

(6) Fixing Devices

Fixings shall be as recommended by the manufacturer to give adequate support to the units in regards to their position, size and weight. The fixings shall be capable of withstanding the design wind load and any operating forces on the windows.

Materials used for anchors, fastenings, fixings and the like should be corrosion-resistant and to the actual requirements.

(7) Hardware

Hardware items containing bolts, latch bolts, catches or other locking devices are to be supplied complete with the companion fittings with which the bolts and the like engage (e.g. with striking plate, staples).

Handles and knobs which are screwed on from the rear are to be supplied complete with caps for the inside.

Ironmongery articles requiring lubrication from time to time must be designed to facilitate such lubrication.

All metals used in hardware shall be rustproof or rustproofed.

6.3 Execution

6.3.1 Protection

All surfaces which are visible in complete work shall be protected during fabrication. Protecting materials shall be removed on completion of the Works and upon approval of the Engineer. All surfaces shall be cleaned as necessary.

6.3.2 Cold formed

Cold formed work shall be free from warping, buckling and fractures. Bends shall be formed with a brake press or by cold rolling.

6.3.3 Corners

Generally corners to be mitred junctions of identical sections.

Corners to aluminium windows doors and screens to be formed by means of accurately formed slots and tenons, and corners of outer frames to be caulked with suitable nonsetting gun grade mastic.

#### 6.3.4 Holes

Work in connection with cutting, holing, riveting and bolting shall comply with B.S. 448, Part 5. Holes shall be formed without distortion of surrounding metal.

#### 6.3.5 Accuracy

All components shall be accurately manufactured and assembled to the correct shape and size and fitted in accordance with the drawings.

An accurate fit shall be ensured using clamps and jigs where practical, or use tack welds for temporary attachment, where jiggling is not practical.

Clear dimensions of openings for doors and windows shall be taken by the Contractor, prior to fabrication.

#### 6.3.6 Welding

Surfaces shall be prepared by removing grease, dirt moisture and oxide from edges to be welded. Scale and residue from arc and power cutting shall be removed by machine or hand grinding.

Welding of steel shall be by one of the following :

1. gas welding complying with B.S. 693;
2. metal-arc welding complying with B.S. 1856;
3. projection welding to B.S. 2630;
4. seam welding to B.S. 2737.

The manufacturer shall ensure that weld joint with parent metal and weld metal shall be fully fused throughout with no inclusions, holes, porosity, or cracks.

Weld spatter shall be prevented from falling on surfaces of material which will be self finished, or visible in completed work.

Butt joints which are visible in completed work shall be ground to a smooth finish, flush to adjacent surfaces, and ensure complete removal of flux residues and slag.

#### 6.3.7 Assembling

Aluminium windows are assembled with mechanically clamped angles. Sliding windows are assembled with screwed angles. All windows and doors shall comply with B.S. 4873.

#### 6.3.8 Finished surfaces

Finished surfaces shall have a smooth, even texture and unless otherwise specified, sharp arises on visible surfaces shall be slightly rounded off or chamfered.

#### 6.3.9 Hardware

When ironmongery articles are part of products supplid by the manufacturer, the procedure given in the manufacturer's instructions shall be followed.

When ironmongery articles are covered by operating instructions supplied by their manufacturer, these instructions shall be passed on to both the contractor and the Supervising Agency. Hardware shall be installed and adjusted plubm, level and aligned to windows and companion fittings so that windows operate freely. All windows shall be tightly and properly sealed at joints.

Hardware articles must bear all over on their seating surfaces; articles to be recessed (e.g. striking plates, reinforcing plates, forends of locks and hinges) must, in addition, lie perfectly flush with the surface of the component to which they are fitted.

Recesses shall be made so that they give an accurate fit.

Doors and windows shall be cut exactly to size for the fittings of hardware articles. The fastening means (e.g. screws used fro fixing hardware articles to doors and windows) shall be of the type, material and size for the articles to be correctly fixed; when used with standard articles they shall conform to the provisions of the standards concerned.

## CHAPTER 7

### GLAZING WORK

#### 7.1 Applicable Publications

##### BS (British Standards)

952 Glass for glazing

##### (CP) Code of Practice

145 Glazing systems

152 Glazing and fixing of glass for buildings.

#### 7.2 Products

##### 7.2.1 Glass

Quality of glass shall comply with B.S. 952 and following specifications :

- clear plate glass, produced by the float process, quality GG.

##### 7.2.2 Glazing compounds and fixing accessories

The Contractor is to ensure that compounds, sealant and paint, which are to be used together are compatible.

Following B.S. are applicable : B.S. 4252 for two part polysulphide based sealant compound, and B.S. 3712 parts 1, 2 & 3 for Methods of tests for building mastics. Bedding materials are glazing compound or preformed glazing sealants. They shall be compatible with the method of glazing. Under no circumstances shall non-skinning compound, non-resilient type preformed sealers or preformed impregnated type gaskets be used. Materials shall not require painting and where exposed to view shall be of standard colours of the manufacturer's colour card.

Fixing accessories include glazing blocks, clips, nylon shims, angles, beads, setting blocks, and spacer strips shall be of standard type and corrosion-resistant.

#### 7.3 Execution

##### 7.3.1 Preparation

All rebates and grooves shall be clean, dry and unobstructed at time of sealing and glazing.

### 7.3.2 Installation

Glazing compounds, putties and springs, clips, distance pieces and setting blocks shall be provided in accordance with C.P. 152.

All external glazing shall be wind and watertight on completion.

The edge clearance shall be equal all round each pane, and not less than 3 mm for single glazing.

Any surplus backing or bedding compound shall be stripped as follows :

1. to top and side edges, flush with top of rebate bead or groove;
2. to bottom edge at an angle to avoid collection of water.

### 7.3.3 Fixing beads

For external glazing, outside beads shall be bedded to rebate on mastic and surplus stripped flush with frame. For internal glazing, beads shall be bedded dry to rebate and to glazing tape.

Unless otherwise specified, beads, screw and clamped fixings shall be supplied by the manufacturer of doors and windows.

### 7.3.4 Cleaning

All smears and excess compound and sealant shall be removed and the glass left clean inside and outside, and free from scratches.

### 7.3.5 Protection

All glass and fixing materials broken or damaged before practical completion shall be replaced.

## CHAPTER 8

### PAINTING WORK

#### 8.1 Applicable Publications

BS (British Standards)

Code of Practice (CP)

231 Painting of buildings

3012 Cleaning and preparation of metal surfaces

#### 8.2 Materials

##### 8.2.1 Primers

Steel Surfaces

Corrosion protection primers

Constituents :

- pigments (e.g. zinc chromate);
- binders (e.g. alkyd resin lacquers, epoxy resin lacquers, polyurethane lacquers).

Galvanized Steel Surfaces

Synthetic resin zinc chromate paint

##### 8.2.2 Synthetic Resin Varnishes (Pigmented Lacquers)

Alkyd resin paints.

Polymer resin paints, e.g. acrylic resin paints, polyvinyl chloride paints, alkali and acid resistant, but not resistant to solvents.

Polyurethane paints (PUR paints), single- and multi-component reaction paints, acid and condensate resistant to solvents and grease.

### 8.3 Execution

#### 8.3.1 Preparation of Materials

The manufacturer's instructions are to be followed when thinning paints and in no case shall thinners exceed 5 % by volume. In the case of polyvinyl acetate emulsion paint, undercoats shall be thinned with water to suit the porosity of the surface to be painted but in no case shall the water exceed 20 % by volume.

Paints shall be stirred regularly unless otherwise recommended by the manufacturer.

#### 8.3.2 Cleanliness

In all painting operations, including preparatory work, cleanliness is essential.

Furniture and components shall be protected by rags or polythene sheeting during painting operations.

#### 8.3.3 Climatic Conditions

No exterior or interior painting, finishing or sealing shall be carried out during periods of rain, sandstorms or high winds unless the areas concerned can be protected until the paint has dried.

#### 8.3.4 Application

Materials covered by processing instructions provided by the manufacturer are to be used according to these instructions. Paint, lacquer and varnish applications and coatings may be applied by hand or mechanically.

Paint, lacquer and varnish applications and coatings must adhere firmly and appear as a uniform finish without joins or streaks.

All paint, lacquer and varnish applications or coatings are to be carried out with uniform finish and proper flow in the case of varnish paints, using the specified materials in accordance with the following performance instructions.

If filling is necessary, the surfaces are to be covered all over with filling compound and smoothed down.

When two or more coats are applied, each preceding coat must be dry before the following coat is applied. This does not apply to wet-on-wet techniques.

Drying times stated by the manufacturer must be observed. Standing times must not be exceeded.

At doors, windows and skirtings, work must be finished off with sharp and straight lines.

### 8.3.5 Priming Coats

Priming coats shall be applied by brush or roller. Primer shall be worked into joints, angles and grain. Priming coats shall be of adequate thickness especially on sharp edges and shall be thinned slightly if necessary to suit surface porosity.

Any primed surfaces which have deteriorated on site or in transit shall be cleaned and touched up or rubbed down and re-primed.

All joinery surfaces to be painted shall be primed before components shall be cleaned and touched up or rubbed down and reprimed.

All joinery surfaces to be painted shall be primed before components leave the joiner's shop. Where components are primed on site they shall be primed immediately after approval.

When priming metal, a minimum drying time of 1 day shall be allowed.

Primer coats shall be executed in a manner suited to the absorbency of the surface, possibly with the addition of a suitable thinner.

### 8.3.6 Finishing Coats

Finishing coats shall be applied in a liquid, even film over all surfaces avoiding brush marks, sags, runs, orange-peel effect and other defects.

Where two hard gloss finishing coats are specified, the second coat shall be applied within 48 hours of the first coat.

Paint shall be applied by brush, roller or spray, whichever method is most suitable for the particular type of paint being used.

Spraying shall be carried out only with the approval of the Engineer.

All adjoining areas shall be masked and all necessary precautions taken to prevent contamination of adjoining areas by spray mist.

Adequate ventilation or air demand respirators shall be provided in areas where painting operations are being carried out.

### 8.3.7 Preparation of surfaces to be painted

#### Shop-coated Iron and Steel Surfaces

Shop coated iron and steel surfaces shall be stored out of contact with the ground in such manner and location as will minimize the formation of water-holding pockets, soiling, contamination and deterioration of the paint film. Such metalwork shall be protected from corrosion before and after installation by treating corroded areas immediately upon detection. Abraded or corroded spots on shop-coated surfaces shall be wire-brushed and touched up with material similar to the shop-coat.



#### Galvanized Steel Surfaces

Galvanized surfaces shall be solvent cleaned before receiving a primer coat.

#### Non-ferrous Surfaces

Non-ferrous surfaces shall be solvent cleaned and treated with an etching primer.

### 8.3.8 Paint Systems

#### Definitions

##### Wash Resistance

A coat is wash resistant if, after the drying time and hardening time appropriate to the coat has elapsed, it can be washed with sponge and water to which a neutral mild detergent has been added without the water becoming discoloured.

Paints and coating materials :

Dispersion type paints, oil paints, oil varnish paints, lacquers and varnish paints.

### 8.3.9 Interior coats for iron and steel surfaces

#### Synthetic Resin Varnish Paint (Pigmented lacquers)

A primer coat with synthetic resin zinc chromate paint.

An intermediate coat with synthetic resin zinc chromate paint according to Clause 9.2.2.

An intermediate coat with alkyd paint.

A final coat with alkyd paint according to Clause 9.2.4.

### 8.3.10 Exterior coats for iron and steel surfaces

#### Synthetic Resin Varnish Paint

A primer coat with synthetic resin zinc chromate paint according to Clause 9.2.2.

An intermediate coat with synthetic resin zinc chromate paint.

An intermediate coat with synthetic resin polyurethane paint.

A final coat with synthetic resin polyurethane paint Clause 9.2.4.



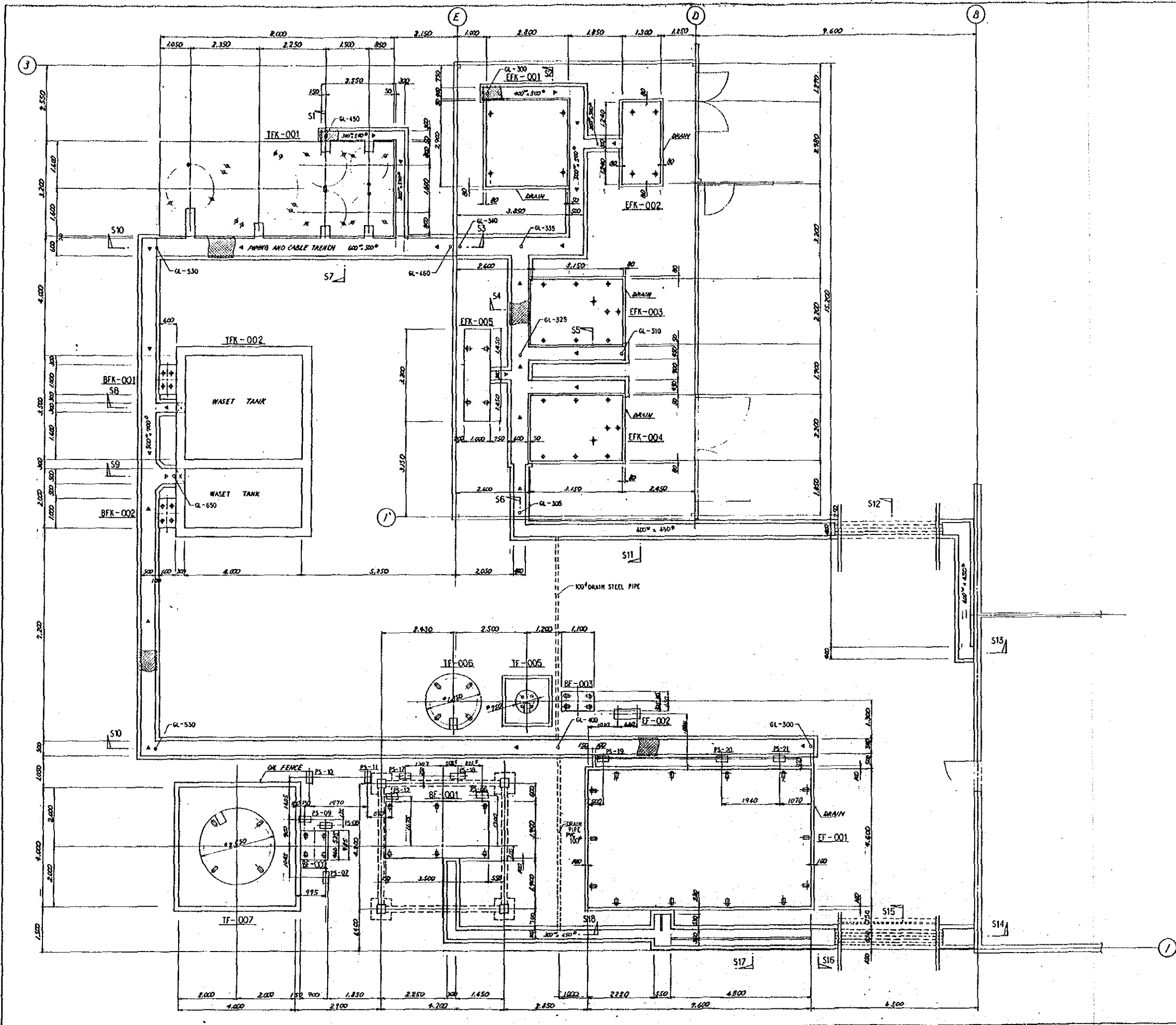
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D R A W I N G S

Drawing List

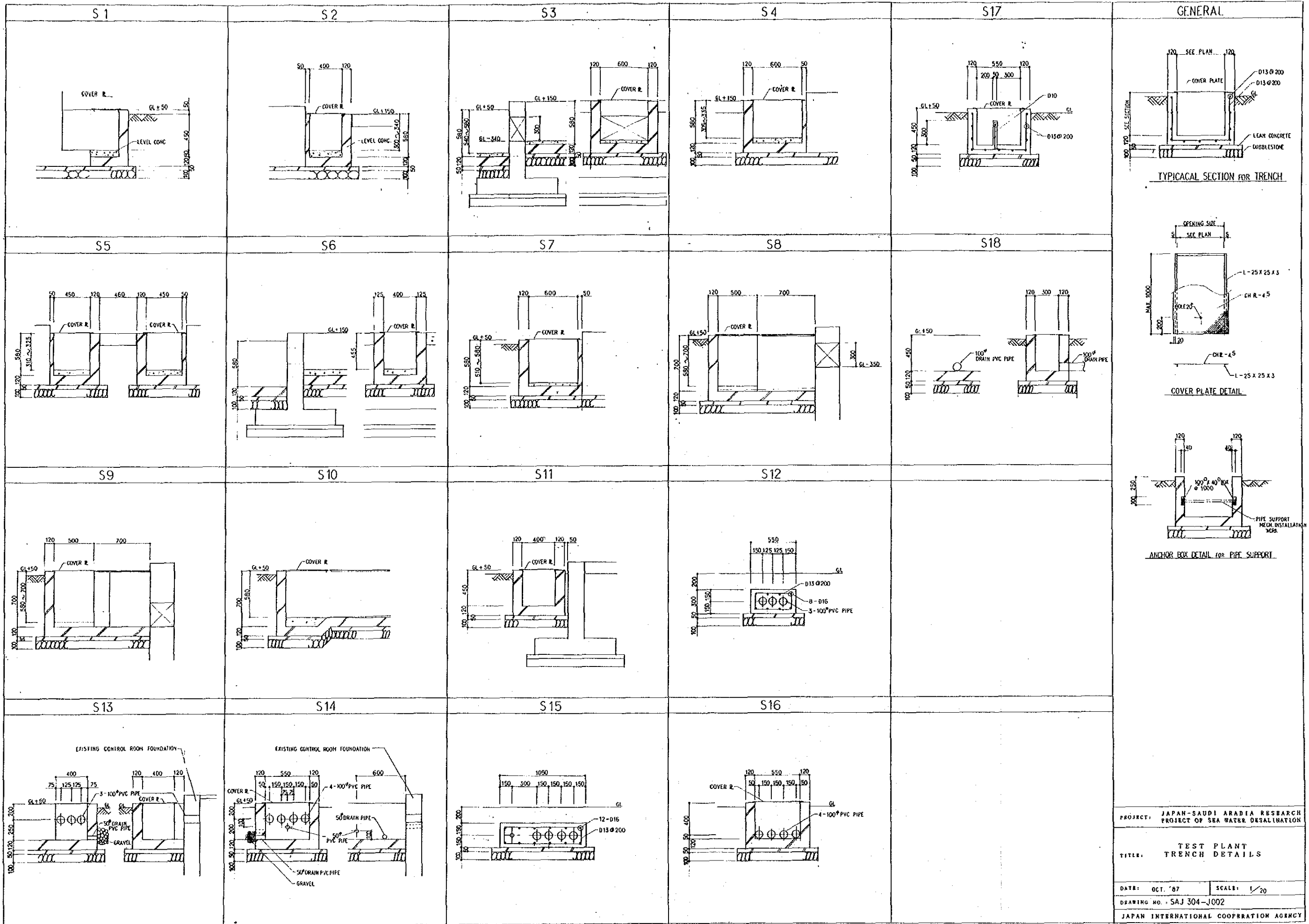
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SAJ 304-J002	TEST PLANT TRENCH DETAILS
SAJ 304-J003	TEST PLANT FOUNDATION DETAILS 1
SAJ 304-J004	TEST PLANT FOUNDATION DETAILS 2
SAJ 304-J005	TEST PLANT FOUNDATION DETAILS 3
SAJ 304-J006	TEST PLANT FOUNDATION DETAILS 4
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SAJ 304-J009	TEST PLANT FOUNDATION DETAILS 7



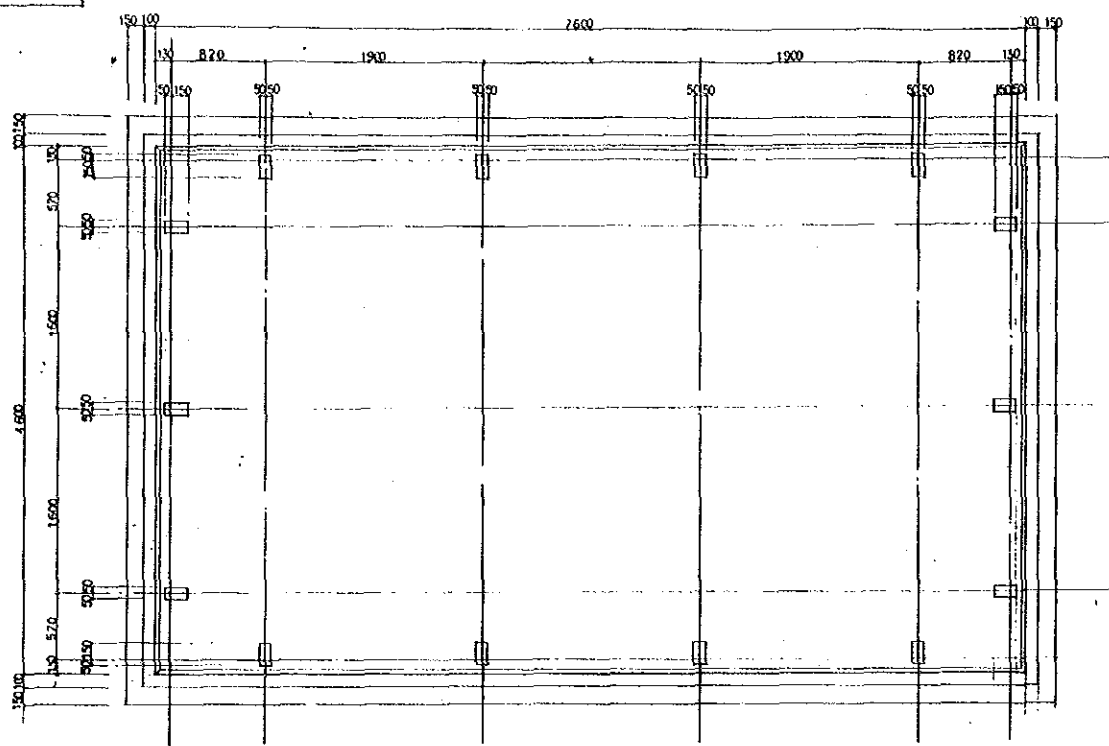
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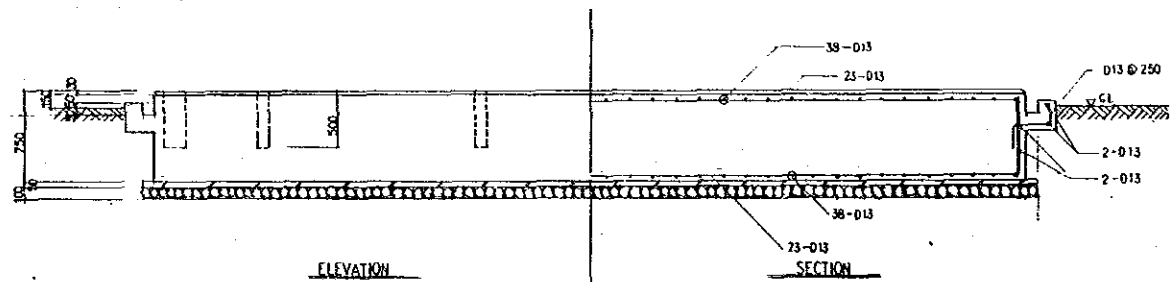
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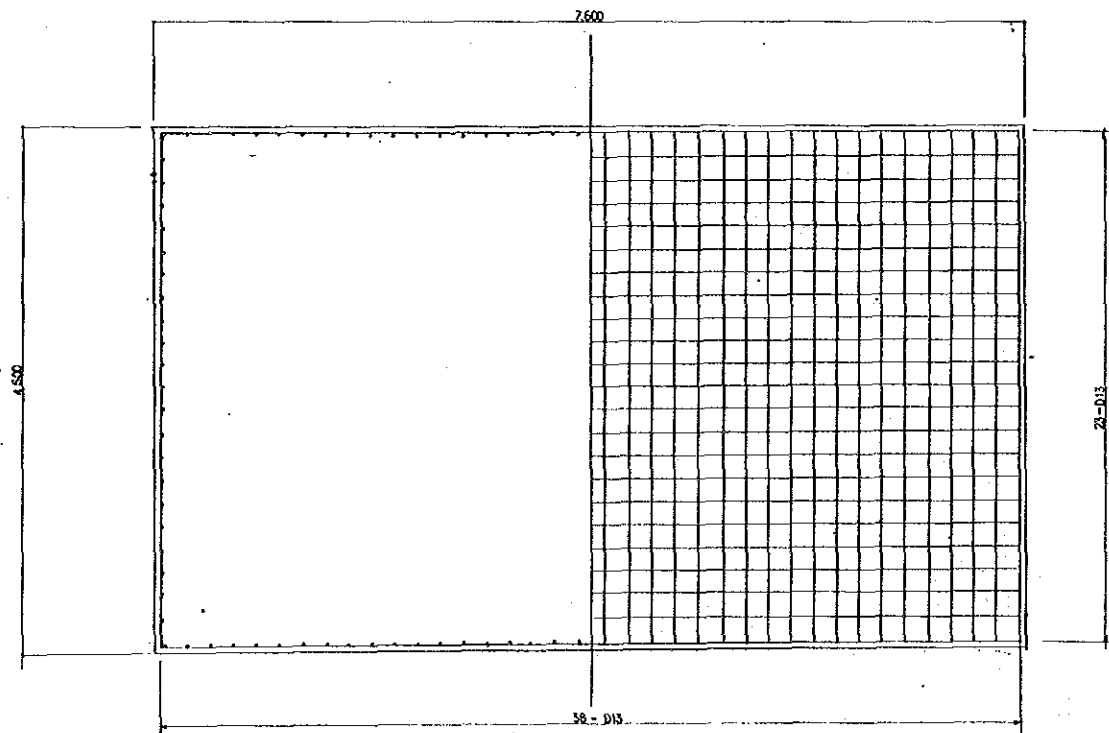


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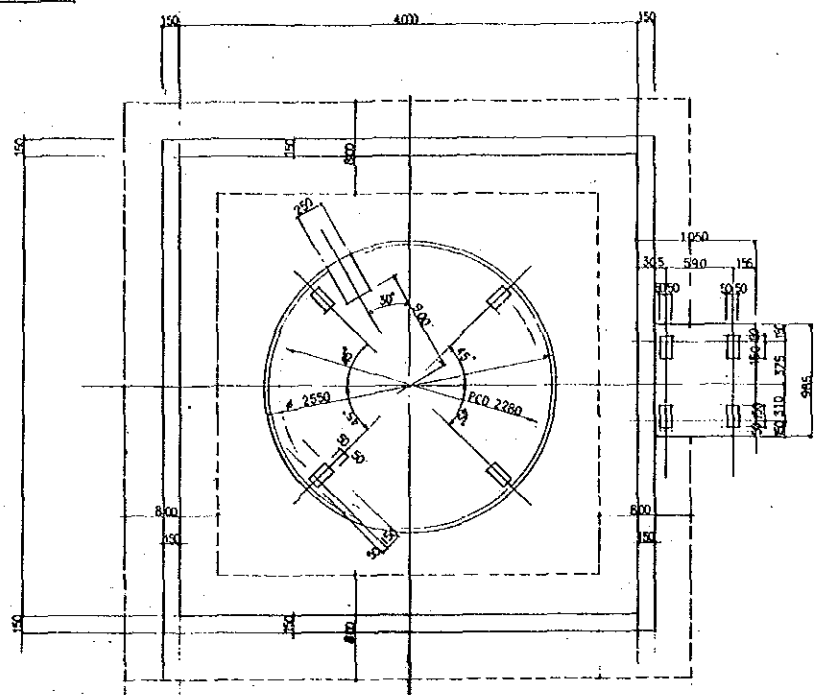
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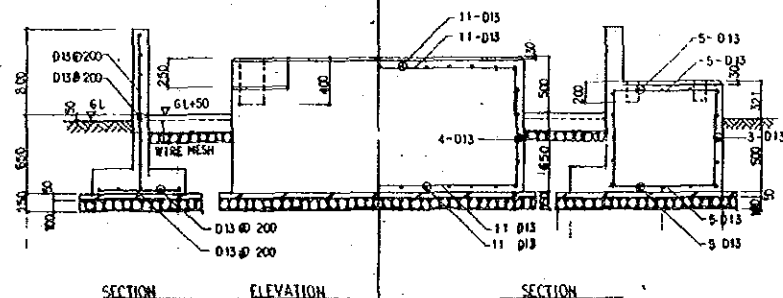


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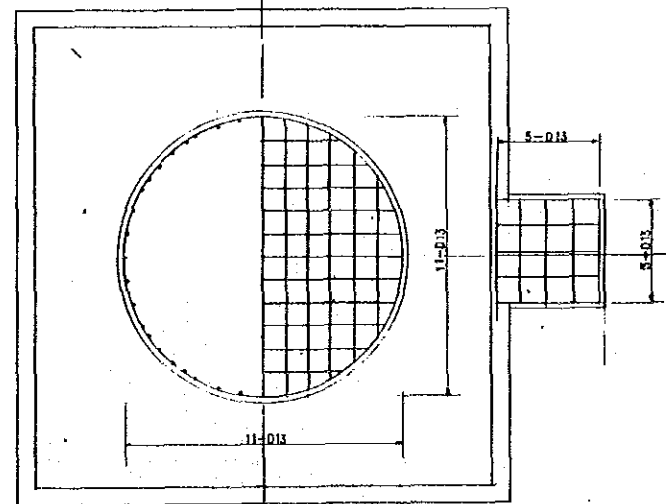
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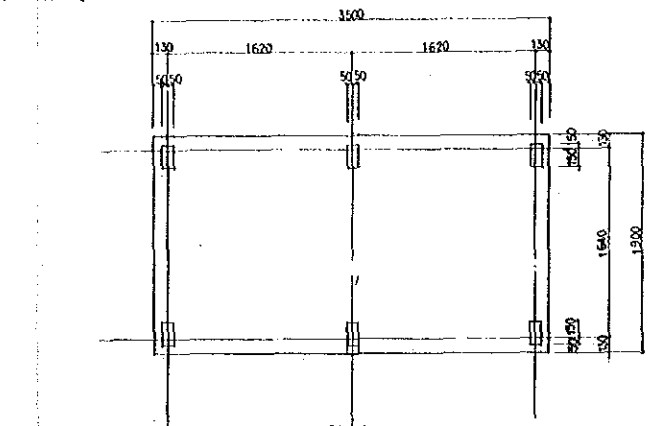
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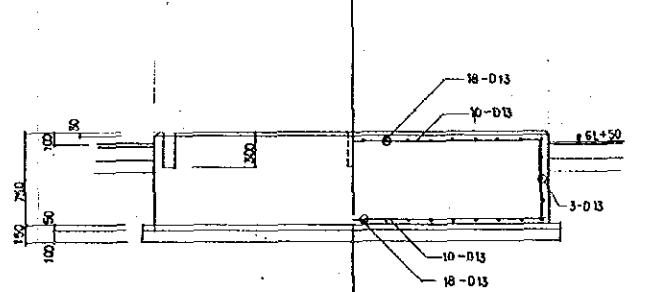


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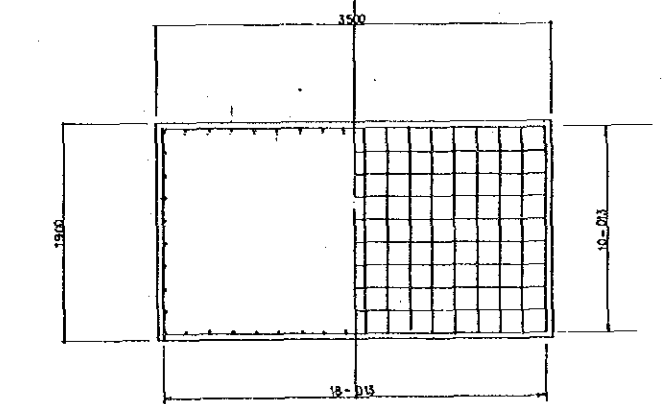


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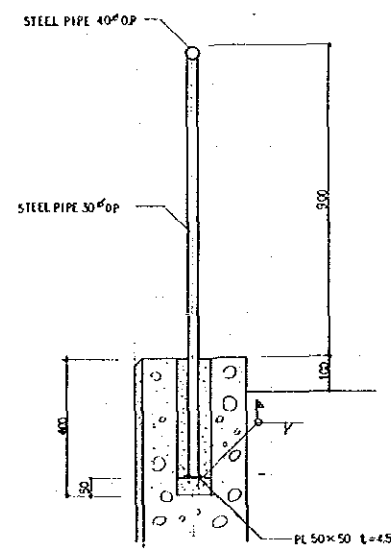
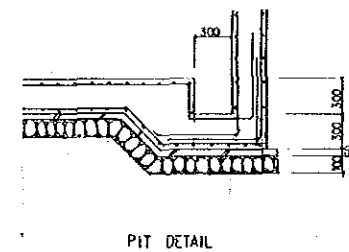
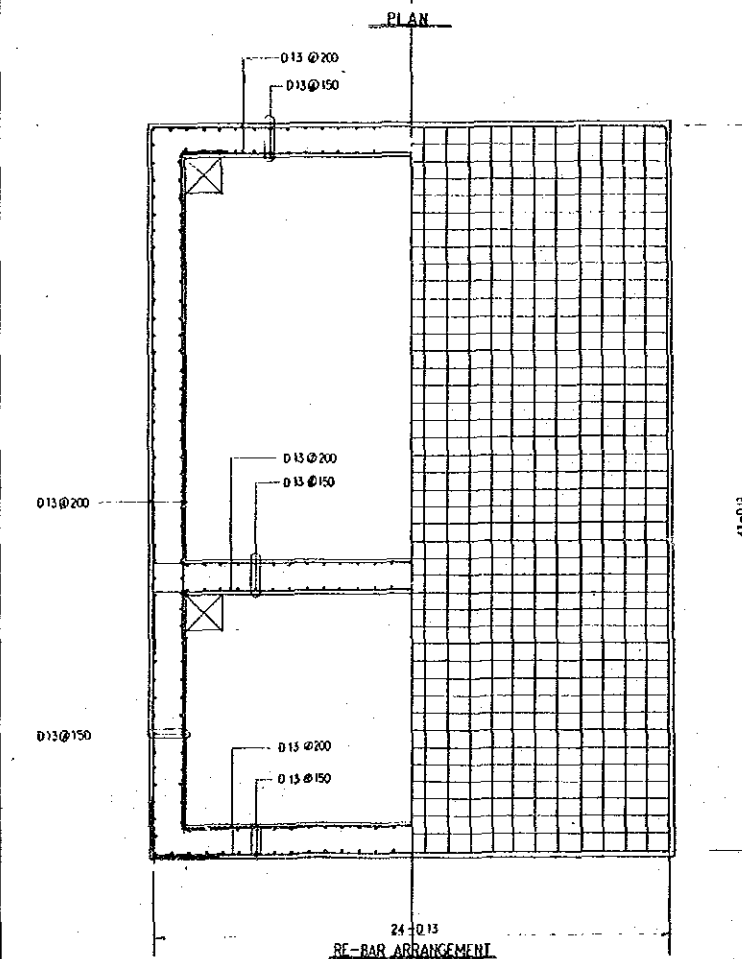
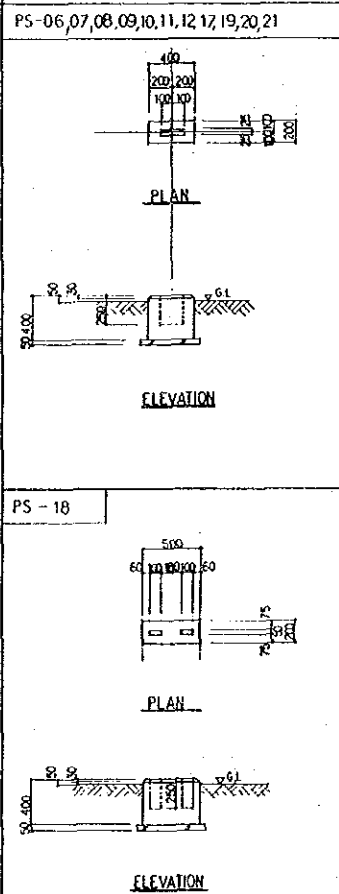
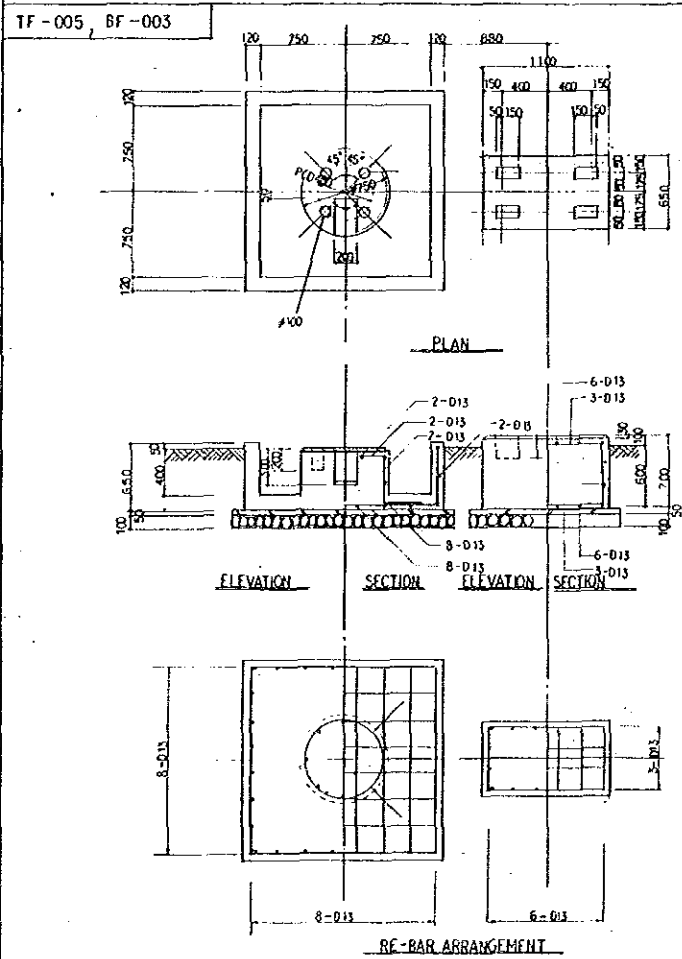
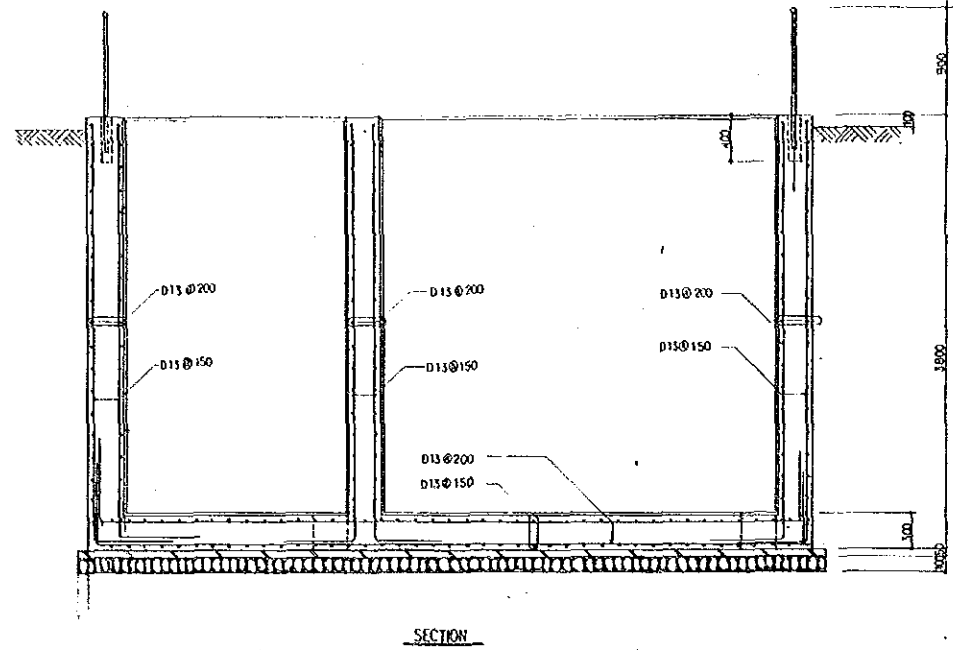
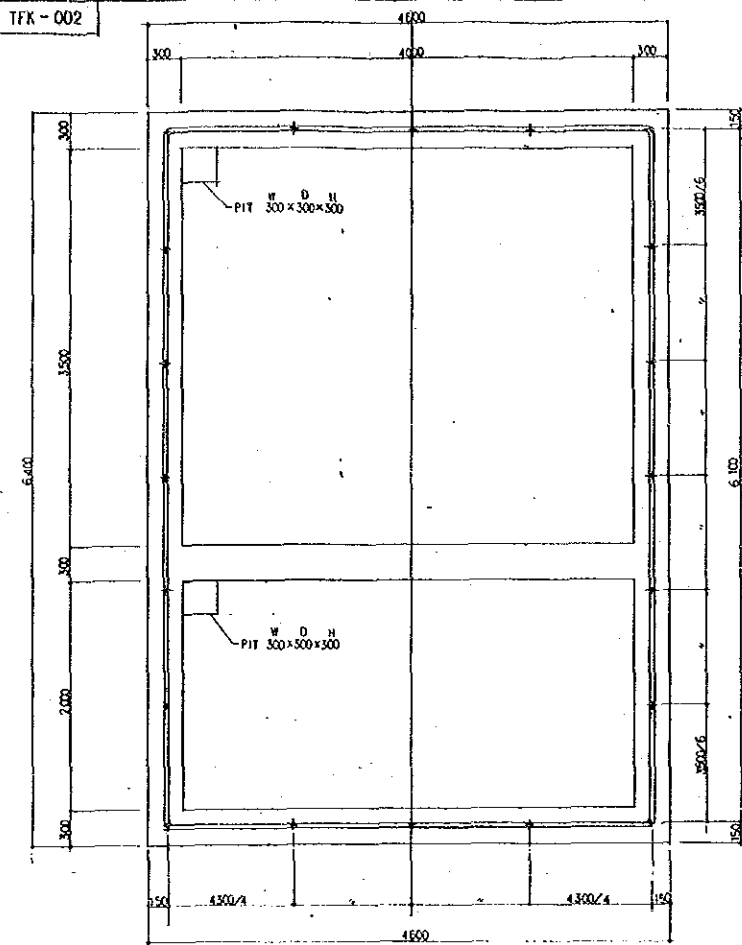
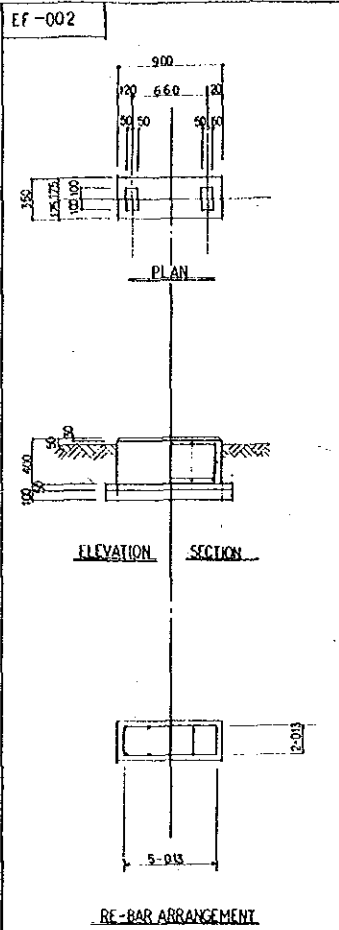
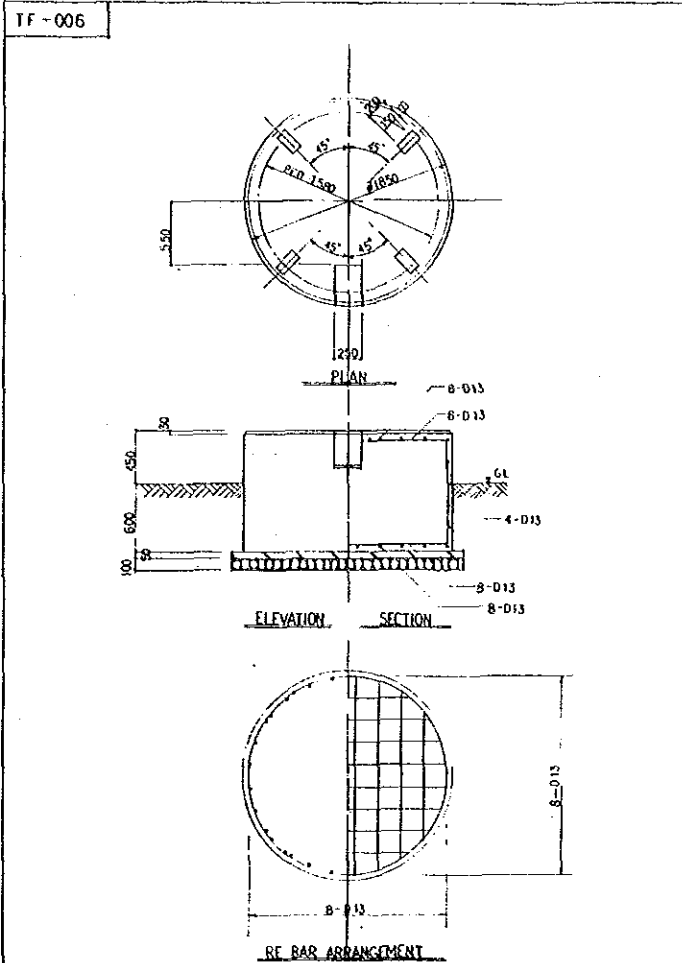
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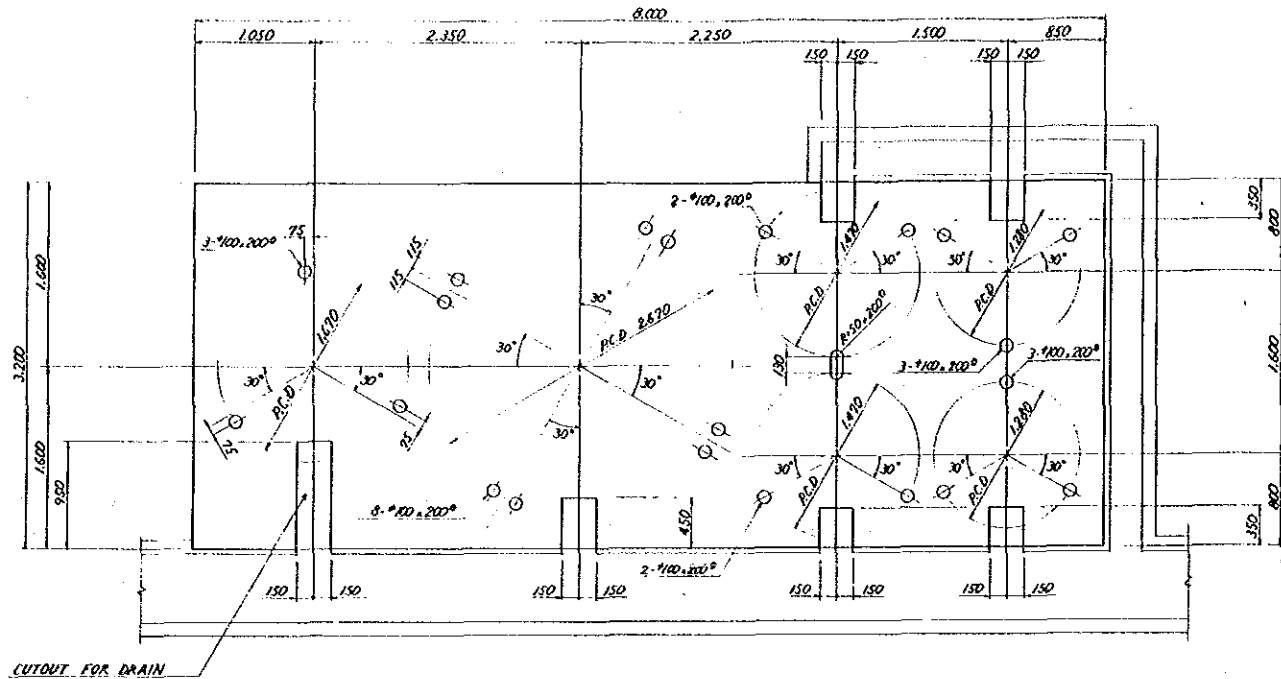
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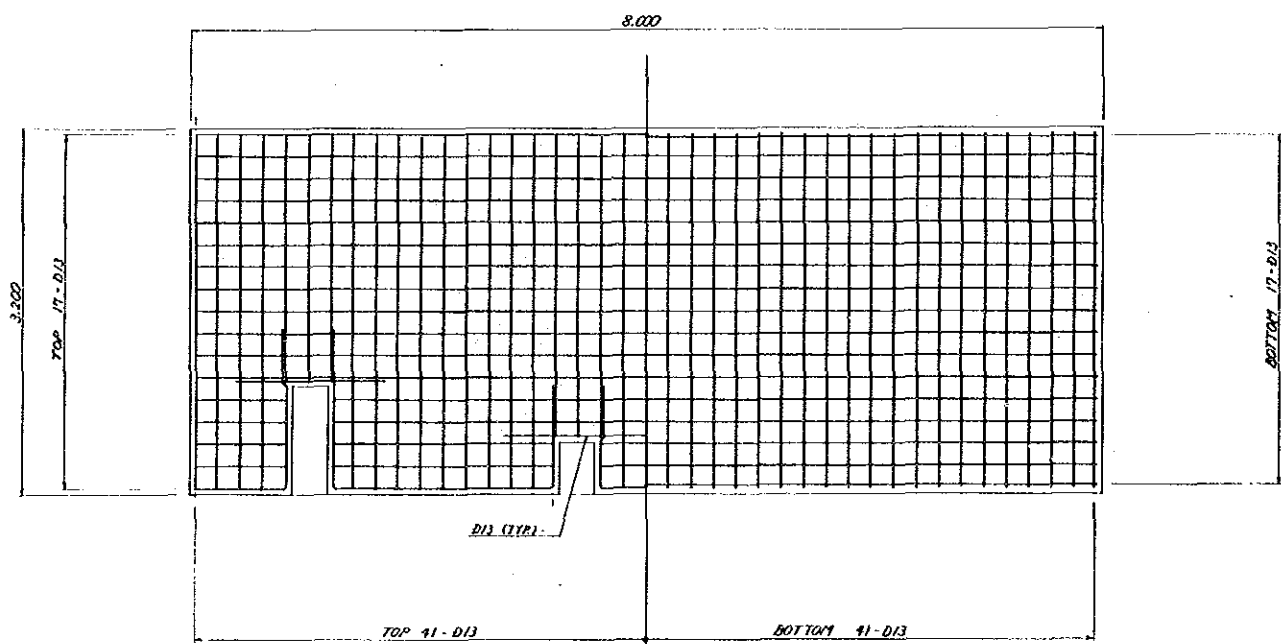


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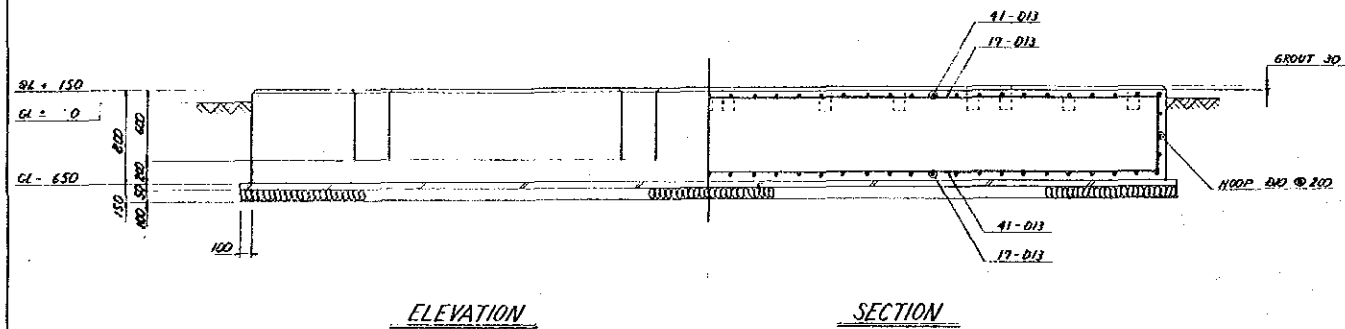
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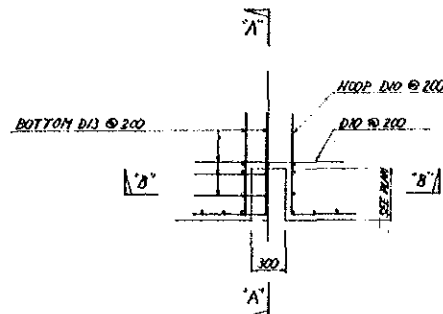


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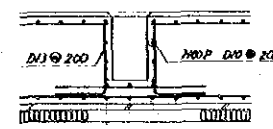


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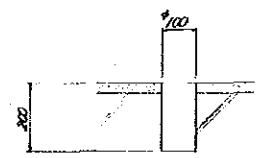
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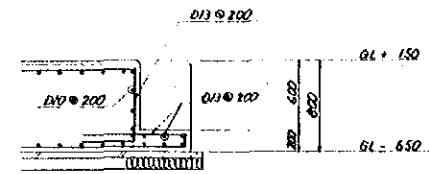
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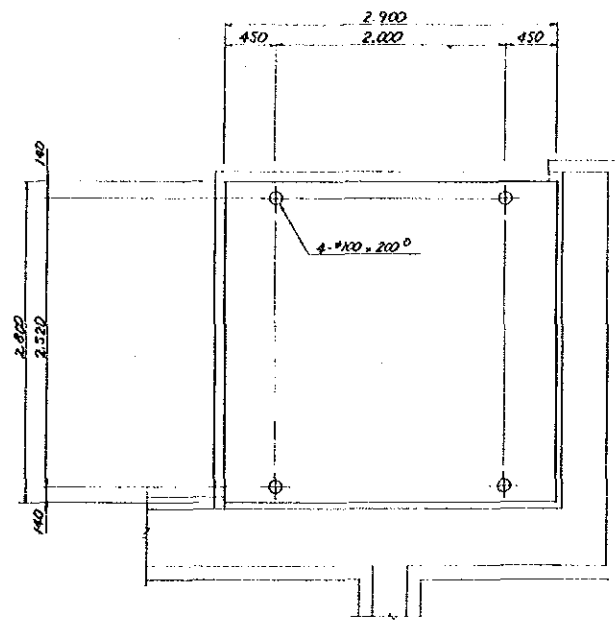
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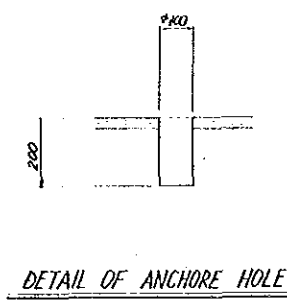
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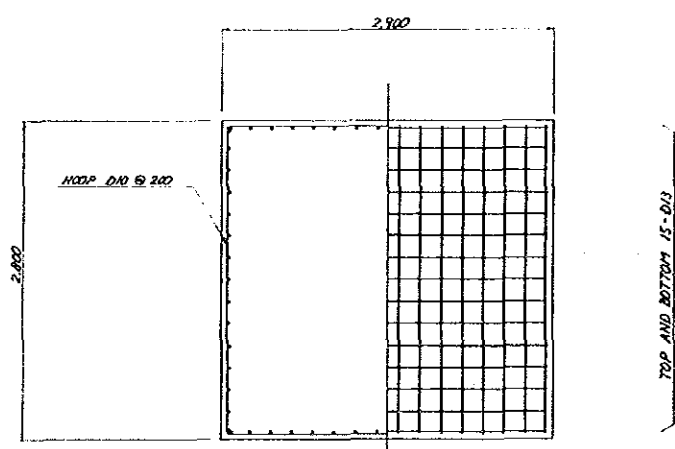
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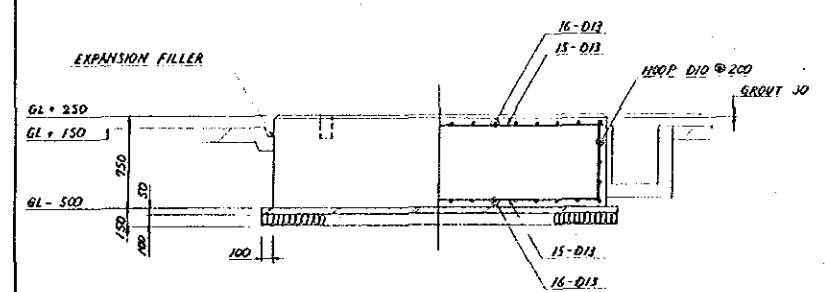
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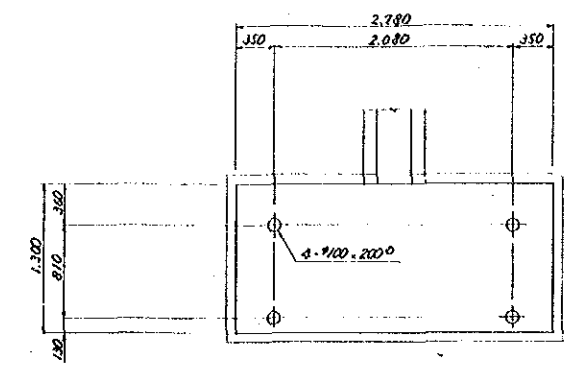


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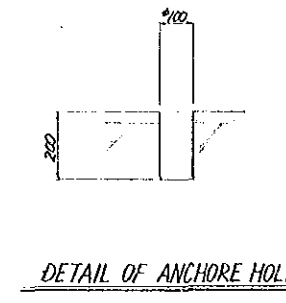


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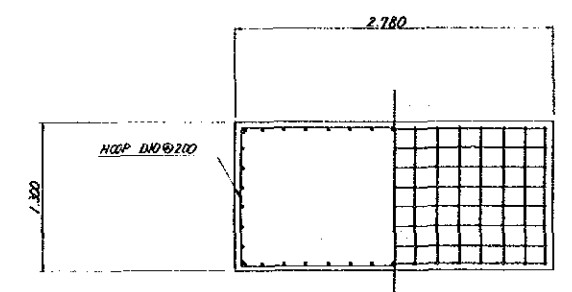
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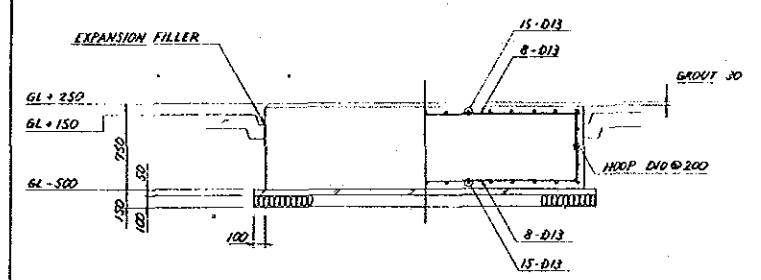
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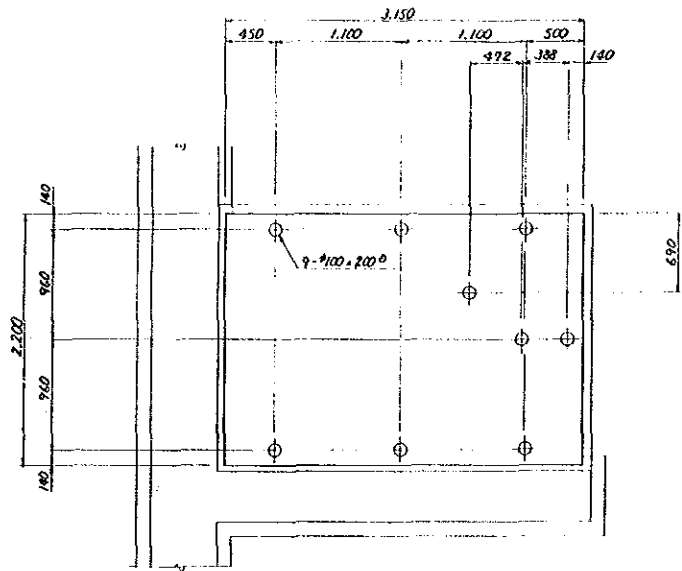
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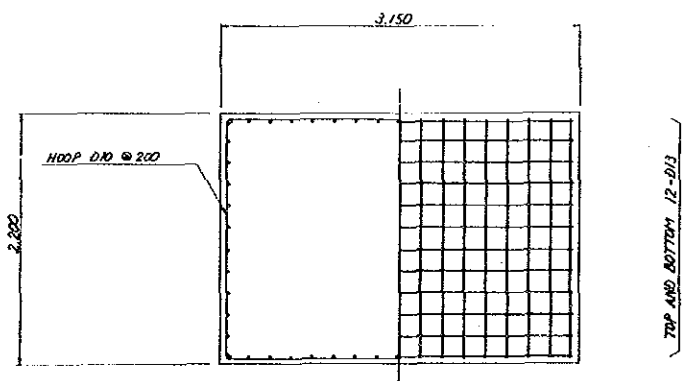
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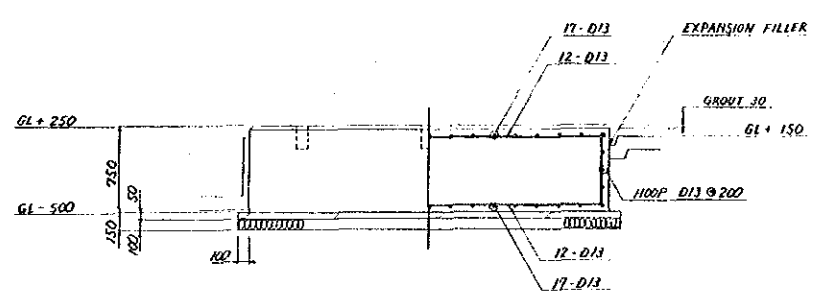
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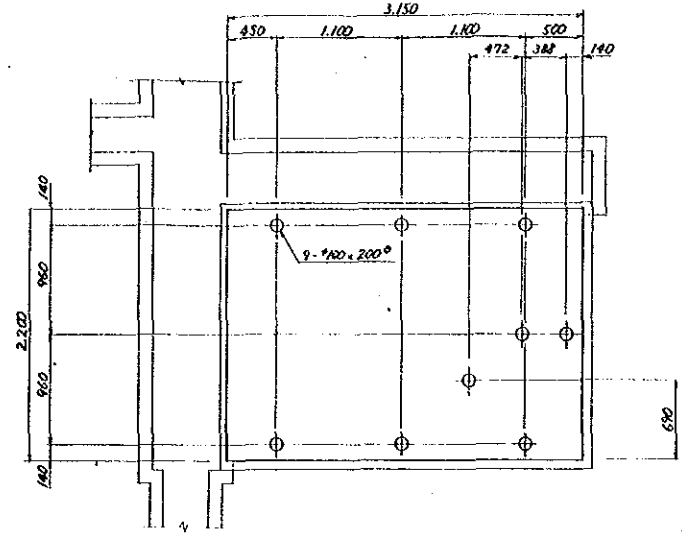
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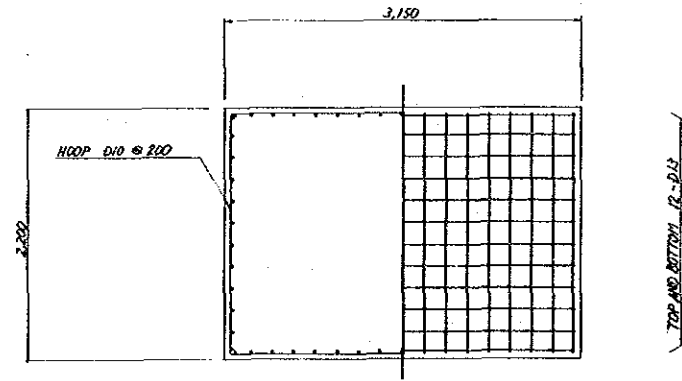
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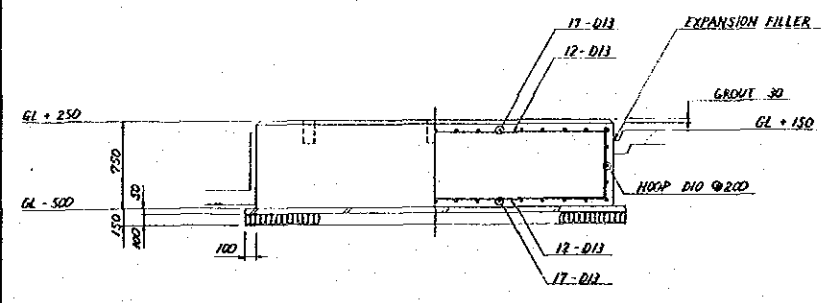
DETAIL OF ANCHORE HOLE

PLAN



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RE-BAR ARRANGEMENT



ELEVATION SECTION

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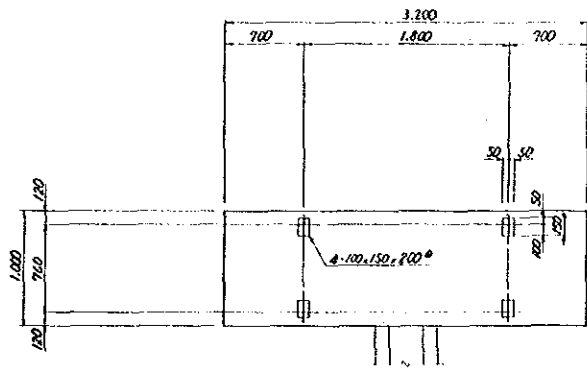
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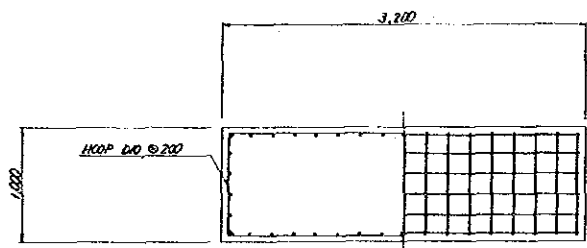
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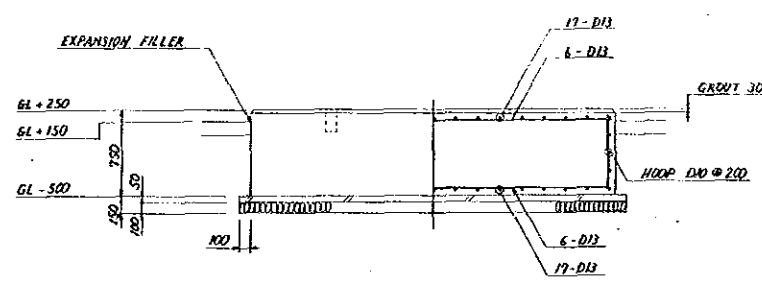
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PLAN



RE-BAR ARRANGEMENT

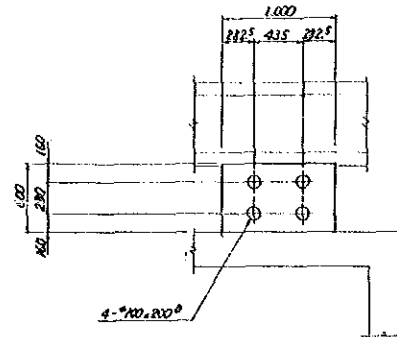


ELEVATION SECTION

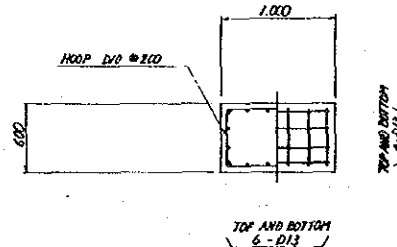


DETAIL OF ANCHORE HOLE

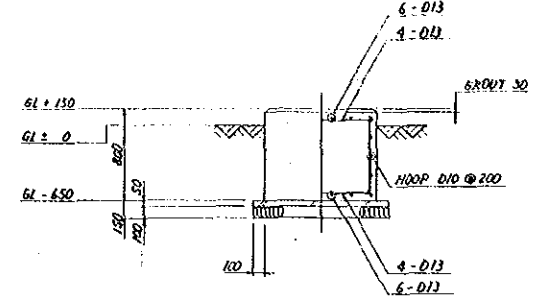
BFK-001



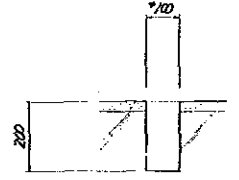
PLAN



RE-BAR ARRANGEMENT

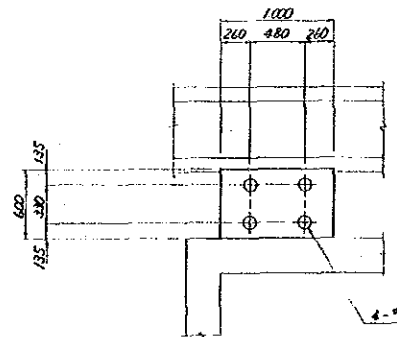


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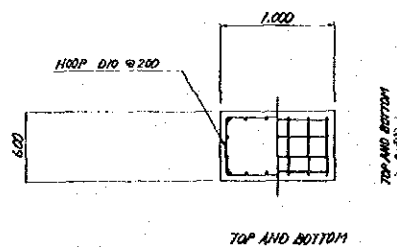


DETAIL OF ANCHORE HOLE

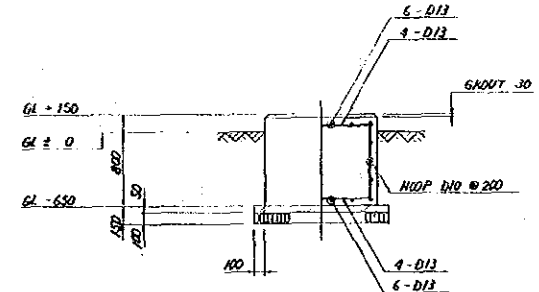
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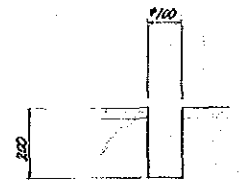
PLAN



RE-BAR ARRANGEMENT



ELEVATION SECTION



DETAIL OF ANCHORE HOLE

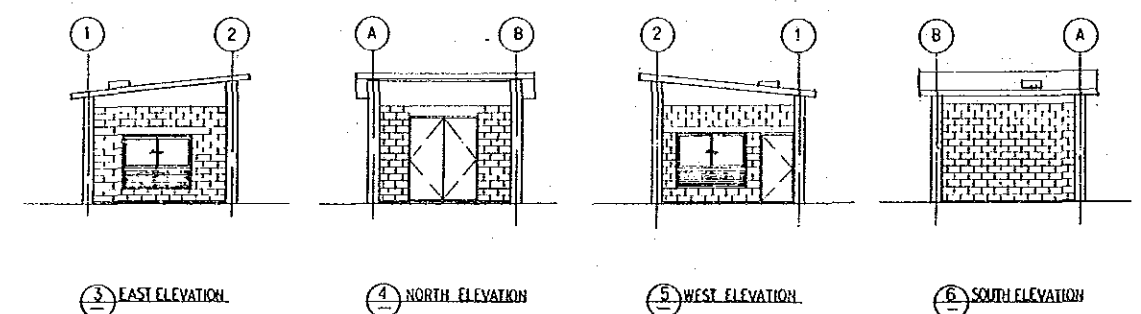
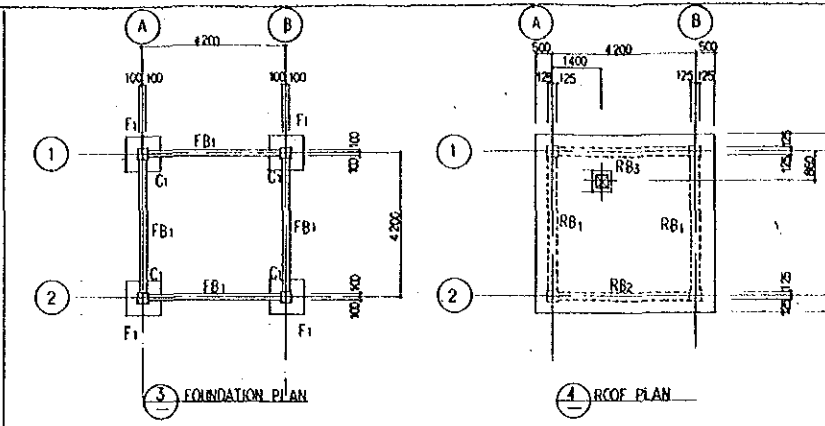
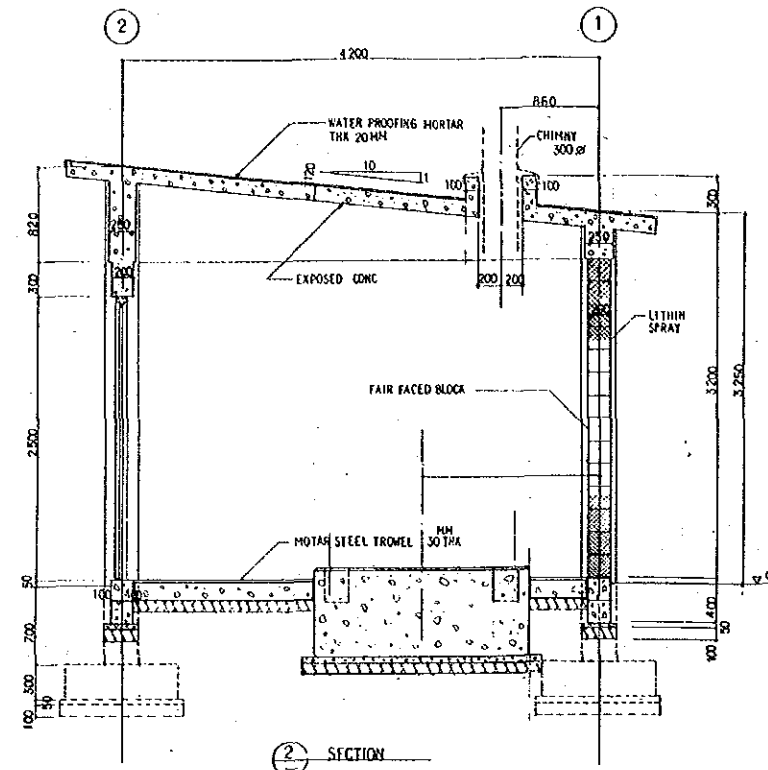
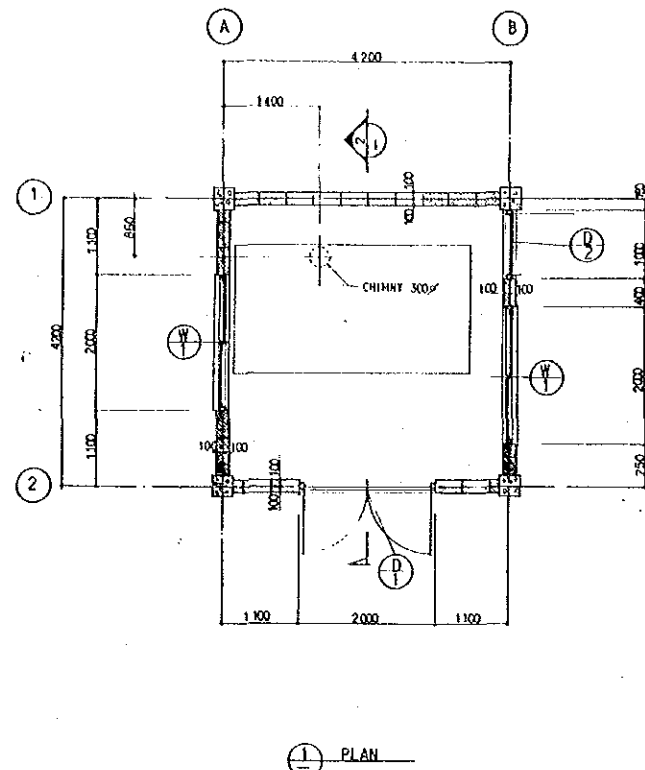
PROJECT: JAPAN-SAUDI ARABIA RESEARCH PROJECT OF SEA WATER DESALINATION

TITLE: TEST PLANT FOUNDATION DETAILS 6

DATE: OCT. 87 SCALE: 1/30 1/10

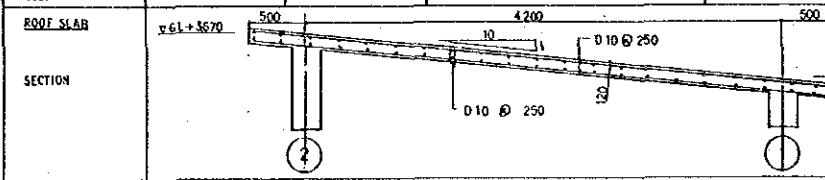
DRAWING NO.: SAJ 304-J008

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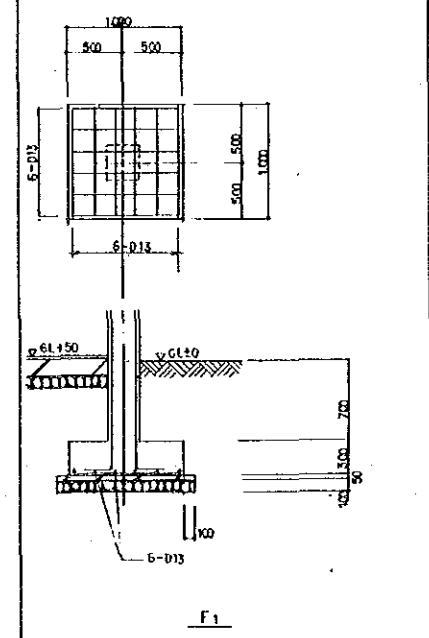
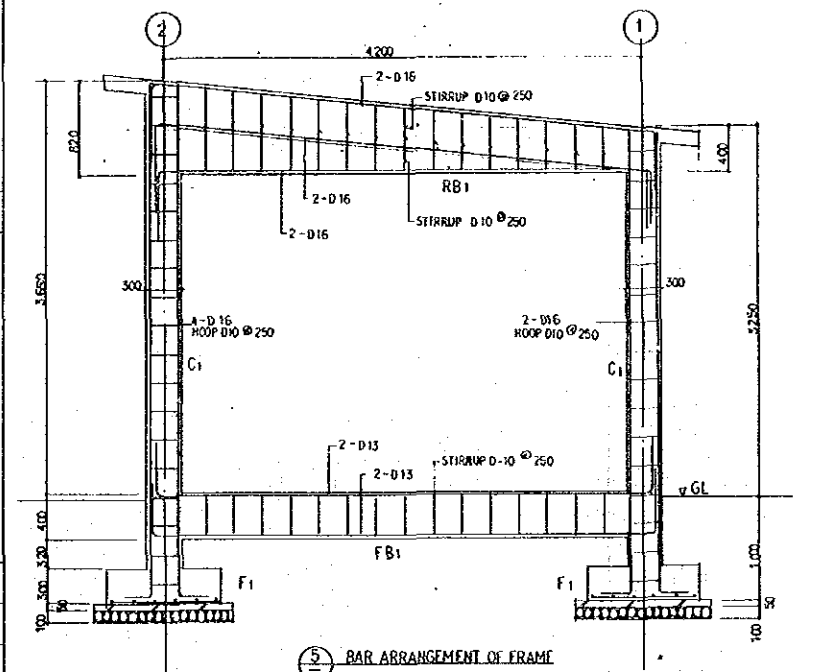
COLUMN, GRADE BEAM, BEAM, LINTEL, SLAB

MARK	C	FB	RB1		RB	RB	LINTEL
PORTION		ALL	1 LINE	2 LINE	ALL	ALL	ALL
SECTION							
TOP BAR		2-D13	2-D13	2-D13	2-D13	2-D13	2-D13
BOT BAR		2-D13	4-D13	4-D13	4-D13	2-D13	2-D13
STIRRUP		D10 @ 250	D10 @ 250		D10 @ 250	D10 @ 250	D10 @ 250
MAIN BAR	4-D16						
HOOP	D10 @ 250						



DOOR & WINDOW SCHEDULE

MARK	1	2	3
ELEVATION			
SIZE	H 2450 x W 1900	H 2050 x W 900	H 1600 x W 1300
THA	40	40	
TYPE	DOUBLE FLUSH HOLLOW STEEL	FLUSH HOLLOW STEEL	SLIDING WINDOW WITH LOUVER
MATERIAL	STEEL	STEEL	ALUMINUM
GLASS			CLEAR GLASS 5MM THK
HARDWARE TYPE	SPAIR BUTTS, LOCKSET-NORTICE TYPE, LEVER HANDLE, ACTIVE HEAVY DUTY DEAD BOLT, FLUSH BUTT FOR FIXING ONE PANEL, DOOR CLOSER	1 - 1/2 D AIR BUTTS, LOCKSET-NORTICE TYPE, LEVER HANDLE, DEAD BOLT, DOOR CLOSER	COMPLETE SET
REMARKS			



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

TITLE: TEST PLANT BOILER HOUSE PLANS, ELEVATIONS, SECTIONS

DATE: OCT, '87 SCALE: 1/100, 1/50, 1/30

DRAWING NO.: SAJ 304-J009

JAPAN INTERNATIONAL COOPERATION AGENCY



BILL OF QUANTITIES  
FOR  
CIVIL AND BUILDING WORK





CIVIL WORKS FOR TEST PLANT

SCHEDULES OF APPROXIMATE QUANTITIES

(Bill of Quantities  
and Unit Costs Schedules)

FOUNDATION AND TRENCH



FOUNDATION AND TRENCH

BILL OF QUANTITIES & UNIT COSTS SCHEDULES						
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT RATE	TOTAL COST	
1	EARTH WORK					
	a) EXCAVATION					
	Only .....					
	Saudi Rials per cubic meter.	M <sup>3</sup>	530			
1	b) EXCESS SOIL DISPOSAL					
	Only .....					
	Saudi Rials per cubic meter.	M <sup>3</sup>	415			
	c) BACK FILLING W/COMPACTION TO GL W/EXCAVATED SOIL					
1	Only .....					
	Saudi Rials per cubic meter.	M <sup>3</sup>	115			
	d) COBBLESTONE					
	Only .....					
1	Saudi Rials per cubic meter.	M <sup>3</sup>	30			
	2	CONCRETE WORK				
	a) LEVELING CONCRETE					
	Only .....					
1	Saudi Rials per cubic meter.	M <sup>3</sup>	15			
	b) CONCRETE					
	Only .....					
	Saudi Rials per cubic meter.	M <sup>3</sup>	161			

BILL OF QUANTITIES & UNIT COSTS SCHEDULES					
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT RATE	TOTAL COST
3	FORM WORK				
	a) FORM				
	Only .....				
	.....				
	Saudi Rials per square meter.	M <sup>2</sup>	567		
4	REINFORCEMENT WORK				
	a) REINFORCING BAR (CHARACTERISTIC				
	STRENGTH : 410 N/mm <sup>2</sup> )				
	Only .....				
	.....				
	Saudi Rials per metric ton.	TON	14		
5	OTHER WORKS				
	a) TRENCH COVER				
	Only .....				
	.....				
	Saudi Rials per square meter.	M <sup>2</sup>	70		
	b) HAND RAIL				
	Only .....				
	.....				
	Saudi Rials per meter.	M	20.8		
	c) PIPE SUPPORT				
	Only .....				
	.....				
	Saudi Rials per meter.	M	70		

BUILDING WORKS FOR TEST PLANT

SCHEDULES OF APPROXIMATE QUANTITIES

(Bill of Quantities  
and Unit Costs Schedules)

BOILER HOUSE



BOILER HOUSE

BILL OF QUANTITIES & UNIT COSTS SCHEDULES						
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT RATE	TOTAL COST	
1	EARTH WORK					
	a) EXCAVATION					
	Only .....					
	.....					
	Saudi Rials per cubic meter.	M <sup>3</sup>	42			
	b) EXCESS SOIL DISPOSAL					
	Only .....					
	.....					
	Saudi Rials per cubic meter.	M <sup>3</sup>	16			
	c) BACK FILLING W/COMPACTION TO GL W/EXCAVATED SOIL					
	Only .....					
	.....					
	Saudi Rials per cubic meter.	M <sup>3</sup>	26			
	d) CUTTING t = 100 mm ~ 300 mm					
	Only .....					
	.....					
	Saudi Rials per square meter.	M <sup>2</sup>	0			
	e) COBBLESTONE t= 100mm					
	Only .....					
	.....					
	Saudi Rials per cubic meter.	M <sup>3</sup>	4.2			
	f) DAMPPROOF COURSE (POLYETHYLENE FILM 0.15 mm thick)					
	Only .....					
	.....					
	Saudi Rials per square meter.	M <sup>2</sup>	17.6			



BILL OF QUANTITIES & UNIT COSTS SCHEDULES					
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT RATE	TOTAL COST
2	CONCRETE WORK				
	a) LEVELING CONCRETE t= 50 mm Only .....	M <sup>3</sup>	1.2		
	..... Saudi Rials per cubic meter.				
b) CONCRETE FOR FOUNDATION SLAB - ON - GRADE & STOOP (GRADE 20) Only .....					
	..... Saudi Rials per cubic meter.	M <sup>3</sup>	10.8		
	c) CONCRETE FOR SUPER STRUCTURE (GRADE 25) Only .....	M <sup>3</sup>	7.1		
	..... Saudi Rials per cubic meter.				
3	FORM WORK				
	a) FORM WORK FOR UNDERGROUND Only .....	M <sup>2</sup>	35		
	..... Saudi Rials per square meter.				
	b) FORM WORK FOR STOOP Only .....	M <sup>2</sup>			
	..... Saudi Rials per square meter.				

BILL OF QUANTITIES & UNIT COSTS SCHEDULES					
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT RATE	TOTAL COST
	c) FORM WORK FOR ABOVE GROUND Only .....				
	..... Saudi Rials per square meter.	M <sup>2</sup>			
	d) FAIR FACED FORM WORK Only .....				
	..... Saudi Rials per square meter.	M <sup>2</sup>	65		
4	REINFORCEMENT WORK				
	a) REINFORCING BAR (CHARACTERISTIC STRENGTH : 410 N/mm <sup>2</sup> ) Only .....				
	..... Saudi Rials per metric ton.	TON	1.8		
	b) WELDED WIRE FABRIC φ6 × 150 × 150 Only .....				
	..... Saudi Rials per square meter.	M <sup>2</sup>	18		
5	MASONRY WORK				
	a) CONCRETE BLOCK 200mm THK (190 × 190 × 290 mm) Only .....				
	..... Saudi Rials per square meter.	M <sup>2</sup>	34		

BILL OF QUANTITIES & UNIT COSTS SCHEDULES					
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT RATE	TOTAL COST
6	WATERPROOF WORK				
	6A. SEALING				
	a) SEALING FOR EXTERIOR DOOR, WINDOW & VENTILATOR				
	Only .....				
	.....				
	Saudi Rials per meter run.	M	155.5		
7	DOOR & WINDOW WORK (INCLUDING FRAME, HARDWARES, GLAZING)				
	7A. DOOR				
	a) DOUBLE FLUSH HOLLOW STEEL 2,000W x 2,500H				
	Only .....				
	.....				
	Saudi Rials per unit.	NOS	1		
	b) FLUSH HOLLOW STEEL 900W x 2,100H				
	Only .....				
	.....				
	Saudi Rials per unit.	NOS	1		
	7B. WINDOW				
	a) ALUMINUM FRAME FIXED WINDOW 2,000W x 1,600H WITH LOOVER				
	Only .....				
	.....				
	Saudi Rials per unit.	NOS	2		

BILL OF QUANTITIES & UNIT COSTS SCHEDULES					
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT RATE	TOTAL COST
8	FINISH WORK				
	8A. PLASTERING (INTERIOR)				
	d) CEMENT MORTAR STEEL TROWEL WINDOW SILL Only .....	M			
	Saudi Rials per meter run.				
	e) CONCRETE STEEL TROWEL FINISH FLOOR Only .....	M			
	Saudi Rials per square meter.				
	8B. PAINTING				
	a) FOR STEEL DOOR Only .....	M <sup>2</sup>	78.32		
	Saudi Rials per square meter.				

SUMMARY

BOILER HOUSE

S. R.

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TOTAL CARRIED TO SUMMARY OF BUILDING WORKS

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**ANCILLARY FACILITIES**



ANCILLARY FACILITIES

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DRAWINGS

BILL OF QUANTITIES





## CHAPTER 1

### WASTE WATER DISCHARGE PIPELINE FROM TEST PLANT

#### 1.1 SCOPE

All the waste water from the test plants (MSF and RO) is tentatively stored in a waste water storage tank and discharged to the sea through the waste discharge pipeline by means of a waste transfer pump. The piping on the discharge side of the waste transfer pump will be connected to the existing discharge line, approximately 15 m away from the test plant area. The pump will be operated and monitored by the panel installed in the control room.

#### 1.2 EQUIPMENT & MATERIAL

- Waste transfer pump and motor 1 set
- Waste discharge pipe 1 set
- Waste transfer pump suction pipe and strainer 1 set
- Level switch for controlling waste water pump 1 unit
- Control panel for waste transfer pump and product transfer pump 1 set
- Cables for waste transfer pump and product transfer pump 1 set
- Stop valve of pump delivery 1 unit
- Other materials for the piping, cabling and wiring works 1 set

#### 1.3 PIPING WORK

- (1) Procedure of the piping work conforms to DWG No. SAJ-304-R4204.
- (2) Operation of the waste transfer pump is automatically controlled by the 'Level High' and 'Level Low' signals transmitted from the level switch installed in the waste storage tank.
- (3) Operation of the waste transfer pump and the product transfer pump as well are monitored and controlled by the panel installed in the control room.

- (4) The waste transfer pump should be fixed with anchor bolts on the concrete foundation provided beside the waste storage tank.
- (5) The level switch will be installed in the waste storage tank in accordance with the work procedure depicted on the tank. In order to prevent possible influence of water flow upon the sensitivity of the switch, it will be fixed on the interior surface of the tank with support plates and screws at the top and the bottom, respectively.
- (6) Suction piping of the waste transfer pump shall be composed of stainless steel pipes of 65A in size. At the intake of the pump, a strainer with 20 mesh stainless steel net will be provided. The piping support shall be pipe band, which will be fixed on the exterior surface of the tank with bolts at least at the top and the bottom.
- (7) The discharge piping of the waste transfer pump requires a stop valve (glob valve 10K-65A) at the pump outlet. From the outlet the piping (PVC-HT) of 65A in size shall run through in the trench up to the end, where the piping shall be expanded from 65A to 100A (PVC-HT pipe) which will be connected to the existing 100A discharge line. Where trench is not provided, the piping shall be placed at 0.5 m or deeper than the ground level.

#### 1.4 ELECTRIC WIRING WORK

- (1) Electric cables for power supply and system control should be installed in conduit pipe.
- (2) As long as they are properly protected by conduit pipe, all the cables may be directly buried under ground. However, the depth should be 0.5 m or more where excessive load of heavy vehicles is expected. For other areas, it may be 0.4 m or deeper.
- (3) Cables may not be connected with each other by joints or splices as much as possible.
- (4) All splicing and terminal connection should be made with compression type solderless connections and lugs only at accessible locations such as junction box, pull box, handhole and

manhole. Any cable splicing and connecting may not be allowed inside conduit pipe and trunking.

- (5) All threaded joints should be made with conductive screw thread lubricant.

A pull box may be provided as required in order to avoid excessive stress upon the cables and wires during installation. All conduit pipes should be cleansed and dried properly in advance to the insertion of cables.

- (6) Execution of the wiring works should conform to DWG No. SAJ-304-RE432.
- (7) Control panel and electrical sequence should conform to DWG No. SAJ-304-RE132.
- (8) Specifications and drawings of the level switch are shown in DWG No. SJ-304-RE133.

## CHAPTER 2

### PRODUCT WATER PIPELINE FROM TEST PLANT TO EXISTING CONNECTION POINT

#### 2.1 OUTLINE OF THE PRODUCT WATER PIPELINE

Test plants produce water of daily amount of approximately 60 cubic meters in its continuous run.

This water is mixed with potable water produced in the Yanbu power/desalination Plant when its quality is allowable.

The qualities of water are to be checked at the product water line of every process (MSF, spiral wound RO and hollow fiber RO).

When the result of the check on some check point turn out not acceptable, water from that process will be discharged to the waste tank.

Both MSF and Ro test plants have no post treatment process.

#### 2.2 SCOPE OF WORK

The scope of work shall include procurement of the material, fabrication, erection and testing related to the following items.

- (1) Product transfer tank with capacity of 0.2 m<sup>3</sup>.
- (2) Level control system annexed to abovementioned tank.
- (3) Pump transferring water from the tank to the existing potable water line.
- (4) Pipeline connected to the existing potable pipeline.

#### 2.3 EQUIPMENT & MATERIAL

- Product transfer tank (DWG NO SAJ304-S0011)	1 set
- Product transfer pump & motor (Table 2.1)	1 set
- Product transfer tank level control system (DRW NO. SAJ304-SI004)	1 set
- Other materials for the piping, cabling, and wiring works. (Table 2.2 2.4)	1 set

#### 2.4 PIPING WORK

- (1) The design and material of piping shall conform to Table 2.5 "PIPING MATERIAL CLASSIFICATION".
- (2) The piping route shall refer to DWG No. SAJ304-S1001, SAJ304-1005.

Table 2.1 PRODUCT TRANSFER PUMP & MOTOR

Operating condition	
Liquid ;Product water	
Capacity;2.7 cuM/H ,Diff. head 30m LC	
Construction	
Location;outdoor,Construction;Horizontal	
Nozzle;50mm(suction) ,40mm(disch)	
JIS 10K ,JIS 10K	
No. of stages; 1	
Coupling Type; Flexible	
Rotation;Counter clockwise view from driver	
Shaft seal;Packing	
Material	
Casing;SCS 13,Impeller;SCS 13,Shaft;SUS 304	
Shaft sleeve;SUS 304	
Driver	
Rated output; 3.7 KW	
Electric motor;No. of pole; 4,Source; 220 V/60 HZ	

Table 2.2 Valve list for Product water transfer

Type	Q'ty	Size mm ND	Rating	End & Type	Material			Des'n		Location
					Body	Disc	Stem	Press	Temp	
Globe	1	50	JIS 10K	Rased fa- ce flange	SCS14	SUS316	SUS316	1.0	40.0	Feed water pump suction
Globe	1	40	JIS 10K	ditto	SCS14	SUS316	SUS316	1.0	40.0	Product tank inlet
Lift check	1	40	JIS 10K	ditto	SCS14	SUS316	SUS316	3.5	40.0	Product water trans.pump disch.
Globe	1	40	JIS 10K	ditto	SCS14	SUS316	SUS316	3.5	40.0	ditto
Globe	2	50	JIS 10K	ditto	SCS14	SUS316	SUS316	1.0	40.0	Product water trans.tank LIC Root

Table 2.3 CONTROL VALVE FOR PRODUCT TRANSFER TANK

- GENERAL -								
CODE AND STANDARD		JIS						
NOISE LIMIT		dba	AMB. TEMP.		50	DEG. C		
TAG. No.		LCV-403						
SERVICE		Product water transfer tank level						
Q'TY		1						
P R D O A C T E A S S	FLUID							
	OPERATING CONDITION		MAX.	NOR.	MIN.	MAX.	NOR.	MIN.
	FLOW UNIT RATE ( M <sup>3</sup> /H )		3.2	2.7	0.9			
	DENSITY ( kg/M <sup>3</sup> )			1.0				
	VISCOSITY ( CP )							
	TEMPERATURE ( DEG. C )			40				
	PRESSURE ( kg/cm <sup>2</sup> )			3.5				
	DIFF. PRESS. ( kg/cm <sup>2</sup> )			0.3				
SHUT OFF PRESS. ( kg/cm <sup>2</sup> )			3.5					
B O D Y	TYPE OF VALVE		GLOBE					
	SIZE ; BODY / PORT							
	LINE SIZE / SCHEDULE		40 A					
	CONNECTION RATING							
	MATERIAL ; BODY		SCS13					
	MATERIAL ; TRIM		SUS304					
	CAL. CV		6.9	5.8	2.0			
	VALVE CV							
	REQUIRED SEAT TIGHTNESS		TIGHT SHUT					
	TRIM FORM							
TYPE OF BONNET		STANDARD						
A C P T O U S A I T T O I R O	TYPE OF ACTUATOR		MANUFACTURE STANDARD					
	AIR / ELECT. SUPPLY		7 kg/cm <sup>2</sup>					
	CONNECTION SIZE ; AIR / ELECT.							
	SIGNAL INCREASE TO		OPEN					
	FAIL POSITION		CLOSE					
	SPRING RANGE							
	TYPE OF POSITIONER		P/P					
	INPUT SIGNAL		0.2 ~ 1.0 kg/cm <sup>2</sup>					
	HARD WHEEL		YES					
	FILTER REGULATOR WITH GAUGE		YES					
C O S E N O I D V A L V E ( V . H Z )	SOLENOID VALVE ( V . HZ )		NO					
	LIMIT SWITCH		NO					
	OTHERS							
	MAKER NAME							
MODEL No.								
WEIGHT								
MAKER DWG. No.								



Table 2.4 LEVEL CONTROLLER FOR PRODUCT TRANSFER TANK

BODY/CAGE	1	Tag Number	LIC-403		
	2	Service	PRODUCT TRANSFER TANK LEVEL		
	3	Line No./Vessel No.			
	4	Body or Cage Mtl	SCS 13		
		Rating			
	5	Conn Size & Location Upper	JIS 10" 50 A		
		Type			
	6	Conn Size & Location Lower	JIS 10" 50 A		
		Type			
	7	Cage Mounting			
		Type			
	8	Rotatable Head			
	9				
10	Orientation				
11	Cooling Extension				
12					
DISPLACER OR FLOAT	13	Dimensions	500 mm		
	14	Insertion Depth			
	15	Displacer Extension			
	16	Diso. or Float Material	SCS 13		
	17	Displacer Spring/Tube Mtl			
	18				
	19				
XMTR/CONT.	20	Function			
	21	Output	0.2 ~ 1.0 kg/cm <sup>2</sup>		
	22	Control Modes	PI		
	23	Differential			
	24	Output Action: Level Rise	OUTPUT INCREASE		
	25	Mounting			
	26	Enclosure Class	WATER PROOF		
	27	Elec. Power or Air Supply	8.0 kg/cm <sup>2</sup>		
28					
SERVICE	29	Upper Liquid	PRODUCT WATER		
	30	Lower Liquid			
	31	sp. gr. : Upper	Lower		
	32	Press. Max.	Normal		
	33	Temp. Max.	Normal	40	
	34				
	35				
OPTIONS	36	Airsel Supply Gage	YES	YES	
	37	Gage Glass Connections			
	38	Gage Glass Model No.			
	39	Contacts: No. Form			
	40	Contact Rating			
	41	Action of Contacts			
	42				
	43				
44					
45					
46	Manufacturer				
47	Model Number				
48					

Notes:

SIDE-SIDE FLANGE TYPE

Table 2.5 PIPING MATERIAL CLASSIFICATION

SERVICE		PRODUCT WATER PIPELINE						
RATING		PRESS.		3.5				
		TEMP.		40.0				
ITEM	NOM. SIZE (A)		WALL THICKNESS	END	MATERIAL		DESCRIPTION	
	FROM	TO						
PIPE		50		PLAIN END	U-PVC			
ITEM	NOM. SIZE ( )		CLASS	END & TYPE	MATERIAL		DESCRIPTION	
	FROM	TO			BODY	TRIM		
VALVES	GATE							
	GLOBE		50	JIS 10 K	RAISED FACE FLANGE	316SS	316SS	
	CHECK		40	JIS 10 K	RF FLANGE LIFT TYPE	316SS	316SS	
	BONNET GASKET	ASBESTOS (Low Cl <sup>-</sup> & F <sup>-</sup> ) or PTFE						
	GLAND PACKING							
FLANGE		50	JIS 10 K	FLAT FACE	U-PVC			
FITTING	ELBOW	}	50		TAPER SOCKET	U-PVC		
	TEE							
	REDUCER							
GASKET		50	JIS 10 K	RUBBER				
BOLTING	BOLT	M16		SS41 / HOT DIP GALVA.		NUT	SS41 / HOT DIP GALVA.	

## CHAPTER 3

### SEAWATER INTAKE PIPELINE FROM EXISTING SEAWATER HEADER TO MSF TEST PLANT

#### 3.1 SCOPE OF WORK

Raw seawater will be supplied directly to the MSF plant through the existing intake header adjacent to the plant facility.

The scope of work shall include procurement of the material, fabrication, erection and testing.

#### 3.2 MATERIALS

Piping materials (pipe, flange, valve, etc.) 1 set

#### 3.3 PIPING WORK

- (1) The design and material of piping shall conform to Table 3.1 "PIPING MATERIAL CLASSIFICATION".
- (2) The piping route shall refer to DWG No. SAJ304-S1002

Table 3.1 PIPING MATERIAL CLASSIFICATION

SERVICE		SEA WATER INTAKE						
RATING	PRESS.	2.3						
	TEMP.	30						
ITEM	NOM. SIZE ( ) FROM   TO	WALL THICKNESS	END	MATERIAL		DESCRIPTION		
PIPE	200		PLAIN END	U-PVC				
ITEM	NOM. SIZE ( ) FROM   TO	CLASS	END & TYPE	MATERIAL		DESCRIPTION		
VALVES	GATE							
	GLOBE							
	CHECK							
	BUTTER-FLY	100	JIS 10 K	WAFER	FC20/CR	316SS		
	BONNET GASKET	RUBBER						
	GLAND PACKING							
FLANGE	200	JIS 10 K	FLAT FACE	U-PVC				
FITTING	ELBOW	200		TAPER SOCKET	U-PVC			
	TEE							
	REDUCER							
GASKET	200	JIS 10 K	RUBBER					
BOLTING	BOLT		SS41 / HOT DIP GALVA.		NUT	SS41 / HOT DIP GALVA.		

## CHAPTER 4

### SEAWATER INTAKE PIPELINE FROM EXISTING SEAWATER HEADER TO RO TEST PLANT

#### 4.1 SCOPE

Raw water will be supplied to the raw water tank (T-101) of the RO test plant through the existing intake header adjacent to the plant facility.

#### 4.2 EQUIPMENT & MATERIALS

- |  |       |
|--|-------|
| - Pipe (rigid polyvinyl chloride pipe)   | 1 set |
| - Valve (JIS 10K-65A cast bronze or PVC) | 1 set |
| - Pipe fittings                          | 1 set |

#### 4.3 PIPING WORK

- (1) A raw water suction nozzle (flange: JIS 10K-50A) shall be welded to the existing raw water header.
- (2) Execution of the piping works shall conform to DWG NO. SAJ-304-R4204.
- (3) Stop valve (glob valve JIS 10K-50A) shall be provided for the suction nozzle installed in the existing header and the supply nozzle of the raw water tank (T-101), respectively. Both nozzles shall be connected to each other with 50A PVC pipe.
- (4) The piping shall be placed in the trench, at both ends of which piping hole shall be provided to the trench cover.
- (5) The piping from the header to the trench shall be placed under ground at 0.5 m or deeper.

## CHAPTER 5

### FUEL OIL PIPELINE FROM EXISTING PUMP STATION TO TEST PLANT.

#### 5.1 OUTLINE OF THE FUEL OIL PIPELINE

Fuel oil is consumed in the boiler annexed to the MSF test plant.

As the kind of fuel oil is a Bunker C type with viscosity of 180 cs at 50°C, the pipeline requires the thermal tracing by the electric heater for keeping fluidity of oil.

#### 5.2 SCOPE OF WORK

The scope of work shall include procurement of the material, fabrication, erection and testing related to the following items.

- (1) Pipeline of carbon steel with the length of about 130 meters.
- (2) Electric heater for the thermal tracing of the pipeline.
- (3) Heat insulators on the pipeline.

#### 5.3 MATERIAL

- |                                   |       |
|-----------------------------------|-------|
| - Oil piping heater (Table 5.1)   | 1 set |
| - Insulation material (Table 5.2) | 1 set |
| - Materials for the piping        | 1 set |

#### 5.4 PIPING WORK

- (1) The design and material of piping shall conform to Table 5.3 "PIPING MATERIAL CLASSIFICATION".
- (2) The piping route shall refer to DWG NO. SAJ 304-S1003.

Table 5.1 OIL PIPING HEATER

Power	AC 220V 1ø 60 Hz	
Piping	50A Carbon Steel	130 m
Control Temp.	0°C--- 30°C	
Material	Auto heater	130 m
	Earth reak breaker 30AF/30AT	1 pcs
	Magnetic contactor	1 pcs
	Push botton switch	2 pcs
	Indicating lamp	2 pcs
	Other material	1 set

Table 5.2 INSULATING SCHEDULE

Insulating material	Rock wool pipe cover;25mm thickness
Sheath material	Aluminum flat sheet ;0.3mm thickness

Table 5.3 PIPING MATERIAL CLASSIFICATION

SERVICE		FUEL OIL						
RATING		PRESS.						
		TEMP.						
ITEM		NOM. SIZE ( )		WALL THICKNESS	END	MATERIAL		DESCRIPTION
		FROM	TO					
PIPE			50	Sch 40	PLAIN END	CARBON STEEL STPG 38		
ITEM		NOM. SIZE ( )		CLASS	END & TYPE	MATERIAL		DESCRIPTION
		FROM	TO			BODY	TRIM	
VALVES	GATE							
	GLOBE		50	JIS 10K	FF FLANGE	CAST IRON	403 SS	
	CHECK							
	BONNET GASKET GLAND PACKING							
FLANGE			50	JIS 10 K	FLAT FACE	MILD STEEL, SS41		
FITTING	ELBOW							
	TEE		50	Sch 40	BEVEL END	CARBON STEEL, PT38		
	REDUCER							
GASKET			50	JIS 10 K	ASBESTOS			
BOLTING		BOLT	M16		SS41 / HOT DIP GALVA.	NUT	SS41 / HOT DIP GALVA.	



## CHAPTER 6

### RAW SEAWATER INTAKE FACILITY

#### 6.1 OUTLINE OF THE RAW SEAWATER INTAKE

Raw seawater without any dosing of sterilizing agent is required for comparing the effect of various sterilizing methods in the RO test plant.

Although the existing intake pipeline which was for the solar energy pilot plant is available for the test plants, seawater via this pipeline is already dosed with chlorine as it is branched off from the big intake pipeline of the Yanbu power/desalination Plant.

By this reason, a new temporary intake pipeline is necessary for the RO test plant.

The influence of the leakage of chlorine which is added at the tip of the big intake pipeline on the seawater at the location of intake for a temporary pipeline is confirmed to be negligible by the analysis of the sample taken from the supposed spot of intake.

#### 6.2 SCOPE OF WORK

The scope of work should include procurement of the material, fabrication, erection and testing related to the following items.

- (1) Submersible pump protected by a simple cage.
- (2) Pipeline along the big pipeline with the length of around 200 meters.
- (3) Extension of the pipeline laid under the ground with the length of around 500 meters to the RO test plant
- (4) Excavation and backfilling for the above-mentioned pipeline
- (5) Connecting this pipeline to the RO test plant.

### 6.3 EQUIPMENT & MATERIAL

- Submersible Pump	1 Set
Capacity	0.12 m <sup>3</sup> /min
Head	20 meters
Material	Stainless Steel
With motor & cable	60 Hz, 480 V
- Pump Cage	1 Set
Material	Carbon steel/Zinc coating
- Seawater Intake Pipe (Offshore)	1 Set Flange Type
Diameter	6 inches
Length	Approximately 200 meters
Material	VLP
- Rubber Joint for Intake Pipe (Offshore)	4 Sets
Diameter	6 inches
- Pipe Bend (Offshore)	4 Sets Flange Type
Diameter	6 inches
Material	VLP
- Seawater Intake Pipe (On Land)	1 Set Socket Joint
Diameter	6 inches
Length	Approximately 500 meters
Material	VP
- Pipe Bend (On Land)	6 Sets Socket Joint
Diameter	6 inches
Material	VP
- Saddle Support (Offshore)	20 Sets
Material	Carbon Steel/Zinc coating
- Clamp Holder (Offshore)	25 Sets
Material	Carbon Steel/Zinc coating

- |                                     |                                      |
|-------------------------------------|--------------------------------------|
| - Pipe Clamp (Offshore)<br>Material | 25 Sets<br>Carbon Steel/Zinc coating |
| -Bolt & Nut for VLP<br>Material     | Carbon Steel/Zinc coating            |
| - Excavation Volume (On land)       | Approximately 630 m <sup>3</sup>     |
| - Backfilling Volume (On land)      | Approximately 620 m <sup>3</sup>     |

## CHAPTER 7

### FIRE FIGHTING SYSTEM

#### 7.1 Fuel Oil Tank (10 m<sup>3</sup>)

The approved portable fire extinguishers of appropriate size, type and number shall be provided, as specified in NFPA 10.

The tank shall be furnished with diking as specified in NFPA 30 for protection of adjoining property or waterways.

The location of the tank with respect to property lines, public ways and important building on the same property shall be in accordance with NFPA 30.

#### 7.2 Boiler House

The approved portable fire extinguishers of appropriate size, type and number shall be provided, as specified in NFPA 10.



D R A W I N G S  
F O R  
A N C I L L A R Y F A C I L I T I E S

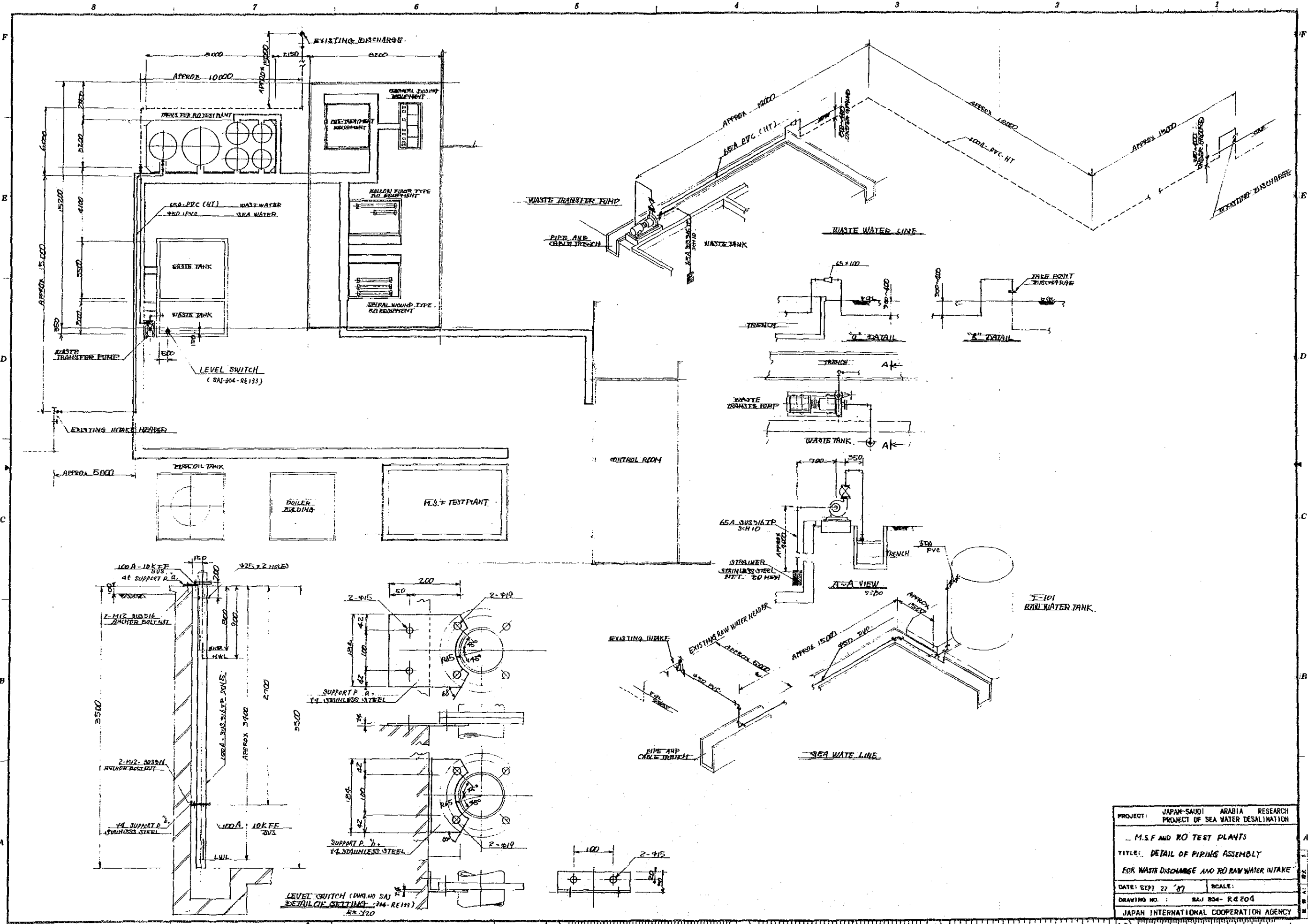


D R A W I N G S

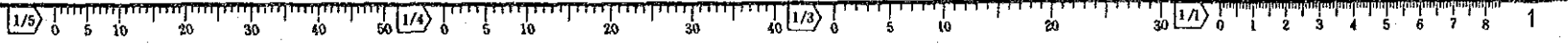
Drawing List

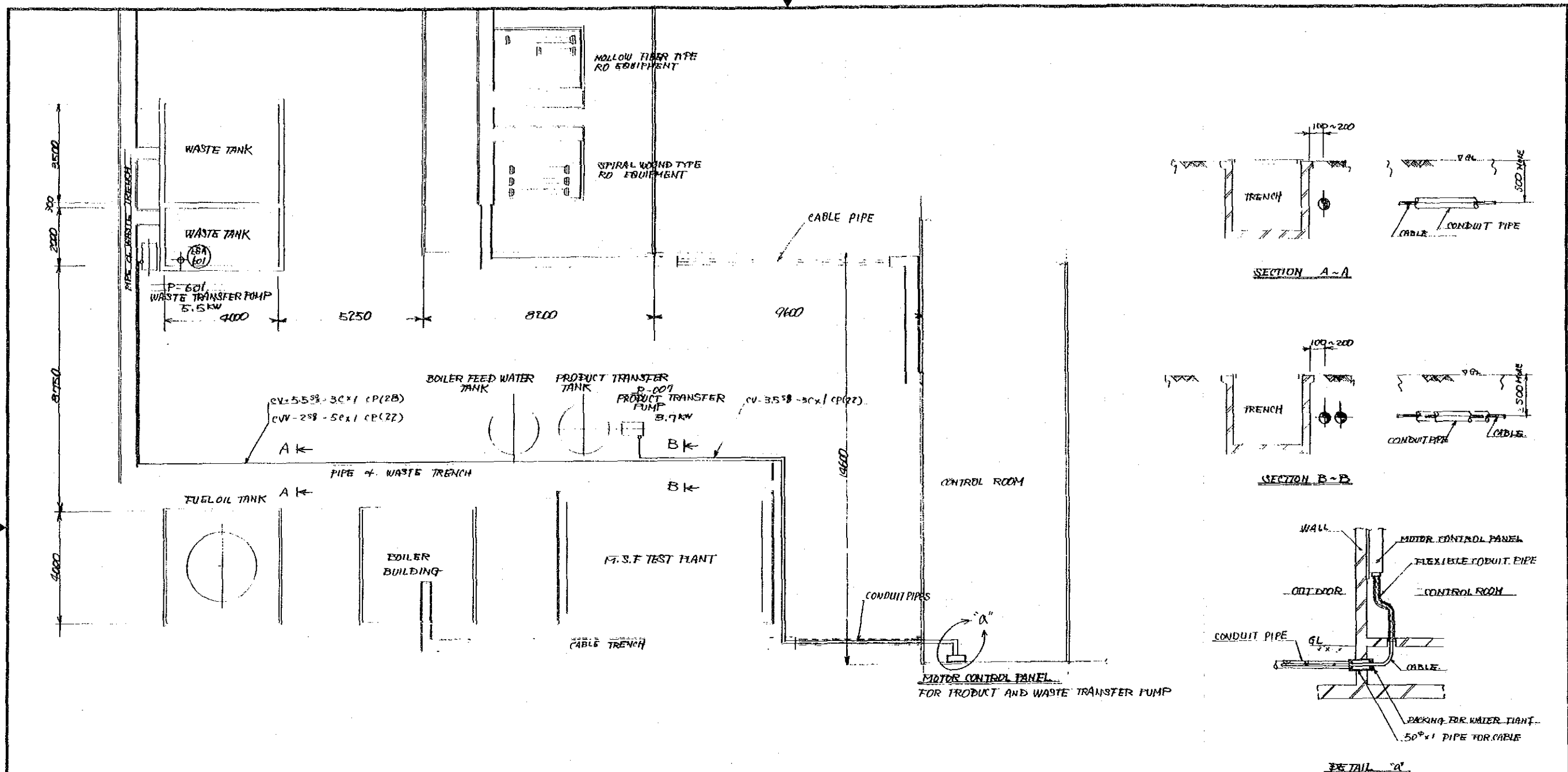
DRW. NO.	Title
SAJ 304-R4204	DETAIL OF PIPING ASSEMBLY FOR WASTEWATER DISCHARGE & RO RAWWATER INTAKE
SAJ 304-RE432	WIRING LAYOUT FOR PRODUT & WASTE TRANSFER PUMP
SAJ 304-RE132	PANEL AND SEQUENCE DRAWING FOR PRODUCT AND WASTE TRANSFER PUMP
SAJ 304-RE133	ELECTRODE TYPE LEVEL SWITCH FOR WASTE TANK
SAJ 304-S0011	PRODUCT TRANSFER TANK
SAJ 304-S1004	PRODUCT TRANSFER TANK LEVEL CONTROL SYSTEM
SAJ 304-S1001	PRODUCT WATER PIPELINE FROM TEST PLANT TO EXISTING CONNECTION POINT
SAJ 304-S1005	PRODUCT LINE FLOW
SAJ 304-S1002	SEAWATER PIPELINE FROM EXISTING SEAWATER HEADER TO TEST PLANT
SAJ 304-S1003	FUEL OIL PIPELINE FROM EXISTING PUMP STATION TO TEST PLANT
SAJ 304-K0001	RAW SEAWATER INTAKE SYSTEM;GENERAL PLAN





PROJECT: JAPAN-SAUDI ARABIA RESEARCH PROJECT OF SEA WATER DESALINATION	
- M.S.F AND RO TEST PLANTS	
TITLE: DETAIL OF PIPING ASSEMBLY FOR WASTE DISCHARGE AND RO RAW WATER INTAKE	
DATE: SEPT. 27 '87	SCALE:
DRAWING NO.: SAU 304- R.4204	
JAPAN INTERNATIONAL COOPERATION AGENCY	





POWER CABLES & CABLE PIPE (CONDUIT PIPE)

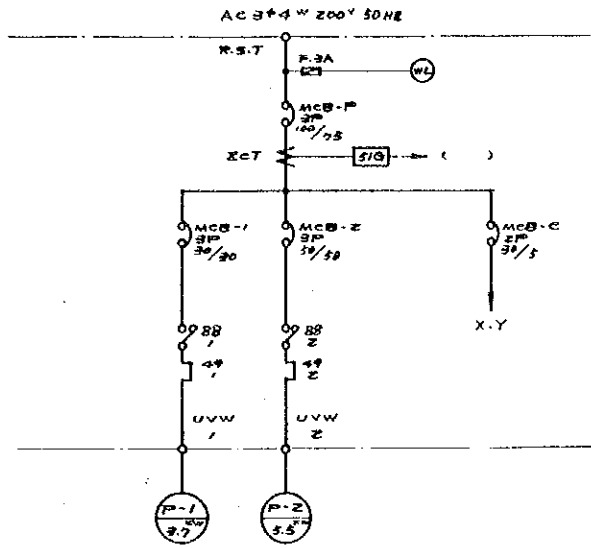
PRODUCT TRANSFER PUMP	P-007	CV-5.5 <sup>3</sup> 8-30x1	CP-28x1
WASTE TRANSFER PUMP	P-601	CV-3.5 <sup>3</sup> 8-30x1	CP-22x1

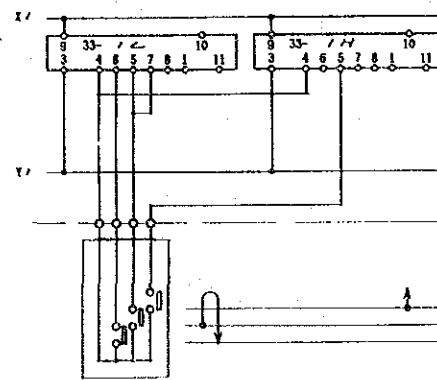
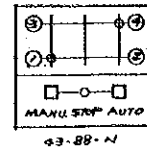
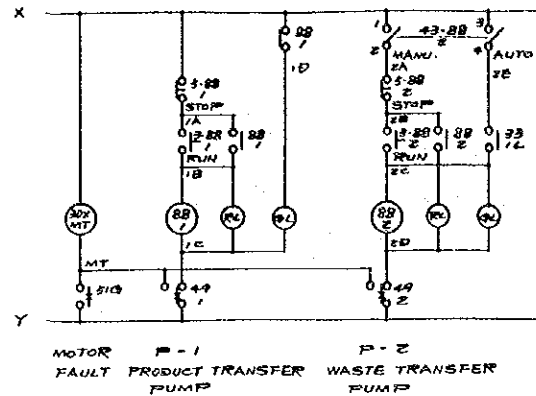
CONTROL CABLE & CABLE PIPE (CONDUIT PIPE)

LEVEL SWITCH FOR WASTE TRANSFER PUMP	LSA-601	CVV-2 <sup>3</sup> 8-50x1	CP-22x1
--------------------------------------	---------	---------------------------	---------

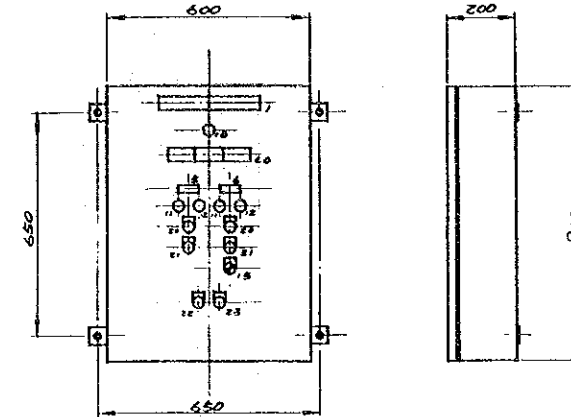
PROJECT: JAPAN-SAUDI ARABIA RESEARCH PROJECT OF SEA WATER DESALINATION	
M.S.F AND RO TEST PLANT	
TITLE: WIRING LAYOUT	
PRODUCT AND WASTE TRANSFER PUMPS.	
DATE: SEPT. 27. '87	SCALE:
DRAWING NO. :	SAJ 304- RE 432
JAPAN INTERNATIONAL COOPERATION AGENCY	



PRODUCT TRANSFER PUMP  
WASTE TRANSFER PUMP  
CONTROL CIRCUIT

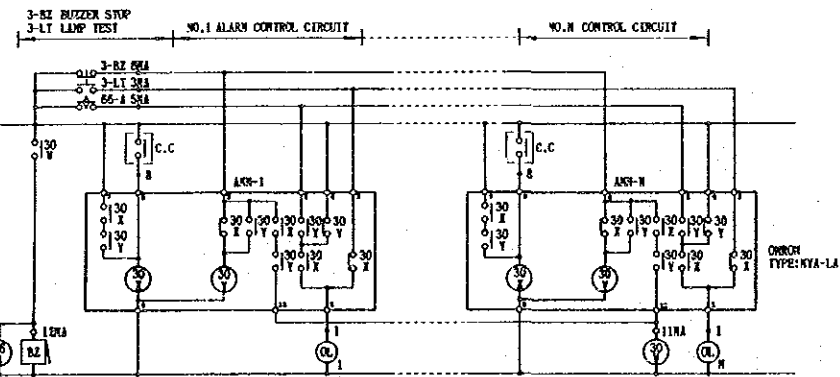


LS-1  
WASTE TANK



MOTOR FAULT	LEVEL HIGH OF WASTE TANK	(SPARE)
-------------	--------------------------	---------

LO INDICATING OF ALARM (OL)



NO.	NAME	WIPE NO.		CONTROL CONTACT	LOCATION	ALARM NO.	INDICATING LAMP NO.	REMARKS
		1	2					
1	MOTOR FAULT	L 1	A 1	30X-MT/A	( - )	ANN-1	PL-1	
2	LEVEL HIGH OF WASTE TANK	L 2	A 2	33-JH/A	( - )	ANN-2	PL-2	
3	( SPARE )	L 3	A 3	/	( - )	ANN-3	PL-3	
4		L 4	A 4	/	( - )	ANN-4	PL-4	
5		L 5	A 5	/	( - )	ANN-5	PL-5	
6		L 6	A 6	/	( - )	ANN-6	PL-6	
7		L 7	A 7	/	( - )	ANN-7	PL-7	
8		L 8	A 8	/	( - )	ANN-8	PL-8	
9		L 9	B 9	/	( - )	ANN-9	PL-9	
10		L 10	A 10	/	( - )	ANN-10	PL-10	
11		L 11	A 11	/	( - )	ANN-11	PL-11	
12		L 12	A 12	/	( - )	ANN-12	PL-12	

NO	PARTS OF NAME	DESCRIPTION	REMARKS
1	NAME PLATE	CRUISE PANEL OF TRANSFER PUMP	ACRYLIC RESIN
2			
3			
4			
5	NAME PLATE	PRODUCT TRANSFER PUMP	ACRYLIC RESIN
6	NAME PLATE	WASTE TRANSFER PUMP	ACRYLIC RESIN
7			
8			
9			
10	INDICATING LAMP		WL
11	INDICATING LAMP		OL
12	INDICATING LAMP		RL
13			
14			
15	CHANGE OVER SW.	MANU. - STOP - AUTO	3 NOTCH
16			
17			
18			
19			
20	PUSH BUTTON SW.	RUN	GREEN
21	PUSH BUTTON SW.	STOP	RED
22	PUSH BUTTON SW.	LAMP TEST	GREEN
23	PUSH BUTTON SW.	ALARM RESET	RED
24			
25			
26			
27			
28			
29			
30			

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

M.S.F AND RO TEST PLANTS

TITLE: PANEL AND SEQUENCE DRAWING FOR PRODUCT AND WASTE TRANSFER PUMPS.

DATE: SEPT. 22, 87 SCALE: N/A

DRAWING NO.: SAJ 304-RE 132

JAPAN INTERNATIONAL COOPERATION AGENCY

1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---

**CONNECTION OF TERMINAL**

**SPECIFICATION**

TYPE: WATER-PROOF ELECTRODE TYPE LEVEL SWITCH

MATERIAL: FLANGE PVC BODY ABS.

FLANGE RATING: JIS 10kg/cm<sup>2</sup> 100A (EQUIVALENT)

ELECTRODE MATERIALS: SUS-316

Tag No.	Use	Condition of Liquid				Dimension of working position (mm)					Remarks (State of mounting place)	
		Name of Liquid	Temperature	Pressure	Specific Gravity	Length of suspending rope (L <sub>0</sub> )	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	L <sub>4</sub>		L <sub>5</sub>
LS	Waste Tank	(Sea water) Waste water	15~ 40°	atmos	1.0	3400	3400	900	800			

MESSERS

STOCK	ISSUED	SCALE	NOT	CHIEF
		DATE		APP
	DMG. CODE	STD. DWG. NO		

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

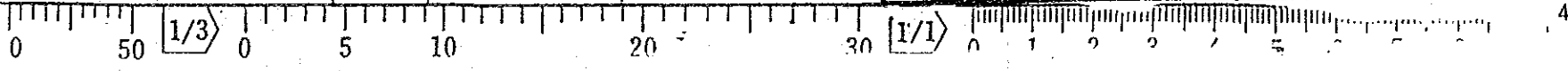
M.S.F. AND RO TEST PLANT

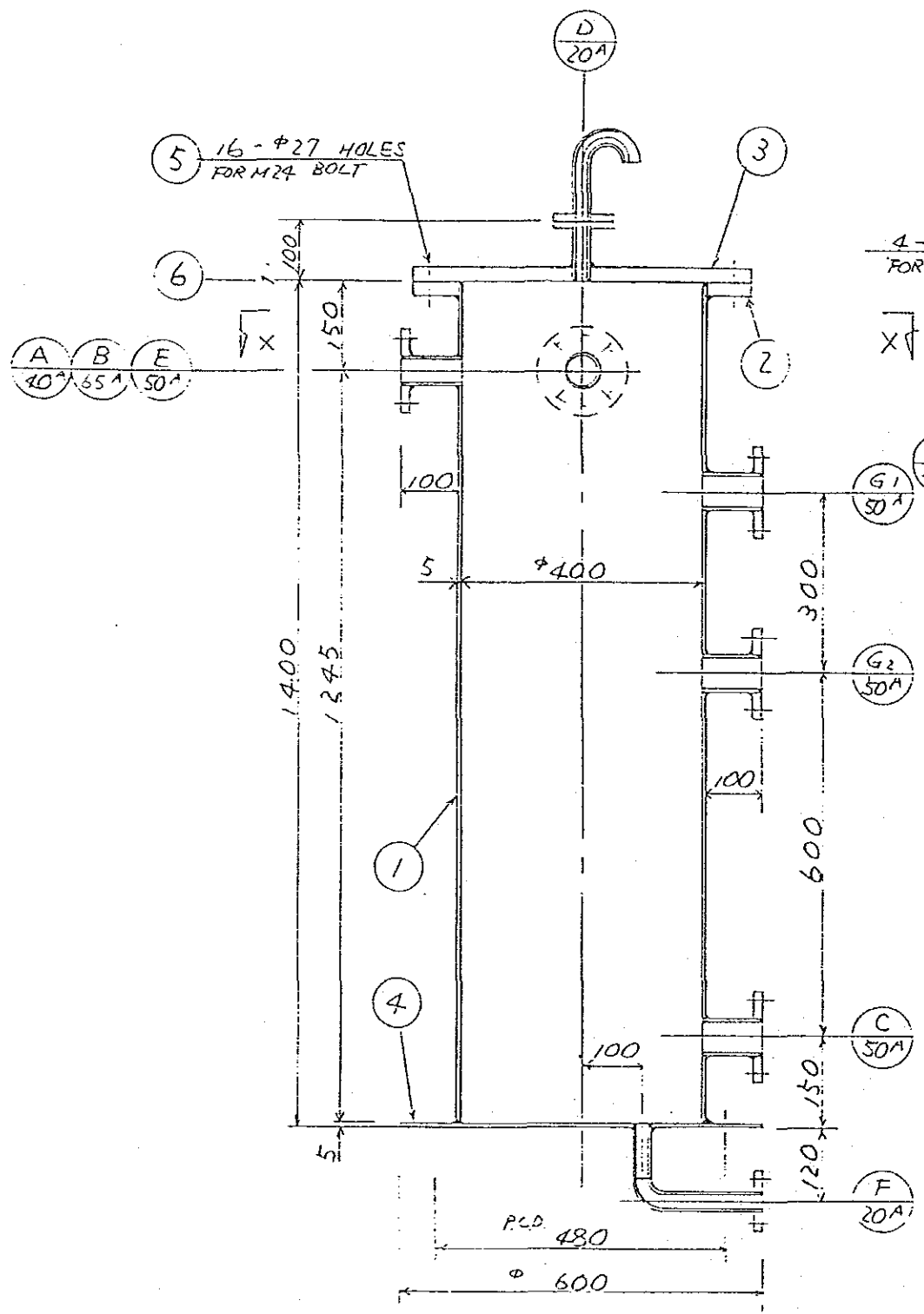
TITLE: ELECTRODE TYPE LEVEL SWITCH FOR WASTE TANK

DATE: SEPT. 22 '87      SCALE: NON

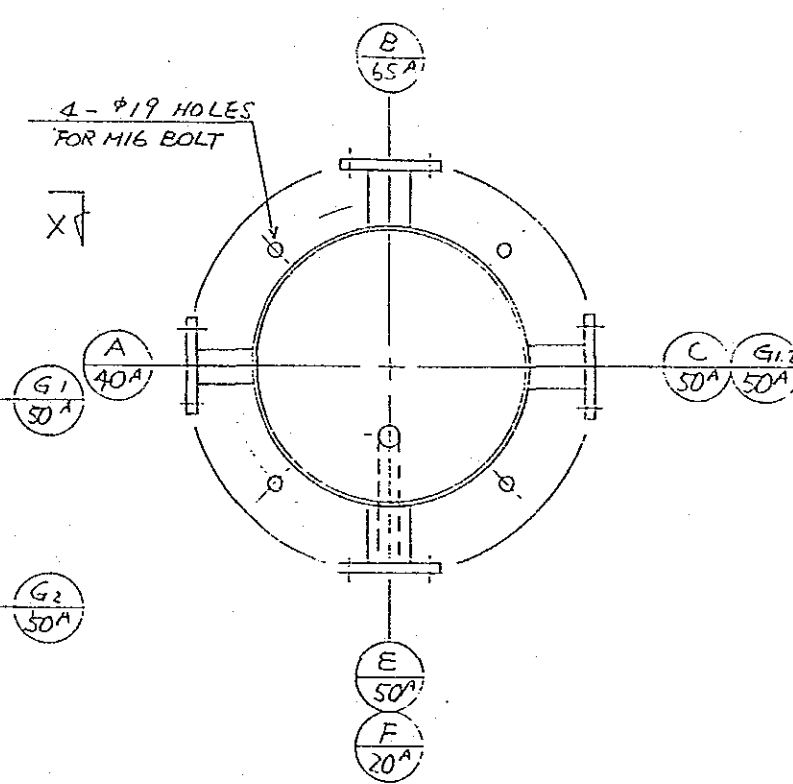
DRAWING NO. : SJ 304- RE 133

JAPAN INTERNATIONAL COOPERATION AGENCY





VIEW X - X



REVISIONS			
NO.	DESCRIPTION	REV'D	CHEK'D/APP'R'D

DESIGN DATA	
FLUID	DISTILLATE
QUANTITY	2.7 m <sup>3</sup> /HR
OPERATING PRESS.	ATMOS.
INLET TEMP.	37.9 °C
OUTLET TEMP.	37.9 °C
DESIGN PRESSURE	1.0 kg/cm <sup>2</sup>
DESIGN TEMP.	40.0 °C
HYDRO'C TEST PRESS.	FULL OF WATER
RADIOGRAPHIC EXAM.	NO
WEIGHT	EMPTY OPERATION FULL OF WATER
	100 kg 217 kg 280 kg

OUTSIDE PAINTING  
 SURFACE TREATMENT --- SPC SP-10  
 PRIME COAT --- CYANAMID HELGON QD. 70%  
 (NIPPON PAINT)  
 TOP COAT --- CR PAINT FINISH COAT 2 1/2%  
 (NIPPON PAINT)

PART NO.	NAME	MATERIAL	Q'TY	REMARKS
6	GASKET	ASBESTOS	1	
5	BOLT & NUT	CARBON STEEL SS 41	16	M24
4	BOTTOM PLATE	DO.	1	EPOXY COATING
3	TOP PLATE	DO.	1	DO.
2	SHELL FLANGE	CARBON STEEL SS 41	1	DO.
1	SHELL	CARBON STEEL STPY 41	1	EPOXY COATING

NOZZLE AND CONNECTION				
MARK	SIZE RATING	SERVICE	MATERIAL	
			NOZZLE	FLANGE
A	40 <sup>A</sup>	JIS 10K 50 FF	CARBON STEEL STPG38	CARBON STEEL SS 41
B	65 <sup>A</sup>	↑	↑	↑
C	50 <sup>A</sup>	↓	↑	↑
D	20 <sup>A</sup>	↑	↑	↑
E	50 <sup>A</sup>	↓	↑	↑
F	20 <sup>A</sup>	↓	↑	↑
G1, G2	50 <sup>A</sup>	JIS 10K 50 FF	CARBON STEEL STPG38	CARBON STEEL SS 41

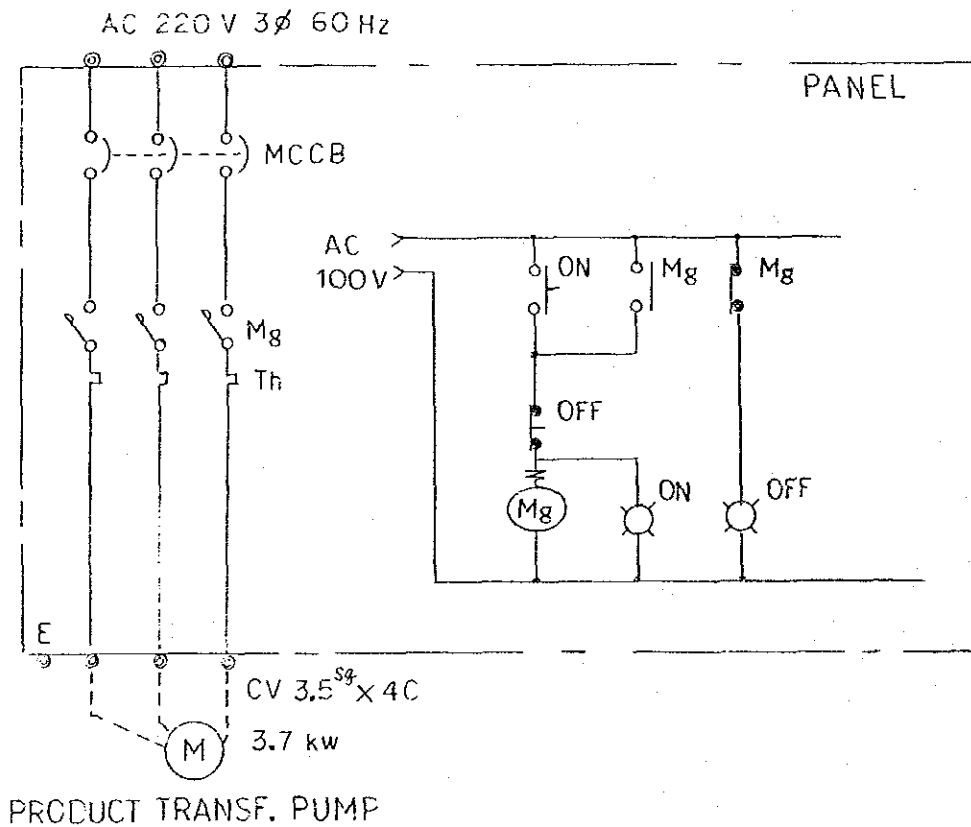
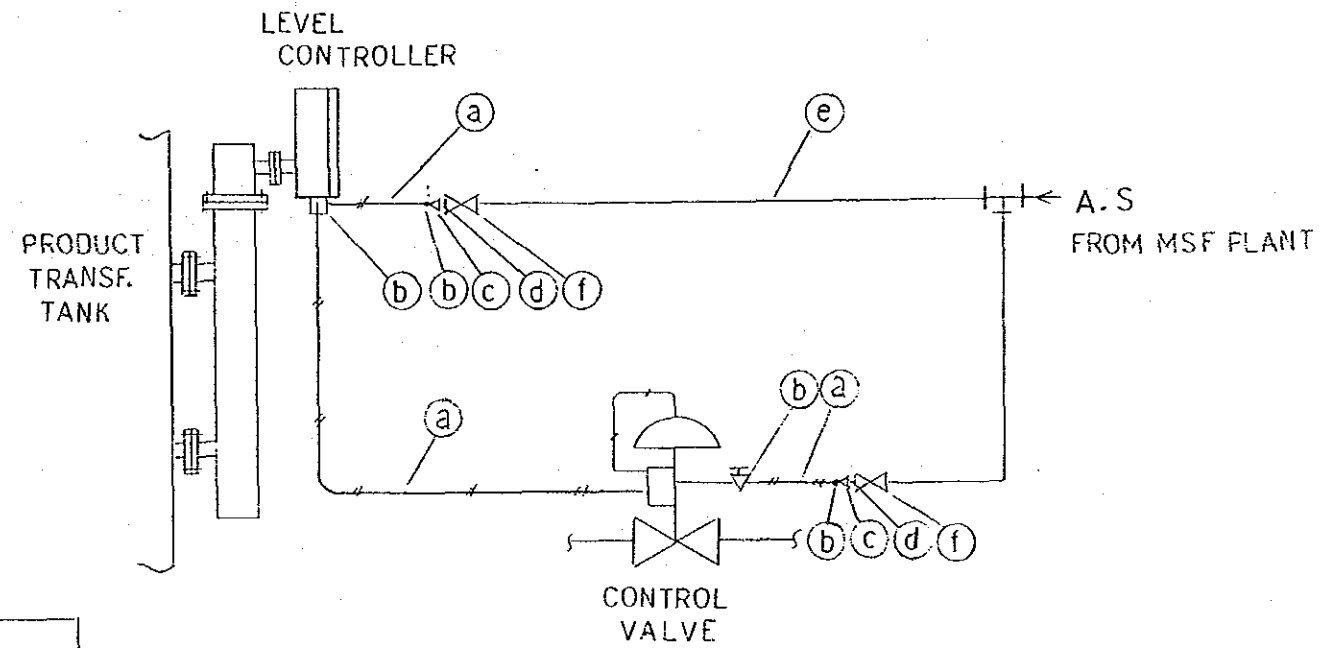
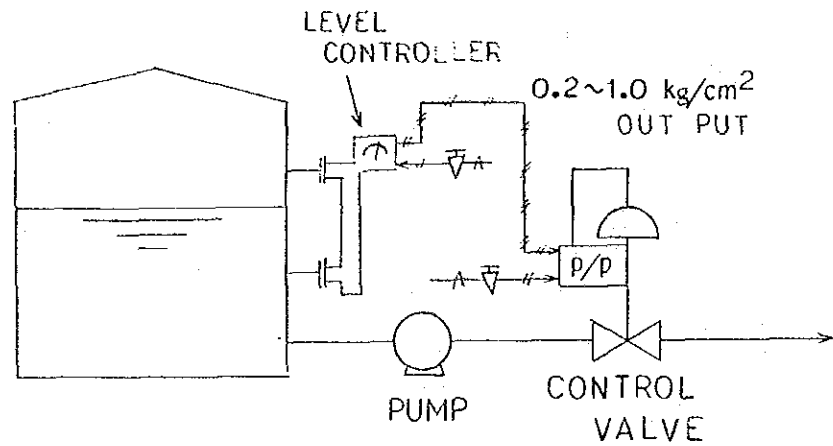
PROJECT: JAPAN-SAUDI ARABIA RESEARCH  
 PROJECT OF SEA WATER DESALINATION

TITLE: PRODUCT TRANSFER TANK

DATE: SEP. '87      SCALE: 1/10

DRAWING NO.:      S&J 304-S0011

JAPAN INTERNATIONAL COOPERATION AGENCY



PART NO.	NAME	MATERIAL	QTY	REMARKS
f	VALVE	BC	2	1/2" GLOBE
e	PIPE	SGP-W		1/2"
d	NIPPLE	FcMB-W	2	1/2"
c	REDUCER	FcMB-W	2	PT 1/2" x PT 1/4"
b	HALF UNION	Bs BM	6	PT 1/4" x 1/4"
a	CUPPER TUBE	Cut		6/4 φ

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

TITLE: PRODUCT TRANSFER TANK  
LEVEL CONTROL SYSTEM

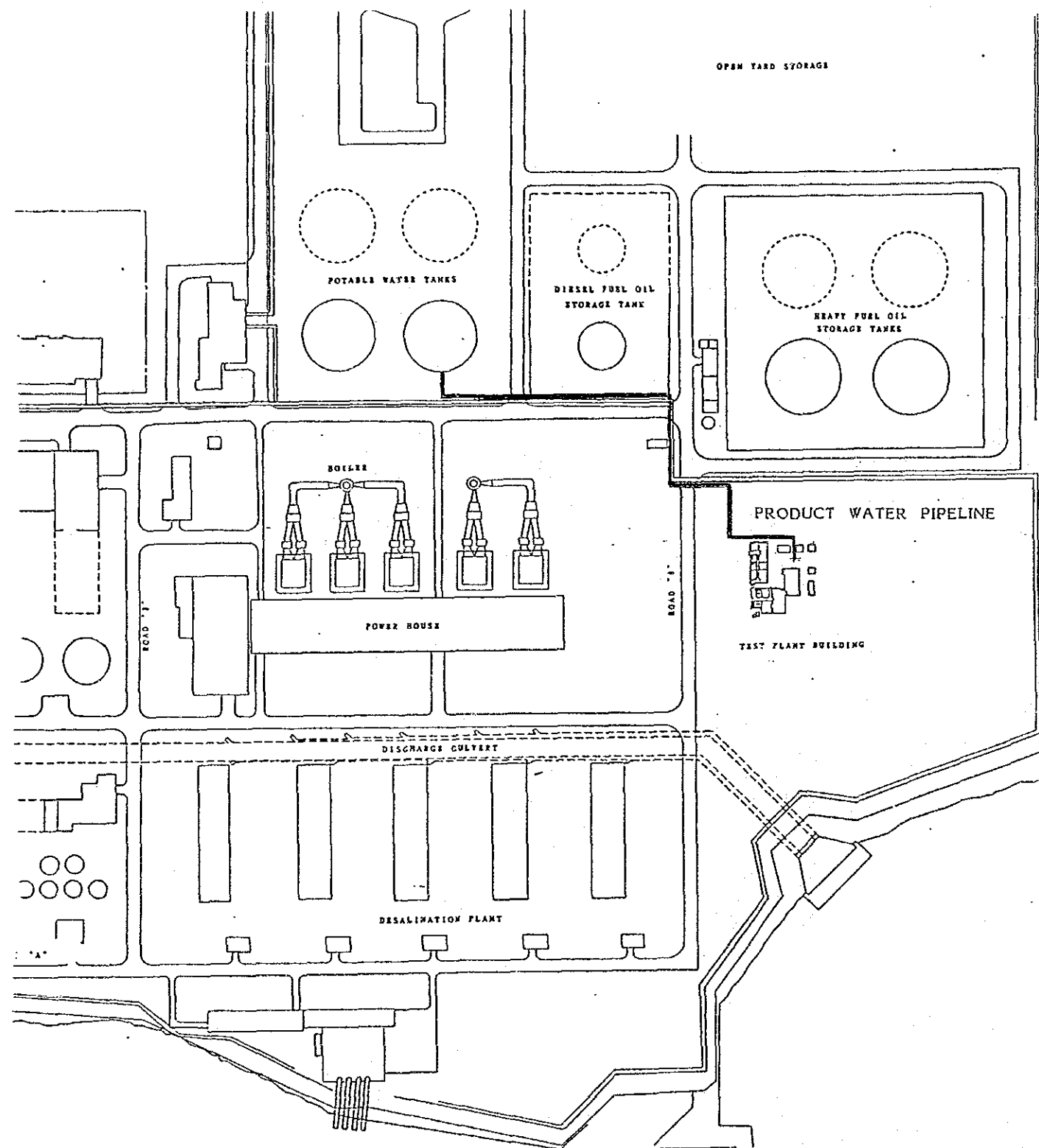
DATE: SEP. 21 '87 SCALE: —

DRAWING NO.: SAJ 304-S1004

JAPAN INTERNATIONAL COOPERATION AGENCY

NO.	DESCRIPTION	REV'D	CHEK'D	APPR'D

REVISIONS



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

TITLE: PRODUCT WATER PIPELINE FROM TEST  
PLANT TO EXISTING CONNECTION POINT

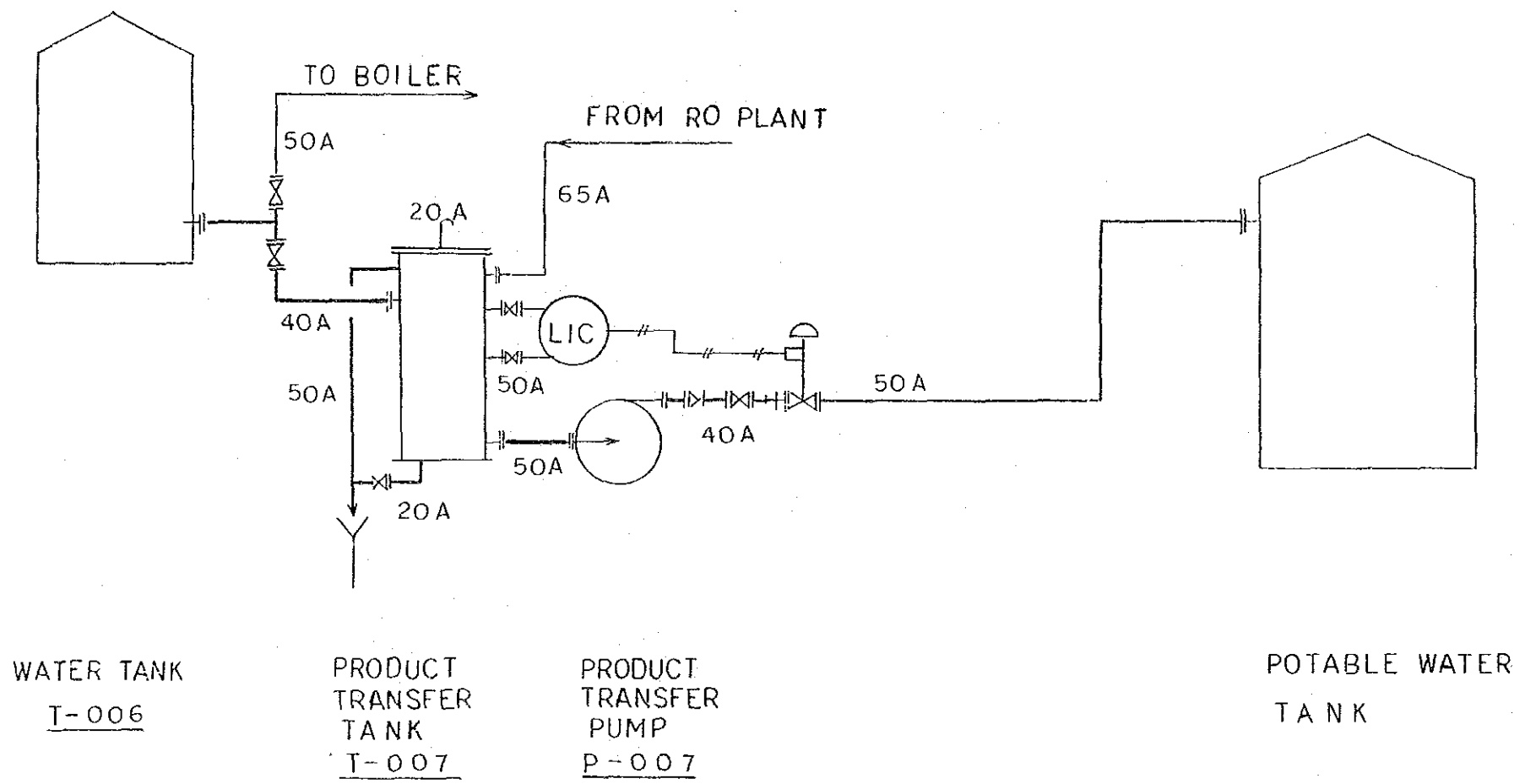
DATE: SEP. 21 '87 SCALE: —

DRAWING NO.: SAJ 304-S10C1

JAPAN INTERNATIONAL COOPERATION AGENCY

NO.	DESCRIPTION	REV'D	CHEK'D	APPR'D
◇				
◇				
◇				

REVISIONS



WATER TANK  
T-006

PRODUCT  
TRANSFER  
TANK  
T-007

PRODUCT  
TRANSFER  
PUMP  
P-007

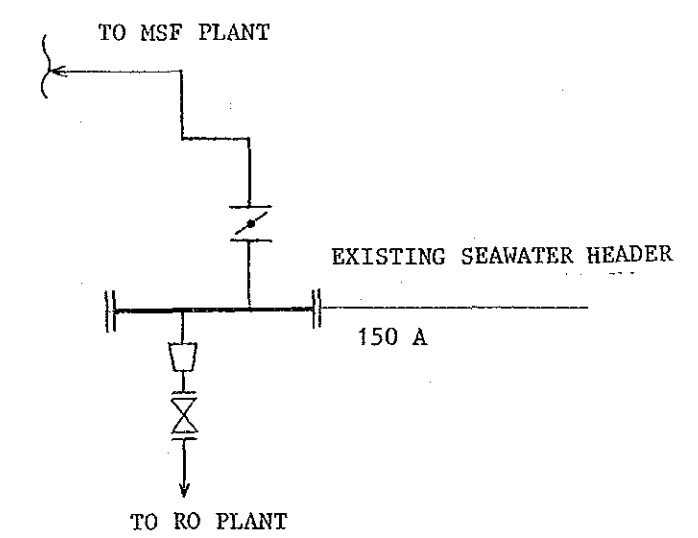
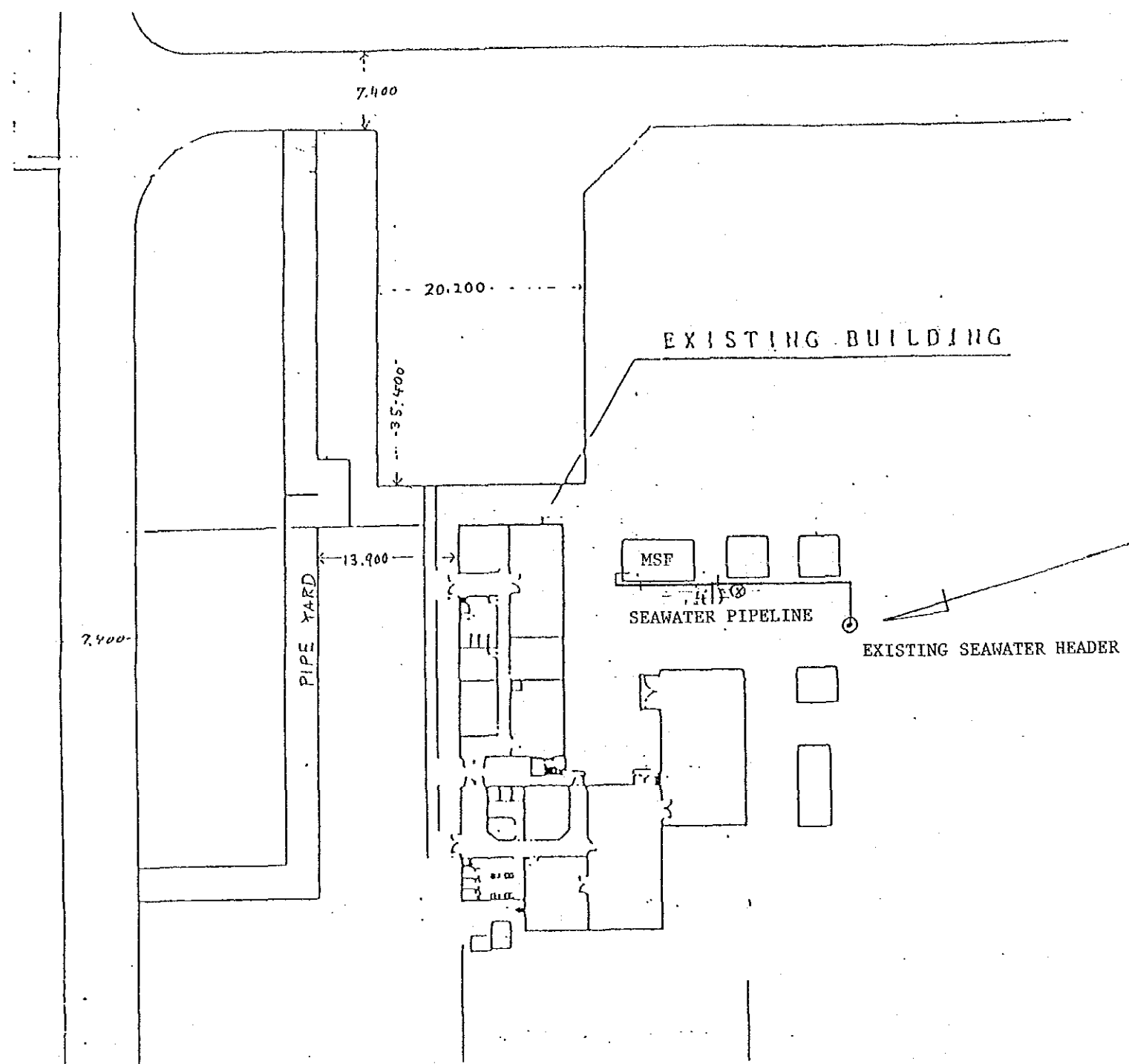
POTABLE WATER  
TANK

PROJECT: JAPAN-SAUDI ARABIA RESEARCH PROJECT OF SEA WATER DESALINATION	
TITLE: PRODUCT LINE FLOW	
DATE: SEP. 21 '87	SCALE:
DRAWING NO.: SAJ 304-S1005	
JAPAN INTERNATIONAL COOPERATION AGENCY	

NO.	DESCRIPTION	REV'D	CHEK'D	APP'D
◇				
◇				
◇				

REVISIONS





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

TITLE: SEAWATER PIPELINE FROM EXISTING  
SEAWATER HEADER TO TEST PLANT

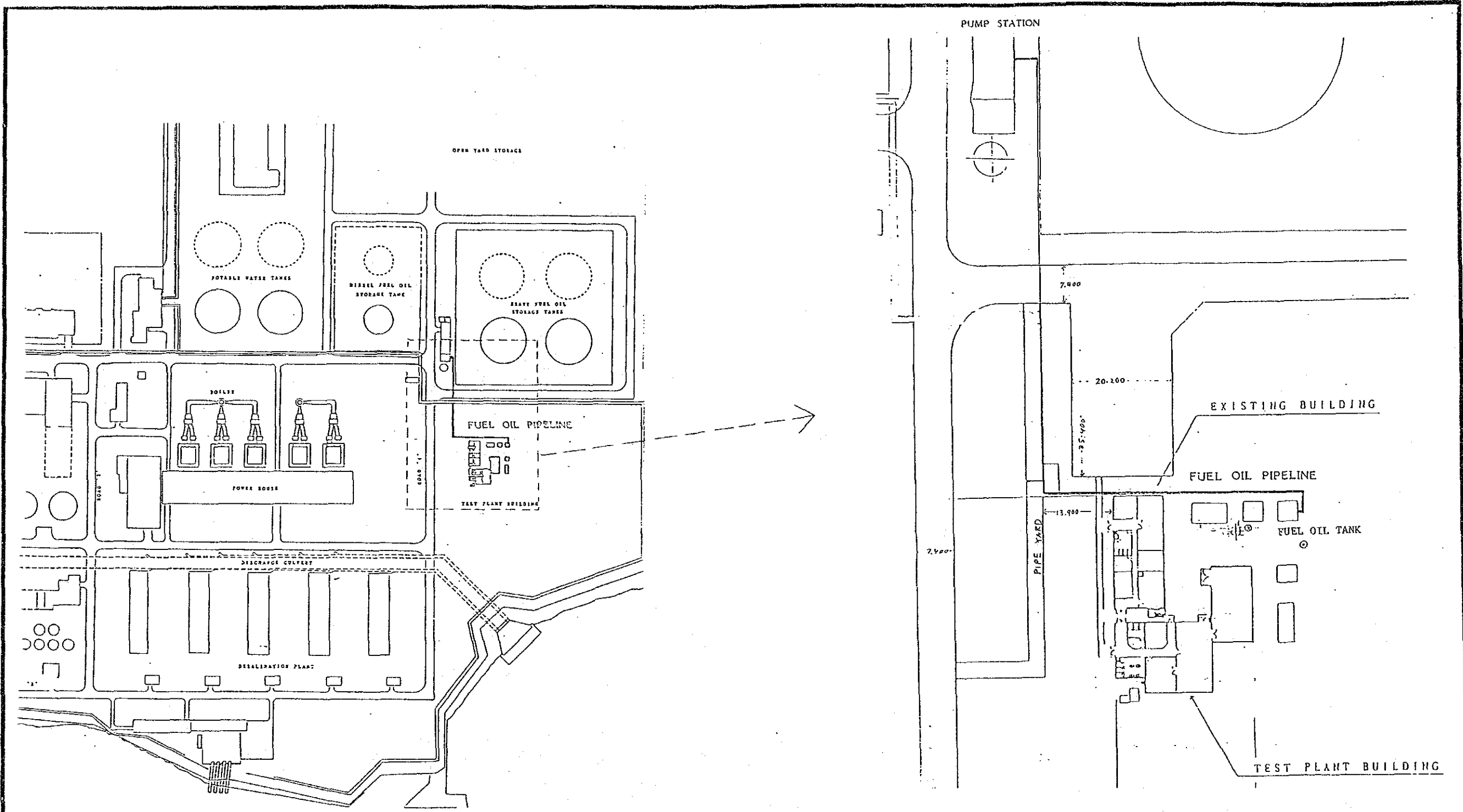
DATE: SEP. 21 '87      SCALE: —

DRAWING NO.: SAJ 304-S10C2

JAPAN INTERNATIONAL COOPERATION AGENCY

NO.	DESCRIPTION	REV'D	CHEK'D	APPR'D

REVISIONS



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

TITLE: FUEL OIL PIPELINE FROM EXISTING  
PUMP STATION TO TEST PLANT.

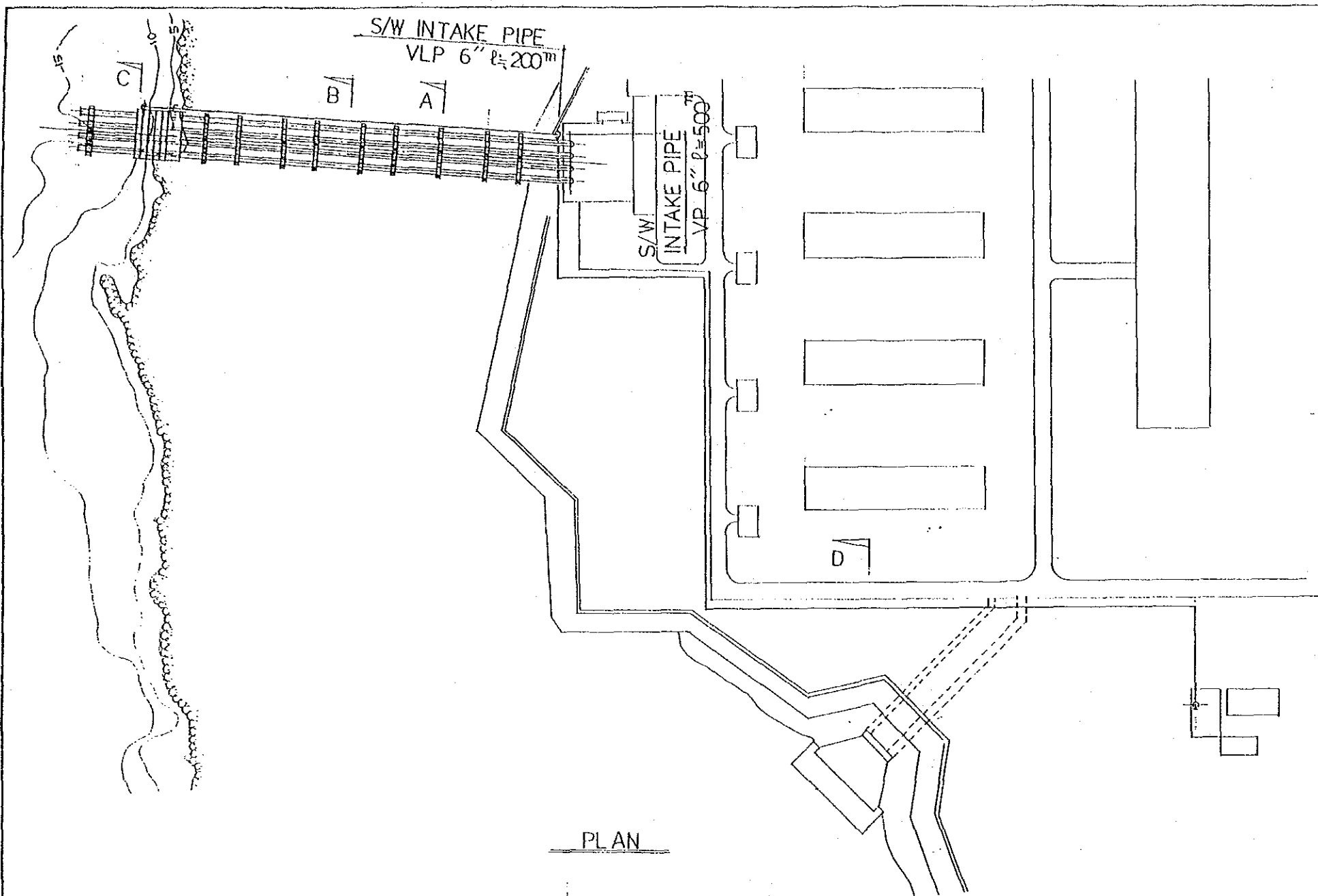
DATE: SEP. 21 '87      SCALE: —

DRAWING NO.: SAJ 304-S1003

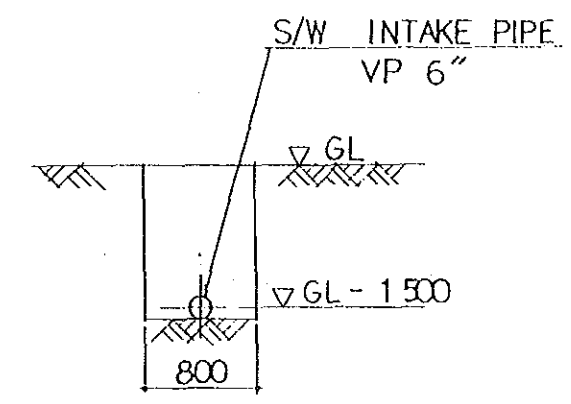
JAPAN INTERNATIONAL COOPERATION AGENCY

NO.	DESCRIPTION	REV'D	CHEK'D	APPR'D
◇				
◇				
◇				

REVISIONS



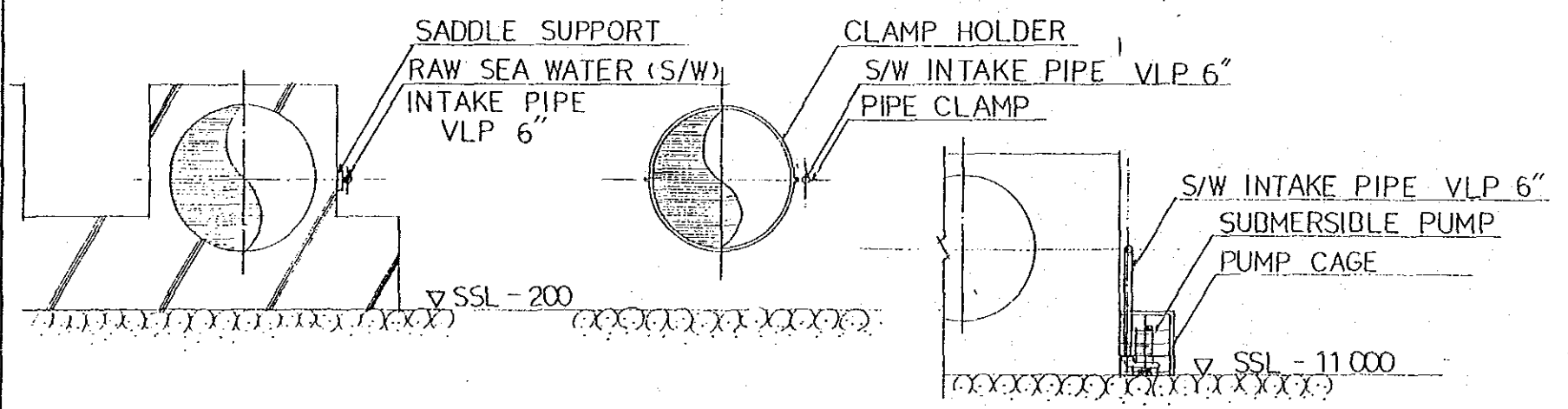
PLAN



SECTION D

REMARKS

- 1 VLP: VINYL LINING PIPE
- 2 VP : PVC PIPE
- 3. VLP OUTER SURFACE COATING :  
TAR EPOXY OVER THAN 0.3 mm



SECTION A

SECTION B

SECTION C

PROJECT: JAPAN-SAUDI ARBIA RESEARCH PROJECT OF SEA WATER DESALINATION	
TITLE : RAW SEAWATER INTAKE SYSTEM GENERAL PLAN	
DATE: AUG. '87	SCALE:
DRAWING NO. :	SAJ 304-K0001
JAPAN INTERNATIONAL COOPERATION AGENCY	



BILL OF QUANTITIES  
FOR  
ANCILLARY FACILITIES



WASTE WATER DISCHARGE PIPELINE

BILL OF QUANTITIES & UNIT COSTS SCHEDULES					
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT RATE	TOTAL COST
1	<u>EQUIPMENT</u>				
	a) Waste Transfer Pump	set	1		
	Type : Self priming centrifugal pump, horizontal mount				
	Capacity : 0.6 m <sup>3</sup> /min.				
	Total				
	head : 25 mHq				
	Revolution: 1750 r.p.m.				
	Material : Stainless steel casting JIS SCS-14				
	Pump	set	1		
	Type : Total enclosed fan cooling (outdoor), horizontal mount				
	Insulation				
	Class : B or E				
	Out rating: 5.5 kW				
	200VAC x 60c/s x 3φ x 4 poles				
	Note: Recommendable pump YOKOTA Mfg. Japan, Type : UHF or UHN 0620-4P				
	- to be continued -				

WASTE WATER DISCHARGE PIPELINE

BILL OF QUANTITIES & UNIT COSTS SCHEDULES					
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT RATE	TOTAL COST
2	<u>PIPING MATERIAL</u>				
	a) Stop Valve	pc.	1		
	Globe type				
	Rating : JIS 10K				
	Bore : 65 mm				
	Conn. : JIS 10K-65A				
	flange				
	Material : Stainless steel				
	casting JIS				
	SCS-14				
	b) Pipe of Pump Suction	m	Approx. 5		
	Bore : 65 mm				
	Material : Stainless steel				
	JIS SUS-316TP #10				
	c) Pipe of Pump Delivery	m			
	Bore : 65 mm		Approx. 12		
	Bore : 100 mm		Approx. 30		
	Material : Polyvinyl chloride				
	(PVC) for the use				
	under high temper-				
	ature (PVC-HT)				
	- to be continued -				



WASTE WATER DISCHARGE PIPELINE

BILL OF QUANTITIES & UNIT COSTS SCHEDULES					
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT RATE	TOTAL COST
	d) Pipe fittings (elbow, flange, reducer, etc.) Material : PVC-HT Rating : JIS 10K Bore : 65 mm, 100 mm	pcs.	As needed		
	Reducer : 65 or 100 mm	pc.	1		
	e) Gasket, bolt & Nut	pcs.	As needed		
	f) Pipe & Flange of Level Switch Bore : 100 mm Flange : JIS 10K-100A Material : Stainless steel Pipe : JIS SUS-316TP sch #5	pc.    m	1    Approx. 3.5		
	g) Supporting Plate & Setting Bolt of Level Switch Material : Stainless steel (4t)	sets	2		
	- to be continued -				

WASTE WATER DISCHARGE PIPELINE

BILL OF QUANTITIES & UNIT COSTS SCHEDULES					
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT RATE	TOTAL COST
3	<u>ELECTRICAL &amp; INSTRUMENTATION</u>				
	a) Control Panel 600W x 800H x 200L (Refer to DWG No. SJ-304-RE132)	unit	1		
	b) Level Switch Electrode Type (3-point) (Refer to DWG No. SJ-304-RE133)	set	1		
	c) Wiring & Piping Materials				
	CV 5.5 sq - 3C	m	50		
	CV 3.5 sq - 3C	m			
	CVV 2 sq - 5C	m	50		
	Conduit pipe (28 mm dia.)	m	50		
	(22 mm dia.)	m	25		
	Miscellaneous	set	1		

PRODUCT WATER PIPELINE

BILL OF QUANTITIES & UNIT COSTS SCHEDULES					
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT RATE	TOTAL COST
1	<u>EQUIPMENT</u>				
	a) Product Transfer Tank	set	1		
	b) Product Transfer Pump & Motor	set	1		
	c) Pump Starter				
	MCCB 30 AF/30AT	pc.	1		
	Magnetic Contactor	pc.	1		
	Thermal Relay	pc.	1		
	Push-button Switch	pcs.	2		
	Indicating Lamp	pcs.	2		
	d) Electrical & Instrumental Work Material				
	. Pump cable; 600V CV 3.5sq x 4C	m	40		
	. Connection Material	set	1		
	. Level Controller and Control Valve for Air	set	1		
2	<u>VALVES</u>				
	. Valve for Feed Water Pump (Globe type)	pc.	1		
	- to be continued -				

PRODUCT WATER PIPELINE

BILL OF QUANTITIES & UNIT COSTS SCHEDULES					
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT RATE	TOTAL COST
	. Valve for Product Tank Inlet (Globe type)	pc.	1		
	. Valve for Product Trans. Pump disch. (Lift check type)	pc.	1		
	. Valve for Product Trans. Pump disch. (Globe type)	pc.	1		
	. Valve for Product Trans. Tank (Globe type)	pcs.	2		
3	<u>POLYCHLORIDE VINYL PIPES</u> Supplying and installation of all polychloride vinyl pipes for "PRODUCT WATER TRANSFER PIPELINE".				
	. $\phi$ 50 PVC Pipe	m	350		
	. $\phi$ 40 PVC Pipe	m	4		
	. $\phi$ 50 PVC 90° Elbow Taper Pocket Joint	pcs.	25		
	. $\phi$ 40 PVC 90° Elbow Taper Socket Joint	pcs.	5		
	- to be continued -				

PRODUCT WATER PIPELINE

BILL OF QUANTITIES & UNIT COSTS SCHEDULES					
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT RATE	TOTAL COST
. ø50	PVC Tee Taper Socket Joint	pc.	1		
. ø50 x ø40	PVC Reducer Taper Socket Joint	pcs.	2		
. ø50	PVC Pipe Socket Taper Socket Joint	pcs.	80		
. ø50	PVC Flange JIS 10K Taper Socket Joint	pcs.	8		
. ø40	PVC Flange JIS 10K Taper Socket Joint	pcs.	7		
. ø50	U-Band for Support ( SS41/Zinc )	pcs.			
. ø40	U-Band for Support ( SS41/Zinc )	pcs.	5		
. M16 x 80mm	Stud Bolt/Nut ( SS41/Zinc )	sets	100		
. M12 x 65mm	Stud Bolt/Nut ( SS41/Zinc )	sets	12		
- to be continued -					

PRODUCT WATER PIPELINE

BILL OF QUANTITIES & UNIT COSTS SCHEDULES						
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT RATE	TOTAL COST	
	. φ65 Gasket JIS 10K ( Rubber )	pc .	1			
	. φ50 Gasket JIS 10K ( Rubber )	pcs.	20			
	. φ40 Gasket JIS 10K ( Rubber )	pcs.	10			
	. φ20 Gasket JIS 10K ( Rubber )	pcs.	3			
4	<u>CIVIL WORK</u>					
	. Excavation	m <sup>3</sup>				
	. Back Filling	m <sup>3</sup>				

SEA WATER INTAKE LINE TO MSF TEST PLANT

BILL OF QUANTITIES & UNIT COSTS SCHEDULES					
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT RATE	TOTAL COST
1	<u>POLYCHLORIDE VINYL PIPES</u> Supplying and installation of all polychloride vinyl pipes for SEA WATER INTAKE LINE".				
	. $\phi$ 150 PVC Pipe	m	0.5		
	. $\phi$ 100 PVC Pipe	m	50		
	. $\phi$ 50 PVC Pipe	m	0.5		
	. $\phi$ 100 PVC 90° Elbow Taper Socket Joint	pcs.	15		
	. $\phi$ 150 x $\phi$ 100 PVC Tee Taper Socket Joint	pcs.	2		
	. $\phi$ 100 x $\phi$ 50 PVC Reducer Taper Socket Joint	pc.	1		
	. $\phi$ 100 PVC Pipe Socket Taper Socket Joint	pcs.	10		
	. $\phi$ 100 PVC Flange JIS 10K Taper Socket Joint	pcs.	4		
	. $\phi$ 50 PVC Flange JIS 10K Taper Socket Joint	pcs.	2		
	- to be continued -				

SEA WATER INTAKE LINE TO MSF TEST PLANT

BILL OF QUANTITIES & UNIT COSTS SCHEDULES					
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT RATE	TOTAL COST
1	. $\phi$ 100 Butterfly Valve Body: Cast Iron/Rubber Trim: 316SS JIS 10K Wafer Type	pc.	1		
	. $\phi$ 100 U-Band for Support ( SS41/Zinc )	pcs.	15		
	. M16 x 70mm Stud Bolt/Nut ( Ss41/Zinc )	sets	24		
	. M20 x 100mm Stud Bolt/Nut	sets	8		
	. M16 x 170mm Stud Bolt/Nut	sets	8		
	. $\phi$ 150 Gasket JIS 10K ( Rubber )	pc.	1		
	. $\phi$ 100 Gasket JIS 10K ( Rubber )	pcs.	5		



SEAWATER INTAKE LINE TO RO TEST PLANT

BILL OF QUANTITIES & UNIT COSTS SCHEDULES					
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT RATE	TOTAL COST
1	<u>PIPING MATERIAL</u>				
	a) Pipe	m	Approx. 20		
	Rigid Polyvinyl chloride 60 OD x 40t (PVC)				
	b) Pipe Fitting Materials	pcs.	As needed		
	Rigid PVC				
	c) Gasket, Bolt & Nut	pcs.	As needed		
	d) Valve	units	2		
	Globe type				
	Rating: JIS 10K				
	Bore : 50 mm				
	Conn. : JIS 10K-50A flange				
	Mat. : Bronze casting or rigid PVC				
	e) Intake Nozzle	pc.	1		
	Type : JIS 10K-50A flange				
	Bore : 50 mm				
	Mat. : Stainless steel SUS316 TP sch#10 50A pipe				

FUEL OIL LINE

BILL OF QUANTITIES & UNIT COSTS SCHEDULES					
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT RATE	TOTAL COST
1	<u>PIPING MATERIAL</u> Supplying and installation of all carbon steel pipes for " FUEL OIL LINE "				
	. 2" STPG38 Sch.40 Pipe	m	130		
	. 2" PT38 Sch.40 90° Elbow	pcs.	15		
	. 2" SS41 JIS 10K Flange	pcs.	4		
	. 2" Globe Valve Body : Cast Iron Trim : 403SS JIS 10K Flange Type	pc.	1		
	. 2" U-Bolt for Support ( SS41/Zinc )	pcs.			
	. M16 x 80mm Stud Bolt/Nut ( SS41/Zinc )	sets	20		
	. 2" Gasket JIS 10K ( Asbestos )	pcs.	5		
	- to be continued -				

FUEL OIL PIPELINE

BILL OF QUANTITIES & UNIT COSTS SCHEDULES					
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT RATE	TOTAL COST
2	<u>INSULATION SCHEDULE</u>				
	. 2" Insulation Material	m	130		
	25mm Rock Wool Pipe Cover				
	0.3mm Aluminium Flat Sheet				
3	<u>OIL PIPING HEATER</u>				
	. 2" Pipe Heater				
	Temp. 0 - 30°C				
	AC 220V / 1ϕ / 60Hz				
	a) Auto Heater	m	130		
	b) Earth Leak Breaker 30AF/30AT	pc.	1		
	c) Magnetic Contactor	pc.	1		
	d) Push-button Switch	pcs.	2		
	e) Indicating Lamp	pcs.	2		
	f) Other Material	set	1		
4	<u>CIVIL WORK</u>				
	. Excavation	m <sup>3</sup>			
	. Backfilling	m <sup>3</sup>			

RAW SEAWATER INTAKE FACILITY

BILL OF QUANTITIES & UNIT COSTS SCHEDULE				
ITEM	DESCRIPTION	UNIT	QUANTITY	TOTAL COST
1	EQUIPMENT			
	-Submersible Pump	pc	1	
	-Pump cage SS41/Zinc	pc	1	
2	PIPING MATERIAL			
	- S/W Intake Pipe VLP 6" Straight Flange Type	m	200	
	- S/W Intake Pipe VLP 6" Bend Flange Type	pcs	4	
	- S/W Intake Pipe VLP 6" Straight Socket Joint	m	500	
	- S/W Intake Pipe VLP 6" Bend Socket Joint	pcs	6	
	- Saddle Support SS41/Zinc	pcs	20	
	- Clamp Holder SS41/Zinc	pcs	25	
	- Pipe Clamp SS41/Zinc	pcs	25	
	- Pipe Socket (VP) SS41/Zinc			
	- Bolt/Nut (for VLP) (SS41/Zinc)			
3	CIVIL WORKS			
	- Excavation	m <sup>3</sup>	627	
	- Back Filling	m <sup>3</sup>	616	







JICA