

FOREWORD

This Manual contains specifications, maintenance, repair, diagnostic and service procedures for the chassis, body and material handling system of the TOYOTA ELECTRIC POWERED FORKLIFT 7FB10 to 30 series and 7FBJ35.

Please use this manual for providing quick, correct servicing of the corresponding forklift models.

This manual deals with the above models as of September 1999. Please understand that disagreement can take place between the descriptions in the manual and actual vehicles due to change in design and specifications. Any change or modifications thereafter will be informed by Toyota Industrial Equipment Parts & Service News.

TOYOTA Material Handling Company

A Division of TOYOTA INDUSTRIES CORPORATION

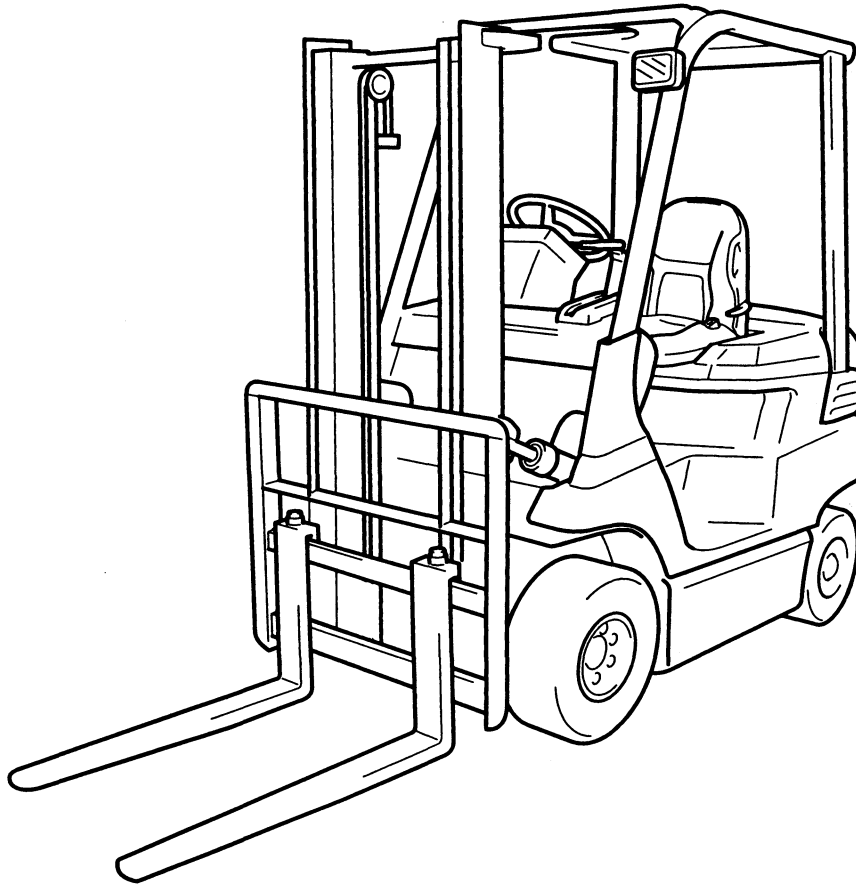
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GENERAL

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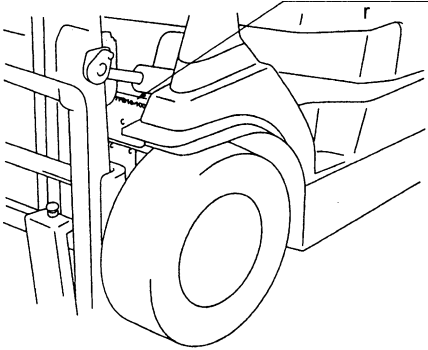
EXTERIOR VIEWS



VEHICLE MODEL

Classification		Vehicle model	Controller type	Voltage (V)
Series	Model			
1 ton series	1.0 ton model	7FB10	AC Micon controller	48
		7FBH10	↑	↑
	1.35 ton model	7FB14	↑	↑
		7FBH14	↑	↑
	1.5 ton model	7FB15	↑	↑
		7FBH15	↑	↑
		40-7FB15	↑	↑
	1.8 ton model	7FB18	↑	↑
		7FBH18	↑	↑
	2 ton series	2.0 ton model	7FB20	↑
7FBH20			↑	↑
40-7FB20			↑	↑
2.5 ton model		7FB25	↑	↑
		7FBH25	↑	↑
		40-7FB25	↑	↑
3 ton series	3.0 ton model	7FB30	↑	80
	3.5 ton model	7FBJ35	↑	↑

FRAME NUMBER

	Drive motor model	Vehicle model	Punching format	Punching position
1 ton series	AP11	7FB10	7FB18-10001	 <p>Frame number punching position</p>
		7FBH10		
		7FB14		
		7FBH14		
		7FB15		
		7FBH15		
		7FB18		
		7FBH18		
2 ton series	AP15	40-7FB15	7FB25-10001	
		7FB20		
		7FBH20		
		7FB25		
	AP15	40-7FB20	407FB25-10001	
		40-7FB25		
3 ton series	AP16	7FB30	7FBJ35-10001	
		7FBJ35		

Note: © in place of [-] on vehicles for EEC.

HOW TO USE THIS MANUAL

EXPLANATION METHOD

1. Operation procedure

(1) The operation procedure is described in either pattern A or pattern B below.

Pattern A: Explanation of each operation step with illustration.

Pattern B: Explanation of operation procedure by indicating step numbers in one illustration, followed by explanation of cautions and notes summarized as point operations.

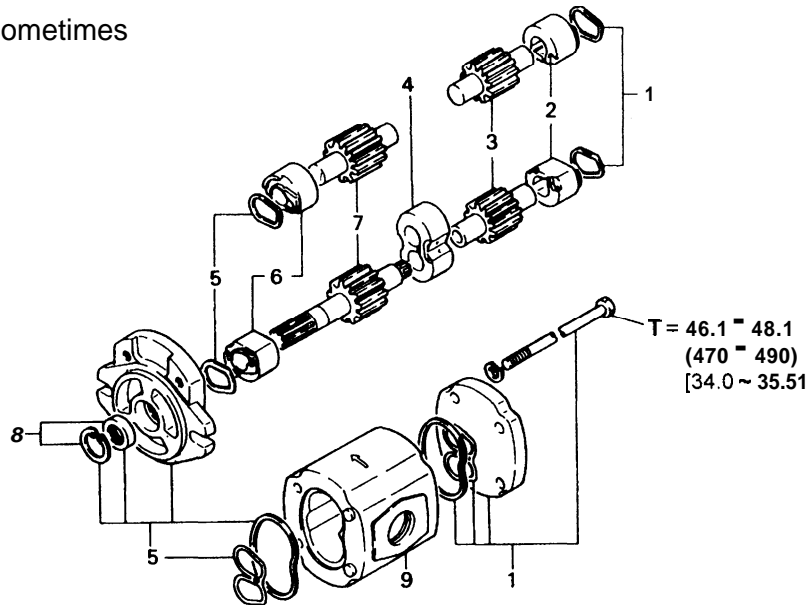
Example of description in pattern B

0

DISASSEMBLY·INSPECTION·REASSEMBLY

Tightening torque unit T = N·m(kgf-cm)[ft-lbf]

- Step Nos. are partially sometimes omitted in illustrations.



Disassembly Procedure

- 1 Remove the cover. **[Point 1]**
- 2 Remove the bushing **[Point 2]** ● Operation explained later
- 3 Remove the gear.

Point Operations

Explanation of key point for operation with an illustration

[Point 1]

Disassembly: Put a match mark when removing the pump cover.

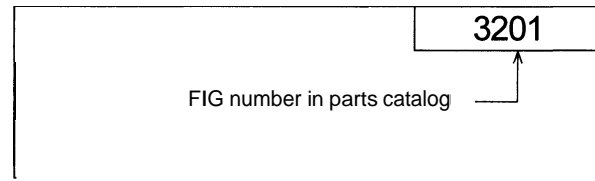
[Point 2]

Inspection: Measure the bush inside diameter.

Limit: 19.12 mm (0.7528 in)

2. How to read components figures
- (1) The components figure uses the illustration in the parts catalog for the vehicle model. Please refer to the catalog for checking the part name. The number at the right shoulder of each components figure indicates the Fig. number in the parts catalog.

(Example)



3. Matters omitted in this manual
- (1) This manual omits description of the following jobs, but perform them in actual operation:
- ① Cleaning and washing of removed parts as required
 - ② Visual inspection (partially described)

TERMINOLOGY

Caution:
Important matters of which negligence may cause accidents. Be sure to observe them.

Note:
Important items of which negligence may cause accidents, or matters in operation procedure requiring special attention.

Standard: Values showing allowable range in inspection and adjustment.
Limit: Maximum or minimum allowable value in inspection or adjustment.

ABBREVIATIONS

Abbreviation (code)	Meaning	Abbreviation (code)	Meaning
ASSY	Assembly	SAS	System of active stability
LH	Left hand	SST	Special service tool
LLC	Long life coolant	STD	Standard
M/T	Manual transmission	T=	Tightening torque
OPT	Option	TIC	Torque converter & transmission
O/S	Oversize	OOT	Number of teeth (0 0)
PS	Power steering	U/S	Undersize
RH	Right hand	W/	With
SAE	Society of Automotive Engineers (USA)	L/	Less

SI UNITS

Meaning of SI

SI represents the International System of Units, which has been established for unifying various systems of units used in the past, for smoother international technical communication.

New Units Adopted in SI

Characteristic	New unit	Conventional unit	Conversion rate* ¹ (1 [conventional unit] = X [SI unit])
Force* ²	N (newton)	kgf	1 kgf = 9.80665 N
Torque* ² (moment)	N.m	kgf.cm	1 kgf.cm = 9.80665 N.m
Pressure* ²	P (pascal)	kgf/cm ²	1 kgf/cm ² = 98.0665 kPa = 0.0980665 MPa
↑	↑	mmHg	1 mmHg = 0.133322 kPa
Revolving speed	r/min	rpm	1 rpm = 1 r/min
Spring constant* ²	N/mm	kgf/mm	1 kgf/mm = 9.80665 N/mm
Volume	L	cc	1 cc = 1 mL
Power	W	PS	1 PS = 0.735499 kW
Heat quantity	W.h	cal	1 kcal = 1.16279 W.h
Specific fuel consumption	g/W.h	g/PS.h	1 g/PS.h = 1.3596 g/kW.h

<Reference>

*1: X represents the value in SI unit as converted from 1 [in conventional unit], which can be used as the rate for conversion between conventional and SI units.

*2: In the past, kilogram [kg] representing the mass was often used in place of weight kilogram [kgf] that should be used as the unit of force.

Conversion between Conventional and SI Units

Value in SI unit = Conversion rate \times value in conventional unit	Conversion rate: Figure corresponding to X in the conversion rate column in the table above
Value in conventional unit = Value in SI unit \div Conversion rate	

Caution:

At the time of conversion, change the unit of the value in conventional or SI unit to the one in the conversion rate column in the table above before calculation. When converting 100 W to the value in conventional unit PS, change it to 0.1 kW first and divide by 0.735499 as the conversion rate.

OPERATIONAL TIPS

1. Safe operation

- (1) After jacking up, always support with wooden blocks or rigid stands.
- (2) When hoisting the vehicle or its heavy component, use wire rope(s) with a sufficient reserve in load capacity.
- (3) Always disconnect the battery plug before the inspection or servicing of electrical parts.

2. Tactful operation

- (1) Prepare the mechanic tools, necessary measuring instruments (circuit tester, megger, oil pressure gauge, etc.) and SSTs before starting operation.
- (2) Before disconnecting wiring, always check the cable color and wiring state.
- (3) When overhauling functional parts, complicated portions or related mechanisms, arrange the parts neatly to prevent confusion.
- (4) When disassembling and inspecting such a precision part as the control valve, use clean tools and operate in a clean location.
- (5) Follow the described procedures for disassembly, inspection and reassembly.
- (6) Replace gaskets, packing and O-rings with new ones each time they are disassembled.
- (7) Use genuine Toyota parts for replacement.
- (8) Use specified bolts and nuts. Observe the specified tightening torque at the time of reassembly. (Tighten to the center of the specified tightening torque range.)
If no tightening torque is specified, tighten the bolt or nut according to the standard tightening torque table.

3. Protection of functional parts

- (1) Thoroughly check each connector for any failure in or imperfect connection before reconnecting the battery plug after the end of vehicle inspection or maintenance.
Failure in or imperfect connection of connectors related to controllers, especially, may damage elements inside the controllers.

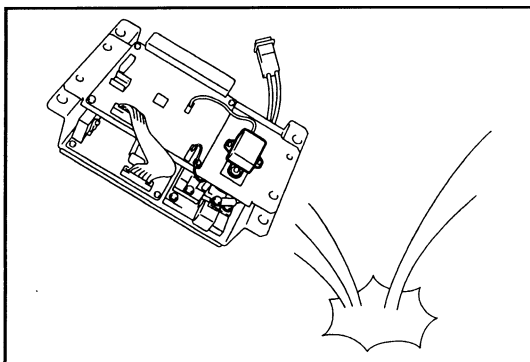
4. Confirming defect status

Do not start immediate disassembly or replacement, but first confirm if such disassembly or replacement is actually needed.

5. Handling of waste fluid, etc.

When draining waste fluid from the vehicle, always receive it with an appropriate container. Since careless or arbitrary discharge or disposal of oil, fuel, coolant, oil filter, battery or any other harmful substance may cause adverse affect to people or environmental destruction, sort each waste and always ask an authorized contractor for appropriate disposal.

6. Handling of electronic parts

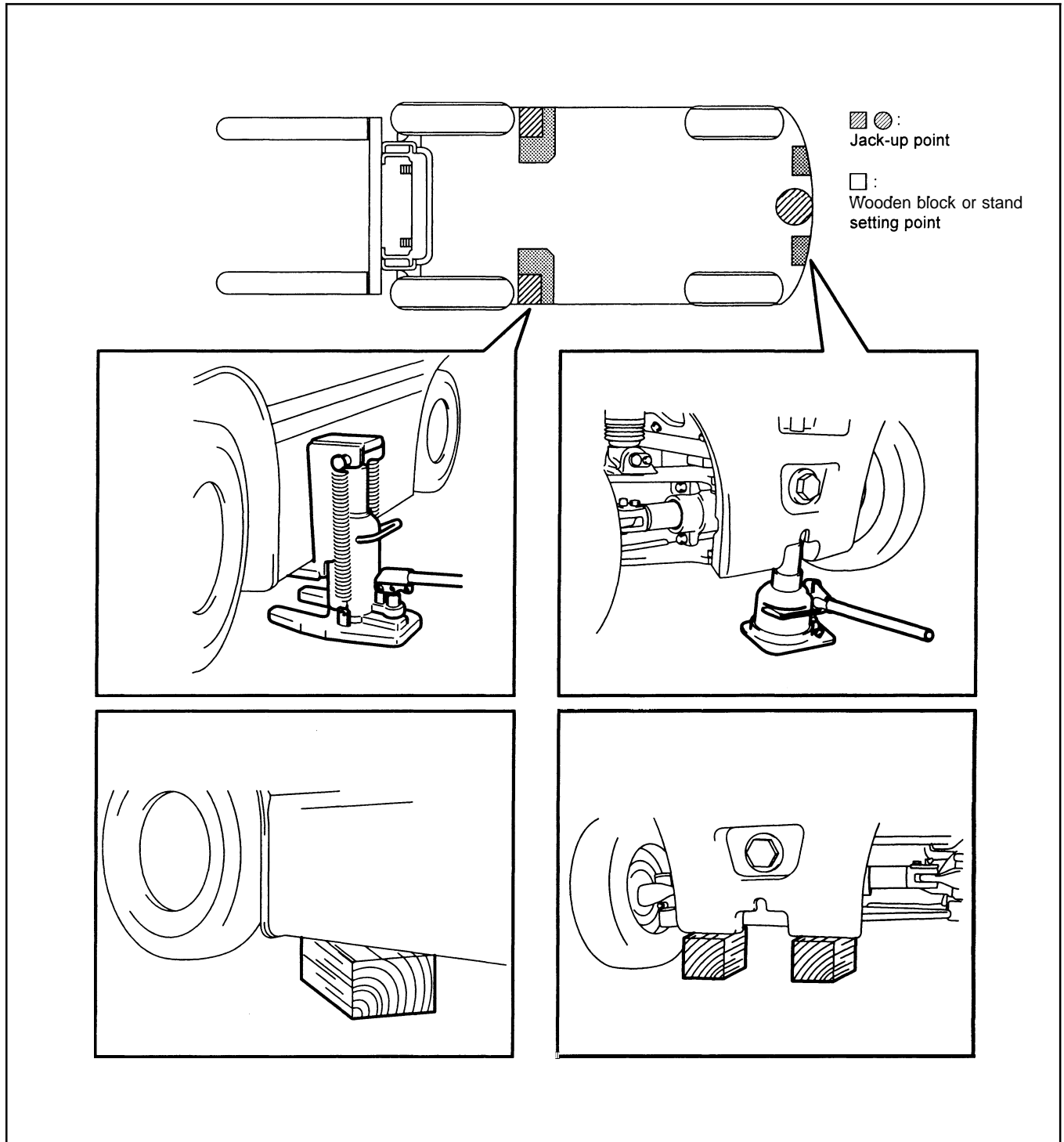


- (1) Never apply impacts to electronic parts such as a microcomputer or relay.
- (2) Never let electronic parts be exposed to a high temperature or humidity.
- (3) Do not touch connector pins since they may be deformed or be damaged due to static electricity.

JACK-UP POINT

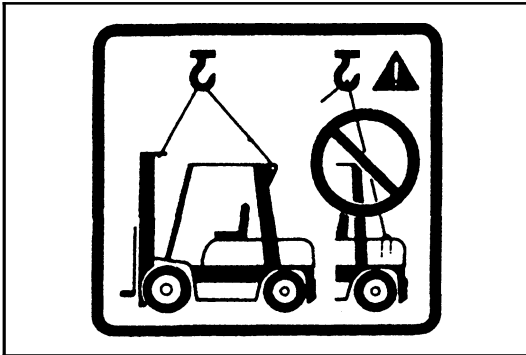
Strictly observe the following instructions when jacking up the vehicle.

- When a load is on the fork, unload it and park the vehicle on a flat floor. Be sure to avoid an inclined or rugged place.
- Use a jack with ample capacity and jack up the vehicle at the specified jack-up point. Jacking up at any other point will be dangerous.
- Never operate while the vehicle is held with a jack. Always support the frame with a wooden block after jacking up.
- In any case, never let a part of the body (including hands and feet) be under the jacked-up vehicle.

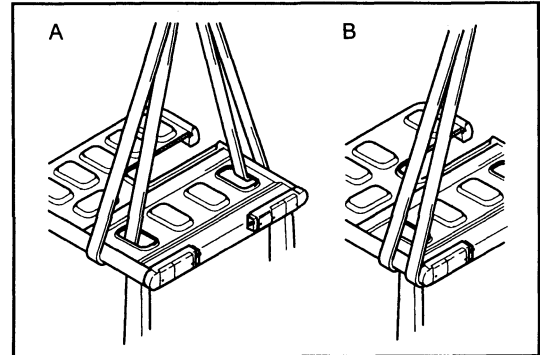


HOISTING THE VEHICLE

Always hoist each part of the vehicle at the specified position. Never hoist at any other position because it is very dangerous.



When hoisting the vehicle, sling with a fiber or wire rope at the mast hook hole and the rear end of the head guard.



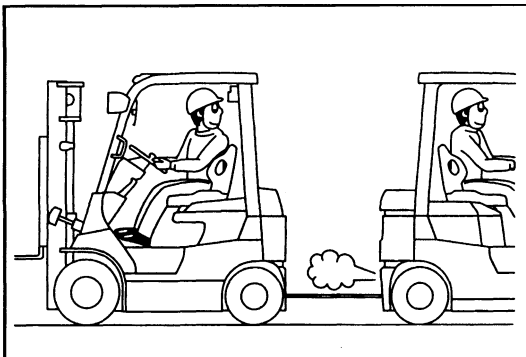
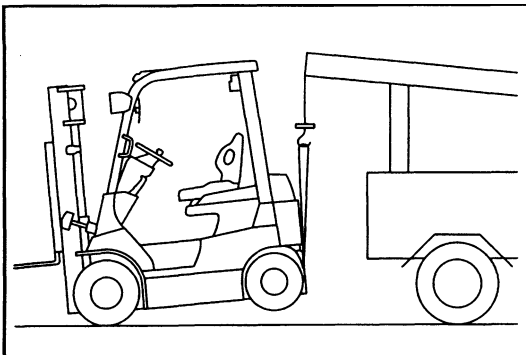
Slinging the head guard can be done in two illustrated ways.

Case A:

Remove the head guard sheet.

case B:

If the fiber or wire rope comes into contact with a rear combination lamp, remove the lamp ASSY.



CAUTION FOR TOWING

1. When towing the forklift, always lift the rear wheels away from the ground.
2. The traveling speed in towing must not exceed the maximum traveling speed of the forklift.
3. Always set the key switch to OFF and the direction switch to the neutral position before starting towing. In case of towing by connection with a wire rope with the operator on the forklift, however, set the key switch to ON (PS operation) and always set the direction switch to the neutral position.
4. Before towing, either remove the fork or take an action to prevent fork contact with the ground due to bounding.

ATTENTIVE POINTS ON SAS

1. Read Section 18 SAS "Precautions for Repair" on Page 18-9 in this repair manual in advance.
2. Whenever the repair or replacement is performed to the place where relative to SAS function, re-setting procedure by which the SAS regain proper function must be performed. (See Page 18-19)
3. The warning on the SAS caution label must be confirmed when the modification or change is such as to change the original specification.
If improper, change the label. (See Page 18-10-1)
4. Care should always be exercised for safety operation whenever you operate the truck.
Make distinction between the SAS featured trucks and those of none, because the control features are different.
5. The SAS oil control valves comprise many precision valves. Since dirty or contaminated hydraulic oil will adversely affect the functions of these valves, always wash the parts clean at the time of installation after disassembly or for replacement of hydraulic parts (valves, piping, etc.). Periodic replacement of the hydraulic oil is very important.
6. Since this vehicle uses high-precision electronic devices, modification of electrical parts may cause faults. Always use genuine Toyota parts when replacing or installing electrical parts (auxiliary equipment, optional parts, etc.).

CIRCUIT TESTER

Circuit testers are available in both the analog and digital types. They should be used selectively according to the purpose of measurement.

Analog type: This type is convenient for observing movement during operation, but the measured value should only be used for reference or rough judgement.

Digital type: Fairly accurate reading is possible, but it is difficult to observe the variation or movement.

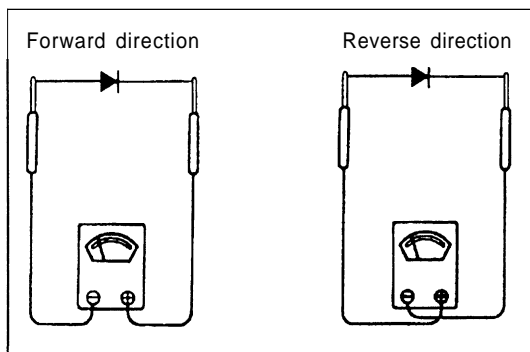
1. Difference in measurement results with the digital type and analog type

* The result may be different between measurements with the analog type and digital type.

Always use a circuit tester according to its operation manual.

Cautions when the polarities are different between the analog type and digital type are described below.

(1) Analog circuit tester

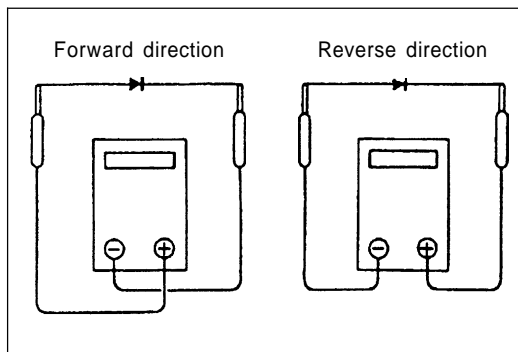


Measurement result example

Tester range: $k\Omega$ range

	Analog type
Forward	Continuity exists
	11 $k\Omega$
Reverse	No continuity
	∞

(2) Digital circuit tester



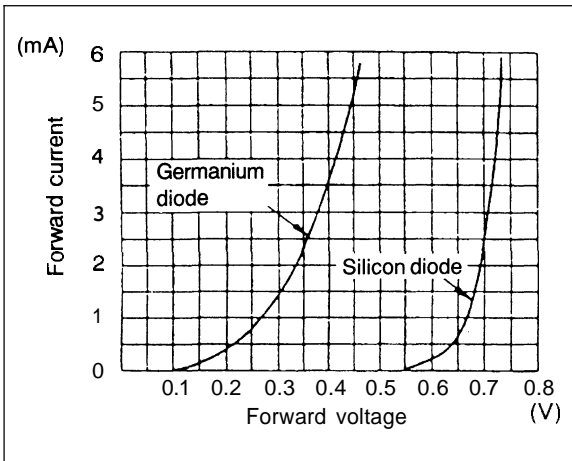
Measurement result example

Tester range: $M\Omega$ range

	Digital type
Forward	No continuity
	1
Reverse	Continuity exists
	2 $M\Omega$

2. Difference in result of measurement with circuit tester

The circuit tester power supply voltage depends on the tester type. 1.5 V, 3.0 V or 6.0 V is used. The resistance of a semiconductor such as a diode varies with the circuit tester power supply voltage. The diode characteristics are shown in the figure below.

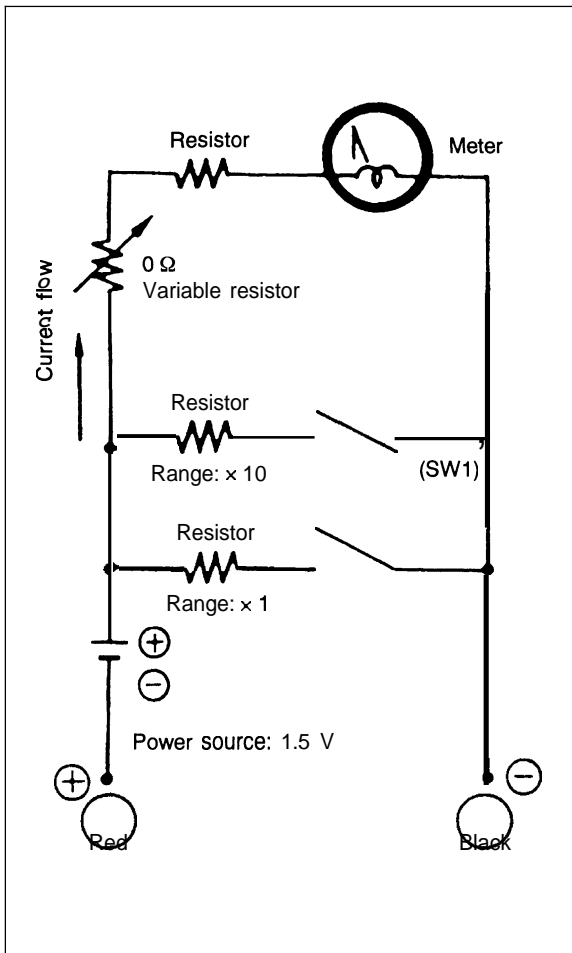


The resistance values of the same semiconductor measured with two types of circuit testers having different power supply voltages are different.

This manual describes the results of measurement with a circuit tester whose power supply voltage is 3.0 V.

3. Difference in measurement result by measurement range (analog type)

In the analog type circuit tester, changing the measurement range switches over the internal circuit to vary the circuit resistance. Even when the same diode is measured, the measurement result varies with the measurement range.



Always use the range described in the repair manual for measurement.








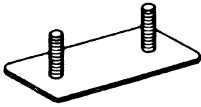


STANDARD BOLT & NUT TIGHTENING TORQUE

Standard bolt and tightening torques are not indicated.
Judge the standard tightening torque as shown below.

1. Find out the type of the bolt from the list below and then find the bolt tightening torque from the table.
2. The nut tightening torque can be judged from the mating bolt type.

BOLT STRENGTH TYPE IDENTIFICATION METHOD

1. Identification by bolt shape

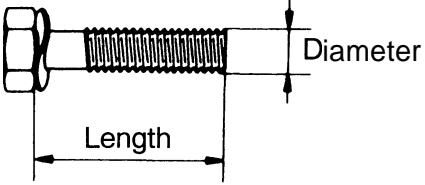
	Shape and class	Class
Hexagon head bolt	 Bolt head No.	4 = 4T 5 = 5T 6 = 6T 7 = 7T 8 = 8T
	 No mark	4T
Hexagon flange bolt	 No mark	4T
Hexagon head bolt	 Two protruding lines	5T
Hexagon flange bolt	 Two protruding lines	6T
Hexagon head bolt	 Three protruding lines	7T
Hexagon head bolt	 Four protruding lines	8T
Welded bolt		4T
Stud bolt	 No mark	4T
	 Grooved	6T

2. Identification by part No.

Hexagon head bolt

Parts No.
91611-40625

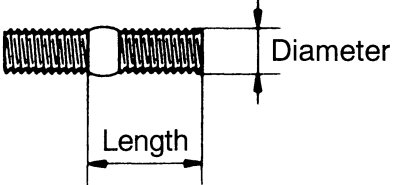
Length (mm)
Diameter (mm)
Class





Stud bolt

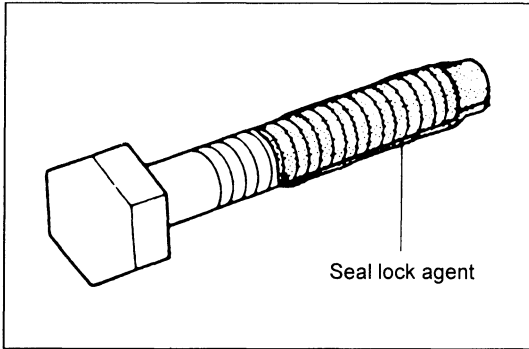
Part No.
92132-40614

Length (mm)
Diameter (mm)
Class



TIGHTENING TORQUE TABLE

Class	Diameter mm	Pitch mm	Specified torque					
			Hexagon head bolt 			Hexagon flange bolt 		
			N·m	kgf·cm	ft-lbf	N·m	kgf·cm	ft-lbf
4T	6	1.0	5.4	55	48 in-lbf	5.9	60	52 in-lbf
	8	1.25	13	130	9	14	145	10
	10	1.25	25	260	19	28	290	21
	12	1.25	47	480	35	53	540	39
	14	1.5	75	760	55	83	850	61
	16	1.5	113	1150	83	—	—	—
5T	6	1.0	6.4	65	56 in-lbf	7.5	75	65 in-lbf
	8	1.25	16	160	12	18	175	13
	10	1.25	32	330	24	36	360	26
	12	1.25	59	600	43	65	670	48
	14	1.5	91	930	67	100	1050	76
	16	1.5	137	1400	101	157	1600	116
6T	6	1.0	7.8	80	69 in-lbf	8.8	90	78 in-lbf
	8	1.25	19	195	14	21	215	16
	10	1.25	38	400	29	43	440	32
	12	1.25	72	730	53	79	810	59
	14	1.5	110	1100	80	123	1250	90
	16	1.5	170	1750	127	191	1950	141
7T	6	1.0	11	110	8	12	120	9
	8	1.25	25	260	19	28	290	21
	10	1.25	52	530	38	58	590	43
	12	1.25	95	970	70	103	1050	76
	14	1.5	147	1500	108	167	1700	123
	16	1.5	226	2300	166	—	—	—
8T	6	1.0	12	125	9	14	145	9
	8	1.25	29	300	22	32	330	24
	10	1.25	61	620	45	68	690	50
	12	1.25	108	1100	80	123	1250	90
	14	1.5	172	1750	127	196	2000	145
	16	1.5	265	2700	195	299	3050	221



PRECOAT BOLTS

(Bolts with seal lock agent coating on threads)

1. Do not use the precoat bolt as it is in either of the following cases:
 - (a) After it is removed.
 - (b) When the precoat bolt is moved (loosened or tightened) by tightness check, etc.

Note:

For torque check, use the lower limit of the allowable tightening torque range. If the bolt moves, re-tighten it according to the steps below.


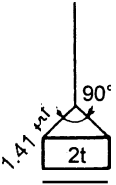
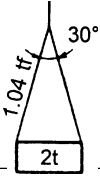
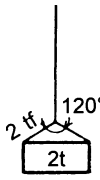
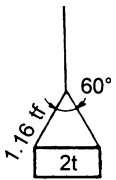
2. Method for reuse of precoat bolts
 - (1) Wash the bolt and threaded hole. (The threaded hole must be washed even for replacement of the bolt.)
 - (2) Perfectly dry the washed parts by air blowing.
 - (3) Coat the specified seal lock agent to the threaded portion of the bolt.

HIGH PRESSURE HOSE FITTING TIGHTENING TORQUE

1. When connecting a high pressure hose, wipe the hose fitting and mating nipple contact surfaces with clean cloth to remove foreign matters and dirt. Also check no dent or other damage on the contact surfaces before installation.
2. When connecting a high pressure hose, hold the hose to align the fitting with the nipple and tighten the fitting.
3. The maximum tightening torque must not exceed twice the standard tightening torque.

Nominal diameter of screw	Standard tightening torque N·m (kgf·cm)[ft·lbf]		Hose inside diameter mm (in)
	Standard	Tightening range	
7/16 — 20UNF	25 (250) [18.1]	24 ~ 26 (240 ~ 270) [17.4 ~ 19.5]	6 (0.24)
9/16 — 18UNF	49 (500) [36.21]	47 ~ 52 (480 ~ 530) [34.7 ~ 38.31]	9 (0.35)
3/4 — 16UNF	59 (600) [43.41]	56 ~ 62 (570 ~ 630) [41.2 ~ 45.61]	12 (0.47)
7/8 — 14UNF	59 (600) [43.41]	56 ~ 62 (570 ~ 630) [41.2 ~ 45.61]	12 (0.47), 15 (0.59)
1-1/16 — 12UNF	118 (1200) [86.81]	112 ~ 123 (1140 ~ 1250) [82.5 ~ 90.41]	19 (0.75)
1-5/16 — 12UNF	137 (1400) [101.3]	130 ~ 144 (1330 ~ 1470) [96.2 ~ 106.4]	25 (0.98)
PF1/4	25 (250) [18.1]	24 ~ 26 (240 ~ 270) [17.4 ~ 19.5]	6 (0.24)
PF3/8	49 (500) [36.21]	47 ~ 52 (480 ~ 530) [34.7 ~ 38.31]	9 (0.35)
PF1/2	59 (600) [43.41]	56 ~ 62 (570 ~ 630) [41.2 ~ 45.61]	12 (0.47)
PF3/4	118 (1200) [86.81]	112 ~ 123 (1140 ~ 1250) [82.5 ~ 90.41]	19 (0.75)
PF1	137 (1400) [101.3]	130 ~ 144 (1330 ~ 1470) [96.2 ~ 106.41]	25 (0.98)

WIRE ROPE SUSPENSION ANGLE LIST

Lifting angle	Tension	Compression	Suspension method	Lifting angle	Tension	Compression	Suspension method
0°	1.00 time	0 time		90°	1.41 time	1.00 time	
30°	1.04 time	0.27 time		120°	2.00 time	1.73 time	
60°	1.16 time	0.58 time					

SAFE LOAD FOR EACH WIRE ROPE SUSPENSION ANGLE

unit: N (tf) [lbf]

Rope diameter	Cutting load	Single-rope suspension	Two-rope suspension					Four-rope suspension			
		0°	0°	30°	60°	90°	0°	30°	60°	90°	
6 mm (0.24 in)	21380 (2.18) [4807]	3040 (0.31) [683.6]	6080 (0.62) [1367]	5880 (0.6) [1323]	5200 (0.53) [1169]	4310 (0.44) [970]	12160 (1.24) [2734]	11770 (1.2) [2646]	10400 (1.06) [2337]	8630 (0.88) [1940]	
8 mm (0.32 in)	31480 (3.21) [7078]	4410 (0.45) [992.3]	8830 (0.9) [1985]	8530 (0.87) [1918]	7650 (0.78) [1720]	6280 (0.64) [1411]	17650 (1.8) [3969]	17060 (1.74) [3937]	15300 (1.56) [3440]	12550 (1.28) [2822]	
10 mm (0.4 in)	49230 (5.02) [11.69]	6960 (0.71) [1565.6]	14020 (1.43) [3153]	13440 (1.37) [3021]	11770 (1.2) [2646]	9810 (1.0) [2205]	27460 (2.8) [6174]	26480 (2.7) [5954]	23540 (2.4) [5292]	19610 (2.0) [4410]	
12.5 mm (0.5 in)	76880 (7.84) [17387]	10980 (1.12) [2469.5]	21570 (2.2) [4851]	21280 (2.1) [4631]	18630 (1.9) [4190]	14710 (1.5) [3308]	43150 (4.4) [9702]	41190 (4.2) [9261]	37270 (3.8) [8379]	29420 (3.0) [6615]	
14 mm (0.56 in)	96400 (9.83) [21675]	13730 (1.4) [3087]	27460 (2.8) [6174]	26480 (2.7) [5954]	23540 (2.4) [5292]	18630 (1.9) [4190]	54920 (5.6) [12348]	52960 (5.4) [11907]	47070 (4.8) [10584]	37270 (3.8) [8379]	

COMPONENTS WEIGHT

Member weight list

Unit: kg

Member	Vehicle model	Weight
Battery ASSY	See page 1-2	
Drive motor ASSY	See page 6-2	
Pump motor ASSY	See page 6-8	
Front axle & drive unit W/drive motor	1 ton series (excluding 40-7FB15)	Approx. 450
	2 ton series (excluding 40-7FB20-25), and 40-7FB15	Approx. 280
	3.0 ton-J3.5 ton, and 40-7FB20.25	Approx. 400
Rear axle ASSY	1 ton series	Approx. 75
	2 ton series	Approx. 75
	3.0 ton-J3.5 ton	Approx. 85
Counterweight	1.0 ton (*1)	Approx. 400 (*1 Approx. 415)
	1.35 ton	Approx. 470
	1.5 ton (*1) (*2)	Approx. 545 (*1 Approx. 545) (*2 Approx. 700)
	1.8 ton	Approx. 720
	2.0 ton	Approx. 825
	2.5 ton (*1) (*2)	Approx. 1205 (*1 Approx. 1165) (*2 Approx. 915)
	3.0 ton	Approx. 1380
J3.5 ton	Approx. 1800	
Oil control valve	Approx. 20	
Oil pump	Approx. 4	
Seat stand ASSY	Approx. 45	
V mast ASSY W/lift bracket (W/lift cylinder, L/fork, lifting height: 3,000 mm)	1 ton series (excluding 40-7FB15)	Approx. 410
	2 ton series (excluding 40-7FB20.25) and 40-7FB15	Approx. 465
	3 ton	Approx. 570
	J3.5 ton	Approx. 680

*1: 7FBH series *2: 40-7FB series

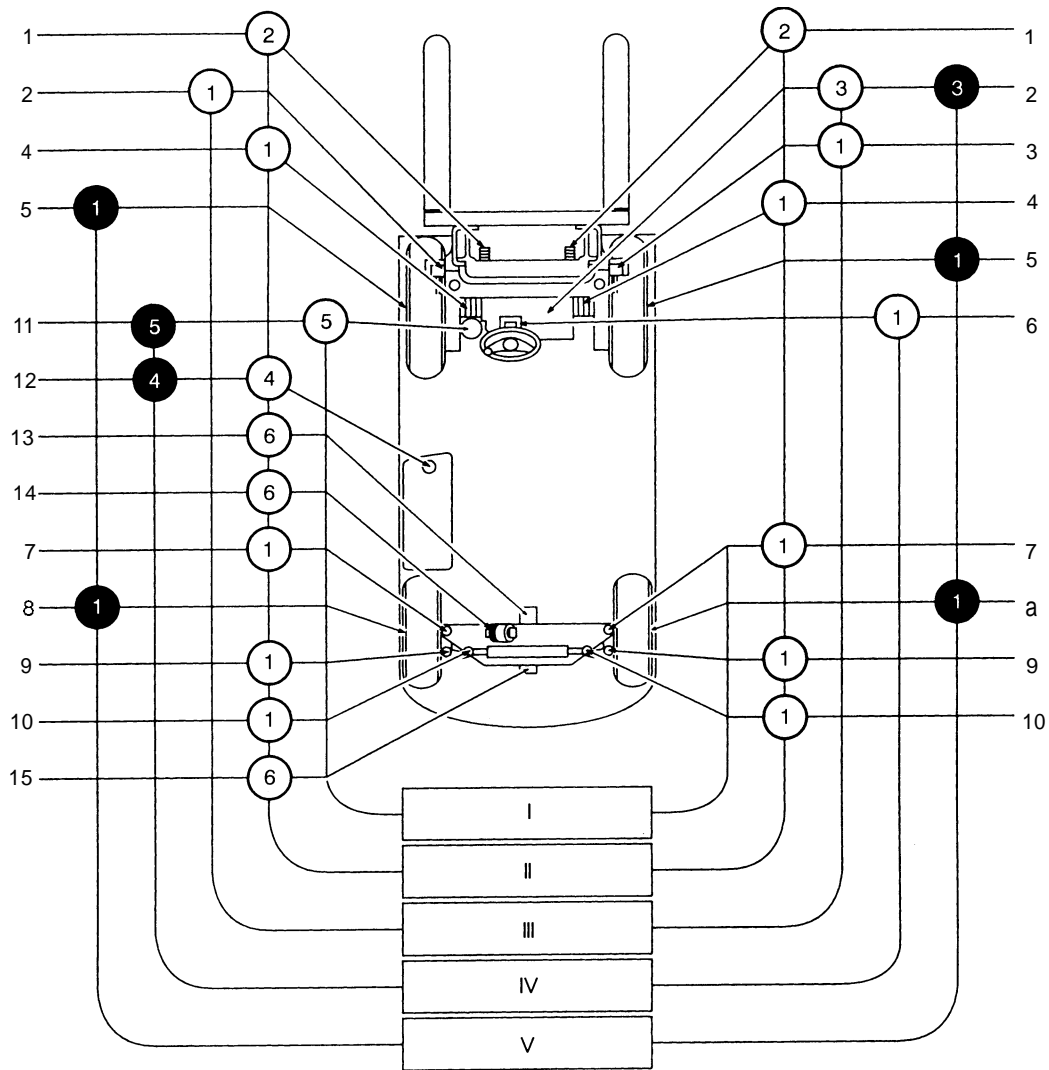
RECOMMENDED LUBRICANT QUANTITY & TYPES

Amounts and Types of Specified Lubricants

Applicable portion	Type		
Drive unit	Hypoid Gear Oil (SAE75W-80W)	1 ton series (excluding40-7FB15)	4.0 ℓ
		2 ton series (excluding40-7FB20-25), and 40-7FB15	4.2 ℓ
		3.0 ton·J3.5 ton, and 40-7FB20.25	6.5 ℓ
		Values shown above are for reference. See page 7-8 for details.	
Hydraulic oil*: Total amount, with tank capacity in ()	STD models: Hydraulic Oil (ISO VG32) Refrigerator model: Mobil Aero HFE	1 ton series	18 ℓ (13 ℓ)
		2 ton series (excluding40-7FB20.25)	18 ℓ (13 ℓ)
		40-7FB20-25	20.5 ℓ (15.3 ℓ)
		3.0 ton	20.5 ℓ (15.3 ℓ)
		J3.5 ton	26.5 ℓ (21.6 ℓ)
Brake line	STD models: SAE J-1703 DOT-3 Refrigerator model 45S: Brake fluid Arctic S	Appropriateamount	
Chassis parts	MP Grease	Appropriateamount	
Battery	Distilled water	Appropriateamount	

*Standard mast

LUBRICATION CHART



- | | | | |
|---|---|------|--------------------------------------|
| ○ | Inspection and supply | I. | Inspect every 8 hours (daily) |
| ● | Replacement | II. | Inspect every 40 hours (weekly) |
| ① | MP Grease | III. | Inspect every 170 hours (monthly) |
| ② | Engine Oil | IV. | Inspect every 1000 hours (6 monthly) |
| ③ | Hypoid gear Oil (SAE75W-80W) | V. | Inspect every 2000 hours (annual) |
| ④ | Hydraulic Oil (ISO VG32) | | |
| ⑤ | Brake Fluid | | |
| | Refrigerator type S45: Brake Fluid Arctic S | | |
| ⑥ | Molybdenum disulfide gress | | |

- | | | | |
|---|------------------------------|----|-------------------------------|
| 1 | Chain | 10 | Rear axle cylinder end pin |
| 2 | Drive unit | 11 | Brake master cylinder |
| 3 | Tilt cylinder front pin | 12 | Oil tank |
| 4 | Mast support bush | 13 | Rear axle beam front pin |
| 5 | Front wheel bearing | 14 | Swing lock cylinder lower pin |
| 6 | Tilt steering lock mechanism | 15 | Rear axle beam rear pin |
| 7 | Steering knuckle king pin | | |
| 8 | Rear wheel bearing | | |
| 9 | Tie rod end pin | | |

PERIODIC MAINTENANCE

INSPECTION METHOD

I : Inspection-Repair or replacement if required.
 M : Measurement-Repair or adjustment if required.
 T : Retightening C: Cleaning L: Lubrication
 * : For new vehicle *1: Flaw detector

Item		Inspection Period	Every month	Every 3 months	Every 6 months	Every 12 months
			Every 170 hours	Every 500 hours	Every 1000 hours	Every 2000 hours
ELECTRICAL SYSTEM						
Motor	Rotation sound	I	←	←	←	←
	Looseness in the connecting parts	T	←	←	←	←
	Insulation resistance			M	←	←
	Brush wear and sliding condition (For PS motor only)				I	←
	Commutator contamination, damage (For PS motor only)				I	←
	Brush, spring wear (For PS motor only)					M
Battery	Charging level	I	←	←	←	←
	Electrolyte level	I	←	←	←	←
	Electrolyte specific gravity	M	←	←	←	←
	Terminal looseness	I	←	←	←	←
	Abnormality in the upper portion of the battery case	I	←	←	←	←
	Insulation resistance			M	←	←
	Voltage measurement of each battery cell after charging					M
Charger	Timer function	I	←	←	←	←
	Terminal looseness	I	←	←	←	←
	HVR function voltage measurement			M	←	←
	Operating condition of the magnetic switch, contact contamination, roughness					I

Item		Inspection Period	Every month	Every 3 months	Every 6 months	Every 12 months
			Every 170 hours	Every 500 hours	Every 1000 hours	Every 2000 hours
Magnet contactor	Contact looseness, damage, abrasion	I	←	←	←	←
	Operating condition of the auxiliary contact, contamination, abrasion	I	←	←	←	←
	Mounting condition of the arc shooter					I
	Operating condition and timings					I
	Looseness of the coil mounting parts					I
	Mounting condition of the main circuit lead wire, looseness					I
Microswitch	Operating condition and timing	I	←	←	←	←
	Damage and looseness of installing parts	I	←	←	←	←
Direction switch	Operation condition, damage	I	←	←	←	←
Controller	Operation condition	I	←	←	←	←
	Interiorcontamination, damage	C	←	←	←	←
	Motor input voltage					M
Fuse	Looseness	I	←	←	←	←
Wiring (including charging cord)	Harness deterioration, champ damage and looseness	I	←	←	←	←
	Looseness in connecting parts, taping condition	I	←	←	←	←
	Connecting condition and damage of the battery connector	I	←	←	←	←
POWER TRANSFER SYSTEM						
Drive unit	Oil leakage	I	←	←	←	←
	Oil level	I	←	←	←	←
	Bolt or nut looseness					T
DRIVE SYSTEM						
Wheels	Tire inflation pressure	M	←	←	←	←
	Tire cuts, damage and uneven wearing	I	←	←	←	←
	Loose rim and hub nuts	T	←	←	←	←
	Tire groove depth	M	←	←	←	←
	Metal chips, pebbles and other foreign matter trapped in tire grooves	I	←	←	←	←
	Rim, side bearing and disc wheel damage	I	←	←	←	←
	Abnormal sound and looseness of front wheel bearing	I	←	←	←	←

Item		Inspection Period	Every 1 month	Every 3 months	Every 6 months	Every 12 months
			Every 170 hours	Every 500 hours	Every 1000 hours	Every 2000 hours
Wheel	Abnormal sound and looseness of rear wheel bearing		I	←	←	←
Front axle	Cracks, damage and deformation of housing					I
Rear axle	Cracks, damage and deformation of beam					I
	Looseness of axle beam in vehicle longitudinal direction	M*				M
STEERING SYSTEM						
Steering wheel	Play and looseness		I	←	←	←
	Function		I	←	←	←
Steering valve	Oil leak		I	←	←	←
	Looseness of mounting		T	←	←	←
Power steering	Oil leak		I	←	←	←
	Mounting and linkage looseness		I	←	←	←
	Damage of power steering hose					I
Knuckle	King pin looseness		I	←	←	←
	Cranks and deformation					I
BRAKING SYSTEM						
Brake pedal	Play and reserve		M	←	←	←
	Braking effect		I	←	←	←
Parking brake	Operating force		I	←	←	←
	Braking effect		I	←	←	←
	Rod and cable looseness and damage		I	←	←	←
Brake pipe	Leak, damage and mounting condition		I	←	←	←
Reservoir tank	Leak and fluid level		I	←	←	←
Master cylinder and wheel cylinder	Function, wear, damage, leak and mounting looseness					I

Item		Inspection Period			
		Every 1 month	Every 3 months	Every 6 months	Every 12 months
		Every 170 hours	Every 500 hours	Every 1000 hours	Every 2000 hours
Brake drum and brake shoe	Clearance between drum and lining	M	←	←	←
	Wear of shoe sliding portion and lining				I
	Drum wear and damage				I
	Shoe operating condition				I
	Anchor pin rusting				I
	Return spring fatigue				M
	Automatic adjuster function				I
Backing plate	Deformation, cracks and damage				I
	Loose mounting				T
MATERIAL HANDLING SYSTEM					
Forks	Abnormality of fork and stopper pin	I	←	←	←
	Misalignment between left and right fork fingers	I	←	←	←
	Cracks at fork root and welded part				I*
Mast and lift bracket	Deformation and damage of each part and crack at welded part	I	←	←	←
	Mast and lift bracket looseness	I	←	←	←
	Wear and damage of mast support bushing				I
	Wear, damage and rotating condition of rollers	I	←	←	←
	Wear and damage of roller pins				I
	Wear and damage of mast trip	I	←	←	←
Chain and chain wheel	Tension, deformation and damage of chain	I	←	←	←
	Chain lubrication	I	←	←	←
	Abnormality of chain anchor bolt	I	←	←	←
	Wear, damage and rotating condition of chain wheel	I	←	←	←
Various attachments	Abnormality and mounting condition of each part	I	←	←	←
HYDRAULIC SYSTEM					
Cylinder	Loosening and damage of cylinder mounting	T	←	←	←
	Deformation and damage of rod, rod screw and rod end	I	←	←	←
	Cylinder operation	I	←	←	←
	Natural drop and natural forward tilt (hydraulic drift)	M	←	←	←

Item		Inspection Period	Every 1 month	Every 3 months	Every 6 months	Every 12 months
			Every 170 hours	Every 500 hours	Every 1000 hours	Every 2000 hours
Cylinder	Oil leak and damage	I	←	←	←	←
	Wear and damage of pin and cylinder bearing	I	←	←	←	←
	Lifting speed	M	←	←	←	←
	Uneven movement	I	←	←	←	←
Oil pump	Oil leak and abnormal sound	I	←	←	←	←
Hydraulic oil tank	Oil level and contamination	I	←	←	←	←
	Tank and oil strainer			C	←	←
	Oil leak	I	←	←	←	←
Control lever	Loose linkage	I	←	←	←	←
	Operation	I	←	←	←	←
Oil control valve	Oil leak	I	←	←	←	←
	Relief pressure measurement					M
	Relief valve and tilt lock valve functions	I	←	←	←	←
Hydraulic piping	Oil leak	I	←	←	←	←
	Deformation and damage	I	←	←	←	←
	Loose joint	T	←	←	←	←
SAFETY DEVICES, ETC.						
Head guard	Cracks at welded portion	I	←	←	←	←
	Deformation and damage	I	←	←	←	←
Back-rest	Loosening of mounting	T	←	←	←	←
	Deformation, crack and damage	I	←	←	←	←
Lighting system	Function and mounting condition	I	←	←	←	←
Hom	Function and mounting condition	I	←	←	←	←
Direction indicator	Function and mounting condition	I	←	←	←	←
Instruments	Functions	I	←	←	←	←
Backup buzzer	Function and mounting condition	I	←	←	←	←
Rear-view mirror	Dirt, damage	I	←	←	←	←
	Rear reflection status	I	←	←	←	←
Seat	Loosening and damage of mounting	I	←	←	←	←
	Seatbelt damage and function	I	←	←	←	←

Item		Inspection Period			
		Every 1 month	Every 3 months	Every 6 months	Every 12 months
		Every 170 hours	Every 500 hours	Every 1000 hours	Every 2000 hours
Body	Damage and cracks of frame, cross members, etc.				I
	Bolt looseness				T
SAS	Functions	I	←	←	←
	Loosening and damage at sensor mounting portion	I	←	←	←
	Damage, deformation, oil leakage and loosening of the mounting of functional parts	I	←	←	←
	Loosening and damage of wire harnesses	I	←	←	←
	Lock cylinder accumulator performance				I
	Rusting and corrosion of load sensor				I
Others	Grease up	L	←	←	←

PERIODIC REPLACEMENT OF PARTS AND LUBRICANTS

● : Replacement

Item	Replacement timing					
	Every week	Every 0.5 month	Every months	Every 3 months	Every 6 months	Every 12 months
	Every 50 hours	Every 100 hours	Every 170 hours	Every 500 hours	Every 1,000 hours	Every 2,000 hours
Drive unit oil						●
Hydraulic oil					●	←
Hydraulic oil filter			● New vehicle initial replacement		●	←
Wheel bearing grease						●
Brake fluid					●	←
Brake master cylinder rubber parts						●
Wheel cylinder cup seals						●
Brake fluid reservoir hose						● Every 2 years
Power steering hose						● Every 2 years
Power steering rubber parts						● Every 2 years
Hydraulic hose						● Every 2 years
Chain						● Every 3 years
Swing lock cylinder						● Every 10,000 hours

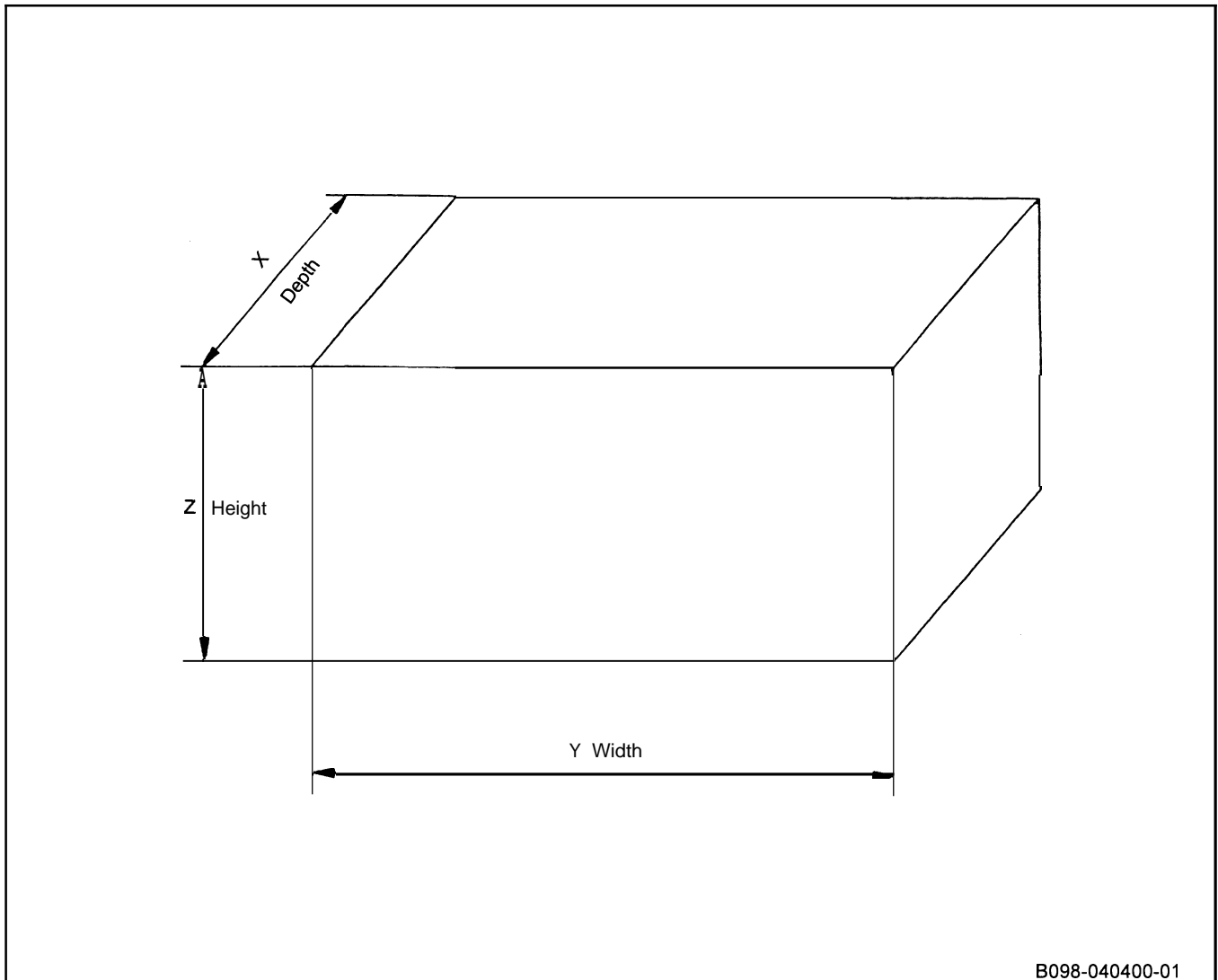
BATTERY

	Page
BATTERY COMPARTMENT AND REQUIRED WEIGHT	1-2
SERVICE STANDARDS	1-3
DISPLAY	1-3
SERVICE STANDARDS (OPT).....	1 4
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BATTERY COMPARTMENT AND REQUIRED WEIGHT

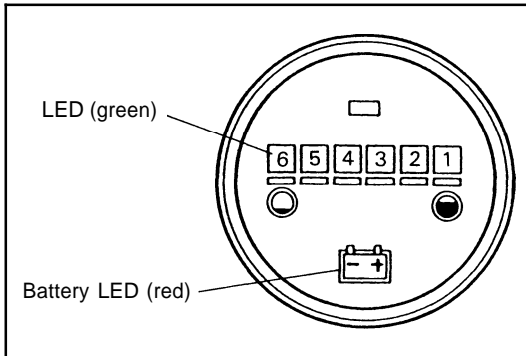
When the battery is to be purchased locally, always adjust the weight to satisfy the minimum required weight as shown in the table below.

	Compartment dimensions mm (in)			Minimum required battery weight (with case) Kg (lb)	Remarks
	Depth X	Width Y	Height Z		
7FB10, 14	747 (29.4)	821 (32.3)	460	550 (1213)	
7FB15, 18			(18.1)	655 (1444)	
7FBH10~18			540	805 (1775)	
40-7FB15	822 (32.4)	911 (35.7)	(21.3)	855 (1885)	
7FB20			460	760 (1676)	
7FB25			(18.1)	825 (1819)	
7FBH20, 25			540	1045 (2304)	
40-7FB20, 25			(21.3)	1225 (2700)	
7FB30, J35		954 (37.6)	570 (22.4)	920 (2029)	



SERVICE STANDARDS

Specific gravity upon perfect charging	1.280 [20°C (68°F)]	
Specific gravity upon end of discharge	1.150 [20°C (68°F)]	
Discharge end voltage	48 V specification	42.5 V
	80 V specification	68 V
Electrolyte	Refined dilute sulfuric acid	
Added fluid	Distilled (deionized) water	
Insulation resistance	1 MR or more	



DISPLAY

Battery Capacity Indicator

The display lights up 6 LEDs (green) to indicate the battery capacity. When battery DISCHARGE reaches 100%, the overdischarge warning function is activated. This function, however, is limited to the vehicle with the display function.

Overdischarge Warning Function

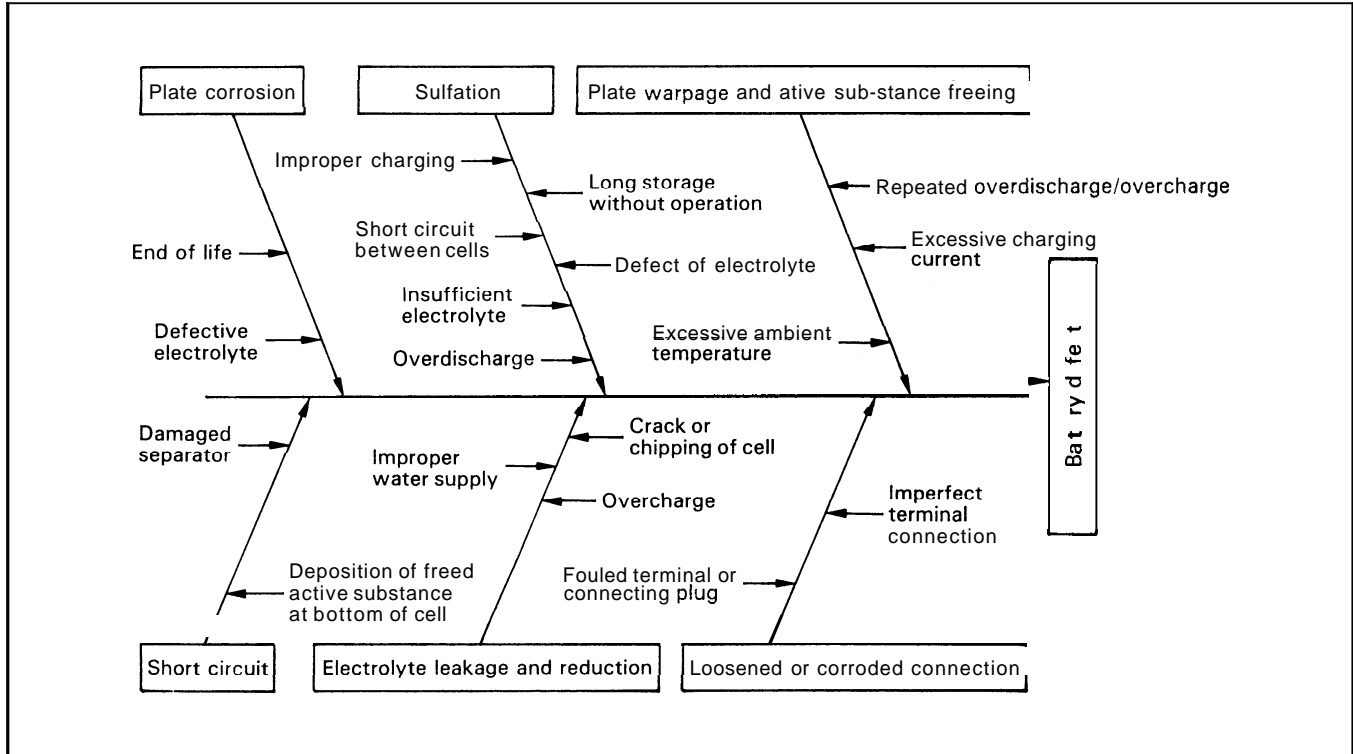
1. When this function is activated, it becomes impossible to operate for traveling and material handling at a time. Simultaneous operation, if attempted, priority is given to traveling and material handling fails. (This prevent the battery from being damaged by large current flow.)
2. Soft starting in load lifting is delayed further to make the operator feel decrease of the remaining battery capacity.

Display

Battery discharged state (%)	LEDs (green)						Battery LED (red)
	6	5	4	3	2	1	
0 to 20 (exclusive)	○	○	○	○	○	○	x
20 to 35 (exclusive)	○	○	○	○	○	x	x
35 to 50 (exclusive)	○	○	○	○	x	x	x
50 to 65 (exclusive)	○	○	○	x	x	x	x
65 to 80 (exclusive)	○	○	x	x	x	x	x
80 to 90 (exclusive)	○	○	x	x	x	x	○
90 to 100 (exclusive)	○	x	x	x	x	x	○
100 or more	x	x	x	x	x	x	○

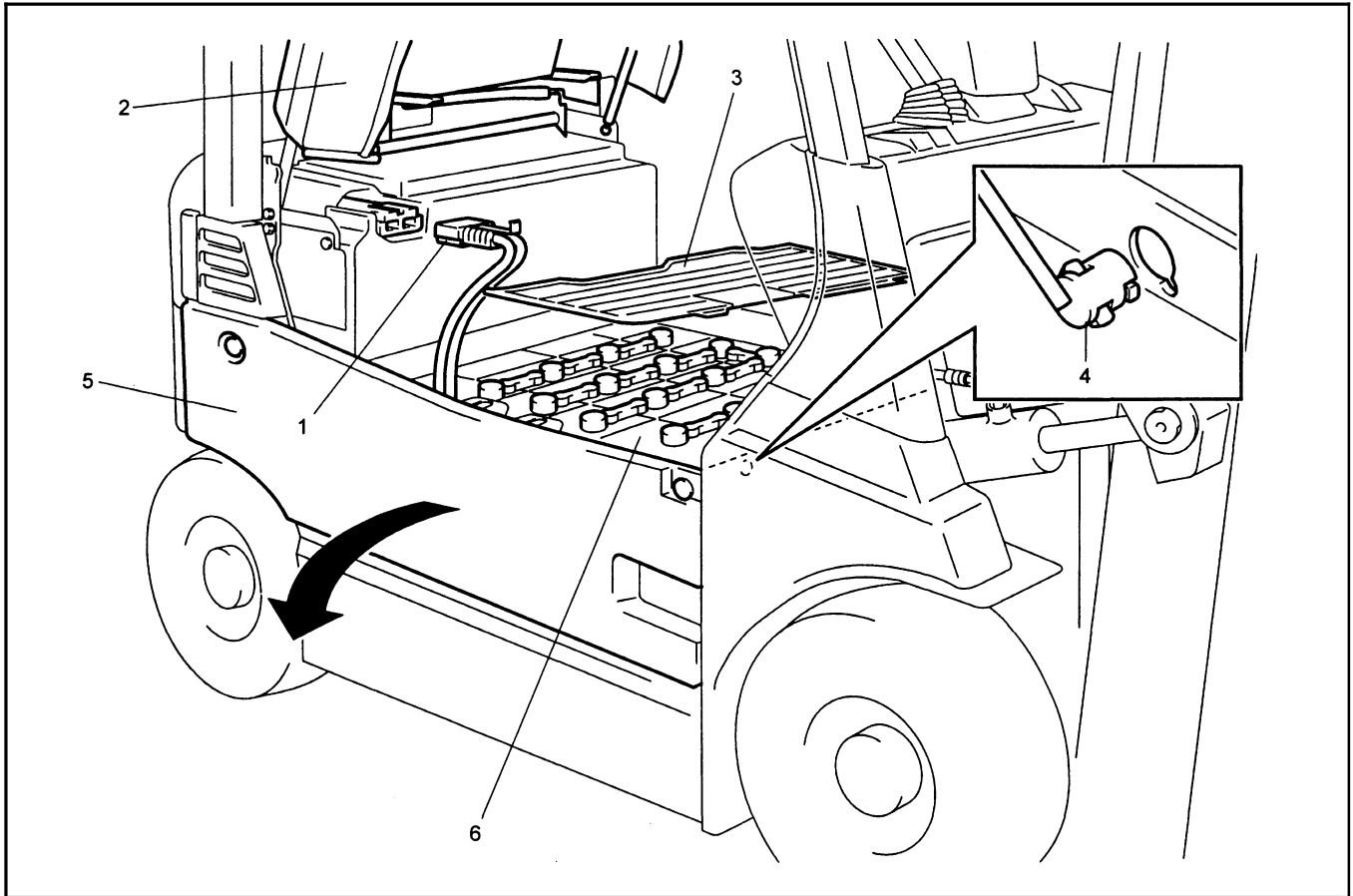
(Note) ○: On, x: Off

TROUBLESHOOTING



BATTERY ASSY

REMOVAL-INSTALLATION

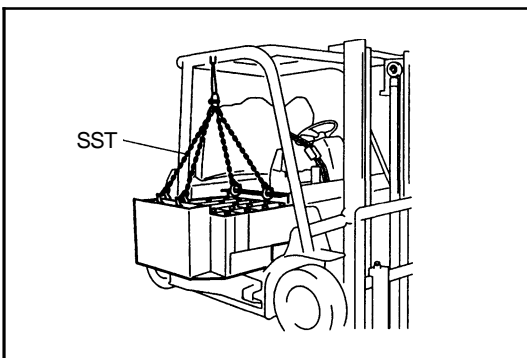


Removal Procedure

- 1 Disconnect the battery plug.
- 2 Open the seat stand.
- 3 Remove the floor mat and toe board.
- 4 Open the side hood RH.
- 5 Remove the battery stopper.
- 6 Remove the battery ASSY. **[Point 1]**

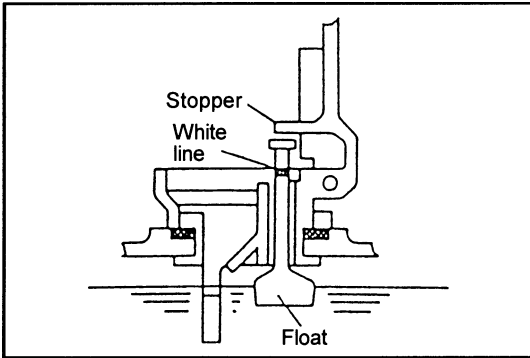
Installation Procedure

The installation procedure is the reverse of the removal procedure.



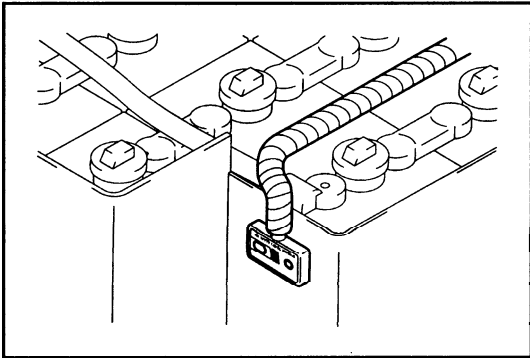
Point Operation

[Point 1]
Removal Installation:
SST 25009-13201-71



INSPECTION

1. Electrolyte level inspection
 Open the cap, and, if the white line on the red float has fallen, add water until the white line appears.
 Since water addition is excessive if the float tip end comes into contact with the stopper, stop water addition as soon as the white line appears.



Since a level gage is provided at a front of the battery case, the electrolyte level can generally be checked at a glance but check the level by opening the cap at the time of periodic inspection.

The green lamp of the level gage comes on to indicate actuation of the level gage sensor, and the red lamp flashes to indicate the necessity of water addition.

	Red lamp	Green lamp
Normal electrolyte level	Off	On
Insufficient electrolyte level	Flashing	On

Note:

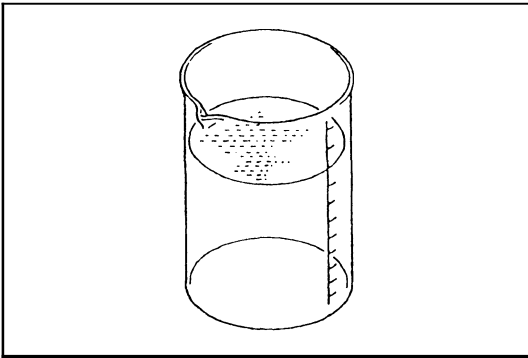
Never change the mounting position of the plug with the sensor.

Reference

The consumption of the electrolyte can be calculated by the following equation:

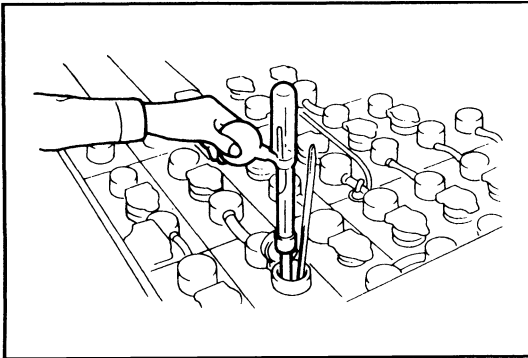
$$\text{Consumption (cc)} = 5 \text{ hour capacity} \times 0.0336 \times \text{number of cells} \times \text{number of charges}$$

	Number of cells	Battery capacity (AH/5HR)
7FB10-14	24	330
7FB15-18	↑	400
7FBH10 ~ 18	↑	545
7FB20	↑	450
7FB25	↑	565
7FBH20:25	↑	730
7FB30-J35	36	370
40-7FB15	24	600
40-7FB20:25	↑	845



2. Electrolyte inspection

The battery electrolyte is colorless and transparent in normal state. Inspect any turbidity at the time of specific gravity inspection. If not checked clearly, put the electrolyte in a breaker for inspection.



3. Battery electrolyte specific gravity inspection

Use a hydrometer and measure the specific gravity of the electrolyte.

Specific gravity upon perfect charging:

1.280 at 20°C (68°F)

Specific gravity upon end of discharge:

1.150 at 20°C (68°F)

The specific gravity of the electrolyte is expressed with that at 20°C (68°F) as the standard.

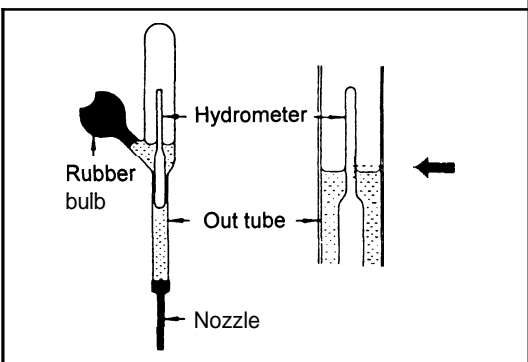
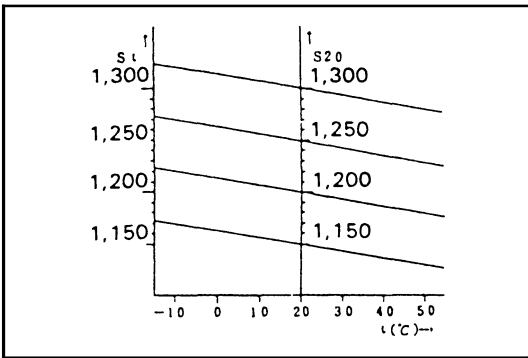
Equation for converting specific gravity

$$S_{20} = S_t + 0.0007 (t-20)$$

S_{20} : Specific gravity at 20°C

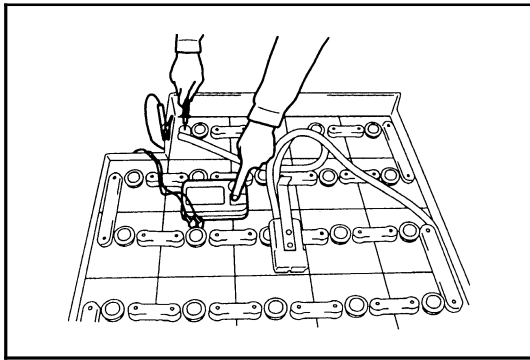
S_t : Specific gravity at t°C

t : Electrolyte temperature (°C) at the time of measurement



* How to use the hydrometer

- ① Insert the nozzle of the hydrometer into the electrolyte port and let the electrolyte be sucked into its outer tube.
- ② Make the hydrometer in the outer tube float correctly without contact with the outer tube, its top or bottom. Wait until the air bubbles in the sucked electrolyte disappear. Read the scale at the top of the raised portion of the surface as shown at left.
- ③ After the measurement, wash the inside and outside of the hydrometer with clear water, and wipe the hydrometer thoroughly with clean cloth for storage.



4. Insulation resistance inspection
 Measure the resistance between the battery and battery case with an insulation resistance meter (megger).
 Insulation resistance value:
 1 MR or more

Note:

- When the insulation resistance is less than 1 MR, remove the battery from the vehicle and wash it with water.
- After washing with water, make the battery dry thoroughly. Measure the insulation resistance again and install the battery on the vehicle after confirming that it is 1 MR or more.

* Battery control table

Prepare a control table for the battery to record and maintain the inspection results.

Inspection date and time	Inspected cell No.	Specific gravity	Electrolyte temperature	Added water quantity	Remarks	Inspector

CHARGER

	Page
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SPECIFICATIONS

Item		Charger type	
		SG3-69-60JBY-1	SG3-69-80JBY-1
Magnet switch (MSch)	Type	CLK-20JT-F (Togami Electric)	FW-1S (Fuji Electric)
	Rating	20 A	26 A
	Thermal setting	18 A	26 A
Transformer (TF)	Capacity	5.0/4.7 KVA (50160 Hz)	6.3/5.9 KVA (50160 Hz)
	Insulation	Type H	←
Diode (Dch)	Type	SKR70/02, SKN71/02	←
Fuse (Fch)	Type	BM 80 A	BM 80 A
	Capacity	96 V, 80 A	96 V, 80 A

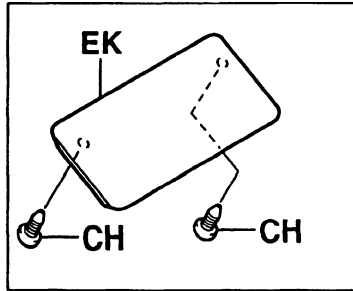
Item		Charger type	
		SG3-69-100JBY-1	SG3-69-130JBY-1
Magnet switch (MSch)	Type	FW-1S (Fuji Electric)	CLK-50JT-F (Togami Electric)
	Rating	26 A	50 A
	Thermal setting	26 A	42 A
Transformer (TF)	Capacity	7.6/7.2 KVA (50160 Hz)	11.0/9.9 KVA (50160 Hz)
	Insulation	Type H	←
Diode (Dch)	Type	SKR130/02, SKN130/02	←
Fuse (Fch)	Type	BM 100 A	BM 150 A
	Capacity	96 V, 100 A	96 V, 150 A

Item		Charger type	
		SG3-69-165JBY-1	SG3-115-85JBY-1
Magnet switch (MSch)	Type	CLK-50JT-F (Togami Electric)	←
	Rating	50 A	←
	Thermal setting	42 A	←
Transformer (TF)	Capacity	11.0/10.0 KVA (50160 Hz)	10.0/9.6 KVA (50160 Hz)
	Insulation	Type H	←
Diode (Dch)	Type	SKR240/02, SKN240/02	SKR71/04, SKN71/04
Fuse (Fch)	Type	BM 150 A	BM 100 A
	Capacity	96 V, 150 A	150 V, 100 A

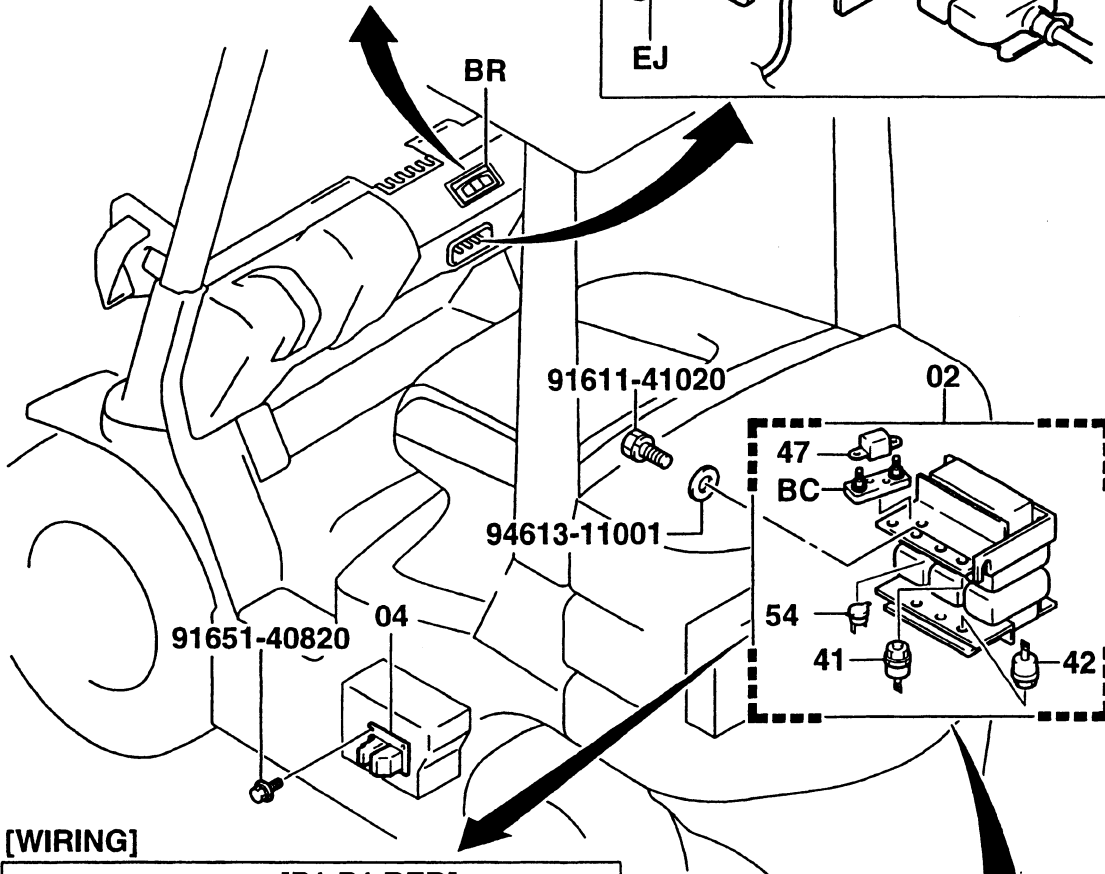
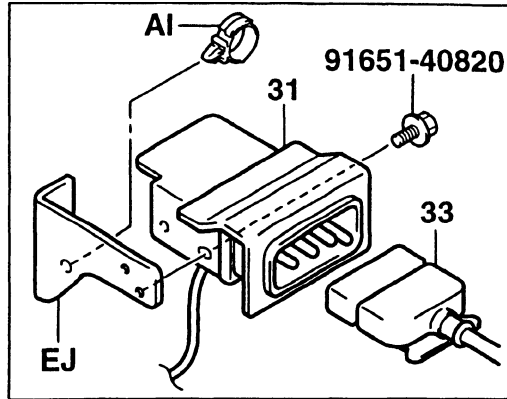
COMPONENTS

2511

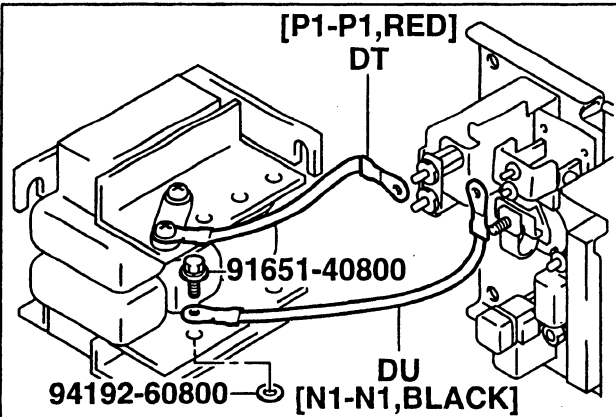
[CHARGER LESS]



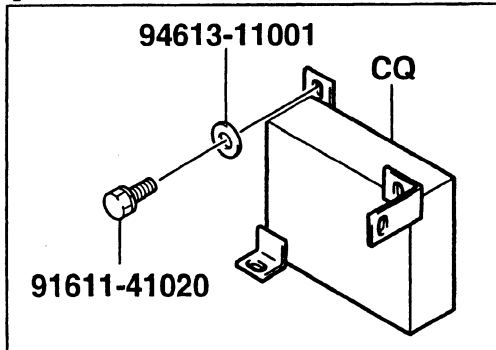
[PLUG]



[WIRING]

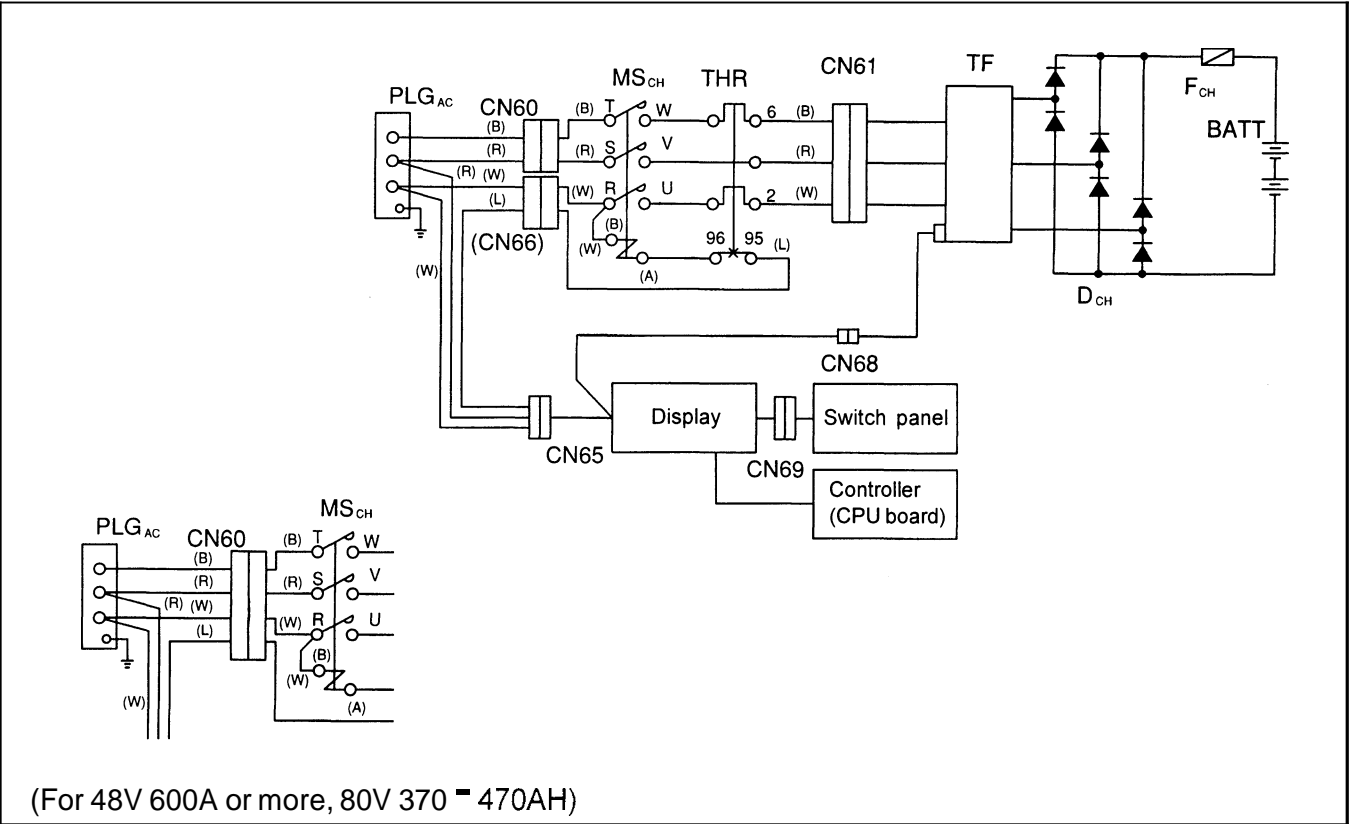


[CHARGER LESS]



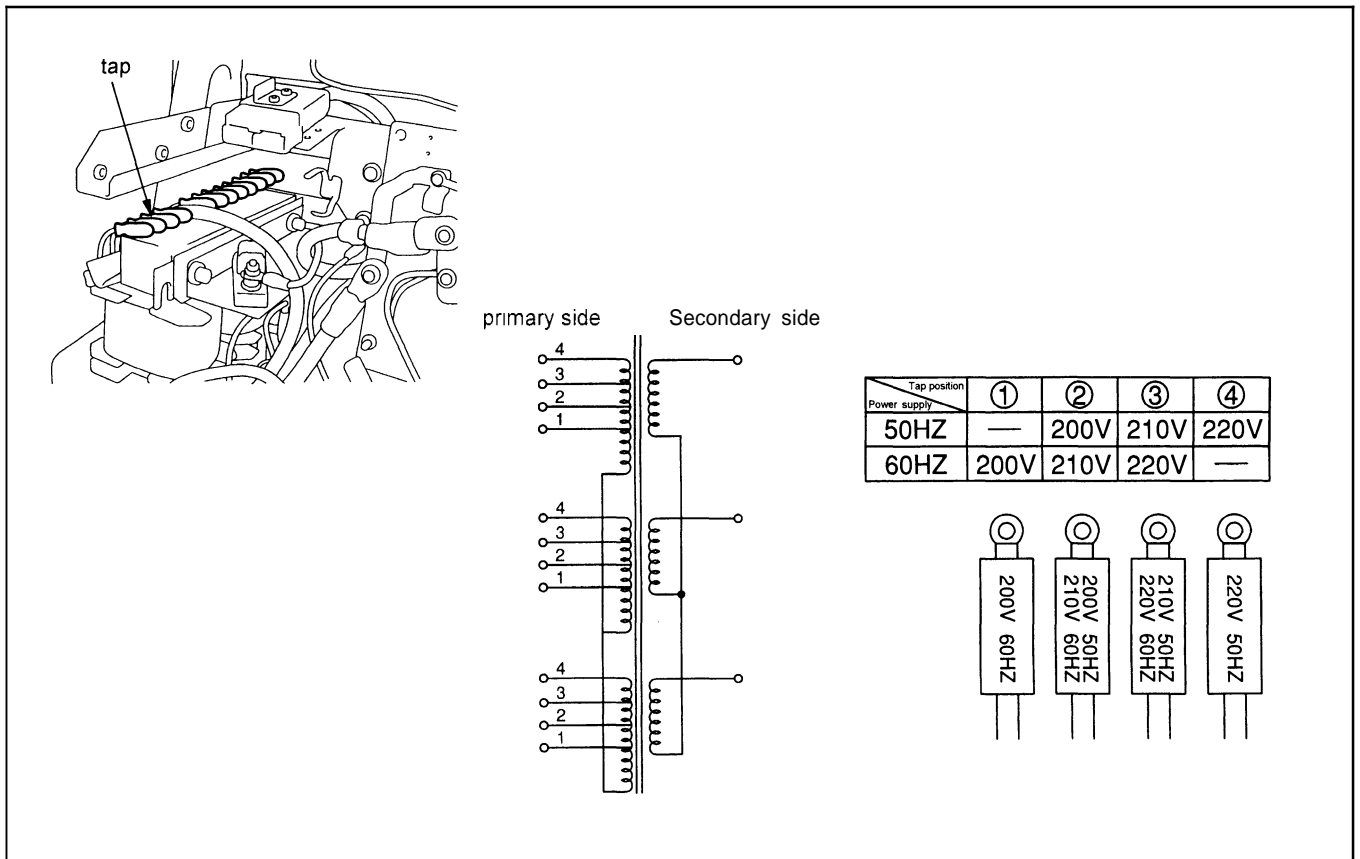
2511-068B

WIRING DIAGRAM



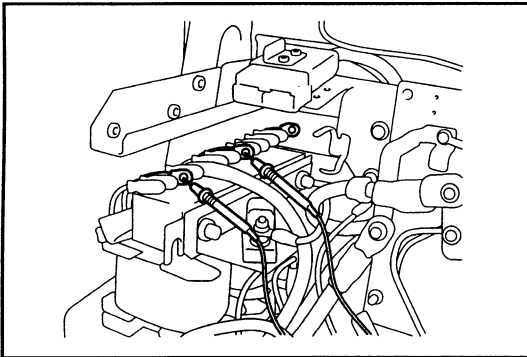
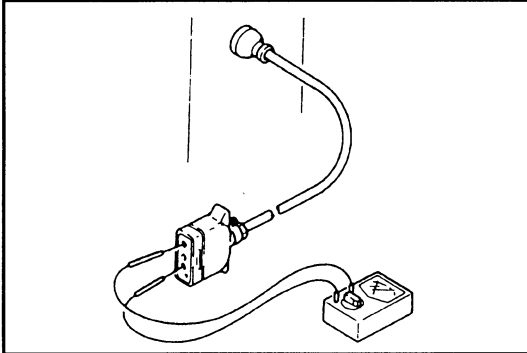
2

TAP LAYOUT



BEFORE CHARGING

If the ampere capacity at the charger installed location is insufficient because of the use of other electrical appliances, ask an electrical work contractor to provide an exclusive circuit for the charger. See the On-vehicle Charger List on page 2-2 for the AC power supply capacity.



If error code "F6-2" is displayed during charging after tap changer setting, change to the tap one rank above.

Tap Changer

1. Measure the power supply voltage to be used for charging.

Tester range: AC (250 or 1000 V)

Note:

Measure the power supply voltage at night (or during the noon recess when electrical appliances are not operated).

2. Set the tap changer.
 - (1) Open the seat stand.
 - (2) Disconnect the battery plug.
 - (3) Remove the transformer cover.
 - (4) Remove the tap cover for each phase corresponding to the power supply voltage measured in step 1.
 - (5) Set the taps.
 - (6) Connect the charger to the power supply outlet and press the NORMAL switch.
 - (7) Check the voltage between the set taps.

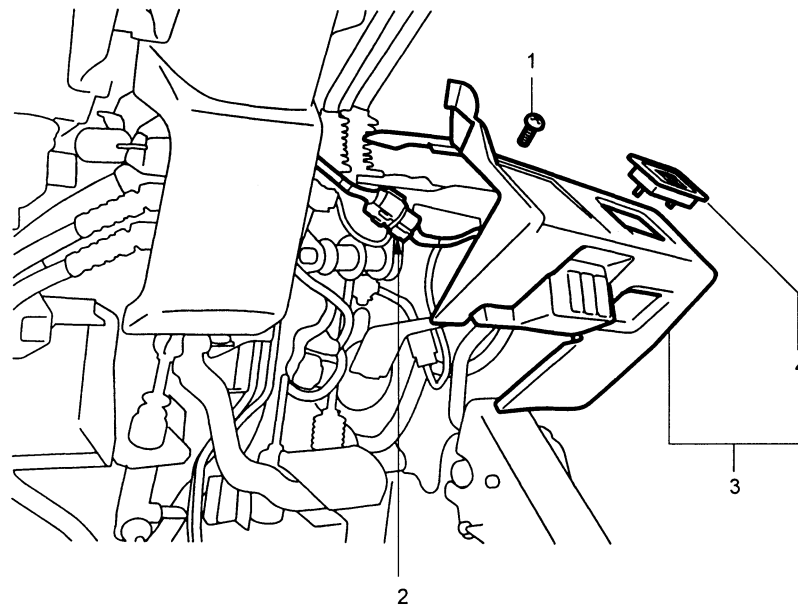
Measured voltage	Tap
199 V or less	200 V
200 ~ 209 V	210 V
210 ~ 219 V	220 V

Note:

- Taps are set to 220 V at the time of shipment.
- Set the tap changer surely for phases U, V and W.
- Surely check the battery charging state (specific gravity and electrolyte level) for about a week after tap changer setting to see if the tap setting is appropriate.

SWITCH BOX

DISASSEMBLY•INSPECTION•REASSEMBLY

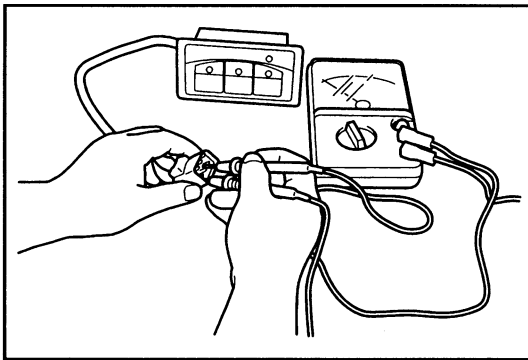


Removal Procedure

- 1 Remove the instrument panel RH set screws.
- 2 Disconnect the CN69 connector.
- 3 Remove the switch box W/instrument panel.
- 4 Remove the switch box ASSY. **[Point 1]**

Installation Procedure

The installation procedure is the reverse of the removal procedure.



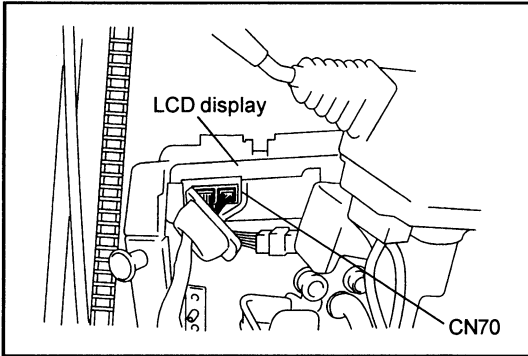
Point Operation

[Point 1]

Inspection:

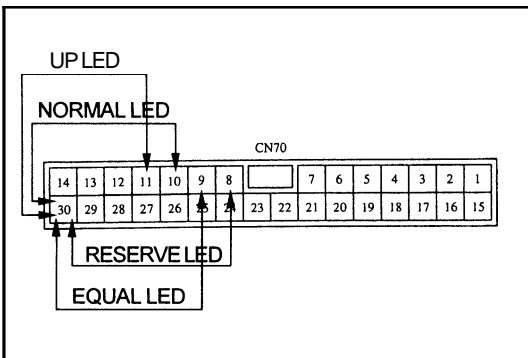
Check the switch ON/OFF state. (CN69 connector)

	Measurement terminals	ON	OFF	Tester range
NORMAL switch	Between 2 and 8	0 Ω	a,	Ω x 1
EQU switch	Between 3 and 8	0 Ω	a,	
RESERVE switch	Between 1 and 8	0 Ω	a,	



Inspection:

Check the voltage applied to the LED at the display connector (CN70). (CN69 must have been connected.)

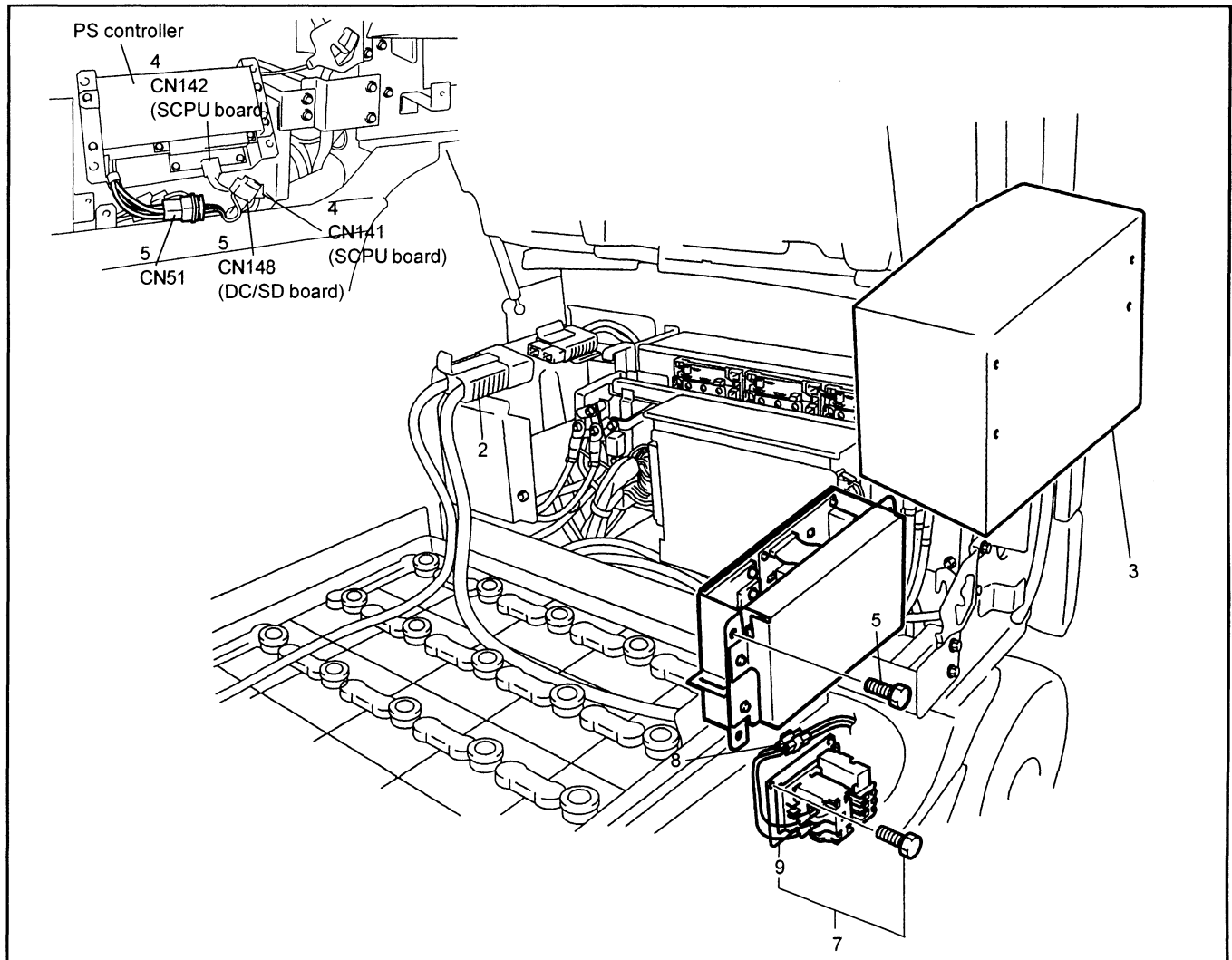


	CN70	During charging (LED on)	Charging stopped (LED off)	Tester range
EQUAL LED	Between 9 and 30 (Y-B and BR)	5 V	0 V	DC 10 V
NORMAL LED	Between 10 and 30 (Y-G and BR)	5 V	0 V	
RESERVE LED	Between 8 and 30 (Y-R and BR)	5 V	0 V	

	CN70	Upon end of test mode (LED on)	Other state (LED off)	Tester range
UP LED	Between 11 and 30 (Y-W and BR)	5 V	0 V	DC 10 V

MAGNET SWITCH ASSY

DISASSEMBLY·INSPECTION·REASSEMBLY

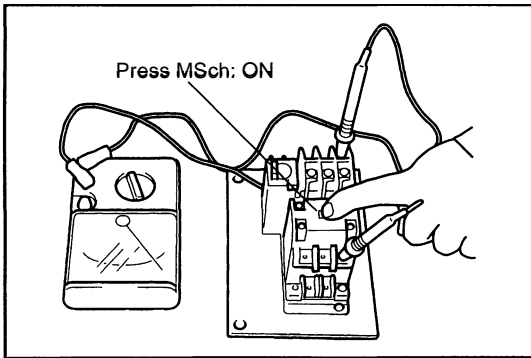


Removal Procedure

- 1 Open the seat stand
- 2 Disconnect the battery plug.
- 3 Remove the PS controller cover.
- 4 Disconnect the SCPU board connector.
- 5 Remove the PS controller set bolt and take the PS controller out.
- 6 Disconnect the DC/SD board connector and CN51, and remove the PS controller.
- 7 Remove the set bolt of the charger magnet switch ASSY Wlbracket, and remove the magnet switch ASSY Wlbracket.
- 8 Disconnect the CN60 and CN66 connectors and the harness (transformer side wiring).
- 9 Remove the magnet ASSY Wlbracket.

Installation Procedure

The installation procedure is the reverse of the removal procedure.



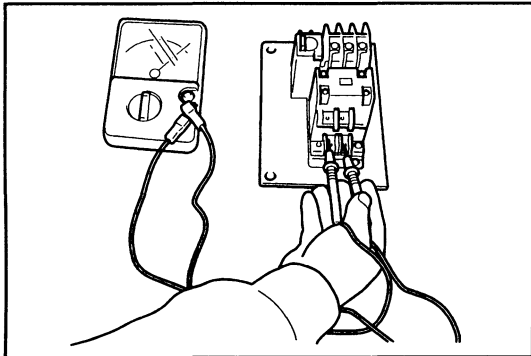
Point Operation

[Point 1]

Inspection:

Magnet switch contact continuity inspection

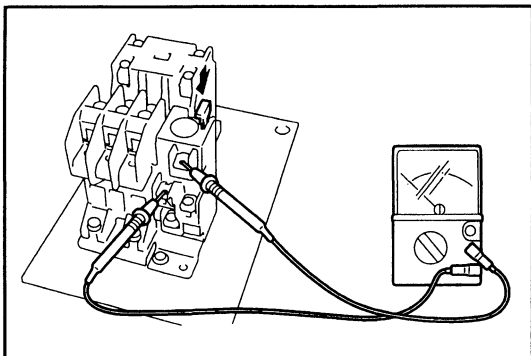
	Tester range	
	Measurement terminals	T-W, S-V, R-U
Standard	MSch ON	
	MSch OFF	



Inspection:

Magnet switch contact continuity inspection

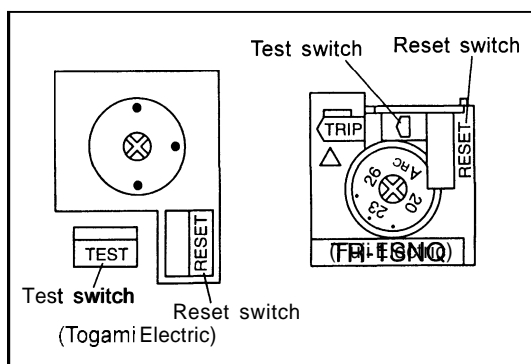
	Tester range	$\Omega \times 1$
	Measurement terminals	A1-A2
Standard	CLK20JT (Togami)	700 Ω
	FW-1S (Fuji)	400 Ω
	CLK50JT (Togami)	350 Ω



Inspection:

Thermal relay contact continuity inspection

	Tester range	$\Omega \times 1$
	Measurement terminals	95-96
Standard	Not operated	0 Ω
	Operated	$\infty \Omega$



Inspection:

Inspect if the thermal relay is deactivated upon pressing the reset switch when the thermal relay is activated. Do not adjust the thermal relay operating current.

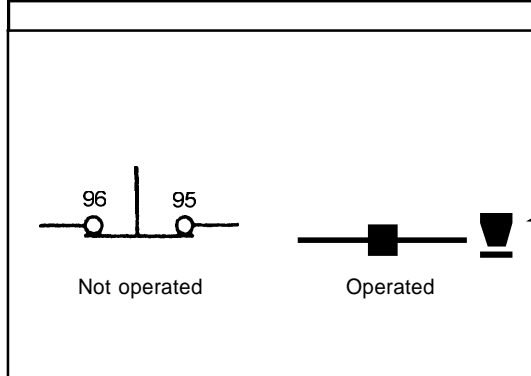
If charging stops due to thermal relay activation while the charger is in use, always check the thermal relay activating cause and perform resetting after taking the corrective action.

Press the reset switch lightly to reset the thermal relay.

Test the thermal relay as follows:

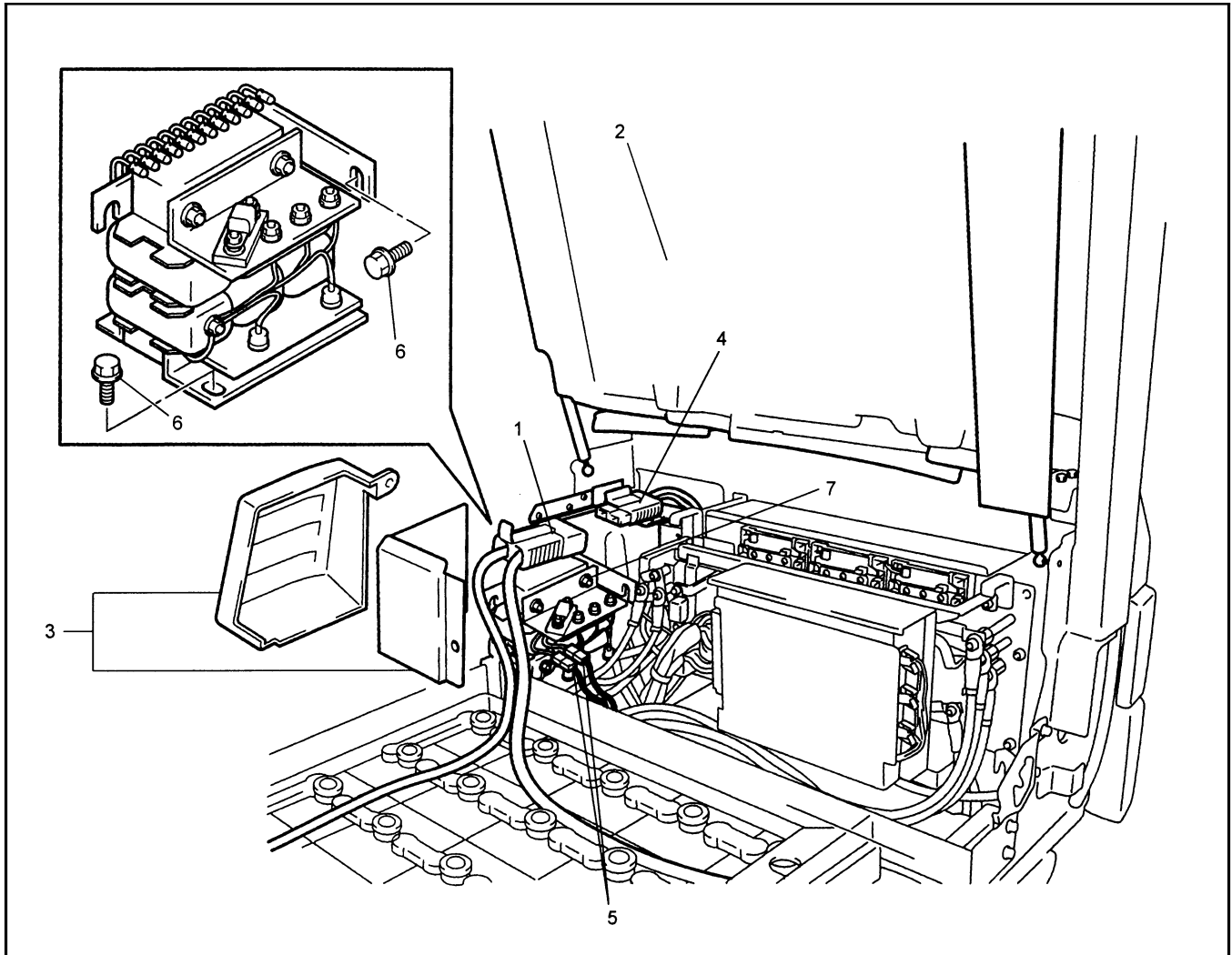
Togami: Press the reset switch.

Fuji: Use a thin screwdriver and move the reset switch to the left.



TRANSFORMER ASSY

REMOVAL·INSPECTION·INSTALLATION

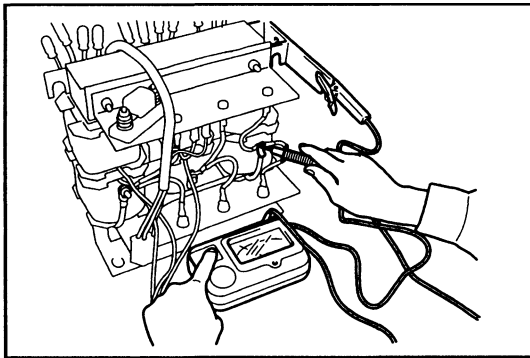


Removal Procedure

- 1 Disconnect the battery plug.
- 2 Remove the seat stand.
- 3 Remove the louver and transformer cover.
- 4 Remove the battery plug bracket.
- 5 Disconnect the CN61. CN68 connector.
- 6 Remove the transformer **ASSY** set bolts.
- 7 Remove the transformer **ASSY** by hoisting it. **[Point 1]**

Installation Procedure

The installation procedure is the reverse of the removal procedure.



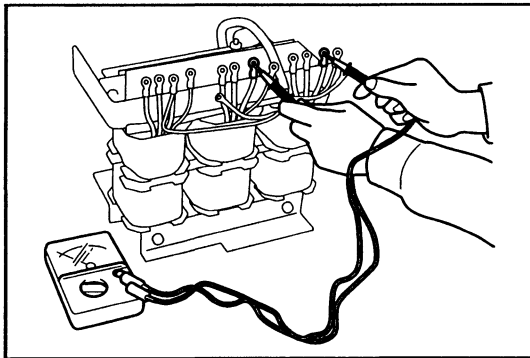
Point Operations

[Point 1]

Inspection:

Measure the insulation resistance.

Measuring instrument	DC 500 V megger
Measurement terminals	Each coil terminal – Frame
Standard	1 MR or more

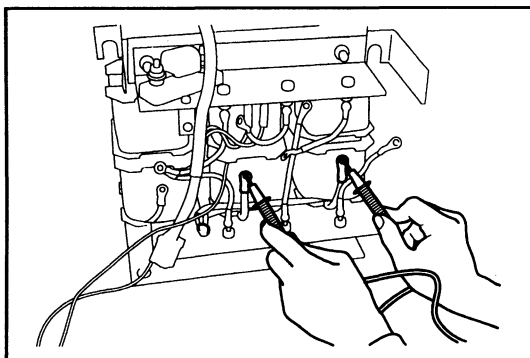


[Point 2]

Inspection:

Measure the primary coil continuity.

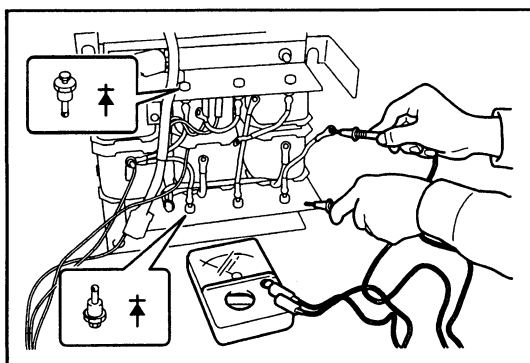
Tester range	R x I
Measurement terminals	$U_1-V_1, V_1-W_1, W_1-U_1$
Standard	OR



Inspection:

Measure the secondary coil continuity.

Tester range	R x I
Measurement terminals	$U_2-V_2, V_2-W_2, W_2-U_2$
Standard	OR

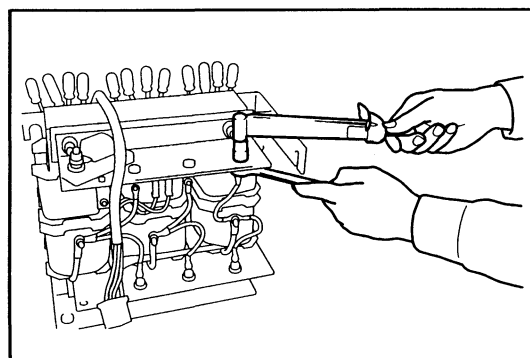


Inspection:

Measure the diode continuity.

Inspect the diode as installed on the radiating fin plate and remove it only when an abnormality is found.

Tester range		$\Omega \times 1K$
Measurement terminals	Forward	Anode \ominus – Cathode \oplus
	Reverse	Anode \oplus – Cathode \ominus
Standard	Forward	Continuity shall exist.
	Reverse	∞R



Installation:

Since two diode different in polarity are used, carefully avoid incorrect installation.

Installation:

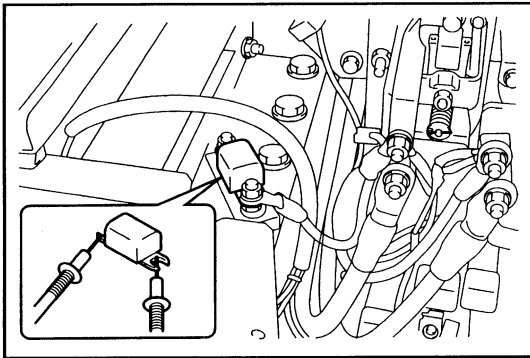
Install each diode by tightening to the specified torque.

SKR71/02, SKN71/02: 4N·m (40 kgf·cm) [2.9 ft·lbf]

SKR130102, SKN130102: 10N·m (100 kgf·cm) [7.2 ft·lbf]

SKR240/02, SKN240/02: 30N·m (300 kgf·cm) [21.7 ft·lbf]

SKR71/04, SKN71/04: 4N·m (40 kgf·cm) [2.9 ft·lbf]



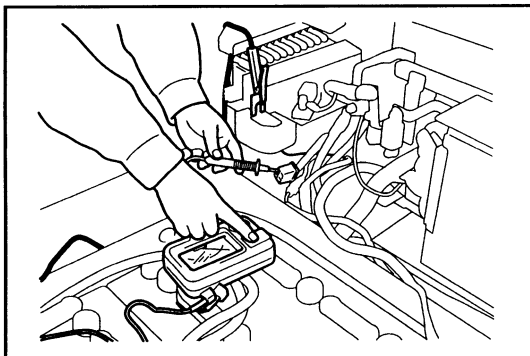
Inspection:
Inspect the fuse.

Standard: 0 Ω

Inspection after Installation

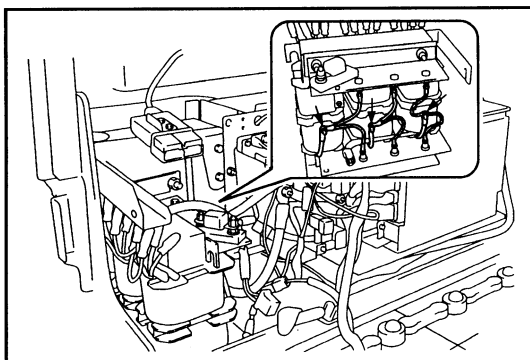
1. Inspect each wiring connection.

Note:
Check each wiring connection by referring to the charger wiring diagram.



2. Measure the insulation resistance.

Measuring instrument	DC 500 V megger
Measurement terminals	Each coil terminal – Frame
Standard	1 MR or more



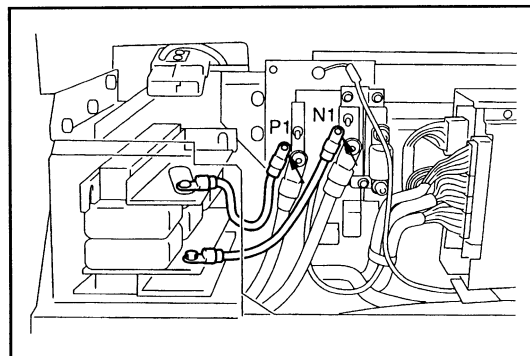
3. Measure the no-load secondary voltages.
Connect the charger plug to an AC power supply outlet (with the transformer P1 and N1 cables disconnected). Start charging (by pressing the NORMAL ON/OFF switch) and measure the following voltages. (“F7” error is displayed when charging is started with either the P1 or the N1 cable of the transformer disconnected, but this is not an abnormality.)

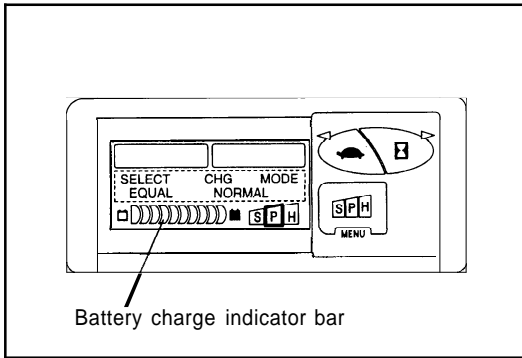
AC voltage

Tester range	AC 250 V-AC 500 V
Measurement terminals	$U_2-V_2, V_2-W_2, W_2-U_2$
Standard (50/60 Hz)	48 V system: 55/55 V 80 V system: 94/94 V

DC voltage

Tester range	DC 250 V
Measurement terminals	Transformer P1 and N1 terminals P1 terminal: ⊕ probe, N1 terminal: ⊖ probe
Standard (50/60 Hz)	48 V system: 74174 V 80 V system: 1271127 V

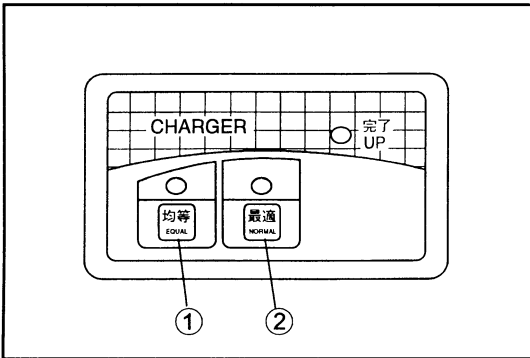




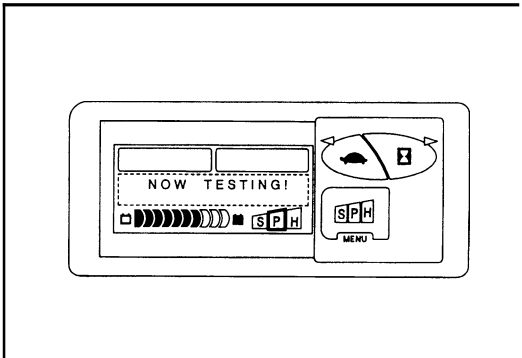
TIMER TEST

Operation Procedure

1. Connect the power plug to the receptacle on the vehicle.
2. The initial timer test screen appears on the display.



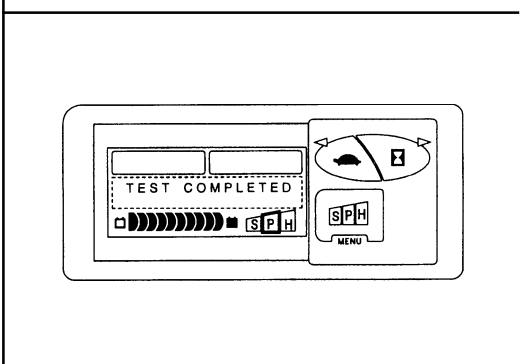
3. Press switches ① and ② at the same time to start the timer test. The display shows "NOW TESTING!".



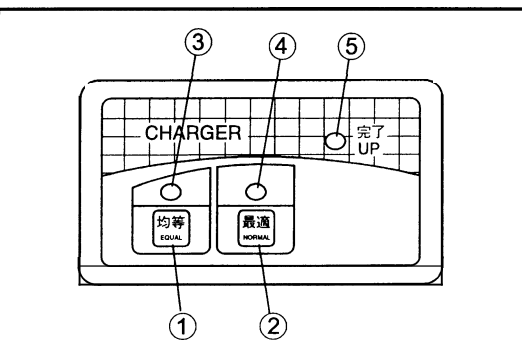
Note:

- The number of charge indicating bars increases at a rate of one per second as the test proceeds. When ten bars are indicated upon lapse of 10 seconds, the test is completed and "TEST COMPLETED" appears on the screen.

LEDs on the switch box come on in the order of ③, ④ and O.



- The magnet switch is closed when "NOW TESTING!" is displayed, and is opened upon display of "TEST COMPLETED" about ten seconds later.

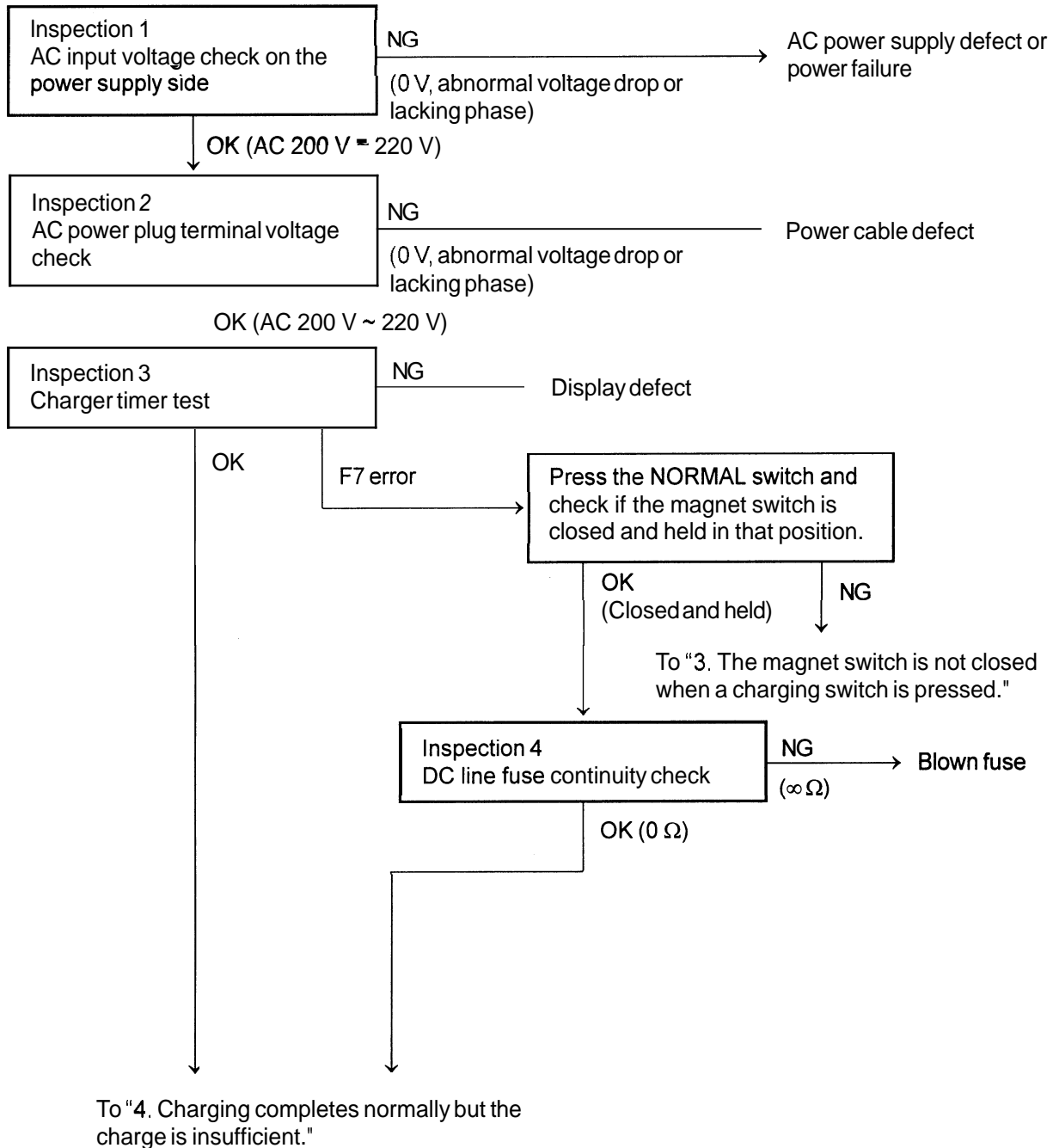


4. The display returns to the initial timer test screen when either switch ① and ② is pressed.

TROUBLESHOOTING

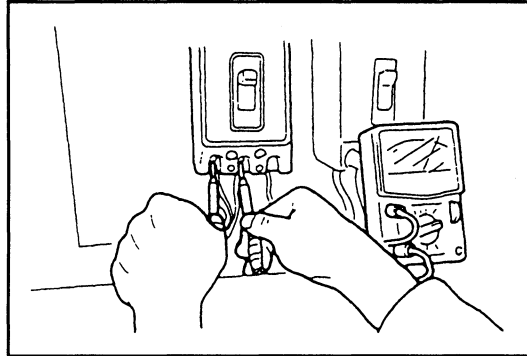
When a Error Code is Displayed

Error Code F6-1: Safety Timer Operated



Inspection 1:
AC input voltage check

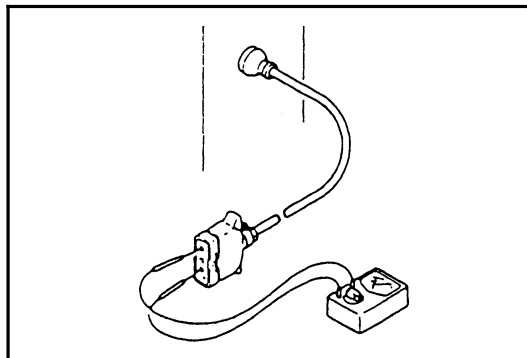
Measurement terminals	AC power outlet terminals
Tester range	AC 250 V
Standard	200 V ~ 220 V



OK (200 V ~ 220 V) → To Inspection 2
 NG (0 V, abnormal voltage drop or lacking phase) → AC power supply defect

Inspection 2:
AC power plug terminal voltage check

Measurement terminals	Power plug terminals
Tester range	AC 250 V
Standard	200 V ~ 220 V



OK (200 V ~ 220 V) → To Inspection 3
 NG (0 V, abnormal voltage drop or lacking phase) → Power cable defect

Inspection 3:

Charger timer test

See the "Timer Test" section on page 2-14.

OK → To "No Diagnosis Error Code Display 4"

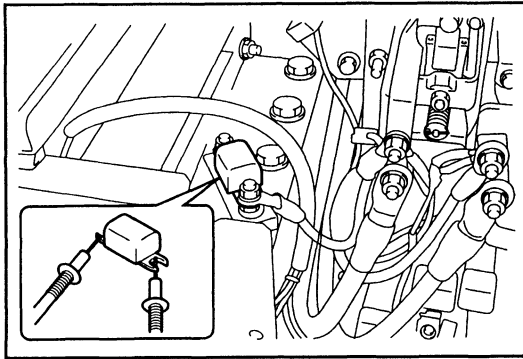
NG → Display defect

Inspection 4:

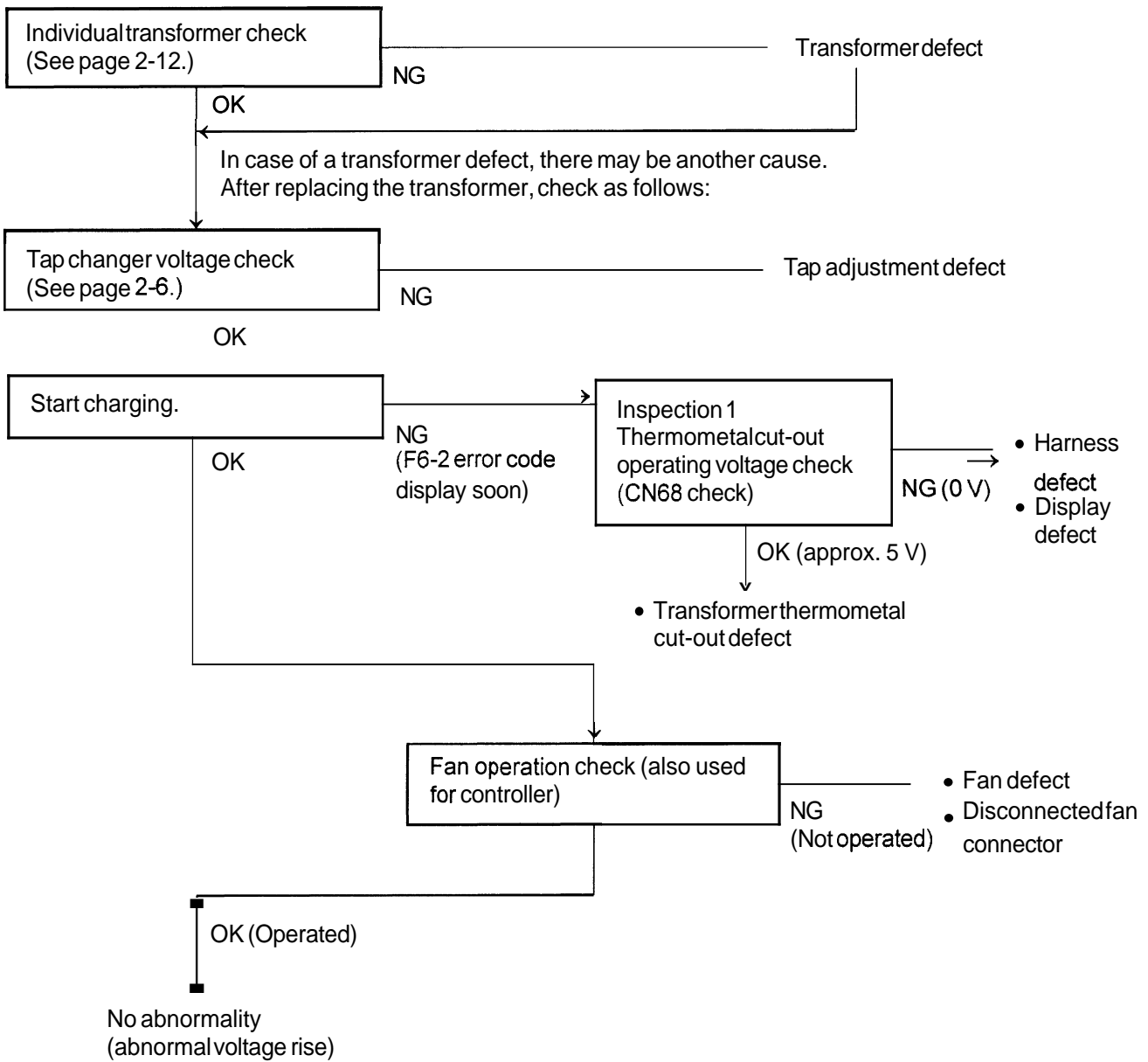
DC line fuse continuity check

AC power plug off, charging switch off and fuse removal

Measurement terminals	Both terminals of DC fuse
Tester range	$\Omega \times 1$
Standard	0Ω

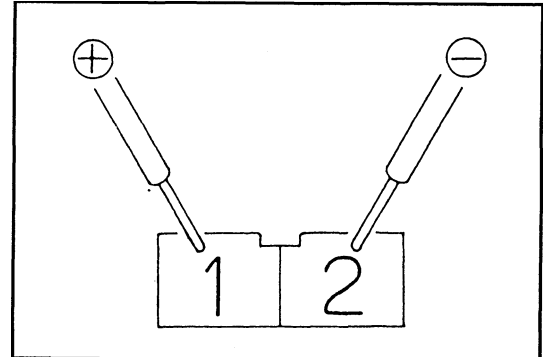
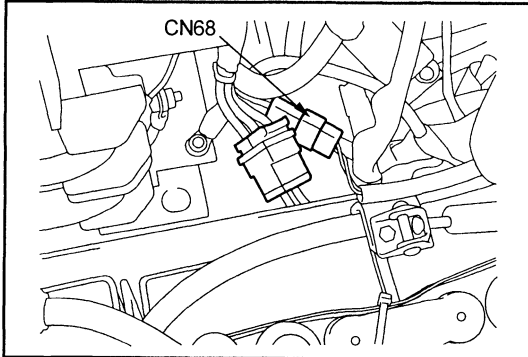
OK (0Ω) → To "No Diagnosis Error Code Display 4"NG ($\infty \Omega$) → Blown fuse

Error Code F6-2: Overheat Detection



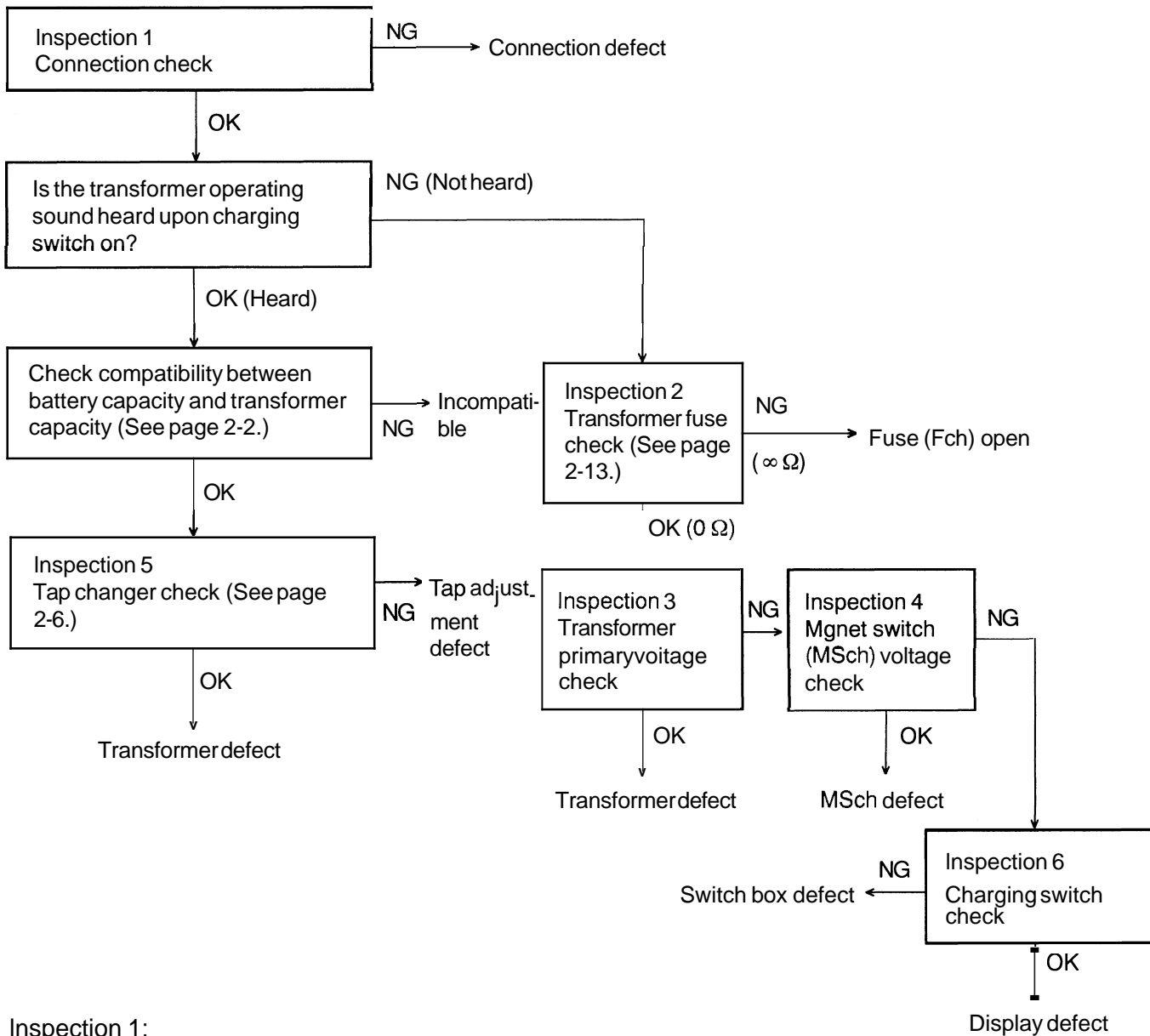
Inspection 1:
Thermometal cut-out operating voltage check

Measurement terminals	CN68-1 (139) ⊕ – CN68-2 (17) ⊖ (main harness side)
Tester range	DC 10 V
Standard	Approx. 5 V



OK (approx. 5 V) → Transformer thermometal cut-out defect
NG (0 V) → Harness defect, display defect

Error Code F7: Charging Starting Failure



Inspection 1:

Connection check

- (1) The P1 and N1 terminals of the transformer and controller shall be connected correctly without any loosening.
- (2) The CN60, CN66 (applicable to 48 V, 330 to 565 AH battery) and CN61 connection shall be connected correctly and securely.
- (3) The AC and DC plugs shall be free from contact defect.
(No roughened terminal or heating during power conduction)
- (4) The power cable shall not be damaged.

OK → Transformer operating sound check

NG → Connection defect

Inspection 2:

Transformer fuse (Fch) check (See page 2-13.)

OK (0 Ω) → To Inspection 3

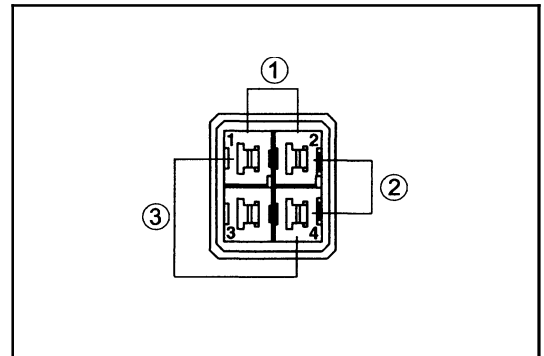
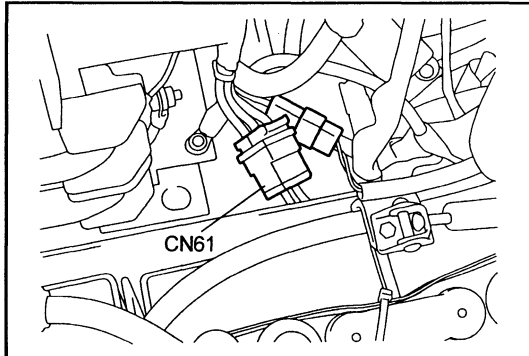
NG (∞ Ω) → Fuse (Fch) open

Inspection 3:

Transformer primary voltage check

CN61 connector disconnection, AC plug ON and charging switch ON

Measurement terminals	① CN61-1 (U) – CN61-2 (V) (REC side) ② CN61-2 (V) – CN61-4 (W) (REC side) ③ CN61-4 (W) – CN61-1 (V) (REC side)
Tester range	AC 250 V
Standard	200 V ~ 220 V



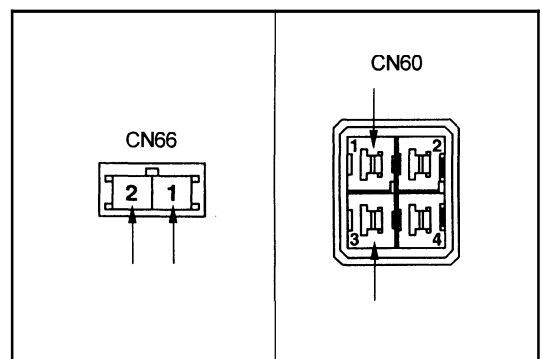
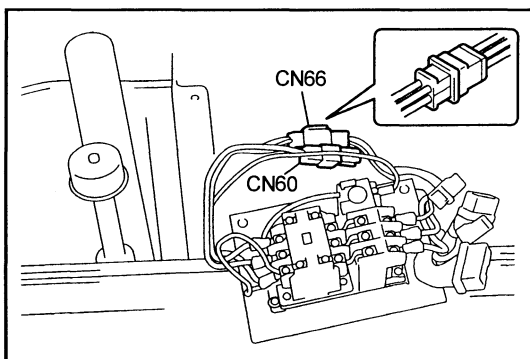
OK (200 V ~ 220 V) → Transformer defect
NG (other than standard) → To Inspection 4

Inspection 4:

Magnet switch voltage check

CN66 connector disconnection (CN60 connector for 48 V, 330 to 565 AH battery, AC plug ON, charging switch ON/OFF operation)

Measurement terminals	CN66-1 (R) – CN66-2 (95) (REC side) CN60-1 (R) – CN66-3(95) (REC side)
Tester range	AC 250 V
Standard	Charging switch ON: 200 V ~ 220 V, charging switch OFF: 0 V



OK (200 V ~ 220 V) → MSch defect
NG (other than standard) → To Inspection 6

Inspection 5:

Tap changer check (See page 2-6.)

OK → Transformer defect

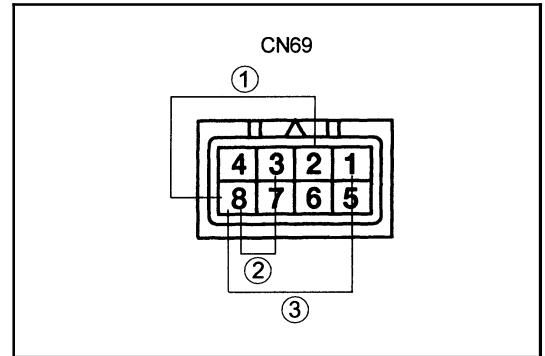
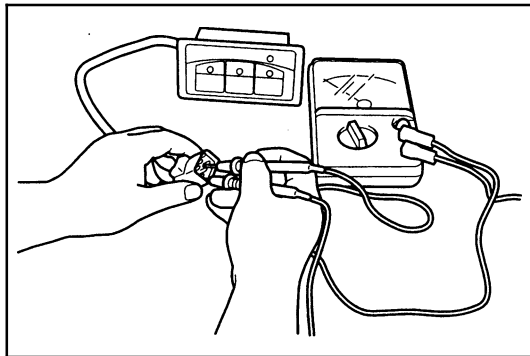
NG → Tap adjustment defect

Inspection 6:

Charging switch check

CN69 connector disconnection

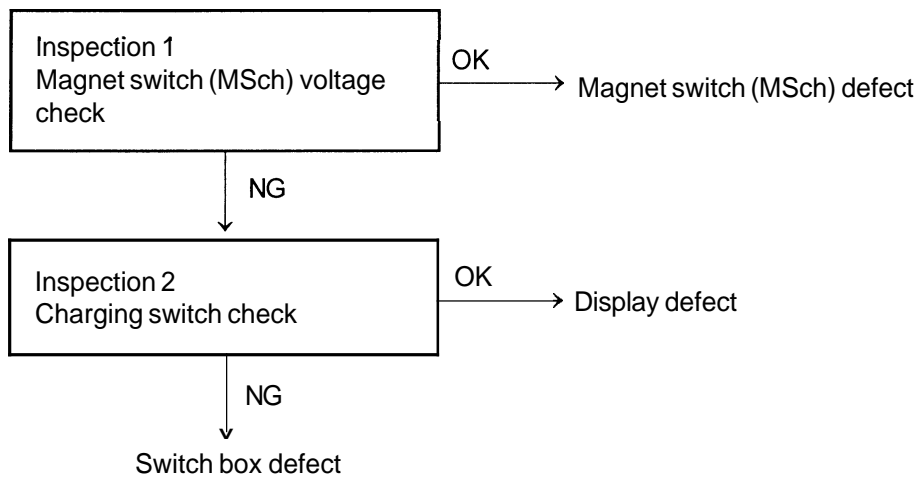
	CN69	Pressed state	Released state	Tester range
NORMAL switch	① Between 2 and 8	0 Ω	∞	Ω x 1
EQUAL switch	② Between 3 and 8	0 Ω	∞	
RESERVE switch	③ Between 1 and 8	0 Ω	∞	



OK → Display defect

NG → Switch box defect

Error Code **F8**: Charging Ending Failure

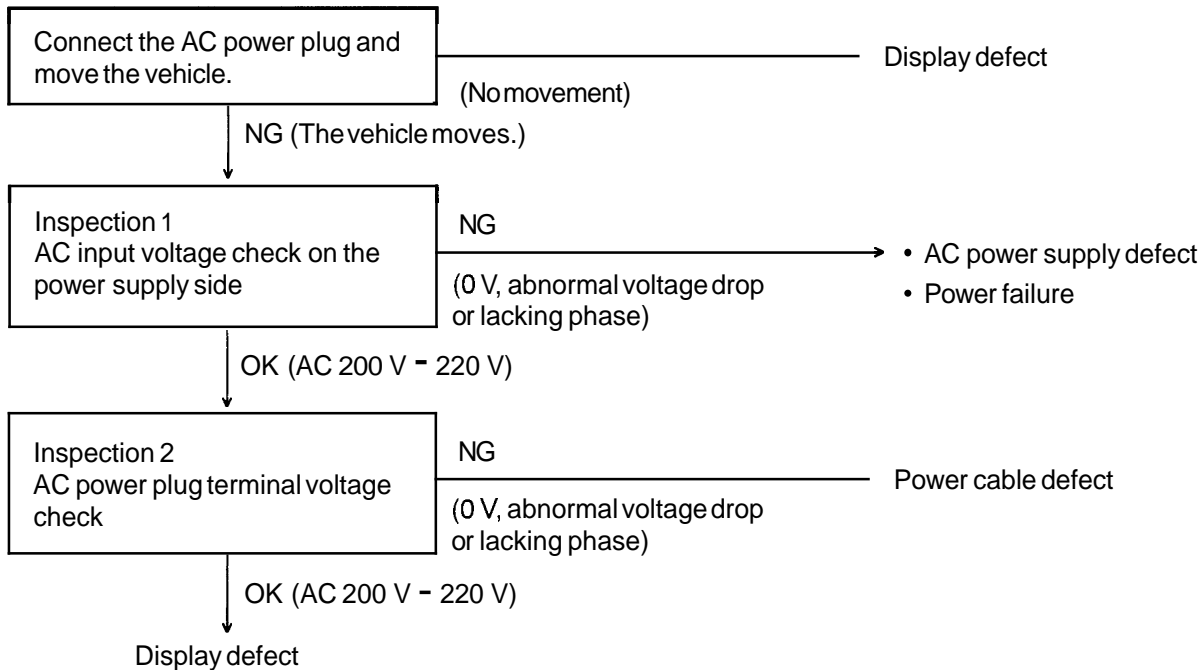


Inspection 1:
Magnet switch (MSch) voltage check
(See page 2-21.)

Inspection 2:
Charging switch check
(See page 2-22.)

No Error Code Display

1. The vehicle does not move at all. (Charging screen appears though the AC power plug is not connected.)
→ Display defect
2. Charging screen does not appear though the AC power plug is connected



Inspection 1:

AC input voltage check on power supply side
See Inspection 2 for error code "F6-1" (page 2-16).

OK (AC 200 V - 220 V) → To Inspection 2

NG (0 V, abnormal voltage drop or lacking phase) → AC power supply defect or power failure

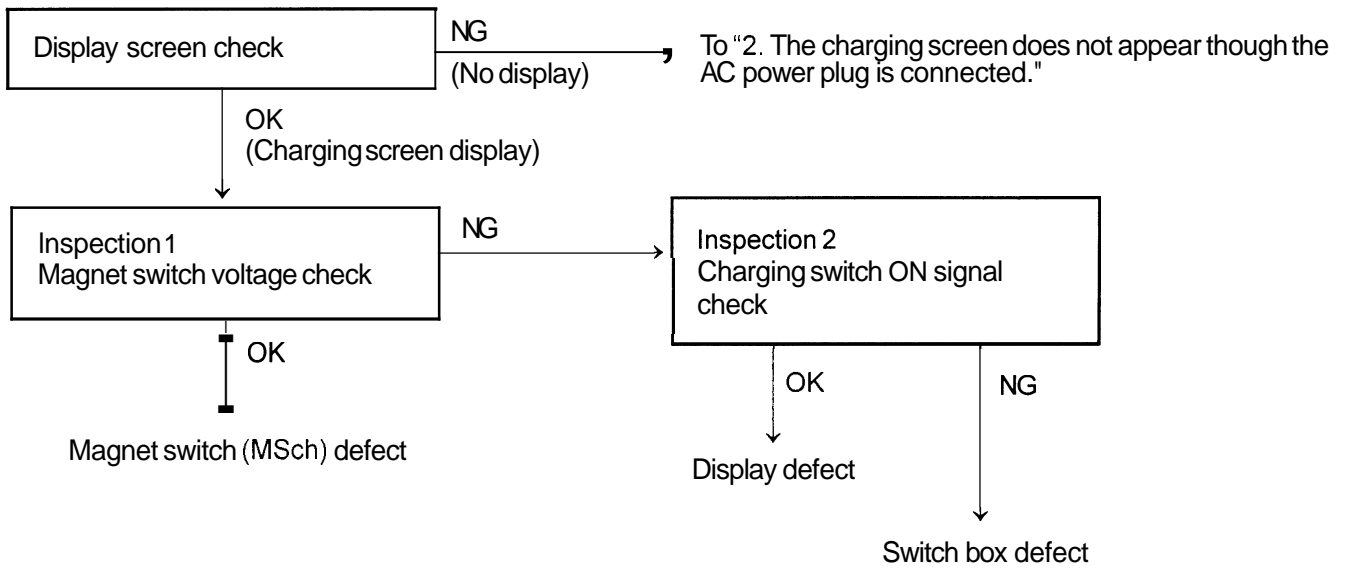
Inspection 2:

AC power plug terminal voltage check
See Inspection 2 for error code "F6-1" (page 2-16)

OK (AC 200 V - 220 V) → Display defect

NG (0 V, abnormal voltage drop or lacking phase) → Power cable defect

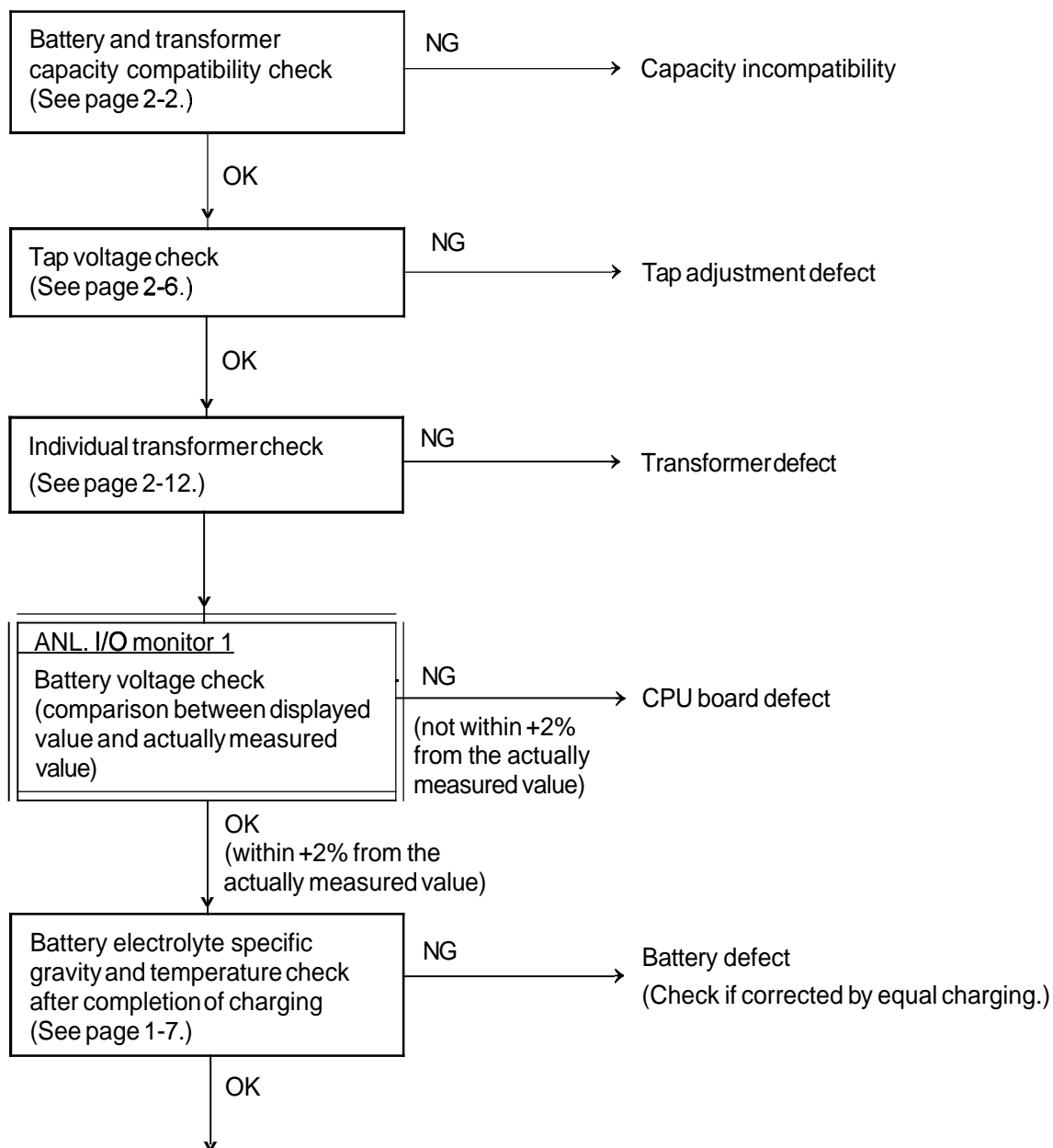
3. The magnet switch is not closed when a charging switch is pressed.



Inspection 1:
Magnet switch voltage check.
(See page 2-21.)

Inspection 2:
Charging switch ON signal check.
(See page 2-22.)

4. Charging completes normally but the charge is insufficient.

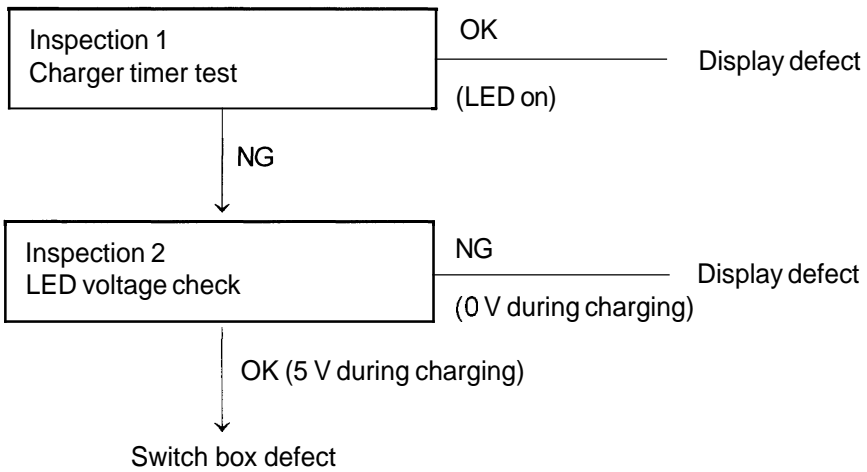


- Decreased capacity due to lowering of electrolyte temperature
- Decreased capacity due to battery service life

5. Charging progress indication does not advance at the time of timer test.

→ Display defect

6. LEDs on the switch box does not come on.



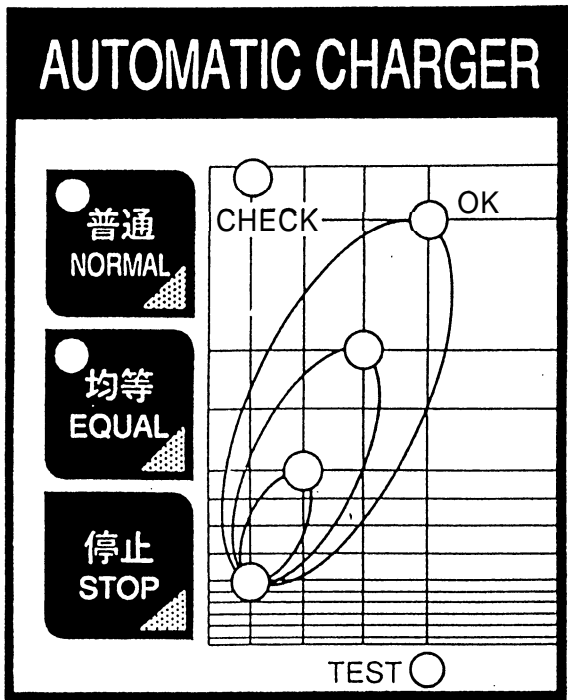
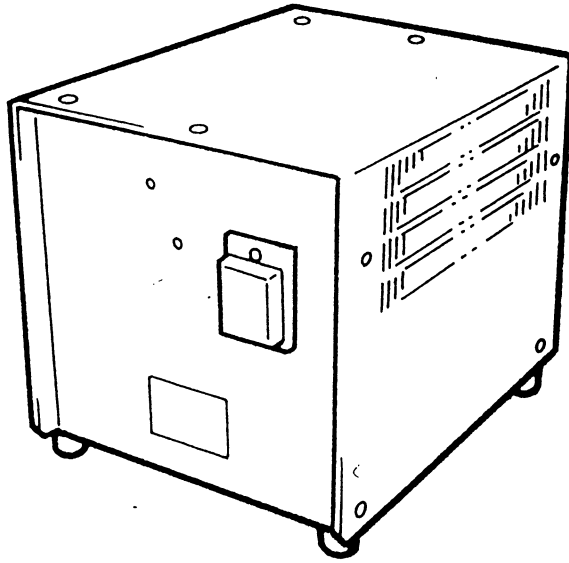
Inspection 1:
Charger timer test
(See page 2-14.)

Inspection 2:
LED voltage check (See page 2-8)
The CN69 connector must be connected.

	CN70	During charging (LED on)	Charging stopped (LED off)	Tester range
NORMAL LED	Between 9 and 30 (Y-B and BR)	5 v	0V	DC 10 V
EQUAL LED	Between 10 and 30 (Y-G and BR)	5 V	0V	
RESERVE LED	Between 8 and 30 (Y-R and BR)	5 v	0V	

	CN70	Test mode end state (LED on)	Other state (LED off)	Tester range
UP LED	Between 11 and 30 (Y-W and BR)	5 V	0V	DC 10 V

GENERAL (GS)



SPECIFICATIONS

200 V POWER SUPPLY VOLTAGE

Item		SG3-69-80JBY-2	SG3-69-100JBY-2	SG3-69-130JBY-2
Magnet switch (MSch)	Type	CLK-20JT	CLK-26JT	CLK-35JT
	Rating	AC 200 V, 50/60 Hz	←	←
Thermal relay (THR)	Type	T-18	←	T-35
	Set value	18 A	22 A	30 A
Transformer (TF)	Capacity (50/60Hz)	7.3/6.5 KVA	9.2/8.1 KVA	12.0/11.0 KVA
	Insulation	Class H	←	←
Silicon diode (Dch)	Type	SKR71/02	SKR130102	45M20
		SKN71/02	SKN130102	45MA20
Timer (AMT)	Operating voltage setting	Microcomputer control	←	←
	Timer setting	Microcomputer control	←	←
	Total timer setting (H)	16	←	←
Fuse (Fch)	Capacity (A)	80	100	150
AC power supply capacity (50/60 Hz) (A)		30.0/120.0	30.0/130.0	40.0/140.0
Charger weight (kg)[lb]		44 (96.8)	60 (132)	64 (140.8)

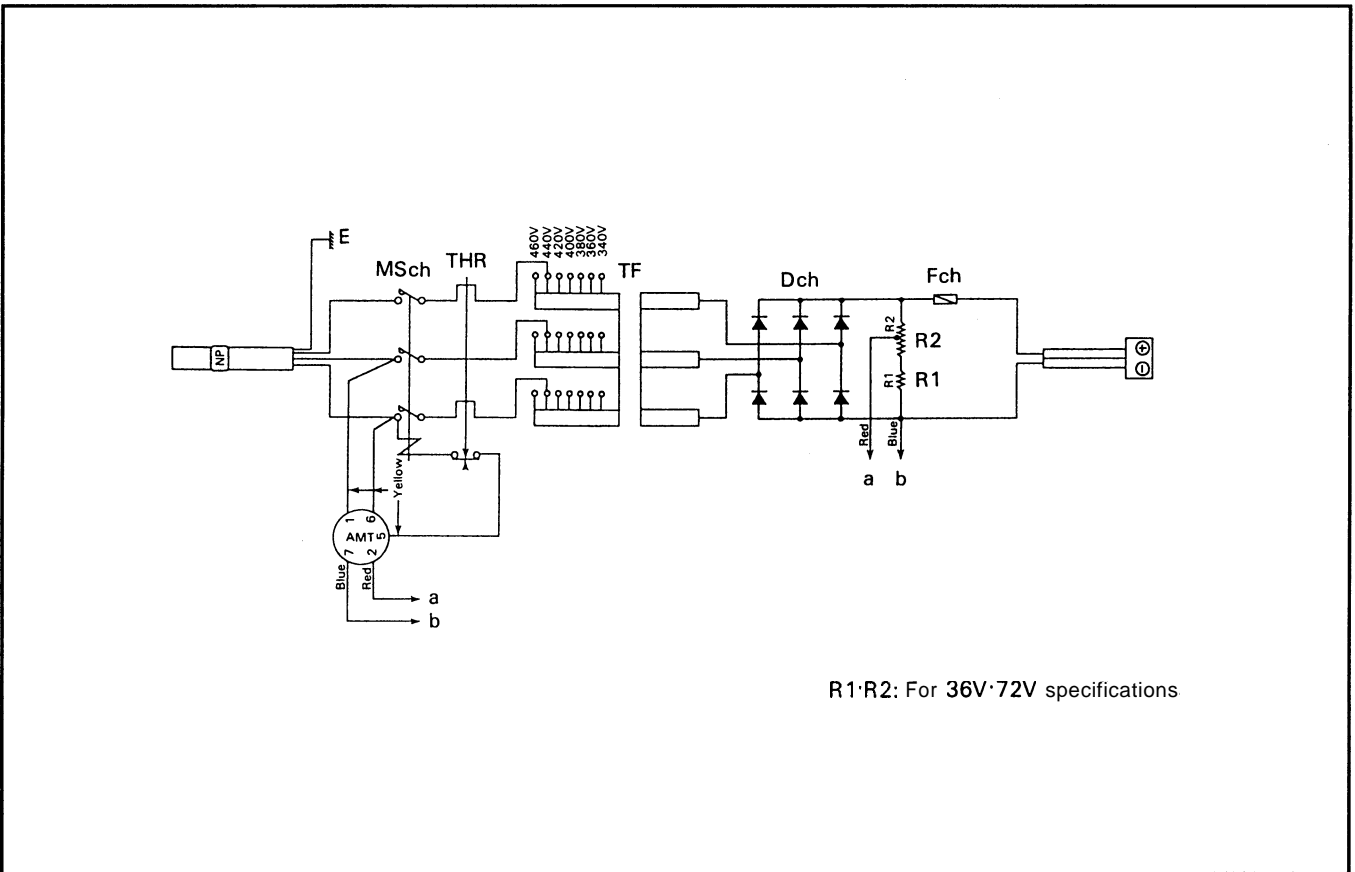
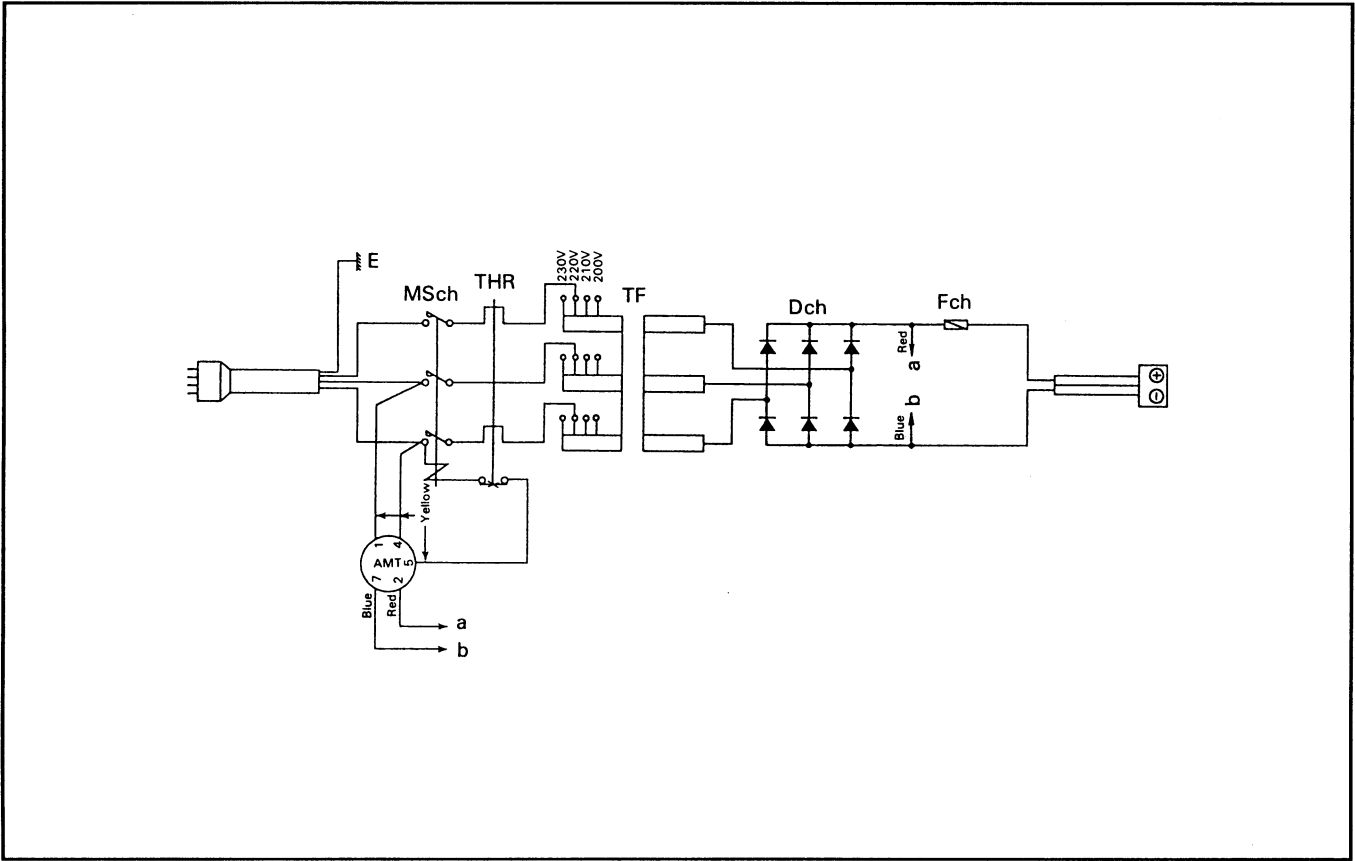
Item		SG3-69-165JBY-2	SG3-115-80JBY-2
Magnet switch (MSch)	Type	CLK-50JT	←
	Rating	AC 200 V, 50/60 Hz	←
Thermal relay (THR)	Type	T-35	←
	Set value	42 A	←
Transformer (TF)	Capacity (50/60 Hz)	16.0/114.0KVA	12.0/110 KVA
	Insulation	Class H	←
Silicon diode (Dch)	Type	SKR240/02	SKR71/04
		SKN240/02	SKN71/04
Timer (AMT)	Operating voltage setting	Microcomputer control	←
	Timer setting	Microcomputer control	←
	Total timer setting (H)	16	←
Fuse (Fch)	Capacity (A)	150	80
AC power supply capacity (50/60 Hz) (A)		50.0/50.0	40.0/130.0
Charger weight (kg)[lb]		98 (216)	85 (187)

400 V POWER SUPPLY VOLTAGE

Item		SG3-69-80JBY-2	SG3-69-100JBY-2	SG3-69-130JBY-2
Magnet switch (MSch)	Type	CLK-15JT	CLK-15JT	CLK-26JT
	Rating	AC 200 V, 50/60 Hz	←	←
Thermal relay (THR)	Type	T-11	←	T-18
	Set value	11 A	15 A	22 A
Transformer (TF)	Capacity (50/60 Hz)	7.3/6.5 KVA	9.2/8.1 KVA	12.0/11.0 KVA
	Insulation	Class H	←	←
Silicon diode (Dch)	Type	SKR71/02	SKR130102	45M20
		SKN71/02	SKN130102	45MA20
Timer (AMT)	Operating voltage setting	Microcomputer control	←	←
	Timer setting	Microcomputer control	←	←
	Total timer setting (H)	16	←	←
Fuse (Fch)	Capacity (A)	80	100	150
AC power supply capacity (50/60 Hz) (A)		15.0/11.0	15.0/11.5	20.0/12.0
Charger weight (kg) [lb]		44 (96.8)	60 (132)	64 (140.8)

Item		SG3-69-165JBY-2	SG3-115-80JBY-2
Magnet switch (MSch)	Type	CLK-26JT	←
	Rating	AC 200 V, 50/60 Hz	←
Thermal relay (THR)	Type	T-18	←
	Set value	22 A	←
Transformer (TF)	Capacity (50/60 Hz)	16.0/14.0 KVA	12.0/11.0 KVA
	Insulation	Class H	←
Silicon diode (Dch)	Type	SKR240/02	SKR71/04
		SKN240/02	SKN71/04
Timer (AMT)	Operating voltage setting	Microcomputer control	←
	Timer setting	Microcomputer control	←
	Total timer setting (H)	16	←
Fuse (Fch)	Capacity (A)	150	80
AC power supply capacity (50/60 Hz) (A)		30.0/30.0	20.0/11.5
Charger weight (kg) [lb]		98 (216)	85 (187)

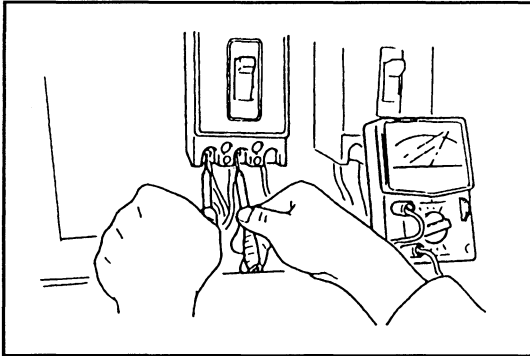
WIRING DIAGRAM



BEFORE CHARGING

Off-truck Charger Circuit Set-up

If there is not enough charging current because of other electrical equipment being used, a separate circuit exclusively for the charger should be installed. This circuit should be provided with circuit breakers or fuses having the capacities shown at page 2-28.

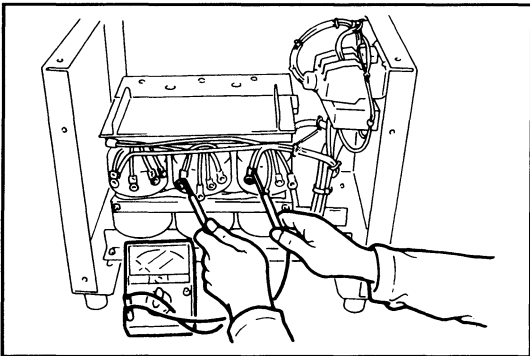


TAP Changer Setting

1. Measure with a circuit tester the supply voltage used for charging.
Circuit tester range: AC (250 V or 1000 V)

Note:

Measure the supply voltage at night (or during lunch break when electrical equipment is not used).



2. Tap changer setting
 - (1) Remove the cover of each tap.
 - (2) Select the appropriate tap according to the supply voltage measured in step 1 above.
 - (3) Manually close the magnet switch, and measure the voltage at each tap terminal.

[For 200 V]

Measured voltage	Tap
199 V or less	200 V
200 - 209 V	210 V
210 ~ 219 V	220 V
220 - 229 V	230 V

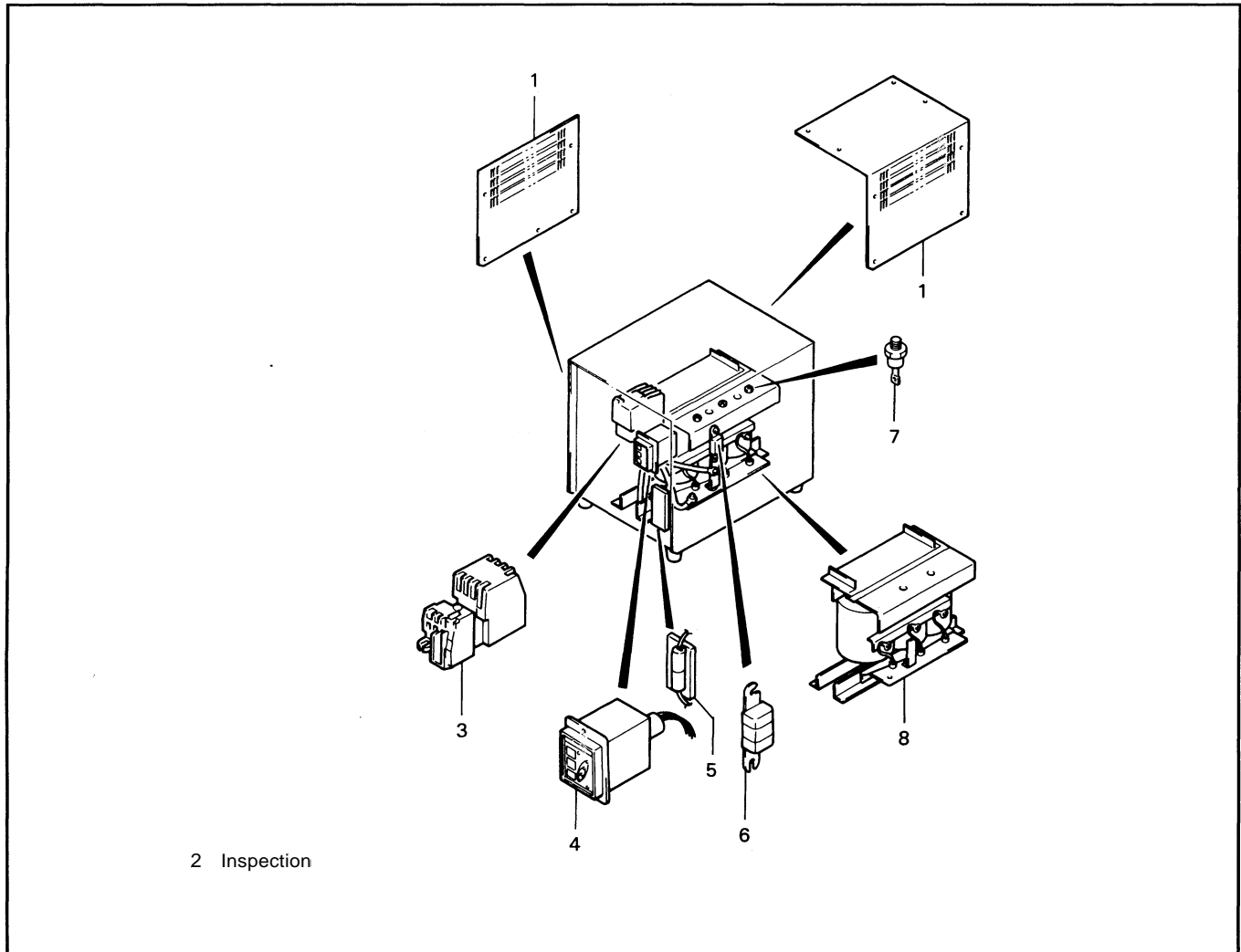
[For 400 V]

Measured voltage	Tap
339 V or less	340 V
341 - 359 V	360 V
360 - 379 V	380 V
380 - 399 V	400 V
400 - 419 V	420 V
420 - 439 V	440 V
440 - 459 V	460 V

Caution:

- The tap is set to 220 V at time of shipment.
- Tap changer setting shall be made for the U, V and W phases.
- After setting the tap changer, be sure to check the battery charging status (specific gravity and fluid level) for about a week to confirm proper tap setting.

DISASSEMBLY-INSPECTION-REASSEMBLY



Disassembly Procedure

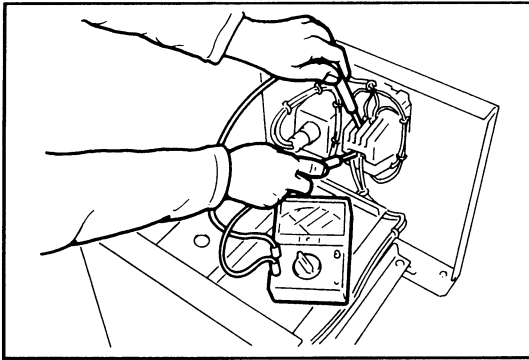
Note:

- Put a tag indicating the connecting position at the time of disassembly to prevent in correct connection at the time of reassembly.

- 1 Remove the charger cover.
- 2 Carry out inspection before disassembly. **[Point 1]**
- 3 Remove the magnet switch ASSY (MSch). **[Point 2]**
- 4 Remove the timer ASSY (AMT).
- 5 Remove the resistor (R1-R2). (For 72 V series and 36 V series)
- 6 Remove the fuse (Fch). **[Point 4]**
- 7 Remove the diode (Dch). **[Point 5]**
- 8 Remove the transformer (TF). **[Point 3]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.



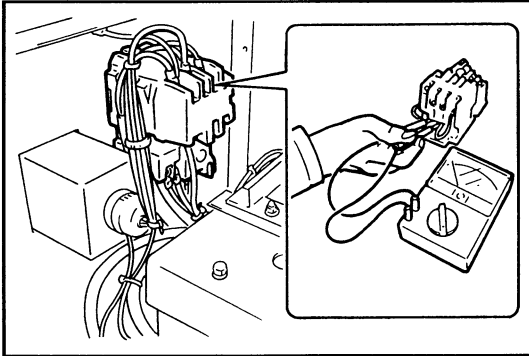
Point Operation

[Point 1]

Inspection:

Inspect the magnet switch contact continuity.

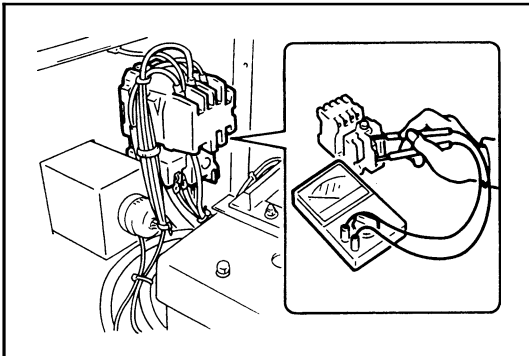
Circuit tester range		R x I
Measuring terminals		T-W, S-V and R-U
Switch	ON	on
	OFF	$\infty \Omega$



Inspection:

Inspect the magnet switch coil continuity.

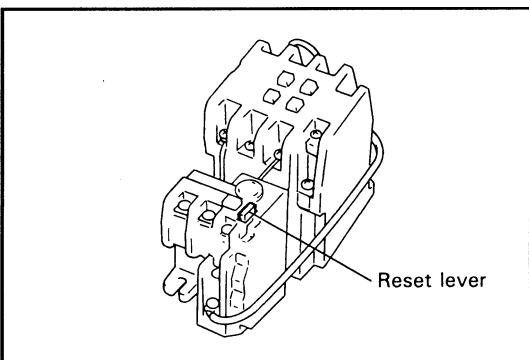
Resistance between A1 and A2	Circuit tester range
See the Service Standards list.	R x I



Inspection:

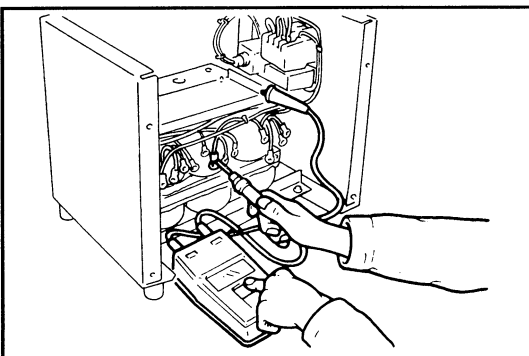
Inspect the thermal relay contact continuity.

Circuit tester range		$\Omega \times 1$
Measuring terminals		95-96
Switch	Not operated	OR
	Operated state	$\infty \Omega$



Note:

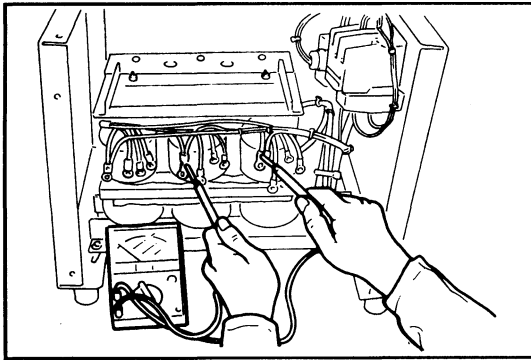
- Do not adjust the thermal relay operating current.
- If the thermal relay is operated to stop charging while the charger is in use, always check the cause of thermal relay operation, and reset the thermal relay after taking the remedial action.
- Push the reset lever lightly to reset the thermal relay.



Inspection:

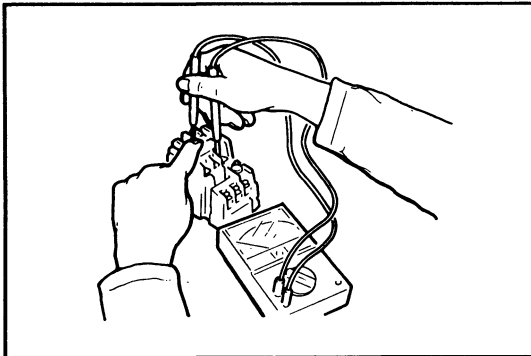
Inspect the transformer insulation resistance.

Measuring terminals	Between each winding and frame
Standard value	0.2 M Ω or more



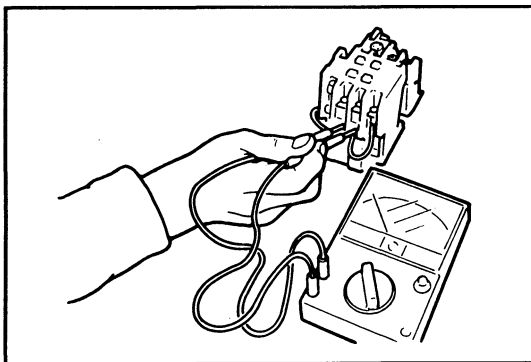
Inspection:
Inspect the transformer continuity

Circuit test range	R x I
Measuring terminals	Primary side U ₁ -V ₁ V ₁ -W ₁ W ₁ -U ₁
	Secondary side U ₂ -V ₂ V ₂ -W ₂ W ₂ -U ₂
Standard value	OR



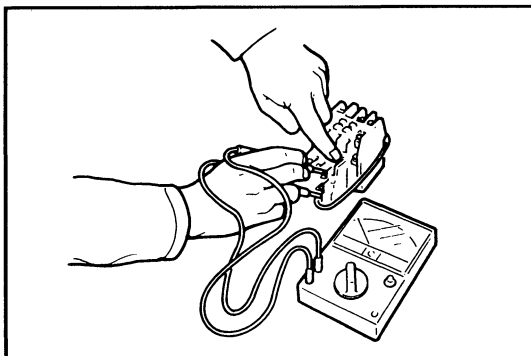
[Point 2]
Inspection:
Inspect the magnet switch contact continuity.

Circuit tester range	Ω x 1	
Measuring terminals	T-W, S-V and R-U	
Switch	ON	OR
	OFF	∞ Ω



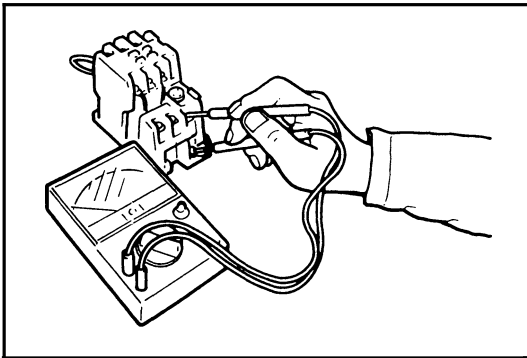
Inspection:
Inspect the magnet switch coil continuity.

Resistance between A1 and A2	Circuit tester range
See the Service Standards list.	Ω x 1



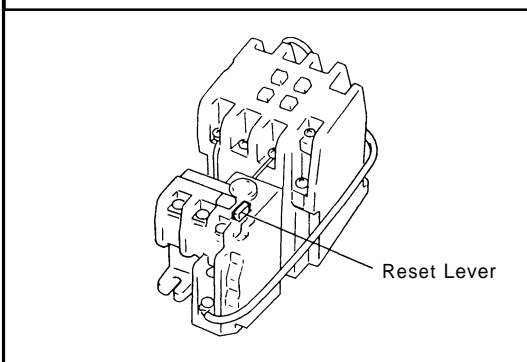
Inspection:
Inspect the thermal relay contact continuity.

Circuit tester range	R x I	
Measuring terminals	95-96	
Switch	Not operated	OR
	In operated state	∞ Ω

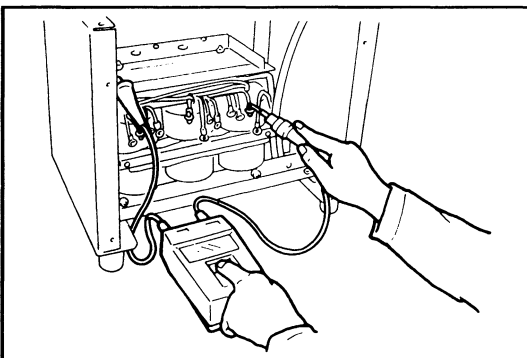


Note:

- Do not adjust the thermal relay operating current.
- If the thermal relay is operated to stop charging while the charger is in use, always check the cause of thermal relay operation, and reset the thermal relay after taking the remedial action.



- Push the reset lever lightly to reset the thermal relay.

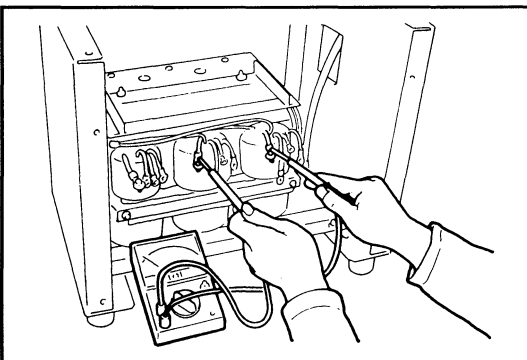


[Point 3]

Inspection:

Inspect the transformer insulation.

Measuring terminals	Between each winding and frame
Standard value	0.2 MΩ or more



Inspection:

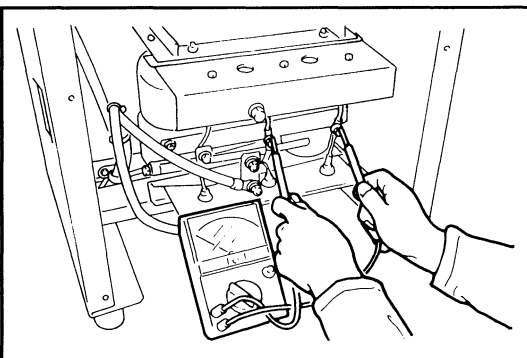
Inspect the transformer winding continuity.

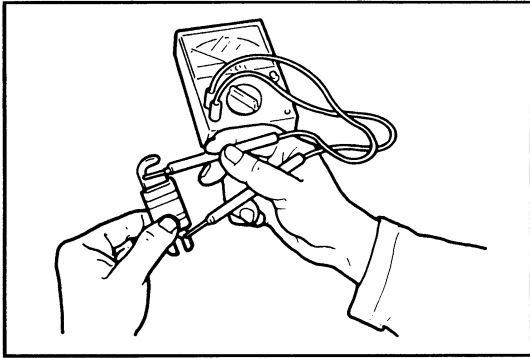
Primary winding

Circuit tester range	Q x 1
Measuring terminals	U ₁ -V ₁ V ₁ -W ₁ W ₁ -U ₁
Standard value	0 Ω

Secondary winding

Circuit tester range	Ω x 1
Measuring terminals	U ₂ -V ₂ V ₂ -W ₂ W ₂ -U ₂
Standard value	0 Ω



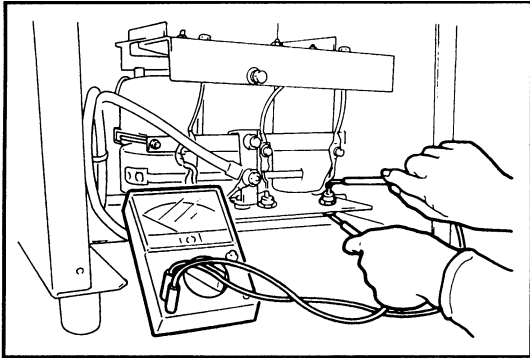


[Point 4]

Inspection:

Inspect the fuse continuity.

Standard: 0 Ω

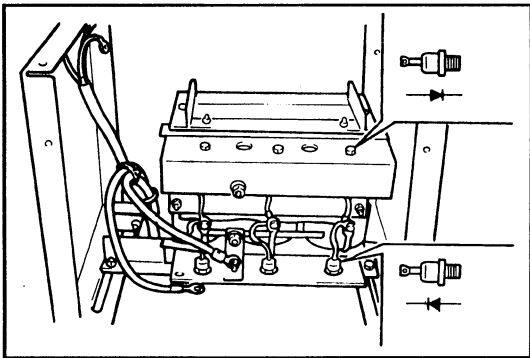


[Point 5]

Inspection:

Inspect the diode in installed state on the fin. Remove it only when an abnormality is found.

Circuit tester range		Ω x 1K
Measuring terminals	Forward	Anode ⊖ - cathode ⊕
	Reverse	Anode ⊕ - cathode ⊖
Standard value	Forward	See the Service Standards list.
	Reverse	0 Ω



Installation:

As two diodes having different polarities are used, install in the correct direction.

Caution:

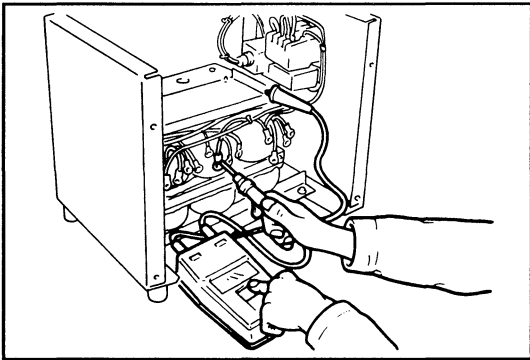
In the case of the charger for batteries with the capacity at 320 AH15 HR or less, the diode mounting direction is the reverse that shown in the figure.

Inspection after Reassembly

1. Inspect each wiring for correctness.

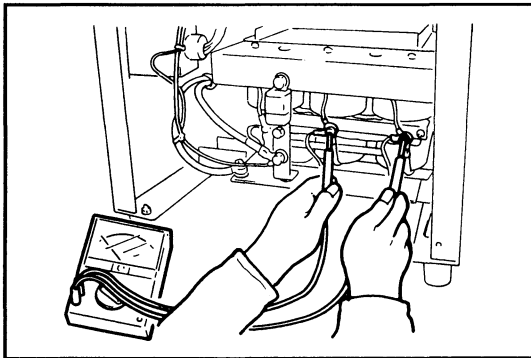
Note:

Check correct wiring at each part by referring to the charger wiring diagram.



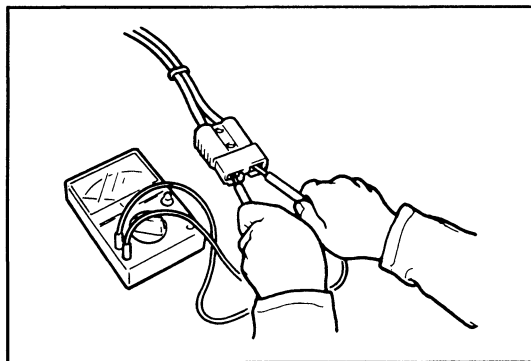
2. Inspect the transformer insulation resistance.

Measuring terminals	Between each winding and frame
Standard value	0.2 MΩ or more



3. Measure the no-load secondary voltage.
Connect the charger plug to the charger receptacle and start the timer.
AC voltage

Circuit tester range	AC 250 V • AC 500 V
Measuring terminals	U ₂ -V ₂ V ₂ -W ₂ W ₂ -U ₂
Standard value	See the Service Standards list.



DC voltage

Circuit tester range	DC 250 V
Measuring terminals	Both terminals of charger plug @ terminal - probe ⊕ ⊖ terminal - probe ⊖
Standard value	See the Service Standards list.

SERVICE STANDARDS

Item		Service Standard	
Power supply voltage	V	For 200 V	200 ± 230
		For 400 V	340 ~ 460
No-load secondary voltage (The values are the same for 200 V and 400 V.)	AC V	SG3-35-60JBY-2	Approx. 28
		SG3-35-85JBY-2	Approx. 28
		SG3-52-120JBY-2	Approx. 42
		SG3-52-165JBY-2	Approx. 42
		SG3-69-45JBY-2	Approx. 56
		SG3-69-60JBY-2	Approx. 55
		SG3-69-80JBY-2	Approx. 57
		SG3-69-100JBY-2	Approx. 58
		SG3-69-130JBY-2	Approx. 56
		SG3-69-165JBY-2	Approx. 58
		SG3-115-80JBY-2	Approx. 94
		SG3-100-100JBY-2	Approx. 85
		SG-100-130JBY-2	Approx. 85
No-load secondary voltage	DC V	Battery for 24 V	Approx. 37
		Battery for 36 V	Approx. 56
		Battery for 48 V	74 ± 78
		Battery for 80 V	Approx. 127
MSch coil resistance	Ω	CLK-15JT	For 200 V: 1300 For 400 V: 5700
		CLK-26JT	For 200 V: 900 For 400 V: 3900
		CLK-35JT	For 200 V: 390 For 400 V: 1600
		CLK-50JT	For 200 V: 390 For 400 V: 1600
Dch resistance in forward		Ω	Approx. 25
Dch resistance in reverse		Ω	∞
Dch tightening torque	N·m (kg·cm) [ft·lbf]	SKR71·SKN71/02,04	4 (40) [2.89]
		20M30·20MA30	2.35 (24) [1.74]
		SKR130·SKN130/02	10 (100) [7.23]
		45M20·45MA20	16.7 (170) [12.3]
		SKR240·SKN240/02	30 (300) [21.7]
Insulation resistance (500 V Megger)		MΩ	0.2 or more

TIMER TEST

1. Main timer inspection

- (1) Turn on the AC power switch.
- (2) Disconnect the battery plug.
(to unload the charger and operate the voltage relay).
- (3) Close the magnet switch (MSch) forcibly by using an insulating bar and keep pressing the NORMAL, switch (black-blue) or EQUAL switch (black-blue) for 5 seconds or more. When the TEST lamp (red) and CHARGING PROGRESS indicator lamps (three lamps excluding the uppermost one) come on. Release the switch as soon as they come on, and measure with a stop watch the time until the uppermost lamp comes on.
- (4) If the time until UP lamp lighting after TEST lamp on is as follows and if all lamps go off immediately after that, the main timer is normal.
When NORMAL switch is pressed: UP lamp on about 6 seconds later
When EQUAL switch is pressed: UP lamp on about 18 seconds later

2. Total timer inspection

- (1) Turn on the POWER switch.
- (2) Connect the battery in discharged state
(as the main timer is operated first because of voltage relay operation in the fully charged state).
- (3) When the NORMAL or EQUAL switch is kept pressed for 5 seconds, the TEST lamp comes on the start charging. Release the switch upon TEST lamp on and measure the time until CHECK lamp on with a stop watch.
- (4) The total timer is normal if the time after TEST lamp on until CHECK lamp on is as follows.
(The UP lamp does not come on.)
CHECK lamp ON in 90 to 100 seconds.
- (5) The lamp goes off when the battery plug is disconnected.

Caution:

If the CHARGE ON/OFF switch is pressed when a fully charged battery is connected, the main timer operates first to light the UP lamp and not the CHECK lamp. This does not indicate a total timer defect. Inspect again as described above after replacing the battery with a discharged one.

TROUBLESHOOTING

Estimated cause	Inspection method	Standard	Corrective action
The thermal relay on the AC side is tripped as soon as charging starts.			
1. Short circuit of MSch	(1) MSch coil continuity inspection Measurement terminals: A ₁ and A ₂	OK: Several hundred Ω NG: Abnormally low resistance	MSch replacement
2. TF insulation defect or short circuit between windings	(1) TF insulation inspection Measurement terminals: Between each winding and frame (2) Inspection of short circuit between TF primary and secondary windings Measurement terminals: Between primary and secondary winding terminals	OK: 0.2 MΩ or more NG: Less than 0.2 MΩ OK: 0.2 MR or more NG: Less than 0.2 MΩ	TF replacement
3. Dch defect	(1) Dch resistance inspection in forward and reverse directions Measurement terminals: Both terminals (anode and cathode) of Dch Anode  Cathode Forward: Anode ⊖ Cathode ⊕ Reverse: Anode ⊕ Cathode ⊖	OK: Forward Several 10 Ω or more Reverse ∞ Ω NG: Forward 0 Ω Reverse 0 Ω	Dch replacement
4. Other short circuit in main circuit	(1) Inspect the short-circuited portion by separating each circuit.	—	Repair of defective portion
Charging does not start though operated correctly for starting charging.			
1. Interruption or missing phase of input power supply	(1) Voltage measurement at mains outlet for power supply Measurement terminals: Between outlet terminals	OK: 200 ~ 220 V (charger for 200 V) 380 ~ 440 V (charger for 400 V) NG: OV	In case of missing phase, repair after checking the cause.
2. Disconnection in the AC plug	(1) Voltage measurement between R, S and T terminals of MSch	OK: 200 ~ 220 V (charger for 200 V) 380 ~ 440 V (charger for 400 V) NG: OV	Repair the plug if any phase is missing or no voltage is detected.
3. Blown fuse on DC side	(1) DC side fuse continuity inspection Measurement terminals: Both terminals of fuse	OK: 0 Ω NG: ∞ Ω	Fuse replacement
4. MSch coil disconnection	(1) MSch coil continuity inspection Measurement terminals: Between MSch terminals A ₁ and A ₂	OK: Several hundred Ω NG: ∞ Ω	MSch replacement
5. AMT defect	(1) AMT inspection Measurement terminals: Between AMT terminals 1 and 5 in wiring diagram	OK: OV NG: 200 V (charger for 200 V) 400 V (charger for 400 V)	AMT replacement

Estimated cause	Inspection method	Standard	Corrective action
6. THR contact defect	(1) THR contact inspection Measurement terminals: Between THR terminals 95 and 96	OK: Non operated state O R Operated state $\infty \Omega$ NG: Non operate state $\infty \Omega$	THR resetting by lever operation or MSch ASSY replacement
Incomplete charging			
1. TF tap changer defect	(1) AC input voltage measurement Measurement terminals: Between TF tap changer terminals	—	Change the wiring to match the input voltage
2. Missing phase in input power supply	(1) Voltage measurement at mains outlet for power supply Measurement terminals: Between mains outlet terminals	OK: 200 ~ 220 V (charger for 200 V) 380 ~ 440 V (charger for 400 V)	In case of a missing phase, repair after checking the cause.
3. THR tripping	(1) THR continuity inspection Measurement terminals: Between THR terminals 95 and 96	OK: Non operated state O R Operated state $\infty \Omega$ NG: Non operate state a, R	Reset lever operation after checking the THR tripping cause
4. Dch defect (open circuit)	(1) Inspection of Dch resistance in forward and reverse directions Measurement terminals: Both terminals (anode and cathode) of Dch Anode  Cathode Forward: Anode \ominus Cathode \oplus Reverse: Anode \oplus Cathode \ominus	OK: Forward Several ten or more Reverse: $\infty \Omega$ NG: Forward: $\infty \Omega$ Reverse: $\infty \Omega$	Dch replacement
5. Disconnection of TF winding	(1) Measurement terminals: Between TH winding terminals	OK: Continuity NG: ∞R	TF replacement
6. MSch contact defect	(1) MSch secondary voltage measurement Measurement terminals: Voltage measurement between MSch terminals U, V and W	OK: 200 ~ 220 V (charger for 200 V) 380 ~ 440 V (charger for 400 V) NG: 189 V or less (charger for 200 V) 359 V or less (charger for 400 V)	MSch contact repair or MSch ASSY replacement
7. TF terminal tightening defect	(1) Inspection of each TF terminal tightening state	No loosening of each terminal	Retightening of each terminal
8. Timer setting at short time	(1) Setting time check in test mode	See timer test section.	AMT replacement

Estimated cause	Inspection method	Standard	Corrective action
9. Other contact defect in charging circuit	(1) Inspection of tightening state and connector state at each portion	No loosening at each portion	Defective portion repair or retightening
10. Lowered battery charge	(1) Inspection of battery fluid specific gravity, battery voltage and fluid level If the battery voltage is less than the standard, inspect the voltage per cell.	NG (measurement after charging): Specific gravity: 1.150 or less Voltage per cell: 1.75 V or less Total voltage of whole cells 48 V battery: 42.5 V or less 80 V battery: 68 V or less	Battery replacement

CONTROLLER

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AC CONTROLLER

The 7FB series vehicle is installed with the travelling and load handling controller that controls the traveling and load handling systems and the PS controller that controls the PS system.

SAS function controllers are built in respective controllers as shown below.

- Mast control: Built in the traveling/load handling controller.
- Rear wheel swing control: Built in the PS controller.
- Steering knob offset correcting control: Built in the PS controller.

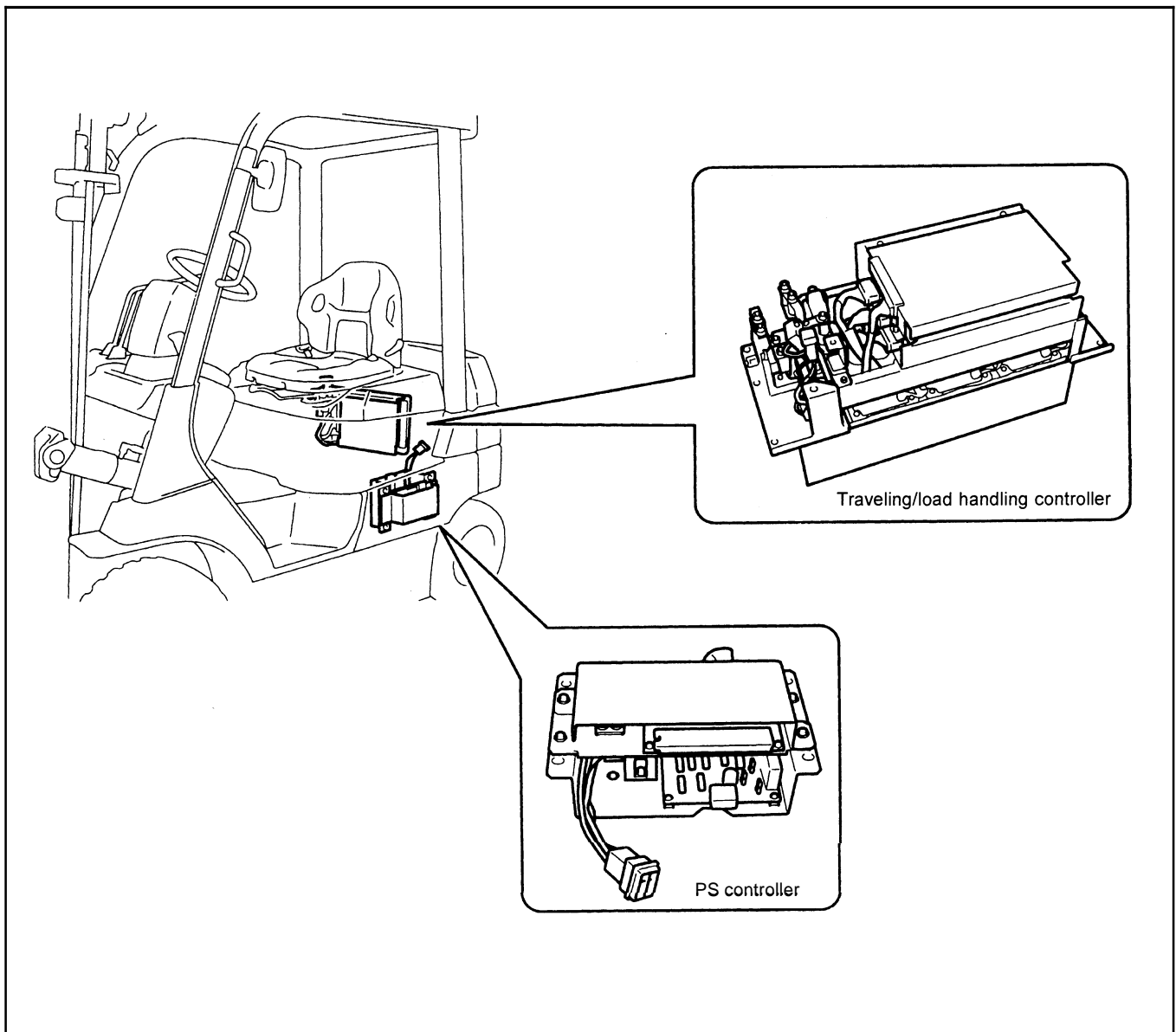
Each of them is a multifunctional controller utilizing a microcomputer. The traveling and load handling controller provides high performance in a wide range by means of inverter control of the AC motor drive system.

The controller has self diagnosis function that automatically detects any abnormality of the accelerator, PS circuit, SAS function or any other sensor and displays the corresponding error code together with the warning buzzer tone.

At the same time, an action such as stopping traveling, stopping load handling or restriction of traveling speed is automatically taken to ensure safety.

Identification of faulty portion and functional check of the traveling and load handling circuits, each operating system and sensors are also possible by setting the display to the analyzer (fault analysis) mode.

See page 4-2 in the "Multidisplay Function" section for the diagnosis, and page 4-7 in the "Multidisplay Function" section for the analyzer.



SPECIFICATIONS

		1 ton series	2 ton series	3 ton and J3.5 ton
Fuse	F1 (For traveling and load handling circuits)	500A 40-7FB15: 600A	600A	500A
	F3 (For PS circuit)	60A	←	←
	F4 (For lamps)	10	←	←
	F5 (For control circuit)	10	←	←
	F6 (For PS and solenoid)	10	←	←
	F7 (For DC/MD)	—	—	10A
Transistor	TMD (For traveling)	100V/640A	100V/800A	150V/600A
	TMP (For load handling)	100V/560A 40-7FB15: 100V/640A	100V/720A	150V/540A
	TMPS (For PS)	1MI 100H-025	←	←
Current sensor	CSBATT (For power supply)	S3CM7-800/4QG	←	←
	CSDA CSDb (For traveling)	S3CM7-800/4QG	←	←
	CSPA, CSPB (For load handling)	S3CM7-800/4QG	←	←
Capacitor	CO (For traveling and load handling)	100V, 2700 μ F × 20 pcs.	100V, 2700 μ F × 22 pcs.	160 V, 1800 μ F x 22 pcs.
Contactors	MB (For power supply)	Type ME251	←	←

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