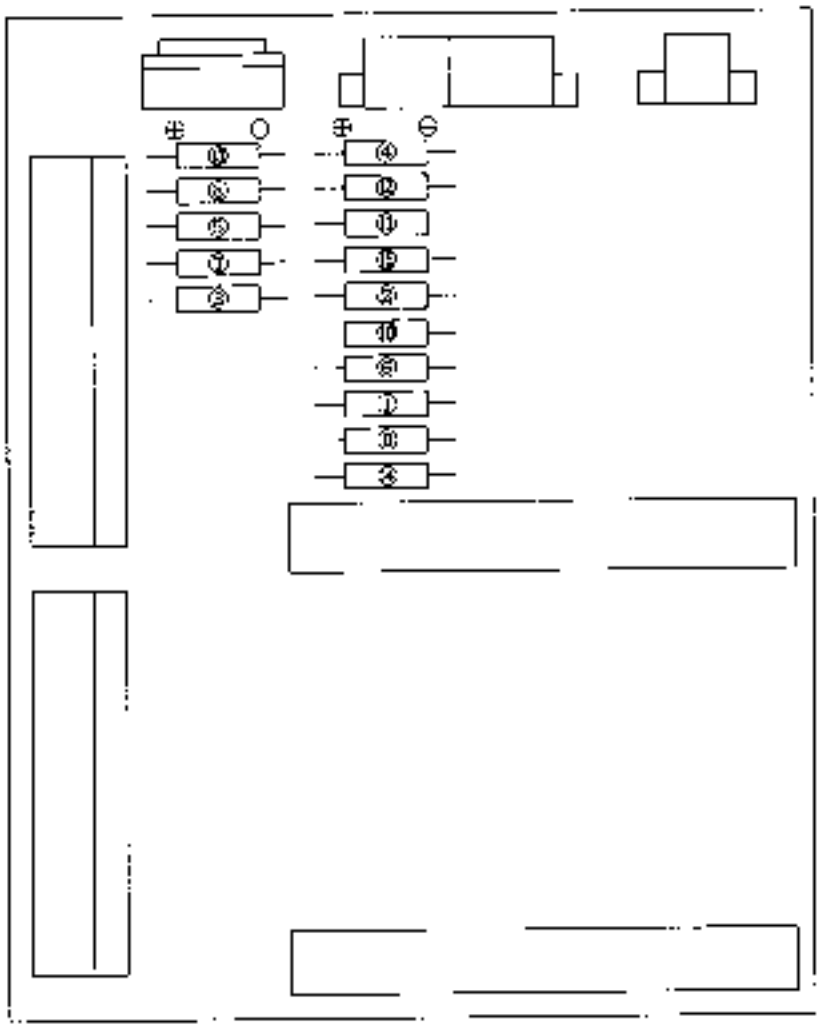
Connector No.	Pin No.	Port name	Specifications
CN109	1	C2	Spare D/O
	2	C3	Hyd. oil heat relay
	3	C4	Boom pump control solenoid valve
	4	C5	Main pump control solenoid valve
	5	C18	Fr. drum turn detection grip
	6	C19	Re. drum turn detection grip
	7	C20	Fr. drum C/V solenoid valve
	8	C21	Re. drum C/V solenoid valve
	9		Vacancy
	10		Vacancy
	11	C24	Free fall voice alarm (Not use)
	12	C25	Spare (D/O)

Connector No.	Pin No.	Port name	Specifications
CN110	1	B12	Mode select
	2	B13	E/G PSW
	3	B32	Re. drum brake detect sensor (for CEN)
	4	B33	Water level
	5	B35	Engine oil filter clog
	6	B36	3rd. drum brake detect sensor (for CEN)
	7	B37	Hydraulic oil temperature
	8	B38	Control primary pressure
	9	B39	Fr. drum free fall speed S/W
	10	B40	Re. drum free fall speed S/W
	11	B41	3rd. drum free fall speed S/W
	12	B43	Fr. drum brake cooling oil temperature
	13	B44	Re. drum brake cooling oil temperature
	14	B45	Cooling line filter clog
	15	B46	Free fall release
	16		Vacancy
	17	A23	Spare A/D
	18	G	

Connector No.	Pin No.	Port name	Specifications
CN111	1	Vacancy	Maintenance PC communication (RS232C)
	2	RxD	
	3	TxD	
	4	Vacancy	
	5	GND	
	6	Vacancy	
	7	Vacancy	
	8	CHK2	For checking connection status
	9	CHK2	

The pins in * shall be assigned to the port 070.

13.4.5 PROPORTIONAL SOLENOID VALVE MEASURING POSITION



Proportional valve detection resistance

Item	Name	Output current	Dither	Detected resistance
1	Boom raising speed control	200 to 625mA	200mAp-p 100Hz	723
2	Boom lowering speed control	↑	↑	739
3	Fr. drum hoisting speed control	150 to 625 mA	↑	755
4	Fr. drum lowering speed control	↑	↑	769
5	Re. drum hoisting speed control	↑	↑	787
6	Re. drum lowering speed control	↑	↑	801
7	3rd. drum hoisting speed control	↑	↑	819
8	3rd. drum lowering speed control	↑	↑	834
9	Fr. drum motor control	300 to 750mA	↑	851
10	Re. drum motor control	↑	↑	865
11	Swing speed control	250 to 700 mA	↑	883
12	Main pump power reduction	200 to 700mA	↑	898
13	3rd. drum motor control	300 to 750mA	↑	915
14	Swing reaction	150 to 510mA	↑	931
15	Boom pump power reduction	200 to 700mA	↑	1045

13.5 ADJUSTMENT OF TOTAL CONTROLLER

13.5.1 NECESSITY OF ADJUSTMENT

Repair contents		Adjusted items		
		option setting	Throttle range adjustment	Engine speed adjustment
Replacement of hand throttle or foot throttle		X	O	X
Replacement of stepping motor		X	X	O
Governor link		X	X	O
Installation/removal of optional equipment	3rd. drum	O	X	X
	Foot throttle	O	X	X
	Drum turn sensor	O	X	X
	Lifting height sensor	O	X	X
	Wind sensor	O	X	X
	Fr. Drum free fall	O	X	X
	Re. Drum free fall	O	X	X
	3rd. Drum free fall	O	X	X
Replacement of total controller assembly		O	O	O
Downloading of program		X	X	X
Replacement of ECU		X	X	O

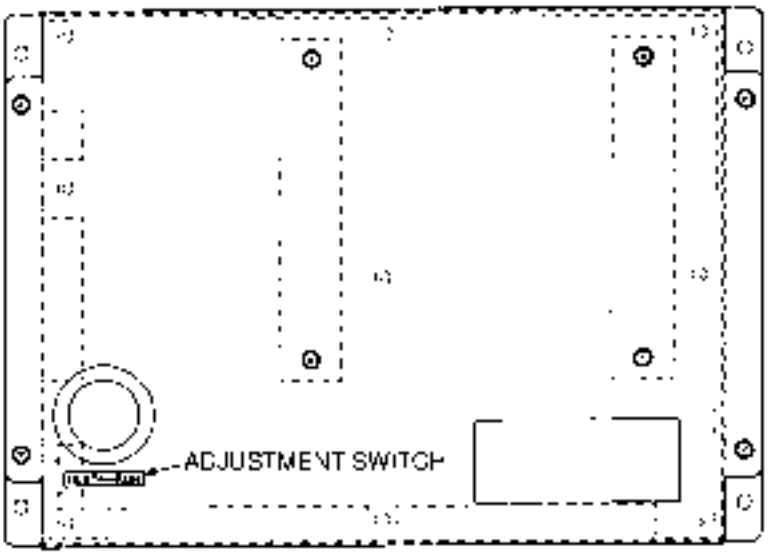
O: Necessary X: Unnecessary

13.5.2 ADJUSTMENT PROCEDURES OF TOTAL CONTROLLER

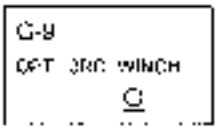
13.5.2.1 OPTION SETTING

1 Set the engine key to the "ON" position (the engine s not started).

2. Set the adjustment switch to the "TEST" position

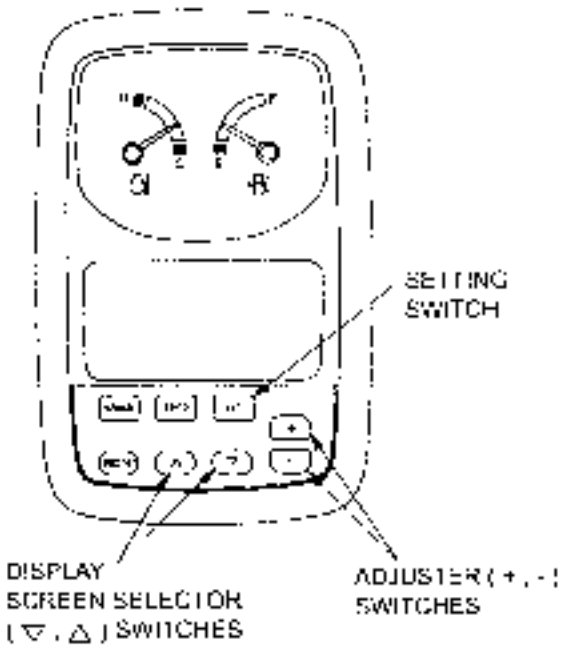


3. The option setting items are displayed on the display screen of the cluster



4. Select any intended option item with the adjuster "△" and "▽" switches on the cluster.
5. If the option setting is necessary, input "O" with the adjuster "+" or "-" switch.
   If the option setting is unnecessary, input "X" with the "+" or "-" switch.

G-9	G-9
OPT 3RD WINCH	OPT 3RD WINCH
O	X



6. After the completion of input of "O" or "X" against all the items, push the "Setting switch" on the cluster.

- Adjustment values can be input into the controller by pushing the "Setting switch".
  Remember that the adjustment becomes ineffective unless the "Setting switch" is pushed.

7. Return the adjustment switch to the "RUN" position.

Option setting procedure		
A.	Adjustment switch:	"1LST" position
B.	Operation mode selector switch:	"▽" and "△"
C.	"O" and "X"	
D.	Setting switch:	Press
E.	Adjustment switch:	"RUN" position

13.5.2.2 ADJUSTMENT OF HAND THROTTLE AND FOOT THROTTLE

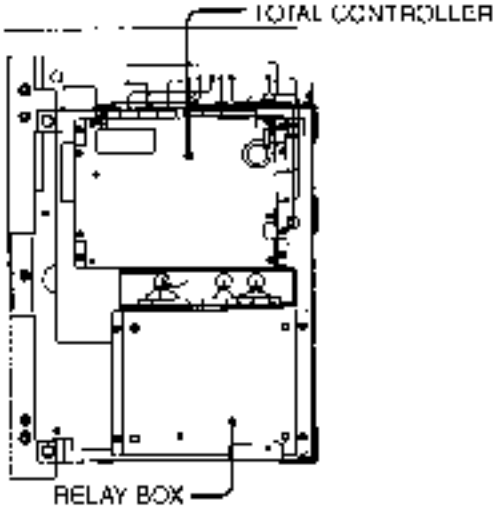
1. Set the engine key to the "ON" position (the engine is not started)
2. Set the adjustment switch to the "TEST" position.
3. Press the "CHECK" switch of the cluster gauge. (The screen can be changed whenever this switch is pressed.)
   Then, the message "THROTTLE LOW ADJUST" is displayed on the display screen of the cluster
4. Set the hand throttle and foot throttle to the low idling positions.
5. Press the "Zero" switch of the cluster gauge.
   Then, the adjustment values are stored by the controller, and the message "THROTTLE HI- ADJUST" is displayed on the display screen of the cluster.
6. Set the hand throttle and foot throttle to the high idling positions.
7. Press the "Zero" switch of the cluster gauge.
   Then, the adjustment values are stored by the controller, and the message "FINISH" is displayed on the display screen of the cluster.
8. Return the "ADJUSTMENT" switch to the "RUN" position.

G-16
CPU THROTTLE LOW ADJUST

G-17
CPU THROTTLE HI-ADJUST

G-5
CPU FINISH
CHPM

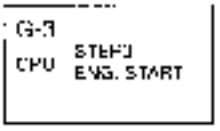
Adjustment of hand throttle & foot throttle	
A. Adjustment switch:	"TEST" position
B. "Check" switch:	THROTTLE LOW ADJUST
C. Hand and foot throttles:	"LOW IDLING" position
D. "Zero" switch:	Press
E. Hand and foot throttles:	"HIGH IDLING" position
F. "Zero" switch:	Press
G. Adjustment switch:	"RUN" position



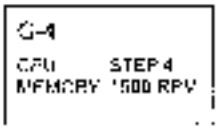
13.5.2.3 ENGINE SPEED ADJUSTMENT

- Prior to the adjustment, sufficiently warm up the machine.

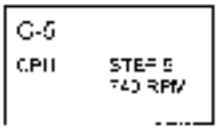
1. Set the engine key to the "ON" position (the engine is not started)
2. Set the adjustment switch to the "TEST" position.
3. Press the "CHECK" switch of the cluster gauge. (The screen can be changed whenever this switch is pressed.)
   Then, the message "STEP3" is displayed on the display screen of the cluster.



4. Start the engine, and press the "ZERO" switch of the cluster gauge. Then, the engine speed reaches at a high idoling
5. When the engine speed reaches the high idling, it is decreased gradually.
   Acontroller assigns engine speed and accelerator signal at this time.



6. When the engine speed reaches the low idling, the message "STEP5" is displayed on the display screen of the cluster.
   Then, adjustment is finished.

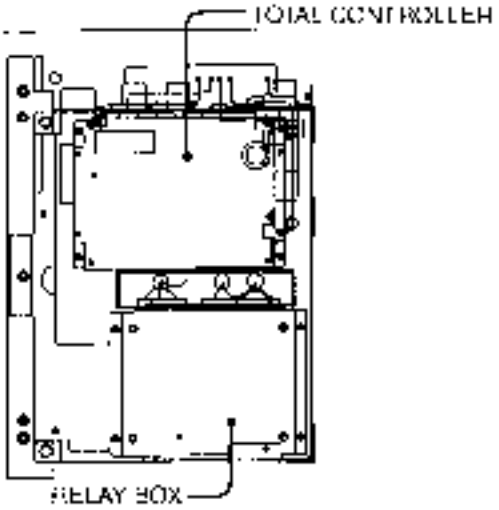


7. Return the "ADJUSTMENT" switch to the "RUN" position.

Adjustment of engine speed	
A. Adjustment switch:	"TEST" position
B. Inching switch:	"STEP 3" ENG. START
C. "Zero" switch:	Press
D. Engine automatic adjustment	
E. Adjustment switch:	"RUN" position

13.5.2.4 WHEN ADJUSTMENT OF TOTAL CONTROLLER IS IMPOSSIBLE

1 After the zero switch is pushed while the message "STEP3 Engine start is possible." is displayed on the display screen of the cluster, the message "CPU adjustment is impossible." appears, and the adjustment is impossible.



[CASE 1]

- Condition : when the engine speed is 1500 min⁻¹ or slower.
- Cause : the reading by the engine turn sensor is incorrect.
- Remedy : after the measurement and adjustment of the turn sensor voltage, perform the adjustment A.
  High idling 3 V (AC) or more

[CASE 2]

- Condition : when the engine speed does not reach 2,090 min⁻¹.
- Cause : the reading by the engine turn sensor is incorrect.
- Remedy : after the measurement and adjustment of the turn sensor voltage, perform the adjustment A.
  High idling 3 V (AC) or more

2. The message "CPU ROM data" is displayed.

(1) Noises are input. Completely perform all the total controller adjustment procedures.

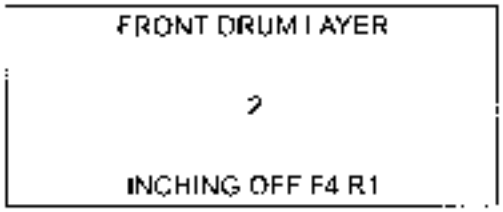
(2) This message is also displayed on the display screen of a new controller (adjustment). Completely perform all the total controller adjustment procedures.

13.5.2.5 INITIAL ADJUSTMENT OF LIFTING HEIGHT GAUGE

If the drum is rotated without a wire rope wrap during the wire rope replacement, or the drum is rotated with the wire rope caught in during the disassembly and the assembly of the boom, the wire rope layers on the drum must be adjusted. If the adjustment is not performed correctly, the lifting height may not be changed, or the displayed value may be incorrect. Be sure to adjust it correctly.
The initial adjustment of the lifting height gauge must be performed for both of the main winch and the aux. winch
The adjustment steps are identical to the front drum and the rear drum.
The adjustment steps for the front drum are described below.

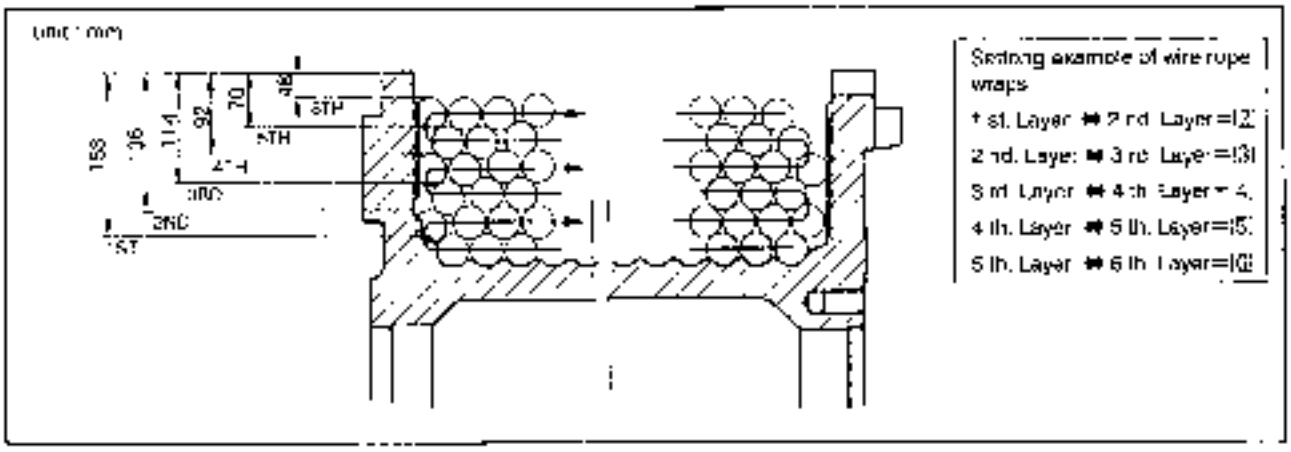
1. Winch up and down the main hook block, and stop it at the position where the wire rope layers on the drum changes.

(1) Display the "Front drum layers display screen".



1) Push the flash switch for more than 5 seconds. Then, the displayed value of the wire rope wraps on the drum flashes.

2) Whenever the adjuster "+" switch is pushed, the wire rope wraps on the drum increases by 1. It can be continuously increased by pushing the switch.
Whenever the adjuster "-" switch is pushed, it decreases by 1.
Adjust the displayed value of the wire rope wraps on the drum to the current correct value. It can be judged by the distance between the drum flange end and the wire rope. Refer to the diagram below

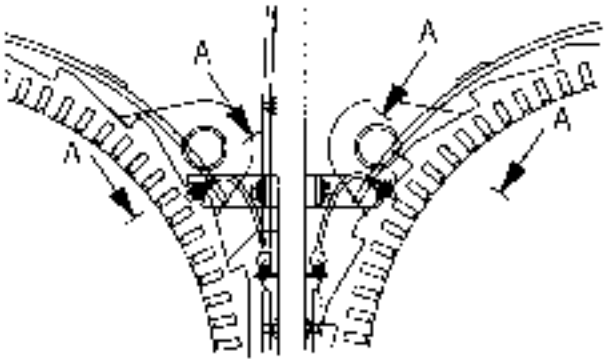


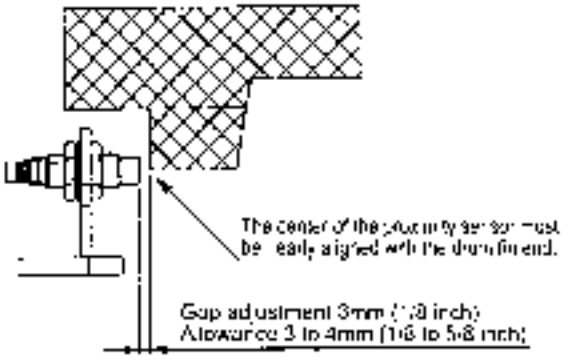
3) Push the setting switch after adjusting the value.
The adjustment is complete, and the screen returns to the normal status.

4) If no alteration is required, select another display screen with the display screen selector switch without pushing the setting switch.
Then, the alteration is canceled, and the value returns to the original one.

5) Follow the steps described in the "(1) USE OF LIFTING HEIGHT GAUGE" of the section 7, and ensure that the lifting height value changes in accordance with the setting.

6) When the indicated lifting height is incorrect, the sensor gap adjustment may be improper. Adjust the gap of the proximity sensor.
If the indicated lifting height is still incorrect, consult with your nearest KOBELCO service shop.

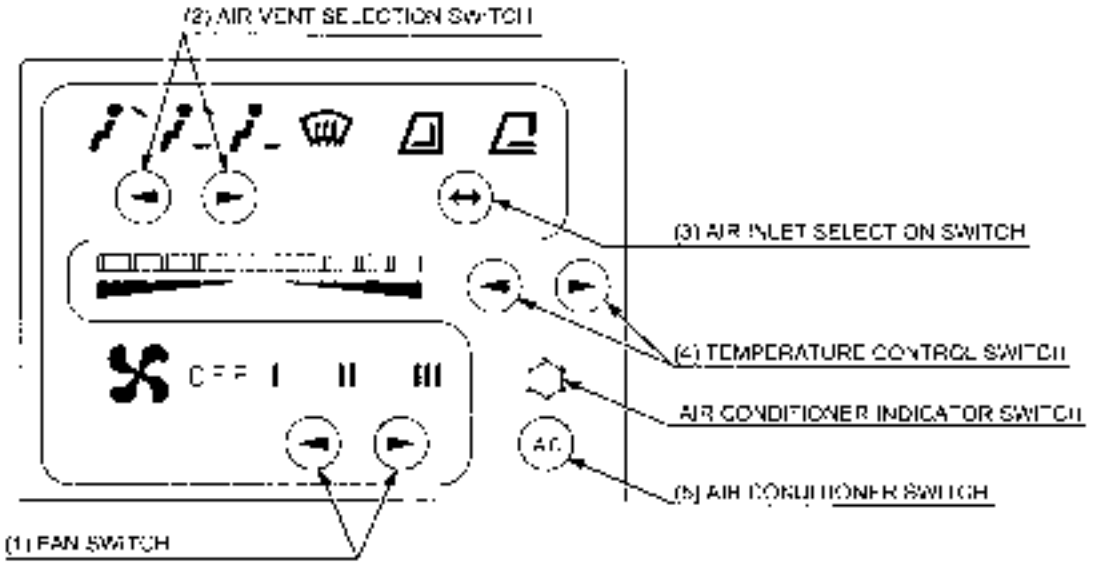




SECTION A-A

14. AIR CONDITIONER

14.1 OPERATION ITEMS



(1) FAN SWITCH

The switches control the air conditioner ON/OFF function and the blower speed.

I ..... position Low
II ..... position Medium
III ..... position High

OFF I II III

(2) AIR VENT SELECTION SWITCH

These switches control the open/close position of each air vent.
Select the desired air flow mode from the three mode position.
The selected position is always shown by a lamp.
Select if the front glass is misted

(3) AIR INLET SELECTION SWITCH

This switch selects the open or close position of air inlet.

	Selector switch for selector between internal air circulation and open intake.
	When this position is selected, the air inlet is closed which causes the air to recirculate inside the cab.
	When this position is selected, the air inlet is opened which allows fresh air to be introduced into the cab.

(4) TEMPERATURE CONTROL SWITCH

These switches control the temperature of air coming out of the air vents to any of five levels during heating (red label) and cooling (green label).

Green indicator ⟷ Red indicator

1. Push the left switch (◀), and the range of the GREEN lights decrease and the air temperature goes down.
2. Push the right switch (▶), and the range of the LED lights increase and the air temperature goes up.

(5) AIR CONDITIONER SWITCH

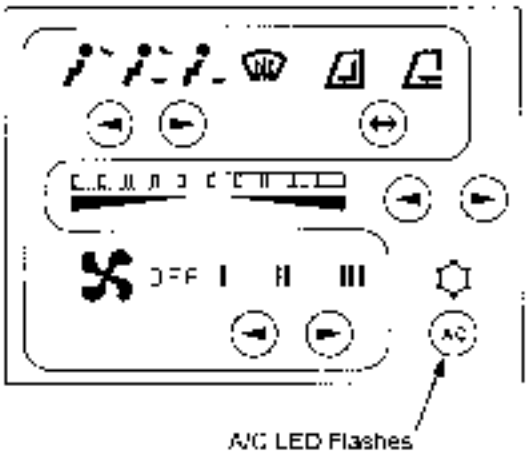
This is used to turn ON and OFF the cooling function during cooling or dehumidification heating.
Push once to change over from ON/OFF to OFF/ON.
When the switch is turned ON, the lamp on the upper part of the switch lights up.

AIR CONDITIONER INDICATOR LAMP
A/C AIR CONDITIONER SWITCH

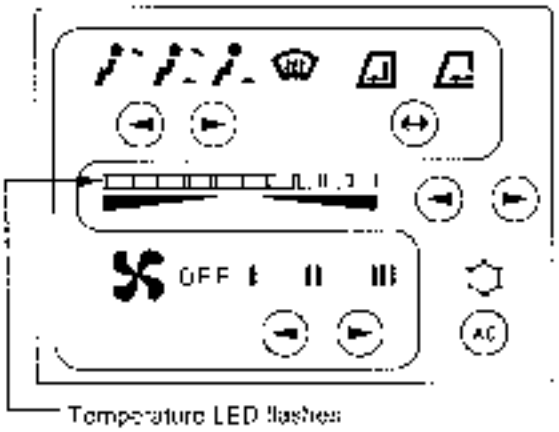
14.2 SAFETY MONITOR FUNCTIONS

This control panel displays the following self-monitoring functions.

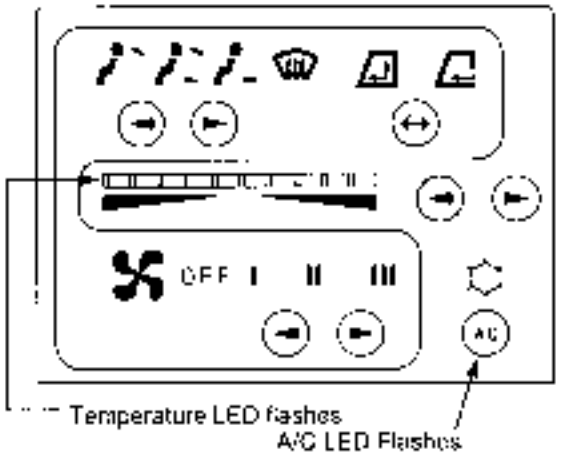
(1) Thermostat Cutoff and short Monitor.
When a cutoff or short occurs on the thermostat circuit, this function detects it and the A/C display LED flashes while the air conditioner remains ON.



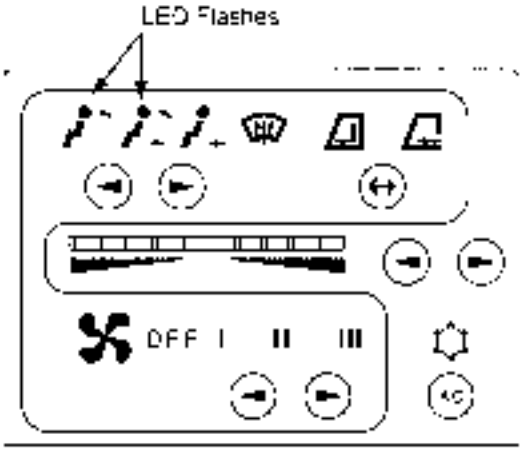
(2) Temperature Motor Actuator Lock and Circuit Monitor.
When there is insufficient motion after the motor actuator starts, it detects this as a short and the appropriate LED based on the set temperature flashes.



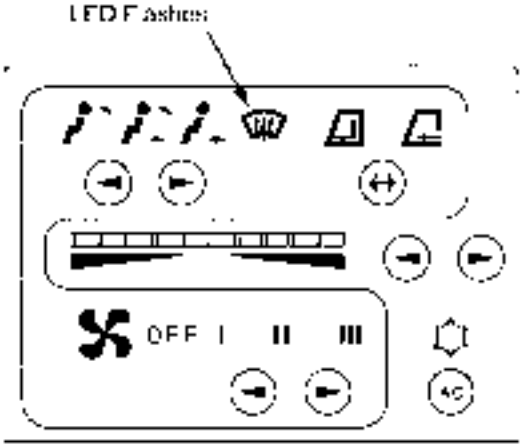
(3) Thermostat Cutoff/Short and Temperature Motor Actuator Lock/Cutoff/Short Monitor.
When thermostat or motor circuit malfunctions occurs, the appropriate LED and the A/C switch LED flash (while the air conditioner is on).



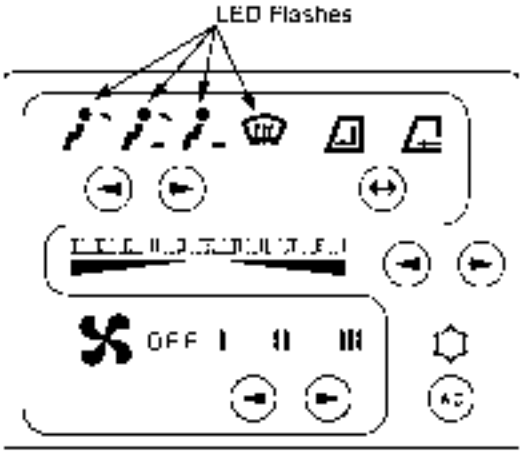
(4) Mode Actuator Lock / Circuit Cutoff Monitor
When a malfunction in the mode actuator lock / circuit occurs, the VENT or VENT & FOOT LED on the set mode flashes



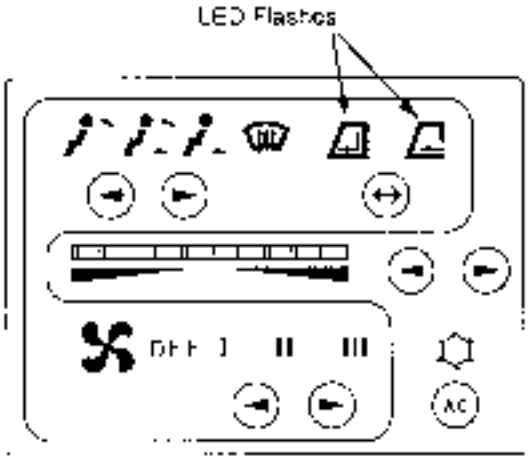
(5) Defogger Motor Actuator Lock or Circuit Cutoff / Short Monitor.
When malfunctions on the monitor actuator lock or circuit occur, the defroster LED flashes



(6) Mode Actuator lock or Circuit Cutoff / Short and Defogger Motor Actuator Lock or Circuit Cutoff / Short Monitor.
When malfunctions on the mode or defroster motor actuator lock or circuit occur, one of the mode LED flashes.



(7) In / Out Motor Actuator Lock or Circuit Cutoff or Short Monitor.
When malfunctions on the in / out air motor actuator lock or circuit occur, the inside air or outside air LED flashes.



14.3 DISASSEMBLY AND ASSEMBLY PROCEDURE

14.3.1 SPECIAL CONSIDERATIONS DURING REPLACEMENT

1. Special maintenance locations
   After assessing the malfunctioning situation, refer to the Trouble Shooting section to learn about remedy procedures.
2. After completing the work, make very sure the malfunction is indeed repaired completely by starting the air conditioner and checking for proper function.
3. Special instructions

(1) Pipe joints
When connecting pipe joints, apply freezer oil (PAG oil: SP20) to the O rings, and tighten with a double spanner to the following torque values

Joint parts	Torque (kg-cm)	Joint parts	Torque (kg-cm)
Compressor M8×25	200 to 250	S hose and AC unit	300 to 350
D hose and condenser	200 to 250	S hose and compressor	300 to 350
L pipe and condenser	120 to 150	Evaporator inlet and expansion valve	120 to 150
Receiver dryer M8×28	120 to 150	Expansion valve and evaporator	200 to 250
L hose and AC unit	80 to 120		

(2) Screw and Bolt Tightening torques
Screws and bolts should be tightened to these designated torque values.

Diameter (mm)	Torque (kg-cm)	
	Metric screws	Tapping screws
4	10 to 15	8 to 10
5	20 to 25	10 to 20
6 (Condenser installation and resin)	40 to 55	-
6	40 to 65	-
8	120 to 160	-
10 (Inside unit installation)	200 to 250	-
10	400 to 550	-

4 Compressor oil capacity

The compressor contains 240 cc of oil. If the oil is insufficient, the compressor may overheat and/or burn under high RPM, thereby lowering its own durability. If the oil amount is too much, it decreases cooling capacity.

Once the air conditioner is turned on, the oil somewhat disperses into the freezing cycle. The amount of oil may need adjusting when the following parts are replaced

Replaced part	Joint parts
Compressor	(1) Measure the oil amount remaining in the removed compressor. (2) 240 cc (oil amount (1) + 30 cc) = remaining oil in circuit. (3) Remove the amount of the remaining oil from the new compressor and install.
AC unit	Add 15 cc
Receiver dryer	Add 20 cc
Condenser	Add 20 cc

* Refill oil should be SP-20

5. Work should start only after the engine is shut off and the air conditioning power has been turned off
6. Under rainy conditions, do not remove or install any pipes.
7. Be careful not to let any water to get into the cooling circuit. Do not leave the pipes disconnected.

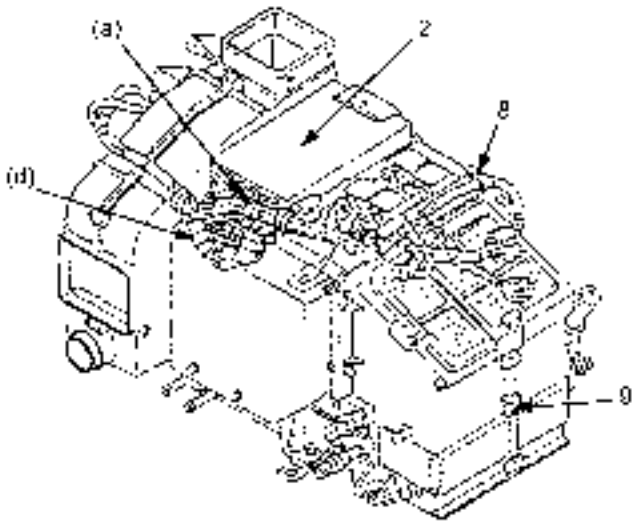
14.3.2 INTERIOR UNIT

14.3.2.1 CASE DISASSEMBLY

1. Removing the amplifier

(1) Take off the 3 connectors (a). [See Figure-1]

(2) Take off the 3 lapping screws (3) and remove the amplifier (2).



View from front

Figure-1

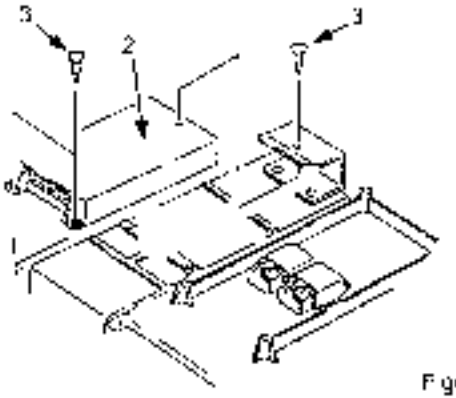


Figure-2

2. Removing the register

(1) Take off 1 tapping screw (45), 2 sems screw (46) and remove the piping cover (44).

(2) Remove the connector (b)

(3) Take off 2 tapping screws (5) and remove the register.

⚠CAUTION

Be careful not to bend the coil (P)

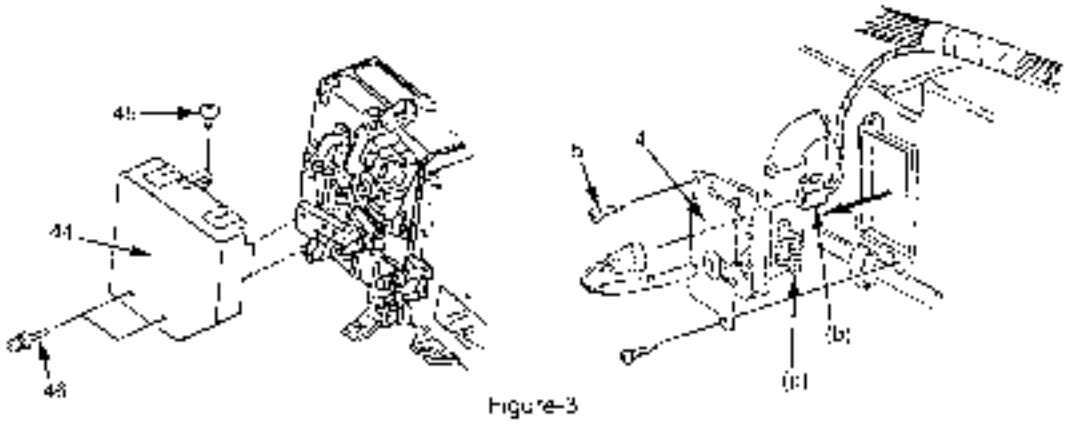


Figure-3

3. Releasing the valve rod

Open the rod clamp (7) to release the valve rod.

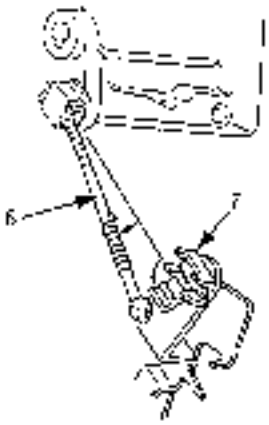


Figure-4

4. Removing the upper case

(1) Take off the connector (d). [See Figure-2]

(2) Take off 3 sems screws (50).

CAUTION

Do not lose the clamp (51).

(3) Take off 7 sems screws (46) and the small screw (47).

(4) Take off 11 clamps (9) with a regular screwdriver.

(5) Lift up the upper case (8) to remove.

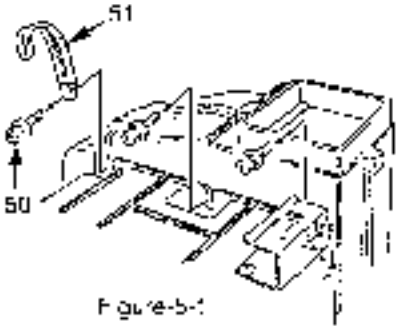


Figure-5-1

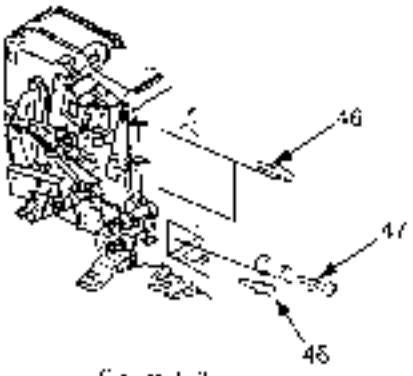


Figure-5-2

Figure-5

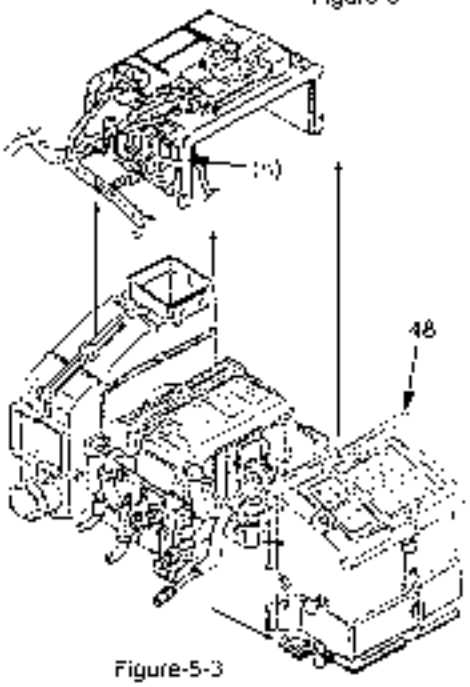


Figure-5-3

14.3.2.2 THERMOSTAT REPLACEMENT

1. Removal

(1) Remove the upper case (8) as shown in Section 14.3.2.1.

(2) Lift up the evaporator assembly (10) to remove.

⚠CAUTION

Be careful not to bend the pipes.

(3) Remove the holder (12).

(4) Take out the thermostat (11) from the holder (12).

(5) Pull out the thermostat (11) with the grommet (13) from the hole on the lower case (14).

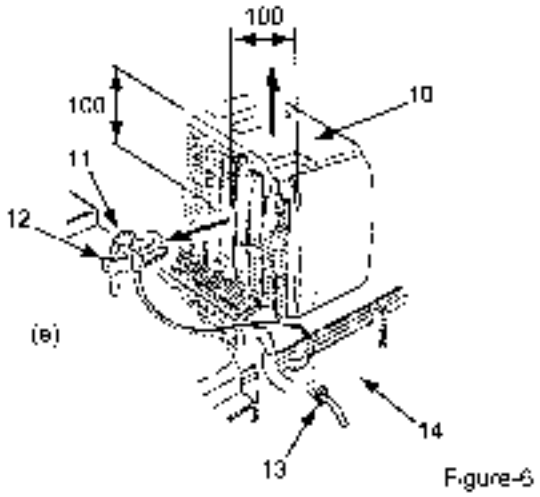


Figure-6

2. Installation

Reassemble in the reverse order from disassembly, with the following special notations.

(1) When installing the thermostat, only the sensor part (e) should protrude from the bottom.

(2) Refer to the Figure-6 for an installation location.

14.3.2.3 EVAPORATOR OR EXPANSION VALVE REPLACEMENT

CAUTION

1. Remove all the coolant in the cooling circuit in advance.
2. Replace with new O-rings at this time.
3. Plug or cover the removed pipe to prevent dust from getting in.

1. Removal

(1) Remove the upper case (8) as shown in Section 14.3.2.1.

(2) Lift up the evaporator Assy (10) to remove. |See Figure-6|

(3) Remove the insulation (15) and take out the stay (16).

(4) Loosen the nuts (f), (g), and take off each pipe.

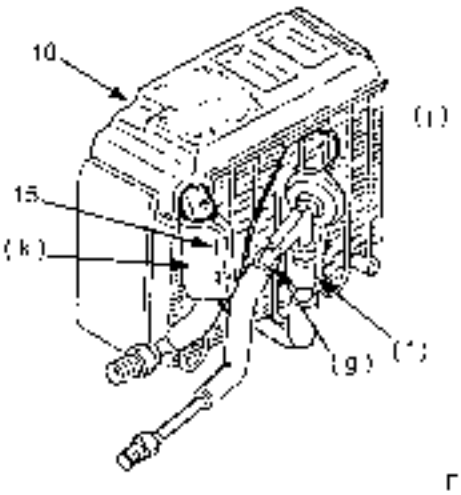


Figure-7

2. Installation

Proceed with reassembly in the reverse order of disassembly, with the following special notations.

(1) Install the temperature sensing tube (h) as shown on Figure-8.

(2) Roll an extra length of the capillary tube (i) to approx. 20.

(3) The insulation (15) can not be reused, so replace it.

(4) Apply the insulation carefully so that the temperature sensing tube (h) is completely insulated from outside air.
As when it was removed, the seam in the insulation should not touch the in/out air dumper.

(5) After installing the upper case (8), be sure to check the following.

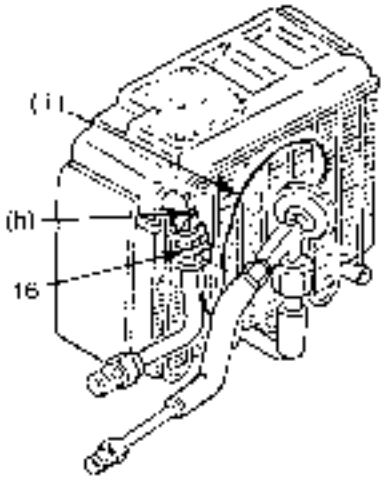


Figure-8

- Turn the linkage bushing (17) toward the arrow, and remove the rod (18).

⚠CAUTION

Do not release the rod clamp (19).
If has been removed, reassemble it again as explained in Section to follow.

- Turn the intake dumper shaft (20) to be sure that the dumper (21) does not interfere with the capillary tube (i).
  There must be more than 5 mm clearance.
- Install the rod (18) to the linkage bushing (17).

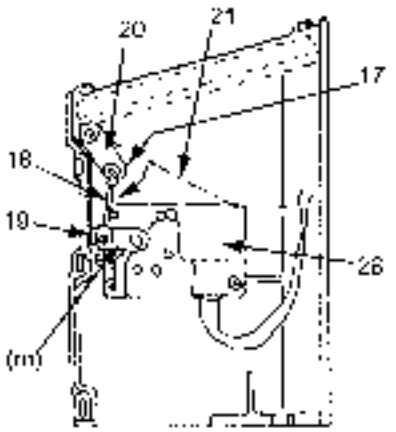


Figure-9

14.3.2.4 HEATER CORE REPLACEMENT

⚠CAUTION

- Make sure the water temperature is low.
- Be careful not to drain the cooling water.

1. Removal

(1) Remove the upper case (8) as explained in Section 14.3.2.1.

(2) Take off the tapping screw (30) to remove the retainer (31).

(3) Loosen 2 hose clamps (22) to remove the heater hose (23), and lift the heater core to remove. (2)

2. Installation
   Proceed with reassembly in the reverse order from disassembly, with the following special notations.

(1) Replace the heater hose (23) and the insulator (32).

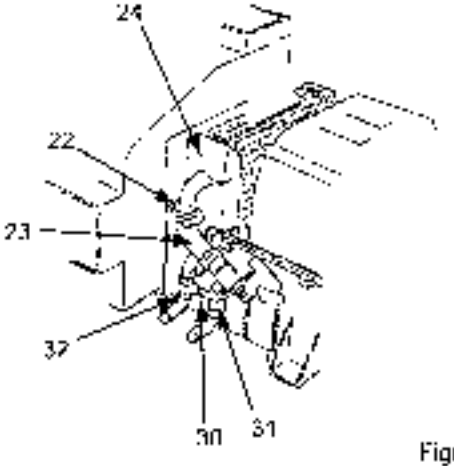


Figure-10

14.3.2.5 INTAKE DUMPER ACTUATOR REPLACEMENT

1. Removal

(1) Open the rod clamp (19) to release the rod (18)

(2) Take off the connector (1) and 4 tapping screws (25) to remove the actuator (26).

2. Installation

(1) Install the actuator (26) with 4 tapping screws (25) and connect the connector (1).

(2) Turn the dumper lever (20) toward the arrow until it stops and then press lightly. Press the actuator lever (m) toward the arrow lightly and fix the rod (18) to the rod clamp (19).

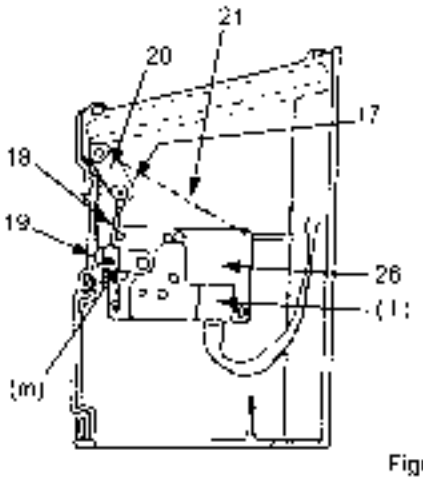


Figure-11

⚠CAUTION

Do not release the rod clamp (19) and remove the rod (18) other than when replacing the actuator. If it has been removed, check to see the lever (m) is at location indicated in Figure-11. If it is not at that location, proceed as follows.

- Turn the power on and set to the ÁgInside Air CirculationÁh mode. (beware that the lever (m) rotates) wait for 10 seconds, and then check to see if the lever (m) is at the location shown in Figure-11.
- Turn off the power and fix the rod (18) as explained in (2) of the previous section.

14.3.2.5 WATER VALVE ACTUATOR OR WATER VALVE REPLACEMENT

1. Removing the actuator

(1) Open the rod clamp (27) to release the rod (6)

(2) Take off the connector (n) [see Figure 5-2] and 4 tapping screws (28) to remove the actuator (29).

2 Installing the actuator

(1) Install the actuator with 4 tapping screws (28) and connect the connector (n).

(2) Fix the valve rod (6) tight to the rod clamp (27) so that the spring (o) is bent 1 mm.

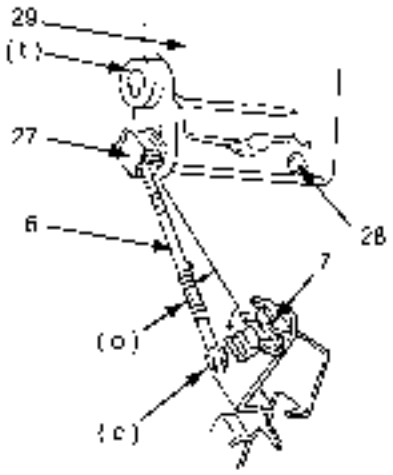


Figure-12

⚠CAUTION

Do not release the rod clamp (27) and remove the rod (6) other than when replacing the actuator. If it has been removed, check to see the lever (t) is at the location indicated in Figure-13.

- Turn the power On and set to the ÅgAir BlowÅh mode, one green and one red Operation Panel LED will glow. (Beware that the lever (t) rotates.) Wait for 10 seconds, and then check to see if the lever (t) is at the location shown in Figure-12.
- Turn OFF the power and fix the rod (6) as explained in w of the previous section.

3. Removing the water valve

(1) Turn the power ON and set to the ÅgAir BlowÅh mode, one green and one red Operation Panel LED will glow. Wait for 10 seconds, and then check to see if the lever (t) is at the location shown in Figure -13.

(2) Turn OFF the power.

(3) Open the rod clamp (7) to release the rod (6).

(4) Take off the tapping screw (30) to remove the retainer (31).

(5) Take off 3 tapping screws (35)

(6) Loosen 2 hose clamps (22) and remove the heater hose (23) and remove the water valve (34)

4. Installing the water valve
Proceed with reassembly in the reverse order from disassembly, with the following special notations.

(1) Pay attention to the location of the spring (o) and washer (c).

(2) Replace the heater hose (23).

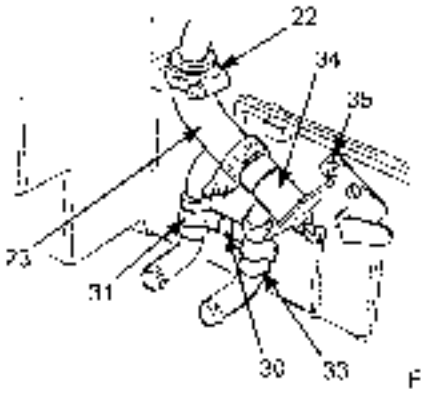


Figure-13

14.3.2.7 MODE ACTUATOR REPLACEMENT

1. Removal

(1) Open the rod clamp (36) to release the rod (37).

(2) Take off the connector (q) and 4 tapping screws (38) to remove the actuator (39).

2. Installation

(1) Install the actuator (39) with 4 tapping screws (38) and connect the connector (q).

(2) Turn the dumper lever (40) toward the arrow until it stops and then press lightly. Press the actuator lever (r) toward the arrow lightly and fix the rod (37) to the rod clamp (36).

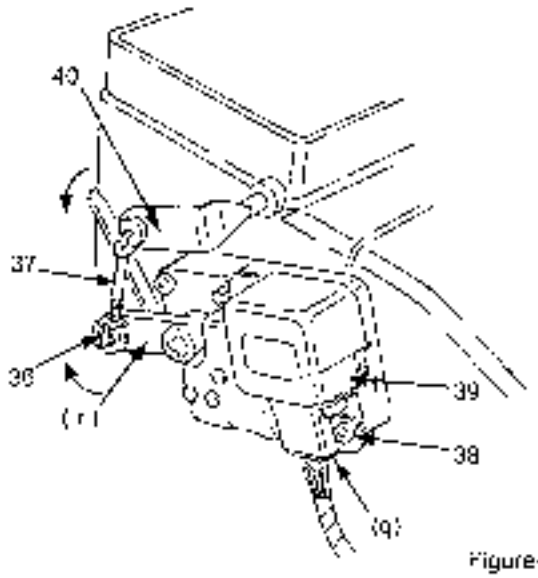


Figure-14

⚠CAUTION

Do not release the rod clamp (36) and remove the rod (37) other than when replacing the actuator. If it has been removed, check to see the lever (r) is at the location indicated in Figure-14.
If it is not at that location, proceed as follows.

- Turn the power ON and set to the "" mode. (beware that the lever (r) rotates) Wait for 10 seconds, and then check to see if the lever (r) is at the location shown in Figure-14
- Turn OFF the power and fix the rod (36) as explained in w of the previous section.

14.3.2.8 BLOWER MOTOR ASSEMBLY REPLACEMENT

1. Removal

(1) Take off coupler(s) and take off 3 sems screws (41).

(2) Remove the blower motor assembly (42).

2. Installation

Proceed in the reverse order of the installation process.

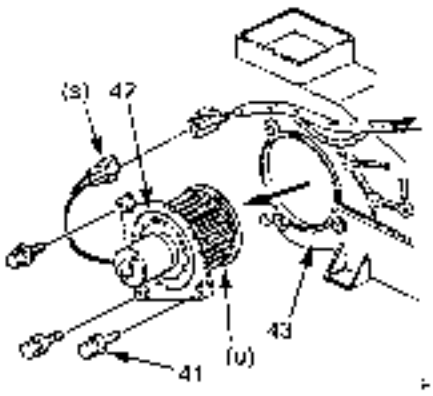


Figure-15

⚠CAUTION

Be careful not to put anything into the blower casing (43).
Foreign objects may damage the fan (u).

14.4 OPERATIONAL PRECAUTIONS

1. For the operators health and comfort
   The purpose of air conditioning is to lower temperature and humidity. They say the cab temperature should be 5 to 6°C lower than the temperature outside. Do not set the temperature too low and do not direct cooled air to the body for extended periods. Use a sensible temperature setting.
2. Ventilating the room
   When the air inside the cab gets dry due to the dehumidifying effects of the air conditioner, smoking may cause some eye irritation. Open the window a little or switch to the Outside Air Intake mode to ventilate when smoking.
3. When inside glass fogs up
   When inside glass fogs up, turn the air conditioner ON for a little while (A/C display LED on). The fog will disappear.
4. When LED flashes
   This indicates an abnormality. Perform inspection and maintenance immediately.

14.5 INSPECTION AND MAINTENANCE

14.5.1 INSPECTION/MAINTENANCE LIST

Inspection frequency	Inspected part	Inspection point	
At least monthly, or often as needed	Outside air filter	Clogging	Airblow or wash w/water When washed in water (may use a mild detergent), hang to dry for 5 to 7 days.
	Inside air filter	Clogging	Wash with water because airblow may damage the filter.
	Condenser	Clogging	
Every month	V belts	Damage and tension	
Every 6 months	Coolant	Refill as needed	
	Assembled pipes	Looseness, gas leaks, damage	
	Compressor	Working condition	
Every 12 months	A/C unit outside air filter	Working condition Replace	

14.5.2 INSPECTION/MAINTENANCE PROCEDURES

1. Cleaning and replacing the filters
   - When a filter is clogged, the air flow decreases and the air conditioner's performance is reduced.
     Clean or replace filters as indicated in the list above.
   - Removal and reinstallation

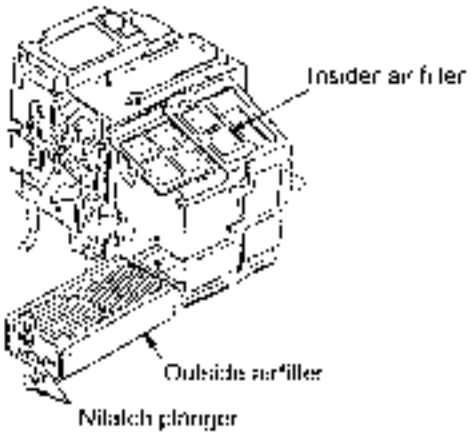
(1) Inside air filter

Removal Lift the hook on the filter and pull it toward you.

(2) Outside air filter

Removal Take off 2 nilatch plungers on top and bottom and pull the filter toward you.

Installation Install in the reverse order from removal.



2. Inspection of the Coolant (gas)
   Ask an air conditioner service person to inspect and top up the coolant as necessary.

(2) Checking the refrigerant (gas)
Cautions for filling the refrigerant

⚠WARNING

Since the refrigerant filling operation may cause serious accident, take the following measures.

- **Qualified and responsible personnel with full knowledge of work contents must perform the filling operation of refrigerant.**
- **If refrigerant gets into your eyes, it may cause vision loss. Be sure to wear the safety goggles.**
- **Liquid refrigerant is at a low temperature (about -30°C). If it splashes over skin, it may cause frostbite. Special care should be taken to handle the refrigerant.**
- **Refrigerant (R-134a) decomposes when it contacts with high temperature parts (at about 400°C or higher) and generates toxic substance (such as phosgene gas). Never release the refrigerant in the room with poor ventilation and where a heat source (such as a stove, etc.) is used.**
- **Care should be taken not to release the gases into the atmosphere in order to protect nature.**

⚠CAUTION

Since the filling operation may cause serious accident, take the following measures.

- When a service canister is to be warmed up in order to fill the refrigerant, be sure to open the low pressure valve at the service canister and gauge manifold and then heat it up in hot water lower than 40°C (the temperature that you do not feel hot when you dip your hand in it). DO NOT dip the canister in boiling hot water or heat it by direct flame because a service canister will burst.
- When you start engine and intend to fill the refrigerant, if the high pressure valve (Hi) is opened, the high pressure gas flows back and the service canister or the hose will burst. Never do this wrong procedure.

Cautions for storage and transportation

WARNING

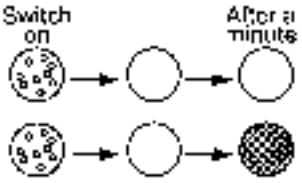
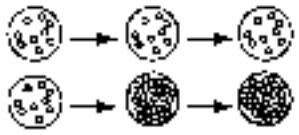
Since the storage and transportation may cause serious accident. take the following measures.

- **Since the high pressure gas is contained in the condition of saturated liquid in a service canister, if the temperature rises, the pressure rapidly increases and the canister may burst. Be sure to keep the canister temperature lower than 40°C. Never place a canister close to fire sources.**
- **Avoid direct sunlight and store the canister in a cool and dark place.**
- **Inside a closed vehicle (including a trunk), the temperature may increase extremely high. Do not bring the canister in a vehicle because the temperature may reach the critical value where it is exposed to direct sunlight even in winter.**
- **The strength of service canister may drop if it received damages, dents or deformation. Do not strike or drop it. Do not throw or drop it while unloading the package sets.**
- **Store the canister where children cannot touch.**

For check and replenishment, contact your air conditioner shop.

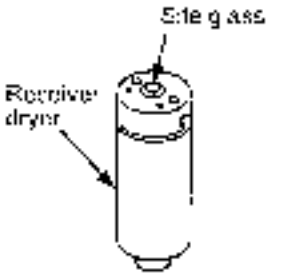
How to Inspect

Turn the air conditioner on and rev the engine slightly. Compare the bubbles seen through the site glass to the figures given below

Amount	Site glass condition (Switch turned on, after a minute)	Treatment
O OK	 • Almost clear • Clear alternating with milky cloudiness	
X Under fill	 Clear since switch ON	Check and refill appropriate amount of agent at the installer.
X Under filled	 • Flow of bubbles seen continuously • Bubbles in white cloudiness seen continuously	
X Almost empty	 Clear since switch ON	

⚠CAUTION

- Operating the air conditioner without sufficient coolant may damage the compressor.
- Too much coolant (overfill) will reduce the cooling power. It also causes dangerous overpressure in the circuit. Maintain the prescribed amount.
- During winter or when the air conditioner is not used for a long time, operating it for a few minutes a couple of times each month helps prevent gas from leaking from the compressor seals.



Caution:
Some models have the site glass at the piping area.

14.6 ELECTRIC SYSTEM SCHEMATIC