

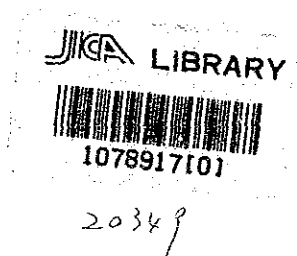
**ANNUAL REPORT 1988
THE TECHNICAL COOPERATION
FOR THE PROJECT (RESEARCH)
OF
THE SEA-WATER DESALINATION TECHNOLOGY
IN
THE KINGDOM OF SAUDI ARABIA**

MARCH, 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

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International Cooperation Agency
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1. Outline of the Project

1.1 History

The project commenced after the basic Record of Discussion entering into contract between the Japan International Cooperation Agency (hereinafter referred to as JICA) and the Saline Water Conversion Cooperation (hereinafter referred to as SWCC) at Riyadh, the Kingdom of Saudi Arabia (hereinafter referred to as the Kingdom) in September 1979.

The scope of the technical cooperation at that time was to establish a research center of desalination technologies together with a test plant having a capacity of 500 cubic meters/day of multistage flash distillation. The test plant is to comprise concrete evaporators developed by the Agency of Industrial Science and Technology of the Japanese Government, with the aim to transfer desalination technologies of Japan to the Kingdom by conducting cooperative research by researchers of both countries.

After the contract, details of the cooperation were discussed by both parties. However, in April 1981, SWCC requested the Japanese Government to establish a training center instead of the test plant comprising concrete evaporators, as the Council of Ministers decided that it was more important to carry out operation management of existing desalination plants by Saudis rather than to introduce the new technology of desalination.

JICA discussed the request of SWCC with relevant organizations and decided to accept this request. The Department of Mining and Industrial Planning and Survey (JICA) and the Department of Social Development Cooperation (JICA) would be in charge of establishing the research center of desalination technologies and the training center, respectively. Then JICA discussed with SWCC to revise the aforesaid basic Record of Discussion.

Consequently, both parties signed a new Record of Discussion (hereinafter referred to as R/D) on 12th of February, 1982. Implementation of the project started based on the said R/D. A technical survey team visited the Kingdom in March 1982 to hold a meeting on detailed matters about implementation of the project and for site survey of the research center.

The department of Mining and Industrial Planning and Survey prepared the conceptual design and sent it to SWCC in September 1982. It also dispatched a technical team for detailed explanation of the conceptual design in October 1982.

SWCC approved the contents of the conceptual design, and further requested JICA to provide the conceptual design for the training center. The reason given was that SWCC intended to award construction of both the research center and the training center to one contractor. As the request of SWCC for the training center involved wide and high technical expertise, it took time to prepare the conceptual design.

Meanwhile Mr. S. Najaar, the Director of Department of Research and Technical Affairs (SWCC), who visited Japan in April 1983 with Mr. Nazer, the Minister of Planning of the Kingdom, proposed in a new idea of nine items regarding the research center. Envisaged was expansion of the area of research activities as well as the facilities. JICA dispatched a joint team comprising of both research and training experts in August 1983. Regarding the research, both parties agreed upon matters after explanation by the Japanese side and also discussed contents of the training project.

SWCC suspended construction of the new building for the research center and proposed to JICA modification of an existing administration building in February 1984. Upon being informed of this matter, JICA dispatched a survey team in May 1984 to carry out site study on the existing building and to discuss modification feasibility of the building. Both parties agreed that the structure of the existing building would be for offices, some rooms could be made available for administration and the remaining spaces would be modified to accommodate the training center. Other spaces for the laboratory were to be newly constructed on the initially proposed site.

JICA provided the revised conceptual design and explained it to SWCC in August 1984. JICA started procedures for procurement of test plants and laboratory equipment so as to meet the timetable of construction of the research center, and delivered it to the Kingdom in May 1985 after procured.

SWCC contracted a consultant and commenced detailed design in December 1984. The cost proposal from the tenderer proved to be far exceeding the budgetary appropriation of SWCC and, in October 1985 SWCC was forced to suspend the project.

This project was to terminate on 31st of March 1986 according to the terms of R/D. However, as the implementation of the project was considerably delayed, JICA dispatched survey teams for consulting SWCC about extension of R/D in July 1985 and March 1986, respectively.

The Council of Ministers entrusted the extension of R/D to the SWCC's Board of Directors in September 1986. Meanwhile, SWCC requested JICA to study full use of the existing building as the Desalination Technology Research Center (this name was formally agreed upon in the Minutes of Meeting dated October 10, 1987, and is hereinafter referred to as the Research Center), reduction in the numbers of training courses at the training center, and transfer of the training center to the existing Research & Training Center in Jubail.

JICA dispatched a technical survey team in February 1987 for studying utilization of the building. The team concluded that the building could be utilized by remodelling.

In the discussions at Riyadh, SWCC strongly requested JICA to carry out not only conceptual design work but also the detailed design which was to be undertaken by SWCC as per R/D, to cope with delay of the schedule and the technical problem.

After discussions with the relevant governmental parties, JICA decided to carry out the detailed design of the Research Center on its own expense in March 1987. JICA commenced to revise the conceptual design and also to prepare the detailed design in April in order to utilize the whole of the existing building. JICA submitted these documents to SWCC in October 1987.

Meanwhile, JICA signed the Minutes of Meeting on 25th October 1987 as to extension of the term of technical cooperation for three years.

SWCC made public the invitation to the tender for construction of the Research Center in February based on the detailed design provided by JICA and opened the bids in March.

As the construction work was expected to start in a while, JICA purchased the additional laboratory equipment.

1.2 Objectives

This project is intended to establish the Desalination Technology Research Center in the Kingdom, and to introduce Japanese desalination technology into the Kingdom through the joint research activities. The objective is to contribute to the stable supply of water resources in the Kingdom.

1.3 Scope

The project covers the following items.

- (1) Establishing the Research Center (in the former phase).
 - (a) Setting up the laboratory building with its related facilities, and installing laboratory equipment.
 - (b) Setting up a multistage flash evaporation process (MSF) test plant (1 unit; 20 cubic meters/day in capacity).
 - (c) Setting up reverse osmosis (RO) test plants (2 units; 20 cubic meters/day in capacity each).
- (2) Conducting joint research on seawater desalination (in the latter phase).
 - (a) Study on technology for corrosion prevention and scale deposition control at the MSF test plant.
 - (b) Study on RO module performance test methods at the RO test plant.
 - (c) Study on the problems in the large scale plant in Saudi Arabia.
 - (d) Study on chemical analysis methods.

1.4 Work Progress in the Year

(1) Outline of progress

SWCC chose the AL-SOAIIB EST. among other bidders in June and the two parties entered into contract on 7th September 1988. The period of construction is slated for 360 days commencing 4th October of the same year.

The submittal of detailed drawings for the construction work by the contractor was scheduled at first to be completed by the end of November, but this work was considerably delayed.

The first drawings were submitted to SWCC in January 1989, and were the very same copies as the drawings in the tender documents provided by JICA.

Regarding the drawings for ancillary facilities of the Test Plants, since no drawing was submitted to SWCC, SWCC asked JICA to assist the contractor in preparing the drawings.

JICA dispatched a contact mission not only for assisting the contractor in this work but also for checking the capability of

the contractor and the progress of work.

The result of checking was that JICA was able to assist in the building work through correspondence. However, as for the ancillary facilities, JICA decided to provide drawing drafts in Riyadh subsequent to site survey.

Progress of construction is as follows.

(a) Building

Remodelling of the existing building has considerably advanced.

(b) Test plants

The dismantlement of the foundation of the solar energy plant, which is inside the area of the Test Plants, is not completed yet.

(2) Assistance in the construction work of the Research Center

JICA dispatched five engineers to Riyadh.

They assisted SWCC engineers in the approvals of the working drawings and also the specifications of materials/equipment submitted by the contractor.

(3) Recognition of necessity of the re-extension of the R/D

JICA dispatched a survey team in January 1989 to discuss the term of cooperation specified in the R/D which was to be expired on February 28, 1989, with SWCC.

The officials of both parties related to the research project recognized necessity of the re-extension of R/D to continue the technical cooperation.

(4) Shipping of the additional laboratory equipment

The additional equipment, which were procured in March 1988, were shipped for Yanbu in May 1988.

2. Study of the Project Implemented in Fiscal Year 1988

2.1 Status of the Contractor (AL-SOAI B EST.)

The head office of AL-SOAI B is located in Riyadh.

The company's major expertise lies in civil and architectural engineering related to the building.

It seems that AL-SOAI B has considerable experiences in the construction of buildings but not plant facilities or laboratories.

The project engineer and attendant engineer are Mr. Salem and Mr. Abastillas, respectively.

2.2 Progress of Construction of the Research Center

The Japanese technical advisors conducted the site survey and confirmed the state of construction progress as follows.

(a) Ancillary facilities of test plants

i. Foundation work

Dismantling work of foundations of the former solar pilot plant is under way in order to construct foundations for the Test Plants. Work progress is about 10% of the completion.

As excavation at the planned location of the wastewater pit encountered existing pipelines and cables, the dimensions of this pit have been revised. Foundation work for the Test Plants has not yet begun.

ii. Plumbing work

Plumbing of the upPVC pipe for unsterilized seawater is almost completed including the excavation.

Installation of the submersible pump on the sea bed will pose some technical difficulties for the contractor from now on.

(b) Modification/Addition of buildings

i. Modification of the existing building

Removal of unnecessary partitions, installation of plumbing for service/waste water, and electric wiring work are nearly completed. Plumbing on the first floor was designed to be laid on the floor under the false floor, not in the existing floor, so as to protect the floor from decreasing strength. Actually, the existing floor was excavated to make shallow trenches and pipes were being laid without prior approval from SWCC.

ii. Additional building for Test Plants

Framework of reinforcing bars is now taking shape.

2.3 Assistance in Construction Drawings

Five technical advisors of JICA were dispatched to the Kingdom for ten days at the beginning of March upon request from SWCC. They prepared drafts to be used as the basis of working drawings at the head office of the contractor, carried out the updated site survey, and reviewed matters related to the construction works with the site engineer. They also provided advice concerning the following items.

- (a) Drawings for laboratory facilities, such as the fume hood.
- (b) Additions to and modifications of the Bill of Quantities.
- (c) Answers to the contractor's inquiries.

The technical advisors and SWCC signed the Technical Memo which included the above items.

2.4 Expiration of Extended R/D

Extended R/D signed in Oct. 1987 was expired on Feb. 28, 1989. Since remodeling work for Research Center is under way as described on chapter 1.1, commencement of research activities will be delayed on and after April, 1990.

Therefore both Japanese and Saudi Arabian side related to Research Cooperation have recognized the necessity of re-extension of technical cooperation.

On the otherhand, Japanese side related to Training Cooperation has intended to extend the term of cooperation, and it is under discussion between Japanese and Saudi Arabian side.

2.5 Shipping of the Additional Laboratory Equipment

Additional laboratory equipment procured by March, 1989, as shown on the Packing List of attachment 2.3, was shipped for Yanbu site in May, 1989.

3. JICA Survey Teams dispatched to the Kingdom of Saudi Arabia

3.1 Contact Mission

(1) Objectives

- (a) To discuss with SWCC the implementation of the technical cooperation after the day when the cooperation term is to be terminated, that is February 28, 1989.
- (b) To discuss with SWCC the dispatching schedule of Japanese engineers to advise SWCC in preparing drawings required for construction works of the research center, after surveying the situation of progress of preparation.

(2) Member and Itinerary of the Team

(a) Member

Isao ITOH	Leader	Head, Natural Resources Division, JICA
Shinji SHIBATA	Coordination	Natural Resources Division, JICA
Hiryoyuki Hotta	Water Generation Policy	Industrial Facilities Division, MITI
Takeo SAKAMOTO	Desalination Technology	Consulting Engineer WRPC

(b) Itinerary

January 26 (Thu.)	Leaving Tokyo. Arriving at Bangkok.
January 27 (Fri.)	Leaving Bangkok. Arriving at Tokyo.
January 28 (Sat.)	Discussing with JICA Riyadh office, Embassy of Japan and SWCC
January 29 (Sun.)	Discussing with SWCC
January 30 (Mon.)	Leaving Riyadh. Arriving at Yanbu.
January 31 (Tue.)	Surveying site. Leaving Yanbu. Arriving Riyadh.
February 1 (Wed.)	Discussing with SWCC and reporting to JICA office and Embassy of Japan.
February 2 (Thu.)	Leaving Riyadh.
February 3 (Fri.)	Arriving Tokyo (via Bangkok)

(3) Meeting Member

(a) SWCC, Riyadh

Mr. Abdulla A. Abanmy	Deputy Governor, SWCC
Mr. Abdullah A. Al-Azzaz	Director General, Department of Research & Technical Affairs, SWCC
Mr. Abdullah Al-Zahrani	Department of Research & Technical Affairs, SWCC

(b) SWCC, Yanbu/Medina Power & Desalination Plant

Mr. Najj A. Darwish	Plant Manager
Mr. A. R. Al-Harbi	Efficiency Engineer

(c) Japanese Residents in Riyadh

Mr. K. Watanabe	Japanese Ambassador to the Kingdom of Saudi Arabia
Mr. E. Hiraoka	First Secretary, Embassy of Japan
Mr. A. Suzuki	Resident Representative, JICA Saudi Arabia Office

(4) Contents of Discussion

- (a) Both sides recognized the necessity of re-extension of the term of cooperation regarding research cooperation to complete the activities specified in the R/D.
- (b) In order to complete construction work for the research center, both sides agreed that four or five Japanese technical advisors were to be dispatched for two weeks to review electrical, instrumental and mechanical drawings for test plant ancillary facilities.

3.2 Technical Advisors for the Drawings of Construction

(1) Objective

To give advice to SWCC in preparing working drawings of the test plant ancillary facilities and in execution of the construction work.

(2) Member and Itinerary of the Team

(a) Member

Takeo SAKAMOTO	Basic Specification for Test Plant	Consulting Engineer, WRPC
Jiro KIJIMA	Electric & Instrument (RO)	ditto
Kazuhiko KISHI	Mechanic (RO)	ditto
Yo'ichi MENO	Electric & Instrument (MSF)	ditto
Shouji TSUBOKAWA	Mechanic (MSF)	ditto

(b) Itinerary

SAKAMOTO, KIJIMA,
KISHI, TSUBOKAWA () : Itinerary for MENO

March 4 (Sat.) Leaving Tokyo. Arriving at Bangkok.

March 5 (Sun.) Leaving Bangkok. Arriving at Riyadh.

March 6 (Mon.) Meeting with JICA, Embassy of Japan,
SWCC and Al-Soaib

March 7 (Tue.) Preparing preliminary drawings.

March 8 (Wed.) ditto

March 9 (Thu.) ditto (Lv. Tokyo, Ar. Bangkok)

March 10 (Fri.) Leaving Riyadh. Arriving at Yanbu.
(Lv. Bangkok, Ar. Riyadh)

March 11 (Sat.) Surveying the site.
(Meeting with JICA,
Lv. Riyadh, Ar. Yanbu)

March 12 (Sun.) Surveying the site.

March 13 (Mon.) Surveying the site and checking equipment stored
at the site. Leaving Yanbu.

March 14 (Tue.) Preparing preliminary drawings.

March 15 (Wed.) Meeting with SWCC, JICA and Embassy of Japan.
Signing Technical Memo.

March 16 (Thu.) Leaving Riyadh.
(Preparing preliminary
drawings)

March 17 (Fri.) Arriving at Bangkok.
(Arranging drawings)

March 18 (Sat.)	Leaving Bangkok, Arriving at Tokyo.	(Preparing preliminary drawings)
March 19 (Sun.)		(ditto)
March 20 (Mon.)		(Meeting with SWCC)
March 21 (Tue.)		(Leaving Riyadh)
March 22 (Wed.)		(Ar. Bangkok, Lv. Bangkok, Ar. Tokyo)

(3) Meeting Member

(a) SWCC, Riyadh

Mr. Abdullah A. Al-Azzaz	Director General, Department of Research & Technical Affairs
Mr. Abdullah Al-Zahrani	Staff, Department of Research & Technical Affairs

(b) SWCC, Yanbu Medina Power & Desalination Plant

Mr. Najj A. Darwish	Plant Manager
Mr. A. R. Al-Harbi	Efficiency Engineer

(c) Japanese Residents in Riyadh

Mr. K. Watanabe	Japanese Ambassador to the Kingdom of Saudi Arabia
Mr. E. Hiraoka	First Secretary, Embassy of Japan
Mr. A. Suzuki	Resident Representative, JICA Saudi Arabia Office

(d) Contractor (Al Soaib Est.)

Mr. Mohamad Salem	Project Manager
Mr. Ben E. Abastillas	Attendant Manager
Mr. Ahamad Abdulaziz Hassan	Site Manager

(4) Contents of Discussion

SWCC agreed upon that technical advices provided and will be provided hereafter by technical advisors of JICA shall be exempted the liability of the fault during the course of construction and installation of the research center project.

Appendix

1. Minutes of Meeting and Technical Memo
2. Packing List of Additional Laboratory Equipment
3. Photographs

1. Minutes of Meeting and Technical Memo

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Kingdom of Saudi Arabia
Saline Water Conversion Corp.



المؤسسة العامة لتحلية المياه المالحة
بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Minutes of Meeting

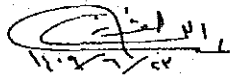
A meeting was held between the delegation of the Japan International Cooperation Agency (JICA) headed by Mr. Isao Ito and the Saline Water Conversion Corporation (SWCC) officials headed by Mr. Abdullah Al-Azzaz from January 28, 1989 to January 29, 1989 at SWCC office in Riyadh.

A list of members attending the meeting is attached as appendix.

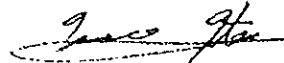
The results of the above meeting held at SWCC are as follows:

1. As the R/D will expire on February 28, 1989, both sides recognized the necessity of the re-extension of the term of cooperation regarding research cooperation to complete the activities specified in the R/D.
2. In order to complete construction work for Research Center and commence research cooperation in the earliest possible time, both sides agreed that four or five Japanese Technical Advisors were to be dispatched for two weeks from the end of February 1989 to review the mechanical drawings of the Pilot Plants.

Signed in Riyadh on: January 30, 1989


11/27/89

Abdullah A. Al-Azzaz
Director General
Dept. of Research &
Technical Affairs



Isao Ito
Leader
JICA Delegation

رقم (.....) Ref. (.....) التاريخ (.....) Date (.....) المرتقات (.....) Attachs (.....)

الرياض - النخيل - شارع التحلية - ت ٤٦٣١١١١ / ٤٦٣١٧٨ / ٤٦٣٠٠٠٠ ٤٦٣٠٠٠٠ / ٤٦٣١٧٨ / ٤٦٣١١١١
من ب ٤٦٦٨ الرياض ١١٤٣١ - ت لكس ٤٠٠٠٩٧ / ٤٠٠١٠١ / ٤٠٠١١١ ٤٠٠٠٩٧ / ٤٠٠١٠١ / ٤٠٠١١١
Riyadh - Olla - Altableeh Street - Tel. 4631111/4631780/4630505
P. O. Box 6968 - Riyadh 11432 - Telex 400097/400401/404699

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Kingdom of Saudi Arabia
Saline Water Conversion Corp.



المؤسسة العامة لتحلية المياه المالحة
الملك عبدالعزيز بن سعود

Appendix

SWCC

1. Mr. Abdullah A. Al-Azzaz
2. Mr. Abdullah Al-Zahrani

JICA

1. Mr. Isao Ito
2. Mr. Hiroyuki Hotta
3. Mr. Shinji Shibata
4. Mr. Takeo Sakamoto
5. Mr. Akira Suzuki
(JICA Resident Representative)

رقم (.....) Ref. (.....) التاريخ (.....) Date (.....) المرفقات (.....) Attachs (.....)

الرياض - العليا - شارع التحلية - ت ٤٦٣١١١١ / ٤٦٣١٧٨٠ / ٤٦٣٠٥٥٥
P.O. Box 5089 Riyadh 11422 - Tel: 400097 / 400401 / 402800

TECHNICAL MEMO

The technical advisers of the JICA, headed by Takeo Sakamoto, visited the Kingdom of Saudi Arabia from the 6th to the 15th (one engineer from 11th to 20th, of March 1989) for the purpose of assisting for the contractor to complete the detailed drawing of the construction work of the research center, especially concerning the test plants facilities.

After the visit to the Yanbu site and the mutual discussion there, the following items are agreed upon among the parties concerned.

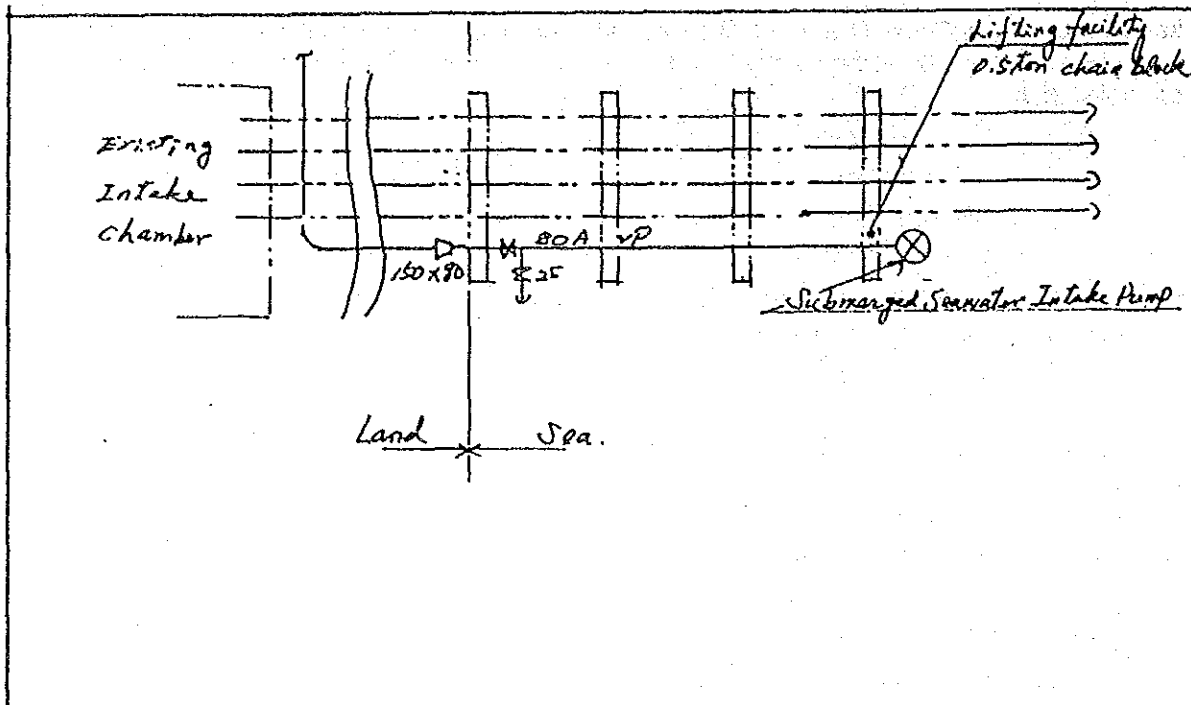
These items include the revision of the design, supplemental materials/equipment from the contractor, advice on the specification and approval of some M/E.

1. Sterilized seawater Intake

Sketch of the existing seawater pipe line and interface for connection is attached as appendix (2)

2. Non-sterilized seawater Intake

For details of the arrangements for the piping and submerged seawater intake pump are as follows:

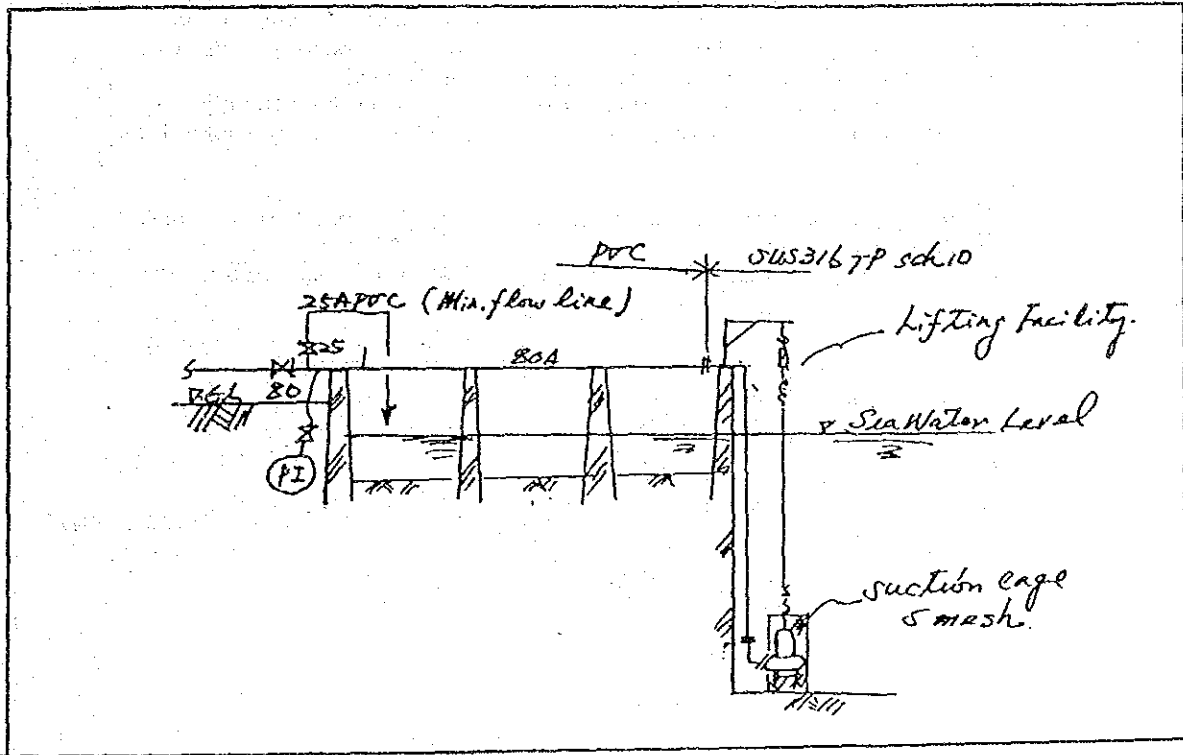


コクヨ コヒ-150 (52x36)

Specification of submergible pump

Type: Detachable type
Cap : 0,2 m³/min
Discharge press: 2,0 kg/cm² G
Rated Power: 1.5 KW X 4P X 480V X 3 PHASE

Note: Power supply of the submergible seawater intake pump shall be taken from the existing seawater intake station.
Pump starter shall be installed near the existing intake structure.

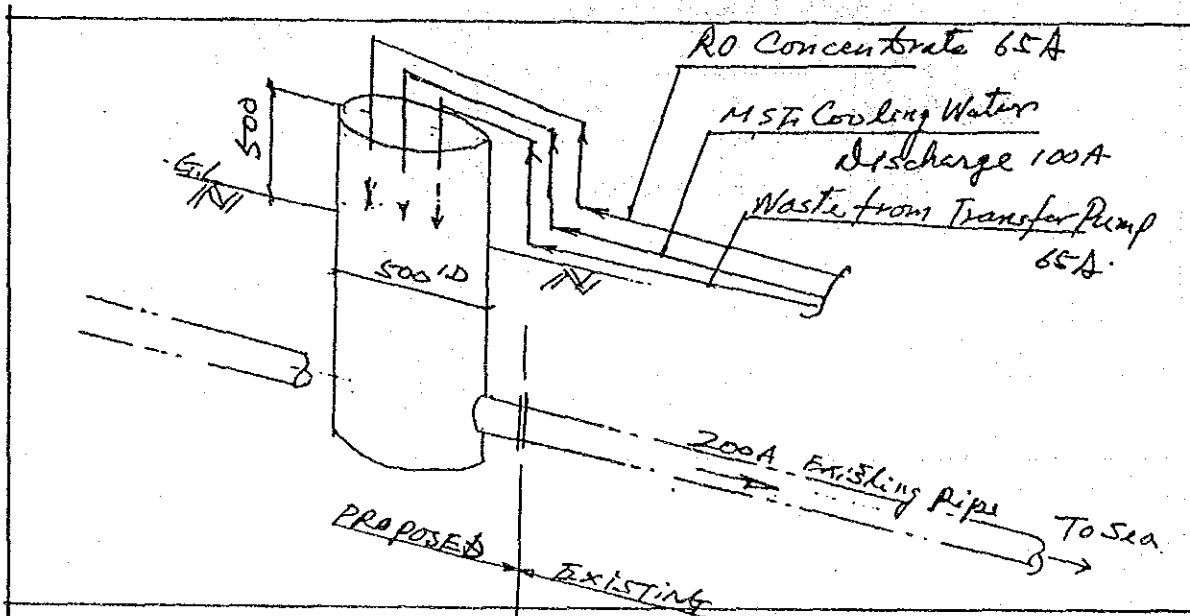


3. Waste Tank/Waste Pump

3.1. In the original design, RO concentrate, MSF cooling water discharge and miscellaneous waste discharged and stored in the waste tank, and transferred and connected to the existing waste pipe by the waste transfer pump.

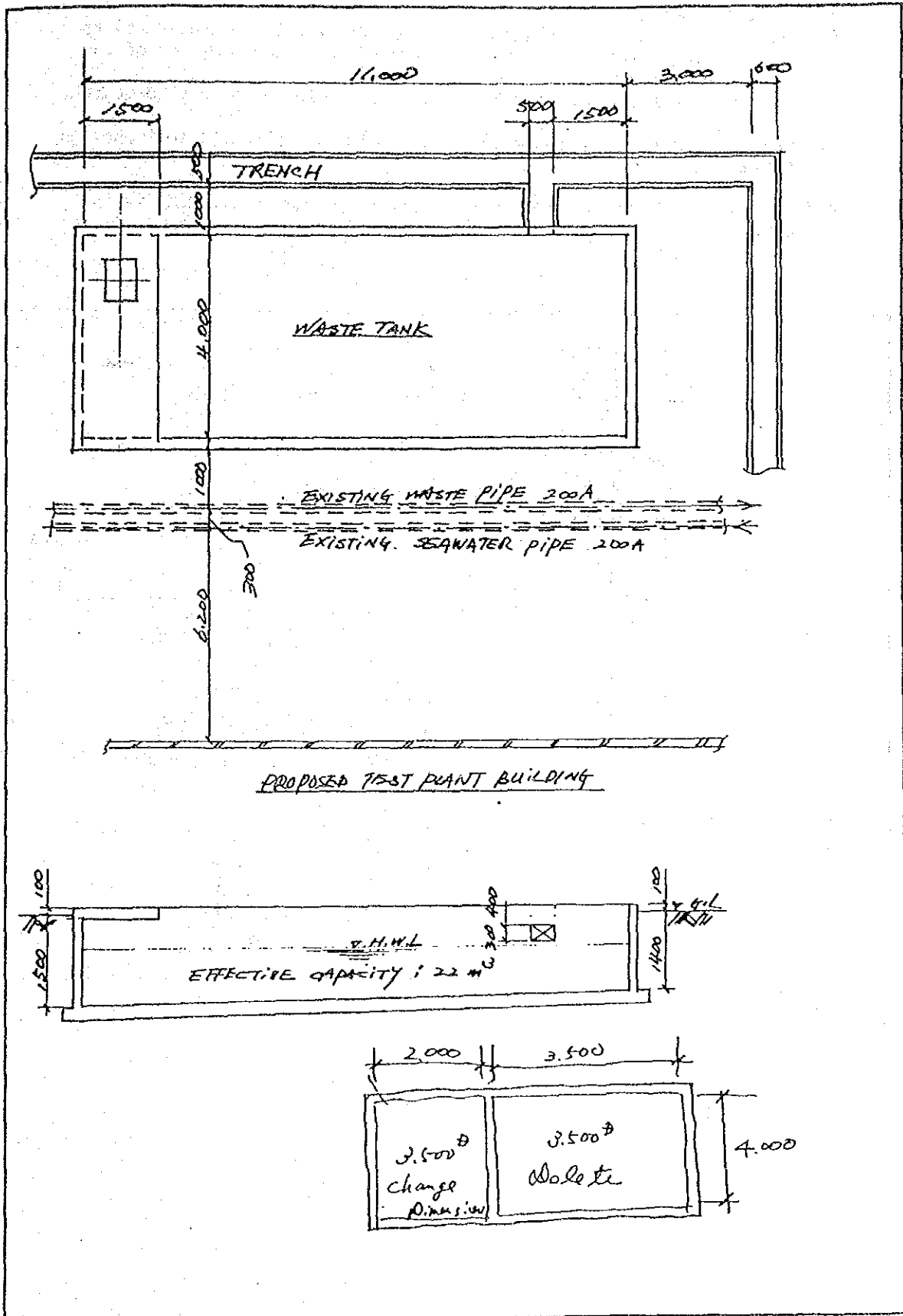
Taking the present site condition into consideration, both parties mutually agreed as follows:

- (1) RO concentrate and MSF cooling water discharge, which are continuously discharged and have enough pressure i.e, 2kg/cm^2 G of RO concentrate and 1.3 kg/cm^2 G of MSF cooling water discharge, are directly connected to the existing waste line of 200mm.
- (2) Waste from sand filter in RO test plants and drains such as sampling and so on from both RO test plant and MSF test plant is discharged into the waste tank and the suspended solids in the waste will be settled down in the waste tank. Supernatant of the waste after sedimentation will be transfer by the waste transfer pump and connected to the existing waste line mentioned the above.
- (3) Both parties confirmed the existing waste line of 200mm. (refer to Appendix (4)
Connection of waste to the existing waste line as follows:



3.2 Waste Tank

Due to the above modification and high ground water level, the dimensions and configuration of the waste tank has been revised as follows:



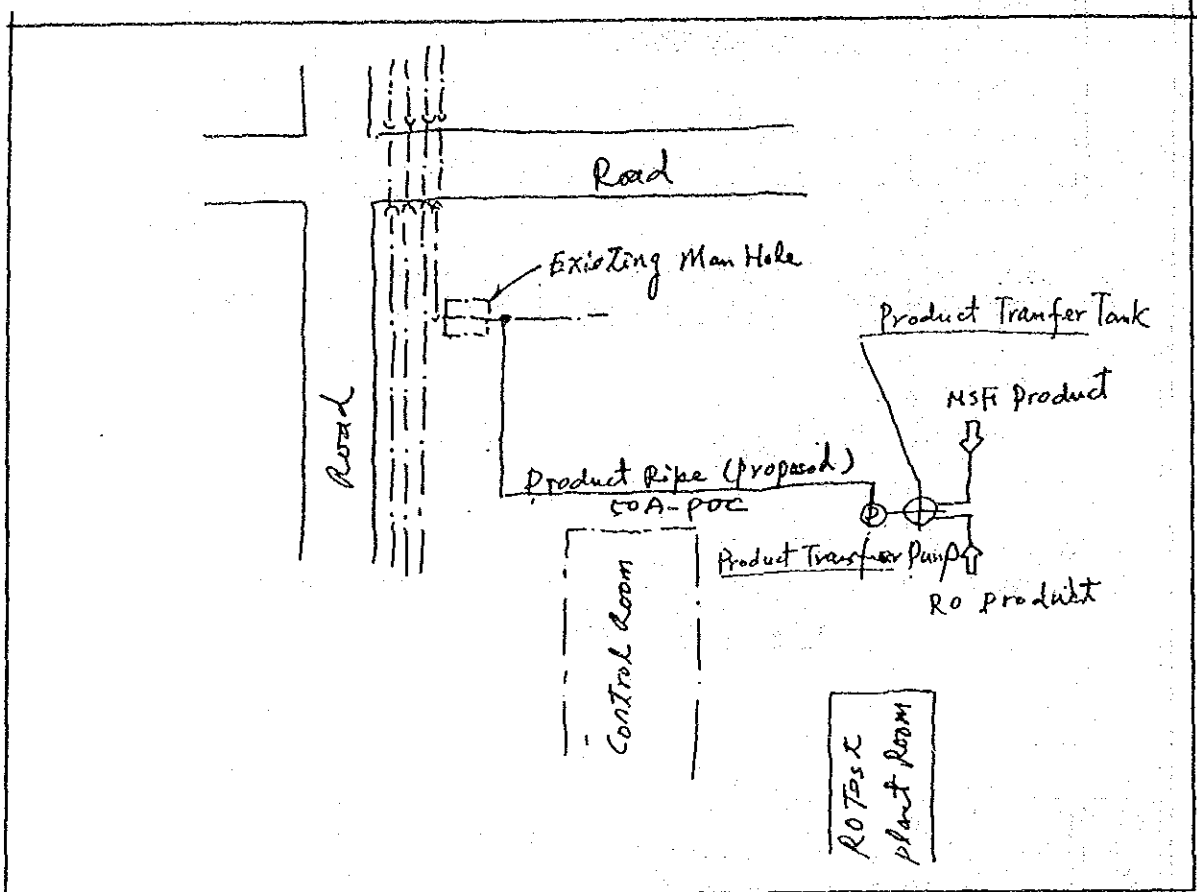
52X36 (52X36) 150-7C E7C

4. Product Transfer

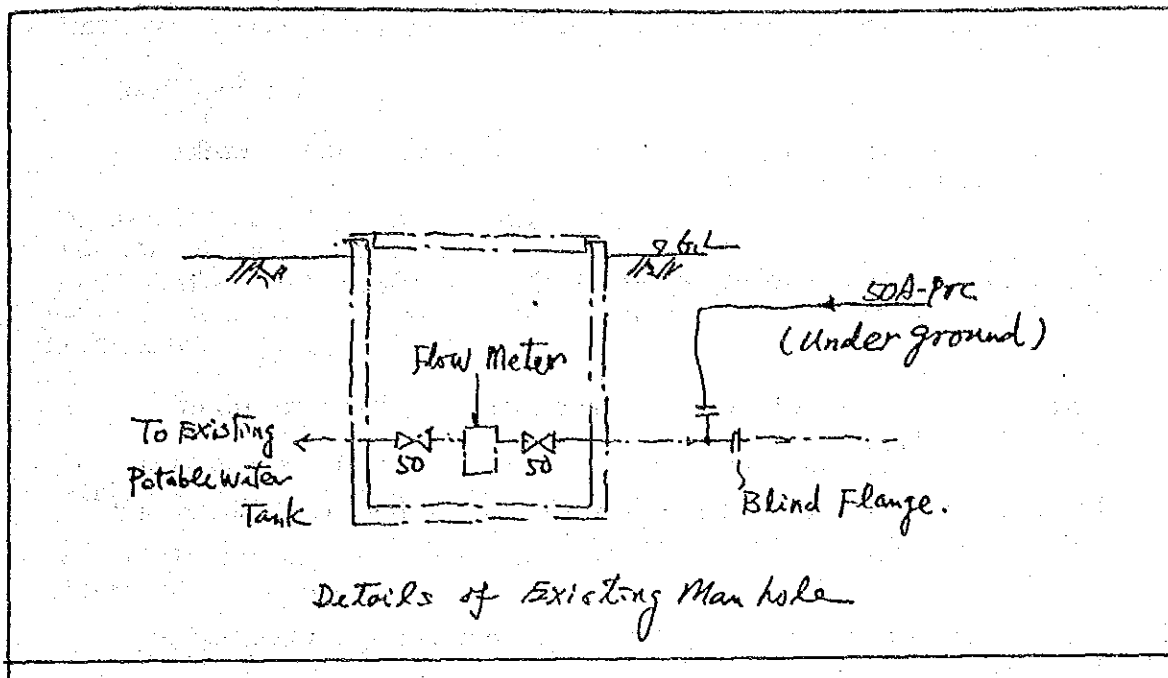
4.1 Products from MSF test plant and RO test plant will be transferred to the existing potable water tank as agreed after confirmation of the quality of water by SWOC. Products shall be connected to the existing potable water pipe of 50A.

4.2 Flow diagram of the product from MSF and RO test plant is indicated as Appendix (5)

4.3 Location of the connection to the existing potable water line is as follows:



コクヨ コピ-15D (52X36)



5. Power Supply to the Test Plants
 - 5-1 Power supply to MSF test plants
To MSF motor control center
45KVA, 220V, 3phase, 3wire, 60Hz
 - 5-2 Power supply to RO test plant
80KVA, 220V, 3phase, 3wire, 60 Hz
 - 5-3 Power supply to the ancillary facility
15KVA, 220V, 3phase, 3wire, 60 Hz
 - 5-4 Power supply to the laboratory equipment and the lighting facility
shall be referred as Dwg No.
 - 5-5 JICA will supply a single line diagram for electrical dis-
tribution panel for the test plants area.

6. The sketch of the product water facilities is attached as Appendix ()
7. The detail of the level controller of the product water tank is attached as Appendix ()
8. The sketch of the heating device of the fuel oil pipeline is attached as Appendix ()
9. Instrumental air supply from RO test plants to MSF test plants is shown as Appendix ()
10. The recommendation from the contractor on the HAVC dust works and the solution are attached as Appendix ()
11. The following advices on the laboratory devices are attached as Appendix ()
 1. Some comments on specification of laboratory furniture.
 2. Plumbing of gas for the instrumental analysis room.
 3. Ventilation for ICP in the room R-05.
 4. Foundation detail for the lathe.

12. ADDITIONAL CABLES FOR POWER, CONTROL AND INSTRUMENTS:

Upon requested by SWCC in 1987, the original plots plan of the test plant has been revised. Cable length between control panel to the respective skids and equipment has been extended in Appox. 20m.

Regarding RO test plant, each cables have already been cut according to the original plot plan as in order to minimize construction work at site. Therefore, extended cables shall be replaced with new cable.

The contractor shall be supplied necessary cables as listed below:

Power cable	CV	2.0 SG-3c	1105m
	"	3.5sg-3c	205m
	"	14sg-3c	198m
CONTROL CABLE	CVV	2sg-2c	775m
	"	2sg-5c	255m
INSTRUMENT CABLE	CVVS	2sg-5c	99m
	"	2sg-3c	198m
Special Cable			
for PH meter			47m
for ORP meter			52m
for CR meter			47m/52 each

Furthermore, cable trays are also shortage of length as listed below:

Width of the tray	Additional length
300mm	20m
150mm	5m

For details of cable tray, please refer to DWG No DT9A-2N03-E42I-Panel and cable tray layout issued by Kurite Water Industries Ltd. which has been submitted by JICA "JAPAN-SAUDI ARABIA RESEARCH PROJECT OF SEA WATER DESALINATION-REVERSE OSMOSIS PROCESS TEST PLANT OPERATION AND MAINTENANCE MANUAL)

13. In accordance with the queries from the contractor piping assembly and wiring layout attached as Appendix-7 and 8.
14. Materials for approval submitted by the contractor, the comment is attached as Appendix-10.
15. Due to the modifications and revisions after site investigation and mutual discussion, the revised bill of quantity for auxiliary facility is attached as Appendix-12.

Furthermore, cable trays are also shortage of length as listed below:

Width of the tray	Additional length
300mm	20m
150mm	5m

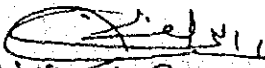
For details of cable tray, please refer to DWG No OT9A-2N03-E421-Panel and cable tray layout issued by Kurite Water Industries Ltd. which has been submitted by JICA "JAPAN-SAUDI ARABIA RESEARCH PROJECT OF SEA WATER DESALINATION-REVERSE OSWOSIS PROCESS TEST PLANT OPERATION AND MAINTENANCE MANUAL.)

The SWCC agreed upon the following exemption clause.


JICA have made their best efforts and will continue to do so hereafter, in providing technical advice to SWCC and the contractor for the implementation of the project.

However technical advices provided and will be provided hereafter by technical advisors of the JICA shall be exempted from the liability of the fault during the course of construction and installation of the research center project.

DATE : 15th of January 1989
Place : Riyadh



Abdullah A. Al-Azzaz
Director General
Dept. of Research &
Technical Affairs



Takeo Sakamoto
Leader of Technical Advisors, JICA

ATTENDANTS:

SWCC

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(Research & Technical Dept)

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(Construction Dept.)

MR. AWADALLA AL HARBI
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AL SOAIB EST

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(MSF Electrical)

2. Packing List of Additional Laboratory Equipment

JAPAN INTERNATIONAL COOPERATION AGENCY

P.O. Box 216, Mitsui Bldg., Shinjuku-ku, Tokyo, Japan.

PACKING LIST

Consigned to : SALINE WATER CONVERSION CORPORATION No :
 YANBU
 WATER DESALINATION STATION OF MADINAH & Date : JULY. 2, 1988
 P.O. BOX 30058 YANBU INDUSTRIAL ZONE,
 KINGDOM OF SAUDI ARABIA Shipped per " ENCOURAGEMENT "

Shipping Mark : from YOKOHAMA, JAPAN
 SWCC to YANBU, SAUDI ARABIA
 SIDE MARK via DIRECT
 TECHNICAL COOPERATION on JULY. 2, 1988
 BY THE GOVERNMENT OF JAPAN
 YANBU
 C/No. 1/8
 MADE IN JAPAN

C/Nos.	Description of Goods	Quantity	Weight		Measure- ment (M3)
			net (KGS)	gross (KGS)	
	EQUIPMENT FOR TECHNICAL COOPERATION OF J.I.C.A. =====				
C/NO. 1/8	TOTAL : 8 CASES - Details are as per Attached Sheets -		1,536 KGS	2,245 KGS	13.701 M3

E. & O. E

C/Nos.	Description of Goods	Quantity	Weight		Measure- ment
			net	gross	
No.1 (CASE)	9-4.1 Liquid chromatograph two pump Gradient LC-6A system consists of		(KGS) 295 KGS	(KGS) 535 KGS	(M3) 3.830 M3 209x123x149CM
	(1) Liquid pump, LC-6A	2 sets			
	(2) Column oven, CTO-6A	1 set			
	(3) Automatic sample injector SIL-6A	1 set			
	(4) Manual sample injector, No.7125	1 set			
	(5) UV-VIS spectrometric detector, SPD-6AV	1 set			
	(6) Refractive index detector RID-6A	1 set			
	(7) High-sensitive filter unit	1 set			
	(8) He degasser unit, DGU-1A	1 set			
	(9) Mixing chamber	1 set			
	(10) 3-pump interface PC-11L	1 set			
	(11) PC-16L interface for SPD-6AV	1 set			
	(12) PC-13L interface for CTO-6A	1 set			
	(13) System controller SCL-6A	1 set			
	(14) Sample vial 1.5ml for SIL-6A 100 pcs/set	1 set			
	9-4 2. Data processing apparatus				
	(1) Data processor unit CR-4AD	1 set			
	(2) Full key board	1 set			
	(3) Current loop interface	1 set			
	(4) 2-channel board	1 set			
	(5) Multiple terminal box	1 set			
	9-4 3. Spare parts				
	(1) Suction filter	1 pce			
	(2) Check valve (in)	1 pce			
	(3) Check valve (out)	1 pce			
	(4) Check valve kit	1 pce			
	(5) Plunger assy	2 pcs			
	(6) Bearing	2 pcs			
	(7) Plunger seal	10 pcs			
	(8) Line filter assy	1 pce			

- to be continued -

C/Nos.	Description of Goods	Quantity	Weight		Measure- ment
			net	gross	
	ITEM NO.		(KGS)	(KGS)	(M3)
	(9) Teflon gasket	1 pce			
	(10) Ferrule 1.6F 3 pcs/set	2 sets			
	(11) Nut 1.6MN	2 pcs			
	(12) Nut 1.6FN	2 pcs			
	(13) Coupling 1.6C	1 pce			
	(14) Adaptor 1.6A	3 pcs			
	(15) Plug 1.6P	3 pcs			
	(16) Ferrule, Teflon 1.6FT 5 pcs/set	2 sets			
	(17) Union 1.6U	1 pce			
	(18) Union 1.6UX	2 pcs			
	(19) Melty 1.6MT	2 pcs			
	(20) Coupling assy 1.6C	1 set			
	(21) Adaptor assy 1.6A	1 set			
	(22) Union assy 1.6U	1 set			
	(23) Union assy 1.6UX	1 set			
	(24) Melty assy 1.6MT	1 set			
	(25) Piping kit C assy	1 set			
	(26) D2 lamp, L613-KH	1 set			
	(27) W lamp	1 set			
	(28) Thermal chart paper	30 rolls			
	(29) Thermal head assy	2 pcs			
	(30) Floppy disk, 10 sheet/box	1 box			
	(31) Ink seat, black 10 sheet/box	1 box			
	9-4 5 Packed column.				
	(1) Zorbax ODS 4.6mm ϕ x25cm	1 pce			
	(2) Zorbax TMS 4.6mm ϕ x25cm	1 pce			
	(3) Zorbax SIL 4.6mm ϕ x25cm	1 pce			
	(4) Shim-pack HSG-50 7.9mm ϕ x50cm	1 pce			
	(5) Empty column	8 pcs			
	(6) Packing material, Zorbax BP-NH2 10g	2 sets			
	(7) Packing material, Zorbax BP-SAX 10g	2 sets			
	(8) Packing material, Zorbax BP-CN. 10g	2 sets			

- to be continued -

C/Nos.	Description of Goods	Quantity	Weight		Measure- ment
			net (KGS)	gross (KGS)	
	ITEM NO.				(M3)
	9-2 1. TOC Analyzer				
	(1) TOC Analyzer main body, TOC-500	1 set			
	(2) TC catalyst set	5 sets			
	(3) TC catalyst set for high sensitivity	2 sets			
	(4) IC filler set	5 sets			
	(5) Recorder	1 set			
	(7) Piping adaptor set, nylon tube 20 m	1 set			
	(8) Pressure regulator	2 sets			
	(9) Absorption type gas purifier	2 sets			
	(10) Soda-line 500g	5 sets			
	(11) Silicon grease 50g	2 pcs			
	9-2 2. Micro syringe 10, 50, 100 each 3 pcs	1 set			
	9-2 3. Spare parts				
	(1) Sleeve set, 6F-T	1 pce			
	(2) Syringe packing	5 pcs			
	(3) O-ring, 4CP 10A	5 pcs			
	(4) Joint	3 pcs			
	(5) Combustion tube for TC	1 pce			
	(6) Reaction tube for IC	1 pce			
	(7) Catalyst, PT	2 pcs			
	(8) Printer paper 5 pcs/box	2 boxes			
	(9) Recorder paper 10 pcs/box	2 boxes			
	(10) Cartridge pen, red	10 pcs			
No. 2 (CASE)	9-2 1. TOC Analyzer	2 pcs	120	180	0.490 M3
	(6) Air cylinder, 10 liter		KGS	KGS	166x59x50CM
No. 3 (CASE)	9-3 1 Research microscope		550	720	5.497
	(1) Microscope AHBS, with S plan ACH objective 10x, 20x, 40x, 100x	1 set			246x152x147
	(2) Phase contrast attachment AH2-PC-2 With S plan ACH phase objective 4x, 10x, 20x, 40x, 100x	1 set			

-- to be continued --

C/Nos.	Description of Goods	Quantity	Weight		Measure- ment
			net	gross	
	ITEM NO.		(KGS)	(KGS)	(M3)
	(3) Reflected light fluorescence attachment, AH2-RFL	1 set			
	(4) Camera apparatus				
	a. Large format camera adaptor AH2-DL	1 set			
	b. 35mm camera back, C-35AD4	2 sets			
	c. Polaroid camera back, PM-CP-W	1 set			
	d. Fuji photorama camera back	1 set			
	(5) Eyepiece 10X	1 pce			
	(6)a. Objective lens 2X	1 pce			
	4X	1 pce			
	b. Objective lens for AH2-RFL				
	(1) 10X	1 pce			
	(2) 20X	1 pce			
	(3) 40X	1 pce			
	(4) 100X	1 pce			
	c. Objective for AH2-PC-2				
	(1) 40X	1 pce			
	(2) 100X	1 pce			
	9-3 2. Adjustment instruments				
	(1) Stereo microscope VMF-4S	1 set			
	(2) Hand press HP	1 set			
	9-3 3. Consumption goods				
	(1) Mercury burner, HBO-200W	4 pcs			
	(2) Silicon immersion oil, 50CC	1 pce			
	9-6 1. Filtration apparatus				
	(1) Filter holder, XX4304700	2 pcs			
	(2) 20 liter pressure tank, XX6700125	1 pce			
	(3) 1/4" nipple, XX6700125	3 pcs			
	(4) Ball valve, YY2029348	1 pce			
	(5) Tease, XX6700101	1 pce			
	(6) Quick disconnect, XX6700030	1 pce			
	(7) Pressure gauge ZDPG0700J	1 pce			
	(8) Filter holder for gas, XX40025SL	1 pce			

- to be continued -

C/Nos.	Description of Goods	Quantity	Weight		Measure- ment
			net	gross	
	ITEM NO.		(KGS)	(KGS)	(M3)
	(9) Filter, SLFG025XS	1 box			
	(10) Release valve, XX6700024	1 pce			
	(11) Tube, LBTUBE300	1 pce			
	(12) Tube, XX6702506	1 pce			
	(13) Pincette, XX6200006	1 pce			
	(14) Filter, HAWPO4700	3 sets			
	9-7 1. Autoclave, SP-21	1 set			
	9-7 2. Transformer for above optional accessory	1 pce			
	9-7 3. Stacking metal fitting rack	1 set			
	9-8 1. Water sampler				
	(1) SPC totalcount sampler MSPC00025	4 sets			
	(2) Millex filter unit, SLHA0250S, 50 pcs/set	1 set			
	9-9 1. Jar tester, 50-820	1 set			
	9-10 1. Cooling thermo-bath, CTE-31	1 set			
	2. Transformer for above	1 pce			
	9-11 1. Immersion cooler, BD-22	1 set			
	2. Transformer for above	1 pce			
	9-12 1. Centrifuge, H-103N	1 set			
	2. 50 ml tube for above	20 pcs			
	9-13 1. Shaker, SA-31	1 set			
	2. Transformer for above	1 pce			
	9-14 1. Standard thermometer No.0 to No.7 (8 pcs/set) with calibration certificate	1 set			
	9-15 1. Aneroid barometer with Japan meteorological agency's certificate	1 set			
	9-16 1. Ice maker, F-120B, 110V	1 set			

- to be continued -

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(6)

C/Nos.	Description of Goods	Quantity	Weight		Measure- ment
			net	gross	
	ITEM NO.		(KGS)	(KGS)	(M3)
	9-17 1. Platinum crucible with cover 30ml, 30g	1 set			
	2. Platinum evaporating dish 150ml, 55g	1 set			
No. 4 (CASE)	9-5 1. (1) Coulter counter Model: ZM	1 set	46 KGS	80 KGS	0.593 M3 103x67x86CM
No. 5 (CASE)	9-5 1. Coulter counter		35 KGS	70 KGS	0.374 M3 83x60x75CM
	(1) Standard accessory for ZM A. beaker 250ml round bottom	5 pcs			
	(2) Aperture tube, 20	1 pce			
	(3) Aperture tube, 100	1 pce			
	(4) Aperture tube, 560	1 pce			
	(5) Standard sample, 1	1 pce			
	(6) Standard sample, 10	1 pce			
	(7) Standard sample, 70	1 pce			
	(8) Printer	1 set			
	9-5 2. Consumption goods				
	(1) Printer paper	5 rolls			
No. 6 (CASE)	9-5 1. Coulter counter		120 KGS	130 KGS	0.246 M3 100x
	(1) Standard accessory for ZM B. Distillation water 20:1	5 pcs			
No. 7 (CASE)	9-5 1. Coulter counter		120 KGS	130 KGS	0.246 M3 100x39x63CM
	(1) Standard accessory for ZM B. Distillation water 20:1	5 Pcs			
No. 8 (CASE)	1. IC500PS Ion chromatograph	1 set	250 KGS	400 KGS	2.425 M3 142x122x140CM
	2. DS50S Data processing system	1 set			
	3. 3396A Integrator	2 sets			
	4. Parts				
	(1) Anion column set	2 sets			

- to be continued -

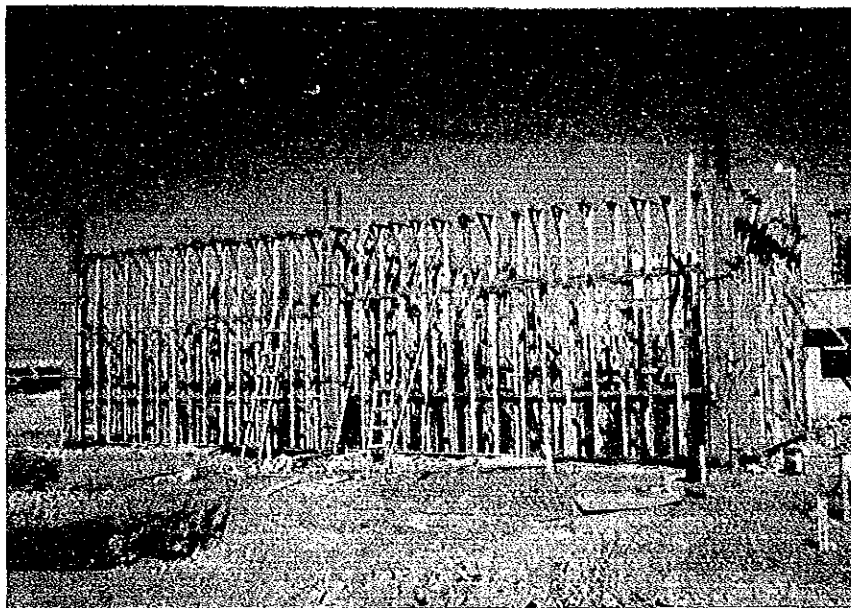
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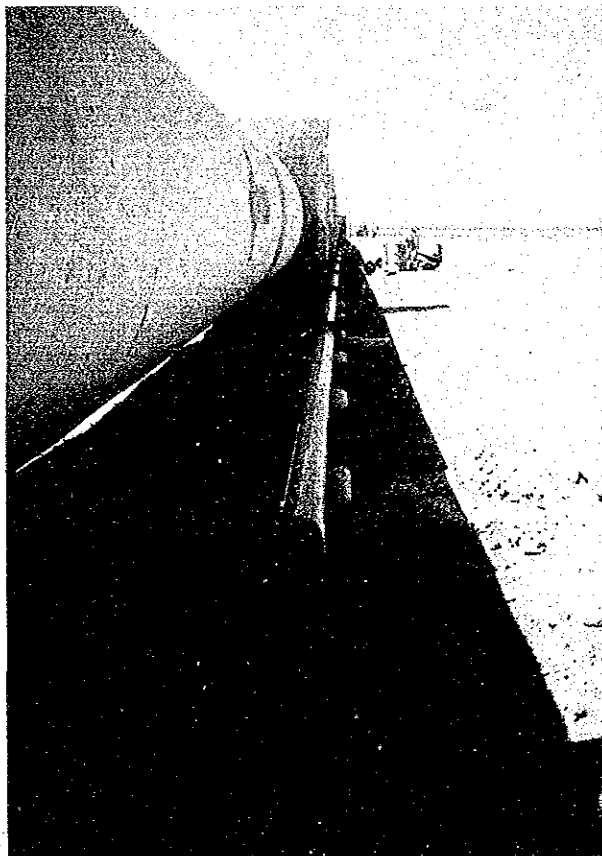
C/No.	Description of Goods	Quantity	Weight		Measure- ment
			net	gross	
			(KGS)	(KGS)	(M3)
	(2) Anion pre-column	2 pcs			
	(3) Cation column set	2 sets			
	(4) Cation pre-column	2 pcs			
	(5) Injection valve disk	3 pcs			
	(6) Injection valve sheet	2 pcs			
	(7) Plunger seal	2 pcs			
	(8) Filter (for column)	2 pcs			
	(9) Column guard	2 pcs			
	(10) Syringe kit	2 pcs			
	(11) Plastic tube	1 pce			
	(12) Line filter	2 pcs			
	(13) Bowlpen (for DS50S)	10 pcs			
	(14) Roll paper (for DS50S)	10 pcs			
	(15) Roll paper (for 3396A)	10 pcs			
	TOTAL : 8 CASES		1,536 KGS	2,245 KGS	13.701 M3

3. Photographs

Photographs of Construction Work



Additional building for test plants (RO module room)



Pipeline of non-sterilized seawater



Pipeline of non-sterilized seawater
(underground)

JICA