

サウディアラビア王国
海水淡水化技術協力計画(研究開発)
年次報告書
昭和59年度

昭和60年3月

国際協力事業団

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1. 議 事 録

- 1.1 昭和59年 5月 JICAミッション
- 1.2 昭和59年 8月 JICAミッション
- 1.3 昭和59年11月 JICAミッション
- 1.4 昭和60年 2月 SWCCミッション
- 1.5 昭和60年 3月 JICAミッション

2. ROテストプラント機器リストおよび関連図面

3. MSFテストプラント計器所要項目, 機器リストおよび関連図面

4. 研究機器リストおよびユーティリティ・コンサンプション・リスト

1. 事業の概要

1.1 経緯

本事業計画は、昭和57年1月リヤド市において、国際協力事業団（以下JICAという。）とサウディアラビア王国海水淡水化公団（以下SWCCという。）との間で本事業に係る討議議事録（以下R/Dという。）が正式調印され、また昭和57年3月技術調査団が訪サシ、SWCCと事業実施内容について詳細な打ち合せを行って、同年6月以降具体的実施のはこびになったものである。

1.2 目的

本事業は、両国が共同してサウディアラビア王国に海水淡水化技術研究センター(仮称)を設立し、その研究協力活動を通じて日本の海水淡水化技術をサウディアラビア王国に移転し、サウディアラビア王国の水資源の安定的な確保に貢献するとともに、両国の友好と発展に資することを目的とする。

1.3 範囲

事業内容は、昭和57年1月12日から昭和61年3月31日まで約4カ年にわたって日-サ両国が共同して、サウディアラビア王国に海水淡水化技術研究センターを建設し、海水淡水化技術に関する共同研究を行うことである。

概要は次のとおりである。

1) 海水淡水化技術研究センターの建設（事業前期2カ年）

- (1) 研究所建屋および付帯設備の建設と研究機材の設置
- (2) 多段フラッシュ蒸発法（以下MSFという。）テストプラントの設置
(20 m³/日 1基)
- (3) 逆浸透法（以下ROという。）テストプラントの設置 (20 m³/日 2基)

2) 海水淡水化共同研究の実施（事業後期2カ年）

- (1) 化学分析研究
- (2) MSFテストプラントによる腐食防止技術およびスケール制御技術等に関する研究
- (3) ROテストプラントによるROモジュールの性能試験法の研究
- (4) その他

なお、本事業の実施は現在かなり遅れているため、期間の延長を行わざるを得ない状況にある。

1.4 現 状

事業が開始された昭和57年度から現在までの実施状況を述べると次のとおりである。

1) 研究センター

研究センター建設に関しては、JICAが行う概念設計を基にSWCCが基本設計から建設まで行うことになっている。

概念設計については、昭和57年10月にSWCCに設計書を提出し、完了している。しかし、その後、計画に遅れが生じていたため、58年8月にJICAミッションは、SWCCとの間でセンター建設計画の打ち合せを行った。

この打ち合せに基づき、JICAは研究センター建設に必要なテストプラントおよび研究機材の基本資料を作成し、SWCCへ送付した。

また、59年2月には、SWCCより既存建物を研究センターとして利用したいという提案があったため、59年5月にはJICAミッションは、既存建物の調査およびSWCCとの打ち合せを行った。

この打ち合せに基づき、JICAは既存建物を研究センターの一部として利用し、新設の建物の規模を若干縮小するために概念設計の修正を行った。

59年8月には、JICAミッションはSWCCに対して修正概念設計の説明を行った。この修正概念設計内に含まれるテストプラントの基礎図に一部修正が生じたため、59年11月JICAミッションは、SWCCに対し修正部分の説明を行った。

その後、SWCCは59年12月に研究センター建設のコンサルタントを選定し、詳細設計に着手した。

60年3月には、JICAミッションは詳細設計のアドバイスを行った。

2) テストプラントおよび研究機材

テストプラントおよび研究機材はJICAが供与することとなっており、昭和57年度にこれらの調達のための仕様書を作成した。JICAは、研究センター建設が遅延しているため、調達業務を延期していたが、仕様書の一部見直しのうえ、59年8月にテストプラントの入札を、11月に研究機材の入札を実施し、発注した。

2. 研究計画の作成（国内作業）

JICAは後期2カ年に実施予定である研究活動の概略的計画を立案し，作成した。その研究項目は次のとおりである。

2.1 ROに関する研究計画

- 1) 以下に示す方法による原海水の滅菌効果の研究
 - i) 塩素滅菌
 - ii) 紫外線滅菌
 - iii) 亜硫酸水素ナトリウムによる滅菌
- 2) ジャーテストおよびテストプラントのインラインテストによる凝集剤の最適使用条件の確立
- 3) 原海水水質と透過性能の関係
- 4) 逆洗排水の処理方法
- 5) 膜基本性能
- 6) 長期運転による膜の性能変化の追跡
- 7) 膜性能低下時の薬剤添加洗浄法および性能回復剤添加による能力回復テスト
- 8) サウディアラビア王国内における実プラント規模の最適プロセスの検討
- 9) 重要試験項目の試験方法の標準化

2.2 MSFに関する研究計画

- 1) 硫酸注入法とスケール抑制剤添加・スポンジボールクリーニング法との効果比較
- 2) 総括伝熱係数変化の追跡試験および開放時のスケール採取と分析
- 3) 無酸素状態での材料試験
- 4) コレクター，テストピースおよび抜管による腐食状況の把握
- 5) 重要試験項目の試験方法の標準化

3. 現地調査団の派遣

JICAは59年5月、8月、11月および60年3月の計4回ミッションを派遣し、研究センターの建設計画、研究活動の実施計画および供与機材の保管方法についてSWCCと協議を行った。

3.1 研究センター建設計画

3.1.1 59年5月ミッション

59年2月にSWCCより既存建物を研究センターとして利用したいという申し入れがあった。それに答えて、既存建物の調査および協議を行った。

その調査結果および協議結果は次のとおりである。

1) 既存建物調査結果

既存建物はSWCCのヤンプープラントの北西約1kmのところのところに位置し、1983年初めに完成されたものである。

建物の概要は、鉄筋コンクリート造り2階建ての標準的かつ近代的な管理業務用建物である。

2) SWCCとの協議結果

既存建物は管理業務用建物であり、研究センター用建物とは、設計条件が本質的に異なっている。研究所として利用するには次の諸問題がある。

i) 床を防水処理する。

ii) 研究機材用ユーティリティの供給設備が必要である。

iii) 天井高、階高を研究機材の寸法にあわせて高くする必要がある。

iv) 内装材を不燃性材質に変更する必要がある。

v) 改造は部屋内の改造だけでなく建屋内の部屋自体、照明、配管、空調、機械等の設備についても必要である。

以上の理由により、JICAは次の提案をし、SWCCと合意をみた。

i) 既存建物は研究センターの管理棟として使用する。

ii) 研究棟およびテストエリアは当初の計画通りヤンプープラントに隣接した場所に新設する。

3.1.2 59年8月ミッション

5月のミッションにおいて合意した内容に基づき修正した研究センターの概念設計の説明、SWCCが実施する詳細設計に関する情報提供および研究センター建設予定地の調査を行った。

3.1.3 60年3月ミッション

JICAは、SWCCが選定した研究センター建設のコンサルタントと詳細設計について、技術的意見交換を行い、そしてコンサルタントが作成した設計書をチェックした。

またJICAは詳細設計の資料として、研究機材のカタログ、ユーティリティ・コンサンプション・リストおよびファニチャーの仕様書をSWCCに提出した。

このファニチャーは、R/DによるとSWCC側供給であるが、現時点においては選定されておらず、詳細設計を進める上でこの仕様書が必要なために、JICAは仕様を想定し準備した。

3.2 研究計画

59年11月 JICA は、本事業後期2カ年の研究活動の概略計画案についての SWCC と協議を行った。JICA が立案した概略研究案の項目は、本報告書の 2.1 および 2.2 に示してある。

協議の結果、JICA の計画案は一部修正のうえ SWCC の合意を得た。

合意した研究計画は次のとおりである。

3.2.1 RO に関する研究計画

- 1) 以下に示す方法による原海水の滅菌効果の研究
 - i) 塩素滅菌
 - ii) 紫外線滅菌
 - iii) 亜硫酸水素ナトリウムによる滅菌
 - iv) 硫酸銅による滅菌
- 2) ジャーテストおよびテストプラントのインラインテストによる凝集剤と凝集助剤の最適化および原海水水質と汚過性能の関係
- 3) 膜洗浄廃液の有害性、処理案についての検討
- 4) ヤンプー地区の条件下での各種膜の性能検討および高温運転時の膜の安定性テスト
- 5) 膜性能低下時の薬剤添加洗浄および性能回復剤添加による能力回復テスト
- 6) サウディアラビア王国内における実プラント規模の最適プロセスの検討
- 7) 重要試験項目の試験方法の標準化

3.2.2 MSF に関する研究計画

- 1) 硫酸注入とスケール抑制剤添加・スポンジボールクリーニング法との併用試験、総括伝熱係数変化の追跡試験および開放時のスケール採取と分析
- 2) チタン、アルミ黄銅および新材料の耐食性テスト
アルミ黄銅に関しては、無酸素状態下での 90/10 Cu-Ni との比較
- 3) コレーター、テストピースおよび抜管による材料の腐食状況の把握
- 4) 重要試験項目の試験方法の標準化

3.3 供与機材の保管

59年5月ミッション派遣の際SWCCとの間に、本事業の今後のスケジュールが合意された。それに沿ってJICAは供与機材の調達準備を進め、60年3月にサウディアラビア王国に向けて船積みを実施する計画をたてた。しかし、59年11月のJICAミッションとSWCCとの打ち合せにおいて、SWCCはヤンプープラントサイトには供与機材を保管できる倉庫がないので、60年3月の船積みを遅らせるように依頼してきた。また、60年2月のSWCCからのミッションとの打ち合せにおいても、同様の依頼があった。

そこで、JICAは60年3月に供与機材の保管用の倉庫調査と保管についてSWCCと協議を行った。

その結果、次に示す項目についてSWCCと合意した。

- i) ヤンプープラント付近で倉庫として使用可能な空調付建屋を調査した結果、管理業務用既存建物とヤンプープラントサイト内の現在使用していない旧ロッカールームが倉庫として適していた。

そこで全研究機材およびテストプラントの一部については上記いずれかの室内保管とし、テストプラントのその他の機器は室外保管とする。

- ii) 供与機材を倉庫に搬入する前の受入検査においてJICAは専門家を派遣する。

4. 供与機材の詳細仕様

58年度に供与機材の基本仕様書（一部においては詳細仕様）を作成したが、59年度には供与機材の調達にあたって、再度機材の仕様を見直し、修正した。

4.1 ROテストプラントの詳細仕様

別添2に機器リストおよび関連図面を示す。

4.2 MSFテストプラントの詳細仕様

別添3に計器所要項目、機器リストおよび関連図面を示す。

4.3 研究機材の詳細仕様

別添4に機器リストおよびユーティリティ・コンサンプション・リストを示す。

別 添

1. 議 事 録

- 1.1 昭和59年 5月 JICAミッション
- 1.2 昭和59年 8月 JICAミッション
- 1.3 昭和59年11月 JICAミッション
- 1.4 昭和60年 2月 SWCCミッション
- 1.5 昭和60年 3月 JICAミッション

2. ROテストプラント機器リストおよび関連図面

3. MSFテストプラント計器所要項目, 機器リストおよび関連図面

4. 研究機器リストおよびユーティリティ・コンサンプション・リスト

1. 議 事 録

- 1.1 昭和59年 5月 JICAミッション
- 1.2 昭和59年 8月 JICAミッション
- 1.3 昭和59年11月 JICAミッション
- 1.4 昭和60年 2月 SWCCミッション
- 1.5 昭和60年 3月 JICAミッション

1.1 昭和59年 5月 JICAミッション

Minutes of Meeting

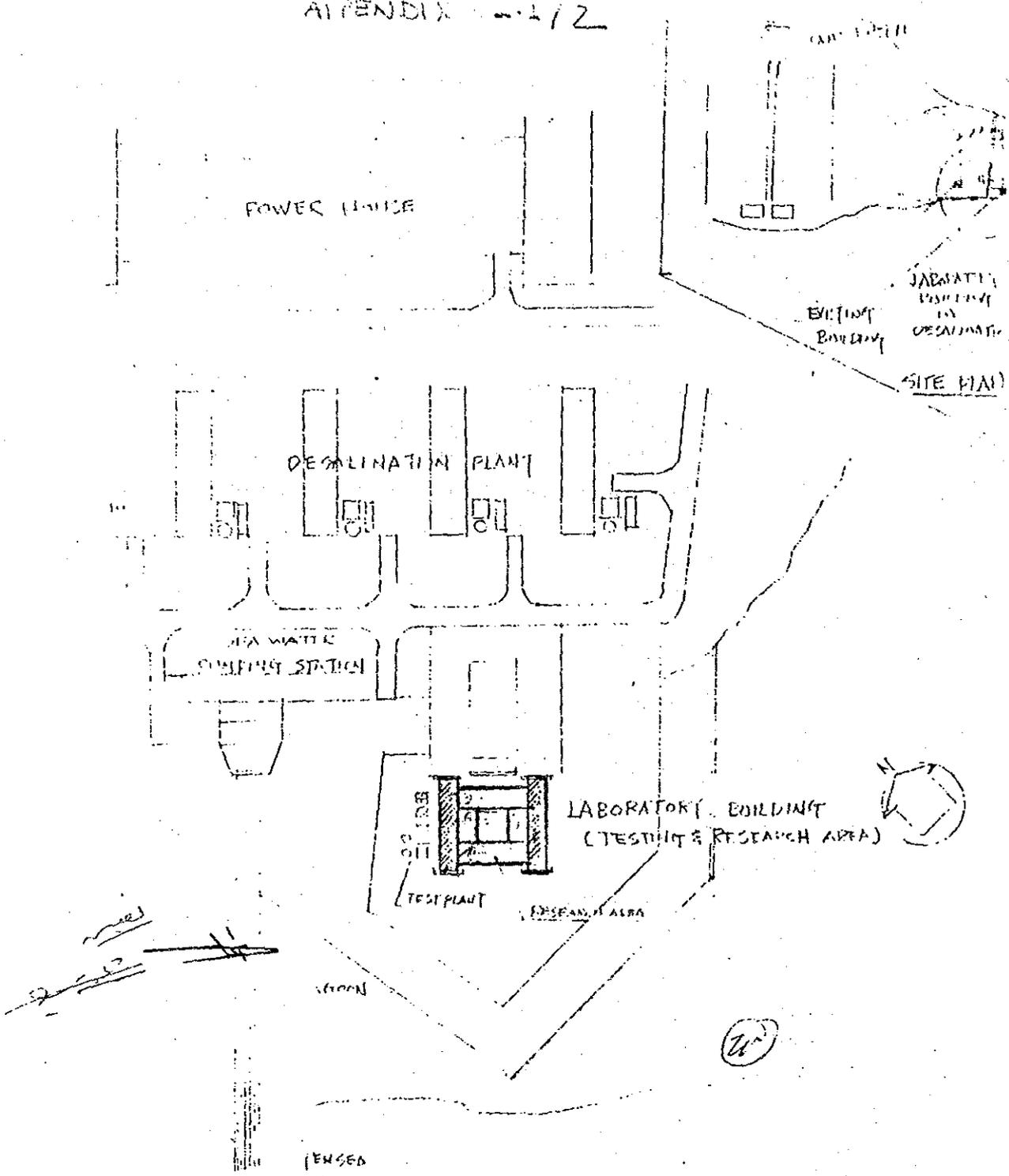
SWCC and the Japanese Team for Research agreed on the following matters on May the 21st, 1984.

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 303) 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 303 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.

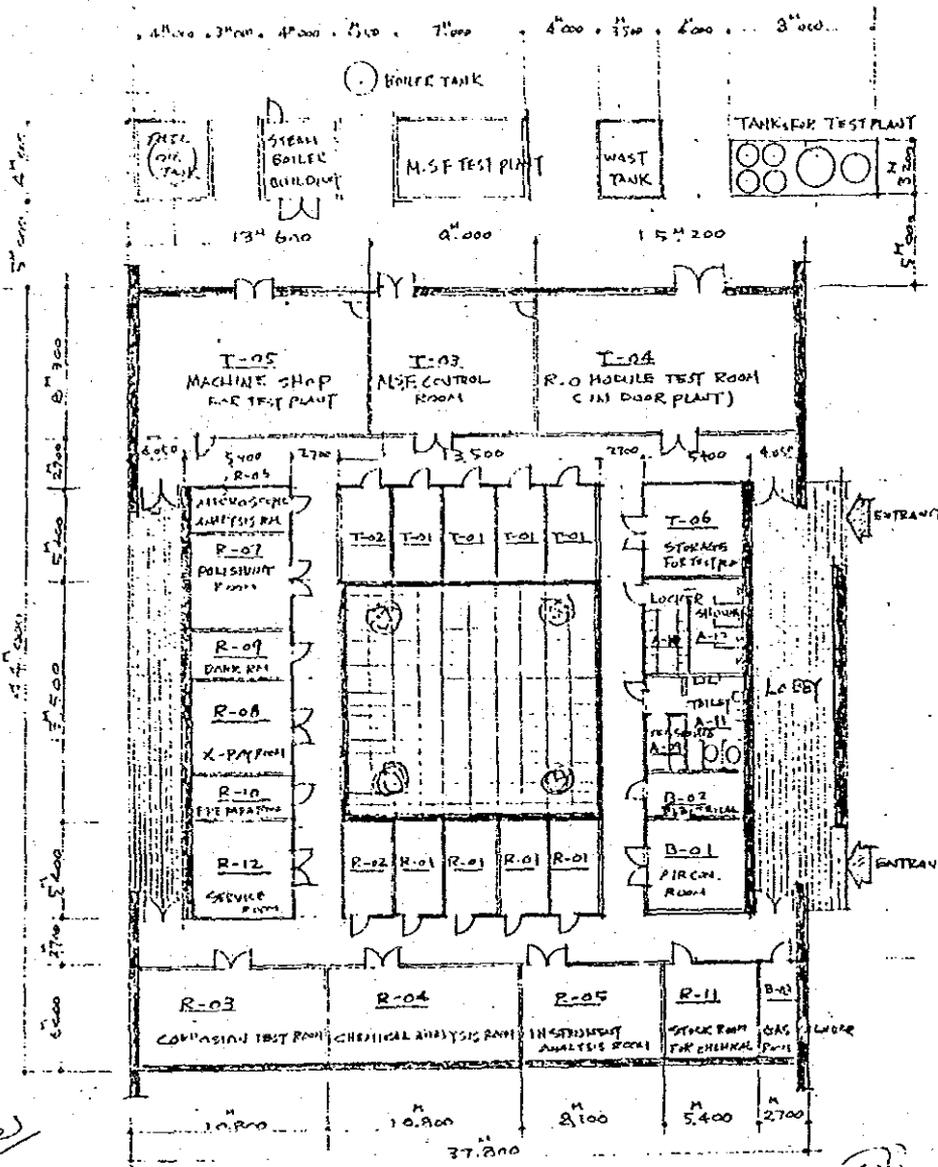
~~_____~~
n/c. 11
(Acting) Dr. Abdulaziz Al-Mujahid
Deputy Governor
for Technical Affairs and Projects
SWCC

F. Wada
Fumio Wada
Leader
Japanese Team for Research
JICA

APPENDIX - 1/2



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



LABORATORY (TEST PLANT & RESEARCH AREA) FLOOR PLAN

SCALE 1:300

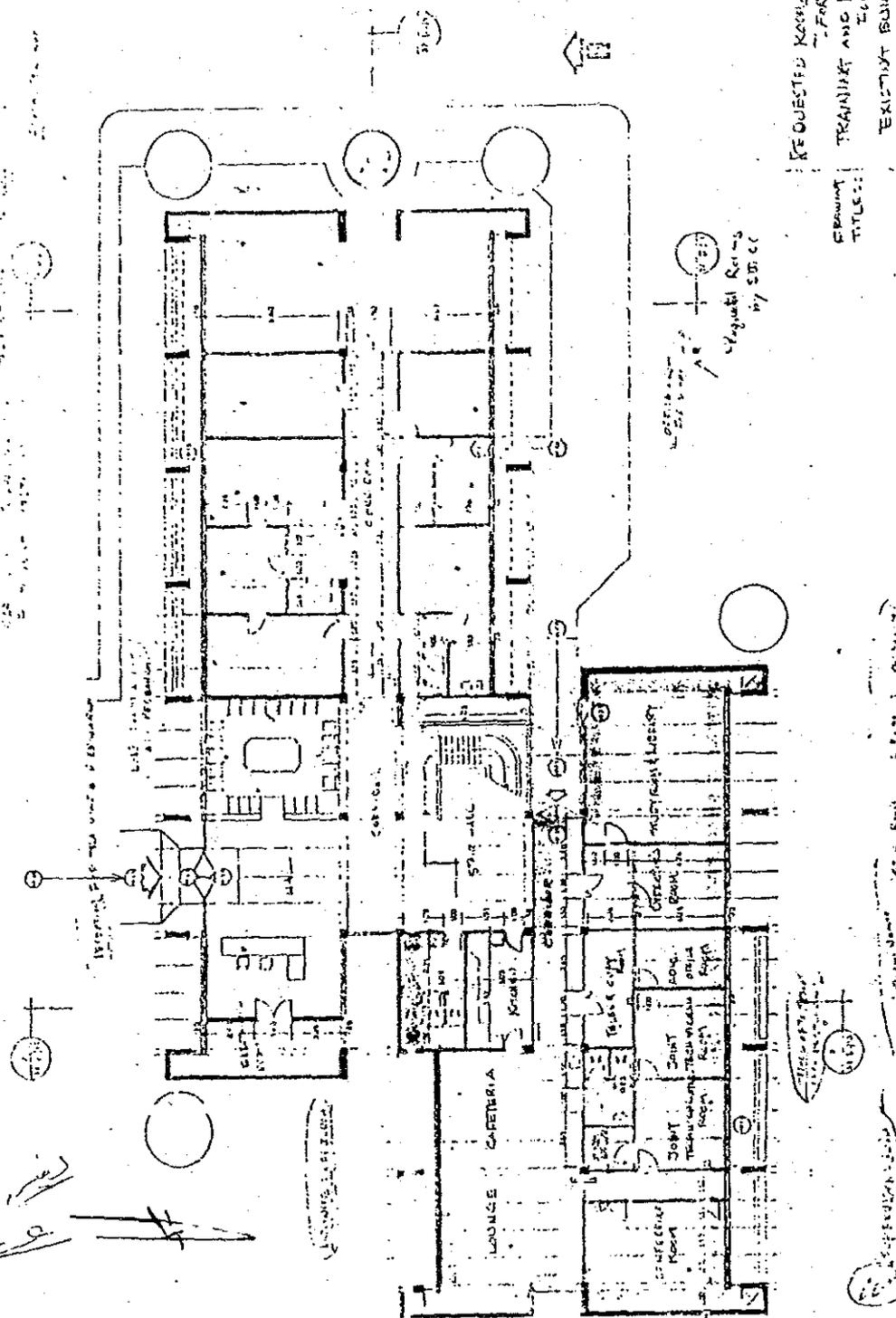
CONCEPTUAL DESIGN
FOR
LABORATORY FLOOR PLAN

NOTE The such rooms equipments layout should be referred to "CONCEPTUAL DESIGN FOR LABORATORY BUILDING OF DESALINATION RESEARCH PROJECT (DOCUMENT NO. SAJ 343-AUGUST 1982 - and the "Habit utilization of test plant's facilities" of November 1983.

DATE MAY 18th 1984

PREPARED BY JICA.

APPENDIX 2



REQUESTED NAME: B. S. U. C. C.
 FOR
 TRAINING AND RESEARCH CENTER
 EXISTING BUILDING (GROUND FLOOR)
 AND
 CONCEPTUAL FLOOR PLAN FOR RESEARCH CENTER
 BUILDING

GROUND
 TITLE:

APPENDIX 2

CONCEPTUAL FLOOR PLAN - SCALE 1:1000
 DATE: 10/10/2010
 DRAWN BY: [Name]

APPENDIX 3

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

STAGE	UNDERTAKINGS	Y													
		1984			1985			1986							
		4	6	8	10	12	2	4	6	8	10	12	2	4	6
Test Plant & 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 1/7 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	Detailed Research Planning 1/10 1/3 1/4 1984 1985 1986													
	JICA	Preparation for Research Commitment of Research 1/12 1/2													

1.2 昭和59年 8月 JICAミッション

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 x50^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 Trowell 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>Abdulrahman Al-Yousef</i>
	Construction Dept.	: Abdullah Joraid
	" "	: Mohammed Al-Oqbi
	" "	: Mohammed Al-Barrak
	Research Dept.	: Habeeb Mohammed <i>Habeeb Mohammed</i>
Japanese Team		: Toshio Harada
" "		: Toshio Kojitani <i>T. Kojitani</i>

Signed

Dr. Abdulaziz 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.

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).

T.H.

TABLE 1. DEVIATION LIST OF LABORATORY EQUIPMENTS

Item No.	Old (June 1984 \diamond 1)		New (August 1984)		Reasons
	Description	Q'ty	Description	Q'ty	
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)						
	Description	Q'ty	Electricity (KW)		Water (l/min.)	Remarks	Description	Q'ty	Electricity (KW)		Water (l/min.)	Remarks
			220V/1ϕ	380V/3ϕ					220V/1ϕ	380V/3ϕ		
-)	Corrosimeter	1 set	0.15				AC Impedance Systems	1 set	0.5			
-17	Potentiostat/ Galvanostat (1) Potentiostat/ 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) C ₂ H ₂ : 3l/min. (1kg/cm ²) Air: 15l/min. (3kg/cm ²) N ₂ O: 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		0.3	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

dit

TABLE 3. DEVIATION LIST OF FURNITURES PURCHASED BY SWCC

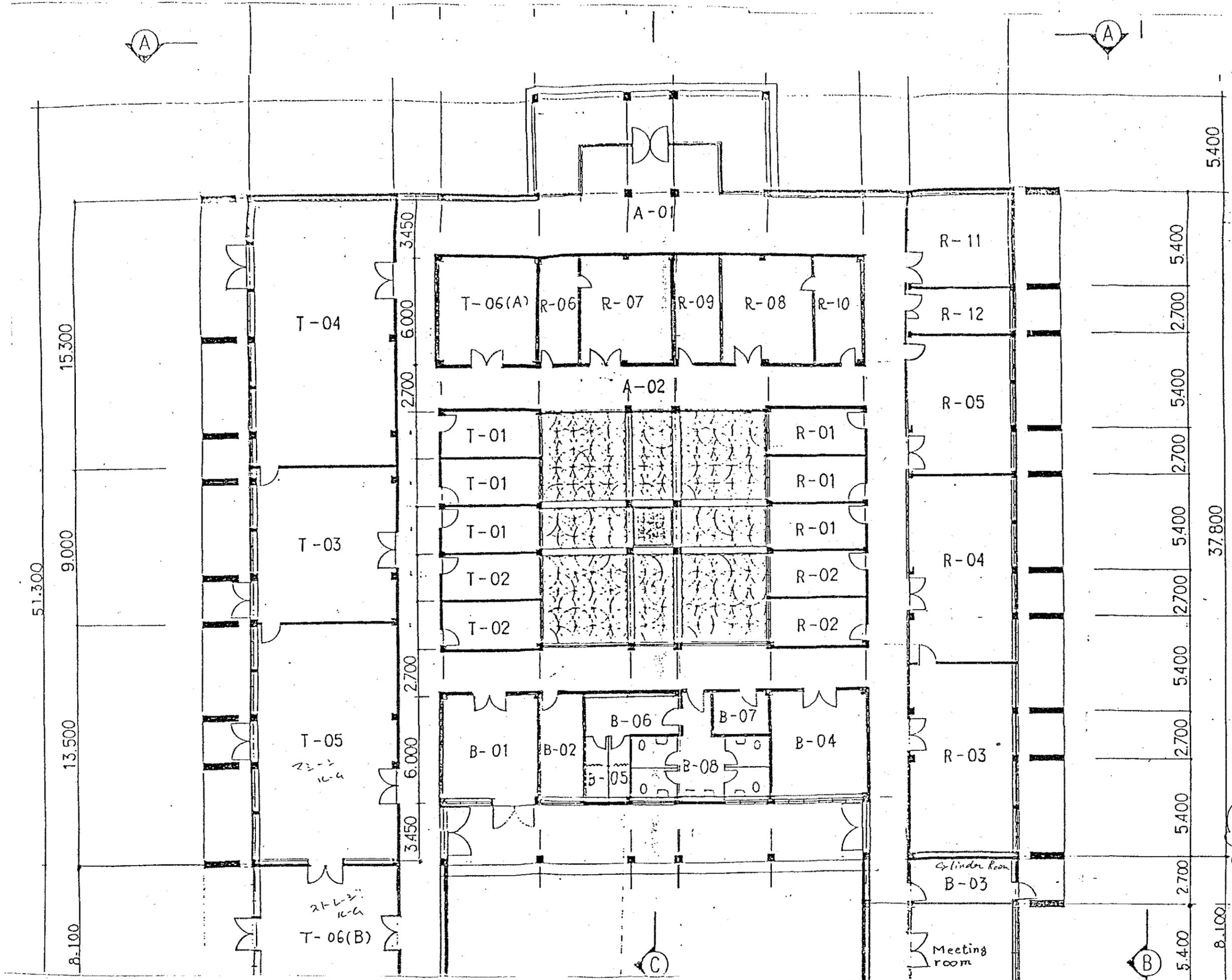
Item No.	Old (June 1984 <input type="checkbox"/>)		New (August 1984)	
	Description	Q'ty	Description	Q'ty
5-6	Side Bench with Utility Box 3,000 (L) x 750 (W) (include Small Sink)	12 sets	Side Bench with Utility Box 3,000 (L) x 750 (W) (include Small Sink)	11 sets

Handwritten initials

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)	(C)	
Item	Item	
5-6 Side bench with ----- 12 sets	5-6 Side bench with ----- 11 sets	

Handwritten initials/signature



SKETCH I
 NOTE: REV
 MADE AT SIV.
 12th AUG 19.

1.3 昭和59年11月 JICAミッション

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.

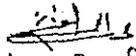
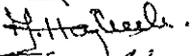
2. SWCC stated that a coordinator for the smooth implementation of the research program should be dispatched to the Kingdom of Saudi Arabia as soon as possible.

D. Request by JICA

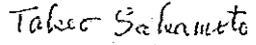
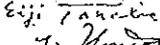
The PS Team informed SWCC that the boiler being supplied by the Japanese side can only use Fuel Oil #A (Japanese nominal name). SWCC suggested that the Japanese study the possibility of using Bunker 'C' or crude oil for the boiler as these fuels will be available on the site and not Fuel Oil #A.

List of Attendants

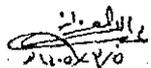
(1) SWCC

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

(2) PS Team

Mr. Junzo Horii 
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 Horii
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

ANNEX II

Our Ref. No.

Date

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.

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.

Saline Water Conversion Corporation

Our Ref. No.

Date

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 Faroj

JAPANESE SIDE

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

A.Rzk.

Riyadh - Olaiya - Makkah St. ☎ 4631780/4631763/4632070 P.O. Box 5968 Riyadh 11432 Telex 200097/200401

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

Item	1404		(Sep 27)		1405		(Sep 15)		1406		(Sep 4)		1407		(Aug 24)		1408		Remarks			
	(Apr 2)		1404/05		(Mar 22)		1405/06		(Mar 11)		1406/07		(Feb 11)		1907/08		(Feb 7)					
	Gregorian Year		1984		1985		1986		1987		1988		1989		1990		1991					
Gregorian Month	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	3
R-1																						
(1) Chlorine																						
(2) UV																						
(3) SBS																						
(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 methods																						
R-6																						
Most reasonable process																						

dashed line means
as occasion demands

66

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

Item	1404		(Sep 27)		1405		(Sep 15)		1406		(Sep 4)		1407		(Aug 24)		1408		Remarks						
	(Apr 2)		1404/05		(Mar 22)		1405/06		(Mar 11)		1406/07		(Feb 11)		1907/08		(Feb 7)								
	Gregorian Year		1984		1985		1986		1987		1988		1989		1990		1991								
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) Corrotor 2) Test Pieces 3) Tubes pulled out 4) SBS Addition																									

KINGDOM OF SAUDI ARABIA
Saline Water Conversion Corporation

No. _____

Date _____

ANNEX III

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 $FeCl_3$. 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 昭和60年 2月 SWCCミッション

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.

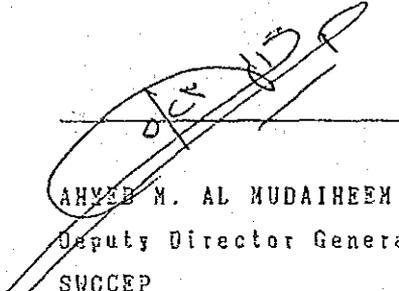
(2) SWCC side stated that any arrangements will be made available as mutually agreed in the R/D.

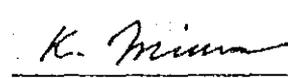
7. SWCC side stated that any question in written form may be asked by JICA through official channel and SWCC will clearly answer to these inquiries.

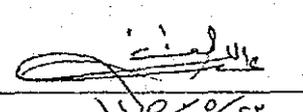
8. JICA side inquired about the schedule of construction of the research center and the time for appointment of SWCC joint technical team members. SWCC will answer officially to these inquiries as soon as possible.

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 1

MEMBER LIST OF THE MEETING

Saudi Arabian Side

AHMED M. AL MUDAIHEEM	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

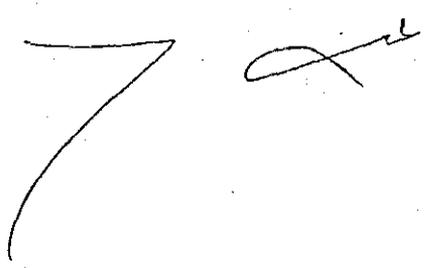
HARUO SUZUKI	Head, Natural Resources Division
MASATAKE KITAJIMA	Deputy Head, Natural Resources Div.
KATSUHIKO OZAWA	Natural Resources Div.

Social Development Cooperation Department

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

Consulting Engineers

YOSHIO MURAYAMA
TAKEO SAKAMOTO
EIJI TANABE
YOSHIHIKO KONISHI
KEIZO ORIHASHI
HASAICHI WATANABE
HINORU 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 昭和60年 3月 JICAミッション

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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12.0/7/CC

[Signature]

D
12.0/7/CC

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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.

JICA

P. 16.0/17/40

JS

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^{3rd} 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.

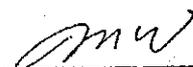
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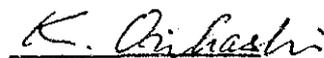
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13th of March, 1985

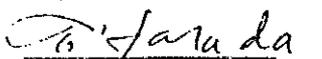
ATTENDANTS

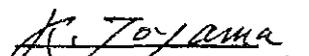
JICA

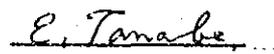

Mr. Masaichi Watanabe (T/C)

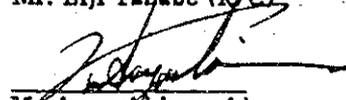

Mr. Keizo Orihashi (T/C)

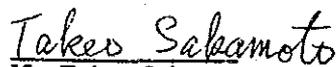

Mr. Minoru Tanaka (T/C)


Mr. Toshio Harada (R/C)

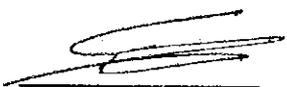

Mr. Kenji Toyama (R/C)

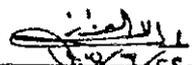

Mr. Biji Tanabe (R/C)


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

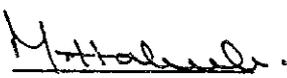
SWCC


Mr. ABDULAZIZ AL-SULGIMAN, DIRECTOR TRAINING
GENERAL,

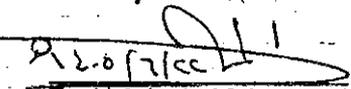

Mr. ABDULLA AL-AZAB, DIRECTOR RESEARCH
GENERAL,


Mr. MOHAMMED AL-QABI ENGINEER


Mr. MOFLIH AL-SHAGATRA SPEC TRAINING


Mr. HABEEB MOHAMMED ENGINEER


Mr. SYED HAWARI ENGINEER


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

(5)

APPENDIX - 1

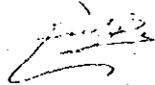
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- 10.03.1985
- 11.03.1985
- 12.03.1985
- 13.03.1985

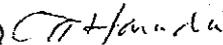
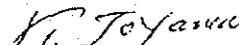
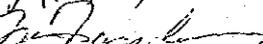
SALINE WATER CONVERSION CORPORATION
RIYADH
KINGDOM OF SAUDI ARABIA

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

127
JIC
27 4

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 Consultant 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 (Research & 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.

[Handwritten signatures and initials]

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)

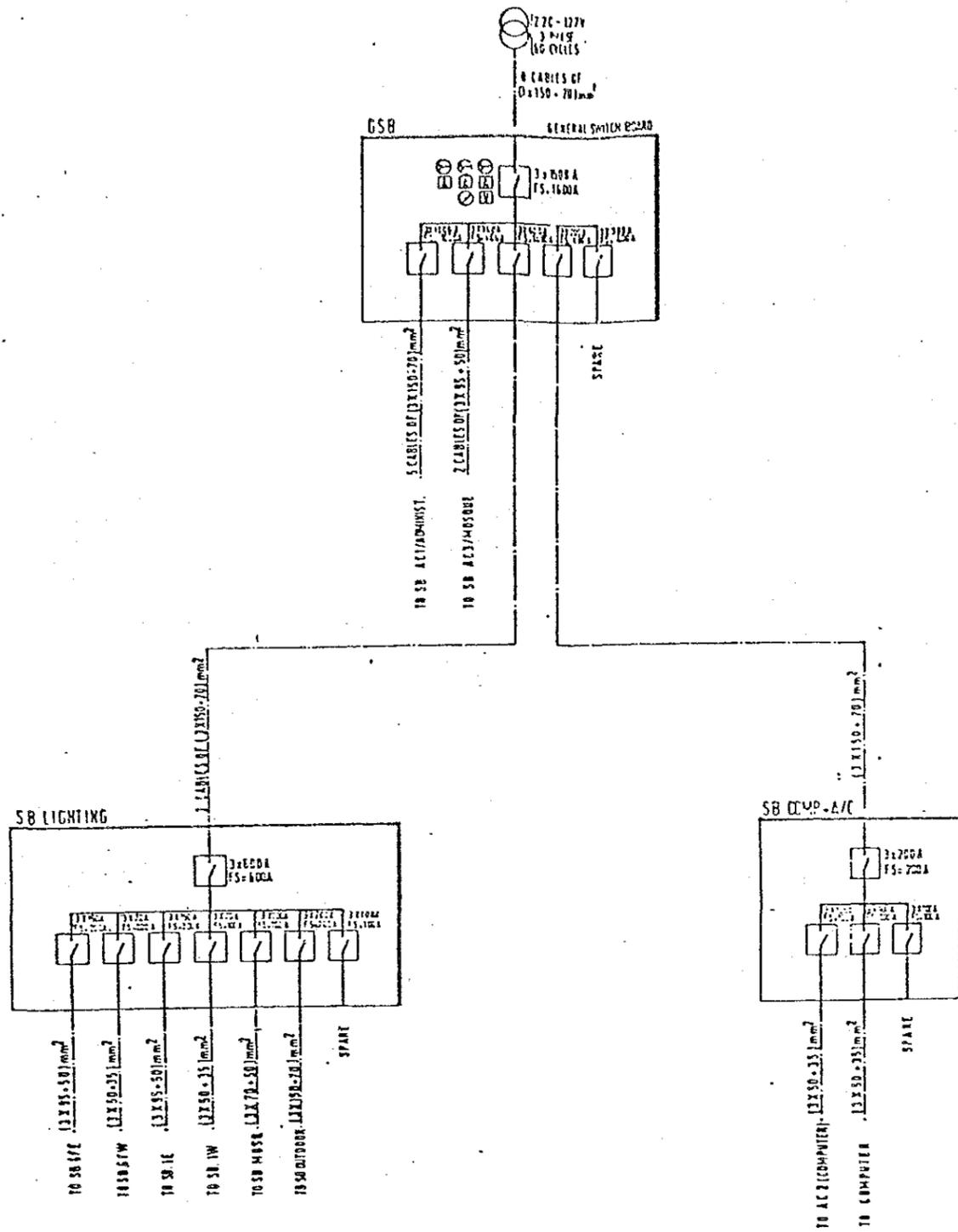
d.2 Dwg SAJ - R. 3206 - loading data (Revision 3)

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

e. Configurations of plugs and receptacles.

Cont

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Handwritten signature and initials: *AB*

KINGDOM OF SAUDI ARABIA		مملكة العربية السعودية	
YANBU & MEDINA POWER & DESALINATION PLANT		محطة توليد الكهرباء والتحلية بالمدينة والجبيل	
SOCETEC SA	ADMINISTRATION	12	12
DEPETEC	MOSQUE HOUSING COMPOUND		
	DISTRIBUTION SWITCHBOARDS SINGLE LINE DIAGRAM		
			068

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) *T. Harada*
KINJI TOYAMA (R/C) *K. Toyama*
MINORU TANAKA (T/C) *M. Tanaka*

for ABCE : Dr. SUBHI OKDEH *S. Okdeh*
Arch. DANIEL MOREL *D. 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.

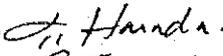
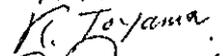
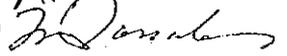
They comprise external works drawings, architectural, electrical, plumbing and H.V.A.C. drawings,

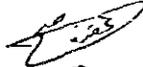
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Minutes of Meeting held at SWCC on 11.03.1985 - 20.06.1405 H.

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.

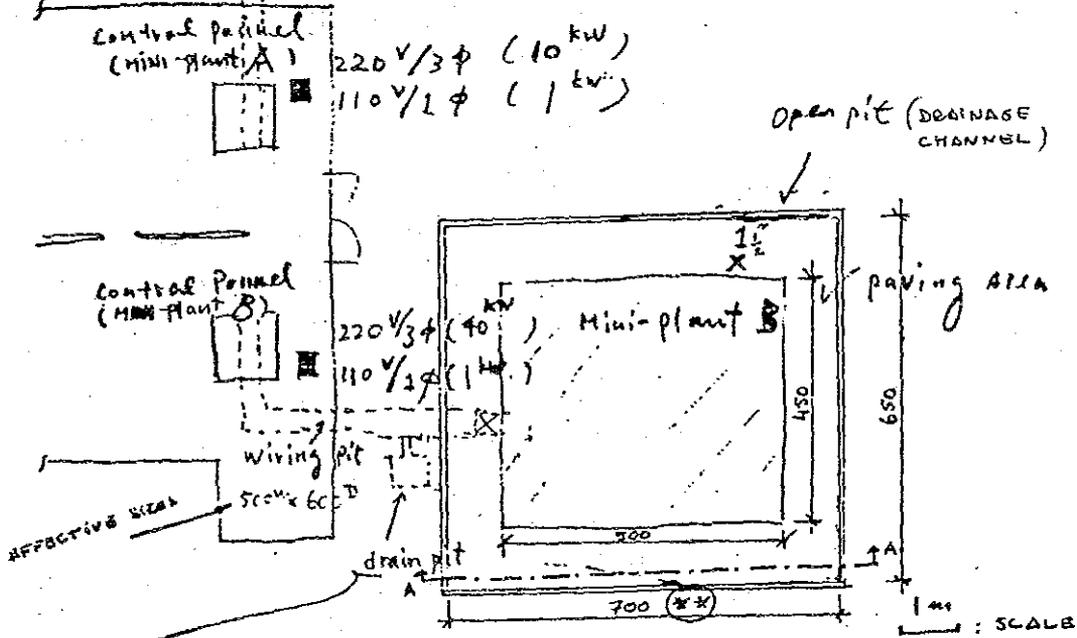
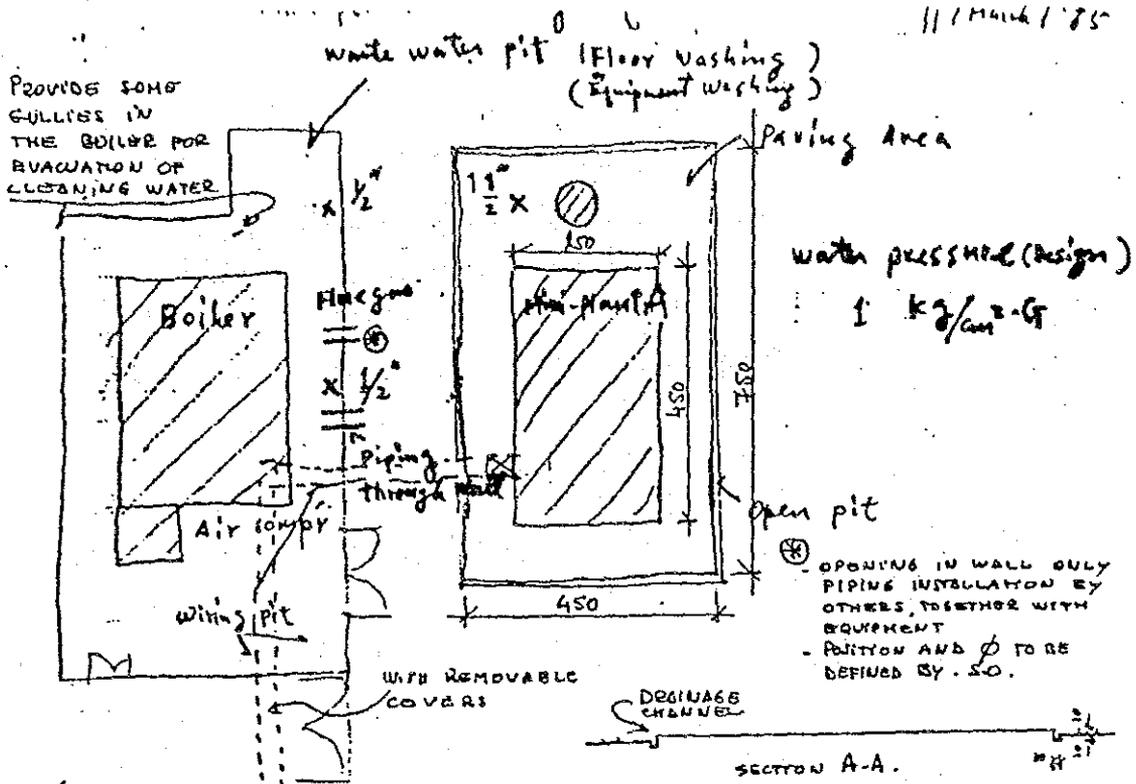
2.2.4 Cable Trenches

These trenches will have weepholes.

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

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11/11/85



X Water connection with a valve
 ⊗ Electric connection
 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.

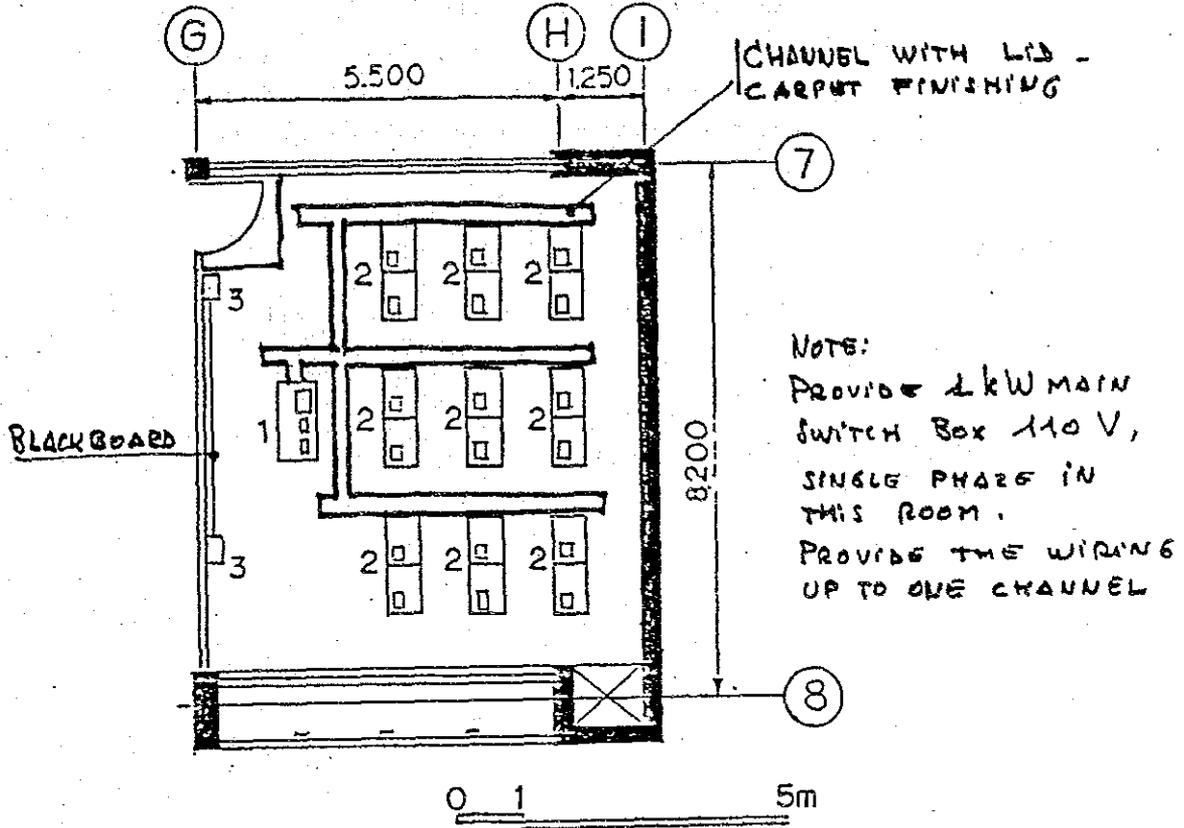
2.4.3 Layout plan of special equipment

- 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.

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SPECIFICATION	SPEC. SHEET NO.
	SAW - 8 - 050



NOTE:
 PROVIDE 2kW MAIN
 SWITCH BOX 110 V,
 SINGLE PHASE IN
 THIS ROOM.
 PROVIDE THE WIRING
 UP TO ONE CHANNEL

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 11/10/85

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.

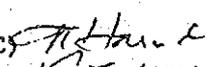
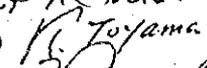
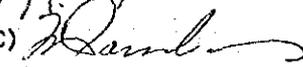
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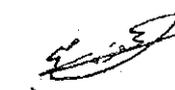
HT.
CH.

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)
KEIZO ORIHASHI (T/C)

for ABCE : Dr. SUBHI OKDEN 
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.

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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 $1\frac{1}{2}$ 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.

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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.

TRAINING CENTRE - YANBU

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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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.

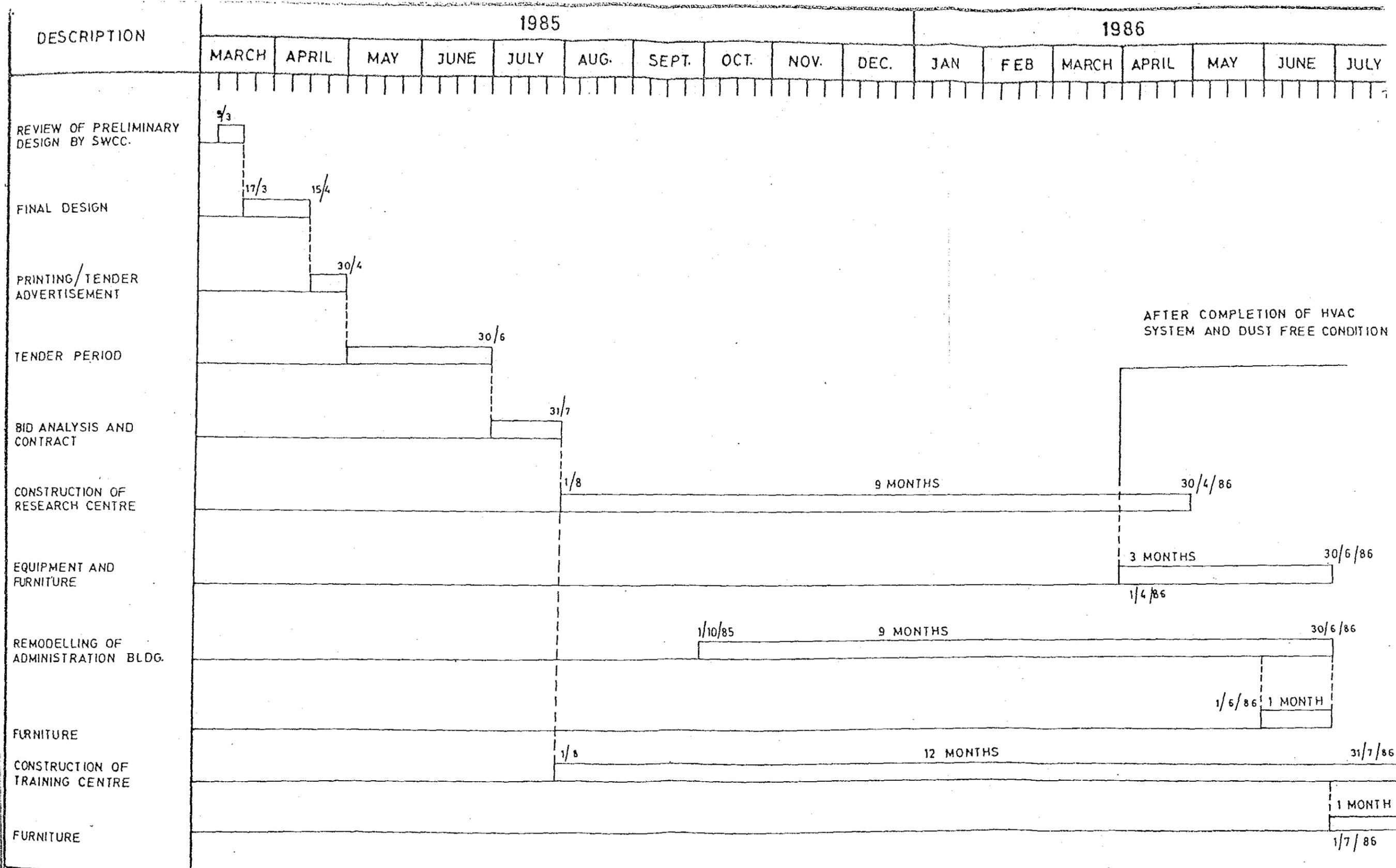
- C. Which is the peak seawater supply to be provided to the pipe and waste trench located on the same drawing?
 - D. Which is the installed capacity and all necessary characteristics for the design of the electricity supply to be laid in the cable trenches from the electrical substation room towards 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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APPENDIX - 2

- Design and Construction Schedule (12.03.1985)



AFTER COMPLETION OF HVAC SYSTEM AND DUST FREE CONDITION

[Signature]
 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 insulaters	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	

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2. The time schedule.

No

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, Carring	—			
Check of equipment, Parts	—			
Installation, Adjustment		—		

JS

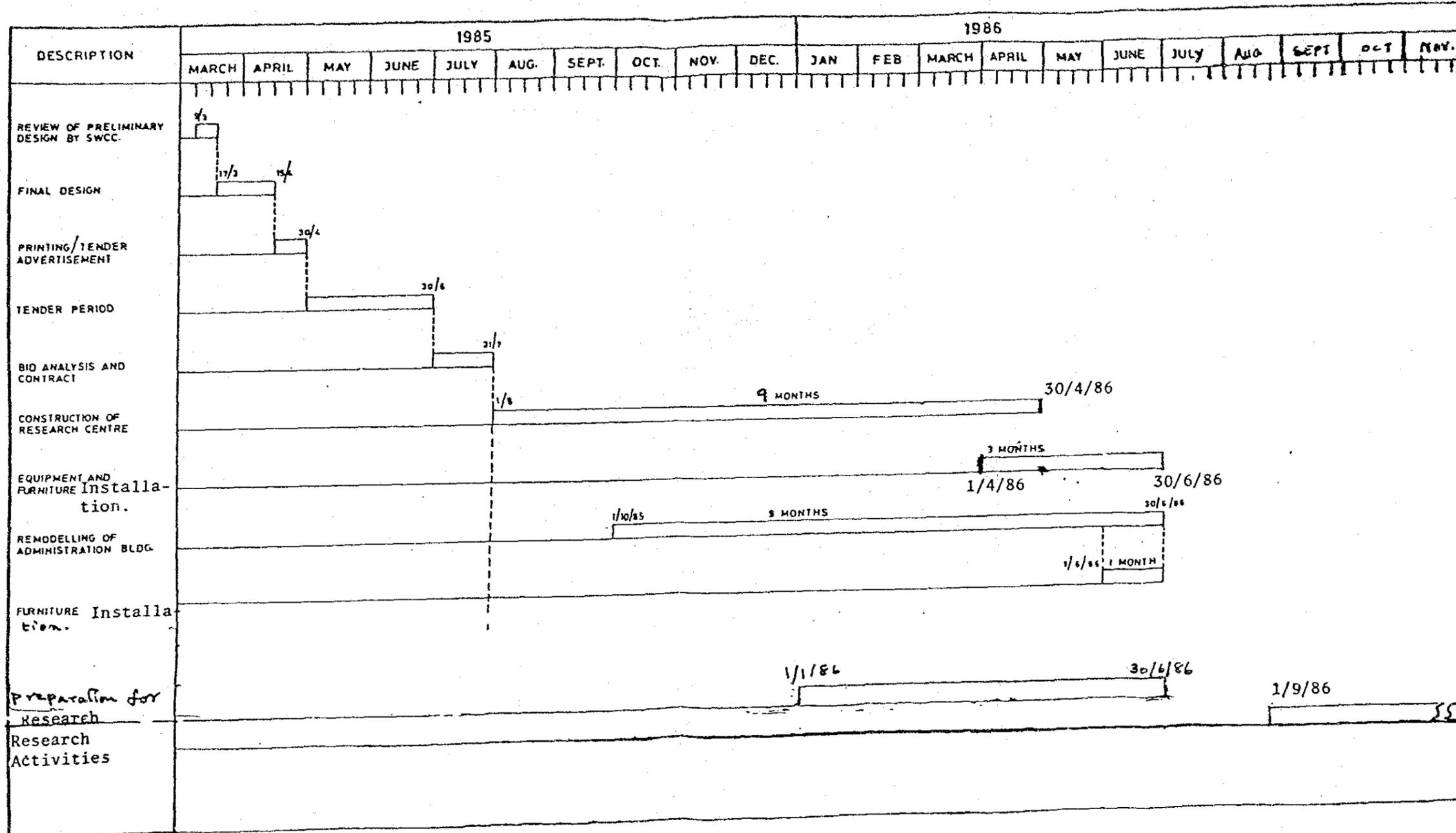
are

The heavy machines required to install the equipment.

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

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APPENDIX - 24



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2. ROテストプラント機器リストおよび関連図面

ROテストプラント機器リスト

1. 海水前処理装置 SEC-100			
機器No	名称	仕様	数量
T-101	原海水受入れ槽	円筒堅密閉型ポリエチレン製 3m ³ 付属品：液面計，オーバフロー，ドレン弁，梯子，マンホール等 基礎ボルト	1 基
T-102	ろ過海水槽	上記T-101槽と同じ 15m ³	1 基
F-101 AB	ろ過器	圧力式二層ろ過器 鋼板ゴムライニング施行 ろ材：砂利-砂-アンスラサイト 付属品：マンホール，各ノズル，配管，サイトグラス等	2 基
P-101	海水ポンプ	型式：電動機直結渦巻ポンプ 材料：ステンレススチールSCS-14(SUS-316) 電動機：屋外220V×3φ×60Hz×3.7kW E種TEFC 付属品：架台，カップリング，その他	1 台
P-102	ろ過器逆洗ポンプ	型式，材料，付属品等は上記P-101と同じ 電動機：屋外220V×3φ×60Hz×2.2kW E種TEFC	1 台
P-105	排水ポンプ	型式，材料，付属品等は上記P-101と同じ 電動機：屋外220V×3φ×60Hz×1.5kW E種TEFC	1 台
P-103	ろ過器逆洗 ブローア	型式：ルーツブローア 材料：鋳鉄 電動機：屋外220V×3φ×60Hz×1.5kW E種TEFC 付属品：架台，Vベルト/ブリー，サイレントクリーナー，安全弁，その他	1 台
UV-101	UV殺菌装置	容量：7.5m ³ /h 材料：灯ガラス以外接液部SUS-316 付属品：取付架台，制御盤（安定器その他）	1 基

機器No	名 称	仕 様	数 量
FI-101 ~103	流量計(供給海水)	逆洗水, 逆洗空気) 型 式: ローターメータ型 材 料: SUS-316またはPVC	3 基
PI-101 ~106	圧 力 計	圧力計: ブルドンチューブ型 材 料: SUS-316	7 個
	配 管	配 管: PVC管, フィチング15~50A ビニールホース	1 式
	弁	弁 : JIS-10K-PVCフランジ型ボール ゲート, 玉形 JIS-10K-FC/ゴムライニングフ ランジ型シリンダー 操作バタフライ自動弁(汙過器A号機) サンプル弁(ラボバルブPVC)	
	ゲージ盤	圧力計: 銘板取付, SS41塗装またはSUS製	1 個
	装置スキッド	型鋼溶接型 2800(L)×2600(W) 付属品: 吊金具, 基礎ボルトその他	1 基
P-401	エヤコンプレッサー	型 式: オイルレスベピコン 運転圧力: 7 kg/cm ² 自動圧力調節 電動機: 屋外 220V×3φ×60Hz×4P×3.7kW E種TEFC 付属品: 架台, Vベルト/ブリー, エヤタンク, 安全弁, その他	1 台
2. FOULING INDEX自動測定装置			
機器No	名 称	仕 様	数 量
FIR- 101	FI自動測定装置	型 式: 自動FI測定式 測定部: 自動汙過測定装置 操作部: デジタルプリンターを含みシーケンス 制御装置 電 源: 110V×1φ×60Hz×0.5kW	1 台

3. 薬液注入装置 SEC-500

機器No	名 称	仕 様	数 量
T-501	次亜塩素酸ソーダ槽	型 式：角型200ℓ 材料PVC 付属品：液面計その他	1 基
T-502	塩化第二鉄槽	上記T-501と同じ	1 基
T-503	硫 酸 槽	上記T-501と同じ	1 基
T-504	重亜硫酸ソーダ槽	上記T-501と同じ	1 基
P-501 AB	次亜塩素酸ソーダ 注入ポンプ	型 式：定量注入ダイヤフラムポンプ 付属品：ポンプ取付架台，ポンプカバー等 電動機：220V×3φ×60Hz×0.03kW 熱帯処理加工	2 台
P-502	塩化鉄注入ポンプ	上記P-501と同じ	1 台
P-503 AB	硫酸注入ポンプ	上記P-501と同じ 注：P-503BはPHIA-301により ON-OFF制御	2 台
P-504 ABC	重亜硫酸ソーダ注 入ポンプ	上記P-501と同じ 注：1) P-504CはORPA-201等の 異常時自動起動，タイマープログラム 注入の上装置自動停止 2) P-504ABは通常SBS40mg/ ℓ注入，P-504Cは500mg/ ℓとする。	3 台
	注入配管，弁	ポンプ吸入弁（ストレーナー付きチャッキ弁） 薬液注入サイホン防止チャッキ弁（吐出） プレート，PVCホース，ホースバード	8 個 8 個 1 式
	攪 拌 棒	材 料：PVC製，薬液槽攪拌用	4 台
	銘 板	各槽，各ポンプ用アクリル板	1 式
	スキッド	形鋼溶接型 2780(L)×1150(W) 付属品：吊金具，基礎ボルト等 注：槽×5（内1は予備槽とする），ポンプ× 8台は同スキッドに取付組立てのこと	1 基

4. スパイラル型逆浸透装置 SEC-200			
機器No	名 称	仕 様	数 量
T-201	給 水 槽	型 式：円筒堅密閉型ポリエチレン製 1.5m ³ 付属品：液面計，ノズル，オーバフロー，ドレン弁，マンホール，梯子，ボールタップ等基礎ボルト	1 基
T-202	脱 塩 水 槽	型 式：円筒堅密閉型ポリエチレン製 1m ³ 付属品：液面計，ノズル，オーバフロー，ドレン弁，基礎ボルト等	1 基
P-201	給 水 ポ ン プ	型 式：電動機直結渦巻ポンプ 材 料：SCS-14 電動機：屋外 220V×3φ×60Hz×1.5kW E種TEFC 付属品：架台，カップリング，その他	1 台
P-202	ブ ー ス タ ー ポ ン プ	型 式：電動機直結渦巻ポンプ 材 料：SCS-14 電動機：220V×3φ×60Hz×3.7kW	1 台
P-203	高 圧 ポ ン プ	型 式：流量可変20~100% 三連プランジャーポンプ 材 料：SCS-14/SUS-316 プランジャー：セラミックコーティング 電動機：220V×3φ×60Hz×300~1375rpm ×15kW可変速モーター(VS) E種TEFC 付属品：架台，駆動装置屋外逃し弁，アキュームレーター，その他	1 台
HE-201	給 水 予 熱 器	型 式：プレート型 伝熱容量45,000Kcal/h 設計圧力：5kg/cm ² 材 料：伝熱板 チタニウム同等	1 基
HE-202	給 水 加 熱 器	型 式：プレート型 容 量：8kg/cm ² 飽和蒸気を適宜に減圧の上 供給，供給量は最大90kg/h，給水	1 基

機器No.	名 称	仕 様	数 量
UV-201	U V 殺 菌 装 置	<p>温度は最高50℃まで自動温度制御のこと。</p> <p>材 料：伝熱板 チタニウム同等</p> <p>設計圧力：5 kg/cm²</p> <p>容 量：3.5 m³/h</p> <p>灯以外接液部 SUS-316</p> <p>設計圧力：5 kg/cm²</p> <p>付属品：取付台，制御盤（安定器その他）</p>	1 基
F-201 AB	保安フィルター	<p>型 式：カートリッジフィルター型</p> <p>容 量：3.5 m³/h×20μm</p> <p>材 料：フィルター ポリプロピレン</p> <p>ハウジング ポリカーボネイト</p> <p>設計圧力：5 kg/cm²</p>	2 基
RO-201 ABC	RO モジュール	<p>ROエレメント：スパイラル型 8 B×6本</p> <p>ROベッセル：FRP製エレメント2本入×3組</p> <p>最高使用圧力，温度 70 kg/cm²×50℃</p> <p>付属品：ROエレメント/ベッセル部品等</p>	1 式
FI-201 202	流量計（脱塩水， ライン用）	<p>型 式：ロータメーター パネル取付型</p> <p>材 料：テーパー管以外，SUS-316またはPVC</p>	2 個
PI-201 ~206	圧 力 計	<p>型 式：ブルドンチューブ型 パネル取付D型</p> <p>材 料：SUS-316</p> <p>注：PI-204，205は耐振型</p>	6 個
TI-201 ~204	温 度 計	棒状0~100℃ 保護管SUS-316	4 個
PSA-201	圧 力 ス イ ッ チ	ベローズまたはブルドンチューブ型 SUS-316	1 個
	ゲ ー ジ 盤	鋼板はステンレス製，圧力計，流量計 圧力スイッチ，銘板等を取り付ける。	1 式
	配 管 ， 弁	高圧 SUS-316TP，高圧ゴムホース ビクトリックジョイント，フランジ，その他	1 式

機器No	名 称	仕 様	数 量
	ス キ ッ ド	弁はSUS-316, 600Lbバルブ 低圧 PVC, ゴム/プラスチックホース JIS10Kフランジ継手 JIS10KPVCボール, ゲート, 玉形弁, サンプル弁 SUS-316またはPVC製 自動調節弁(ダイヤフラム空気作動ポジ ショナー付き), ドレントラップ, その他 形鋼溶接型 3,000(L)×2,000(W) 付属品: 吊り金具, 基礎ボルト等 注: TC-201, TR-201, TA-201, ORPA-201, CR-201, LSA-201 等の計器は別途電気計装の項に記す。	1 基
	特 殊 部 品	他メーカー(外国)のスパイラルモジュール取 付金具 ベッセル取付金具その他 注: 外国メーカースパイラル型ROエレメント にはUOP・FLUID SYSTEM製TFC -1501PAエレメントを対象とする。	1 式
5. 中空糸型逆浸透装置 SEC-300			
T-301	給 水 槽	型 式: 円筒縦密閉型 ポリエチレン製 容 量: 1.5m ³ 付属品: 液面計, ノズル, オーバフロー, ドレ ン弁, マンホール, 梯子, ボールタッ プ等, 基礎ボルト	1 基
T-302	脱 塩 水 槽	上記T-301と同じ(ただしボールタップ不用)	1 基
P-301	給 水 ポ ン プ	型 式: 電動機直結渦巻ポンプ 材 料: 屋外220V×3φ×60Hz×3.7kW E種TEFC 付属品: 架台, カップリングその他	1 台
P-302	ブ ー ス タ ー ポ ン プ	型 式: 電動機直結渦巻ポンプ 材 料: SCS-14	1 台

機器No	名 称	仕 様	数 量
P-303	高 圧 ポ ン プ	<p>電動機：220V×3φ×60Hz×3.7kW 付属品：架台，カップリング，その他 型 式：流量可変20～100% 三連プランジャーポンプ 材 料：SCS-14/SUS-316 プランジャー：セラミックコーティング</p> <p>電動機：220V×3φ×60Hz×300～1375rpm ×15kW可変速モーター E種TEFC 付属品：架台，駆動装置屋外逃し弁 アキュムレーター，その他</p>	1 台
HE-301	給 水 加 熱 器	<p>型 式：プレート型，伝熱容量45,000Kcal/h 設計圧力：5kg/cm² 材 料：伝熱板 チタニウム同等</p>	1 基
HE-302	給 水 加 熱 器	<p>型 式：プレート型 容 量：8kg/cm²飽和蒸気を適宜に減圧の上 供給，供給量は最大90kg/h給水温 度は最高50℃まで自動温度制御のこ と。 材 料：伝熱板 チタニウム同等 設計圧力：5kg/cm²</p>	1 基
UV-301	U V 殺 菌 装 置	<p>容 量：3.5m³/h 灯以外接液部 SUS-316 設計圧力：5kg/cm² 付属品：取付台，制御盤（安定器その他）</p>	1 基
F-301 AB	保 安 フ ィ ル タ ー	<p>型 式：カートリッジフィルター型 容 量：3.5m³/h×10μm 材 料：フィルター ポリプロピレン ハウジング ポリカーボネイト 設計圧力：5kg/cm²</p>	2 基

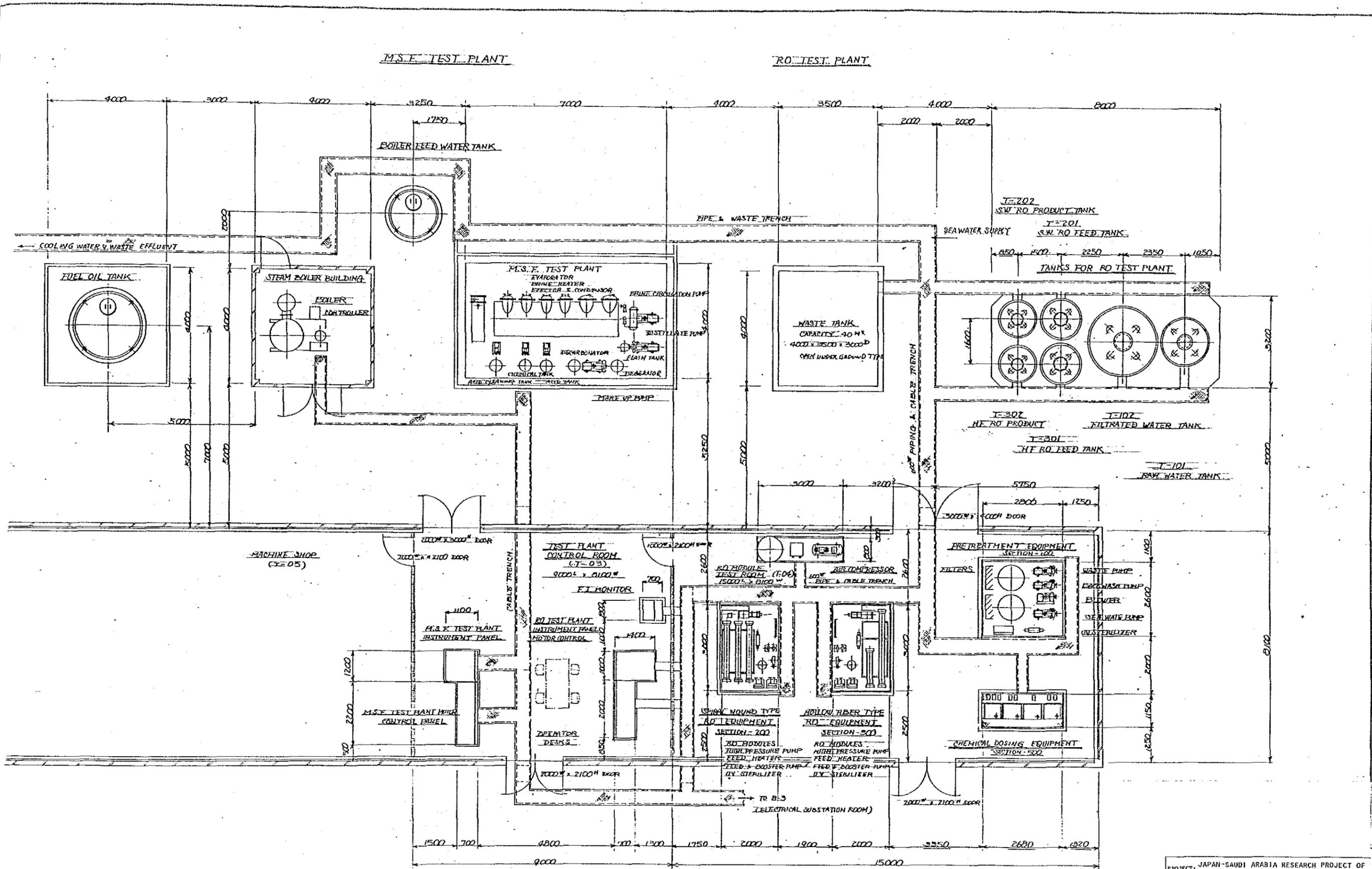
機器No.	名 称	仕 様	数 量
RO-301 AB	ROモジュール	中空糸型モジュール 2エレメント入×1モジュール 1エレメント入×1モジュール 最高使用圧力、温度 65 kg/cm ² ×50℃	1 式
FI-301 -302	流量計(脱塩水, ブライン用)	型 式:ローターメーター, パネル取付型 材 料:テーパー管以外SUS-316または PVC	2 基
PI-301 ~306	圧 力 計	型 式:ブルドンチューブ型パネル取付D型 材 料:SUS-316 注:PI-303~305は耐振型	6 個
TI-301 -304	温 度 計	棒状0~100℃ 保護管SUS-316	2 個
PSA- 301	圧カスイッチ	ベローズ, 又はブルドンチューブ型 SUS-316 圧 力:0~3 kg/cm ²	2 個
	ゲージ盤	鋼板またはステンレス製, 圧力計, 流量計, 圧 カスイッチ, 銘板等を取り付ける。	1 式
	配管, 弁	高圧 SUS-316TP, 高圧ゴムホース, ビク トリックジョイント, フランジ, その他 低圧 弁はSUS-316 600Lbバルブ PVC, ゴム/プラスチックホース JIS10K-フランジ継手 10K-PVCボール, ゲート, 玉形弁 サンプル弁 SUS-316及びPVC弁 自動調節弁(ダイヤフラム空気作動 ポジショナー付き), ドレントラップ, その他	1 式
	スキッド	形鋼溶接型 3,000(L)×2,000(W) 付属品:吊金具, 基礎ボルト等 注:TC-301, TR-301, TA-301, PHRA- 301, CR-301, LSA-301等の計器は別 途電気計装部品として手配する。	1 基

機器No.	名 称	仕 様	数 量
	特 殊 部 品	他メーカー（外国）のHF型モジュール取付金具 ベッセル取付金具その他 注：外国メーカーHF型ROモジュールは DuPont Permasep B-10 6840-060 型 ×1モジュールとする。	1 式
6. 逆浸透膜モジュール洗浄装置 SEC-600			
T-601	洗 浄 槽	型 式：可搬式円筒堅密閉型 500ℓ容量，ポリエチレン製 付属品：液面計，ノズル，マンホール等	1 基
	洗 浄 配 管	可搬取外し式 プラスチックホース継手	1 式
7. 電気計装設備 SEC-700			
MCP- 701	動 力 操 作 盤	型 式：鋼板製屋内自立閉鎖型 寸 法：3,000(W)×2,350(H)×800(D) 盤内取付機器（制御部品） 主 MCCB，電源表示灯 分岐 MCCB，電磁開閉器 サーマルリレー，運転表示灯， VSコントローラー，VSオペレーター，VSシステム モジュール等 警報表示灯操作スイッチ（切替スイッチ，押 釦スイッチ），補助リレー，補助タイマー， 遅延リレー，警報リレー，液面リレー，フリ ッカーリレー，ブザー，制御電源スイッチ， 時間計制御用トランス220/100V 盤内照明，名板，端子板，盤内配線材料 盤取付工業計器 pH指示警報計 温度記録計 注：調節計はROスキッド上に取付け 伝導度記録計	1 面

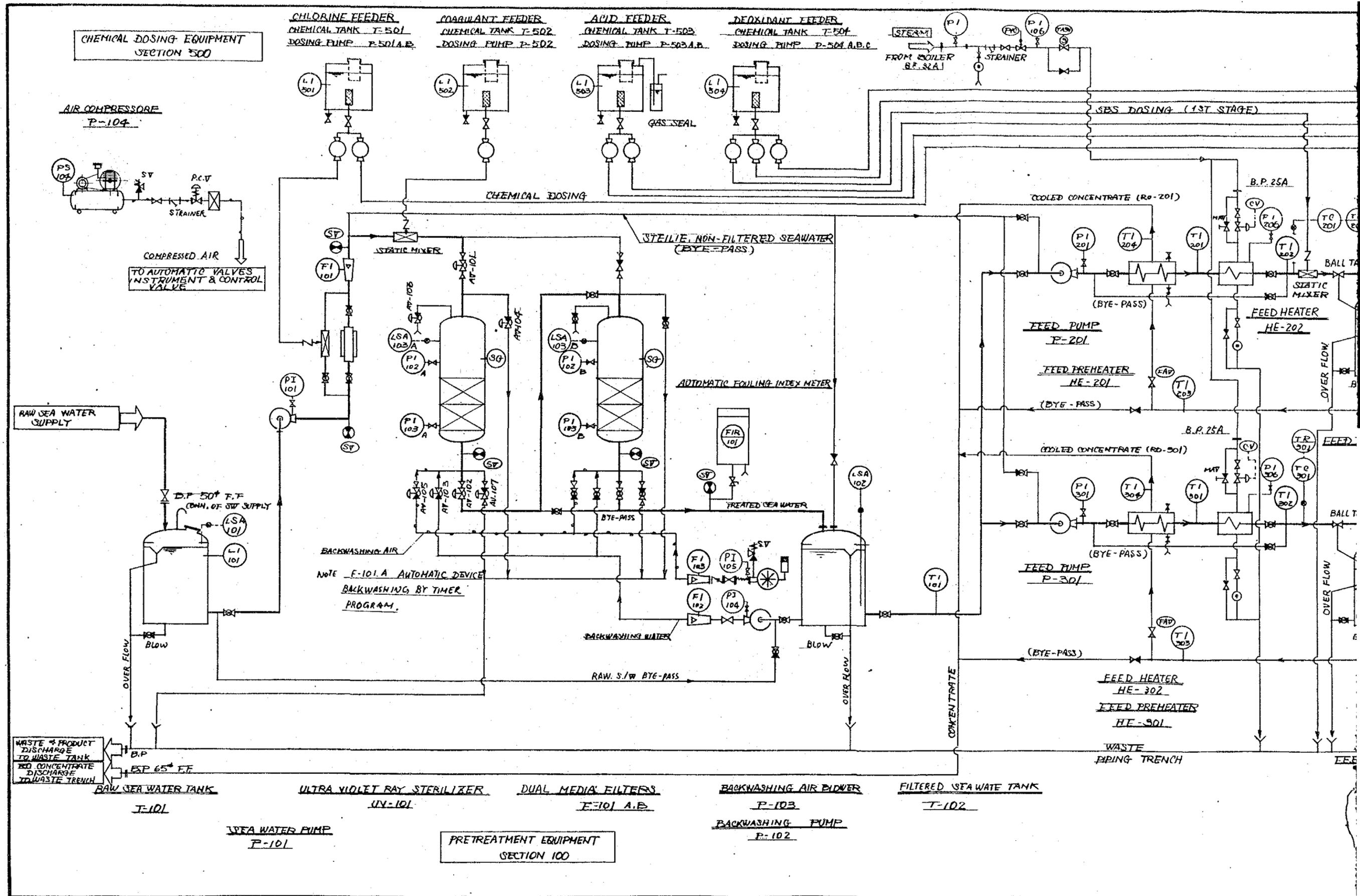
機器No	名 称	仕 様	数 量
MVP-701	電 磁 弁 盤	溶存酸素指示警報計（スパイラルROスキッドに取りつける場合あり） 型 式：鋼板製屋内自立閉鎖型 （MCP-701盤に内装） 汙過器（F-101A）の自動逆洗浄弁 操作制御盤 盤内取付機器 電 磁 弁 警報表示，弁開閉表示灯，自動／手動切替スイッチ，補助リレー，タイマーリレー，遅延リレー，その他	1 面
TR-201-301	工 業 計 器 温度記録調節計	2 ペン記録計（目盛0～100℃）	1 台
TC-201-301	温 度 調 節 計	空気式温度指示調節計（出力4～20mA DC）	2 台
		センサー	2 台
		専用ケーブル	1 式
ORPA-201	酸化還元 電位差警報計	電極式 警報計（目盛-700～700mV）	1 台
		センサー，電極保持器	1 台
		専用ケーブル	1 式
PHRA-301	pH 記 録 警 報 計	電極式 pH 記録警報計（目盛0～14 pH）	1 台
		電極保持具，電極	1 台
		専用ケーブル	1 式
CR-201-301	伝 導 度 記 録 計	2 ペン伝導記録計（目盛0～1,000 μ S/cm）	1 台
		電 極	2 台
		専用ケーブル	1 式
TSA-201-301	温 度 ス イ ッ チ		2 個
LSA-101 -102 -201 -301 -103 AB	レ ベ ル ス イ ッ チ	電極式レベルスイッチ	6 個

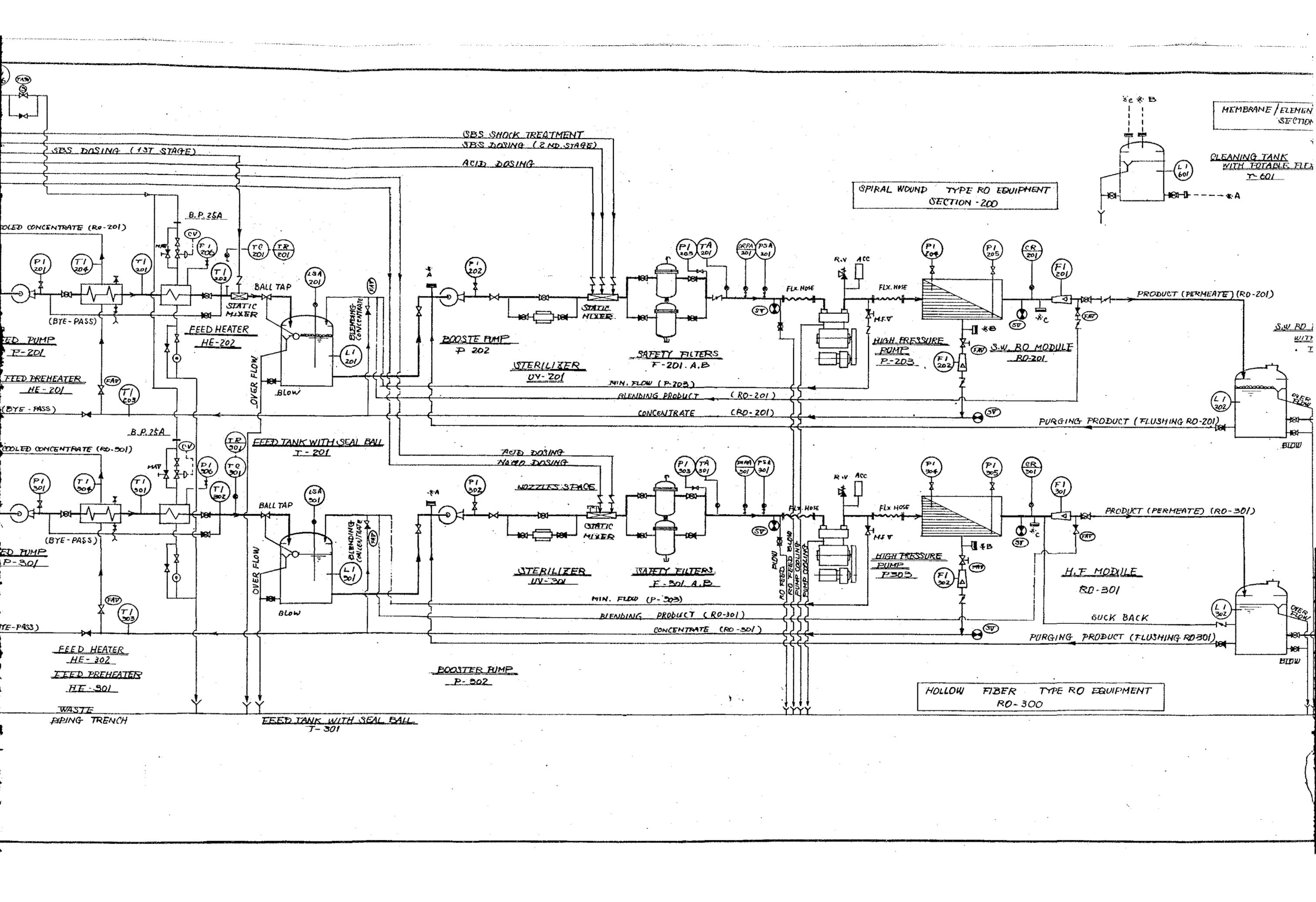
8. 配管, 配線材料			
機器No	名 称	仕 様	数 量
	本仕様書に添付する系統図, および配置図に示す範囲の配管材料, 配線材料を供給範囲とする。		
	配 管 材 料	本実験設備へ供給される海水受取り口, また, 設備より排出される排水口から設備の各装置, 槽各間の海水, 前処理汚過海水, RO給海水, 脱塩水, 濃縮海水, オーバフロー, ドレン排水, サンプル水等の配管 薬液注入等の配管材料 10~80A PVC管およびフィティング材 15~25A SUS, SGP管およびフィティング材 JIS10K PVC, SSフランジ 8A PVCフレッドホース, ビニールホース, ホースバンド等, パイプ取付Uボルト, ビニールバンド	1 式
	弁	JIS10K BC, FC, PVC玉形ボール弁, サンプル弁等	1 式
	そ の 他	ドレントラップ, ストレーナー等	1 式
	電 気 計 装 材 料	動力操作盤より各装置, 槽の電動機, 電気機器及び計器への動力, 計装	1 式
		配線材料	1 式
	動 力 ケ ー ブ ル	CVケーブル	
	制 御 ケ ー ブ ル	CVVケーブル	
	計 器 信 号 ケ ー ブ ル	CVVSケーブル, 必要に応じて専用ケーブル使用	
	電 線 管	厚鋼電線管	
	フレキシブル電線管	ビニール被覆フレキシブル電線管	
	サポ-ト材その他		
	作 動 空 気 配 管	硬質ビニールパイプおよびフィティング	1 式
	エ ア セ ッ ト		

機器No	名 称	仕 様	数 量
	塩 化 第 2 鉄	3.4% FeCl ₂ 溶液ドラム缶入	800kg
	重亜硫酸ソーダー	9.5%以上SBSビニールバック入り	2,400kg
	重合磷酸ソーダー	9.8%以上SHMPビニールバック入り	200kg
	ク エ ン 酸	9.8%クエン酸ビニールバック入り	120kg
	ア ン モ ニ ア 水	2.5%アンモニア水20ℓポリビン入り	60ℓ
	ホ ル マ リ ン	3.4%ホルムアルデヒド20ℓポリビン入り	100kg
	膜性能処理薬品		1 式



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	





MEMBRANE / ELEMENT SECTION

CLEANING TANK WITH ROTABLE FLEX T-601

SPIRAL WOUND TYPE RO EQUIPMENT SECTION - 200

HOLLOW FIBER TYPE RO EQUIPMENT RO-300

SBS SHOCK TREATMENT
SBS DOSING (2ND STAGE)
ACID DOSING

SBS DOSING (1ST STAGE)

FEED TANK WITH SEAL BALL T-201

FEED TANK WITH SEAL BALL T-301

BOOSTER PUMP P-302

BOOSTER PUMP P-202

STERILIZER UV-201

STERILIZER UV-301

SAFETY FILTERS F-201 A.B.

SAFETY FILTERS F-301 A.B.

HIGH PRESSURE PUMP P-203

HIGH PRESSURE PUMP P-303

H.F. MODULE RO-301

S.W. RO MODULE RO-201

PURGING PRODUCT (FLUSHING RO301)

PURGING PRODUCT (FLUSHING RO201)

PRODUCT (PERMEATE) (RO-201)

PRODUCT (PERMEATE) (RO-301)

MIN. FLOW (P-203)

MIN. FLOW (P-303)

BLENDING PRODUCT (RO-201)

BLENDING PRODUCT (RO-301)

CONCENTRATE (RO-201)

CONCENTRATE (RO-301)

ACID DOSING

NOZZLES SPACE

STATIC MIXER

STATIC MIXER

FEED HEATER HE-202

FEED HEATER HE-302

FEED PREHEATER HE-201

FEED PREHEATER HE-301

WASTE PIPING TRENCH

S.W. RO WITH T

OVER FLOW

BLDW

OVER FLOW

BLDW

SHOCK TREATMENT
DOSING (2ND STAGE)
DOSING

PUMP

STERILIZER
UV-201

ACID DOSING
NANO DOSING

STERILIZER
UV-301

PUMP

MEMBRANE / ELEMENT CLEANING EQUIPMENT
SECTION 600

CLEANING TANK
WITH FOLDABLE FLEXIBLE HOSES
T-601

SPIRAL WOUND TYPE RO EQUIPMENT
SECTION -200

HIGH PRESSURE
PUMP
P-203

S.W. RO MODULE
RO-201

S.W. RO PRODUCT TANK
WITH BALL SEAL
T-202

H.F. MODULE
RO-301

HOLLOW FIBER TYPE RO EQUIPMENT
RO-300

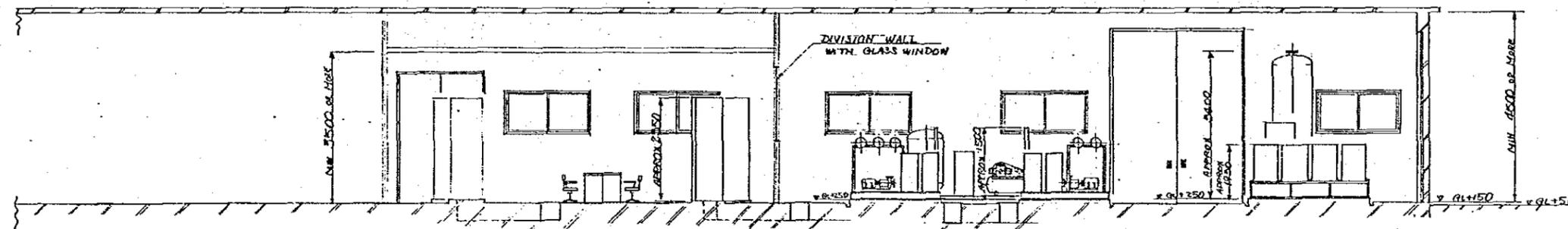
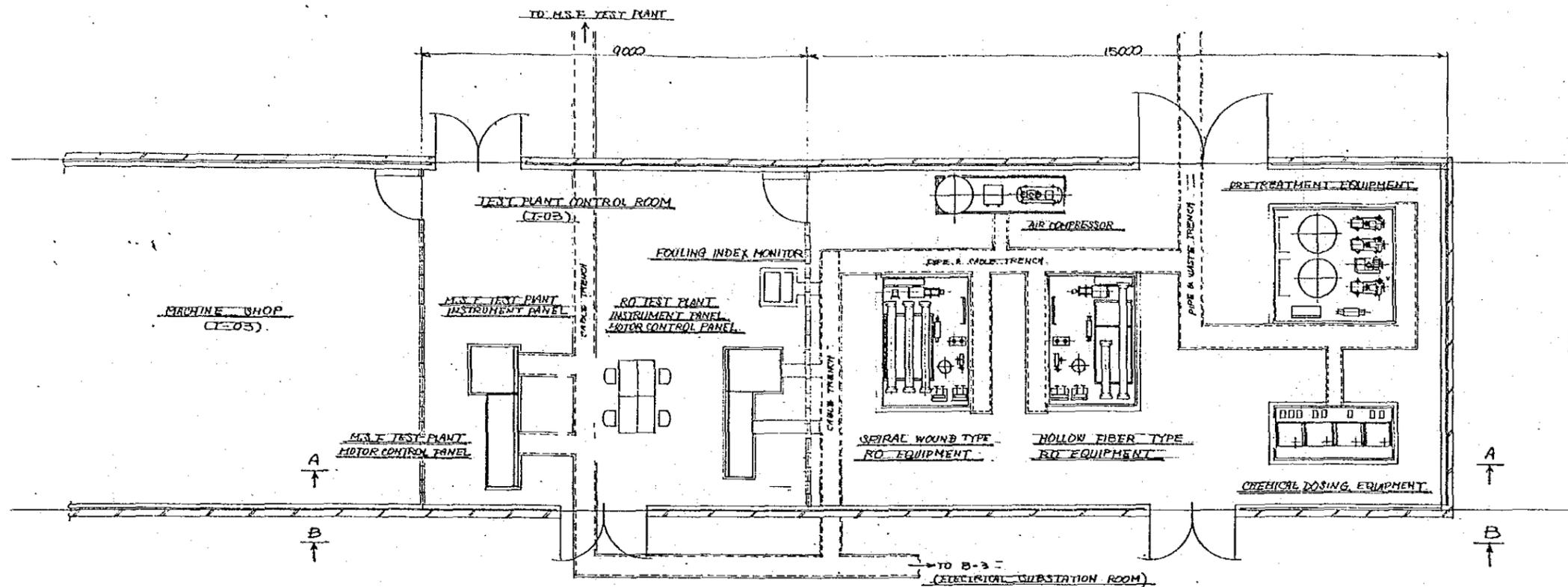
H.F. PRODUCT TANK
T-302

SYMBOL MARKS

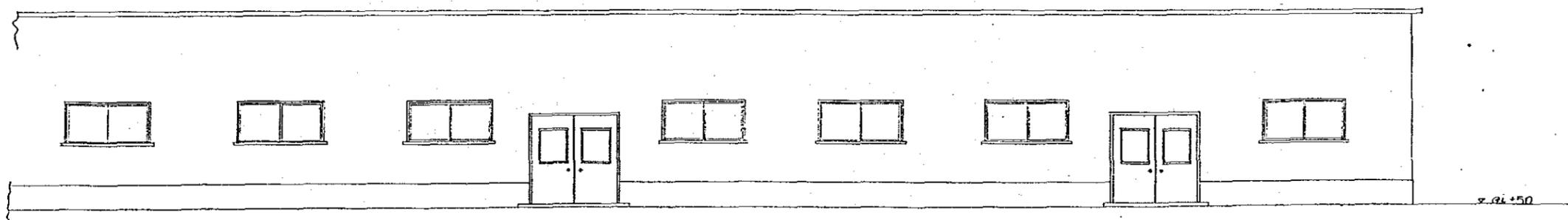
●	BALL VALVE
○	GLOBE OR GATE VALVE
⊗	NONRETURN VALVE
⊘	NEEDLE VALVE
⊕	AUTOMATIC ON/OFF VALVE
⊖	REGULATING VALVE
⊙	PRESSURE REGULATING VALVE
⊚	RELIEF OR SAFETY VALVE
⊛	SAMPLE VALVE OR COCK
⊜	AUTOMATIC SHUT DOWN VALVE
⊝	STEAM OR DRAIN TRAP
PI	PRESSURE INDICATOR
LI	LEVEL INDICATOR
FI	FLOW INDICATOR
TI	THERMOMETER
LSA	LEVEL SWITCH WITH ALARM
PSA	PRESSURE SWITCH WITH ALARM
TR	TEMPERATURE RECORDER
TC	TEMPERATURE CONTROLLER
TA	TEMPERATURE SWITCH WITH ALARM
PHRA	PH RECORDER WITH ALARM
DORA	DISSOLVED OXYGEN RECORDER WITH ALARM
OR	CONDUCTIVITY RECORDER
○	LOCAL MOUNT TYPE INSTRUMENT
⊖	PANEL MOUNT TYPE INSTRUMENT
BP-FF	BATTERY LIMIT POINT, CONNECTING SIZE

PRODUCT TO LABORATORY

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	

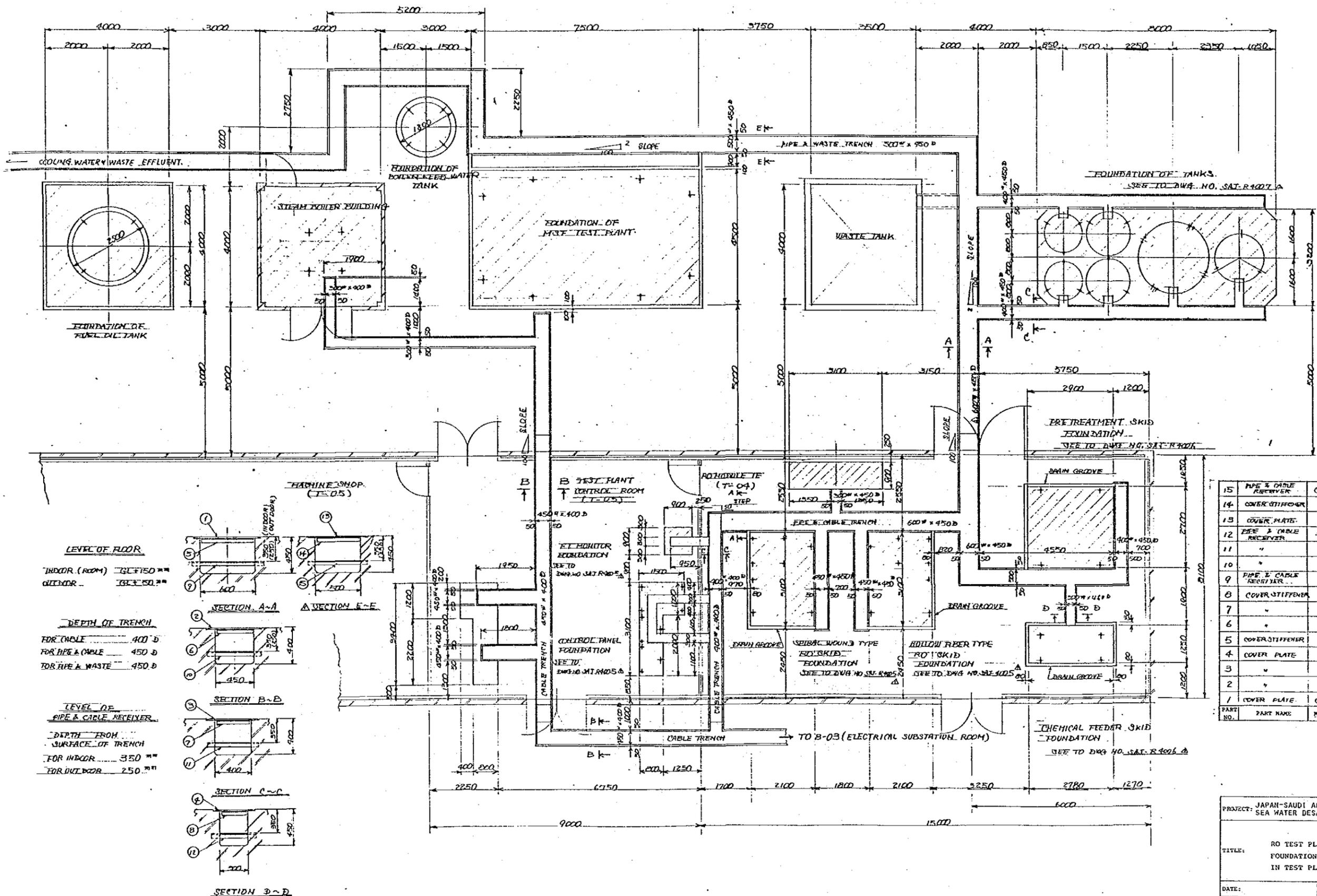


A-A VIEW



B-B VIEW

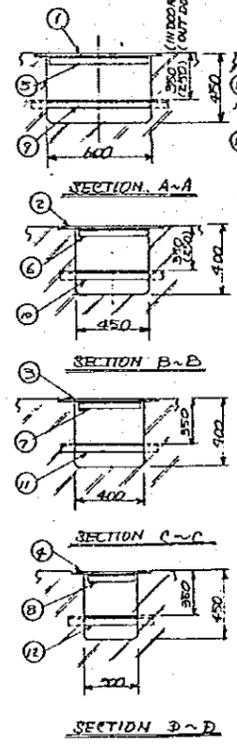
PROJECT: JAPAN-SAUDI ARABIA RESEARCH PROJECT OF SEA WATER DESALINATION	
TITLE: RO TEST PLANT PLOT PLAN OF INDOOR & SIDE VIEW	
DATE:	SCALE:
DRAWING NO.: SAJ-R4003	
JAPAN INTERNATIONAL COOPERATION AGENCY	



LEVEL OF FLOOR
 INDOOR (ROOM) 121750 mm
 OUTDOOR 121750 mm

DEPTH OF TRENCH
 FOR HOLE 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	CS		125x25x12
14	COVER STIFFENER	"		125x25x12
13	COVER PLATE	"		CHECK PLATE 1.4.5
12	PIPE & CABLE RECEIVER	"		125x25x12
11	"	"		"
10	"	"		"
9	PIPE & CABLE RECEIVER	"		125x25x12
8	COVER STIFFENER	"		125x25x12
7	"	"		"
6	"	"		"
5	COVER STIFFENER	"		125x25x12
4	COVER PLATE	"		CHECK PLATE 1.4.5
3	"	"		"
2	"	"		"
1	COVER PLATE	CS		CHECK PLATE 1.4.5

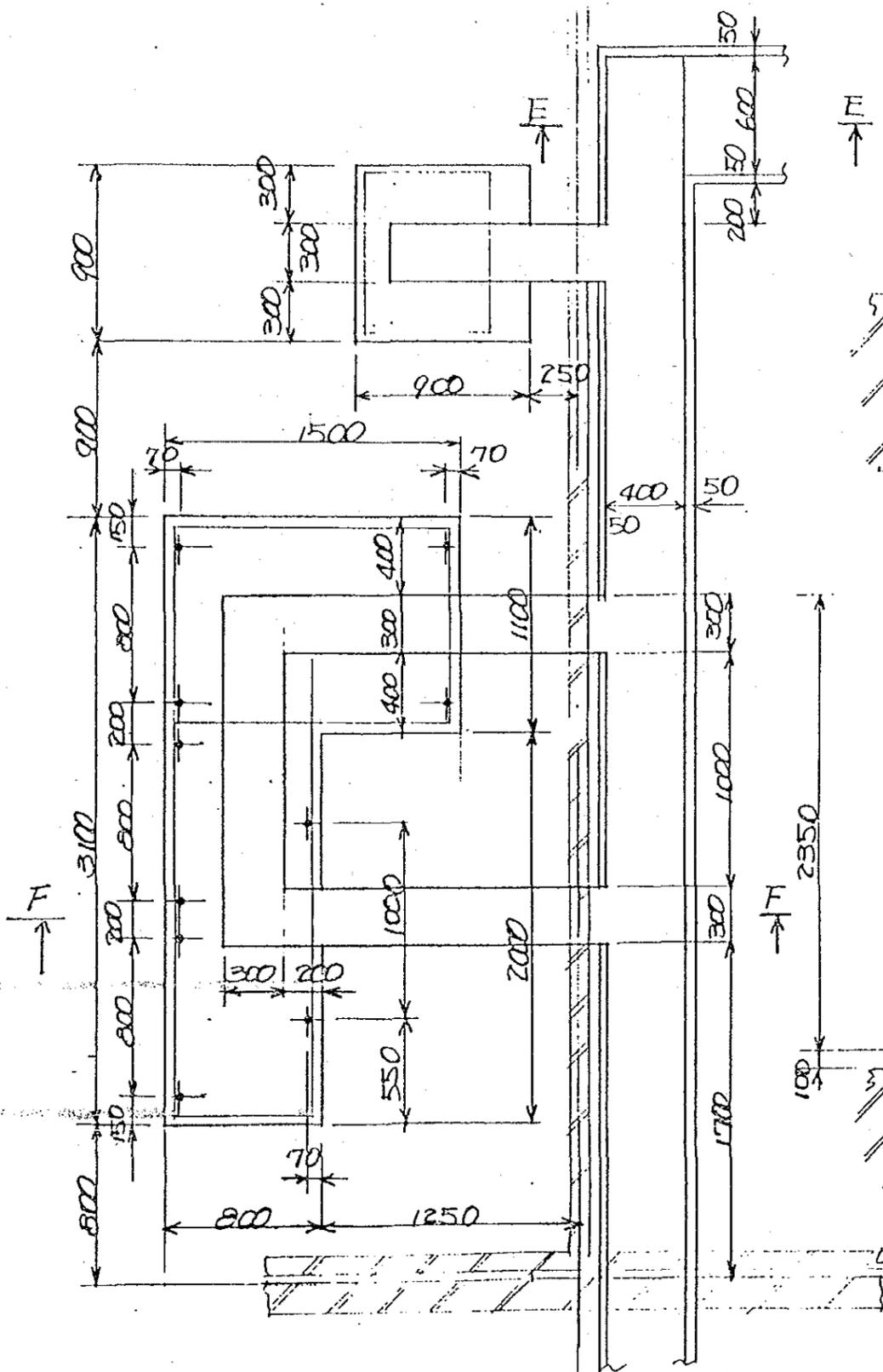
PROJECT: JAPAN-SAUDI ARABIA RESEARCH PROJECT OF SEA WATER DESALINATION

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

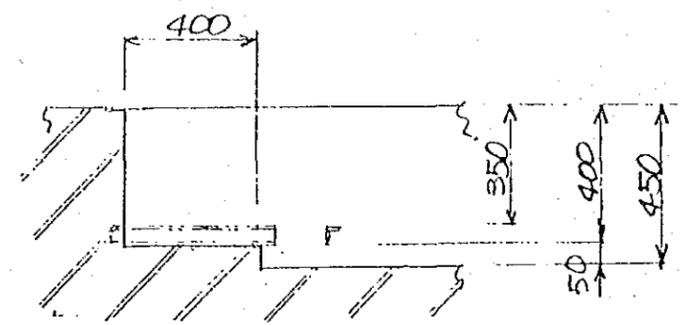
DATE: SCALE:

DRAWING NO.: SAJ-R4004

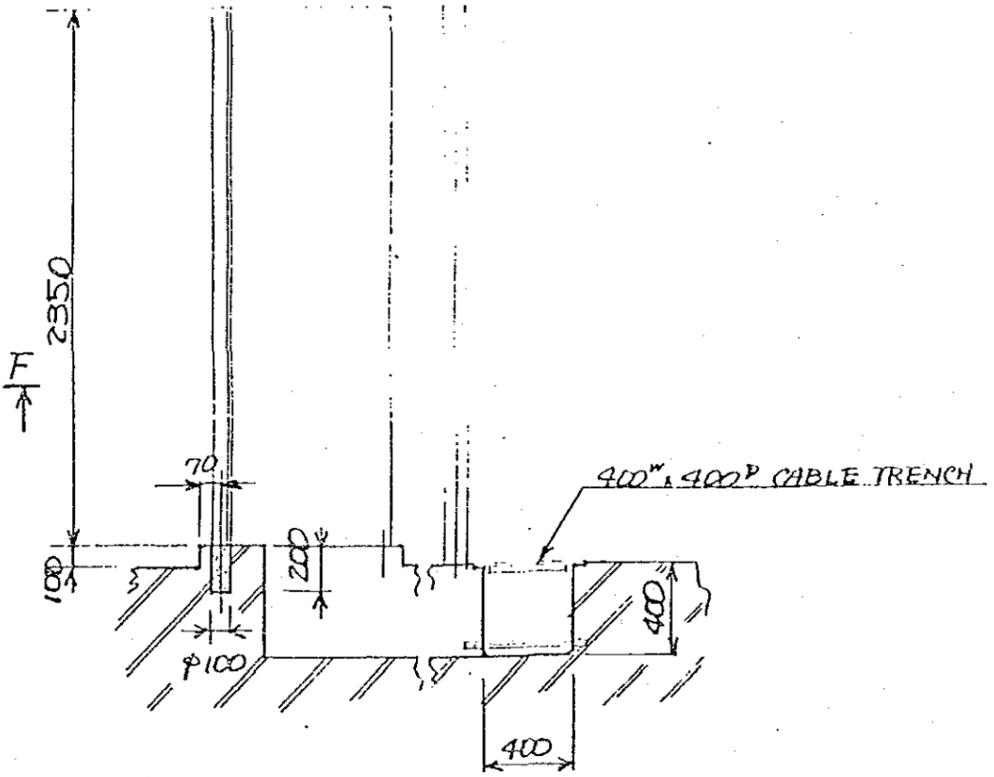
JAPAN INTERNATIONAL COOPERATION AGENCY



FOUNDATIONS OF CONTROL & INSTRUMENT PANEL & FOULING INDEX MONITOR
 SECTION - 700
 SECTION - 100



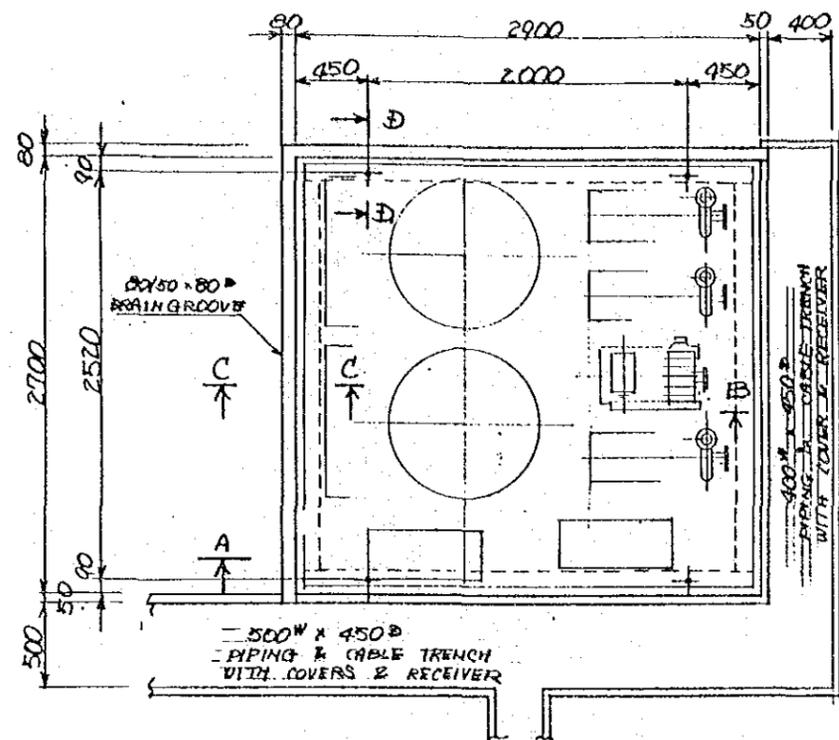
SECTION E~E
 S=1/20



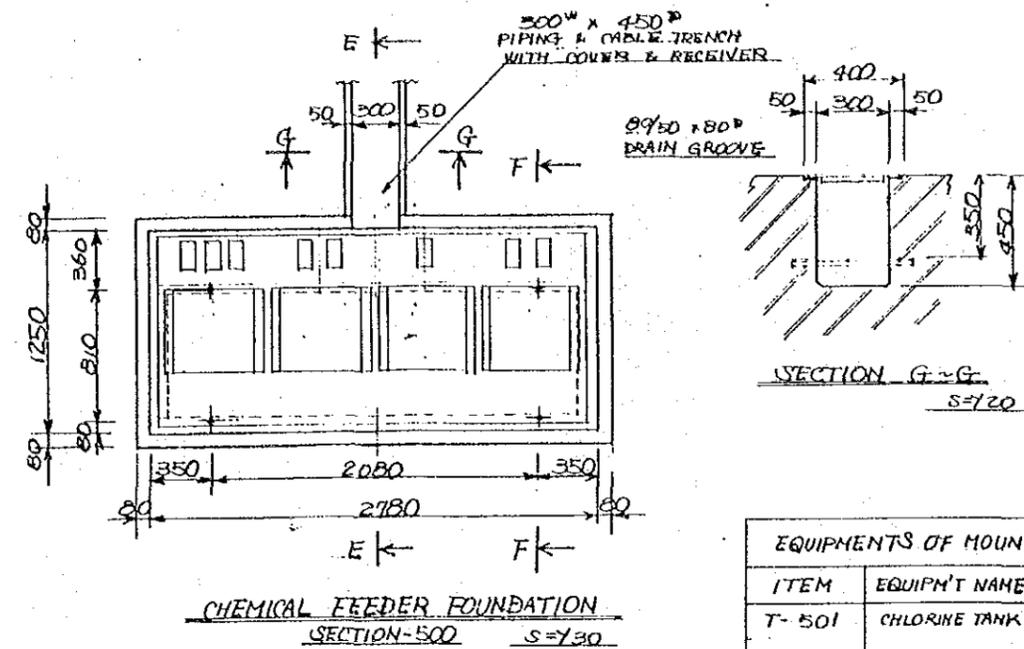
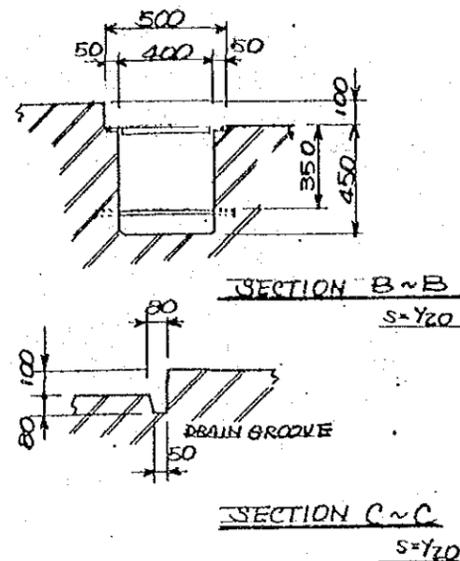
SECTION F~F
 S=1/30

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

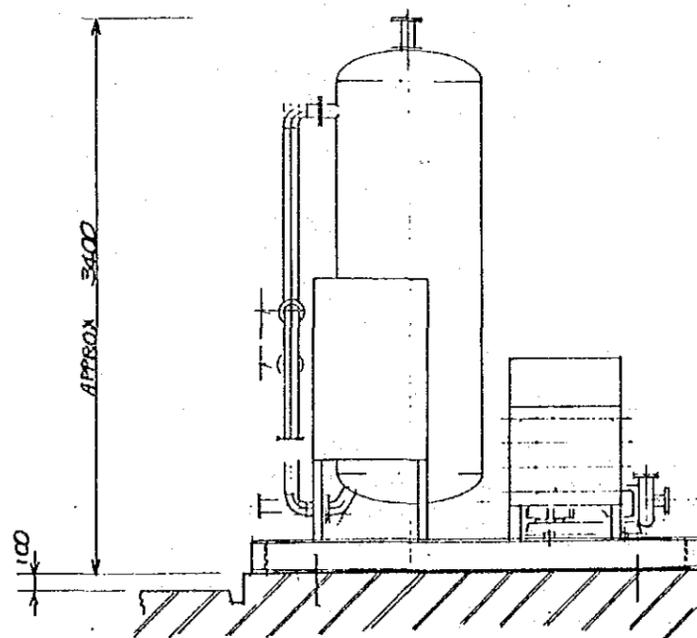
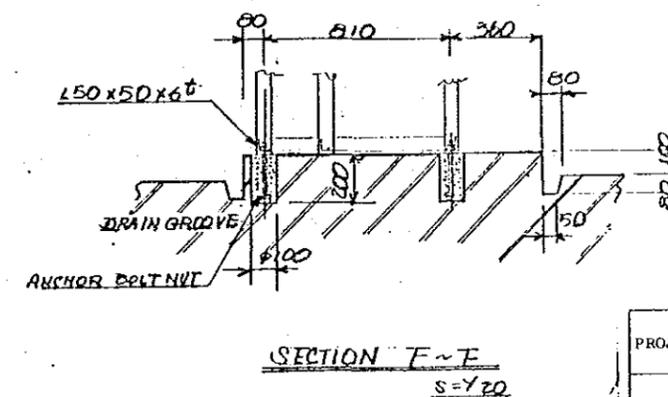
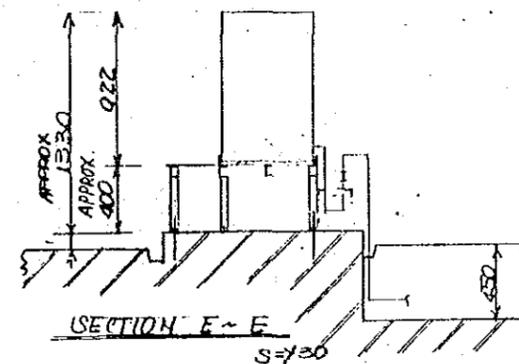


PRETREATMENT EQUIPMENT FOUNDATION
SECTION -100 S=1/30



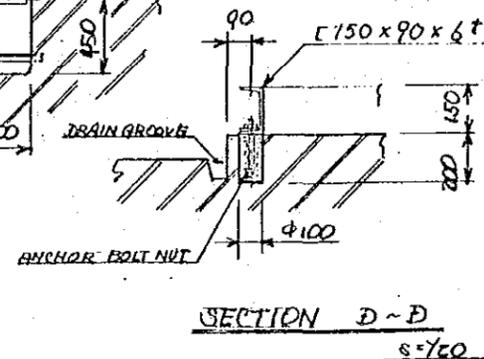
CHEMICAL FEEDER FOUNDATION
SECTION-500 S=1/30

EQUIPMENTS OF MOUNT SKID		
ITEM	EQUIP'T 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		
SKID DIMENSION APPROX 2780 ^L x 1160 ^W x 1350 ^H		
WEIGHT		
AT EMPTY; APPROX 0.4 TONS		
AT OPERATION; " 1.5 TONS		



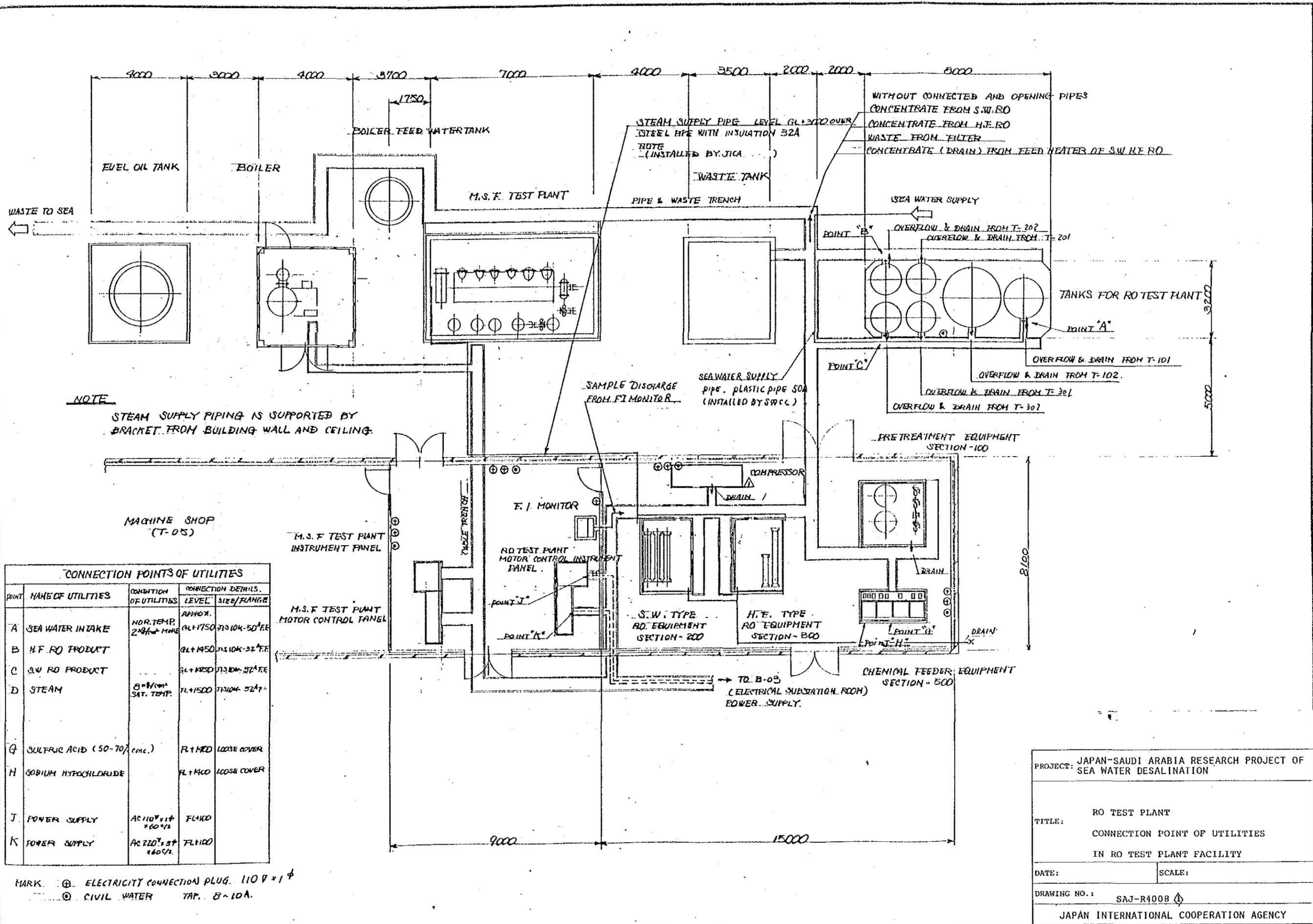
A-A VIEW
S=1/30

EQUIPMENTS OF MOUNT SKID		
ITEM	EQUIP'T 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		
SKID DIMENSION APPROX 2800 ^L x 2600 ^W x 5700 ^H		
WEIGHT		
AT EMPTY; APPROX 3.2 TONS		
AT OPERATION; " 6.7 TONS		



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	



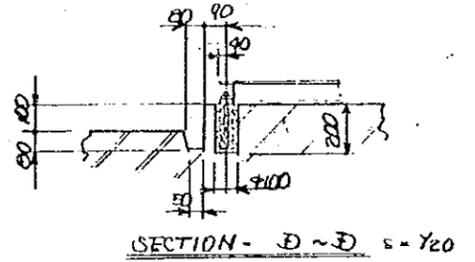
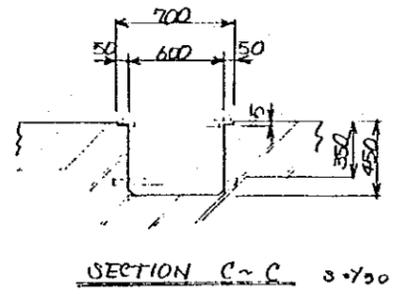
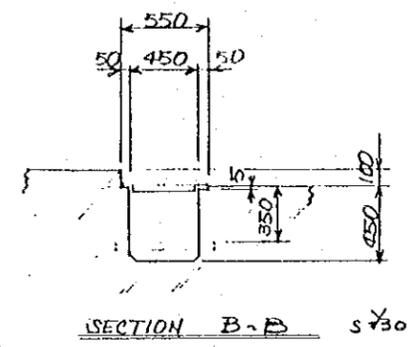
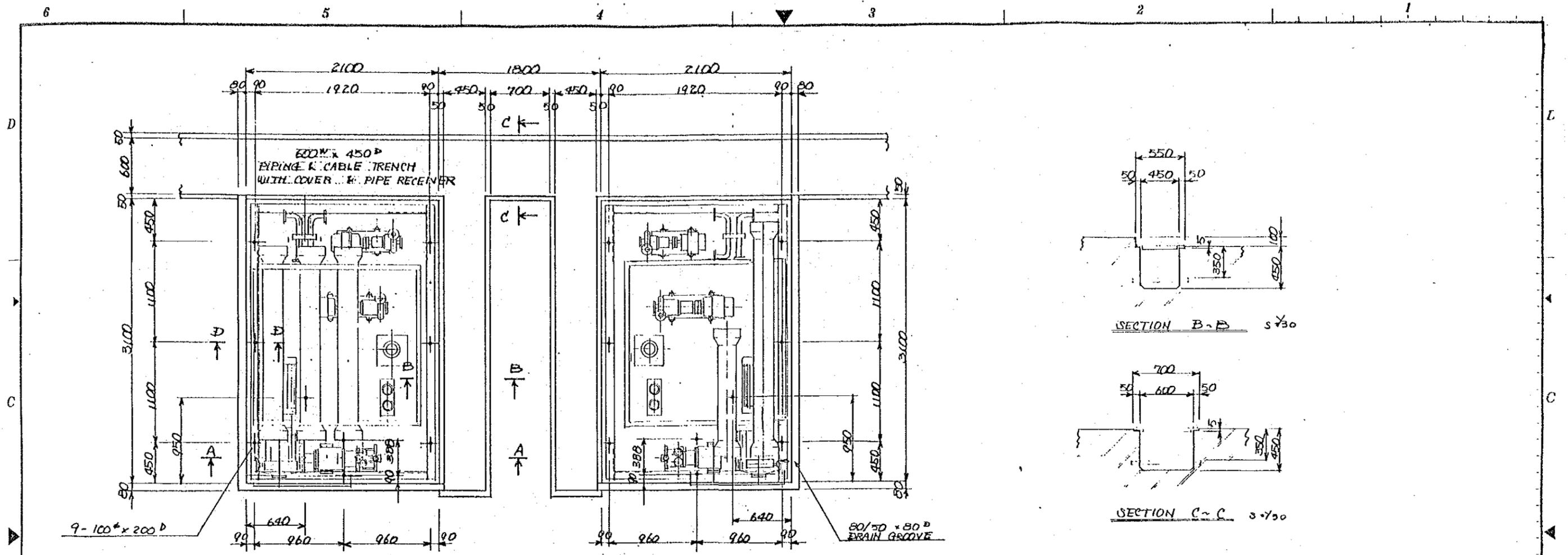
NOTE

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

CONNECTION POINTS OF UTILITIES			
POINT	NAME OF UTILITIES	CONDITION OF UTILITIES	CONNECTION DETAILS
			LEVEL SIZE/RANGE
A	SEA WATER INTAKE	NOR. TEMP. 24°C ± MORE	APPROX. GL+1750 75.104-50"EE
B	H.F. RO PRODUCT		GL+1450 75.104-32"EE
C	S.W. RO PRODUCT		GL+1450 75.104-32"EE
D	STEAM	0.8 MPa SAT. TEMP.	FL+1500 75.104-52"EE
G	SULFURIC ACID (50-70% conc.)		FL+1400 LOOSE COVER
H	SODIUM HYPOCHLORIDE		FL+1400 LOOSE COVER
J	POWER SUPPLY	AC 110V ± 1% 60 Hz	FL+1400
K	POWER SUPPLY	AC 220V ± 1% 60 Hz	FL+1400

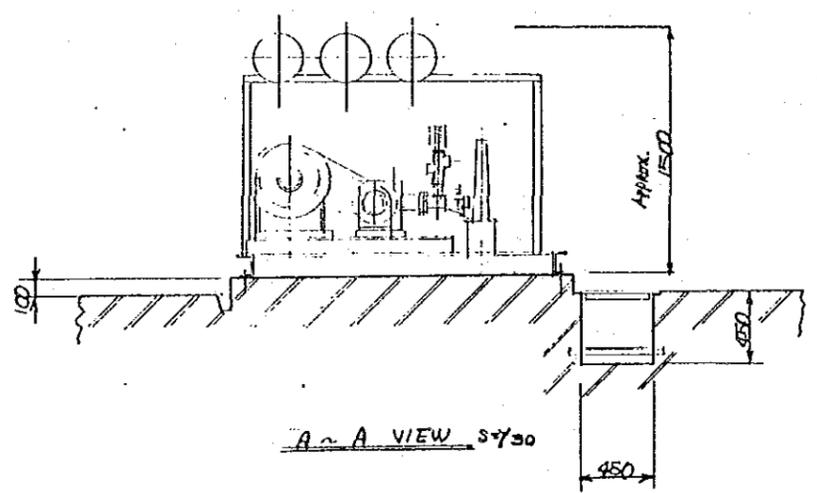
MARK: ⊕ ELECTRICITY CONNECTION PLUG. 110V x 1 φ
 ⊙ CIVIL WATER TRF. 8-10A.

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	
JAPAN INTERNATIONAL COOPERATION AGENCY	



FOUNDATION OF RO EQUIPMENT
SPIRAL WOUND RO SECTION-200

FOUNDATION OF RO EQUIPMENT
HOLLOW FIBER RO SECTION-300



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' x 2000' x 1700'			SKID DIMENSION APPROX. 3000' x 2000' x 1700'		
WEIGHT AT EMPTY 2.2 TONS AT OPERATION 2.5 TONS			WEIGHT AT EMPTY 2.3 TONS AT OPERATION 2.55 TONS		

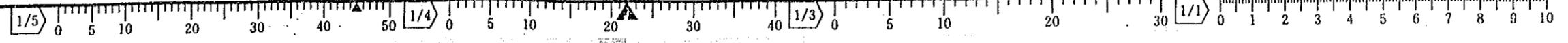
PROJECT: JAPAN-SAUDI ARABIA RESEARCH PROJECT OF SEA WATER DESALINATION

TITLE: RO TEST PLANT
FOUNDATION OF RO

DATE: SCALE:

DRAWING NO.: SAJ-R4009

JAPAN INTERNATIONAL COOPERATION AGENCY



3. MSFテストプラント計器所要項目，機器リスト
および関連図面

MSFテストプラント計器所要項目

作動項目 測定場所・項目	現場 指示	記録	制御	警報	異常時作動
1. 測量測定					
(1) 原海水	○	○			
(2) 補給水	○	○	○		
(3) 循環ライン	○	○	○		
(4) 蒸留水	○	○			
(5) コンデンセート	○	○			
2. 流量測定					
(1) エゼクター 復水器冷却海水	○		○	○	エゼクター駆動 蒸気停止 アナンシェータ
(2) 硫酸	○		○	○	アナンシェータ
(3) スケール抑制剤	○		○	○	アナンシェータ
(4) 消泡剤	○				
(5) 亜硫酸水素 ナトリウム	○				
3. 温度測定					
(1) 原海水		○			
(2) 熱放出部冷却 海水出口		○	○		
(3) エゼクター 復水器冷却海水 出口	○				
(4) 補給水最終段入口		○			
(5) 循環ライン 熱回収部入口		○			

測定場所・項目	作動項目	現場指示	記録	制御	警報	異常時作動
(6) 循環ライン ヒーター入口			○			
(7) 循環ライン ヒーター出口			○	○	○	加熱蒸気停止 アナランシェータ
(8) ブライン ヒーター入口 加熱蒸気		○				
(9) ブライン ヒーター内蒸気			○			
4. 温度測定用座 (保護管付)						
(1) 各段ブライン		○				
(2) 各段蒸発室		○				
5. 圧力測定						
(1) 原海水		○				
(2) 各ポンプ出口		○				
(3) 第1段入口 ブライン		○				
(4) 第1段蒸発室		○				
(5) 第6段蒸発室		○	○			
(6) エゼクター復水器 入口海水		○				
(7) エゼクター 駆動蒸気		○				
(8) ブラインヒーター 加熱蒸気		○		○		

作動項目 測定場所・項目	現場 指示	記録	制御	警報	異常時作動
(9) ブラインヒーター 内蒸気	○				
(10) フラッシュタンク	○				
(11) ボイラー蒸気	○	○			
(12) ボイラーバーナー 不着火				○	アナンシェータ
6. 液面測定					
(1) 各段ブライン	○				
(2) 第6段ブライン	○		○	○	アナンシェータ
(3) 各段蒸留水	○				
(4) ブラインヒーター	○		○		
(5) 脱炭酸装置	○		○		
(6) 脱気器	○		○	○	アナンシェータ
(7) フラッシュタンク	○		○		
(8) 硫酸タンク	○				
(9) スケール抑制剤 タンク	○				
(10) 消泡剤タンク	○				
(11) 亜硫酸水素 ナトリウムタンク	○				
(12) 給水タンク	○				
(13) 油タンク	○				
7. pH測定					
(1) 補給水	○	○		○	アナンシェータ
(2) 循環ブライン	○	○		○	アナンシェータ

作動項目 測定場所・項目	現場 指示	記録	制御	警報	異常時作動
8. 濃度測定					
(1) 製造水	○	○		○	アナンシエータ
(2) 加熱蒸気 コンデンセート	○	○		○	アナンシエータ
(3) ブラインおよび 補給水溶存酸素	○	○		○	アナンシエータ

MSFテストプラント機器リスト

番 号	機 材 名	仕 様	数 量
1.	蒸 発 器		1 基
	形 式	短管式多段フラッシュ蒸発法	
	容 量	20m ³ /日 (pHコントロール定格時)	
	段 数	熱回収部4段+熱放出部2段	
	作業方式	ブライン再循環方式(貫流方式も可能なこと)	
	スケール 制御方式	pHコントロール方式(薬剤注入方式も可能なこと)	
	造水比	2.5 (pHコントロール定格時)	
	主要部材質	外板および隔壁 90/10 Cu-Ni 伝熱管 16mm×1t 90/10 Cu-Ni 管板 90/10 Cu-Ni 水室 90/10 Cu-Ni 内部品 90/10 Cu-Ni デミスター SUS 316 水室連絡管 90/10 Cu-Ni ブラインループシール管 90/10 Cu-Ni 蒸留水ループシール管 90/10 Cu-Ni	
2.	ブライン ヒーター		1 基
	形 式	シェルアンドチューブ式熱交換器	
	主要部材質	胴 体 銅 板 伝熱管 16mm×0.5t チタン 管 板 90/10 Cu-Ni 水室(アノード付) 90/10 Cu-Ni	

番 号	機 材 名	仕 様	数 量
3. 3-1	抽気装置 エゼクター 形 式 主要部材質	2 段式蒸気エゼクター 吸 入 室 SUS 304 ノ ズ ル SUS 304 放 射 筒 SUS 304	1 式
3-2	エゼクター 復水器 形 式 主要部材質	シェルアンドチューブ式 熱交換器 胴 体 SUS 316 伝 熱 管 16 mm×0.4 t チタン 管 板 チタン 水 室 SS 41 + ネオプ レーンゴムライニング (3t) 管支持板 SUS 316	1 基
4. 4-1	脱気脱炭素 装置 真空脱気装置 形 式 性 能 処理能力 主要部材質	堅型円筒式 溶存酸素濃度 20ppb 以下 8 m ³ /h 胴 体 SS 41 + ネオプ レーンゴムライニ ング(3t) 内 部 品 SUS 316 FRP	1 基

番 号	機 材 名	仕 様	数 量
4-2	脱ガス塔 形 式 性 能 処理能力 主要部材質	スプレートレイ式空気接触脱ガス塔 脱ガス効率 80%以上 8m ³ /h 胴 体 SS 41+ネオプ レーンゴムライニ ング(3t) 内 部 品 SUS 316	1 基
5. 5-1	ポンプおよび モーター ブライン循環 ポンプ 形 式 容 量) 揚 程) N P S H 主要部材質	ポンプおよびモーターは、各々1台倉庫予備付とし、 計2台とする。ただし、酸洗ポンプは1台とする。 横形片吸込渦巻ポンプ 10%以上の余裕をもってメーカーにて決定のこと。 0.5m(NPSH _{av} -NPSH _{req}) ケーシング、インペラー SCS 14 シャフト SUS 316	2 台
5-2	補給水ポンプ 形 式 容 量) 揚 程) N P S H 主要部料質	横形片吸込渦巻ポンプ 10%以上の余裕をもってメーカーにて決定のこと。 0.5m(NPSH _{av} -NPSH _{req}) ケーシング、インペラー SCS 14 シャフト SUS 316	2 台
5-3	蒸留水ポンプ 形 式 容 量) 揚 程) N P S H	横形片吸込渦巻ポンプ 10%以上の余裕をもってメーカーにて決定のこと。 0.5m(NPSH _{av} -NPSH _{req})	2 台

番 号	機 材 名	仕 様	数 量
5-4	主要部材質	ケーシング, インペラー SUS 13	2 台
	硫酸注入ポンプ	シャフト SUS 304	
	形 式	ダイヤフラム式	
	容 量	10 ml/min	
	揚 程	70 mAq	
5-5	スケール抑制剤 ポンプ	ダイヤフラム テフロン	2 台
	形 式	ダイヤフラム式	
	容 量	10 ml/min	
	揚 程	70 mAq	
	材 質	本体 SUS 14 注入量遠隔調整付	
5-6	消泡剤ポンプ	ダイヤフラム式 メーカー標準	2 台
	形 式	ダイヤフラム式	
	容 量	5 ml/min	
	揚 程	70 mAq	
	材 質	メーカー標準	
5-7	亜硫酸水素ナト リウムポンプ	ダイヤフラム式 メーカー標準	2 台
	形 式	ダイヤフラム式	
	容 量	5 ml/min	
	揚 程	70 mAq	
	材 質	メーカー標準	
5-8	酸洗ポンプ	遠心ポンプ メーカー標準(接液部非金属)	1 台
	形 式	遠心ポンプ	
	容 量	30 l/min	
	揚 程	20 mAq	
	材 質	メーカー標準(接液部非金属)	

番 号	機 材 名	仕 様	数 量
5-9	循環ブラインポンプ用モーター	全閉外扇形, B種絶縁 AC 220V, 3相, 60Hz, 2P, 5.5kW	2 台
5-10	補給水ポンプ用モーター	全閉外扇形, B種絶縁 AC 220V, 3相, 60Hz, 2P, 5.5kW	2 台
5-11	蒸留水ポンプ用モーター	全閉外扇形, B種絶縁 AC 220V, 3相, 60Hz, 4P, 3.7kW	2 台
5-12	硫酸注入ポンプ用モーター	B種絶縁	2 台
5-13	スケール抑制剤ポンプ用モーター	B種絶縁	2 台
5-14	消泡剤ポンプ用モーター	B種絶縁	2 台
5-15	亜硫酸水素ナトリウムポンプ用モーター	B種絶縁	2 台
5-16	酸洗ポンプ用モーター	B種絶縁	1 台
6.	電気計装設備 モーターコントロールパネル	屋内自立形 寸 法 700(W)×2000(H)×400(D) 電 源 220V, 3相, 60Hz 110V, 単相, 60Hz (制御) 遮断器 NFB 起動方式 直入れ 付属品 過電流継電器 3素子 地絡保護 地絡トリップ	1 面

番 号	機 材 名	仕 様	数 量
6-2	計装パネル	<p>運転停止ランプ 計装パネルに設置 コントロールスイッチ 計装パネルに設置 現場・中央スイッチ</p> <p>屋内自立形 大きさ：1400(W)×2000(H)×1200(D) 電 源：AC110V, 単相, 60Hz, 設計条件： 温 度 40℃ 関係湿度 60%</p>	1 面
6-3	記録計 調節計 演算器 アナシメータ 押ボタン ランプ 電気・ 計装工事材料	<p>詳細は6-4項に示すとおりである。</p> <p>テストプラント敷地内および同プラントと計装パネル・モーターコントロールパネル間の配線材料を納入。ただし、現地工事については範囲外とする。</p>	1 式
6-4	パネル計器 6 打点式記録計 2 ペン式記録計 3 ペン式記録計 指示調節計 指 示 計 比率設定器 2 点警報設定器 1 点警報設定器	<p>M S Fテストプラント計器所要項目を満足する計器を設置するものとする。</p> <p>1~5V 測温抵抗体入力 1 個 1~5V DC 入力 4 個 1~5V DC 入力 2 個 1~5V DC 入力 7 個 1~5V DC 入力 1 個 1~5V DC 入力 2 個 1~5V DC 入力 3 個 上下限定設定 1~5V DC 入力 4 個 上限または下限警報</p>	1 式

番 号	機 材 名	仕 様	数 量	
6-5	アナンシェータ	異常点灯, テスト押釦 確認押釦, リセット押釦付き R / V 変換器 ディストリビューター トランス	2 台 8 台 2 台	
	現場発信器	MSFテストプラント計器所要項目を満足する計器 を設置するものとする。	1 式	
	差圧伝送器	4~20mA DC出力	5 個	
	圧力伝送器		3 個	
	空気式液位 調節計	0.2~1.0 kg/cm ² 外筒浮力式	3 個	
	液位伝送器	4~20mA DC出力	2 個	
	伝導度計	4~20mA DC出力 直接取付電極	2 個	
	pH計	4~20mA DC出力 流通計電力	2 個	
	オリフィス プレート	フランジタップまたはリングタップ SUS 316	5 組	
	側温抵抗体	Pt100Ω 3線式	7 個	
	現場圧力計	100φ ダイヤル式, ブルドン管式	17 個	
	現場温度計	ガラス管式, くりぬきウェル付	17 本	
	液面計	ガラス管式	5 本	
	液面計	フロート式	1 個	
	圧力伝送器	4~20mA DC出力	3 個	
	溶存酸素計	0~0.2 / 1 / 5 / 20 ppm	2 個	
	6-6	調節弁		1 式
		デスーパーヒ ター水調節弁	グローブ弁, 連続制御, ポジショナー付 SCPH/SUS316	1 台
		ブラインヒー ター蒸気圧力 調節弁	グローブ弁, 連続制御, ポジショナー付 SCPH/SUS316	1 台

番 号	機 材 名	仕 様	数 量
	ブライン	グローブ弁, 連続制御, ポジショナー付	
	温度調節弁	1台 SCPH/SUS316	
	ブライン	グローブ弁, 連続制御, ポジショナー付	
	液位調節弁	1台 SCS14/SUS316	
	製造水オン	ボール弁, SCS14/SUS316	1台
	ラインおよび		
	ダンプ三方弁		
	海水流量	バタフライ弁, 連続制御, ポジショナー付	
	調節弁	1台 FC20+ゴムライニング/SUS316	
	脱 気 器	グローブ弁, 連続制御, ポジショナー付	
	液位調節弁	1台 SCS14/SUS316	
	エゼクター	グローブ弁, ON-OFF制御, 電磁弁	1台
	蒸気ON-		SCPH
	OFF弁		
	ブライン	グローブ弁, 連続制御, ポジショナー付	
	流量調節弁	1台 SCS14/SUS316	
	ブライン	グローブ弁, 連続制御, ポジショナー付	
	ヒータコン	1台 SCPH/SUS316	
	デンセート		
	液位調節弁		
	補給水流量	グローブ弁, 連続制御, ポジショナー付	
	調節弁	1台 SCS14/SUS316	
	フラッシュ	グローブ弁, 連続制御, ポジショナー付	
	タンク液位	1台 SCS14/SUS316	
	調節弁		
	脱炭酸装置	グローブ弁, 連続制御, ポジショナー付	
	液位調節弁	1台 SCS14/SUS316	
	硫酸注入		1台
	定圧弁		
	薬剤注入		4台
	定圧弁		

番 号	機 材 名	仕 様	数 量
7.	配 管	<ul style="list-style-type: none"> 多段フラッシュ蒸発法テストプラントのスキッド内配管を施行 ボイラ, 給水タンク, 燃料タンク及びMSFテストプラントスキッドの間の配管は, 完成品または半完成品にて供給 	1 式
	使用材料 海水および ブライン 蒸留水ライン 抽気ライン その他	Cu-Ni, FRP, ゴムライニング材 SUS SUS メーカー標準	
8.	各種タンク および混合器等		
8-1	硫酸タンク	容 量 100 ℓ 材 質 SUS316	1 台
8-2	スケール抑制剤 タンク	容 量 100 ℓ 材 質 SUS316	1 台
8-3	消泡剤タンク	容 量 25 ℓ 材 質 SUS316	1 台
8-4	亜硫酸水素ナト リウムタンク	容 量 25 ℓ 材 質 SUS316	1 台
8-5	フラッシュ タンク	容 量 150 ℓ 材 質 SUS304	1 台
8-6	酸洗タンク	容 量 300 ℓ 材 質 ポリエチレン	1 台
8-7	硫酸混合機	材 質 FRP	1 台
8-8	スケール抑制剤 混合機	材 質 SUS316	1 台