

## Specification of Pump Unit



7A-6514

國際協力事業団 殿

ブータン国 ウォンディフオドラン県  
地下水 開発 計画 調査

納 入 図 書

403-09

2/4

## SPECIFICATION OF EQUIPMENT

### 1. INTAKE PUMP

2 SETS

- |                                |  |          |
|--------------------------------|--|----------|
| 1) TYPE                        | HORIZONTAL SHAFT, SINGLE SUCTION VOLUTE PUMP |          |
| 2) CAPACITY                    | 1.88 M <sup>3</sup> /MIN                     |          |
| 3) TOTAL HEAD                  | 34 M   |          |
| 4) SPEED                       | 1460 R.P.M.                                  |          |
| 5) SIZE                        | SUCTION 125 MM, DELIVERY 100 MM              |          |
| 6) MATERIAL                    | CASING : CAST IRON                           | FC250    |
|                                | IMPELLER : CAST IRON                         | FC250    |
|                                | SHAFT : CARBON STEEL                         | S45C     |
|                                | SLEEVE : STAINLESS STEEL                     | SUS420J2 |
| 7) ACCESSORIES<br>(PER 1 PUMP) | - COUPLING (FUNCTIONS AS FLY-WHEEL, AS WELL) | 1 SET    |
|                                | - COUPLING COVER                             | 1 SET    |
|                                | - PRESSURE GAUGE                             | 1 PC     |
|                                | - COMPOUND GAUGE                             | 1 PC     |
|                                | - PRIMING FUNNEL                             | 1 PC     |
|                                | - TOOL (PER 2 PUMP SETS)                     | 1 SET    |

### 2. MOTOR FOR INTAKE PUMP

2 SETS

- |                |   |
|----------------|---|
| 1) TYPE        | HORIZONTAL SHAFT, TOTALLY ENCLOSED, SQUARE CAGE |
| 2) OUTPUT      | 18.5 KW   |
| 3) NO. OF POLE | 4 P   |
| 4) VOLTAGE     | 415 V   |
| 5) FREQUENCY   | 50 HZ   |
| 6) INSULATION  | B   |

### 3. SLIDE BASE

2 SETS

- |                |              |
|----------------|--------------|
| 1) MATERIAL    | MILD STEEL   |
| 2) ACCESSORIES | FIXING BOLTS |

### 4. VALVES

#### 4-1. FOOT VALVE

2 SETS

- |                |                 |
|----------------|-----------------|
| 1) SIZE        | 150 MM          |
| 2) FLANGE      | JIS 10K         |
| 3) MATERIAL    | CAST IRON       |
| 4) ACCESSORIES | FLOAT AND FRAME |

#### 4-2. SLUICE VALVE

2 SETS

- |             |                                 |
|-------------|---------------------------------|
| 1) SIZE     | 125 MM                          |
| 2) FLANGE   | JIS 10K                         |
| 3) TYPE     | MANUAL OPERATION, OUTSIDE SCREW |
| 4) MATERIAL | BODY/DISC : CAST IRON FC200     |
|             | SEAT : BRONZE BC6               |

4-3. NON-RETURN VALVE

2 SETS

- |             |                             |
|-------------|-----------------------------|
| 1) SIZE     | 125 MM                      |
| 2) FLANGE   | JIS 10K                     |
| 3) TYPE     | SWING                       |
| 4) MATERIAL | BODY/DISC : CAST IRON FC200 |
|             | SEAT : BRONZE BC6           |

5. SUCTION PIPING

5-1 FLEXIBLE PIPE

2 SETS

- |                   |                               |
|-------------------|-------------------------------|
| 1) SIZE           | 150 MM                        |
| 2) TYPE           | PVC HOSE WITH REINFORCED CORD |
| 3) CONNECTION     | FLANGE                        |
| 4) RATED PRESSURE | 5 KGF/CM <sup>2</sup>         |
| 5) ACCESSORIES    | FLOAT, FRAME AND FITTINGS     |

5-2 CONNECTING PIPE

2 PCS

- |               |                   |
|---------------|-------------------|
| 1) SIZE       | 150 MM X 125 MM . |
| 2) MATERIAL   | MILD STEEL        |
| 3) CONNECTION | JIS 10K FLANGE    |

5-3 ACCESSORIES

- 1) BOLTS, NUT, (STAINLESS STEEL), PACKING

1 SET

6. DELIVERY PIPING

6-1 FLEXIBLE PIPE

2 SETS

- |                   |                               |
|-------------------|-------------------------------|
| 1) SIZE           | 125 MM                        |
| 2) TYPE           | PVC HOSE WITH REINFORCED CORD |
| 3) CONNECTION     | FLANGE                        |
| 4) RATED PRESSURE | 5KGF/CM <sup>2</sup>          |

6-2 CONNECTING PIPE

2 PCS

- |               |                 |
|---------------|-----------------|
| 1) SIZE       | 100 MM X 125 MM |
| 2) MATERIAL   | MILD STEEL      |
| 3) CONNECTION | JIS 10K FLANGE  |

6-3 HEADER PIPE

1 PC

- |               |                             |
|---------------|-----------------------------|
| 1) SIZE       | 200 MM/200 MM/125 MM/125 MM |
| 2) MATERIAL   | MILD STEEL                  |
| 3) CONNECTION | JIS 10K FLANGE              |

6-4 ACCESSORIES

- |   |       |
|---|-------|
| 1) BOLT, NUT (STAINLESS STEEL), PACKING | 1 SET |
| 2) AIR VALVE 50 MM                      | 1 PC  |

7. PUMP CONTROL PANEL

1 SET

- |                                  |       |
|----------------------------------|-------|
| 1) TYPE : OUTDOOR, SELF-STANDING |       |
| 2) STARTING METHOD : STAR-DELTA  |       |
| 3) POWER SOURCE : 415 V, 50 HZ   |       |
| 4) ACCESSORIES                   | 1 SET |
| VOLT METER                       |       |
| AM-METER                         |       |
| PROTECTION RELAY                 |       |

8. WIRING MATERIALS

1 SET

- |                               |       |
|-------------------------------|-------|
| 1) TYPE : SUBMERSIBLE CABLE   |       |
| 2) OTHERS : EARTHING MATERIAL | 1 SET |

9. SPARE PARTS

9-1 FOR PUMP

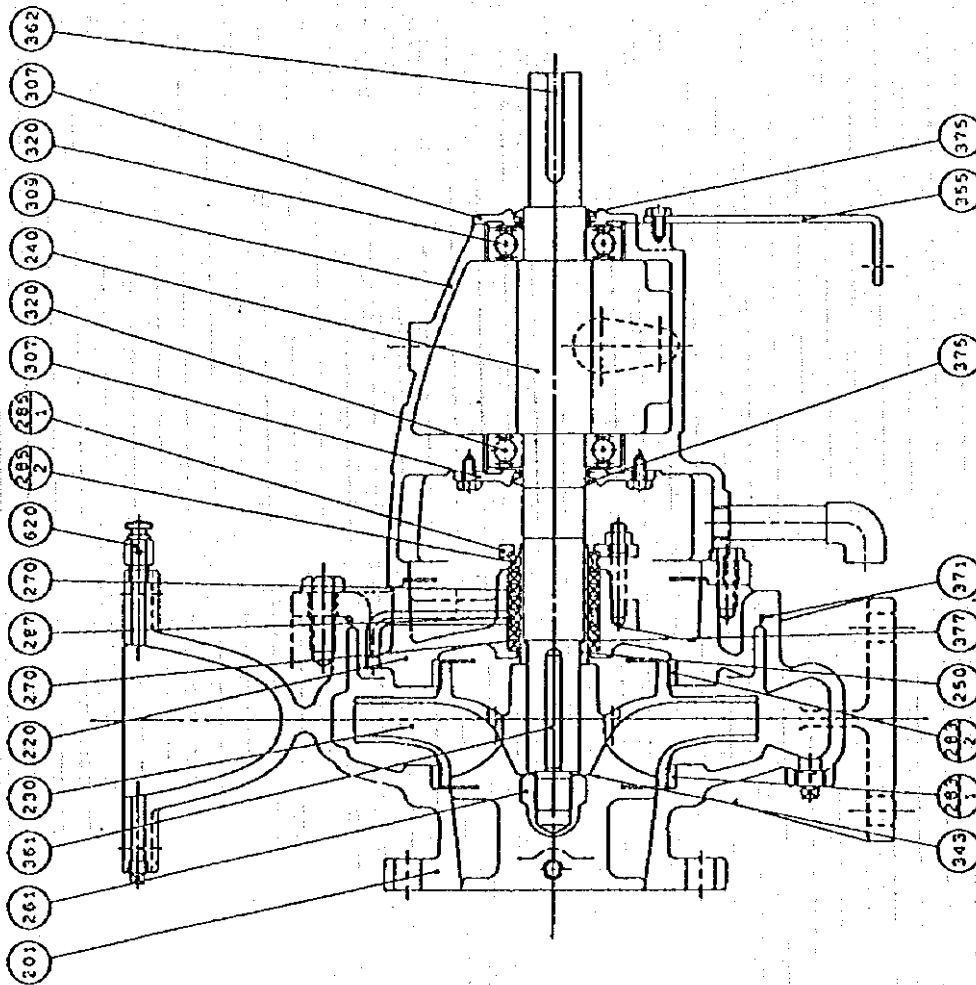
- |                  |        |
|------------------|--------|
| 1) GLAND PACKING | 6 SETS |
| 2) SLEEVE        | 2 SETS |
| 3) BEARING       | 2 SETS |
| 4) CASING RING   | 2 SETS |

9-2 FOR MOTOR

- |            |        |
|------------|--------|
| 1) BEARING | 2 SETS |
|------------|--------|

9-3 FOR CONTROL PANEL

- |          |       |
|----------|-------|
| 1) LAMP  | 100 % |
| 2) FUSE  | 100 % |
| 3) RELAY | 1 PC  |



## APPLICATION

SUCTION PRESSURE: UP TO 2 kgf/cm<sup>2</sup>

MODEL : SV-JA154A, 135A, 153A, 154A

SV-JA155A, 204A, 205A

FILE NO.

ORDER NO.

7A-6514-01A

NO.	PARTS NAME	MATERIAL	QTY	REMARKS
620	AIR VENT COCK	C3604	1	
377	GASKET	ASBESTOS	1	VALQUA #1500
375	V-RING	NBR	2	V-50S
371	O-RING	NBR	1	
362	COUPLING KEY	S45C	1	
361	IMPELLER KEY	S45C	1	
355	SUPPORT FOOT	SS400	1	
343	IMPELLER LOCK WASHER	SUS304	1	
320	BALL BEARING	—	2	6310ZZ (SHIELDED TYPE)
309	BEARING HOUSING	FC200	1	
307	BEARING COVER	FC200	2	
287	LANTERN RING	PHENOL RESIN	1	
285-2	GLAND RING	PHENOL RESIN	1	
285-1	GLAND	FC200	1	
283-2	CASING RING(2)	BC6	1	
283-1	CASING RING(1)	BC6	1	
270	GLAND PACKING	GRAPHITE ASBESTOS	5	VALQUA #134 Ø55 x Ø75 x 10W
261	IMPELLER NUT	SS400	1	
250	SHAFT SLEEVE	SUS420J2	1	
240	SHAFT	S45C	1	
230	IMPELLER	FC250	1	
220	CASING COVER	FC250	1	
201	CASING	FC250	1	

APPROVED BY	CHECKED BY	DATE	TYPE	TYPE	TYPE	TYPE	TYPE

CONSTRUCTION DRAWING

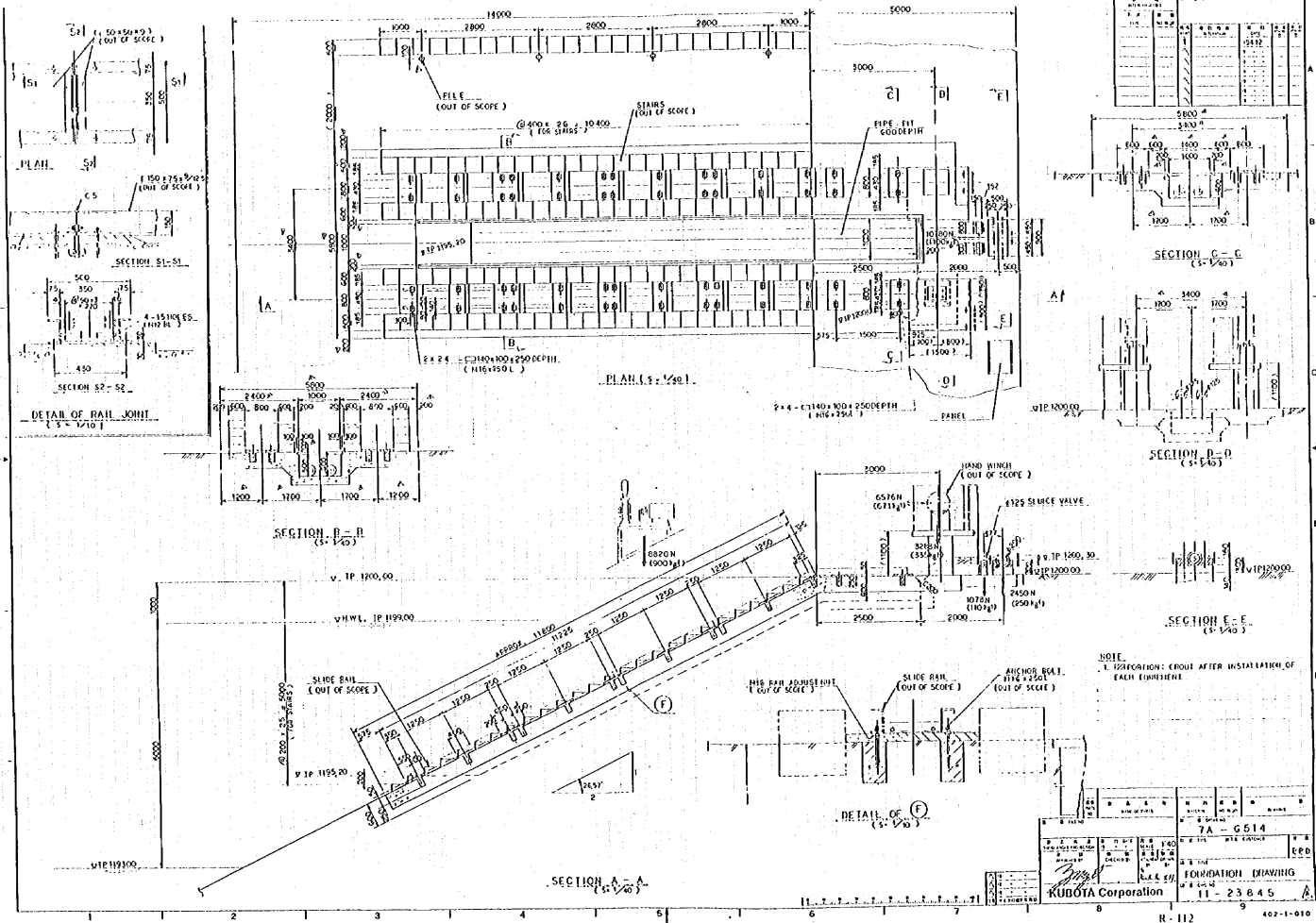
KUBOTA Corporation

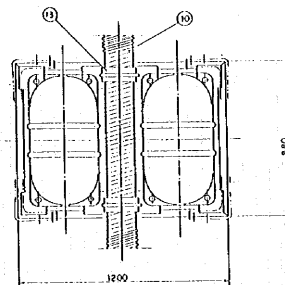
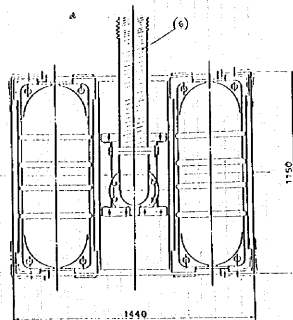
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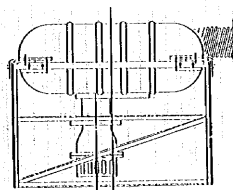
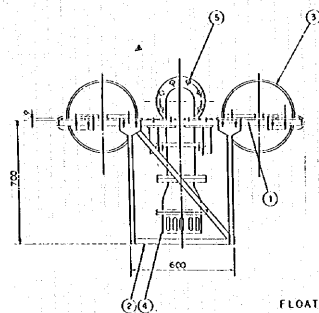




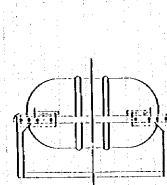
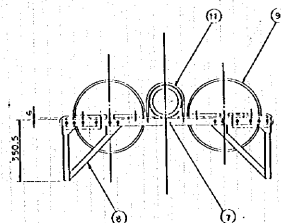




NO.	REV.	DATE	BY	CHKD.	APP.
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20					



FLOAT  
TYPE (1)



FLOAT  
TYPE (2)

8	FRAME S-2	4			
7	FRAME S-1	2			
6	PVC HOSE WITH REINFORCED CORD (Ø150x6m)	1			
5	90° BEND PIPE (Ø150)	1	13	RUBBER	4
4	FOOT VALVE (Ø150)	1	12	RUBBER	12
3	FLOAT (TYPE: 180A-11L1)	2	11	U BOLT	4
2	FRAME L-2	1	10	PVC HOSE WITH REINFORCED CORD (Ø150x6m)	1
1	FRAME L-1	1	9	FLOAT (TYPE: 180A-11)	4
PARTS NO.	NAME OF PARTS	NO. REQD	PARTS NO.	NAME OF PARTS	NO. REQD

7A-6514	7A-6514	7A-6514	7A-6514	7A-6514	7A-6514
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顧客名  
Customer

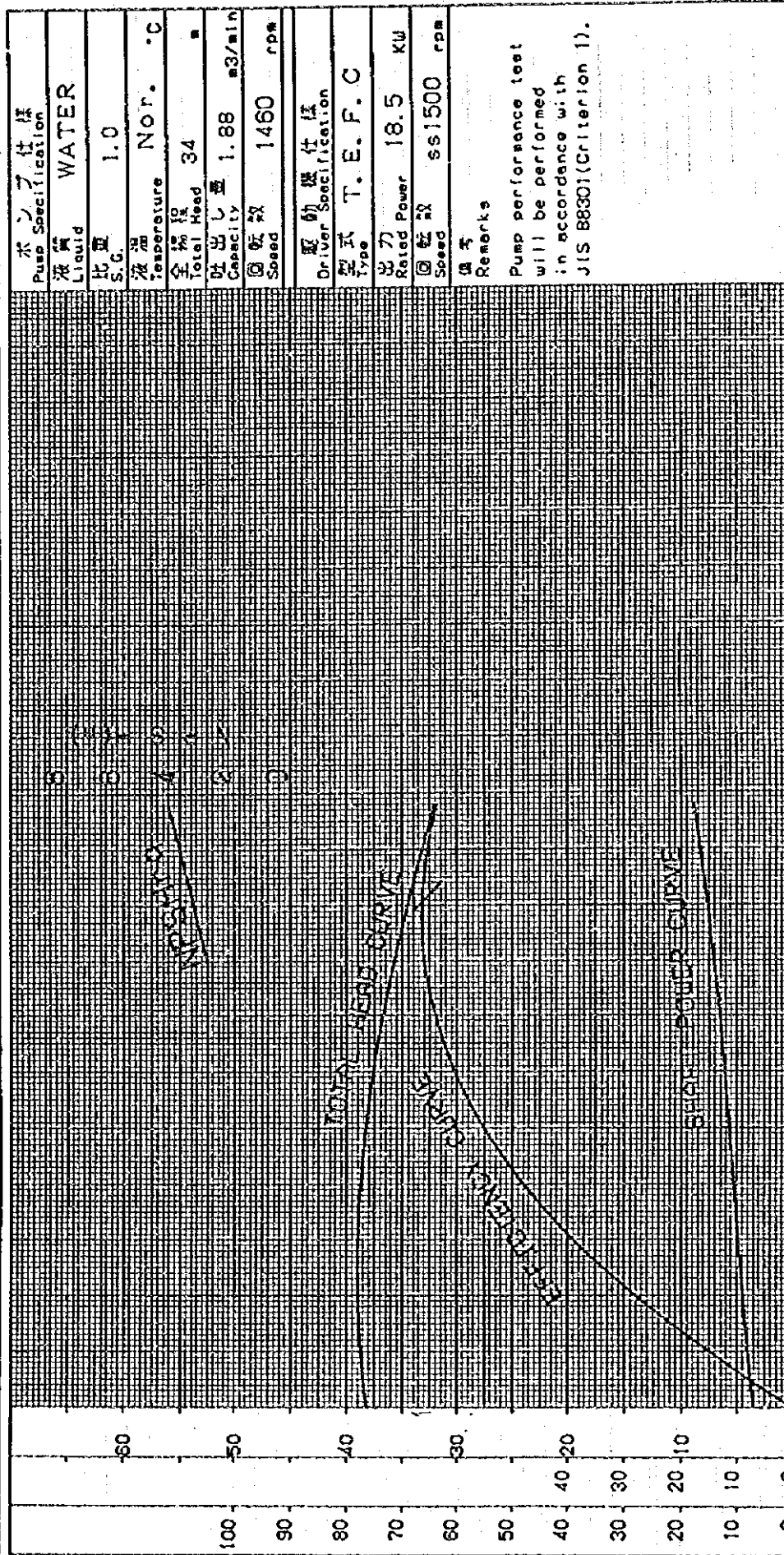
Item No.

型式 SV-JA135AZK

ポンプ予想性能曲線  
EXPECTED PUMP PERFORMANCE CURVES

口径 125mm 吐出 100mm 段数 1  
Bore Suction Discharge No. of Stages

株式会社 クボタ  
KUBOTA Corporation



0 1 2 3 4

吐出量  
Capacity (m<sup>3</sup>/min)

承認 Approved by	作成 Designed by
	<i>W. Williams</i>

見積り Estimate No.	日付 Date
7A-8514-01A	1994.10.6
発注 Order No.	図番 File No.
7A-8514-01A	X-23/57

ポンプ仕様  
Pump Specification

液質  
Liquid WATER

比重  
S.G. 1.0

液温  
Temperature Nor. °C

全揚程  
Total Head 34 m

吐出量  
Capacity 1.88 m<sup>3</sup>/min

回転数  
Speed 1460 rpm

駆動機仕様  
Driver Specification

型式  
Type T. E. F. C

出力  
Rated Power 18.5 kW

回転数  
Speed 551500 rpm

備考  
Remarks

Pump performance test will be performed in accordance with JIS B8301 (Criterion 1).



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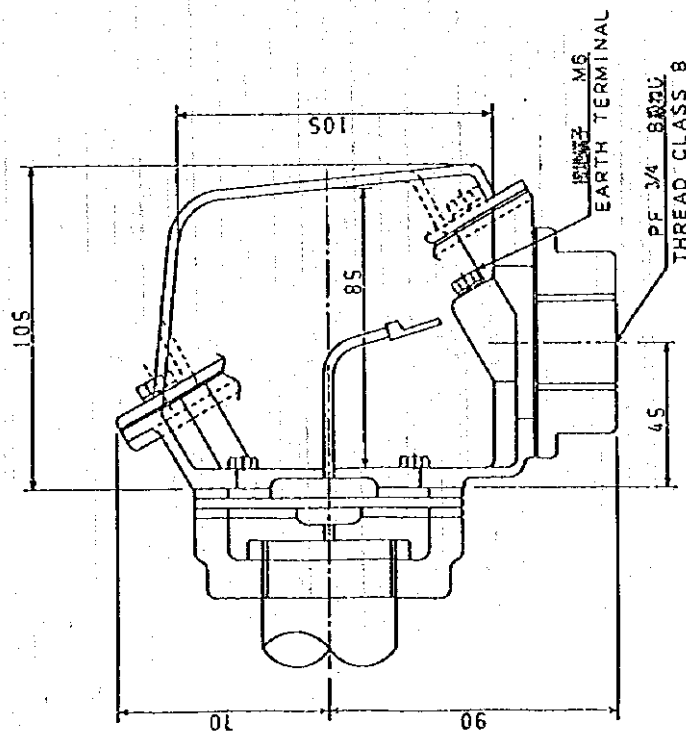
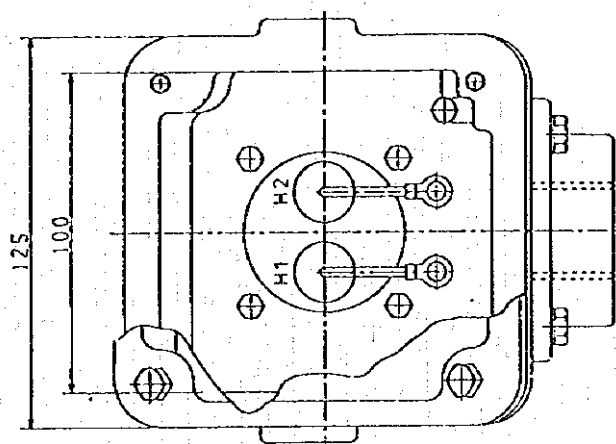
# 御承認用図書

製造番号 CR04136 MB 1

御承認の上 通御返却願います。

平成 6.10.3

株式会社 東芝



図番号 DRAWING NO.

M 7076273

図番号 REV. MARK



R-117

図番号 DRAWING NO. M 7076273		社名 株式会社 東芝 TOSHIBA CORPORATION TOKYO JAPAN		図番号 M 7076273	
図名 端子箱 (24-28-9用) CONSTRUCTION OF TERMINAL BOX FOR SPACE HEATER		承認 承認者 承認日 承認場所		承認 承認者 承認日 承認場所	
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図番号 DRAWING NO. M 7076273

社名 株式会社 東芝

TOSHIBA CORPORATION

TOKYO JAPAN

図番号

M 7076273

承認

承認者

承認日

承認場所

承認

承認者

承認日

承認場所

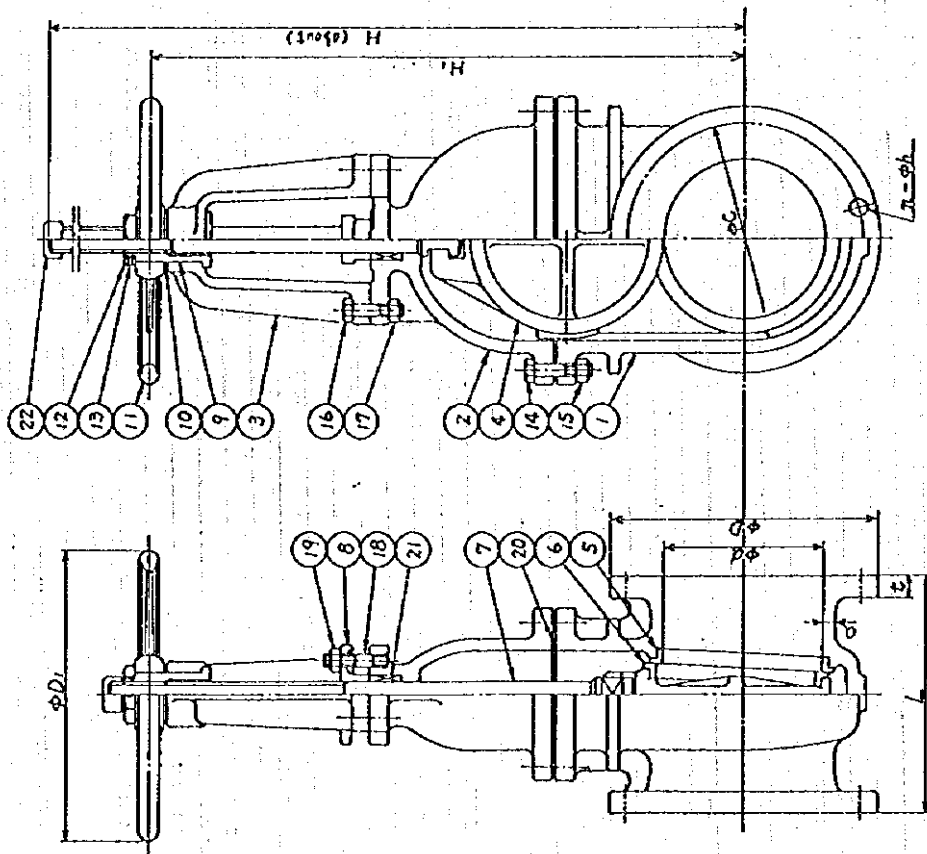
承認

承認者

承認日

承認場所





Nominal SIZE	d	L	FLANGE (JIS B2210 10K)								D <sub>1</sub>	H <sub>1</sub>	H
			D	C	a	b	c	d	e	f			
125	125	250	250	210	8	23	24	11	280	504	686		
150	150	270	280	240	8	23	26	13	300	585	797		
200	200	290	330	290	12	23	26	15	355	723	991		
250	250	330	400	355	12	25	30	17	400	875	1194		
300	300	350	445	400	16	25	32	19	450	1002	1381		

Mass : 61kg

PARTS No	NAME OF PARTS	MATERIAL	QTY	REMARKS
22	Stem cap	Rubber	1	
21	Gland packing	Asbestos	1.5	
20	Gasket	Asbestos	1	
19	Hexagon nut	Steel	2	
18	Stud bolt	Steel	2	
17	Hexagon nut	Steel	4	
16	Hexagon bolt	Steel	4	
15	Hexagon nut	Steel	~	
14	Hexagon bolt	Steel	~	
13	Set screw	S. steel	1	
12	Lock nut	Steel	1	SS400
11	Hand wheel	Cast iron	1	FC200
10	Washer	Brass	1	C2801P
9	Yoke sleeve	Cast bronze	1	BC6
8	Gland	Malleable iron	1	FCMB270
7	Stem	Brass	1	C3711B
6	Disc seat ring	Cast bronze	2	BC6
5	Body seat ring	Cast bronze	2	BC6
4	Disc	Cast iron	1	FC200
3	Yoke	Cast iron	1	FC200
2	Bonnet	Cast iron	1	FC200
1	Body	Cast iron	1	FC200

USE

T E S T	HYDROSTATIC
PRESSURE	SHELL 2.06 MPa
	SEAT 1.51 MPa

WORKING PRESSURE	WORKING TEMPERATURE
---------------------	------------------------

TITLE 10K - 125 ~ 300

CAST IRON GATE VALVE O.S. and Y.

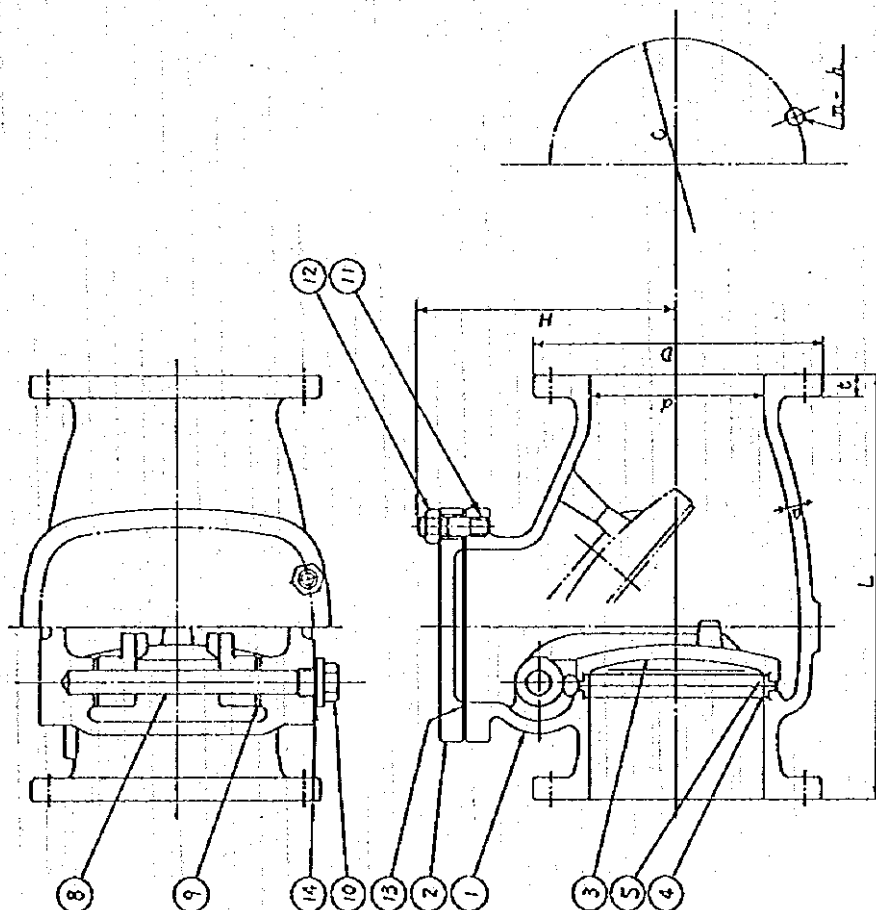
BRONZE TRIM

DIMENSIONS IN mm	THIRD ANGLE PROJECTION
CHECKED BY <i>[Signature]</i>	DATE 1994-09-05
DESIGNED BY <i>[Signature]</i>	SCALE ~
DWG No. RA-07580	

SHOWA VALVE CO. LTD.

No.	DATE	ALTERATION	DESIGNED BY
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△			
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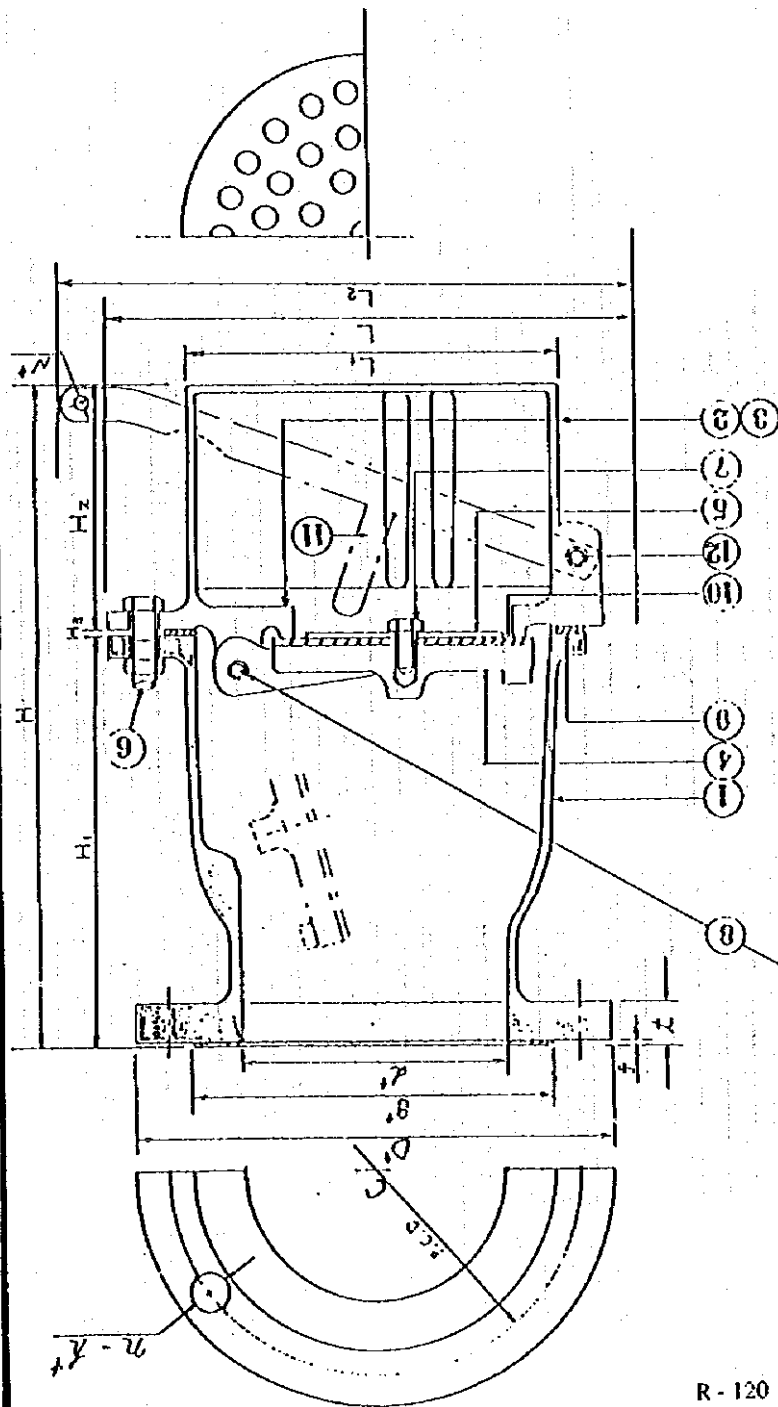
Mass : 48 kg



Nominal SIZE	FLANGE (JIS B2210 10K)							
	d	L	D	C	a	h	p	H
100	100	290	210	175	8	19	24	10
125	125	360	250	210	8	23	24	11
								205

Mass : 48 kg				

SHOWA VALVE CO., LTD.

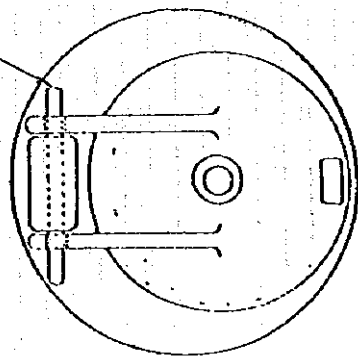


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品番	部 品 名 称	数	材質	備 考
1	本体 (ボデー)	1	FC 200	
2	翼 (ストレーナー)	1	FC 200	
3	弁 座	1	FC 200	
4	弁 体 (オモリ)	1	FC 200	
5	座金 (ワッシャー)	1	SS 400	
6	外蓋ボルト・ナット	6	SS 400	M12X15-S0
7	六角ボルト	1	SUS304	M8X16
8	ピン	1	SUS304	φ3mm
9	外蓋パッキン	1	NBR	2mm
10	弁 パッキン	1	NBR	t=3mm
11	レバー	1	PCD450	
12	レバー止ボルトナット	1	SUS304	M8X50-SS

三 角 法	検 図	尺 寸	設 計	図 番	NO. 0113
付	付	1991.06.13	玉 城		
品 名	フランジ型 (鉄板) レバー式 フートバルブ (標準品) ALL/FC (10K)				

重量	4 B=13.5 B=20.6 B=24Kg
塗 装	
水圧試験	本体 1.0 Xkgf/cm <sup>2</sup>
シート漏れ試験	0.5 Xkgf/cm <sup>2</sup>

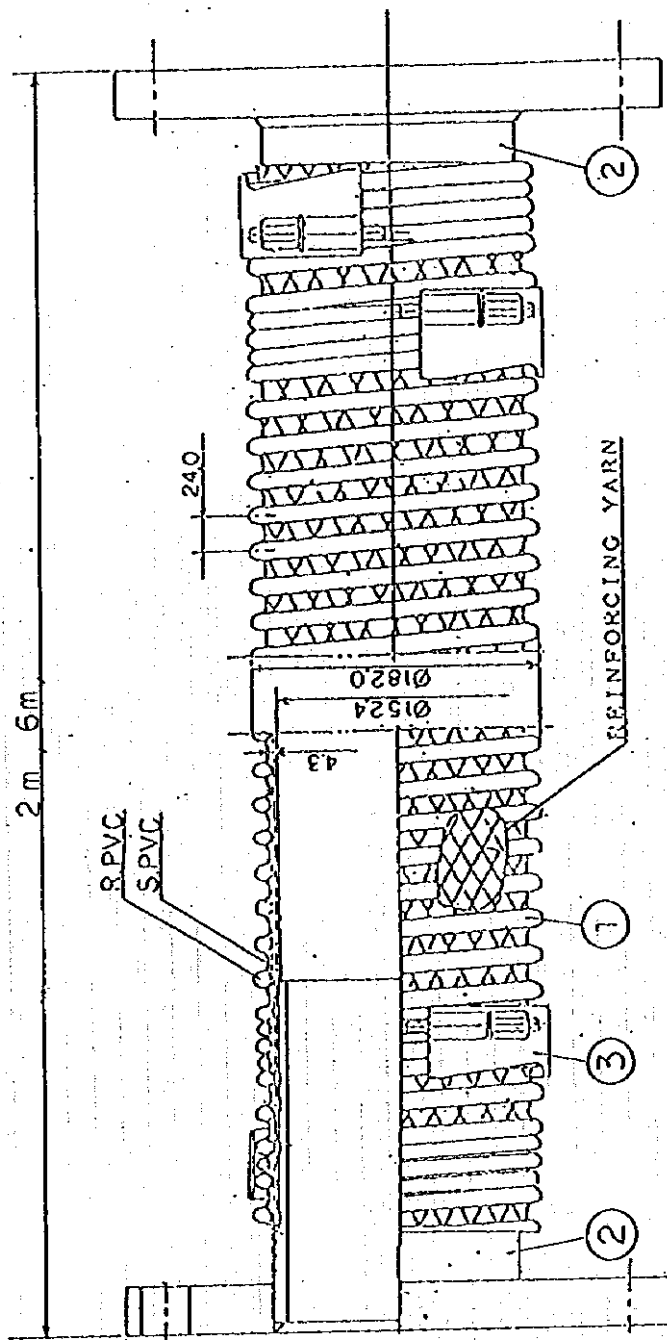


① 玉 城 鉄 工 株 式 会 社

呼び径	d	D	t	f	g	H	H1	H2	H3	L	L1	C	n	h	L2	N
4"	108	210	17	2	155	250	160	88	2	245	166	175	8	19	290	85
5"	133	250	18	2	185	300	195	113	2	270	184	210	8	23	330	85
6"	158	280	20	2	215	310	188	120	2	298	218	240	8	23	350	85



Rev. No.	Rev. Date	Rev. Description	Rev. By	Rev. Date	Rev. Description
1					



3	Power Lock Band	SWRM	4	6"
2	Apply with Flange	SS400	2	1/2" x 6" JIS X 5505-6"
1	HOSE Ø150	PVC	1	
Rev. No.	Rev. Date	Rev. Description	Rev. By	Rev. Date
1				
Approved	Checked	Scale	Rev. No.	Rev. Date
Designed	Drawn	Traced	Rev. No.	Rev. Date
KUBOTA CORPORATION				
KANALINE A Ø150				
OVSD-444				

MESSRS

納入先 BHUTAN/CARD PUMP STATION

CUSTOMER

得意先

PROJECT

工事名

TITLE


品名

CONTROL PANEL

KUBOTA Corporation

NOV. 18. 1994

Pump Engineering  
Dept.

CHANGE OR ALTERATIONS 図面変更			JOB. NO.
MARK	REVISION 訂正	DATE	工事番号
1	THE 1ST REVISION	OCT. 5 '94	PRESENTATION 出図
2	THE 2ND REVISION	NOV. 9. '94	
			CHECKED BY 照査 <i>T. Yoshida</i>
			PLANNED BY 計画 <i>M. Mantani</i>
			DRAWN BY 製図 <i>M. Mantani</i>
			DATE OF DRAWING SEP. 30. 1994
 <b>TERASAKI ELECTRIC CO., LTD. OSAKA JAPAN</b>			

**APPLICATION**

JIS, JEC, JEM

(IN DOOR) MAX 40°C MIN -5°C MAX 1000M (ABOVE SEA LEVEL)  
(OUT DOOR) MAX 40°C MIN -20°C MAX 1200M (ABOVE SEA LEVEL)

H<sub>x</sub>      W<sub>x</sub>      D<sub>x</sub>

○	EACH PANEL	SYMBOL 'Δ' SEE TO OUTLINE VIEW
---	------------	--------------------------------

**RATED**

CONTROL PANEL

415 / AC3  $\phi$  3W

50

2000

1500

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LL53408

MO 1 CG 0 1

1

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# SPECIFICATION

## INTERNAL WIRING

### MAIN CIRCUIT

BUS	MATERIAL	COPPER
	TREATMENT	JOINT PARTS IS COATED SILVER OR TIN PLATE
	INSULATION COVER	NOT PROVIDED
	COLOR DISTINGUISHED METHOD	VINYL TAPE
INSULATION WIRE	MATERIAL	600V WLFC
WIRE END TREATMENT	COLOR DISTINGUISHED METHOD	COLOR VINYL CAP

### CONTROL CIRCUIT

INSULATION WIRE	MATERIAL	JIS 600V GRADE POLYVINYL CHLORIDE INSULATED WIRE (IV) FOR GENERAL CIRCUIT: 1.25mm <sup>2</sup> FOR PT'S, CT'S SECONDARY: 2mm <sup>2</sup>
WIRE END TREATMENT	END CAP	NOT INSTALLED
	MARK BAND	 KN TYPE (TERMINAL NO. OF PARTS)
	COLOR DISTINGUISHED METHOD	NOT INSTALLED
TERMINAL	SOLDERLESS TYPE: CRIMP	



### COLOUR IDENTIFICATION

DISTRIBUTION SYSTEM	JEM 1134	REMARKS
DC	POSITIVE POLE P	RED
	NEGATIVE POLE N	BLUE
1φ 3W	1ST LINE A	RED
	NEUTRAL LINE N	BLACK
3φ 3W	2ND LINE B	BLUE
	1ST PHASE	RED
	2ND PHASE S	WHITE
3φ 4W	3RD PHASE T	BLUE
	1ST PHASE	RED
	2ND PHASE S	WHITE
3φ 4W	3RD PHASE T	BLUE
	NEUTRAL PHASE N	BLACK
EARTHING LINE	G	GREEN

### COLOUR OF INSULATION WIRE

APPLICATION CIRCUIT	JEM 1122	REMARKS
DC MAIN	BLACK YELLOW	
AC MAIN	BLACK	
DC CONTROL	YELLOW	
AC CONTROL	YELLOW	
PT 2NDARY	YELLOW	
CT 2NDARY	YELLOW	
EARTH	GREEN	

### EARTHING

EARTHING BUS	COPPER 3mm × 25mm
DISTRIBUTION, TERMINAL MOTOR CONTROL PANEL	 MB-M6
REAR OPENED TYPE SWITCHBOARD	 MB-M6 Ue 3x25 SPC 3.2t



TERASAKI ELECTRIC CO., LTD.  
OSAKA JAPAN

JOB No.  
工号

LL53408

BYC No.  
図番

M01CG02

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## PAINTING COLOR

**PAINTING COLOR**

	SAMPLE	
○	FRAME OF METER & RELAY	<del>MUNSELL No. 2.5B01/1.5</del> - MUNSELL No. N1.5
○	HANDLE OF SWITCH	<del>MUNSELL No. 2.5B03/3.5</del> - MUNSELL No. N1.5
○	POLISH	SEMI POLISHED <del>=POLISHED=</del>
○	PAINTING METHOD	<del>=(IN DOOR) MELAMINE RESIN=</del> (OUT DOOR) ACRYL RESIN

[illegible]

**TERASAKI ELECTRIC CO., LTD.**  
OSAKA JAPAN

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工号

LL 53408

圖書

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100	100

3

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PAINTING SCHEDULE TABLE

ITEM		TO BE CARRIED OUT AT WORKS			
		(1) PREPARATION	PRIME & MIDDLE COAT	FINISH COAT	TOTAL THICKNESS
FRAME	HOT ROLLED STEEL SECTIONS ON IRON OR STEEL	DEGREASE, PICKLING AND PHOSPHATE COAT TREATMENT (SOLVENT CLEANING)	ACRYL RESIN PRIMER & SURFACER EACH 1 COAT	ACRYL RESIN 1 COAT	40 $\mu$
INTERNAL OF ENCLOSED STEEL PLATE	ZINC COATING SHEETS ELECTRO PLATING ON STEEL	DO	DO	DO	40 $\mu$
EXTERNAL OF ENCLOSED STEEL PLATE	DO	DO	DO	DO	40 $\mu$



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OSAKA JAPAN

Doc. No.  
1号

LL53408

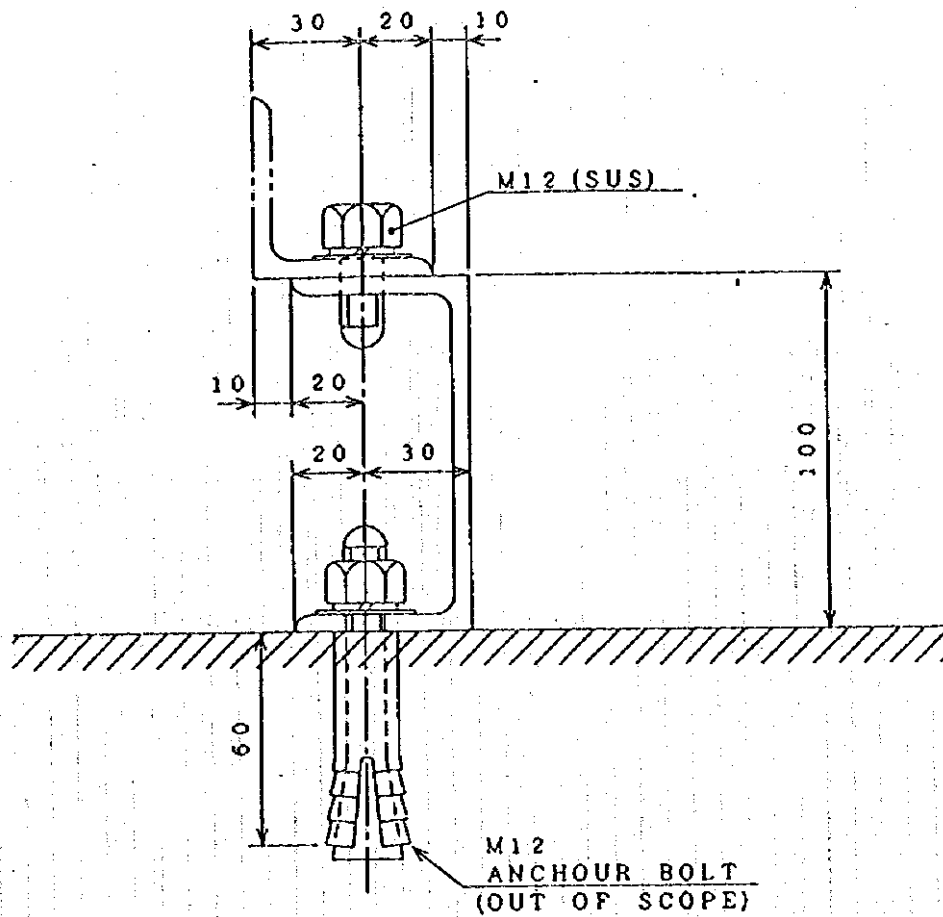
Doc. No.  
図表

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# FITTING HOLES DETAIL (OUTDOOR TYPE)



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OSAKA JAPAN

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図番

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1/2

# PARTS LIST

NO.	NAME	TYPE	DESCRIPTION	MAKER	REMARK
TR	TRANSFORMER	TSE-50M	415/220V 500VA	TERASAKI	
MCCB	MOULDED CIRCUIT BREAKER	XS30NS	30AF RC2.5KA at 460V FRONT CONNECTION TYPE	DO	
DO	DO	XS50NS	50AF RC10KA at 460V DO	DO	
DO	DO	XS100NS	100AF RC10KA at 460V DO	DO	
DO	DO	XE225NB	225AF RC15KA at 460V DO	DO	
CT	CURRENT TRASF	CW30-30L	60/5A 15VA	DO	
PT	POTENTIAL TRASF	PSE-50MP	415/110V 50VA	DO	
M	METER	ACF-6	65x60 2.5 CLASS	TOYO	
SW	CONTROL SWITCH	RC310F-1	CAM TYPE	FUJI	
MC	MAGNETIC SWITCH MAGNETIC CONTACTOR	SC-2N SC-5-1	CONT SOURCE 220V	DO	
PB	PUSH BUTTON SW	AH30-FB	30φ	DO	
3E	3E RELAY	SE-KP1N	FIXED TYPE SET. OPE. TIME 5 SEC	OMRON	
F	FUSE	FCF2	RC50KA at 500V	FUJI	
L	INDICATING LIGHT	AH30-2M	30φ	DO	
AUR	AUX RELAY	LY4	PLUG IN TYPE	OMRON	
TLR	TIMMING RELAY	H3BG-8	DO SET START TIME 10 SEC	DO	
SH	SPACE HEATER	SH-2950	220V 100W	OKUTANI	



TERASAKI ELECTRIC CO., LTD.  
OSAKA JAPAN

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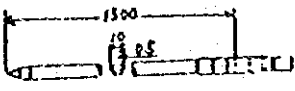
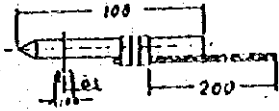
DWG No.  
図番

M01CG06

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# ACCESSORY LIST

	NAME	OUTLINE	TYPE	Q.TY	MAKER	WORKING
○	PULLER FOR FUSE			1	TERASAKI	
○	PAINT SY7/1			500g		
○	EARTH ROD WITH TERMINAL			1		φ10×1500L
○	EARTH			1		
○	EARTH WIRE			10m		5.5 <sup>φ</sup> ×10000L
◎ TERASAKI ELECTRIC CO., LTD. OSAKA JAPAN			JOL No. 工号 LL53408		JOL No. 図番 M01CG07	PAGE 7

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# SPARE PARTS LIST

[illegible]

# NAME PLATE

## 1 SPECIFICATION

### A) MATERIAL

ACRYL RESIN , (BACK ENGRAVED)

### B) LETTERING

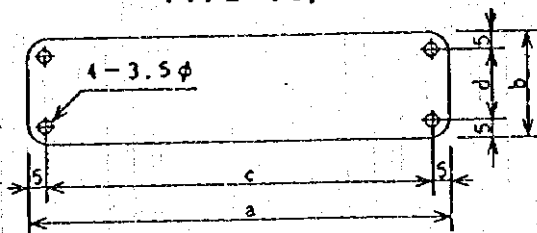
GOTHIC TYPE · BLACK LETTER & WHITE GROUND

### C) FITTING METHOD

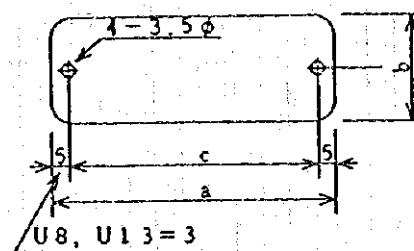
B	SCREW
T	PASTE UP

## 2 DIMENSION (MM)

TYPE U1, U2



TYPE U3, U14



U8, U13=3

TYPE	a	b	c	d	THICKNESS	NOTE
U1	315	63	305	53	3	
U2	200	40	190	30	3	
U3	100	31.5	90		2	
U4	100	20	90		2	
U5	63	25	53		2	
U6	63	16	53		2	
U7	50	12.5			2	
U8	40	12.5	34		2	
U9	100	40	90		2	
U10	100	25	90		2	
U11	80	31.5	70		2	
U12	80	20	70		2	
U13	40	25	34		2	
U14	63	12.5				



TERASAKI ELECTRIC CO., LTD.  
OSAKA JAPAN

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NAME PLATE

[illegible]

**TERASAKI ELECTRIC CO., LTD.**  
OSAKA JAPAN

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LL 53408

圖書

M01CN02

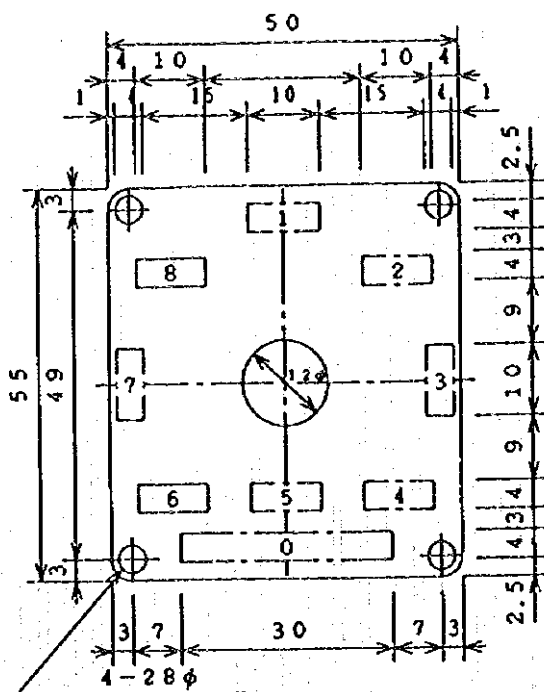
**FACE**

9

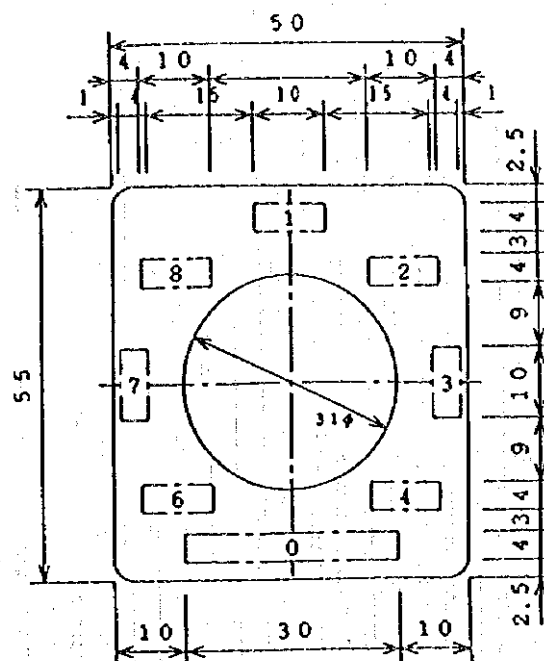


## CAM SWITCH

THICKNESS 1 mm



TYPE C1



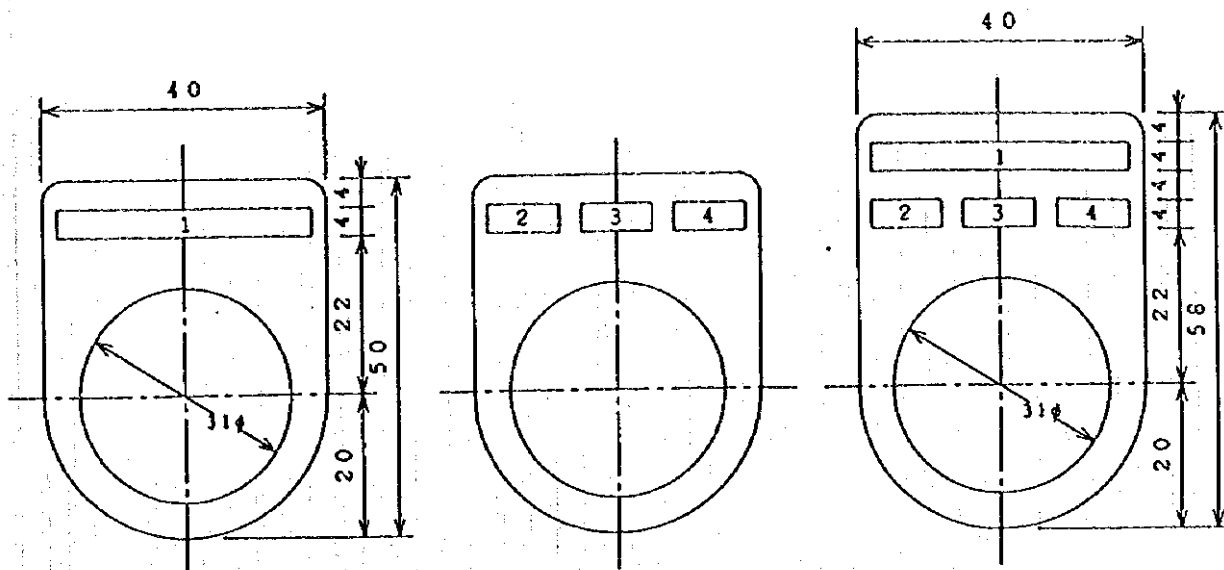
TYPE C2

[illegible]

# NAME PLATE

## SELECT SWITCH PUSH BUTTON

MATERIAL.....ACRYL RESIN (20)



TYPE A1

TYPE A2

TYPE A3

NO.	TYPE	QT.	NAME				REMARK
			1	2	3	4	
RL PB	A1	4	ON				
GL PB	↓	4	OFF				
OL	A1	2	FAULT				



TERASAKI ELECTRIC CO., LTD.  
OSAKA JAPAN

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M01CN04

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# SETTING RANGE LIST

## 1. 3E RELAY

### CURRENT SETTING RANGE

MOTOR PROTECTIVE RELAY		CURRENT CONVERTER		
RATED CURRENT (CURRENT SETTING RANGE) (A)	CURRENT SCALE MULTIPLYING FACTOR DECAL NO.	NUMBER OF CONDUCTOR RUNS THROUGH HOLES	SETTING TAP	TYPE
3	0.5	4	20	SET-3A

## 2. TIMMING RELAY

### TIME RANGE

RATED STAR TIME	STAR-DELTA TRANSFER TIME
10/10sec	0.1sec



**TERASAKI ELECTRIC CO., LTD.**  
OSAKA JAPAN

JOB NO.  
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M01C-L02

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12A

M53408G7A

# GRAPHICAL SYMBOLS FOR ELECTRICAL ENGINEERING DIAGRAMS

## Basic Symbols

Symbol	Description
	Gen. general symbol
	Conductor (general)
	Junction of conductors
	Crossing conductors (connected)
	Crossing conductors (not connected)
	Junction wires (reference no. of the conductor shall be written in Q)
	Conns. from other panel
	Conns. from outside of the board
	Terminal
	Earth
	Resistance or resistor
	Variable resistance or capacitor
	Variable resistor
	Capacitor
	Rectifier (general)
	Diode
	Enclosed type fuse
	Fuses in series
	Socket (female)
	Plug (male)
	Plug and socket (male and female)
	Generator
	Motor
	Ammeter
	Voltmeter
	Wattmeter
	Vermeter
	Frequency meter
	Power factor meter
	Watt-hour meter
	Synchroscope
	Bell

## Auxiliary switch

Symbol	Description
	Contact by relay
	Normally operated switch
	Push-button switch (non-locking)
	Pull-button switch (non-locking)
	Turn-button switch (locking)
	Contact delayed when operating
	Contact delayed when releasing
	Contact of a limit switch
	Contact of thermal relay

## Power switch

Symbol	Description
	Contact
	Circuit breaker (fixed type)
	Circuit breaker (draw out type)
	Disconnector
	Load switch

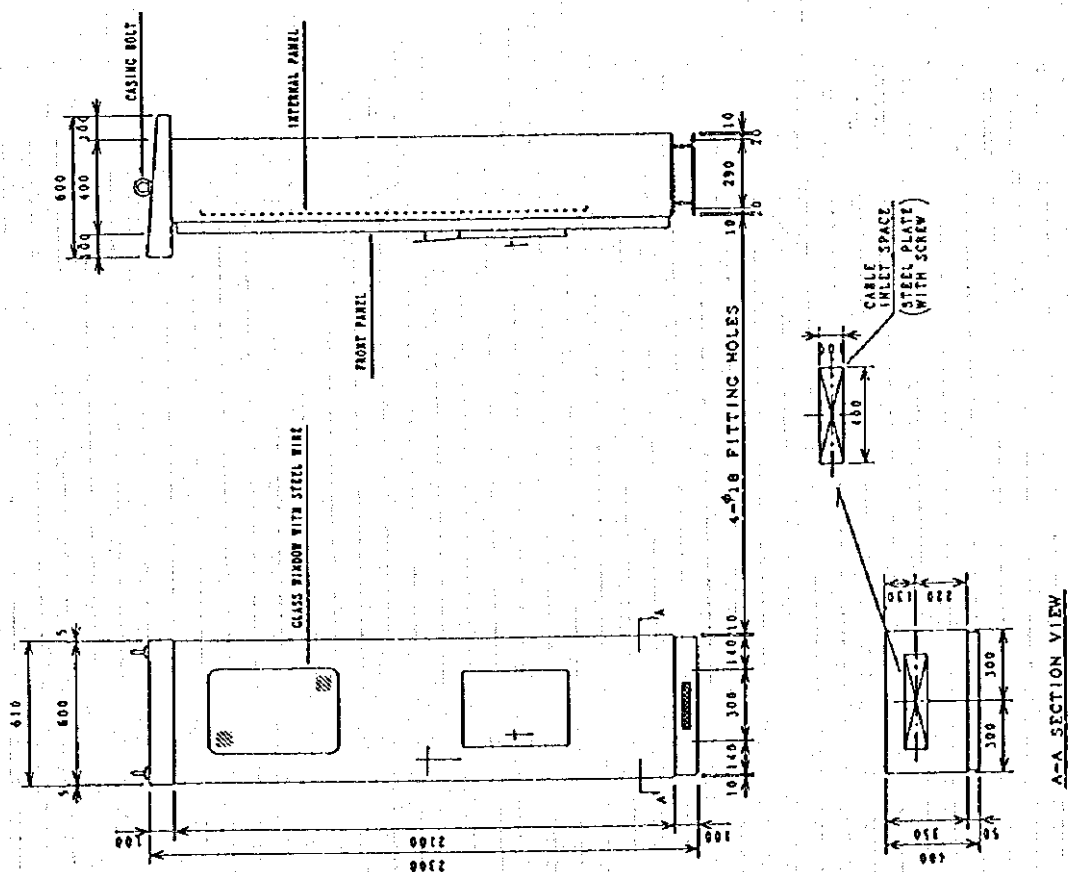
## Electrical measuring relay

Symbol	Description
	Measuring relay
	Voltage
	Voltage by failure to earth
	Current
	Differential current
	Earth fault current
	Active power
	Reactive power
	Frequency
	Temperature
	Pressure
	Flow
	Operating when the characteristic quantity is higher than the setting value
	Operating when the characteristic quantity is lower than the setting value
	Operating when value of the characteristic quantity becomes abnormally large
	Delayed overcurrent relay
	Overcurrent relay with a setting range from 5A to 10A
	Undercurrent relay
	Setting range from 50V to 500V
	Setting range 110V

## Contacts with two of three position

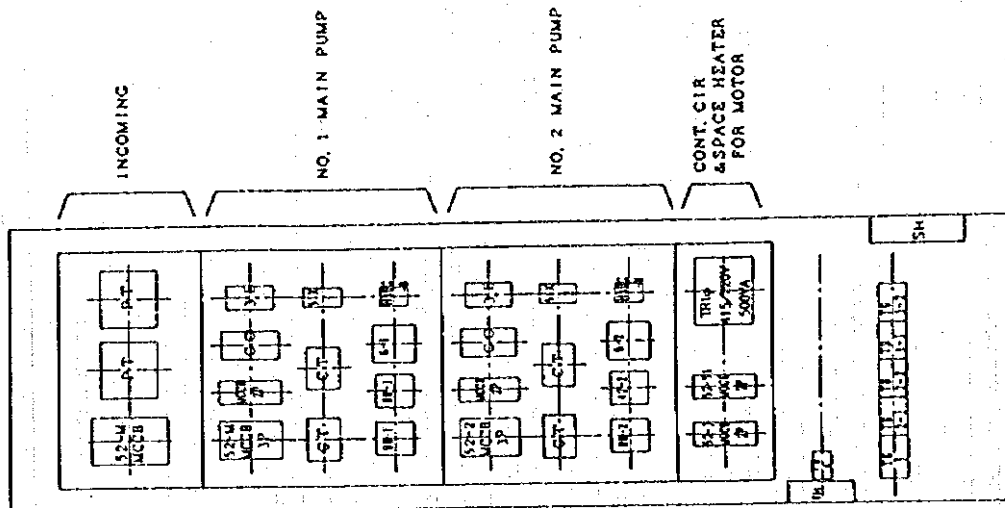
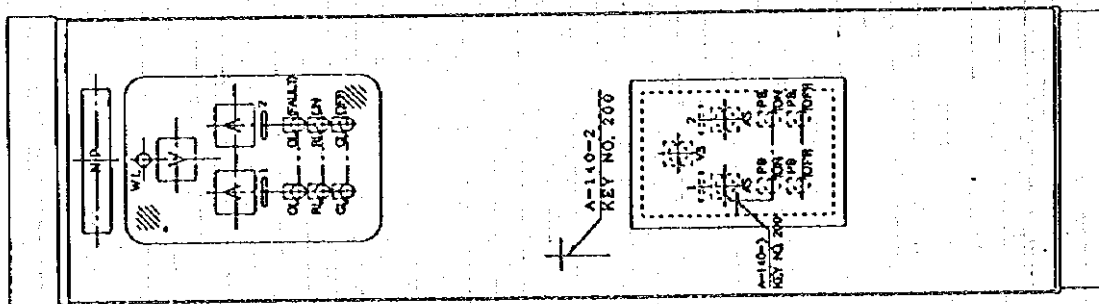
Symbol	Description
	Contact (general) or manual contact
	Change over contact (break before make)
	Two way contact with center OFF position
	Contact with spring return
	Contact without spring return (latching)

DATE	REVISION	FILE	DATE
CHECKED BY 		DRAWN BY M. M. M.	TITLE CONTROL PANEL SYMBOL LIST
DESIGNED BY J. J. J.		SCALE 1:1	SHEET NO. 1
TRANSMAT ELECTRIC CO., LTD. 1000 JAPAN		JAN. 1968	



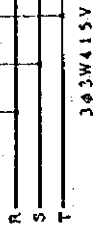
THICKNESS OF DOOR PLATE	12.31
" SIDE PLATE	12.31
" TOP PLATE	12.31
" BOTTOM PLATE	12.31
" OTHER PLATE	12.31

[illegible]



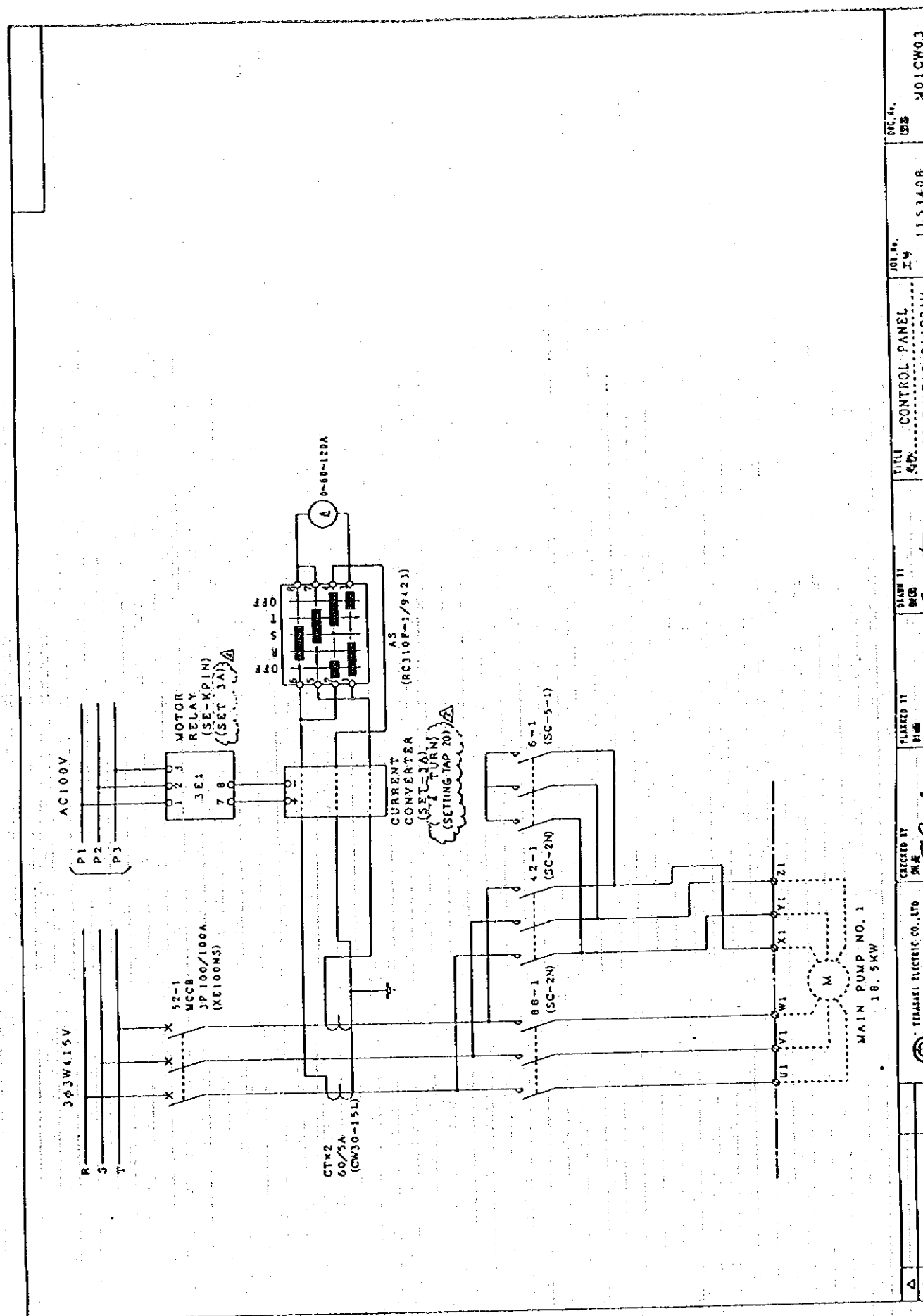
Δ	REVISION	DATE	BY	DATE	BY	PLANNED BY	DATE	BY	TITLE	JOB NO.	OPC. NO.
Δ						<i>W. H. Miller</i>			CONTROL PANEL OUTLINE VIEW	19	LL53408
Δ						<i>W. H. Miller</i>					M01CF02

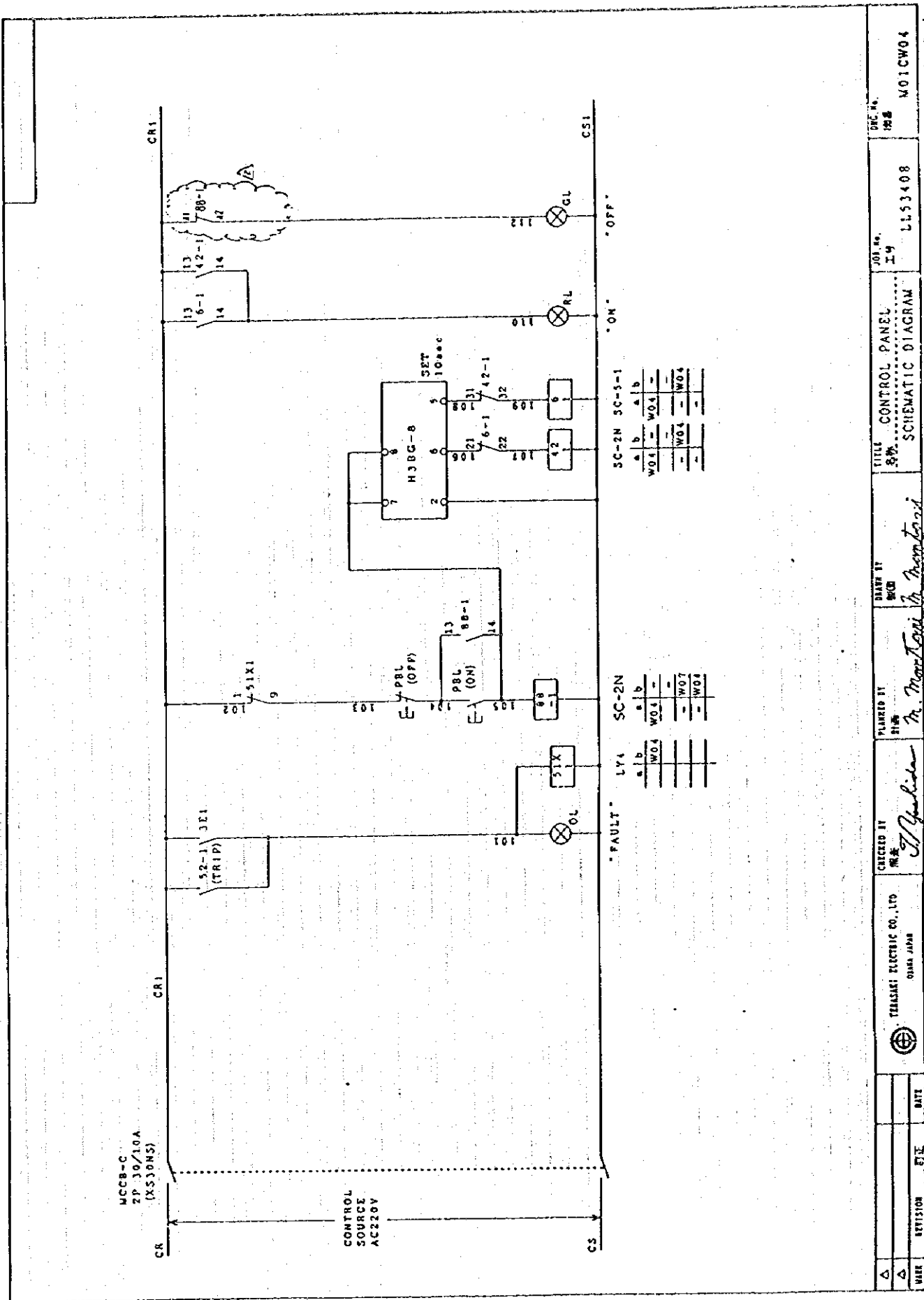


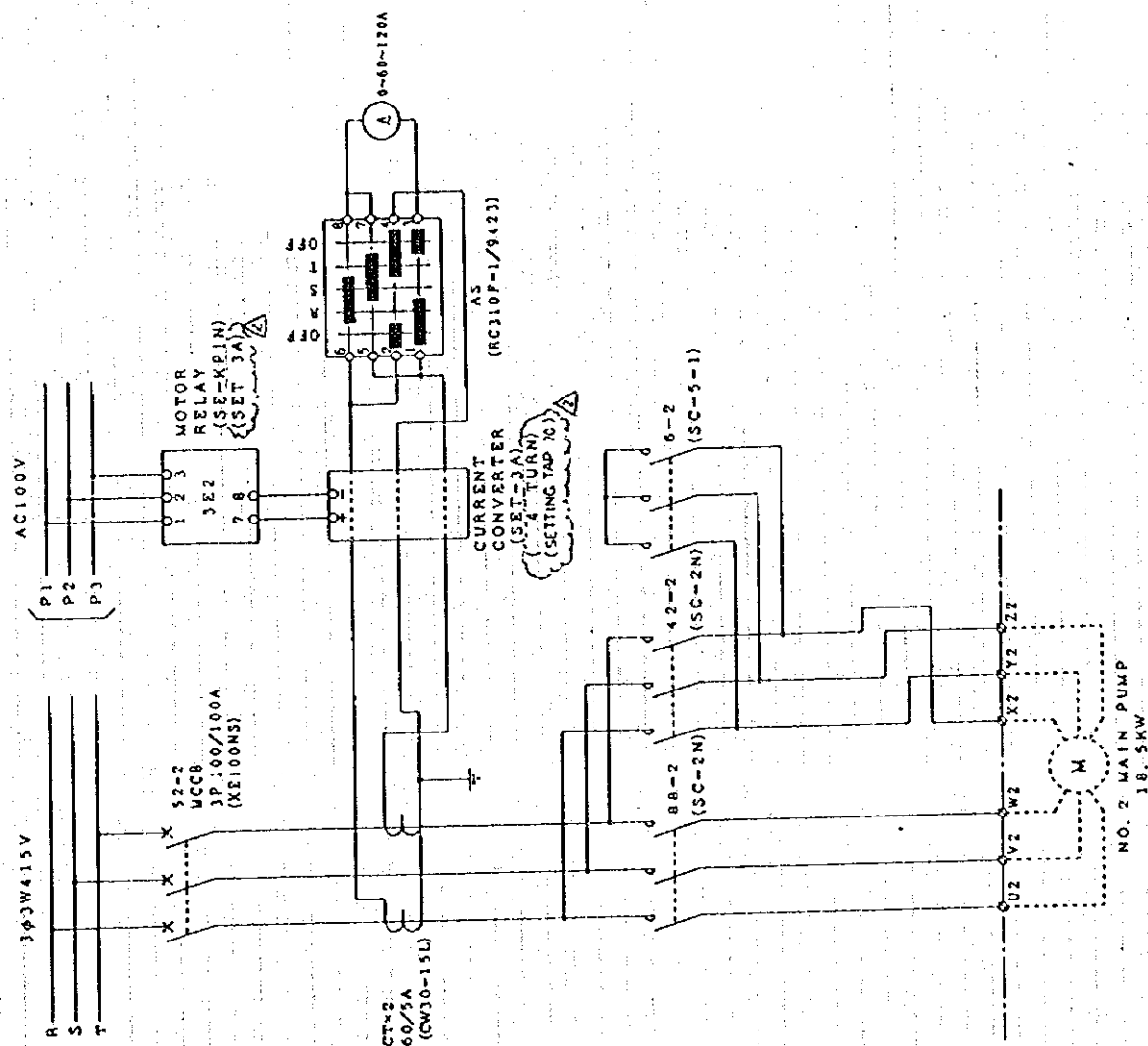


DATE		CHECKED BY J. J. GILLEN	PLANNED BY J. J. GILLEN	TITLE CONTROL PANEL SCHEMATIC DIAGRAM	JOB No. W-9	DWG. No. 0008
NAME	DEVISION	DATE				
	ENGINE					
TREASANT ELECTRIC CO., LTD.						
SARAJEVO						
W01CW02						



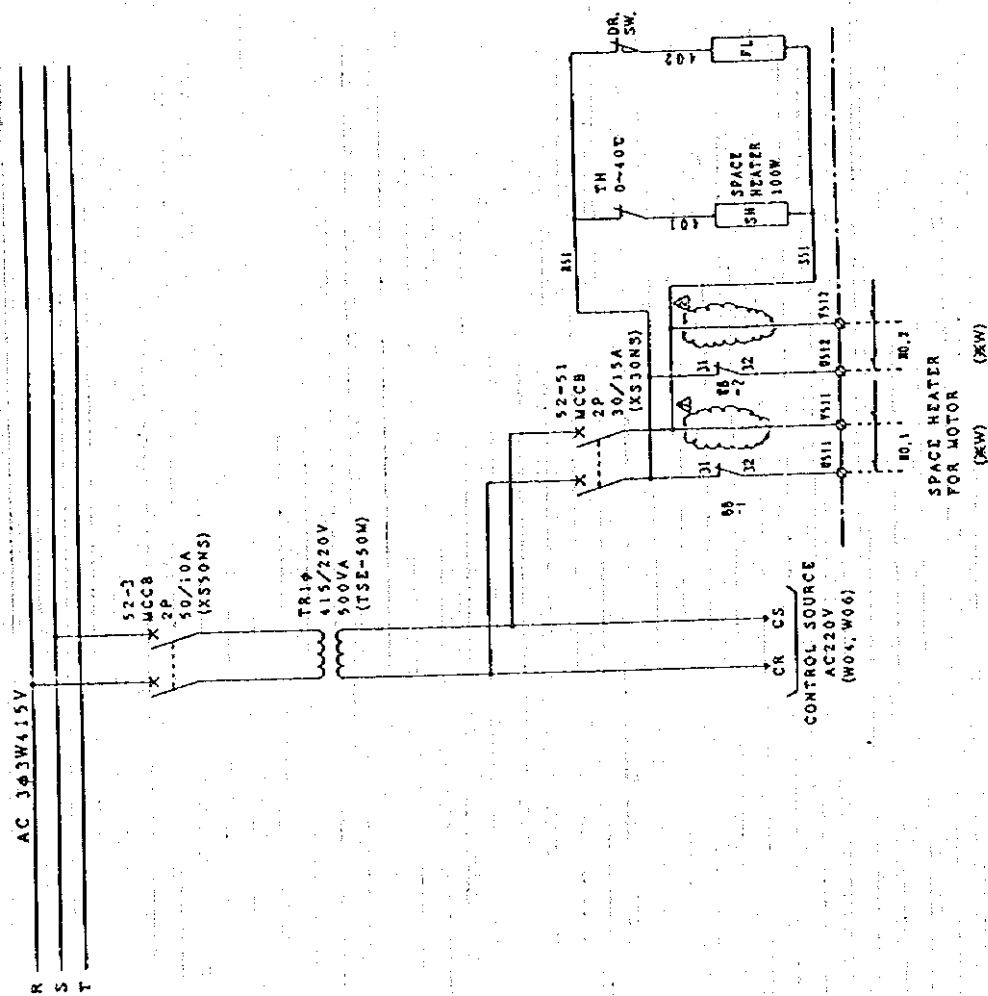






△	 TOSHIBA ELECTRIC CO., LTD. OMAHA, JAPAN	DESIGNED BY 熊本	PLANNED BY 2144	ORDER BY 9/10	TITLE 39	JOB No. 19	DATE 1954. 10. 10
△					CONTROL PANEL	LLS3408	
△					SCHEMATIC DIAGRAM		MOICW05



[illegible]

# BLOCK TERMINAL NAME PLATE

TU150- 3P

PANEL NO.		CABLE		Upper		Lower	
R		S		T		T	
343W 415V 50Hz MAIN CIRCUIT BREAKER							

TU150- P

PANEL NO.		CABLE		Upper		Lower	

TU150- P

PANEL NO.		CABLE		Upper		Lower	

TU150- P

PANEL NO.		CABLE		Upper		Lower	

TU150- P

PANEL NO.		CABLE		Upper		Lower	



TERASAKI ELECTRIC CO., LTD.

JOB. NO.  
1 2

LL53408

ORC. NO.  
1 2

M01CT01

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# BLOCK TERMINAL NAME PLATE

TU60 - 3P	
18.5KW NO. 1 MAIN PUMP	U1 V1 W1
PANEL NO.	
CABLE	
Upper Lower	

TU60 - 3P	
18.5KW NO. 1 MAIN PUMP	X1 Y1 Z1
PANEL NO.	
CABLE	
Upper Lower	

TU60 - 3P	
18.5KW NO. 2 MAIN PUMP	U2 V2 W2
PANEL NO.	
CABLE	
Upper Lower	

TU60 - 3P	
18.5KW NO. 2 MAIN PUMP	X2 Y2 Z2
PANEL NO.	
CABLE	
Upper Lower	

TU60 - P	
PANEL NO.	
CABLE	
Upper Lower	

Ⓢ TERASAKI ELECTRIC CO., LTD..

JOB. NO.

LL53408

ORC. NO.

M01CT02

123

# BLOCK TERMINAL NAME PLATE

TU20 - 4P

IB4	US11	V511	US12	V512
PANEL NO.	NO. 1			
CABLE	SPACE HEATER FOR MOTOR			
Upper	US11	V511	US12	V512
Lower				

TU20 - P

PANEL NO.	
CABLE	
Upper	
Lower	

TU20 - P

PANEL NO.	
CABLE	
Upper	
Lower	

TU20 - P

PANEL NO.	
CABLE	
Upper	
Lower	

TU20 - P

PANEL NO.	
CABLE	
Upper	
Lower	



TERASAKI ELECTRIC CO., LTD.

JOB. NO.  
I 8

LL53408

DWG. NO.  
■ ■

M01CT03

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# GRAPHICAL SYMBOLS FOR ELECTRICAL ENGINEERING DIAGRAMS

## Basic Symbols

Symbol	Description
	Conductor (general)
	Junction of conductors
	Closing conductors (connected)
	Closing of conductor (not connected)
	Joining wires (reference up of the conductor shall be written in O)
	Cones from other panel
	Cones from outside of the board
	Terminal
	Earth
	Resistance or resistor
	Variable resistance or variable resistor
	Condenser
	Rectifier (general)
	Diode
	Enclosed type fuse
	Fluorescent lamp
	Socket (lamps)
	Plug (lamp)
	Plug and socket (male and female)
	Generator
	Motor
	Ammeter
	Voltmeter
	Wattmeter
	Varmeter
	Frequency meter
	Power factor meter
	Watt-hour meter
	Synchroscope
	Bell

## Auxiliary switch

Symbol	Description
	Contact by relay
	Usually operated switch
	Push-button switch (non-locking)
	Pull-button switch (non-locking)
	Toggle-button switch (locking)
	Contact delayed when operating
	Contact delayed when releasing
	Contact of a limit switch
	Contact of thermal relay

## Power switch

Symbol	Description
	Contact
	Circuit breaker (fixed type)
	Circuit breaker (draw out type)
	Disconnector
	Load switch

## Electrical measuring relay

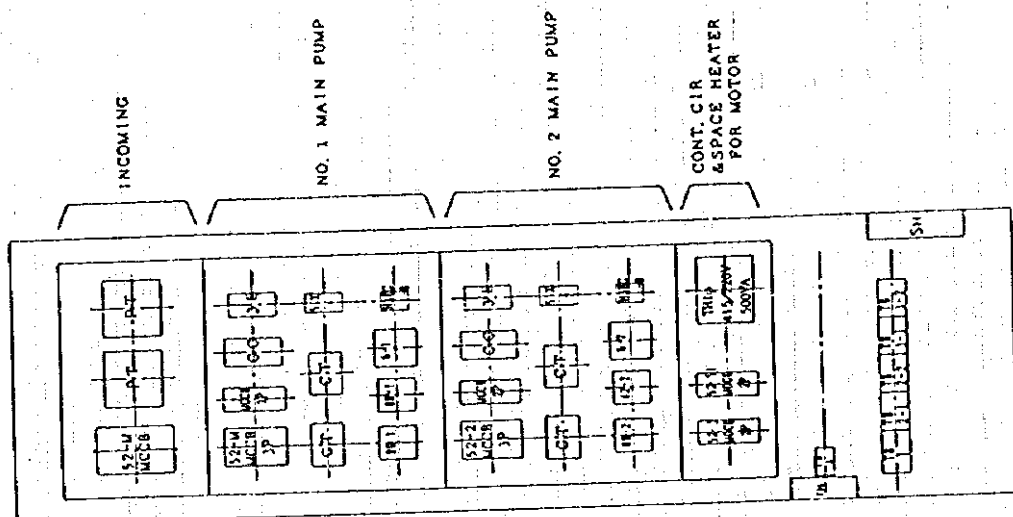
Symbol	Description
	Measuring relay
	Voltage
	Voltage by failure to earth
	Current
	Differential current
	Earth fault current
	Active power
	Reactive power
	Frequency
	Temperature
	Pressure
	Flow
	Operating when the characteristic quantity is higher than the setting value
	Operating when the characteristic quantity is lower than the setting value
	Operating when value of the characteristic quantity becomes virtually zero
	Delayed overcurrent relay
	Overcurrent relay with a setting range from 5A to 10A
	Undercurrent relay setting range from 50V to 80V
	Relaying action time


## Contact with two of three position

Symbol	Description
	Contact (general) or normal contact
	Change over contact (break before make)
	Two way contact with center OFF position
	Contact with spring return
	Contact without spring return (latching post)

DATE	REVISION	DATE	REVISION
11/15/54	1	11/15/54	1
DESIGNED BY		CHECKED BY	
J. H. H. H.		J. H. H. H.	
DRAWN BY		PLANNED BY	
J. H. H. H.		J. H. H. H.	
SYMBOLS		CONTROL PANEL	
SYMBOLS		SYMBOLS	

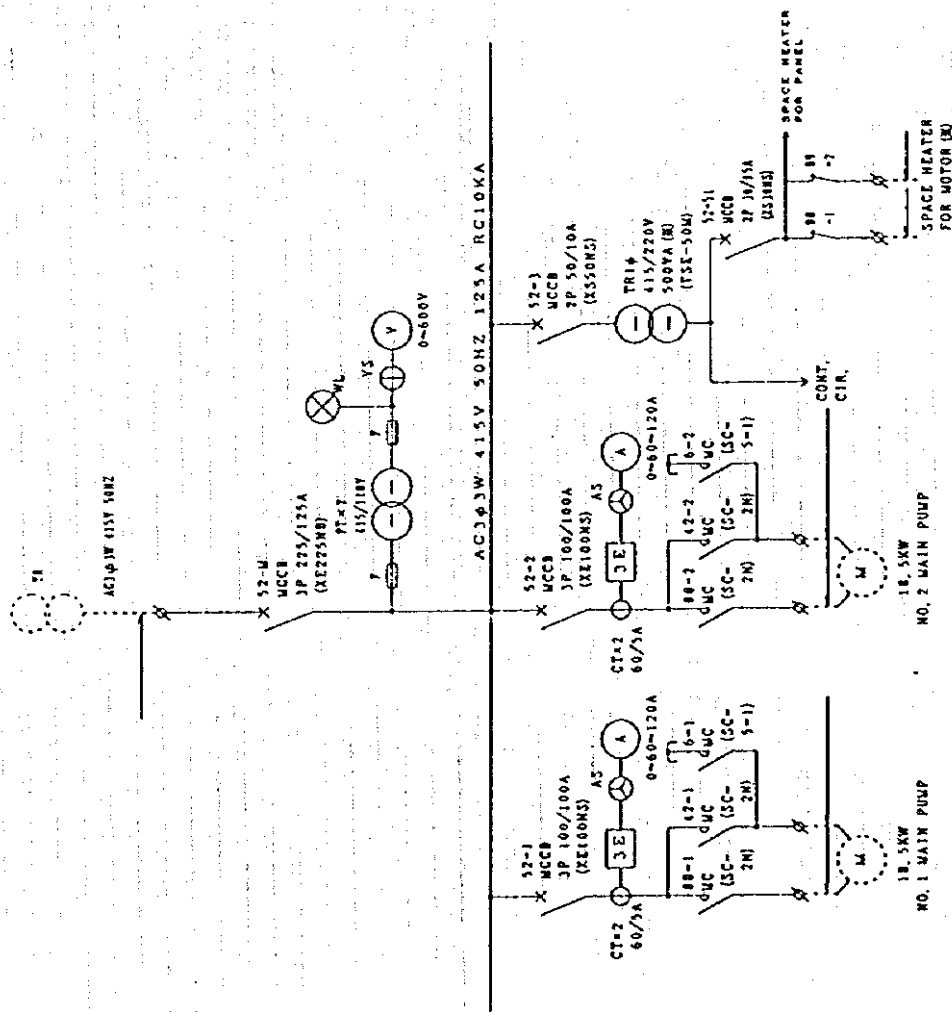




DATE	REVISION	DATE	REVISION	DATE	REVISION
△	△	△	△	△	△
 TOSHIBA ELECTRIC CO., LTD. 03042 JAPAN			DESIGNED BY <i>J. Yoshida</i>	PLANNED BY 3145 <i>M. Morita</i>	DRAWN BY 3145 <i>M. Morita</i>
			TITLE 874 OUTLINE VIEW		
			JCS No. 424 MA01CP02	JCS No. 424 LL53408	

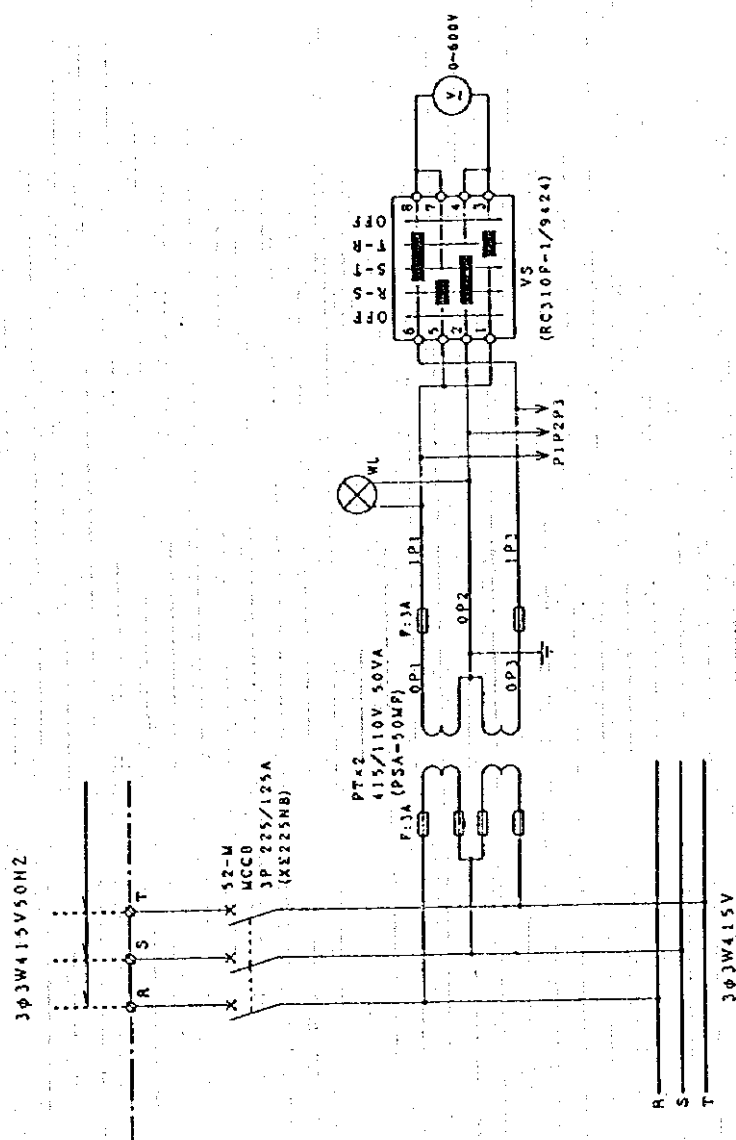
# ABBREVIATIONS

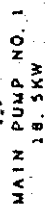
PT	Potential transformer
TR	Transformer
CT	Current transformer
MCCB	Molded case circuit breaker
MC	Magnetic contactor
F	Fuse
VS	Voltmeter change-over switch
V	Voltmeter
A	Ammeter
AS	Ammeter change-over switch
FL	3 elements protective relay
CONT. CIR.	Control circuit



RESERVATION IS RESERVED

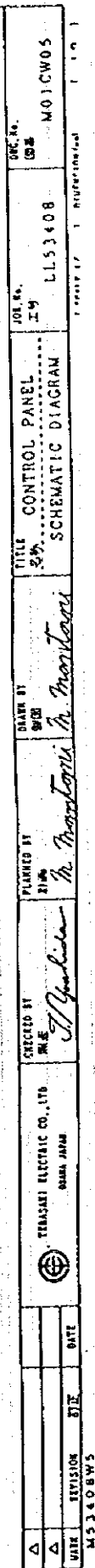
DATE	REVISION	DATE	DESIGNED BY	PLANNED BY	DRAWN BY	TITLE	JOB NO.	DATE	NO.
						CONTROL PANEL	50%	LL53408	NO1CW01
						SINGLE LINE DIAGRAM			

[illegible]

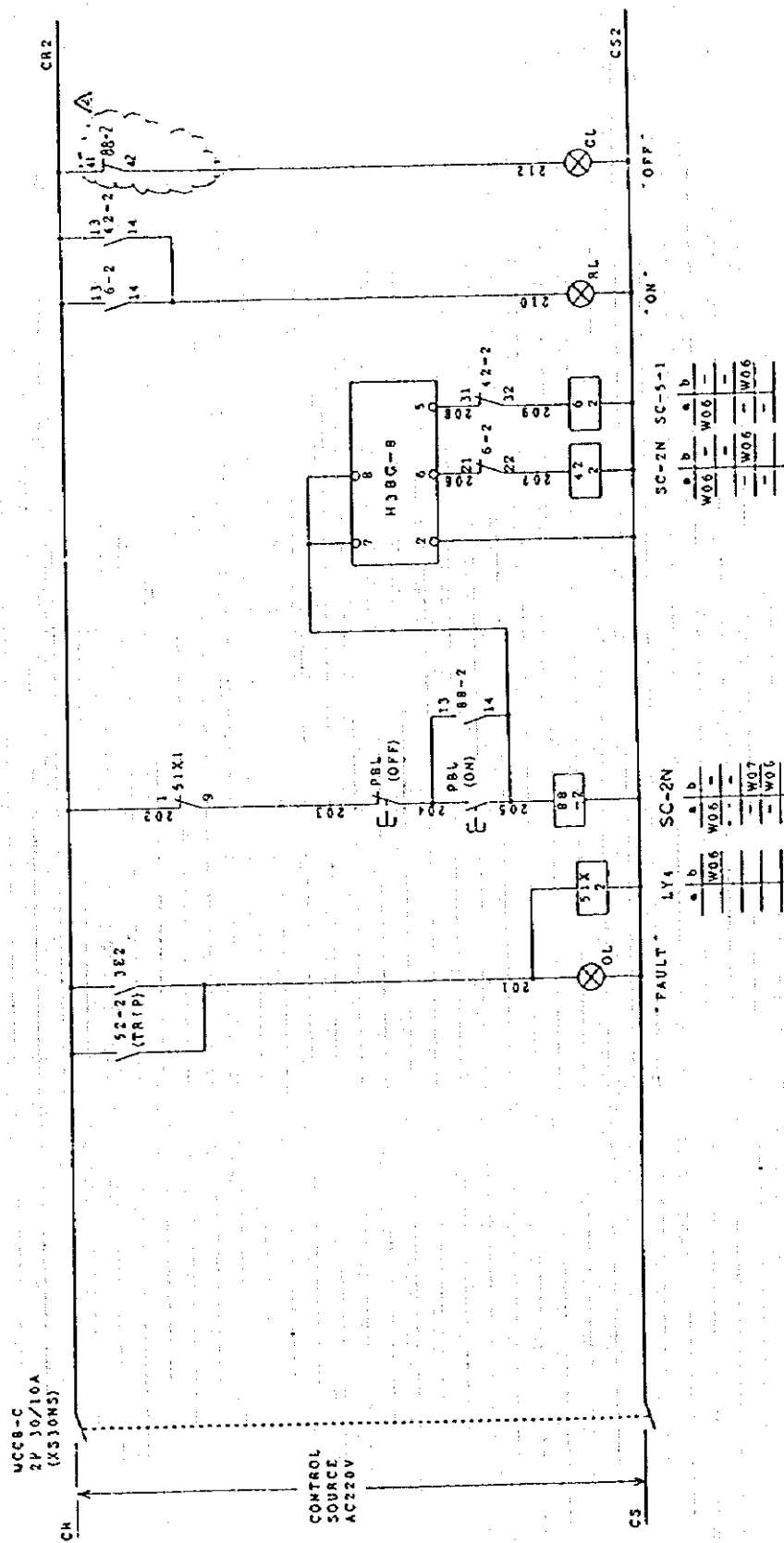




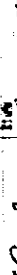

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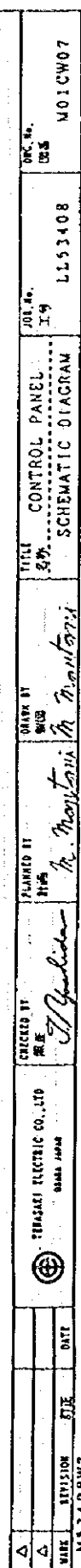








DATE	REVISION	SIZE	DATE
△			
△			
 TOSHIBA ELECTRIC CO., LTD OHIO JAPAN			
CHECKED BY		PLANNED BY	DRAWN BY
			
TITLE		JOL. No.	
SCHEMATIC DIAGRAM		54	
CONTROL PANEL		JLS3408	
DTC No.		M01CW06	



# BLOCK TERMINAL NAME PLATE

TU150- 3P

TER	R	S	T
3W 415V 50Hz MAIN CIRCUIT BREAKER			
TER	R	S	T

TU150- P

PANEL NO.	
CABLE	
Upper	Lower

TU150- P

PANEL NO.	
CABLE	
Upper	Lower

TU150- P

PANEL NO.	
CABLE	
Upper	Lower

TU150- P

PANEL NO.	
CABLE	
Upper	Lower



TERASAKI ELECTRIC CO., LTD.

JOB. NO.  
1 4

LL53408

DWG. NO.  
0 0

M01CT01

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# BLOCK TERMINAL NAME PLATE

TU60 - 3P

IB2-1	U1	V1	W1
PANEL NO.	18.5KW NO. 1 MAIN PUMP		
CABLE			
Upper Lower	U1	V1	W1

TU60 - 3P

IB2-2	X1	Y1	Z1
PANEL NO.	18.5KW NO. 1 MAIN PUMP		
CABLE			
Upper Lower	X1	Y1	Z1

TU60 - 3P

IB3-1	U2	V2	W2
PANEL NO.	18.5KW NO. 2 MAIN PUMP		
CABLE			
Upper Lower	U2	V2	W2

TU60 - 3P

IB3-2	X2	Y2	Z2
PANEL NO.	18.5KW NO. 2 MAIN PUMP		
CABLE			
Upper Lower	X2	Y2	Z2

TU60 - P

PANEL NO.	
CABLE	
Upper Lower	



TERASAKI ELECTRIC CO., LTD..

JOS. NO.  
1 4

LL53408

OSG. NO.  
8 8

M01CT02

(23)

BLOCK TERMINAL NAME PLATE

TU20 - 4P											
PANEL NO.		U511		V511		U512		V512			
CABLE		NO. 1		NO. 2							
		SPACE HEATER FOR MOTOR									
Upper Lower		U511		V511		U512		V512			

TU20 - P											
PANEL NO.											
CABLE											
Upper Lower											

TU20 - P											
PANEL NO.											
CABLE											
Upper Lower											

TU20 - P											
PANEL NO.											
CABLE											
Upper Lower											

TU20 - P											
PANEL NO.											
CABLE											
Upper Lower											

TERASAKI ELECTRIC CO., LTD.

JOB. NO.  
1 2

LL53408

Dwg. No.  
B 1

M01CT03

JOE. 100  
I 2

DWC. NO.  
B 6

(24)

Desing Dimension and O/M

## STUDY OF DESIGN DIMENSIONS AND O/M AT RIVER PUMPING STATION IN THE RNR-RC

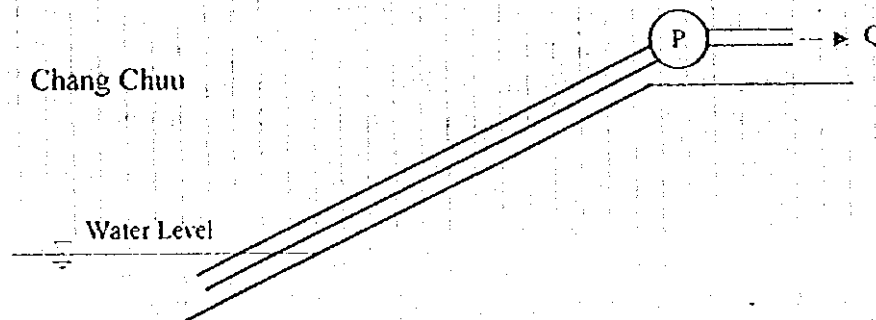
### 1. Design Condition

The RNR-RC is expecting to establish the irrigation system for 12.2 ha of there experimental farm land. According to irrigation plan of RNR-RC, the canal system and required canal capacity is proposed as shown in Fig. 1-1. The water from the Chang Chhu will be irrigated using double pumping system as shown in Fig. 1-2. The both storage tank (upper and lower) were already constructed and the 8 inches pipe connecting storage tank was also installed. The design condition is summarized as below;

- Water source	Chang Chhu	
	Design low water level	: TP. 1,195 m
	Design high water level	: TP. 1,200 m
	Suction water level	: TP. 1,195 m ~ 1,198 m
- Storage tank	Bottom elevation	: TP. 1,216 m
	Effective water depth	: 1.8 m
	Design delivery water level	: TP. 1,218 m
- Actual head	20 m ~ 23 m	
- Total Head	31 m	

### 2. Type of Pumping Station

At first, RNR-RC was expecting the type of pumping station as shown below;



In this plan, as the altitude of the site is comparatively high and the actual suction head is varying 3 ~ 8 m, it is necessary to consider the cavitation. Following condition must be satisfied for against the cavitation.

$$NPSH_{av} > NPSH_{rq} + 0.5$$

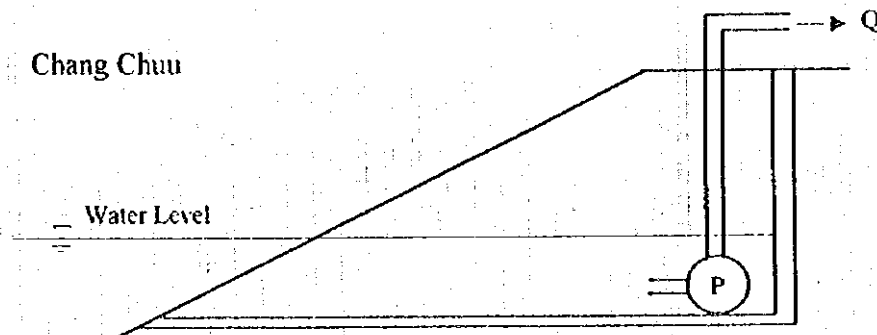
Where  $NPSH_{av}$  : Available net positive suction head (m)  
 $NPSH_{rq}$  : Required net positive suction head (m)

Based on the proposed pump characteristics, NPSH<sub>rq</sub> was estimated as 3 ~ 4 m. On the other hand, NPSH<sub>av</sub> was calculated using the formula as shown below;

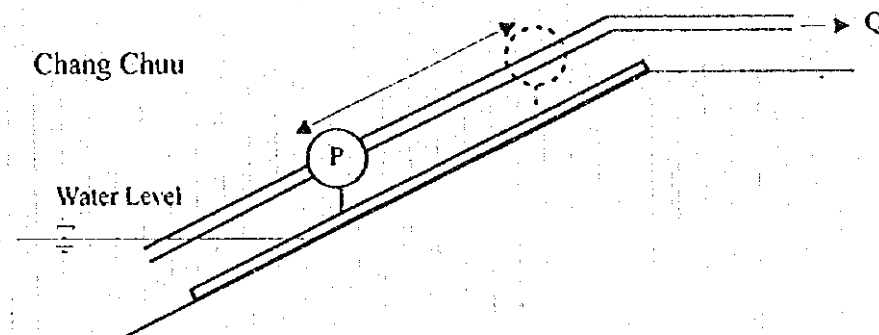
$$\text{NPSH}_{\text{av}} = P_a - H_{\text{sa}} - H_{\text{sl}} - H_{\text{sp}}$$

Where  $P_a$  : Atmospheric pressure ( 9.4 m at 1,200 m altitude)  
 $H_{\text{sa}}$  : Static suction Head (4.0 ~ 6.0 m)  
 $H_{\text{sl}}$  : Suction loss (0.5 m)  
 $H_{\text{sp}}$  : Saturated vapor pressure (0.3 m at 1,200 m altitude)

As NPSH<sub>av</sub> was expected as 2.6 ~ 4.6 m, the normal operation cannot be expected in the lowest water level season. For the against from the cavitation, applying the submerged pump was considered as shown below;



It is possible to against the cavitation applying this pumping station type. However, as approximately more than 100,000 m<sup>3</sup>/year of sediment load was expected at the site from the result of the hydrological analysis, it can be said this type is not feasible to apply considering operation and maintenance. Hence, the slide type of pumping station was considered as shown below;



In this type, there are no problems for the cavitation and sedimentation. Therefore, this type was applied for one of the experimental facilities in the Study.



### 3. Design of Pump

The capacity of pump was expected to be 81.27 l/s for 8 hr/day, based on the total water requirement at RNR-RC. However, from the result of detailed study, it was suggest to reduce the pump capacity considering cost performance, condition of existing facilities and seasonal operation pattern. Finally, 62 l/s for 10.5 hr/day which is equivalent to 81.27 l/s for 8 hr/day was selected for pump capacity. Considering the seasonal operation pattern, 2 units of pumping equipment were applied. The dimensions of pump are summarizes as below;

- Number of pump : 2 set
- Type : Single suction volute pump
- Capacity : 1.88 m<sup>3</sup>/min/unit
- Total head : 34 m
- Mortar Type : Totally enclosed square cage
- Output : 18.5 KW
- No. of poles : 4 P
- Voltage : 215 V

### 4. Proposed Operation Plan

The lower pump station was construted as one of experimental facilities of the Study and pump capacity at the lower was already fixed. The upper pump station is not yet constructed and RNR-RC is expecting to apply the pump which was already purchased.

#### 1) Case study of pumping operation

Considering the conditions mentioned above, the pumping operation might be difficult. Because, in spite of the water requirement from the upper storage and proposed pump capacity of upper pump are larger than those of the lower, the storage capacity of the upper is smaller then that of the lower. Therefore, following case study was carried out to fined out the optimum pumping operation.

##### a) Case 0

Pumping operation was proposed as below;

- Lower pump: running entire time
- Upper pump: must be switched on, when water depth of the lower storage ( $H_L$ ) become more than 1.6 m against the over flow at the lower storage.  
must be switched off, when  $H_L$  become less than 0.6 m against surging for the upper pump

The outlet discharge from storage was calculated using following formula;

$$Q_0 = C (2GH)^{1/2} A$$

where  $Q_0$  : Outlet discharge ( $m^3/s$ )

$C$  : Orifice coefficient (0.6)

$G$  : Gravity accretion ( $m/s^2$ )

$H$  : Water depth in storage

$A$  : Area of outlet section ( $m^2$ )

Diameter 0.1 m of pipe was installed for outlet thus  $A$  is  $0.00785 m^2$

The result is shown in Fig. 4.1 and the upper pump is switch on 38 minutes after starting the pumping operation and running for 22 minutes then switched off when  $H_L$  become less than 0.6 m. After that waiting 24 minutes for rising up the  $H_L$  the upper pump is switch on again. It is necessary to operate the upper pump with 46 minutes interval (22 min. running, 24 minutes waiting). However, in this case, the upper storage is filling up for 14 minutes and maximum 62 l/s of over flow water is expected. This means it is necessary to construct some extra drainage canal, or, to design the irrigation canal with larger capacity than exactly required.

#### b) case 1

For against the over flow from upper storage, the condition of switching off for the upper pump was changed below.

Lower pump: running entire time

Upper pump: must be switched on as same as case 0

must be switched off, when water depth of the upper storage ( $H_L$ ) become more than 1.6 m against the over flow at the upper storage.

The result is shown in Fig 4.2. As the first interval time of the upper pump is same as case 0, the second interval time is reduced to only 8 minutes and after 102 minutes from the starting pumping operation, the interval time of the upper pump became only two secant (hanching phenomenon) and it is impossible to operate the any kind pump with two secant interval time. If more waiting time of upper pump was given, this hanching phenomenon can be taken over. However, around 40 l/s of excess water might be over flowed from lower storage in this case.

#### C) Case 2

For against this hanching phenomenon and over flow, it is necessary to switched of the lower pump adequately and following pumping operation was proposed.

Lower pump: must be switch on ,when water depth of the both storage become to less than 0.1 m

must be switched off, when  $H_U$  become to more than 1.6 m

Upper pump: must be switched on as same as case 1  
must be switched off as same as case 1

The result is shown in Fig. 4.3. The interval time of both pump was expected around 120 minutes (60 minutes running, 60 minutes waiting for the lower pump, 24 minutes running, 96 minutes waiting for the upper pump) and both pump can be operate without over flow. However, considering the water requirement from the upper storage, it is necessary to operate more than 30 hr par day for supplying the enough irrigation water.

Those result show that it is impossible to apply this pump up system for supplying the adequate irrigation water without any problem and it is necessary to modify some conditions. Hence following 3 alternatives was proposed.

- reduce the pump capacity of the upper pump for against the over flow from the upper storage (Case 3)
- modify the upper storage height to obtain the more outlet capacity (Case 4)
- install the another outlet on the upper storage to obtain the more outlet capacity (Case 5)

#### C) Case 3

The pump with 31 l/s of capacity was suggested for the upper pump and pumping operation was proposed as below;

Lower pump: as same as Case 0  
Upper pump: as same as Case 0

The result is shown in Fig. 4.4 and both pump can be operated with running for entire time and entire operation time was expected 16 hours. However, it is necessary to purchase new pump with adequate capacity.

#### D) Case 4

To modify the upper storage height as 1m higher than that of present condition and pumping operation was proposed below;

Lower pump: must be switch on , as same as Case 3  
must be switched off, when  $H_U$  become to more than 2.6 m  
Upper pump: must be switched on as same as case 1  
must be switched off when  $H_U$  become to more than 2.6 m

The result is shown in Fig. 4.5. The interval time of both pump was expected around 130 minutes (76 minutes running, 64 minutes waiting for the lower pump, 28 minutes running, 102 minutes waiting for the upper pump) and around 18 hr of entire operation time was expected. However, it is necessary to make additional construction works for the upper storage.

#### E) Case 5

Installation of another one more outlet was suggested and the pumping operation was proposed below;

Lower pump: as same as Case 0

Upper pump: as same as Case 0

The result is shown in Fig. 4.6. In this case, the pumping operation is expected almost same as case 0 and the interval time of the upper pump was expected around 46 minutes (24 minutes running, 22 minutes waiting for the upper pump) and around 11 hr of entire operation time was expected. However, it is necessary to make additional construction works for the upper storage.

Considering the cost estimation of those modification, the first priority must be given to the Case 5. Those result are summarized as shown in Table 4.1.

#### 2) Tentative pumping operation

As the construction of the lower pump station was finished by end of March, RNR-RC has been requesting the budget to establishment new irrigation system including the construction of the upper pump station. And it is expected to establish the new irrigation system by end of this year. Considering the existing canal system for lower part of their experimental farm from the lower storage, RNR-RC can use the lower pump. Therefore, following tentative pumping operation was suggested by the completion of the establishment of entire new irrigation system.

Lower pump: using the one of two pump  
must be switched on, when  $H_L$  became less than 1.0 m  
must be switched off, when  $H_L$  become more than 1.6 m

Using this condition, the pumping operation was estimated as shown in Fig. 4.7. The interval time is expected as 110 minutes (running time 90 minutes, waiting time 40 minutes) and 7 hr of entire operation time is expected.

Table 4.1 Summary of Case Study of Pumping Operation at RNR-RC

Case		0	1	2	3	4	5	
Condition		Present condition	Present condition	Lower pump is controlled with water depth at upper storage	Reduce the pump capacity of upper pump	Same operation as case 3 with changing the height of upper storage	Same operation as case 0 with installation the new outlet pipe	
Pump on/off								
P Lower	on	-	-	HL, HU=0.1	HL, HU=0.1	HL, HU=0.1	-	
	off	-	-	HU=1.6	HU=1.6	HU=2.6	-	
P Upper	on	HL=1.6	HL=1.6	HL=1.6	HL=1.6	HL=1.6	HL=1.6	
	off	HL=0.6	HU=1.6	HU=1.6	HU=1.6	HU=2.6	HL=0.6	
Pump Capacity								
Storage Dimens	Lower	Lower	0.062	0.062	0.062	0.062	0.062	0.062
		Upper	0.084	0.084	0.067	0.031	0.067	0.084
		A (m2)	60.000	60.000	60.000	60.000	60.000	60.000
	Upper	H (m)	2.000	2.000	2.000	2.000	2.000	2.000
		Outlet d (m)	0.100	0.100	0.100	0.100	0.100	0.100
		A (m2)	35.000	35.000	35.000	35.000	35.000	35.000
Upper	H (m)	2.000	2.000	2.000	2.000	3.000	2.000	
	Outlet d (m)	0.100	0.100	0.100	0.100	0.100	0.150, 0.100	
	Outlet Maximum Discharge (m3/s)							
	Lower	0.026	0.027	0.026	0.031	0.026	0.026	
	Upper	0.084	0.035	0.029	0.031	0.035	0.059	
Outlet Mean Discharge (m3/s)								
	Lower	0.022	0.027	0.017	0.031	0.016	0.021	
	Upper	0.037	0.035	0.014	0.031	0.024	0.040	
Water Requirement (M3/day)								
	Lower	624	624	624	624	624	624	
	Upper	1639	1639	1639	1639	1639	1639	
Required Interval Time (min.)		46	(2 secants)	120	-	130	46	
Required Total Operation Time (hr)		12.384	13.008	32.962	14.687	18.845	11.361	
Appraisal		No	No	No	OK	OK	OK	
Remark		Maximum outlet discharge is more than canal capacity at upper storage	It is impossible to operate the pump with this interval time	Required operation time is more than 24 hr	It is necessary to perches new pump	The height of upper storage must be 1 m higher than exiting condition	The additional outlet pipe of upper storage must be installed with 0.15 m diameter	

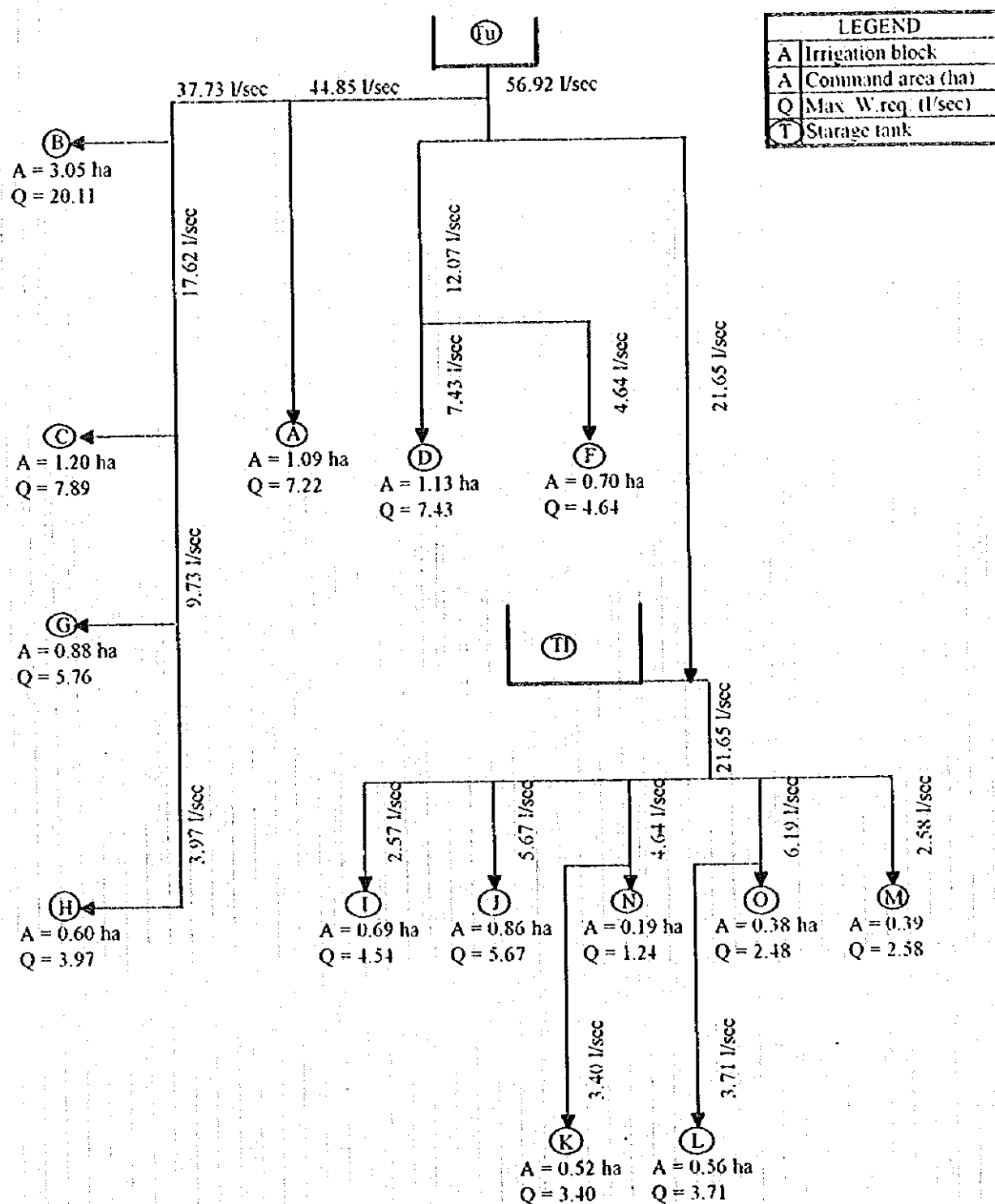


Fig. 1.1 IRRIGATION PLAN AT RAR-RC

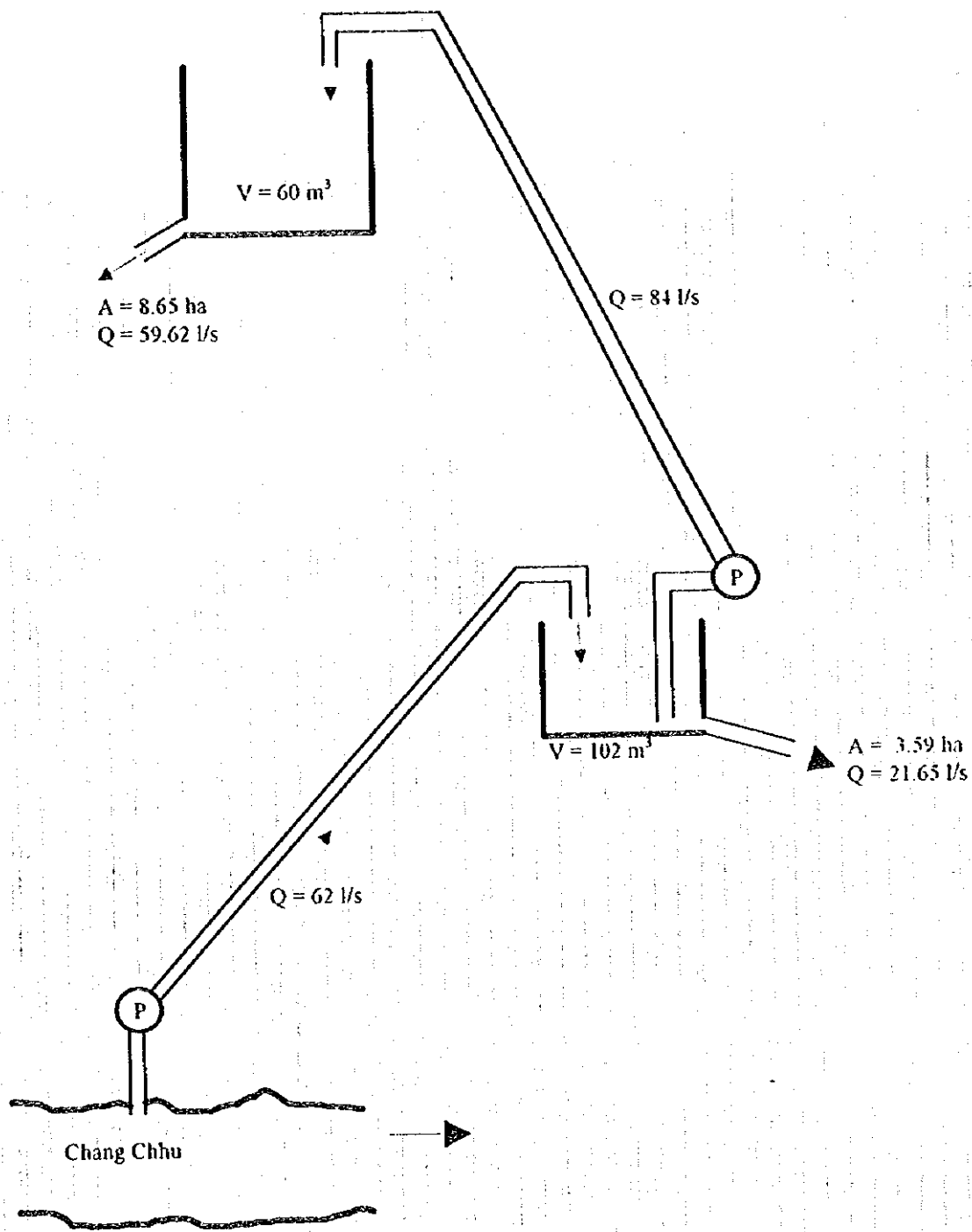


Fig. 1.2 PROPOSED PUMPING SYSTEM AT RNR-RC

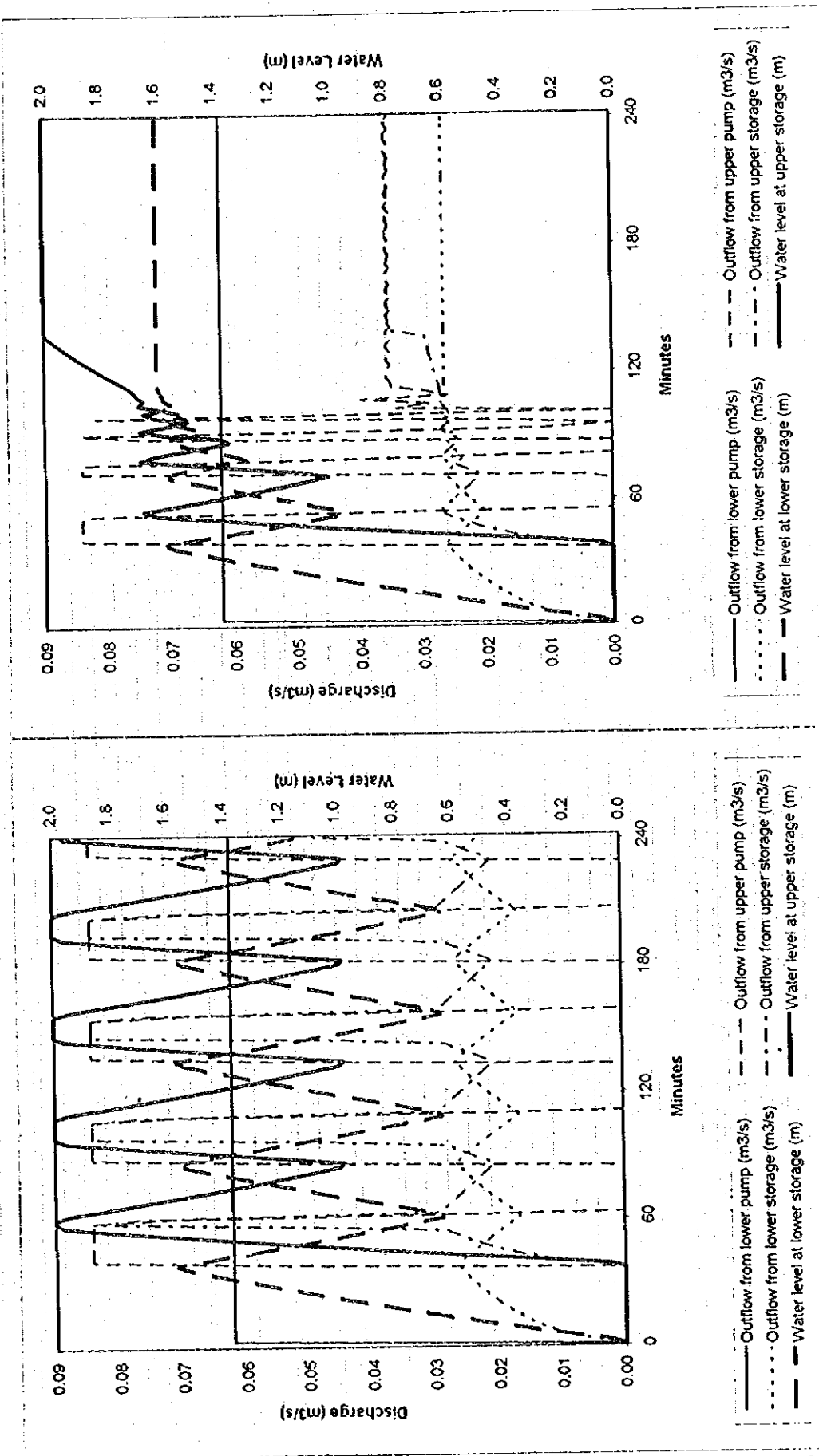


Fig 4.2 PUMPING OPERATION & WATER LEVEL  
FOR CASE 1

Fig 4.1 PUMPING OPERATION & WATER LEVEL  
FOR CASE 0



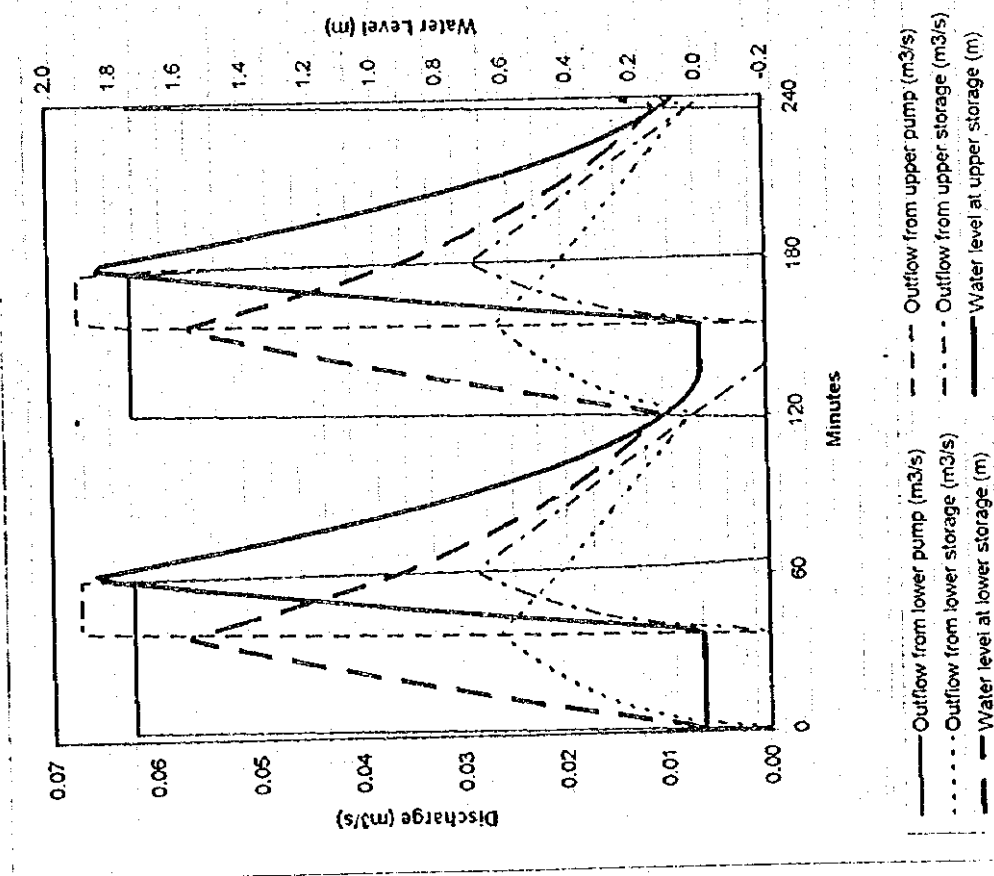


Fig 4.3 PUMPING OPERATION & WATER LEVEL  
FOR CASE 2

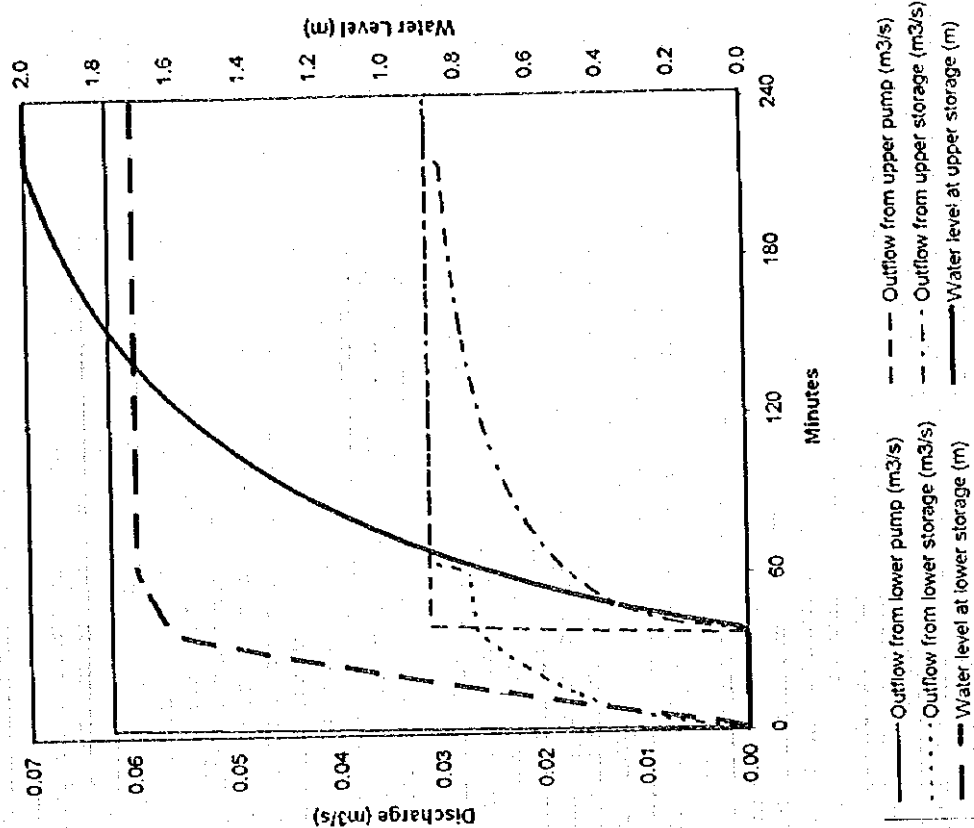


Fig 4.4 PUMPING OPERATION & WATER LEVEL  
FOR CASE 3

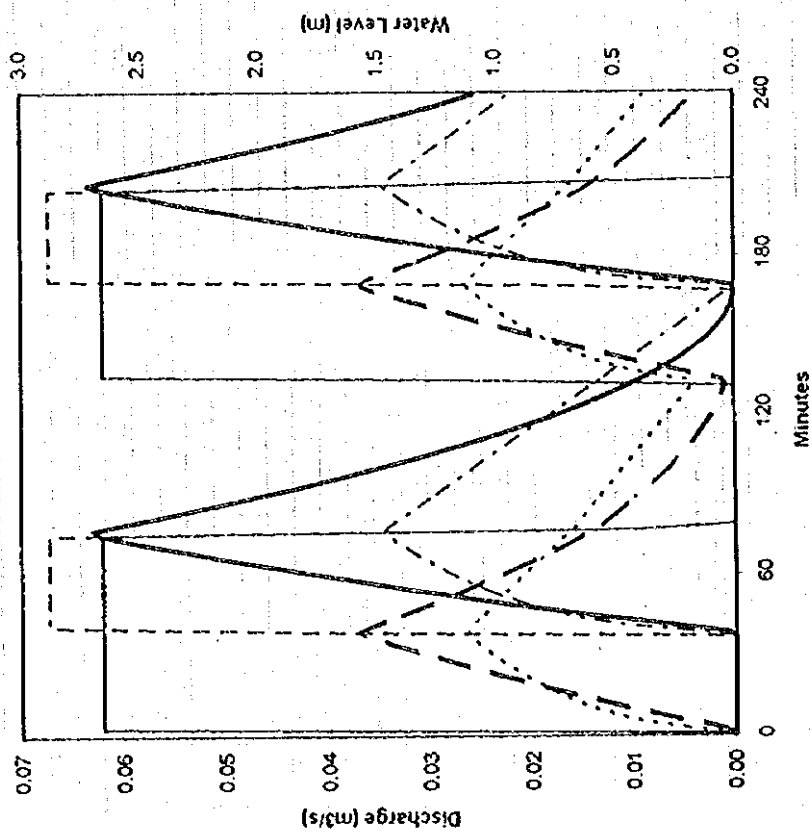


Fig 4.5 PUMPING OPERATION & WATER LEVEL  
FOR CASE 4

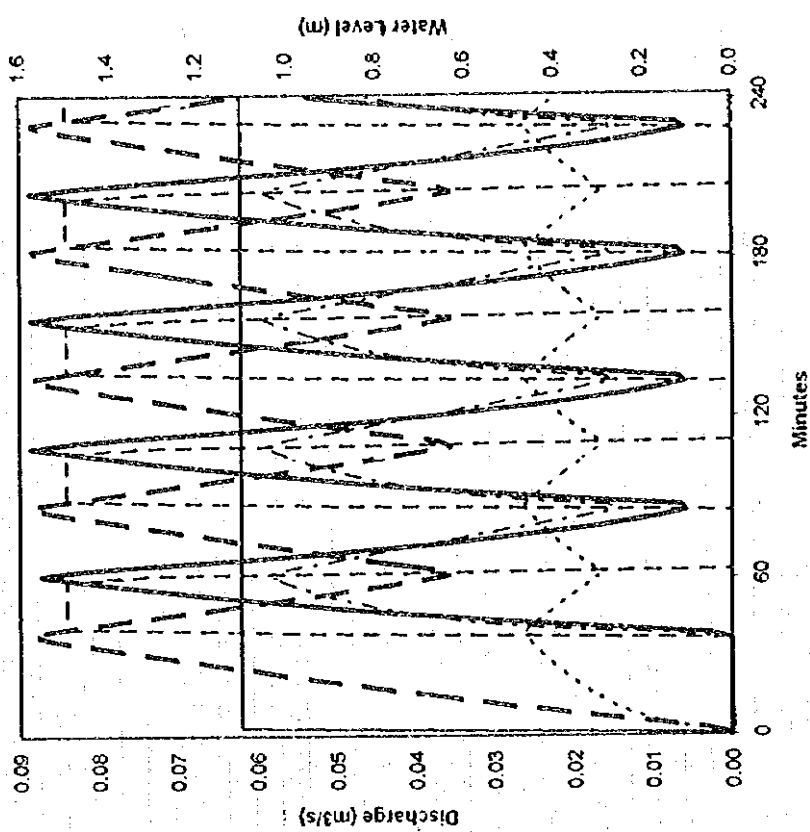


Fig 4.6 PUMPING OPERATION & WATER LEVEL  
FOR CASE 5

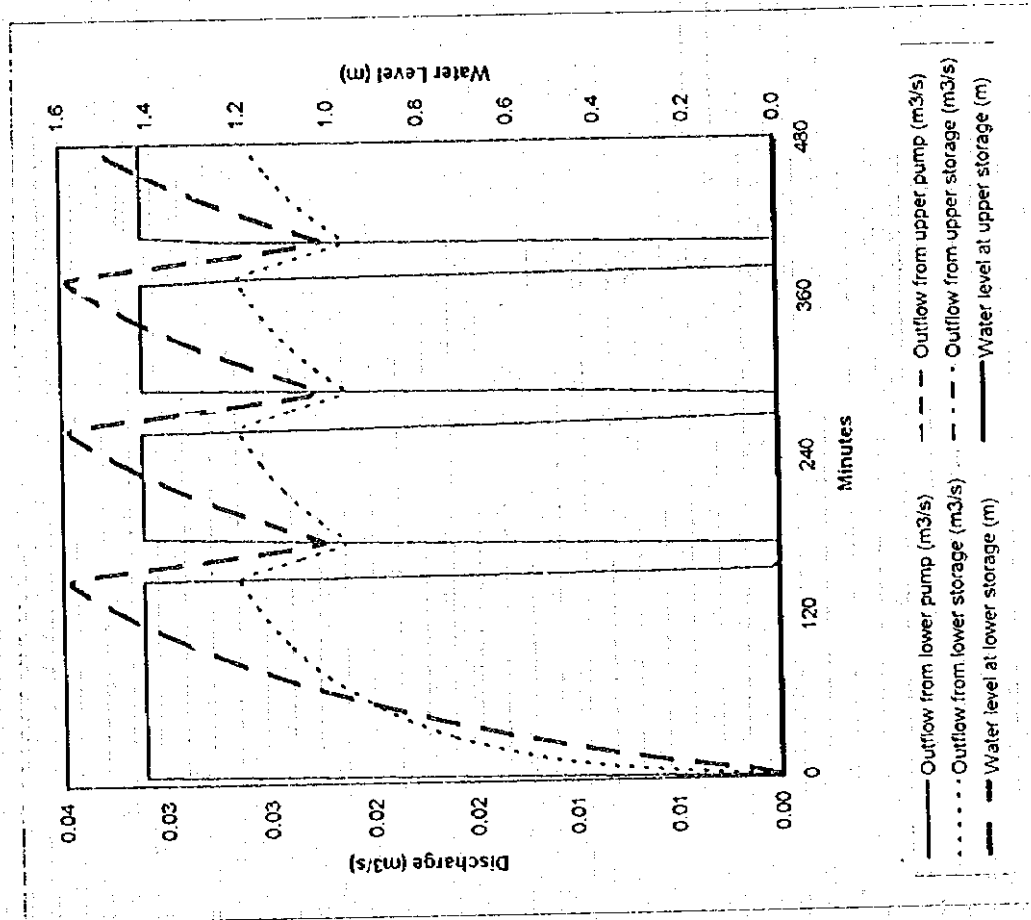


Fig 4.7. PUMPING OPERATION & WATER LEVEL  
FOR TENTATIVE OPERATION