NOTICE TO TENDERERS

MWH

BUILDING A BETTER WORLD

Number Two

Date: 22 July 2016

Reference: 80507610

Client Fiji Electricity Authority

MWH New Zealand Ltd

Project Wailoa Power Station Generator Rehabilitation
Tender No. MR58/2016

Q. In the specification it mentions the Contractor shall supply ALFLOC 2000 in the quantities and concentration specified in the manual. We cannot find this in the manual but may have found reference to a separate 3b) manual. Are you able to send this manual, or advise the quantity/concentration of ALFLOC 2000 required?

A. Please find attached part of the cooling system manual detailing the requested information. We have reviewed other parts of the manuals and no further information is available.

SECTION 1

CONTENTS.

DRAWINGS.

The following drawings are included at the end of this section:

- UW 103.517 - Cooling Water System Schematic.
- Fig 1-7 - Arrangement of CW System Components and Piping.
- UW 103.912 - CW Surge Tank.
- UW 302.517 - Tailrace Water/Water Cooler.

1. Cooling Water System

1.1. Description

The Cw system is shown diagramatically on drg. UW 103.517 and is arranged as illustrated in Figs. 1-6 included at the end of this section.

The main elements of the system, as described in other volumes (refer equipment list Section 2.), are:-

4 - Generator air/water coolers

1 - Generator upper bearing oil cooler

1 - Generator lower bearing oil cooler

1 - Govenor oil/water cooler

1 - Turbine bearing

Other Elements specific to this system are:-

2 - CW pump + motor sets (one duty plus one standby)

2 - Tailrace water/water coolers

1 - Surge tank

- Flow and pressure switches, etc.

Orifice plates are provided in the pipework system to achieve the correct flows to the generator and turbine coolers. The sizes of orifices required was determined during commissioning and recorded in Section 2.

The CW pipework and fittings in the tailrace (Figs. 1 & 2) fabricated from stainless steel while the remainder of the pipework is executed in carbon steel. In general, flanges are ASA 150 LB RF series and threaded connections to BSP.

Details of all individual valves, fittings and devices are provided in Section 2 and the completed CW system was pressure tested on site at 1 MPa (10 bar).

1. Cooling Water System (cont'd)

1.2. Operation

1.2.1. Filling, Venting, Dosing & Draining

Each CW system is to be filled with clean filtered drinking quality water only via the supply line to the surge tank (Fig.6).

During filling, vent the generator air/water coolers with the valves provided (Fig.5); similarly for the generator bearings.

When the system has been filled, the float valve 553 will automatically maintain the level in the surge tank to compensate for temperature variations and any losses.

On completion of filling, run each CW pump under the manual control (see below) for a short period to assist in expelling any trapped air and continue to vent and run the CW pumps alternately until the system is free of all trapped air and only water is released via the vent valves.

Dose the CW water charge using a product as Catoleum "Alfloc 2000" or comparable locally available product. Dosing chemicals to be mixed in concentrated liquid form and introduced into the CW system by means of the hand pump provided (one between 4 units - temporarily connected to valve 552a when dosing is to be undertaken).

Dosing should be undertaken with a CW pump running and the correct level of dosing ascertained using the maker's stipulated testing methods by taking samples via valves 552 or 531f.

1. Cooling Water System (cont'd)

1.2. Operation (cont'd)

1.2.1. Filling, Venting, Dosing & Draining (cont'd)

Draining the system may be carried out in parts by isolating the section on which it is desired to carry out work using the valves provided. For convenience, an isolating valve has been provided in the downpipe from the surge tank. On reassembly of the CW system, open the isolating valve and vent any trapped air in the manner described above.

1.2.2. CW Pump Operation for Service

Selection and control of the pumps for service in automatic and manual modes are described in Volumes 5 and 7a. Starting and stopping of the selected pump in these modes are subject to certain preconditions associated with unit sequence control and interlocking requirements being met.

Low CW pressure is detected by pressure switch "e2" which, if the pressure does not recover after a short adjustable time delay, initiates the start of the standby pump and an alarm. If the pressure still does not recover after a further adjustable time delay, the unit is tripped. Monitoring of pump operation and of CW flows in the individual cooling circuits for the generator and turbine are desribed in further detail in Volume 5.

1.2.3. CW Pump Operation for Test

Selection of an individual CW Pump for test is made using the CWP four position selector switch on the MCC (see Volume 7a. Section). The pump can then be started and stopped for test purposes, without the need for "service" preconditions being met, using the CW Pump start/stop switch on the main control panel.

1.2.4. Abnormal Operation

Abnormal operation with one tailrace heat exchanger out of service is forseen with unit loads up to 13 MW. No special precautions or adjustments are necessary.

1. Cooling Water System (cont'd)

1.3. Maintenance

1.3.1. Chemical Dosing

Check a satisfactory level of chemical dosing at intervals of approximately 3 months or on any occasion where there has been a significant loss of CW charge due to maintenance operations following the procedures described in the chemical supplier's recommendations. Correct dosing is important in order to prevent scale deposits in the CW System and to avoid corrosion of the metallic components. See Page 4a for procedure.

1.3.2. Protection Devices

Check the correct operation of the protection devices e2 - e327 on a routine basis in line with the time program established for similar work for the remainder of the plant.

1.3.3. Lubrication

CW Pump	-	check weekly and top up as necessary the oil level in the bearing housing-check with the dipstick provided. Employ same grade of oil as for turbine and generator bearings.
CW Motors	-	dismantle bearing housings and check bearings after 3-5 years. If bearings are provided with removable dust caps then remove old grease and replace with new. Repeat about every 3 years and replace the complete bearing when necessary but not later than after about 50,000 operating hours. If fitted with fully sealed bearings it is recommended these be replaced after about 20,000 operating hours.
Valve Spindles	-	grease via the nipple provided on the yoke.

MODIFIED SODIUM NITRITE TEST METHOD FOR USE AS LIMIT TEST FOR ALFLOC 2000 CONTROL.

1. Collect sample of the circulating water, prior to next addition of Alfloc 2000 in plastic bottle supplied.

2. All testing equipment must be washed well with tap water (NOT TREATED WATER) and shaken to remove surplus water.

3. Assemble the 3.5 gram per litre Sulphamic Acid burette and squeeze reservior to fill burette. The burette will return to zero when the reservior is released. (N.D. Sulphamic solution may deteriorate and fresh reagent solution should be made up every 4-6 weeks).

4. Measure 25ml sample of the treated jacket cooling water and transfer to the plastic dish.

5. Add two level teaspoons of Sodium Bisulphate powder to the dish containing the measured sample.

6. Add one or two drops of sample (5) to a piece of starch iodide test paper. A deep blue colour will develop if any Sodium Nitrite is present.

7. Add 8.0ml of 3.5 grams per litre of sulphamic acid solution from the burette.

8. Stir for 20-30 seconds.

9. Immediately add one or two drops of the stirred liquid (8) onto 1½" - 2½" of the starch iodide test paper.

10. If the sodium nitrite level is above 800 ppm the paper will turn blue to a very dark blue immediately.

11. Wash all equipment with fresh tap water and shake dry.

ACTION TO BE TAKEN BASED ON TEST.

(a) If paper (9) turns blue treatment level is satisfactory.

(b) If paper does not turn blue, add a quart of Alfloc 2000 for every 10 gallons of water in the system. Circulate system for one hour and test again.

NOTE: For actual sodium nitrite refer to Alfloc Test Method - TM 85.

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ADELAIDE Telephone 268 2422 • ROTORUA Telephone 53 461

RETYPED FOR INSTRUCTION MANUAL.

1. Cooling Water System

1.3. Maintenance

1.3.4. CW Pump Glands

Adjust the gland follower to control the stuffing box leakage so that it is always sufficient to lubricate the packing.

Repack when the follower has entered the stuffing box by more than one packing width using locally available packing material and readjust.

1.3.5. Tailrace Water to Water Coolers

These coolers have been designed for use with clean water only and a fouling factor of 10% was allowed in the design.

In case, due to unforeseen factors, fouling of the heat exchanger tube external surfaces occurs, cleaning by high pressure water jet may be carried out in-situ. Frequency of cleaning will depend on the rate of deterioration of the heat dissipation capacity which will be indicated by high CW return temperatures which in turn results in high lubricating oil temperatures and is indicated by the bearing oil temperature indicators.

1. Cooling Water System (cont'd)

1.4. Dismantling

1.4.1. Tailrace Cooler

Removal of tailrace water to water coolers can be undertaken via the turbine casing access door (see Volume 2).

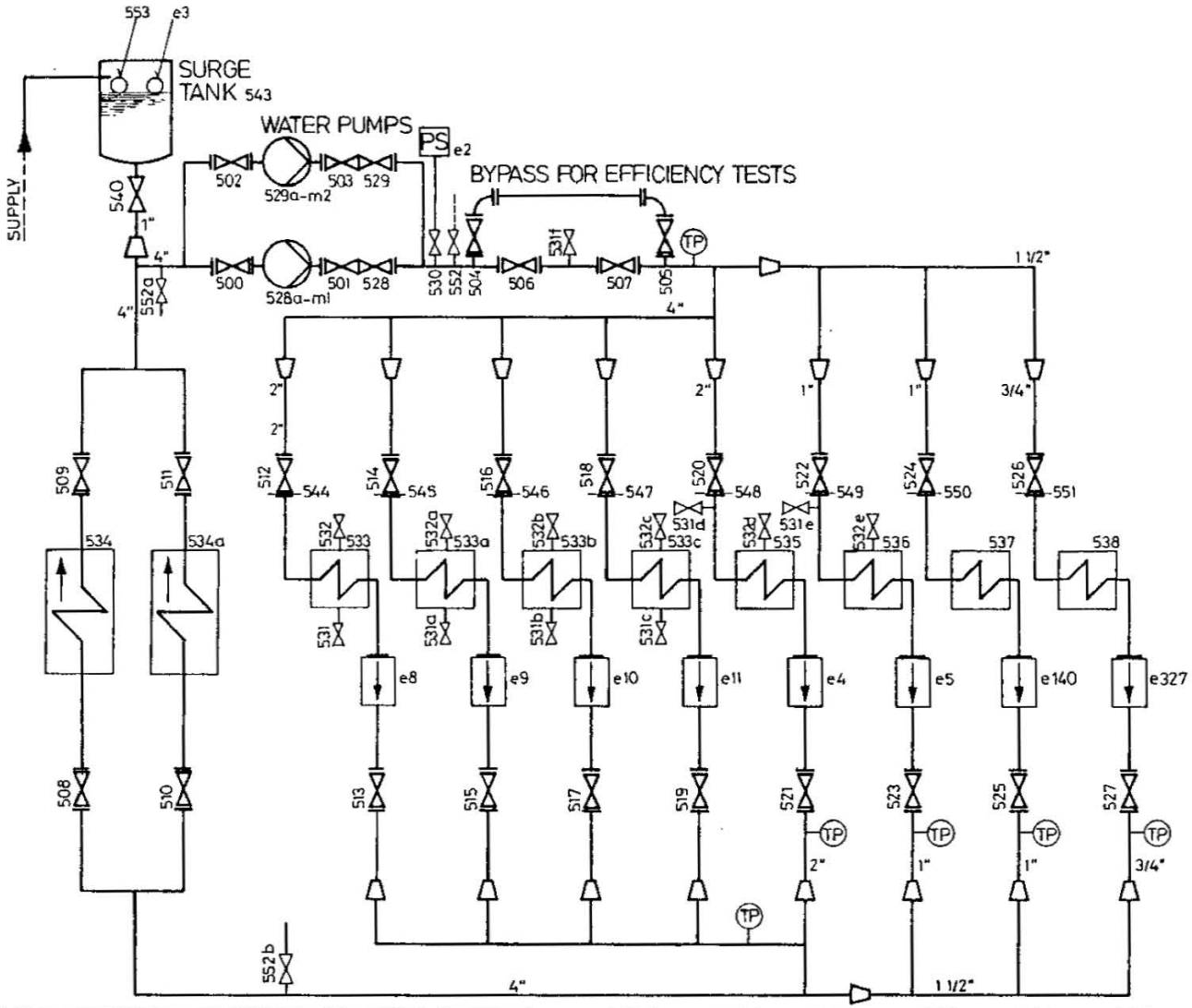
To assist this operation, the grid flooring beneath the turbine runner will need to be partially removed to allow the erection tackle for the turbine inlets (Volume 2, Section 4) to lift the cooler from the tailrace floor to a height above the grid floor sufficient to allow the introduction of a temporary floor to support the cooler weight.

1.4.2. CW Pump

To dismantle the CW pump, first remove the complete pump from the bedplate to the workshop where the pump body may be separated from the bearing housing as shown in the exploded sectional view included in the enclosures to the equipment list 2.7.

1.4.3. Motors

For motors of the size under consideration, it is cheaper to replace with new than repair. The exception to this is dismantling for the maintenance and/or replacement of the bearings, details of which are given in Section 3.



Water-Water Coolers	Air Coolers		U. Bearing Oil Cooler	L. Bearing Oil Cooler	Bearing Cooling	Governor Oil Cooler
TAILRACE	GENERATOR				TURBINE	

504, 505	Gate Valves 3"
500-503, 506-511	Gate Valves 4"
512-521	Gate Valves 2"
522-525	Gate Valves 1"
526, 527	Gate Valves 3/4"
528, 529	Non Return Valves 4"
530, 531f	Isolating Valves 1/2"
531-531e	Drain Valves 3/8"
552-552b	Tapping Point 1/2"
532-532e	Breathing Valves 3/8"
533-533c	Generator Air-Water Coolers
534-534a	Tailrace Water-Water Coolers
535	Generator Upper Bearing Oil Cooler
536	Generator Lower Bearing Oil Cooler
537	Turbine Bearing Oil Cooler
538	Turbine Governor Oil Cooler
e4 & e5	Liquid Flow Monitor with Switch
e140 & e327	Liquid Flow Monitor with Switch
e8-e11	Liquid Flow Monitor with Switch
e2	Pressure Switch
e3	Low Level Alarm Switch
543	Surge Tank
544-551	Flow Regulation Orifice
528a-m1	Cooling Waterpump P1
529a-m2	Cooling Waterpump P2
TP	Thermometer Pocket
553	Float Valve 3/4"

Numeric Device Numbers (e.g. 536) correspond to the items in the Equipment List, Volume 3b, Section 2.

Alpha Device Numbers (e.g. e140) correspond to the items in the same Equipment List and are also shown on the Field Termination Diagram UW 390109.

e2, e4 - e327 appear on Circuit Diagram USA 001990, Sht. 2.
e3 appears on Circuit Diagram USA 001995, Sht. 3.

Mod.	Mod	Mod	Scale:	Drawn	D.K. 6.12.84
			N/A	CHK'D	5-12-84

FIJI ELECTRICITY AUTHORITY

DRAWING Nº

TIBB
TECNOMASIO ITALIANO BROWN BOVERI MILANO

Title:

SCHEMATIC

COOLING WATER SYSTEM

Redrawn for O&M Manual

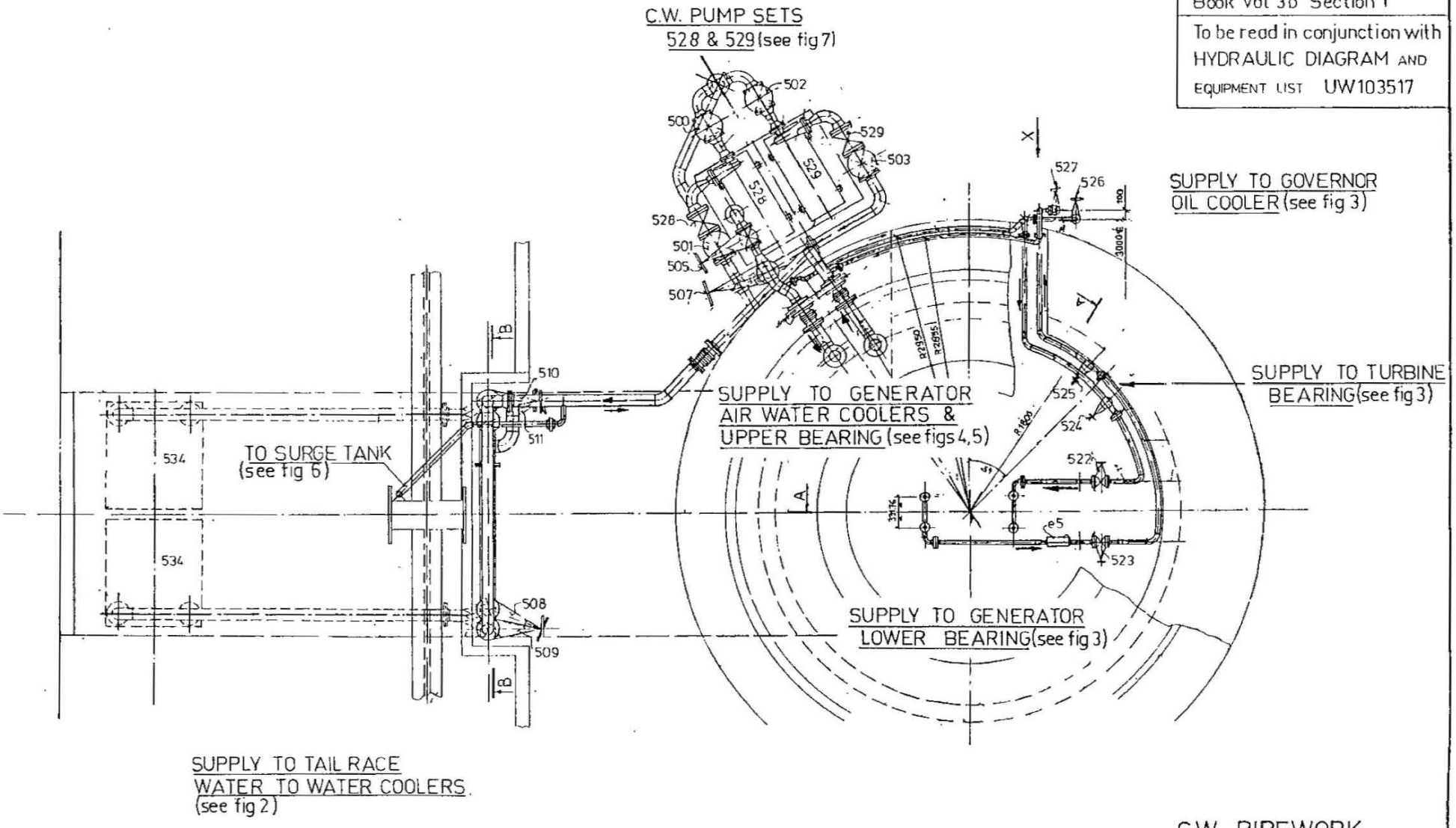
UW 103 517

FEA-WAI ?A1-4

C.W. SYSTEM

Illustration for Instruction Book Vol 3b Section 1

To be read in conjunction with HYDRAULIC DIAGRAM AND EQUIPMENT LIST UW103517



C.W. PIPEWORK PLAN VIEWS

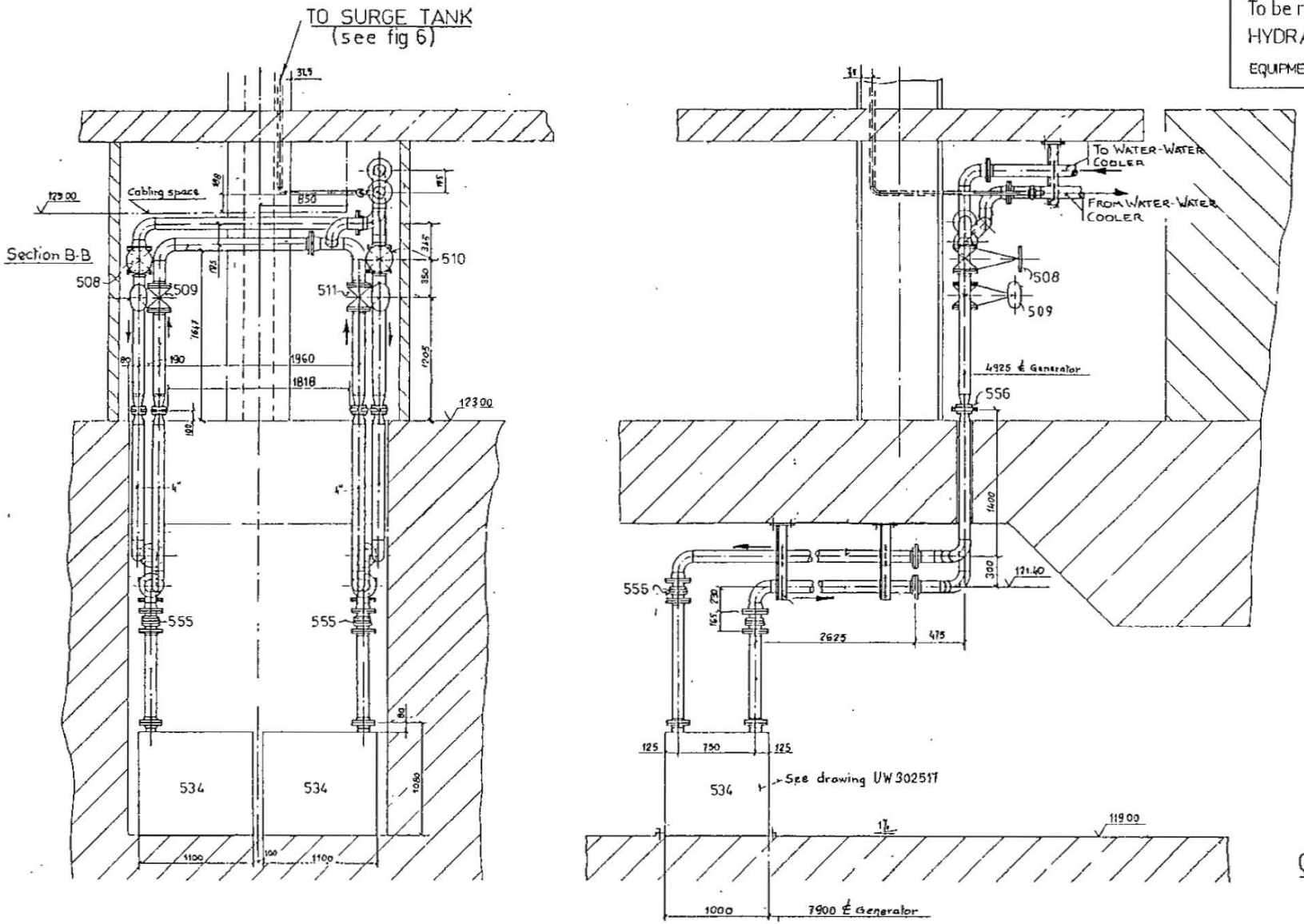
FIG Nº 1

FEA-WAILOA 1-4

C.W. SYSTEM

Illustration for Instruction Book Vol 3b Section 1

To be read in conjunction with HYDRAULIC DIAGRAM AND EQUIPMENT LIST UW103517

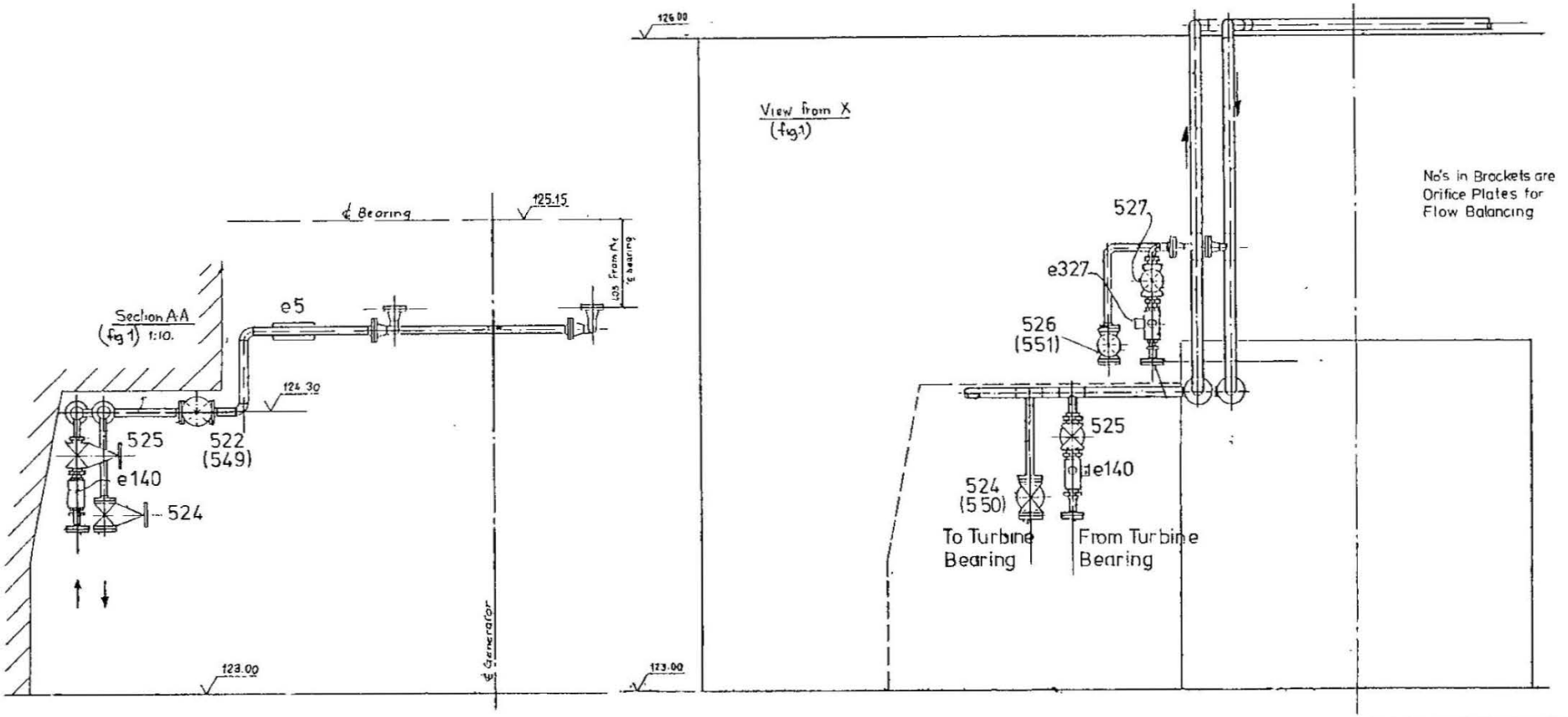


C.W. PIPEWORK ELEVATIONS

SUPPLY TO TAIL RACE
WATER TO WATER COOLER

FIG Nº 2

FEA-W' '.0A1-4
C.W. SYSTEM
Illustration for Instruction Book Vol 3b Section 1
To be read in conjunction with HYDRAULIC DIAGRAM AND EQUIPMENT LIST UW103517

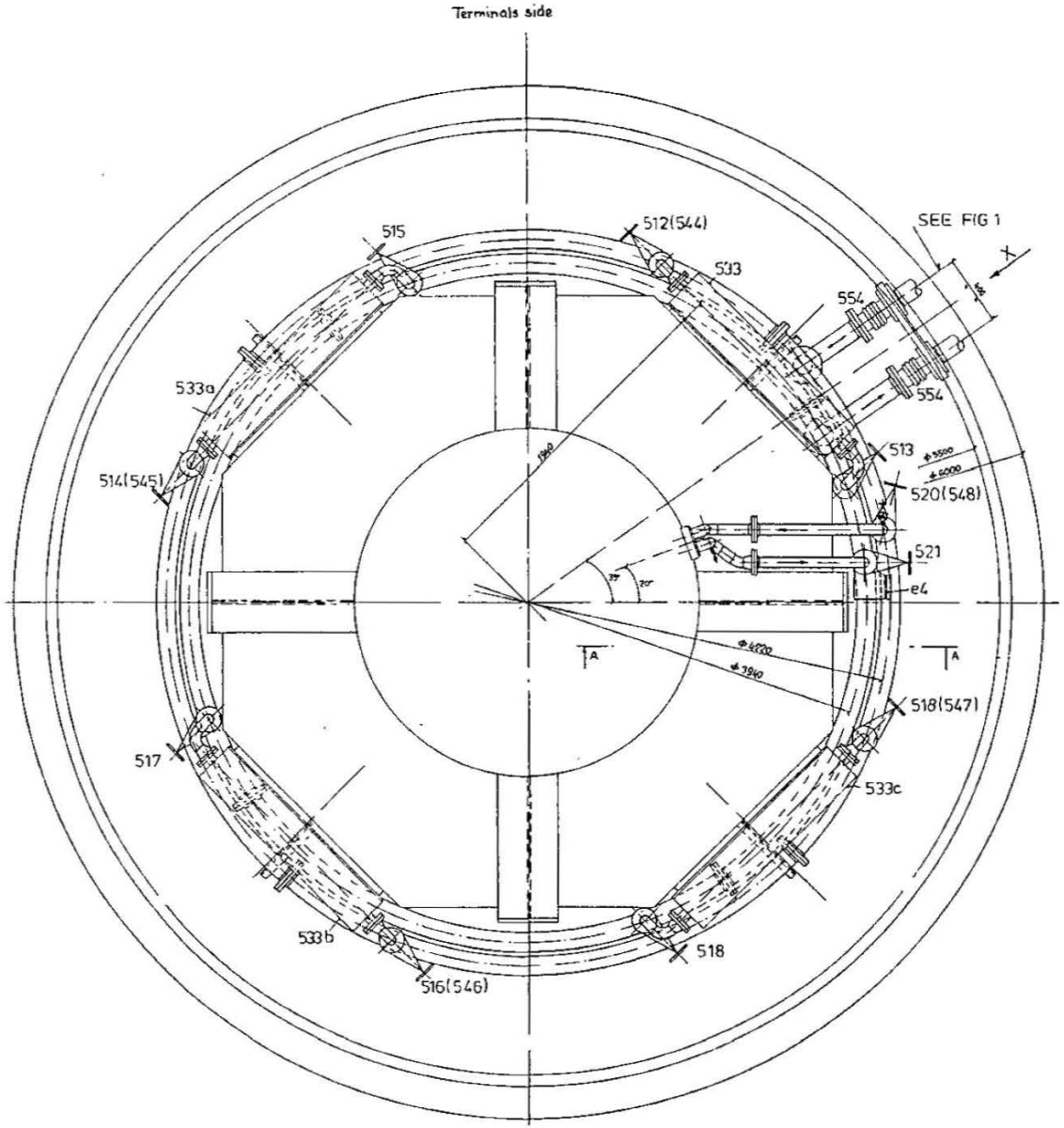


SUPPLIES TURBINE BEARING, GENERATOR LOWER BEARING & GOVERNOR OIL COOLER.

CW PIPEWORK ELEVATIONS

FIG Nº 3

FEA-V .0A1-4
C.W. SYSTEM
Illustration for Instruction Book Vol 3b Section 1
To be read in conjunction with HYDRAULIC DIAGRAM AND EQUIPMENT LIST UW103517



SUPPLY TO GENERATOR AIR/WATER COOLER

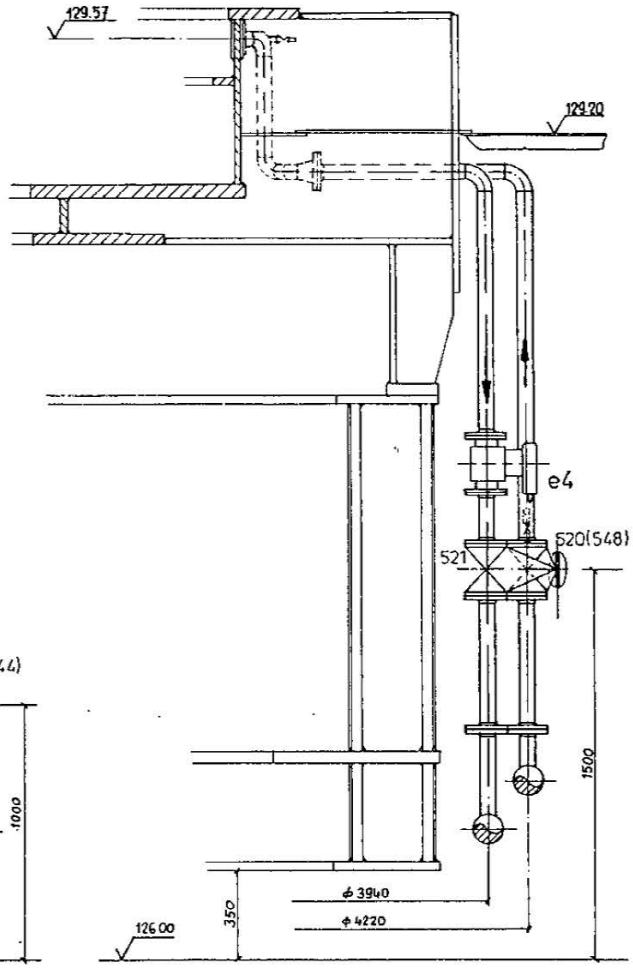
Nos in Brackets are Orifice Plates for Flow Balancing

C.W. PIPEWORK PLAN VIEW

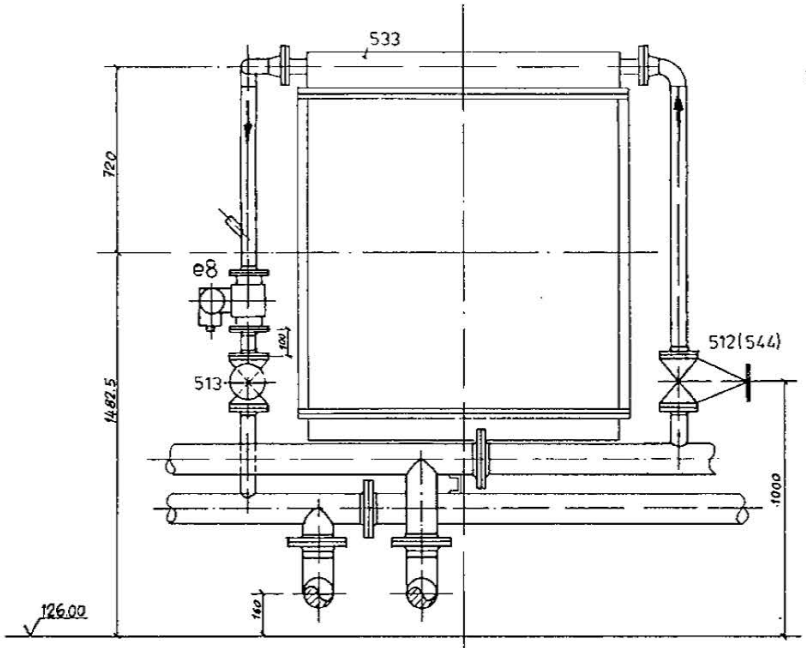
FIG Nº 4

FEA-W 0A1-4
C.W. SYSTEM
Illustration for Instruction Book Vol 3b Section 1
To be read in conjunction with HYDRAULIC DIAGRAM AND EQUIPMENT LIST UW103517

Section A-A(fig 4)



View from X (fig 4)



SUPPLY TO GENERATOR AIR/WATER COOLER

SUPPLY TO GENERATOR UPPER BEARING

Nos in Brackets are Orifice Plates for Flow Balancing

C.W. PIPEWORK ELEVATIONS

FIG Nº 5

FEA-WAILOA 1-4
C.W. SYSTEM
Illustration for Instruction Book Vol 3b Section 1
To be read in conjunction with HYDRAULIC DIAGRAM UW103517

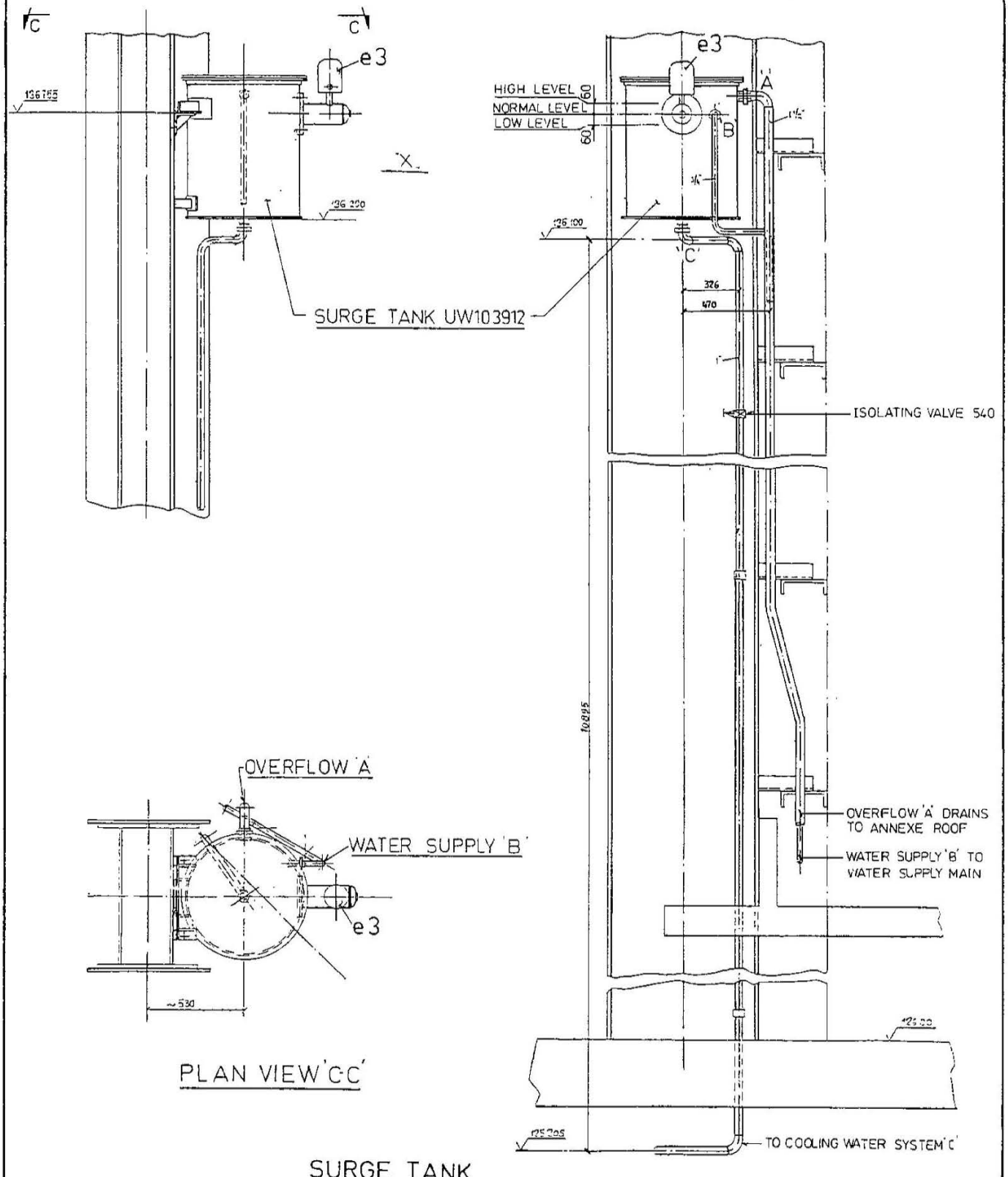
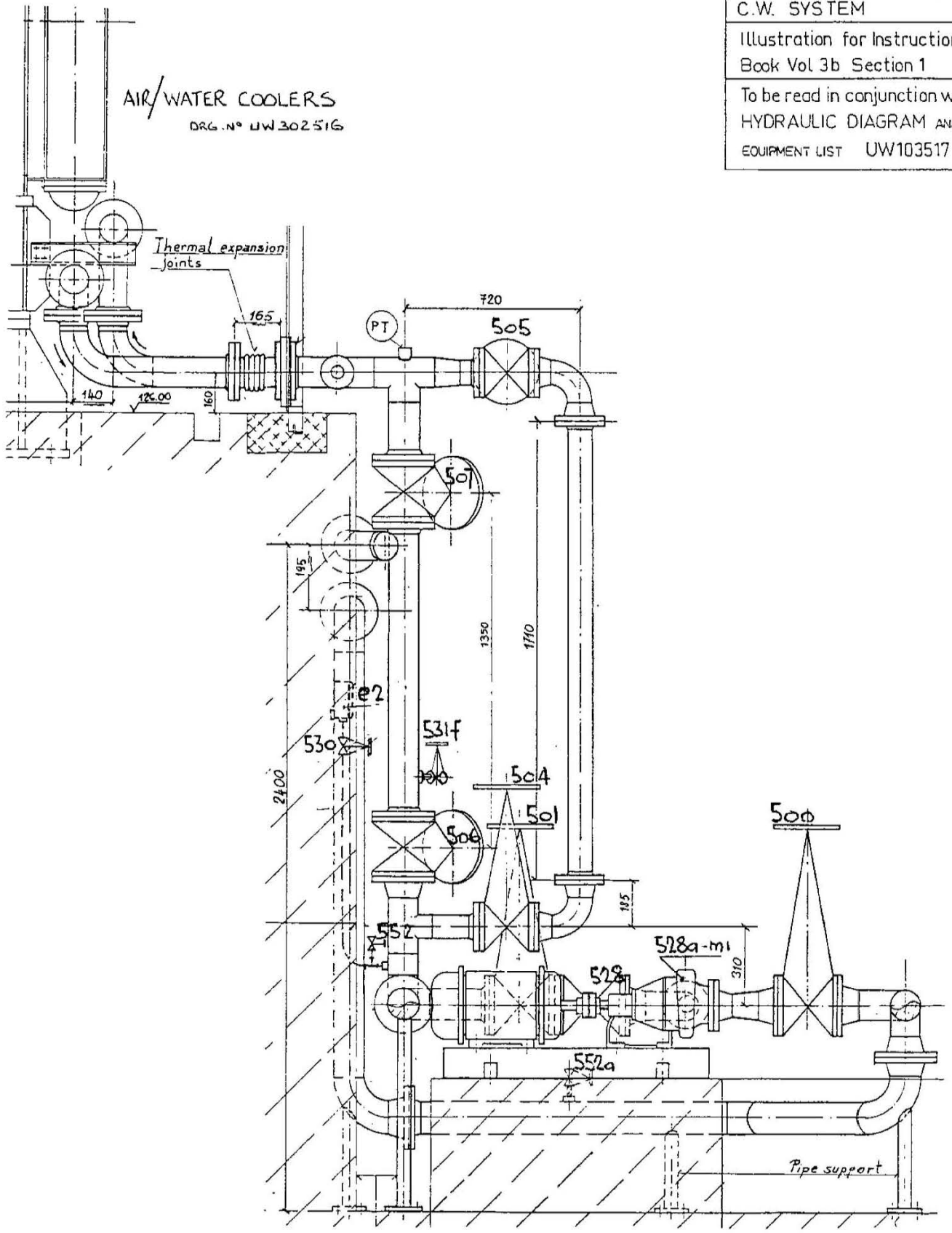


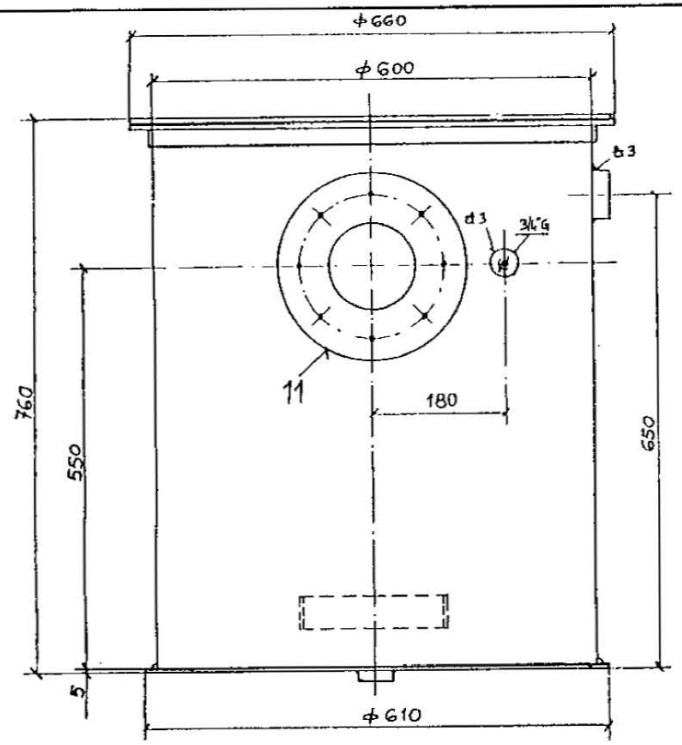
FIG Nº 6

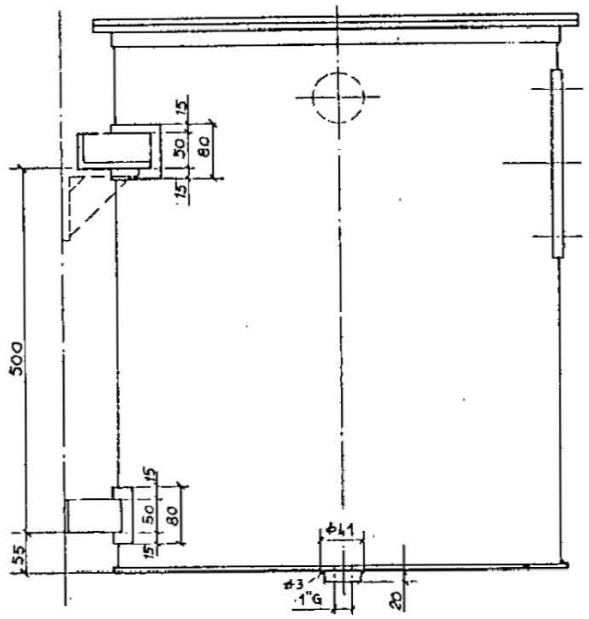
FEA-WAILOA 1-4
C.W. SYSTEM
Illustration for Instruction Book Vol 3b Section 1
To be read in conjunction with HYDRAULIC DIAGRAM AND EQUIPMENT LIST UW103517

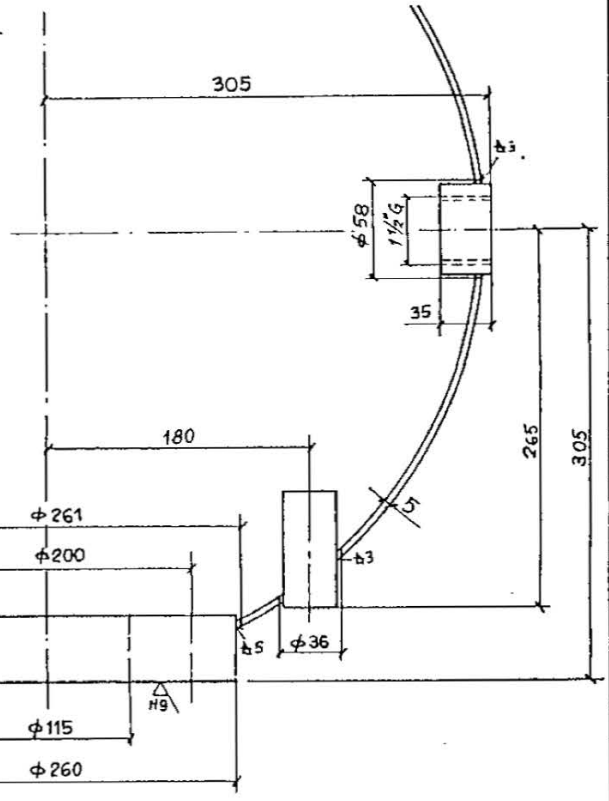


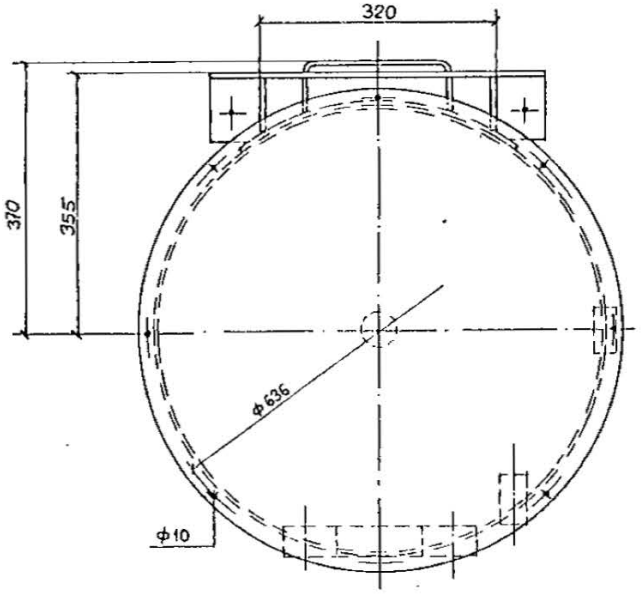
C.W. PIPEWORK ELEVATION

FIG No 7









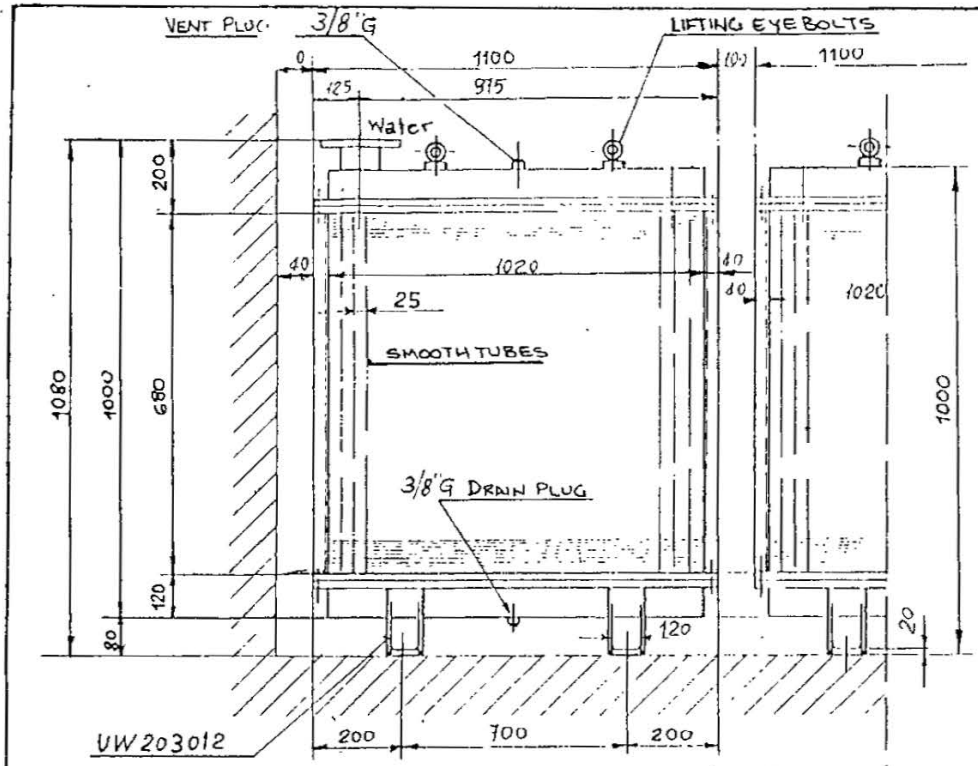
Mod.		Mod.		Mod.		Scale:	Drawn	

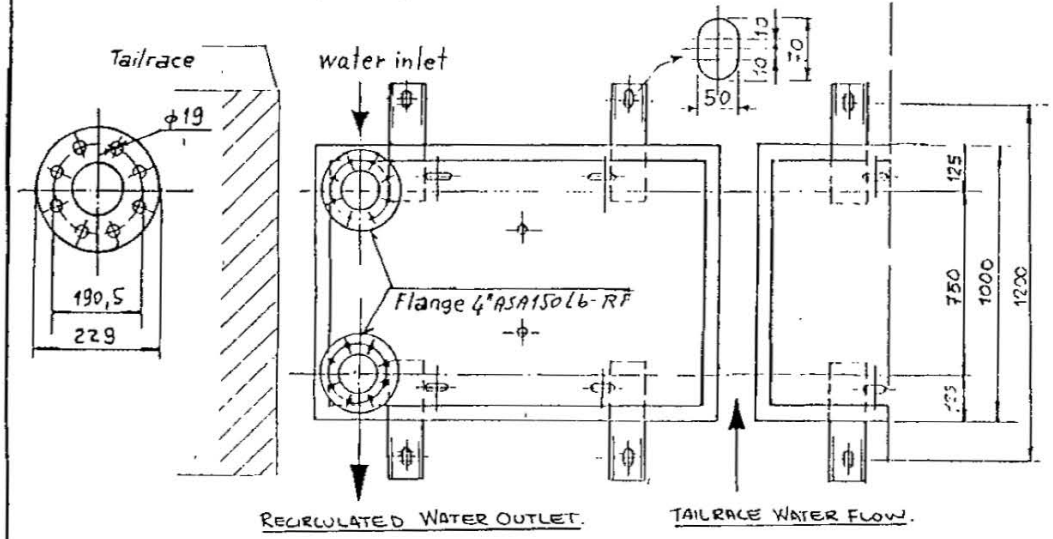
TIBB
TECNOMASIO ITALIANO
BROWN BOVERI
MILANO

Title:
C.W. SURGE TANK

REDRAWN for
INSTRUCTION MANUAL

UW 103 912





Ord. W9.01017/W01/1

MATERIALS

SMOOTH TUBES	:	19.05 ϕ x 1.066 THK - ALUMINIUM BRASS
TUBE PLATES	:	MUNTZ METAL
HEADER BOXES	:	STAINLESS STEEL AISI 304
SIDE PANELS & SUPPORTS	:	STAINLESS STEEL AISI 304

DESIGN PERFORMANCE AT TAILRACE WATER TEMPERATURE 25°C	RATED 100% LOAD AND 2 TAILRACE WATER/ WATER COOLERS	VAR 1 MAX.LOAD WITH 1 GENERATOR AIR COOLER OUT OF SERVICE	VAR 2 MAX.LOAD WITH 1 TAILRACE WATER/ WATER COOLER OUT OF SERVICE
HEAT LOSSES PER COOLER kw	317	257	514
QUANTITY OF INTERNAL RECIRCULATED TREATED WATER l/min	686	630	1045
INTERNAL RECIRCULATED WATER INLET TEMPERATURE °C	33.7	32.4	36.6
OUTLET TEMPERATURE °C	27.1	26.6	29.6
QUANTITY OF EXTERNAL (ie TAILRACE) WATER m^3 sec	APPROX 4	APPROX 3	APPROX 3

INTERNAL PRESSURE LOSS	15m HEAD MAX
TAILRACE WATER TO WATER COOLER SURFACE	49.4 m^2
OPERATING PRESSURE	5 bar
INTERNAL TEST PRESSURE	10 bar for 30 min
COOLER WIGHT EMPTY	1220 kg
FULL	1400 kg

Mod.	Mod.	Mod.	Scale:	Drawn

TIBB
TECNOMASIO ITALIANO BROWN BOVERI MILANO

Title:
TAILRACE WATER / WATER COOLER

REDRAWN for INSTRUTION MANUAL

UW 302 517