



Department of Alternative
Energy Development and Efficiency
MINISTRY OF ENERGY

HUAI MAE SALIT NOI MICRO-HYDROPOWER PROJECT
AMPHOE THA SONG YANG CHANGWAT TAK
MAE MOEI NATIONAL PARK

CONTRACT C2

ELECTRO – MECHANICAL EQUIPMENT

VOLUME 4

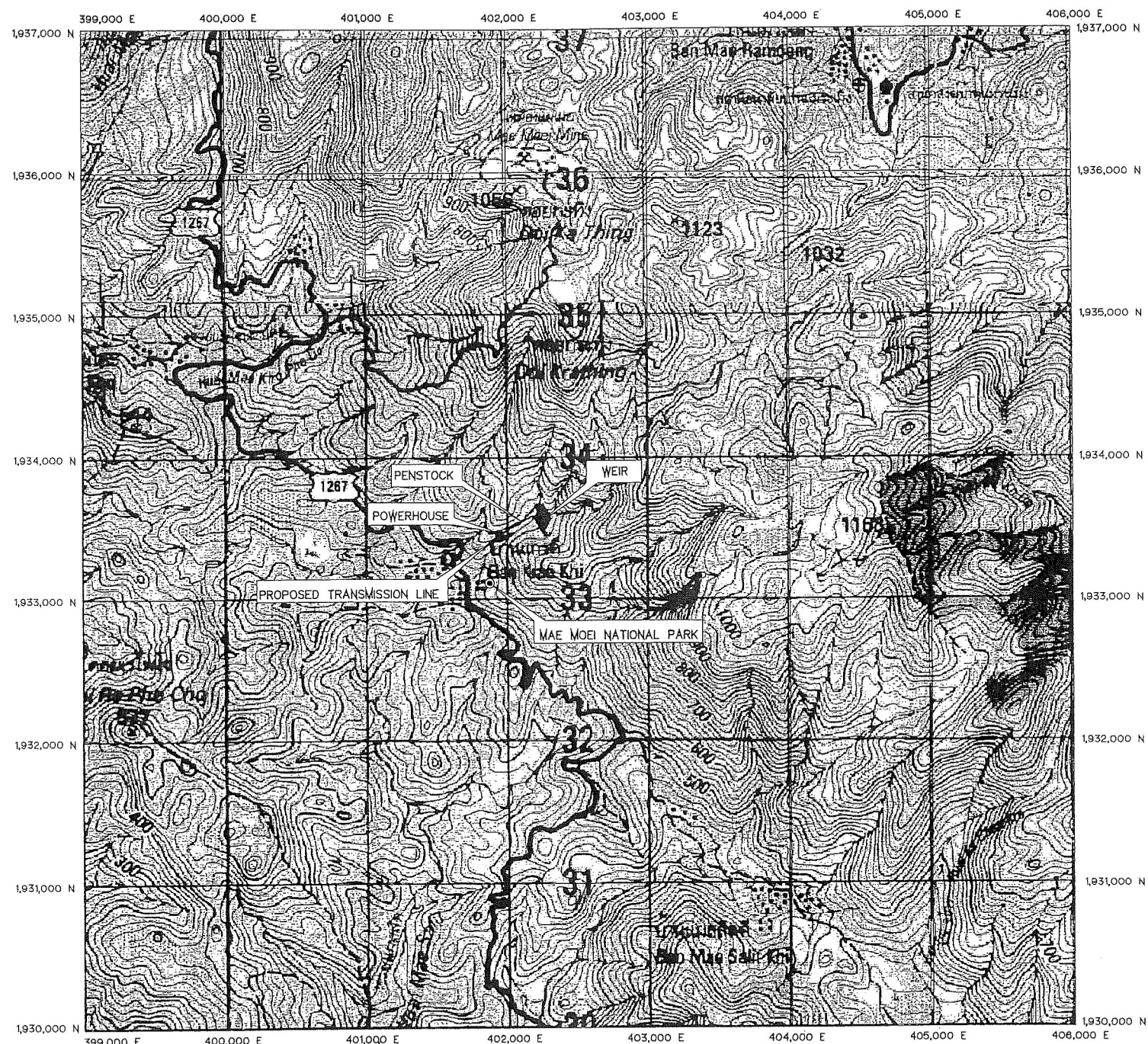
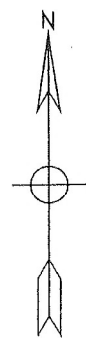
DRAWINGS



FRONTIER ENGINEERING CONSULTANTS CO.,LTD.

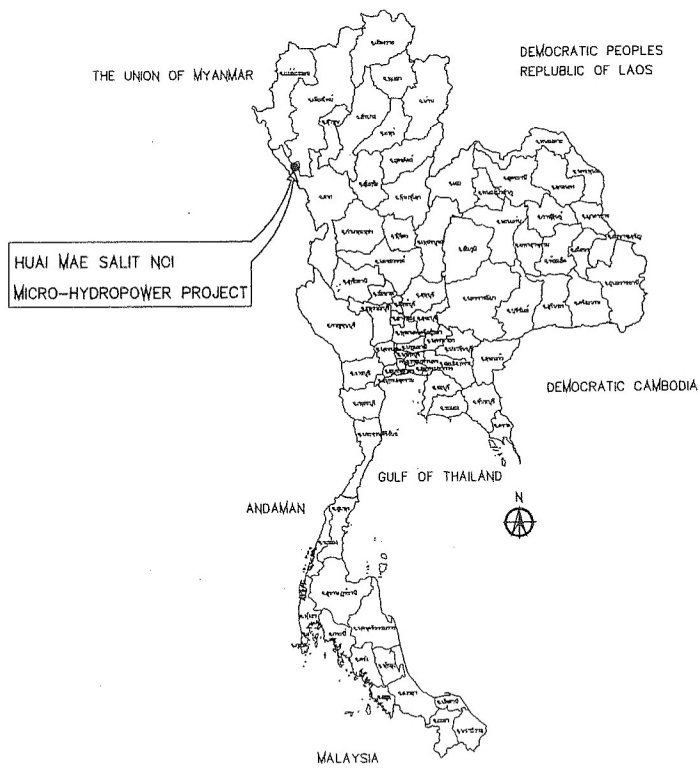
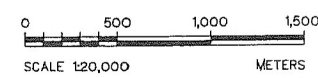
HUAI BONG 2 MICRO-HYDROPOWER PROJECT
CONTACT C2 : LIST OF DRAWINGS

SHEET NO.	DRAWING NO.	DRAWING DETAIL
GENERAL		
1	HBG-GN-01	LOCATION MAP AND PROJECT AREA MAP
2	HBG-GN-02	PROJECT AREA MAP
3	HBG-GN-03	PLAN AND SECTIONS
ELECTRO-MECHANICAL EQUIPMENT		
4	HBG-EM-01	GENERAL TURBINE LAY-OUT
5	HBG-EM-02	SINGLE LINE DIAGRAM
6	HBG-EM-03	GENERAL ARRANGEMENT
7	HBG-EM-04	VIEW A
8	HBG-EM-05	RUNNER & SHAFT
9	HBG-EM-06	FLYWHEEL & SHAFT
10	HBG-EM-07	NOZZLE
11	HBG-EM-08	HYDRAULIC SYSTEM



PROJECT AREA MAP
SCALE 1:20,000

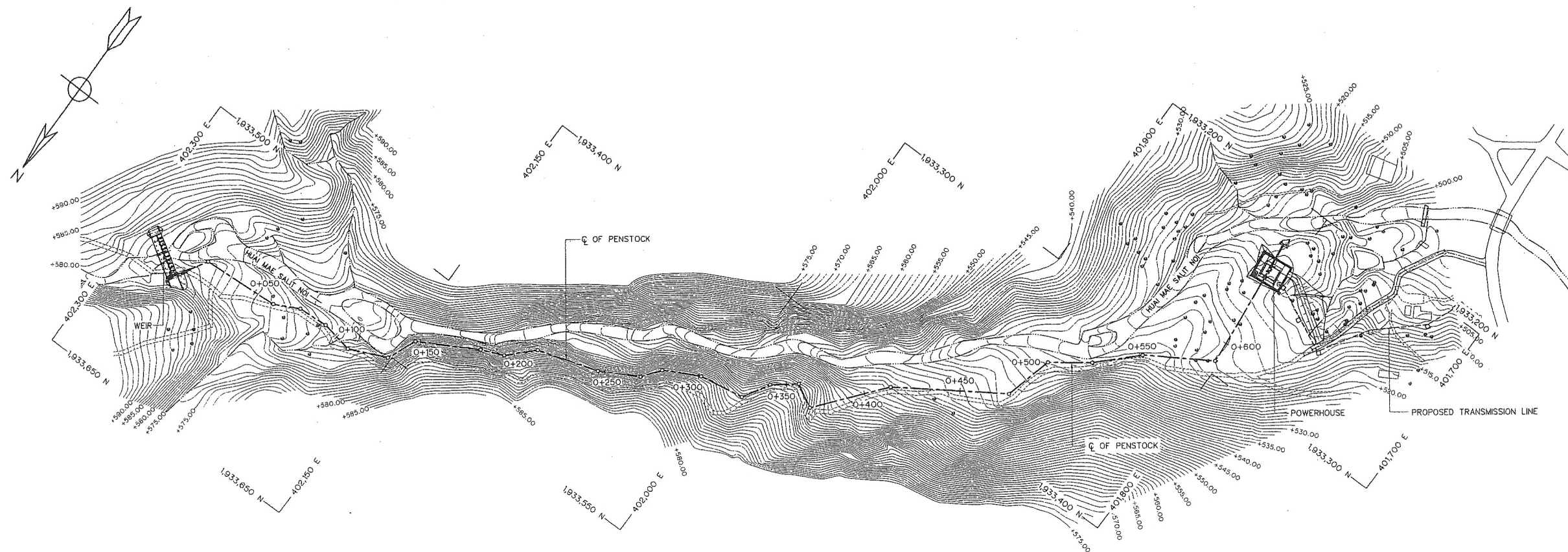
NOTE :
1. ALL DIMENSION AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.



LOCATION MAP
NOT TO SCALE

- LEGENDS :
- STREAM
 - WEIR
 - NATIONAL PARK
 - PENSTOCK
 - POWERHOUSE
 - ACCESS ROAD
 - PROPOSED TRANSMISSION LINE

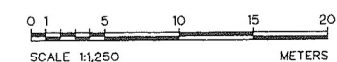
KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY			
HUI MAE SALIT NOI MICRO-HYDROPOWER PROJECT MAE MOI NATIONAL PARK			
ELECTRO - MECHANICAL EQUIPMENT GENERAL LOCATION MAP AND PROJECT AREA MAP			
FRONTIER ENGINEERING CONSULTANTS CO., LTD.		Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
3		REVIEWED	S.M.
2		DESIGNED	S.M.
1		DRAWN	S.M.
NO.	DATE	REVISIONS	CHECKED
			APPROVED
CONSULTANTS		DEDE	
PROJECT MANAGER		DATE	DRAWING NO.
		5/8/88	MSN-GN-01
			SHEET NO.
			1 OF 11



PROJECT MAP
SCALE 1:1,250

NOTE :

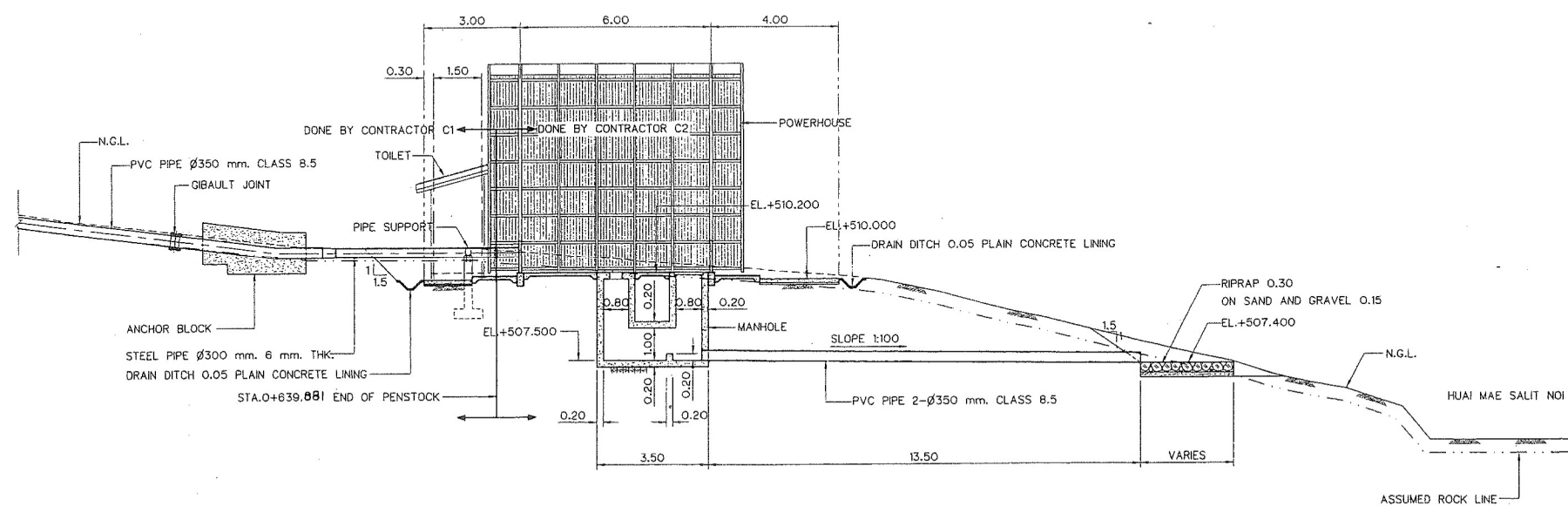
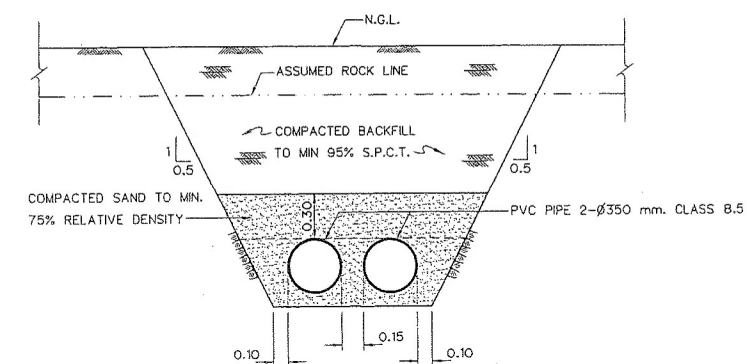
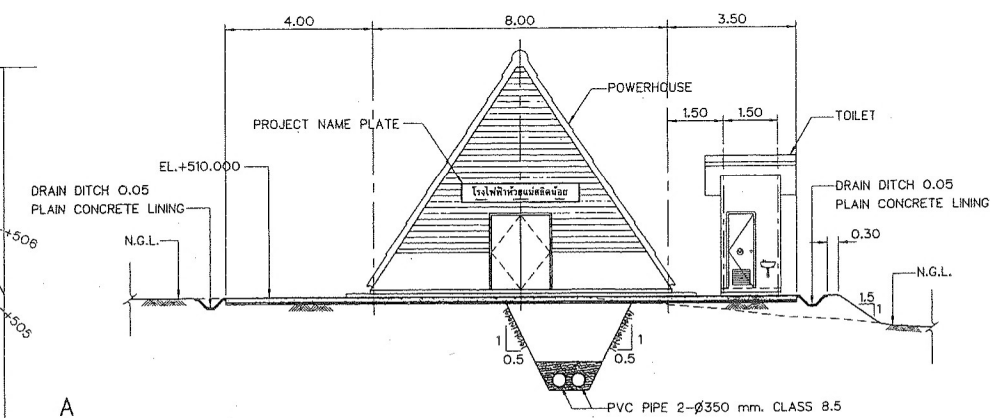
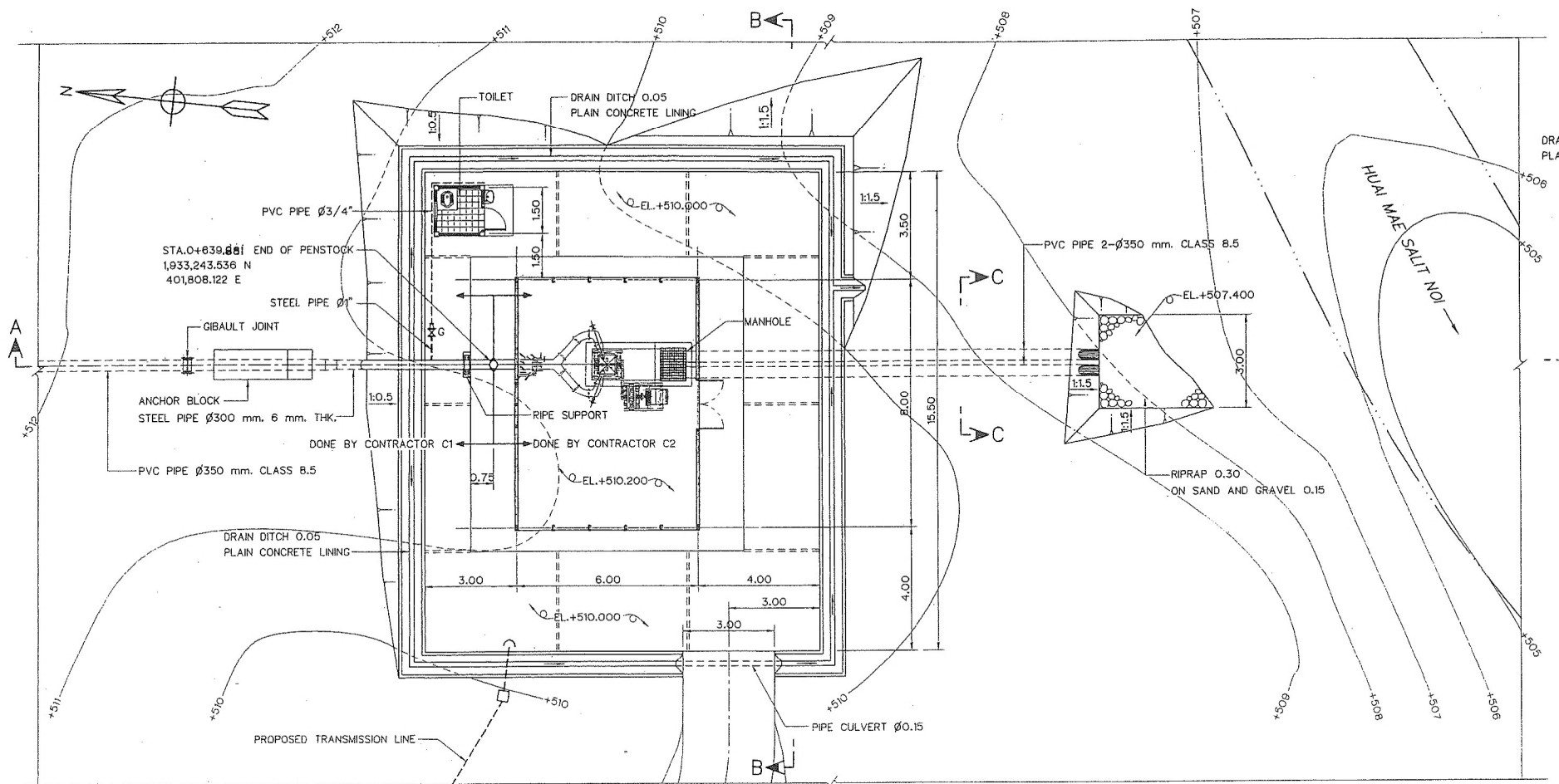
1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.



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NO.	DATE	REVISIONS	CHECKED	APPROVED

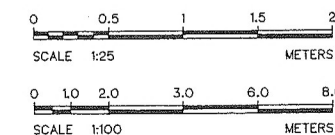
CONSULTANTS DEDE

KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY			
HUAI MAE SALIT NOI MICRO-HYDROPOWER PROJECT MAE MOEI NATIONAL PARK			
ELECTRO - MECHANICAL EQUIPMENT GENERAL PROJECT MAP			
FRONTIER ENGINEERING CONSULTANTS CO., LTD.		Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
DESIGNED	RB.6651	REVIEWED	RB.6651
DRAWN	RB.7324	SUBMITTED	RB.6651
CHECKED	RB.7324	RECOMMENDED	RB.6651
DATE	5/8/98	APPROVED	RB.6651
PROJECT MANAGER	DATE	DRAWN	SHEET NO.
		MSN-UN-02	2 OF 11

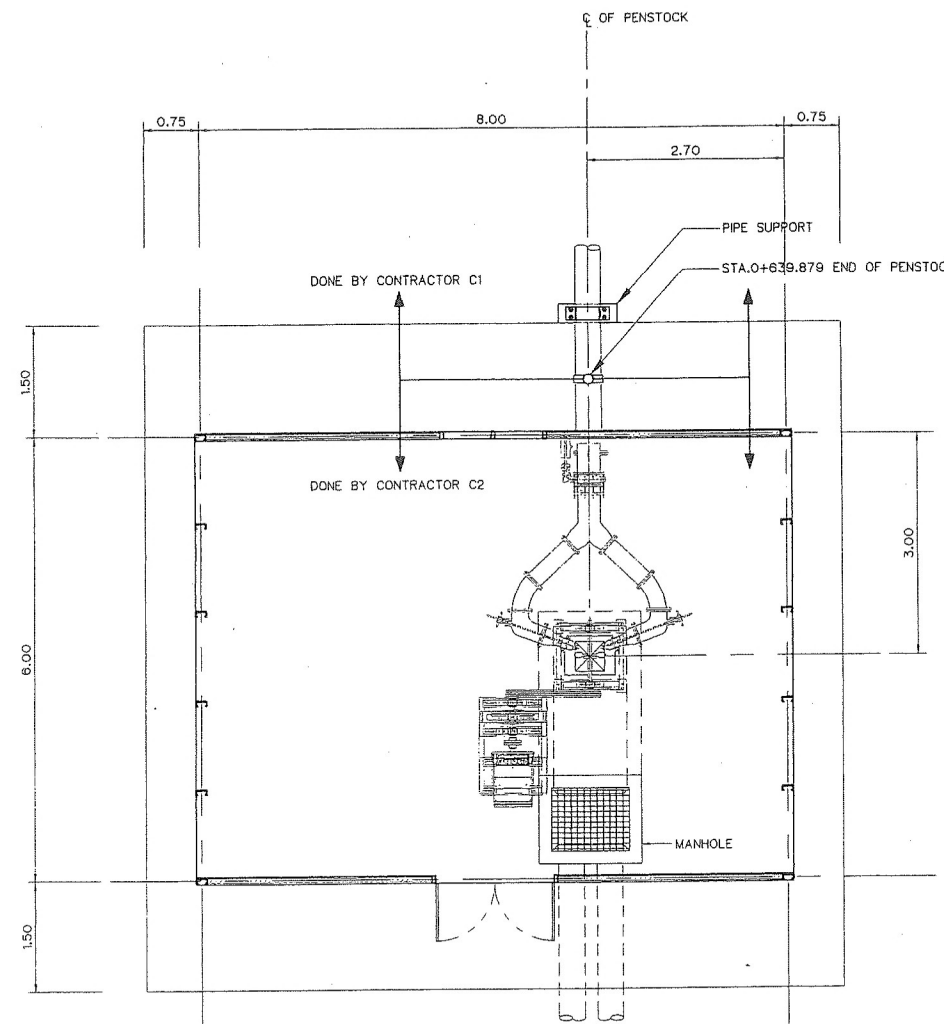


NOTE:

1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.



3					DESIGNED	RE. 8651	REVIEWED	FLK
2					DRAWN	sh	SUBMITTED	80244
1					CHECKED	P. H. H. H.	RECOMMENDED	80244
NO.	DATE	REVISIONS	CHECKED	APPROVED	CHECKED	RE. 7324	APPROVED	P. H. H. H.
CONSULTANTS				DEDE	DATE		DRAWING NO.	SHEET NO.
					5/8/58		MSN-GN-03	3 of 1
					PROJECT MANAGER			



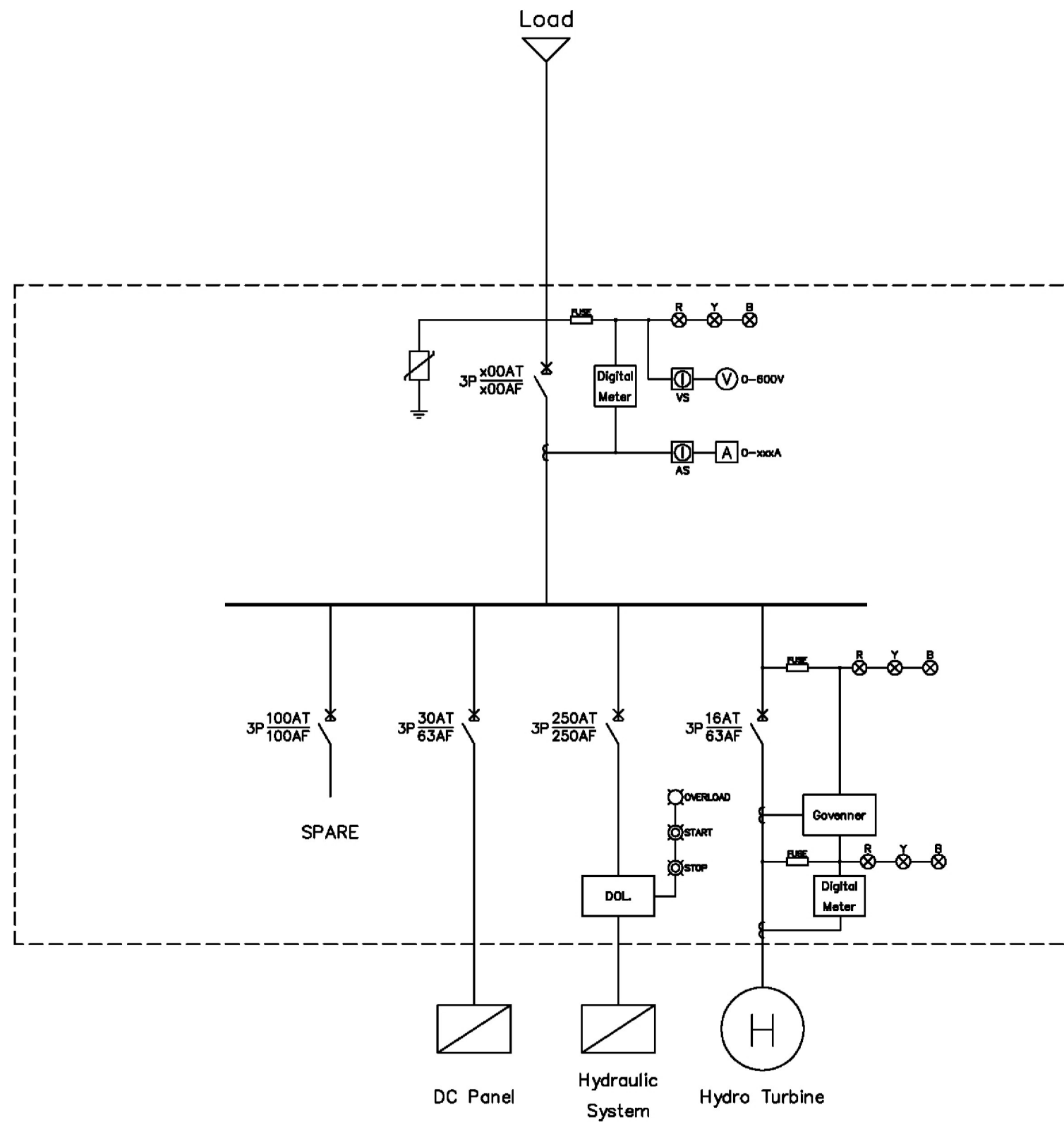
PLAN
SCALE 1:50

NOTE:

1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
2. TURBINE & GENERATOR FOUNDATION, BLOCKOUT SIZES AND LOCATIONS ARE ONLY APPROXIMATE, ELECTRO-MECHANICAL CONTRACTOR IS REQUIRED TO SUBMIT THE SHOP DRAWINGS INDICATED ALL FINAL SIZES AND LOCATIONS TO FIELD ENGINEER.



KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
HUAI MAE SALIT NOI MICRO-HYDROPOWER PROJECT MAE MOEI NATIONAL PARK	
ELECTRO - MECHANICAL EQUIPMENT GENERAL TURBINE LAY-OUT	
FRONTIER ENGINEERING CONSULTANTS CO.,LTD.	
DESIGNED <i>[Signature]</i> 20/2/97	REVIEWED <i>[Signature]</i>
DRAWN <i>[Signature]</i>	SUBMITTED <i>[Signature]</i>
CHECKED <i>[Signature]</i> 20/2/97	RECOMMENDED <i>[Signature]</i>
APPROVED <i>[Signature]</i>	APPROVED <i>[Signature]</i>
PROJECT MANAGER <i>[Signature]</i> 5/8/98	DATE
DRAWING NO. MSN-EM-01	SHEET NO. 4 OF 11

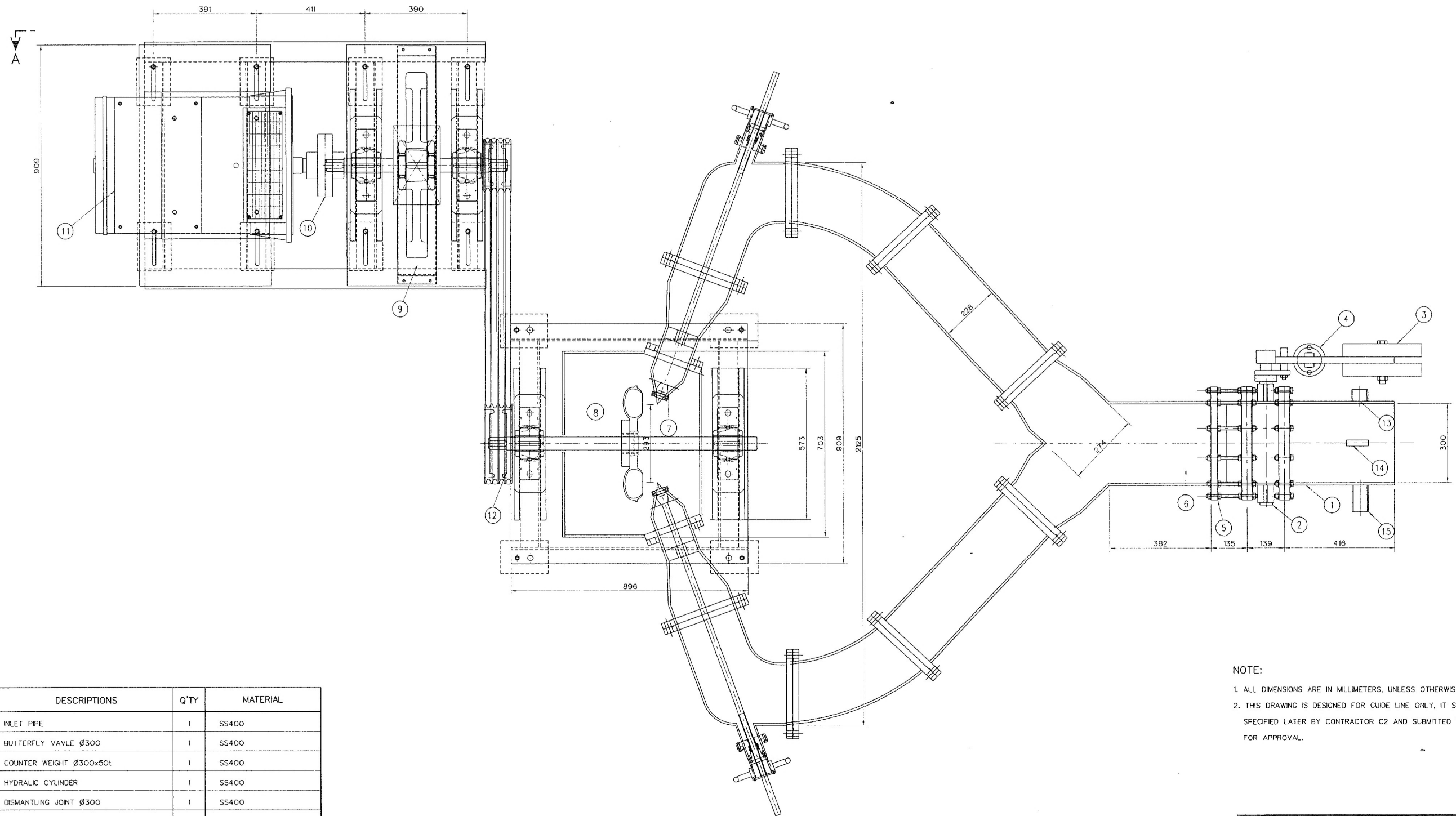


NOTE:

1. THIS DRAWING IS DESIGNED FOR GUIDE LINE ONLY, IT SHALL BE DESIGNED AND SPECIFIED LATER BY CONTRACTOR C2 AND SUBMITTED TO FIELD ENGINEER FOR APPROVAL.

KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
HUA MAE SALIT NOI MICRO-HYDROPOWER PROJECT MAE MOEI NATIONAL PARK	
ELECTRO - MECHANICAL EQUIPMENT SINGLE LINE DIAGRAM	
FRONTIER ENGINEERING CONSULTANTS CO., LTD.	
DESIGNED	27/10/29
DRAWN	27/10/29
CHECKED	5/8/58
APPROVED	DATE
PROJECT MANAGER	DATE
REVIEWED	27/10/29
SUBMITTED	27/10/29
RECOMMENDED	27/10/29
APPROVED	27/10/29
DRAWING NO.	MSN-EM-02
SHEET NO.	5 of 11

NO.	DATE	REVISIONS	CHECKED	APPROVED
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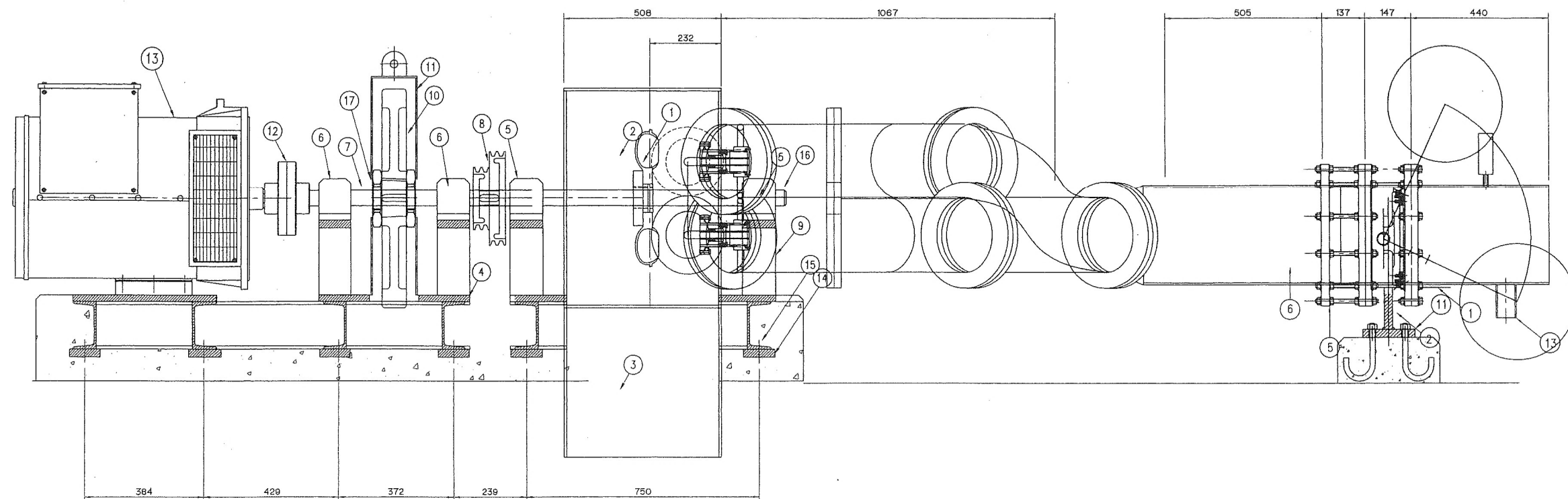


- NOTE:
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 2. THIS DRAWING IS DESIGNED FOR GUIDE LINE ONLY, IT SHALL BE DESIGNED AND SPECIFIED LATER BY CONTRACTOR C2 AND SUBMITTED TO FIELD ENGINEER FOR APPROVAL.

NO.	DESCRIPTIONS	Q'TY	MATERIAL
1	INLET PIPE	1	SS400
2	BUTTERFLY VAVLE Ø300	1	SS400
3	COUNTER WEIGHT Ø300x50t	1	SS400
4	HYDRALIC CYLINDER	1	SS400
5	DISMANTLING JOINT Ø300	1	SS400
6	BIFERCATION	1	SS400
7	NOZZLE	2	ASTM-A743CA6NM
8	TURGO TURBINE	1	SS400
9	FLYWHEEL	1	SS41
10	FLEXIBLE COUPLING	1	JIS B-1452
11	GENERATOR 30 KW., 37.5 KVA.	1	400V,50Hz
12	PULLEY 1:1.5	1	SS400
13	PRESSURE RELEASE VALVE Ø125 mm	1	SS400
14	PRESSURE GAUGE	1	0-25 Bar
15	DRAINAGE PIPE	1	SS400

GENERAL ARRANGEMENT
NOT TO SCALE

KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY			
HUAI MAE SALIT NOI MICRO-HYDROPOWER PROJECT MAE MOEI NATIONAL PARK			
ELECTRO - MECHANICAL EQUIPMENT GENERAL ARRANGEMENT			
FRONTIER ENGINEERING CONSULTANTS CO.,LTD.		Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
3		DESIGNED	REVIEWED
2		DRAWN	SUBMITTED
1		CHECKED	RECOMMENDED
NO.	DATE	REVISIONS	APPROVED
CONSULTANTS		DEDE	
PROJECT MANAGER		DATE	DRAWING NO.
		5/8/58	MSN-EM-03
			SHEET NO.
			6 OF 11



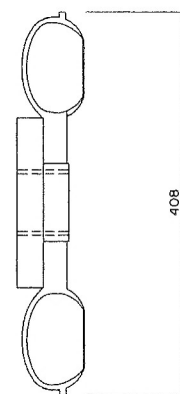
VIEW A
NOT TO SCALE

NO.	DESCRIPTIONS	Q'TY	MATERIAL
1	RUNNER	1	ASTM-A743 CA6NM
2	CASING	1	SS400
3	DRAFT TUBE	1	SS400
4	PLATE	1	SS400
5	SPHERICAL ROLLER BEARING	2	SKF or Equal
6	SPHERICAL ROLLER BEARING	2	SKF or Equal
7	FLYWHEEL SHAFT	1	S45C
8	PULLEY 1:1.5	4	STEEL
9	BEARING SUPPORT	4	SS400
10	FLYWHEEL	1	SS400
11	GUARD FLYWHEEL	1	SS400
12	FLEXIBLE COUPLING	1	JIS B-1452
13	GENERATOR	1	380V, 50Hz
14	PLATE 25t	1 SET	SS400
15	CHANNEL 150x75x6.5x10 mm	1 SET	JIS G3102
16	SHAFT RUNNER	1	S45C
17	FLYWHEEL LOCKRING	2	SS400

NOTE:

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2. THIS DRAWING IS DESIGNED FOR GUIDE LINE ONLY, IT SHALL BE DESIGNED AND SPECIFIED LATER BY CONTRACTOR C2 AND SUBMITTED TO FIELD ENGINEER FOR APPROVAL.

KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
HUAI MAE SALIT NOI MICRO-HYDROPOWER PROJECT MAE MOEI NATIONAL PARK	
ELECTRO - MECHANICAL EQUIPMENT VIEW A	
5555 FRONTIER ENGINEERING CONSULTANTS CO., LTD. DESIGNED <i>Rinw 4/19/97</i> DRAWN <i>Rinw 4/19/97</i> CHECKED <i>Rinw 4/19/97</i> PROJECT MANAGER <i>Rinw 4/19/97</i>	DEPARTMENT OF ALTERNATIVE ENERGY DEVELOPMENT AND EFFICIENCY MINISTRY OF ENERGY REVIEWED <i>EV 12</i> SUBMITTED <i>EV 12</i> RECOMMENDED <i>P. Hanth</i> APPROVED <i>P. Hanth</i> DATE 5/8/98
CONSULTANTS DEDE	DRAWING NO. MSN-EM-04 SHEET NO. 7 OF 11



The diagram shows three orthographic views of a mechanical part. The front view (top) is a rectangle with a width of 61 and a height of 90. The top view (bottom) is a rectangle with a width of 61 and a depth of 62. The side view (right) is a rectangle with a height of 90 and a depth of 62. The part has a central rectangular feature with a semi-circular top and a rectangular base. The dimensions are indicated by arrows and numbers: 61 for width, 90 for height, and 62 for depth.

Technical drawing of a shaft with the following dimensions:

- Overall length: 1064
- Section 1 length: 112
- Section 2 length: 127
- Section 3 length: 697
- Section 4 length: 121
- Shaft diameter: $\varnothing 60$

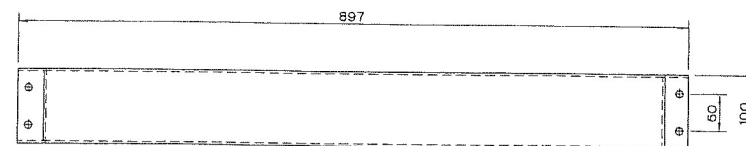
The drawing shows a shaft with a central section (Section 3) that is wider than the other sections. A cross-section of the shaft is shown on the right, indicating a hollow shaft with a central bore.

NOTE:

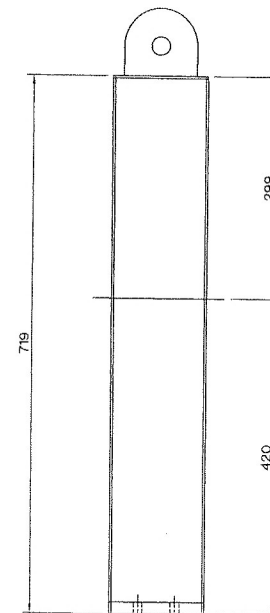
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 KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY		HUAI MAE SALIT NOI MICRO-HYDROPOWER PROJECT MAE MOEI NATIONAL PARK	
		ELECTRO - MECHANICAL EQUIPMENT RUNNER & SHAFT	
FRONTIER ENGINEERING CONSULTANTS CO., LTD.		 Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
DESIGNED	<i>Runn Wongsai</i>	20.2197	REVIEWED <i>Runn</i>
DRAWN	<i>Runn</i>		SUBMITTED <i>Runn</i>
CHECKED	<i>Runn Wongsai</i>	20.2197	RECOMMENDED <i>Runn Wongsai</i>
	<i>Runn</i>		APPROVED <i>P. Hongsai</i>
PROJECT MANAGER		5/8/58	DRAWING NO. MSN-EM-05
DATE			SHEET NO. 8 of 11

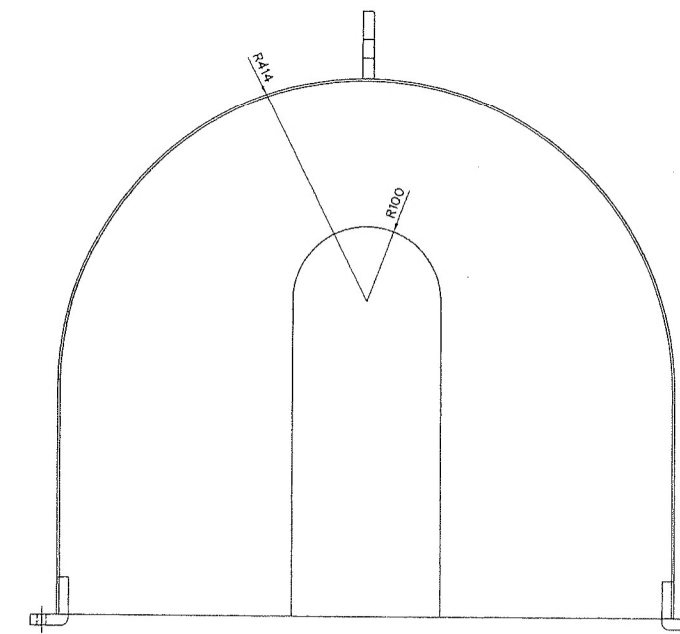
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NO.	DATE	REVISIONS	CHECKED	APPROVED
	CONSULTANTS		DEDE	



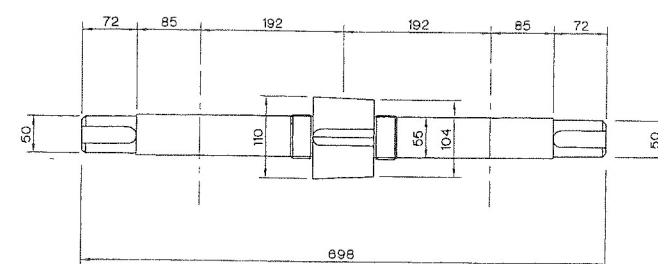
FLYWHEEL GUARD



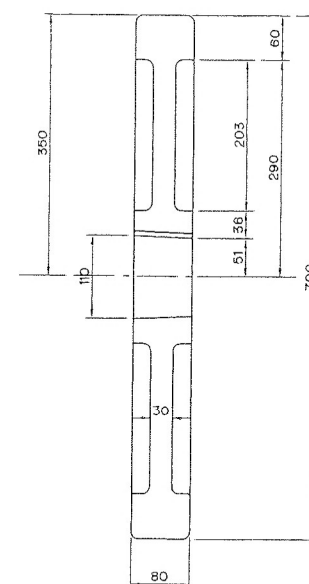
FLYWHEEL GUARD



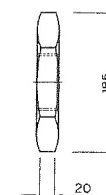
FLYWHEEL GUARD



FLYWHEEL SHAFT



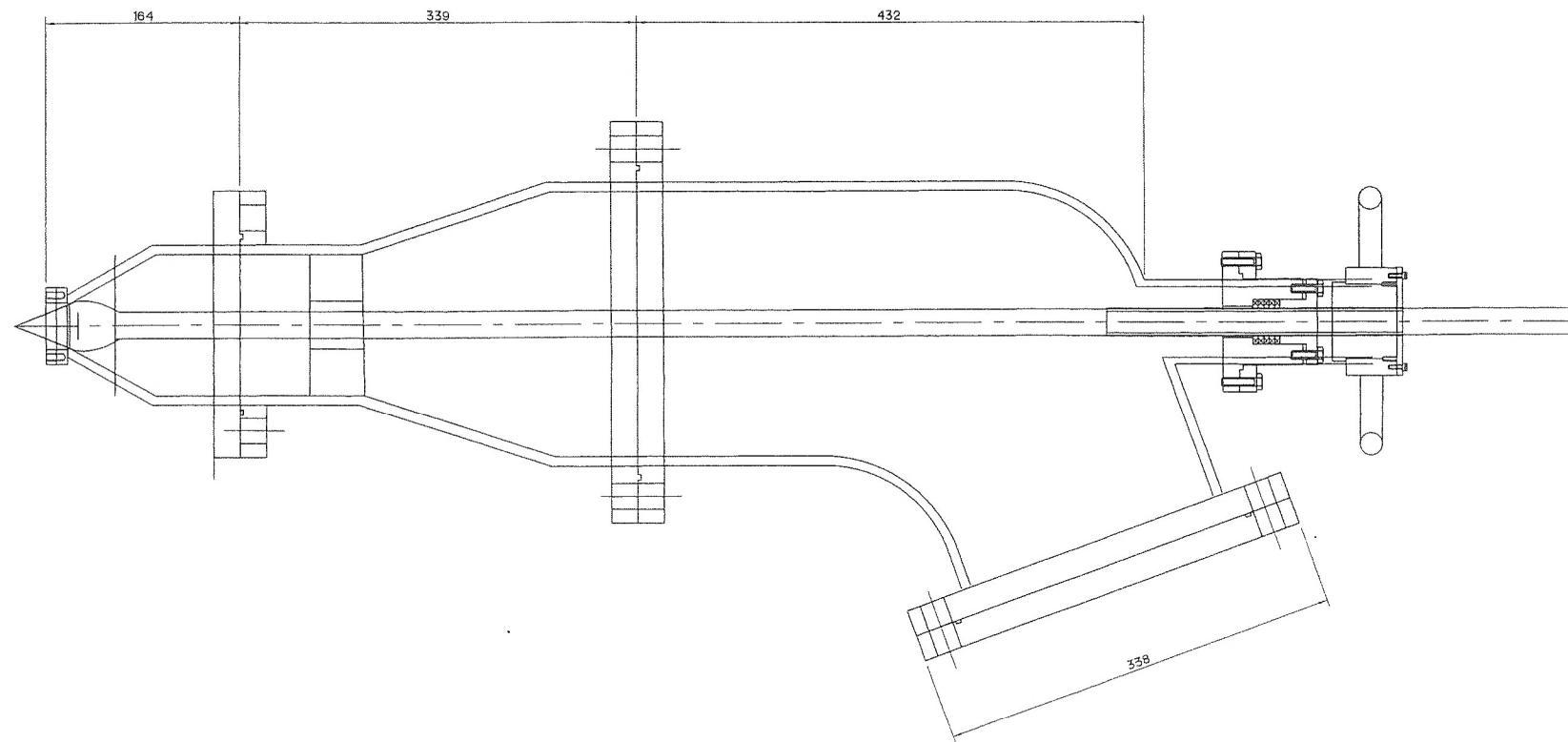
FLYWHEEL



NOTE:

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KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
HUAI MAE SALIT NOI MICRO-HYDROPOWER PROJECT MAE MOEI NATIONAL PARK	
ELECTRO - MECHANICAL EQUIPMENT FLYWHEEL & SHAFT	
DESIGNED <i>[Signature]</i> DRAWN <i>[Signature]</i> NO. DATE REVISIONS CHECKED APPROVED	REVIEWED <i>[Signature]</i> SUBMITTED <i>[Signature]</i> RECOMMENDED <i>[Signature]</i> APPROVED <i>[Signature]</i>
FRONTIER ENGINEERING CONSULTANTS CO., LTD. PROJECT MANAGER DATE 5/8/58	SHEET NO. 9 of 11

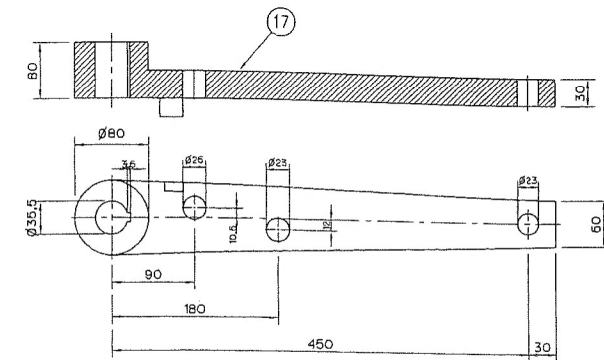
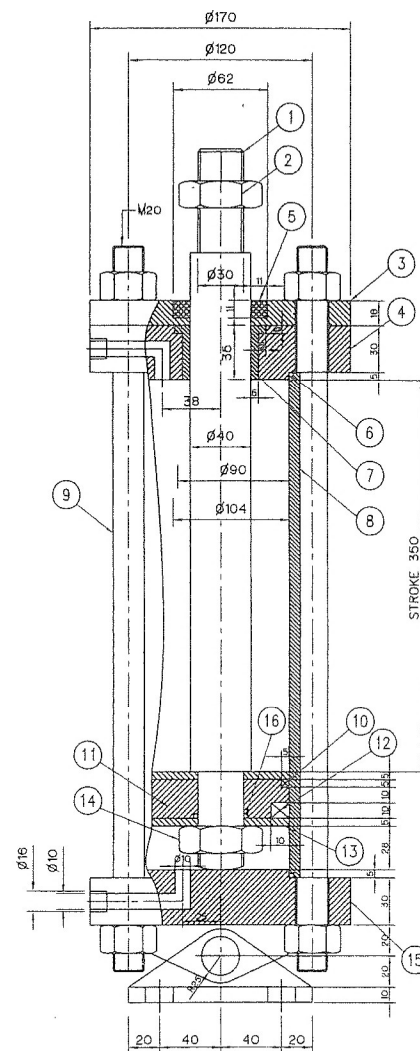
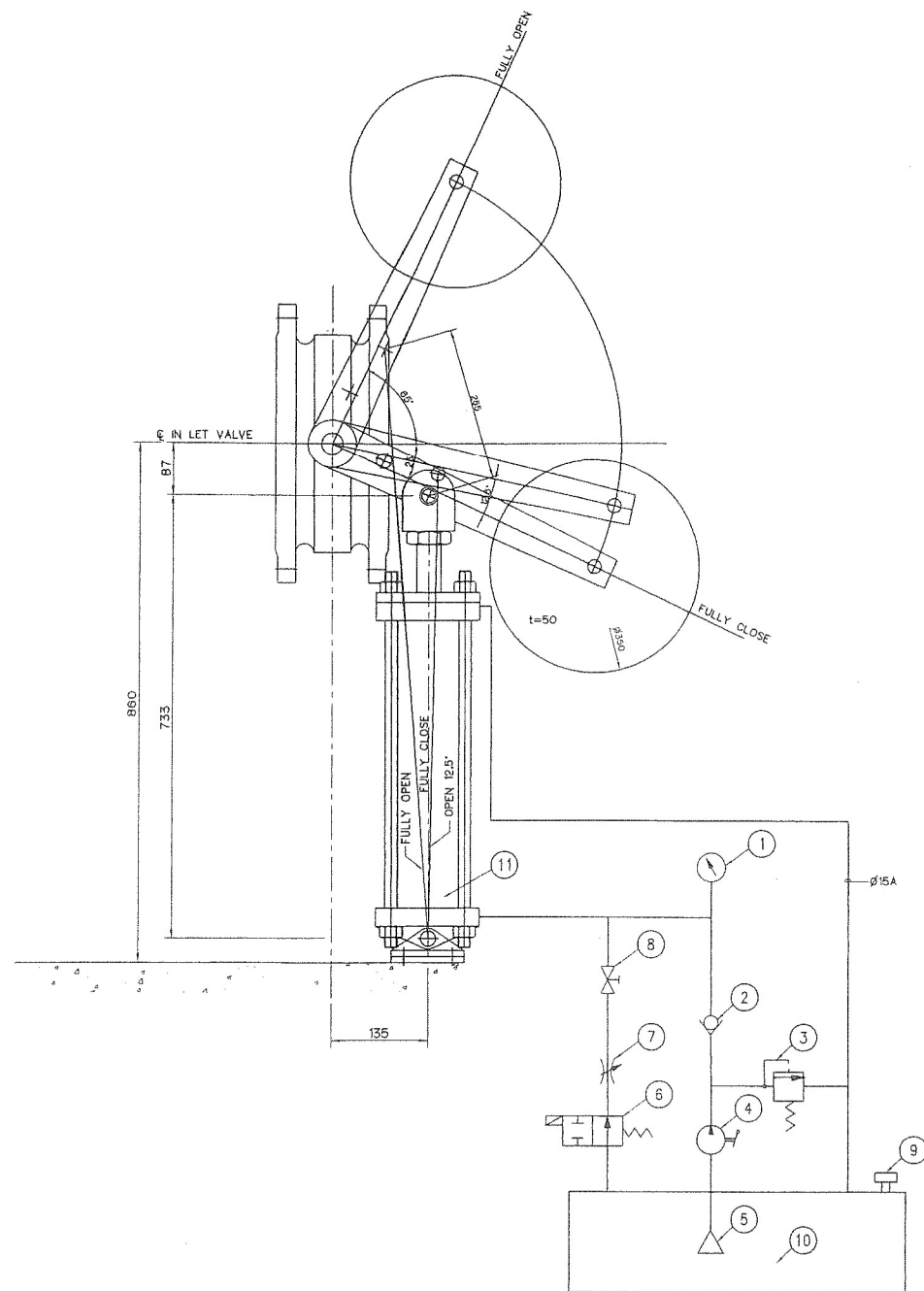


NOZZLE & NEDDLE VALVE

NOTE:

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KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
HUAI MAE SALIT NOI MICRO-HYDROPOWER PROJECT MAE MOEI NATIONAL PARK	
ELECTRO - MECHANICAL EQUIPMENT NOZZLE	
FRONTIER ENGINEERING CONSULTANTS CO., LTD.	
DESIGNED <i>P. H. H.</i> 21/2/97 DRAWN <i>P. H. H.</i> NO. DATE REVISIONS CHECKED APPROVED CONSULTANTS DEDE	REVIEWED <i>P. H. H.</i> SUBMITTED <i>P. H. H.</i> RECOMMENDED <i>P. H. H.</i> APPROVED <i>P. H. H.</i> PROJECT MANAGER DATE 5/8/58 DRAWING NO. MSN-EM-07 SHEET NO. 10 OF 11



ARM LINK
NOT TO SCALE

NO.	DESCRIPTIONS	Q'TY	MATERIAL
1	PISTON ROD	1	SS41
2	NUT M30	1	SS41
3	OIL SEAL SEAT	1	SS41
4	HEAD COVER	1	SS41
5	OIL SEAL	1	JIS D 40 62 11
6	O-RING	1	RUBBER
7	ROD BUSHING	1	OLLESS METAL
8	CYLINDER	1	STKM 130
9	BOLT & NUT	1	SS41
10	O-RING	1	RUBBER
11	PISTON	1	SS41
12	V-PACKING	1	RUBBER
13	CUSHION BRASS	1	SS41
14	NUT M30	1	SS41
15	BOTTOM COVER	1	SS41
16	O-RING	1	RUBBER
17	ARM LINK	1	SS41

CYLINDER
NOT TO SCALE

NOTE:

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NO.	DESCRIPTIONS	Q'TY	MATERIAL
1	PRESSURE GAUGE	1	
2	CHECKING VALVE	1	
3	RELIFE VALVE	1	
4	HAND PUMP (>25kg/cm ²)	1	
5	SECTION FILTER	1	
6	SOLINOID VALVE	1	
7	NEEDLE VALVE	1	
8	BALL VALVE	1	
9	AIR BREATHER	1	
10	OIL TANK	1	
11	CYLINDER	1	

KINGDOM OF THAILAND Department of Alternative Energy Development and Efficiency MINISTRY OF ENERGY	
HUA MAE SALIT NOI MICRO-HYDROPOWER PROJECT MAE MOE NATIONAL PARK	
ELECTRO - MECHANICAL EQUIPMENT HYDRAULIC SYSTEM	
FRONTIER ENGINEERING CONSULTANTS CO., LTD.	
DESIGNED <i>[Signature]</i> 20/2197	REVIEWED <i>[Signature]</i>
DRAWN <i>[Signature]</i>	SUBMITTED <i>[Signature]</i>
CHECKED <i>[Signature]</i> 20/2197	RECOMMENDED <i>[Signature]</i>
APPROVED <i>[Signature]</i> 5/8/58	APPROVED <i>[Signature]</i>
PROJECT MANAGER	DRAIVING NO. MSN-EM-08
DATE	SHEET NO. 11 OF 11

NO.	DATE	REVISIONS	CHECKED	APPROVED
3				
2				
1				