<Reference-3> Maintenance Procedure

Regarding detailed procedure and matters that require attention on maintenance and inspection of each equipment, instruction manual which was issued by the maker should be referred.

2.1 Maintenance of Storage Battery

2.1.1 Refilling Water into the Storage Battery

As a general rule, supplementary water should be utilized exclusive distilled water which is on the market. However, when it is remarkably impossible to purchase the abovementioned water by reason of geographic or environmental matters at the construction place, rain water is assembled and can be utilized as supplementary water by means of the following procedure.

And refilling water into the storage battery should be done only when its level becomes prescribed position (LOWER LEVEL) or below at the execution of daily inspection.

·A vessel which was made of glass or plastic should be prepared.
However, a metallic vessel must not be used.

·The above-mentioned vessel is clean washed by means of rain or well water.

·Rain water is assembled by placing the above-mentioned vessel in the outdoor.

The vessel should be placed where there is no obstacle such as a roof,trees and so on.

·The refilling water into the storage battery is done.
And that should not be done until the level of storage battery exceeds prescribed position (UPPER LEVEL).

2.1.2 A Point to be Confirmed After Refilling Water

The following items should be confirmed after refilling water into the storage battery.

·The terminal voltage of storage battery.
And that should be converted at 20[℃] in accordance with the instruction manual.

·The water level of storage battery.

·The state of main body of the storage battery.
(To check and see whether the water is spilt or not.)

2.1.3 Cleaning

In and around the storage battery should be kept clean and dry condition at all times.

Cleaning of main body and a cap of the storage battery should be done by cloth which is moistened with water or tepid water.

And, when a stain is not taken off by water,kerosene should be used.

However, an organic solvent such as thinner, gasoline, benzin and alcohol must not be use.

2.1.4 Periodical Inspection

The inspection is done of the following items at six-month interval, there by, when result of the inspection missed the criterion, suitable measure should be done and all those should be recorded.

(1)Contents of the Inspection

The inspection item is shown in Table 2-1.

Table 2-1 Contents of the Inspection

Item	Contents of inspection	measure
1.Outward Appearance	To check whether there is a damage like crack and water leak in main body of that or cap.	If there is a water leak there,to cleaning following above-stated 2.1.3. When a water leak continue for a long time.
	To check whether there is a damage to cap and packing.	To replace a new article when there is a damage.
	To check whether there is a stain by dust and so on.	To clean by cloth which is moistened with water.
	To check whether there is a rust in the mount, terminal, connecting plate and cable.	To do measure such as cleaning, painting and so on when there is a rust.
2.A Point of Connection	Tightening of bolts and nuts M-8 (From 90 to 140[kg/cm])	

And terminal voltage, specific gravity and temperature of the electrolyte should be recorded whenever the inspection is done.

(2)Equalizing Overcharging

(a)Frequency

Equalizing overcharging is done at one-month interval and it should be continued for 48 hours (two days) after its beginning.

However, it is possible that the duration of that is changed again depending on a state of level after that.

(b)Method

Although equalizing overcharging is done by switching of NFB on the switch board, lighting equipment can be utilized during the execution of that.

In order to do equalizing overcharging, the switch(S2) is turned off and the switch(S3) is turned on as mentioned below.

The switch action are shown in Fig 2.1 and Fig 2.2.

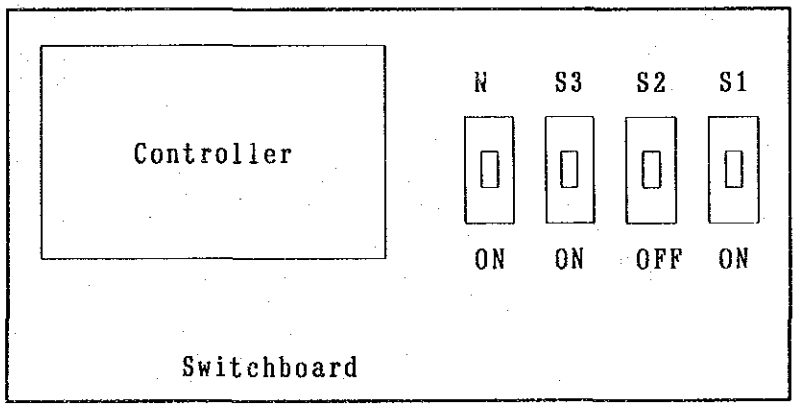


Fig 2.1 In Case of Equalizing Overcharging Execution

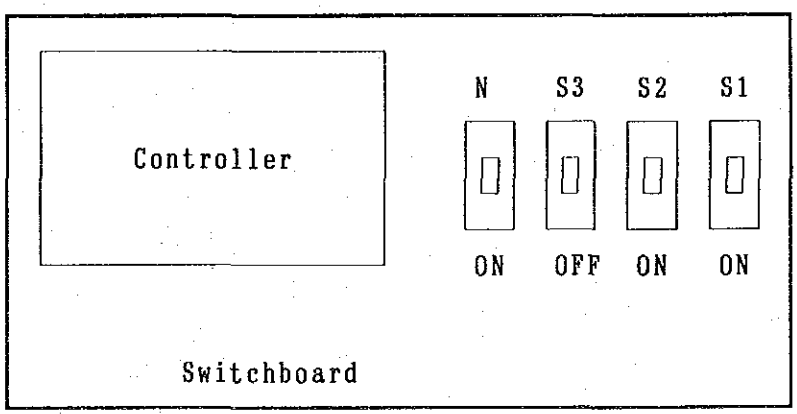


Fig 2.2 In Case of Normally Operation

ON : Turn switch over down.

OFF : Turn switch over up.

The change to equalizing overcharging mode should be done between 7:00 and 9:00 and the returning to normally operation mode should be done between 16:00 and 17:00 because of the prevention of reverse charging to solar module. And after equalizing overcharging finish, terminal voltage of the storage battery, specific gravity and temperature of the electrolyte should be measured and recorded.

2.1.5 Matters that require attention at the execution of daily maintenance

(1)Because the storage battery emits an explosive gas during its operation, no fire must be strictly obeyed.

(2)Running out of electrolyte should be avoided because the storage battery is damaged.

(3)Housing place of the storage battery should be sufficiently paid attention to its ventilation.

(4)Rubber gloves and shoes should be put on during the inspection because there is the possibility that touch on the conductive part will be gotten an electric shock.

(5)Protective tools such as rubber gloves and goggles should be put on during filling of the electrolyte because there is the possibility that the loss of eye-sight or a bun will be occurred when eyes or the skin or clothes were stained with electrolyte.

When the skin or clothes were stained with electrolyte, it should be cleaned with a large quantity of water.

Especially, when it got into eyes, a medical examination must be done.

2.2 Maintenance of Solar Module

(1)To check and see whether a point of fitting of the solar cell module becomes loose or not.

When there is a damage there or the fitting is unsuitable, the repairs shou ld be done.

(2)To check and see whether there is a crack on surface of the glass of the solar module or not.

When a crack is there, it should be changed a new article.

2.3 Maintenance of Charge/discharge Controller

(1)To check and see whether a point of fitting of the charging/discharging controller becomes loose or not.

When there is the slack there, fitting should be properly done by a screw.

(2)To check and see whether a point of connection becomes loose or not.

When there is the slack there,tightening should be done.

2.4 Maintenance of Load (Lighting equipment)

(1)To check and see whether a light is switched on or not.

When it is not switched on, it should be changed a new one.

(2)To check and see whether a point of fitting of a light becomes loose or not. When there is the slack there,tightening should be done.

(3)To check and see whether connecting is surely done or not and there is a damage on the plastic coating (insulation) or not.
When there is the slack there,tightening should be done. And when the cable is damaged,suitable repairs such as taping in a place of damage should be done.
(4)When there is a cover on the light, dirt of the outside and the inside should be cleaned removing it. When there is no cover on the light, an electric bulb should be carefully wiped so as not to be damaged it.

2.5 Maintenance of Wiring Cable
(1)To check and see whether there is a damage on the coating (insulation) of the cable or not.
When the cable is disconnected or damaged, it should be changed a new article,or suitable repairs such as taping in a place of damage should be done.
(2)To check and see whether the cable is firmly fitted and it rub against the sharp edges in the wind or not. When it is not fitted, suitable repairs should be done.
(3)To check and see whether the cable is properly fitted in a newplace or not when the direction of wiring, and the like has been changed at the inspection last time. When it is not fitted, suitable repairs should be done.
(4)When an unauthorized building is done in the house, its wiring should be promptly removed.

2.6 The Others (Assignment of SEC)
2.6.1 The Prevention of an Unauthorized Building
When an unauthorized building of the load is done, the system falls into overdischarging state, thereby, the life of the storage battery get shorter. Because the capacity of each system equipment, solar module, storage battery, and the like is designed on the basis of the capacity of the current load demand; therefore that should be prevented.
As prevention measure, it is considered that the following penalty should be provided and the direction for the consumer should be thoroughly done when there is a breach at the execution of the periodical patrol.
·A ban on utilization for a definite or an indefinite period.
·A fine.

2.6.2 The Prevention of Nonpayment of an Electric Bill

When the consumer does not pay an electric bill, it is considered in the same way as above-mentioned prevention measure of an unauthorized building that the following penalty should be provided and the direction for them should be thoroughly done.

·A ban on utilization for a definite or an in definite period.

·A fine.

However, when a ban on utilization is carried out, it is apprehended that the natural discharging or separation of active material of the storage battery will occur because it comes to be unable to use;therefore,it should be carried back and tried to do maintenance such as charging work.

2.6.3 Cooperation of Saving Electricity

SPECIFICATIONS

Model : MD200PV-I

Spec. No. : 920901

1992–NOV.–4

THE FURUKAWA BATTERY CO., LTD.
YOKOHAMA, JAPAN

Model MD200PV-I

SPECIFICATIONS

1. Scope

This Specifications apply to the Model MD200PV-I Charge-Discharge Controller (which is referred to, hereinafter, as the Controller) used in solar power generation systems.

2. Model

MD200PV-I

3. Applicable Standards

JIS, JEM, JEC

4. Applicable batteries

Sealed-type lead-acid batteries

Battery type	Rated capacity
12CTE-120	12 V-120 Ah / 100HR
	(100 Ah / 5HR

5. Appearance and Construction

(1) The appearance is shown in Fig. 1.

(2) Sealed insect-proof construction

6. Configuration

The circuit configuration of the Controller is shown in Fig. 2.

7. Specifications

(1) Main Circuit

① Connections to battery

a. Voltage : DC 8–16 V (Rated voltage: 12 V)

b. Current : 30 A maximum

② Connections to load

a. Voltage : 14.4 V maximum

b. Current : 30 A maximum

③ Connections to solar cell modules

a. Voltage : 16 V maximum

b. Current : 10 A maximum

(2) *Charge-discharge control*

Item	Characteristics	Remarks
① Charge Control (Prevention of overcharge)	• Battery capacity: ≥ 90% (Capacity equivalent) • Battery voltage: ≥ 14.4 V (Variable 14.0–14.9 V) • Battery temperature: ≥ 55°C (Operation resumes at 50°C.)	
② Discharge Control (Prevention of overdischarge)	• Battery capacity: ≤ 10% (Capacity equivalent) • Battery voltage: ≤ 10.5 V (Variable 10.0–10.9 V) • Battery temperature: ≥ 55°C (Operation resumes at 50°C.)	
③ Display of Residual Battery Capacity	Residual battery capacity is displayed by LEDs in five steps of 20% each, i.e.,: 20, 40, 60, 80, 100% The display continues for about 3 seconds when the Button for the purpose is pressed.	

(Continues on the next page)

Item	Characteristics	Remarks
④ Detection of Troubles and Display of Alarms	• Low Battery Voltage (≤ 8V; No automatic recovery) • High Battery Temperature (≥ 55°C; Returns to normal operation at 50°C.)	
⑤ Self Diagnosis	Operations of the circuit boards are tested, and an alarm is given if some trouble is detected.	
⑥ Temperature Measurement	The Controller measures the battery surface temperature continuously with a thermistor sensor attached to battery and connected with the Controller with lead wires. (Accuracy: ± 1°C) The lead wire length is 3 m.	
⑦ Battery Capacity Measurement	The Controller calculates the battery capacity from charges and discharges using respective conversion factors and displays it in percent of rated capacity.	

(3) Protective functions

Item	Characteristics	Remarks
① Sensor trouble	The charge and discharge functions stop when the thermistor sensor is in trouble. (Broken wire, failure, etc.)	
② Abnormal Charge or Discharge Current	The Controller is protected against abnormal current which might flow in and out of the battery due to short-circuiting, etc. (Overcurrent breaker: 30 A)	

(4) Environmental conditions

① Temperature : 0 to 40°C

② Humidity : 30 to 90%RH

③ Altitude : Below 3,000 m

(5) Other characteristics

① Insulation resistance : Over 3 MΩ by 500-V megger

② Temperature rise : To be specified after confirmation of practical value

8. Accessories

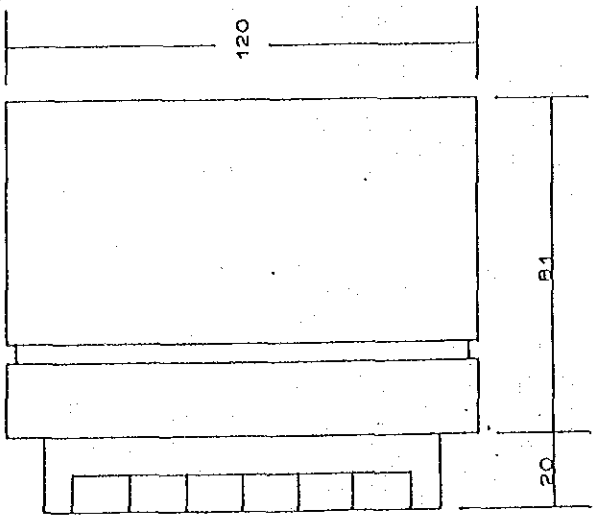
LCD monitor — The controller has a built-in LCD monitor inside for displaying data of the battery.

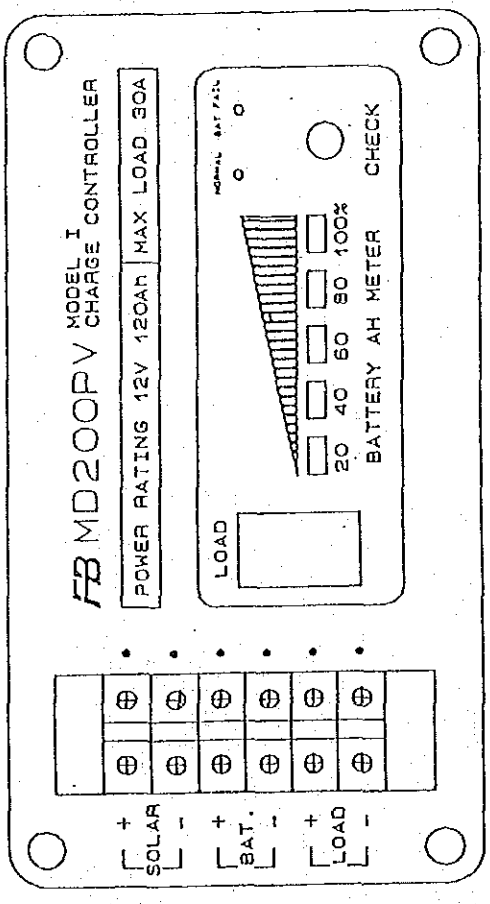
9. **Documents to Be Submitted**

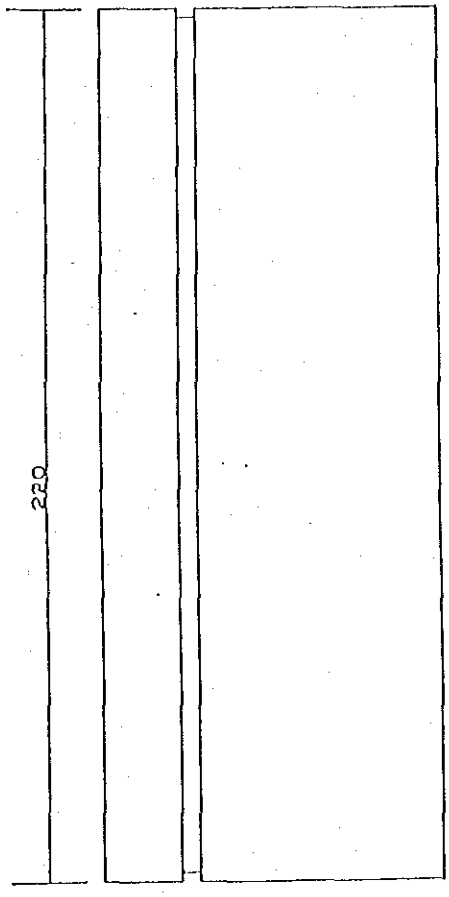
(1) Approval Drawings 5 copies

(2) Instruction Manual 5 copies

(3) Test Report 5 copies



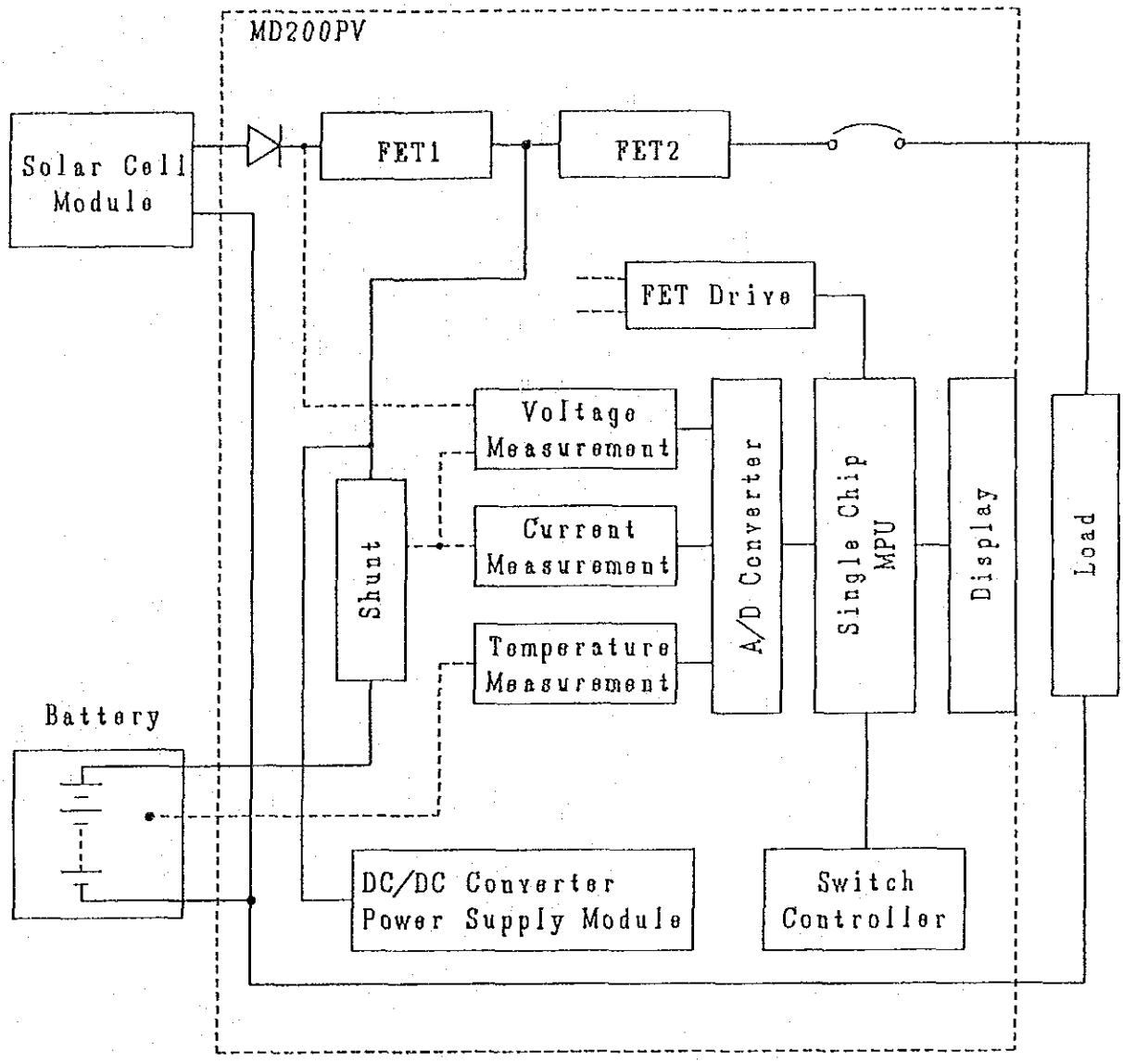




記号 MARK	年月日 DATE	変更者 REVISED BY	記事 DESCRIPTIONS

尺度 SCALE	承認APPROVED BY	照査CHECKED BY	名称 TITLE: MD200PV—I OUTLINE DRAWING
単位 UNIT mm	設計 DESIGNED BY Hanai	製図 DRAWN BY Hanai	
第3角法 3RD ANGLE PROJECTION	古河電池株式会社 THE FURUKAWA BATTERY CO.,LTD.		図面番号 DWG NO. 92090101

MD200PV Charge-Discharge Controller
Block Diagram



記号 MARK	年月日 DATE	変更者 REVISED BY	記事 DESCRIPTIONS

尺度 SCALE /	承認APPROVED BY	照査CHECKED BY	名称 TITLE: MD200PV-1 BLOCK DIAGRAM
単位 UNIT mm	設計 DESIGNED BY	製図 DRAWN BY	
第3角法 3RD ANGLE PROJECTION	古河電池株式会社 THE FURUKAWA BATTERY CO.,LTD.		図面番号 DWG NO. 920901021 /

NO. U-252(E)

SMALL SIZE
PHOTOVOLTAIC POWER SUPPLY SYSTEM USE

TYPE : 12CTE-120

(Valve regulated type)

SERVICE MANUAL

THE FURUKAWA BATTERY CO., LTD.

YOKOHAMA, JAPAN

1. Battery Type and Specification

Type	Voltage (V)	Capacity 100 HR (Ah)	Weight Filled (Approx. Kg)
12CTE-120	12	120	35

Since the battery is shipped in an initial charge condition, put it into service after taking necessary steps in the following sequence:

Keep the battery area will ventilated. Not only that but also extreme care must be taken to be free from shorting and to keep open flames and sparks away from the battery.

2. Preparation and Check before Freshening-Charge.

1) Battery Appearance.-

Check out the battery thoroughly to see if it is free from any distortion or damage on its container and other in transit or unpacking.

2) Never remove the exhaust caps on the battery cover. If remove it, cause damage the battery.

3) Freshening-Charge

Freshening-charge the battery before placing in service, since it causes the partial loss of capacity due to self-discharge in transit or in storage.

In condition that Loads circuit , Inverter circuit and Preventing-overcharge circuit shall be taken off the Photovoltaic power supply system , must be keeping on charging at least ten (10) days of shining .

Follow the service manual of Charge-Discharge Controller. (Type: MD200 PV-1)

3. Daily Maintenance and Handling

3.1 Cleaning

Always keep the battery and its neighbouring area dry and clean . Wipe plastic covers and containers with a rag moistened with cold or lukewarm water . Further , use kerosene if dust or dirt won't be removed from the battrey .

NEVER use organic solvents such as the thinner , gasoline , benzine , alcohol , etc .

When used organic solvents , they may cause cracks on plastic covers and containers .

3.2 Periodic Check

Check the battery every 6 months when it is out of specific criteria , and record all the results . (Voltage and Temperature of battery)

1) Battery Appearance	Check the cover and container for damage, i.e., cracks, distortion, and acid leakage.		If any acid leakage, clean the battery as Par. 3.1, When acid leakage is prolonged, identify the cause of trouble and repair or replace the cell with cracks and checks.
	Check the various cap aparatuses and gasket for damage		Replace defective parts.
	Check the battery for contamination due to dust or dirt.		Wipe with a water damp cloth, if any contamination.
	Check the cabinet, rack, connector, jumper cable, terminal for corrosion.		Keep the battery clean, rust-proof, coated and reconditiong.
2) Connection	Tightening screws & nuts. M:8 , 90~140Kg·cm		

3.3 Cautions during Daily Maintenance and Handling.

1) Any inflamable gas evolves within the cell, when placing the battery in service. Keep UNDER ANY CIRCUMSTANCES, open flames, e.g., cigarette light and sparks due to shorting away from batteries.
2) NEVER keep the battery dried, since this neglect is unsafe and leads to battery damage.

4) Wear rubber gloves and rubber-soled shoes as far as possible during maintenance and checks, since there is any fear with electric shock caused in touching a live metal part.

3) Do not disassemble the battery. Also, in case acid is splashed on skin, clothing as a result of causing damage, immediately flush with water. If acid is splashed into eyes, flush eyes with fresh water and see a doctor to get medical attention.
4) When the battery is put into fire, it will explode.
Do not attempt to do this.
5) When the battery placed in a vessel or bog, make sure of providing any evacuation section in it and keep the cabinet and the battery room will ventilated.

8) The operating temperature for batteries is within a range of -15 to 45°C. It is , however, recommended that the battery is put to use within a range of 5 to 40°C as much as possible.

END

No. 92-006-1

TEST REPORT

NAME OF ARTICLE : BATTERY (TYPE 12CTE 120)

QUANTITY : 2 Pcs.

DELIVERED TO :

MANUFACTURED BY : THE FURAKAWA BATTERY CO., LTD.

MANUFACTURED No. : 2138 - 209281

DATE : NOV. 1992

SUMMARY TABLE

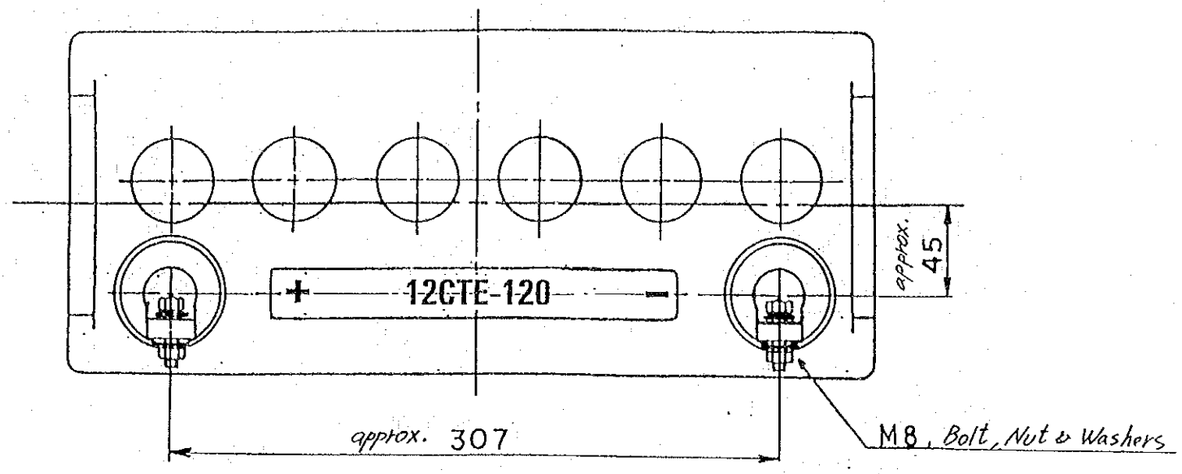
No.	INSPECTION ITEM	SPECIFIED VALUE	MEASURED VALUE	MAKER'S JUDGEMENT
1	Appearance			Good
2	Capacity	Discharge Current : 20 A	20 A	Good
		Discharge Time : 5 Hr	5.4 Hr	
		Discharge Rate : 5 Hr. Rate	5 Hr. Rate	
		Capacity : 100 Ah	108 Ah	
		Room Temp. : 25 ± 5 ℃	25.0 ℃	
		Final Volt : 10.2 V	10.2 V	

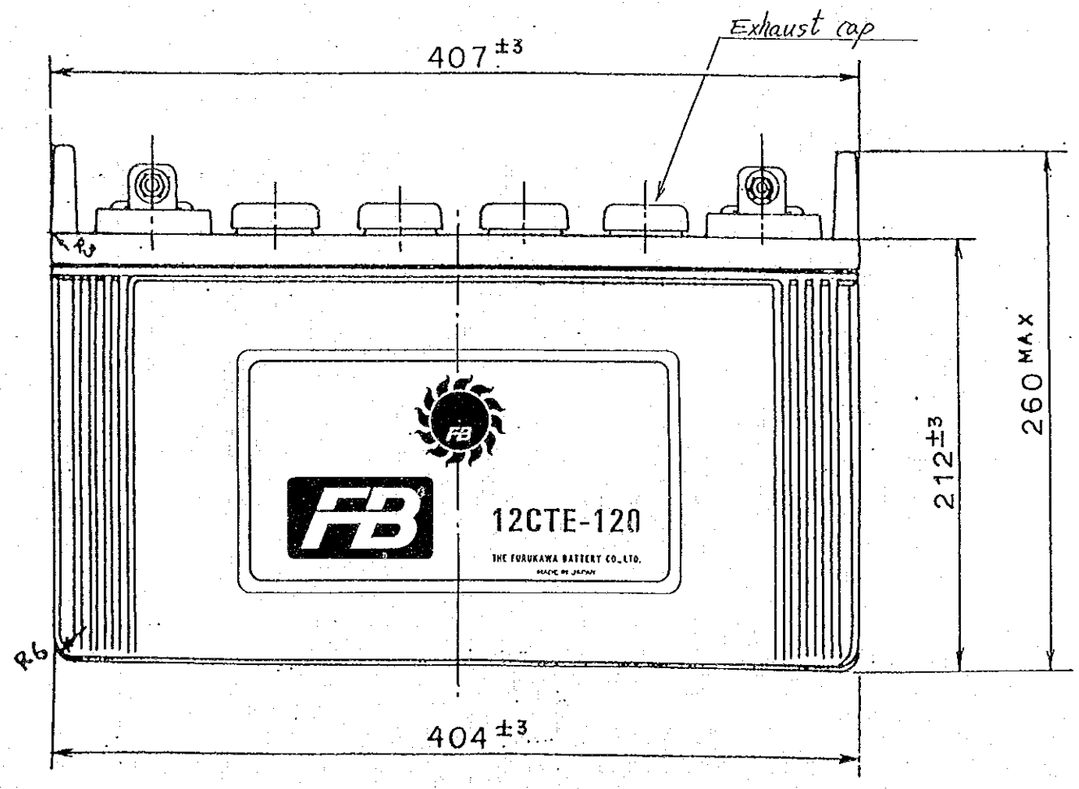
Approved By M. Kurosawa

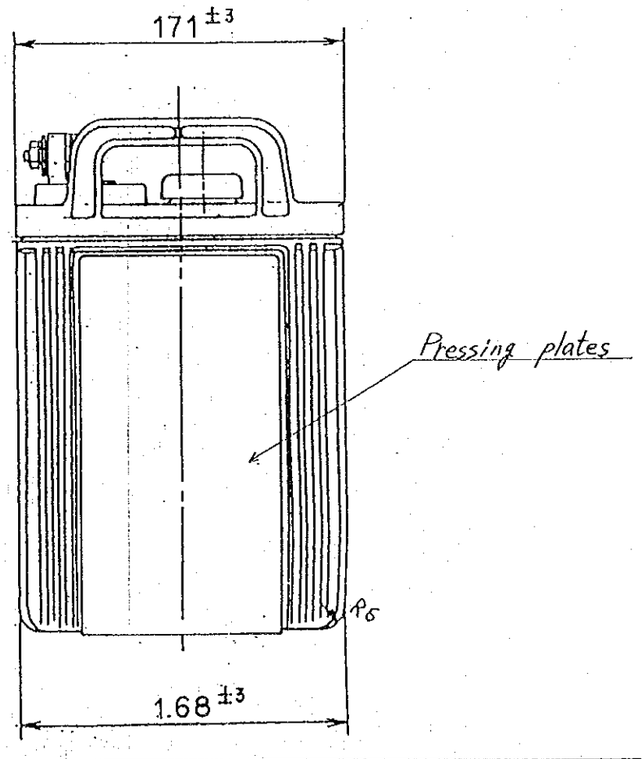
Inspection Dept.

THE FURUKAWA BATTERY CO., LTD.

記号 MARK	年月日 DATA	変更者 REVISED BY	記事 DESCRIPTIONS	照合 NO.	品名 NAME OF PARTS	材質 MATERIAL	重量 WEIGHT	員数 QT'Y	部品番号 RARTS NO	備考 REMARKS
					Container	Polypropylene				Gray
					Cover	Do.				Gray







尺度 SCALE	承認 APPROVED BY	照査 CHECKED BY	出図 ISSUED	名称 TITLE Valve regulated Type
単位 UNIT mm	設計 DESIGNED BY H. Takahashi	製図 DRAWN BY H. Takahashi	4.11.11	TYPE: 12CTE-120 12V, 120Ah/100HR
第三角法 3RD ANGLE PROJECTION	FB 古河電池株式会社 THE FURUKAWA BATTERY CO., LTD.			図面製作日 DESIGN DATE 11th. Nov. 1992
				図面番号 DRAWING NO. EB-27094

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Fig 4.2.1-2 Vented Type 12CT-110 type battery discharging characteristic diagram

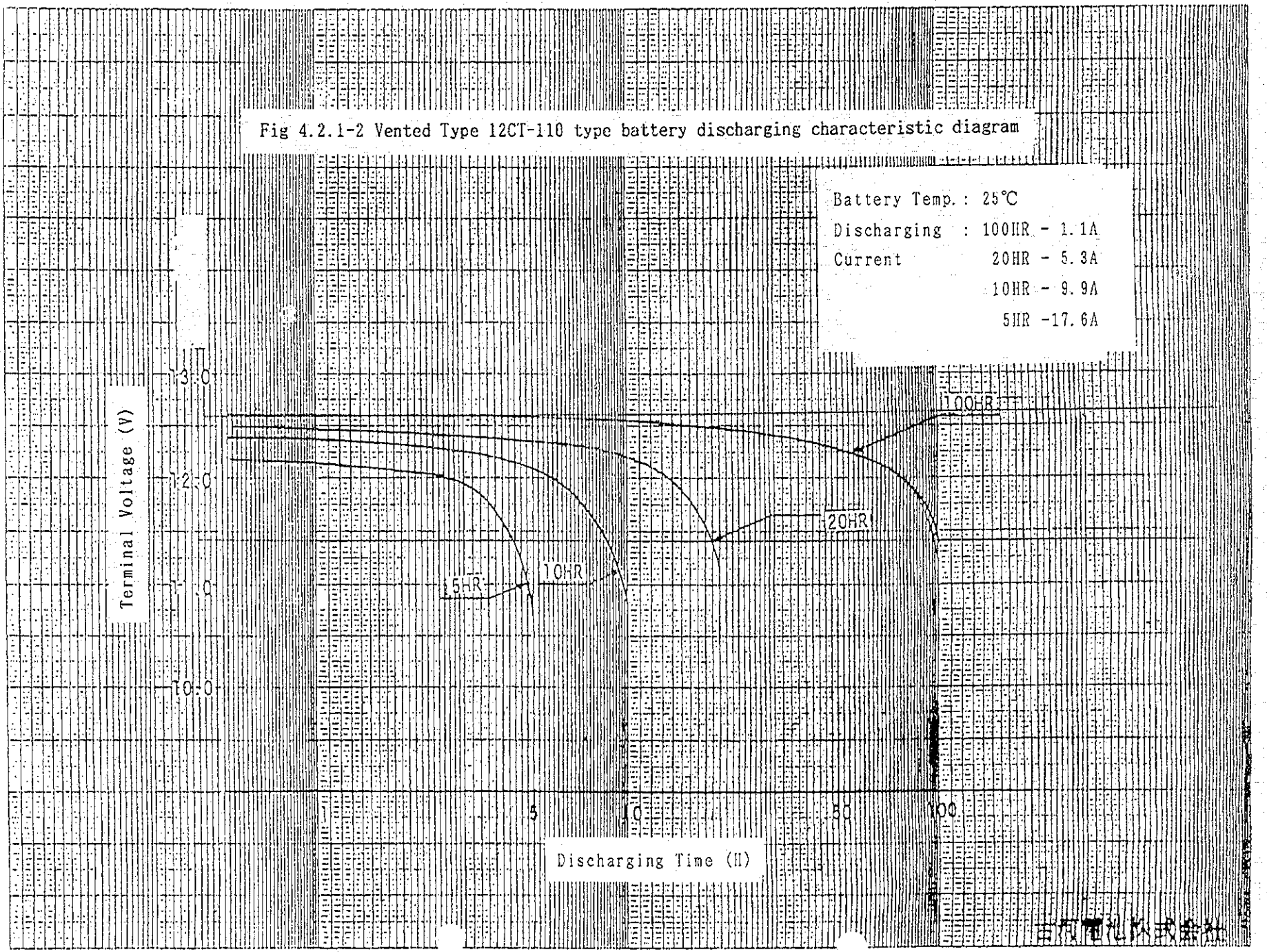


Fig 4.2.1-3 Vented Type 12CT-110 type battery charging characteristic diagram

Fig 4.2.1-4 Vented Type 12CT type battery charging characteristic diagram

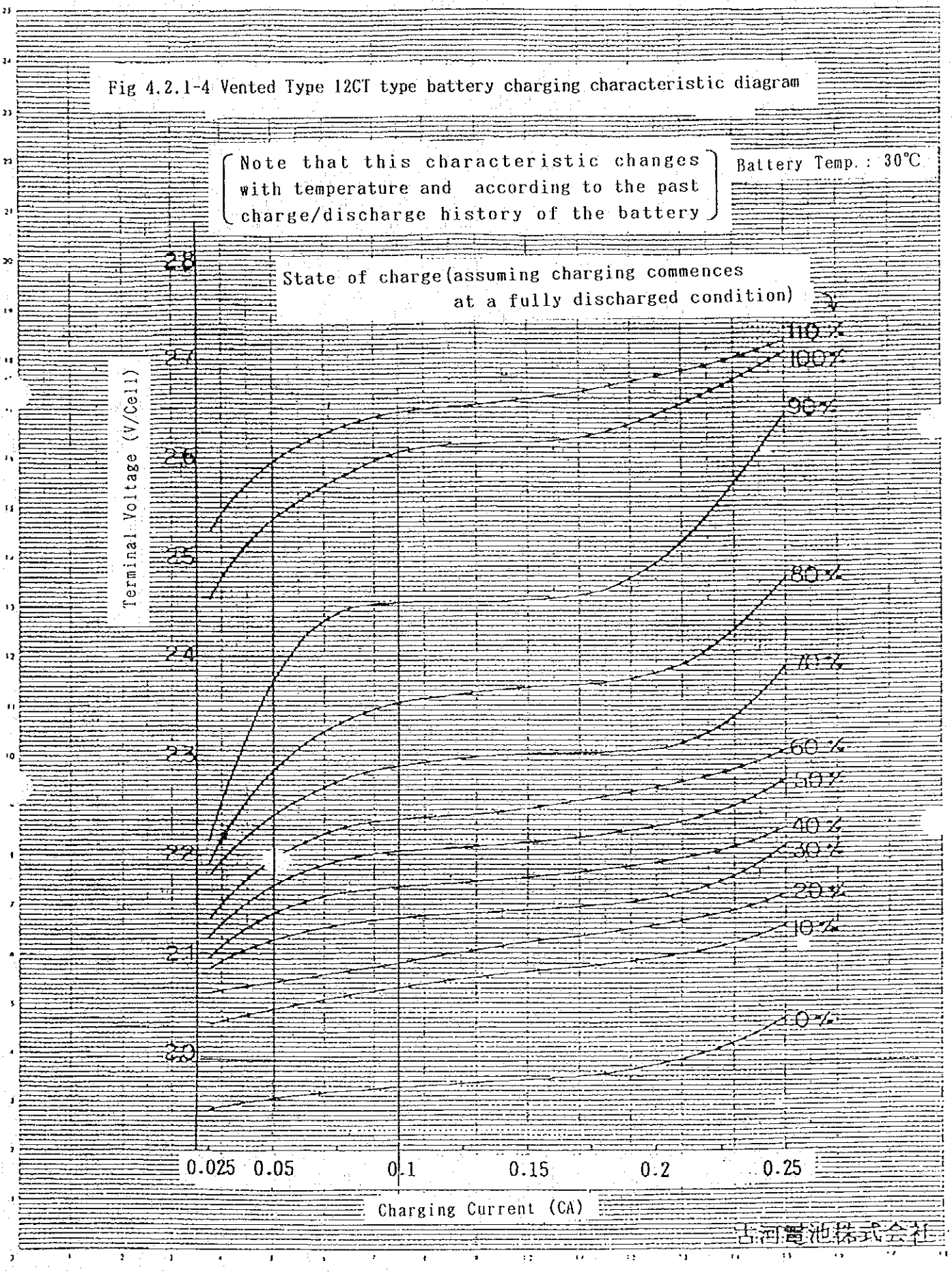


Fig 4.2.1-5 Seal Type 12CTE-120 type battery discharging characteristic diagram

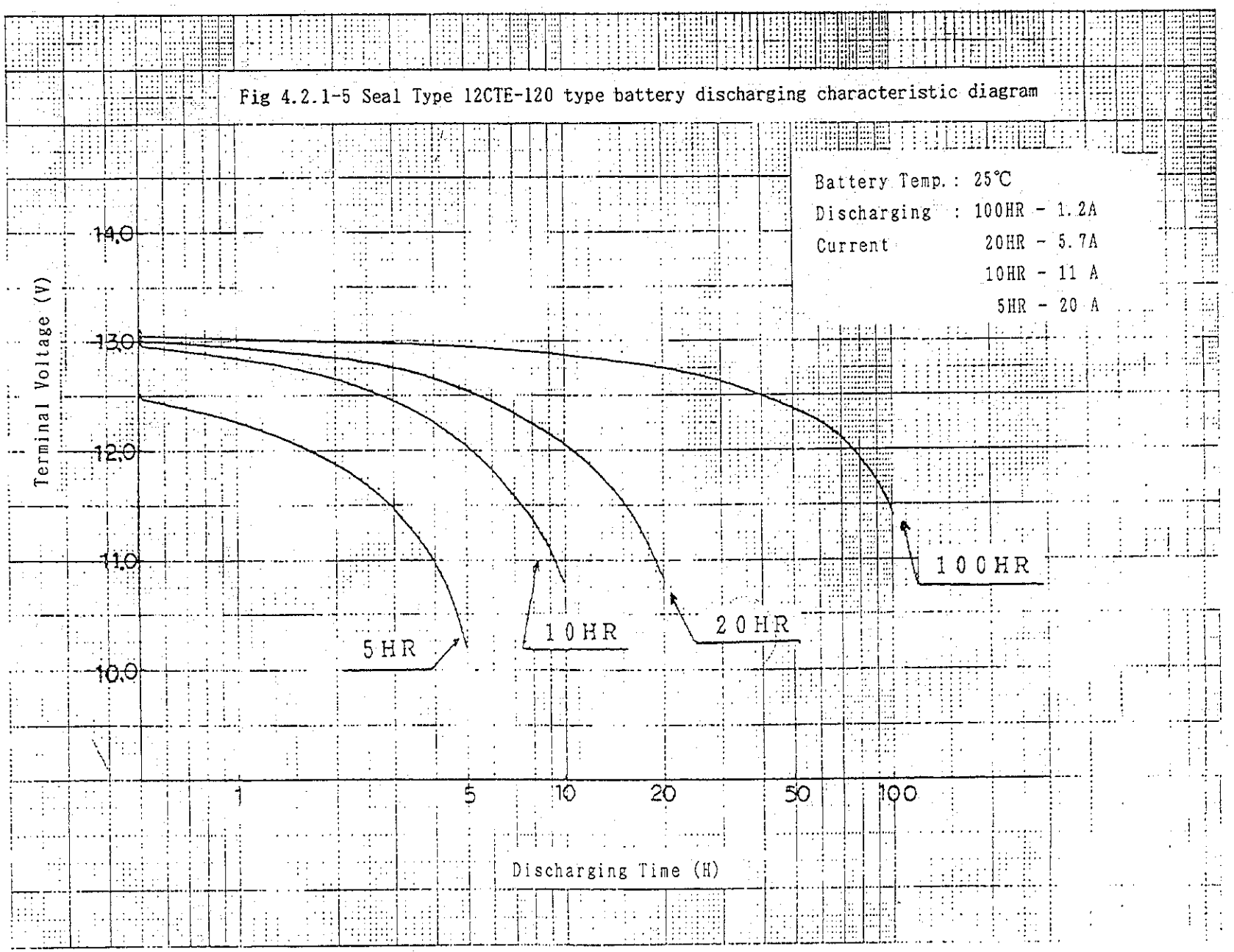
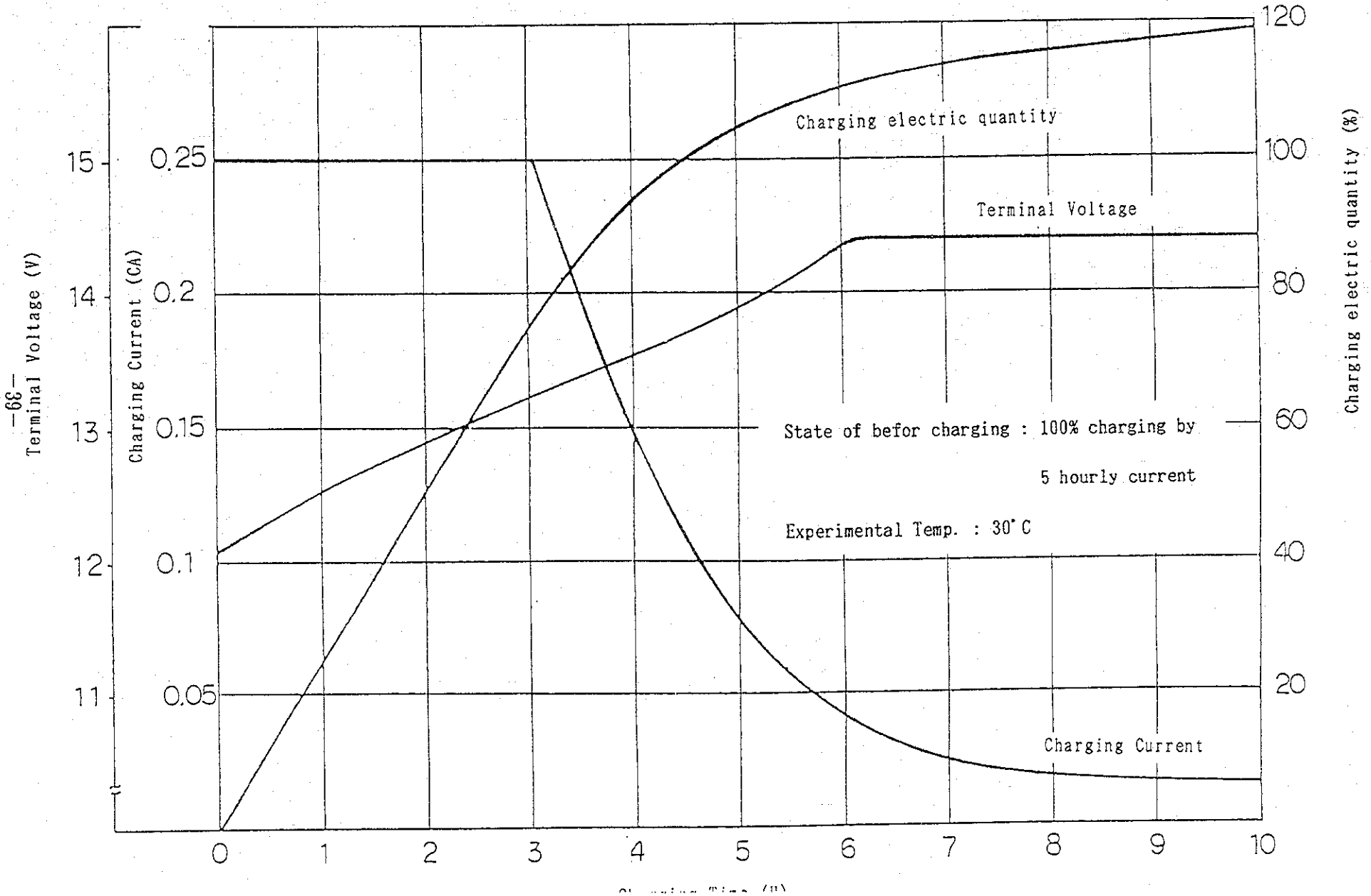


Fig 4.2.1-6 Seal Type 12CTE type battery discharging characteristic diagram



NO. U-250(E)

SMALL SIZE
PHOTOVOLTAIC POWER SUPPLY SYSTEM USE

TYPE : 12CT-110

(CHARGED AND DRY CONDITION)

INITIAL CHARGE AND SERVICE MANUAL

THE FURUKAWA BATTERY CO., LTD.

YOKOHAMA, JAPAN

1. Battery Type and Specification

Type	Voltage (V)	Capacity 100 HR (Ah)	Weight Filled (Approx. Kg)	Electrolyte Volume (Approx. liter)
12CT-110	12	110	35	6.6

Note : Electrolyte specific gravity (hereinafter called acid gravity) of full charged battery :

1.280 ± 0.01 (at 20 ℃)

2. Preparation and Check before Initial Charge.

1) Battery Appearance.-

Check out the battery thoroughly to see if it is free from any distortion or damage on its container and other in transit or unpacking.

2) Number of Dilute Acid Vessels: Check to see if there are required quantities.

3) Specific Gravity of Dilute Acid: Check to see if the acid gravity is 1.280±0.01 @ 20°C, providing the acid temperature must be corrected to the standard temperature by measuring the acid temperature at the same time during acid gravity measurement, since the reading of acid gravity @ 20°C becomes standard.

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

where,

S_{20}: Acid gravity corrected to 20°C

S_t : Acid gravity @ t°C (reading)

t : Acid temperature (reading)

3. Remove the yellow cap

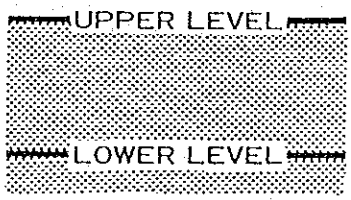
A red colored adhesive vinyl tape is attached to the vent hole of the yellow cap to prevent the plate surface from oxidation during storage.

JUST BEFORE FILLING , Remove the yellow cap out of the Battery. After finishing off initial charge , put the atttached explosion resistant plug (White cap) to use .

Do away with Yellow cap .

4. Battery Filling

Fill the battery with electrolyte up to the " Proper Level " of each cell . Temperature of the electrolyte shall be below 35 ℃ . In a 2- to 3- hour stand after battery filling , the acid level falls , since plates and separators absorb and hold the electrolyte . Therefore , add the same electrolyte up to the " UPPER LEVEL " once again .



5. Start of Initial Charge.

In a 3- to 10-hour stand after filling the battery with dilute acid, it is not until the acid temperature drop to 40° C or less that the battery is initial-charged.

6. Initial Charge Method and Initial Charging Time

Choose from the three Methods . (① Modified constant potential charge , ② Constant - current charge , ③ Initial Charge by Photovoltaic power supply system)

① Modified constant potential charge

Choose the charger that starting charge current is approx. 20 Ampere and finishing charge curret is approx. 6 Ampere .

The detailed charging Method shall be conformed with the Procedure of its Charger .

In keeping with the time befitting to the storage period of the battrey as shown in Table - 1 .

Table - 1

Storage period after Manufacture	Initial charging Time
0 – 3 Months	Approx. 25 Hours
3 – 6 Months	Approx. 35 Hours
6 – 9 Months	Approx. 40 Hours
9 – 12 Months	Approx. 50 Hours

② Constant - current charge

In keeping with the time befitting to the storage period of the battery as shown in Table - 2 , the initial charge must be given at approx. 10 Ampere of costant charge current .

Table - 2

Storage period after Manufacture	Initial charging Time
0 — 3 Months	Approx. 10 Hours
3 — 6 Months	Approx. 15 Hours
6 — 12 Months	Approx. 25 Hours

③ Initial Charge by Photovoltaic power supply system

In case of not charging by ① and ② .

In condition that Loads circuit , Inverter circuit and Preventing-overcharge circuit shall be taken off the Photovoltaic power supply system , must be keeping on charging at least ten (10) days of shining .

In this case , the acid gravity taken shows no increase up to specified value , 1.280 sp.gr. at 20 ℃ sometimes .

Note: Regarding the initial charging time, even if batteries stored for 6 months or improperly sealed; batteries allowed to stand keeping them mistakenly unsealed intact, etc., are charged for specified hours, the reading of the specific gravity taken shows no increase up to the specified value, 1.280sp.gr. at 20°C sometimes. In this case, prolong the charging time accordingly until the readings of the voltage and specific gravity show no more change and are kept constant fixed values respectively.

7. Specific Gravity Adjustment.

The acid gravity of the battery should be substantially 1.280 at 20°C, when near the end of charge. Due to the difference in storage requirements, there is somewhat any variation in acid gravity between batteries. If the acid gravity is out of the range of 1.270 - 1.290 sp.gr., when its reading taken shows no increase, the acid gravity adjustment must be made. When the acid gravity is lower, adjust the electrolyte by adding dilute acid. When it is higher, adjust the electrolyte by adding pure water.

Table 2 shows a guide line of the amounts of dilute acid and pure water added to each individual cell respectively.

Further, make acid gravity adjustment during charge and check to see if an observed acid gravity is corrected to 1.280sp.gr. as a standard at 20°C in a hour or so once again.

TABLE 1

	Low Acid Gravity	High Acid Gravity
Battery Type	Withdraw the amount of electrolyte per 0.01 of acid gravity difference and add dilute acid of the same amount of 1.400sp.gr. @ 20°C.	Withdraw the amount of electrolyte per 0.01 of acid gravity difference and add pure water of the same amount.
12CT-11O	82 cc	36 cc
	cc	cc

Notes: 1. The value in the above table shows the amount of acid or water to add per cell.

2. The value in the above table shows the amount of acid or water to add per 0.01 of acid gravity difference.
When the acid gravity difference is 0.02 or 0.03, the amount of acid or water to add becomes twice or three times as much as the value in the above table.

8. Precaution after Charging.

After keeping outside of cells dry and clean by wiping acid

spillage during charge after completion of initial charge, mount filler caps on the battery. (White Cap)

9. Caution during Charge.

9.1 Start charging when the acid temperature falls to 40°C or less after battery filling and keep a very careful look not to allow the battery to stand for a long time.

9.2 When the acid temperature reaches 50°C or more during charge, cut off charging temporarily and try to decrease the temperature.
To cut off charging, rotate the timer adjust knob counterclockwise and back it to the OFF position. Also, in changing after the temperature cools off, rotate the timer adjust knob clockwise once again.

9.3 As batteries generate a highly explosive gas, KEEP, UNDER ANY CIRCUMSTANCES, sparks or flames such as lighted cigarettes away from the battery.

9.4 Reasonable care must be taken in handling electrolyte, i.e., dilute acid.
If electrolyte is splashed on skin or clothing, flush with large amounts of water. Should electrolyte be splashed into eyes, flush eyes with large amounts of clean water and immediately SEE A DOCTOR.

10. Daily Maintenance and Handling

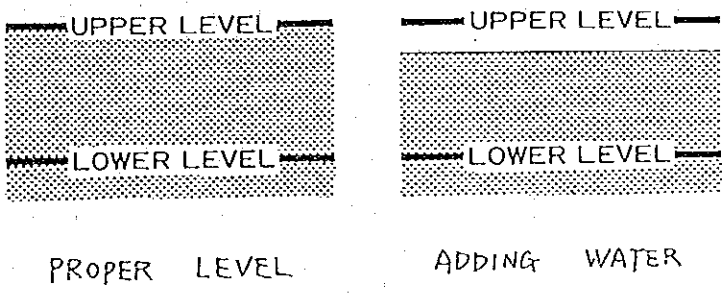
10.1 Adding Pure Water

The electrolyte gradually results in water loss due to water decomposition and spontaneous vapourization during charge .

Once every month check the acid level to ensure that nothing is wrong . When the electrolyte decreases , add pure water up to the " Proper Level " .

Further , when the electrolyte is added beyond the specified level , it may overflow the battery sometimes during charge .

Keep a careful watch in any water addition .



PROPER LEVEL ADDING WATER

10.2 Cleaning

Always keep the battery and its neighbouring area dry and clean .

Wipe plastic covers and containers with a rag moistened with cold or lukewarm water . Further , use kerosene if dust or dirt won't be removed from the battrey .

NEVER use organic solvents such as the thinner , gasoline , benzine , alcohol , etc .

When used organic solvents , they may cause cracks on plastic covers and containers .

10.3 Periodic Check

Check the battery every 6 months when it is out of specific criteria , and record all the results .

1) Battery Appearance	Check the cover and container for damage, i.e., cracks, distortion, and acid leakage.		If any acid leakage, clean the battery as Par.10.2, When acid leakage is prolonged, identify the cause of trouble and repair or replace the cell with cracks and checks.
	Check the various cap aparatuses and gasket for damage		Replace defective parts.
	Check the battery for contamination due to dust or dirt.		Wipe with a water damp cloth, if any contamination.
	Check the cabinet, rack, connector, jumper cable, terminal for corrosion.		Keep the battery clean, rust-proof, coated and reconditiong.
2) Connection	Tightening screws & nuts. M:8 , 90~140Kg·cm		

10.4 Cautions during Daily Maintenance and Handling.

1) Any inflamable gas evolves within the cell, when placing the battery in service. Keep UNDER ANY CIRCUMSTANCES, open flames, e.g., cigarette light and sparks due to shorting away from batteries.
2) NEVER keep the battery dried, since this neglect is unsafe and leads to battery damage.
3) Keep your cabinet and battery room well ventilated.
4) Wear rubber gloves and rubber-soled shoes as far as possible during maintenance and checks, since there is any fear with electric shock caused in touching a live metal part.
5) Electrolyte contains sulfuric acid. In case electrolyte is splashed on EYES, skin or clothing, it can burn or cause loss of eyesight. Always wear protectors such as goggles, rubber gloves, etc. In cause of contact with skin or clothing, flush immediately with large amounts of water and especially in case of direct contact with eyes, see a doctor immediately after flushing eyes with water.

END

No. 92-006-2

TEST REPORT

NAME OF ARTICLE : BATTERY (TYPE 12CT 110)

QUANTITY : 63 Pcs.

DELIVERED TO :

MANUFACTURED BY : THE FURUKAWA BATTERY CO., LTD.

MANUFACTURED No. : 2138 - 209281

DATE : NOV. 1992

SUMMARY TABLE

No.	INSPECTION ITEM	SPECIFIED VALUE	MEASURED VALUE	MAKER'S JUDGEMENT
1	Appearance			Good
2	Capacity	Discharge Current : 17.6 A	17.6 A	
		Discharge Time : 5 Hr	5.65 Hr	
		Discharge Rate : 5 Hr. Rate	5 Hr. Rate	Good
		Capacity : 88 Ah	99.4 Ah	
		Electrolyte Temp. : 25 ± 5 ℃	25.0 ℃	
		Final Volt : 10.2 V	10.2 V	

Approved By M. Kawakawa

Inspection Dept.

THE FURUKAWA BATTERY CO., LTD.

920901M

INSTRUCTION MANUAL

Charge-Discharge Controller for Solar Power Generation System

THE FURUKAWA BATTERY CO., LTD.
YOKOHAMA, JAPAN

Model MD200PV-I

Charge-Discharge Controller

(with Built-In Microprocessor)

1. Outline

This manual describes the Charge-Discharge Controller (which is referred to, herein after as the Controller) which protects storage batteries against overcharges and overdischarges in a solar power generation system where electricity generated by solar cells is stored in storage batteries and the electricity stored in storage batteries is supplied to loads as necessary.

《Remarks》

1. Read all this manual before starting to use the Controller. Retain this manual at hand so that it can be referred as necessary even after the start of using the Controller.

2. This manual explains only of the Controller. For storage batteries and solar cells, refer to respective equipment manuals.

3. Never use the Controller at voltages and currents exceeding the maximum voltage and current specified in the Specification. Otherwise, the Controller may be damaged and, in the worst case, cannot be usable again.

2. General Description

This Controller controls in a variety of ways to utilize electric power generated by solar cells at maximum efficiency. The controller is provided with non-contact-making switches independent for charging and discharging to control overcharges and overdischarges, and carries out controls properly and accurately by switching such switches to ON and OFF according to cumulative capacity and voltage of the storage battery. The Controller determines the residual capacity of storage battery accurately because the Controller makes capacity cumulation and conversion pertinent to battery characteristics and makes corrections for ambient temperature (battery temperature), which much affects the battery characteristics, by measuring the ambient temperature continuously. The residual capacity of storage battery can be displayed, only when a button for the purpose is pressed, at steps of 20% by five LEDs existing on the front panel of the Controller. The Controller also keeps monitoring the storage battery at all times, and such troubles as low voltage, abnormally high temperature and sensor trouble are indicated by alarm lamps.

The Controller is housed in a sealed container to prevent moisture, insects, etc. from getting inside and for the ease of mounting on a wall indoors and has four mounting holes at the bottom.

With the use of the built-in LCD monitor, in addition, it is also possible to check the values of the residual capacity, voltage, current, temperature and expected life of the battery. (The LCD monitor is to be used only by expert engineers.)

3. Related System Components

(1) Solar Cell Module

Be sure to use 12-V solar cell modules. The minimum voltage for charging the battery is 15.0 V. Select the voltage also taking the voltage drop in connecting wires into consideration if solar cell modules are installed away from the storage battery. The current is basically not a problem so far as it does not exceed the maximum allowable current of the Controller (10 A), but follow any instructions given by the module supplier in consideration that the Controller is for lead-acid storage batteries of 12 V in rated voltage.

(2) Storage Battery

The most significant feature of the Controller is that it controls switches according to the residual capacity of battery. Capacity conversion and cumulation parameters have therefore been set according to battery characteristics. The Controller therefore must be used in combination with the battery indicated below. If the Controller is used with other batteries, the Controller may not provide proper control, and the batteries might be adversely affected.

Batteries to Be Used with the Charge-Discharge Controller

12CTE-120 Sealed Lead-Acid Batteries

(12 V, 120 Ah/100 HR)

(Produced by THE FURUKAWA BATTERY CO., LTD.)

《Remarks》

1. Be sure to use the recommended batteries.
2. The Controller and the batteries cannot be used with other power generating equipment such as hydraulic and wind power generators.

4. Major Specifications

(1) Electrical ratings (Main Circuit)

① Connections to battery

- Voltage : DC 8–16 V
- Current : 30 A maximum

② Connections to load

- Voltage : 14.4 V maximum
- Current : 30 A maximum

③ Connections to solar cell modules

- Voltage : 16 V maximum
- Current : 10 A maximum

(2) Charge-discharge control

Charge/discharge / Control items	Overcharge control	Overdischarge control
Residual capacity of battery	≥ 90%	≤ 10%
Battery voltage	≥ 14.4 V	≤ 10.5 V
Battery temperature	≥ 55°C	≥ 55°C

(3) Display

① Residual battery capacity

- LED display in five steps of 20%

② Alarm indicators

- Low battery voltage (The indicator blinks when battery voltage is below 8 V. The blinking does not stop automatically even when the battery voltage returns to normal.)
- High battery temperature (The indicator blinks when battery temperature is above 55°C. The blinking stops when the temperature returns to 50°C.)

(4) Appearance and nomenclature

The appearance and nomenclature of the Controller are as shown in the figure below.

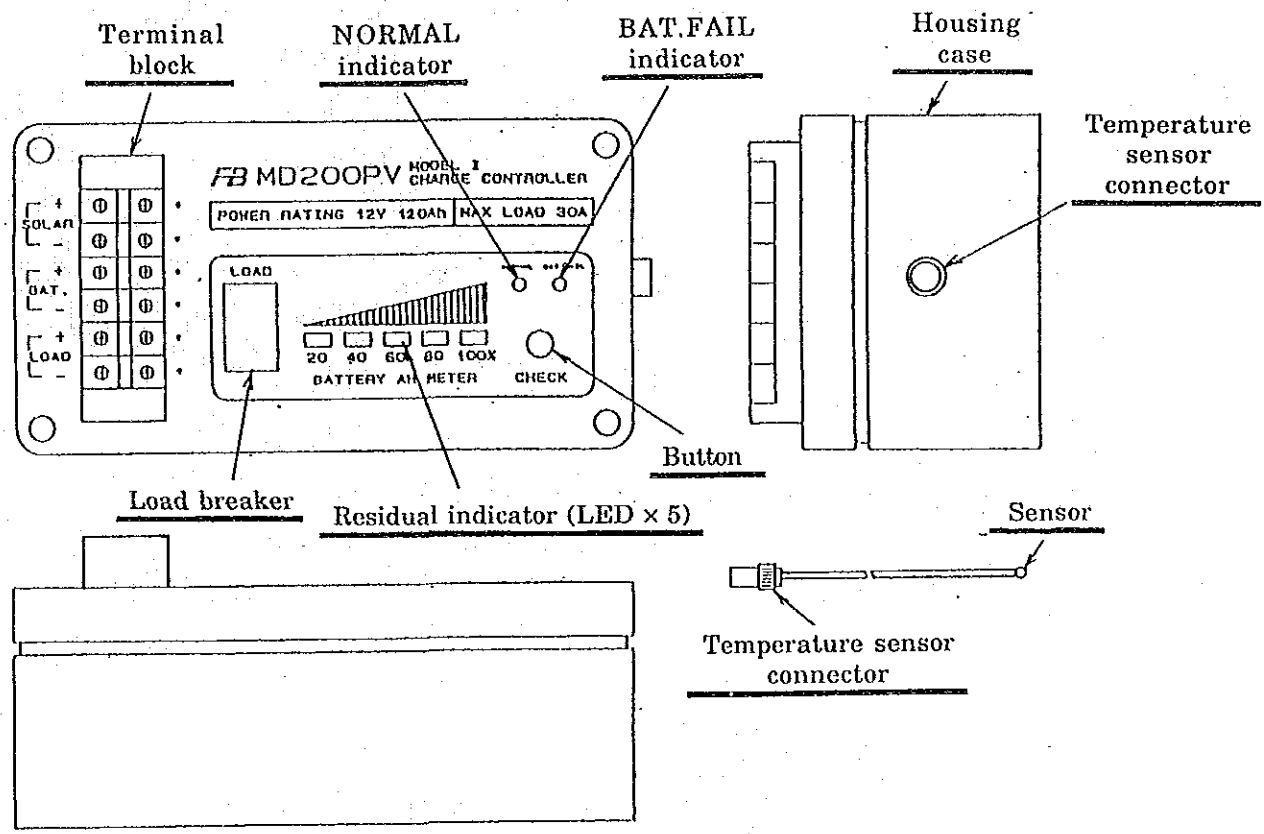


Fig. 1 External appearance and nomenclature

5. Place of Installation

The Controller is housed in a case of sealed construction, but it has not been designed to install outdoors. Install the Controller at a place where no rain, sea water or sunshine falls directly on the Controller. If drip-proofing is required, put the whole Controller in another casing of drip-proof construction.

Install solar cell modules and batteries, in addition, as specified by respective manufacturers.

6. How to Install the Controller

The controller is provided with four holes for mounting at its bottom. Fix firmly to wooden wall using wood screws. To do so, remove the cover (the panel having the LED display) once, and fix with wood screws from inside. Internal circuit components, lead wires, connectors, etc. are exposed when the cover is removed, and care must be taken not to damage or splash water to such components. Care must be taken also not to let foreign matters get inside the Controller. Be careful, in addition, not to let the case bite lead wires.

《Remarks》 Never touch internal components.

7. Connections

Make connections to battery, solar cell module and load directly at the terminal block. Connections are as shown in Fig. 2. Each terminal has a polarity of positive (+) or negative (–), and make connections with proper polarity as shown, and tighten bolts firmly so that they will not get loose.

As for the battery temperature sensor, set and fix its connector to its counterpart on the Controller.

Make connections properly in the order described below while confirming operations.

(1) Confirm that the load breaker is switched to "OFF." If the breaker is "ON," turn it to the "OFF" position.

(2) Make connections for the load.

(3) Make connections for the solar cell module.

(4) Make connections for the battery. When the battery is connected to the Controller, electric power is supplied for the first time to the Controller, and the Controller starts its operations. The residual capacity indicator of five LEDs repeats running blinking, and the BAT.FAIL indicator blinks finally. The BAT.FAIL indicator blinks because the battery temperature sensor has not yet been connected, and it is not a trouble. If the LEDs of the residual capacity indicator is not blinking at this point and all of them are just lighting, the Controller is not functioning properly, and all connections must be removed and made again from the first. If the symptom persists, have the Controller checked by an expert engineer.

(5) Finally, connect the battery temperature sensor to the Controller at its connector. The BAT.FAIL indicator goes off and the NORMAL indicator blinks indicating that the Controller is now in proper operation.

Attach the temperature sensor to a wider side wall of the battery container with adhesive, and then cover it further with adhesive tape for fixing (see Fig. 3).

The temperature sensor should be set to a battery. If it is not possible due to some inconveniences such as short lead wires, be sure to fix it near the battery with the sensor tip (about 5 mm at the tip) in the air but not under direct sunshine.

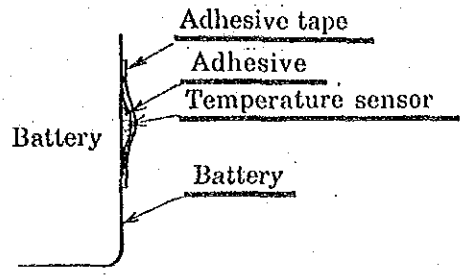
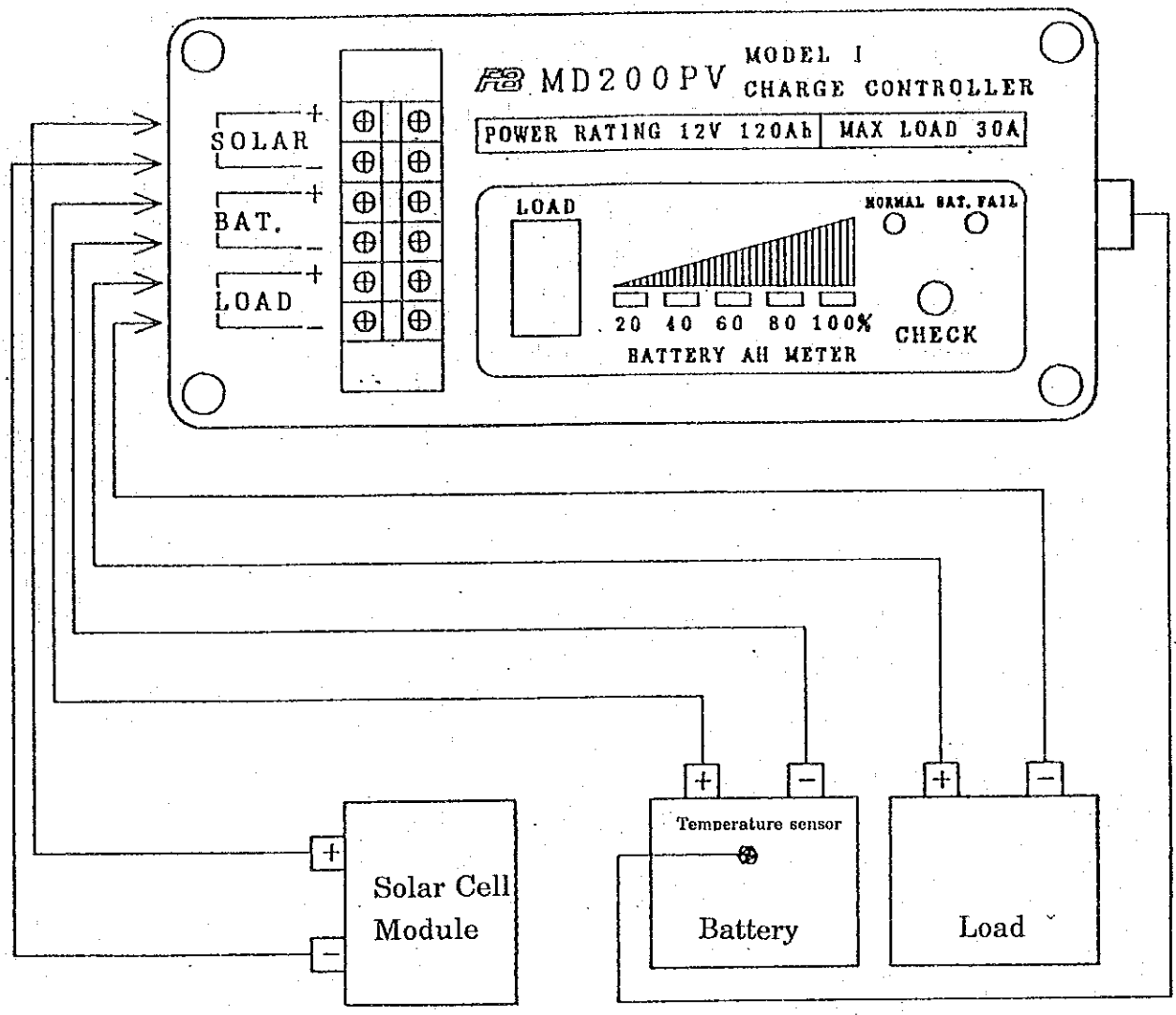


Fig. 3 How to fix the temperature sensor

《Remarks》

1. Be careful never to make connections in wrong polarity. If connected in wrong polarity, the Controller may suffer serious damages instantaneously. The same caution applies also to the case when the battery is replaced.

2. Without the temperature sensor connections, the BAT.FAIL indicator will keep blinking, and the Controller would not operate properly.



《Remarks》 Be sure to connect the battery temperature sensor at the very last.

Fig. 2 System connection diagram

8. Description of Operation

(1) The electric power to the Controller is supplied only when the battery is connected in the system, and the Controller starts to operate.

(2) The built-in microprocessor is automatically initialized, charging and discharging switches are turned off, and the following operations begin.

(3) The Controller makes self diagnosis automatically, and all residual capacity indicator LEDs light up if something is wrong, and the Controller waits for treatment. If such is a case, repeat disconnection and connection of the battery several times. If all the LEDs still light, it is suspected that the Controller is in trouble by some reason, and have the Controller inspected by an expert engineer.

(4) When the self diagnosis and self inspection ends successfully, the LEDs blink five times to notify that the system is normal. The NORMAL indicator then blinks indicating that the Controller is in the properly operating condition.

(5) The battery used in the system has been shipped by the manufacturer in a fully charged state, but some ampere-hour has been lost by self discharge by the time it is used in the system for the first time. The ampere-hour lost by self discharge depends on the time since the battery was shipped from factory and ambient temperatures it experienced during such time. The initial value of residual capacity set to the Controller has therefore been set to be 50% because of the uncertainty. There is therefore a discrepancy at first between the actual state of charge of the battery and the setting of the Controller, and charging from solar cells is repeated at first without discharging the battery. Start using the system (i.e., start discharging the battery) only after the LED display indicates a fully charged state of 100%.

《Remarks》

Repeat only charging from the solar cells at first, and start discharging only after the LED display indicates 100%. Otherwise, the discrepancy between actual residual capacity and that understood by the Controller may not be corrected. Overcharging or overdischarging will be repeated in such a state, and it will have extremely adverse effects on battery life. Thus, be sure to repeat charging from solar cells at first until the LED display indicates the fully charged state of 100%.

(6) When the Controller starts a normal operation with blinking NORMAL indicator, the built-in microprocessor makes calculations on various measured values, and turns the charging and discharging non-contact-making switches (which are referred to, hereinafter, simply as Charging and Discharging Switches, respectively) to ON and OFF according to results of calculations to control the system so that no overcharging or overdischarging occurs.

The Controller first checks whether the temperature is above 55°C or not. If the temperature is above 55°C, the Controller turns both the Charging and Discharging Switches to OFF to stop the use of battery until the temperature is below 55°C. If the temperature is normal, the Controller checks the next condition.

(7) The Controller then checks the battery voltage. When the battery voltage is below 10.5 V, the Controller sets the residual capacity to 10% and turns the Discharging Switch to OFF to prevent overdischarging.

In this case, the LED for 20% lights up at the resisual capacity indicator. When this happens in the early morning, charging starts immediately, and the Discharging Switch may turn to ON and OFF repeatedly if power is being supplied to the load. If this is the case, turn the load breaker to OFF or cut off the load for the sake of charging the battery. (Such situation would rarely occur because the battery usually has a capacity which is well enough for the load, but might occur if the battery has been deteriorated and has a smaller capacity.)

(8) When the battery voltage is above 14.4 V, the Controller sets the residual capacity to 90% and turns the Charging Switch to OFF to prevent overcharging.

(9) As for alarming on the battery, the Controller monitors two items, and blinks the BAT.FAIL indicator for either trouble.

① Low battery voltage

The Controller assumes that the battery failed if the measured battery voltage is below 8 V irrespective of the battery condition of charging, discharging or doing nothing, and turns both the Charging and Discharging Switches to OFF and starts the red BAT.FAIL indicator to blink. If such is a case, the battery is no good anymore, and replace the battery with a good one.

《Remarks》

Once "low battery voltage" is indicated, the system cannot be recovered to a normal operating state until the battery is replaced. The BAT.FAIL indicator, however, blinks either at "low battery voltage" or at "high battery temperature" and it is not possible to distinguish the trouble by the indicator. If the BAT.FAIL indicator is blinking, identify the trouble by measuring the battery voltage with a voltmeter.

② High battery temperature

The Controller turns both the Charging and Discharging Switches to OFF when the battery temperature is above 55°C by some reason, and starts the red BAT.FAIL indicator to blink. The use of the battery cannot be continued as it is in this case. Be sure to wait until the battery temperature goes down before using the battery again. If the battery is kept used continuously, it will extremely shorten the battery life and, in some cases, it will be dangerous because the battery temperature will rise even higher. The Controller returns to normal operation automatically when the battery temperature lowers to 50°C.

It should be noted that the same alarm occurs also at sensor troubles such as broken wire and shorting or when the temperature sensor is not connected.

《Remarks》

Replace the battery if the battery temperature rises to the alarming level easily after recovery and such cycles are repeated frequently, because the battery might have been used to its life.

(10) The Controller has a bult-in LCD monitor inside for displaying the state of use and expected life of the battery. The monitor is usually not visible from outside. In case of a trouble in the battery or Controller, an expert engineer will open the Controller and check necessary information on the monitor.

《Remarks》

The internal system of the Controller is initialized at the time of connection of a new battery when the battery is replaced by some reason. The control data of the history of use of the old battery is also lost forever. It is recommended therefore to record the control data periodically before the fails completely.

The Controller repeats the series of such operations at high speed, and works to maintain the battery in a good condition by switching the Charging and Discharging Switches.

9. Description of Operations

The Controller gets electric power at connection of a battery and starts a series of monitoring operations. The NORMAL indicator blinks when the Controller is operating properly. The Controller allows the following two external operations:

(1) Residual Capacity indicator

Press the red Button once to display the current residual capacity of the battery. The current residual capacity of the battery is displayed for 3 seconds, and the indicator goes off automatically for power saving.

(2) Load breaker

The load breaker operates when an excessive current flows to the load and cuts off the load to protect the internal controller circuits. If such is a case, eliminate the cause of the excessive current, and turn up the load breaker to resume power supply to the load.

10. Troubleshooting

Inspect and take actions referring to the table below when some trouble occurs in the use of the Controller.

Trouble	Possible causes	Actions to be taken
The NORMAL indicator, etc. do not blink.	① Battery failure, or trouble in connecting wires	Replace the battery, or repair or replace connecting wires.
	② Controller failure	Replace the Controller.
The load breaker tripped.	Excessive load current	Check for the cause of overloading, and adjust the load current to a proper level (below 30 A).
Residual capacity LED indicator does not light.	The Button switch failed.	Replace the Controller.
The BAT.FAIL indicator is blinking.	① The temperature sensor failed.	Replace the whole temperature sensor.
	② Battery deterioration or failure	Replace the battery.
	③ The battery temperature or ambient temperature is too high.	Replace the battery (if the battery temperature is too high). Select a proper place of installation (if the ambient temperature is too high).
No output to load while the residual capacity is over 20%.	The breaker failed, or the Controller as a whole failed.	Replace the Controller.
No charging is made. (The battery power is lost quickly.)	The solar cell module failed.	Consult with the solar cell module supplier.

Charge Regulator Type ~~LR114-12 (24)~~ LR114-12 (24) EK

Application

The battery charge regulator for photovoltaic power supply protects the battery against over-charging and over-discharging by automatic load rejection. The charge regulator can be optionally used for 12V or 24V DC power installations.

Mode of Operation

- Protection against over-charging
  The regulator automatically limits the battery charging voltage to the cutt-off voltage regulating the average charging current by a switching operation mode down to the charge conservation current. If the battery voltage decreases the charging starts again which means that the battery is always main-tained on the highest possible charging level in consideration of the insolation energy.

- Protection against over-discharging
  If, during the discharging of the battery by the consumer, the battery voltage falls below the over-discharge threshold, the consumer will be disconnected automatically from the battery via a bistable relay. At the same time a red LED ligths up. If, after charging, the battery voltage increases to the values of the load reset threshold, the consumer will be automatically reconnected and the red LED extinguishes.

Features

The charge regulator has the following features:

- It operates as a shunt switching regulator. Thus, there is no power loss at the actuator in the operating range. The operating frequency in the range of the cutt-off voltage amounts to 100 Hz, so that radio frequency interferences are excluded.

- A Schottky diode operates as a discharge blocking diode.

- The regulator has a very low power consumption of approx. 3.5mA in the total operating range (in the case of over-discharge approx. 7mA.).

- Polarity reversal protection is obtained by an external fuse.

- Terminals are fixed for sensing the ambient temperature of the battery (temperature-depending reduction of the maximum charging end-voltage per cell -4.5 mV/°C.

- Load rejection is effected when the battery voltage falls below the over-discharge threshold. The load is reset automatically.

- The load rejection is signalled by a red LED.

- Terminals are fixed for sensing the ambient temperature of the battery (temperature-depending reduction of the maximum charging end-voltage per cell -4,5 mV/°C.

- All parts are fixed in a plastic casing (degree of protection (IP65) with cable penetrations.

- The green LED lights up as soon as the moduls are exposed to daylight and the battery is charged.

Technical Data:

Rated voltage	: 12	(24)	(V)
Cut-off voltage	: 15.6	(31.2)	(V)
Over-discharging Threshold LED lights up!	: 11.4	(22.8)	(V)
Load reset threshold	: 12,6	(25,2)	(V)
Max. solar module current	: 16,0		(A)
Power consumtion	: 3,5 (7,0)		(mA)typical
Max. switchable consumer current via load relay	: 16		(A) constant load
Dimensions (mm) L x W x H without cable penetrations	: 174 x 80 x 58		
Weight	: 0.58	(kg)	

		~~LR 114-12/24 standard version~~	LR 114-12/24 EK extended climate range
admiss.operating temp.	:	~~-10...+50 °C~~	-25...+80 °C
admiss.storage temp.	:	~~-15...+60 °C~~	-30...+85 °C
admiss.relative hummidity	:	~~75%~~	90%

Operation of the charge regulator:
Prior to operation it ist important to strictly adhere to the following points.

- System voltage:
  The solar charge regulator can optionally be opereted with 12V or 24V battery voltage. In the delivered condition the regulator is appropriat for 12V For an operation at 24V, the slide-switche on the printed circuit board (see connection diagram) must be

switched before operation starts. The technical data put in brackets are valid for the 24V-system.

- Mounting

The regulator must be protected against direct insolation and should be mounted as close as possible to the battery.

-*Operations with battery temperature sensor (optional)

If the ambient temperature of the battery exceeds approx. 40°C a sensor (KTY881) can be connected adjusting the charging end-point voltage according to the battery.

The (2 K-Ohm) resitor R19 (see connection diagram) positioned above the two red T-marked terminals of the printed wiring board must be removed and the feed line to the sensor is fixed directly to the negative pole terminal of the battery for temperature measurment.

- Polarity reversal protection

The regulator is soecially designed and protected against polarity reversal of the battery or confusing of the terminals. It is also absolutely necessary to instal a fuse (time lag) with a rated value which does not exceed 15 A in the positive wire of the battery. This fuse also protects consumer, relay and cable against fire in the case of a short-circuit. Each regulator is supplied with a holding device equipped with one 15A-euro fuse (and also one spar fuse) which is internationally introduced and available at all motocar accessories shops or service stations. All claims to warranty are disqualified if the enclosed fuse is not fitted.

Important

A not fitting of the enclosed fuse as prescribed disqualifies all claims to warranty.

The battery must not be separated from the regulator during solar operation (i.e. in the case of insolation). Otherwise this may cause damage to a connected consumer.

When connecting the charge regulator for operation the following points must be adhered to in the indicated order.

- During the connection the polarity must absolutely be observed. Moreover, the local prescriptions concerning the erection of electrical installations are valid.
- Unscrew the four screws and open the casing cover.
- Insert the connection lines into the casing via the cable penetrations and connect as follows:

Battery	
Fuse output	to terminal "B+"
Negative pole of the battery	to terminal "B-"
Solar Module	
Positive pole of the solar module	to terminal "S+"
Negative pole of the solar module	to terminal "S-"
Consumer	
Positive pole of the consumer	to terminal "L+"
Negative pole of the consumer	to terminal "L-"

- Close the casing of the device.

The charge regulator is now ready for operation.

R e m a r k

All additional connections marked with(*) are only used in the case of long battery cables or if increased ambient temperatures of the battery are expected. They are not absolutely essential for the function of the solar plant.

Operating instructions for the solar facility

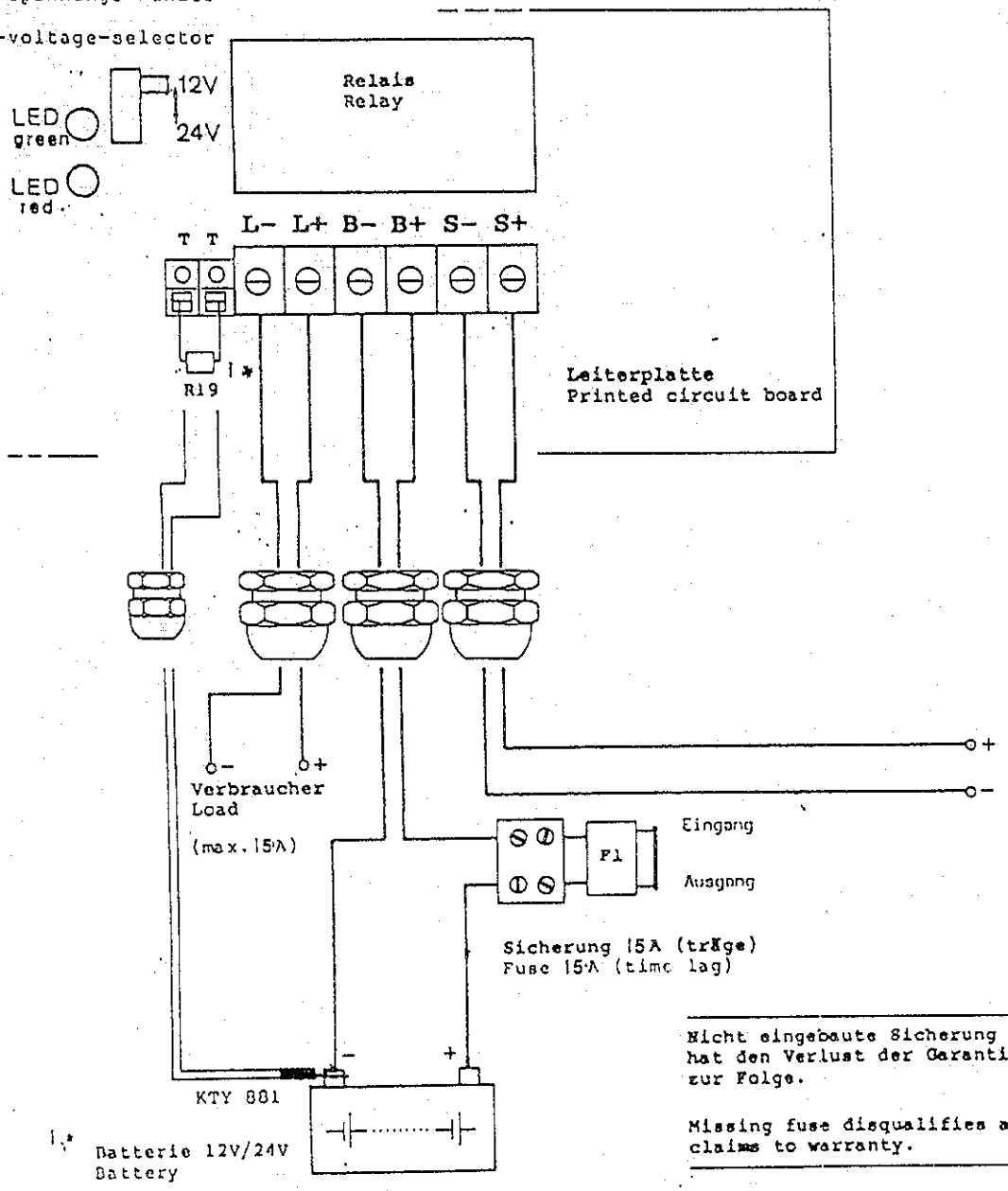
When operating the charge regulator attend to the following points:

- The solar charge regulator operates without maintenance.
- Connection, operation and maintenance are to be carried out according to the manufacturer's instructions.
- If the battery has to be disconnected (e.g. due to changing the battery or external recharge) the solar modules at the terminals S+, S- must previously be disconnected. The solar modules are not to be reconnected before the battery is reconnected. The solar power facility should not be operated without battery.

ANSCHLUSS-SKIZZE
CONNECTION-DIAGRAM

2 *
System-Spannungs-Wähler

System-voltage-selector



Nicht eingebaute Sicherung hat den Verlust der Garantie zur Folge.

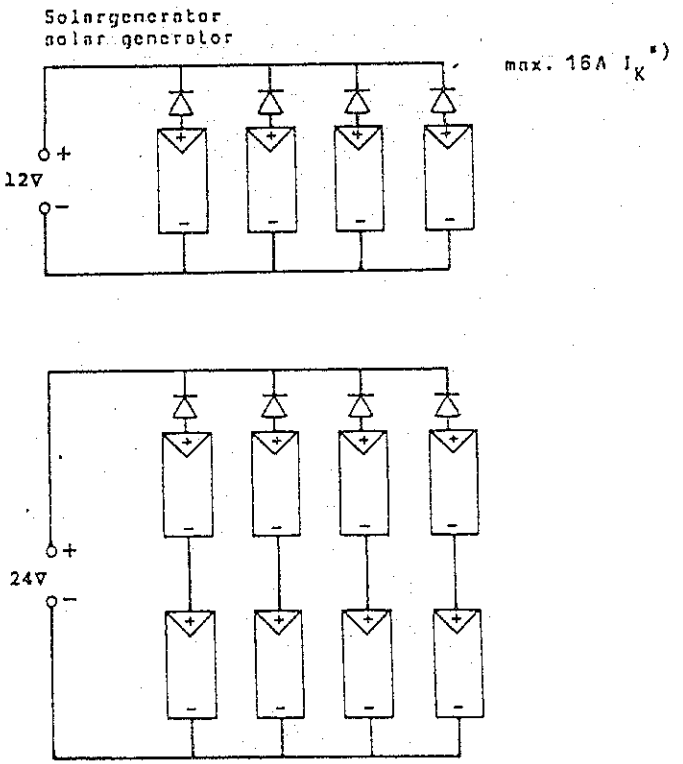
Missing fuse disqualifies all claims to warranty.

1 * Bei Anschluß des Temperaturfühlers ist der Widerstand R19 zu entfernen.

When using temperature sensor remove resistor R19.

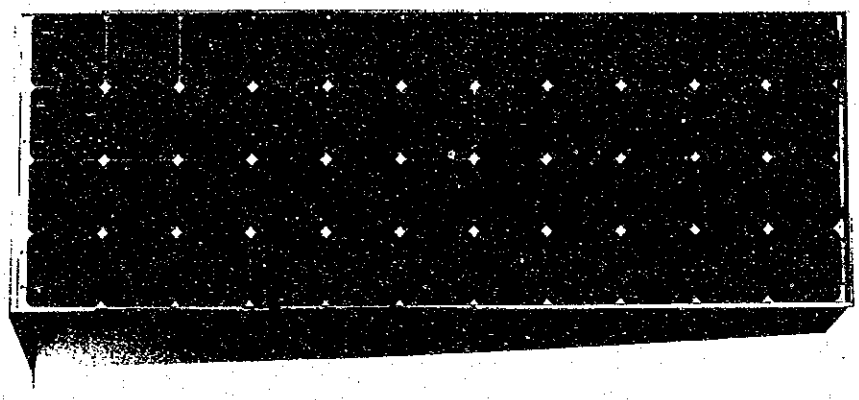
2 * Bei 24V - Systemspannung ist der Schiebeschalter auf 24V Position zu stellen.

By 24V-System voltage the slide switch must be in 24V-position



*) I_K = Solargenerator / solar generator
Kurzschl.-Strom / short circuit current

GL144N ——— 65W



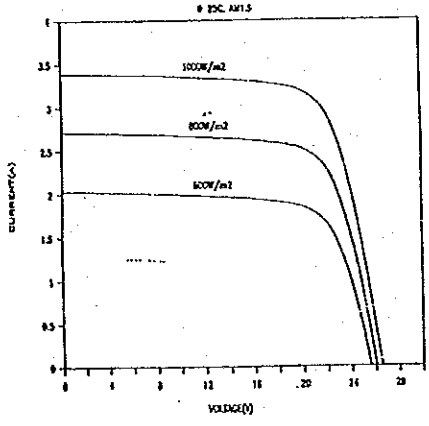
The GL144N generates 65W from 44 cells in series. It is powerful, precisely built, and reliable. This module is well suited for various applications, especially baterry chargers and DC motors.

Electric Specifications

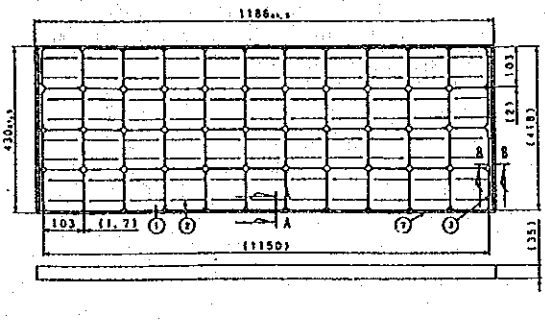
(Measuring conditions: 1000W/m², 25℃, AM1.5)

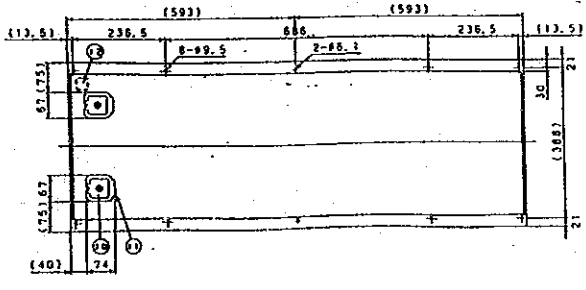
Maximum Power	Pm	65.0Watts
Maximum Operating Current	Ipm	3.05A
Maximum Operating Voltage	Vpm	21.3V
Short Circuit Current	Isc	3.4A
Open Circuit Voltage	Voc	26.8V
Module Efficiency		12.75%

GL144N I-V CHARACTERISTICS



Dimensions(mm)





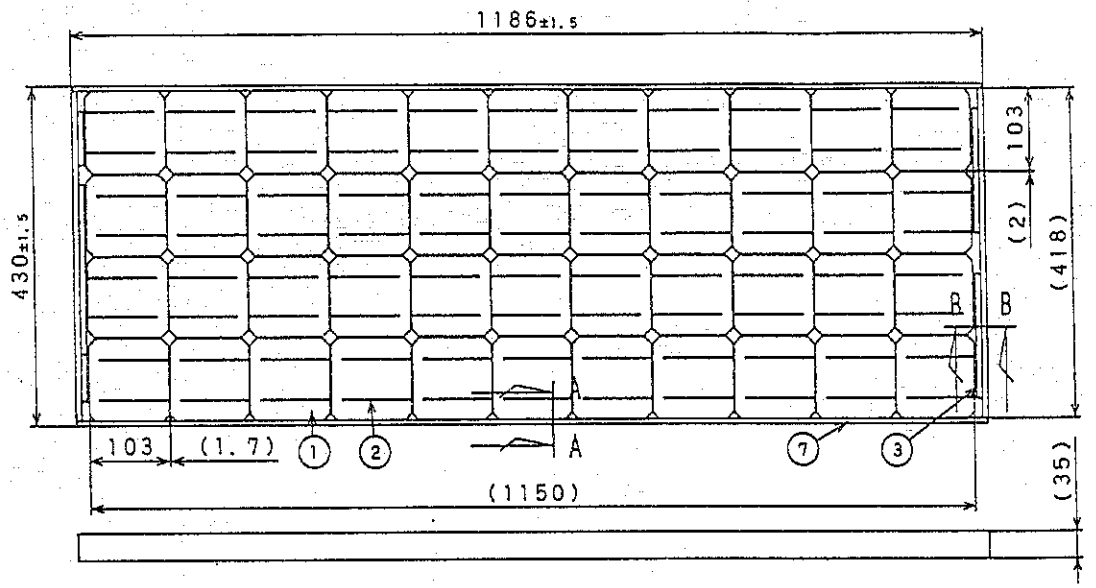
WEIGHT:7.2kg

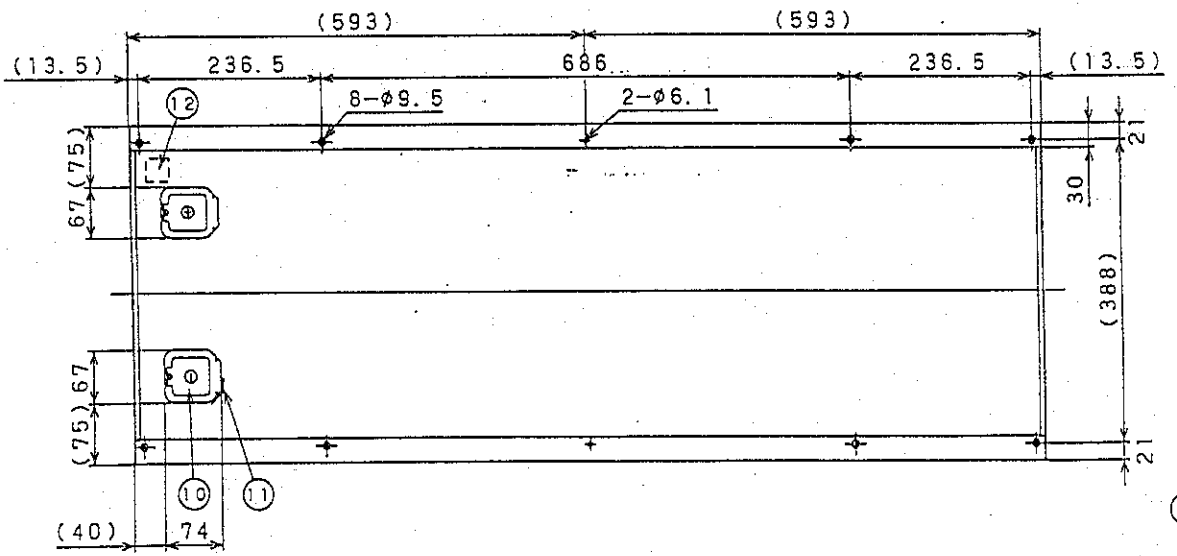
●Enquiries should be directed to:

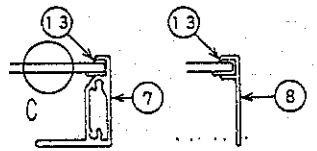
Showa Shell Sekiyu K.K. Photovoltaic DIV.

Tokyo Building 7-3, Marunouchi 2-chome Chiyoda-ku, Tokyo. 100 Japan Tokyo Central P.O. Box 1239
Telephone: Tokyo(03)3215-9661 Telex: Overseas J22373·J22901 Inland 222-2915·222-2075
Telefax: Tokyo(03)3284-1589

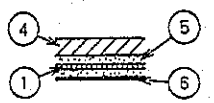
NO.	ITEM	QT'Y.	DESCRIPTION
1	Solar Cell	44	AR coated Cz Cell
2	Interconnect Ribbon		Solder coated Cupper Ribbon 2mmW
3	Jumper Ribbon		Solder coated Cupper Ribbon 7.5mmW
4	Cover Glass	1	Water White Tempered Glass
5	Encapsulant		E.V.A
6	Back Face Sheet		"TEDLAR/PET/TEDLAR" Film
7	Frame Side	2	Anodized Al Alloy
8	Frame End	2	Anodized Al Alloy
9	Screw	8	Stainless steel Tap Screw
10	Junction Box	2	NORYL
11	Adhesive		Silicon R.T.V.
12	Label	1	
13	Edge Sealant		Butyl Tape







A-A B-B



DETAIL OF C

Typical Power Spec		
Isc	3.40	A
Voc	26.8	V
Ipm	3.05	A
Vpm	21.3	V
Pm	65.0	W

@ 1kW/m², 25°C, AM1.5

DIMENTIONAL TOLERANCE: ±0.5mm

NO.	DATE	DESCRIPTION	CHK'D

REVISIONS

TITLE: GL144N

APP'D	CHK'D	DRN'N	DATE	SCALE
			92-09-30	NON

HOXAN Corp.,

DWG.NO. SCD-92178ROE

SPECIFICATION
OF
PHOTOVOLTAIC POWER GENERATING SYSTEM
IN
KIRIBATI

Oct, 1992

KYOCERA CORPORATION
SAKURA SOLAR CENTER

APPROVED	CHECKED	DRAWN

Contents

Attached drawings

Description	Drawing No.
1. Solar module (LA441K59)	AC-32216
2. Solar array (1)	SAA517A
3. Solar array (2)	SAA519A
4. Solar array (3)	SAA518A
5. Pole	SAC388E

1. General

This specification applies to the pole, mounting structure and solar module of photovoltaic power generating system installed in KIRIBATI.

2. Equipment list

No.	Description	Model No.	Q'ty	Remarks
1.	Solar module	LA441K59	50 pcs.	Drawing No. AC-32216
2.	Mounting structure (1) *1		3 sets	Drawing No. SAA517A
3.	Mounting structure (2) *2		32 sets	Drawing No. SAA519A
4.	Mounting structure (3) *3		23 sets	Drawing No. SAA518A
5.	Pole		61 sets	Drawing No SAC388E
6.	Cable			
	· Inter module cable *3	2PNCT-2.0sq-1C	23 sets	

*1 Four modules - type of GL144N - have been fixed on panel frames and wired between them at factory.

*2 Two modules - type of GL144N - have been fixed on panel frames and wired between them at factory.

*3 Two modules - type of LA441K59 - have been fixed on panel frames and wired between them at factory.

3. Specifications

1) Solar module

Type	:	Multicrystal silicon photovoltaic module
Model	:	LA441K59
Dimension	:	Refer to Drawing No. AC-32216
Weight	:	7.3kg
Output characteristic	:	Refer to table 1
Insulation resistance	:	DC1000V Not less than 500MΩ
Dielectric strength	:	DC3000V 1 minute
Operating temperature	:	−40°C ~ +90°C

2) Mounting structure (1)

Type of solar array	:	Ground mount type
Array tilt angle	:	10°
Frame material	:	Hot dipped galvanized steel
Dimension	:	Refer to Drawing No. SAA517A
Nos. of solar module	:	4 pcs. (GL144N)
Weight of mounting structure	:	Approx. 20 [kg]

3) Mounting structure (2)

Type of solar array	:	Pole mount type (With band)
Array tilt angle	:	10°
Frame material	:	Hot dipped galvanized steel
Dimension	:	Refer to Drawing No. SAA519A
Nos. of solar module	:	2 pcs. (GL144N)
Weight of mounting structure	:	Approx. 25 [kg]

4) Mounting structure (3)

Type of solar array	:	Pole mount type (With band)
Array tilt angle	:	10°
Frame material	:	Hot dipped galvanized steel
Dimension	:	Refer to Drawing No. SAA518A
Nos. of solar module	:	2 pcs. (LA441K59)
Output characteristic	:	Refer to table 1
Weight of mounting structure	:	Approx. 25 [kg]

5) Pole

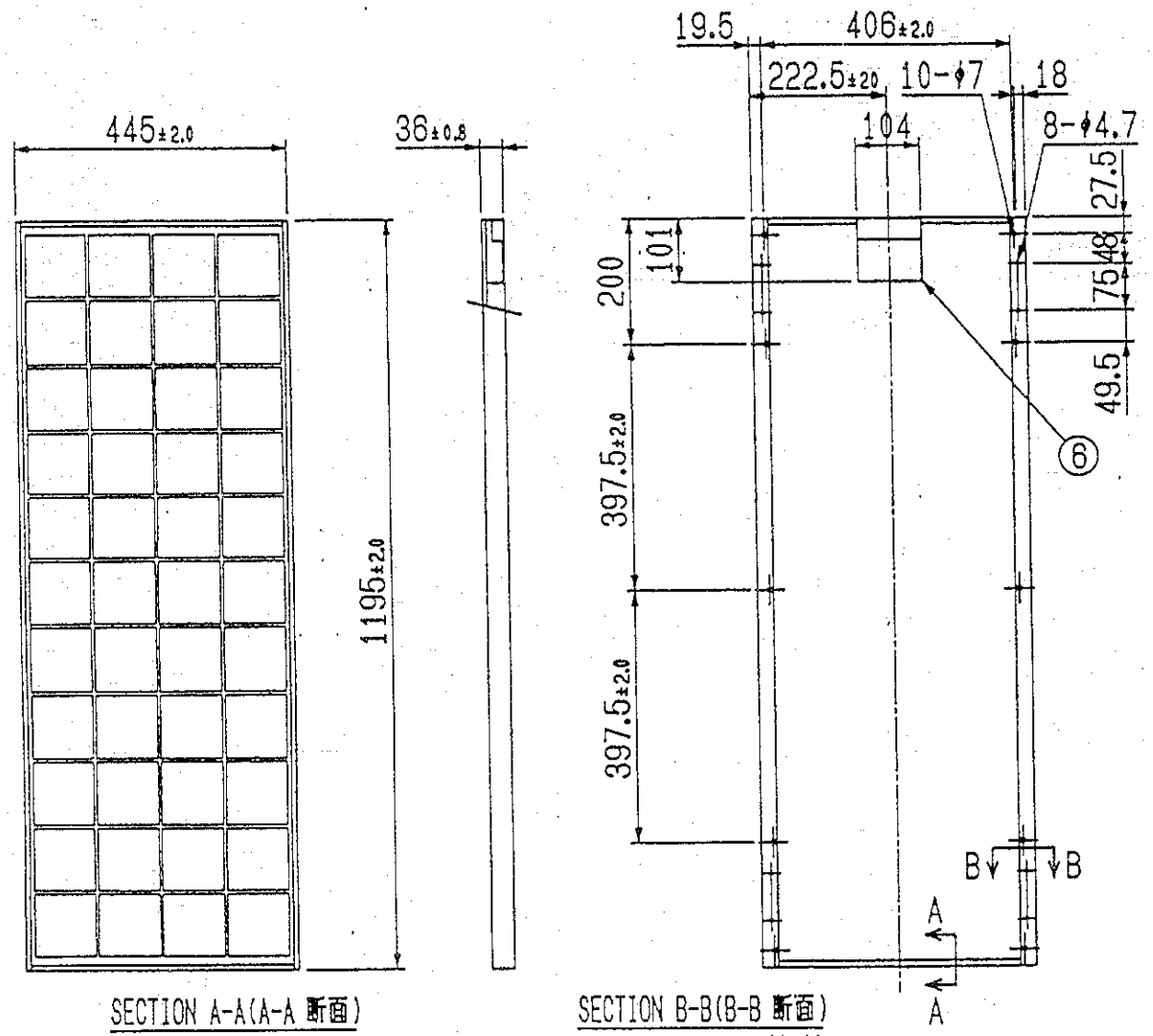
Material	:	Hot dipped galvanized steel
Length	:	5 [m]
Diameter	:	114.3 [mm]
Weight	:	Approx. 45 [kg]
Dimension	:	Refer to Drawing No. SAC388E

Table 1

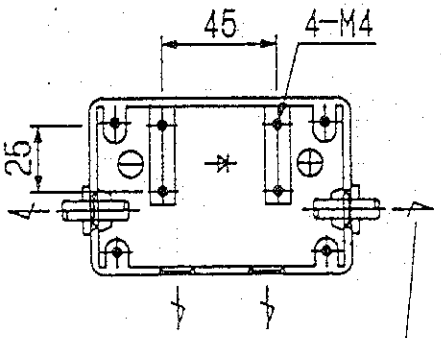
Item	Module		Array
	Typical	Minimum	Typical
Maximum output power	58.7 Wp	52.8 Wp	117.4 Wp
Maximum power voltage	20.3 V		20.3 V
Maximum power current	2.89 A		5.78 A
Open circuit voltage	25.4 V		25.4 V
Short circuit current	3.10 A		6.20 A
Nos. of module	1		2
Module connecting	—		1S 2P

Condition : Irradiance AM1.5, 100mW/cm^2
: Cell temperature 25°C

NO (部番)	DESCRIPTION (部品名称)	QT. (数量)	MTL. (材質)	REMARKS (備 考)
1	SOLAR CELL (太陽電池素子)	44	Si	PSC100H
2	GLASS (ガラス)	1		LOW-IRON TEMPERED (白板強化)
3	POTTANT (ポッタント)	1S.	EVA	
4	BACK SHEET (バックシート)	1	PVF/AL	
5	FRAME (フレーム)	1S.	AL.	
6	JUNCTION BOX (ジャンクション・ボックス)	1	ABS	USABLE CABLE O.D. 6.6~7.4mm (適合ケーブル外径 6.5~7.4mm)

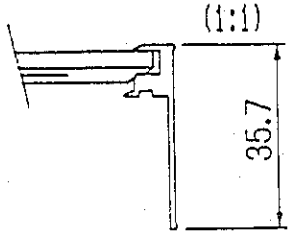


DETAIL OF JUNCTION BOX (1:2)
(ジャンクションボックス内部詳細)

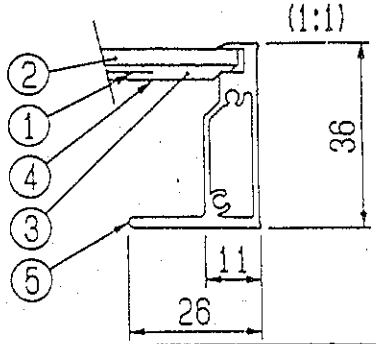


DIRECTION OF CABLE FEED-THROUGH
(ケーブル取出方向)

SECTION A-A(A-A 断面) (1:1)



SECTION B-B(B-B 断面) (1:1)

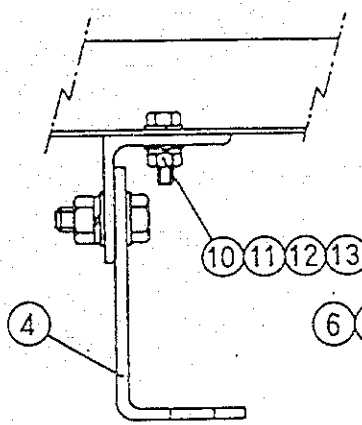


Unit(単位): 100mm

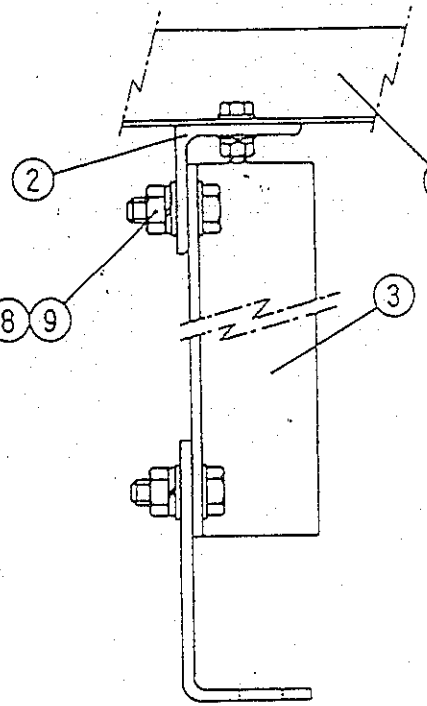
DESIGNED(設計) M. Tajishita	DRAWN(製図)	NAME(名称)	SOLAR MODULE (太陽電池モジュール)
CHECKED(検図) S. Inoue	SCALE(尺度) 1:8 (1:1.1:2)	TYPE(型式)	LA441K59
APPROVED(承認) S. Intesar	DATE(作成日) MAR. 14. 1990	DWG No.(図番)	AC-32216

KYOCERA CORPORATION KYOTO

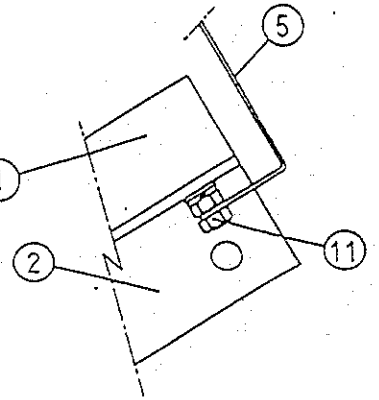
SECTION A - A (A - A断面)

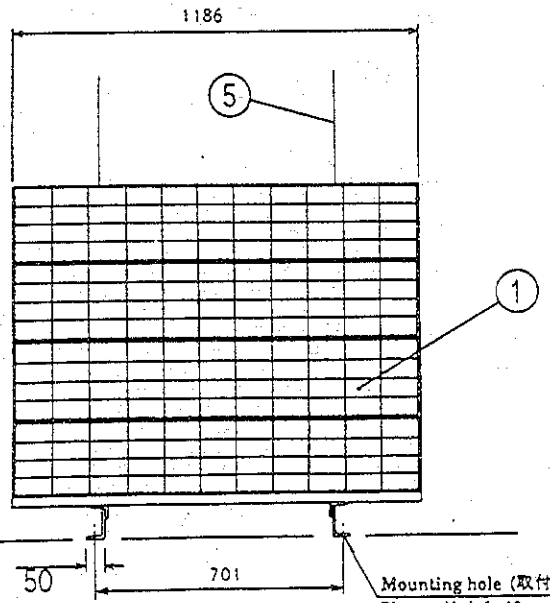


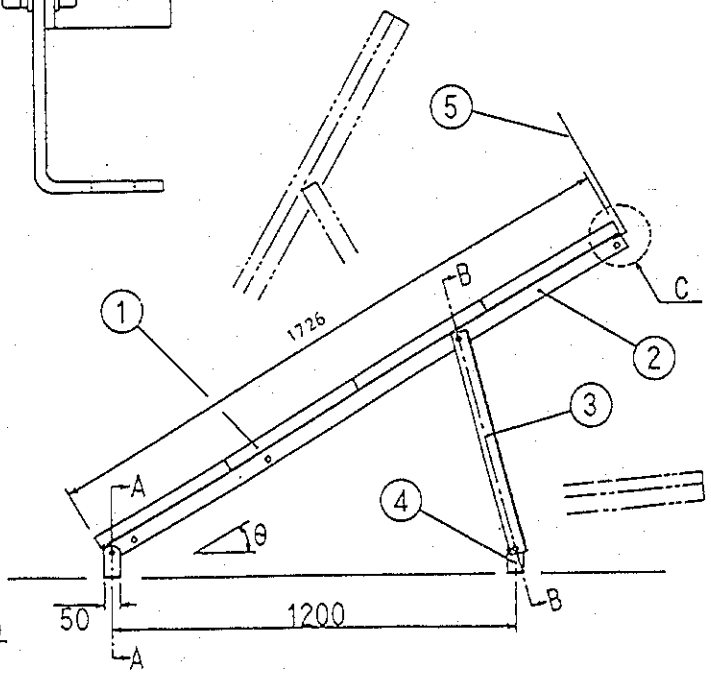
SECTION B - B (B - B断面)



DETAIL C (C部詳細)







NO	PART NO. (製品番号)	QTY (数量)	MATL (材質)	DESCRIPTION (説明)
1	GL144N	4		Solar module (太陽電池モジュール)
2	SAC380A	2	SS41	Panel frame L50×50×4 (パネルフレーム)
3	SAC380A	2	SS41	Support leg L50×50×4 (サポートレッグ)
4	SAC380A	4	SS41	Foot bracket (フットブラケット)
5	SAC380A	2	SUS304	Bird spike (バードスパイク)
6		6	SS41	Hex. head bolt M10×30 (六角ボルト M10×30)
7		6	SS41	Hex. nut M10 (六角ナット M10)
8		12	SS41	Plain washer M10 (平座金 M10)
9		6	SS41	Spring washer M10 (バネ座金 M10)
10		16	SUS304	Hex. head bolt M8 (六角ボルト)
11		18	SUS304	Hex. nut M8 (六角ナット)
12		32	SUS304	Plain washer M8 (平座金)
13		16	SUS304	Spring washer M8 (バネ座金)
		1 set		Intermodule cabling set (モジュール間配線セット)

Note (注) : SS41 ; Hot dipped galvanized steel (溶融亜鉛メッキ鋼)
SUS304 ; Stainless steel (ステンレス鋼)

Array angle (アレイ傾斜角) θ	5°	10°	15°	20°	25°	30°

Array angle (アレイ傾斜角) θ	35°	40°	45°	50°	55°	60°

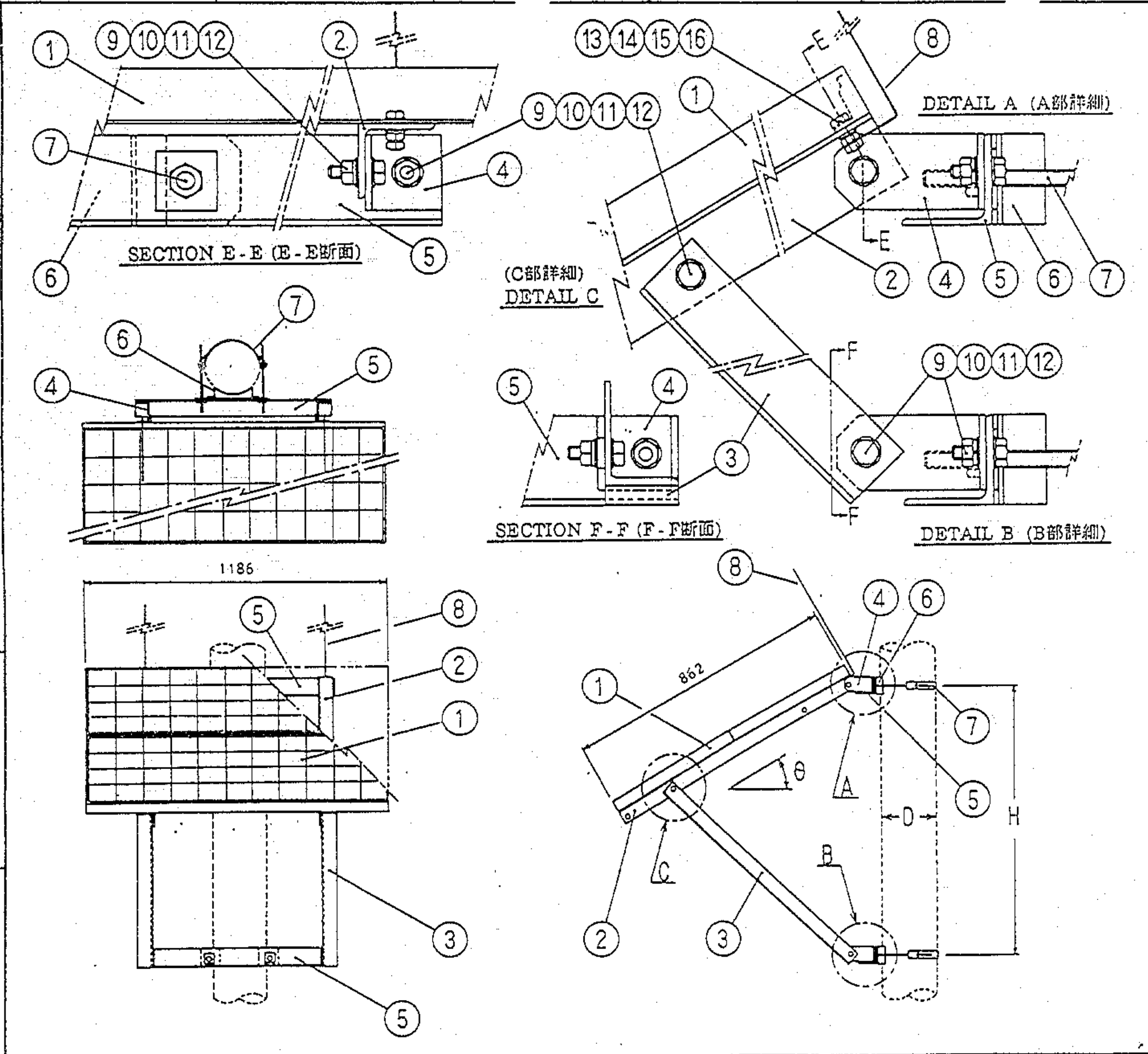
UNIT (単位) : mm

MODIFICATIONS (変更)	ACCOUNT (記事)	DATE (日付)	DRAWN (設計)	CHECKED (検査)	APPROVED (承認)

NAME (名称) SOLAR ARRAY (太陽電池アレイ)
SCALE (尺度) FREE
MATERIAL (材質)
TOLERANCES (普通公差) ±2.0

DRAWN (設計)	CHECKED (検査)
APPROVED (承認)	DATE (日付)
	SEP. 28 '92

KYOCERA CORPORATION KYOTO JAPAN
DWG. No. (図番) SAA517A



NO	PART NO. (部品番号)	QTY (数量)	MAT'L (材質)	DESCRIPTION (摘要)
1	GL144N	2		Solar module (太陽電池モジュール)
2	SAC382A	2	SS41	Panel frame L50×50×4 (パネルフレーム)
3	SAC382A	2	SS41	Support leg L50×50×4 (サポートレッグ)
4	SAC382A	4	SS41	Foot bracket (フットブラケット)
5	SAC382A	2	SS41	Cross arm L60×60×4 (クロスアーム)
6	SAC382A	2	SS41	Attachment (M座)
7	SAC382A	2	SS41	Band with bolts & nuts M12 (取付バンドM12ボルト・ナット付)
8	SAC382A	2	SUS304	Bird spike (バードスパイク)
9		10	SS41	Hex. head bolt M10×30 (六角ボルト M10×30)
10		10	SS41	Hex. nut M10 (六角ナット M10)
11		20	SS41	Plain washer M10 (平座金 M10)
12		10	SS41	Spring washer M10 (バネ座金 M10)
13		8	SUS304	Hex. head bolt M8 (六角ボルト)
14		10	SUS304	Hex. nut M8 (六角ナット)
15		16	SUS304	Plain washer M8 (平座金)
16		8	SUS304	Spring washer M8 (バネ座金)
		1 set		Intermodule cabling set (モジュール間配線セット)

Note (注): SS41 ; Hot dipped galvanized steel (溶融亜鉛メッキ鋼)
SUS304 ; Stainless steel (ステンレス鋼)

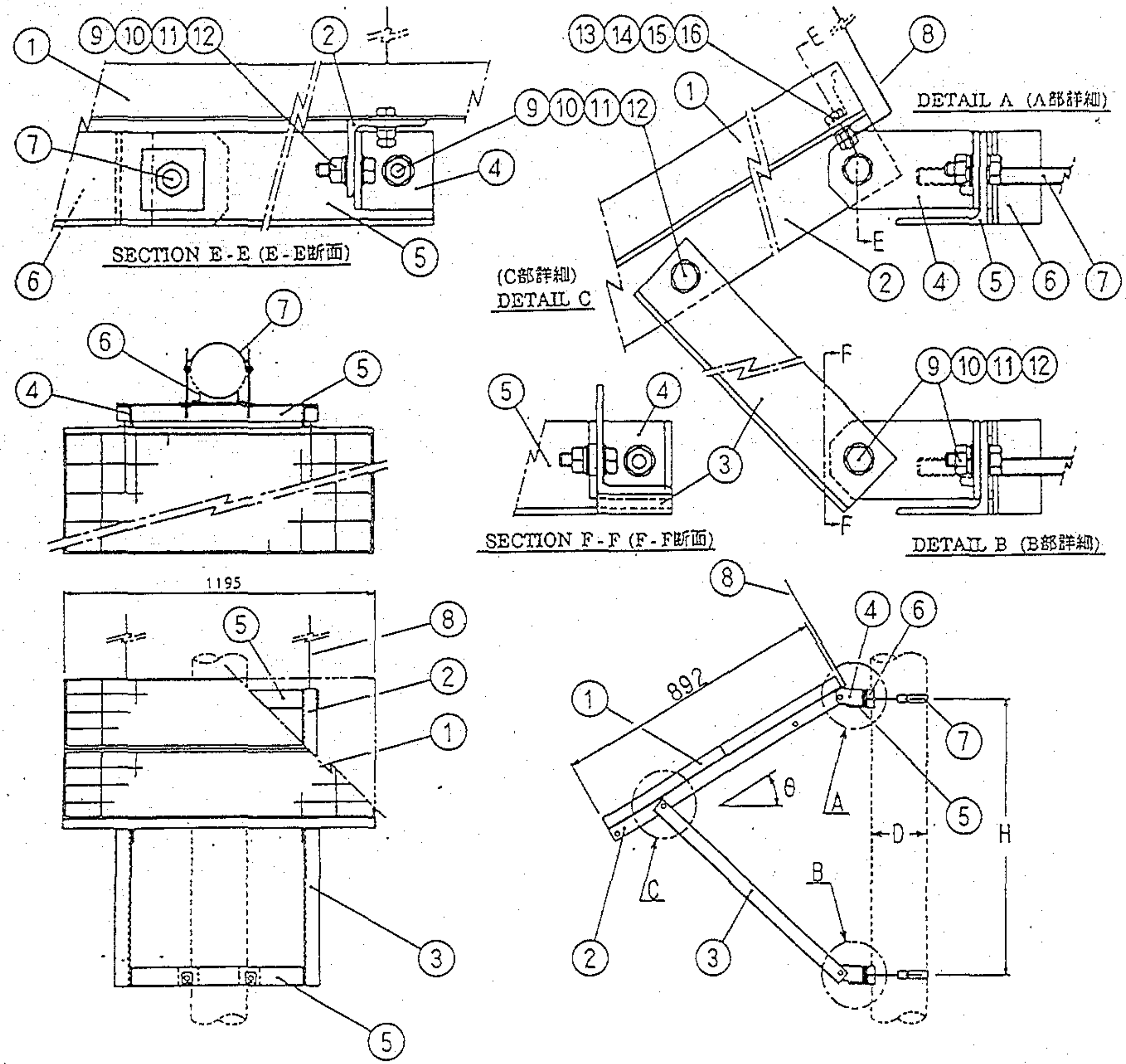
Applicable pole dia. (適合ポール径) "D" mm	100-120	120-150	150-177	170-214	205-251	240-286	275-322

Array angle (アレイ傾斜角) θ	5°	10°	15°	20°	25°	30°	35°	40°	45°
Dimension (取付寸法) "H" mm	485	555	635	715	795	880	966	1040	1120

UNIT (単位) : mm

MODIFICATIONS (変更)	DATE (日付)	DRAWN (設計)	CHECKED (検査)	APPROVED (承認)
ACCOUNT (記事)				

NAME (名称) SOLAR ARRAY (太陽電池アレイ)
SCALE (尺度) FREE
MATERIAL (材質)
TOLERANCES (普通公差) ±2.0
DRAWN (設計) CHECKED (検査) APPROVED (承認) DATE (日付) SEP.28 '92
KYOCERA CORPORATION KYOTO JAPAN
DWG. No (図番) SAA519A



NO	PART NO. (部品番号)	QTY (数量)	MATL (材質)	DESCRIPTION (摘要)
1	LA441K	2		Solar module (太陽電池モジュール)
2	SAC381A	2	SS41	Panel frame L50×50×4 (パネルフレーム)
3	SAC381A	2	SS41	Support leg L50×50×4 (サポートレッグ)
4	SAC381A	4	SS41	Foot bracket (フットブラケット)
5	SAC381A	2	SS41	Cross arm L60×60×4 (クロスアーム)
6	SAC381A	2	SS41	Attachment (M座)
7	SAC381A	2	SS41	Band with bolts & nuts M12 (取付バンドM12ボルト・ナット付)
8	SAC381A	2	SUS304	Bird spike (バードスパイク)
9		10	SS41	Hex. head bolt M10×30 (六角ボルトM10×30)
10		10	SS41	Hex. nut M10 (六角ナットM10)
11		20	SS41	Plain washer M10 (平座金M10)
12		10	SS41	Spring washer M10 (バネ座金M10)
13		8	SUS304	Hex. head bolt M6×20 (六角ボルトM6×20)
14		10	SUS304	Hex. nut M6 (六角ナットM6)
15		16	SUS304	Plain washer M6 (平座金M6)
16		8	SUS304	Spring washer M6 (バネ座金M6)
		1 set		Intermodule cabling set (モジュール間配線セット)

Note (注): SS41 ; Hot dipped galvanized steel (溶融亜鉛メッキ鋼)
SUS304 ; Stainless steel (ステンレス鋼)

Applicable pole dia. (適合ポール径) "D" mm	100–120	120–150	150–177	170–214	205–251	240–286	275–322

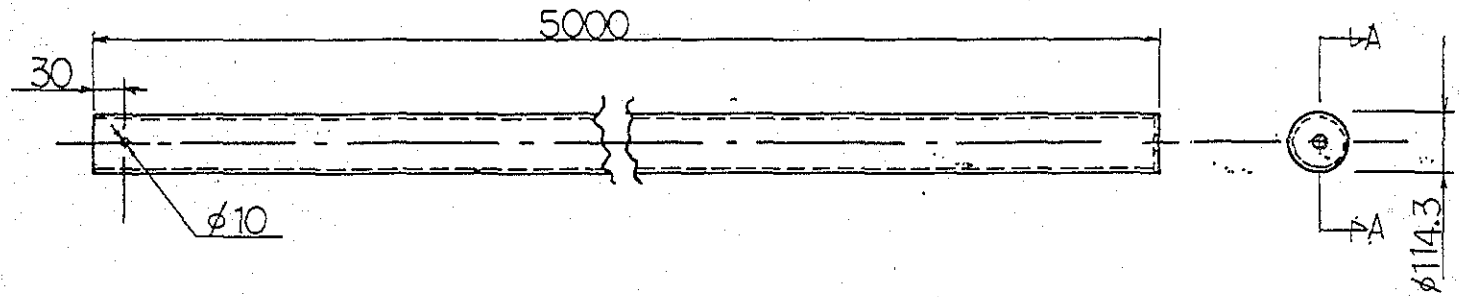
Array angle (アレイ傾斜角)	θ	5°	10°	15°	20°	25°	30°	35°	40°	45°
Dimension (取付寸法)	"H" mm	485	555	635	715	795	880	966	1040	1120

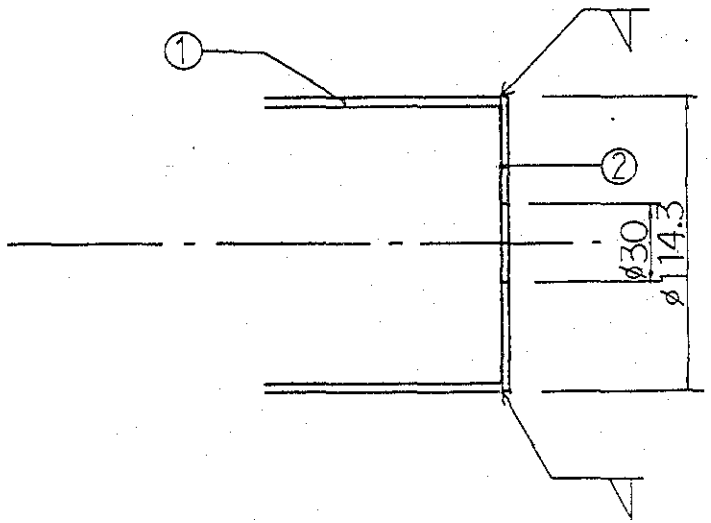
UNIT (単位) : mm

NAME (名称) SOLAR ARRAY (太陽電池アレイ)	TOLERANCES (普通公差) ±2.0	DRAWN (設計)	CHECKED (検査)
SCALE (尺度) FREE	MATERIAL (材質)	APPROVED (承認)	DATE (日付) SEP. 28 '92
KYOCERA CORPORATION	KYOTO JAPAN	DWG. No. (図番)	SAA518A

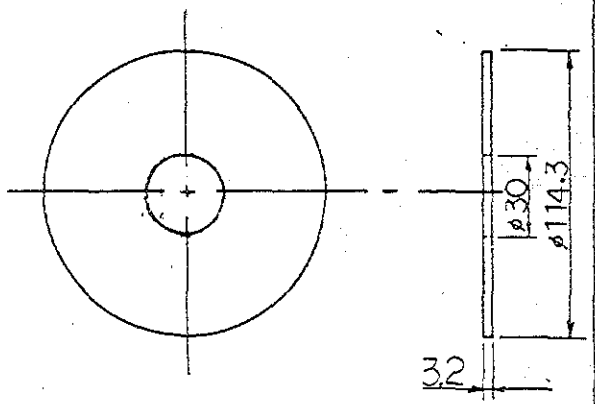
MODIFICATIONS (訂正) | ACCOUNT (記事) | DATE (日付) | DRAWN (設計) | CHECKED (検査) | APPROVED (承認)

NO	PART NO. (部品番号)	QTY (数量)	MATL (材質)	DESCRIPTION (摘要)
①	Pole	/		t=3.2
②	Pole cover	/		t=3.2





SECTION A-A



UNIT : mm

MODIFICATIONS (変更)	ACCOUNT (記事)	DATE (日付)	DRAWN (設計)	CHECKED (検査)	APPROVED (承認)

NAME (名称): POLE
SCALE (尺度): Free
MATERIAL (材質): Hot dipped galvanized
TOLERANCES (普通公差):
DRAWN (設計): S. Yamaguchi
CHECKED (検査): A. Honda
APPROVED (承認): ~~A. Honda~~
DATE (日付): 1992.10.12

KYOCERA CORPORATION KYOTO JAPAN

DWG. No. (図番) SAC 388E

KPS-703357-M1

INSTALLATION MANUAL

OF

SOLAR ARRAY

Covered : Ground mount type solar array

– For 24V SYSTEM –

KYOCERA CORPORATION

CHIBA SAKURA PLANT

SOLAR ENERGY SYSTEM DIVISION

CONTENTS

Attached drawings

1 General

(1) Location

Solar array is installed normally on the array foundation which is free from shade of house, trees, tower or other obstructions, that could interfere with the operation of the solar modules.

(2) Orientation

It is important that the modules be facing in the correct direction to realize their maximum power output. Installations in the northern hemisphere should face towards true south, and those in the southern hemisphere towards true north.

A compass should be used to determine the magnetic heading, and a correction for compass variation determined to obtain the true bearing. Variation is different for every geographical location and local government maps or navigational charts must be utilized to obtain the current correct variation.

2 Mounting Facilities

Ideally, a permanent concrete pad would provide the best foundation on which a solar array is mounted. Assuming proper ground condition, individual concrete footings for each of the array's attaching feet is acceptable. Obviously, it is fairly well that a steel platform is utilized. If a wooden platform is utilized, it must be adequately secured. Wooden platforms present the problems of weathering and warping.

Concrete foundation height from ground level should be a minimum of 300mm (11.81 inches).

All array mounting feet have a elongated hole to accommodate a 10mm (0.39 inch) dia. anchor bolt or fixing bolt. (Solar array does not include anchor bolt or fixing bolt, that will be supplied by erector or customer.) It is preferable to precast the anchor bolt or studs in concrete installations.

3 Parts List per Array

Solar array has been semi - assembled at factory. (Four modules have been fixed on panel frames and properly wired between them at factory.) Components marked as "*1" in the following table have been assembled at factory and components marked as "*2" are assembled at site, i.e. "*2" components are shipped as array parts and/or attachments.

Table 1 Parts List per Array

No.	Component parts / System voltage			Quantity 24V	Remarks
1.	Solar module	*1		4	With by pass diode
2.	Panel frame	*1		2	
3.	Support leg	*2		2	
4.	Foot bracket	*2		4	
5.	Bird spike	*2		2	
6.	Hex. head bolt	*2	M10	6	for fixing support legs and brackets
7.	Hex. nut	*2	M10	6	- do -
8.	Plain washer	*2	M10	12	- do -
9.	Spring washer	*2	M10	6	- do -
10.	Hex. head bolt	*1	M8	16	for fixing modules
11.	Hex. nut	*1, *2	M8	18($16^{*1}+2^{*2}$)	for fixing modules and bird spikes
12.	Plain washer	*1	M8	32	for fixing modules
13.	Spring washer	*1	M8	16	- do -
14.	Cable	*1		4	for intermodule wiring
15.	Cable clamp	*1		8	
16.	Screw	*1	M5	8	for fixing cable clamps
17.	Hex. nut	*1	M5	8	- do -
18.	Plain washer	*1	M5	8	- do -
19.	Spring washer	*1	M5	8	- do -

4 Array Assembly / Wiring Flowchart

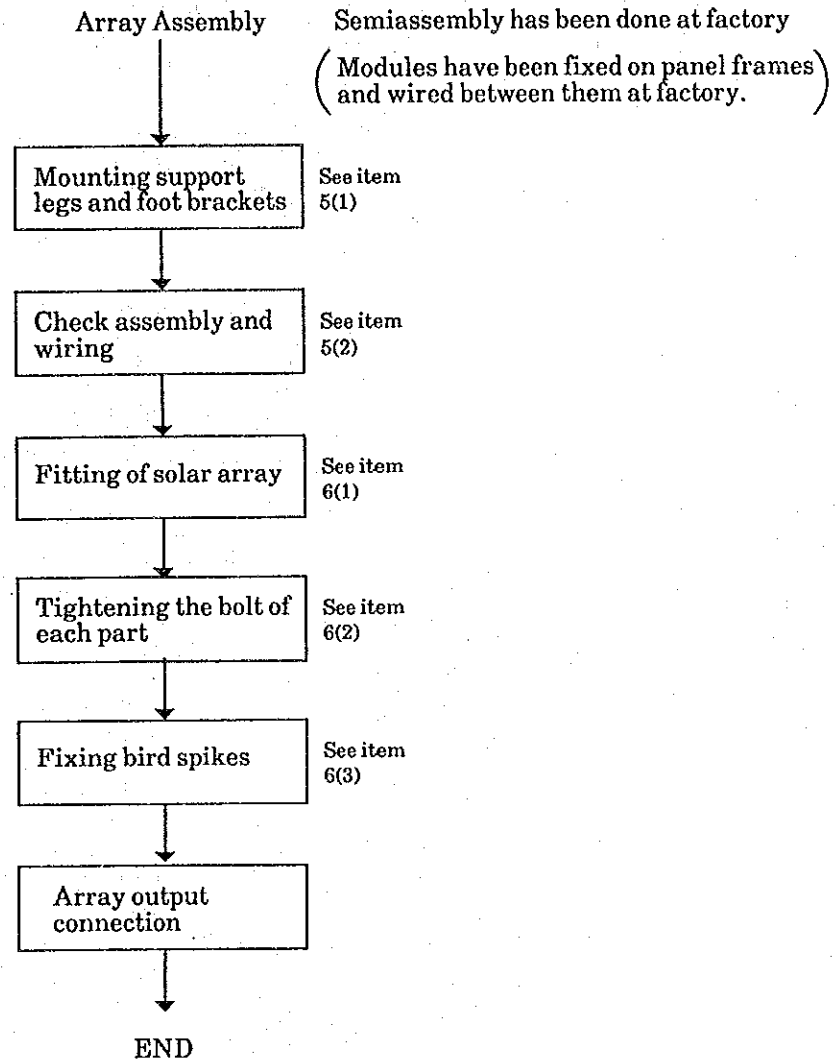


Fig. 1 Array assembly / wiring flowchart

5 Array Assembly

(1) Mounting support legs and foot brackets

– Refer to drawing No. SAA544E –

After wiring the module's junction box, and while the assembly is still lying face down, attach front foot brackets from outside of the panel frame, corner side in.
Attach support legs from outside of the panel frame. Attach rear brackets from inside of the support legs, corner side in.
All attachments are made with M10 hexagon head bolts. Each bolt must be installed with a plain washer under the head and plain washer, spring washer, and nut on the threaded portion.

Tighten the bolts just enough to allow movement of the brackets and legs.

CAUTION

SHOCK MUST NOT be give to the solar module / array. Be cautious against possible shock hazard when installations are performed during daylight hours.

(2) Check after the completion of assembling works of solar array

Check right or wrong for wiring works, tightening of fixing screws of module.

With regard to wiring of array, refer to drawing No. SAB114E .

6 Fitting of Solar Array

(1) Fitting of solar array

– Refer to drawing No. SAA517A –

By using the anchor bolts of 10mm (0.39 inch) dia., fit the solar array onto the foundation or steel platform.

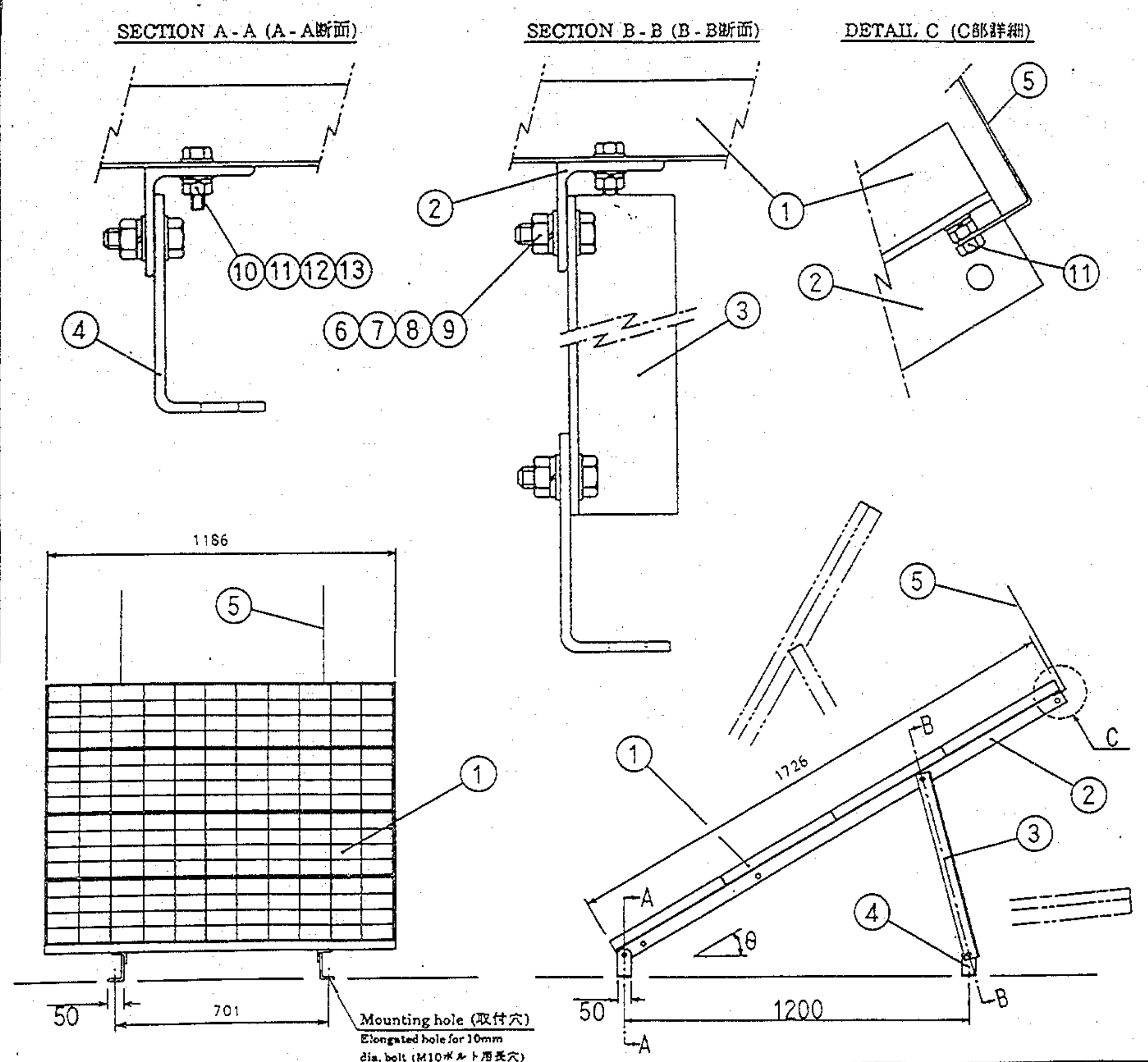
(2) Tightening the bolt of each part of the array

Tighten the bolts of the solar array that is assembled temporarily in initial stage of the works.

(3) Fixing bird spike

– Refer to drawing No. SAA517A and SAA544E –

Fix two bird spikes on top of array.
The fixing works should be performed by inserting the ring of bird spike to 8mm bolts (M8) that mount the solar module to the panel frame.



NO	PART NO. (部品番号)	QTY (数量)	MAT'L (材質)	DESCRIPTION (摘要)
1	CL144N	4		Solar module (太陽電池モジュール)
2	SAC380A	2	SS41	Panel frame L50×50×4 (パネルフレーム)
3	SAC380A	2	SS41	Support leg L50×50×4 (サポートレッグ)
4	SAC380A	4	SS41	Foot bracket (フットブラケット)
5	SAC380A	2	SUS304	Bird spike (バードスパイク)
6		6	SS41	Hex. head bolt M10×30 (六角ボルト M10×30)
7		6	SS41	Hex. nut M10 (六角ナット M10)
8		12	SS41	Plain washer M10 (平座金 M10)
9		6	SS41	Spring washer M10 (バネ座金 M10)
10		16	SUS304	Hex. head bolt M8 (六角ボルト)
11		18	SUS304	Hex. nut M8 (六角ナット)
12		32	SUS304	Plain washer M8 (平座金)
13		16	SUS304	Spring washer M8 (バネ座金)
		1 set		Intermodule cabling set (モジュール間配線セット)

Note (注): SS41 ; Hot dipped galvanized steel (溶融亜鉛メッキ鋼)
SUS304 ; Stainless steel (ステンレス鋼)

Array angle (アレイ傾斜角) θ	5°	10°	15°	20°	25°	30°

Array angle (アレイ傾斜角) θ	35°	40°	45°	50°	55°	60°

UNIT (単位) : mm

MODIFICATIONS (変更)	ACCOUNT (記事)	DATE (日付)	DRAWN (設計)	CHECKED (検査)	APPROVED (承認)

NAME (名称) SOLAR ARRAY (太陽電池アレイ)

SCALE (尺度) FREE

MATERIAL (材質)

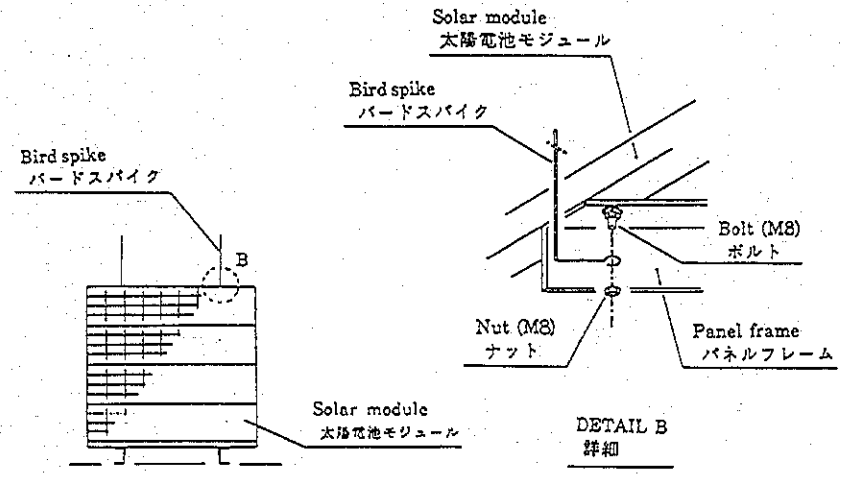
TOLERANCES (普通公差) ±2.0

DRAWN (設計) / CHECKED (検査) / APPROVED (承認) / DATE (日付) SEP. 28 '92

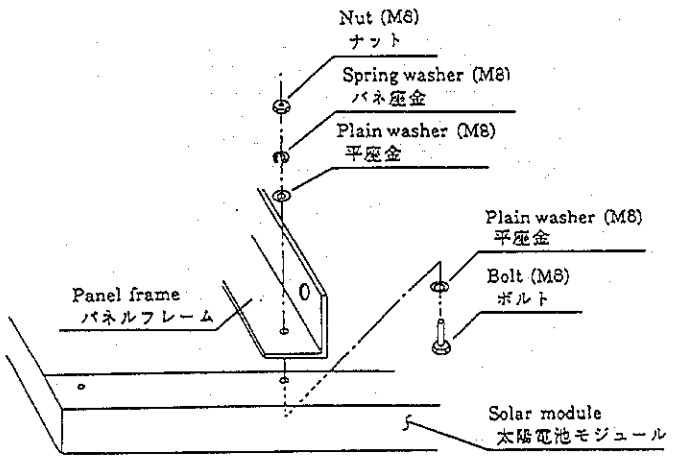
KYOCERA CORPORATION KYOTO JAPAN

DWG. No. (図番) SAA517A

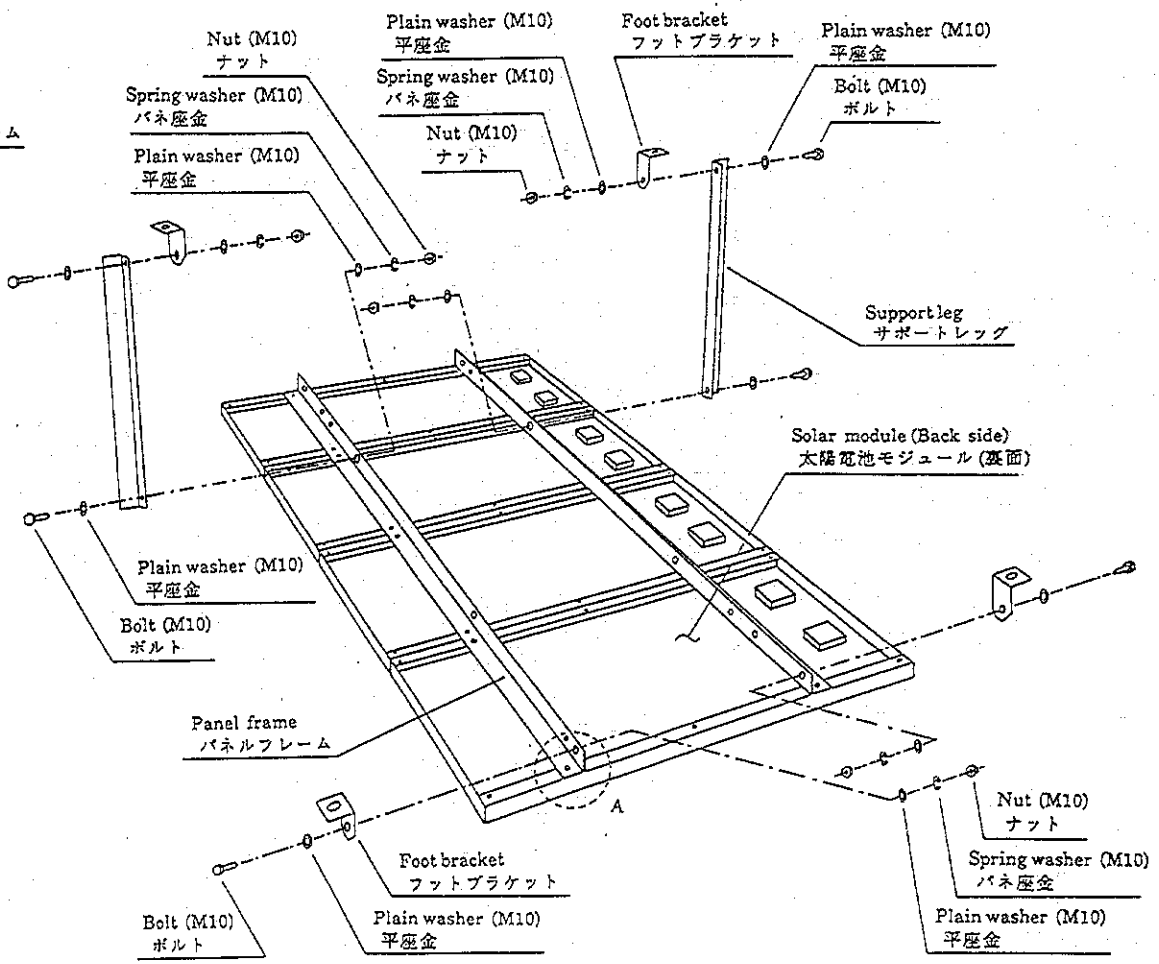
NO	PART NO. (部品番号)	QTY (数量)	MATL (材質)	DESCRIPTION (摘要)



DETAIL B
詳細



DETAIL A
詳細



MODIFICATIONS (変更)	ACCOUNT (記事)	DATE (日付)	DRAWN (設計)	CHECKED (検図)	APPROVED (承認)

NAME (名称): ARRAY ASSEMBLY (4 modules)
アレイ組立図 (4モジュール)

SCALE (尺度): /

MATERIAL (材質):

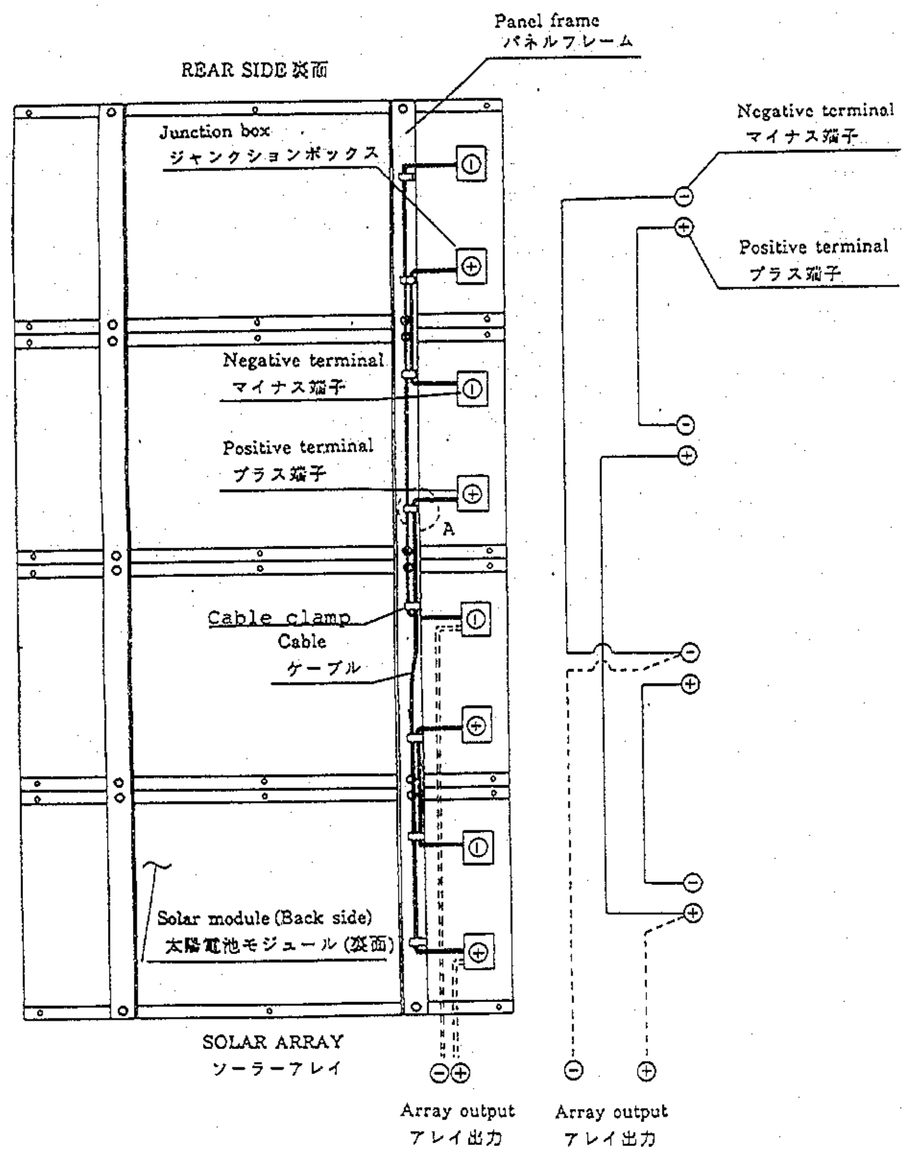
TOLERANCES (普通公差):

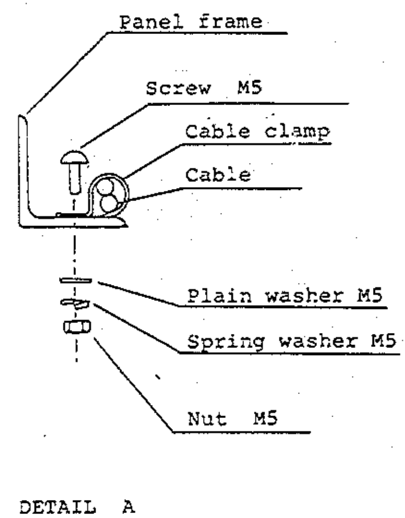
DRAWN (設計)	CHECKED (検図)
T. Tamesada	
APPROVED (承認)	DATE (日付)
[illegible]	Nov. 11'92

KYOCERA CORPORATION KYOTO JAPAN

DWG. No. (図番): SAA544E

NO	PART NO. (部品番号)	QTY (数量)	MATL (材質)	DESCRIPTION (摘要)





DETAIL A

MODIFICATIONS (変更)				
ACCOUNT (記事)	DATE (日付)	DRAWN (設計)	CHECKED (検査)	APPROVED (承認)

NAME (名称)	WIRING OF ARRAY (4 modules/24V system)	TOLERANCES (普通公差)	DRAWN (設計)	CHECKED (検査)
SCALE (尺度) /	MATERIAL (材質)		APPROVED (承認)	DATE (日付) Nov.11'92
KYOCERA CORPORATION	KYOTO JAPAN	DWG.No. (図番) SAB114E		

KPS-703357-M2

INSTALLATION MANUAL

OF

SOLAR ARRAY

Covered : Pole mount type solar array
(Solar module : GL144N)
– For 12V SYSTEM –

KYOCERA CORPORATION
CHIBA SAKURA PLANT
SOLAR ENERGY SYSTEM DIVISION

CONTENTS

Attached drawings

1 General

(1) Location

Solar array is installed normally on the array foundation which is free from shade of house, trees, tower or other obstructions, that could interfere with the operation of the solar modules.

(2) Orientation

It is important that the modules be facing in the correct direction to realize their maximum power output. Installations in the northern hemisphere should face towards true south, and those in the southern hemisphere towards true north.

A compass should be used to determine the magnetic heading, and a correction for compass variation determined to obtain the true bearing. Variation is different for every geographical location and local government maps or navigational charts must be utilized to obtain the current correct variation.

2 Mounting Facilities

This solar array is specially designed for mounting the array to 100 mm ~ 120 mm diameter steel (or concrete) pole.

3 Parts List per Array

Solar array has been semi - assembled at factory. (Two modules have been fixed on panel frames and properly wired between them at factory.) Components marked as "*1" in the following table have been assembled at factory and components marked as "*2" are assembled at site, i.e. "*2" components are shipped as array parts and/or attachments.

Table 1 Parts List per Array

No.	Component parts / System voltage			Quantity 12V	Remarks
1.	Solar module	*1		2	
2.	Panel frame	*1		2	
3.	Support leg	*2		2	
4.	Foot bracket	*2		4	
5.	Cross arm	*2		2	
6.	Attachment	*2		2	
7.	Band	*2		2	with bolts and nuts M12
8.	Bird spike	*2		2	
9.	Hex. head bolt	*2	M10	10	for fixing support legs and brackets
10.	Hex. nut	*2	M10	10	- do -
11.	Plain washer	*2	M10	20	- do -
12.	Spring washer	*2	M10	10	- do -
13.	Hex. head bolt	*1	M8	8	for fixing modules
14.	Hex. nut	*1, *2	M8	10($8^{*1}+2^{*2}$)	for fixing modules and bird spikes
15.	Plain washer	*1	M8	16	for fixing modules
16.	Spring washer	*1	M8	8	- do -
17.	Cable	*1		2	for intermodule wiring
18.	Cable clamp	*1		4	
19.	Screw	*1	M5	4	for fixing *cable clamps*
20.	Hex. nut	*1	M5	4	- do -
21.	Plain washer	*1	M5	4	- do -
22.	Spring washer	*1	M5	4	- do -

4 Array Assembly / Wiring Flowchart

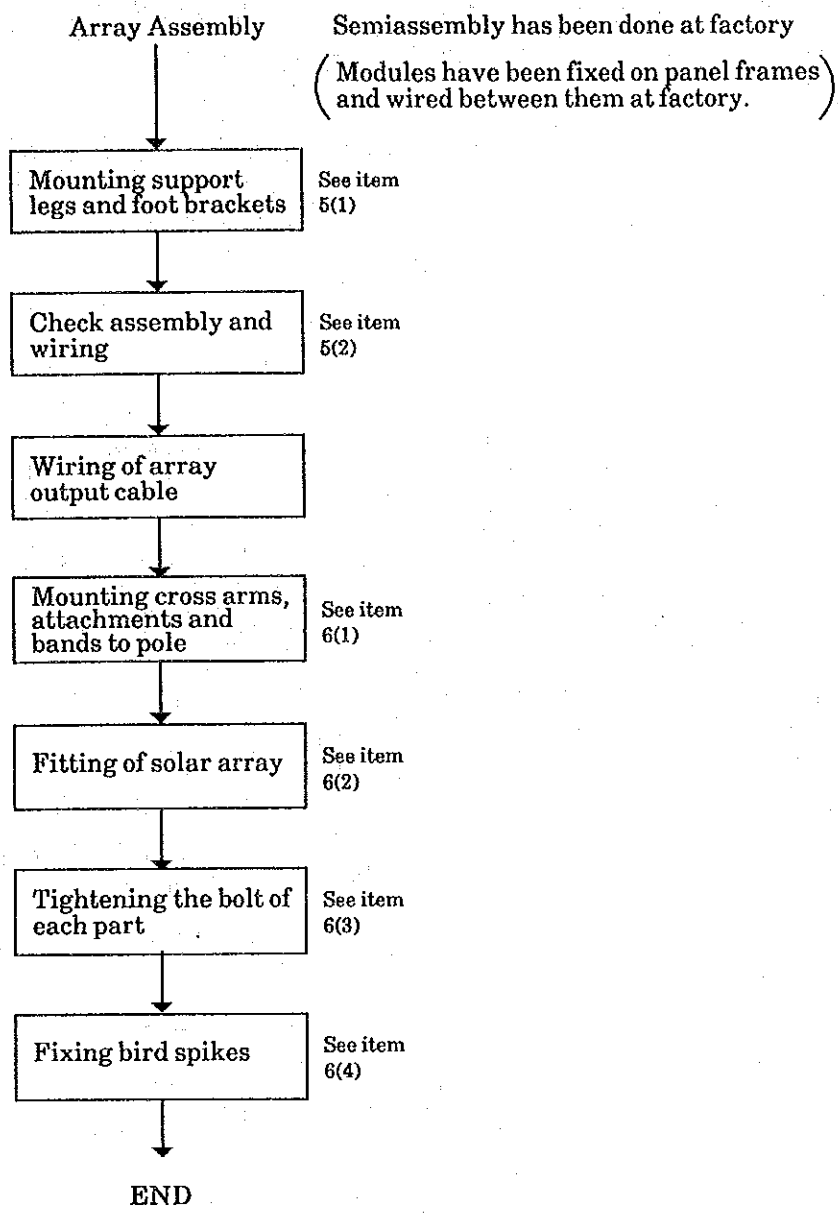


Fig. 1 Array assembly / wiring flowchart

5 Array Assembly

(1) Mounting support legs and foot brackets

– Refer to drawing No. SAA545E(1/2) –

After wiring the module's junction box, and while the assembly is still lying face down, attach front foot brackets from outside of the panel frame, corner side in.
Attach support legs from outside of the panel frame. Attach rear brackets from inside of the support legs, corner side in.
All attachments are made with M10 hexagon head bolts. Each bolt must be installed with a plain washer under the head and plain washer, spring washer, and nut on the threaded portion.

Tighten the bolts just enough to allow movement of the brackets and legs.

CAUTION

SHOCK MUST NOT be give to the solar module / array. Be cautious against possible shock hazard when installations are performed during daylight hours.

(2) Check after the completion of assembling works of solar array

Check right or wrong for wiring works, tightening of fixing screws of module.

With regard to wiring of array, refer to drawing No. SAB115E .

6 Fitting of Solar Array

(1) Mounting cross arm, attachment and band to pole

– Refer to drawing No. SAA545E(2/2) and SAA546E –

Mount cross arms, attachments and bands to pole by employing M12 stud bolts and M12 nuts.

With regard to the position of them, refer to drawing No. SAA546E.

The cross arm should face towards true south (in the northern hemisphere) or face towards true north (in the southern hemisphere).

(2) Fitting of solar array

– Refer to drawing No. SAA545E(2/2) –

Fix the foot brackets to the cross arms by employing M10 bolts, nuts.

Each bolt must be installed with a plain washer under the head and plain washer, spring washer, and nut on the threaded portion.

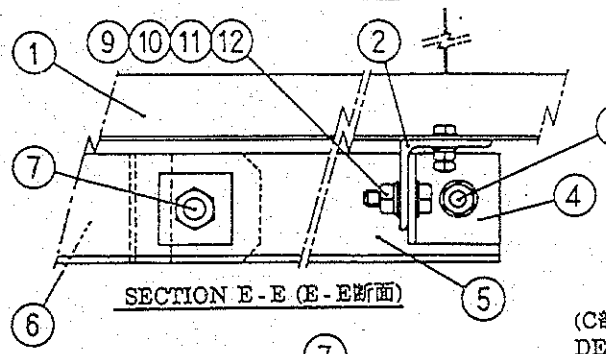
(3) Tightening the bolt of each part of the array

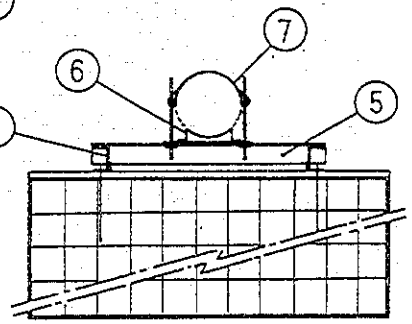
Tighten the bolts of the solar array that is assembled temporarily in initial stage of the works.

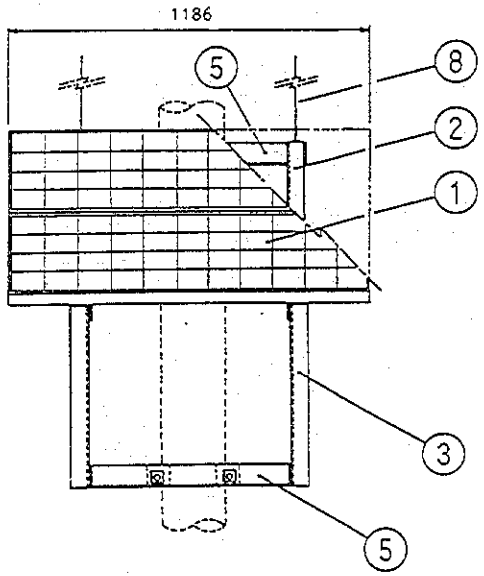
(4) Fixing bird spike

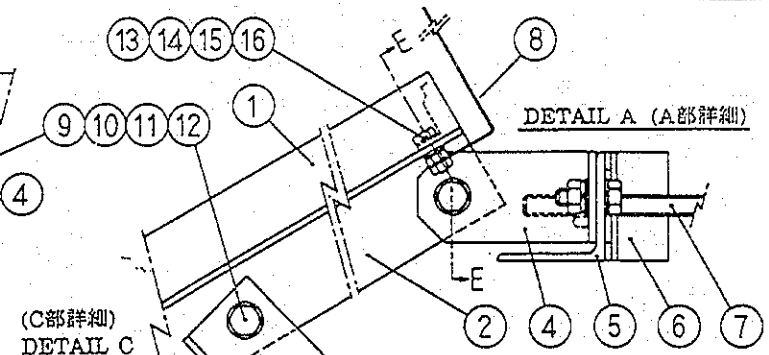
– Refer to drawing No. SAA519A and SAA545E(2/2) –

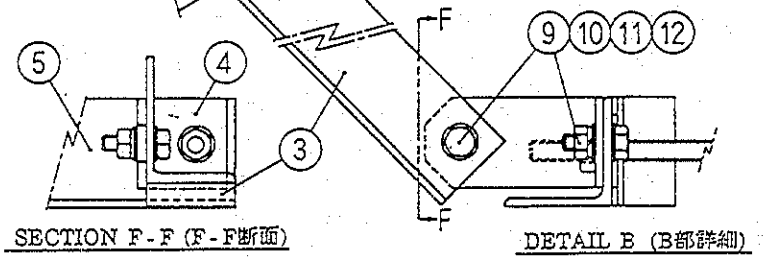
Fix two bird spikes on top of array.
The fixing works should be performed by inserting the ring of bird spike to 8mm bolts (M8) that mount the solar module to the panel frame.

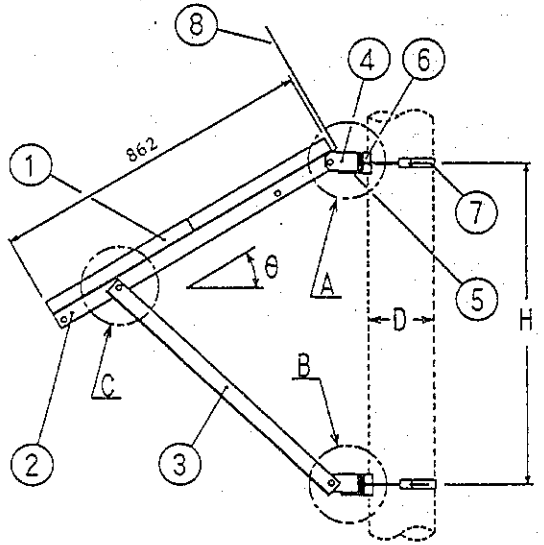












NO	PART NO. (部品番号)	QTY (数量)	MATL (材質)	DESCRIPTION (摘要)
1	GL144N	2		Solar module (太陽電池モジュール)
2	SAC382A	2	SS41	Panel frame L50×50×4 (パネルフレーム)
3	SAC382A	2	SS41	Support leg L50×50×4 (サポートレッグ)
4	SAC382A	4	SS41	Foot bracket (フットブラケット)
5	SAC382A	2	SS41	Cross arm L60×60×4 (クロスアーム)
6	SAC382A	2	SS41	Attachment (M座)
7	SAC382A	2	SS41	Band with bolts & nuts M12 (取付バンドM12ボルト・ナット付)
8	SAC382A	2	SUS304	Bird spike (バードスパイク)
9		10	SS41	Hex. head bolt M10×30 (六角ボルト M10×30)
10		10	SS41	Hex. nut M10 (六角ナット M10)
11		20	SS41	Plain washer M10 (平座金 M10)
12		10	SS41	Spring washer M10 (バネ座金 M10)
13		8	SUS304	Hex. head bolt M8 (六角ボルト)
14		10	SUS304	Hex. nut M8 (六角ナット)
15		16	SUS304	Plain washer M8 (平座金)
16		8	SUS304	Spring washer M8 (バネ座金)
		1 set		Intermodule cabling set (モジュール間配線セット)

Note (注) : SS41 ; Hot dipped galvanized steel (溶融亜鉛メッキ鋼)
SUS304 ; Stainless steel (ステンレス鋼)

Applicable pole dia. (適合ポール径) "D" mm	100-120	120-150	150-177	170-214	205-251	240-286	275-322

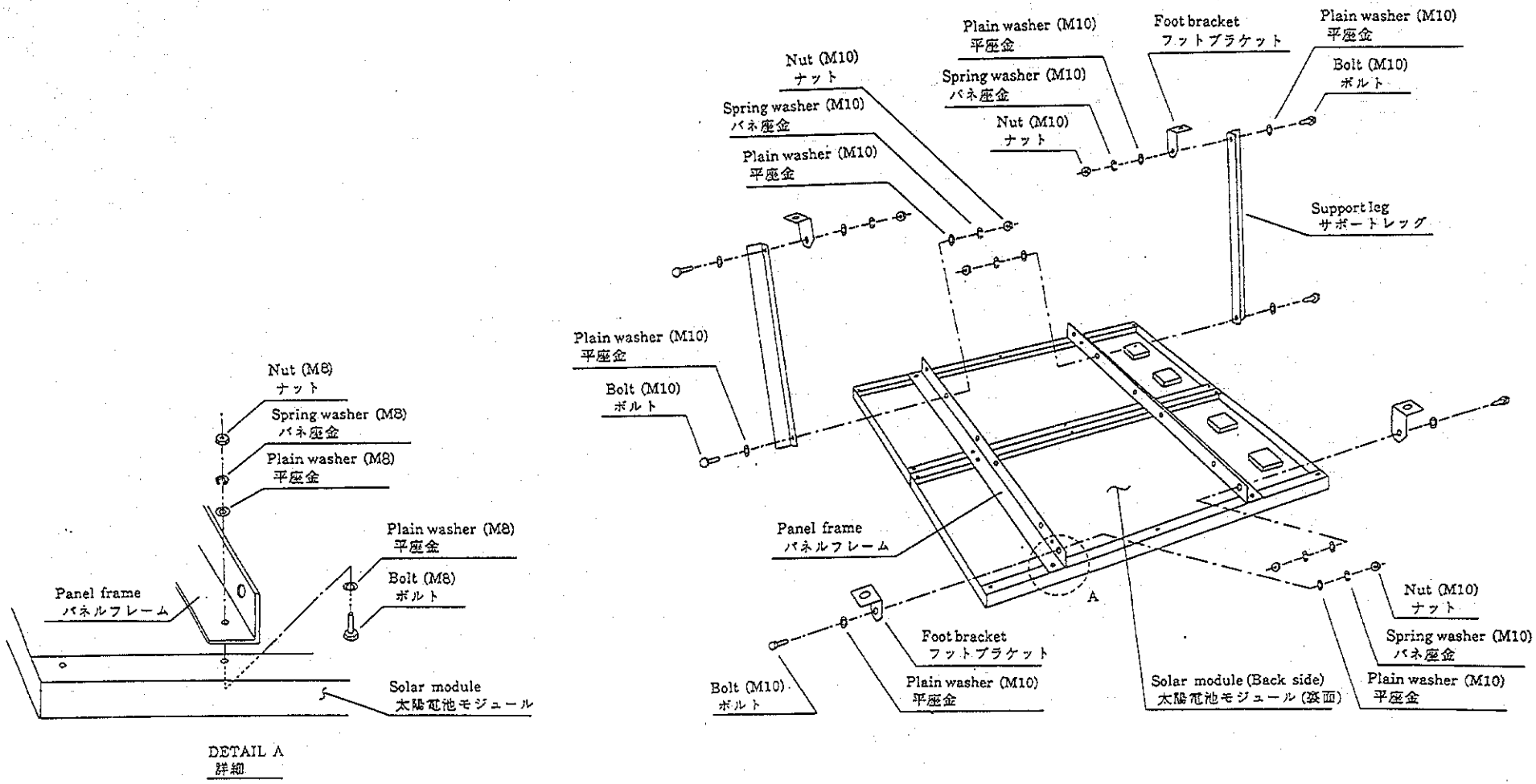
Array angle (アレイ傾斜角) θ	5°	10°	15°	20°	25°	30°	35°	40°	45°
Dimension (取付寸法) "H" mm	485	555	635	715	795	880	965	1040	1120

UNIT (単位) : mm

MODIFICATIONS (変更)	ACCOUNT (記事)	DATE (日付)	DRAWN (設計)	CHECKED (検査)	APPROVED (承認)

NAME (名称) SOLAR ARRAY (太陽電池アレイ)
SCALE (尺度) FREE
MATERIAL (材質)
TOLERANCES (普通公差) ±2.0
DRAWN (設計) CHECKED (検査)
APPROVED (承認) DATE (日付) SEP. 28 '92
KYOCERA CORPORATION KYOTO JAPAN
DWG. No. (図番) SAA519A

NO	PART NO. (部品番号)	QTY (数量)	MATL (材質)	DESCRIPTION (摘要)



DETAIL A
詳細

MODIFICATIONS (変更)	ACCOUNT (記事)	DATE (日付)	DRAWN (設計)	CHECKED (検査)	APPROVED (承認)

NAME (名称): ARRAY ASSEMBLY (2 modules)
アレイ組立図 (2モジュール)

SCALE (尺度): /

MATERIAL (材質):

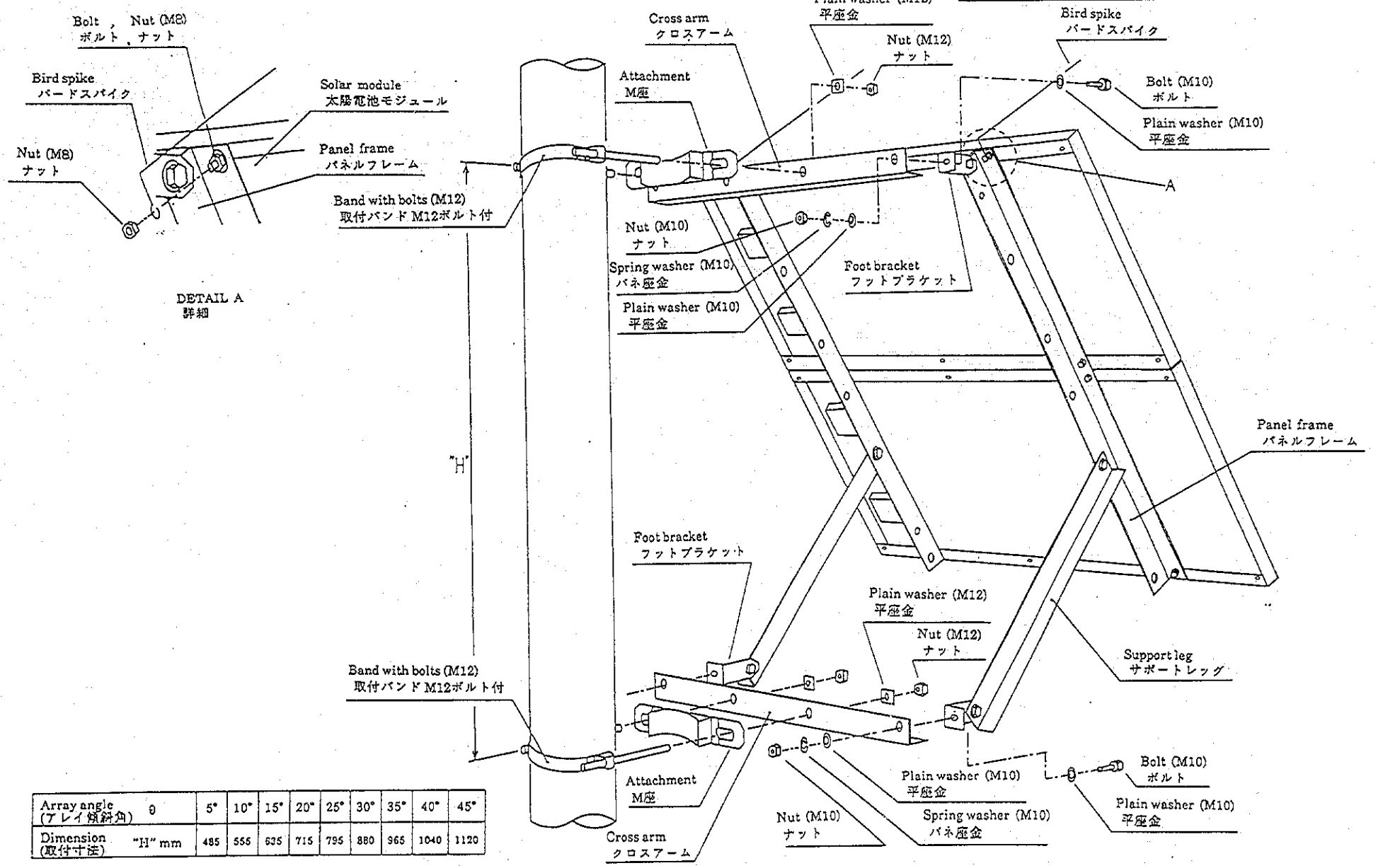
TOLERANCES (普通公差):

DRAWN (設計)	CHECKED (検査)
T. Hasegawa	
APPROVED (承認)	DATE (日付)
	Nov.11'92

KYOCERA CORPORATION KYOTO JAPAN

DWG. No. (図番): SAA545E (1/2)

NO	PART NO. (部品番号)	QTY (数量)	MATL (材料)	DESCRIPTION (摘要)



Array angle (アレイ傾斜角) θ	5°	10°	15°	20°	25°	30°	35°	40°	45°
Dimension (取付寸法) "H" mm	485	555	635	715	795	880	965	1040	1120

MODIFICATIONS (変更)	ACCOUNT (記事)	DATE (日付)	DRAWN (設計)	CHECKED (検査)	APPROVED (承認)

NAME (名称): ARRAY ASSEMBLY (2 modules)
アレイ組立図 (2モジュール)

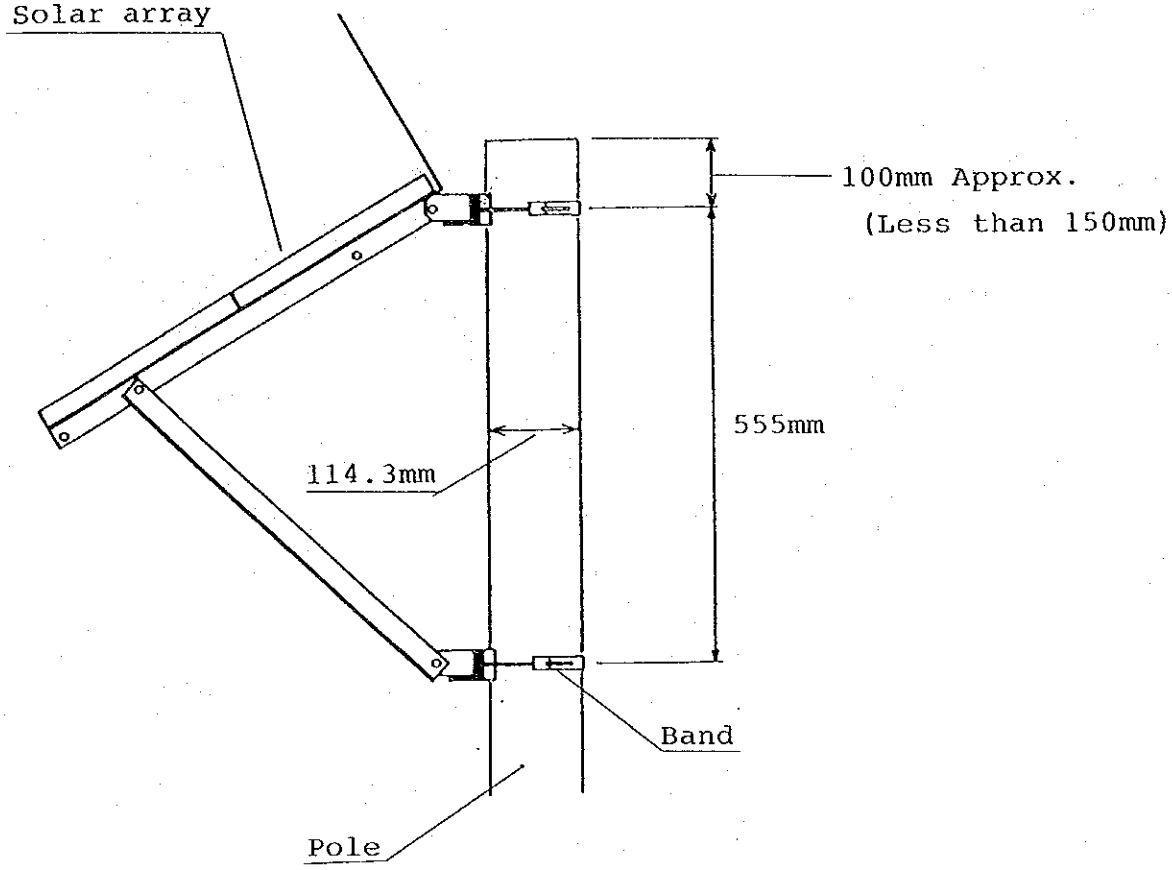
TOLERANCES (普通公差)

SCALE (尺度) | MATERIAL (材質)

DRAWN (設計)	CHECKED (検査)
T. Matsuoka	
APPROVED (承認)	DATE (日付)
	Nov. 11' 92

KYOCERA CORPORATION KYOTO JAPAN

DWG. No. (図番) SAA545E (2/2)



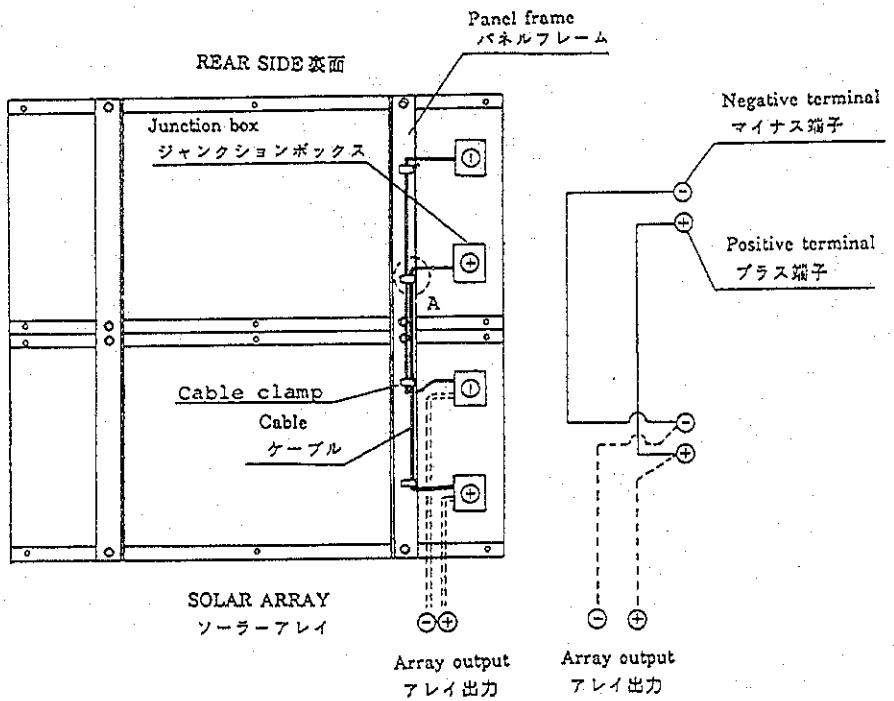
MODIFICATIONS (変更)					
	ACCOUNT (記事)	DATE (日付)	DRAWN (設計)	CHECKED (検査)	APPROVED (承認)

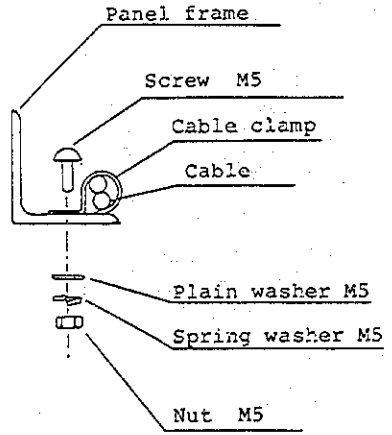
NAME (名称)	TOLERANCES (普通公差) :	DRAWN (設計)	CHECKED (検査)
Mounting array to pole		T. Yamagishi	
SCALE (尺度) / MATERIAL (材質)		APPROVED (承認)	DATE (日付)
/			NOV.11'92

KYOCERA CORPORATION KYOTO JAPAN

DWG.No. (図番) SAA546E

NO	PART NO. (部品番号)	QTY (数量)	MATL (材質)	DESCRIPTION (摘要)





DETAIL A

MODIFICATIONS (変更)	ACCOUNT (記事)	DATE (日付)	DRAWN (設計)	CHECKED (検査)	APPROVED (承認)

NAME (名称) WIRING OF ARRAY
(2 modules/12V system)

SCALE (尺度) | MATERIAL (材質)

TOLERANCES (普通公差)

DRAWN (設計)	CHECKED (検査)
T. Yamazaki	
APPROVED (承認)	DATE (日付)
	NOV. 11'92

KYOCERA CORPORATION KYOTO JAPAN

DWG. No. (図番) SAB115E

KPS-703357-M3

INSTALLATION MANUAL

OF

SOLAR ARRAY

Covered : Pole mount type solar array
(Solar module : LA441K59)
– For 12V SYSTEM –

KYOCERA CORPORATION
CHIBA SAKURA PLANT
SOLAR ENERGY SYSTEM DIVISION

CONTENTS

Attached drawings

1 General

(1) Location

Solar array is installed normally on the array foundation which is free from shade of house, trees, tower or other obstructions, that could interfere with the operation of the solar modules.

(2) Orientation

It is important that the modules be facing in the correct direction to realize their maximum power output. Installations in the northern hemisphere should face towards true south, and those in the southern hemisphere towards true north.

A compass should be used to determine the magnetic heading, and a correction for compass variation determined to obtain the true bearing. Variation is different for every geographical location and local government maps or navigational charts must be utilized to obtain the current correct variation.

2 Mounting Facilities

This solar array is specially designed for mounting the array to 100 mm ~ 120 mm diameter steel (or concrete) pole.

3 Parts List per Array

Solar array has been semi - assembled at factory. (Two modules have been fixed on panel frames and properly wired between them at factory.) Components marked as "*1" in the following table have been assembled at factory and components marked as "*2" are assembled at site, i.e. "*2" components are shipped as array parts and/or attachments.

Table 1 Parts List per Array

No.	Component parts / System voltage			Quantity 12V	Remarks
1.	Solar module	*1		2	
2.	Panel frame	*1		2	
3.	Support leg	*2		2	
4.	Foot bracket	*2		4	
5.	Cross arm	*2		2	
6.	Attachment	*2		2	
7.	Band	*2		2	with bolts and nuts M12
8.	Bird spike	*2		2	
9.	Hex. head bolt	*2	M10	10	for fixing support legs and brackets
10.	Hex. nut	*2	M10	10	- do -
11.	Plain washer	*2	M10	20	- do -
12.	Spring washer	*2	M10	10	- do -
13.	Hex. head bolt	*1	M6	8	for fixing modules
14.	Hex. nut	*1, *2	M6	10 ($8^{*1}+2^{*2}$)	for fixing modules and bird spikes
15.	Plain washer	*1	M6	16	for fixing modules
16.	Spring washer	*1	M6	8	- do -
17.	Cable	*1		2	for intermodule wiring
18.	Cable tie	*1, *2		4 ($2^{*1}+2^{*2}$)	

4 Array Assembly / Wiring Flowchart

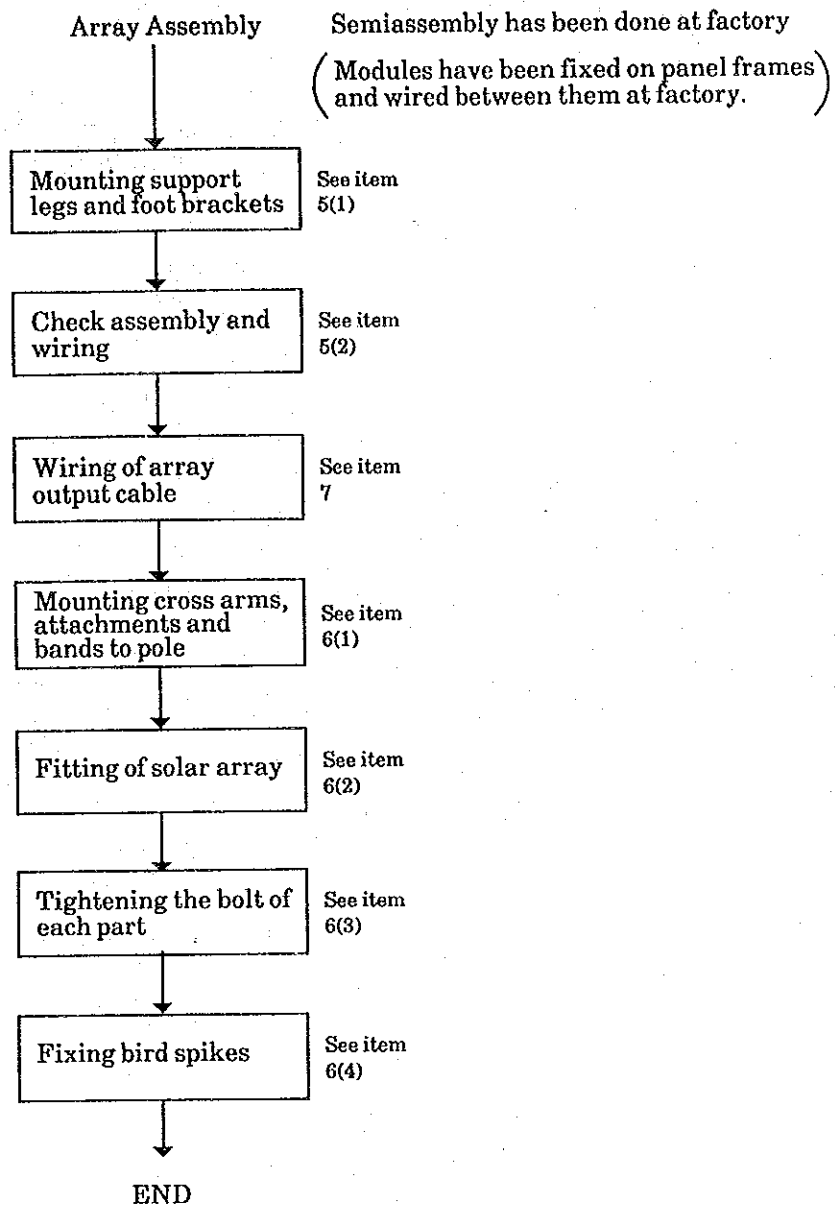


Fig. 1 Array assembly / wiring flowchart

5 Array Assembly

(1) Mounting support legs and foot brackets

– Refer to drawing No. NAA064A(1/2) –

After wiring the module's junction box, and while the assembly is still lying face down, attach front foot brackets from outside of the panel frame, corner side in.
Attach support legs from outside of the panel frame. Attach rear brackets from inside of the support legs, corner side in.
All attachments are made with M10 hexagon head bolts. Each bolt must be installed with a plain washer under the head and plain washer, spring washer, and nut on the threaded portion.

Tighten the bolts just enough to allow movement of the brackets and legs.

CAUTION

SHOCK MUST NOT be give to the solar module / array. Be cautious against possible shock hazard when installations are performed during daylight hours.

(2) Check after the completion of assembling works of solar array

Check right or wrong for wiring works, tightening of fixing screws of module.

With regard to wiring of array, refer to drawing No. NAB003A .

6 Fitting of Solar Array

(1) Mounting cross arm, attachment and band to pole

– Refer to drawing No. NAA064A(2/2) and SAA546E –

Mount cross arms, attachments and bands to pole by employing M12 stud bolts and M12 nuts.

With regard to the position of them, refer to drawing No. SAA546E.

The cross arm should face towards true south (in the northern hemisphere) or face towards true north (in the southern hemisphere).

(2) Fitting of solar array

– Refer to drawing No. NAA064A(2/2) –

Fix the foot brackets to the cross arms by employing M10 bolts, nuts.

Each bolt must be installed with a plain washer under the head and plain washer, spring washer, and nut on the threaded portion.

(3) Tightening the bolt of each part of the array

Tighten the bolts of the solar array that is assembled temporarily in initial stage of the works.

(4) Fixing bird spike

– Refer to drawing No. SAA518A and NAA064A(2/2) –

Fix two bird spikes on top of array.
The fixing works should be performed by inserting the ring of bird spike to 6mm bolts (M6) that mount the solar module to the panel frame.

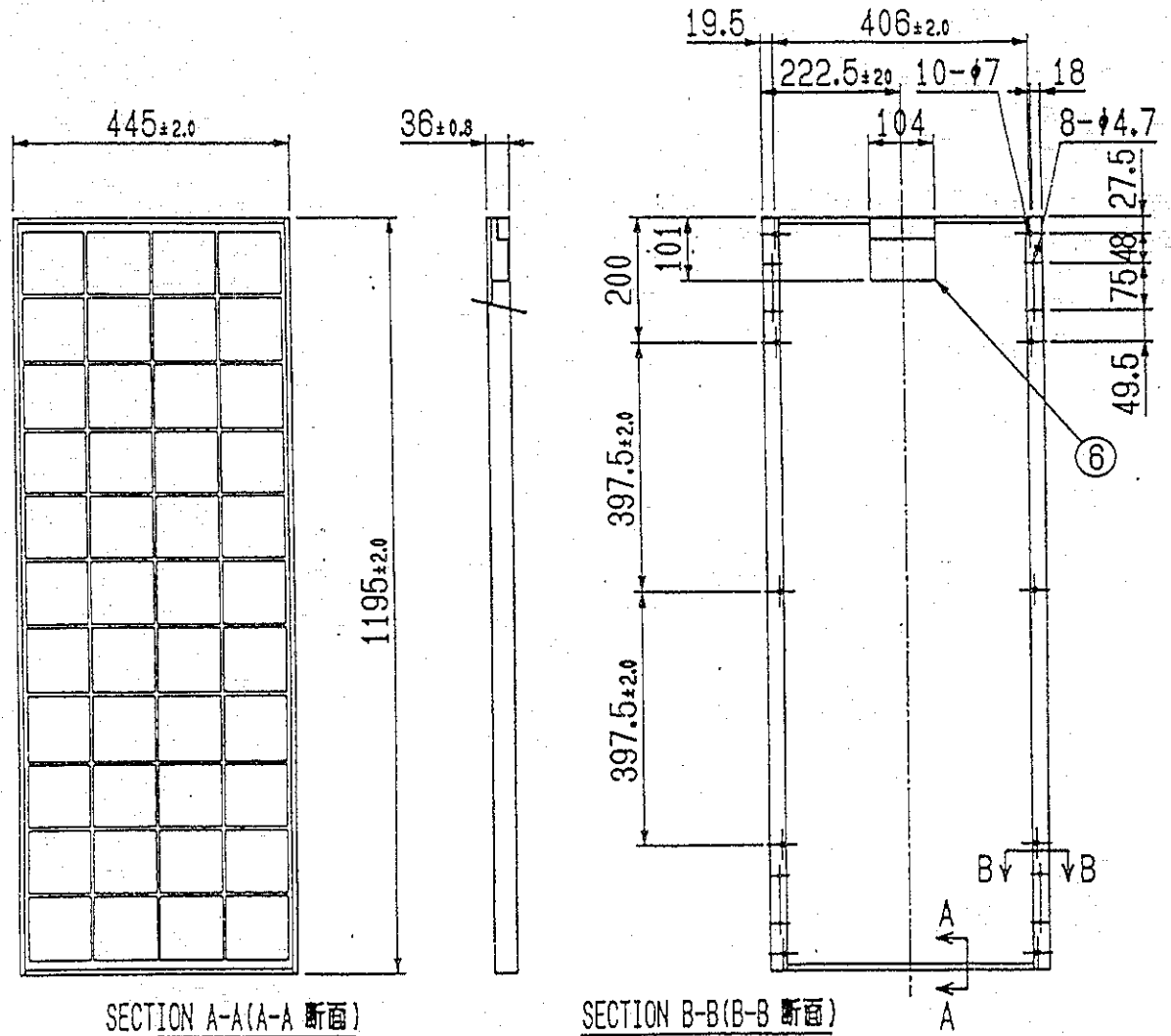
7. Wiring of Array Output Cable

– Refer to drawing No. NAB003A –

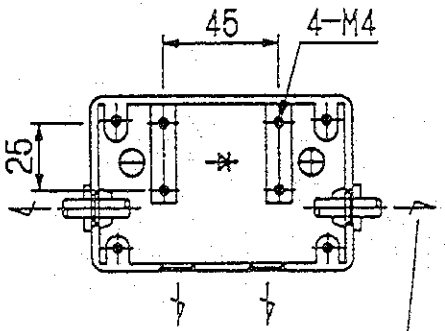
Connect the wire to the array output terminals in module's junction box by using crimp-type terminal lug. Screw size of array output terminal is M4 (4mm diameter), it is already fitted onto the output terminals in the shipment or supplied as attachment, never apply other screws than this.

Usable cable outer diameter for module's junction box is approximately 8.5mm~7.4mm.3.5mm^2 or 2mm^2-single core type flexible power cable is recommended. Don't use small size wire and unsuitable cable for outdoor use.

NO (番号)	DESCRIPTION (部品名称)	QT. (数量)	MTL (材質)	REMARKS (備考)
1	SOLAR CELL (太陽電池素子)	44	Si	PSC100H
2	GLASS (ガラス)	1		LOW-IRON TEMPERED (白板強化)
3	POTTANT (ポッタント)	1S.	EVA	
4	BACK SHEET (バックシート)	1	PVF/AL	
5	FRAME (フレーム)	1S.	AL.	
6	JUNCTION BOX (ジャンクション・ボックス)	1	ABS	USABLE CABLE O.D. 6.5~7.4mm (適合ケーブル外径 6.5~7.4mm)

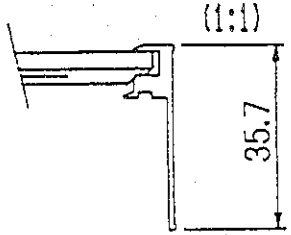


DETAIL OF JUNCTION BOX (1:2)
(ジャンクションボックス内部詳細)

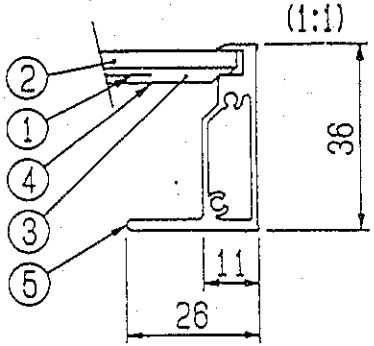


DIRECTION OF CABLE FEED-THROUGH
(ケーブル取出方向)

SECTION A-A(A-A 断面) (1:1)



SECTION B-B(B-B 断面) (1:1)



Unit(単位): 100mm

DESIGNED(設計) M. Tsujioka	DRAWN(製図)	NAME(名称)	SOLAR MODULE (太陽電池モジュール)
CHECKED(検図) S. Inoue	SCALE(尺度) 1:8 (1:1, 1:2)	TYPE(型式)	LA441K59
APPROVED(承認) S. Inoue	DATE(作成日) MAR. 14. 1990	DWG No.(図番)	AC-32216

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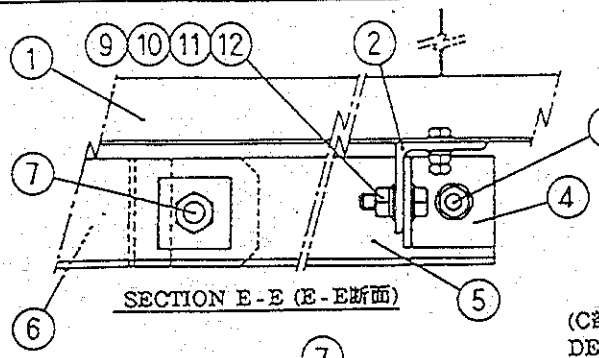
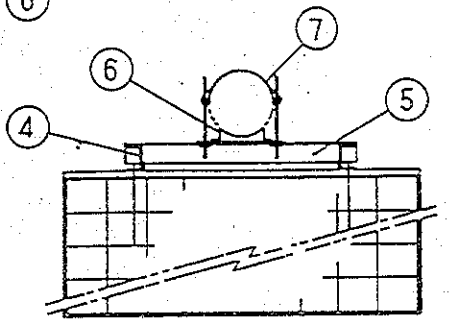
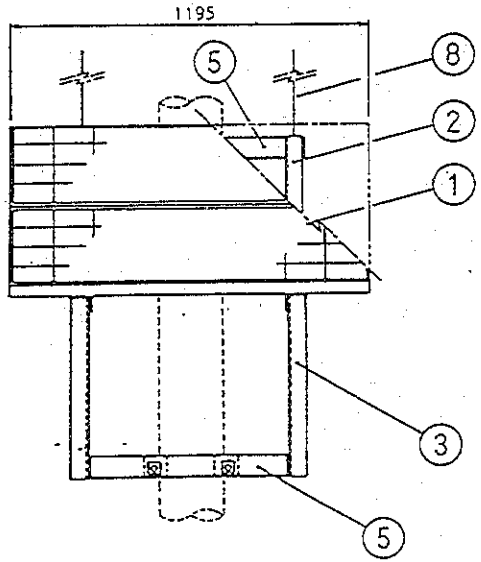
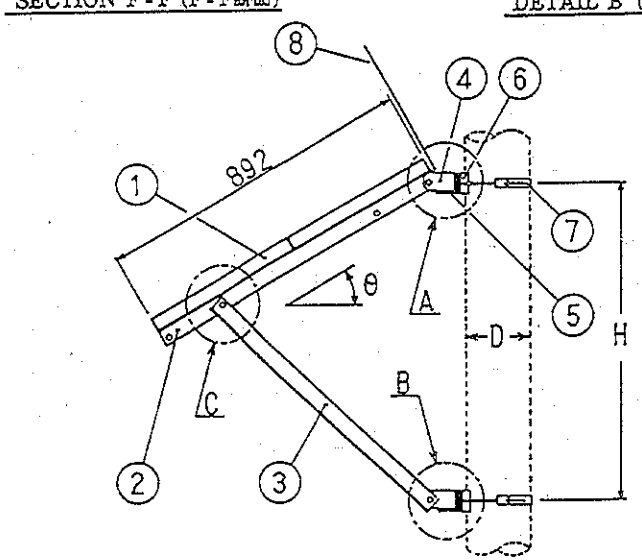
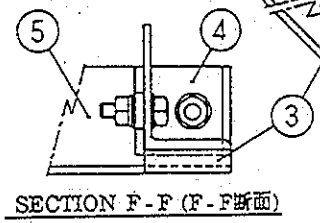
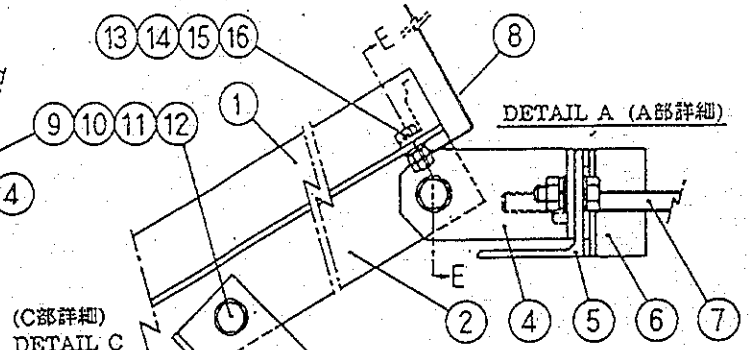


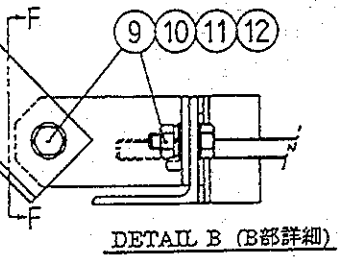












NO	PART NO. (部品番号)	QTY (数量)	MATL(材質)	DESCRIPTION (説明)
1	LA441K__	2		Solar module (太陽電池モジュール)
2	SAC381A	2	SS41	Panel frame L50×50×4 (パネルフレーム)
3	SAC381A	2	SS41	Support leg L50×50×4 (サポートレッグ)
4	SAC381A	4	SS41	Foot bracket (ファトブラケット)
5	SAC381A	2	SS41	Cross arm L50×60×4 (クロスアーム)
6	SAC381A	2	SS41	Attachment (M座)
7	SAC381A	2	SS41	Band with bolts & nuts M12 (取付バンドM12ボルト-ナット付)
8	SAC381A	2	SUS304	Bird spike (バードスパイク)
9		10	SS41	Hex. head bolt M10×30 (六角ボルト M10×30)
10		10	SS41	Hex. nut M10 (六角ナット M10)
11		20	SS41	Plain washer M10 (平座金 M10)
12		10	SS41	Spring washer M10 (バネ座金 M10)
13		8	SUS304	Hex. head bolt M6×20 (六角ボルト M6×20)
14		10	SUS304	Hex. nut M6 (六角ナット M6)
15		16	SUS304	Plain washer M6 (平座金 M6)
16		8	SUS304	Spring washer M6 (バネ座金 M6)
		1 set		Intermodule cabling set (モジュール間配線セット)

Note (注) : SS41 ; Hot dipped galvanized steel (溶融亜鉛メッキ鋼)
SUS304 ; Stainless steel (ステンレス鋼)

Applicable pole dia. (適合ポール径) "D" mm	100–120	120–150	150–177	170–214	205–251	240–286	275–322

Array angle (アレイ傾斜角) θ	5°	10°	15°	20°	25°	30°	35°	40°	45°
Dimension (取付寸法) "H" mm	485	555	635	715	795	880	966	1040	1120

UNIT (単位) : mm

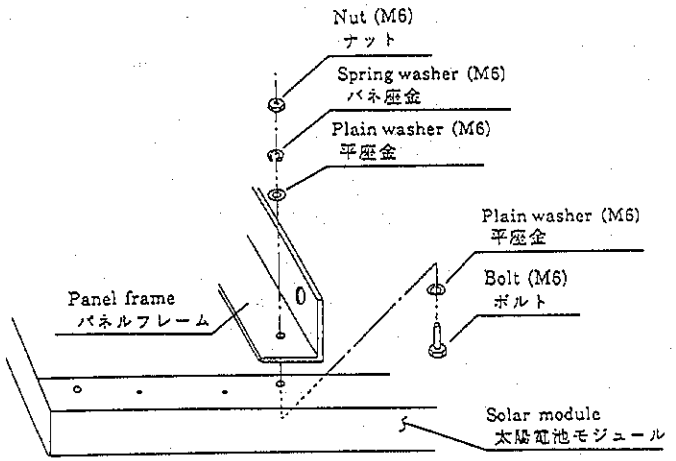
MODIFICATIONS (変更)	ACCOUNT (記事)	DATE (日付)	DRAWN (設計)	CHECKED (検査)	APPROVED (承認)

NAME (名称) SOLAR ARRAY (太陽電池アレイ)
SCALE (尺度) FREE
MATERIAL (材質)
TOLERANCES (普通公差) ±2.0

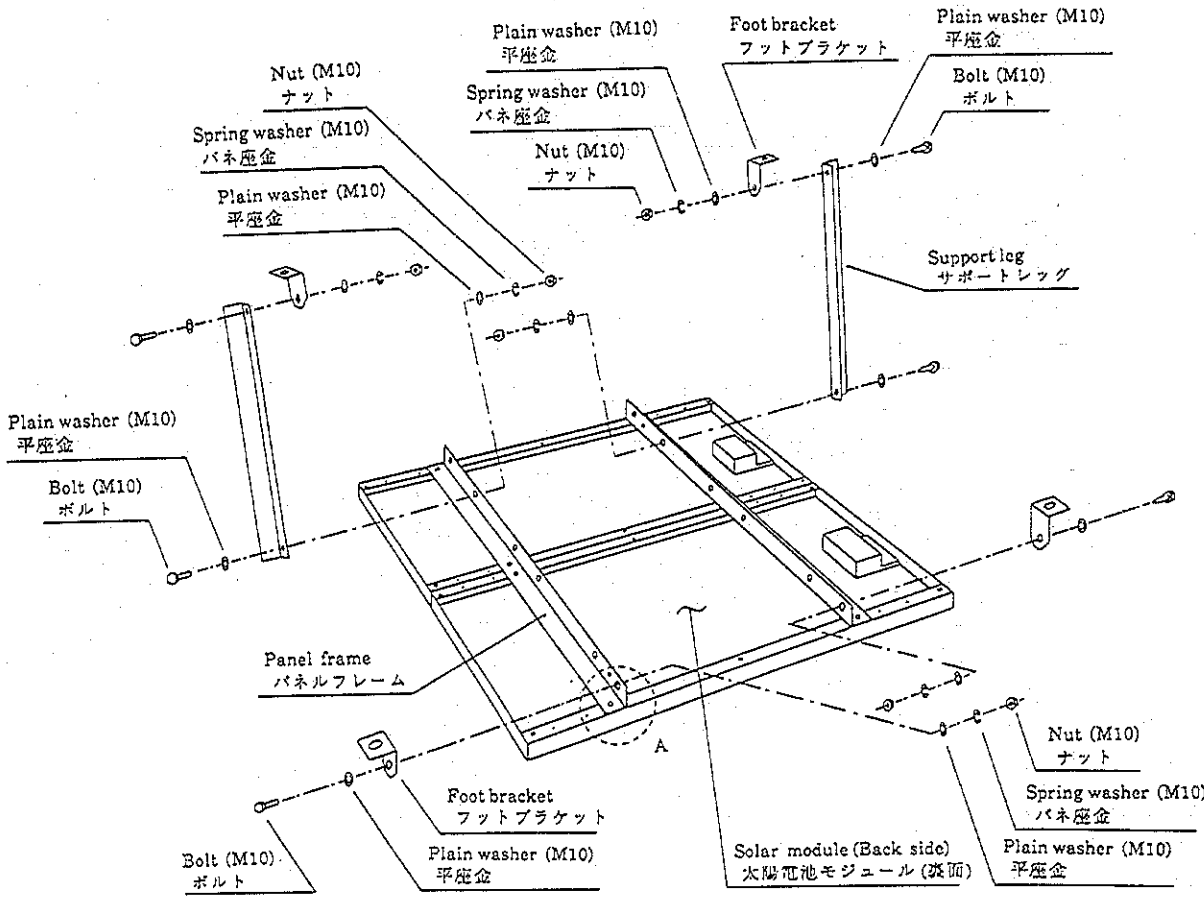
DRAWN (設計)	CHECKED (検査)
APPROVED (承認)	DATE (日付)
	SEP. 28 '92

KYOCERA CORPORATION KYOTO JAPAN
DWG. No. (図番) SAA518A

NO	PART NO. (部品番号)	QTY (数量)	MATL (材質)	DESCRIPTION (摘要)



DETAIL A
詳細



MODIFICATIONS (変更)	ACCOUNT (記事)	DATE (日付)	DRAWN (設計)	CHECKED (検査)	APPROVED (承認)

NAME (名称): ARRAY ASSEMBLY (2 modules)
アレイ組立図 (2モジュール)

TOLERANCES (機械公差):

SCALE (尺度): /

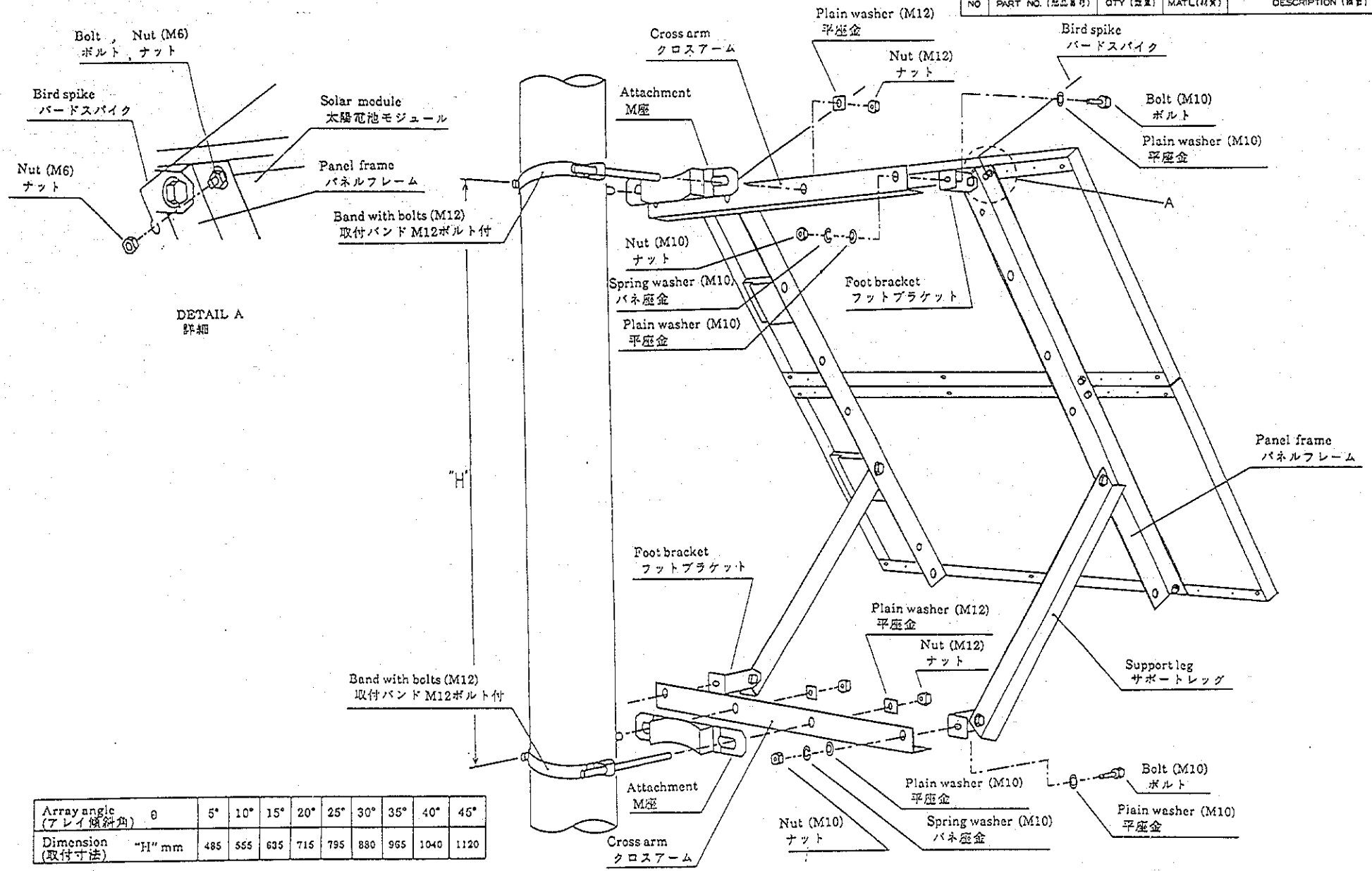
MATERIAL (材質):

DRAWN (設計)	CHECKED (検査)
APPROVED (承認)	DATE (日付)
	OCT. 28 '92

KYOCERA CORPORATION KYOTO JAPAN

DWG. No. (図番): NAA064A (1/2)

NO	PART NO. (品番号)	QTY (数量)	MATL(材料)	DESCRIPTION (摘要)



Array angle (アレイ傾斜角) θ	5°	10°	15°	20°	25°	30°	35°	40°	45°
Dimension (取付寸法) "H" mm	485	555	635	715	795	880	965	1040	1120

MODIFICATIONS (変更)	ACCOUNT (記事)	DATE (日付)	DRAWN (設計)	CHECKED (検査)	APPROVED (承認)

NAME (名称): ARRAY ASSEMBLY (2 modules)
アレイ組立図 (2モジュール)

SCALE (尺度): /

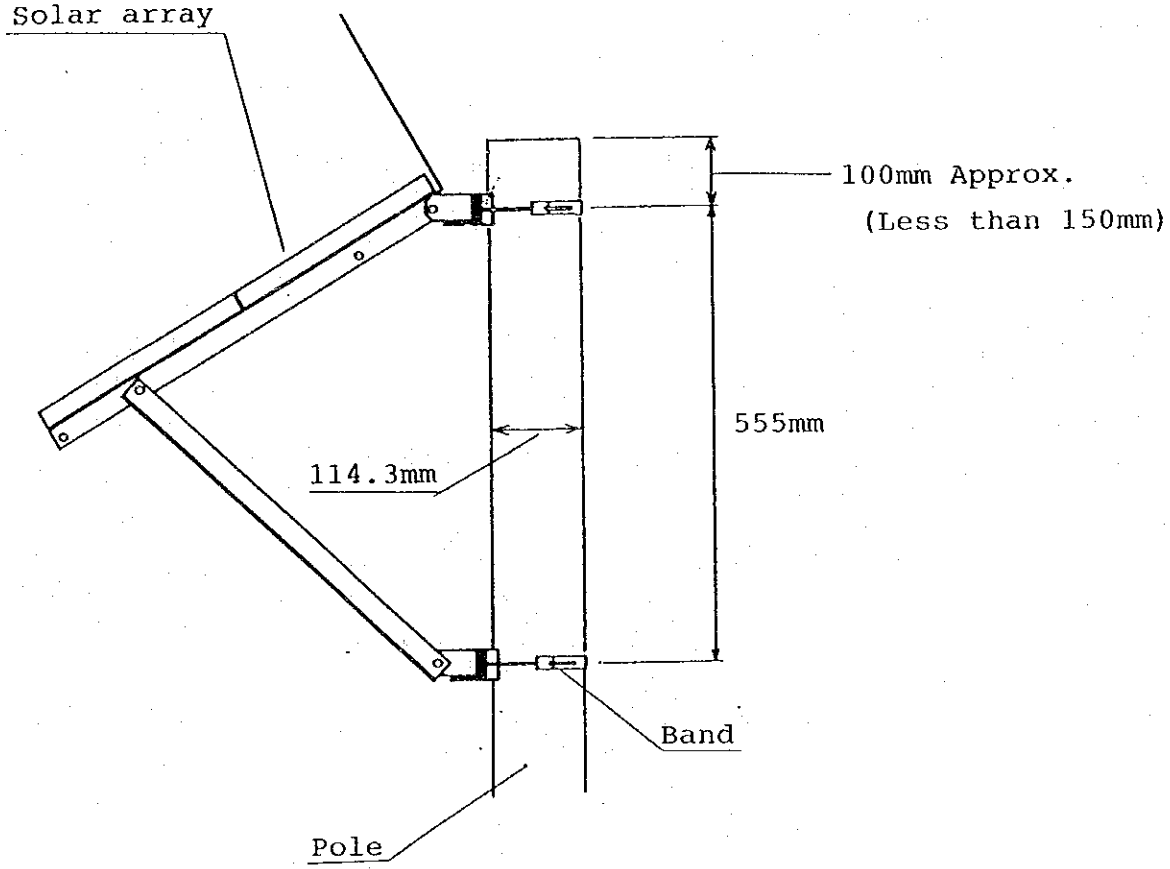
MATERIAL (材質):

TOLERANCES (普通公差):

DRAWN (設計)	CHECKED (検査)
APPROVED (承認)	DATE (日付)
	OCT. 28 '92

KYOCERA CORPORATION KYOTO JAPAN

DWG. No. (図番) NAA064A (2/2)



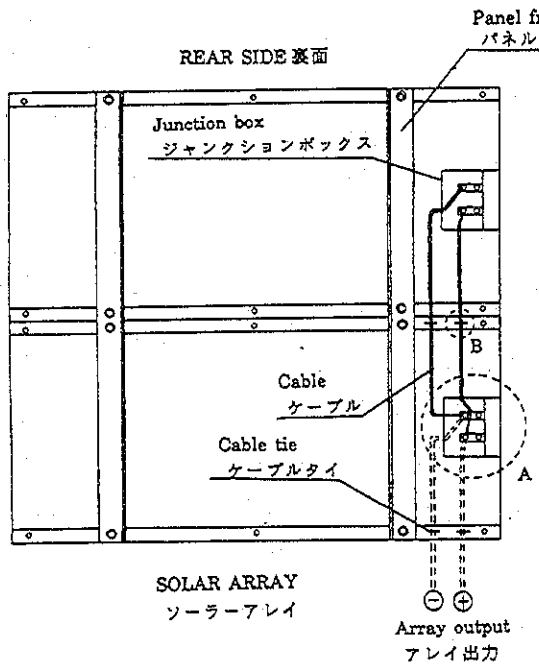
MODIFICATIONS (変更)	ACCOUNT (記事)	DATE (日付)	DRAWN (設計)	CHECKED (検査)	APPROVED (承認)

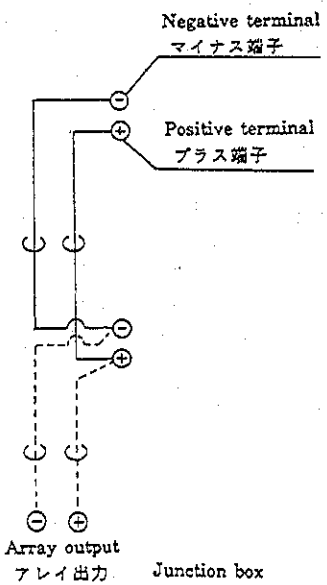
NAME (名称)	TOLERANCES (普通公差):	DRAWN (設計)	CHECKED (検査)
Mounting array to pole		T. Yamagoshi	
SCALE (尺度) / MATERIAL (材質)	-112-	APPROVED (承認)	DATE (日付)
/			NOV.11'92

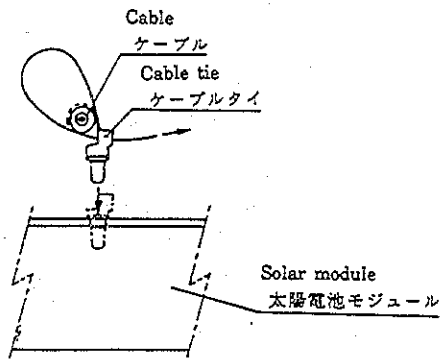
KYOCERA CORPORATION KYOTO JAPAN

DWG.No. (図番) SAA546E

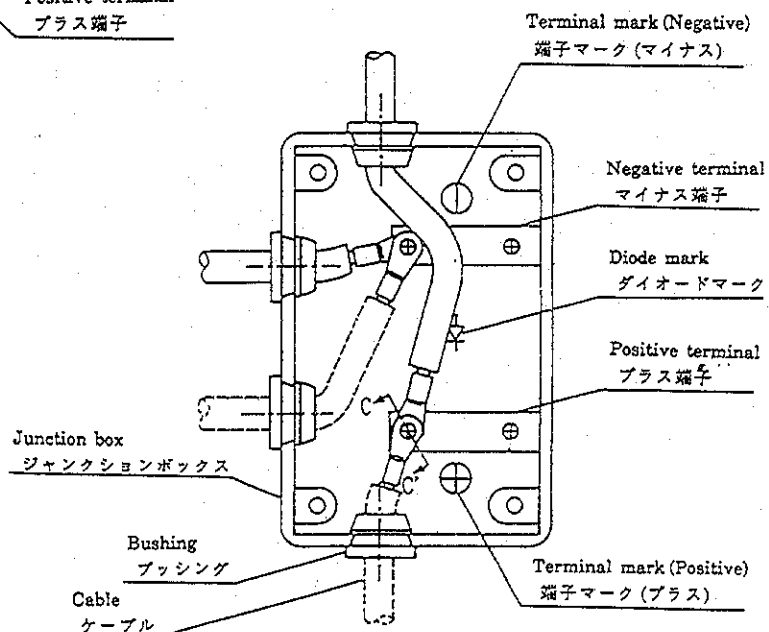
NO	PART NO. (部品番号)	QTY (数量)	MATL (材質)	DESCRIPTION (説明)





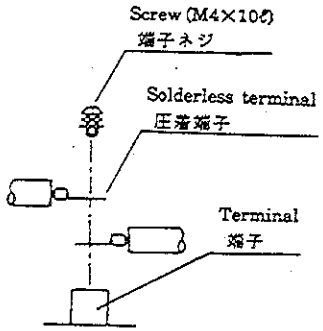


DETAIL B



DETAIL A

Detail of junction box
ジャンクションボックス詳細



SECTION C-C'

MODIFICATIONS (変更)	ACCOUNT (記事)	DATE (日付)	DRAWN (設計)	CHECKED (検査)	APPROVED (承認)

NAME (名称): WIRING OF ARRAY (2 modules in parallel)
アレイ内結線図 (2モジュール並列接続)

SCALE (尺度): /

MATERIAL (材質):

TOLERANCES (普通公差):

DRAWN (設計)	CHECKED (検査)
APPROVED (承認)	DATE (日付)
	OCT. 28 '92

KYOCERA CORPORATION KYOTO JAPAN

DWG. No. (図番): NAB003A

JICA