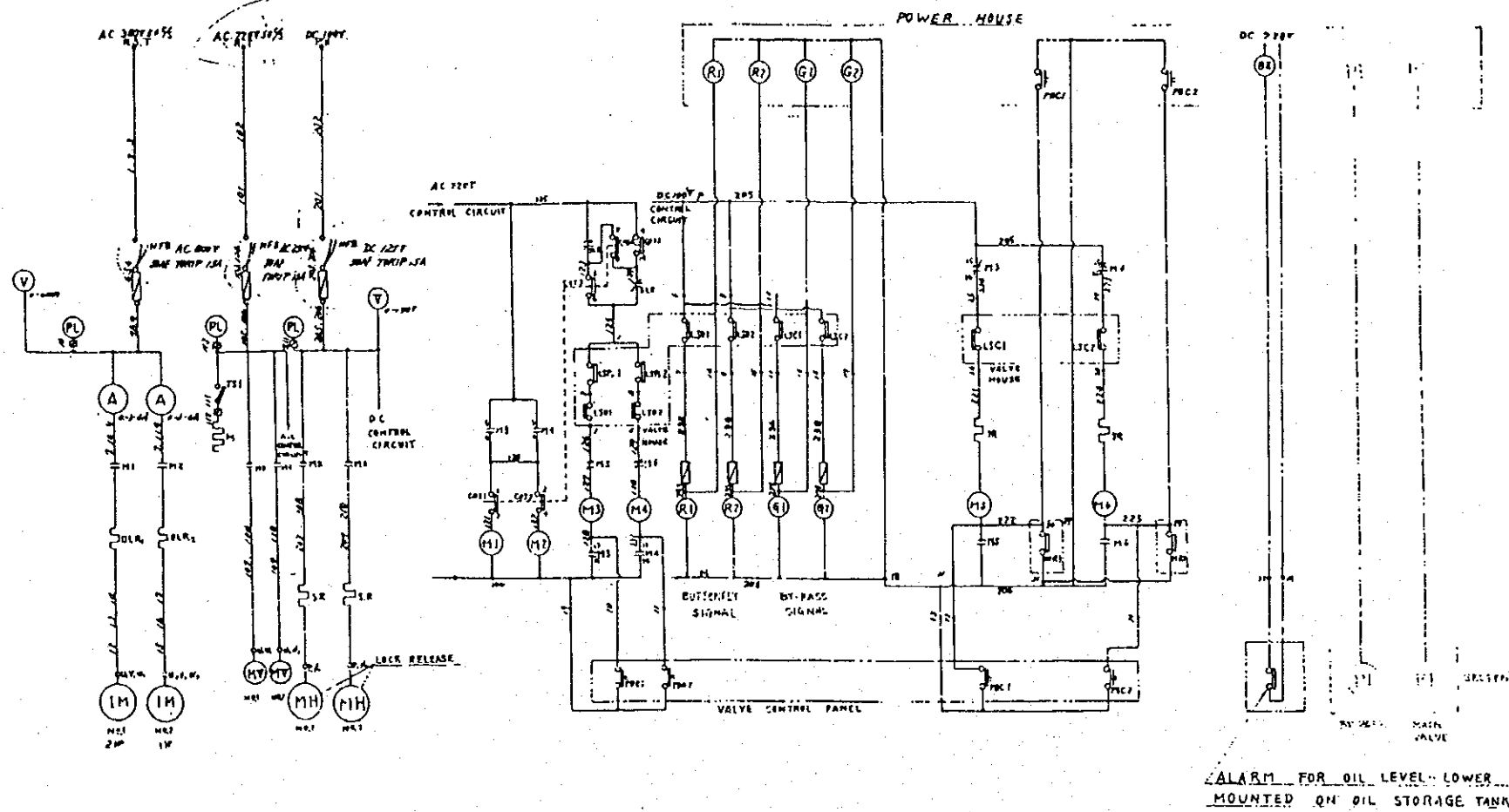


SYMBOL	DESCRIPTION
. I.M	INDUCTION MOTOR
. M.V	SOLENOID VALVE
. M.H	HAMMER UNLOCKING MAGNET
. O.R.L.	OVER LOAD RELAY
H	HEATER
T.S	TUMBLER SWITCH
P.L	PILOT LAMP
S.R	SERIES RESISTANCE.
E.F	ENCLOSED FUSE
N.F.B	NO FUSE BREAKER
C.O.S	SELECTION SWITCH FOR MOTOR
M	MAGNETIC SWITCH
L.S.O	LIMIT SWITCH AT OPENING
L.S.C	LIMIT SWITCH AT CLOSING
L.S.P	PRESSURE SWITCH
L.S.F	LIMIT SWITCH FOR OVER FLOW
P.B.O	PUSH BUTTON FOR OPENING
P.B.C	PUSH BUTTON FOR CLOSING
R.G	SIGNAL LAMP

SYMBOL	DESCRIPTION
I.M	INDUCTION MOTOR
P.F	OIL PUMP
F	FILTER
T	OIL TANK
R.V	RELIEF VALVE
C.V	CHECK VALVE
P.F.M.A.N	MANUAL PUMP
F.C.V	SLOW RETURN VALVE
F.W.V	CONTROL VALVE
S.V	SOLENOID VALVE
C.Y	CYLINDER

註
 1.製作枚 1枚
 2.本図の縮尺は約 1/50
 330x260 に縮少の比.
 3.材料は 1.6mm 厚鋼板 使用の比.
 4.文字は JIS に準ずる.
 5.文字線、フチ等は 浮彫り 及び
 他は 銀線色 エナル 使用の比.

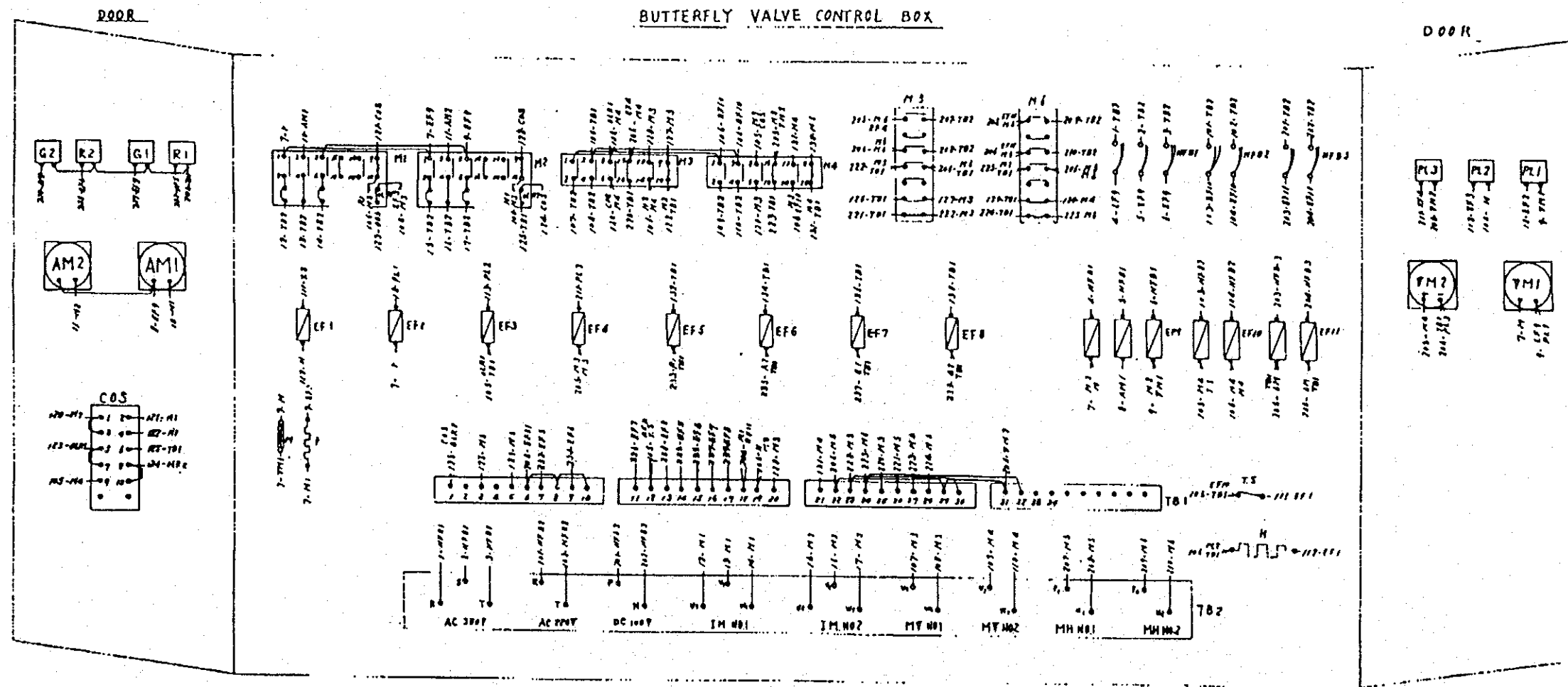
R. 1.14-220V



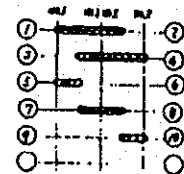
C.O.S CONTACT DIAGRAM

CONTACT NO.	COS 1	COS 2	COS 3	COS 4	COS 5
NO. 1	○		○		
NO. 1, NO. 2	○	○		○	
NO. 2		○			○

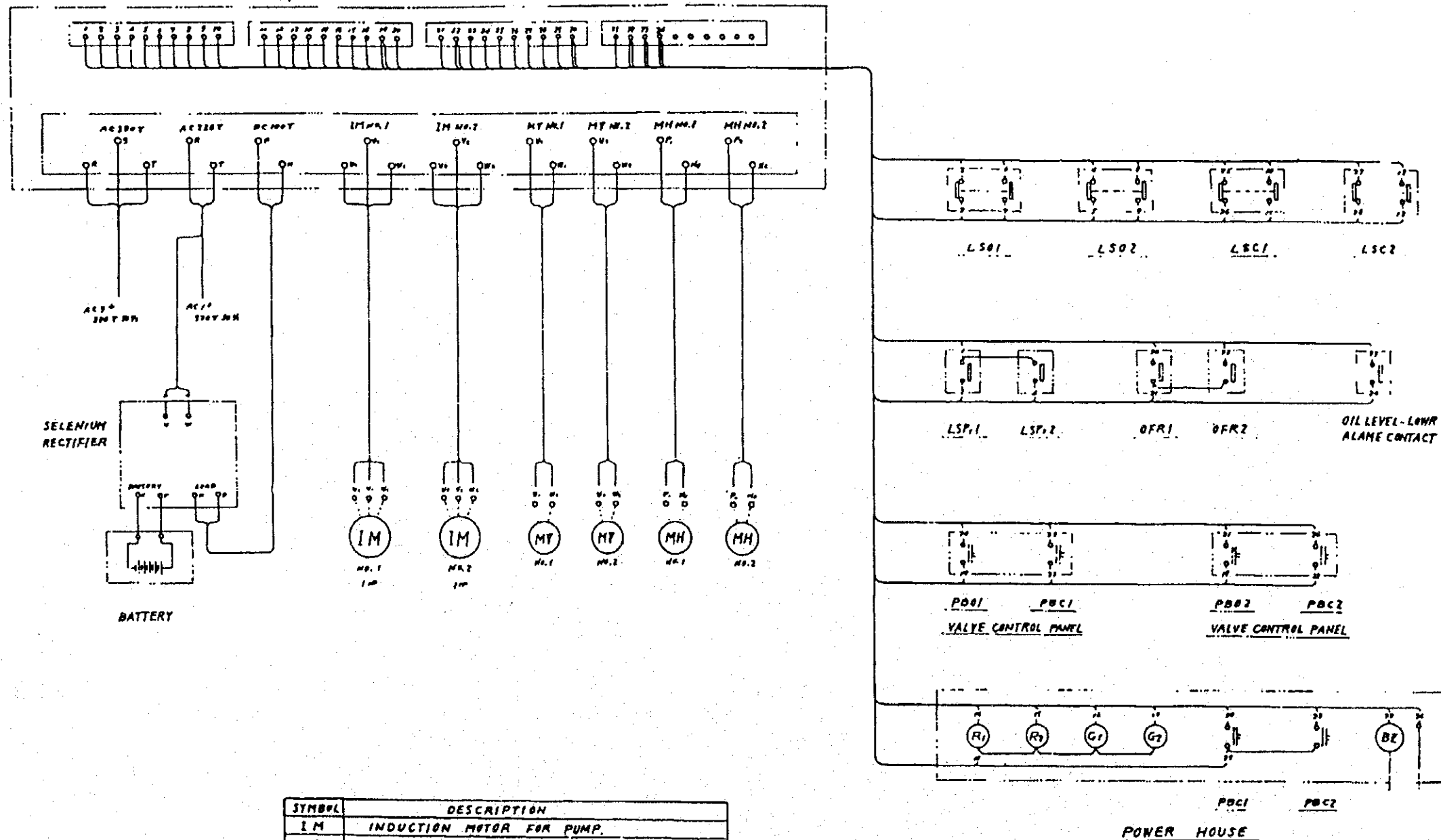
SYMBOL	DESCRIPTION
IM	INDUCTION MOTOR FOR PUMP
NFB	NO FUSE BREAKER
EF	ENCLOSED FUSE
PL	PILOT LAMP
TS	TUMBLER SWITCH
H	HEATER
M1-M2	MAGNETIC SWITCH FOR PUMP
OLR	THERMAL RELAY FOR OVER LOAD
LSO	LIMIT SWITCH FOR OPENING
LSC	LIMIT SWITCH FOR CLOSING
LSP	PRESSURE SWITCH MOUNTED ON AIR RELIEF VALVE
R, G	SIGNAL LAMP
PBO, PBC	PUSH BUTTON FOR OPEN (FOR CLOSE)
QFR	TRIPPING DEVICE FOR EMERGENCY FLOW CONDITION
M3, M4	MAGNET SWITCH FOR HYDRAULIC PILOT VALVE
M5, M6	MAGNET SWITCH FOR HAMMER LOCKING
S R	SERIES RESISTANCE



COS CONTACT DIAGRAM

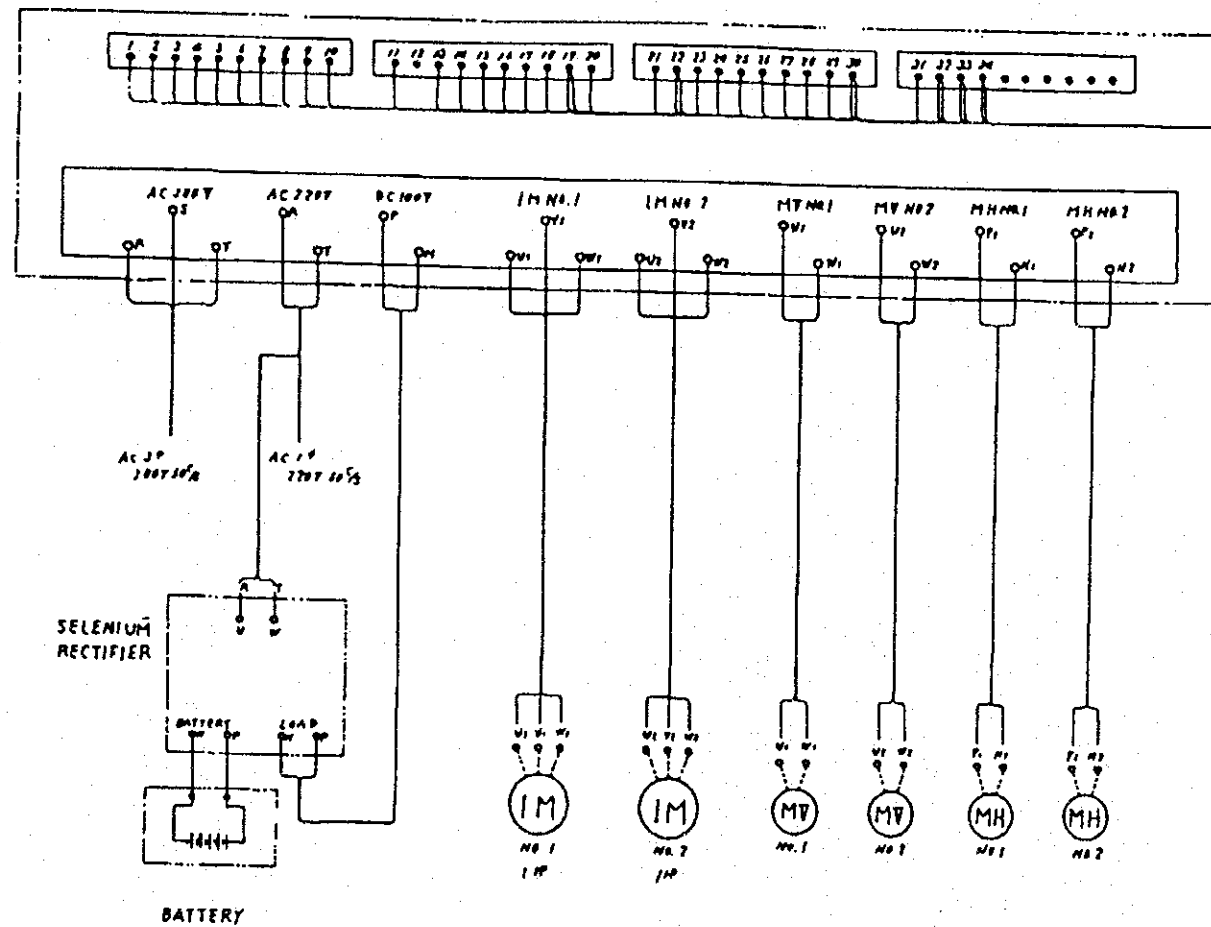


BUTTERFLY VALVE CONTROL BOX

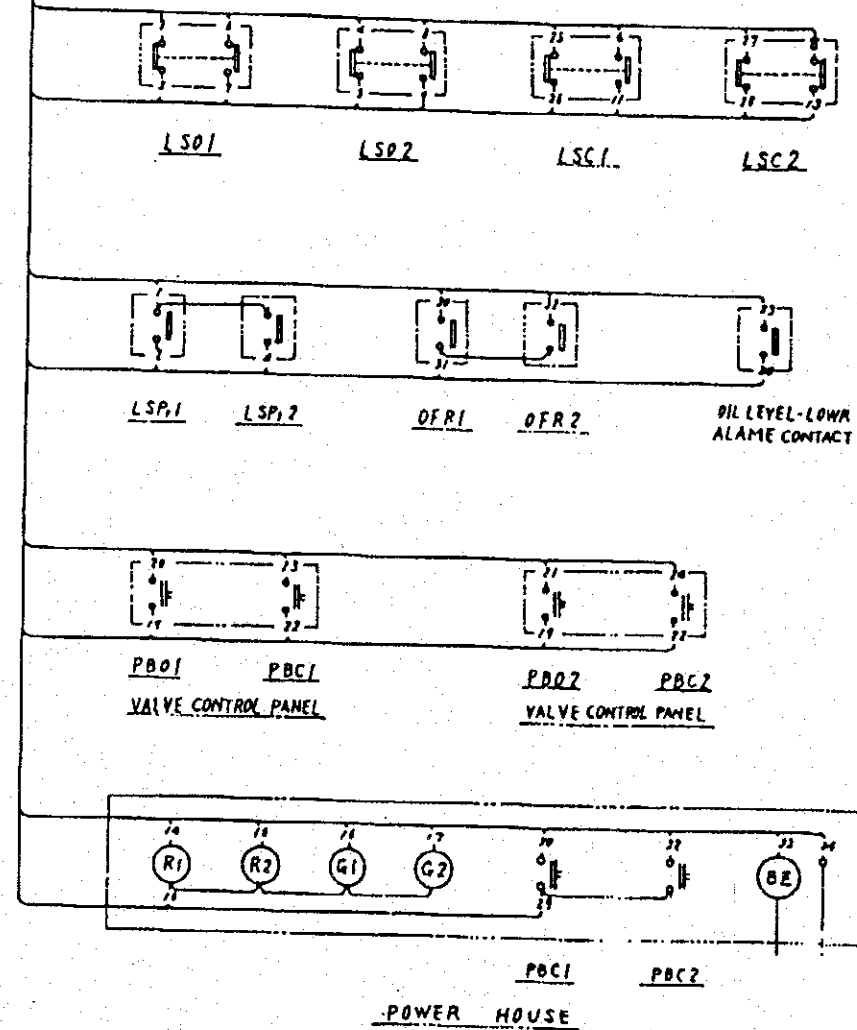


SYMBOL	DESCRIPTION
IM	INDUCTION MOTOR FOR PUMP.
MY	SOLENOID VALVE.
MH	HAMMER UNLOCKING MAGNET.
LSO	LIMIT SWITCH FOR OPENING VALVE.
LSC	LIMIT SWITCH FOR CLOSING VALVE.
LSP	PRESSURE SWITCH.
OFR	TRIPPING DEVICE SWITCH FOR EMERGENCY FLOW CONDITION
PBO	PUSH BUTTON SWITCH FOR OPEN
PBC	PUSH BUTTON SWITCH FOR CLOSE

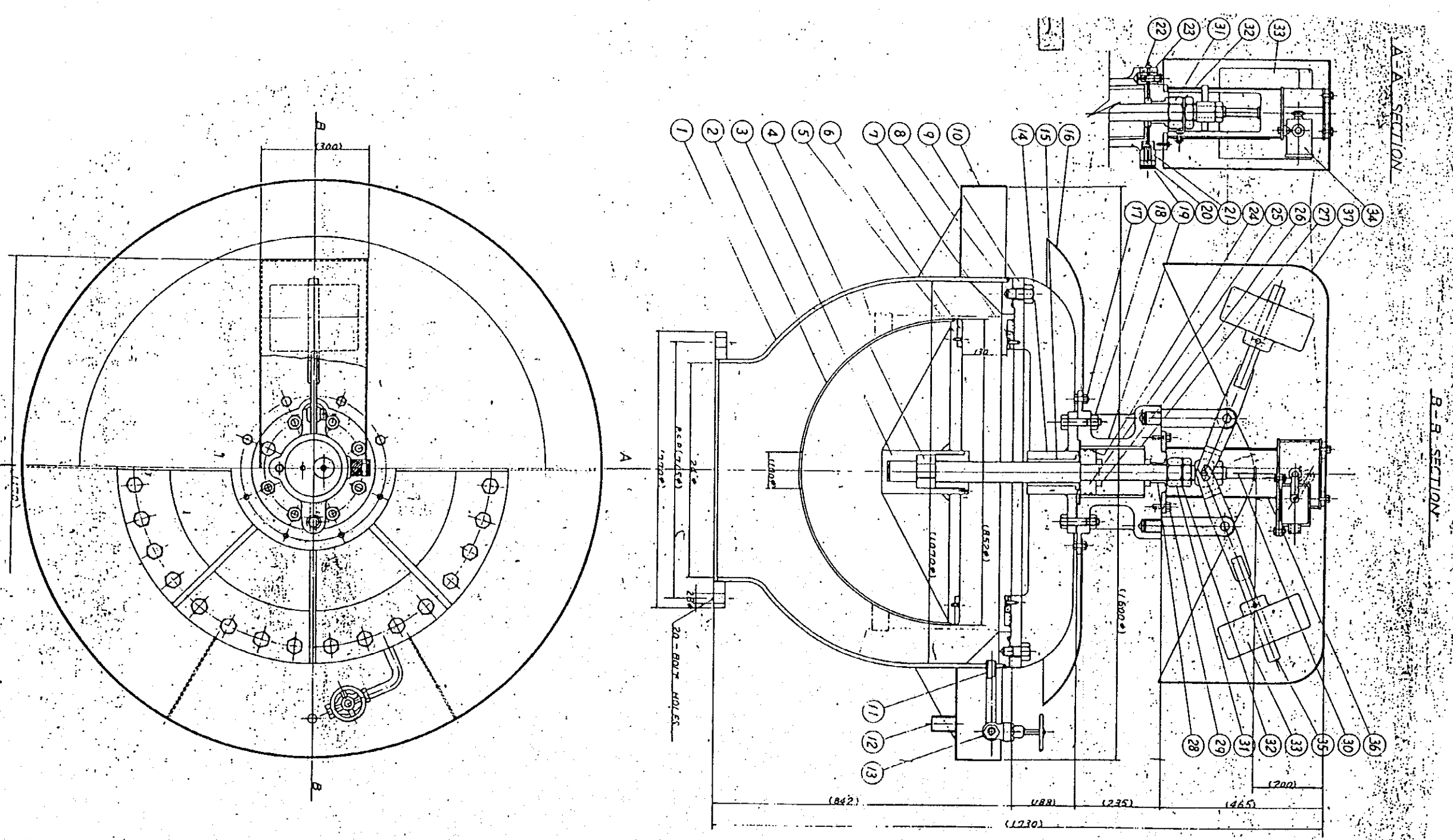
BUTTERFLY VALVE CONTROL BOX



SYMBOL	DESCRIPTION
IM	INDUCTION MOTOR FOR PUMP
MV	SPLendid VALVE
MH	HAMMER UNLOCKING MAGNET
LSD	LIMIT SWITCH FOR OPENING VALVE
LSC	LIMIT SWITCH FOR CLOSING VALVE
LSP	PRESSURE SWITCH
DFR	TRIPPING DEVICE SWITCH FOR EMERGENCY FLOW CONDITION
PBO	PUSH BUTTON SWITCH FOR OPEN
PBC	PUSH BUTTON SWITCH FOR CLOSE



TERMINAL NO.	WIRE COLOR
1	YELLOW
2	
3	BLUE
4	
5	BROWN
6	GRAY
7	BLACK
8	
9	YELLOW-GREEN
10	
11	GREEN, BLUE
12	
13	BLACK, BLUE
14	
15	
16	
17	
18	
19	BROWN, BLACK
20	BROWN, GRAY
21	BLACK, GRAY
22	YELLOW, GREEN
23	BLACK, GREEN
24	GREEN, BROWN
25	BLACK, GRAY
26	
27	
28	
29	
30	BROWN, BLACK
31	GREEN, BLACK
32	YELLOW, BROWN



STROKE OF VALVE (FLOAT) 130
 HYDRAULIC TEST PRESSURE 350 % (240/80)

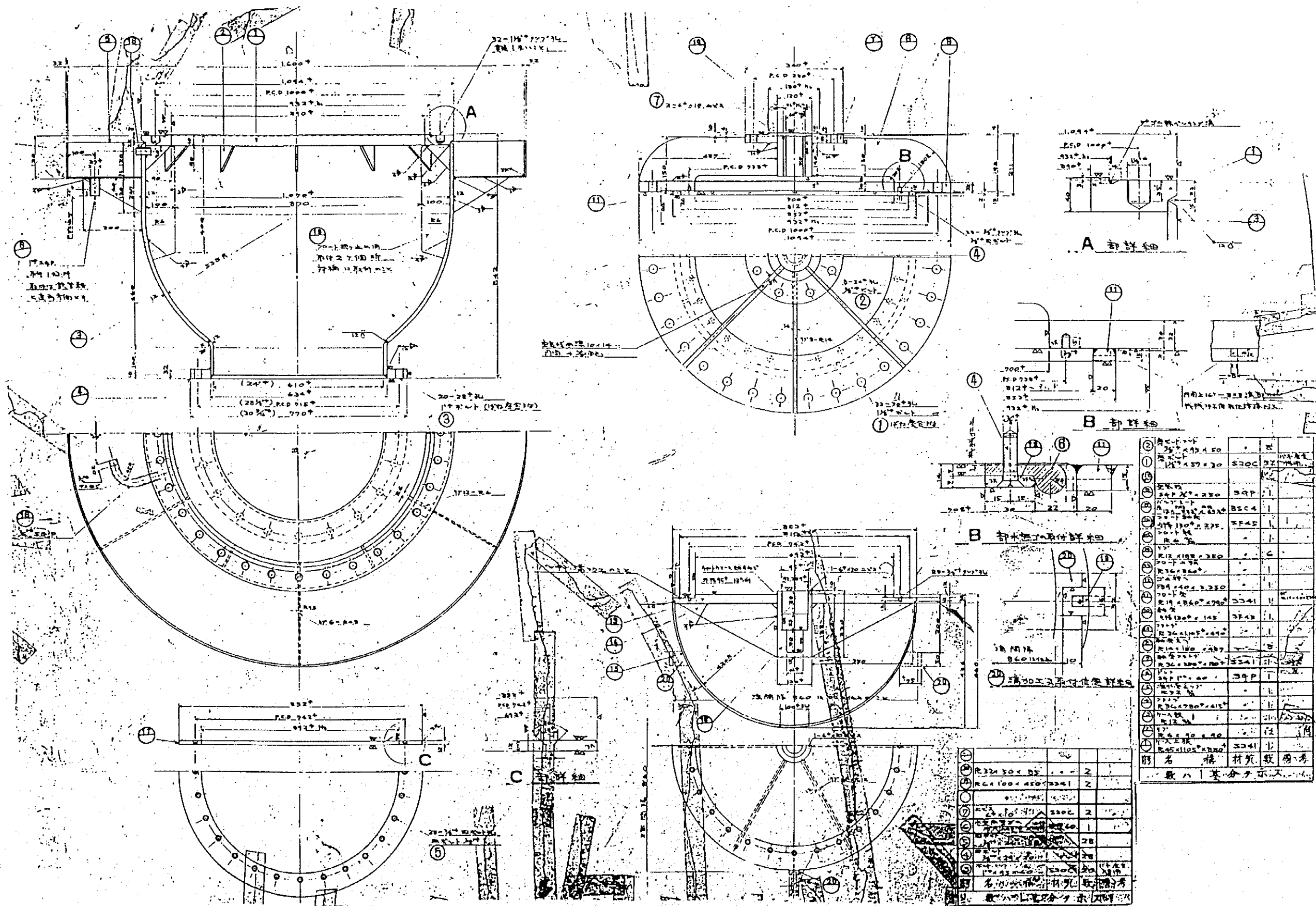
37	WEIGHT COVER	SS&I	1
36	STEM COVER	SS&I	1
35	WEIGHT LEVER	SS&I	1
34	LIMIT SWITCH	FC 15	1
33	WEIGHT	FC 15	1
32	OPENING INDICATOR	SS&I	1
31	ADJUSTING NUT	SS&I	2
30	STEM	SS&I	1
29	BOLTS	SS20C	4
28	BUSH	BC 4	1
27	CYLINDER LINING	BC 4	1
26	NUT	SS 45	1
25	PISTON	BC 4	1
24	PISTON RINGS	FC 15	2
23	BALL	SS&I	1
22	AIR INLET	BC 4	1
21	AIR OUTLET	BC 4	1
20	AIR OUTLET	BC 4	1
19	CYLINDER	FC 23	1
18	BOLTS AND NUTS	SS20C	1
17	BOLTS AND NUTS	SS20C	8
16	SEPARATE REFLECTOR	SS&I	1
15	BUSH	BC 4	1
14	VALVE COVER	SS&I	1
13	STOCK VALVE	BC 4	1
12	DRAIN PIPE	SGP	1
11	AIR OUTLET	SS&I	1
10	WATER PAN	SS&I	1
9	VALVE COVER	SS&I	1
8	BOLTS	SS20C	12
7	VALVE SEAT (BODY)	RUBBER	1
6	VALVE SEAT (VALVE)	BC 4	1
5	BOLTS	BC 4	28
4	SEPARABLE RING	BC 4	1
3	BOLTS	SS&I	1
2	VALVE (BODY)	SS&I	1
1	BODY	SS&I	1
NO	DESCRIPTION	MATERIAL	QTY

24" AUTOMATIC AIR
 RELIEF VALVE

FEASIBILITY STUDY ON
 REHABILITATION OF DA NHIM
 POWER SYSTEM

MINISTRY OF ENERGY
 JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 1.56
 2,000 mm Butterfly Valve
 Air Relief Valve (1/2)

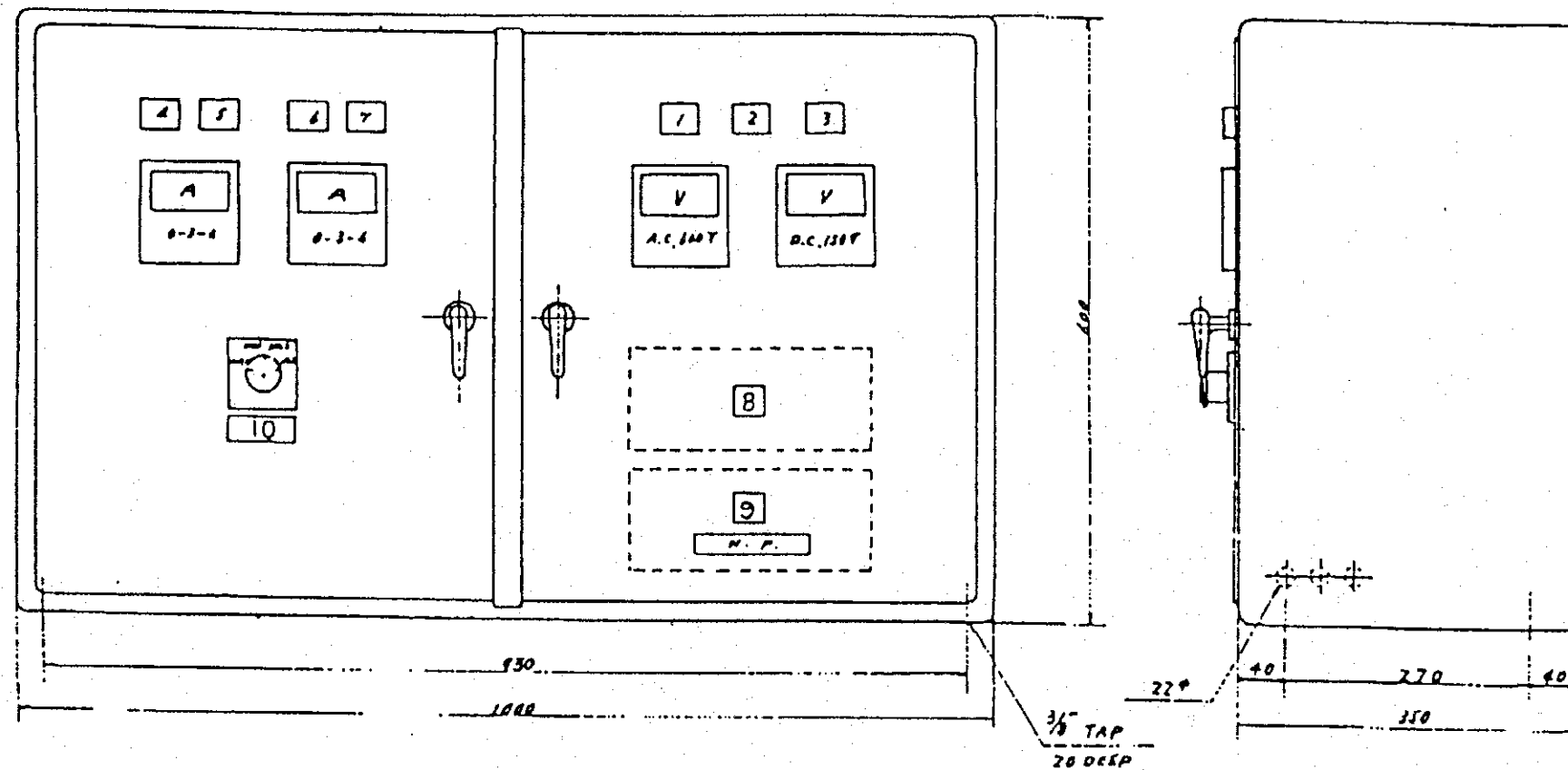


部名	材料	数量	備考
1			
2			
3			
4			
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FEASIBILITY STUDY ON REHABILITATION OF DA NIHM POWER SYSTEM

MINISTRY OF ENERGY
JAPAN INTERNATIONAL COOPERATION AGENCY

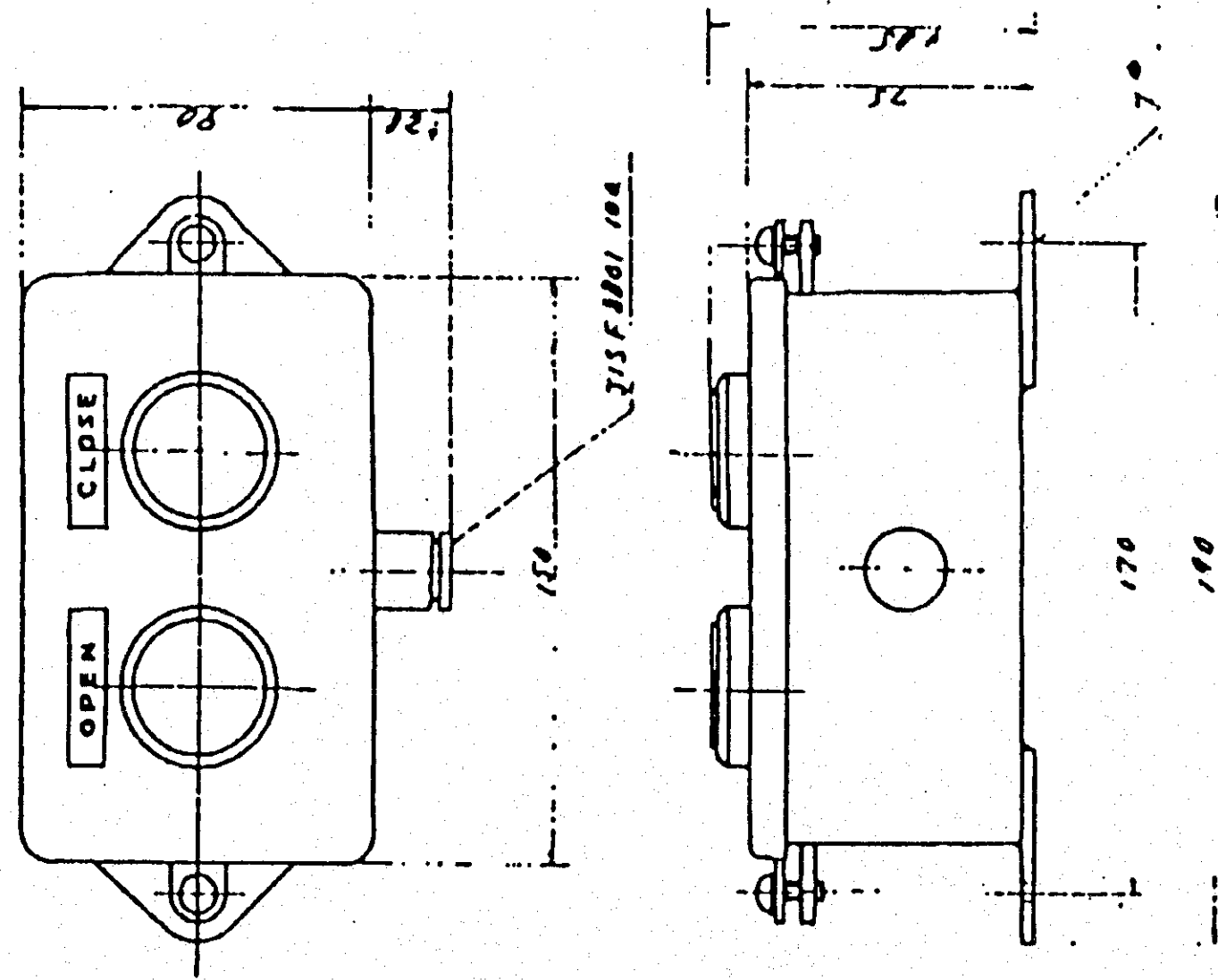
Figure 1.57
2,000 mm Butterfly Valve
Air Relief Valve (2/2)

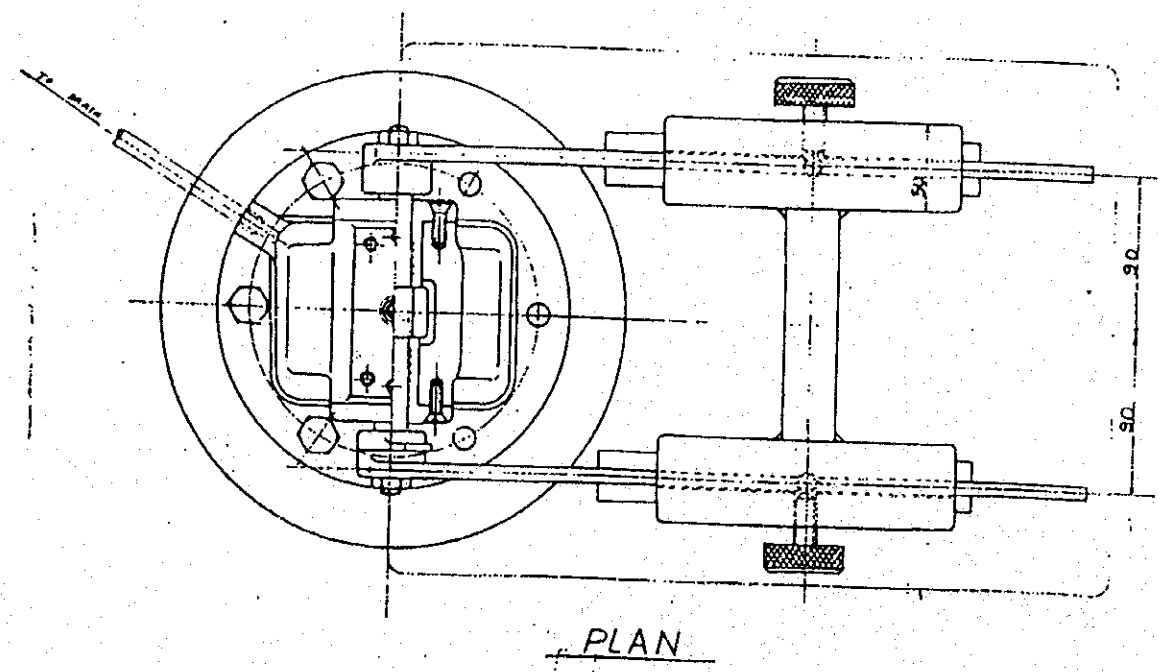
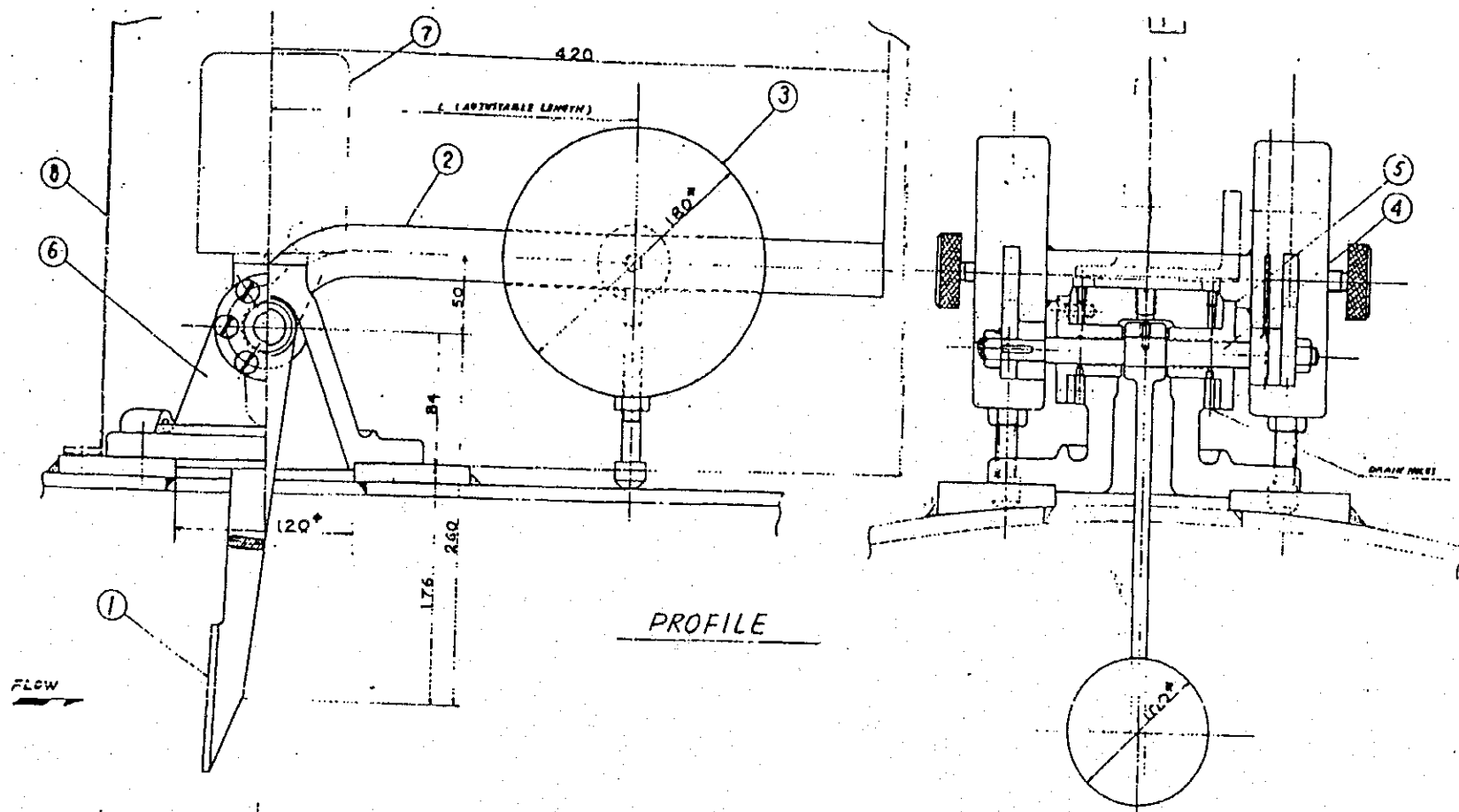


REMARKS

NO	NAME	GLOBE COLOR
1	A.C. 400	WHITE
2	A.C. 230	WHITE
3	D.C. 100	WHITE
4	OPEN	RED
5	CLOSE	GREEN
6	OPEN	RED
7	CLOSE	GREEN

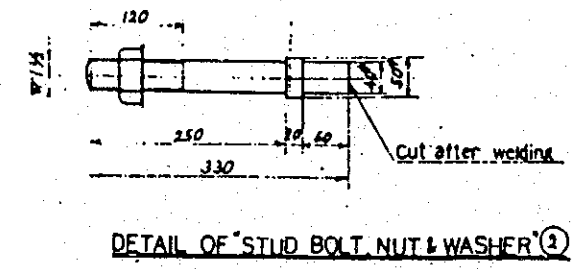
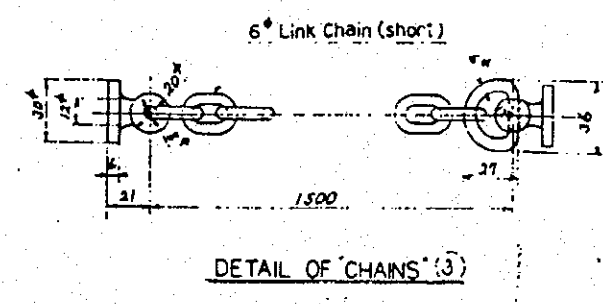
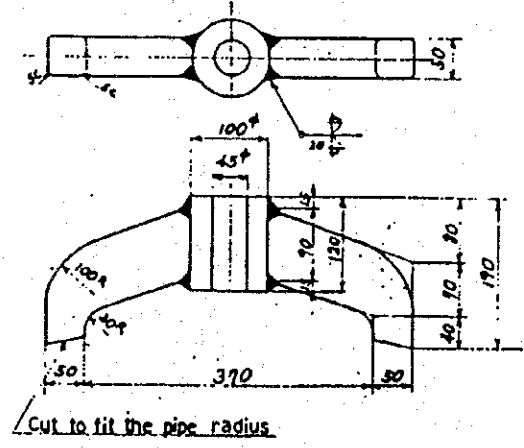
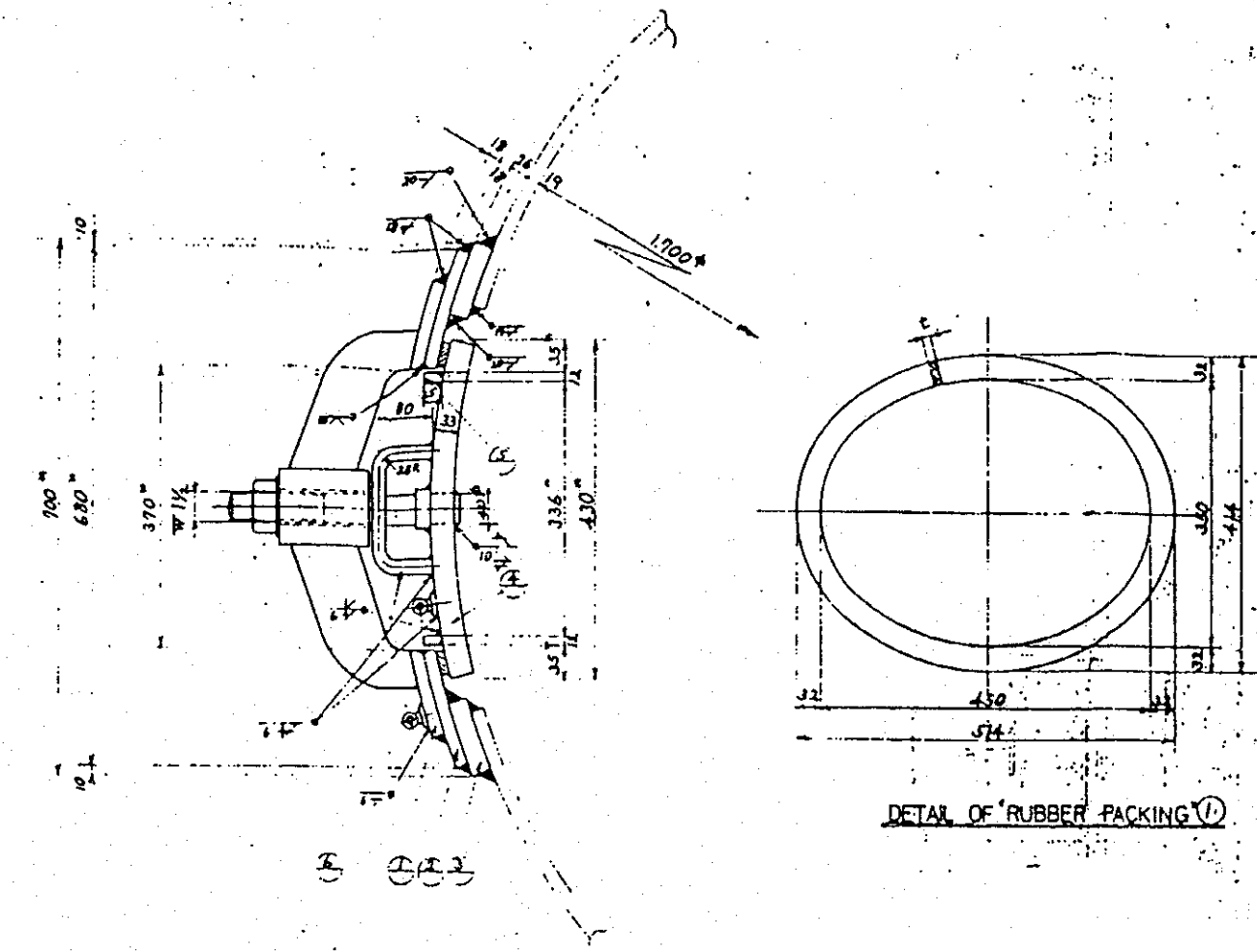
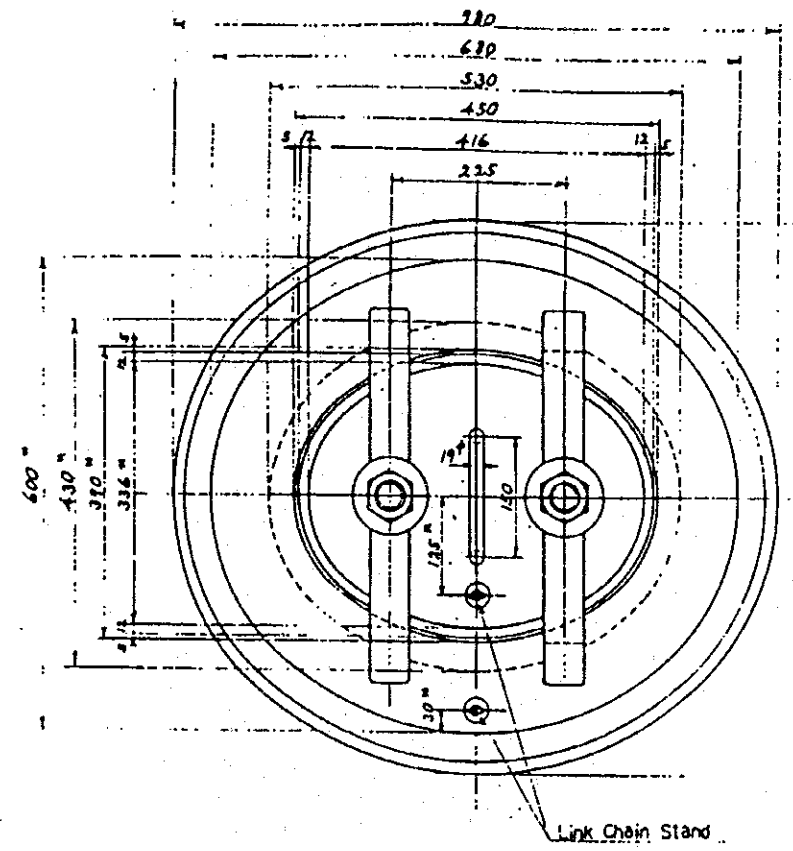
- 8] SCHEMATIC CONTROL DIAGRAM (ATTACHED INSIDE OF DOOR)
- 9] CONTROL WIRING DIAGRAM (" " ")
- 10] SELECTION SWITCH FOR MOTORS
 Note: "NO. 1" SHOWS NO.1 MOTOR, AND
 "NO. 2" SHOWS NO.2 MOTOR.





NOTES:
 1. MOUNTING IS SHOWN ON
 DWG. NO. 13953.
 2. FOR WELDING OF SEATS,
 SEE I/W. NO. 14050.

ITEM	DESCRIPTION	MATERIAL	REMARK
①	PADLE	CAST BRONZE	JIS BC3
②	CONNECTING LEVER	MILD STEEL	JIS S541
③	COUNTER WEIGHT	MILD STEEL	JIS S541
④	SHAFT	STAINLESS STEEL	JIS SUS22
⑤	BEARING BUSHES	CAST BRONZE	JIS BCB
⑥	BRACKET	CAST IRON	JIS FC20
⑦	SWITCH UNIT		
⑧	COVER		

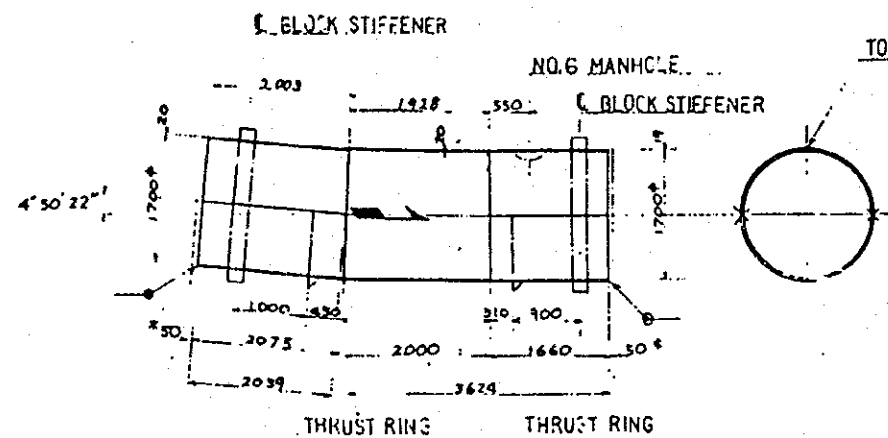


PARTS LIST

ITEM	DESCRIPTION	MATERIAL	NO. REQ'D	NOTE
(1)	Reinforcement A	SM580	1	
(2)	Reinforcement B	SM580	1	
(3)	Filler	SM580	1	
(4)	Cover	SM580	1	
(5)	Packing Stopper	SS41	1	
(6)	Handle	SS41	1	
(7)	Keep Plate	SS41	2	
(8)	12" Rubber Packing	RUBBER	1	
(9)	1 1/2" Stud Bolt, Nut & Washer	SS41	2	Gal'd
(10)	Chains	SS41	1	

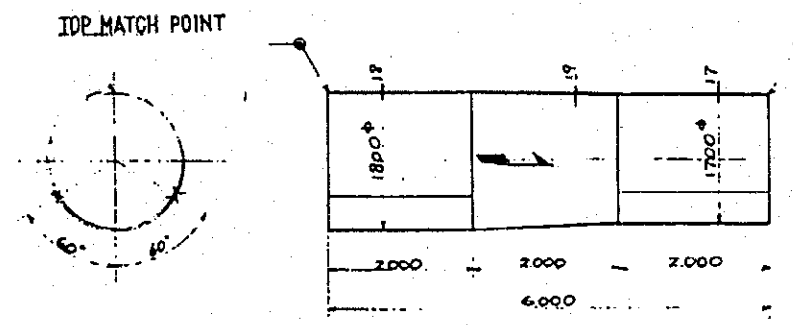
NOTE

1. Mark * shows developed dimension.
2. Fitting Pipe No. : (14)
3. Fitting Position : Top point of the pipe

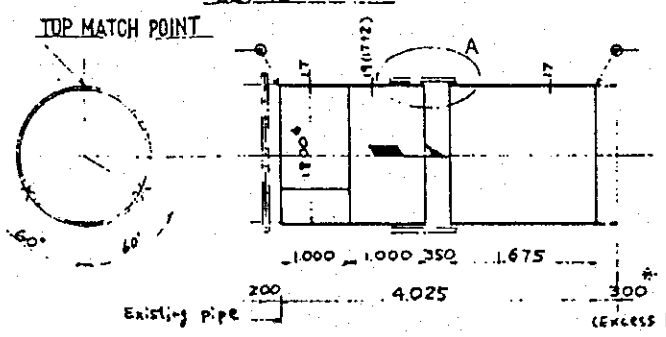
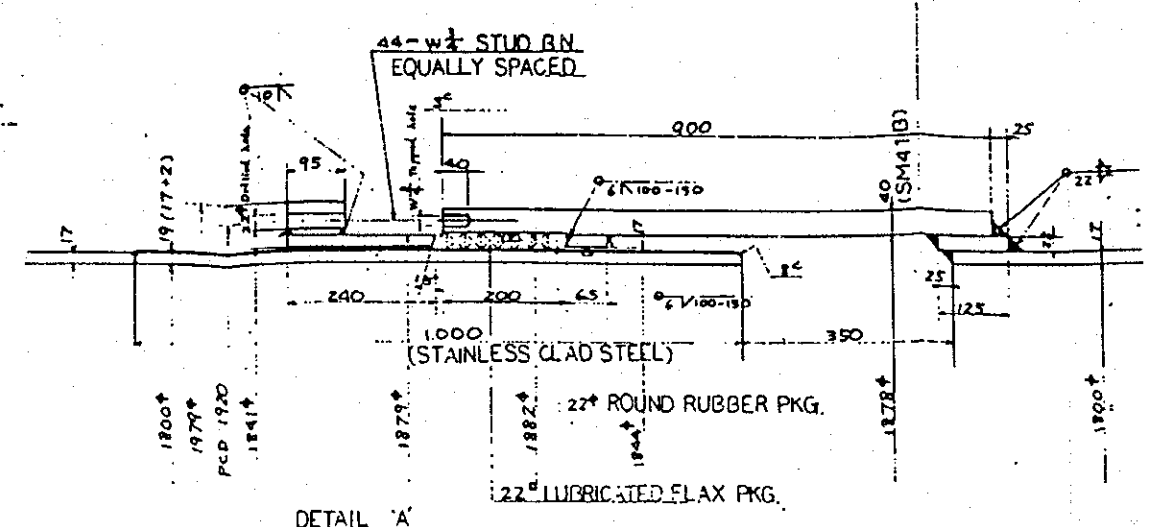


PIPE NO. 114
 BEND NO. 6
 $\theta = 4^\circ 50' 22''$
 $\tan \frac{\theta}{2} = 0.0422548$
 $Z = 7.2$
 NO. REQ'D 1

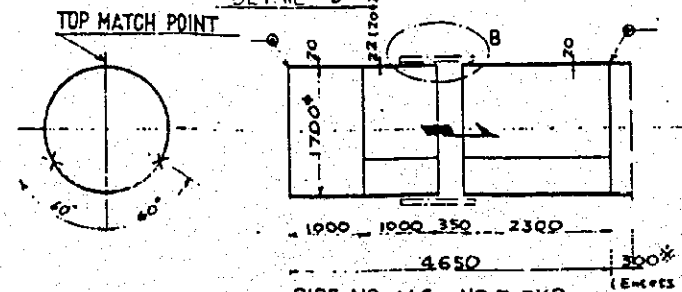
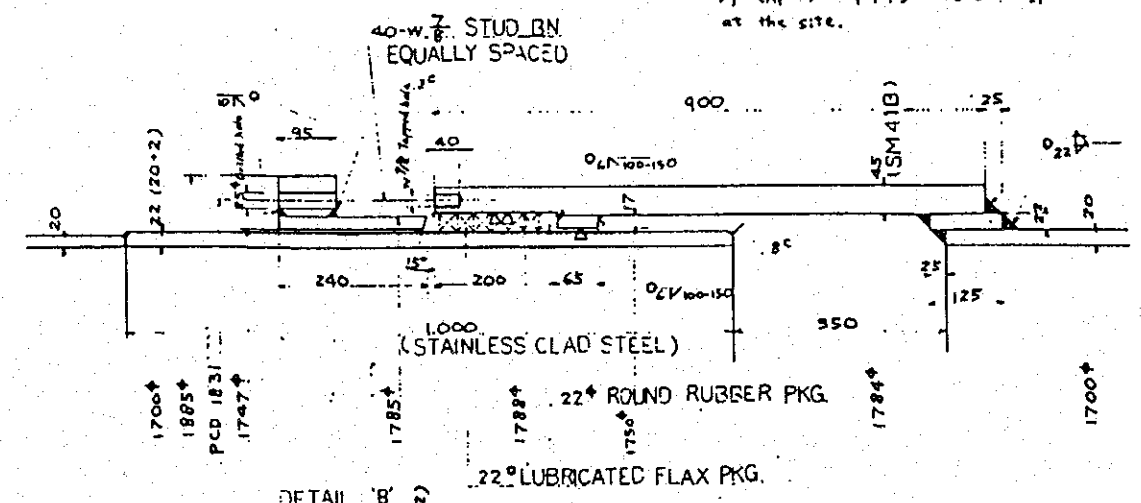
REMARKS
 * Marked 50mm excess length of bend pipe shall be cut off and provided with appropriate welding groove after the 'Shop Hydraulic Test'.



PIPE NO. 103 (REDUCER)
 NO. REQ'D 1



PIPE NO. 93 NO.6 EXP.
 NO. REQ'D 1
 * Marked 300mm excess length of expansion pipe shall be cut-off at the site.



PIPE NO. 116 NO.7 EXP.
 NO. REQ'D 1



STUD BOLTS NUTS
 Zn Galvanized

d_1	NO. REQ'D	EXP. NO.
$w \frac{3}{4}$	44	6
$w \frac{7}{8}$	40	7

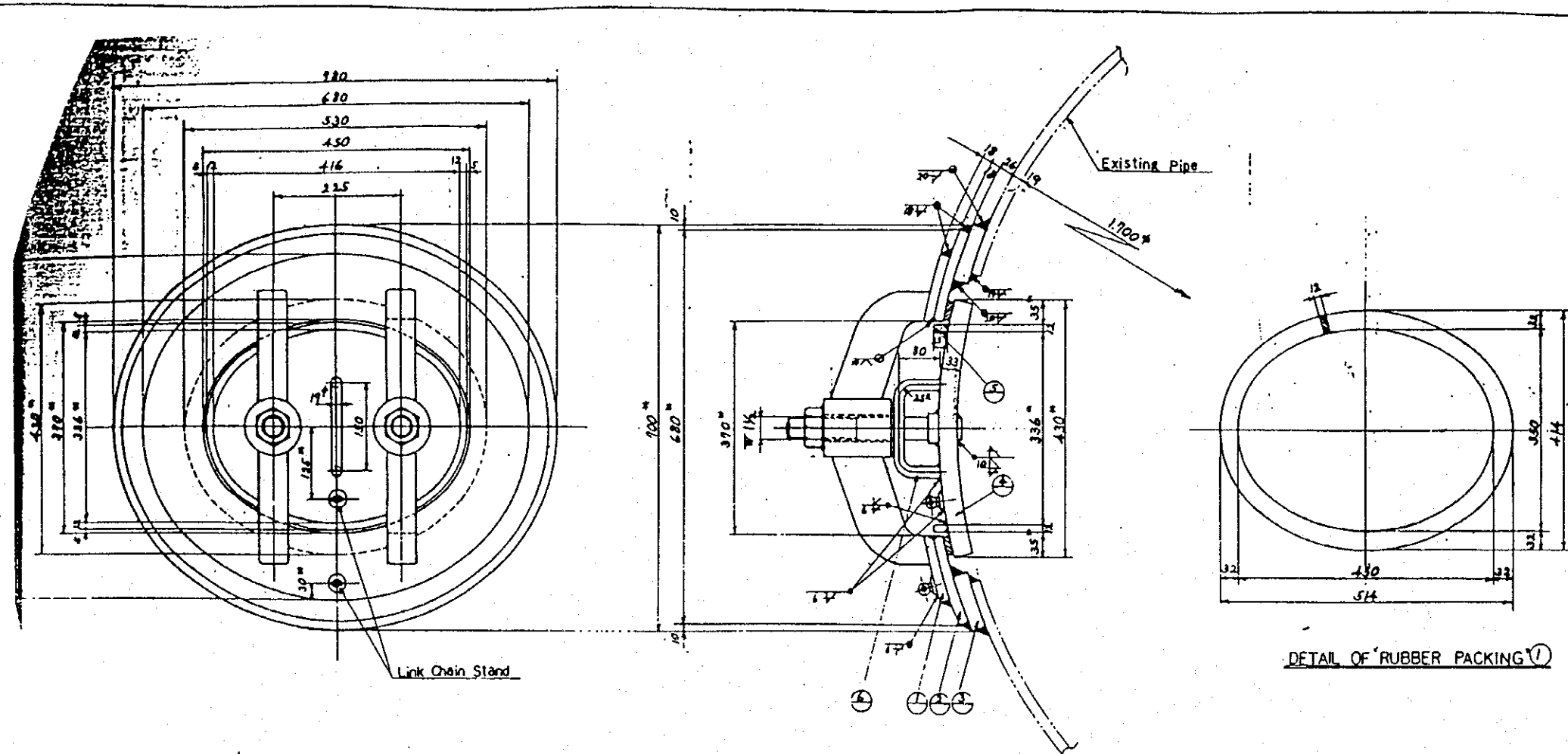
$N = d_1$ Push-off bolts
 Equally spaced between Stud-bolts



PUSH-OFF BOLTS
 Zn Galvanized

d_1	N	NO. REQ'D	EXP. NO.
$w \frac{5}{8}$	11	1	6
$w \frac{3}{4}$	10	1	7

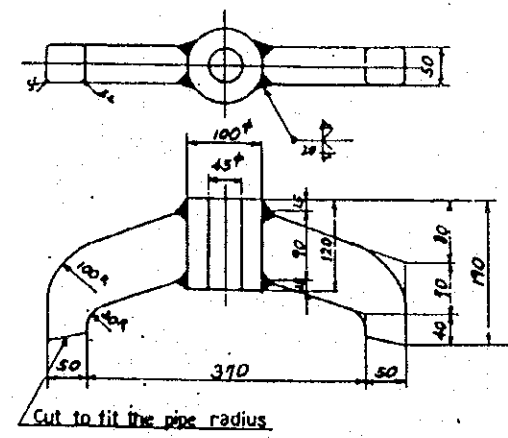
REMARKS
 MATERIAL
 PIPE SHELL SM58Q
 EXP. OUTER SLEEVE --- SM41B
 OTHERS SS41



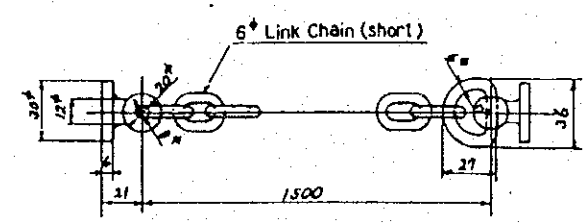
PARTS LIST

ITEM NO.	DESCRIPTION	MATERIAL	NO. REQ'D	NOTE
①	Reinforcement A	SM58Q	1	
②	Reinforcement B	SM58Q	1	
③	Filler	SM58Q	1	
④	Cover	SM58Q	1	
⑤	Packing Stopper	SS41	1	
⑥	Handle	SS41	1	
⑦	Keep Plate	SS41	2	
⑧	Rubber Packing	RUBBER	1	
⑨	W 1/2 Stud Bolt, -Nut & Washer	SS41	2	Gal'd
⑩	Chains	SS41	1	

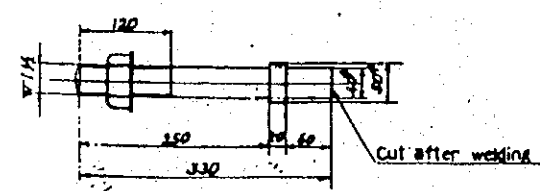
NOTE
 1. Mark * shows developed dimension.
 2. Fitting Pipe No. : (14)
 3. Fitting Position : Top point of the pipe



DETAIL OF 'KEEP PLATE' (7)



DETAIL OF 'CHAINS' (10)



DETAIL OF 'STUD BOLT, NUT & WASHER' (9)

CHAPTER 2

TECHNICAL SPECIFICATION FOR TURBINES

**CHAPTER 2 TECHNICAL SPECIFICATION OF TURBINE AND
ANCILLARY FACILITIES**

SECTION 1

GENERAL SPECIFICATIONS

1.1 Scope of Works

The Contract shall include the designing, manufacturing, testing before shipment, finishing, galvanizing and protective coating where specified packing for export, insuring to the power plant, shipping and delivery to the Port of Saigon, landing, customs clearance, transport from the Port of Destination to the Site and delivery to the Site of all the following:

(1) Runners and bolts concerned	4 sets
(2) Components of upper and lower nozzle, needle and deflectors	4 sets
(3) Baffle plate of turbine housing	4 sets
(4) Jet brake and pipe	4 sets
(5) Parts for repair of deflector servomotor	4 sets
(6) Parts for repair of inlet valve	4 sets
(7) Bypass valve	4 sets
(8) Distributing valve and distributor	4 sets
(9) Discharge valve of penstock and branch pipe	1 set each
(10) Valve and piping material for high pressure waterline	4 sets
(11) Renewal parts of oil pressure system	4 sets
(12) Air compressor	1 set
(13) Renewal parts of water supply system	2 sets
(14) Governor	4 sets

All the site works will be carried out by the workforces of the Employer.

The Contract shall include the dispatch of their installation and repairing supervisors, and services of instruction to the project staff and Employer's shop inspection. All shall be in accordance with these Specifications, the accompanying Drawings and Tender Schedules.

1.2 General Description of the Project

The Da Nhim Hydro Power project located at about 250 km northeast of the Ho Chi Minh City, was constructed in 1964 with the installed capacity of 160 MW (4 units x 40 MW).

The Da Nhim basin which feeds water to the reservoir has an area of about 1,400 km², and an annual rainfall of 1,700 mm.

1.3 Climate

Generally, the site of the Da Nhim power station is subjected to the summer and winter monsoons.

The alternation of season is as follows:

- Jan. - Mar. : Dry and cool season under continental winter monsoon
- Apr. - May : Thunderstorm season with the highest temperature
- Jun. - Aug. : Summer season, west wind, accompanied by long rain
- Sept. - Dec. : Changeable weather, some times truck by typhoon with heavy rainfalls resulting in flood

Atmospheric temperature in this site is divided into two parts. One is the power station site with an altitude of about 200 meters where the climate is tropical and not so comfortable and the other is the dam and tunnel sites with an altitude of more than 1,000 meter where the climate is moderate and comfortable.

The temperature ranges from 40°C to 15°C at the power station site and from 30°C to 15°C at the dam site. The temperature difference in a day is more than 10°C.

The average humidity is 60 to 70% in the dry season and more than 70% in the rainy season.

In the day time, the humidity drops to less than 70% in any season and to less than 50% even at the hottest period at the end of dry season.

1.4 Traffic Condition

There is the railway having a track gauges of 1 meter from Ho Chi Minh to Phan Rang on a length of about 350 km.

Rain shipment on the largest flat car from Saigon is subjected to the following limitation.

Width	:	2.1 m
Length	:	11.1 m
height	:	2.5 m
Load	:	25 metric ton

The paved high way, national route No. 20, runs to Don Duong from Ho Chi Minh through mountainous area on a distance of about 250 km, and the national route No. 11 runs on about 350 km along east coast to the power house.

The highways are 6 m in width with the minimum bridge capacity of 12 metric tons.

The steepest grade of the highway is 6 percent except 10 percent in the mountainous areas where the smallest radius of curve is about 20 m.

The daily air service is available between the Ho Chi Minh airport and the Lien Khang airport which is about 30 km apart from the dam site.

The required time fo air travelling between the two airports is approximately 50 minutes.

1.5 Telephone Facilities

At least two circuits of telephone line will be, but exclusive use available to the Contractor at terminals of the telephone facilities in the site.

The Contractor shall provide and install and wiring and telephone and telefax sets at his own cost and expense, from such terminals.

1.6 Permanent Electricity Supplies

The power supply at the site is:

(1) Alternate Current

3-phase, 4-wire, 50 Hz

Voltage between phases 400 volts

Voltage between phase and neutral 230 volts

Voltage variation $\pm 10\%$

Frequency variation $\pm 5\%$

Neutral point Solidly grounded

(2) Direct Current

220 volts, 2 wires for essential controls, indication, alarm, emergency lighting, circuit breaker tripping, control motors and control device. All equipment and apparatus shall be capable of operating satisfactorily at ± 20 percent of the rated voltage.

1.7 Grounding

All electrical equipment in the plant shall be substantially grounded to the existing grounding system in the vicinity of the respective structure. Adequate size of copper grounding conductor, based on the maximum ground fault current and the protection in the circuit, shall be used for these connections and the minimum size shall be 8.00 mm².

1.8 Tropicalization

In choosing materials and their finishes due regard shall be given to the humid tropical condition under which the power plant and equipment will be called upon to work.

The Contractor shall submit details of his practice which have been proven satisfactorily.

The materials and finishes used shall be approved by the Engineer.

All control cubicle or box shall also be vermin proof and the minimum thickness of steel plate of them shall be 2.3 mm.

1.9 Change to Material or Equipment

The Contractor shall not make any changes to the equipment or the materials to be incorporated in the equipment from that specified or implied in the specifications without the written approval of the Engineer.

Such change or alteration shall in no way be detrimental to the interests of the Employer and shall not result in any increase to the Contract price.

1.10 Labels and Plates

The Contractor shall supply and install at least one name plate made of bronze or corrosion-resisting steel in approximately 500 mm wide by 400 mm high, for each Plant to be provided under this Contract. All duty labels and instruction plates on cubicles and equipment, including above name plates, shall be in either English or Vietnamese language.

The Contractor shall submit sentence and letters in English of all duty labels and instruction plate to the Engineer. Translation from English to Vietnamese will be made by the Employer.

Unless otherwise required by the Engineer, all data and name plates on equipment shall be in English.

1.11 Drawings and Documents to be Supplied by the Contractor

Award of Contract does not imply the approval of drawings and documents prepared for and submitted with the Tender.

Immediately after concluding the Contract Agreement, the Contractor shall firstly submit a master list of drawings and documents to be provided under the Contract for approval of the Engineer, clearly indicating title (to always contain the Employer's name, Project name, Contract No., Work Division, etc.), numbering method, size and quantity of drawings, dimensions and form of title block and bibliography, etc.

The Contractor shall include in his Tender the cost for preparation of the drawings, documents and others to be provided under this Contract.

(1) Drawings and Documents for Approval

Prior to commencement of manufacturing the Plant, the Contractor shall submit the design criteria, calculations, specifications, dimensioned and traced drawings and diagrams showing all details of the Plant and materials to be used as well as all arrangements related to the other contractor's works, for approval of the Engineer and the Employer simultaneously. These drawings and data with stamp of "FOR APPROVAL", "DATE OF SUBMISSION" and "CONTRACTOR'S SEAL" shall be submitted within the times mentioned hereunder reckoned in calendar month from the Commencement Date. The Contractor shall allow a period of at least six (6) weeks for such approval procedure and another one (1) week for return mail after receipt by the Engineer. One copy of them submitted will be returned to the Contractor by the Engineer with one of the marks tentatively planned as "APPROVED" or "APPROVED EXCEPT AS NOTED" (authorizing the Contractor to proceed with the contractual works taking account of the Notes) or "RETURNED FOR CORRECTION AND RESUBMISSION". In any case these shall be submitted in sufficient time to permit modifications to be made, if such are deemed to be necessary and/or are instructed by the Engineer without delaying the completion of the Works. Claims or extensions of time will not be permitted on account of the late submission of drawings and documents to the Engineer or for delays caused by drawings and documents being not approved by the Engineer.

It is to be understood, however, that approval of drawings and documents will not relieve the Contractor of any responsibility in connection with the Work.

All drawings and documents to be submitted for approval or sent to the Employer or the Engineer for any other reason shall be sent by registered airmail or by hand.

The title of the drawings, the signature of the Contractor's responsible engineer, the date prepared, the drawing number, etc., shall appear in the bottom right-hand corner of the drawing. The size of drawings shall be as follows:

- A1 594 mm x 841 mm
- A3 297 mm x 420 mm
- A4 210 mm x 297 mm

A blank in 200 mm wide by 100 mm high shall be kept unoccupied above the title block of drawing for the Engineer's comments.

(2) For-Work-Drawings

After approval of the drawings and documents by the Engineer, the Contractor shall supply copies of the approved-drawings with stamp of "FOR WORK DRAWING", "DATE OF APPROVAL" and "CONTRACTOR'S SEAL" to the Employer and the Engineer.

(3) Final Drawings and Documents

After all items of the Work have been manufactured, repaired, erected and commissioned, a complete set of the negatives of the drawings previously approved and/or corrected during site works are to be submitted to the Employer and the Engineer.

Negatives of the drawings to be submitted to the Employer shall be of "Mylar film" or other approved permanent transparent materials, and one set of microfiche, and those to the Engineer shall be of microfiche.

The reduced size of drawings into A3 size shall be bound in A3 size covers and be submitted to the Employer and the Engineer.

(4) Required Numbers of Drawings and Documents

Numbers of the drawings and documents to be submitted to the Employer and the Engineer shall be as follows:

	<u>To the Employer</u>	<u>To the Engineer</u>
<u>Within times mentioned</u>		
Drawings and documents for approval	6 copies	9 copies
For-work-drawings and documents	- do -	4 copies
<u>Within two(2) months upon Completion of the Work</u>		
Complete set of negatives of drawings and documents	1 set	NIL
Complete set of microfiche of drawings and documents	1 set	1 set
Complete set of bound print of drawings and documents		
Full size	6 sets	NIL
Reduced size (A3 size)	4 sets	2 sets

Further copies of particular drawings and documents are to be provided at the Contractor's own expense if so requested by the Engineer or the Employer.

1.12 Operation and Maintenance Manuals

The Contractor shall submit to the Engineer the general instructions concerning the correct manner of operation and maintenance of all the Plant provided under this Contract with special references to any recently developed features.

The instruction manual shall be prepared for each plant system as outlined in Clause 1.1 "Scope of Work", and shall be submitted for approval in the same manner as the drawings. It shall be finalized before delivery of the Plant to the Site, and when finally approved, ten (10) copies and two (2) copies shall be prepared and forwarded to the Employer and the Engineer, respectively. The Contractor shall ensure that his supervisor has a copy in his site office.

The instruction manual shall include a separable and complete section describing the normal operating procedures for the control of the Plant, and shall include easily read diagrammatic drawings of the equipment to facilitate understanding the descriptive information.

The instruction manual shall describe and illustrate in detail the method and procedure for assembling, adjusting, operating and dismantling of each component, system and machine and the use of equipment devices necessary for such works. The maintenance of each component shall be described, including the recommended frequency of inspection and lubrication.

The Contractor shall, in preparing the instruction manual, take into account the lack of experience and familiarity of the operating personnel with this type of equipment.

The manual shall include a complete list of all drawings prepared for this Contract, the approved painting specification, the tool list, the spare parts list, the parts list for each component of item of equipment with necessary catalogues, etc. The parts list shall include manufacturer's code and serial numbers and ordering instructions. The parts list shall be detailed for only the equipment supplied and shall not include general reference or description of similar equipment which is of the same model but different only in detail. The manual shall be prepared in English language.

1.13 Instructions for Erection Works

The Contractor shall submit to the Engineer for approval within ten (10) months from the Commencement Date the instruction manual for the erection work of the Plant to be executed at the Site.

The instruction manual shall be submitted for approval in the same manner as the drawings and, when finally approved, three (3) copies shall be submitted to the Employer and two (2) copies to the Engineer. The Contractor shall ensure that his supervisor has a copy in his office at the Site.

The instruction manual shall describe and illustrate in detail the methods and procedures for installation of the Plant, the use of the construction facilities and measurement devices together with their capacity and required number, field shop to be provided for the installation work and other necessary explanations on the installation work.

1.14 Standards and Workmanship

(1) Standard Specifications

Japanese standards as issued by Japanese Government or authorities have been used throughout these specification.

Other material or international standards may be accepted, provided the requirements therein are, in the opinion of the Engineer, equivalent to the current issue of IEC or the Japanese standards.

If the Contract documents conflict in any way with any or all of the above standards or codes, the Contract documents shall have precedence and shall govern.

All equipment, materials and their details shall comply with the requirements of the latest revision of the following codes and standards where applicable:

- | | |
|---|-----|
| (a) Japanese Industrial Standard | JIS |
| (b) Japanese Electro-Technical Committee's Standard | JEC |
| (c) Japanese Electric Machine Industry Association's Standard | JEM |
| (d) Japanese Cable-makers Association Standard | JCS |
| (e) International Electrotechnical Commission | IEC |

(f) International Organization for Standardization

ISO

(g) Standard of local regulatory bodies having jurisdiction over and installation

(2) Workmanship

All materials shall be new, the best of their respective kinds and of such as are usual and suitable for work of like character.

All materials shall comply with IEC on the latest Japanese Standards for Testing Material unless otherwise specified or permitted by the Engineer.

All workmanship shall be of the highest class throughout to endure smooth and vibration free operation under all possible operating conditions, and the design, dimension and materials of all parts shall be such that the stresses to which they may be subjected shall not render them liable to distortion, under wear, or damage under the most severe condition encountered in services.

All parts shall conform to the dimension shown on and shall be built in accordance with approved drawings. All joints, datum surfaces, and mating components shall be machined and all casting shall be spot faced for nuts. All machined finishes shall be shown on the approved drawings.

All screws, bolts, studs and nuts and other threads for pipe shall conform to the latest standards of the International Organization for Standard covering these components and shall either all conform to the standards for metric size.

(3) Shop Assembly

All items of equipment and components shall be assembled in the shop prior to shipment, and tests shall be performed by the Contractor as may be required to demonstrate to the satisfaction of the Engineer the adequacy of the equipment and its component parts.

All test should simulate the normal operating conditions as closely as possible. All dismantled parts shall be properly match marked and dowelled to ensure correct assembly in the field.

(4) Castings

All castings shall be true to pattern, of workmanlike finish and of uniform quality and condition, free from blowholes, porosity, hard spots, shrinkage, cracks or other injurious defects, and shall be satisfactorily cleaned for their intended purpose.

Casting shall not be repaired, plugged, or welded without permission of the Engineer.

Such permission will be given only when the defects are minor and do not adversely affect the strength, use, or machinability of castings.

Excessive segregation of impurities or alloys at critical points in casting will cause for its rejection.

(5) Forgings

The ingots from which the forgings are made, shall be cast in metal mould, the workmanship shall be first class in every respect and forgings shall be free from all defects affecting their strength and durability, including seams, pipes, flaws, cracks, scales, fins, porosity, hard spots, excessive non-metallic inclusions and segregations.

The largest fillets compatible with the design shall be incorporated wherever a change in section occurs. All finished surface of forgings shall be smooth and free from tool marks.

The forging shall be clearly stamped with the heat number in such location as to be readily observed when the forging is assembled in completed unit.

(6) Weldings

Wherever welding is specified or permitted, the approved welding process shall be used. All welder and welding operators shall be fully qualified. After the welding process has been approved by the Engineer, the welding operator shall record it on a special drawing which shall become one of the drawings of the Contract.

All defects in welds shall be chipped out the sound metal and such areas shall be magnafluxed or ultrasonically tested to ensure that the defect has been completely removed before repair welding.

Plate to be jointed by welding shall be accurately cut to size and rolled by pressure to the proper curvature which shall be continuous from the edge. Flattering in the curvature along the edges with correction by blow will not be allowed. The dimension and shape of the edges to be jointed shall be such as to allow thorough fusion and complete penetration, and the edges of plates shall be properly formed to accommodate the various welding condition. The surfaces of the plates adjacent to the edge to be welded shall be thoroughly cleaned of all rust, grease and scale to bright metal.

(a) Qualification of welding procedure

The technique of welding employed, the appearance and quality of the welds made and methods used in correcting defective work, shall conform to American Welding Society (AWS) Standard D.1.1 or other approved equivalent standard.

(b) Qualification of welder and welding operator

All welders and welding operators assigned to the Work shall have passed a qualification test, within the preceding six (6) months, for welders and welding operators, in accordance with JIS Z3801 and/or Z3841 or AWS D.1.1 or other approved equivalent standard. The Contractor shall furnish the Engineer with certified copies of reports of the results of physical test of specimens welded in the qualification test. If in the opinion of the Engineer, the work of any welder at any time appears questionable, he shall be required to pass the appropriate requalification test. All cost of qualification test shall be borne by the Contractor.

(c) Welding electrodes

The welding electrodes shall conform to JIS Z3211 or Z3212, low hydrogen type covering or other approved standards. Stainless type weld metal, were used in the water passage for protection against pitting, shall be chromium nickel steel. The type, chemical composition and JIS number of welding rods for this purpose shall be approved by the Engineer.

(7) Pipings

Seamless steel pipe and/or copper tubing shall be used for all oil lines. Steel pipe shall be used for waterlines. All necessary studs, bolts, screws, nuts, washers, gaskets, packing, supports etc., required in connection with the field assembly of

pipng system shall be supplied by the Contractor. All gaskets and packing shall be of approved material and of a type that has been proved satisfactorily for the service to which they will be subjected.

Where pipe is embedded in concrete, it shall be carefully set to the required lines and grades and securely braced and held so that no movement shall occur during concreting operations. Pipe supports to be embedded in concrete shall be made of which will not deteriorate, weaken or cause damage to the pipe.

(8) Replacement Work and Workmanship

Piping shall be replaced in the location, elevation and to line shown on the drawings which is referred to existing state. All lines shall be sloped to allow drainages to the lower point. All piping shall be fitted and assembled to introduce the minimum of stressing to the pipe and fittings, and the assembly shall conform to the best piping practice. The Engineer shall be the sole judge of the standard of workmanship. All pipes shall be supported shown on the drawing which is referred to the existing state and approved. All piping shall be supported and installed to avoid pockets that will not drain completely. All treads shall be accurately and clearly cut, and burrs shall be removed. Pipe unions shall be fitted where necessary to facilitate installation or maintenance of equipment. Junction of copper to ferrous pipe shall be made with bronze adapter if necessary.

(9) Test for Piping System

PC-2 shall test all pipelines as directed by the Engineer and shall provide all labour, material, pump, plugs, gauges etc., required to make the complete test. Lines shall be tested in convenient sections. In the case of failure due to faulty workmanship on the part, material failure or leak, they shall repair all damage and leak, replace the faulty material, and retest the piping until the tested section is acceptable to the Engineer. All piping system shall be flushed clean prior to test. Before testing, all anchor blocks, thrust support, and hangs shall be in place. If piping is tested in sections, temporary end caps shall be fitted to the approved position. Each section shall be slowly filled with the test medium, care being taken to expel all air from the piping if liquid is used. For acceptance, the test pressure shall be remained constant for the test period without additional pumping water into the section under test. If a drop in pressure occurs, leaks shall be repair and the pipe line retested until acceptable.

(10) Galvanizing

Unless specifically mentioned to the contrary all iron and steel shall be galvanized after all fabrication completed. The zinc coating is to be uniform, clean, smooth and as free from spangle as possible. Galvanizing shall be applied by the hot dip process for all parts other than steel wires. All steel wires shall be galvanized by an approved process before stranding. The preparation for galvanizing shall not distort or adversely affect the mechanical properties of the materials. After galvanizing holes shall be free from modules of specter. Manufacturer's attention shall be given to that galvanized parts are subject to the formation of white rust during shipment or storage on the field, and special treatment shall be made during galvanizing process to prevent the formation of white rust, the detail of which shall be stated.

1.15 Protection, Cleaning and Painting

All machined parts or bearing surfaces shall be cleaned and protected from corrosion before leaving the manufacture's plant by the application of the rust preventive lacquer, or a peelable plastic film. Where the latter is impracticable such parts shall be heavily covered with high melting paint grease. After replacement such part shall be cleaned with solvent and lopped or polished bright.

All parts, other than machined parts, which will be exposed after replacement shall be thoroughly cleaned and given two coats of best quality primer and one coat of best quality finish paint before leaving the manufacture's plant and further one coat of paint of an approved colour after replacement and touching up on the site, except such apparatus as panels and instrument which will be finish painted under approved procedure. Primer shall be applied to surfaces prepared in accordance with the paint manufacture's instruction. the surface shall be wiped clean immediately prior to applying the paint. The primer and finish coats of paint shall be applied using the methods and equipment recommended by the manufacture.

The internal surface of all pipeline shall be cleaned out before installation and again prior to commissioning, to endure freedom from dirt, rust, scale, welding slag, etc. All exposed pipe shall be colour coded for identification after setting up is completed. The code system shall be applied by the same as existing system.

1.16 Packings

Each item shall be packed properly or protected for shipment from the place of manufacture to the site. Each crate or packing shall contain a packing list in a waterproof envelope, and a copy in triplicate shall be forwarded to the Engineer prior to dispatch. All items of materials shall be clearly marked for easy identification against the packing list. All cases, packings, etc., shall be clearly marked on the outside to indicate the total weight, to show where the weight is bearing and the correct position of slings and shall bear an identification mark relating them to the appropriate shipping documents. The Engineer shall reserve the right to inspect and approve the equipment and the packing before the items are dispatched. The Contractor shall be directly responsible for enduring that the packing is suitable for transit and such inspection will not relieve the Contractor from responsibility for any loss or damage due to faulty packing.

1.17 Delivery

No part of the work or Contractor's equipment shall be delivered to the site until approval in writing has been obtained from the Engineer for such delivery. Each application shall include a complete shipping list of the contents of each packing to be delivered, and shall indicate the anticipated date of delivery and the serial number for each component to be used for identification and evidence of the insurance. Upon shipment of each package or item, copies of shipping documents comprising of Bill of Lading, Detailed Invoice, Packing List, Insurance Policy and Inspection Certificate shall be received by the Employer in () copies, at least one week before arrival of the cargoes at Saigon port and by the Engineer in () copies.

1.18 Test Procedure Instructions

The Contractor shall submit to the engineer for approval, during or immediately following the submission of drawing, an instruction procedure describing each test to be performed for commission and performance testing.

The procedure shall define the sequence of the tests, the equipment preparation and operation procedures to be followed and the detailed procedure for conducting the tests and moreover shall contain performance guarantees, design values, technical particulars or any other standard data for testing which will be treated as criteria for the evaluation of each test. These instructions shall be submitted for approval and distributed in the same manner as the drawings.

1.19 Field Test

During the repairing or replacement works of each item of equipment, governor, piping system, etc., tests shall be performed, as specified herein, to establish the accuracy of the assembly and to prove the adequacy of materials and the workmanship. All tests and test procedure shall be approved by the Engineer. PC-2 shall perform the following tests, as applicable to ensure that the equipment has been correctly repaired or replaced, all necessary adjustments and settings made, and is in sound condition to run under load by the instruction of the manufacture's guidance experts.

(1) Oil Pressure System

- Measurement of oil pump discharge valve
- Adjustment and setting of unloader pilot valve
- Continuous operation test of oil pumps
- Measurement of relation between oil level and pressure valve in main tank
- The time of oil pressure making by air compressor
- Adjustment and setting of safety valve
- check of oil level control system
- Setting of oil level switch and pressure switches
- Insulation resistance measurement of motor

(2) Air Compressor

- Continuous operation test of compressor
- Adjustment and setting of safety valve
- The time of air pressure making in air tank
- Adjusting and setting of reducing valve
- Insulation resistance measurement of motor

(3) Water Supply System

- Strainer operation check
- Measurement of cooling water pump discharge valve
- Continuous operation test of pump
- Automatic start and stop of stand-by pump
- Operation check and setting of relays
- Insulation resistance measurement of motor

(4) Governor and Turbine

- Check of control device
- Automatic start and stop device
- Adjustment and setting of rated speed
- Adjustment and setting of limit switches
- Characteristic of needle distributing valve
- Characteristic of deflector distributing valve
- Adjustment and setting of deflector and needle valve servomotor closing and opening time
- Adjustment and setting of distribution valve and control valve
- Adjustment and setting of servomotor stroke for turbine starting and no-load running
- Adjustment range of speed droop
- Relation between needle valve servomotor stroke and deflector servomotor stroke
- Measurement of differential pressure of each servomotor
- Operation check of needle valve for jet brake
- Unbalance check of needle valves
- Characteristic of speed signal generator (SSG)
- Manual operation test on the site
- Remote operation test from the control room

(5) Inlet Valve and Bypass Valve

- Check of water leakage
- Check of operation
- Adjustment and setting of operation times
- Characteristic of inlet valve distributing valve
- Characteristic of bypass valve distributing valve
- Adjustment and setting of bypass valve servomotor closing and opening time

SECTION 2

TECHNICAL SPECIFICATIONS FOR TURBINES AND ANCILLARIES

2.1 Runners

The runners shall be of one casting type. The buckets shall be made of stainless high nickel cast steel (13-4% Cr-Ni). The bucket stems shall be made to endure the repeated and centrifugal stresses.

The runners shall be completely balanced and interchangeable with the existing runners in the power station. The hydraulic surfaces of buckets shall be carefully ground to templates and smoothly finished.

Each portion of the runners shall be inspected by the most adequate method which is subject to the approval of the Engineer. The finished runners shall be accurately balanced statically and dynamically, and satisfactory for all rotating speed including the maximum runaway speed. The static balance shall be demonstrated to the satisfaction of the Engineer, before delivery to the site.

The Contractor shall guarantee the runners against excessive pitting caused by cavitation for a period of one year from the date of the Acceptance Certificate. Excessive pitting is defined as the removal of metal from the runner aggregating 0.4 grams per one hour or more, and as the reduction of the bucket thickness at any point of 15 percent or more.

Erosion and damage caused by suspended matters in the water or corrosion caused by chemical composition of the water is not intended to be covered by the pitting guarantee.

The runner shall be fixed to the flange of the generator shaft by the straight reamer bolts and lock plate solidly. The bolts shall be locked in position to prevent loosening during operation.

Item, number and material supplied under the Contract are as below:

Item	Quantity	Material
Runner	4 sets	SCS 5 of JIS G5121
Straight reamer bolt	48 sets	SNC 631 of JIS G4102
Lock plate for the above	48 sets	SPCC-SD of JIS G3141
Cover	4 sets	SS 400 of JIS G3101
Bolt for the above cover	16 sets	S35C of JIS G4051

Reference is made to the attached Figure _____.

2.2 Upper and Lower Nozzle, Needle and Deflector

Nozzles for supplying water to the turbine runner shall be designed for a hydraulic pressure of _____ kg/cm² and constructed to produce the most uniform jet and shall be equipped with automatically operated direct-motion needles.

The existing main nozzle bodies shall remain for the further use. Each nozzle tip shall be provided with a renewable seat ring at the final point of water discharge. The needle tip shall be replaceable, made of stainless steel and securely locked to the stems.

In order to prevent excessive pressure rise in the penstock and to endure quick response and power speed regulation with a jet deflector, the deflector shall be of the cut in type, constructed of steel with stainless steel overlay cutting edge including the hydraulic passage. Each deflector shall be constructed to withstand the maximum discharge from the nozzle.

Item, number and material of the renewal or replacement facilities are as follows:

Item	Quantity	Material
Needle head	8 sets	SUS 403 of JIS G4303
Needle tip	8 sets	SUS 403 of JIS G4303
Needle spindle	8 sets	S35C of JIS G4051
Needle servomotor spindle	8 sets	S35C of JIS G4051
Balance piston	8 sets	S35C of JIS G4051
Needle spindle liner	16 sets	BC3 of JIS H5111
Protecting pipe for needle spindle	8 sets	STPG38S of JIS G3454
Needle guide	8 sets	SS400 of JIS G3101

Item	Quantity	Material
Upper nozzle	4 sets	SC450 of JIS G5101
Lower nozzle	4 sets	SC450 of JIS G5101
Nozzle tip	8 sets	SUS403 of JIS G4303
Deflector tip	8 sets	SCS1 of JIS G5121
Deflector head	8 sets	SC450 of JIS G5101
Key for deflector head	32 sets	S45C of JIS G4051
Balance piston sleeve	8 sets	BC3 of JIS H5111
Balance piston guide bushing	8 sets	BC3 of JIS H5111
V shape gasket for balance piston	40 sets	leather
Cover bushing for needle servomotor	8 sets	BC3 of JIS H5111
Spring for needle servomotor	16 sets	SUP8 of JIS G4801
Piston ring for needle servomotor	16 sets	special cast iron
J shape gasket for upper needle servomotor	8 sets	leather
Gasket for upper needle servomotor	8 sets	oil-seal
J shape gasket for lower needle servomotor	8 sets	leather
Gasket for lower needle servomotor	8 sets	oil-seal
Bushing in needle servomotor	16 sets	BC3 of JIS H5111
Bushing in link for restoring mechanism	16 sets	BC3 of JIS H5111
Link pin	16 sets	S35C of JIS G4051
Bushing for upper deflector bearing	8 sets	BC3 of JIS H5111
Bushing for lower deflector bearing	12 sets	BC3 of JIS H5111
Bushing for deflector bearing	8 sets	BC3 of JIS H5111
Bushing for deflector arm	16 sets	BC3 of JIS H5111
Bushing for governor arm	4 sets	BC3 of JIS H5111
Deflector operating rod pin	16 sets	S35C of JIS G4051
Bushing for governor bearing	8 sets	BC3 of JIS H5111
Round rubber gaskets	4 sets	rubber
O ring	4 sets	

Reference is made to Figure ____.

2.3 Baffle Plate of Turbine Housing

The damage exists on the wing viewing from the lower nozzle. The following rehabilitation works will be conducted at site.

- (1) Cutting out of the damaged baffle plate and the related portion from the existing housing in the suitable section to reweld the new baffle plate after disassembly of the upper housing.
- (2) The existing baffle plates shall be replaced with new plates after the weld-repair in the same dimension and structure as those of the existing plate.

The baffle plate shall be constructed to withstand the maximum discharge by the jet water. Four (4) baffle plates shall be supplied in material quality of SS400 of JIS G3101 for the replacement.

2.4 Jet Brake

A brake nozzle is provided on each turbine being arranged to direct a stream of water against the backs of the buckets to restrain the rotating part of the turbine after the unit will be taken off. A needle valve shall be provided for control of the nozzle.

Item	Quantity	Material
Nozzle for jet brake	4 sets	SUS 403 of JIS G4303
Needle valve for jet brake with servomotor (95 mm)	4 sets	

2.5 Deflector Servomotor

The deflector servomotor is of the oil pressure actuated type, having sufficient capacity to operate the jet deflectors under all hydraulic condition and minimum oil pressure from the governor oil system.

Such automatic closing shall take place at a controlled rate which will not result in a penstock pressure rise in excess of ____ percent of the maximum gross head.

Item, number and material of the supplied facilities for repair are as follows:

Item	Quantity	Material
Round rubber gasket	4 sets	rubber
L-shape gasket	4 sets	leather
V-shape gasket	32 sets	leather
Adopter	8 sets	
Piston rods	8 sets	S45C of JIS G4051

2.6 Inlet Valve

The existing inlet valves are of spherical type. The main valve is operated by oil pressure, and the seat valve is operated by pressured water supplied from the penstock.

The repair of the inlet valve shall be achieved for smooth operation of the valves without appreciable vibration and without causing dangerous pressure variation in the penstock under the maximum static head.

Item, number and material of the facilities to be repaired or replaced are as follows:

Item	Quantity	Material
Materials for repair		
Movable seat	4 sets	SC49 of JIS G5101
Valve rotor	4 sets	SC49 of JIS G5101
Valve body	4 sets	SC49 of JIS G5101
Materials or components for replacement		
Rubber gasket for movable eat	4 sets	rubber
Gasket for movable seat	4 sets	rubber
Bearing bushing	8 sets	BC3 of JIS H5111
O ring for bearing bushing	8 sets	rubber
Thrust ring	4 sets	PBC2 of JIS
Base ring	4 sets	SS400 of JIS G3101
V-shape gasket for spindle seal	48 sets	leather
Gasket for spindle seal	4 sets	rubber
Arm pin	8 sets	S45C of JIS G4051
Piston rod bushing	16 sets	BC3 of JIS H5111
Piston pin	8 sets	S45C of JIS G4051
Piston liner	16 sets	BC3 of JIS H5111
L-shape gasket for piston	16 sets	leather
Bushing for servomotor head cover	8 sets	BC3 of JIS H5111
V-shape gasket for plunger	32 sets	leather

Item	Quantity	Material
Swivel joint	8 sets	
Fixing bolt for movable seat	4 sets	S35C of JIS G4051
Piping material for air release in valve rotor	4 sets	
Round rubber gasket and o-ring	4 sets	

2.7 Bypass Valve

The bypass valve is provided for the operation of the inlet valve in case that the upstream and downstream pressures are not balanced. The exiting bypass valves are of a needle type and operated by the oil pressure.

Item, number and material of the facilities to be replaced are as follows:

Item	Quantity	Material
Bypass valve of needle type with servomotor	4 sets	
Sluice Valve, 80mm , 80 kg/cm ²	4 sets	
Pipe for bypass valve	4 sets	STPG38S of JIS G3101
Bolts and gasket for piping	4 sets	

2.8 Distributing Valve and Distributor

The distributing valves and distributors shall be constructed so as to smoothly operate under any pressure of oil and water without vibration under the minimum oil or water pressure and to endure the maximum oil or water pressure.

Item, number and material of the facilities to be renewed are as follows:

Item	Quantity	Material
Distributing valve for inlet valve (25 mm)	4 sets	
Distributing valve for bypass valve (12 mm)	4 sets	
Distributing valve for seat valve (25 mm)	4 sets	
Distributing valve for automatic drainage valve (12 mm)	4 sets	
Distributor for inlet valve control	4 sets	

2.9 Discharge Valves

The discharge valves for drainage of penstock and branch pipe shall be fabricated so as to be smoothly operated without appreciable vibration and dangerous pressure variation to the penstock under the maximum static head.

Facilities supplied under the Contract are as follows:

Item	Quantity	Material
Penstock automatic discharge valve (160mm)	1 set	
Branch pipe automatic discharge valve (110mm)	1 set	

2.10 Valve and Piping Material for High Pressure Water Line

Following valves and piping materials for the high pressure water line shall be supplied under the Contract. Those valves and materials will be used for renewal of the existing facilities.

Item	Quantity	Material
Sluice valve (80 kg/mm ²)		
6 1/4 B	4 sets	
5 B	4 sets	
4 B	8 sets	
3 B	4 sets	
2 B	12 sets	
Stop valve (80 kg/mm ²)		
1 1/2 B	40 sets	
1 B	25 sets	
3/4 B	8 sets	
1/2 B	28 sets	
Piping materials for high pressure water line	4 lots	STPG 370 of JIS G3454
Copper tube for distributing valve	4 sets	

2.11 Oil Pressure System

Each turbine is running with a complete oil pumping set for its governor and main inlet valve. Pressure oil is fed by an AC motor driven pump for the normal service and by a small water turbine driven pump for the emergent service.

Pump supplied under the Contract shall have a sufficient capacity to drive the servomotor from the oil reservoir, and shall be complete with its own strainer, safety valve, unloading valve, non-return valve, and stop valve. The system shall be so designed

that in case of stoppage of the normal motor driven pump due to voltage drop, the pump shall automatically restart after restoration of the power source.

All motors shall be of horizontal shaft, high starting torque, low starting current, squirrel cage, induction type, designed for full voltage starting, and totally enclosed.

The insulation for the motor shall be in accordance with JIS C4210 or equivalent standards, and shall have an approved continuous rating for nature of the equipment at the ambient temperature of 40 degrees centigrade.

The cable terminals shall be supplied with stud-type connectors.

Indoor use control cubicle shall be made of steel sheet with the minimum thickness of X mm, of rigid, self-supporting construction and supplied with channel base. Cubicles shall be of weather, dust and vermin-proof construction. Space heating elements with thermostatic control shall be provided in the cubicles. The instrument and control wiring including all electrical interlocks and interconnecting wiring between other facilities, shall be completely installed and connected to terminal blocks. The arrangement of control and protection devices on the panel and the exterior finish of panel shall be subject to the approval of the Engineer. Colour code of the cubicles shall be mascal code No. 7.5BG6/1.5.

All indicators such as meters and signal lumps shall be visible from outside without opening the doors and/or windows.

Following are the materials and equipment for renewal or replacement of the existing oil pressure system supplied under the Contract.

Item	Quantity	Remarks
Oil pressure pump	4 sets	30 kg/cm ² , 280 l/min.
Motor for the above	4 sets	22 kW, 1,000 rpm
Air supply system	4 sets	
Unloader system	4 sets	UL-80
Pressure relay	4 sets	GBW-1
Manual valve	4 sets	
Oil safety valve	4 sets	
Dial type level gauge	4 sets	
Level gauge for pressure oil tank	8 sets	L=1,000 mm
Pressure gauge	4 sets	100 mm
Oil gauge for sump tank	4 sets	
Packing for sump tank	4 sets	
Oil drainage valve	4 sets	150 A
Breather for sump tank	4 sets	
Sluice valve	4 sets	80 A
Oil pressure control cubicle with anchor bolts	4 sets	except cables and terminal from outside

2.12 Air Compressor

An AC motor-driven air compressor shall be supplied under the Contract. The air compressor will charge compressed air to the pressure oil tank. The compressor shall be capable of filling air of the working pressure in an oil tank within one hour.

Following are the equipment for replacement of the existing air compressor system supplied under the Contract.

Item	Quantity	Remarks
Motor-driven 15 kW air compressor	1 set	30 kg/cm ² , 1,000 l/min.
Cubicle box for the above with anchor bolts	1 set	

Specifications for the motor and cubicle shall be referred to Clause 2.11.

2.13 Water Supply System

The existing cooling water system is separated into two groups; one is for No.1 and No.2 generating units and another is for No.3 and No.4 units. Each system consists of duplicate AC motor-driven pumps, water head tank, strainer, valves, and necessary pipes. The cooling water shall be continuously fed to the overflow type head tank of 30 m head and of 300 m³ capacity for each system.

When the normal use pump becomes to stop due to any reason, another shall start automatically.

Item, number and material of the facilities supplied under the Contract are as follows:

Item	Quantity	Remarks
Water supply pump	4 sets	X kg/cm ² , Y l/min.
Motor for the above	4 sets	
Automatic valve for water supply	4 sets	200 mm
Flow relay	4 sets	
Main strainer	8 sets	200 A
Strainer for seat valve and balance piston	8 sets	80 A
Sand separator for seat valve and balance piston	4 sets	80 A
Indoor use cubicle box with anchor bolts (except cables and terminals from outside)	2 sets	

Specifications for the motor and cubicle shall be same as those stated in Clause 2.11.

2.14 Governor

Each turbine is provided with an efficient automatic governor of oil pressure and cabinet type, and have an ample capacity to operate the needle valve and deflector under all operating conditions. At any load it shall regulate the turbine to an uniform speed free from hunting or surging, and shall make each set to operate satisfactorily in parallel with the other in the interconnected system in the station.

The governor shall also be capable of local hand control and remote electrical control from the control room.

Turbine speed detector shall consist of toothed wheel and of non-contact speed pick-up (sensor) on the end of the exciter shaft instead of the existing permanent magnet generator for a pendulum motor.

Maximum momentary speed rise caused by sudden rejection of the full rated output of 42,000 kW at any head shall be guaranteed, and shall not exceed 20 % of the normal speed.

The sensitivity of the governor, expressed in percentage of the speed to which the governor will respond, shall be less than six hundredth of one percent.

The permanent speed droop between no-load and full-load shall be readily adjustable from 0% to 5%. The governor speed shall be adjusted by not less than plus or minus 10% of the normal speed while running.

Maximum momentary pressure rise caused by sudden rejection of 168,000 kW (i.e. four units are connected with two penstock pipes and one surge tank.) at any operating head shall be guaranteed and not exceed 120 m (15% of gross head).

Each governor cabinet shall be provided with the following control and indicating devices.

- (1) A solenoid-controlled shutting-down devices (refer to Note 1) for closing and preventing the opening of the governor servomotor, in case of over-speed, failure of oil or under other predetermined condition.
- (2) A speed and load adjusting devices arranged for operation by both hand and remote.
- (3) A local limiting devices arranged for operation by both hand and remote with indication.
- (4) Two stroke indicators showing the needle valve opening.
- (5) A manual device for readily adjusting the permanent speed variation and provided with an indicator to show the setting.
- (6) Indicating wattmeter
- (7) Tachometer to show the turbine speed in revolutions per minute.
- (8) Dial type thermometer for bearings

- (9) Dial type thermometer for the inlet and outlet air temperature of the governor cooler
- (10) Oil pressure gauge (refer to Note 2)
- (11) Water pressure gauge to indicate the water pressure in the penstock and the turbine, respectively (refer to Note 2)
- (12) Sequence indicator
- (13) Signal lamp for the machine running shall be mounted on the top of the cabinet for the remote discrimination.

Note 1: Existing solenoid-controlled devices and others in the control cabinet to be located beside the governor cabinet are as follows:

- nine (9) double solenoids of 20QS, 75S, 21DS, 74LS, 65S, 74S, 20WS, and 20WCS
- four (4) oil pressure relays of 63Q1, 63Q2, 63Q3, and 63Q4
- one (1) water pressure relay of 63W
- twine head strainer for oil pressure system

Following spare parts and tools shall be supplied for maintenance of the facilities for a period of 3 years. The Tenderer shall indicate in his offer the quantities supplied by him of each part and tool:

- lamps
- fuses
- printed circuit boards
- switches
- lamp removal tools
- printed circuit board adapter for detailed measurement of board
- other parts and tools recommended by the Contractor

Following external devices may be optionally mounted on the facilities:

(1) Automatic load regulator (ALR)

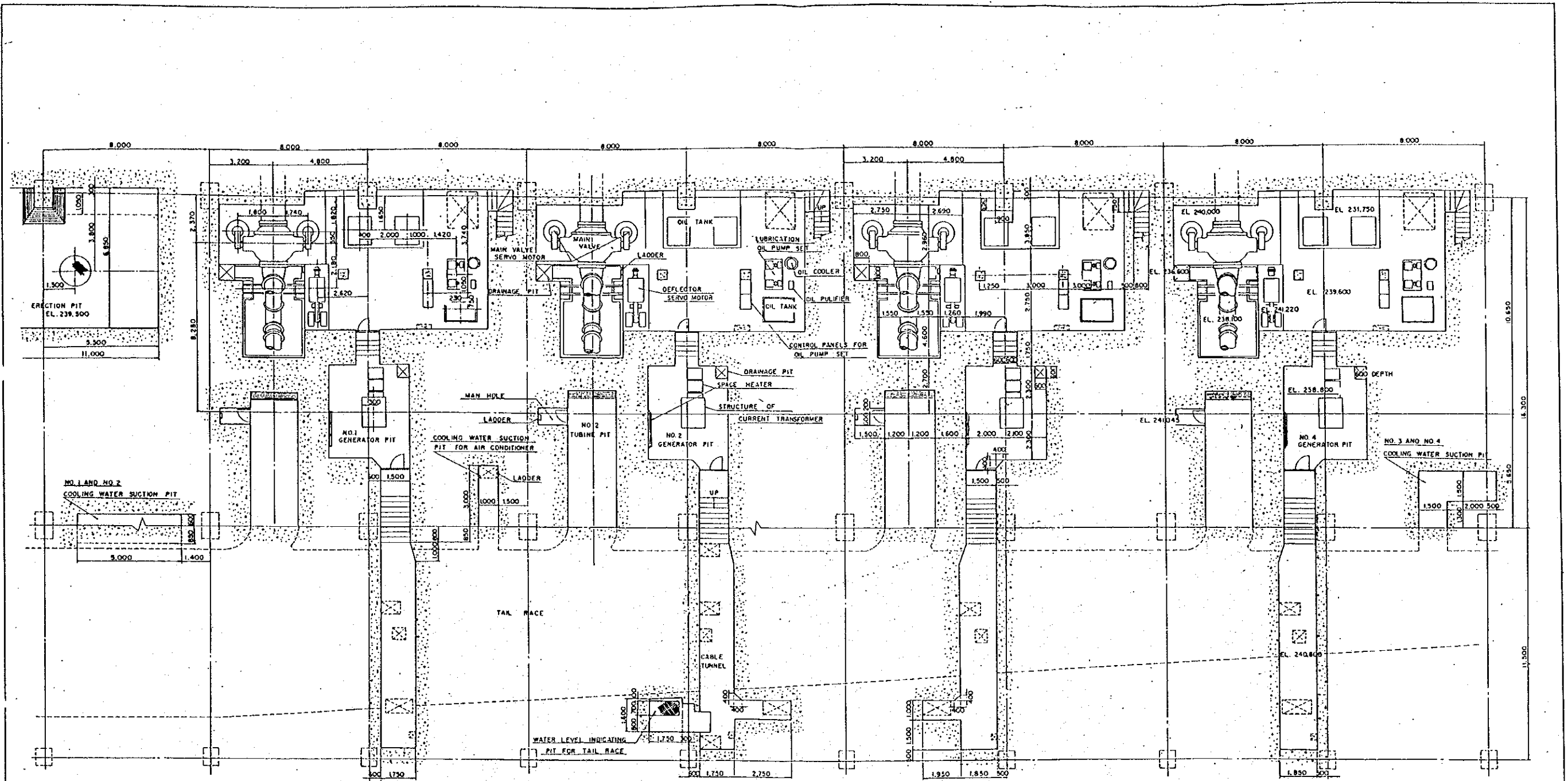
The regulator receives the load setting signal and the actual load signal. The needle opening control signal is transmitted to the governor so that the output of the generator meets the setting load.

(2) Automatic frequency control (AFC)

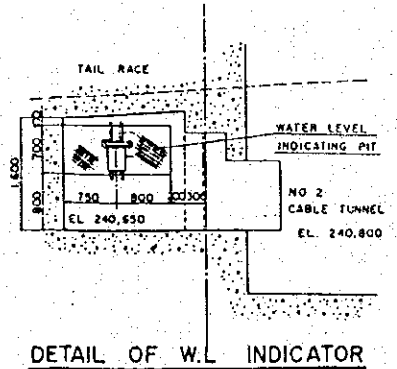
Receiving the load increase or decrease signal from the central dispatching center, the load control signal is transmitted to the governor and the feedback signal of the actual load is transmitted to the central dispatching center.

Note 2: Water pressure shall be measured in meter unit, while oil pressure shall be indicated in kg/cm^2 unit. All pressure gauges shall be provided with stop valves and devices for bleeding of entrapped air. All instrument shall be of high grade accuracy type, and the test certificates shall be submitted with the pressure gauge and tachometer. Following transducer shall be supplied for the governor cabinet for indications on the control board:

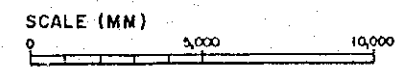
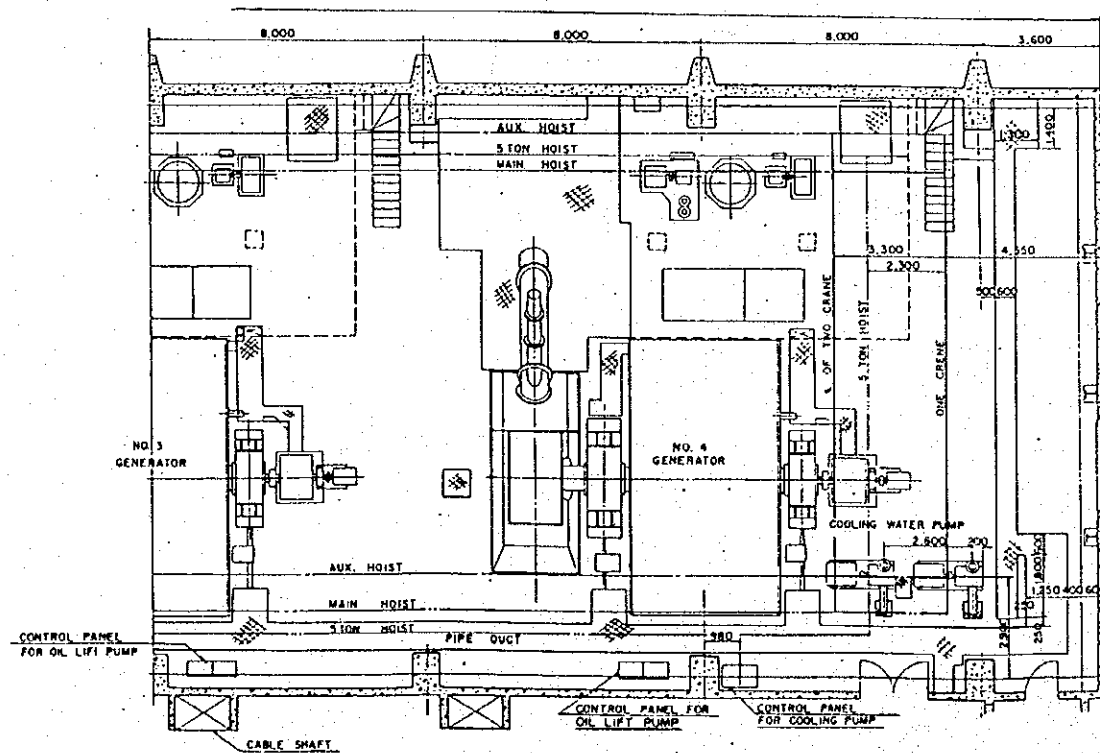
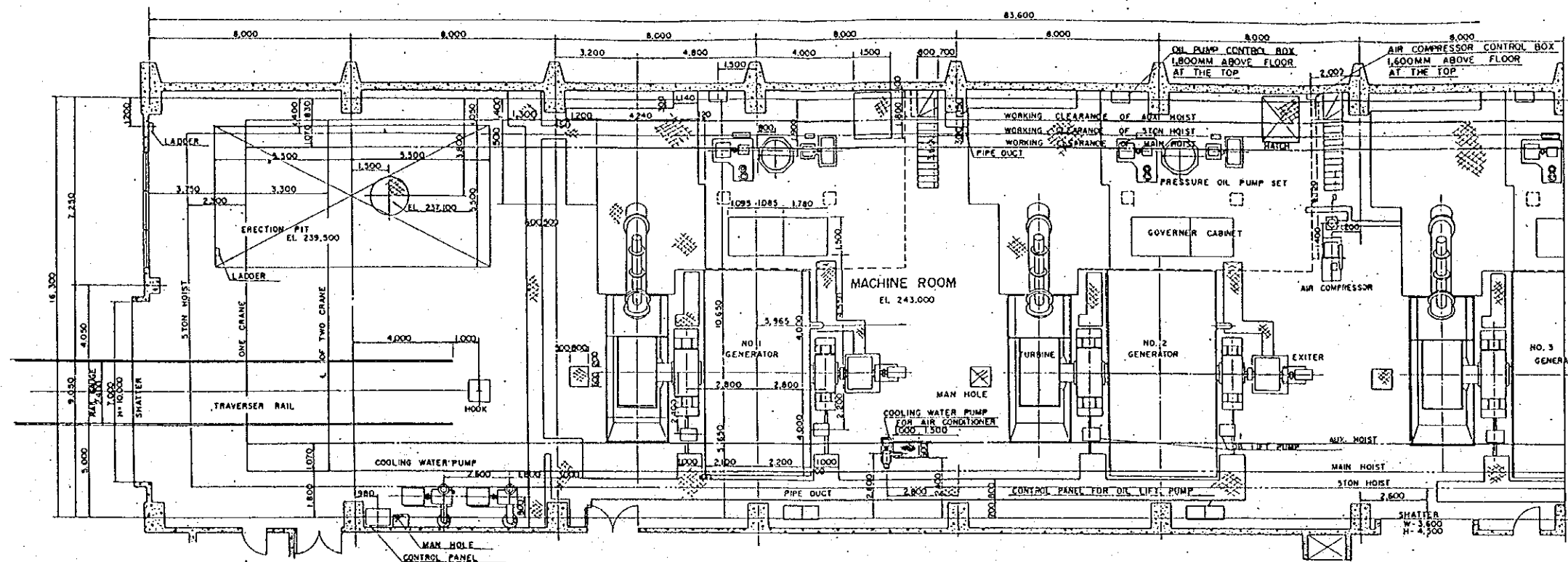
- one for speed indicator
- two for indication of opening condition of the needle valve
- one for indication of load limiter

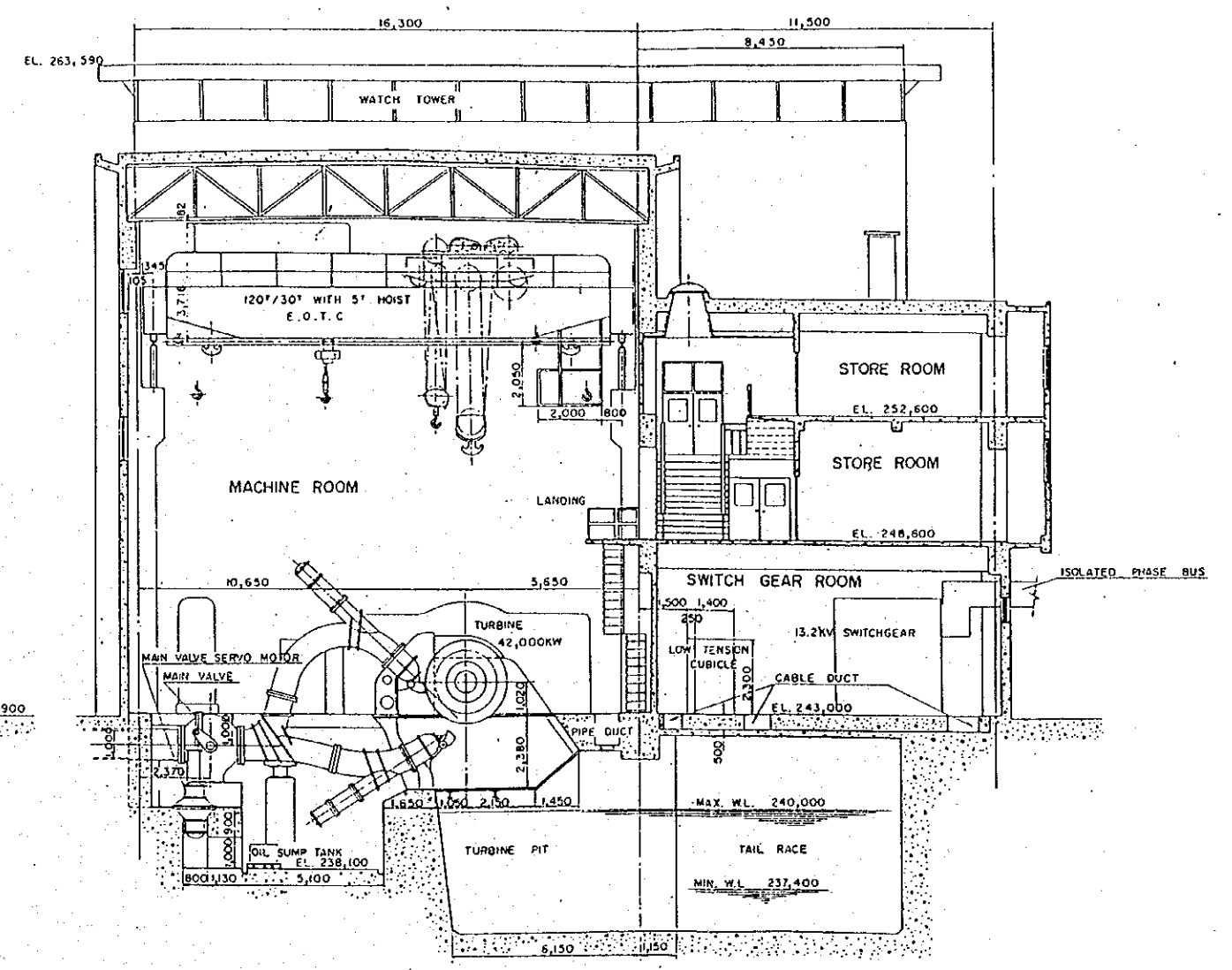
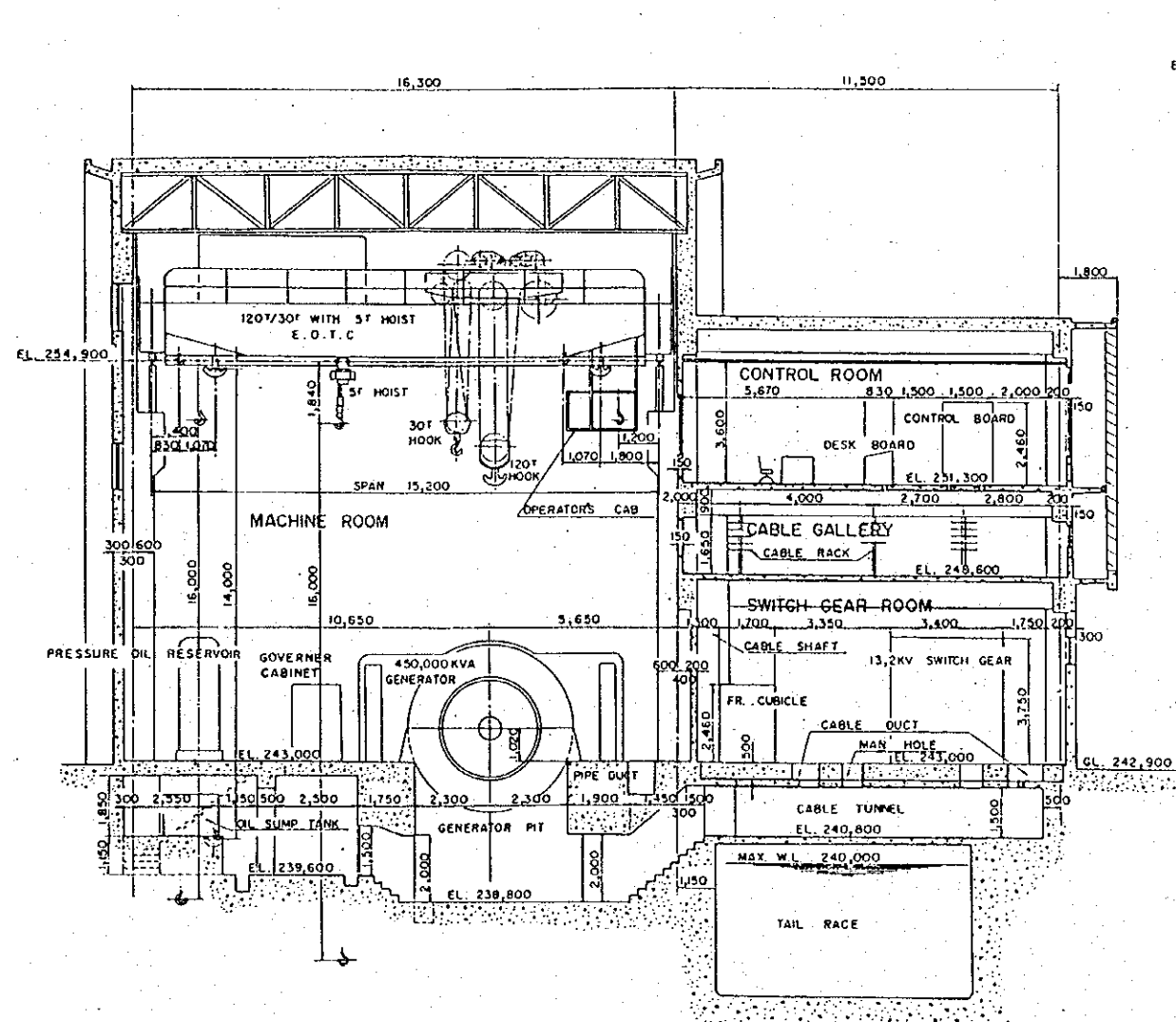


SCALE (MM) 1:100
 0 3000 10000



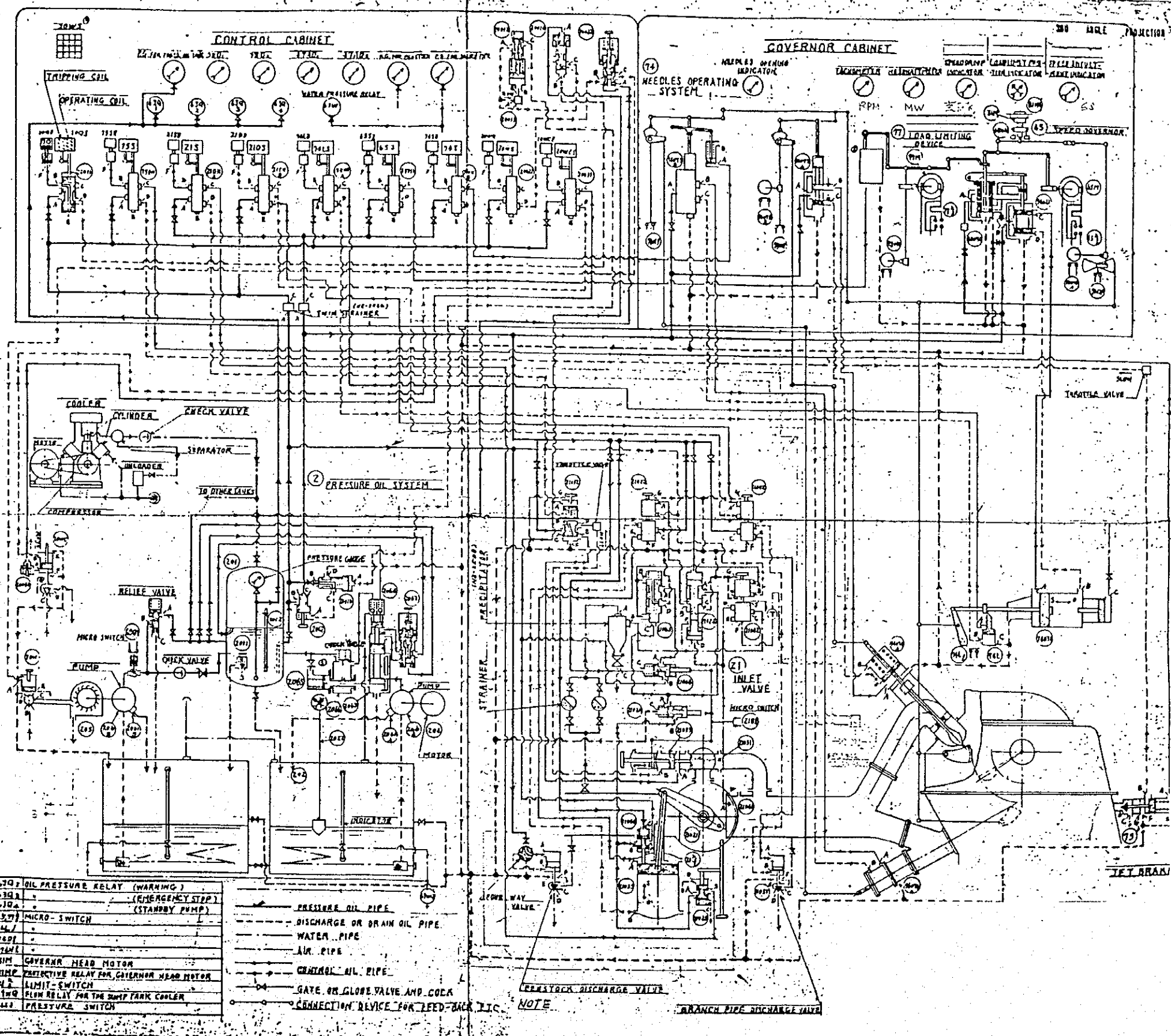
SCALE (MM) 1:50
 0 1000 2000 3000 4000 5000





SCALE (MM) 1:100
 0 5000 10000

Z	PRESSURE OIL SYSTEM
Z1	PRESSURE OIL TANK
Z101	SAFETY VALVE
Z102	OIL LEVEL SIGHT GLASS
Z103	SUMP TANK
Z104	FLOAT INDICATOR
Z105	3PHASE INDUCTION MOTOR
Z106	SMALL TURBINE
Z107	PRESSURE OIL PUMP
Z108	SAFETY VALVE
Z109	PILST VALVE
Z110	UNLOADING VALVE
Z111	AIR VALVE
Z112	CHECK VALVE
Z113	AIR TANK
Z114	OIL-OPERATED ANGLE VALVE
Z115	DOUBLE SOLENOID
Z116	PRESSURE SWITCH
Z117	DOUBLE SOLENOID VALVE
Z118	TIMED DELAY
Z119	THROTTLE VALVE
Z120	DISTRIBUTOR
Z121	RELAY VALVE
Z122	RELAY VALVE
Z123	RELAY VALVE
Z124	RELAY VALVE
Z125	RELAY VALVE
Z126	RELAY VALVE
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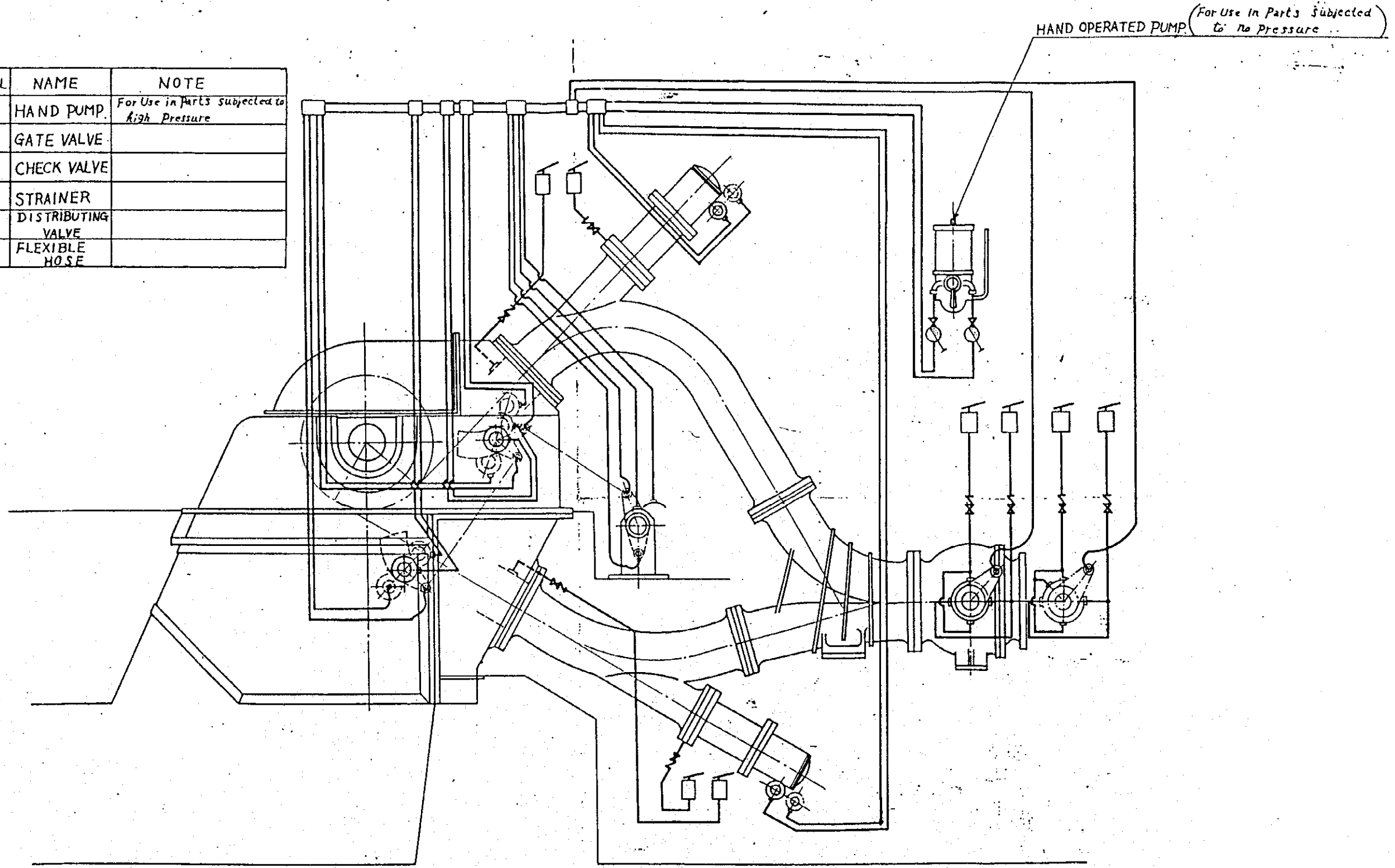


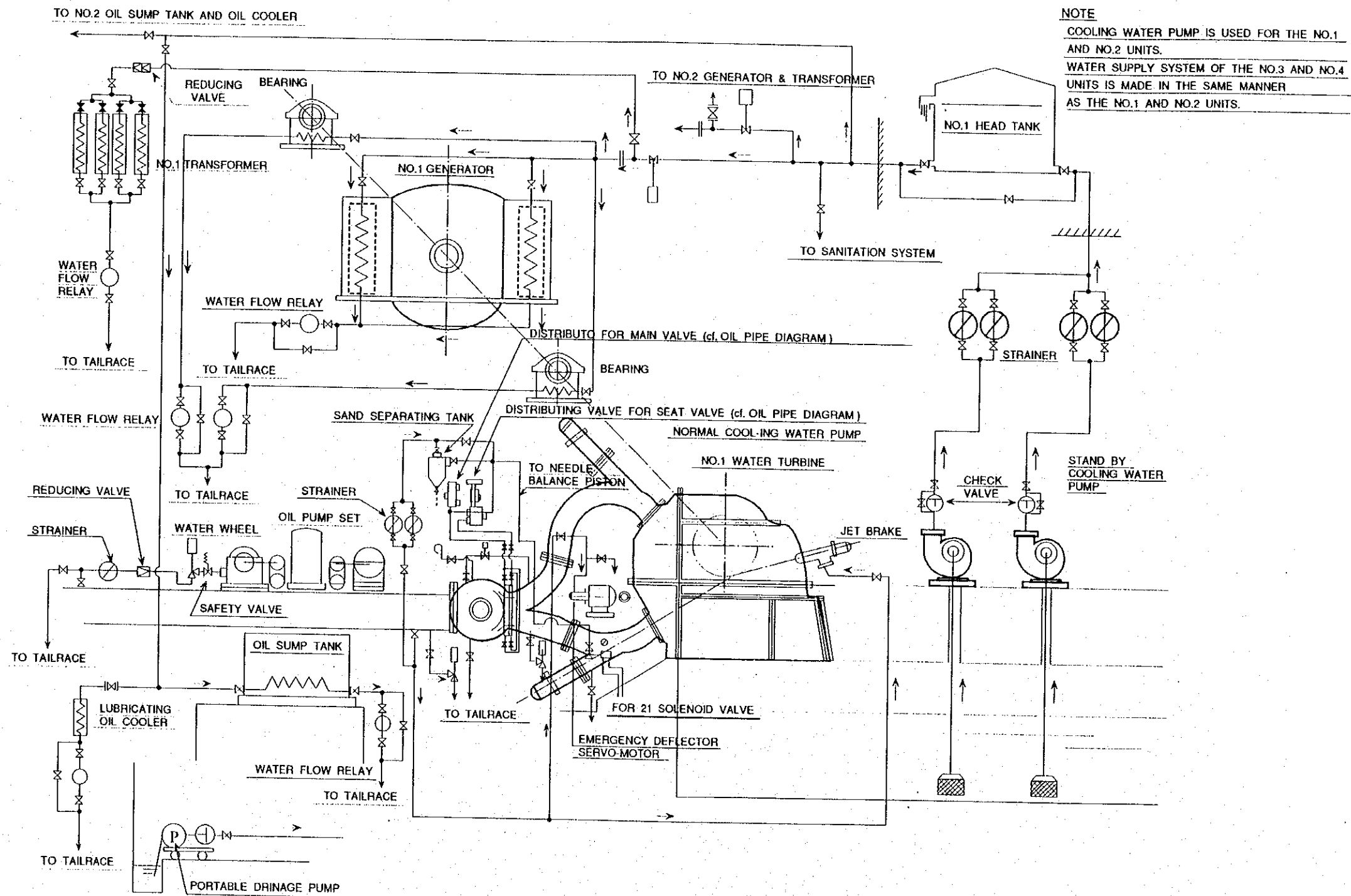
FEASIBILITY STUDY ON REHABILITATION OF DA NHIM POWER SYSTEM

MINISTRY OF ENERGY
JAPAN INTERNATIONAL COOPERATION AGENCY

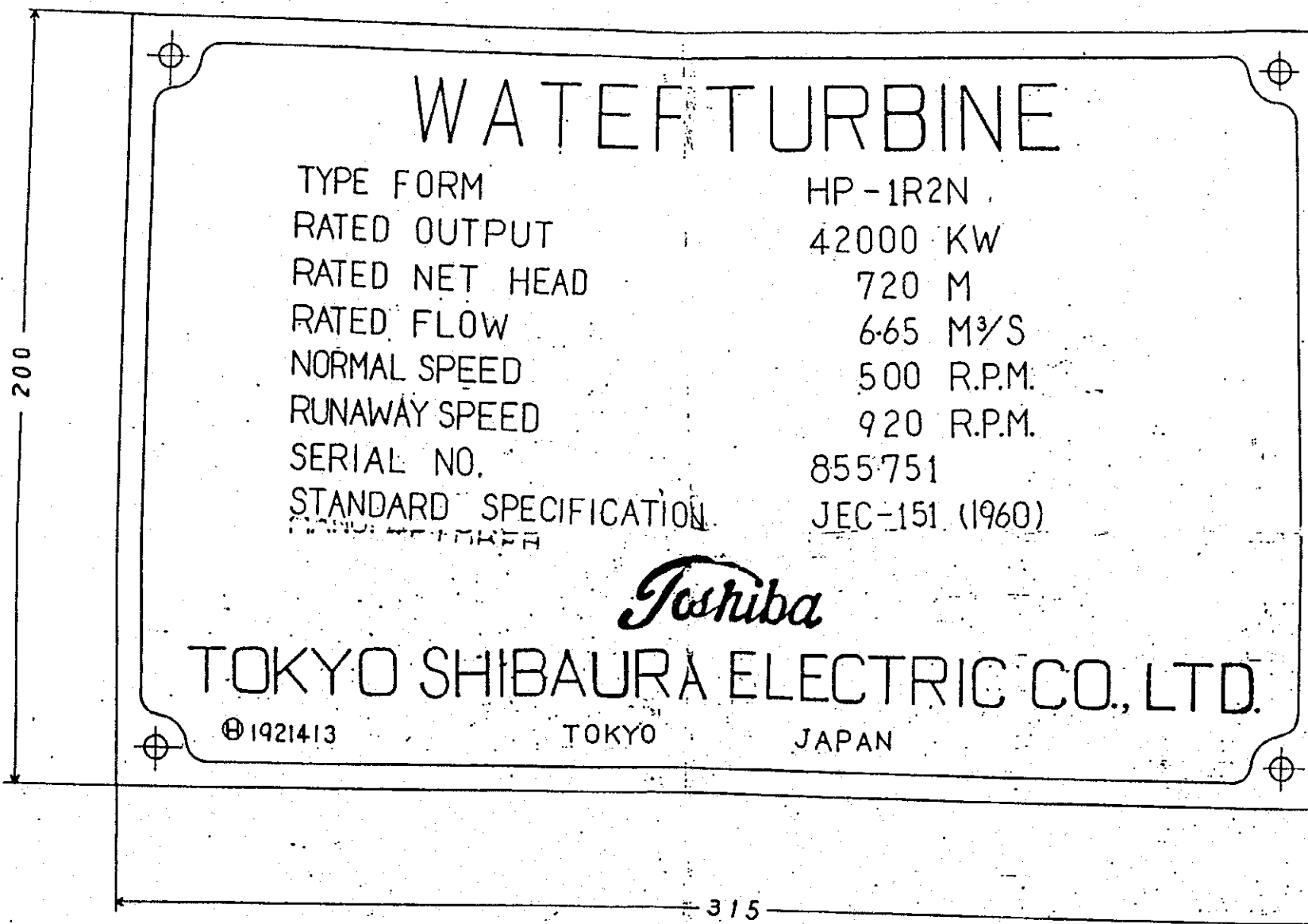
Figure 2.4
Schematic Diagram of Pressure Oil and Air Supply System

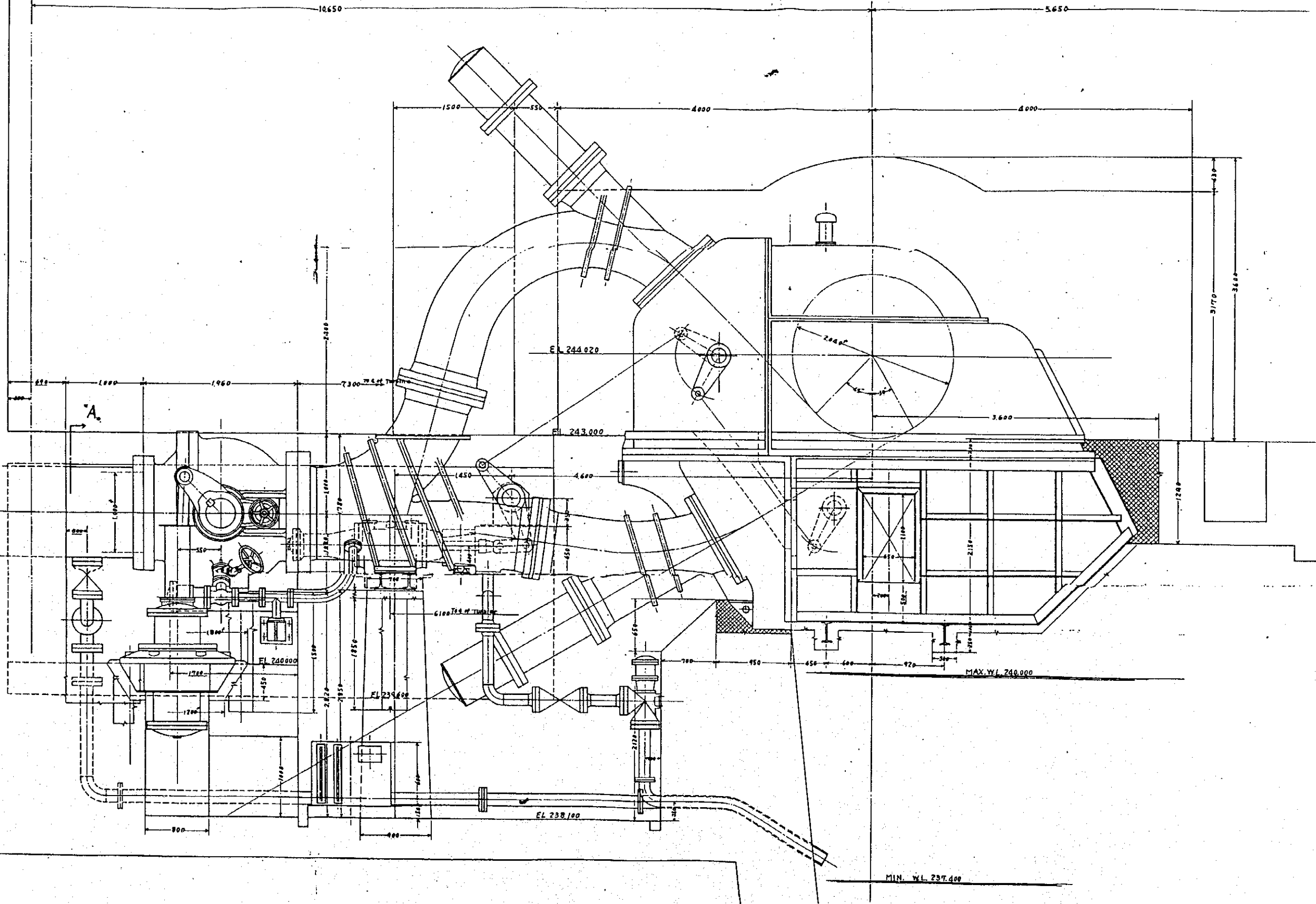
SYMBOL	NAME	NOTE
	HAND PUMP	For Use in Parts subjected to High Pressure
	GATE VALVE	
	CHECK VALVE	
	STRAINER	
	DISTRIBUTING VALVE	
	FLEXIBLE HOSE	





NOTE
 COOLING WATER PUMP IS USED FOR THE NO.1
 AND NO.2 UNITS.
 WATER SUPPLY SYSTEM OF THE NO.3 AND NO.4
 UNITS IS MADE IN THE SAME MANNER
 AS THE NO.1 AND NO.2 UNITS.

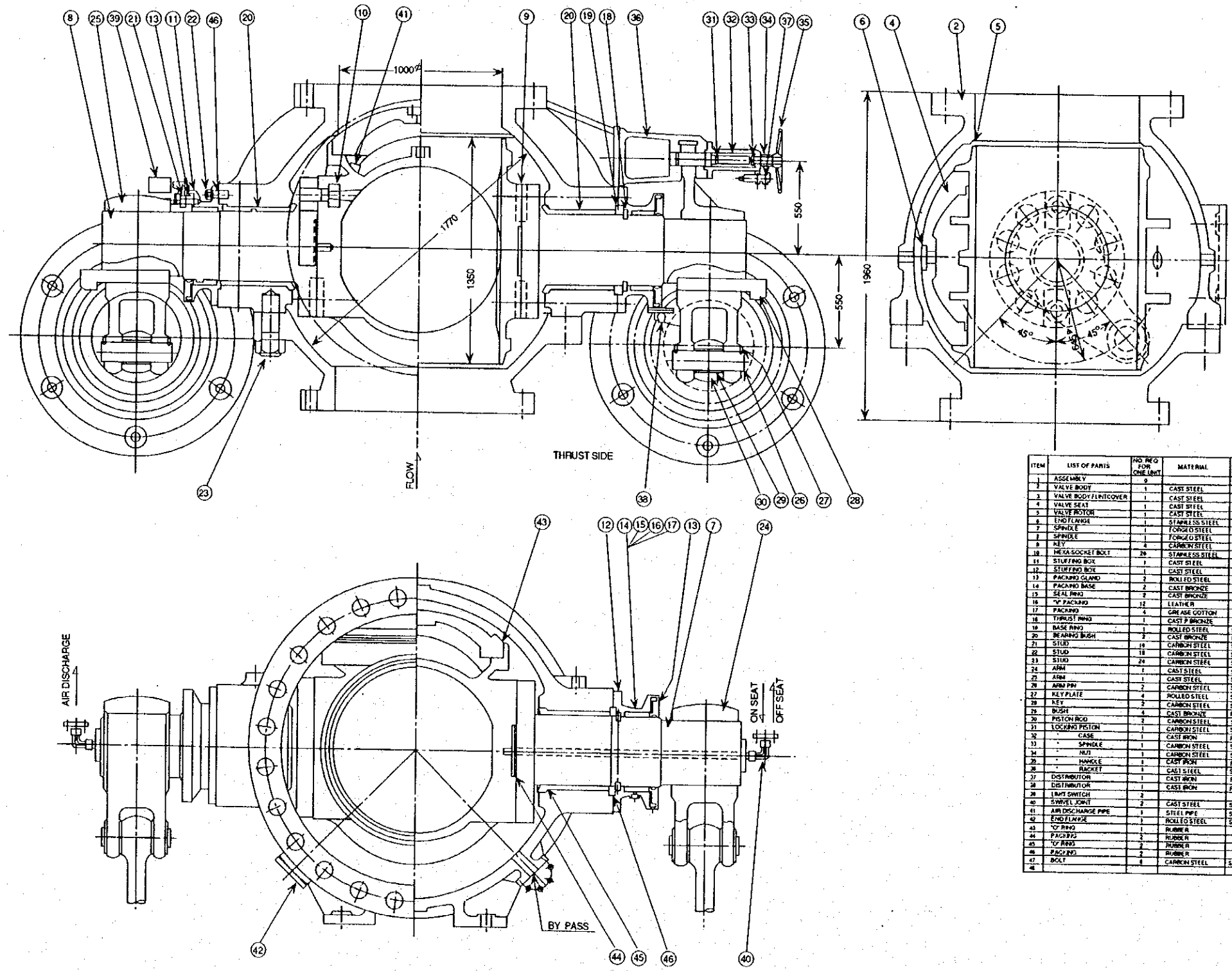




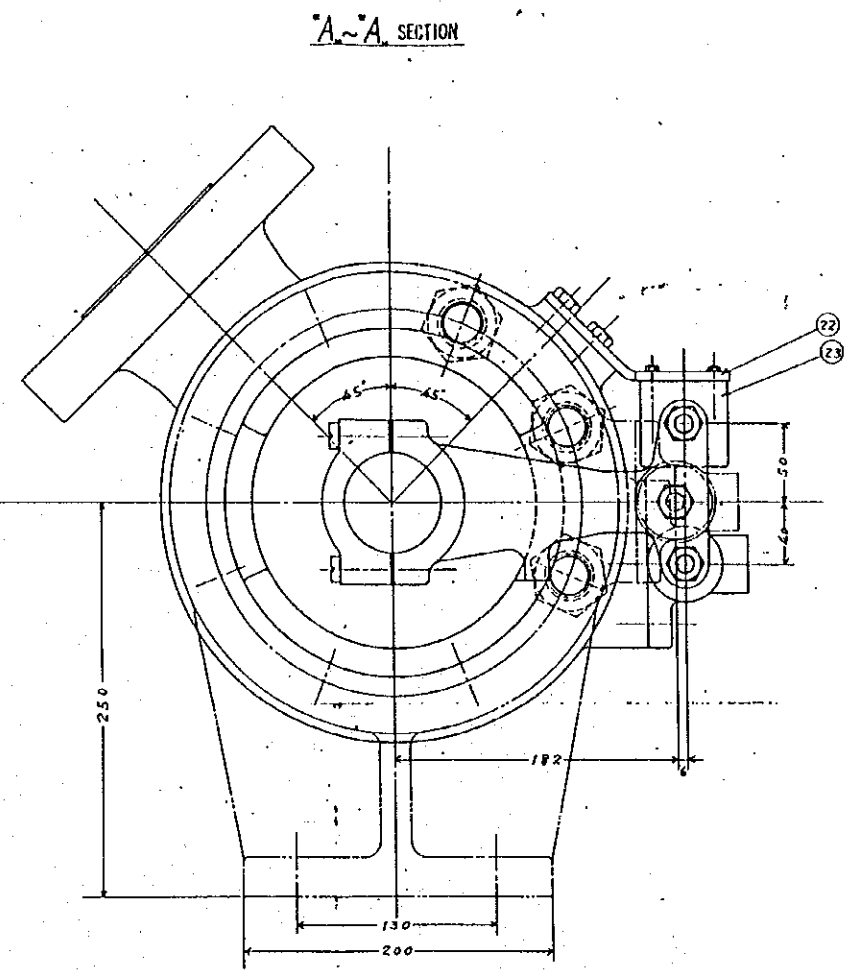
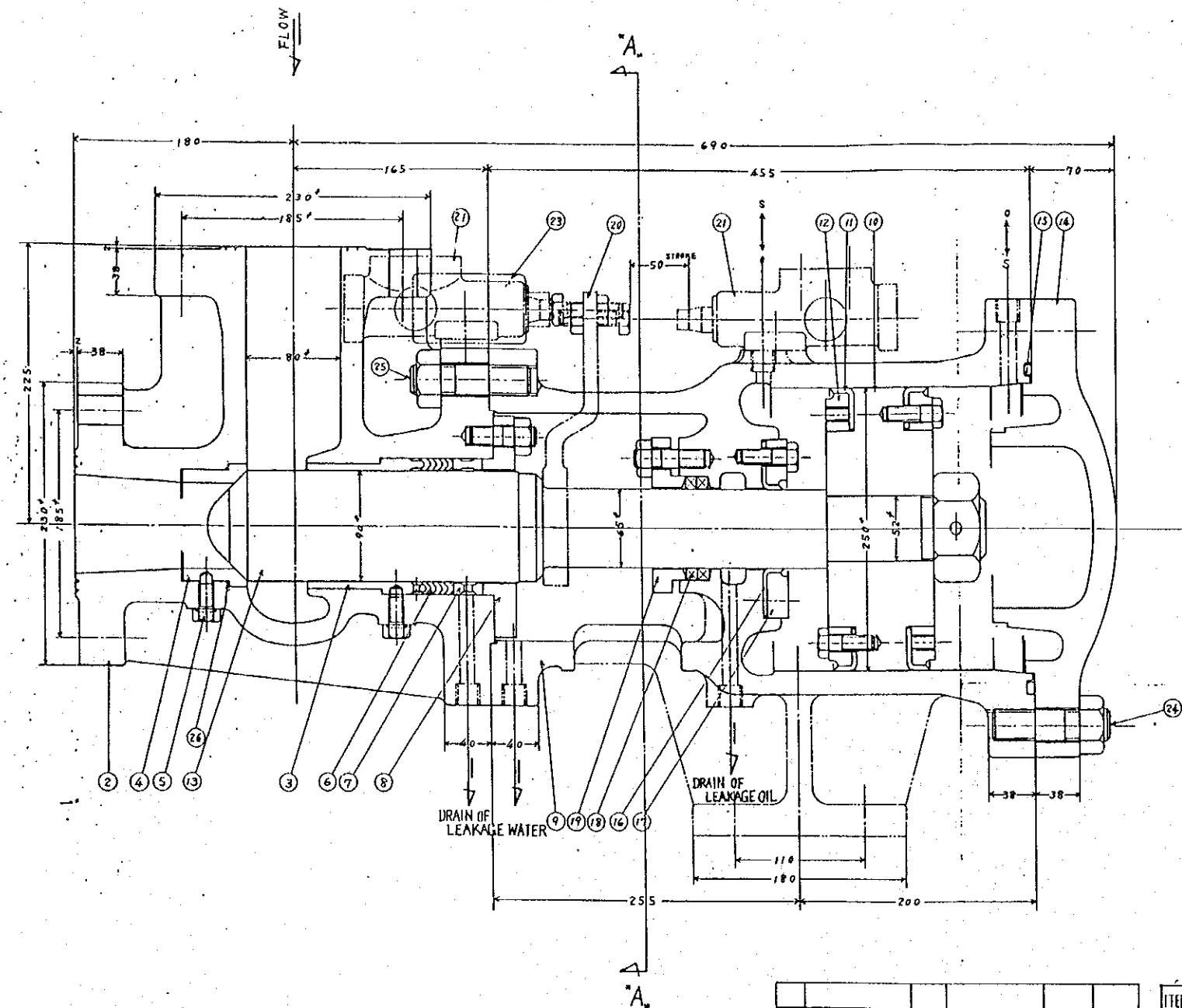
FEASIBILITY STUDY ON
REHABILITATION OF DA NHIM
POWER SYSTEM

MINISTRY OF ENERGY
JAPAN INTERNATIONAL COOPERATION AGENCY

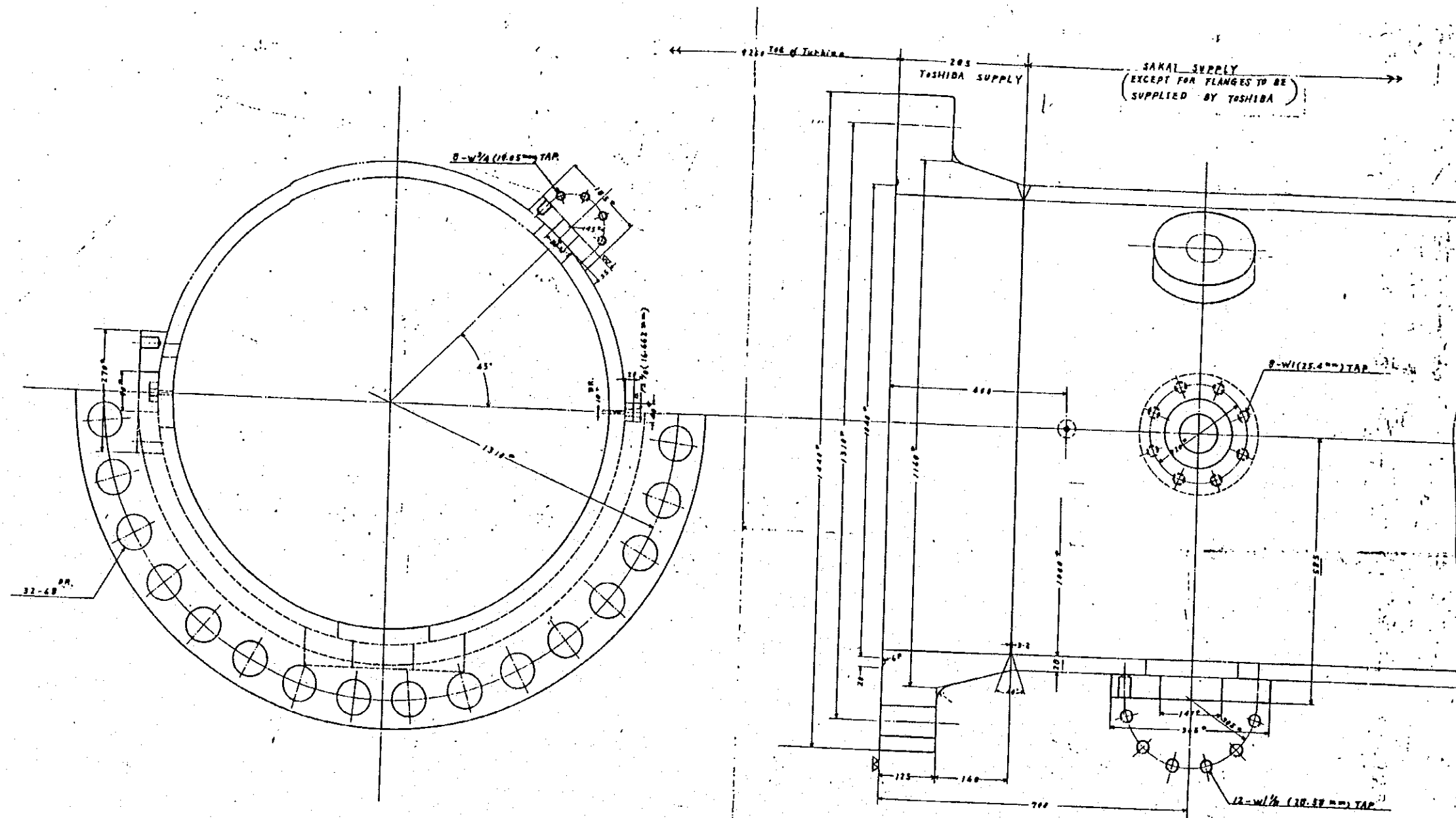
Figure 2.8
Assembly of Water Turbine



ITEM	LIST OF PARTS	NO REQ FOR ONE UNIT	MATERIAL	SS SYMBOLS	REMARKS
1	ASSEMBLY	1			
2	VALVE BODY	1	CAST STEEL	SC40	
3	VALVE BODY FLNICOVER	1	CAST STEEL	SC40	
4	VALVE SEAT	1	CAST STEEL	SC40	
5	VALVE ROTOR	1	CAST STEEL	SC40	
6	END FLANGE	1	STAINLESS STEEL	S316L	
7	SPRINCLE	1	FORGED STEEL	FC20	THRUST SIDE
8	KEY	4	CARBON STEEL	S30C	
9	HEX SOCKET BOLT	20	STAINLESS STEEL	S316L	
10	STUFFING BOX	1	CAST STEEL	SC40	
11	STUFFING BOX	1	CAST STEEL	SC40	
12	PACKING GLAND	1	CAST STEEL	SC40	
13	PACKING GLAND	2	ROLLED STEEL	S541P	
14	PACKING BASE	2	CAST BRONZE	BC1	
15	SEAL RING	2	CAST BRONZE	BC3	
16	"O" PACKING	12	LEATHER		
17	PACKING	4	GREASE COTTON		
18	THRUST RING	1	CAST P BRONZE	PBC1	
19	BASE RING	1	ROLLED STEEL	SS41P	
20	BEARING BRUSH	2	CAST BRONZE	BC3	
21	STUD	10	CARBON STEEL	S30C	WITH NUT
22	STUD	18	CARBON STEEL	S30C	WITH NUT
23	STUD	24	CARBON STEEL	S30C	WITH NUT
24	ARM	1	CAST STEEL	SC40	THRUST SIDE
25	ARM	1	CAST STEEL	SC40	
26	ARM PIN	2	CARBON STEEL	S30C	
27	KEY PLATE	4	ROLLED STEEL	S541P	
28	KEY	2	CARBON STEEL	S30C	
29	BUSH	4	CAST BRONZE	BC1	
30	PISTON ROD	2	CARBON STEEL	S30C	
31	LOCKING PISTON	1	CARBON STEEL	S30C	
32	CASE	1	CAST IRON	FC20	
33	SPRINCLE	1	CARBON STEEL	S30C	
34	NUT	1	CARBON STEEL	S30C	
35	HANDLE	1	CAST IRON	FC20	
36	BACKET	1	CAST STEEL	SC40	
37	DISTRIBUTOR	1	CAST IRON	FC20	FOR PACKING
38	DISTRIBUTOR	1	CAST IRON	FC20	FOR BYPASS
39	LIMIT SWITCH	2			
40	SWIVEL JOINT	2	CAST STEEL	SC40	
41	AIR DISCHARGE PIPE	1	STEEL PIPE	SP	
42	END FLANGE	1	ROLLED STEEL	S541P	
43	"O" RING	1	RUBBER		
44	PACKING	2	RUBBER		
45	"O" RING	2	RUBBER		
46	PACKING	2	RUBBER		
47	BOLT	4	CARBON STEEL	S30C	

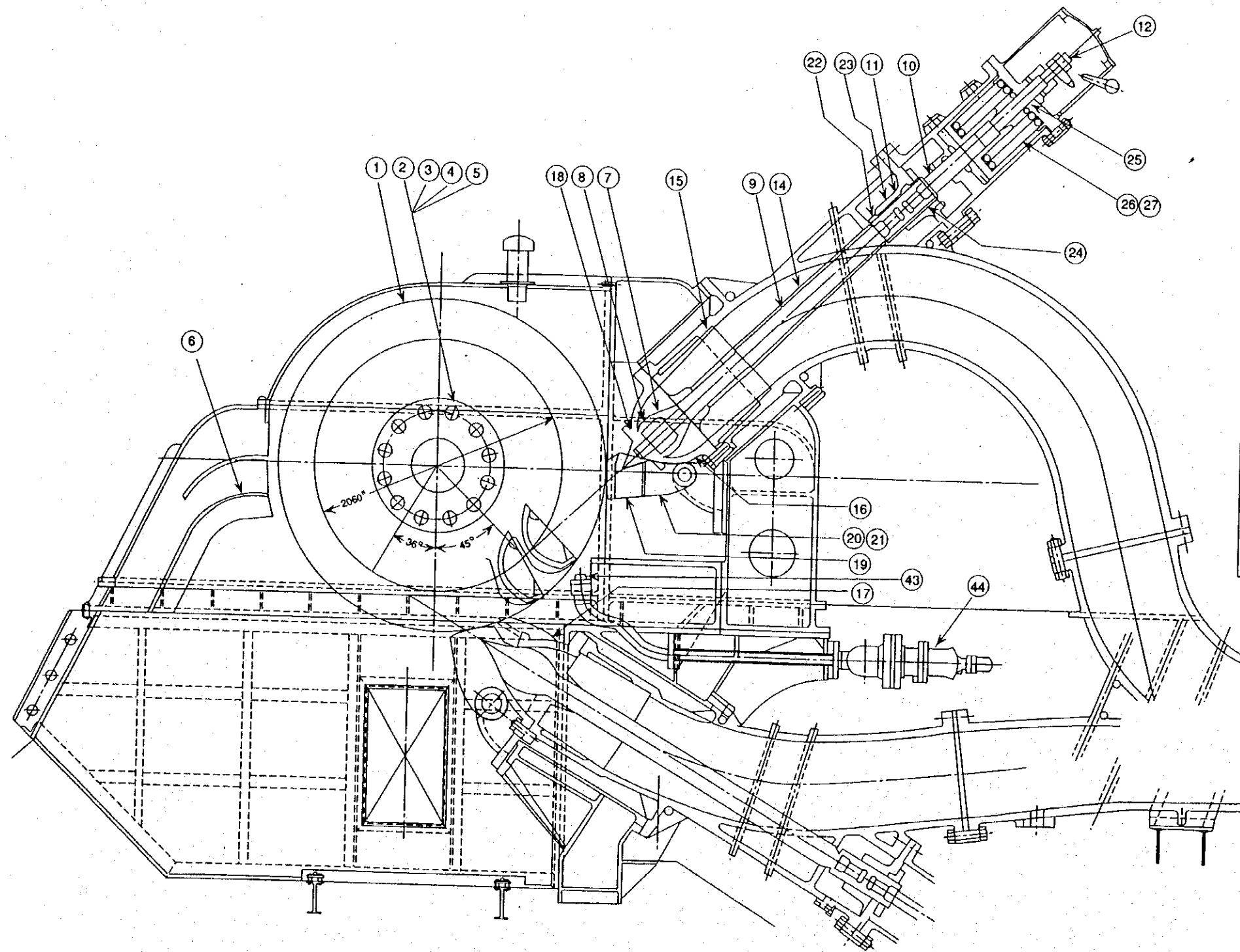


ITEM	LIST OF PARTS	MR. REQ. BY UNIT	MATERIAL	JIS SYMBOL	REMARKS
1	ASSEMBLY	1			
2	VALVE BODY	1	CAST STEEL	SC49	
3	VALVE BODY LINER	1	CAST BRONZE	BC7	
4	VALVE BODY SEAT	1	CAST BRONZE	BC3	
5	STOPPER	1	STAINLESS STEEL	SUS22	
6	PACKING	2	LEATHER		
7	SEAL RING	1	CAST BRONZE	BC3	
8	PACKING GLAND	1	CAST BRONZE	BC3	
9	CYLINDER	1	CAST IRON	FC20	
10	PISTON	1	ROLLED STEEL	S45C	
11	PACKING	2	LEATHER		
12	PACKING GLAND	1	ROLLED STEEL	S45C	
13	PISTON ROD	1	CARBON STEEL	S50C	WITH RING
14	CYLINDER COVER	1	CAST IRON	FC20	
15	O-RING	1	RUBBER		
16	PACKING	1	LEATHER		
17	PACKING GLAND	1	ROLLED STEEL	S45C	
18	PACKING	2	GREASE COTTON PACKING		
19	PACKING GLAND	1	CAST IRON	FC20	
20	ARM	1	CAST IRON	FC20	
21	DISTRIBUTOR	2	CAST IRON	FC20	
22	LIMIT SWITCH BASE	1	ROLLED STEEL	S45C	
23	LIMIT SWITCH	1			
24	STUD	12	CARBON STEEL	S45C	WITH RING
25	STUD	8	CARBON STEEL	S45C	WITH RING
26	O-RING	1	RUBBER		



NOTE TEST PRESSURE AT THE SITE IS 11.4 kg/cm²

FEASIBILITY STUDY ON REHABILITATION OF DA NHIM POWER SYSTEM	MINISTRY OF ENERGY	Figure 2.11 Distance Pipe between Penstock and Inlet Valve
	JAPAN INTERNATIONAL COOPERATION AGENCY	



REPLACEMENT	
ITEM	LIST OF PARTS
1	RUNNER
2	REAMER BOLT
3	LOCK PLATE
4	COVER
5	BOLT FOR COVER
6	BAFFLE PLATE
7	NEEDLE HEAD
8	NEEDLE TIP
9	NEEDLE SPINDLE SERVO-M
10	NEEDLE SPINDLE
11	BALANCE PISTON
12	STOPPER FOR NEEDLE & LOCK NUT SERVO SPINDLE
13	NEEDLE SPINDLE LINER
14	PROTECTING PIPE
15	NEEDLE GUIDE
16	UPPER NOZZLE
17	LOWER NOZZLE
18	NOZZLE TIP
19	DEFLECTOR TIP
20	DEFLECTOR HEAD
21	KEY FOR DEFLECTOR HEAD
22	BALANCE PISTON SLEEVE
23	BALANCE GUIDE
	PISTON BUSHING
24	V SHAPE GASKET
25	COVER BUSHING FOR NEEDLE SERVO
26	SPRING FOR NEEDLE SERVO
27	PISTON RING FOR NEEDLE SERVO
43	NOZZLE FOR JET BRAKE
44	NEEDLE VALVE FOR JET BRAKE