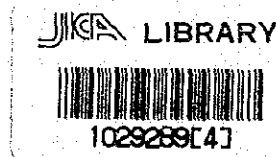


ANNUAL REPORT 1984
ON
THE TECHNICAL COOPERATION
FOR THE PROJECT (RESEARCH)
ON
SEA-WATER DESALINATION TECHNOLOGY
IN
THE KINGDOM OF SAUDI ARABIA

MARCH, 1985

JAPAN INTERNATIONAL COOPERATION AGENCY

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JAPAN INTERNATIONAL COOPERATION AGENCY

国際協力事業団	
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1. Outline of the Project

1.1 History

The Record of Discussion (hereinafter referred to as R/D) on this project was formally agreed on between Saline Water Conversion Corporation (hereinafter referred to as SWCC) and Japan International Cooperation Agency (hereinafter referred to as JICA) in Riyadh, January 1982. In March 1982, a Japanese technical survey team visited the Kingdom of Saudi Arabia (hereinafter referred to as the Kingdom) and had detailed discussions with SWCC officials on project implementation. In the discussions, it was agreed that the project was to get under way in June 1982.

1.2 Objective

This project is intended to establish, through joint efforts of Japan and the Kingdom, the Research Center of Desalination Technology (provisional) that will introduce Japanese desalination technology into the Kingdom, thereby contributing to the stable supply of water resource in the Kingdom and promoting amicable relations between the two countries.

1.3 Scope of Work

The project will span about four years starting on January 12, 1982 and ending on March 31, 1986. During the period, Japan and the Kingdom will jointly set up the Research Center of Desalination Technology in the Kingdom for joint research on seawater desalination.

The project plans to implement the following targets:

- 1) Establishing the Research Center of Desalination Technology (in the first two years)
 - [1] Setting up the laboratory building with its related facilities, and installing laboratory equipment
 - [2] Setting up a multi-stage flash evaporation process (hereinafter referred to as MSF) test plant [1 unit; 20m³/day in capacity]
 - [3] Setting up a reverse osmosis (hereinafter referred to as RO) test plant [2 units; 20m³/day in capacity]
- 2) Conducting joint research on seawater desalination (in the later two years)
 - [1] Chemical study
 - [2] Study on technology for corrosion prevention and scale deposition control at MSF test plant
 - [3] Study on RO module performance test methods at RO test plant
 - [4] Others

The implementation schedule of this project is now being fairly delayed. Therefore, the period of research activities must be extended.

1.4 Present State

The progress of project started in 1982 is described in the followings.

1] Research center

With regard to the construction of the research center, SWCC will take charge of all stages ranging from basic design to construction, on the basis of the conceptual design to be carried out by JICA. The conceptual design was concluded in October 1982.

However, in view of delays that came about in the implementation schedules, the JICA mission held a meeting with SWCC for consultations about the construction of the building in question. In conformity with this consultations, JICA prepared basic data about the Test Plant required for construction of laboratory building as well as laboratory equipment and sent them to SWCC.

SWCC proposed in February 1984 to use an existing building as the Research Center. The JICA mission checked this existing building and discussed the possibility of using this building with SWCC in May 1984.

On the basis of the discussion, JICA revised conceptual design of laboratory of which dimensions were a little reduced compared to formally designed building as the existing building is used as a part of the Research Center.

JICA mission explained SWCC the revised conceptual design in August 1984. Further, JICA mission explained SWCC amended basement drawings of the Test Plants in November 1984.

Thereafter, SWCC had selected a consulting firm to conduct detailed design for the construction of Research Center in December 1984.

JICA mission examined the detailed design and gave necessary advices to SWCC and consulting firm in March 1985.

2] Test plant and laboratory equipment

The test plant and the laboratory equipment will be provided by JICA.

The relevant specifications were drawn up in 1982, and as things now stand they are only short of being procured.

JICA had postponed procurements of the Test Plants components and the laboratory equipment as the construction of the Research Center by SWCC was delayed. However, JICA offered a tender for the Test Plants components in August 1984 and that for the laboratory equipments in November 1984.

2. Research Planning

Outlined planning of research activities to be conducted in the later two years of the project was drawn up. Research items are as follows:

2.1 Research Planning for RO

- 1] To examine sterilization effect of:
 - [1] Chlorine
 - [2] Ultraviolet Radiation and
 - [3] Sodium Bisulfite [SBS]
- 2] To seek the optimum condition of the coagulant by jar tester and inline test of the Test Plant
- 3] To examine the relationship between the filter performance and the quality of sea water
- 4] To study the treatment of the effluent containing sludges from the filter through backwashing procedure by the laboratory devices
- 5] To examine the permeability and the salt rejection of the module vs operating pressure, temperature and salinity
- 6] To follow the performance of the modules through long term operation of Test Plant
- 7] To test the chemical cleaning methods when the module is fouled or deteriorated
- 8] To estimate a most reasonable process of a large scale plant for the prevailing conditions in the Kingdom
- 9] To standardize the main analytical methods

2.2 Research Planning for MSF

- 1] To examine the effect of acid dosing and that of anti-scale chemical dosing with a sponge ball cleaning process
- 2] To examine the reduction of the overall heat transfer coefficient as the measure of scale deposition through long term operation and to analyze the scales taken from the tube walls of the Test Plant
- 3] To test less expensive materials if these would stand well against corrosion in a less oxidizing condition made by addition to the effluent of the deaerator as oxidizer
- 4] To measure the corrosion tendency of the materials by the corrater, the test pieces and the inspection of the tubes pulled out from tube sheet
- 5] To standardize the main analytical method

3. Field Survey

JICA has sent a total of four missions to the Kingdom in May, August and November 1984, and in March 1985 in order to hold a series of meetings with SWCC regarding construction plan of the Research Center, implementing schedule of research activities and storage of granted components and equipment.

3.1 Construction Plan of the Research Center

3.1.1 Items conducted by JICA Mission sent in May 1984

SWCC proposed JICA to use an existing building as the Research Center in February 1984. In reply to this proposal, JICA mission investigated this building and discussed with SWCC about the use of this building.

The results of investigation and discussion are as follows:

1] Investigation Result of Existing Building

The building is located about one kilometer north west of the SWCC Yanbu Plant, and was constructed in early 1983.

It is a standard and modern two storied building of reinforced concrete for administration work.

2] Discussion Result with SWCC

This building is for administration work and its design basis is fundamentally different from that for research activity. If it were to be used for research activity, there would be the following problems:

- [1] The floor must be remodeled to waterproof.
- [2] A utility supply systems must be installed for the research equipment.
- [3] Heights of ceiling and floor must be raised in accordance with the dimensions of research equipment.
- [4] Interior furnish materials must be changed to fireproof.
- [5] Remodelings are necessary not only for the room inside, but also for room layout and facilities such as lighting, piping, air conditioning and machineries.

Because of the above reasons, JICA mission proposed the followings to SWCC, and SWCC accepted those.

- [1] The existing building will be used for administration office of the Research Center:
- [2] The research building and test area will be newly constructed in a site neighboring to the SWCC Yanbu Plant.

3.1.2 Items conducted by JICA Mission sent in August 1984

JICA mission explained SWCC the revised conceptual design for the Research Center which was drafted on the basis of the items mutually agreed upon in May 1984. The mission also offered SWCC information required for detailed design to be conducted by SWCC, and investigated the proposed site for the Research Center.

3.1.3 Items conducted by JICA Mission sent in March 1985

JICA mission discussed technical matters related to detailed design of the Research Center drafted by a consulting firm selected by SWCC with staff of SWCC and this consulting firm, and checked design documents and drawings.

JICA mission submitted SWCC catalogue of research equipment, list of utility consumption and specifications of furnitures as reference materials for detailed design.

The furnitures are to be procured by SWCC according to the R/D, but selections have not been completed. JICA has prepared tentative specifications because they are necessary for drafting detailed design.

3.2 Research Planning

JICA mission discussed with SWCC in November 1984 an outlined plan of research activities to be conducted in the later two years of the project. Items drafted by JICA are shown in 2.1 and 2.2 of this Report.

SWCC accepted the plan proposed by JICA after a partial amendment after a series of discussions. The agreed upon research plannings are as follows:

3.2.1 Research Planning for RO

- 1] To examine sterilization effect of:
 - [1] Chlorine
 - [2] Ultraviolet Radiation
 - [3] Sodium Bisulfite [SBS] and
 - [4] Copper Sulphate
- 2] To optimize the use of coagulants and coagulant aids by jar Tester and in-line test and study the relationship between filter performance and quality of seawater. Evaluate the economic feasibility of using the coagulating agents.
- 3] To study the pollution effect of membrane cleaning discharge in the laboratory
- 4] To study the performance of various membranes under local operating conditions. Studies to be carried out to test stability of the membranes with increased feed water temperature
- 5] To test the chemical cleaning methods when the module is fouled or deteriorated
- 6] To estimate a most reasonable process of a large scale plant for the prevailing conditions in the Kingdom

- 7] To standardize the main analytical methods

3.2.2 Research Planning for MSF

- 1] To examine the effect of acid dosing + anti-scale chemical dosing to control scale deposition and use sponge ball cleaning process. Study the change in over all heat transfer coefficient as the measure of scale deposition through long term operation and to analyze the scales taken from the walls of the Test Plant
- 2] To test alternative materials such as titanium, aluminum brass and other new materials and in the case of aluminum brass, 90/10 Cu-Ni to examine if in a less oxidizing condition made by SBS addition to the effluent of the deaerator as de-oxidizer
- 3] To measure the corrosion tendency of the materials by the corrater, the test pieces and the inspection of the tubes pulled out from tube sheet
- 4] To standardize the main analytical method

3.3 Storage of Equipment Provided by JICA

The figure implementation schedule of this project was mutually agreed upon between JICA and SWCC when JICA mission visited the Kingdom in May 1984. JICA has started preparation for the procurement of those components and equipment, and established a plan to ship those to the Kingdom in March 1985.

However, SWCC requested at a meeting with JICA mission in November 1984 that the shipments of those components and equipment to the Kingdom in March 1985 should be postponed because no warehouse is available in the proposed site of Yanbu.

Further, SWCC mission visited Japan in February 1985 repeatedly requested JICA to postpone the shipment. Consequently, JICA mission sent to the Kingdom in March 1985 investigated warehouse discussed to store provided components and equipments and discussed with SWCC about storage of those.

JICA mission and SWCC agreed upon the following items:

- 1] The existing building for administration office and the locker room in the SWCC Yanbu Plant, which is not used at present, were found suitable for storage of the provided components and equipment as a result of investigation of buildings with air conditioning systems that could be used as warehouse in the neighborhood of SWCC Yanbu Plant.
All the laboratory equipment and a part of test plant components will be stored in either of the above mentioned room or building, and remaining part of test plant components will be stored in outdoor area.
- 2] JICA will send specialists to the Kingdom in order to attend at the acceptance inspection of the provided components and equipment and in order to conducted before those are carried into warehouse.

4. Detailed Specifications of Equipment Provided by JICA

Basic specifications of test plant components and laboratory equipment, as well as detailed ones of some components and equipment were prepared in fiscal 1983.

These specifications were reviewed and revised in fiscal 1984 when the some of components and equipment were procured by JICA.

4.1 Detailed Specifications for RO Test Plant

List of equipment and related drawings are shown in Appendix 2.

4.2 Detailed Specifications for MSF Test Plant

Table of instrument, list of equipment and related drawings are shown in Appendix 3.

4.3 Detailed Specifications for Laboratory Equipment

List of laboratory equipment and utility consumption list are shown in Appendix 4.

APPENDIX

1. Minutes of Meeting
 - 1.1 JICA Mission in May 1984
 - 1.2 JICA Mission in August 1984
 - 1.3 JICA Mission in November 1984
 - 1.4 SWCC Mission in February 1985
 - 1.5 JICA Mission in March 1985

2. List of Equipment and Drawings
for RO Test Plant

3. Table of Instrument, List of Equipment
and Drawings for MSF Test Plant

4. List of Laboratory Equipment and
Utility Consumption List

1. Minutes of Meeting

1.1 JICA Mission in May 1984

1.2 JICA Mission in August 1984

1.3 JICA Mission in November 1984

1.4 SWCC Mission in February 1985

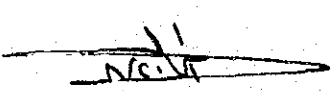
1.5 JICA Mission in March 1985

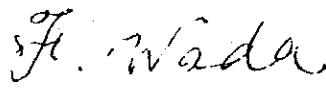
1.1 JICA Mission in May 1984

Minutes of Meeting

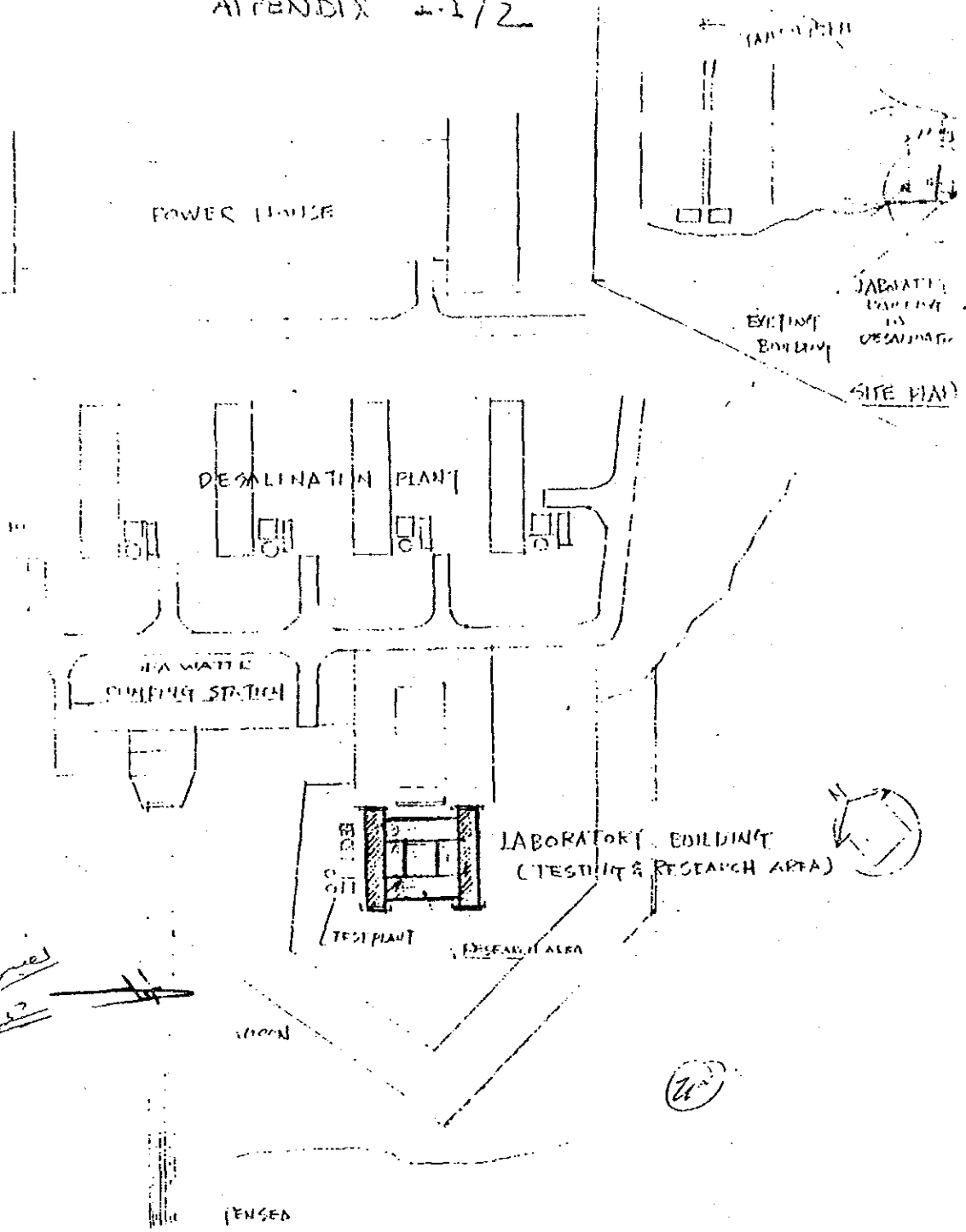
SWCC and the Japanese Team for Research agreed on the following matters on May the 21st, 1984.

1. Both SWCC and the Japanese Team for Research agreed on the earliest possible establishment of the Research Center, since both sides, who are deeply interested in the project and willing to devote necessary resources, wish to implement the Record of Discussion of January 1982 in the best way.
2. Both sides SWCC and JICA agreed to modify the original design (conceptual design document No. SAJ 300) to the design shown in Appendix 1. The modified design includes the areas for Research and Testing Buildings whereas the administration and library will be allocated in the existing administration building at Yanbu (Appendix 2). JICA agree to study both designs and amend the conceptual design Document No. SAJ 300 to suit the modified (proposed) design and submit it to SWCC no later than July 1, 1984.
3. JICA will start procurement of the test plants and research equipments and SWCC will start the necessary procedures for construction according to the schedule attached in Appendix 3.
4. JICA will send two representative engineers who will assist SWCC for detail designing by a contractor/consultant, as soon as JICA is informed by SWCC at least one month in advance, for one-month period.
5. JICA will send experts of research activities on October this year, who will cooperate with SWCC counterparts for making detailed research planning.

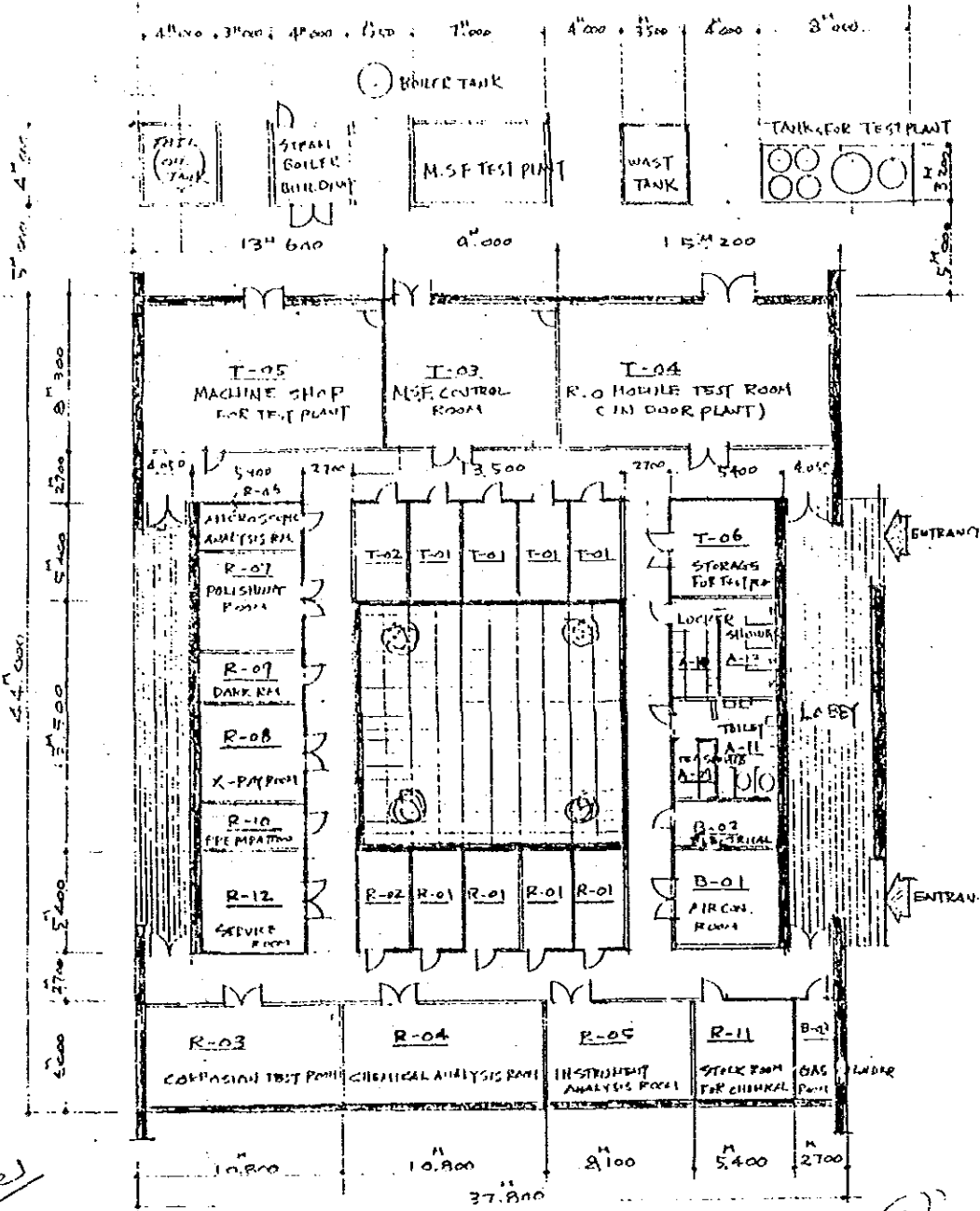

(Acting) Dr. Abdulaziz Al-Mujahid
Deputy Governor
for Technical Affairs and Projects
SWCC


Fumio Wada
Leader
Japanese Team for Research
JICA

APPENDIX 4-1/2



CONCEPTUAL DESIGN FOR
LABORATORY BUILDING
(TESTING & RESEARCH AREA)
SITE PLAN



LABORATORY (TEST PLANT & RESEARCH AREA) FLOOR PLAN

SCALE 1:300

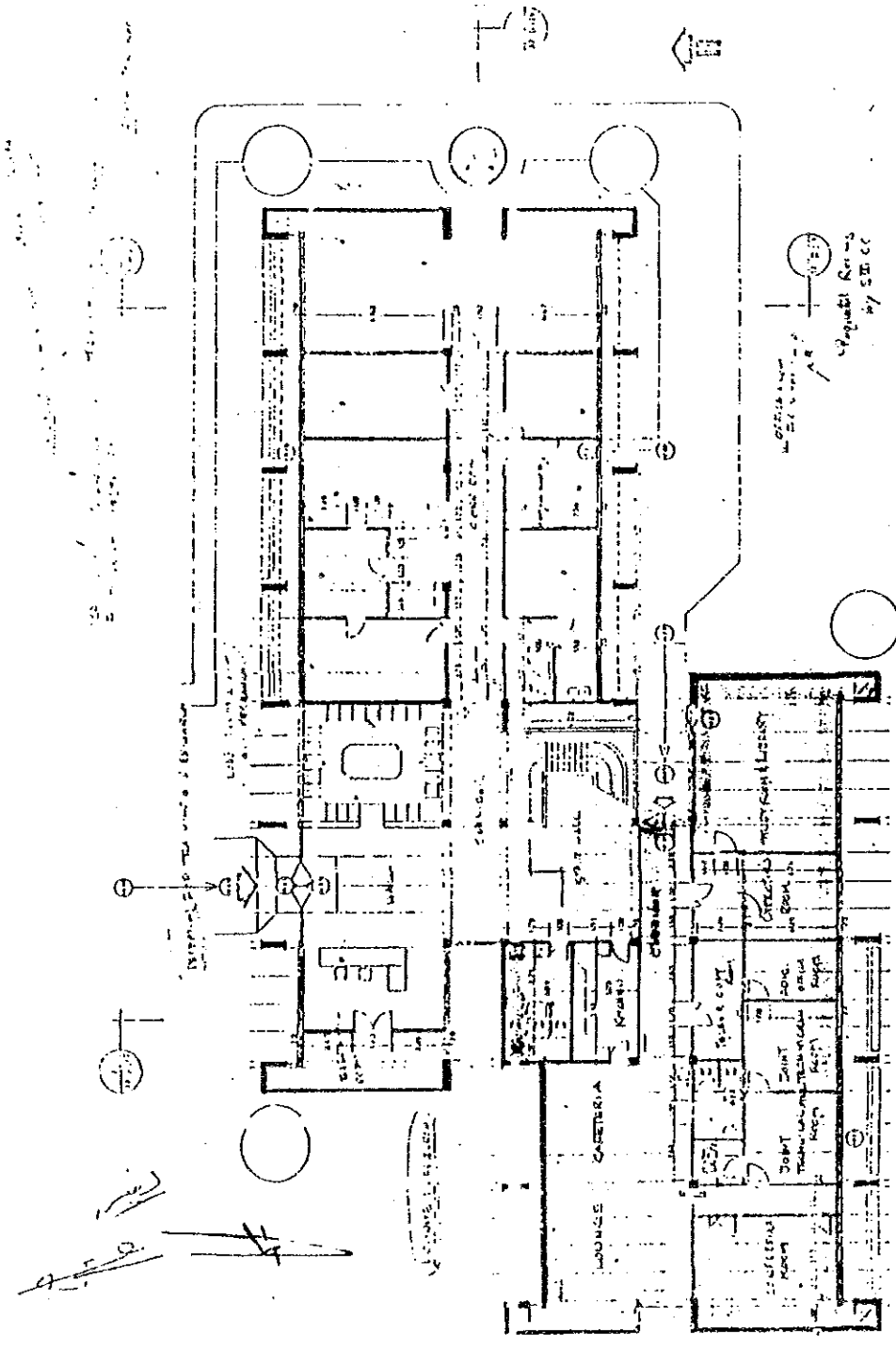
CONCEPTUAL DESIGN
FOR
LABORATORY FLOOR PLAN

NOTE The each rooms equipments layout should be referred to "CONCEPTUAL DESIGN FOR LABORATORY BUILDING OF DESALINATION RESEARCH PROJECT (DOCUMENT NO. SAJ 303-AUGUST 1982- and the final submission of the plant's facilities" of December 1983.

DATE MAY 18th 1984

PREPARED BY JICA.

APPENDIX 2



REQUESTED ROOMS BY SUGG
 FOR
 TRAINING AND RESEARCH CENTER
 E.G.
 EXISTING BUILDING (GROUND FLOOR)
 AND
 CONCEPTUAL FLOOR PLAN FOR SEASONAL USE

DRAWING
 TITLE:

APPENDIX 2

CONCEPTUAL FLOOR PLAN SCALE 1/8" = 1'-0"

APPENDIX 3

TENTATIVE IMPLEMENTATION SCHEDULE FOR THE RESEARCH CENTER BEFORE ITS START OF OPERATION

STAGE	UNDERTAKINGS	1984												1985												1986											
		Y	M	4	6	8	10	12	2	4	6	8	10	12	2	4	6	4	6	8	10	12	2	4	6	4	6	8	10	12	2	4	6				
Test Plant 5 Test Area	JICA	Amend the Conceptual Design 21/5 1/7																																			
	SWCC	Detailed Design Construction Civil Work 1/7 1/10																																			
	JICA	Procurement Transportation 1/6 Arrival Installation & Trial Operation																																			
Research Area	SWCC	Detailed Design Construction Civil Work 1/7 1/10																																			
	JICA	Procurement Transportation Installation (Order - Made) 1/6 (70%) 1/4 (30%) 24/12 1st Arrival 1/7 (Ready - Made) 2nd Arrival																																			
Research Activities	SWCC JICA	Detailed Research Planning 1/10 1/5 1/4 1/12 1/2 Preparation for Research of Research 1984 1985 1986																																			

1.2 JICA Mission in August 1984

MINUTES OF MEETING FOR RESEARCH CENTER

Japanese Team for Research visited SWCC for the following purposes:

- 1) To explain "Conceptual Design "REV.I."
- 2) To have informations of Detail Design Work Procedure by SWCC.
- 3) To assist in investigating Site Conditions;

SWCC and Japanese Team discussed and agreed on 14th Aug. as follows:

1. Conceptual Design Explanations.

Japanese Team explained and discussed contents of "Conceptual Design", and answered to the SWCC's queries to which SWCC appreciated and accepted.

SWCC and Japanese Team agreed that:

- 1-1) SWCC will take care for the following; during and/or before detail design by Consultants selected by SWCC.
 - a) Selection of structural framing material (Reinforced concrete or Precast concrete).
 - b) Soil conditions, seismic activity and climatic condition.
 - c) Applicable International Codes
 - d) Selection of Finishing materials
 - e) Outdoor design conditions for Air-conditioning
 - f) Provisions for future extensions
 - g) Site conditions (Layout, utilities tie points)
- 1-2) Following corrections will be made for C/D, SWCC will give instructions to the Consultants.
 - i) 6 researchers private rooms to 3 researchers private room in page 2-5.
 - ii) 4 Operating Engineers' private rooms to 3 Operating Engineers' private rooms in page 2-7.
 - iii) Alluminium glass mounted curtain wall for administrative area - for entrance area in page 3-3.
 - iv) To delete size 50^m/m x 50^m/m of ceramic tile in page 3-3.

- v) To add floor drain in rooms T-04, R-11, B-04, in page 3-25 and page 3-26.
- vi) To modify room arrangements and to add rooms as shown in Sketch I here attached.
- vii) Rooms finished with Terrazzo tile for floor, will be R-04, R-11, B-05, B-06, and B-08.
- viii) Rooms finished with Terrazzo tile for floor, will be A-01, A-02 and B-07.
- xi) Rooms finished with mortar steel Trowel for floor will be: T-04, T-05, B-01, B-02, B-03 and B-04.

1-3) Japanese Team explained the revised laboratory equipment information enclosed and that revised laboratory equipments will be better and more functionable than those originally proposed in Conceptual Design. SWCC accepted, and will take consideration into detail design.

Japanese Team also submitted the preliminary detail informations (manufacturers catalogues) of the laboratory equipments, (now under selection in Japan) as for reference to the detail design.

Japanese Side will send the final detail informations of the laboratory equipments, when they are finally selected and purchased, in order to be taken into consideration in the detail design.

2- Detail Design work Procedure undertaken by SWCC.

2-1) SWCC explained Japanese Team that the Consultant for detail design have not been selected yet, but will be soon selected by SWCC.

Japanese side will be informed of signing date of the detail design contract with the consultant, when the contract is signed.

2-2) SWCC also explained that Contractor for Construction work will be selected by SWCC after detail design, and construction will be completed before the date agreed with the last Japanese Mission, (May, 1984), which means 1st. of October, 1985.

2-3) Japanese Team Discussed and gave all the necessary informations to SWCC, so that SWCC could give the necessary information for starting the detail design to the selected Consultant.

3- Site conditions for Research Center

To be referred to "Minutes of Meeting in Yanbu Plant" here attached.

The following matters were stated by SWCC that:

1) The detail design which will be produced by the selected Consultant, will be reviewed by both SWCC and Japanese side for their correctness

of the design and the conformity with the Conceptual Design.

- 2) Establishment of the Joint Technical Team as per Article 6 of the R/D. SWCC requested the Japanese side to send relevant specialist during the Detail Design and construction phase of this project.

1) Above meetings were held at SWCC office from 5th, Aug. 1984 to 14th, Aug. 1984.

2) Attendants for the above meetings are as follows:

SWCC	:	Deputy Governor (Acting)	
	:	for Technical Affairs & Projects	: Dr. Abdulaziz M. Al-Mujahid
	:	Technical Advisor to Governor	: Abdulrahman Al-Yousef <i>A. R. Al-Yousef</i>
	:	Construction Dept.	: Abdullah Joraid <i>Abdullah Joraid</i>
	:	" "	: Mohammed Al-Oqbi <i>Mohammed Al-Oqbi</i>
	:	" "	: Mohammed Al-Barrak <i>Mohammed Al-Barrak</i>
	:	Research Dept.	: Habeeb Mohammed <i>Habeeb Mohammed</i>
Japanese Team	:		: Toshio Harada
" "	:		: Toshio Kojitani <i>T. Kojitani</i>

Signed *Dr. Abdulaziz M. Al-Mujahid*
Dr. Abdulaziz Al-Mujahid
Acting Deputy Governor
for Projects & Technical Affairs,
SWCC.

Signed *Toshio Harada*
Toshio Harada
Team Leader
Japanese Team for Research
JICA.

TH

MINUTES OF MEETING IN YANBU PLANT

Date : 9th August 1984

Place : Plant Manager Room in Yanbu Plant.

Attendants : SWCC YANBU PLANT MANAGER MR. NAJI A. DARWISH
DY. PLANT MANAGER MR. ABDUL SALAM DABOUR

SWCC (RIYADH) MR. MOHAMMED AL-OQBI
MR. MOHAMMED AL-BARRAK

JAPANESE TEAM, TEAM LEADER MR. TOSHIO HARADA
SUB TEAM LEADER MR. TOSHIO KOJITANI

SUBJECT: SITE CONDITIONS FOR RESEARCH

On 9th August, 1984 the above mentioned SWCC Engineers, accompanied by the Japanese Team, visited the Madina-Yanbu Plant, in order to determine the Site Conditions, the available utilities, and connection points for the various utilities.

A) Utilities available in the Madina-Yanbu Plant.

It is confirmed that it is possible to provide the following utilities for the Research building. The details of the flow rates, capacities, and possible connection points, etc. will be studied by SWCC and confirmed later.

1) Potable Water.

The connection will be given directly from the existing supply lines, (instead of providing a tank and compression pump, as requested by JICA).

2) Raw Sea Water Intake.

Various alternatives will be studied by SWCC Site Engineers and JICA will be informed.

3) Electrical power - Same comment as for item (2) above

4) Sewage & Drainage - Same comment as for item (2) above

5) Compressed Air - Refer to B-4

B) SWCC engineers requested JICA to study the following matters and inform SWCC about their findings.

1) Possibility of Supplying Steam required for the R/O Test Plant from the boiler of MSF Test Plant. (This was requested in view of the fact that it is not feasible to supply the steam from the existing plant, as requested by

- 2) Possibility of providing the Burners of Boiler of a type which will be capable to run on different types of fuels such as Bunker C, white deisel, gas, etc.
- 3) The need for providing additional water storage tank for storing the product water from the R/O & MSF Test Plants, for possible re-use.
- 4) Air compressor to be provided by JICA together with the test plants, in order to produce compressed air. (This was requested in view of the fact that it is not feasible to supply the compressed air from the existing plant, as requested by JICA).

TH

Revised Laboratory Equipment Informations
Research Center

Contents

- 1) Table 1: Deviation List of Laboratory Equipments
- 2) Table 2: Deviation List of Utilities Consumption
- 3) Table 3: Deviation List of Furnitures Purchased by SWCC
- 4) Deviation List of Conceptual Design for Laboratory Building (SAJ 303-1).

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TABLE 1. DEVIATION LIST OF LABORATORY EQUIPMENTS

Item No.	Old (June 1984)		New (August 1984)		Reasons
	Description	Qty	Description	Qty	
1-1	Corrosometer	1 set	AC Impedance Systems	1 set	New product is possible to measure resistance and impedance for parts of corrosion.
1-3	Electrometer (1) Body	(1)	Electrometer (1) Body	(3)	_____
1-17	Potentiostat/Galvanostat	1 set	_____	_____	This device is included in the Item No. 1-1, new description.
2-1	Atomic Absorption Spectrophotometer	1 set	Inductive coupled Plasma Emission Spectrophotometer	1 set	New one is able to analyze various elements at the same time and high speed.
2-4	Electrical Conductivity Meter	1 set	Electrical Conductivity Meter	2 sets	_____
2-15	X-ray Fluorescence Analyzer	1 set	Electron Probe Micro Analyzer	1 set	New apparatus can be analyze micro part of sample by up to date electron microscope.

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TABLE 2. DEVIATION LIST OF UTILITIES CONSUMPTION

Item No.	Old (June 1984)				New (August 1984)				Remarks	
	Description	Qty	Electricity (KW)		Water (L/min.)	Description	Qty	Electricity (KW)		
			220V/1ϕ	380V/3ϕ				220V/1ϕ		380V/3ϕ
-1	Corrosimeter	1 set	0.15			AC Impedance Systems	1 set	0.5		
-17	Potential stat/ Galvanostat (1) Potential stat/ Galvanostat (2) Function Generator (3) Logarithmic (4) X-Y Recorder	(1) (1) (1) (1)	0.05 0.008 0.008 0.035							
-1	Atomic Absorption Spectrophotometer (1) Atomic Absorption Spectrophotometer (2) Air Compressor (3) Recorder	(1) (1) (1)	0.35 0.4 0.03		0.5	Chilled water (below 30°C) C2H2; 3l/min. (1kg/cm ²) Air; 15l/min. (3kg/cm ²) N2O; 10l/min. (3kg/cm ²)	Inductive Coupled Plasma Emission Spectrophotometer (1) Dual Monochromator (2) High Frequency Unit (3) Micro Processor (4) Graphic Printer	(1) (1) (1) (1)	1.0 5.0 0.4 0.4	Ar: 20l/min. Microchemical Analysis of Ingredients Scale and Chemical Products
-15	X-ray Fluorescence Analyzer	1 set	0.36		15		Electron Probe Micro Analyzer	1 set	7.0	6. PR Gas

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TABLE 3. DEVIATION LIST OF FURNITURES PURCHASED BY SWCC

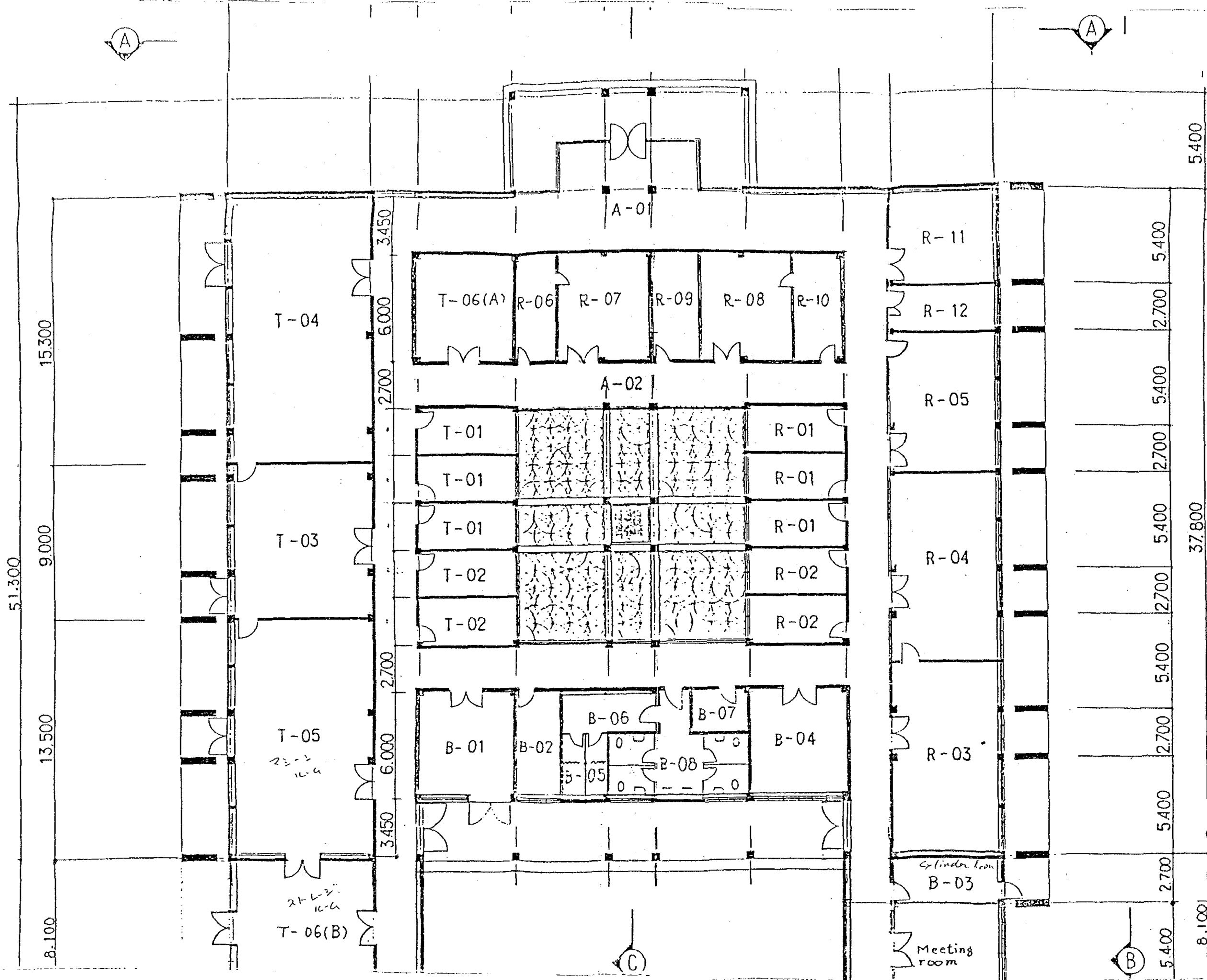
Item No.	Old (June 1984 \diamond 1)		New (August 1984)	
	Description	Q'ty	Description	Q'ty
5-6	Side Bench with Utility Box 3,000 (L) x 750 (W) (include Small Sink)	12 sets	Side Bench with Utility Box 3,000 (L) x 750 (W) (include Small Sink)	11 sets

TH

DEVIATION LIST OF CONCEPTUAL DESIGN FOR
LABORATORY BUILDING (SAJ303- 1)

PAGE	OLD	NEW
2-7	(j) -----	(j) ----- (k) EPMA room This room will be equipped with electron probe micro analyzer.
2-8	(C) (c) Gas cylinder room ----- --- gases (N ₂ , C ₂ H ₂ , and N ₂ O) ----	(C) (c) Gas cylinder room ----- --- gases (N ₂ and Ar, PR)---
2-11	R-11 -----	R-11 ----- R-12 EPMA room ----- 16 M ²
3-16	R-11 ----- Aircon system	R-11 ----- Aircon system R-12 EMPA room o
3-23	(g) Other gas facilities (N ₂ O, N ₂ , C ₂ H ₂) gases will be ---	(g) Other gas facilities (N ₂ , Ar, PR,) gases will be ---
3-26	Cold Hot Floor Fume Other Water Water Drain Hood Gas Gas	Cold Hot Floor Fume Other Water Water Drain Hood Gas Gas
12 --		12 -- 13 o o o EPMA room
ANNEX2 (C) Item		(C) Item
5-6 Side bench with ----- 12 sets		5-6 Side bench with ----- 11 sets

Handwritten initials/signature



SKETCH 1
 NOTE: REVISED
 MADE AT SITE
 12th AUG 1960
[Signature]

1.3 JICA Mission in November 1984

Minutes of Meeting

SWCC and the Japanese Preliminary Study Team (hereinafter referred to as the PS Team.) which was dispatched by JICA stayed in the Kingdom of Saudi Arabia from November 4th 1984, agreed on the following matters on November 20, 1984. Schedule of the PS Team is attached in ANNEX I.

A. Themes and Schedules of Research and Related Matters

1. SWCC and the PS Team agreed on the "Themes and Schedules of Research" which is attached in ANNEX II.

The proposed themes and schedules of the research submitted by the PS Team and the discussion on these subjects between two parties are attached in ANNEX III.

2. SWCC and the PS Team agreed on to discuss formation of hard scale, of which data and samples were provided by the Yanbu Plant, as a theme of research in the future meeting, of which details are attached in ANNEX IV.

The PS Team will examine the data and analyze the samples and these results will be reflected upon the discussion in the future meeting. The data is attached in ANNEX V.

3. The PS Team visited the seawater desalination plant of SWCC in Jeddah and Yanbu from November 10th through 13th, 1984 for the purpose of studying the present conditions of operation and maintenance. A report on this visit by the PS Team is attached ANNEX VI.

B. Revised Drawings to be taken up as a basis of Detailed Design.

1. SWCC and the PS Team agreed on to use the revised drawings of the RO Test Plant, which was submitted to SWCC by the PS Team on November 6th, instead of the drawing sent by the Embassy of Japan on October 10th. List of the revised drawings with a table of revision is attached in ANNEX VII.

2. SWCC and the PS Team agreed on to use revised drawings of the MSF Plant, which was submitted to SWCC by the PS Team on November 6th. List of drawings with a table of revision is attached in ANNEX VIII.

C. Requests by SWCC

1. The PS Team stated to convey to the Japanese Government and JICA that SWCC requested JICA two experts (a mechanical instrumentation engineer and a civil engineer) to come to the Kingdom of Saudi Arabia to review detail design with SWCC during the two stages: 1) Drafting of Detail Design 2) Preparation of

Tender Documents, official TELEX will be sent to JICA after signing the contract with the Consultant.

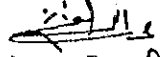
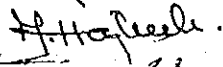

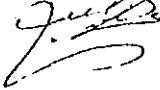
2. SWCC stated that a coordinator for the smooth implementation of the research program should be dispatched to the Kingdom of Saudi Arabia as soon as possible.

D. Request by JICA


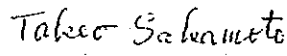
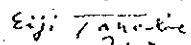
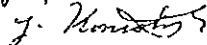
The PS Team informed SWCC that the boiler being supplied by the Japanese side can only use Fuel Oil #A (Japanese nominal name). SWCC suggested that the Japanese study the possibility of using Bunker 'C' or crude oil for the boiler as these fuels will be available on the site and not Fuel Oil #A.

List of Attendants

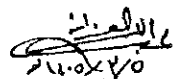
(1) SWCC


Mr. Abdullah Al-Azzaz 
Mr. Habeeb Mohammed 
Mr. Saeed Najjar 
Mr. Mohammed Al-Uqbi 

(2) PS Team

Mr. Junzo Hori 
Mr. Takeo Sakamoto 
Mr. Eiji Tanabe 
Mr. Yoshihiko Konishi 

Date: November 20, 1984
Place: Riyadh

for 
Abdul Aziz Al-Mujahid
Deputy Governor
Saline Water Conversion Corporation


Junzo Hori
Team Leader
Preliminary Study Team
JICA

ANNEX I

Schedule of the PS Team

Nov. 5,	Mon.	0830-0900	Greeting to SWCC Deputy Governor H.E. Dr. Abdulaziz Al-Mujahid
		0900-1030	Meeting with SWCC Research Dept. General Director Abdullah Al-Azzaz
Nov. 6,	Tue.	0900-0930	Greeting to SWCC Governor H.E. Dr. Abdullah M. Al-Gholaikah
		0930-	Meeting with SWCC, Mr. Al-Azzaz
Nov. 7,	Wed.	0900-1200	Meeting with SWCC, Mr. Al-Azzaz & University Professors
Nov. 8,	Thu.		Meeting within the PS Team
Nov. 9,	Fri.		Trip to Jeddah
Nov. 10,	Sat.	0800-	Meeting with Staff Engineers of Jeddah Plant
			Visit to Phase 2 and RO Plants
Nov. 11,	Sun.	0800-	Visit to Laboratory
Nov. 12,	Mon.		Trip to Yanbu
		0900-	Meeting with Staff Engineers of Yanbu Plant
			Visit to Plant and Laboratory
Nov. 13,	Tue.	0900-	Meeting with Staff Engineers
			Trip to Riyadh
Nov. 14,	Wed.	0900-	Meeting with SWCC, Mr. Al-Azzaz
Nov. 15,	Thu.		Meeting within the PS Team
Nov. 16,	Fri.		Meeting within the PS Team
Nov. 17,	Sat.	0900-1100	Meeting with SWCC, Mr. Al-Azzaz
Nov. 18,	Sun.	1200-	Meeting with SWCC, Mr. Al-Azzaz
Nov. 19,	Mon.	0900-	Meeting with SWCC, Mr. Al-Azzaz
Nov. 20,	Tue.		Signing of Minutes of Meeting
			Greeting on SWCC Governor H.E. Dr. Abdullah M. Al-Gholaikah

Saline Water Conversion Corporation

Our Ref. No.

Date ANNEX II

The revised Research themes and the schedules are as follows:

1- REVERSE OSMOSIS

<u>ITEM NO.</u>	<u>DESCRIPTION</u>
R-1	To examine sterilization effect of : 1) Chlorine 2) Ultraviolet Radiation. 3) Sodium Bisulfite (SBS) and 4) Copper Sulphate
R-2	To optimize the use of coagulants and coagulant aids by Jar Tester and in line test and study the relationship between filter performance and quality of seawater. Evaluate the economic feasibility of using the coagulating agents.
R-3	To study the pollution effect of membrane cleaning discharge in the laboratory.
R-4	To study the performance of various membranes under local operating conditions. Studies to be carried out to test stability of the membranes with increased feed water temperature.
R-5	To test the chemical cleaning methods when the module is fouled or deteriorated.
R-6	To estimate a most reasonable process of a large scale plant for the prevailing conditions in the Kingdom of Saudi Arabia.
R-7	To standardize the main Analytical - methods.

contd.2.

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KINGDOM OF SAUDI ARABIA
Saline Water Conversion Corporation

Our Ref. No.

Date

2- MULTI-STAGE FLASH (MSF)

ITEM NO.

DESCRIPTION

M-1

To examine the effect of using acid + anti scale agent dosing to control scale deposition and use sponge ball cleaning system. Study the change in over all heat transfer coefficient as the measure of scale deposition through long term operation and to analyze the scales taken from the tube walls of the test plant.

M-2

To test alternative materials such as titanium, aluminum brass and any other new materials and in the case of aluminum brass, Cu-Ni 90/10 to examine if this would stand well against corrosion in a less oxidizing condition made by SBS addition to the effluent of the deaerator as de-oxidizer.

M-3

To measure the corrosion tendency of the materials by the corrator, the test pieces and the inspection of the tubes pulled out from tube sheet.

M-4

To standardize the main Analytical - methods.

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Saline Water Conversion Corporation

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The following were present :

SWCC

- 1- Mr. Abdullah Al-Azzaz
- 2- Mr. Habeeb Mohammed
- 3- Dr. Fahad Al-Habdaan
- 4- Dr. Mohammed Amin Mandil
- 5- Dr. Ahmed Omer Faraj

JAPANESE SIDE

- 1- Mr. Junzo Hori
- 2- Mr. Takco Sakamoto
- 3- Mr. Eiji Tanabe
- 4- Mr. Yoshihiko Konishi

A.Rzk.

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ol.

Research Schedule of RO Process (February 1986 - January 1988)

Item	Hijra Year		1404			1405			1406			1407			1408			Remarks								
	Saudi Fiscal Year		1404/05			1405/06			1406/07			1407/08			1408/09											
	Gregorian Year		1984			1985			1986			1987			1988											
	Gregorian Month		4	5	6	7	8	9	10	11	12	1	2	3	4	5	6		7	8	9	10	11	12	1	2
R-1																										
(1) Chlorine																										
(2) UV																										
(3) S B S																										
(4) Copper sulphate																										
R-2																										
(1) Jar Test																										
(2) In line Test & Filter test																										
R-3																										
Pollution effect																										
R-4																										
Performance of various membranes																										
R-5																										
Chemical cleaning methodes																										
R-6																										
Most reasonable process																										

dashed line means
as occasion demands

of

Research Schedule of MSF Process (February 1986 - January 1988)

Item	Hijra Year	1404			1405			1406			1407			1408			Remarks									
	Saudi Fiscal Year	1404/05			1405/06			1406/07			1407/08			(Feb 7)												
	Gregorian Year	1984			1985			1986			1987			1988												
	Gregorian Month	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6		7	8	9	10	11	12	1	2	3
M-1 Acid Dosing combined with Anti-Scale Chemical Dosing and Sponge Ball Cleaning																										
M-2 (1) Overall Heat Transfer Coefficient																										
(2) Analysis of Scales																										
M-3 and M-4 (1) Corrator																										
(2) Test Pieces																										
(3) Tubes pulled out																										
(4) SBS Addition																										

KINGDOM OF SAUDI ARABIA
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No. _____

Date _____

ANNEX BT

Dated November . . . 1984

A meeting was held between SWCC and JICA to discuss Research Themes and Schedules of Research proposed by JICA in October 1984.

The Japanese side initiated the discussions by explaining the Research Themes for Reverse Osmosis.

The following items were described in detail:

<u>ITEM NO.</u>	<u>DESCRIPTION</u>
R-1	To examine sterilization effect of : 1) Chlorine 2) Ultraviolet Radiation. and 3) Sodium Bisulfite (SBS)
R-2	To seek the optimum condition of the Coagulant by jar Tester and in-line test of the Test plant.
R-3	To examine the relationship between the filter performance and the quality of sea water.
R-4	To study the treatment of the effluent containing sludges from the filter through backwashing procedure by the laboratory devices.
R-5	To examine the permeability and the salt rejection of the modules VS operating pressure, temperature and salinity.
R-6	To follow the performance of the modules through long term operation of the Test plant.
R-7	To test the chemical cleaning methods when the module is fouled or deteriorated.
R-8	To estimate a most reasonable process of a large scale plant for the prevailing conditions in the Kingdom of Saudi Arabia.
R-9	To standardize the main Analytical methods.

contd.2.

Saline Water Conversion Corporation

Our Ref. No. _____

Date _____

-2-

The following comments were made by SWCC on the Research Themes for R.O.

R-1 Use of chlorine should not be considered as the only one sterilizer of great potential. As sufficient data exists on the use of chlorine as an sterilizer more time should be devoted in testing UV for this purpose. The effect of Sodium Bisulfite should also be taken into account under the local conditions.

 It was proposed that the schedule for the use of chlorine and UV should be modified, providing a considerable period of time for testing UV.

R-2
and
R-3

Other coagulants and coagulant aids should be tried in addition to FeCl₃. Economic aspects of using the Coagulants, and coagulant aids should be carried out. The tasks R-2 and R-3 will be combined as a single task. The Japanese side agreed to this suggestion.

R-4

Instead of studying the effect of effluent sludges from the filters emphasis should be placed on the study of pollution from the membrane cleaning discharge which is more harmful than the effluent from the filters.

R-5
and
R-6

It was suggested that tasks R-5 and R-6 be combined as a single task to study the long term effect on membranes under local conditions. It was further suggested that stability tests be carried out with increasing temperature of the feed water.

 A revised schedule should be prepared for this task.

contd.3.

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Saline Water Conversion Corporation

Our Ref. No.

Date

-3-

- R-7 The schedule for this task to be modified as the cleaning procedures are specified by the manufacturers of membranes and consequently the operator has no choice other than using the cleaning procedures prescribed by the manufacturer.
- R-8 SWCC asked if the Japanese side will prepare a conceptual design for a large capacity plant based on the results arrived at from the tasks mentioned above. Japanese side mentioned that they will make recommendations as to the type of process which can be adopted from the results.

2. Multistage Flash (MSF)

The Japanese side explained the following proposed Research themes in detail.

<u>ITEM</u>	<u>DESCRIPTION</u>
M-1	To examine the effect of acid dosing and that of anti-scale chemical dosing with a sponge ball cleaning process.
M-2	To examine the reduction of the overall heat transfer coefficient as the measure of scale deposition through long term operation and to analyze the scales taken from the tube walls of the Test Plant.
M-3	To test less expensive materials if these would stand well against corrosion in a less oxidizing condition made by SBS addition to the effluent of the deaerator as oxidizer.

contd.4.

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Saline Water Conversion Corporation

Our Ref. No.

Date

-4-

- M-4 To measure the corrosion tendency of the materials by the corrotor, the test pieces and the inspection of the tubes pulled out from tube sheet.
- M-5 To standardize the main Analytical methods.

The following comments were made by SWCC on the proposed research themes for MSF.

- M-1 and M-2 The two tasks mentioned cover the same subject and therefore should be considered as a single task.
- SWCC has considerable experience in the use of acid and anti scale agents for scale control. It was suggested that a combination of acid + anti scale dosing should be studied to examine its effect in controlling the formation of scale in comparison with available data on acid dosing and anti scale dosing only. The Japanese side agreed to these suggestions.
- M-3 As recommended by the Japanese side several materials will be studied such as Al-Brass, 90-10 Cu-Ni and thin walled Titanium Tubes under the condition of zero DO.
- SWCC: When excess SBS is used will there be residual SBS in the reject ?
- Japanese side will reply to this question at a later date.

ANNEX IV

A Theme to be Discussed in the Future Meeting

SWCC and the PS Team agreed on to discuss in the future meeting the following as a theme of research activities:

S-1 To examine the causes of the hard scale formations on the walls of the brine heater under the reproduced conditions of the large Yanbu MSF Plant in operation

These hard scales had been formed on the whole surface of the brine heater walls (This means the tubes and both sides water boxes of the brine heater.) under the full design operating conditions last time; and also are found on the walls of the outlet parts of the tubes and a water box of the brine heater under more mild operating conditions than design this time.

ANNEX V

Data Received from the Yanbu Plant

1. Sea Water Analysis in Yanbu
2. Design Parameter of Yanbu Desalination Plant
3. Daily Analytical Result Sheet of Yanbu Desalination Plant

ANNEX VI

Report on the Visit of Jeddah and Yanbu Plant of SWCC.

The PS Team visited the sea water desalination plants of SWCC in Jeddah and Yanbu from November 9th through 12th, 1984. The followings are report prepared by the PS Team.

1. Jeddah Plant (November 10th and 11th)

1.1 The RO plant are in normal operation and having no problem in recent years after the materials of the high pressure system had been upgraded to prevent the crevice corrosion attributable to 316 stainless steel.

1.2 Copper sulphate is used as the sterilizing agent in the RO Plant. We are somewhat anxious about the problem associated with the accumulation of copper metals after long elapsed time in the sea bottom sand and/or muds in the vicinity of the discharge point as well as that in the marine organisms such as a lugworm and a shellfish.

You should bear in mind the fact that the hazard of a heavy metal of a trace amount is not an acute toxic problem for fish in the sea, but an accumulation of metals in the sand and/or muds and its influence on the ecosystem of the marine organisms.

A problem of a kind of heavy metal had come about in Japan though the concentration of the metal ions was not detectable in the rejection.

We regret being unable to help SWCC about this problem except giving SWCC a brief remark after returning to Tokyo. We recommend SWCC to analyze the samples of the sea bottom sand and/or muds in the vicinity area of the discharge point and if SWCC detect any accumulation of copper metals, it would be better to consult with the experts of a fisheries college or a fisheries faculty in the university of the Kingdom of Saudi Arabia.

1.3 Machine noises which might be made by the high pressure pumps and the internal combustion engines served as driving pumps were fairly high in the proximity of the high pressure pumps of the RO Plant.

1.4 The staff engineers of plants told us that there were no material failures in the brine heater, the recovery and the rejection.

The materials used in the reject and the other equipments are 70/30 copper nickel and 90/10 copper nickel, respectively.

1.5 The water boxes made of carbon steel with 90/10 copper nickel lining are in good condition.

1.6 Combination of acid dosing and anti-scale chemical dosing with ball cleaning were agreed by the staff engineers.

2. Yanbu Plant (November 12th and 13th)

2.1 Very serious pitting around 10 mm depth per year (or a term between scheduled shutdowns) for original 36 mm thickness and extensive corrosions were found on the walls of the vapor zone of the flash chambers made of carbon steel.

We did not ask about the composition of the vapors extracted by the vacuum systems. But we do not suppose the cause of this troubles depend on such a simple reason as the manager of Yanbu Plant was bothered about this trouble and asked us how to solve this problem as well as he considered this problem was suitable to the research theme of the Test Plant.

2.2 We were informed that the bends, tees and welded portions of the pipe containing 98% concentration sulfuric acid are badly corroded and frequently leakage of acid occurred. The material of the pipe is carbon steel 40.

2.3. We were informed that the boiler tube were slightly bended.

2.4 A few chemicals would be discharged from the Test Plant into the sea, although its amount is a little. We have a concern for the problem if these rejections were against law related to anti-pollution or not.

We asked Mr. Darwish to give us applicable regulations or codes for anti-pollution, he recommended us to send him a list of chemicals to be discharged, however. He told us he would check these chemicals according to applicable regulations or codes.

2.5 We required that the raw water to be supplied from the existing facilities should be without the dosage of chlorine for the test of the effect of the sterilizing agents.

3. The PS Team met the following persons during the trip:

3.1 Jeddah Plant

Mr. Abdulaziz O. Nasief
Mr. Saeed Najjar
Mr. Abdul Aziz Shawly
Mr. Muhammad B. Fallatah
Mr. Hassan Burai
Mr. Abdulhadi Alshoiku
Mr. M.A. Muhurji
Mr. Talal K. Usta
Mr. Omar Mughram
Dr. Nabil Nada
Mr. Jamil H. Bakhah
Mr. Abdul Rahman Al-Badawi

3.2 Yanbu Plant

Mr. Naji A. Darwish
Mr. Saeed Najjar
Mr. A.I. Dabbour
Mr. Hassan Mousa

ANNEX VII

List of Revised Drawings with a Table of Revision of the RO Test Plant

<u>Title</u>	<u>Drawing No.</u>		<u>Revised Part</u>	
	<u>Org*</u>	<u>Revised</u>	<u>Original</u>	<u>Revised</u>
Plot Plan of MSF & RO Test Plants	R1001	R1001 Δ		
Plot Plan of Indoor & Side View	R4003	R4003 Δ		
Foundation of Pipe & Cable Trench in Test Plant Facilities	R4004	R4004 Δ	Cable Trench Width (mm)	
			400	450
			500	600
			Foundation Size of Air Compressor	
Foundation of Control Pannels	R4005	R4005 Δ	Foundation Size of Control Pannels	
			Including Drawing of Foundation of RO Skid	Excluding Drawing of Foundation of RO Skid
Foundation of Pretreatment Skid & Chemical Feed Skid	R4006	R4006 Δ	No. of Chemical Tank	
			5	4
Foundation of Tanks	R4007	R4007 Δ	Location of Raw Sea Water Tank & Filtered Sea Water Tank	
			Filtered Sea Water Tank Capacity (m ³)	
			10	15
Connection Point of Utilities in RO Test Plant Facilities	R4008	R4008 Δ	Air Compressor	
			Chemical Feeder	
			Control Pannel	

Foundation of
RO Skid

R4005 R4009

Only Separated from
R4005 Δ

Revised Parts of
R4005 Δ :

Cable Trench Width
Details is shown in
Drawing R4004 Δ

Note: Org* stands for Original.

ANNEX VIII

List of Revised Drawings of the MSF Plant

<u>Title</u>	<u>Drawing No.</u>		<u>Revised Parts</u>	
	<u>Org.*</u>	<u>Revised</u>	<u>Original</u>	<u>Revised</u>
Foundation Plan	R3004	R3004-1	Foundation Size	
			<u>Water Tank</u>	
			Height (mm)	
			100	400
			Outer Diameter (mm)	
			1.950	1.800
			<u>Oil Tank</u>	
			Height (mm)	
			100	500
			Outer Diameter (mm)	
	2.600	2.500		
Loading Data		R3004-2	New Drawing	

Note: Org.* stands for original.

1.4 SWCC Mission in February 1985

MINUTES OF MEETING

A meeting was held between the delegation from SWCC and JICA (a list of attendants is attached as appendix I).

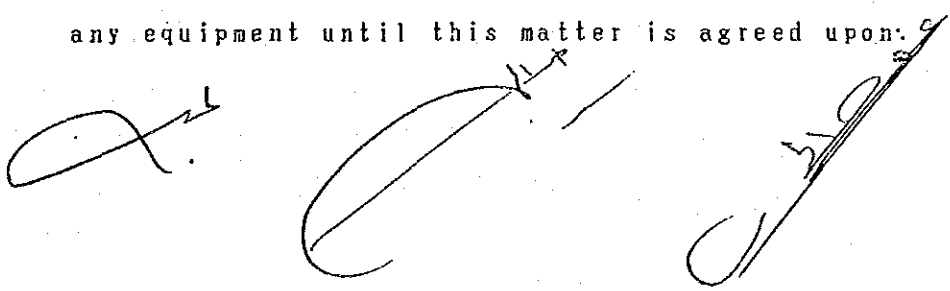
In the beginning of the meeting JICA presented an agenda (appendix II), upon which both sides discussed as follows:

1. Shipment and Storage of equipment

- (1) SWCC side requested that JICA should delay the shipment of the equipment, because SWCC does not have any ware houses in the plant site to store them until the completion of the research center, nor SWCC could construct a new ware house suitable for storage of equipment.
- (2) JICA side replied that JICA cannot delay the shipment, firstly because JICA and SWCC should follow the schedule determined in the M/M (May 21, 1984), secondly because the fiscal year in Japan ends in March, 1985, by which JICA is severely required to complete all expenditure.
- (3) JICA side proposed that the JICA team (which is scheduled to be dispatched to Saudi Arabia in March 5, 1985) and SWCC team discuss the storage of equipment.

JICA side believes that the best possible building for the storage of equipments could be the existing administration building in Yanbu.

SWCC side still iterated their opinion, however, SWCC's final decision will be made after the visit of JICA team. In the mean time JICA should not ship any equipment until this matter is agreed upon.



2. SWCC-engineers to be trained in 1985
 - (1) SWCC side commented that SWCC-engineers may not come to Japan except after the equipment arrives at Yambu site or just before the shipment.
 - (2) JICA side replied that Training Affairs Department of JICA will send information (in response to SWCC's questionnaire) regarding the fields and timing of the training of SWCC-engineers.

3. Next JICA team to be dispatched to Saudi Arabia

JICA is going to dispatch a study team on March 5, 1985 in response to the recent request of SWCC.

4. Materials to be used during the operation of the test plant

JICA will prepare time schedule regarding the use of these materials (including kinds and quantities) by the beginning of the research activities, so that SWCC can procure the materials in time in case it complies with the SWCC's responsibility as per R/D.

5. Workers required for the installation of the equipment

JICA will prepare time schedule and man-months of workers needed to install the equipment when the schedule of the research center construction is presented by SWCC to JICA, in order for SWCC to supply the workers in case it's part of SWCC responsibility as per R/D.

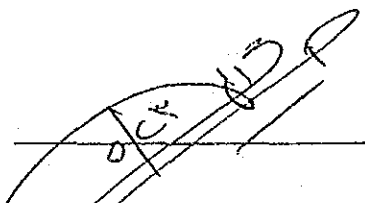
6. Living environment of the Japanese specialists
 - (1) JICA side requested that the Japanese specialists are to be conveniently provided with some services and facilities by SWCC, which shall be discussed in detail when the research schedule is set.
 - (2) SWCC side stated that any arrangements will be made available as mutually agreed in the R/D.


7. SWCC side stated that any question in written form may be asked by JICA through official channel and SWCC will clearly answer to these inquiries.


8. JICA side inquired about the schedule of construction of the research center and the time for appointment of SWCC joint technical team members. SWCC will answer officially to these inquiries as soon as possible.

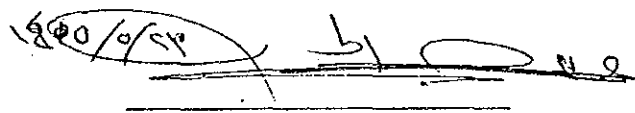
Date : February 13, 1985

Place: JICA, Tokyo


AHMED M. AL MUDAIHEEM
Deputy Director General,
SWCCEP


KEIJI MIURA
Director,
Mining & Industrial
Planning and Survey
Department, JICA


ABDULLA A. AL-AZZAZ
Acting Director General
of Research and Technical
Affairs, SWCC


NASSER AL JARBA
C. Engineer,
Construction Department.

APPENDIX I

MEMBER LIST OF THE MEETING

Saudi Arabian Side

AHMED M. AL MUDAIHEEN	Deputy Director General, SWCCEP
ABDULLA A. AL-AZZAZ	Acting Director General of Research and Technical Affairs, SWCC
NASSER AL JARBA	C. Engineer, Construction Department

Japanese Side

Mining & Industrial Planning and Survey Department

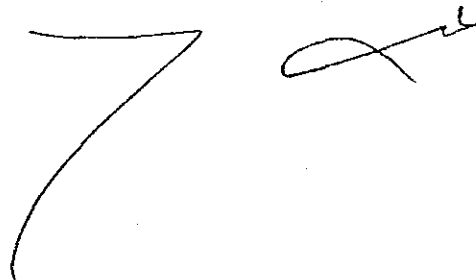
HARUO SUZUKI	Head, Natural Resources Division
MASATAKE KITAJIMA	Deputy Head, Natural Resources Div.
KATSUHIKO OZAWA	Natural Resources Div.

Social Development Cooperation Department

NOBUJI ABE	Deputy Director, Social Development Cooperation Department
TOMOCHIKA UCHIDA	Deputy Head, Overseas Center Division
KAZUAKI HAYASHI	Overseas Center Division

Consulting Engineers

YOSHIO MURAYAMA
TAKEO SAKAMOTO
EIJI TANABE
YOSHIHIKO KONISHI
KEIZO ORIHASHI
MASAICHI WATANABE
MINORU TANAKA



February 12, 1985

Agenda

The purpose of this agenda presented by JICA is for the smooth implementation of the project through discussion in accordance with "Record of Discussion".

1. The latest progress of the schedule taken by JICA

Shipment: End/March 1985

Selection of specialists: Midyear/1985

Dispatch of personnel At completion of building
for installation:

2. The latest progress of the schedule taken by SWCC.
3. The schedule and the preparation based upon it for receiving the test plants and the laboratory equipments provided by JICA.

For example:

Construction of laboratory building and sea water intake.

Preservation of equipments.

Wiring up to B.L. and the like.

4. The time for dispatch of JICA JTT members.
5. The time for appointment of SWCC JTT members.
6. Items to be confirmed.

6.1 SWCC will take necessary measures to meet:

- [1] Supply of chemicals used routinely in the SWCC plants, or easily available on the market in Saudi Arabia for the operation of the test plants.

For example:

Sulfuric acid, Belgard EV and the like.

- [2] Expenses for chemicals and new materials indispensable to the practice of the revised research themes.

For example:

Copper sulfate, new alloy tube and the like.

- [3] Operating costs for research activities such as commodities, articles of consumption as well as chemicals for tests in the laboratory.
- [4] Expenses for communication with JICA headquarters such as telex, telephone and mail.
- [5] Expenses for the internal travel of the Japanese specialists in Saudi Arabia on duty.

6.2 Living environment of the Japanese specialists.

- [1] The accommodation
- [2] Vehicles with drivers
- [3] A medical institution and medical expenses
- [4] Meals and shopping

6.3 The workers required for the installation of the test plants and laboratory equipments under the supervision of the Japanese specialists.

6.4 The intake facilities of sea water without the dosing of any disinfectant for the evaluation of the UV radiation.

Supplement

S-1 The schedule and the details of the practice related with two Saudi Arabian experts to be sent to Japan in April-May 1985.



1.5 JICA Mission in March 1985

MINUTES OF MEETING
ON
THE TECHNICAL COOPERATION FOR THE PROJECT
OF
SEA WATER DESALINATION
TRAINING AND RESEARCH CENTER

The Japanese Team organized by the Japan International Cooperation Agency (hereinafter referred to as JICA) visited the Kingdom of Saudi Arabia from the 4th of March, 1985 to the 13th of March, 1985 and discussed with the Saline Water Conversion Corporation (hereinafter referred to as SWCC) on the technical cooperation for the Project of the Sea Water Desalination Training and Research Center, and agreed on the following matters:

I. For the TRAINING CENTER

1. Detail Design now being undertaken by SWCC

1.1 Information for Detail Design

JICA submitted the outline of information on the Training Equipment for the detail design.

Further detailed specification of the Training Equipment shall be submitted to SWCC by beginning of July, 1985.

1.2 Reviews of the Preliminary Design Documents

JICA reviewed captioned documents together with SWCC and his Consultant and exchanged the comments.

1.3 Remodelling of the existing building

The Consultant proposed some modification on room layout of remodellings of the existing building to minimize the work. Their proposals were approved by JICA.

1.4 Other technical matters

Both parties exchanged and confirmed their comments on technical matters.

The detail contents of above discussions shall be referred to APPENDIX-1

2. Both sides had series of discussions on demarcation of the training equipment but did not enter conclusions.

JICA will inform SWCC tentative estimated cost of training equipment later for reference and next mission will continue to discuss in detail on this matter.

3. SWCC stated that according to the working plan, which had been submitted during the meeting of May 30, 1984, text books draft supposed be available for review in March 13, 1984.

JICA will dispatch a mission as early as possible to discuss with SWCC in detail on making drafts of the text books.

SWCC requested that all documents regarding text books and other training materials should be available to SWCC for review before one month from the arrival of JICA missions.

JICA will inform subjects and contents to be discussed with SWCC in advance before dispatching missions.

4. Design and Construction Schedule

SWCC submitted the schedule for the Detail Design, Tendering and Construction. (Refer to Appendix-2). JICA shall bring it to Japan and inform comments if any.

5. Dispatch of JICA's Mission

JICA will dispatch a Japanese Team to discuss with SWCC on the following matters:

a) Installation of the Equipment

b) Preparation of the Training (*Textbooks, Instruction guides and Teaching materials*)

c) Dispatch of Japanese Experts

d) Training of Counterparts in Japan.

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vc-

[Signature]
12.0/7/CC

[Signature]

[Signature]
12.0/7/CC

(2)

II. For the RESEARCH CENTER

1. Detail Design now undertaking by SWCC.

1.1 Up-dated information for detail design

JICA submitted up-dated informations on Laboratory Equipment and Test Plants for SWCC's detail design.

1.2 Reviews of the Preliminary Design Documents

JICA reviewed the Preliminary Design Documents such as "Preliminary Design Report", "Specifications" and "General Master Drawings" submitted by the Consultant through SWCC.

1.3 Remodelling of existing administration building.

The Consultant proposed some modifications on room layout of remodellings of the existing building to minimize the work. Their proposals were approved by JICA.

1.4 Other Technical matters

Both parties exchanged and confirmed their comments on technical matters.

The detail contents of above discussions shall be referred to APPENDIX-1.

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P. 16.0 / 7 / CC

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2. JICA has already procured the research equipment which will be shipped from Japan during April, 1985.

SWCC agreed to store the research equipment in the rooms located on the ground floor, available in the existing administration building ^{and} inside the plant area.

JICA agreed that the equipment will be shipped in containers which are protective against corrosion and damage.

These containers should be convenient for SWCC to check the contents of the containers and easy to re-pack them. These will be kept until the time of the installation.

When SWCC-JICA check and repack the equipment, JICA will send the advisors to assist SWCC.

3. SWCC shall take charge of the installation according to R/D.

JICA has proposed the list of the requisite workers and heavy transportation machines as well as the schedule for the installation of the equipment. The list is attached in APPENDIX-3. JICA shall dispatch the technical advisors for the installation.

4. SWCC agreed to provide two kinds of seawater intake facilities as follows:

- 4.1 The branched line for MSF test plant from the existing intake.

- 4.2 Intake line without dosing of any disinfectant for RO Test Plant is required at a flow rate of 150m³/day.

5. JICA will provide a list of consumables for the research center during their next visit to SWCC.
6. As per minutes of meeting of 14th Aug. 1984 and Article 6 of R/D SWCC emphasized the necessity of establishing the Joint Technical Team as soon as possible and nominate a specialist as a coordinator at SWCC.
7. The schedule for implementation of R/D as agreed to on 21st May 1984 Article 3 of the minutes of meeting and Appendix-3 is amended as shown in Appendix-4.

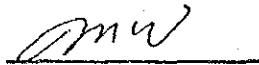
Done JS

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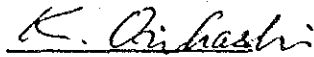
13th of March, 1985

ATTENDANTS

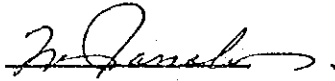
JICA



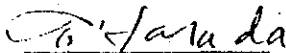
Mr. Masachi Watanabe (T/C)



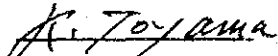
Mr. Keizo Orihashi (T/C)



Mr. Minoru Tanaka (T/C)



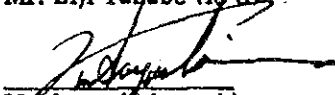
Mr. Toshio Harada (R/C)



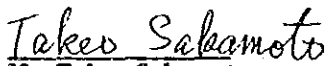
Mr. Kenji Toyama (R/C)



Mr. Biji Tanabe (R/C)

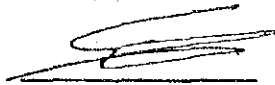


Mr. Kazuaki Hayashi
Head of the Japanese
Team for the Training
Centre, JICA

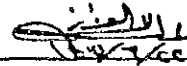


Mr. Takeo Sakamoto
Head of the Japanese
Team for the Research
Centre, JICA

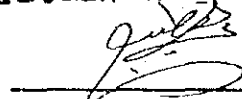
SWCC



Mr. ABDULAZIZ AL-SULGIMAN, DIRECTOR TRAINING
GENERAL,



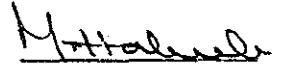
Mr. ABDULLA AL-AZAB, DIRECTOR RESEARCH
GENERAL,



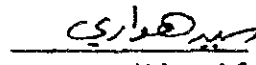
Mr. MOHAMMED AL-ORBI ENGINEER



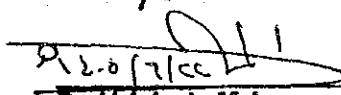
Mr. MOFLIH AL-SHAGATRA SPEC TRAINING



Mr. HABEEB MOHAMMED ENGINEER



Mr. SYED HAWARI ENGINEER



Dr. Abdulaziz Mohammed Al Mijshed
Acting Deputy Governor
For Technical Affairs & Projects SWCC

(5)

APPENDIX - 1

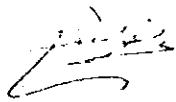
- Minutes of Meetings of:- 09.03.1985
- 10.03.1985
- 11.03.1985
- 12.03.1985
- 13.03.1985

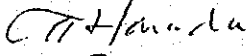
SALINE WATER CONVERSION CORPORATION
RIYADH
KINGDOM OF SAUDI ARABIA

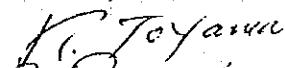
RESEARCH AND TRAINING CENTRE FOR THE DESALINATION PLANT AT YANBU

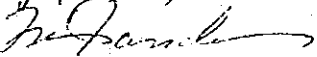
Minutes of the meeting held at SWCC on 09.03.1985 - 18.06.1405 H.

The meeting was attended by:

for SWCC : Eng. MOHAMED OQBI 

for JICA : TOSHIO HARADA (R/C) 

KINJI TOYAMA (R/C) 

MINORU TANAKA (T/C) 

KAZUAKI HAYASHI (T/C) part time

MASAICHI WATANABE (T/C) part time

KEIZO ORIHASHI (T/C)

for ABCE : Dr. SUBHI OKDEH 

Arch. DANIEL MOREL 

TRAINING CENTRE

1. The voltage for the training buildings shall be the same as for the existing administration building because some same pieces of equipment will be used in both buildings.

The voltage is 220 - 127 V. 3 Phase - 60 Cycles.
One line diagram "as built" is attached.

2. Equipment layout

- 2.1 It is noticed that the series number and item numbers of equipment and furniture on Consultant's drawings deviate from the numbers in the c/d (conceptual design). This should be corrected.

- 2.2 J.I.C.A. hands-over the following modified documents:

- a. equipment layout plan of workshop and laboratory (1/5) Mechanical maintenance.
- b. equipment layout plan of workshop and laboratory (2/5) piping equipment maintenance.
- c. process control model room - equipment layout.
- d. spec sheet no. SW-7-100

- 2.3 Mechanical : see revised layout (1/5)

- 2.4 Piping : see revised layout (2/5)

- 2.5 Electrical machines

- a. items 20 Insulation test equipment
3 Induction regulator
24 Tool cabinet

shall be grouped near the drawing room as per c/d layout page 114.

- b. the layout of the "drawing room" shown on Consultant's drawing is accepted.

- 2.6 Operation building.

- a. J.I.C.A. requests that the double external doors of the workshops should be replaced by a rolling shutter of same dimensions used for the other workshops. The equipment/furniture in the workshop should be flipped

over so that nos. 11 - 12 - 21 - 22 are in the top half of the workshop and nos. 19 - 13 - 14 are in the bottom half.

Nos. 16 - 17 - 18 - 15 remain unchanged.

- b. the no. 37 shall be mentioned on the layout.

2.7 Equipment/furniture

- a. All items indicated by a "SW and figures" item no. are equipment which will be supplied by J.I.C.A. and SWCC.

The Consultant shall design the connections to the utilities as per c/d and information provided by J.I.C.A. during these meetings.

- b. All items of the equipment layout plans of the c/d which are not identified by a "item no. " relate to furniture to be supplied by SWCC. The furniture shall be specified and quantified by the Consultant respectively in the specifications and B.Q.

2.8 Doorheight

The doorheight for industrial building type shall be not less than 250 cm in order to enter large equipment into the rooms.

3. Connection of equipment to utilities.

J.I.C.A. will provide the information during their stay in Riyadh, as much as possible and missing information will be telexed to SWCC later.

4. Miniplant A and B

- a. connections to utilities
same as for 3 hereabove
- b. foundation loads/dimensions

J.I.C.A. still has to design the miniplants.

- c. The cooling towers are part of miniplants A & B.

The quantities mentioned in J.I.C.A. reply telex include the cooling towers.

Peak flow: same as for 3 hereabove.

The Consultnat shall provide the assumed quantities of reinforced concrete and earthworks in the Bill of Quantities, unless J.I.C.A. supplies the exact data in keeping with the Consultant's design schedule. For J.I.C.A.'s information the Consultant has to submit the final design, specification and B.Q. four weeks following the approval of the preliminary design which is now being reviewed.

5. Remodelling of existing administration building (Reasearch & Training)

5.1 The Consultant's drawing A40 deviates from the remodelling works proposed by J.I.C.A. in the c/d. These deviations were proposed by the Consultant during the visit of the premises in presence of SWCC representative and were noted in the report concerning the review of the c/d.

J.I.C.A. is in agreement with remodelling works shown in drawing A40.

5.2 The "computer room" to be converted into "process control model room" is now equipped with a AC-package unit for the computer and a voltage regulator.

SWCC will request the J.I.C.A. representatives now present in the desalination plant to survey this room and note the sizes and characteristics of this equipment.

5.3 The J.I.C.A. representatives shall indicate the rooms which will be used to temporary store the equipment of the Research centre.

5.4 Lighting fixtures shall be added and shall be connected to suitably located switches to suit the layout of rooms.

6. Design and Construction schedule

The Consultant hands over the proposed Design and Construction schedule.

This schedule will be studied by SWCC and J.I.C.A.

RESEARCH CENTRE

1. J.I.C.A. hands-over the following documents:

a. Laboratory furniture

A selection of furniture to be used for guidance.

b. A list of chemicals which will be discharged from the test plants.

c. Information for lab equipment

c.1 Revised layout of lab building

Dwg SAJ EL 001 - 1

Dwg SAJ EL 002 - 1

Catalogues of additional equipment A and B.

c.2 Catalogue for laboratory equipment

The technical data mentioned in the c/d were taken from the catalogues. The Consultant should refer to the catalogues for any further clarification.

c.3 Utility consumption list

d. Revised MSF test plant information.

d.1 Dwg SAJ - R. 5003 (layout)

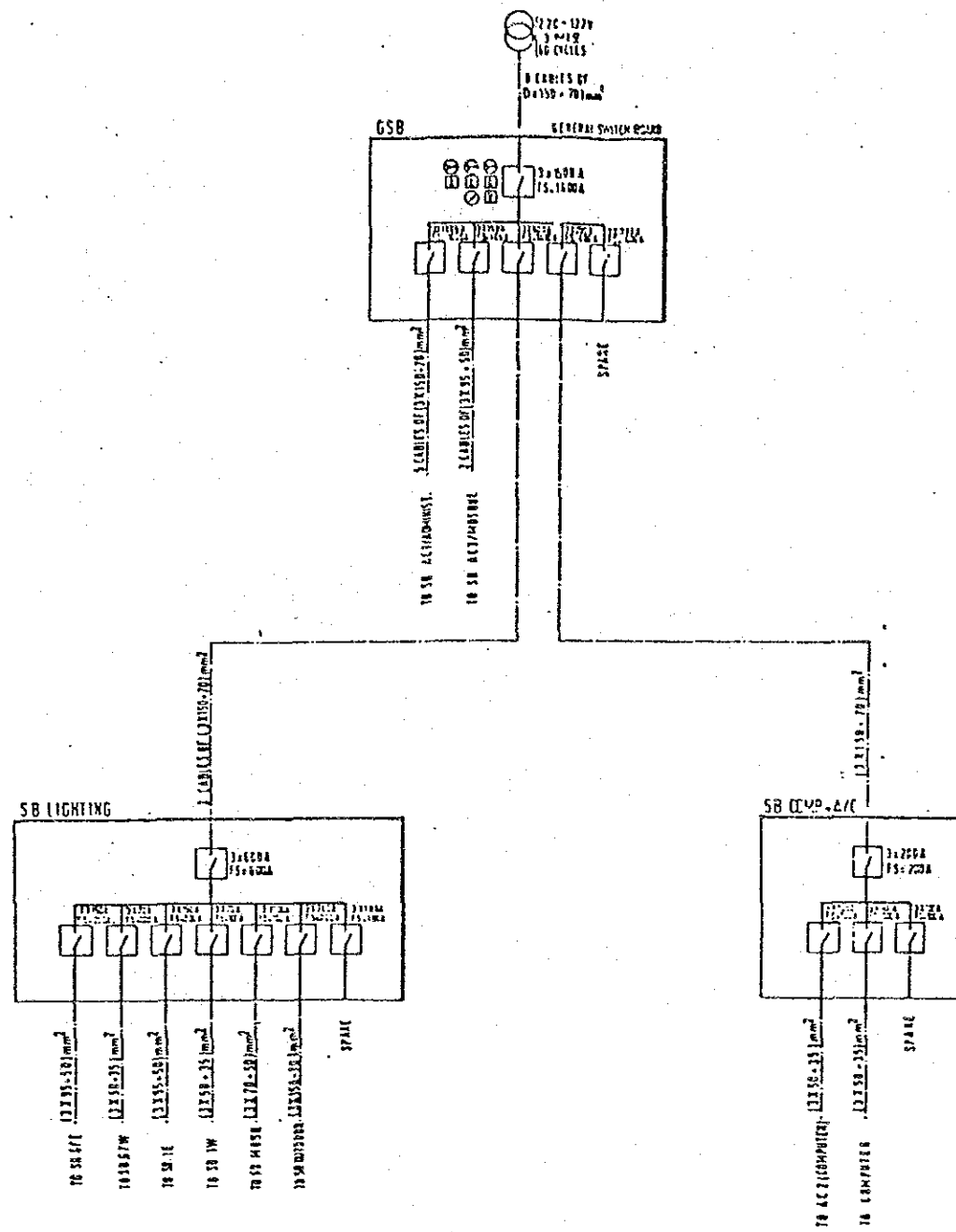
d.2 Dwg SAJ - R. 3206 - loading data (Revision 3)

d.3 Dwg SAG - R. 3205 - foundation plan (Revision 2)

e. Configurations of plugs and receptacles.

Call 3

EH
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Kingdom of Saudi Arabia Jeddah	مملكة العربية السعودية جدة	YASSU & SIBTA POWER & DISTRIBUTION PLANT	محطة توليد الطاقة الكهربائية يأسو وسبتة
SUCETEC SA SUCETEC ENGINEERING & CONTRACTING JEDDAH	ADMINISTRATION MOSQUE HOUSING COMPOUND DISTRIBUTION SWITCHGEAR SINGLE LINE DIAGRAM	12	12

Minutes of meeting held at SWCC on 10.03.1985 - 19.06.1405 H.

The meeting was attended by:

for SWCC : Eng. MOHAMED OQBI

for JICA : TOSHIO HARADA (R/C)

KINJI TOYAMA (R/C)

MINORU TANAKA (T/C)

for ABCE : Dr. SUBHI OKDEH

Arch. DANIEL MOREL

1. The minutes of the meeting of 09.03.1985 were read, discussed and confirmed.

2. Training Centre

2.1 J.I.C.A. has studied the specifications for building works and external works.

There are no comments.

2.2 The Consultant submits a descriptions and concept of the neutralization tanks along with a questionnaire regarding missing design data. (copy attached)

2.3 A set of drawings containing new drawings (4 roofplans) and revised drawings were handed over to J.I.C.A.

2.4 J.I.C.A. points out that a layout plan of the furniture of the existing administration building should be prepared.

Now that the layout of the remodelling of the building is approved the Consultant can show the furniture in the rooms.

3. Research Centre

3.1 On 09.03.1985 the Consultant submitted the questionnaire attached.

The following answers were noted:

Item A.2 Hot Water

No hot water supply required to the equipment. The hot and cold water lines to the sinks of the lab furniture as shown on the Consultant's drawing SAN 01 and 02 are adequate.

Item B.2.B Discharge Channels

The channels and trenches shall be designed as indicated in the c/d.

The channel referred to in the Consultant's questionnaire shall be connected to the sea without any treatment.

Item 3

The list of the chemicals which will be discharged from the test plants was submitted on 09.03.1985, see list R/C (item 1.b).

The flow/hour per connection point will be given by JICA.

3.2 The Consultant submitted the design report, the specifications and additional drawings of the Research Centre. They comprise external works drawings, architectural, electrical, plumbing and H.V.A.C. drawings,


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EJ
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19

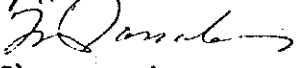
Minutes of Meeting held at SWCC on 11.03.1985 - 20.06.1405 H.

The meeting was attended by:

for SWCC : Eng. MOHAMED OQBI 

for JICA : TOSHIO HARADA (R/C) 

KINJI TOYAMA (R/C) 


MINORU TANAKA (T/C) 

KAZUAKI HAYASHI (T/C) part time

MASAICHI WATANABE (T/C)

KEIZO ORIHASHI (T/C)

for ABCE : Dr. SUBHI OKDEH 

Arch. DANIEL MOREL 

1. The minutes of the meeting of 10.03.1985 were read, discussed and confirmed.

2. TRAINING CENTRE (T/C)

2.1 Chemical Waste Water

J.I.C.A. estimates that the total amount of chemical waste water will occur during +/- 15 days/year, and each time during periods of 2 to 3 days.

The quantity of chemical waste water is 200 L/day. The lowest pH is 1 to 2, the highest pH is 12.

The neutralization tanks proposed by the Consultant are too elaborated. The neutralization tank should be one or two underground tanks into which the water is retained, chemicals are mixed with the water, the pH is measured with a portable gauge and the water is discharged into the sewerage system.

2.2 Operation building and Mini-plants (see sketch attached)

2.2.1 Control Room

- a. The position of the control panels of mini-plants A and B should be switched.
- b. The external door should be positioned in the middle of the facade. Window should be provided left and right of the doors to the full width of the facade in order to allow the observation of the miniplants.

Provide sunlouvers for these windows.

2.2.2 Boiler Room

The layout of the boiler room is changed. Some gullies should be provided for evacuation of cleaning water.

2.3.3 Besides the changed layout of the boiler room, the sketch indicates the position of the miniplants A and B, the horizontal dimensions of the foundation slabs and the plants, the load on the foundations.

The sketch further shows the cable trenches (wiring pit) and water and electricity connections.

The consultant shall provide the sleeves through the wall only. When the plants will be erected the gas and water pipes and the connections will be done along with the closing of the sleeves.

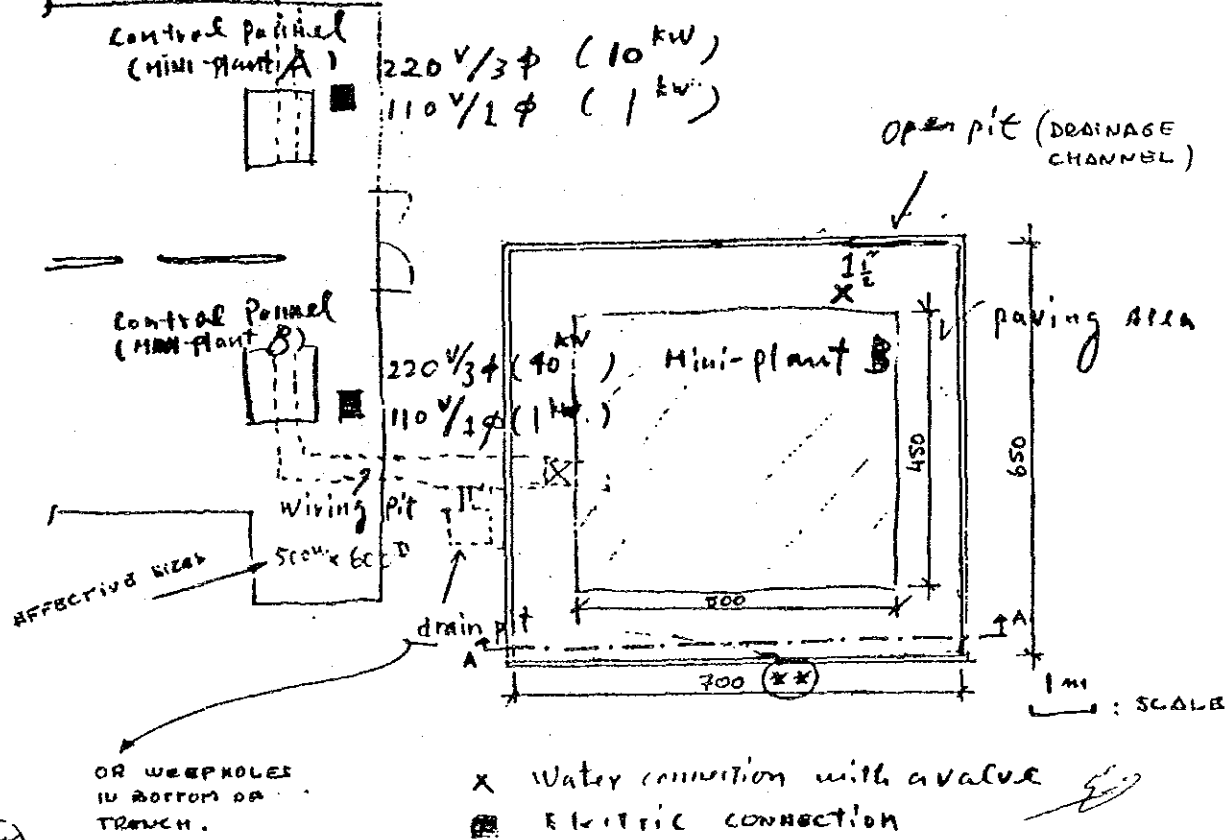
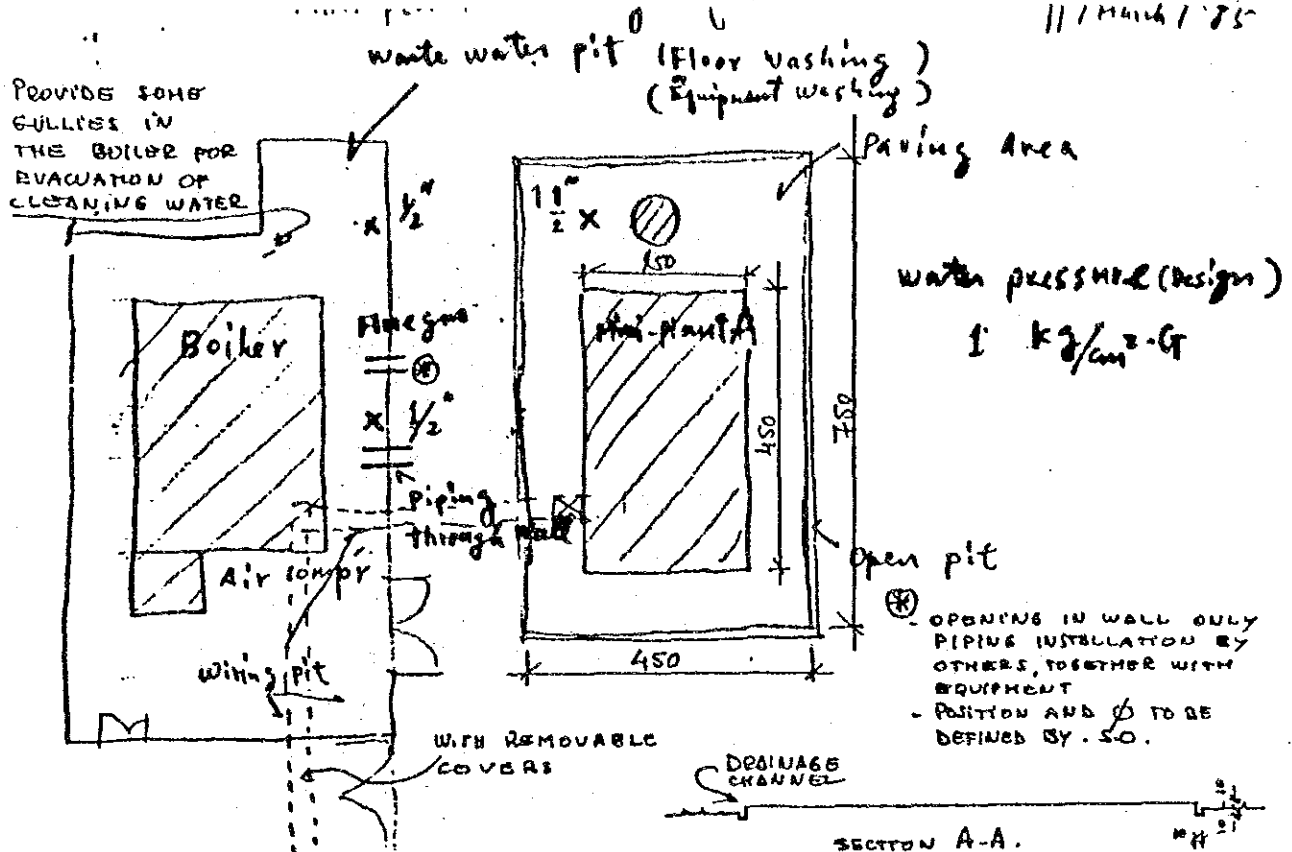
2.2.4 Cable Trenches

These trenches will have weepholes.

2.2.5 For the drainage of the miniplants only the rainfall should be considered.

[Handwritten signatures and initials]

11/11/1975



THE DIMENSIONS OF THE FOUNDATION SLABS ARE GIVEN IN FUNCTION OF THE DIMENSIONS OF THE EQUIPMENT. FOR THE CALCULATION OF THE FOUNDATIONS CONSIDER THE LOAD OF EQUIPMENT OF 1T/M².

2.3 Administration Building (T/C)

2.3.1 Language Laboratory

- a. The floor shall be raised 150 mm (net space height). The construction can be of wood. The floor shall be carpet finished.

Provide three cable channels with lid as shown on the sketch attached.

- b. Provide a blackboard.

2.4 J.I.C.A. handed over the following information during this meeting:

2.4.1 Utility requirement (consumption) of training equipment.

2.4.2 Layout plan of wall mounted type receptacles and hose station of gas (compressed air) and water.

Note 1: except for operation laboratory and workshop.

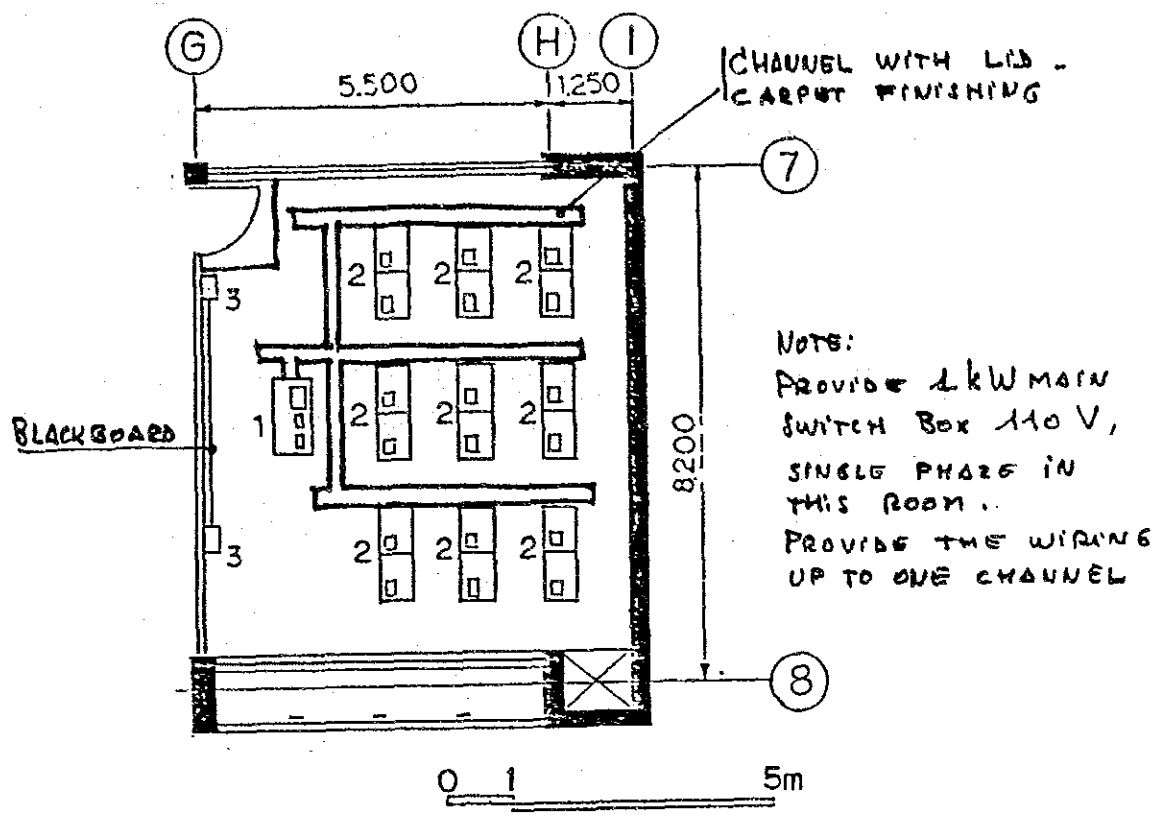
Note 2: The wall mounted receptacles and hose station are for portable equipment and are not the utility supply lines exclusively intended for the fixed equipment.

2.4.3 Layout plan of special equipment

- a. Miniplant A and B
- b. Process Control model
- c. Language laboratory
 - layout with indication of channels in raised
 - equipment configuration (for illustration only).

2.4.4 Design base (Basic data) check sheet.

SPECIFICATION	SPEC. SHEET NO.
	SAW - 8 - 050



No.	Item No.	Description	Q'ty	Dimension (W x D x H mm)	Weight (Kg)	Remarks
1	AW-8-050 -(1)	Teacher console	1	1268x634x807	77	
2	-(2)	Booth console	9	1504x514x1002	34	each 2 students
3	-(3)	Room speaker	2			
4		BLACKBOARD	1			

Language Laboratory
Equipment Layout

Received 1/13/85

3. RESEARCH CENTRE (R/C)

3.1 The HVAC plans shall take into consideration the exhausts of the fume hoods (Items nos. 5 - 14 and 5 - 15)

3.2 J.I.C.A. recommends to check if there is sufficient space in the machine room for HVAC considering maintenance and operation.

3.3 Architectural.

The external double doors shall be dimensioned to allow bringing in the large equipment, such as the RO-skid (200 x 300 x 170).

Drawing SAJ - R.1001 - 1 requires external doors of 3000 W x 4000 H.

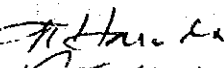
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Minutes of meeting of 12.03.1985 - 21.06.1405 H.

The meeting was attended by:

for SWCC : Eng. MOHAMED OQBI 

for JICA : TOSHIO HARADA (R/C) 

KINJI TOYAMA (R/C) 

MINORU TANAKA (T/C) 

MASAICHI WATANABE (T/C)

KEYZO ORIHASHI (T/C)

for ABCE : Dr. SUBHI OKDEH 

Arch. DANIEL MOREL 

1. The minutes of the meeting of 11.03.1985 were read, discussed and confirmed.

2. TRAINING CENTRE (T/C)

2.1 Construction Schedule

The equipment for T/C should not appear on the construction schedule. *As requested by JICA.*

2.2 a. J.I.C.A. handed over the Plant Operation

Workshop layout (5/5)

The layout shows also the utilities for fixed and portable equipment.

b. J.I.C.A. informed the Consultant of some revisions to the "utility requirement of Training Equipment" document.

- 2.3 The Consultant shall provide a reservoir and piping for the fuel gas (propane) for the laboratory of Operation Workshop.
- 2.4 The Consultant shall check the dimensions of the doors against the dimensions of equipment.
- 2.5 The Consultant shall provide the design data to J.I.C.A. requested for in the column D/D of document Design Base (Basic data) check sheet.
- 2.6 J.I.C.A. will supply foundation outline drawings for fixed equipment and provision of water pressure to the equipment.

3. RESEARCH CENTRE

3.1 Consultant's Questionnaire

- a. For utility consumption and peak flows the "Utility consumption list" submitted on 09.03.1985 shall be consulted.
- b. Steam and instrument air are not necessary to be considered by SWCC (Consultant) for MSF and RO plants.
- c. The diameter of the SW pipe is indicated in drawing OT9A - 2 N 03 - Y 002 (1/4) revision 1. The diameter is 50 A.

The quantity of SW is mentioned in drawing SAJ-R4002 of c/d.
- d. The electrical cable trench shown on drawing SAJ - R1001 indicates the trench being connected to sub-station B-3 (S/S).

This trench which is shown on Consultant's drawing A-30 should be connected to the S/S B-02 on drawing A31.

Actually the better solution will be to run the electrical cables from S/S B-02 to the test rooms in the false ceiling. As from the test rooms the cables will run in trenches as shown on c/d.

The installed capacity is shown in the c/d.

- e. Regarding the chemical waste from the laboratories J.I.C.A.'s telex should be consulted.

The hourly 800 L is an average figure, evenly distributed over the sinks of the labs.

The chemical composition varies according to the test programme.

3.2 E.P.M.A. (R-12)

Provide a 1½ leaf door for bringing in the equipment.

4. T/C and R/C (Electrical)

4.1 The Consultant shall confirm the standards used and the types of electrical receptacles available.

4.2 The electrical receptacles shown on c/d are necessary for the actual equipment.

Additional receptacles should be provided for general use and maintenance.

RF

RF *AK*
RF *4*

SALINE WATER CONVERSION CORPORATION
RIYADH
KINGDOM OF SAUDI ARABIA.

RESEARCH AND TRAINING CENTER FOR THE DESALINATION PLANT AT YANBU.

Minutes of the meeting held at SWCC on 13.03.1985 (22.06.1405 H).

The meeting was attended by:

For SWCC : Eng. Mohammed Oqbi

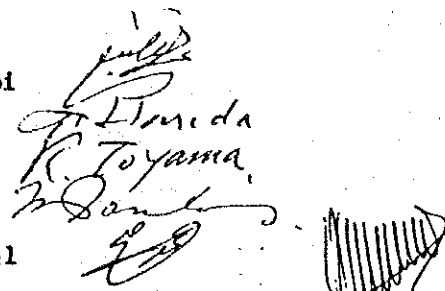
For JICA : Toshio Harada

Kinsi Toyama

Minoru Tanaka

For ABCE : DR. Subhi Okdeh

Arch. Daniel Morel



1. A Sea Water (S.W.) supply line is required for the MSF-Test Plant. This supply line of chlorinated S.W. shall be connected at the outgoing pipe at the chlorination building.
2. A raw S.W. line is required for the RO Test Plant. The connection point will be checked by the consultant and SWCC.
3. The electrical receptacles proposed by JICA are not available on the Saudi Arabian market. JICA shall provide plugs in accordance with British Standards. SWCC will inform JICA about the type(s) of receptacles to be used.
4. JICA is fully satisfied with the preliminary design of the Research and Training Center and have no further comments.
5. The Consultant received the required information from JICA.
6. The information requested for by the consultant and JICA, minuted in the M/M will be exchanged through SWCC.

Description and concept of neutralization tank

1. Introduction

For the neutralization pH of the chemical waste waters a neutralization tank is foreseen, having the following main characteristics:

- installation of two neutralization units with a monthly alternating operation;
- content of each unit : approx. 5 m³;
- a pH at the discharging point between 6 and 9.

2. Concept of neutralization tank

Each neutralization unit consists of the following parts:

- an overflow weir between the two compartments;
- on top of each compartment the following will be installed:
 - . a mixer
 - . a pH-meter
 - . supply lines for dosing chemicals.
- the last compartment has to be equipped with:
 - . corrosion resistant submersible pump
 - . waterlevel meter
 - . water supply line.
- a compact service building of +/- 3 x 4 m to house:
 - . control panel
 - . dosing equipment
 - . storage tanks of chemicals.

3. Working of the neutralization tank.

The chemical waste water is discharged into the first compartment when when a primary neutralization is done by

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L. 207
E. S.
M. H.
22 U

means of the present buffer solution.

Then the water flows along passing the pH-meter into the second compartment for a final neutralization by means of chemical dosing.

When the second compartment is filled and the waste water completely neutralized ($6 < \text{pH} < 9$) a submersible pump pumps the waste water into the sanitary sewage network.

When the waste water is not completely neutralized, the water is recirculated automatically to the first compartment of the neutralization tank.

An overflow on the second compartment is provided for discharging the waste water when the pump is out of order.

4. Missing important data

For the adequate dimensioning of neutralization units, we have to know the following data regarding the chemical waste water from each discharging point:

1. the discharge flow/hour
2. the pH of the discharged waste water
3. the chemical composition of the discharged waste water.

—oo0oo—

RESEARCH CENTRE

A. W.S.

1. We have only the information about the total water supply, being $250 \times 1.5 \times 1.2 \times 32$ or 14,400 L/day of 8 hours, taking into account the extension possibility and the occupancy figure to cope for visitors.

We need also a breakdown of the peak supply per unit of time and per laboratory facility.

2. Which is the hot water peak consumption per hour and per hot water consuming facility?
3. Which is the peak consumption per unit of time per laboratory facility regarding the cold water distribution?

B. S.S.

1. We need the exact location and invert level of the sanitary sewerage manhole, located along the road B, on which we plan to connect our sanitary network.
2. A. We need all connection capacities of the different utilities to be connected with regard to the MSF test plant and R.O. test plant.

B. On the left side of drawing no. SAJ-R1001 prepared by JICA we notice that an open discharge channel containing cooling water and waste effluent occurs.

Do we have to assume that this channel has to be connected to the sanitary sewerage system?

If this is the case, we need the peak discharge of

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cooling water, waste water, possible chemical waste per unit of time.

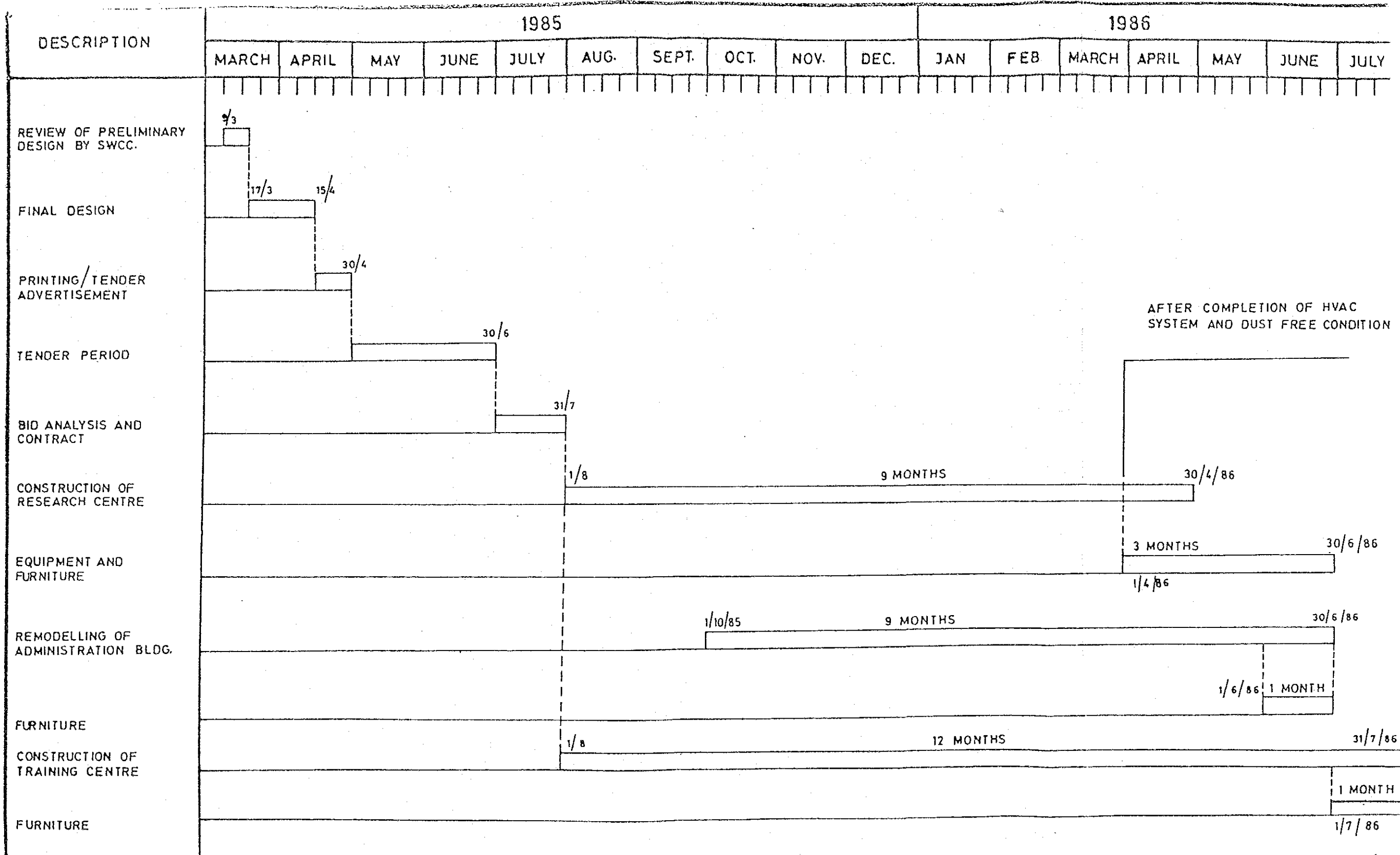
- C. Which is the peak seawater supply to be provided to the pipe and waste trench located on the same drawing?
 - D. Which is the installed capacity and all necessary characteristics for the design of the electricity supply to be laid in the cable trenches from the electrical substation room towards the MSF test plant and to the R.O. test plant.
3. Regarding the chemical waste water we need the following data: Discharge flow/hour per connection point, PH of the discharged waste water, chemical composition of the discharged waste water.

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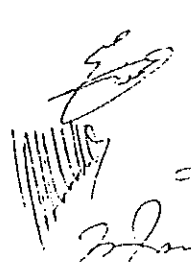
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APPENDIX - 2

- Design and Construction Schedule (12.03.1985)

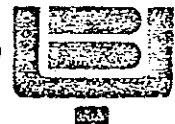


AFTER COMPLETION OF HVAC SYSTEM AND DUST FREE CONDITION



 SALINE WATER CONVERSION CORPORATION
 RIYADH

DESIGN AND CONSTRUCTION SCHEDULE (12-3-1985)
 RESEARCH AND TRAINING CENTRE
 YANBU



 AL-BAWARDY CONSULTING ENGINEERS
 DRAWN / DESIGNED BY: M.A. APPROVED BY: PROJECT NUMBER:

APPENDIX-3

The time schedule and man-months
of workers required to install the equipment.

The time schedule and man-months of workers required to install the equipment.

1. Man-days of workers

	RO	MSF	LAB
Foremen			
Mechanical	39	36	
Electrical	13	26	
Fitters for equipment	48	18	
Piping workers			
for steel pipe	15	33	
for PVC pipe	62		
for support	42		
Welders			
for arc welding	5	7	
for TIG welding		3	
for PVC welding	10		
Milieurighter	2	2	
Thermal insulators	6	60	
Painters	10	12	
Instrument.Electric workers	60	65	
Unpacking.Carrying			45
Check of equipment.Parts			24
Installation.Adjustment			162
Simple workers	38	56	

TS

2. The time schedule.

Na

RO Test plant

Work \ Months	1	2	3
Preparation	—		
Installation	—		
Piping		—	
Instrument, Electric			—

MSF test plant

Work \ Months	1	2	3
Preparation	—		
Installation	—		
Piping, Insulation		—	
Instrument, Electric		—	

Laboratory equipment

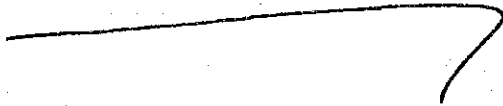
Work \ Months	1	2	3	4
Unpacking, Carrying	—			
Check of equipment, Parts	—			
Installation, Adjustment	—	—	—	

JS

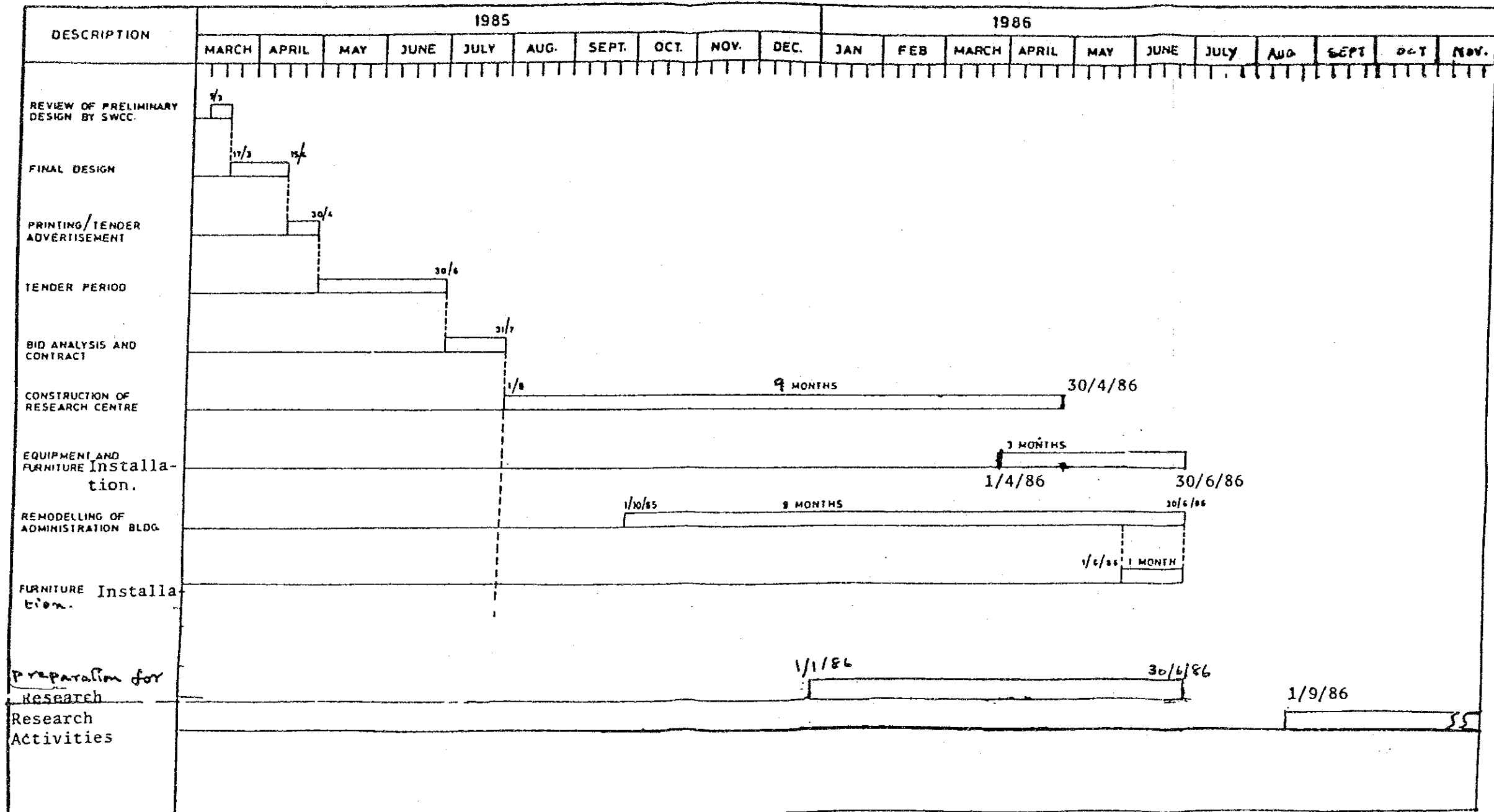
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The heavy machines required to install the equipment.

	R O		MSF	
truck crane	units	days	units	days
75 tons			1	1
15 "	1	4		
10 "			1	6
Fork lift	1	33		

9.2  *IS*

APPENDIX - 24



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**2. List of Equipment and Drawings
for RO Test Plant**

List of Equipment for RO Test Plant

1. Sea Water Pretreatment Equipment Section-100

Item	Equipment Name	Specification	Q'ty
T-101	Seawater intake tank Material Capacity Accessories	Vertical, cylindrical, and closed type Polyethylene 3 m ³ Level indicator, overflow pipe, drain valve, ladder, manholes, anchor bolts, etc.	1 set
T-102	Filtered sea water tank Capacity	Same as T-101 15 m ³	1 set
F-101AB	Filter Material Media Accessories	Pressured dual media layer filter Steel inside of filter lining with rubber sheet Gravel-Sand-Anthracite Manhole, nozzles, piping, sight glass, etc.	2 sets
P-101	Sea water pump Material Motor Accessories	Volute centrifugal pump SCS14/SUS316 Outside, 220V x 3 ϕ x 60 Hz x 3.7 kW, TEFC, insulation class JIS E Common bed, coupling etc.	1 set
P-102	Back washing pump Motor	Pumps type and material is same as P-101. Outside, 220V x 3 ϕ x 60 Hz x 1.5 kW, TEFC, insulation class JIS E	1 set
P-103	Back washing air blower Material Motor Accessories	Roots blower, three blade helical Cast iron Outside 220V x 3 ϕ x 60Hz x 1.5 kW, TEFC, insulation class JIS E Common bed, V belt/pulley, silent cleaner, relief valve etc.	1 set
P-105	Waste pump Material Motor	Volute centrifugal pump SCS-14/SUS-316 Outside, 220V x 3 ϕ x 60 Hz x 1.5 kW, TEFC, insulation class JIS E	1 set

Item	Equipment Name	Specification	Q'ty
UV- 101	UV sterilizer Capacity Material Accessories	Ultra violet ray type 7.5 m ³ /h Hard glass, SUS 316 Setting bed, controller, etc.	1 set
FI- 101 - 103	Flow indicator Material	Rotor-meter type For sea water feed, back washing, back washing air. SUS 316 or plastic	3 sets
PI- 101 - 106	Pressure indicator Material Piping & valve Material Valve Automatic valve	Bourdon tube type SUS 316, plastic Class JIS 10K type Plastic pipe & fitting JIS 10K type gate, ball valve plastic made JIS 10K air torque cylinder type diaphragm Valve (PVC) Steam pressure regulating valve (PVC) Heated steam automatic shut down valve (TASV) Cast iron line with rubber made sample valve, etc. Strainer, Steam trap, etc.	8 sets 1 set
	Indicator board Material Skid Accessories	Pressure & flow indicators setting Steel Shape steel made Anchor bolt, others Note: Instruments such as LSA-101, 102, 103 AB etc. are listed in Section 700.	1 set 1 set
P-401	Air compressor Discharge pressure Motor Accessories	Oilless baby compressor 7 kg/cm ² , automatic pressure control Outside, 220V x 3φ x 60Hz x 4P x 3.7 kW, TEFC, insulation Class JIS E Bed, V belt/pulley, air receiver, safety valve, etc.	1 set

2. Fouling Index Automatic Indicating Recorder

Item	Equipment Name	Specification	Q'ty
FIR-101	FI meter Sampling & measuring part Controlling part Power source	Automatic sampling, measuring, indicating and recorder for filtered seawater fouling index Automatic operation Digital printer, sequence controller 110V x 1 ϕ x 60Hz x 0.5 kW	1 set

3. Chemical Feeder Section-500

Item	Equipment Name	Specification	Q'ty
T-501	Sodium hypochlorite solution tank (NaHClO) Material Accessories	Square type 200 ℓ capacity Plastic Level indicator, etc.	1 set
T-502	Ferric chloride solution tank (FeCl ₃)	Same as T-501	1 set
T-503	Sulfuric acid solution tank (H ₂ SO ₄)	Same as T-501	1 set
T-504	Sodium bisulfite solution tank	Same as T-501	1 set
P-501AB	Sodium hypochlorite injection pump Accessories Motor	Constant flow injection diaphragm pump Pump bed, pump cover, etc. 220V x 3φ x 60Hz x 0.03 kW, Tropical insulation treated	2 sets
P-502	Ferric chloride injection pump	Same as P-501	1 set
503AB	Sulphuric acid	Same as P-501. Note: P-503B pump operation (ON-OFF) is controlled by PHRA-301.	2 sets
504ABC	Sodium bisulfate injection pump	Same as P-501; Note: 1) P-504C pump operation is controlled by ORPA-201 and timer program. 2) P-504AB pumps inject 40 ppm SBS for normal operation, P-504C inject 500 ppm SBS for shock treatment.	3 sets

Item	Equipment Name	Specification	Q'ty
FIR-101	Piping & valve	Pump suction valve (non-return with strainer) Pump delivery valve (non-return with siphon protector) Braid hose, hose band, etc.	1 set
	Mixing bar Material	For chemical tank PVC	4 sets
	Skid Accessories	Shape steel made Anchor bolts, others Note: 5 tanks (one is S/P tank) and 8 pumps shall be installed and mounted on the same skid.	1 set

4. Spiral wound type Reverse Osmosis Equipment Section-200

Item	Equipment Name	Specification	Q'ty
T-201	Feed tank Material Capacity Accessories	Vertical, cylindrical, closed type Polyethylene 1.5 m ³ Level indicator, nozzles, overflow pipe, drain valve, manhole, bolt-tap, anchor bolt, etc.	1 set
T-202	Permeate tank Capacity Accessories	Vertical, cylindrical, closed type and polyethylene make. 1.0 m ³ Level indicator, nozzles, overflow pipe, drain valve, anchor bolt, etc.	1 set
P-201	Feed water supply pump Material Motor Accessories	Centrifugal pump SCS-14 Outside, 220V x 3 ϕ x 60Hz x 1.5kW, TEFC, insulation class E Common bed, coupling, etc.	1 set
P-202	Booster pump Material Motor Accessories	Centrifugal pump SCS-14 220V x 3 ϕ x 60Hz x 3.7 kW Common bed, coupling, etc.	1 set
P-203	High pressure pump Material Motor Accessories	Variable flow 20 - 100%, triplex plunger pump SCS-14/SUS-316 Plunger: Ceramic coating 220V x 3 ϕ x 60Hz x 300 – 1,375 rpm x 15 kW, VS motor, TEFC, insulation class E Common bed, driving system, relief valve, accumulator, etc.	1 set
HE-201	Feed preheater Capacity Design pressure Material	Plate type heat exchanger 45,000 Kcal/h 5 kg/cm ² Heating surface; titanium or equivalent equal	1 set

Item	Equipment Name	Specification	Q'ty
HE-202	Feed heater Capacity Material Design pressure	Plate type Steam supply : max. 90 kg/hr : saturated steam of 8 kg/cm ² /g Supply water temperature is to be automatic- controlled up to max. 50°C Titanium or equivalent equal 5 kg/cm ²	1 set
UV-201	UV sterilizer Capacity Material Design pressure Accessories	Ultra violet ray type 3.5 m ³ /hr Hard glass, SUS 316 5 kg/cm ² Setting bed, controller, etc.	1 set
F-201AB	Safety filter Capacity Material Design pressure	Cartridge filter type 3.5 m ³ /h x 20 micron Filter element: polypropylene Housing: Polycarbonate 5 kg/cm ²	2 sets
RO-201 ABC	RO membrane module RO membrane element RO vessel Accessories	Spiral wound type 8"φ x 6 elements FRP made 2 elements x 3 vessels Max. applied pressure x temperature 70 kg/cm ² x 50°C RO element/Vessel parts	1 set
FI- 201 - 202	Flow indicator for permeate, brine Material	Rotor meter type panel mounted Taper tube-hard glass Other: SUS 316 or plastic	2 sets
PI- 201 - 206	Pressure indicator Material	Bourdon tube type panel mounted D model SUS 316/plastic case Note: PI-204, 205 are vibro-isolating type	6 sets

5. Hollow fiber type Reverse Osmosis Equipment Section-300

Item	Equipment Name	Specification	Q'ty
T-301	Feed tank Material Capacity Accessories	Vertical, cylindrical closed type Polyethylene 1.5 m ³ Level indicator, nozzles, overflow pipe, drain valve, manhole, ladder, ball-tap, anchor bolt, etc.	1 set
T-302	Permeate tank	Same as T-202 Note: Without ball-tap	1 set
P-301	Feed water supply pump Material Motor Accessories	Centrifugal pump SCS-14 Outside 220V x 3 ϕ x 60Hz x 1.5 kW, TEFC, insulation class E Common bed, coupling, etc.	1 set
P-302	Booster pump Material Motor Accessories	Centrifugal pump SCS-14 220V x 3 ϕ x 60Hz x 3.7 kW Common bed, coupling, etc.	1 set
P-303	High pressure pump Material Motor Accessories	Variable flow 20 – 100%, triplex plunger pump SCS-14/SUS-316 Plunger: Ceramic coating 220V x 3 ϕ x 60Hz x 300 – 1,375 rpm x 15 kW, VS motor, TEFC, insulation class E Common bed, driving system, relief valve, accumulator, etc.	1 set
HE-301	Feed preheater	Same with HE-201	1 set
HE-302	Feed heater	Same with HE-202	1 set

Item	Equipment Name	Specification	Q'ty
UV-301	UV Sterilizer Capacity Material Design pressure Accessories	Ultra violet ray type 3.5 m ³ /hr Hard glass and stainless steel 5 kg/cm ² Setting bed, controller, etc.	1 set
F-301AB	Safety Filter Capacity Material Design pressure	Cartridge filter type 3.5 m ³ /h x 10 micron meter Filter element: Polypropylene Housing: Polycarbonate 5 kg/cm ²	2 sets
RO-301AB	RO membrane module	RO membrane module: Hollow fiber type 2 elements (8"φ) x 1 module 1 element(8"φ) x 1 module Max. applied pressure x temperature 65 kg/cm ² x 50°C	1 set
FI- 301 - 302	Flow indicator Material	Rotor meter type panel mounted For permeate, brine Taper tube: Hard glass Other: Stainless steel or plastic	2 sets
PI- 301 - 306	Pressure indicator Material	Bourdon tube type panel mounted model D Stainless steel/plastic case Note: PI-304 – 305 are vibro-isolating type	6 sets
TI- 301 - 304	Thermometer	Local mounted scale 0 – 100°C with protecting tube SUS-316 made	4 sets
PSA-301	Pressure switch Material Setting pressure Indicator board	Bellows or bourdon tube type Stainless steel 0 – 3 kg/cm ² Steel plate or stainless steel. Mounted pressure, flow indicators, pressure switch and name plate, etc.	2 sets 1 set

Item	Equipment Name	Specification	Q'ty
PSA-301 (Cont'd.)	Piping & Valve	High pressure side; SUS-316 TP, high pressure rubber hose, victaulic coupling, flange and fitting Valve: 600 lbs. type stainless steel made Low pressure side; Plastic pipe, rubber and plastic hose, JIS 10K flange and fitting Valve: JIS 10K type plastic made ball, glove, gate valve, etc. Automatic control valve (CV), diaphragm valve, drain trap, etc.	1 set
	Skid Size Accessories	Shape steel made Approx. 3,000 L x 2,000 W mm Anchor bolt, others Note: Instruments such as TC-301, TR-301, PHRA-301, CR-301, LSA-301, TA-301 are listed in SECT. 700.	1 set
	Special parts	Setting parts for other foreign hollow fiber type RO module. Note: Other module is U.S.A. DuPont Permasep B-10 model 6840-060 x 1 module.	1 set

7. Electrical Equipment and Instrumentation Section-700

Item	Equipment Name	Specification	Q'ty
MCP-701	Motor control panel Size	<p>Self-supporting indoor use type Approx. 3,000W x 2,350H x 800D mm Attached apparatus Main molded case circuit breaker, distribution molded case circuit breaker, pilot lamp, magnetic contactor, thermal relay, VS controller, VS operator, VS system module etc., pilot lamp (running), annunciator lamp for operation switch, (changeover switch, push button switch), auxiliary relay, auxiliary timer, floatless switch, flicker relay, off delay relay, annunciator relay, buzzer, power control switch, hour meter for transformer 220/110V, panel inner lighting, name plate, terminal plate, inner wiring material. Attached instrument Feed pH recorder with alarm, temperature recorder, conductivity recorder,</p>	1 set
MVP-701	Solenoid valve panel	<p>Self-supporting indoor use type (attached in MCP-701 panel) Back washing automatic valve for filter (F-101A) Operating control panel Attached apparatus Solenoid valve, annunciator lamp, pilot lamp for valve (open-close), changeover switch (auto-manu), auxiliary relay, timer relay, off delay relay, etc.</p>	1 set
TR- 201 - 301	Instrument Temperature recorder	2-pen recorder (range 0 – 110°C)	1 set

Item	Equipment Name	Specification	Q'ty
TC- 201 - 301	Temperature controller	Temperature indicating-controlling instrument using air pressure	2 sets
ORPA-201	Oxidation reduction potential with alarm	Electrode type with alarm (range: -700 – 700mV) Sensor, electrode holder, Special cable	1 set 1 each 1 set
PHIA-301	pH recorder with alarm	Glass electrode type recorder with alarm (range 0 – 14 pH) Electrode, electrode holder Special cable	1 set 1 each 1 set
CR- 201 - 301	Conductivity recorder	2-pen conductivity recorder (range: 0 – 1,000 μ S/cm) Electrode Special cable	1 set 2 sets 1 set
LSA-101 -201 -301 -103AB	Level switch	Conductivity type level switch	6 sets
TA- 201 - 301	Temperature switch		1 set

8. Piping and Wiring Materials

Item	Equipment Name	Specification	Q'ty
	Scope of Supply for piping and wiring materials inside of battery limit shown in flow sheet and plot plan of this test plant.		
	Piping material	Sea water intake pipe Waste, steam and concentrate discharge pipe, sea water, filtered water, product concentrate, etc.	1 set
	Material	Pipes between each equipment and tank. Chemical injection pipe 10 - 80 mm ϕ plastic pipe (pvc) and fitting JIS 10K class plastic flange. 15 - 25 mm ϕ SGP & SUS-316 pipe & fitting, JIS 10K class 8 mm ϕ plastic braid hose, vinyl hose, hose hand, pipe fitting, etc.	
	Valve	JIS 10K class, BC or FC, PVC Globe, ball, check valves, Sampling valve, etc.	1 set
	Other	Drain trap, strainer, etc.	1 set
	Wiring material	Wiring material between control panel and electrical equipment and instruments.	1 set
	Pneumatic pipe air set		
	Power cable	CV cable type	
	Control cable	CVV cable type	
	Instrument cable	CVV cable type and special type	
	Wiring pipe	Steel pipe for wiring	
	Flexible wiring pipe	Flexible wiring pipe covered with vinyl	
	Supporting material, etc.	Hard vinyl pipe & fitting	

9. Apparatus and tool for Operation and Maintenance

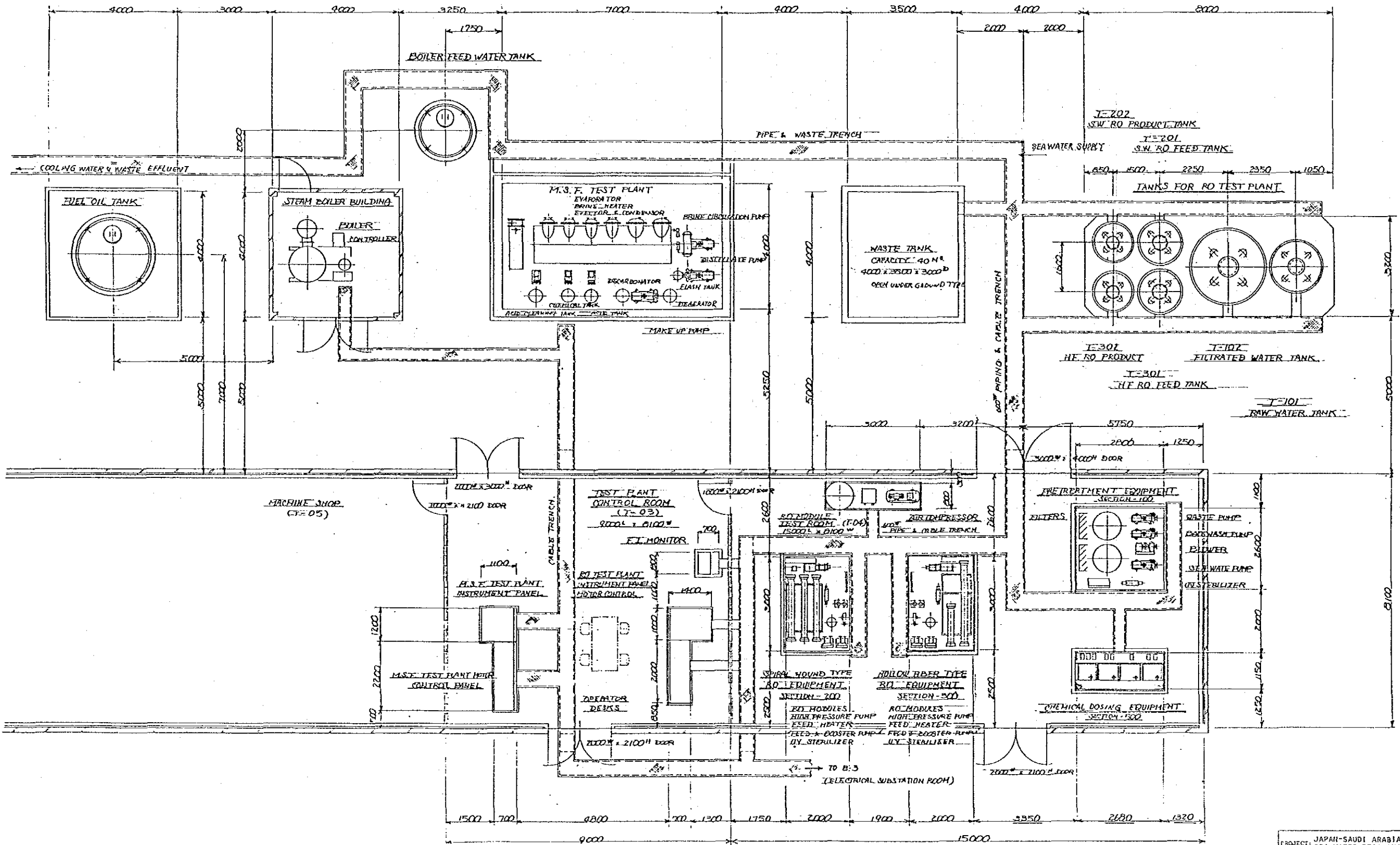
Item	Equipment Name	Specification	Q'ty
	Apparatus	Portable measuring instruments and mess cylinder, sampling bottle, etc. for daily operation and maintenance.	1 set
	Portable fouling index meter	Pressure water vessel, FI filter, baby compressor, etc.	1 set
		Portable pH meter	1 set
		Portable conductivity meter	1 set
		Portable dissolved oxygen meter	1 set
		Portable residual chlorine meter	1 set
		Thermometer 0 – 100° C	2 sets
		Mess-cylinder, bottle, filter paper, etc.	1 set
	Tools	Tools for daily operation and maintenance	1 set
	Ordinary tool	Spanner, pench, hammer, driver, metal saw etc. and tool box.	
		Waste cloth, fitting material for piping, glue, seal gasket, maintenance paint, etc.	
		Buckets	
	Special tool	Special tool for overhaul and fabrication of pump and RO module.	
	Spare parts and reagent	For one year operation	1 set

10. Chemical for Operation and Maintenance

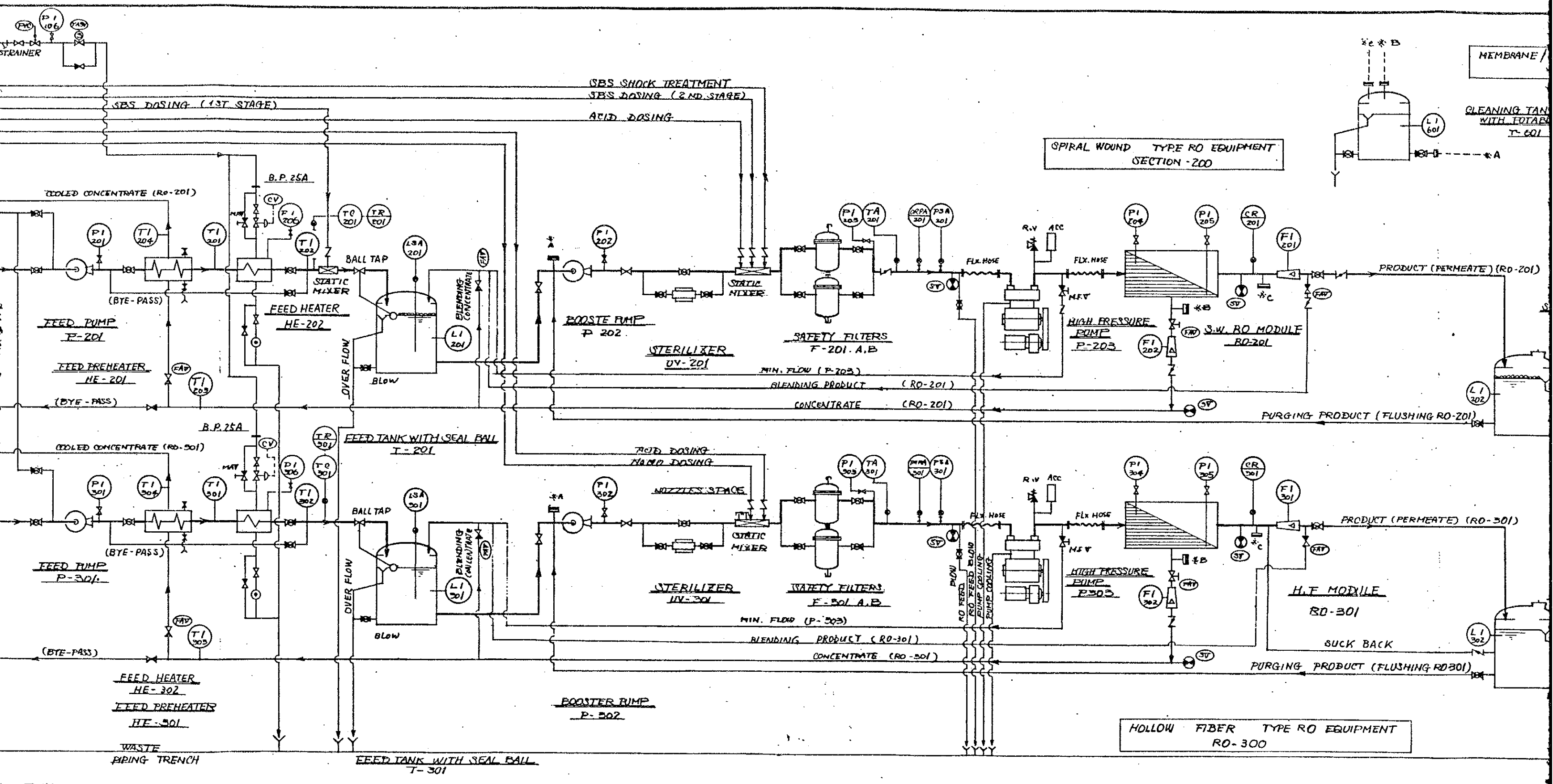
Item	Equipment Name	Specification	Q'ty
	Chemicals for one year operation and maintenance		1 set
		Note: Not include chemicals (Sulfuric acid, sodium hypochlorite)	
	Ferric chloride	34% conc. FeCl ₃ drum can	800 kg
	Sodium bisulfite	95% more conc. S.B.S. vinyl bag	2,400 kg
	Sodium hexametaphosphate	98% more conc. S.H.M.P. vinyl bag	200 kg
	Citric acid	98% citric acid vinyl bag	120 kg
	Ammonia	25% ammonia 20ℓ plastic bottle	60 ℓ
	Formaline	34% Formaldehyde 20 ℓ plastic bottle	100 kg
	Membrane treatment agent		1 set

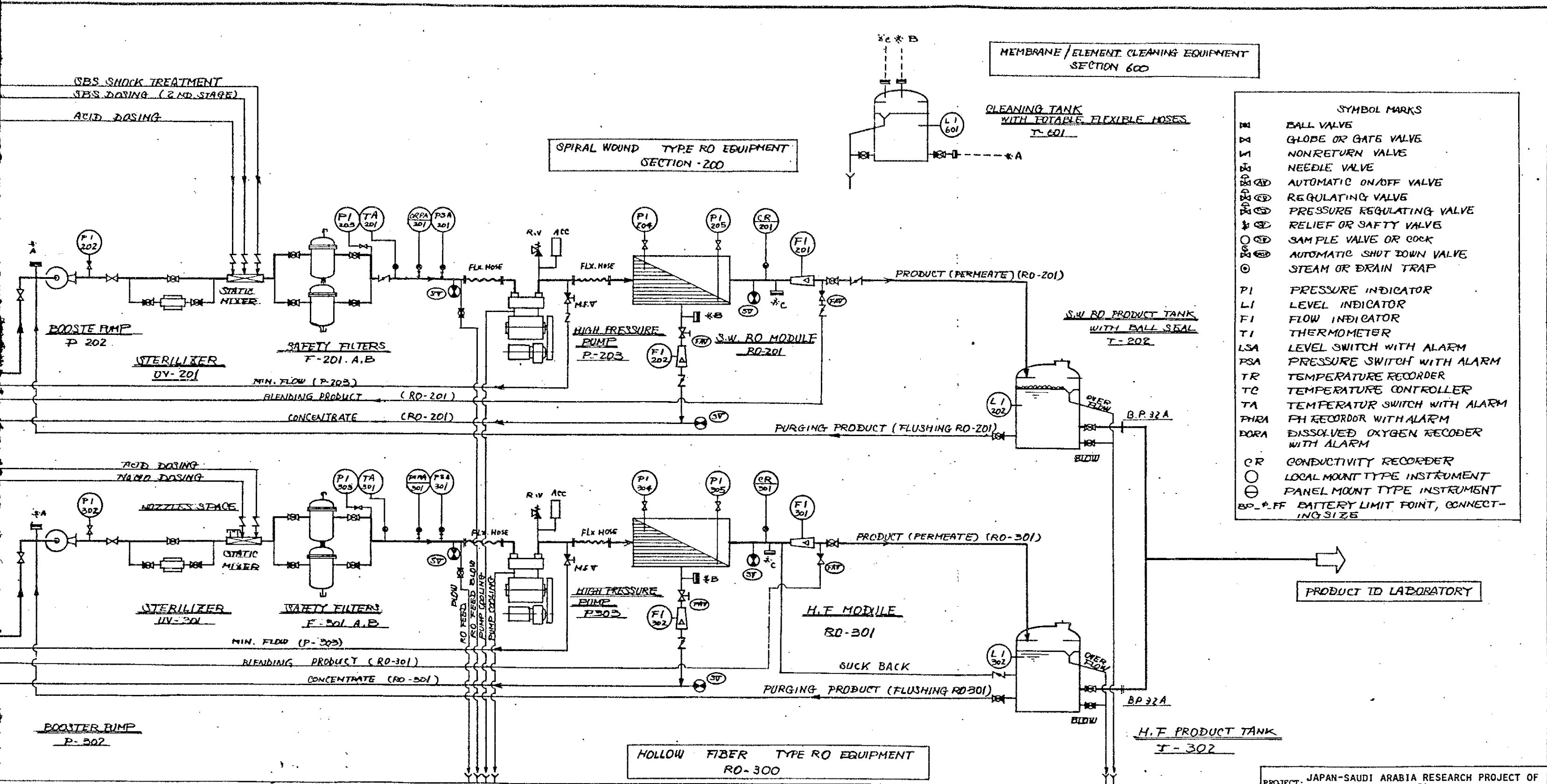
M.S.F. TEST PLANT

RO TEST PLANT



PROJECT: JAPAN-SAUDI ARABIA RESEARCH PROJECT OF SEA WATER DESALINATION	
TITLE: PLOT PLAN OF MSF & RO TEST PLANTS	
DATE:	SCALE:
DRAWING NO.: SAJ-R1001	
JAPAN INTERNATIONAL COOPERATION AGENCY	

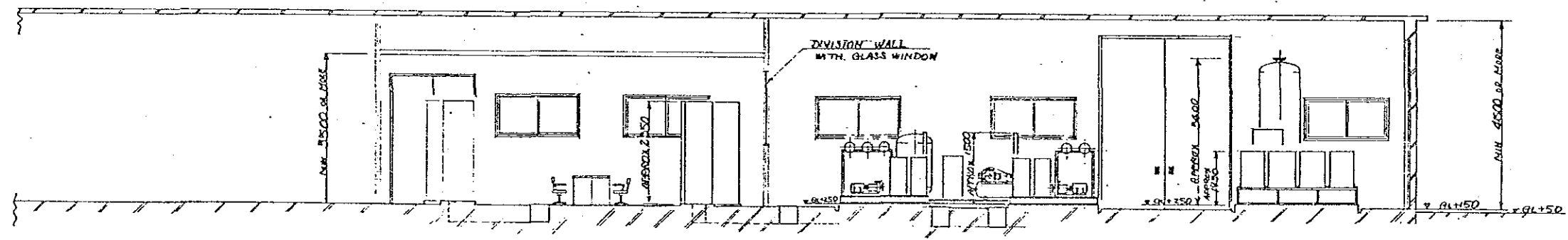
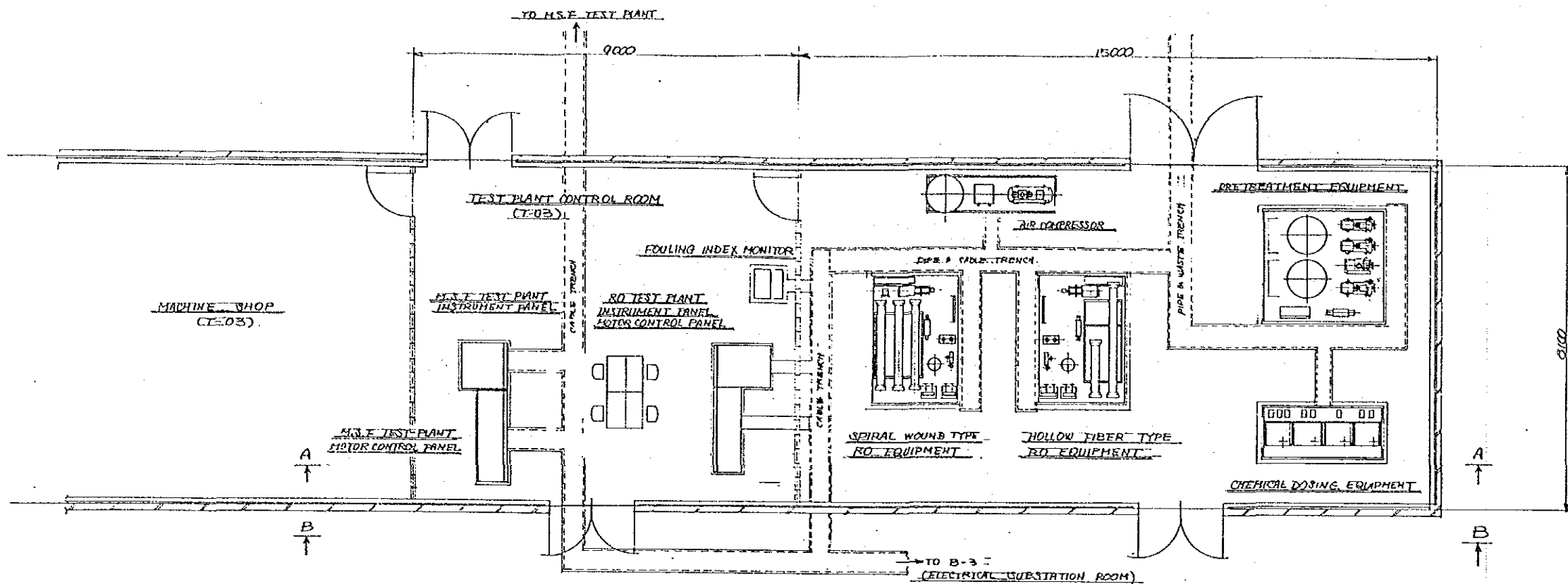




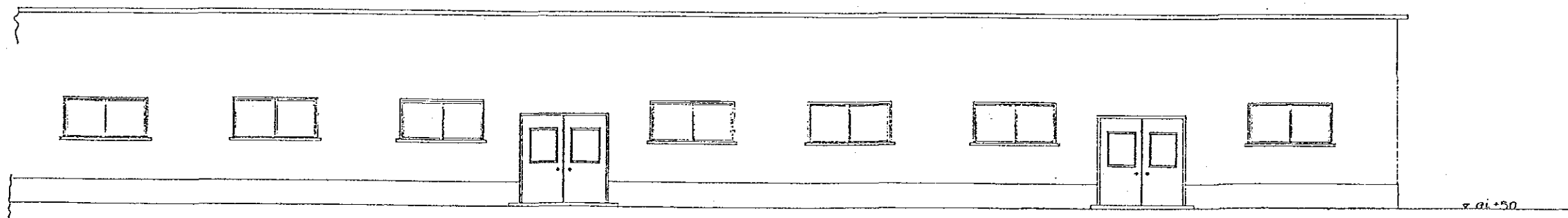
SYMBOL MARKS

⊘	BALL VALVE
⊞	GLOBE OR GATE VALVE
⊥	NON RETURN VALVE
⊘	NEEDLE VALVE
⊘	AUTOMATIC ON/OFF VALVE
⊘	REGULATING VALVE
⊘	PRESSURE REGULATING VALVE
⊘	RELIEF OR SAFETY VALVE
⊘	SAMPLE VALVE OR COCK
⊘	AUTOMATIC SHUT DOWN VALVE
⊘	STEAM OR DRAIN TRAP
PI	PRESSURE INDICATOR
LI	LEVEL INDICATOR
FI	FLOW INDICATOR
TI	THERMOMETER
LSA	LEVEL SWITCH WITH ALARM
PSA	PRESSURE SWITCH WITH ALARM
TR	TEMPERATURE RECORDER
TC	TEMPERATURE CONTROLLER
TA	TEMPERATUR SWITCH WITH ALARM
PHRA	PH RECORDER WITH ALARM
DORA	DISSOLVED OXYGEN RECORDER WITH ALARM
CR	CONDUCTIVITY RECORDER
○	LOCAL MOUNT TYPE INSTRUMENT
⊖	PANEL MOUNT TYPE INSTRUMENT
BP-#FF	BATTERY LIMIT POINT, CONNECTING SIZE

PROJECT: JAPAN-SAUDI ARABIA RESEARCH PROJECT OF SEA WATER DESALINATION	
REVERSE OSMOSIS TEST PLANT FACILITY	
TITLE: PIPING & INSTRUMENT DIAGRAM	
DATE: 30-OCT-1983	SCALE: NON
DRAWING NO.: SAJ-R4001	
JAPAN INTERNATIONAL COOPERATION AGENCY	

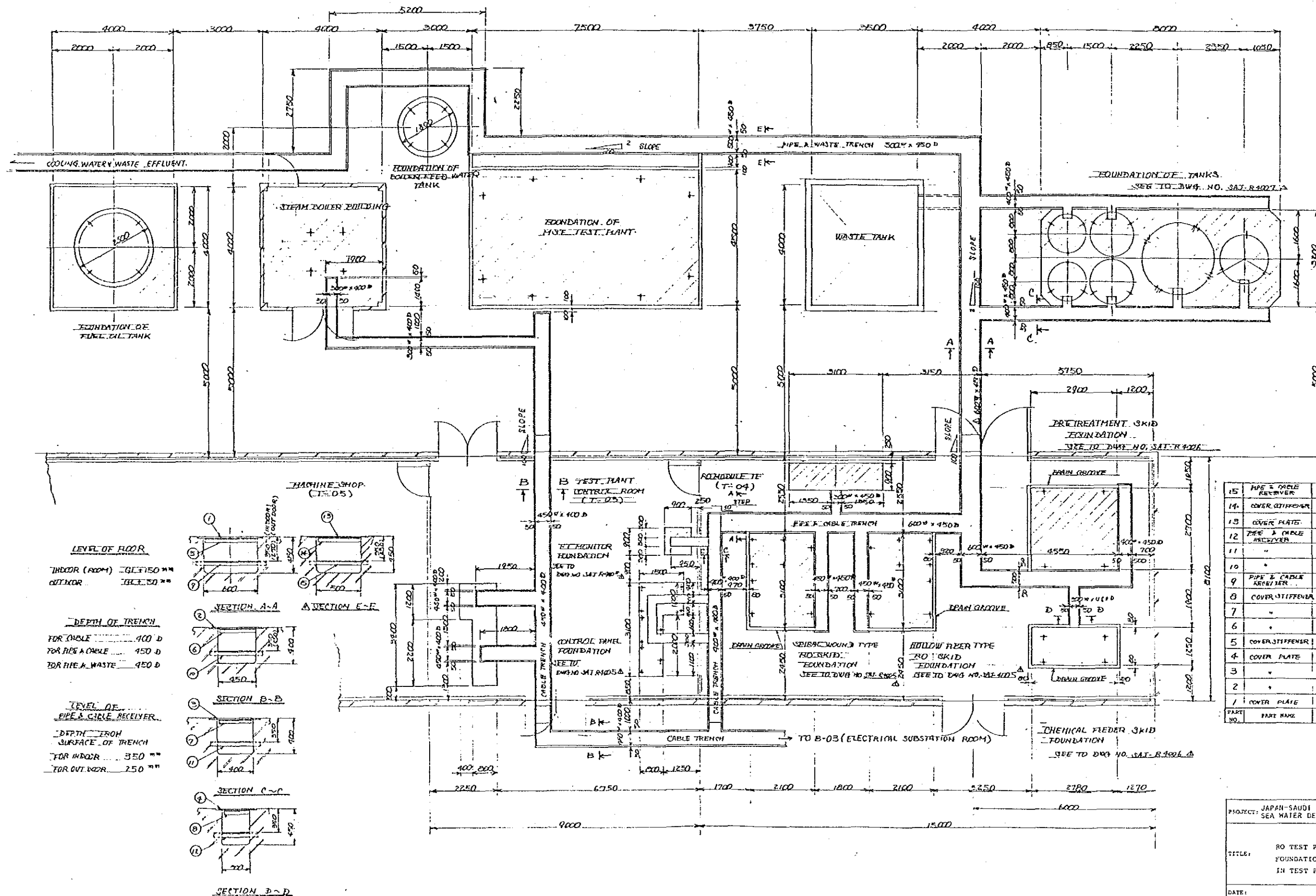


A-A VIEW



B-B VIEW

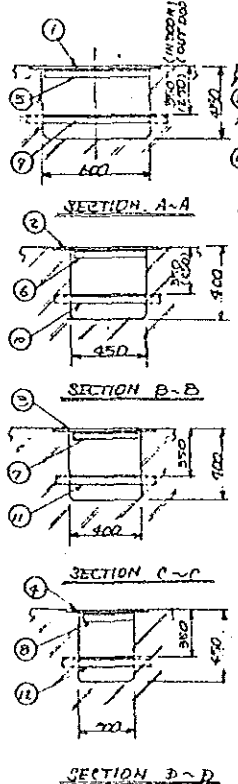
PROJECT:	JAPAN-SAUDI ARABIA RESEARCH PROJECT OF SEA WATER DESALINATION
TITLE:	RO TEST PLANT PLOT PLAN OF INDOOR & SIDE VIEW
DATE:	SCALE:
DRAWING NO.:	SAJ-R4001
JAPAN INTERNATIONAL COOPERATION AGENCY	



LEVEL OF FLOOR
 INDOOR (ROOM) 101.150 MM
 OUTDOOR 101.350 MM

DEPTH OF TRENCH
 FOR CABLE 400 D
 FOR PIPE & CABLE 450 D
 FOR PIPE & WASTE 450 D

LEVEL OF PIPE & CABLE RECEIVER
 DEPTH FROM SURFACE OF TRENCH
 FOR INDOOR 350 MM
 FOR OUTDOOR 250 MM



15	PIPE & CABLE RECEIVER	C/S		1.25 x 2.5 x 1.2
14	COVER STIFFENER	"		1.35 x 0.5 x 1.3
13	COVER PLATE	"		CHECK RATING 6.9-5
12	PIPE & CABLE RECEIVER	"		1.25 x 2.5 x 1.2
11	"	"		"
10	"	"		"
9	PIPE & CABLE RECEIVER	"		1.25 x 2.5 x 1.2
8	COVER STIFFENER	"		1.35 x 0.5 x 1.3
7	"	"		"
6	"	"		"
5	COVER STIFFENER	"		1.35 x 0.5 x 1.3
4	COVER PLATE	"		CHECK RATING 6.9-5
3	"	"		"
2	"	"		"
1	COVER PLATE	C/S		CHECK RATING 6.9-5
PART NO.	PART NAME	PART	INCR. (SPARE)	QUANTITY/SET
				REMARK

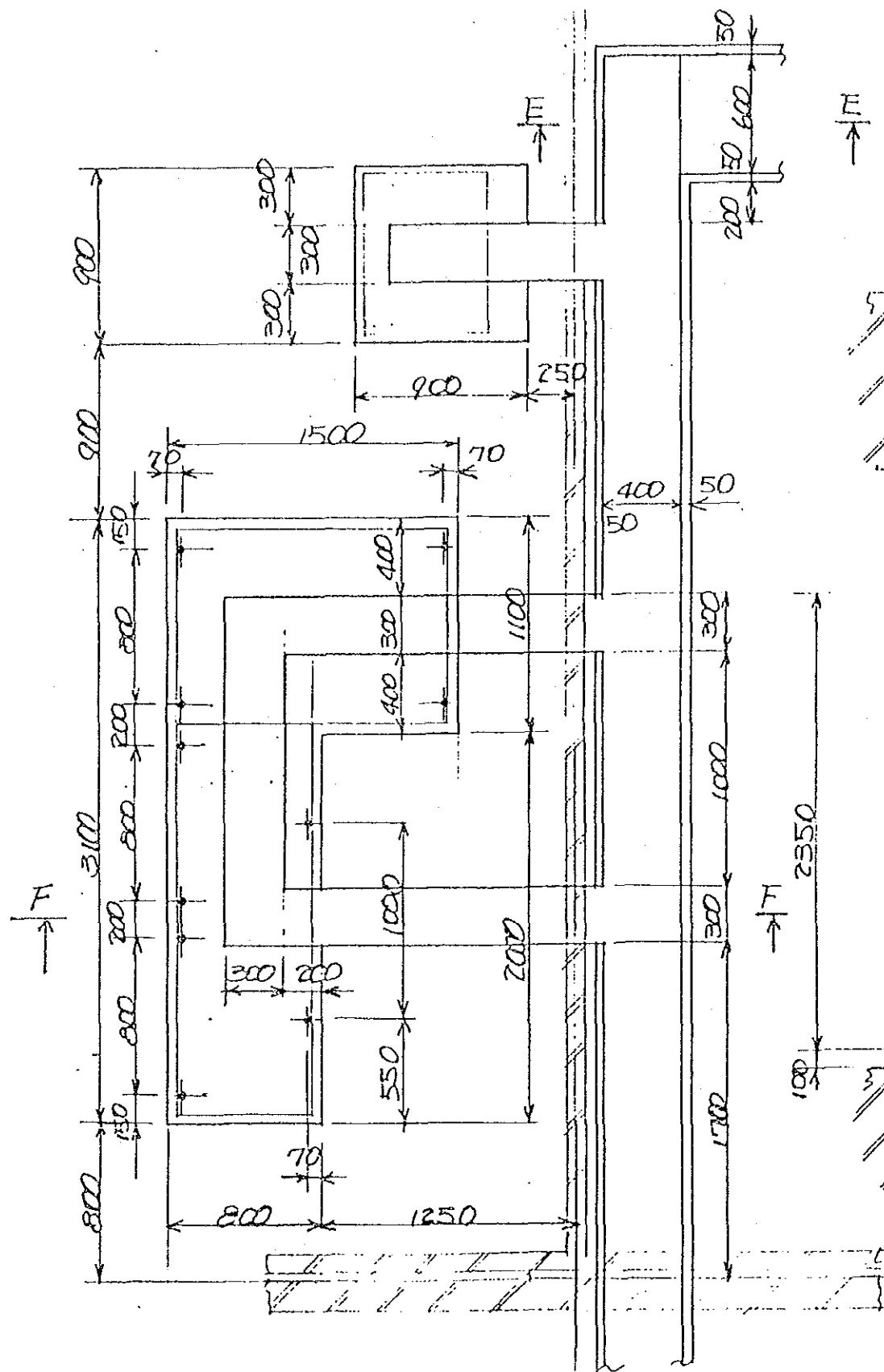
PROJECT: JAPAN-SAUDI ARABIA RESEARCH PROJECT OF SEA WATER DESALINATION

TITLE: RO TEST PLANT FOUNDATION OF PIPE & CABLE TRENCH IN TEST PLANT FACILITY

DATE: SCALE:

DRAWING NO.: SAJ-R4004

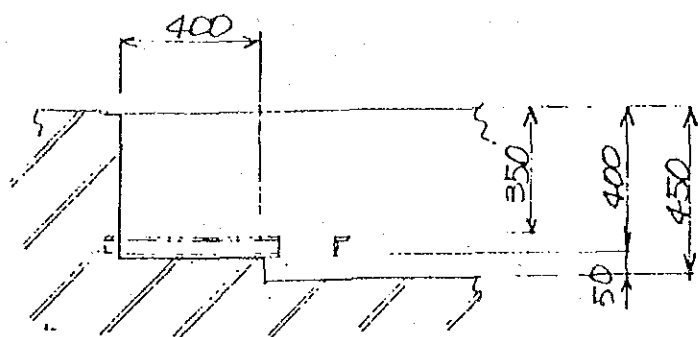
JAPAN INTERNATIONAL COOPERATION AGENCY



FOUNDATIONS OF CONTROL & INSTRUMENT PANEL & FOULING INDEX MONITOR

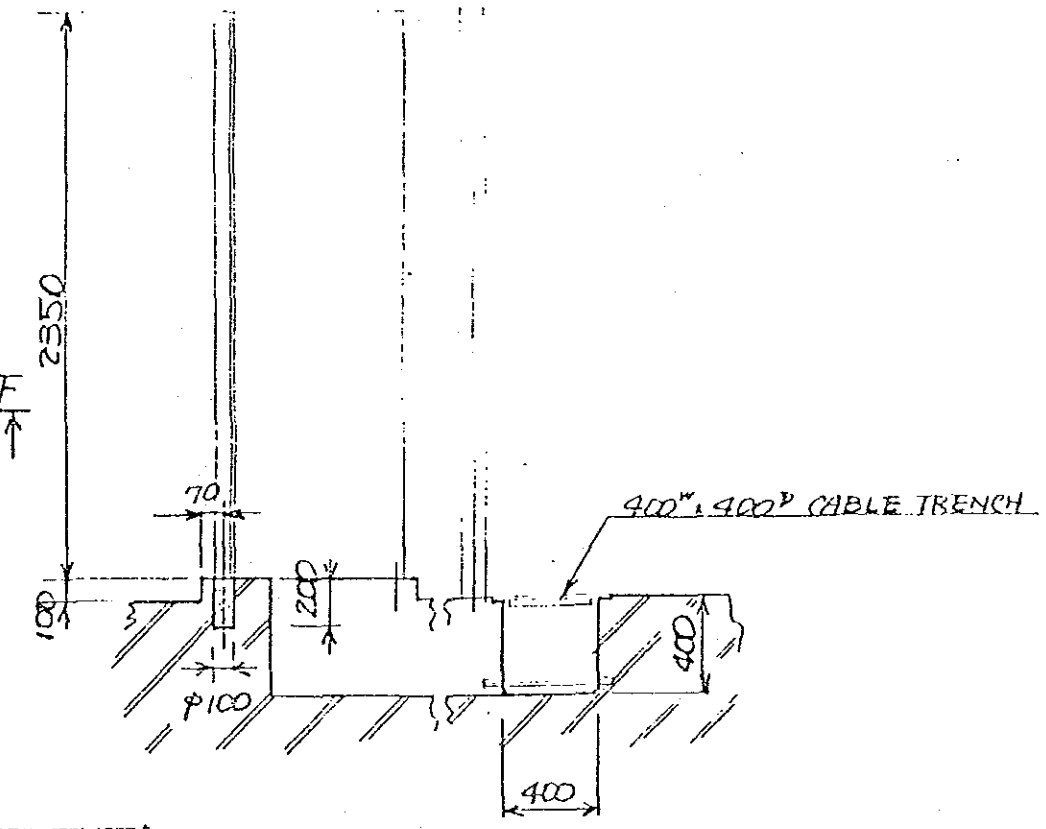
SECTION - 700
SECTION - 100

S=γ=20



SECTION E~E

S=γ=20



SECTION F~F

S=γ=30

LOADING DATA

<u>CONTROL & INSTRUMENT PANEL</u>	
DIMENSION	2000 ^L x 700 ^W x 2350 ^H
APPROX.	1000 ^L x 1400 ^W x 2350 ^H
WEIGHT	250 kg, 150 kg
<u>FOULING INDEX MONITOR</u>	
DIMENSION	
APPROX.	700 ^L x 680 ^W x 1600 ^H
WEIGHT	100 kg

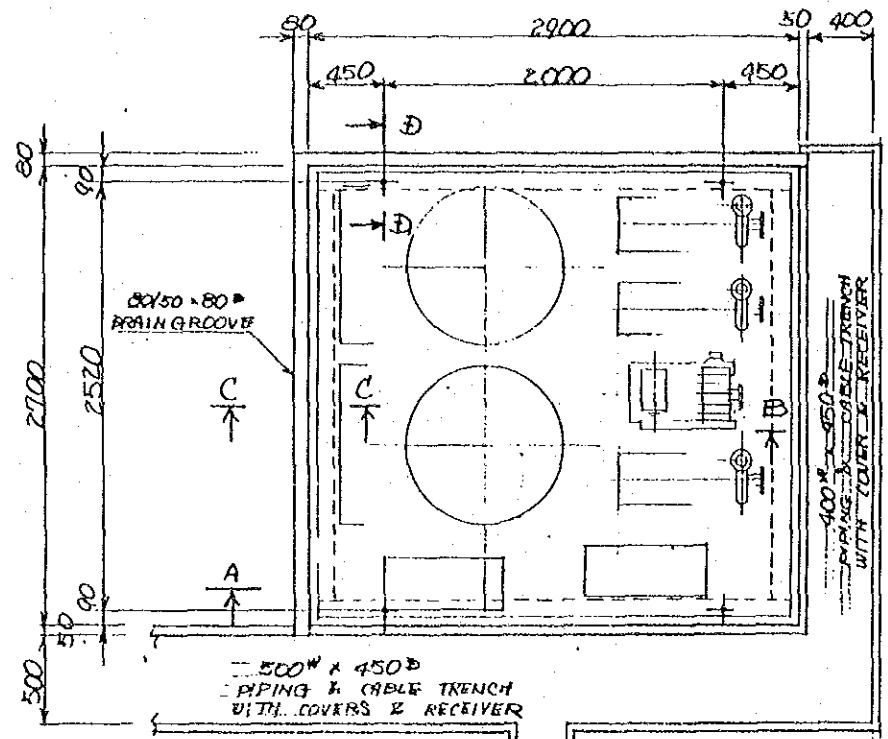
PROJECT: JAPAN-SAUDI ARABIA RESEARCH PROJECT OF SEA WATER DESALINATION

TITLE: RO TEST PLANT
FOUNDATION OF RO SKID & CONTROL PANELS

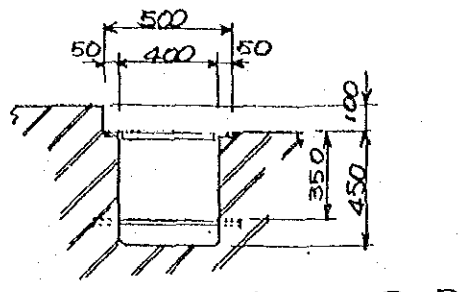
DATE: SCALE:

DRAWING NO.: SAJ-R4005 2

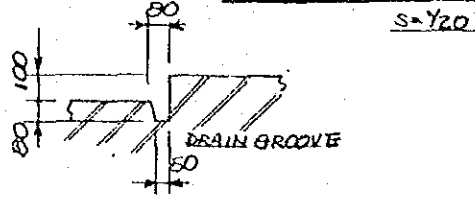
JAPAN INTERNATIONAL COOPERATION AGENCY



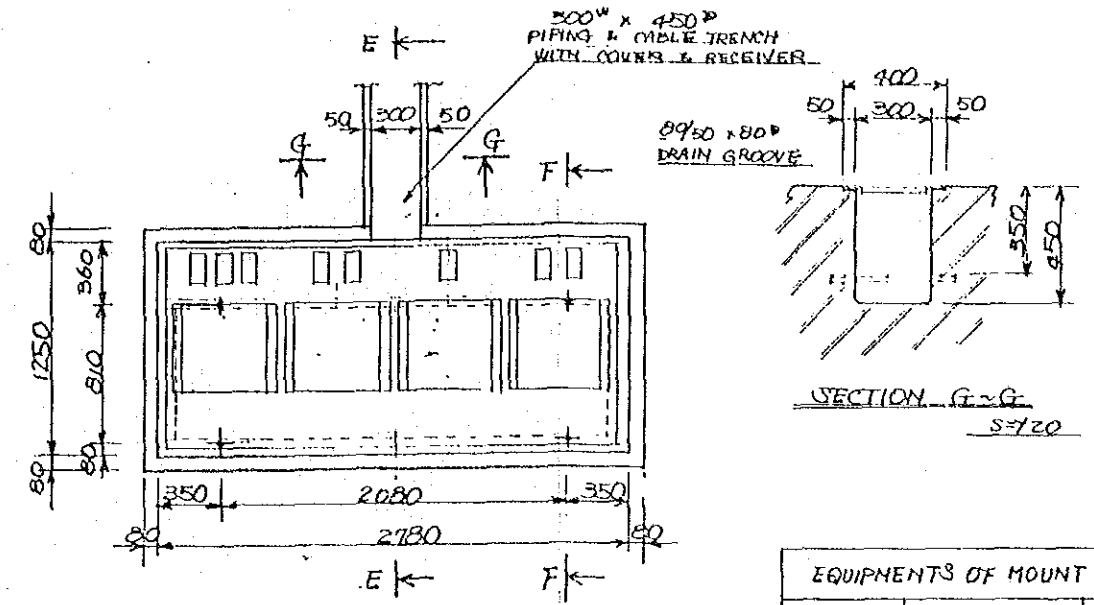
PRETREATMENT EQUIPMENT FOUNDATION
SECTION-100 S=1/30



SECTION B~B
S=1/20



SECTION C~C
S=1/20

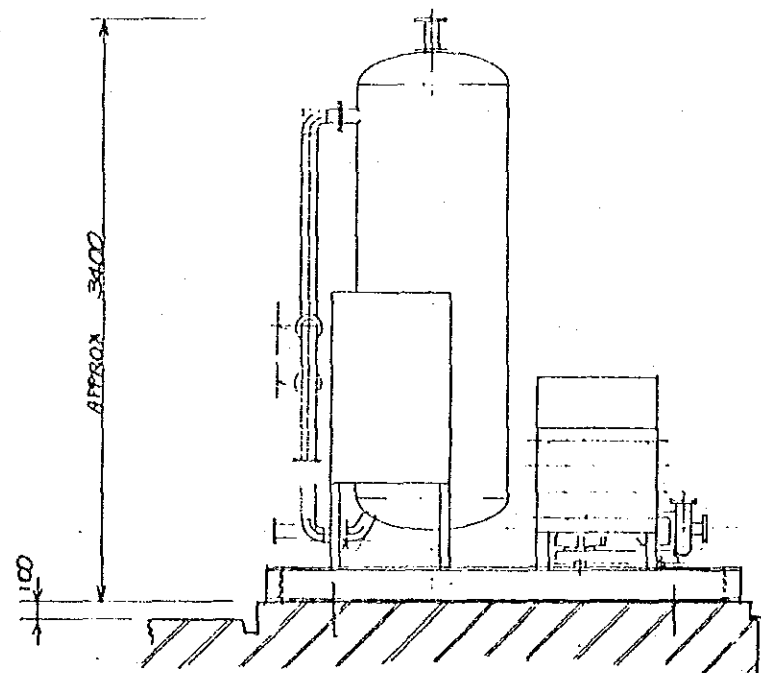


CHEMICAL FEEDER FOUNDATION
SECTION-500 S=1/30

EQUIPMENTS OF MOUNT SKID		
ITEM	EQUIPMT NAME	REMARK
T-501	CHLORINE TANK	200L CAP.
T-502	COAGULANT TANK	"
T-503	ACID TANK	"
T-504	DEOXIDANT TANK	"
P-501 A,B	CHLORINE DOSING PUMP	
P-502	COAGULANT DOSING PUMP	
P-503 A,B	ACID DOSING PUMP	
P-504 A,B,C	DEOXIDANT DOSING PUMP	

LOADING DATA

LOADING DATA	
SKID DIMENSION APPROX 2180' x 1160' x 1350'	
WEIGHT	
AT EMPTY ; APPROX	0.4 TONS
AT OPERATION ;	1.5 TONS

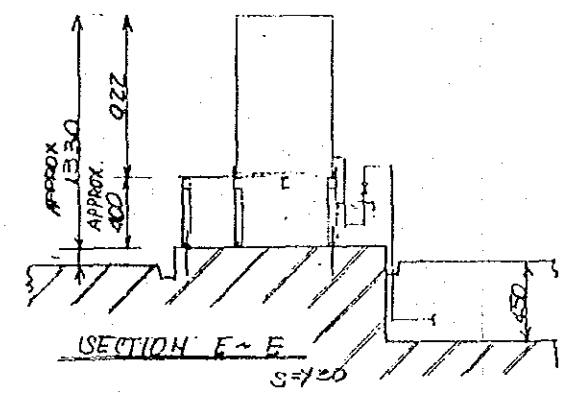


A~A VIEW
S=1/30

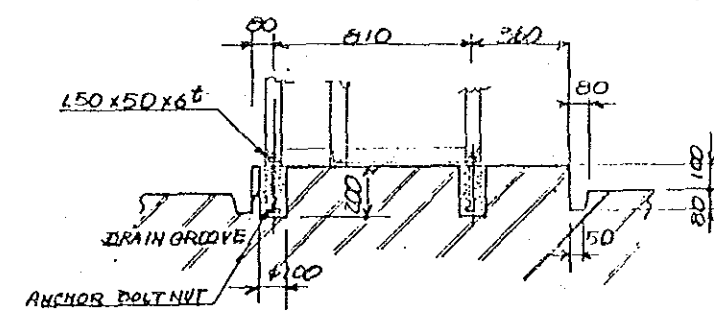
EQUIPMENTS OF MOUNT SKID		
ITEM	EQUIPMT NAME	REMARK
F-101 A,B	FILTERS	
P-101	RAW WATER PUMP	
P-102	BACK WASH PUMP	
P-103	BACK WASH AIR BLOWER	
UV-101	UV STERILIZER	

LOADING DATA

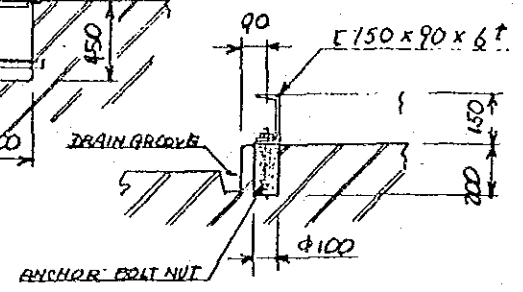
LOADING DATA	
SKID DIMENSION APPROX 2800' x 2600' x 5900'	
WEIGHT	
AT EMPTY ; APPROX	3.2 TONS
AT OPERATION ;	6.7 TONS



SECTION E~E
S=1/20

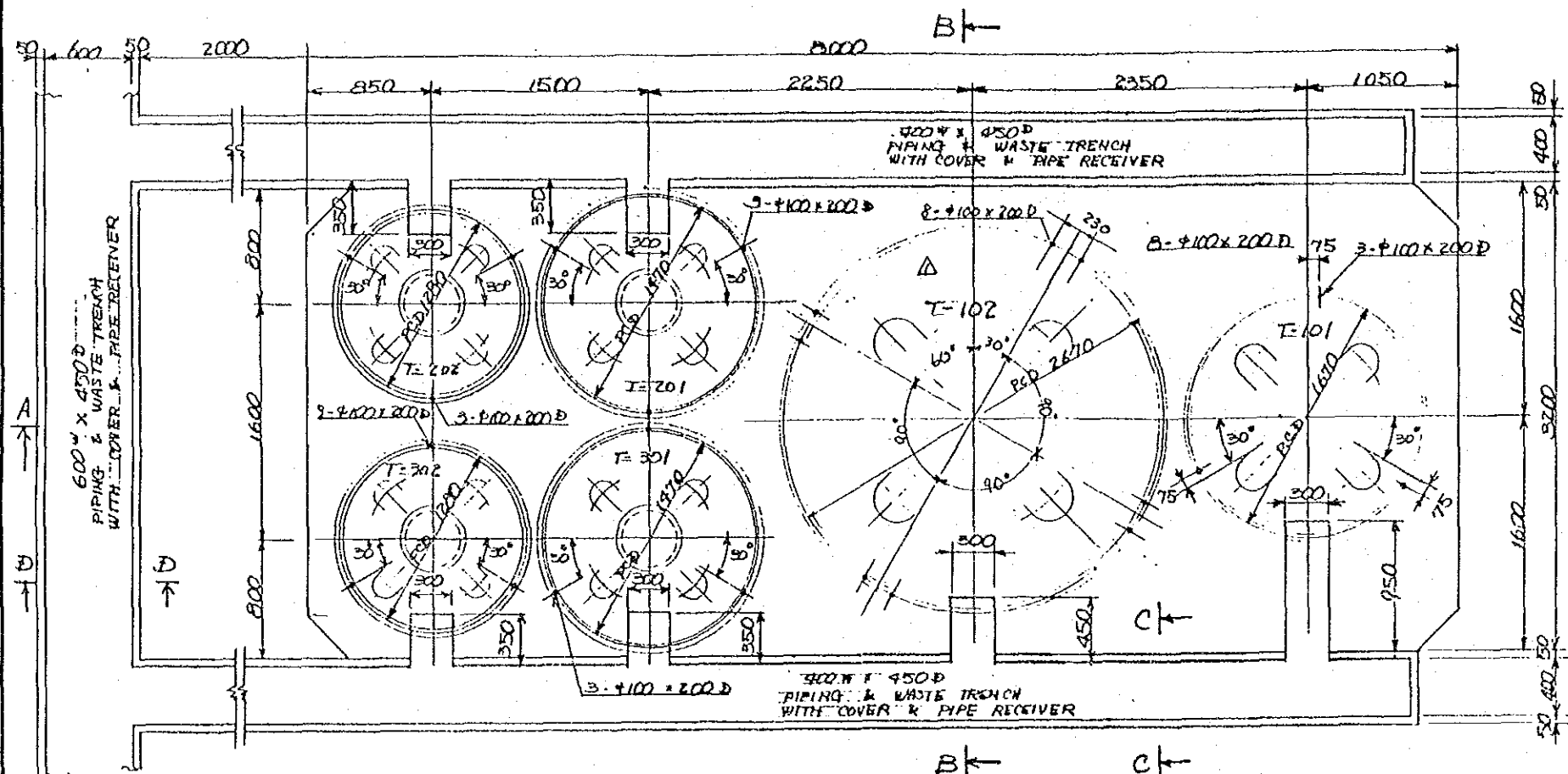


SECTION F~F
S=1/20



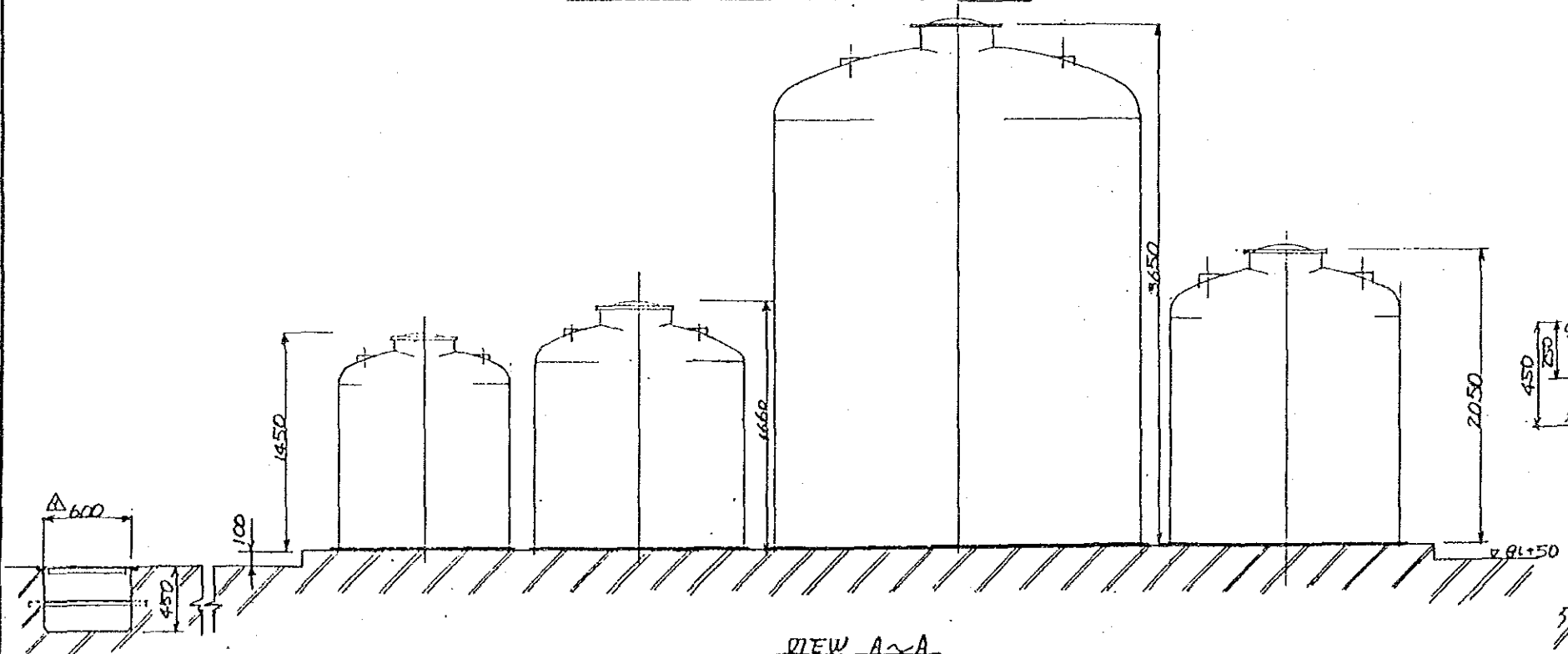
SECTION D~D
S=1/20

PROJECT: JAPAN-SAUDI ARABIA RESEARCH PROJECT OF SEA WATER DESALINATION	
TITLE: RO TEST PLANT FOUNDATION OF PRETREATMENT SKID & CHEMICAL FEEDER SKID	
DATE:	SCALE:
DRAWING NO.: SAJ-R4006	
JAPAN INTERNATIONAL COOPERATION AGENCY	

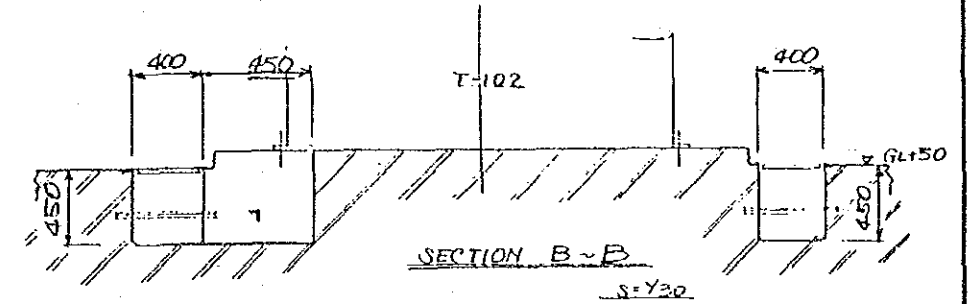


LOADING DATA OF TANKS				
ITEM	TANK NAME	DIMENSION	WEIGHT AT EMPTY APPROX	WEIGHT AT FILL UP APPROX
T-101	RAW SEA WATER TANK	1620 ^φ x 2050 ^H	250 kg	3.34 TMS
T-102	FILTERED SEA WATER TANK	2580 ^φ x 3650 ^H	860	16.2
T-201	SW/RO FEED TANK	1276 ^φ x 1660 ^H	70	1.62
T-301	HF/RO FEED TANK	1276 ^φ x 1660 ^H	70	1.62
T-202	SW/RO PRODUCT TANK	1106 ^φ x 1450 ^H	50	1.05
T-303	HF/RO PRODUCT TANK	1106 ^φ x 1450 ^H	50	1.05

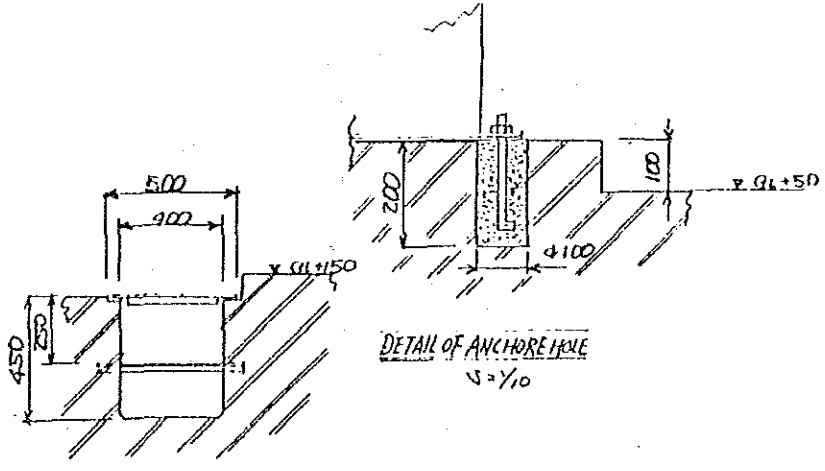
FOUNDATION OF TANKS



VIEW A~A
S=1/50

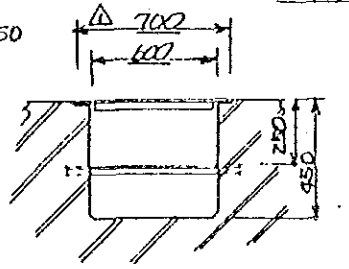


SECTION B~B
S=1/20



DETAIL OF ANCHOR BOLT
S=1/10

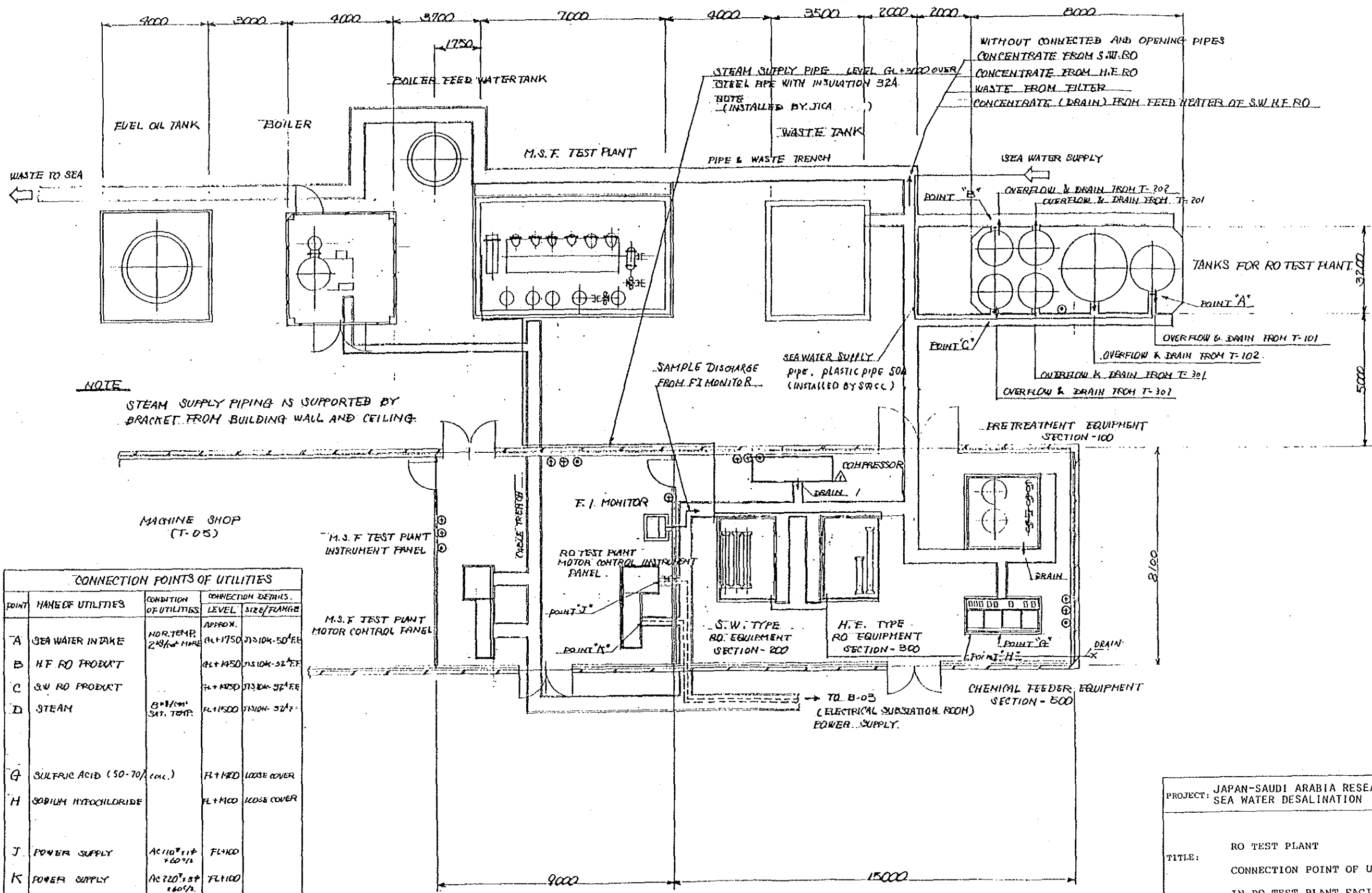
SECTION C~C
S=1/20



SECTION D~D
S=1/20

PROJECT: JAPAN-SAUDI ARABIA RESEARCH PROJECT OF SEA WATER DESALINATION	
TITLE: RO TEST PLANT FOUNDATION OF TANKS	
DATE:	SCALE:
DRAWING NO.: SAJ-R4007	
JAPAN INTERNATIONAL COOPERATION AGENCY	

△ REVISED ON OCT. 3. 1984



NOTE
 STEAM SUPPLY PIPING IS SUPPORTED BY BRACKET FROM BUILDING WALL AND CEILING.

CONNECTION POINTS OF UTILITIES			
POINT	HAND OF UTILITIES	CONDITION OF UTILITIES	CONNECTION DETAILS
A	SEA WATER INTAKE	NOR. TEMP. 24°C MAX	APPROX. FL+1750 3" DIA. 50' EE
B	H.F. RO PRODUCT		FL+1450 3" DIA. 52' EE
C	S.W. RO PRODUCT		FL+1450 3" DIA. 52' EE
D	STEAM	8-11/16" SAT. TEMP.	FL+1500 3" DIA. 52' EE
G	SULFURIC ACID (50-70% conc.)		FL+1450 LOOSE COVER
H	SODIUM HYPOCHLORIDE		FL+1450 LOOSE COVER
J	POWER SUPPLY	AC 110V, 1ϕ, 60Hz	FL+100
K	POWER SUPPLY	AC 220V, 3ϕ, 60Hz	FL+100

MARK: ⊕ ELECTRICITY CONNECTIONS PLUG. 110V x 1ϕ
 ⊙ CIVIL WATER TAP. 8-10A.

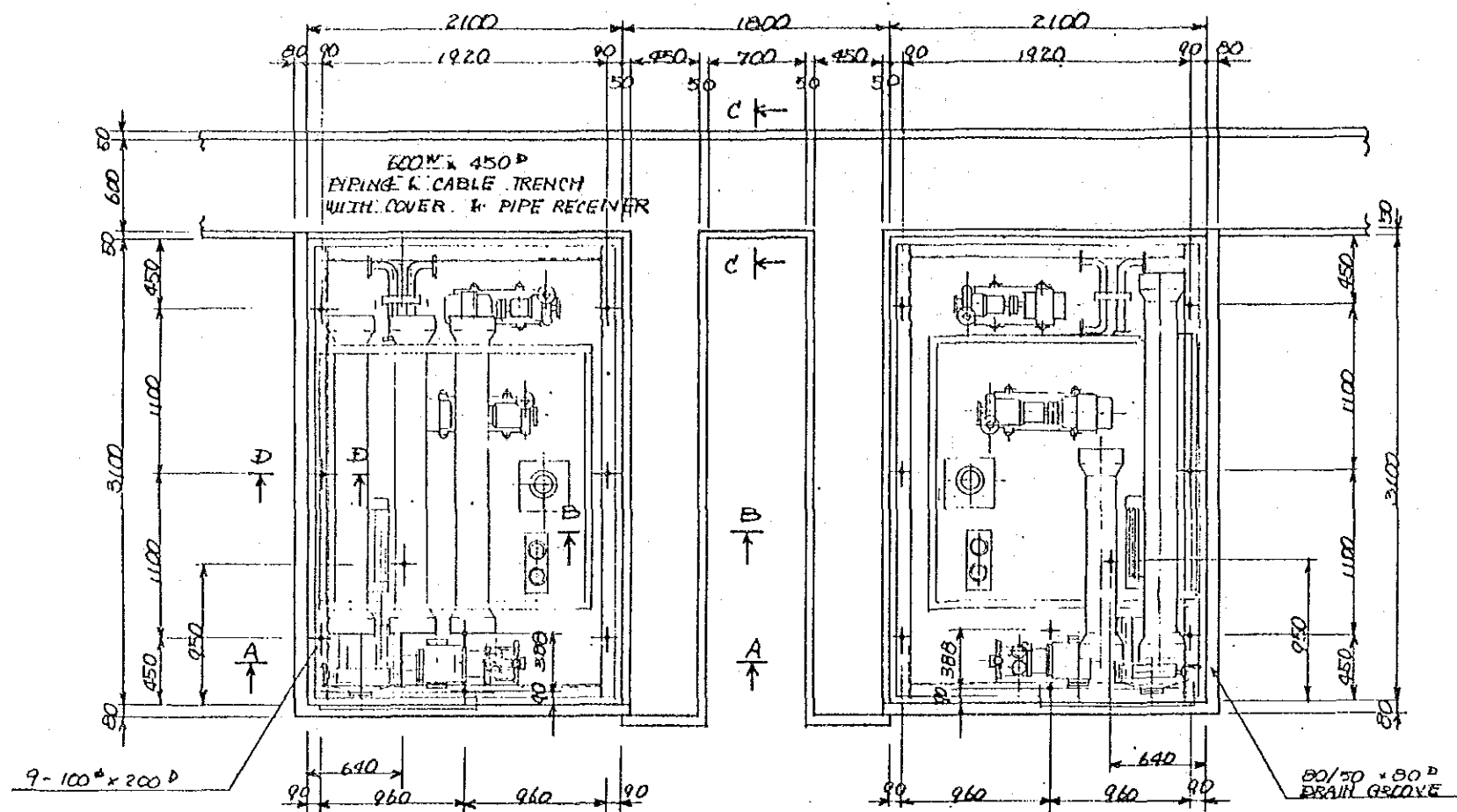
PROJECT: JAPAN-SAUDI ARABIA RESEARCH PROJECT OF SEA WATER DESALINATION

TITLE: RO TEST PLANT
 CONNECTION POINT OF UTILITIES
 IN RO TEST PLANT FACILITY

DATE: _____ SCALE: _____

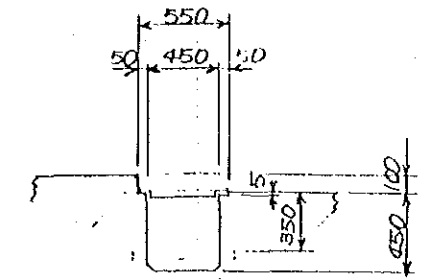
DRAWING NO.: SAJ-R4008 (1)

JAPAN INTERNATIONAL COOPERATION AGENCY

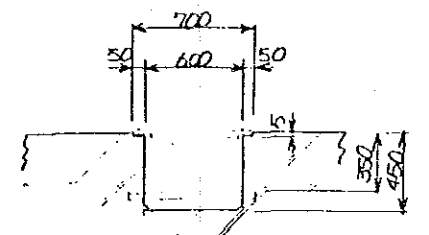


FOUNDATION OF RO EQUIPMENT
SPIRAL WOUND RO SECTION - 200

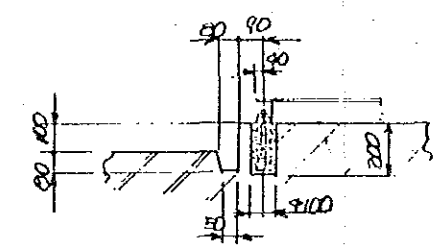
FOUNDATION OF RO EQUIPMENT
HOLLOW FIBER RO SECTION - 300



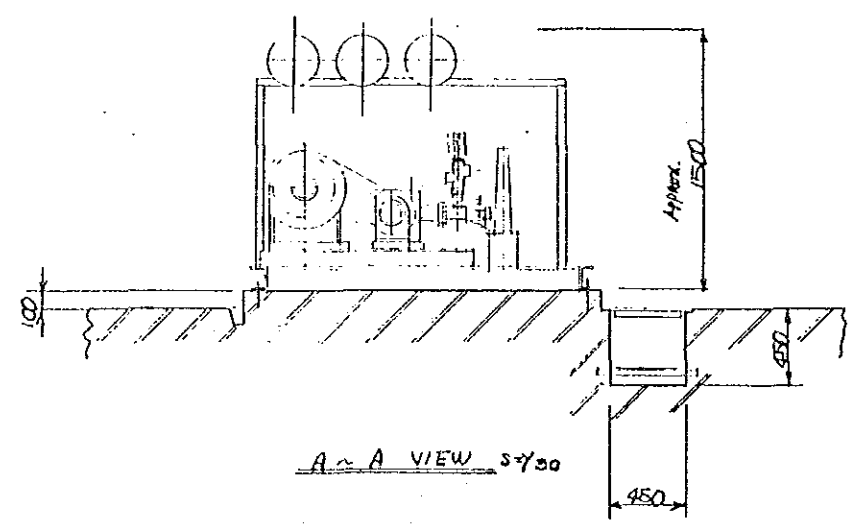
SECTION B-B s-750



SECTION C-C s-750



SECTION - D-D s-750



A-A VIEW s-750

EQUIPMENT MOUNT ON SKID (S.W RO) SECTION - 200			EQUIPMENT MOUNT ON SKID (H.F RO) SECTION - 300		
ITEM	EQUIP'T NAME	REMARK	ITEM	EQUIP'T NAME	REMARK
RO-201	RO MODULE	3 VESSELS	RO-301	RO MODULE	2 VESSELS
F-201 A,B	SAFETY FILTER	2 FILTERS	F-301 A,B	SAFETY FILTER	2 VESSELS
HE-201	FEED PRE-HEATER		HE-301	FEED PRE-HEATER	
HE-202	FEED HEATER		HE-302	FEED HEATER	
UV-201	UV STERILIZER		UV-301	UV STERILIZER	
P-201	FEED PUMP		P-301	FEED PUMP	
P-202	BOOSTER PUMP		P-302	BOOSTER PUMP	
P-203	HIGH PRESSURE PUMP		P-303	HIGH PRESSURE PUMP	
LOADING DATA SECTION - 200			LOADING DATA SECTION - 300		
SKID DIMENSION APPROX 3000 ^L x 2000 ^W x 1700 ^H			SKID DIMENSION APPROX 3000 ^L x 2000 ^W x 1700 ^H		
WEIGHT AT EMPTY 2.2 TONS AT OPERATION 2.5 TONS			WEIGHT AT EMPTY 2.3 TONS AT OPERATION 2.55 TONS		

PROJECT: JAPAN-SAUDI ARABIA RESEARCH PROJECT OF SEA WATER DESALINATION

TITLE: RO TEST PLANT FOUNDATION OF RO

DATE: SCALE:

DRAWING NO.: SAJ-R4009

JAPAN INTERNATIONAL COOPERATION AGENCY

