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FINAL REPORT

PHASE III

PREFEASIBILITY STUDY FOR A GREENFIELD INVESTMENT

ON

JUTE PULPING

FOR

UNIDO, VIENNA

BY

I V A

SYNOPSIS

INTRODUCTION

The United Nation Development Programme (UNDP) in response to a request from the Ministry of Textiles, Government of India has approved the project DG/IND/92/316
- JUTE FOR INTERNATIONAL QUALITY SPECIALITY PULP -
as a part of the National Jute Programme. The implementing Agency is the Ministry of Textiles through the Central Pulp and Paper Research Institute (CPPRI), Saharanpur, in collaboration with the ITC Ltd. - Tribeni Tissue Division /TTD), Calcutta.
UNIDO as cooperating Agency for the project engaged IMPCO-VOEST-ALPINE Pulping Technologies GmbH (IVA), Linz, Austria, as contractor, to provide services and perform the work for Phase III as described in the terms of reference for the subcontract envisaged by the project.

Phase III - Pre-Feasibility Study for a Greenfield Investment

- Preparation of a pre-feasibility study, given recommendations about the latest technology to be used for a greenfield jute based pulp mill with a capacity of 150 t/d, on the basis of the results achieved from the investigations in Phase I and Phase II. Technologies for black liquor recovery/utilization as well as environmental protection should be included.

- Preparation of a report including:
  - Process Description
  - Process Flow Diagram
  - Main Equipment (imported and locally manufactured)
  - Investment and Operational Costs

  TTD will provide the necessary market study and the economic viability analysis. The report is attached to the synopsis.

The services and work of IVA was carried out under the contract No. 94/028, Project DG/IND/92/316 in collaboration with CPPRI and ITC Ltd.

OBJECTIVE OF THE PROJECT

The objective of the project is

1. To investigate the cost for a greenfield mill with a capacity of 150 ADMTD bleached jute pulp.

2. to produce jute pulp of international standard which can be used as long fibre speciality pulp such as pulp produced from hemp, flax etc.

The investment is based on a complete greenfield project including

* Jute Handling
* Pulping Line
* Recovery System
* Energy System
* Water and Effluent System

As shown in detail in item 8 the production cost per ton of BDMT of bleached pulp depends heavily from price of purchased jute. For this reason two different cases are shown.

Case A:	For a jute price of Ind. Rs. 14.000,-- the operating cost will be 34.140,-- Ind. Rs.
Case B:	For a jute price of Ind. Rs. 7.000,-- the operating cost will be 20.762,-- Ind. Rs.

As shown in detail in item 9 the overall investment cost for the greenfield investment will be

2.642,8 Million Indian Rs.

Attachment

Economic Viability of Greenfield Investment of Jute Pulp Mill prepared by ITC Limited

I.T.C. LIMITED

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ECONOMIC VIABILITY OF GREENFIELD INVESTMENT OF JUTE PULP MILL

Introduction

Tribeni Tissues is using non-conventional fibre from the very inception of the Mill for Cigarette Papers. Initially hemp was used in larger quantity and it was an essential component in the fibre furnish. Due to shortage of hemp fibre, an alternate fibre was looked at and jute fibre introduction started. The technology for jute pulping was developed inhouse and through R&D efforts, continuous improvement in the quality of jute pulp was done.

Due to its high holocellulose content and low lignin content in jute fibre, the pulp yield is high in comparison to other conventional papermaking raw materials and the resulting strength properties of the paper are of higher quality. Because of its long fibre nature and bulkier fibre characteristics, it has been used in a number of speciality grades in TTD.

Depending on the relative cost of jute pulp to imported woodpulp prices and the fiscal benefit derived out of non-conventional fibre usage, the jute usage varied widely over the years.

Usage of Jute by Tribeni Tissues

For many years, jute fibre has been used for pulping in Tribeni Tissues. Through inhouse R&D, in the area of pulping and bleaching of pulp, jute pulp quality is brought upto a level where usage of jute has gone up considerably from a level of few thousand bales in 1980s to 1,20,000 bales in 1995-96. Details of yearwise consumption is shown in Annexure I.

It might be seen that while there has been sustained increase in consumption of jute up to 1995-96, there has been drop in the consumption of jute in 1996-97. The factors affecting jute fibre usage at TTD are as follows :

1) **Jute price fluctuation** : The jute price fluctuates so much with in a year and between years such that it becomes very difficult to predict its price. The average landed price of the fibre in 1996 was Rs.16125 which has come down to an average price of Rs. 9600 in 1997.

2) **Fiscal Incentive** : As per Govt. of India Excise Notifications, the fibrous materials i.e. Agricultural residues like Jute, Bagasse & Rice Straw etc. and Waste paper have been categorised under 'Unconventional Fibrous Materials' which attracts certain Fiscal benefits.

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Prior to 1996, there were three slabs of excise duty :

5% duty - If > 75% non-conventional fibre used.
10% duty - If > 50% & <75% non-conventional fibre used
20% duty - If < 50% non-conventional fibre used

This three tier system has been changed to two tier system since July,1996 :

10% duty - If > 50% non-conventional fibre used
20% duty - If < 50% non-conventional fibre used.

This has been further changed in Sept, 1996.

5% duty - If > 75% non-conventional fibre used
20% duty - If < 75% non-conventional fibre used.

This has been changed in March, 1997 and continuing till date.

5% duty - If > 75% non-conventional fibre used
18% duty - If < 75% non-conventional fibre used.

The withdrawal of Excise benefit for usage of more than 50% & < 75% of unconventional fibre resulted in change in furnish with more use of woodpulps. Some of these grades coluld not be manufactured with 75% jute pulp due to product quality requirement and hence these grades are converted to 18 % excise duty.

3) Since 1996, more industries have been extended with MODVAT credit and hence customer is not affected by excise duty . In those cases 100% woodpulp furnishes were used in those papers resulting in reduce jutepulp usage.

4) **Imported Pulp Price** : There is a cyclic phenomenon in the imported pulp price. When the imported pulp prices are lower than the jute pulp price, for cost reasons there is a drop in jute pulp consumption in that year if the excise benefit is not compensating for the differential cost of the pulps.

5) With liberalization and opening up of the economy for International competitions, there has been considerable quality and cost awareness for all products in India, more so in speciality paper line that ITC-Tribeni Tissues Divison is in. In some grades for quality reasons jute pulp usage has been reduced or taken out.

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Jute Fibre Procurement

Prior to 1988, most of the jute fibre was procured through brokers in Calcutta who purchase the bottom cuttings from the jute mills. Occasionally jute mills have sold bottom cuttings directly. The jute cutting has the bark percentage of 10% to 20%.

Since 1988, TTD initiated processing centres at Dalkhola, Baidyabati and Rishra in which long jute was purchased, chopped, baled and dispatched to the Mill from the processing centres and the total process was managed by a designated supplier. Sometimes bottom cuttings of export quality jute were purchased from outside sources. These cuttings and choppings have average 10% bark.

In 1994-95, jute cuttings were purchased from Bangladesh. Bulk purchases of BTCA quality with 10% bark was done. In 1995-96, along with BTCA and BTCB quality were purchased which has bark content of 20% to 35%.

The introduction of high percentage of bark material caused seroius quality problem in the paper which resulted in upgrading the quality of jute to be used in the process subsequently to a low bark content fibre (about 7% bark).

The landed cost of jute fibre from 1987-98 has been given in Annexure II.

Woodpulp Procurement

The prices of imported woodpulp is cyclic in nature. The pulp price is mostly affected by recession of the Paper Industry internationally. Exchange rate of US $ to Indian Rupee and custom duty also affect the landed price of the imported pulp.

The detailed Mill delivered prices for NBSKP and Soporcel pulps are listed for the period 1987-1998 in Annexure II.

Cost of Jute Pulp

A detailed conversion cost of jute pulp of the existing mill is listed at a jute price of Rs 8000 per AD tonne of jute fibre which is listed in the Annexure III.

Comparison of pulp prices for the period 1987-1998 (Annexure IV) shows that there is no specific pattern in the cost of Jute pulp and the prices of Kamloop (NBSKP) & Soporcel (Hardwood).

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From the pre-feasibility study for a greenfield investment for 150 t/day jute pulp mill, it is noticed that there is a need of about Rs.264 crores investment for this project. This project includes fibre line with rotary digestors and O-A-Eop- P bleaching sequences, Chemical Recovery Unit, Steam & Power Unit, Water Treatment Unit, Effluent Treatment Unit, Chemical Handling Unit.

Based on the pulp production cost given in the Phase III report for jute pulp, keeping the price of jute fibre at Rs.8000 per tonne, delivered at the mill, the cost of pulp manufacture will be Rs 22674 per BDT. This does not include the interest & depreciation for the project. Considering total investment for the project of Rs 264 crores, on annualized basis Interest @ 14% will be Rs 37 crores and Depreciation @ 5.28% will be Rs. 14 crores. For 350 days working, there will be 47250 BDT pulp and hence the interest and depreciation per tonne of pulp will be Rs.10,794/-. Total cost of pulp production will be Rs.33,468/- per BDT and Rs.30,326/- per ADT.

Jute pulp will be commercially viable if imported pulp prices will be more than US$620. Since at present imported pulps are available to the subcontinent at a price of around US$ 400, even as low as US$ 350 for Indonesian pulps, it will not be commercially viable to produce jute pulp from a greenfield investment.

RECOMMENDATION

At present scenario, it is not economically viable to invest in the new jute pulp mill of 150 tpd.

N.C. Behera

(Dr. N. C. Behera)

I.T.C. LIMITED

TRIBENI TISSUES DIVISION

ANNEXURE - I

JUTE CONSUMPTION

Year	Bales	Tonnes
1991-92	62299	11214
1992-93	43484	7827
1993-94	64960	11693
1994-95	79107	14239
1995-96	100645	18116
1996-97	28777	5180

I.T.C. LIMITED

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ANNEXURE -II

Mill delivered Prices for Jute fibre, NBSKP & Soporcel Pulps *

Year	TD5 Bark free Moisture corrected Rs./Tn	NBSKP ** Rs./Tn	Soporcel ** Rs./Tn
1987	5300	9072	--
1988	5300	11225	--
1989	6600	15975	15,325
1990	8950	15152	12,130
1991	8100	14897	14,339
1992	6600	18022	18,380
1993	8000	16400	16,827
1994	9730	20,350	25,428
1995	13,000	35,290	43,570
1996	16,125	24,725	23,128
1997	9600	24,185	24,090
1998***	8000	27300	25,200

* Data supplied by Materials Management Dept.

** Average price of four quarters prices for the year.

*** Plan.

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ANNEXURE -III

COST OF MANUFACTURING JUTE PULP

	Existing Mill	New Mill	
Annual pulp production T	5000 AD	52500 AD	47250 BD
	Rs.	Rs.	Rs.
Cost per tonne of Jute	8000	8000	8000
Cost of Jute per tonne of pulp at a yield of 58.5 %	13675	13899	15289
Chemicals per tonn of pulp			
- Cooking	3004	2110	2321
- Bleaching chemicals	962	1137	1251
Steam, Elecrtricity and Water	2553	2777	3055
Repairs and Consumables	900	NA	NA
Fixed cost			
- Employee	1499	689	758
- Depreciation	1612	9714	10794
TOTAL	24,205	30,326	33,468

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ANNEXURE -IV

Pulp prices for 1987-1999

	Price i n Rs / tonne		
Year	Jute Pulp	Kamloop	Soporcel
1987	13190	9072	
1988	13410	11230	
1989	15860	15980	15330
1990	20120	15150	12130
1991	18920	14900	14340
1992	17770	18020	18380
1993	20500	16400	16830
1994	23820	20350	25430
1995	29780	35290	43570
1996	35520	24730	23130
1997	24790	24190	24090
1998	24200	21628	21677
Planned for 98-99			EBKP price taken

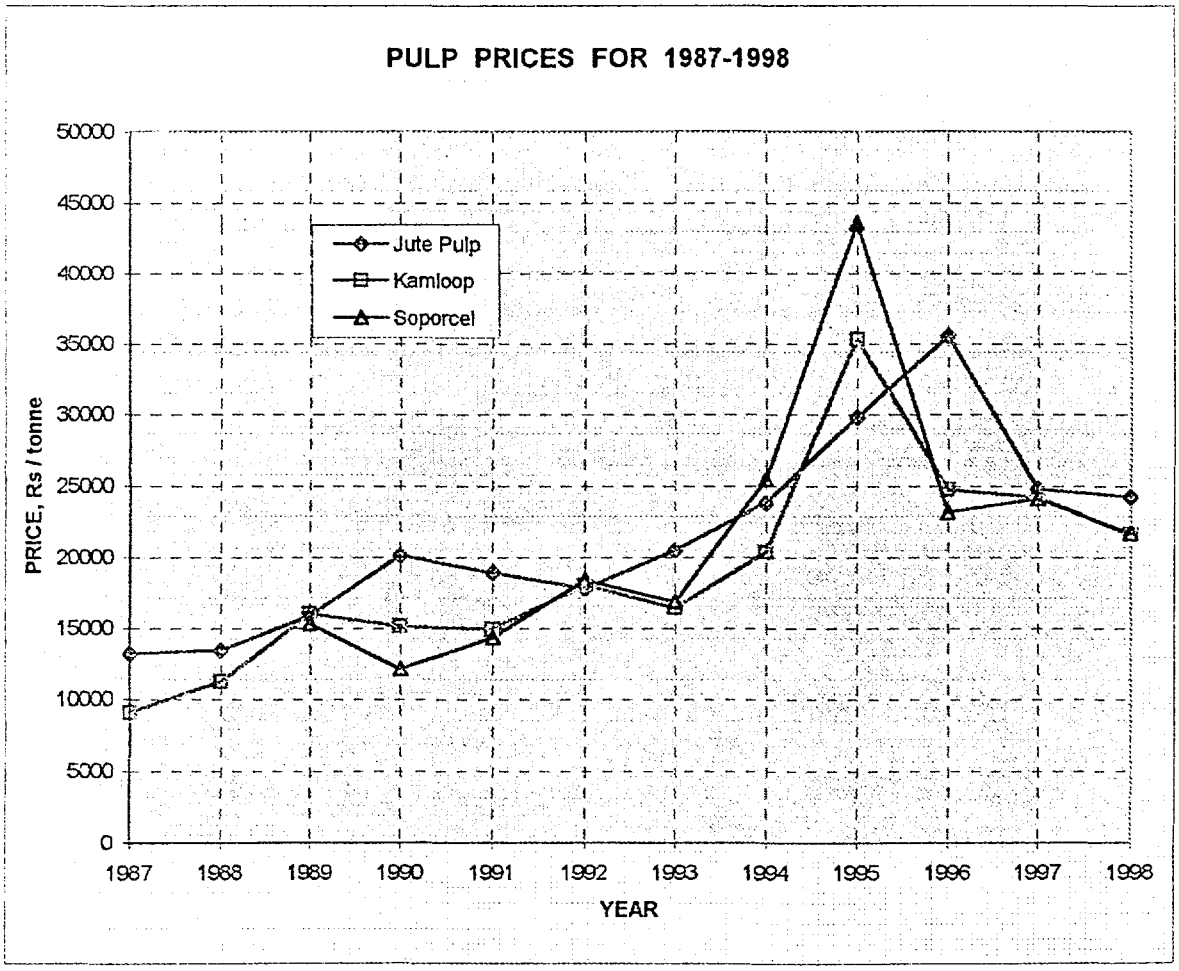

TABLE OF CONTENT

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The United Nation Development Programme (UNDP) in response to a request from the Ministry of Textiles, Government of India has approved the project DG/IND/92/316
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Phase III - Pre-Feasibility Study for a Greenfield Investment

- Preparation of a pre-feasibility study, give recommendations about the latest technology to be used for a greenfield jute based pulp mill with a capacity 150 t/d, on the basis of the results achieved from the investigations in Phase I and Phase II. Technologies for black liquor recovery/utilization as well as environmental protection should be included.
- Preparation of a report including:
  - Process Description
  - Process Flow Diagram
  - Main Equipment (imported and locally manufactured)
  - Investment and Operational Costs

  TTD will carry out the necessary market study and the economic viability analysis.

  On the basis of the recommendations made, Tribeni Tissues will consider investment in a Jute Pulp Mill.

The services and work of IVA was carried out under the contract No. 94/028, Project DG/IND/92/316 in collaboration with CPPRI and ITC Ltd.

2. OBJECTIVE OF THE PROJECT

The objective of the project is to produce jute pulp of international standard which can be used as long fibre speciality pulp such as pulp produced from hemp, flax etc.

For Phase III a greenfield investment with a capacity of 150 ADMTD will be investigated in this report.

The following problems are being encountered in increasing the content of jute pulp in various grades of paper and extending its use to more varieties of speciality papers:

- Removal of internal and external contraries like bark, dirt, plastics, rubber pieces and other trash material from the pulp produced out of jute during the manufacturing process.
- Low brightness of bleached pulp if high physical properties of pulp are required, partly due to morphological characteristics of the material and partly due to entrapped dirt.
- Stiffness of fibre due to pulping process and fibre characteristics. The fibre needs to be softened.

Table A summmarizes the target bleached pulp quality which should be achieved.
Based on the problems mentioned extensive cooking and bleaching laboratory and mill trials has been undertaken, which are summarized in the Final Report Phase I.

Based on these tests the TCF - sequence O - A - EOP - P has been selected by ITC. Table B summarizes the physical properties which has been achieved in the tests.

These findings were used for the retrofitting concept as described in the Final Report Phase II.

TABLE A: General Targets for Bleached Pulp Quality

	1 Existing (actual cond.) (actual cond.)		2 Desired (intermediate) Intermediate		3 Desired (Final) Final
Bleaching sequence	**CEH**	**CEpH**	**CEH**	**CEpH**	
Viscosity cP	15-25	15-25	15-25	15-25	15-25
Brightness % Elrepho	73-77	77-79	78-80	82-84	88+
Dirt count mm^2/m^2	250	250	10	10	5
Breaking length (30°SR) m*	8.200	8.200	9.000	9.000	9.000+
Fibre length mm	1.56	1.56	1.60	1.60	1.60+
Coarseness mg/100 m	11.4	11.4	10.5	10.5	10.5
Fibre strength Index Nm/g	114	114	120+	120+	130+
Slenderness factor 100 x WAFL/coarseness	13.7	13.7	16+	16+	17+
Kappa no. after cooking	15	15	13 ± 2	13 ± 2	13 ± 2

* Based on Valley beating equipment, bone dry

During the execution of the project Phase 1 it has been decided to modify the brightness and the breaking length to the ISO standard. The new values are:

Brightness % Elrepho: 88+

Brightness % ISO (relative): 88+

Brightness % ISO (absolute): 86+

Breaking length (30° SR) m: 6.700+

(based on PFI/Rapid Koethen analysis air dry)

TABLE B: Selected Bleaching Sequence: O-A-EOP-P

Bleaching sequence	Reached	Target
Viscosity ml/g	650 - 850	600 - 800
Brightness % ISO absolute	81 - 83	82 - 83
Brightness % ISO relative	83 - 85	84 - 85
Breaking length (50°SR) km	6,8 - 6,9	6,7
Coarseness mg	0,11 - 0,12	0,105
Slenderness factor 100 x WAFL/coarseness	12 - 15	16,0

3. GENERAL PROJECT DESCRIPTION

3.1 INTRODUCTION

The concept of the greenfield mill is based on information and utilities (e.g. electric power, raw material etc.) available to ITC Tribeni Mill.

In case to place the greenfield mill at another location there might be a change in availability of raw materials leading to a sligthly changed concept.

The general mill layout, as shown under chapter 6 is based on optimum conditions that means not taking into account different mill elevations, wind directions, natural and community boundaries, water supply etc. It shall be understood that the mill layout may change considerably.

3.2 DESCRIPTION

The pulp mill consists of following department.

Fibre Line

Consisting of a jute cuttings handling system followed by twelve spherical digesters,screening, cleaning, washing ,oxygen delignification, bleaching sequence O - A - EOP - P giving a final brightness of approx. 83 - 85 % ISO. The bleached pulp can either be transferred to the paper machine or exported. For exporting a double wire press and a drying section giving a final dryness of 88 - 90 % with baling is included.

Recovery Unit

Consisting of a 5-effect evaporation plant, a recovery boiler with electrostatic precipitator, a recausticizing plant and a lime kiln.

Steam & Power System

For generating the steam needed for the production a coal fired power boiler as well as turbine & generator with all auxiliaries is foreseen.

Electric Energy

The foreseen electric energy generation covers only a part of the energy demand. It is assumed that the additionally required electric energy is provided by the community.

Water

The raw water treatment includes following process steps:
Raw water pumping station, raw water pipe line to the treatment plant, lime milk dosing, flash mixing, clarification and sedimentation in sedimentation clarifiers, filtration through gravity sand filters, storage and distribution of chemically treated water (process water).

Effluent System

The effluent system consists of a mechanical treatment, neutralization of the bleach plant effluent, biological treatment and polishing pond for the treated effluent.

Chemical Handling

Storage and dissolving facilities for the required chemicals are also foreseen.

This includes the handling of Oxygen, Peroxide, Caustic Soda, DTPA/EDTA, $MgSO_4$, Na_2SO_3, H_2SO_4, Anthraquinone. Where only small amounts of chemicals are needed, at e.g. the water treatment or recovery boiler, these chemical stations are included in the corresponding area.

A detailed description of the mentioned areas are described in detail in Section 4.

3.3 TECHNICAL DATA

The pulp mill is designed for a capacity of 150 ADMTD bleached pulp. For detailed technical data see the corresponding section as described under 4.

3.4 UTILITIES AVAILABLE AND ENVIRONMENTAL REGULATIONS

Received from ITC Tribeni on February 20, 1998.

3.4.1 Raw Water

Analysis of raw water is enclosed.

pH		7,0
Colour (Hazen Unit)		Nil
Turbidity		Nil
Odour		Unobjectionable
Total Hardness as $CaCO_3$	mg/l	210
Permanent Hardness	mg/l	Nil
Temporary Hardness	mg/l	210
Calcium as Ca	mg/l	50
Magnesium as Mg	mg/l	20
Bicarbonate as HCO_3	mg/l	305
Chloride as Cl	mg/l	14
Sulphate as SO4	mg/l	Below detectable limit
Iron as Fe	mg/l	Below detectable limit

3.4.2 Fuel

3.4.2.1 Fuel Oil

For Recovery Boiler and Lime Kiln.

3.4.2.2 Fuel for Power Boiler

Coal		"B" Grade Bituminous Coal
Low heating value	kJ/kg (G.C.V.-Kcal/kg)	5800 - 6000
Ash	%	20 - 25
Sulphur	%	0,30 - 0,55
Moisture	%	8 - 12

3.4.3 Electric Energy

3.4.3.1 Electric Energy

Available from West Bengal State Electricity Board.

Frequency	C/S	50 - 48
Voltage	KV incomer	33
Phase	phase	3

3.4.3.2 Electric Energy in Mill

Voltage for motors > 225 kW	kV	3,3
Frequency	C/S	50 - 48
Phase	phase	3

3.4.3.3 Electric Energy in Mill

Voltage for motors < 225 kW	volt	415
Frequency	C/S	50 - 48
Phase	phase	3

3.4.3.4 Control Voltage

	V	110, 30

3.4.4 Steam (Preferences)

3.4.4.1 High Pressure Steam

Temperature	°C	420
Pressure	bar (g)	45

3.4.4.2 Medium Pressure Steam

Temperature	°C	200 - 220
Pressure	bar (g)	12

3.4.4.3 Low Pressure Steam

Temperature	°C	160
Pressure	bar (g)	4,5

3.4.4.4 Feed Water Temperature

	°C	105

3.4.5 Environmental Regulations and Requirements

3.4.5.1 Emission

Max. dust content - mg/m³n dry	mg/Nm³	150

3.4.5.2 Effluent

Requested figures of treated effluent		
BOD5 at 20 °C	ppm	30
COD	ppm	350
Suspended Solids	ppm	50
pH		7 - 8,5
Volume	m³/ton paper	200
TOCl	kg/t paper	2

4. TECHNICAL SPECIFICATION OF PROCESS AREAS

4.1 FIBRE LINE

Capacity: 150 ADMTD bleached Jute Pulp

4.1.1 Jute Cuttings Handling

PROCESS DESCRIPTION

Jute cuttings will arrive at the mill on trucks, unloaded directly to the transfer conveyor or to the storage area.

Important:
As there is no cleaning possibility for jute bales the removal of all extraneous materials must be done prior to the baling.

The jute bales are transferred via an overhead crane to the transfer conveyor and feed to the digester house.

It is foreseen to install two independent feeding lines to allow a proper feeding, when two digesters are fed simultaneously.

Before reaching the digesters the jute ropes are cut on two sides.

By this reduction in length it will be possible to feed the jute ropes also into the digesters.

The conveyors are designed with side walls to avoid that the cut ropes will fall from the conveyors to the floor. .

TECHNICAL DATA

Bale size	cm	132 x 66 x 53
Bale weight	kg	180
(with 10 % moisture)		
Number of jute ropes		one (8 - 10 rounds)
Required bales/batch		60
Conveyor capacity		1 bale / 40 sec.

4.1.2 Digesting

GENERAL CONSIDERATIONS

For this greenfield study and due to the higher capacity the installation of a more modern cooking system has been investigated.

There are basically three modern cooking systems available:

- Continuous Tube Digester (e.g. PANDIA®)
- Kamyr Digester
- Stationary Batch Digesters

Comparison of the Different Cooking Systems

	Kamyr Digester	Continuous Tube Digester	Stationary Batch Digester	Rotary Spherical Digester
Jute transport system	Simple	Simple	Complicated	Complicated
Jute feeding	Rotary type	Screw type	Open lid	Open lid
Amount of digester	1	2 Tubes	5 à 160 m³	12 à 60 m³
Space requirements	low	low	medium	high
Investment cost	high	low	medium	medium
Maintenance cost	medium	medium	low	low
Operating cost	low	low	medium	medium
Discharge system	Blow valve with scraper	Blow valve with scraper	Blow valve	Blow valve

The above table was given to have an general overview about the existing cooking systems disregarding the special requirements for jute.

However when pulping jute following must be considered:
For the rotary and screw feeder type feeding system the jute must be cut into short pieces in the range of 2 - 5 cm (max. 10 cm).
The jute cutting bales, which are very strong, slim and long, must be broken and cut by means of a rotary or drum type chipper. Since this type of equipment is not proven, there can not be given any recommendation for the Kamyr and Continuous Tube Digester (PANDIA®).

Stationary Digester

Compared with the spherical digesters the stationary digester can be built in bigger sizes, thus reducing the space requirement and subsequently the overall investment cost.

A major draw back to this system is:

a) Due to the partly unopened jute bales there may be some areas within the digester which may not cooked thoroughly.
b) Compared with the spherical digester, where the material is during the whole cooking cycle under motion, in the stationary digester the fibre may settle down.

Both cases a) and b) have a major influence on the ability of the digester to blow the pulp and there are considerably doubts that this can be accomplished. Before IVA can recommend this solution a trial in a large scale digester should be undertaken.

Based on above considerations the only possible solution for the time being remains the rotary spherical digester.

In addition per CPPRI's request a typical specification of a Continuous Digester System (PANDIA®) has been added and is attached in Annex 10.

As mentioned above the PANDIA® Digester is not proven for jute pulping and therefore this specification is only for information.

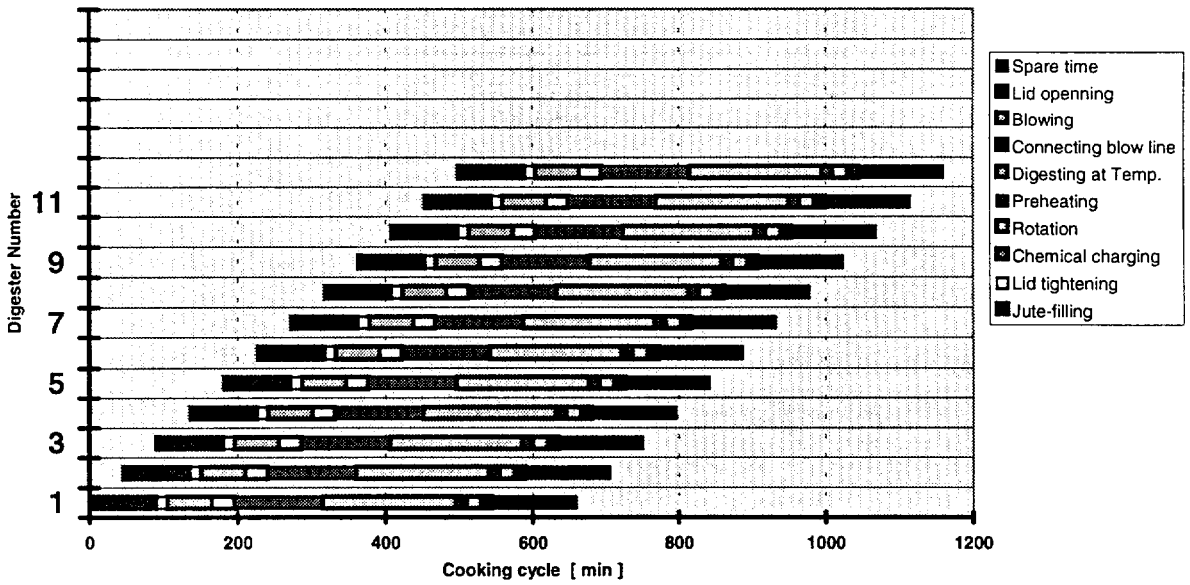
PROCESS DESCRIPTION

Jute is fed by a system of conveyors to the digesters. Via the digester lid, which is equipped with a quick opening device, the jute bales are thrown into the digester.

Cooking is done with following cycle:

Jute filling	90 min
Lid tightening	15 min
Chemical charging	60 min
Rotation	30 min
Preheating	120 min
Digesting at temperature	180 min
Connecting blow line	15 min
Blowing	20 min
Lid opening	15 min
Net time	545 min
Spare time	120 min
Total cooking cycle	**665 min**

DIGESTER - CYCLE



After digestion the blow line is connected to the digester and then the pulp is blown out into the top dome of the blow tank. The digesting system consists of 12 spherical digesters (see Drawing No. ITC.ZF13.M01/ZAM 2101 E) and two blow tanks. Each blow tank has a capacity of 180 m^3. In the bottom zone the pulp will be mixed and diluted and pumped to the washing section.

For heat recovery there is a two stage condensing / heating system installed. Vapors from blow tank are condensed in a direct condenser with circulated condensate. The condensate which is collected in the accumulator is led via a fibre filter to spiral type heat exchangers where it heats fresh water to approx. 70°C and cools the circulated condensate to 70°C.

Contaminated excess water from the condensate tank is led to the effluent treatment plant or to the cooking chemical preparation.

TECHNICAL DATA

Pulp production	ADMTD	162,8
Pulp production	BDMTD	146,5
Cooking temperature	°C	160 - 165 (162)
Digester yield	%	62
Digesting process:		Kraft - AQ
A.A. charge per BDMT jute	% as Na_2O	12 - 14
Cooking liquor conc. as Na_2O	g/l A.A.	100
Sulphidity	%	20
Anthraquinone	% on BD Jute	0,05
Liquor ratio in digester (excl. steam)	t/t	3.5
MP steam pressure (in line)	bar (g)	12
MP steam temperature	°C	200

4.1.3 Washing, Screening & Cleaning

PROCESS DESCRIPTION

The purpose of the brown stock washing is to wash out the pulp from the used cooking chemicals and dissolved organic material at minimal water consumption. The black liquor from the first washer is collected, filtered and pumped to the chemical recovery system.

The brown stock is pumped from the blow tanks via a sand separating cyclone through a single washing line, where displacement washing takes place in a counter current flow system comprising of three vacuum washers. The third washer is installed after the screening and cleaning system and operate as thickener / washer.

Each washer has its own filtrate tank, enabling the filtrate from each washing stage to be kept segregated for individual reuse. The first tank is fitted with a foam breaker.

Filtrate from the first washer is injected, into the blow tank for dilution and at the stock entry to the washing line. Excess liquor is filtered by a drum type black liquor filter before flowing to the recovery plant. Fibres removed by this filter are returned to the 1st stage washer inlet. The filtrate from the second and third washers is, in each case, used as the washing medium for the proceeding stage and for dilution in the intermediate repulpers. In the third stage washing filtrate from O_2-delignification and / or hot water are used.

The purpose of the screening and cleaning is to remove undigested fibrous material, shives and foreign materials, and other impurities, especially bark. The pre-washed pulp, collected in the brown stock HD-tower, is diluted, mixed and pumped to the primary centrifugal screen. Screening by size will take place in the two-stage screening. Accepted pulp is fed to a stock chest, diluted and pumped to a three stage centricleaner unit in which classification is not made by size but by weight which means that mainly heavy particles like sand, knots, etc. are sorted out.

Accept from first centricleaner stage is brought to the third washer where it will be washed and thickened to approx. 10 - 12 % consistency. The third washer consists of 2 vacuum filters one as prethickener and the other one as washer. From the washer the pulp is transferred to a HD-Tower with a retention time of approx. 8 hours.

Rejects from the first pressure screen are screened once more in the secondary stage. Accepts from the secondary screen are brought back to the inlet of primary screen, the rejects will be pumped through a sand separating unit to a vibrating screen. Rejects from the vibrating screen will be discharged and accepted fibre will flow back to the secondary screen.
The reason for installing the sand separating unit is to reduce the sand content in the recirculated fibers to avoid accumulation of fine sand in the system.
The filtrate of the third brown stock washer is pumped and used in the second brown stock washer as wash water and for pulp dilution.
The third washer uses filtrate from the O_2-delignification or alternatively hot water.

TECHNICAL DATA

Screening and cleaning losses	% max.	2,0
Consistency after thickener	%	10 - 12
(third brown stock washer)		
Dilution factor	t/t	3,0

4.1.4 Oxygen Delignification & Bleaching

PROCESS DESCRIPTION

The technical concept of oxygen delignification and post oxygen washing is made in order to combine the advantage of oxygen delignification with the effect of counter-current washing.

Advantages of proposed system are as follows:

- Selective delignification to lower Kappa number
- Elimination of chlorinated organic compounds formed in bleach plant
- Utilization of the heat value of dissolved organic solids from the oxygen stage with simultaneous recovery of inorganic chemicals used in oxygen bleaching
- Reduction of the effluent load

Washed pulp from the HD-Tower is transferred by means of a scraper discharger into the connected stand pipe of the MC-pump and is pumped via oxygen mixer to the bottom of the oxygen reactor. Low pressure steam is uniformly distributed in the stand pipe to reach nearly the reaction temperature at approx. 85 °C.

In the pipe line between the MC pump and oxygen mixer the pulp is heated to 95°C with medium pressure steam and mixed with caustic soda and oxygen gas in the oxygen mixer.
In the oxygen reactor, having 10 - 12 % inlet consistency, 60 min. retention time and 4 bar (g) of discharge pressure, the pulp is performed to delignification with oxygen.

The pulp is blown from the oxygen reactor to a blow tank, diluted and fed to the first post oxygen wash filter. As wash water filtrate from the second post oxygen wash filter is used. Pulp from the first wash filter is diluted, mixed and transfered to the second wash filter by an intermediate repulper.
The washed and dewatered pulp from the second post oxygen wash filter drops, after adding of H_2SO_4 to the repulper, directly into the A-tower of the bleaching plant.

DESIGN CRITERIA

Consistency

The pulp fiber matrix formed in a consistency range of 11 - 14 % has been found to be optimal for retaining gas bubbles and maintaining plug flow. At consistencies below 10 %, channelling may occur in the reactor. Above 14 %, fluidization of the pulp slurry becomes difficult, resulting in a loss of high shear mixing efficiency. Therefore, equipment capable of handling these consistencies, such as BELOIT's HI™-Shear Mixer, is critical in this application.

Oxygen Mixing

Good mixing occurs when the chemical is efficiently distributed throughout the pulp fiber matrix and gas bubbles are sheared to the smallest possible diameter. This enhances diffusion by providing the largest surface area between the reactants. This requires that the oxygen bubbles formed during high shear mixing be small enough to provide the maximum surface area available. The amount of oxygen addition also plays an important role since coalescing of the gas bubbles commences when oxygen occupies more than 30 % of the total volume. This reduces the gas contact surface area and increases the risk of channelling.

Reactor Design

The primary criteria for the reactor design is to provide effective pressure control at the mixer while minimizing the risk of channelling. To minimize reactor channelling and assure plug flow, the height to diameter ratio, or aspect ratio is kept within strict guidelines. In addition, a transition cone is provided at the reactor bottom eliminating the requirement of a mechanical bottom distributor.

Bleaching Plant

The bleaching plant is designed for a three stage sequence: A - EOP - P
Washed and dewatered pulp from second oxygen washer drops directly into the A-tower. H_2SO_4 will be added at the repulper of the second washer.

The A-tower is designed as an down flow tower. At the bottom of the tower the pulp is mixed, diluted and pumped to the A-washer.

After washing and dewatering NaOH, DTPA, $MgSO_4$ are added in the repulper. After the repulper the pulp drops into a steam mixer to obtain the required temperature for the EOP-stage. After the steam mixer the pulp drops into the stand pipe of the MC-pump where O_2 and is added. H_2O_2 is added in the Peroxide mixer located after the MC-pump.

Via the MC-pump the pulp is transferred to a pressurized EOP-pretube. The pressure in the pre-tube is maintained by a pressure control valve, which acts as a blow valve to the down flow EOP-tower.

In the bottom of the EOP-tower pulp is diluted, mixed and pumped to the EOP-washer. After washing and thickening $MgSO_4$, DTPA and NaOH are added. From the EOP-washer the pulp drops into the steam mixer and further to the stand pipe of a MC-pump and is transferred to the P-tower.

Before entering the down flow P-tower steam and H_2O_2 is added in two mixers.

In the bottom of the P-tower pulp is diluted, mixed and pumped to the P-washer. After washing and thickening Na_2SO_3-water is added.

Bleached and washed pulp is transfered to two HD-Towers via Screw Conveyors.

TECHNICAL DATA

Ingoing Kappa to oxygen delignification	approx.	14
Kappa number to Bleach Plant	approx.	8
Bleaching losses total	%	6,0
Final brightness of bleached pulp	% ISO	82 - 84
Estimated COD-Load to effluent	kg/BDMT	20

Process Data		O	A	EOP	P
NaOH	kg / BDMT	15		15	7,5
Oxygen	kg / BDMT	18		5	
Na_2SO_3 (as SO_2)	kg / BDMT				0-3 *
H_2SO_4	kg / BDMT		10		
H_2O_2	kg / BDMT			30	10
DTPA	kg / BDMT			2	2
$MgSO_4$	kg / BDMT			2	2
Retention time	minutes	60	30	15 + 150	180
Temperature	°C	95	70	85	90
Consistency	%	10	10	10	10

* For acidification of pulp - depending on paper machine requirements

4.1.5 Wet Lap Machine, Drying and Baling

PROCESS DESCRIPTION

4.1.5.1 Wet Lap Machine

Double Wire Press

The stock suspension is fed directly from a level-controlled machine chest with agitator via a pulp pump and a consistency regulator into the headbox of the double wire press. The consistency will be approx. 3,5 %.

On the double wire press the stock suspension is mechanically dewatered between 2 wire belts, without any vacuum.

The wire is made of polyamide with 60 mesh.

The particular feature of the machine is the long flat inlet wedge and the following ascending press section.

Within the range of the inlet wedge the water is discharged via the top and bottom wires. In the top wire the water is drained off laterally. There is no remoistening in this part of the machine since volume displacment is effected and the stock cake is still saturated with water.

In the following press zone the ascending arrangement of the wire belts effects that the press water in the top wire belt runs into the white water trays arranged immediately before the press points. Thus the water is being discharged in the quickest possible way and remoistening is avoided. The white water flows into a white water pit and is returned to the process by the white water pump.

Felt Clothed Heavy Duty Press

It consists of two prepressnips and one main press nip. It is clothed with a special type of felt belt.

The water squeezed out at the press nip can flow along the path of least resistance into the drainage channels of the top and bottom felts because multiple-thread wrap material is used.

4.1.5.2 Drying

For pulp drying to 90 % dryness will be used a "Airborne Dryer" with heat recovery- and condensate system.

The airborne dryer mainly consists of
Drying section
Cooler sections
Air system
Heat recovery unit for air preheating
Condensate system
Water heating system

4.1.5.3 Baling

The bale handling line conveys, presses, wraps, binds, stacks and marks the bales coming from the cutter layboy.
The cutter is designed for cutting wet or dry sheets and also for wrapping pulp sheets.

TECHNICAL DATA

Capacity	ADMTD	150
Pulp consistency after press	%	48
Basis weight	g/m²	1.400-1.800
Dryness of pulp leaving dryer	% BD	90
Water evaporation	kgs/h	5.469
Width of pulp sheet leaving dryer	mm	2.400
Heat consumption per kg evaporated water, to be covered by saturated steam at 4 bar (e)	kJ/kg	2.830
Cutter / Layboy		
Web width	mm	2.400
Operating speed	m/min.	approx. 80
Sheet Size		
Slitting	mm	800
Cutting	mm	600
Number of sheets		3
Wrapper Size		
Slitting	mm	1.600
Cutting	mm	approx. 1.350
Number of wrapper		2
Stacking height	mm	800 - 1.000

4.2 CHEMICAL RECOVERY SYSTEM

For cost estimation the complete recovery system process description and specification is based on certain subsuppliers.

During project execution the specification will be changed depending on selected suppliers.

This system consists of:
Evaporation plant
Recovery boiler
Recausticizing plant
Lime kiln

GENERAL PROCESS DESCRIPTION

The chemicals required for the cooking process are regenerated and thus reactivated after having been used in the digester. Chemicals losses in the cycle are made-up by the addition of caustic soda/sodium carbonate and sodium sulphate.

Black liquor from the pulp washing contains used pulping chemicals and dissolved organic substances. In the evaporation plant, black liquor is concentrated to approx. 60 %.

The thickened black liquor (strong black liquor) is burnt in the recovery boiler. The molten chemicals, mainly consisting of sodium carbonate and sodium sulphite as well as sodium sulphate, are discharged at the bottom of the furnace. The smelt flows out to the dissolving tank, where it is dissolved in weak white liquor (WWL) to make green liquor (GL), which is pumped to the recausticizing plant for white liquor preparation.

An electrostatic precipitator is to be installed to recover the valuable sodium chemicals from the flue gases. This is of great importance not only in chemicals recovery but also for controlling air pollution.

Part of the steam required for the process is provided by the recovery boiler. The rest of the steam is generated in a power boiler. The generated steam can also be used for power generation.
In the recausticizing plant green liquor is converted into an active cooking chemical - white liquor - for further use as cooking liquor.

Green liquor, primarily sodium carbonate is converted into caustic soda by using burnt lime. The white liquor contains crystallised calcium carbonate - lime mud - which is removed by clarification. The lime mud is washed with condensate from the evaporation plant, thickened again and stored in the lime mud storage tank. The filtrate is weak white liquor and is used in the dissolving tank.

Prewashed lime mud is pumped to a vacuum filter, dewatered and washed with hot water to remove sodium chemicals.

The lime mud will be reburnt to quick lime in a rotary lime kiln together with lime stone.

4.2.1 Evaporation Plant

PROCESS DESCRIPTION

1. GENERAL

The design capacity of the evaporation plant will be 55 tons/hr evaporated water. The dry solids content of the heavy black liquor after the evaporation plant will be 60 %.

Particular aspect with non-wood liquor evaporation is high viscosity and serious scaling on the heat transfer surfaces on the liquor side due to silica and large colloidal lignin macro-molecules. In the evaporation plant the scaling aspect has to be taken in consideration and the first and the second effect should be cleaned during normal operation.
The evaporation plant will be a five stage evaporator and to be designed to give the full design evaporation capacity when 4 of the 5 evaporator units are in operation, while the first or the second effect is shut off for washing. During normal operation the evaporation plant works as 5-effect evaporator with 5-effect steam economy.

2. EVAPORATOR UNITS

The main equipment of the evaporation plant consists of five Free Flow Falling Film evaporator units. The heating elements of the evaporator units comprises of two-sheet elements (lamella).

The vapour is condensed inside the elements. The evaporation takes place from a falling film of black liquor on the outside of the elements. A circulation pump circulates the liquor from the bottom of the unit to the top, where the liquor is distributed evenly to the elements. The liquor circulation flow is very large compared to the evaporation rate. This ensures that the heating surface is always adequately wetted and no dry-boiling occurs in any of the units.

The secondary vapour is released from the boiling liquor film immediately upon the generation and it escapes from the elements to the vapour body and further to the next effect, where it acts as heating medium.

3. LIQUOR FLOW

The weak liquor from the feed liquor tank is pumped to the fourth effect. The liquor is then pumped through the evaporator from effect 4 to effect 5 and then to 3. From effect 3 it is pumped to effect 2 and 1 in counter current flow against the vapour flow. The heavy black liquor is discharged from the effect 1 (or effect 2 when effect 1 is in wash) and is flashed to atmospheric conditions in the flash vessel.

4. STEAM / VAPOUR FLOW

The live steam is fed to the unit effect 1 (or effect 2 when effect 1 is in wash). A small portion of the primary condensate can be pumped to the live steam pipeline for live steam desuperheating.

The liquor film is boiling on the surface of the heating elements and the released vapour is led through a separator to the next effect, where it acts as a heating medium.

Because the vapour released from the liquor contains small amount of non-condensable gases, a vent is necessary from the condensing side of each unit. In average 0,5 % of the vapour is vented. The vent is accomplished with the jet steam ejector vacuum system. The vents are led to the vacuum system via the surface condenser, where the vapour in the vent is condensed as completely as possible to reduce the suction flow to the vacuum system.

The vapour from the fifth effect is condensed in the surface condenser system.

5. CONDENSATE FLOW

The primary condensate from the first effect (i.e. effect 2 when effect 1 is in wash) is flashed in a level vessel. The generated steam is condensed in the effect 3.

The secondary condensate from each effect is expanded to the next effect. The secondary condensate from the evaporator effect 2 to 5 are mixed with the secondary condensate from the surface condenser. The secondary condensate tank operates as a level tank for the secondary condensate.

6. LIQUOR SIDE-WASH

As most serious scaling occurs in the first and the second effect, they can be washed with condensate or with a chemical cleaning agent (caustic or acid) on the liquor side without disturbing the normal evaporator operation. The evaporation plant is to be designed for operation with four of the five evaporator effects in operation while one is washed. During washing of one effect the steam consumption is slightly higher.

Piping for feeding the evaporator effect 1 and 2 with the chemical cleaning agent, free of choice, should be foreseen. The washing with chemical cleaning agent can be foreseen to operate with manual valves in pipelines to and from the units. The washing with condensate is to be foreseen with automatically operated valves. The isolation valves in the vapour lines to be foreseen with automatically operation.

The wash with condensate goes as follows:

The unit to be washed is drained from liquor with the circulation pump. When the unit is empty the vapour valve to the elements will close. The unit will be flushed with condensate which is automatically routed to the unit. To minimize the effluent from the wash, the washing can be done batch wise by entering a measured quantity of condensate or washing chemical to the unit for circulation. The batch wise wash can then be repeated as required.

The frequency of washing will be determined by operating experience.

During the wash the evaporator is vented with a small fan so that gases, which are formed in reaction between the washing solution and the organic deposits, can be transported to destruction.

7. VACUUM SYSTEM

The vacuum in the evaporator will be maintained with two stage venturi type jet ejector system.

Hogging jet ejector of the venturi-type operated with steam is included for speedy start-up evacuation of the evaporation plant.

8. TECHNICAL DATA

		Design	Balance (Operation)
Evaporation capacity	t/h	55,6	43,6
Weak Black Liquor From Digester Plant			
Dry solids	BDMT/day	160	141
DS-content	% DS	10	12
Flow rate	t/h	66,7	53,4
Temperature	°C	70 - 80	70 - 80
Heavy Black Liquor			
Flow rate	t/h	11,1	9,8
DS-content	% DS	60	60
Temperature	°C	~ 103	~ 103
Live Steam Consumption			
t/t evaporated water	5 effects	0,23	
	4 effects	0,29	
Pressure	bar (a)	4 - 5	
Temperature	°C	~ 160	
Cooling Water For Surface Condensers			
m^3/t evaporated water		~ 13	
Temperature in/out	°C	35/45	
Pressure	bar (a)	6	
Motive Steam For Vacuum Ejectors			
Flow rate	t/h	~ 0,5	
Pressure	bar (a)	12	

4.2.2 Chemical Recovery Boiler

PROCESS DESCRIPTION

The recovery boiler represents the main item of the chemical recovery system where the concentrated black liquor is burnt in order to recover the chemicals used in the cooking process. The green liquor produced is then transferred to the recausticizing plant, where it is reacting with burnt lime to produce white liquor for the process.

The main components of the boiler system are the boiler itself, the air and flue gas system, the electrostatic precipitator and the green liquor handling system. The boiler unit should be designed and fabricated in accordance with the DIN boiler and pressure vessel code, JIS-, ASME code or indian code for pressure vessels.
The pressure parts are of suspended design with natural circulation, equipped with drum and economiser of vertical tube design.

The furnace walls consists of seal-welded finned tubes which form a membrane construction. The lower part of the furnace is made of composite tube.Mineral wool blankets provide insulation against heat emission by radiation.

To protect the superheater from furnace radiation and to cool the flue gases down to the superheater inlet temperature, the upper part of the furnace is equipped with screen tubes which are of finned tubes welded together thus forming a solid construction against chemical build-up falling from the superheater. The screen tubes rise to the drum and from a heat transferring surface with parallel flow and wide tube spacing.

The drum is equipped with manholes and stub tubes for valves and piping. The steam drum has an inlet pipe for feed water, piping for continuous blow down, cyclones equipped with feed water spray and steam dryer.
The screen tubes and the boiler tubes are fastened into the drums by expanding.

The economiser is located behind the actual boiler in one pass. It is constructed of vertical steel tubes which are welded to the headers.

The cleanness of the heating surfaces is maintained with retractable soot-blowers whose wall boxes and lances are equipped with high pressure steam rinsing.
Automatic sequential programmable control panel will be furnished with the soot-blower to control the operation.

The boiler is equipped with rapid drain equipment by which the water can be drained from the boiler in 20 minutes in case of emergency.

The strong black liquor from the evaporating plant is pumped at appr. 60 % solids to the mixing tank. From the mixing tank concentrated black liquor is pumped to the liquor burners via an indirect steam heater.

The black liquor is sprayed into the boiler furnace by guns. A charbed is maintained in the bottom of the furnace and the smelt flows to the dissolving tank through water cooled smelt spouts.

In order to shatter the smelt flow the discharging point is equipped with steam nozzles. The resulting green liquor will be pumped to the causticizing department. Vent gases generated in the dissolving tank are led above the roof through a weak white liquor scrubber.

The combustion air divided into primary and secondary air (including tertiary air), is supplied by a motor driven forced draft fan.
The primary and secondary air is heated to min. 150°C by a LP and MP steam heater.

The boiler unit is also equipped with auxiliary and load carrying fuel oil burners.

2 - 4 % excess oxygen is maintained in the flue gas for combustion control.

The cooled down flue gases leaving the economiser are entering an electrostatic precipitator for recovering the remaining inorganic particles carried with the gas flow.
The precipitator is a plate-type collector with horizontal gas flow in a steel casing with flat bottom.

The unit has one electrostatic line with three fields with transformer-rectifier for each field. The voltage is automatically adjusted to the possible maximum value to achieve an optimum collection efficiency. The internal equipment consists essentially of the discharge system and the collecting electrodes which are continuously cleaned by motor-driven-aping mechanism. The dry dust is discharged to the mixing tank, where the dust is mixed with black liquor and further transferred to the liquor guns.

The required draft in the flue gas system will be maintained by an induced draft fan.

TECHNICAL DATA

Design Data

Type:	Single drum, top supported natural circulation outdoor.
Capacity:	
Normal rate:	141 tDS/day
Maximum continuous rating:	160 tDS/day
Steam at Super Heater Outlet:	
Steam production net:	18,6 t/h
Pressure:	min. 45 bar(a))
Temperature:	max. 420 °C ± 10
Design pressure:	In accordance with Boiler Standards
Feed water temperature to feedwater tank:	105 °C
Black Liquor:	
Pulping process:	Kraft - AQ
Raw material:	Jute
Dry solids concentration from evaporation:	60 %
Temperature:	100 °C
Estimated HHV of dry solids:	12,0 MJ/kgDS

Raw black liquor analysis (received from ITC Tribeni on December 16, 1996)
Preliminary

pH	-	11,7
Total Solids	% w/w	16,0
- do -	% w/w	17,2
Suspended Solids	% w/w	0,007
Active Alkali, Na_2O	gpl	3,3
Total Alkali, Na_2O	gpl	35,6
Inorganics as NaOH	% w/w	30,1
Organics	% w/w	69,9
Silica	% w/w	0,55
Inerts	% w/w	Nil
Chlorides	% w/w	Nil
Sulphur	% w/w	1,30
Carbon	% w/w	39,6
Hydrogen	% w/w	4,0
Nitrogen	% w/w	2,2
Oxygen (by difference)	% w/w	36,4
Calorific value	cals/gm	3507

Viscosity in CPS at various Temperature
Preliminary

Solid % w/w	at 60 °C	at 90 °C
Original	Too low	Too low
45	21,3	8,5
60	436	50

Fuel Oil:

Net calorific heat value	40 MJ/kg
Viscosity at 50 °C	max. 350 cSt
Sulphur content weight	max. 2,8 %

Combustion Air and Flue Gas

Combustion Air

Ambient Air Temperature:

*	For performance calculation and guarantees	30 °C
*	Design maximum	40 °C

Air Temperature After Preheater:

*	Primary air	min. 150 °C
*	Secondary air	min. 150 °C

Flue Gas:

*	After economizer	165 °C
*	O_2-content	3 % vol. in dry flue gas after the economizer

Electrostatic Precipitator:

Dust loading at precipitator (normal cubic metre dry gas):

*	Inlet	approx. 15 g/m³
*	Outlet	max. 150 mg/m³

4.2.3 Recausticizing Plant

GENERAL CAUSTICIZING REACTION

In the recausticizing plant sodium carbonate (Na_2CO_3) reacts with calcium hydroxide ($Ca(OH)_2$) to sodium hydroxide (NaOH) and calcium carbonate ($CaCO_3$) according to the formula

$Na_2CO_3 + CaO + H_2O$ ---------> $2\ NaOH + CaCO_3$

Sodium carbonate is brought into the plant with the green liquor.

Calcium oxide comes into the plant as burnt lime and reacts first with water of the green liquor, forming calcium hydroxide

$CaO + H_2O$ ---------> $Ca(OH)_2$.

This calcium hydroxide reacts later on with sodium carbonate to sodium hydroxide.

The process is continuous and most efficient at a temperature of approx. 100°C.

PROCESS DESCRIPTION

Green liquor is fed from the dissolving tank to the green liquor clarifier. The dregs from the bottom of the clarifier are pumped directly to a precoat dregs filter for washing and dewatering. The dregs filter is meant to function continuously and the dregs are removed from the system to a container.

The quantity of the green liquor are measured before the slaker and lime is added at need.

From the slaker-classifier the lime mixture is led to the causticizers which allow minimum 2,5 hours retention time before filtering.

From the last causticizer the lime mix is led to a feed tank from where it is pumped to a clarifier for white liquor filtration and lime mud thickening. The white liquor is stored in the upper part of the clarifier. The lime mud is thickened in the bottom of the clarifier and removed at a consistency of approx. 30% (nonsoluble) to dilution.

Diluted lime mud is pumped to an other clarifier for lime mud washing and thickening. The weak white liquor is stored in the upper part of the clarifier. The washed and thickened lime mud is removed from the bottom at a consistency of approx. 30 % (nonsoluble) to a storage tank.

From the lime mud storage tank the lime mud is diluted and pumped to lime mud precoat filter for the final washing and dewatering. The filtrate is pumped to the lime mud collecting box.

The lime mud receiving screw conveyor after the lime mud filter has different flight directions at half of its total length and is movable along the filter discharge blade. This design allows to feed the lime mud either to a kiln feed system (up to 100 % of total mud amount) and the rest amount or up to 100 % to the disposal system.

TECHNICAL DATA

White Liquor Production:		
Balance:	m^3/d	430
Design Capacity:	m^3/d	500
Active alkali concentration as NaOH:	g/l	110
Causticizing degree:	%	80
Suspended solids in clarified white liquor:	mg/l	100
Lime mud dry content after filter:	%	60
Alkali content as NaOH in washed lime mud:	%	< 1,0
Burnt lime quality:	%	min. 80

4.2.4 Lime Kiln

PROCESS DESCRIPTION

Limestone and lime sludge will be fed by separate feed systems to the kiln feed screw conveyor for homogenizing and feeding the limestone/lime sludge mixture into the kiln. Crushed limestone will be fed from the storage hopper by means of a dosing conveyor. The throughput can be varied in conformity with requirements.

The lime sludge conveyor feed to the kiln feed screw conveyor, which will be a retractable unit, where the part of it being situated within the kiln is fitted with a watercooled jacket.

The rotary kiln, operated 24 hours a day, consists of drying zone equipped with a chain assembly for heat exchange, a burning and a calcinizing zone. The refractory brick qualities for the various zones of the rotary kiln will be in conformity with the thermal, chemical and mechanical stress acting on them.

The shell of the rotary kiln is constructed by use of boiler quality steel. The kiln will run on casted carbon steel riding rings.

A thrust mechanism will be incorporated to accommodate the force resulting from the downward slope of the kiln. The support rollers are equipped with roller bearings and metal shield as heat protection.

The kiln rotation is done by a DC-motor with variable speed and mechanical reduction gear with mechanical coupling. A diesel engine complete with radiator, fuel tank, reduction gears and a hand-operated clutch will be supplied to keep the kiln turning slowly in the case of electrical power interruption.

The greasing of the main pinion will be reached by a lubricating system.

The kiln product will be discharged via integrated satellite cooling tubes into a discharge housing.

The waste gas leaving the rotary kiln at a temperature of approx. 200 - 250 °C and goes to a electrostatic precipitator and then to a wet scrubber by means of an induced draft fan and discharged through a stack to the atmosphere.

The burner uses heavy fuel oil and is located at the discharge end of the kiln, is a steam-atomized type, with the possibility to adjust the insertion length.

Flame failure equipment, complete with interlocks and alarm, and a retrect-able gas ignitor will also be supplied. Fuel oil will be pumped to the burner from a local day tank via a fuel oil pumping and heating system. A fan guarantees the necessary primary air required for combustion.

The burnt lime leaves the kiln and enters an impact crusher, which will reduce any large lumps to appr. 12 mm before entering the burnt lime handling system.

The gas cleaning will be done in a dedusting system consisting of a induced draught fan and electrostatic precipitation and wet scrubber complete with adjustable throat and spray manifold followed by a drop separating tower and chimney.

The crushed kiln product will be transported from the impact crusher to a bucket elevator. The bucket elevator will discharge to the burnt lime storage bin.

TECHNICAL DATA

Kiln Production		
Nominal capacity	tpd of burnt lime (as 80 % CaO)	80
Design capacity	tpd	100
Available kiln product (burnt lime)	% CaO	appr. 80
Consumable and Utilities		
Lime sludge		
Solids content in lime sludge	%	appr. 60
Alkali content	% as NaOH	< 1

Make-up Limestone		
Handling capacity to silo	t/h	max. 7,0
Limestone size	mm	max. 25
$CaCO_3$ content	%	appr. 95
MgO content	%	max. 1
Moisture content	%	appr. 2

Limestone has to be free of contaminations such as clay minerals, ironpieces, wood etc.

Fuel Oil		
Required quantity	kg/h	appr. 800
Lower calorific value	MJ/kg	min. 40
Ash	%	max. 0,2
Sulphur content	% by weight	max. 2,8
Viscosity at 50 °C	Cst	max. 350

Steam (for fuel oil preheating and atomizing)		
Pressure	bar	appr. 12
Required quantity	kg/h	appr. 300

Water		
For scrubber system, kiln feeding screw conveyor and periodical washing of chain system	m^3/h	appr. 10

Compressed Air		
Required quantity	m^3/h	appr. 20
Pressure	bar	6 - 7,5

4.3 OXYGEN GENERATION PLANT AND CHEMICAL PREPARATION AND HANDLING

4.3.1 Oxygen Generation Plant

PROCESS DESCRIPTION

1. GENERAL

The adsorption technology is a physical separation process which uses the different adsorption affinities of gases to a microporous solid substance, the so-called adsorbent. Nitrogen, for example, has a higher adsorption capacity to some zeollte molecular sieves than oxygen.

This characteristic is used with the Pressure Swing Adsorption (PSA) or Vacuum Swing Adsorption (VSA) plants for the generation of oxygen.

The main advantages of this process are the ambient working temperature which results in low stresses to equipment and adsorbent material and the low specific power consumption.

The PSA-plant consists of the main equipment: air compressor, and 2 absorber vessels filled with adsorbent material. For higher delivery pressures a booster oxygen compressor is foreseen.

Each adsorber operates on an alternating cycle of adsorption and regeneration, thus always a continuous oxygen product flow is achieved.

The PSA-Plant works according to the following process steps:

2. ADSORPTION

Air will be sucked from outside by air compressor. Compressed and back-cooled air is fed at ambient temperature to the 2 Pressure-Swing-Adsorption (PSA)-vessels.

Each of the adsorbers is filled with drying agent and molecular sieve.

The moisture and carbon dioxide in the air are removed by drying agent, nitrogen is adsorbed by the molecular sieve filling. The remaining, oxygen-rich product gas leaves the adsorber at the outlet and is fed to the oxygen buffer.

Before the adsorption capacity for nitrogen is depleted, the adsorption process is interrupted so that no nitrogen can break through at the adsorber outlet.

3. REGENERATION

3.1 Depressurization

The exhausted adsorber is regenerated by means of depressurization using the pressure difference at atmosphere in order to remove the adsorbed gases H_2O, CO_2, N_2 from the adsorbent bed. The waste gas is sent to atmosphere.

3.2 Refilling

Afterwards the regenerated adsorber is refilled with part of the recycled oxygen. The adsorber is then ready for the next adsorption step.

4. PLANT CONTROL

4.1 General

The plant is designed for automatic, selfsupervising 24h-operation.

The time cycle sequence of the adsorption- and regeneration process and the supervision of the process parameters is done by a free programmable logic control system. In case of a failure the plant will be switched automatically in his fall safe position.

TECHNICAL DATA

Product gas:	
Capacity Design:	126 Nm^3/h product oxygen
	i.e. 116 Nm^3/h pure oxygen = 4,0 tons/day pure oxygen
Capacity Average:	4,0 tons/day pure oxygen
Composition:	O_2 93 % by vol.
Ar	4,5 % by vol.
N_2	2,5 % by vol.
H_2O	acc. to dewpoint
	~ 60°C degrees celsius
	(0°C, 1,013 bar)
Delivery pressure:	8 bar (abs) downstream oxygen booster compressor
Outlet temperature:	appr. 35°C

4.3.2 Peroxide Storage System

DESCRIPTION / DESIGN DATA

Peroxide will be supplied by trucks and stored in a storage tank. From there it will be pumped to the bleaching plant.

Peroxide demand (100 %):	t/day	5,5
Capacity of H_2O_2 storage tank (35 %):	m^3	100
		approx. 8 days
Capacity of dosing equipment	m^3/h	1,0

4.3.3 Caustic Storage & Dilution

DESCRIPTION / DESIGN DATA

Caustic will be supplied by trucks and unloaded to the storage tank with pumps, installed on the trucks.

Capacity of NaOH storage tank (50 %)	m^3	100 (7 days)
Capacity of NaOH storage tank (10 %)	m^3	30
NaOH pump capacity for oxygen delignification and bleaching	m^3/h	2,5 (10 %)
NaOH pump capacity for make-up	m^3/h	1,5 (10 %)

4.3.4 DTPA/EDTA Dosing Station

DESCRIPTION / DESIGN DATA

DTPA/EDTA will be supplied in barrels and unloaded to the storage tank with pumps, installed on the trucks.

Capacity of storage tank (30 %):	m^3	5
Capacity of dosing equipment	l/h	20

4.3.5 $MgSO_4$ Dosing Station

DESCRIPTION / DESIGN DATA

$MgSO_4$ is supplied in bags, dissolved, stored and pumped to consumers.

Capacity	l/h	250
Concentration	g/l	100
Tank capacity	m^3	10 (approx. 1,5 days)

4.3.6 Na_2SO_3-Water Dosing Station

DESCRIPTION / DESIGN DATA

Na_2SO_3 is supplied in bags, dissolved, stored and pumped to consumers.

Capacity dosing equipment	l/h	400
Concentration	g/l	150
Tank capacity	m^3	10 (approx. 1 day)

4.3.7 H_2SO_4-System

DESCRIPTION / DESIGN DATA

Sulfuric acid will be supplied by trucks and unloaded to the storage tank with pumps, installed on the trucks.

Capacity of H_2SO_4 storage tank (96 %)	m^3	10 (approx. 8 days)
Capacity dosing equipment	l/h	700 (10 %)

4.3.8 Anthraquinone Dosing Station

DESCRIPTION / DESIGN DATA

Anthraquinone will be supplied in barrels with 50 - 60 % concentration. Anthraquinone is dissolved, stored and pumped to the digesting plant.

Capacity of storage tank	m^3	5
Capacity dosing equipment	l/h	5

4.4 STEAM & POWER SYSTEM

4.4.1 Steam & Power Boiler

PROCESS DESCRIPTION

Circulating Fluidized Bed Boiler

The power boiler operates on the circulating bed principle. Fluidizing is achieved by blowing air through the bed material lying on the grid (air distributor). At high fluidizing velocities (~ 5 m/s) part of the bed material becomes entrained and is carried through the combustion chamber with the flue gases.

The coarser entrained particles are separated in a hot cyclone and returned via a loop seal back to the bed. Finest fly ash is carried through the boiler convection sections and separated from the flue gases in an electrostatic precipitator.

Fuel is fed into the fluidized bed via the loop-seal. Combustion takes place in the bed at about 870 °C at full load. The bed material is formed from the fuel ash and sand. Due to the large heat capacity of the bed, combustion is stable and no supporting fuels are required. The intense turbulence ensures good mixing and combustion of the fuel.

High heat transfer is obtained through the circulating material which is approximately proportional to load. That is, the boiler has good response over a wide range of loads with a range of loads with a relatively small excess air factor.

Heat is recovered from the circulated material and flue gases in the water cooled combustion chamber. After the cyclones the flue gases are further cooled in the superheaters, economizer and air heater areas before removal of fly ash in the electrostatic precipitator.

Advantages of the Circulating Fluidized Bed (CFB) Boiler

- Can burn wide range of low grade fuels, due to the large heat capacity and mixing of the bed
- High combustion efficiency, due to turbulent mixing and long residence time in the circulating bed
- Low SO_2 emissions, due to ease of sulphur retention with limestone at ideal temperatures
- Low NO_x emissions, due to low bed temperature and staged combustion
- Low CO and C_xH_y emissions, due to turbulent condition and long residence time and mixing in the cyclone
- Stable operating conditions and boiler response due to the high heat transfer from the circulating material
- Good turn down rates due to heat transfer being approximately proportional to load. No need to slump section of the bed at low loads
- No need for in-bed tubes which are subject to erosion
- Fewer fuel feed points due to better mixing in the bed compared to bubbling beds

SO_2 Emissions

The CFB boiler is ideal for reducing the SO_2 emissions. By feeding limestone into the bed a high sulphur retention rate is achieved with rather low calcium/sulphur molar ratios. The chemical reactions may be expressed as:

Calcination of limestone

Heat + $CaCO_3$ -> $CaO + CO_2$

Sulphation

$CaO + SO_2 + 1/2\ O_2$ -> $CaSO_4$ + heat

Sulphur capture is most efficient at a bed temperature of 850 °C.

NO_x Emissions

Due to the low combustion temperature "thermal" NO formation by oxidation of molecular nitrogen in the air is negligible. NO_x formation due to nitrogen in the fuel is reduced by "staged" combustion. That is, in the lower part of the bed, combustion takes place under reducing conditions which leads to the formation of molecular nitrogen N_2, instead of NO as in the case with oxidizing conditions. Additional secondary air to complete the combustion is introduced at higher levels.

By injecting ammonia into the combustion chamber or cyclone further lower NO_x emission levels can be achieved. By using 25 % NH_3 solution the feeding system is very simple consisting of a storage tank, feeding lines with necessary valves and nozzles at the injection points.

Combustible Material Emissions

CO emissions are low due to the turbulent mixing in the bed and mixing in the cyclone.
Similarly hydrocarbons C_xH_y and residual unburnt carbon are minimized due to the turbulent mixing in the bed and longer residence time in the circulating bed type boiler.

Particulate Emissions

Particulate emissions are reduced by the use of an electrostatic precipitator after the boiler. Typically separation efficiencies > 99,5 % are achieved.

Feed Water Deaerator

Demineralized water is brought to the feed water tank/deaerator. The purpose of the deaerator is to remove dissolved gases from the water. Feed water is heated above 105 °C and is scrubbed by low pressure steam and the gases are removed together with any exhaust steam which has not condensed.

Feed water pumps take the water from the deaerator to the boiler.

To further reduce the oxygen in the water, 0_2 scavenging chemicals such as Hydrazine or sodium sulphite are added to the water according to the water analysis. This installation is included in the scope of the recovery boiler.

Feed Water System

Feed water is pumped from the deaerator to the boiler by means of high pressure feed water pumps. There are two motor driven pumps, both sized for full boiler load. One of the pumps is on stand-by duty. This installation is included in the scope of the recovery boiler.

Boiler Water System

From the feed water valve group the water first enters the boiler proper via the economizer, where the feed water is preheated before entering the steam drum.

Following the economizer the feed water enters the steam drum where it is mixed with the boiler water. The boiler is a natural circulation boiler and the tubes are arranged so that as the water is evaporated to steam it is free to rise up into the drum. Unheated downcomer pipes take the water from the drum to the combustion chamber inlet headers. The combustion chamber wall tubes are heated by the flue gases and the water is party evaporated to steam.

Water and steam rise through these tubes back to the steam drum where the steam is separated from the water in cyclone separators and the water is returned to the circulating system.

Boiler Steam System

After leaving the drum the saturated steam is led to superheaters.

It is necessary to cool the superheated steam at higher loads, so that full superheat can be obtained at lower loads. This is done by means of desuper-heaters located in the interconnecting piping between the superheaters. Feed water is sprayed into the steam to cool it.

After superheaters the steam enters the main steam pipe line.

Combustion Air System

Primary Air

Primary air is taken from the atmosphere by a centrifugal fan. It first passes through the steam airheaters and then the tubular air heater in the boiler rear pass, before being brought to the wind box where it is blown through the grid to fluidize the bed and provide combustion air. The steam air heater is only used at low loads to protect the tubular air heater from corrosion due to low flue gas temperatures.

Part of the primary air is taken to the lower level air nozzles (bed lances).

Secondary Air

Secondary air is also taken from the atmosphere by a centrifugal fan. It is also taken via a steam air heater and tubular air heater, as for the primary air, before being brought to the boiler combustion chamber.

Secondary air is brought in at about 1,5 and 3,0 metres from the grid. Secondary air achieves the "staged" combustion explained earlier, and completes the combustion of the fuel without the formation of excessive Nox.

High Pressure Air

High pressure air is used for fluidizing the circulating bed material in the loop seal. The quantity of air needed is very small and it is not considered in the combustion controls. There are two high pressure Roots type blowers, one is on stand-by duty.

Flue Gas System

Following combustion of the fuel in the combustion chamber the flue gases first pass through the cyclones, where the coarser ash is separated and returned to the bed via the loop seal, and the finer fly ash is transported through the convection section of the boiler to the electrostatic precipitator where the fly ash is separated. The gases are drawn through the boiler fly-ash separator by means of an induced draft (ID) fan, after which they are discharged to the atmosphere via the stack.

TECHNICAL DATA

Steam production (design)	t/h	40
Design pressure	bar g	45
Steam temperature	°C	420
Fuel flow coal	t/h	3,5
Feedwater temperature	°C	105

Fuel

"B" Grade Bituminous Coal		
Lower heating value	kJ/kg	24.300 - 25.150
Moisture	%	8 - 12
Ash	%	20 - 25
Sulphur	%	0,30 - 0,55

4.4.2 Steam Turbine and Alternator

PROCESS DESCRIPTION

Steam produced by the recovery boiler and power boiler with a pressure of 45 bar g, 420 °C passes through the back pressure-type turbine.

Under normal operating condition the live steam pressure is controlled by the power boiler. Medium pressure steam is controlled by the turbine bleeding pressure control and low pressure steam by the turbine back pressure control.

The design of the steam turbine is in accordance with IEC-recommendations.

Turbine

Multi-stage reaction turbine with horizontally split turbine casing, top and bottom basing parts symmetrically mounted to prevent different extension at the two casing parts with regard to casing axis.

TECHNICAL DATA

Operating Data

Medium: Superheated Steam

Inlet:		norm.	max.
Pressure	bar g	45	50
Temperature	°C	420	450
Flow	t/h	44,3	55

Bleeding:		norm.	max.
Pressure	bar g	12	16
Temperature	°C	210	215
Flow	t/h	19,1	25

Extraction:		norm.	max.
Pressure	bar g	4,5	8
Temperature	° C	160	165
Flow	t/h	25,2	30
Generated Energy	MW	3,8	

4.4.3 Feedwater Treatment

PROCESS DESCRIPTION

The feedwater treatment consists of a demineralisation unit, a condensate-polishing unit and a mixed bed exchanger unit.

The demineralisation plant consists of two lines. One line is in service the other line in regeneration or stand-by.

The condensate polishing plant is designed as single line - one hydroanthrazit filter and one cation exchanger. Downstream the condensate cation exchanger and the demi-plant anion exchanger, 2 mixed bed exchanger (one as stand-by) are provided.

Start up, operating and shut off is performed from a central control room with a digital control system in automatic mode. Manual local operation is possible in emergency case only.

The water will be cleaned from mechanical impurity by passing the rubble filter. The rubble filter will be back-washed automatically after reaching a preadjusted differential pressure. Change over to the stand-by filter takes place automatically.

First all cations will be exchanged in the cation exchanger against equivalent amounts of H-ions. In the following degasifier the free carbon acid will be removed.

By using pumps the water will pass the anion exchanger where the strong and weak anions and SiO2 will be removed. After anion exchanger outlet there is a connection point where condensate from the condensate polishing plant will be mixed with the water from the demi plant.
This mixture of condensate and demi water is passing the mixed bed-exchanger where the last traces of minerals will be removed. The treated water will be stored in the following deionat storage tank.

The condensate will be collected in the condensate storage tank. By using pumps the condensate is passing one heat exchanger, a hydroanthrazit filter and a cation exchanger. In the hydroanthrazit filter mechanical impurities will be removed; the back-wash program of the filter will start automatically after reaching a preadjusted differential pressure. In the cation exchanger all cations will be exchanged into the equivalent amounts of H-ions. After the cation exchanger the pretreated condensate is mixed with the water from the demineralisation line and pass the mixed bed exchanger.

TECHNICAL DATA

Demineralization Plant

Capacity	norm.	m^3/h	2 x 25
	max.	m^3/h	2 x 35
Net rate of flow		m^3/h	25
Operating time		h	12 (one line)

Condensate Polishing Plant

Capacity	norm.	m^3/h	1 x 21
	max.	m^3/h	1 x 30
Operating time		h	200
Net cycle		m^3	4.200
Temperature	norm.	°C	95
	max.	°C	100

Process Water Inlet

Pressure	bar a	6,5
Temperature	°C	30

4.5 WATER TREATMENT

4.5.1 Raw Water Treatment

PROCESS DESCRIPTION

In the water treatment plant tube well water is softened for the use as process water in the pulp mill.

The raw water treatment plant includes the following process steps:

- Raw water pumping station
- Raw water pipe line to the treatment plant
- Lime milk dosing, polymere dosing
- Flash mixing
- Clarification and sedimentation in sedimentation clarifiers
- Filtration through gravity sand filters
- Storage and distribution of chemically treated water (process water)

Raw Water Screening and Pumping

The raw water from the tube well has to be pumped to the lime softening plant, which is located in the pulp mill area.

Flash Mixing And Flocculation

The lime milk will be added into the flash mixing tank and rapidly mixed with the raw water. The lime milk solution of 8 % concentration will be prepared in a mixing tank by dissolving the lime. The solution will be than transfered by a pump into a dosing tank (capacity for approx. 10 hours). One pump (prefered as dosing pump is a excentric rotor pump) will be foreseen to dose the lime into the flash mixing tank.

Clarification

For the sedimentation of the lime sludge one clarifier is required. The clarifier will be designed as circular basin (made of concrete) with a sedimentation zone and a sludge collecting zone. Raw water from the flash mixing and flocculation tank will be distributed uniformly to the inlet part of the clarifier. In the sedimentation zone the separation of flocs from water takes place. The sludge settles at the bottom of the clarifier tank, the clean water rises to the surface where it flows continuously via the circular arranged overflow weirs to the sand filter station.

The settled sludge is conveyed by means of a scraper, which is mounted on the moving bridge, into the central sludge sump and will periodically be discharged by a pump. A flushing system will be foreseen to avoid plugging of the pipe. Before the pump will be started the lines have to be backwashed into the clarifier and afterwards the sludge pump will be started automatically.

pH-Control

The treated water from the clarifier basin needs to be pH-adjusted therefore a acid dosing is foreseen.

Open Sand Filtration

The filtration plant will be designed as open gravity type sand filters. The clarified water will be distributed uniformly to each filter via channels (made of concrete or stainless steel). The treated water will be filtrated through the sand layer. Suspended particles are retained in the sand layer.

As soon as a filter is clogged a backwashing of the filter with air and water will be started. Backwash water to be taken from the storage tank. For backwash air, if required, a rotary air blower will to be foreseen.
The filter station has to include a complete unit with all required piping, valves, level switches, control station.

Water Storage And Distribution

The filtered water will be collected and stored in a covered concrete basin to cover peak demands.
The process water will be distributed by two centrifugal pumps, one additional pump should be installed as a stand-by unit.

Chemical Storage and Treatment

The chemicals required for raw water treatment are stored and processed in the treatment plant in the amount as necessary. The storage capacity of the chemicals will be for approximately 10 hours.

Lime is supplied from recausticizing plant.

BASIC DATA

Water intake:		
Q balance	m^3/h	450
Q design	m^3/h	600
Mixing and flocculation basin:		
Retention time	min	5
Net volume (total)	m^3	50
Sedimentation clarifier:		
Surface load	$m^3/m^2.h$	1,0
Surface area - total	m^2	600
Number of clarifier		1
Dimensions	m	28 (diam) x 4,5 m

Sand filter:		
Number of filter cells		4
Surface load	$m^3/m^2.h$	10
Surface area - total	m^2	60
Back wash water demand	m^3/h	max. 150
Back wash air demand	Nm^3/h	max. 600
Clearwell	m^3	1.500
Consumption figures:		
Lime $Ca(OH)_2$	g/m^3	max. 150
Polymere powder	g/m^3	1,5 - 2

Treated Water Quality (expected)

pH		7,0
Alkalinity, bicarbonate is HCO_3	mg/l	< 20
Nitrogen, NO_3	mg/l	-
Calcium, Ca as $CaCO_3$	mg/l	< 15
Magnesium, Mg	mg/l	< 20
Sulphates, SO_4	mg/l	below detactable limit
Chlorides, Cl	mg/l	< 5
Iron, Fe	mg/l	below detactable limit
Silica, Si	mg/l	< 20
Acidity	pH	6,8 - 7,2
Suspended Solids	mg/l	< 5
Total hardness as $CaCO_3$	mg/l	< 50
Turbidity	nil	
Colour (hazen unit)	nil	

4.5.2 Cooling Tower

PROCESS DESCRIPTION

The function of a closed circuit evaporation counterflow cooling tower is to cool water by the effect of evaportation.

It guarantees a high heat transfer. The water, which has to be cooled, is supplied by circuit pumps to the consumers and then to the water inlet of the cooling tower, from there into the main-trough and distribution troughs.

The design of the water distribution provides a flow by gravity-system.

The cooling air enters the cooling tower at the air inlet above cooling tower basin and passes the tower fill in counterflow manner to the trickling water.

The special arrangement of the cooling tower fill (splash grids and fill blocks) gurantees a turbulent flow of the air and water all over the tower fill giving a substantial increase of heat and mass transfer rates as compared with plane surfaces.

The air comes into intimate contact with the water to be cooled, during evaporation of a small part to be cooled; that's the effect of a cooling tower principle.

After water has passed the throughs and the tower fill, it is collected in the cooling tower basin. The level in the cooling water basin is controlled by addition of chemically treated water. From the cooling water basin the cooled water is pumped to the cooling units.

Appropriate equipment is provided for the water treatment so as to prevent salt deposits, accumulation of sludge and algae growth, and to reduce corrosion. From the cooling-water basin, approx. 10 % of the total water quantity is filtered, so as to prevent the downstream equipment from being plugged with impurities. To avoid increasing of concentration of chemicals, a contstant overflow is required.

TECHNICAL DATA

Design

Type of cooling tower	counterflow-splash-film
Strucutre	wood-impregnated
Number of cells	2
Disposition of cells	in line
Distribution of water	by gravity

Design Data

Design water capacity	m^3/h	1.500
Inlet water temperature	°C	45
Outlet water temperature	°C	32,5
Design wet bulb temperature	°C	29
Maximum evaporation losses	%	1,99
Maximum driftlosses	%	0,08
Overflow	m^3/h	20

Consumption Figures

(g/m^3 of make-up water)

Corrosion inhibitors	g/m^3	15 - 25
Chlorination	g/m^3	0,5 - 1
Shock chlorination	g/m^3	5
H2SO4	g/m^3	100 - 325

The dosing rate is depending on the pH-value of the cooling water.

Characteristical Data

Number of cells		2
Length of cooling tower	m	29,5
Width of cooling tower	m	10,7
Fan deck hight	m	4,3
Fan stack height	m	1,9
Total height	m	6,2
Inlet water	m	4,6
Number of fans per cell		1
Total number of fans		2
Power absorbed by each fan		
at design conditions	kW	36,4
Motor power	kW	49
Motor-speed	rpm	1.450
Speed of fan	rmp	188
Cooling water basin	m	30 x 11 x 2/2,5

Filter

Flow design	m^3/h	150
Surface load	$m^3/m^2.h$	18

4.5.3 Effluent Treatment Plant

Process Description

By the production of jute pulp different kind of effluents are produced which have to be discharged to a treatment plant.

Pollution control of mill effluents centres on three traditional polutants, such as biochemical oxygen demand (BOD), chemical oxygen demand (COD) and suspended solids (SS).

The requested figures of treated effluent:

BOD5	mg/l	30
SS	mg/l	50 - 100
COD	mg/l	350
pH		7,0 - 8,5

The system consists of a mechanical treatment, neutralization of the bleach plant effluent, biological treatment and polishing pound for the treated effluent.

DETAILED PROCESS DESCRIPTION

Mechanical Treatment

The high solids effluent - after lifting by a screw pump - flows by gravity through a static and a mechanical rake. The screened coarse is fed via a belt conveyor into a container. The pre-treated effluent flows by gravity into the primary clarifier. Easily settleable materials, such as fibre, sand or grids are collected in the gravity clarifier. The settled sludge is scraped by a scimmer into a integrated sludge pit. From there the sludge is pumped into the sludge thickener by means of centrifugal pumps.

Neutralization

The acid and alkaline filtrate from the bleach plant is taken in separate lines to the neutralization basin. Other small leakages are also discharged to the neutralization basin. The neutralization is done with NaOH or H_2SO_4 depending on the pH of the mixed chemical effluent. A chimney equipped with fan is provided to extract the gases obtained from the degassing by the chemical reaction.

The neutralized effluent is pumped by means of a screw pump into the primary chlarifier too.

Biological Treatment

The mixed chemical and high solids effluents leaves the primary clarifier and enters the mixing basin were nutrients in the form of N and P are added. To maintain the biological decomposition a certain ratio of nutrient salts is required. For an aerated sludge process a BOD5 : N: P ratio = 100 : 5,0 : 1,0 is sufficient. The waste water of pulp industry practically does not contain any nitrogen and/or phosphor.

Before entering the biological treatment basins the temperature, the pH-value of the effluent will be checked and monitored.

In the aeration basin the biological decomposition of organics and other by oxidation reduceable compounds takes place. The bacteria are forming mainly biomass, CO_2 and H_2O. After leaving the aeration tank the effluent flows into the final clarification tanks.

In the clarifiers the activated sludge is separated from the water. The purified water leaves the plant. The settled sludge is sucked off the bottom by a suction scraper and the main part of it is returned to the biological step. The return sludge is necessary to maintain a certain concentration of activated sludge in the mixed liquor of suspended solids in the biological treatment step. The excess sludge is separated and pumped to the gravity thickener.

The biologically treated effluent is then collected in a polishing pond for a few days. Through a measuring station the clarified effluent is discharged to the recipient.

Sludge Thickening and Dewatering

The primary sludge from the pre-clarification and the biological excess sludge are pumped into the gravity thickener, there the solid concentration of the sludge is increased. The overflow form the thickener is returned to the pre-clarification via ducts.

The sludge from the thickener is dewatered - by addition of a polyelectrolyte - by means of a double wire press. The separated water is returned to the primary clarifier. The dewatered sludge will be deposited.

TECHNICAL DATA

Pulp Production Effluents

High Solids Effluent

Q normal	m^3/h	130
Q design	m^3/h	160

Chemical Effluent

Q normal	m^3/h	195
Q design	m^3/h	270

DESIGN OF MAIN EQUIPMENT/PARTS

Screens and Racks

Q norm	m^3/h	325
Q design	m^3/h	425

Screw Pumps

High solids sewage		
Q design	m^3/h	160
Head approx.	m	4,5
Chemical sewage		
Q design	m^3/h	270
Head approx.	m	4,5

Neutralization

Q design	m^3/h	270
pH inlet		3 - 4,5
pH outlet		7,5 - 8,5
Retention time	min.	20
Net volume	m^3	~ 90
Dimensions	m	4 x 8 x 3,0 (4,0)

Pre-Clarification Basin (Total Effluent)

Q design	m^3/h	430
Surface load	m^3/m^2 h	1
Surface	m^2	430
Net volume	m^3	1.300
Number of basins		1
Dimensions	m	12 x 36 x 3 (3,6)

Mixing Basin

Q design	m^3/h	430
Net volume	m^3	60
Dimension	m	3 x 6 x 3,3 (4,0)

Aeration Basin

Q design		m^3/h	430
Temperature		° C	35 - 37
pH-value		-	7,0 - 8,5
BOD5-load	normal	t/d	1,5
	design	t/d	2,0
COD-load	normal	t/d	3,0
	design	t/d	4,0
V_L* $BOD_5/m^3.d$		kg	0,5
Net volume (total)		m^3	4.000
Number of basins			1

* Volumetric load

Dimensions	m	31 x 31 x 4,2 (5,2)
Spec. Oxygen demand	kg 0_2/kg BOD_5 removed	1,8 - 2,2
Air transfer system		surface aerators (8 pieces)
Retention time	hrs.	20
BOD5 removal	%	approx. 95
COD removal	%	approx. 65

Final Clarification

Q design	m^3/h	430
Surface load	$m^3/m^2.h$	0,50
Surface	m^2	860
Net volume	m^3	3.400
Number of basins		1
Dimensions	m	16x 54 x 4 (4,8)

Retention Pond

Q design	m^3/h	430
Retention time	d	3
Net volume	m^3	~ 31.000

Sludge Thickener

Sludge load	t/d	2
Surface load	kg DS/m^2.d	25 - 30
Surface	m^2	78
Number		1
Tank diameter	m	10

Sludge Dewatering

Sludge flow	m^3/h	3
TS after dewatering	%	approx. 28

Treated Effluent Quality- After Biological Treatment

Q normal	m^3/h	325
BOD5 normal approx.	mg/l	< 30
COD normal approx.	mg/l	< 250
SS normal approx.	mg/l	< 100 *)
pH-value		7,0 - 8,5

The requested quality of treated effluent can be all reached by the selected system.

*) If the suspended solids content of 50 mg/l in the treated effluent has to be reached an addition equipment will be needed. The cheapest solution is to have a so called retention pond (retention time of approx. 3 - 4 days).

This solution is used for the study. Another option would be the installation of additional filtration (sand filters).

4.6 ANCILLARIES

4.6.1 Compressor Station

PROCESS DESCRIPTION

Central Compressor

A central compressor plant is provided to ensure the working and instrument air supply of the plant.

Two screw-type compressors water cooled are provided, each of a capacity of 800 Nm^3/h of compressed air. Two compressors will be in operation, one stand by. Part of the compressed air generated by the compressor is used as mill air. One 20 m^3 buffer bin is provided to compensate for the extraction fluctuations which might occur unexpectedly. Part of the compressed air is treated to instrument air.

The air is dried in two refrigeration dryers of 800 Nm^3/h each.

Refrigeration Dryers

Moisture saturated compressed air is led into the refrigeration dryer were it is precooled in the first stage with an air/air heat exchanger of counter flow type. This heat exchanger warms up dry air leaving the dryer to cool down inlet air of the dryer. Cooling down to the necessary pressure dew point is done in the refrigerant/air heat exchanger.

During the entire cooling process the moisture precipitates out of the compressed air is condensated and automatically drained of. A maintenance free static control device permits operations of the refrigeration dryer from 0 to 100 % of the air flow.

The compressed air de-humidified and cooled to the pressure dew point is heated up again in the air/air heat exchanger.

TECHNICAL DATA

Air Inlet

Flow (each)	Nm^3/h	800

Air Outlet

Pressure	bar a	9,0

4.6.2 Fuel Oil Storage

PROCESS DESCRIPTION

Fuel oil will be used as an auxiliary fuel for the recovery boiler and as main fuel in the lime kiln.

The storage tank will receive shipments by tank truck. Facilities for unloading will be provided as well as for transfering oil to the day tank. The fuel oil storage tank will be equipped with steam coils and a steam heater at tank outlet to transfer pumps.

Capacity of storage tank	m^3 (approx. 8 days)	200
Capacity	t/h	1,0

4.7 MILL WIDE SYSTEMS

4.7.1 Electrical Equipment

GENERAL

Standards and Regulations

All electrical equipment shall meet the standards and regulations VDE, DIN, IEC or the corresponding regulations required in India.

Nominal Voltage Levels and Frequency

AC 3 x 3.3 kV ± 5 % ..... High voltage of the feeder for the whole mill and supply voltage of HV-motors > 225 kW

AC 3 x 415 V ± 5 % ..... Supply voltage of motors < 225 kW

AC 3 x 415 V ± 5 % ..... Supply voltage of frequency converters

AC 3 x 415 V ± 1 % ..... Output voltage of Uninterruptable Power Supply system (UPS)

Frequency: ..... 50 cps ± 0,2 Hz

Safety Measures

AC 3.3 kV HV-system:..... low-resistance grounded - if applicable

AC 415 V system:..... TN-C and TN-C-S system according to IEC364-3

AC 415 V system:..... TN-C-S system according to IEC364-3

Description of Power Supply Principles

DETAILS

The HV-switchgear shall be equipped with incoming, transformer- and motor-outgoing cubicles in order to supply power to distribution transformers and HV-motors. For improving power factor to better than 0.85, HV switchgears shall be equipped with power factor correction equipment (capacitors).

The LV-switchgears shall be designed for voltage levels of 415 V for power supply to LV-motors.

Distribution transformers as well as connected 415 V LV-switchgears shall be installed within the plant sections in order to enable short cable length to transformers, motors and other consumers.

For power supply to the DCS and other important systems, an Uninterruptable Power Supply system (UPS) shall be foreseen.

As far as possible, all motors shall be designed as 3-phase squirrel cage motors and starting direct on line. For variable speed drives, frequency converters shall be provided.

For monitoring and supervision, electrical switchgears, transformers, UPS and others shall be connected to the DCS. Motors shall be operated automatically and interlocked via DCS or not interlocked via local control station for maintenance purpose only, other feeders (transformers etc.) shall be operated manually.

EQUIPMENT SPECIFICATION

Low Voltage Switchgears

LOW VOLTAGE DISTRIBUTION SWITCHGEARS AND MCC'S

General

Designed as factory assembled metal enclosed switchgears for installation in closed, well ventilated electrical rooms.

Supply voltage:..... 3 x 415 V/50 cps, 4-wire
Control voltage: ..... 115 up to 240 V/50 cps, line to neutral
Degree of protection:..... IP4X
Short circuit rating, busbar-rating and rating of incomer circuit breaker shall be chosen according to the distribution-transformer to which they are associated.

Each switchgear shall consist of:

- Incomer cubicle(s)
- The necessary outgoing cubicles, housing:
  withdrawable motor starters and fix installed circuit breaker feeders for:
  power factor correction equipment, remote subdistributors,
  package-units (electrical equipment which is direct bonded to mechanical)
  distributors for other loads (control systems, ventilation etc.)

Incoming Cubicles

Each incomer cubicle shall essentially consist of:

- 1 Suitable rated withdrawable triple pole air circuit-breaker with manual closing mechanism and direct acting overcurrent and short circuit trip devices (subdistributors which are fed by other distributors shall be equipped with a manual operated load switch only)
- 1 Set of current transformers
- 2 Voltmeter with change over-switches
- 3 Ammeters, one with average value indication
- 1 kWh-integrator
- 1 Suitable rated control voltage transformer 415/240 V ± 2 x 2.5%
- 1 Set of circuit breakers for control voltage transformer and voltage metering

Motor Starter and Outgoing Feeder Cubicles

Each individual motor starter cubicle shall essentially consist of:

- The horizontally main bus bar section
- The vertically busbar section
- The vertically cable section
- The withdrawable motor-starters
- The interface department with devices for bus-connection devices to the DCS and current transducers for analog input signals

Withdrawable Motor Starters

Shall essentially consist of:

- 1 Suitable rated triple pole air circuit-breaker with manual closing mechanism and direct acting short circuit and thermal overload trip device
- 1 Suitable rated triple pole contactor (for reversible motor starters a second contactor is provided which shall be electrically interlocked with the other contactor so that both cannot be closed at one and the same time)
- 1 Circuit breaker for control circuit
- 1 Current transformer .../1 Ampere for all drives with continuous operation, or respectively where a current measurement is necessary for the process
- 1 Interposing relays if necessary
- 1 Terminal-strip with all terminals for power, control and measurement

Outgoing Feeders Units

Each outgoing feeder shall essentially consist of

- 1 Suitable rated withdrawable moulded case circuit breaker with manual closing mechanism and direct acting short circuit and thermal overload trip device
- 1 Set of terminals and where necessary:
- 1 Current transformer

POWER FACTOR CORRECTION

General

Shall be provided for each 415 V-switchgear and designed as metal enclosed cubicles for indoor installation with:

- Individual three phase of single phase capacitors with fitted discharge-resistors
- Equipment for switching the groups, consisting of molded case circuit breakers and air break-contactors
- Reactors to protect capacitors against harmonics (where necessary
- Multi stage capacitor control relay for automatic and manual control and power factor and operating stage indication.

Above mentioned cubicles shall be located in the same switchroom as the motor switch gear to which they are associated. Depending on the brand of LV-switchgears, the power factor correction equipment may directly be installed within the LV-switchgears.

Rating of capacitors: Depending on the final design, respectively power balance of switchgears.

Low Voltage Induction Motors (up to 225 kW)

Shall be designed as Asynchronous Motors with Squirrel Cage-Rotor.

* Operating voltage .....415 V / 50 cps
* Type of enclosure .....IP 55 acc. to IEC 34-5
* Type of construction .....IM B3 acc. to EC 34-7, other types acc. to motor list
* Cooling method .....IC 0141 acc. to IEC 34-6
* Insulation class .....F, temperature rise acc. B
* Main dimensions .....acc. to IEC-72
* Terminal box .....all 6 winding ends brought out to terminals
* Bearings .....ball-or-roller-bearings, facilities for greasing from outside (only large sizes: depending on manufacturer's standard)

Uninterruptable Power Supply (UPS)

Provided for back up of the digital process control system (DCS). Designed as factory assembled metal enclosed cabinets, for installation in closed, well ventilated electrical rooms.

The UPS shall consist of:

- Rectifier
- Converter
- Static by-pass switch
- Maintenance bypass switch (manually operated)
- Lead-acid batteries (to be installed the battery room)
- Control and monitoring devices
- AC-distribution switchgear

TECHNICAL DATA

Supply voltage:..... 415/240 V, 50 cps, 3phase resp. single phase
Nominal output voltage:..... 115 V up to 240 V, 50 cps, single phase
Nominal power output:..... see below
Capacity: ..... for backing up a power gap of 30 minutes

Local Controls

LOCAL CONTROL STATIONS

To enable a local testing and inspection operation some drives shall be equipped with local switches.
The switches have the following functions:

a. Selector switch (sequence switch)
   - Zero position (loackable)
     Drive cannot be switched on

- Automatic operation
  In this position, the drive is prepared for automatic start by the control system.
- Local/single operation
  The drive is prepared for non interlocked local operation. In this position, however, the electric drive monitoring (cutoff relay) remains operating.

b. Reversing switch
For reversing and/or bi-directional operation, an additional selector switch for forward/backward operation is provided. This switch becomes only effective in position "local operation" of the sequence switch.
Design Protection: IP 65

Tripping Wire-Switches

Conveyors shall be - where necessary - equipped with tripping wire-switches. In danger, tripping wire switch can be operated from each position of the conveyor. The switch will be blocked when operated respectively when wire breaks, manual deblocking.

Design
- Protection: IP 65
- With contacts for control

Speed Monitors

Conveyors shall be - where necessary - speed monitored at the return-station. If the belt shall not come up to speed in time respectively if the belt is broken, this shall be detected by the speed sensor resulting in switching off of the motor and initiating an alarm.

Design:
- Local installed speed sensors, monitoring relay, if necessary shall be installed in the electrical room
- With contacts for control

Start Warning Systems

Conveyors and other machinery shall be - where necessary - equipped with start warning systems, consisting of sirens and flashing/revolving lights. The system shall be activated prior to each start.

Emergency Stop Push Buttons

Where necessary, emergency stop push buttons shall be provided for special machinery.

Cables

Design of Low Voltage Power Cable

Standard cable for indoor and outdoor installation.

Design of Signal Cables

Screened Leads for mA-signals, setpoint-potentiometers etc.
VDE-type: YSLCY, nominal voltage 300/500 V

Control Voltage Cable

Standard cable for indoor and outdoor installation.

High Voltage Electrical Equipment Specification

High Voltage Switchgears

3,3 KV MAIN SWITCHGEAR

General Technical Design

The cubicles will be of metal clad type

* For indoor installation
* Selfstanding
* Dustproof
* Divided into circuit breaker-, cable connection- and low voltage-compartments
* With metallic automatic shutters
* With safety flaps for the HV compartments on the top of cubicles
* With withdrawable circuit breakers, with all interlocks
* With rigidly installed cast resin current and voltage -transformers
* With earthing switches handoperated, interlocked with the circuit breaker truck
* With protection-, control- and metering-devices installed in the low voltage compartment, respectively on the door
* Completely wired and pretested incl. certificates for function test and for short circuit capacity
* Accuracy of meters and instruments: class 1,5 minimum

Technical Main Data

Operating voltage .....3,3 kV
Nominal voltage.....7,2 kV
Operating frequency.....50 Hz
Rated bus bar current.....2000 A
Rated degree of protection IP4X
Rated short circuit breaking current.....25 kA

Maximum short circuit time .....1 sec
Power frequency withstand voltage .....20 kV rms
Lightning impulse withstand voltage .....60 kV (peak value)
Starpoint.....isolated
Auxiliary voltage .....110 V DC

Design of Outgoing Cubicles for HV-Motors

1 3 pole HV-contactor, vacuum type, 400 A, withdrawable

3 Current limiting HV-fuses, 400 A

2 Current transformers, 3,3 kV, 100/1/1 A

1 3 pole earthing switch

1 2 phase motor protection relay, with overload, single phase, unbalance, stator earth fault protection

1 Motor-temperature protection relay

1 A-meter

1 kW-meter

1 kWh-integrator

Design of Outgoing Cubicles for Distribution Transformers

1 3 pole circuit breaker vacuum type, 630 A

motor operated, withdrawable on truck

2 Current transformers 3,3 kV, 200/1/1 A

1 3 pole earthing switch

1 2 phase overcurrent and short circuit time relay

1 A-meter

Design of Metering Cubicle

3 Voltage transformers 3,3/0,1/0,1 kV and 3 HV-fuses, 3,3 kV, 6 A, mounted withdrawable

1 Undervoltage time relay (for HV-motors)

1 Earth fault indication relay

1 3 pole bus bar earthing switch

1 V-meter with change over switch

Design of Spare Cubicles

Empty cubicles with main busbars and front cover. LV-compartment equipped with terminals, if necessary to be upgraded either to motor- and transformer outgoing cubicles.

Auxiliaries for HV-Switchgears

1 pc. Stationary, lead-acid battery, in closed design, transparent plastic casings including plastic coating steel racks
Operating voltage: .....110 V, DC
Capacity: .....100 Ah, at 8 hours discharge

1 pc. Charging rectifier, of metal enclosed design for charging and trickle charging of the 110 V lead-acid battery

* With automatic voltage control and monitoring
* With voltmeter and voltmeter change-over switch for voltage metering of the cells and the consumers
* With ammeter and ammeter change-over switch for current measuring of the rectifier and the consumers
* With rectifier main switch ON-OFF
* With change-over switch-hand-automatic
* With operating lamp

* With disturbance signaling lamps and contacts for
  - system failure
  - rectifier failure
  - overvoltage - consumer
  - undervoltage - consumer
  - undervoltage - battery
  - ground fault indication relay

  equipped and wired ready for operation

Supply voltage ..... 3 x 415 V, 50 Hz
Rectifier - DC-voltage ..... 110 V

1 pc. DC-Distributor
in steelsheet cabinet, containing:

1 circuit breaker 100 A
20 miniature circuit breakers 10 - 25 A
1 A-meter
1 V-meter

1 set Accessories, comprising
- voltage tester
- insulation mat, insulation gloves
- etc.

High Voltage Motors (bigger than 225 kW)

Shall be designed as Asynchronous Motors with Squirrel Cage-Rotor

- Rated power.....> 225 kW
- Operating Voltage: .....3300 V / 50 cps
- Enclosure Type: .....IP 55 acc. to IEC 34-5
- Type of Construction: .....IM B3 acc. to IEC 34-7 other types acc. to motor list
- Cooling method: .....either IC 01 41 or IC 0151 acc. to IEC 34-6
- Insulation Class: .....F (rated and loaded)

- Overtemperature Protection: .....Pt 100 - resistance-thermometers for the stator winding
- Bearings: .....ball-or-roller-bearings, facilities for greasing from outside
- Space heaters .....with anti condensation heaters

Transformers

Transformer for connection to public grid and distribution transformers.

TECHNICAL DATA

Threephase oil immersed transformers for indoor and outdoor installation according to IEC76.

Continous ratings of HV and LV windings:

Size	2,0	MVA
Rated frequency	50	cps
Full-load voltage of HV winding	3,3	kV +/- 5 %
Full-load LV winding	415/240	V
Type of connection	4	Dyn 5
Impedance voltage	6,5	%
LV winding (0,415 kV)	50	kA
Maximum short circuit time	3	sec
Type of cooling (natural surface cooling)		ONAN
Maximal ambient temperature	40	°C

DESIGN PRINCIPLES

- With copper windings
- With oil tight welded tank and radiators
- With all fittings for oil filling, draining and oil sampling
- With sealed construction with pressure relief valve with contact for trip
- With dial-type tele-thermometer for indication and contacts for warning or trip

- With oil level indicator
- With attached terminal box for connection of all thermometer signal cabling
- With off-load tap changer on HV-side, adjustable +/- 2 x 2,5 % under no voltage condition from top cover
- With high voltage bushings within cable terminal box
- With low voltage bushings within cable termination box
- With flat rollers, re-pluggable for longitudinal and cross movement
- With lifting eyes and lifting hooks
- With primer and finishing coat of paint
- Filled with transformer oil ready for operation
- With oil drain and filling valve facilities

4.7.2 Instrumentation and Distributed Control System (DCS)

GENERAL

The equipment described in the following items may be changed during the detail design depending upon the subsupplier's standard and the process requirements.

FIELD INSTRUMENTS

Control Valves

Control valves shall generally be operated pneumatically by means of piston or diaphragm actuators as appropriate to the type of valve and for the service specified. Control valves shall be equipped with an electro-pneumatic positioner with the signal 4-20 mA. The air supply to the valves shall be 5 to 6 bar g.

On-Off valves shall generally be operated pneumatically by means of a piston or diaphragm actuators as appropriate to the type of valve and for the service specified. On-Off valves shall be equipped with a solenoid valve and a limit switch for open and closed position. The air supply to the valves shall be 5 to 6 bar g. The type of body design and inner throttling assembly shall be chosen to suit each service application and in all cases the material of construction shall be equal to or of superior quality than those specified for the piping standard and shall suit the process conditions.

Control valves for steam service shall generally be of globe type with a design for easy in-line inspection and maintenance. Body material shall be of carbon steel whereas the seat and cone shall be of 316 SS or equal.

Positioning actuators shall be fitted to provide accurate control and high stroking speed.

Control valves for process water and liquor shall generally be of the butterfly type with tight shut-off. The bodies shall be of ductile iron with replaceable moulded liner with integral seat and 316 SS disc or suitable for the media. Piston type actuators shall be fitted and for modulating service E/P-positioner additionally.

Control valves for stock shall generally be a ball sector type or full bore type. Bodies and balls shall be of stainless steel or suitable for the media respectively with seat rings of stellite and gland packings of PTFE. Positioning actuators shall be fitted in order to provide accurate control at high modulating speeds.

Shut-off valves for stock shall be of the slide type offering full bore flow and tight shut-off with knife-edge slide seat-in against an internal seal. Valve bodies shall be cast steel with spindle and knife-edged slide of SS or suitable for the media. Actuation shall be by means of a pneumatic cylinder.

Transmitters

All significant and important physical and mechanical measurements which are going to be processed shall be transduced into a DC unit signal of 4-20 mA. All transmitters where applicable shall be of the two-wire system.

Pressure-Measurements

Pressure transmitters shall be designed to withstand an overpressure of 1,25-times the nominal pressure. DP-cell pressure transmitters shall be designed to withstand a single-side full static load. The normal operational measuring value shall be around 50-80 % of the full measuring range (scale). The erection of the transmitters shall be in a suitable location near the process connection tapping point.

Level-Measurements

Level Transmitters

Normally DP-cell pressure transmitters shall be used for the level measurement and shall be designed to withstand an overpressure of 1.25-times the nominal pressure. For aggressive and dirty media two types of level transmitters shall be used, either with plane diaphragm or with extended diaphragm. Normally the flange type (according to DIN or ANSI) with a size of ND 80 or flange size of 3" are used in order to mount them directly to the tank nozzle.

Radioactive level transmitters shall be applied where applicable and necessary.

Capacitive or conductive level measurements shall be applied where applicable and necessary.

Temperature-Measurements

For all measurements of temperature Resistance Thermometers shall be used. Wherever possible RTD or Thermocouples with built-in transmitters in the connection head shall be applied. These types of sensor-transmitters are of the two wire circuit with a signal of 4-20 mA. Generally the RTD shall be wired with the 3-wire connection.

RTD's or Thermocouples are generally fitted into thermowells either of screw-in or weld-in protection-tubes to serve as mechanical protection and for easy exchange of defective elements during operation.

Flow-Measurements

For flow measurements the magnetic flowmeter shall normally be applied. The material for lining and electrodes as well as the decision whether AC- or DC-field shall be used, shall depend on the media and process conditions.

The nominal size of the magnetic flowmeter shall be chosen in a way that the velocity is between 1.5 to 4 m/sec.

For steam service the orifice or venturi nozzle in connection with a DP-cell transmitter shall be applied. The circuit generally is a two-wire circuit with the signal 4-20 mA.

For gases such as oxygen the vortex type sensors / transmitters are applied according to the process requirements. The circuit is (generally) a two-wire circuit with the signal 4-20 mA.

Variable area flowmeters shall be applied where applicable and necessary. These types of instruments are fitted into the pipeline between flanges. The float and the transmitter are magnetically linked. The circuit is (generally) a two-wire circuit with the signal 4-20 mA.

Consistency-Measurements

For the measurement of consistency blade sensor coonsistency transmitters shall be applied. These types shall have an output signal of 4-20 mA.

Installation

* Signal converters shall be housed in field boxes, if the protection is less than IP65.
* The supply air for control valves shall come from an instrument air manifold with 6 or 10 outputs shall be of a solid type made of SS with weld on shut off valves and shall be freely mounted without field boxes and located centrally for a group of valves (instrument air consumers).
* Shielded cables shall be used for the instrument signal cabling. Instrument cable bridges and trays must be separate from other cables 220 volt A.C. or power cables.
* The erection of the transmitters shall be in a suitable location near the process connection tapping point.

DISTRIBUTED CONTROL SYSTEM (DCS)

For a modern, reliable, accurate operation of the pulp mill a distributed control system shall be installed.

A proposal of the DCS-Lay Out is shown in the enclosure. As there are many different systems available the following is to understood as a guideline for selecting the proper DCS- System.

The DCS-System shall have following features:

- Distributed controllers capable of independently controlling single and / or multiloop analog and / or discrete processes.

- Controller input / output capable of interfacing analog and discrete signals to the system.

- Operator consoles consisting of video display units, keyboards and related devices, capable of accepting control commands from the operator and displaying process status history in alphanumeric and a variety of graphic formats.

- A redundant data communications highway connecting all the system components in various mill areas and capable of being interfaced to one or more computers for management information and programmable controller systems.

- The basic element used for process control shall be a microprocessor-based digital controller. The controller shall contain algorithms that are user-configurable and tuneable to suit the process. The controller shall allow for on-line configuration changes.

- Control algorithms shall include, but not necessarily be limited to the following:

  - PID control
  - High limit
  - Low limit
  - High alarm
  - Low alarm
  - Deviation alarm
  - Set-point entry limiting
  - Cascade
  - Ratio
  - Bias
  - Multiply
  - Divide
  - Square root extraction
  - Signal characterization
  - High select
  - Low select
  - External feedback for tracking.
    For cascade loops, the secondary controller shall give the signal for the tracking to the primary controller.
  - Integration
  - And logic
  - Or logic
  - Not logic
  - Nor logic
  - Nand logic
  - Timer logic

- The controller shall be able to communicate through a data highway to respond to information requests from other parts of the system.

- The controller shall be modular and hierarchical in design, so that the failure and/or replacement of any module does not affect the operational status of other modules at the same or higher level.

- Video monitors used in operator consoles shall be for X-windows techniques.

- The system shall provide per operator control console with the following displays:

  - Overview:
    A graphic representation of the plant operation showing the major process areas with important process parameters data, alarms, motor status, etc. It shall also enable the operator to access directly various mill areas.

  - Areas:
    A graphic representation of a process area which shall allow the operator to monitor, control, start/stop motors and access other displays up, down or laterally in the display hierarchy.

  - Loop:
    A loop display to enable the operator to zoom into a particular single control loop display for fine tuning purposes.

  - Trend:
    Real time trending with adjustable time based for process variables. The number of variables to be shown per page, shall be the Vendor's standard.

  - Alarm:
    Alarm display summary showing alarms in the order of their occupance. (All displays shall have some method to indicate an alarm condition).

- The operator keyboard shall perform the process control commands for the following functions:

  - On/off control
  - Automatic/manual mode control
  - Remote manual output
  - Set-point change
  - Start/stop pumps and motors
  - Acknowledge audible alarms
  - Select trending parameters
  - Call up alarm summaries or reports
  - Access any display in the display hierarchy
  - Print a display

- The engineering keyboard shall be used for controller configuration, display formatting, and loop tuning. These functions shall be under key lock or otherwise inaccessible to the operator.

- The alarm system regarding critical alarms shall be detected by external hardware and shall enter the system as discrete inputs. All other alarms shall be detected by the system examining the analog input/output values, and shall be displayed on all displays containing that loop, by means of colour changes, flashing symbols, etc.

- On alarm, a flashing back-lit indication shall appear regardless of which display is on the screen. Alarms shall be acknowledged via the keyboard. When the alarm is displayed and acknowledged it shall remain displayed until the alarm condition is rectified.

- The system shall include self-diagnostics to alert any malfunctions of the physical and/or logical components of the system, this shall be alarmed as a "System Status Alarm".

- The system shall generate automatically a hard copy of all alarms as they occur and are rectified.

- The required hardware and software for the generation of the necessary customized interactive graphic displays shall be provided for the project.

- The printer shall use standard edge-perforated Z-fold "computer" paper and shall be adjustable for printable paper widths from 8,5 to 14 inches (plus one (1) inch allowance for removable edge perforations).

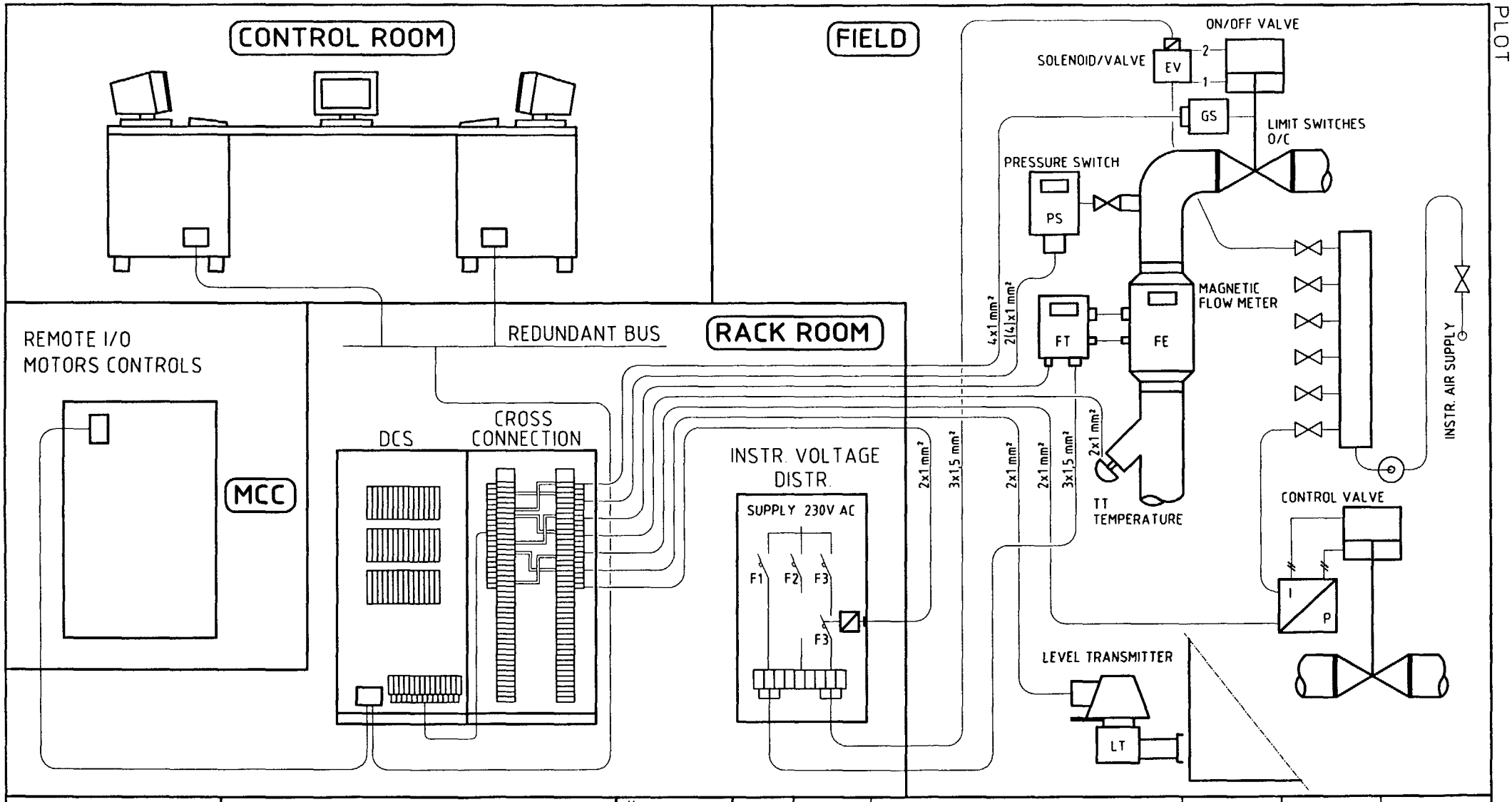
- Configuration shall be accomplished by responding to questions asked by the system, by filling in the blanks in a table, or some equally simple technique. Configuration mode shall be under key protection, to prevent changes from being made by unauthorized personnel.

Enclosure

Principle connections for instrumentation
DCS - Layout - 3 pages

ACAD - PART: JPMPCI

PLOT



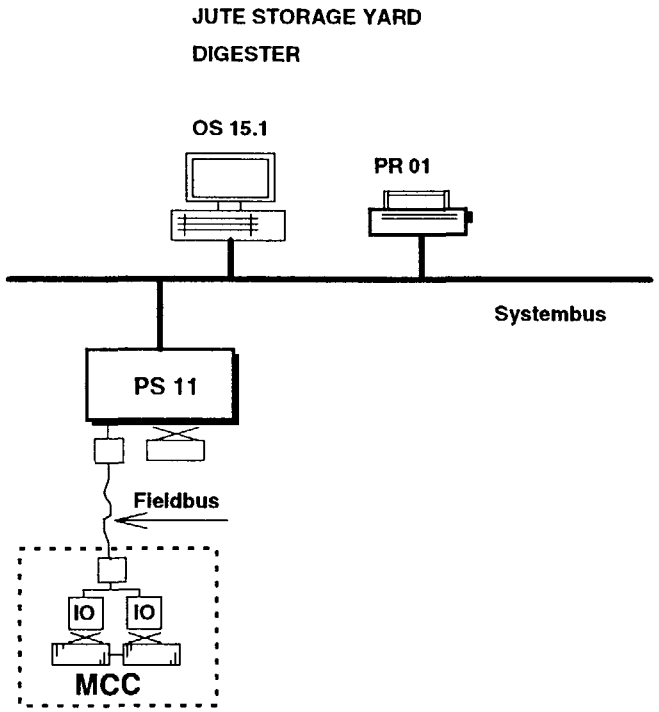
Customer: JUTE PULP MILL	Title: PRINCIPLE CONNECTION FOR INSTRUMENTATION		Mass	Revision	No. of Mod	Modification	Date	Made by	Checked by
			Material		Date	Name			
				Drawn	98-05-27	RT			
Customer-Doc-No	IVA-Doc-No: ITC-ZF-J/ZAL6001E	Sheet 1 of 1	Size A4	Checked	98-05-27	HEIDEN	Scale: -		
			Revision						

IMPCO-VOEST-ALPINE
PULPING TECHNOLOGIES GmbH (IVA)
A Subsidary of Beloit

JUTE PULP MILL
(PHASE III)

DCS - LAY OUT
DIGESTER HOUSE

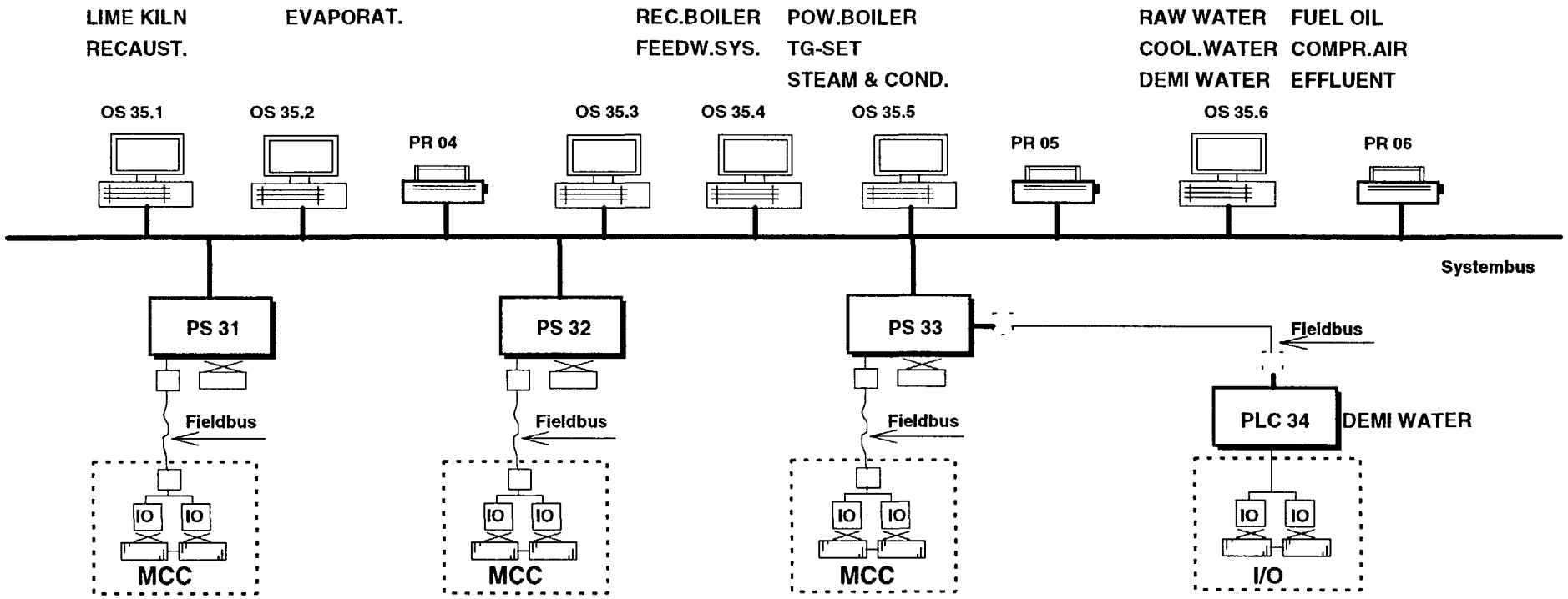
IVA



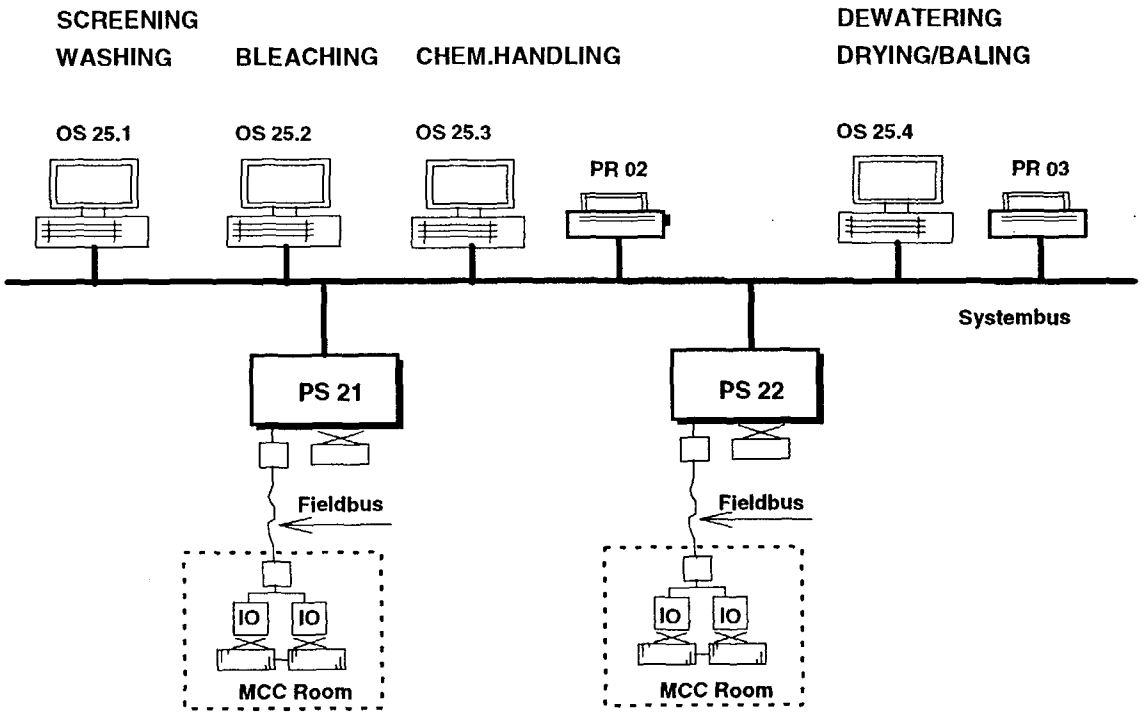
JUTE PULP MILL (PHASE III)

DCS-LAY OUT RECOVERY / UTILITIES

IVA



DCS - LAY OUT
FIBRE LINE



5. EQUIPMENT LIST

Enclosure: 32 Pages Equipment Lists

Due to the purpose of this work - a prefeasibility study- for some equipments no dimensions or capacities are given, as these missing items usually only can be done during the execution of the project.
All these items are marked with D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.1.1 JUTE CUTTINGS HANDLING					
ZH10C01	Feeding Conveyor	1	Width 1m, Length 40 m		L
ZH10C02	Conveyor	1	Width 1m, Length 9 m		L
ZH10C03	Turnable Conveyor	1	Width 1m, Length 1 m		L
ZH10C04	Conveyor	1	Width 1m, Length 7,5 m		L
ZH10C05	Turn- and moveable Conveyor	1	Width 1,4 m, Length 5 m		L
ZH10C06	Conveyor	1	Width 1 m, Length 19 m		L
ZH10C07	Turnable Conveyor	1	Width 1m, Length 1 m		L
ZH10C08	Conveyor	1	Width 1m, Length 7,5 m		L
ZH10C09	Turn- and moveable Conveyor	1	Width 1,4 m, Length 5 m		L
ZH10C10	Conveyor	1	Width 1 m, Length 19 m		L
ZH10C20	Feeding Conveyor	1	Width 1m, Length 40 m		L
ZH10C21	Conveyor	1	Width 1m, Length 9 m		L
ZH10C22	Turnable Conveyor	1	Width 1m, Length 1 m		L
ZH10C23	Conveyor	1	Width 1m, Length 7,5 m		L
ZH10C24	Turn- and moveable Conveyor	1	Width 1,4 m, Length 5 m		L
ZH10M01	Deropping Machine	1	Width 1m		I
ZH10M02	Deropping Machine	1	Width 1m		I

D.D.E. = Defined during Detail Engineering

QUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.1.2 DIGESTER SYSTEM					
ZF13M01-12	Spherical Digester	12	Dia 16 ft; Volume 60 m³	CS/SS	L
ZF13M15	Fibre filter	1	Drum Dia. 1,0 m	SS	L
ZF13M20	Blow Tank Cyclone	1	Dia 2,5 x 4,0 m	CS	L
ZF13M21	Blow Tank Cyclone	1	Dia 2,5 x 4,0 m	CS	L
ZF13E01	Blow Steam Condenser	1	180 t/h vapours	CS	L
ZF13E02	Heat exchanger	1	120 t/h Water Spiral Type	CS/SS	L
ZF13P01	Hot Water Pump	1	120 m³/h, 30 m WC, 1.500 rpm, 18,5 kW	CS	L
ZF13P02	Condensate Pump	1	500 m³/h, 20 m WC, 1.500 rpm, 45 kW	CS	L
ZF13P03	Condensate Pump	1	150 m³/h, 20 m WC, 1.500 rpm, 15 kW	CS	L
ZF13P04	Cooking Liquor Pump	1	60 m³/h, 50 m WC, 1.500 rpm, 15 kW	CS/SS	L
ZF13P05	Fibre Pump	1	5 m³/h, 20 m WC, 1.500 rpm, 5,5 kW	CS	L
ZF13T01	Cooking Liquor Tank	1	30 m³ / Dia. 3,0 m	SS	L
ZF13T02	Blow Tank	1	180 m³ / Dia. 4,5 m	SS	L
ZF13T03	Blow Tank	1	180 m³ / Dia. 4,5 m	SS	L
ZF13T04	Condensate Tank	1	500 m³ / Dia. 7 m	SS	L
ZF13T05	Hot Water Tank	1	50 m³ / Dia. 4,0 m	SS	L
ZF13T06	Fibre Recovery Tank	1	2 m³ / Dia. 1,0 m	SS	L

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.1.3.1 SCREENING PLANT					
ZF25M01	Primary Centrifugal Screen	1	Capacity: 170 BDMTD, Inlet consistency 2.0 %	SS	I
ZF25M02	Secondary Centrifugal Screen	1	Capacity: 30 BDMTD	SS	I
ZF25M03	Vibrating Screen	2	Capacity: 6 BDMTD (total); 1,5 m^2/each	SS	L
ZF25M04	Thickener	1	15 m^2 / Dia. 1,2 m, 40 mesh SS	SS	L
ZF25M05	Vacuum Drum Filter	1	40 m^2 / Dia. 3 m, 40 mesh SS	SS	L
ZF25M06	Cleaner Stage 1	1	Inlet Capacity 180 BDMTD	SS	I
ZF25M07	Cleaner Stage 2	1	Inlet Capacity 50 BDMTD	SS	I
ZF25M08	Cleaner Stage 3	1	Inlet Capacity 12 BDMTD	SS	I
ZF25M09	Sand Cleaner	1	Inlet Capacity 20 m^3/h	SS	I
ZF25A01	Pulp Chest Agitator	1	Dia 0,7 m	SS	L
ZF25C02	Screw Conveyor	1	Dia 0,8 m	SS	L
ZF25F01	Hood Extraction Fan	1	35 Nm^3/min.	CS	L
ZF25P01	Primary Screen Feed Pump	1	400 m^3/h, 25 m WC 1.500 rpm, 45 kW	SS	L
ZF25P02	Cleaner Feed Pump	1	1.200 m^3/h, 20 m W, 1.500 rpm, 110 kW	SS	L
ZF25P03	Filtrate Pump	1	160 m^3/h, 20 m WC, 1.500 rpm, 15 kW	SS	L
ZF25P04	Filtrate Pump	1	75 m^3/h, 30 m WC 1.500 rpm, 11 kW	SS	L
ZF25P05	Secondary Screen Feed Pump	1	180 m^3/h, 25 m WC 1.500 rpm, 22 kW	SS	L
ZF25P06	Sand Cleaner	1	60 m^3/h, 30 m WC, 1.500 rpm, 11 kW	SS	L
ZF25P07	Decker Wire Wash Pump	1	40 m^3/h, 60 m WC, 1.500 rpm, 11 kW	SS	L
ZF25P08	Cleaner feed pump	1	400 m^3/h, 20 m WC, 1.500 rpm, 45 kW	SS	L
ZF25P09	Cleaner feed pump	1	120 m^3/h, 20 m WC, 1.500 rpm, 11 kW	SS	L
ZF25T01	Screen Accept Tank	1	40 m^3 / 3 m x 3,5 m x 4 m	Concrete	Civil Works
ZF25T02	Filtrate Tank	1	350 m^3 / Dia. 8,0 m	SS	L

D.D.E. = Defined during Detail Engineering

QUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.1.3.2 BROWN STOCK WASHING					
ZF31M01	Vacuum Drum Filter	1	40 m², Dia. 3 m, Mesh 40 SS	SS	L
ZF31M02	Vacuum Drum Filter	1	40 m² Dia. 3 m, Mesh 40 SS	SS	L
ZF31M03	Black Liquor Filter	1	Drum Type Capacity 50 m³/h, Mesh 60 SS Dia. 1 x 1 m	CS/SS	I
ZF31M04 A.B	Tramp Material Separator	2	Dia 1,0 m , Height 1,2 m	SS	L
ZF31A01 A,B	Blow Tank Agitator	2	Dia 0,7 m	SS	L
ZF31A02	HD-Tower - Agitator	1	Dia 0,7 m	SS	L
ZF31C01	Screw conveyor	1	Dia. 0,8 m	SS	L
ZF31F01	Hood Extraction Fan	1	35 Nm³/min.	CS	L
ZF31F02	Hood Extraction Fan	1	35 Nm³/min.	CS	L
ZF31G01	Sand Separating Cyclone	1	Dia. 0,5 m	SS	L
ZF31G03	Foam Breaker	1	Dia. 1,3 m	CS	L
ZF31P01A,B	Brown Stock Pump	2	370 m³/h, 25 m WC 1.500 rpm, 45 kW	SS	L
ZF31P02	Black Liquor Pump	1	20 m³/h, 25 m WC, 1.500 rpm, 3 kW	SS	L
ZF31P03	First Washer Headbox Dilution Pump	1	370 m³/h, 20 m WC, 1.500 rpm, 45 kW	SS	L
ZF31P04	Dilution Pump	1	310 m³/h; 20 m WC, 1.500 rpm, 30 kW	SS	L
ZF31P05	Black Liquor Filter Feed Pump	1	60 m³/h, 25 m WC, 1.500 rpm, 7,5 kW	SS	L
ZF31P06	Wire Cleaning Pump	1	40 m³/h, 60 m WC, 1.500 rpm, 11 kW	SS	L
ZF31P07	Second Washer Headbox Dilution Pump	1	680 m³/h, 20 m WC, 1.500 rpm, 75 kW	SS	L
ZF31P08	First Washer Shower Feed Pump	1	85 m³/h, 30 m WC, 1.500 rpm, 11 kW	SS	L
ZF31P09	Wire Cleaning Pump	1	40 m³/h, 60 m WC, 1.500 rpm, 7,5 kW	SS	L
ZF31T01	First Washer Filtrate Tank	1	350 m³ / Dia. 8,0 m	SS	L
ZF31T02	Second Washer Filtrate Tank	1	230 m³ / Dia. 6,5 m	SS	L
ZF31T03	HD-Tower	1	500 m³ / Dia. 5,0 m/8,0 m	Concrete	Civil Works

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.1.4.1 OXYGEN DELIGNIFICATION					
ZF41M01	Oxygen Mixer	1	Type High Shear Mixer	SS	I
ZF41M02	Vacuum Drum Filter	1	40 m² / Dia. 3,0 m, 40 mesh SS	SS	L
ZF41M03	Vacuum Drum Filter	1	40 m² / Dia. 3,0 m, 40 mesh SS	SS	L
ZF41M04	HD Tower Discharge Unit	1	Scraper Type Dia. approx. 4,0 m	SS	I
ZF41A01	Agitator	1	Dia. 0,5 m	SS	L
ZF41F01	Hood Extraction Fan	1	35 Nm³/min.	CS	L
ZF41F02	Hood Extraction Fan	1	35 Nm³/min.	CS	L
ZF41P01	Medium Consistency Pump	1	60 m³/h, 100 m WC, 1.500 rpm, 30 kW	SS	I
ZF41P02	Stock Pump	1	230 m³/h, 25 m WC 1.500 rpm, 30 kW	SS	L
ZF41P03	Filtrate Pump	1	20 m³/h, 25 m WC, 1.500 rpm, 3 kW	SS	L
ZF41P04	Filtrate Pump	1	150 m³/h, 25 m WC, 1.500 rpm, 18,5 kW	SS	L
ZF41P05	Washer Shower Feed Pump	1	80 m³/h, 30 m WC, 1.500 rpm, 11 kW	SS	L
ZF41P06	Wire Cleaning Pump	1	40 m³/h, 60 m WC, 1.500 rpm, 11 kW	SS	L
ZF41P07	Filtrate Pump	1	650 m³/h, 20 m WC, 1.500 rpm, 75 kW	SS	L
ZF41P08	Washer Shower Feed Pump	1	80 m³/h, 30 m WC, 1.500 rpm, 11 kW	SS	L
ZF41P09	Wire Cleaning Pump	1	40 m³/h, 60 m WC, 1.500 rpm, 11 kW	SS	L
ZF41V01	Oxygen Reactor	1	60 m³ / Dia. 2,4 m	SS	L
ZF41T01	HD Tower with Stand Pipe	1	500 m³ / Dia. 7 m	SS	L
ZF41T02	O_2-Blow Tank	1	40 m³ / Dia. 3 m	SS	L
ZF41T03	Filtrate Tank	1	150 m³ / Dia. 5,5 m	SS	L
ZF41T04	Filtrate Tank	1	150 m³ / Dia. 5,5 m	SS	L

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = Imported
4.1.4.2 BLEACHING PLANT					
ZF43.M01	A-Washer	1	40 m² / Dia. 3 m, Mesh 40 SS	SS	L
ZF43.M02	E0P-Washer	1	40 m² / Dia. 3 m, Mesh 40 SS	SS	L
ZF43.M03	P-Washer	1	40 m² / Dia. 3 m, Mesh 40 SS	SS	L
ZF43.M04	Steam Mixer	1	Dia. 0,4 m	SS	L
ZF43.M05	Oxygen Mixer	1	Tube type, Dia. 0,2 m	SS	I
ZF43.M06	Steam Mixer	1	Dia. 0,4 m	SS	L
ZF43.M07	Static Steam Mixer	1	Dia. 0,2 m	SS	I
ZF43.M08	Static Peroxide Mixer	1	Dia. 0,2 m	SS	L
ZF43.A01	Agitator	1	Dia. 0,7 m	SS	L
ZF43.A02	Agitator	1	Dia. 0,7 m	SS	L
ZF43.A03	Agitator	1	Dia. 0,7 m	SS	L
ZF43.A04	Agitator	1	Dia. 0,7 m	SS	L
ZF43.C01	Screw Conveyor	1	Dia. 0,8 m	SS	L
ZF43.C02	Screw Conveyor	1	Dia. 0,8 m	SS	L
ZF43.F01	Hood Extraction Fan	1	35 Nm³/min.	SS	L
ZF43.F02	Hood Extraction Fan	1	35 Nm³/min.	SS	L
ZF43.F03	Hood Extraction Fan	1	35 Nm³/min.	SS	L
ZF43.P01	Stock pump	1	230 m³/h, 25 m WC, 1.500 rpm, 30 kW	SS	L
ZF43.P02	Wire Cleaning Pump	1	40 m³/h, 60 m WC, 1.500 rpm, 11 kW	SS	L
ZF43.P03	Filtrate pump	1	650 m³/h, 20 m WC, 1.500 rpm, 75 kW	SS	L
ZF43.P04	Medium Consistency Pump	1	60 m³/h, 100 m WC, 1.500 rpm, 30 kW	SS	I
ZF43.P05	Stock pump	1	230 m³/h, 25 m WC, 1.500 rpm, 30 kW	SS	L
ZF43.P06	Wire Cleaning Pump	1	40 m³/h, 60 m WC, 1.500 rpm, 11 kW	SS	L

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
ZF43.P07	Filtrate pump	1	650 m³/h, 20 m WC, 1.500 rpm, 75 kW	SS	L
ZF43.P08	Washer Shower Feed Pump	1	80 m³/h, 30 m WC, 1.500 rpm, 11 kW	SS	L
ZF43.P09	Stock pump	1	230 m³/h, 25 m WC, 1.500 rpm, 30 kW	SS	L
ZF43.P10	Wire Cleaning Pump	1	40 m³/h, 60 m WC, 1.500 rpm, 11 kW	SS	L
ZF43.P11	Washer Shower Feed Pump	1	80 m³/h, 30 m WC, 1.500 rpm, 11 kW	SS	L
ZF43.P12	Filtrate pump	1	650 m³/h, 20 m WC, 1.500 rpm, 75 kW	SS	L
ZF43.P13	MC-Pump	1	80 m³/h, 60 m WC, 1.500 rpm, 22 kW	SS	I
ZF43.T01	A-Tower	1	40 m³ / Dia. 2,4 m	SS	L
ZF43.T02	EOP-Pre-tower		14 m³ / Dia. 1,0 m	SS	L
ZF43.T03	EOP-Tower	1	140 m³ / Dia. 3,2 m	SS	L
ZF43.T04	P-Tower	1	200 m³ / Dia. 4,0 m	SS	L
ZF43.T05	Filtrate tank	1	40 m³ / Dia. 3,5 m	SS	L
ZF43.T06	Stand Pipe	1	Dia 0,8 m x 4,0 m Height	SS	L
ZF43.T07	Filtrate tank	1	60 m³ / Dia. 4,0 m	SS	L
ZF43.T08	Filtrate tank	1	60 m³ /Dia. 4,0 m	SS	L
ZF43.T09	Stand Pipe	1	Dia 0,8 m x 4,0 m Height	SS	L
ZF43.T10	HD-Storage tower	1	500 m³ / Dia. 5,0 / 8,0 m	Concrete	Civil Works
ZF43.T11	HD-Storage tower	1	500 m³ / Dia. 5,0 / 8,0 m	Concrete	Civil Works

D.D.E. = Defined during Detail Engineering

QUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.1.5.1 WET LAP MACHINE					
ZF60.M01	Double wire press	1	Working Width 2.400 mm Total length 18,0 m Height 2.800 mm		I
ZF60.M02	Heavy duty press	1	Working Width 2.400 mm part of M01		I
ZF60.A01	HD-Tower agitator	1	Dia. 0,7 m	SS	L
ZF60.A02	HD-Tower Agitator	1	Dia. 0,7 m	SS	L
ZF60.T01	Machine chest	1	40 m³ / 3 m x 3,5 m x 4 m	Concr. lined	Civil Works
ZF60.T02	White water tank	1	60 m³ / 4 m x 4 m x 4 m	Concr. lined	Civil Works
ZF60.T03	Broke chest	1	40 m³ / 2,8 m x 3,5 m x 4 m	Concr. lined	Civil Works
ZF60.T04	Broke chest	1	40 m³ / 2,8 m x 3,5 m x 4 m	Concr. lined	Civil Works
ZF60.A03	Machine chest agitator	1	Dia. 0,7 m	SS	L
ZF60.A04	Broke pulper	1	Dia. 1,2 m	SS	I
ZF60.A05	Broke pulper	1	Dia. 1,2 m	SS	I
ZF60.P01	Pump	1	180 m³/h, 20 m WC, 18,5 kW	SS	L
ZF60.P02	Pump	1	180 m³/h, 20 m WC, 18,5 kW	SS	L
ZF60.P03	Pump	1	220 m³/h, 20 m WC, 22 kW	SS	L
ZF60.P04	Pump	1	52 m³/h, 120 m WC, 5,5 kW	SS	L
ZF60.P05	Pump	1	10 m³/h, 40 m WC, 3 kW	SS	L
ZF60.P06	Pump	1	10 m³/h, 40 m WC, 3 kW	SS	L
ZF60.P07	Pump	1	200 m³/h, 25 m WC, 28 kW	SS	L
ZF60.P08	Pump	1	150 m³/h, 15 m WC, 15 kW	SS	L
ZF60.P09	Pump	2	150 m³/h, 15 m WC, 15 kW	SS	L

D.D.E. = Defined during Detail Engineering

QUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.1.5.2 DRYING					
ZF71.M01	Drying unit, consisting of:	1	Working Width 2.400 mm Total Length: 30 m Total Height 4,8 m		I
	Framework, fan towers		Part of Dryer		I
	Blow boxes		Part of Dryer		I
	Lifting arrangement for blow boxes		Part of Dryer		I
	Circulation fans for dryer		Part of Dryer		I
	Coils and screens		Part of Dryer		I
	Fire extinghuishing		Part of Dryer		I
	Turning roll towers		Part of Dryer		I
	Turning rolls with tape pulleys		Part of Dryer		I
	Coller Section		Part of Dryer		I
	Framework, fan towers		Part of Dryer		I
	Blow boxes		Part of Dryer		I
	Turning rolls		Part of Dryer		I
	Cooling fans		Part of Dryer		I
	External Air System		D.D.E.		I
	Heat recovery unit for preheating of the supply air to the dryer		D.D.E.		I
	Water heater		D.D.E.		I
	Heat exchanger		D.D.E.		I
	Tail cutter		Part od Dryer		I

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = Imported
4.1.5.3 BALING					
ZF82.M01	Pulp cutter	1	Working Width 2.400 mm Length 5,0 m Height 4,0 m		I
	Pulp layboy	1	Part of Cutter		I
ZF82.M10	Baling line, consisting of:				I
	Chain conveyor	1	5.000 mm		I
	Swing-chain conveyor	1	5.000 mm		I
	Chain conveyor	2	5.000 mm		I
	Scale-chain conveyor	1	1.500 mm		I
	Scale	1	300 kg		I
	Bale press	1	2.000 mm		I
	Chain conveyor	1	1.500 mm		I
	Chain conveyor	1	1.500 mm		I
	Stacker-chain conveyor	1	1.500 mm		I
	Chain conveyor	1	5.000 mm		I
	Chain conveyor	1	5.000 mm		I
	Chain conveyor	1	5.000 mm		I

D.D.E. = Defined during Detail Engineering

QUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.2.1 EVAPORATION PLANT					
M01	Evaporator I	1	850 m², Lamella	CS / SS	L
M02	Evaporator II	1	850 m², Lamella	SS	L
M03	Evaporator III	1	450 m², Lamella	SS	L
M04	Evaporator IV	1	400 m², Lamella	SS	L
M05	Evaporator V	1	400 m², Lamella	SS	L
M06	Surface condenser	1	350 m², Lamella	SS	L
M07	Steam jet ejector	1	venturi type, Dia. 100 mm	SS	L
M08	Condenser system	1	Total 20 m², tubular	SS	L
M09	Start up ejector	1	venturi type, Dia. 80 mm	SS	L
V01/V02	BL flash tank	1	Dia. 0,7 m	SS	L
V03/V04	Level tank prim. condensate	2	Dia. 0,5 m	CS	L
V05	Collecting tank prim. condensate	1	Dia. 0,7 m	CS	L
V06/V07	Level tank condensate	2	Dia. 0,5 m	SS	L
V08	Flash tank sec. condensate	1	Dia. 0,7 m	SS	L
V09	Flash tank sec. condensate	1	Dia. 0,8 m	SS	L
V10	Level tank sec. condensate	1	Dia. 1,0 m	SS	L
A 01	Agitator	1	Dia. 0,5 m	SS	L
P 01	WBL feeding pump	1	80 m³/h, 15 m WC, 1.500 rpm, 5,5 kW	SS	L
P02	HBL discharge pump	1	15 m³/h, 20 m WC, 1.500 rpm, 2,2 kW	SS	L
P 03	HBL discharge pump	1	15 m³/h, 20 m WC, 1.500 rpm, 2,2 kW	SS	L
P 04	Circulation I	1	800 m³/h, 15 m WC, 1.500 rpm, 55 kW	SS	L
P 06	Circulation II	1	800 m³/h, 15 m WC, 1.500 rpm, 55 kW	SS	L
P 08	Circulation III	1	250 m³/h, 15 m WC, 1.500 rpm, 18,5 kW	SS	L
P 09	Circulation IV	1	250 m³/h, 15 m WC, 1.500 rpm, 18,5 kW	SS	L
P10	Circulation V	1	220 m³/h, 15 m WC, 1.500 rpm, 15 kW	SS	L

D.D.E. = Defined during Detail Engineering

QUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
P11	Wash liquor pump	1	30 m³/h, 10 m WC, 1.500 rpm, 1,5 kW	SS	L
P12	Sec. condensate discharge	1	80 m³/h, 20 m WC, 1.500 rpm, 7,5 kW	SS	L
P13	Prim. condensate discharge	1	25 m³/h, 20 m WC, 1.500 rpm, 3 kW	SS	L
P14	Wash condensate discharge	1	60 m³/h, 15 m WC, 1.500 rpm, 8,5 kW	SS	L
P15	Sec. cond. to consumer	1	80 m³/h, 20 m WC, 1.500 rpm, 7,5 kW	SS	L
P16	Strong black liquor pump	1	15 m³/h, 25 m WC, 1.500 rpm, 2,2 kW	SS	L
T01	Weak black liquor tank	1	900 m³ / Dia. 10,0 m	CS	L
T02	Weak black liquor tank	1	900 m³ / Dia. 10,0 m	CS	L
T03	Thick black liquor tank	1	250 m³ / Dia. 6,0 m	CS	L
T04	Condensate tank	1	50 m³ / Dia. 4,0 m	CS	L
T05	NaOH tank	1	8 m³ / Dia. 2,0 m	SS	L
T06	Acid tank	1	8 m³ / Dia. 2,0 m	SS	L
T07	Hot Well Tank	1	5 m³ / Dia. 1,8 m	SS	L

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.2.2 RECOVERY BOILER					
A02	Agitator	1	Dia. 0,3 m		L
C04	Hopper conveyor	2	Width 400 mm		L
C05	Gathering conveyor	1	Width 400 mm		L
C06	Ash conveyor		Width 400 mm		L
C07	Salt-cake conveyor	1	Width 300 mm		L
C10	Salt-cake feeder	1	Width 300 mm		L
E01	Boiler unit consisting of	1	D.D.E.		L
	Furnace	1			L
	Superheater	1			L
	Economizer	1			L
	Steam air heater	1			L
	Steam air heater	1			L
	Soot blower	1			L
	Steel structure	1			L
	Refractory and insulation	1			L
F03	Primary air forced draft fan	1	10.000 m³/h	CS	L
F04	Secondary air forced draft fan	1	7.000 m³/h	CS	L
F05	Tertiary air forced draft fan	1	7.000 m³/h	CS	L
F07	Induced draft fan	1	40.000 m³/h	CS	L
G02	Smelt spouts	2	D.D.E.		L
G08	Spray oscillators	2	D.D.E.		L
G11	Dust valve	2	D.D.E.		L
G12	Auxiliary boiler burner	4	D.D.E.		L
G13	Load carrying oil burner	2	D.D.E.		L
G17	Electrostatic precipitator	1	Flow 12 m³/s		L

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
G21	Steel stack	1	Drum Type Capacity 50 m³/h, Mesh 60 SS Dia. 1 x 1 m	CS	L
P01, P02	Condensate pumps	2	25 m³/h / 40 m WC, 5,5 kW	CS	L
P03, P04	Cooling water pumps	2	10 m³/h, 60 m WC, 1.500 rpm, 3 kW	CS	L
P05, P06	Black liquor fuel pumps	2	15 m³/h, 30 m WC, 1.500 rpm, 3 kW	SS	L
P10, P11	Green liquor transfer pumps	2	30 m³/h, 25 m WC, 1.500 rpm, 4 kW	SS	L
P14	Dump tank pump	1	D.D.E.	SS	L
P15, P16	Fuel oil pumps	2	1 t/h	CS	L
P17, P18, P19	Na_3PO_4 Solution injection pump Na_3 & N_2H_4 Solution injection pump	3	each 200 l/h	SS	L
P20, P21	Boiler feed water pumps	2	65 m³/h, 600 m WC, 3.000 rpm, 165 kW	CS	L
T01	Drain pot for steam air heater	1	D.D.E.		L
T02	Cooling water head tank for smelt spout	1	D.D.E.		L
T03	Cooling water reservoir tank for smelt spout	1	D.D.E.		L
T04	Mixing tank	1	5 m³ / Dia. 1,8 m	SS	L
T05	Dissolving tank including agitator	1	40 m³ / Dia. 4,0 m	SS	L
T06	Dump tank	1	15 m³ / Dia. 2,5 m	SS	L
T07	Salt-cake hopper	1	5 m³	SS	L
T10	Deaerator	1	30 m³ / Dia. 2,8 m	CS	L
T11	Flash Tank	1	1 m³	CS	L
T12	Blow off tank	1	1 m³	CS	L

D.D.E. = Defined during Detail Engineering

QUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.2.3 RECAUSTICIZING PLANT					
A 01	Agitator for mixing tank	1	Dia. 0,8 m	CS	L
A 02	Agitator for lime milk tank	1	Dia. 0,8 m	CS	L
C 01	Burnt lime conveyor	1	Width 300 mm		L
C 02	Burnt lime conveyor	1	Width 300 mm		L
C 03	Lime mud conveyor (screw)	1	Dia. 500 mm	CS	L
C 04	Lime mud conveyor (screw)	1	Dia. 500 mm	CS	L
C 07	Bucket elevator	1	Width 300 mm	CS	L
G 01	Green liquor heater	1	15 m³/h set type	SS	L
G 02	Scrubber	1	Dia. 0,7 m	SS	L
G 03	Dedusting system	1	D.D.E.		L
M 01	Green liquor clarifier	1	d = 14,0 m , h = 9,0 m	CS	L
M 02	Dregs filter	1	Capacity 0,5 BDMTD	CS	L
M 03	Lime slaker	1	d = 2,0, h = 1,9, l = 6 m	SS / CS	L
M 04	Causticizer mechnism	1	d = 2,8 m, h = 3,6 m	CS / SS	L
M 05	Causticizer mechnism	1	d = 2,8 m, h = 3,6 m	CS / SS	L
M 06	Causticizer mechnism	1	d = 2,8 m, h = 3,6 m	CS / SS	L
M 07	White liquor clarifier	1	d = 15,0 m, h = 8,0 m	CS	L
M 08	Lime mud washer mechanism	1	d = 14,0 m, h = 9,0 m	CS	L
M 09	Lime mud storage tank agitator	1	d = 5,5 m, h = 5,5 m	CS	L
M 10	Lime mud filter	1	Dia. 2,0 m, Width 3,0 m	CS	L
M 11	Lime milk slaker	1	Dia. 1,2 m	CS/SS	L
P 01, P02	Dregs pump	2	4 m³/h, 20 m WC, type Diaphragma	CS	L
P 03, P04	Green liquor pump	2	25 m³/h, 25 m WC, 1.500 rpm, 3 kW	SS	L
P 05, P06	Raw white liquor pump	2	25 m³/h, 20 m WC, 1.500 rpm, 3 kW	SS	L

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
P 07, P08	Lime mud pump	2	8 m³/h, 20 m WC, 1.500 rpm, 1,5 kW	SS	L
P 09, P10	White liquor pump	2	22 m³/h, 25 m WC, 1.500 rpm, 3 kW	SS	L
P 11, P12	Lime mud pump	2	8 m³/h, 20 m WC, 1.500 rpm, 1,5 kW	SS	L
P 13, P14	Weak white liquor pump	2	25 m³/h, 25 m WC, 1.500 rpm, 3 kW	SS	L
P 15, P16	Lime mud pump	2	10 m³/h, 20 m WC, 1.500 rpm, 1,5 kW	SS	L
P 17	Vacuum pump for LMF	1	2.000 m³/h, 1.500 rpm, 90 kW	CS	L
P 18	Filtrate pump	1	10 m³/h, 20 m WC, 1500 rpm, 1,1 kW	SS	L
P 19	Vacuum pump for DF	1	100 m³/h, 1.500 rpm, 7,5 kW	CS	L
P 20	Static Peroxide Mixer	1	4,0 m³/h, 20 m WC, 1.500 rpm, 0,5 kW	SS	L
P 21	Lime milk pump	1	5 m³/h, 20 m WC, 1.500 rpm, 0,5 kW	CS	L
T 01	Green liquor clarifier	1	d = 14,0 m /h = 9,0 m	CS	L
T 02	Splitter box	1	1 m³	SS	L
T 03	Causticizer tank	1	d = 2,8 m, h = 3,6 m	SS	L
T 04	Causticizer tank	1	d = 2,8 m, h = 3,6 m	SS	L
T 05	Causticizer tank	1	d = 2,8 m, h = 3,6 m	SS	L
T 06	Causticizer sump tank	1	d = 2,0 m, h = 2,0 m	SS	L
T 07	White liquor clarifier	1	d = 15,0 m, h = 8,0 m	CS	L
T 08	Lime mud collecting box	1	0,5 m³	CS	L
T 09	Lime mud mixing tank	1	d = 2,0 m, h = 2,0 m	CS	L
T 10	Lime mud washer	1	d = 14,0 m, h = 9,0 m	CS	L
T 11	Lime mud storage tank	1	d = 5,5 m, h = 5,5 m	CS	L
T 12	Lime milk storage tank	1	d = 2,0 m, h = 5,0 m	CS	L
T 13	Burnt lime bin	1	d = 3,5 m	CS	L
V 01	Filtrate receiver	1	d = 0,25 m, h = 0,6 m	CS	L
V 02	Filtrate receiver	1	d = 1,0 m, h = 1,0 m	CS	L

D.D.E. = Defined during Detail Engineering

'QUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.2.4 LIME KILN					
C01	Vibrating feeder	1	7 t/h, Width 600 mm	CS	L
C02	Bucket elevator	1	Width 300 mm	CS	L
C03	Lime stone conveyor	1	Width 500 mm	CS	L
C04	Kiln feed screw	1	d = 400 mm	CS	L
C05	Drag chain conveyor	1	Width = 400 mm	CS	L
C07	Dust conveyor (screw)	1	d = 300 mm	CS	L
C08	Rotary valve	1	Dia. 300 mm	CS	L
F01	ID fan	1	30.000 Nm³/h	CS	L
F02	Primary air fan	1	2.500 Nm³/h	CS	L
G01	Lime stone ground hopper	1	4 m³ Grain size max. 25 mm	CS	L
G02	Dedusting system	1	Capacity 9.000 Nm³/h	CS	L
G03	Impact crusher	1	5 t/h	CS	L
G04, G05	Fuel oil system	2	1,0 t/h	CS	L
M01	Rotary lime kiln	1	l = min. 50 m, Dia. = 2,8 m	CS	L
M02	Kiln drive	1	variable speed drive with DC-motor		L
M03	Auxiliary kiln drive	1	diesel engine, 45 kW		L
M 04	Venturi washer system	1	chimney height min. 30 m	SS	L
M05	Kiln burner	1	D.D.E.	CS	L
M06	Electrostatic precipitator	1	30.000 Nm³/h	CS	L
P01,02	Scrubber circulation pump	2	60 m³/h, 20 m WC, 1.500 rpm, 7,5 kW	SS	L
T01	Lime stone bin	1	150 m³	CS	L
T02	Oil day tank	1	40 m³	CS	L

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.3.1 OXYGEN GENERATING PLANT					
ZC93F01	Air compressor	1	1.800 m³/h		I
ZC93F02	Oxygen compressor	1	126 m³/h		I
ZC93M01	Inlet Filter	1	D.D.E.		I
ZC93M02	Air cooler	1	D.D.E.		I
ZC93M03	Water separator	1	D.D.E.		I
ZC93T01	Air buffer vessel	1	10 m³	CS	L
ZC93T02	Adsorber vessel	2	5 m³	CS	L
ZC93T03	Oxygen storage tank	1	10 m³	CS	L
-	Panel	1	D.D.E.		I
-	Oxygen Analyzer	1	D.D.E.		I
4.3.2 PEROXIDE STORAGE SYSTEM					
ZC94P01	Pump	1	1 m³/h, 20 m WC, 1.500 rpm, 0,25 kW	SS	L
ZC94T01	Storage tank	1	100 m³ / Dia. 4,5 m	SS	L
4.3.3 CAUSTIC STORAGE & DILUTION					
ZC92A01	Static Mixer	1	Dia. 0,1 m	SS	I
ZC92P01	Pump	1	0, 8 m³/h, 25 m WC, 1.500 rpm, 0,25 kW	SS	L
ZC92P02	Pump	1	1,5 m³/h, 25 m WC, 1.500 rpm, 0,25 kW	SS	L
ZC92P03	Pump	1	2,5 m³/h, 25 m WC, 1.500 rpm, 0,5 kW	SS	L
ZC92T01	Storage Tank	1	100 m³ / Dia. 4,5 m	CS	L
ZC92T02	Storage Tank	1	30 m³ / Dia. 3,0 m	CS	L

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.3.4 DTPA/EDTA DOSING STATION					
ZC96A01	Agitator	1	D.D.E.	SS	L
ZC96P01	Moyno Pump	1	20 l/h, 25 m WC, 1.500 rpm, 0,01 kW	SS	I
ZC96T01	Dosing Tank	1	5 m³ / Dia. 1,8 m	SS	L
4.3.5 $MgSO_4$ DOSING STATION					
ZC81A01	Agitator	1	D.D.E.	SS	L
ZC81P01	Pump	1	5 m³/h, 20 m WC, 1.500 rpm, 0,5 kW	SS	L
ZC81P02	Pump	1	250 l/h, 25 m WC, 1.500 rpm, 0,05 kW	SS	L
ZC81T01	Dissolving Tank	1	5 m³ / Dia. 1,8 m	CS	L
ZC81T02	Tank	1	10 m³ / Dia. 2,2 m	CS	L
4.3.6 Na_2S0_3 DOSING STATION					
ZC98A01	Agitator	1	D.D.E.	SS	L
ZC98P01	Pump	1	5 m³/h, 20 m WC, 1.500 rpm, 0,5 kW	SS	L
ZC98P02	Pump	1	400 l/h, 25 m WC, 1.500 rpm, 0,1 kW	SS	L
ZC98T01	Dissolving Tank	1	5 m³ / Dia. 1,8 m	SS	L
ZC98T02	Tank	1	10 m³ / Dia. 2,2 m	SS	L
4.3.7 H_2SO_4 - SYSTEM					
ZC97P01	Pump	1	50 l/h, 25 m WC, 1.500 rpm, 0,01 kW	CS	L
ZC97P02	Pump	1	650 l/h, 30 m WC, 1.500 rpm, 0,15 kW	CS	L
ZC97T01	Tank	1	10 m³ / Dia. 2,2 m	CS	L
ZC97A01	Static mixer	1	Dia. 0,1 m	CS	L

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.3.8 ANTHRAQUINONE DOSING STATION					
ZC95A01	Agitator	1	D.D.E.	SS	L
ZC9P01	Moyno Pump	1	5 l/h, 25 m WC, 1.500 rpm, 0,01 kW	SS	L
ZC95T01	Dosing Tank	1	5 m^3 / Dia. 1,8 m	SS	L

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.4.1 POWER BOILER					
	Fuel feeding & handling equipment	1 set	D.D.E.		L
	Solid fuel feeding equipment	1 set	5 t/h capacity		L
	Fuel silos inside the boiler	1	100 m³		L
	Dust control system for fuel S.	1 set	D.D.E.		L
	Fuel handl. equip. at fuel Y.	1 set	D.D.E.		L
	Fluidizing grid	1	42 m²		L
	Evaporative surfaces	1	50 m²		L
	Furnace water walls	1	290 m²		L
	Steam drum	1	Dia. 1.200 mm		L
	Water drum	1	Dia. 800 mm		L
	Superheaters	1	720 m²		L
	Deaerator	1	10,0 m³		L
	Economizer	1	530 m²		L
	Flue gas filters	1 set	D.D.E.		L
	Electrostatic precipitator(s)	1 set	1.100 m³/h		L
	Steel stack	1	Dia. 1.500 mm, height 45 m		L
	Desuperheaters	1 set	D.D.E.		L
	Ash handling equipment	1 set	D.D.E.		L
	Fly ash storage silo	1	100 m³		L
	Additive handling and feeding equipment	1 set	D.D.E.		L
	Sand handling + feeding equipment	1 set	D.D.E.		L
	Limestone handling + feeding equipment	1	40 m³ Storage		L
	Fuel oil heating and pumping	1 set	D.D.E.		L
	Blowdown tank	1	1,5 m³		L
	Continuous blowdown tank	1	1 m³		L
	Feedw. pumps	2	50 t/h		L

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = Imported
	Primary air fan	1	500 m³/min.		L
	I.D. fan	1	1.100 m³/min.		L
	Silencers for air and flue gas	1 set	1.100 m³/min.		L
	Tubular air preheater	1	1.500 m²		L
	Boiler structure	1 set	D.D.E.		L
	Boiler house	1 set	D.D.E.		L
	Hot cyclones and hot gas ducts	1 set	D.D.E.		L
	Ash hoppers	1 set	D.D.E.		L
	Ash hoppers	1 set	D.D.E.		L
	Refractory material	1 set	D.D.E.		L
	Oil burners	1set	D.D.E.		L
	Sootblowers	1 set	D.D.E.		L
	Burner control equipment	1 set	D.D.E.		L

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.4.2 STEAM TURBINE AND ALTERNATOR					
	Back pressure turbine	1	3,8 MW		L
	Emergency stop valve	1	D.D.E.		L
	Steam strainer	set	D.D.E.		L
	Control valves	set	D.D.E.		L
	Gear box	1	D.D.E.		L
	Generator	1	4 MW		L
	Exitation system	1	D.D.E.		L
	Electric protection system	1	D.D.E.		L
	Control and synchronization c.	1	D.D.E.		L
	Generator cubicle	1	D.D.E.		L
	Lubrication and gov. oil syst.	1	D.D.E.		L
	Main oil tank	1	1.200 l		L
	Main oil pump (direct driven)	1	D.D.E.		L
	Auxiliary oil pump	1	D.D.E.		L
	Emergency oil pump	1	D.D.E.		L
	Oil cooler	1	D.D.E.		L
	Oil filter	1	D.D.E.		L
	Desuperheating station MP-Pro.	1	D.D.E.		L
	Desuperheating station LP-Pro.	2	D.D.E.		L
	Condensate pumps	2	2 m³/h / 3 bar g.		L
	Medium pressure reducing stat.	1	25 t/h		L
	Desuperheating stat. for MP-Pr	1	D.D.E.		L
	Low pressure reducing station	1	25 t/h		L
	Desuperheating station f. LP-P	1	D.D.E.		L
	Flush tank for start up	1	0,8 m³		L
	Condensate collecting tank	1	0,5 m³		L
	Local panel and instruments		D.D.E.		L

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.4.3 FEEDWATER TREATMENT					
	Rubble filter 1	1	Dia. 1.400 mm x 2.500 mm	CS	L
	Rubble filter 2	1	Dia. 1.400 mm x 2.500 mm	CS	L
	Cation exchanger 1	1	Dia. 1.200 mm x 2.800 mm	CS	L
	Cation exchanger 2	1	Dia. 1.200 mm x 2.800 mm	CS	L
	Anion exchanger 1	1	Dia. 1.200 mm x 2.500 mm	CS	L
	Anion exchanger 2	1	Dia. 1.200 mm x 2.500 mm	CS	L
	CO2-Degasifier	1	Dia. 1.200 mm x 4.500 mm	PP	L
	Mixed bed filter 1	1	Dia. 1.500 mm x 2.500 mm	CS	L
	Mixed bed filter 2	1	Dia. 1.500 mm x 2.500 mm	CS	L
	NaOH-Storage tank	1	Dia. 1.200 mm x 2.000 mm	GFK	L
	HC1-Storage tank	1	Dia. 1.200 mm x 2.000 mm	GFK	L
	Resin flushing tank	1	Dia. 1.200 mm x 3.000 mm	PP	L
	Hyradzine storage tank	1	200 l		L
	Sodium-phosphate storage tank	1	200 l		L
	Neutralisation pit	1	50 m^3	Concrete	Civil works
	Deionate tank	1	80 m^3 / Dia. 4,5 m	SS	L
	NaOH Measuring vessel	1	D.D.E.	PE	L
	HC1 Measuring vessel	1	D.D.E.	PE	L
	Degasifier pump 1	1	40 m^3/h, 4 bar, 7,5 kW	SS	L
	Degasifier pump 2	1	40 m^3/h, 4 bar, 7,5 kW	SS	L
	NaOH-Dosing pump 1	1	D.D.E.	SS	L
	NaOH-Dosing pump 2	1	D.D.E.	SS	L
	HCL-Dosing pump 1	1	D.D.E.	SS	L
	HCL-Dosing pump 2	1	D.D.E.	SS	L
	Regenerating pump 1	1	6 m^3/h, 3 bar, 1,5 kW	SS	L
	Regenerating pump 2	1	6 m^3/h, 3 bar, 1,5 kW	SS	L

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
	Waste water pump 1	1	50 m³/h, 2 bar, 5,5 kW	SS	L
	Waste water pump 2	1	50 m³/h, 2 bar, 5,5 kW	SS	L
	Dearator feed pump-A	1	50 m³/h, 5 bar, 11 kW	SS	L
	Dearator feed pump-B	1	50 m³/h, 5 bar, 11 kW	SS	L
	Drain pump	1	10 m³/h, 2 bar, 1,5 kW	SS	L
	Blower 1	1	150 m³/h, 0,5 bar, 0,75 kW	Mild steel	L
	Blower 2	1	150 m³/h, 0,5 bar, 0,75 kW	Mild steel	L
	Blower - CO_2 Degasifier	1	D.D.E.	Mild steel	L
	Resin for ionexchanger	1	D.D.E.		L
	Hydro-Antracite filter	1	D.D.E.	Mild steel	L
	Condens. cation exchanger	1	D.D.E.	Mild steel	L
	Raw condensate tank	1	20 m³ / Dia. 2,8 m	Mild steel	L
	Mixer 1 NA_3PO_4 dosing	1	D.D.E.	SS	L
	Raw condensate pump 1	1	40 m³/h, 6 bar	SS	L
	Raw condensate pump 2	1	40 m³/h, 6 bar	SS	L
	N_2H_4 Dosing pump	1	D.D.E.	SS	L
	NH_3 Dosing pump	1	D.D.E.	SS	L
	Transfer pump	1	D.D.E.	SS	L
	NaOH Dosing pump	1	D.D.E.	SS	L
	Na_3PO_4 Dosing pump	1	D.D.E.	SS	L
	Plate heat exchanger	1	D.D.E.	SS	L

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.5.1 RAW WATER TREATMENT					
M01	Clarifier	1	Dia. 28.000 mm	Concrete	Civil Works
M02	Scraper bridge	1	sized for M01	CS	L
M03	Sand filter equipment	1	surface area = 60 m²	PVC / PP	L
A01	Agitator lime milk	1	D.D.E.	SS/CS	L
A02	Agitator mixing	1	D.D.E.	SS/CS	L
A03	Agitator mixing	1	D.D.E.	SS/CS	L
A04	Agitator mixing	1	D.D.E.	SS/CS	L
F01	Air blower	1	Q= 600 Nm³/h	SS/CS	L
P01A,B	Raw Water Pump	2	660 m³/h, 15 m WC, 1.500 rpm, 45 kW	SS/CS	L
P02	Lime milk pump	1	Q = 0,2, 1,5 m³/h, 15 m WC 1.500 rpm, 0,15 kW	CI/SS	L
P03	Centrifugal pump	1	Q= 20 m³/h, 20 m WC, 1.500 rpm, 2 kW	CI/SS	L
P04	Centrifugal pump	1	Q= 300 m³/h, 30 m WC, 1.500 rpm, 45 kW	CI/SS	L
P05	Centrifugal pump	1	Q= 300 m³/h, 30 m WC, 1.500 rpm, 45 kW	CI/SS	L
P06	Centrifugal pump	1	Q= 300 m³/h, 30 m WC, 1.500 rpm, 45 kW	CI/SS	L
P07	Centrifugal pump	1	Q= 250 m³/h, 30 m WC, 1.500 rpm, 37 kW	PVC, CI	L
P08	Submersible pump	1	Q= 40 m³/h, 15 m WC, 1.500 rpm, 3 kW	PVC, CI	L
P09	Polyelectrolyte pump	1	Q= 0,2-1,5 m³/h, 15 m WC 1.500 rpm, 0,15 kW	CI/SS	L
T01	Treated water tank	1	1.500 m³	Concrete	Civil Works
T02	Dosing tank for lime milk	1	10 m³ / Dia. 2,2 m	C-steel	L
T03	Mixing basin	1	16,7 m³	Concrete	Civil Works
T04	Mixing basin	1	2 x 16,7 m³	Concrete	Civil Works
T05	Dosing tank for polyelectrolyte	1	10 m³ / Dia. 2,2 m	C-steel	L
	Piping	set	C-steel, st. Steel incl. Valves		L

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.5.2 COOLING TOWER					
M01	Cooling tower	1	29,5 m x 10,7 m x 6,2 m	Wood impregn.	L
M02	Pressure filter	1	D.D.E.	CS, protected	L
A01	Agitator	1	Dia. 400 mm	SS	L
G01	Air blower	1	Q = 250 m³/h	C.I.	L
P 01	Centr. pump	1	Q = 1500 m³/h, 40 m WC, 1.500 rpm, 250 kW	C.I./SS	L
P02	Centr. pump	1	Q = 1500 m³/h, 40 m WC, 1.500 rpm, 250 kW	C.I./SS	L
P03	Centr. pump	1	Q = 150 m³/h, 40 m WC, 1.500 rpm, 30 kW	C.I./SS	L
P04	Dosing pump H2SO4	1	Q = 20 - 200 l, 15 m WC, 1.500 rpm, 0,05 kW	PP/Viton	L
P05	Dosing pump hypo	1	Q = 5 - 50 l/h, 15 m WC, 1.500 rpm, 0,05 kW	PVC/Viton	L
P06	Dosing pump	1	Q = 10 - 50 l/h, 15 m WC, 1.500 rpm, 0,05 kW	PVC/Viton	L
P07	Dosing pump inhibitor	1	Q = 10 - 100 l/h, 15 m WC, 1.500 rpm, 0,05 kW	PVC/Viton	L
T01	Tank-H2SO4	1	1 m³	CS	L
T02	Tank-Hypo	1	5 m³ / Dia. 1,8 m	PP	L
T03	Tank-Inhibitor	1	1 m³	PP	L
T04	Tank-Dispergator	1	1 m³	PP	L
T05	Cooling water basin	1	30 m x 11 m x 2,5 m	Concrete	Civil Works

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.5.3 EFFLUENT TREATMENT PLANT					
70.01.01	Coarse trash rack	1	500 m³/h, 800 mm x 1.200 mm x 50 mm	SS/CS	L
70.01.02	Mechanical bar screen	1	500 m³/h, 800 mm x 2.800 mm x 250 mm	SS/CS	L
70.01.03	Chimney	1	Dia. 350 mm x 8.500 mm	SS	L
70.01.04	Scraper bridge	1	12,5 m x 1,20 m x 1,0 m (+ scraper)	CS/SS	L
70.01.05	Sets overflow weirs	1	standard V - notches	SS	L
70.01.09	Suction scraper	1	17,0 m x 2.200 m x 1.500 m (+ suction pipes)	CS/SS	L
70.01.10	Tank installations	1	16,0 m x 1,2 m x 0,7 m	SS	L
70.01.12	Discharge Device	1	16,0 m x 0,2 m x 0,3 m	SS	L
70.01.14	Overflow trough	1	16,0 m x 0,40 m x 0,50 m	SS	L
70.01.15	Overflow trough	1	16,0 m x 0,40 m x 0,50 m	SS	L
70.01.18	Weir	2	16,0 m x 0,05 m x 0,25 m	SS	L
70.01.19	Weir	2	16,0 m x 0,05 m x 0,25 m	SS	L
70.01.20	Thickener equipment	1	Dia. 15 m	CS/tor/ epoxi	L
70.01.21	Set v-notch overflow weirs	1	D.D.E.		L
70.01.22	Belt filter press	1	belt width 2,2 m, 5.020 mm x 2.800 mm x 2.780 mm	CS/tor/ epoxi	L
70.02.01	Storage tank for H2SO4	1	10 m³ / Dia. 2,2 m	CS	L
70.02.02	Storage tank NaOH	1	40 m³ / Dia. 3,2 m	CS	L
70.02.03	Tank phosphate solution	1	5 m³ / Dia. 1,8 m	PP	L
70.02.04	Tank urea solution	1	3 m³	PP	L
70.02.05	Tank urea solution	1	3 m³	PP	L
70.02.06	Tank defoamer agent	1	1 m³	PVC/FRP	L
70.02.10	Neutralization basin	1	4 m x 8 m x 4 m	Concrete	Civil Works
70.02.11	Screw pump pit 1	1	D.D.E.	Concrete	Civil Works
70.02.12	Screw pump pit 2	1	D.D.E.	Concrete	Civil Works
70.02.13	Rake pit	1	D.D.E.	Concrete	Civil Works
70.02.14	Pre-clarification basin	1	12 m x 42 m x 3,6 m	Concrete	Civil Works

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = Imported
70.02.15	Mixing basin	1	3 m x 6 m x 4 m	Concrete	Civil Works
70.02.16	Aeraration basin	1	31 m x 31 m x 5,2 m	Concrete	Civil Works
70.02.17	Final clarific. basin 1	1	16 m x 54 m x 4,8 m	Concrete	Civil Works
70.02.18	Screw pump pit 1	1	D.D.E.	Concrete	Civil Works
70.02.19	Screw pump pit 2	1	D.D.E.	Concrete	Civil Works
70.02.20	Thickener basin	1	Dia. 15 m	Concrete	Civil Works
70.02.21	Retention Pond		31.000 m^3		Civil Works
70.03.01	Agitator- (Neutralization basin)	1	Dia. 0,7 m	SS/CS	L
70.03.02	Agitator- (Neutralization basin)	1	Dia. 0,7 m	SS	L
70.03.04	Agitator (mixing basin)	1	Dia. 0,7 m	SS	L
70.03.05	Agitator (mixing basin)	1	Dia. 0,7 m	SS	L
70.03.06	Agitator - phosphate tank	1	Dia. 0,5 m	SS	L
70.03.07	Agitator - urea solution tank	1	Dia. 0,4 m	SS	L
70.03.08	Agitator - urea solution tank	1	Dia. 0,4 m	SS	L
70.03.09	Surface aerator	1	Turbine Dia. approx. 1,8 m, approx. 15,5 kW	SS/CS	L
70.03.10	Surface aerator	1	Turbine Dia. approx. 1,8 m, approx. 15,5 kW	SS/CS	L
70.03.11	Surface aerator	1	Turbine Dia. approx. 1,8 m, approx. 15,5 kW	SS/CS	L
70.03.12	Surface aerator	1	Turbine Dia. approx. 1,8 m, approx. 15,5 kW	SS/CS	L
70.03.11	Surface aerator	1	Turbine Dia. approx. 1,8 m, approx. 15,5 kW	SS/CS	L

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = Imported
70.03.14	Surface aerator	1	Turbine Dia. approx. 1,8 m, approx. 15,5 kW	SS/CS	L
70.03.15	Surface aerator	1	Turbine Dia. approx. 1,8 m, approx. 15,5 kW	SS/CS	L
70.03.16	Surface aerator	1	Turbine Dia. approx. 1,8 m, approx. 15,5 kW	SS/CS	L
70.03.25	Agitator	1	Dia. 0,4 m	SS/CS	L
70.03.27	Tubular mixer	1	D.D.E.	CS/epoxi	L
70.04.01	Dosing pump NaOH	1	Q = 100 - 1.000 l/h, 15 m WC 1.500 rpm, 0,1 kW	CI/SS	L
70.04.02	Dosing pump NaOH	1	Q = 100 - 1.000 l/h, 15 m WC 1.500 rpm, 0,1 kW	CI/SS	L
70.04.03	Dosing pump - H2SO4	1	Q = 50 - 250 l/h, 15 m WC 1.500 rpm, 0,1 kW	CI/SS	L
70.04.04	Dosing pump - H2SO4	1	Q = 50 - 250 l/h, 15 m WC 1.500 rpm, 0,1 kW	CI/SS	L
70.04.05	Screw pump	1	Q = 320 m³/h	CS/epoxi	L
70.04.06	Screw pump	1	Q = 500 m³/h	painting	L
	Gear (part of the gear screw pumps)	2	incl. in screw pump		L
70.04.07	Lubrication pump	1	incl. in screw pump		L
70.04.08	Lubrication pump	1	incl. in screw pump		L
70.04.09	Centrifugal pump	1	Q = 20 m³/h, 20 m WC 1.500 rpm, 2 kW	CI/SS	L

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = Imported
70.04.10	Centrifugal pump	1	Q = 20 m³/h, 20 m WC 1.500 rpm, 2 kW	CI/SS	L
70.04.11	Dosing pumps phosphate solution	1	Q = 10 - 50 l/h, 15 m WC 1.500 rpm, 0,5 kW	PVC, CI	L
70.04.12	Dosing pumps phosphate solution	1	Q = 10 - 50 l/h, 15 m WC 1.500 rpm, 0,5 kW	PVC, CI	L
70.04.13	Dosing pumps urea solution	1	Q = 50 - 250 l/h, 15 m WC 1.500 rpm, 0,5 kW	PVC, C.O.	L
70.04.14	Dosing pumps urea solution	1	Q = 50 - 250 l/h, 20 m WC 1.500 rpm, 0,5 kW	PVC, C.O.	L
70.04.15	Submersible pump	1	Q = 30 m³/h, 20 m WC, 1.500 rpm, 3 kW	CI/SS	L
70.04.16	Screw pump	1	Q = 500 m³/h	CS	L
70.04.17	Static Peroxide Mixer	1	Q = 500 m³/h	Epoxi paint.	L
	Gears (part of the screw pumps)	2	incl. in screw pump		L
70.04.18	Pump - lubrication	1	incl. in screw pump	CI/SS	L
70.04.19	Pump - lubrication	1	incl. in screw pump	CI/SS	L
70.04.20	Sludge pump	1	Q = 6 m³/h, 20 m WC, 1.500 rpm, 1,5 kW	CI/SS	L
70.04.21	Sludge pump	1	Q = 6 m³/h, 20 m WC, 1.500 rpm, 1,5 kW		L
70.04.22	Centrifugal pump	1	Q = 8 m³/h, 40 m WC, 1.500 rpm, 1,5 kW	CI/SS	L
70.04.23	Dosing pump, floccul.	1	Q = 100 - 1300 l/h, 15 m WC, 1.500 rpm, 0,1 kW	PVC/CI	L
70.05.01	Fan	1	D.D.E.	FRP	L
70.08.01	Through belt conveyor	1	2.500 mm x 500 mm x 650 mm	CS/rubber	L
70.08.03	Discharge belt conveyor	1	5.500 mm x 500 mm x 650 mm	CS/rubber	L
70.09.01	Gate valves	1	800 mm x 80 mm x 1200 mm	SS	L
70.09.02	Gate valves	1	800 mm x 80 mm x 1200 mm	SS	L
70.09.03	Gate valves	1	800 mm x 80 mm x 1200 mm	SS	L
70.09.04	Gate valves	1	800 mm x 80 mm x 1200 mm	SS	L
70.09.05	Gate valve	1	800 mm x 80 mm x 1200 mm	SS	L
70.09.09	Polymere preparation plant plant	1	2000 mm x 1100 mm x 1800 mm	PVC	L
70.09.10	Dilution apparatus	1	400 mm x 80 mm x 500 mm		L
70.09.11	Piping		FRP, stainless steel, PVC-incl. valves		L
70.09.12	Steel structure		stairs, platforms		L

D.D.E. = Defined during Detail Engineering

EQUIPMENT LIST: JUTE PULP MILL Greenfield Investment

Item	Description	Pcs	Main Dimensions/ Capacities	Material	Supplied from L = local I = imported
4.6.1 COMPRESSOR STATION					
	Screw-type compressor	1	800 m³/h		L
	Screw-type compressor	1	800 m³/h		L
	Refrigeration dryer	1	D.D.E.		L
	Refrigeration dryer	1	D.D.E.		L
	Buffer bin for mill air	1	20 m³ / Dia. 2,8 m	galv. CS	L
4.6.2 FUEL OIL STORAGE					
ZD51.T01	Fuel Oil Storage Tank	1	200 m³ / Dia. 6,5 m	CS	L
ZD51.T02	Oil Day Tank	1	30 m³ / Dia. 3,0 m	CS	L
ZD51.P01	Transfer Pump	1	5 m³/h, 20 m WC, 1.500 rpm, 0,75 kW	CS	L
ZD51.P02	Transfer Pump	1	5 m³/h, 20 m WC, 1.500 rpm, 0,75 kW	CS	L
ZD51.P03	Oil Circulating Pump	1	5 m³/h, 20 m WC, 1.500 rpm, 0,75 kW	CS	L
ZD51.P04	Fuel Oil Unloading Pump	1	20 m³/h, 20 m WC, 1.500 rpm, 3 kW	CS	L

D.D.E. = Defined during Detail Engineering

6. DRAWINGS

LAYOUT

General Mill Layout	ITC.Z/ZAL 2101 E

FLOWSHEET

Jute Handling	ITC.ZH10 / ZVV 2101 E
Digester System	ITC.ZF13 / ZVV 2101 E
Washing Plant	ITC.ZF31 / ZVV 2101 E
Washing Plant	ITC.ZF31 / ZVV 2102 E
Stock Screening	ITC.ZF25 / ZVV 2101 E
O_2-Delignification	ITC.ZF41 / ZVV 2101 E
O_2-Delignification	ITC.ZF41 / ZVV 2102 E
Bleaching Plant A-Stage	ITC.ZF43 / ZVV 2101 E
Bleaching Plant EOP-Stage	ITC.ZF43 / ZVV 2102 E
Bleaching Plant P-Stage	ITC.ZF43 / ZVV 2103 E
Wet Lap Machine	ITC.ZF60 / ZVV 2101 E
Drying and Baling	ITC.ZF71 / ZVV 2101 E
Evaporation	ITC.ZR11 / ZVV 2101 E
Recovery Boiler	ITC.ZR21 / ZVV 2101 E
Recausticizing	ITC.ZR33 / ZVV 2101 E
Lime Kiln	ITC.ZR49 / ZVV 2101 E
Oxygen Generation Plant	ITC.ZC93 / ZVV 2101 E
H_2O_2-Storage	ITC.ZC94 / ZVV 2101 E
Caustic Storage & Dilution	ITC.ZC92 / ZVV 2101 E
DTPA Dosing Station	ITC.ZC96 / ZVV 2101 E
$MgSO_4$ Dissolving Station	ITC.ZC81 / ZVV 2101 E
Na_2SO_3 Dissolving Station	ITC.ZC98 / ZVV 2101 E
H_2SO_4-Storage	ITC.ZC97 / ZVV 2101 E
Anthraquinone Dosing Station	ITC.ZC95 / ZVV 2101 E
Power Boiler - Coal Feeding	ITC.ZD53 / ZVV 2101 E
Steam & Power	ITC.ZD81 / ZVV 2101 E
Power Boiler, Air Fluegas	ITC.ZD82 / ZVV 2101 E

Demineralization Plant / Condensate Polishing Plant	ITC.ZD90 / ZVV 2101 E
Raw Water Treatment	ITC.ZW10 / ZVV 2101 E
Cooling Water Plant	ITC.ZW50 / ZVV 2101 E
Effluent Treatment	ITC.ZV10 / ZVV 2101 E
Fuel Oil Storage & Handling	ITC.ZD51 / ZVV 2101 E

MECHANICAL DETAILS

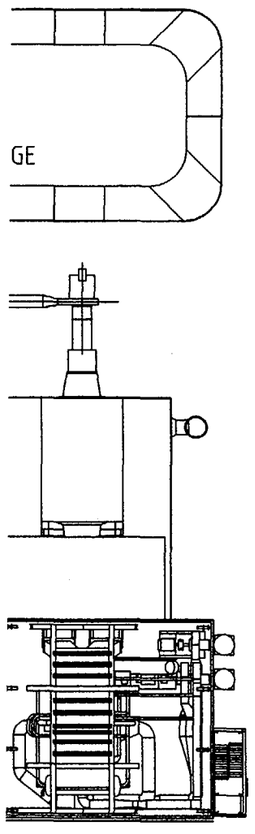
Spherical Digester Dia. 16"	ITC.ZF13.M01/ZAM 2101 E

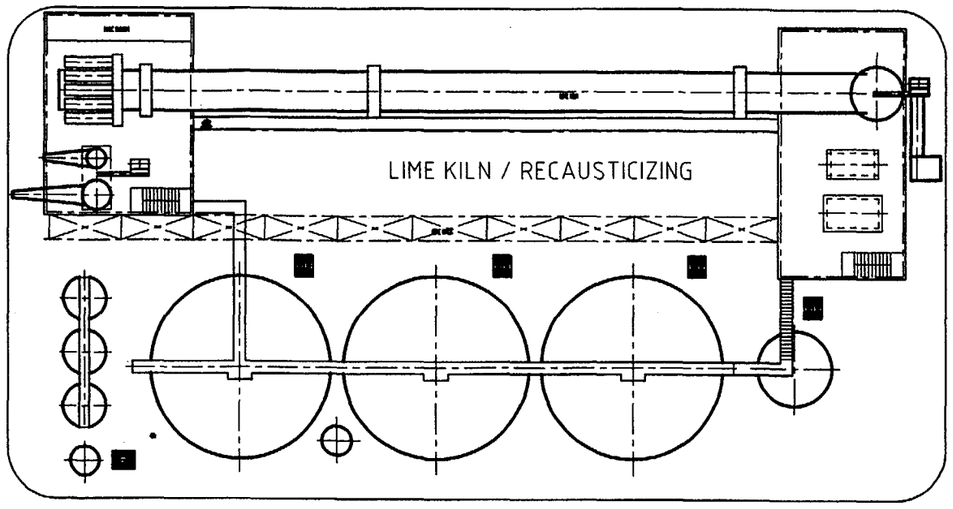
D E F G H

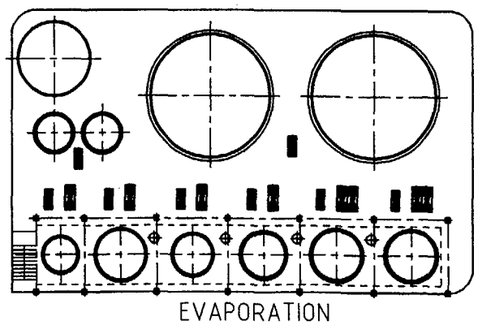
12 11 10 9

A section 1

GE

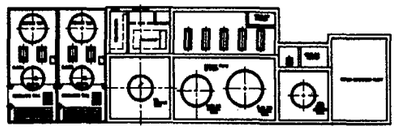


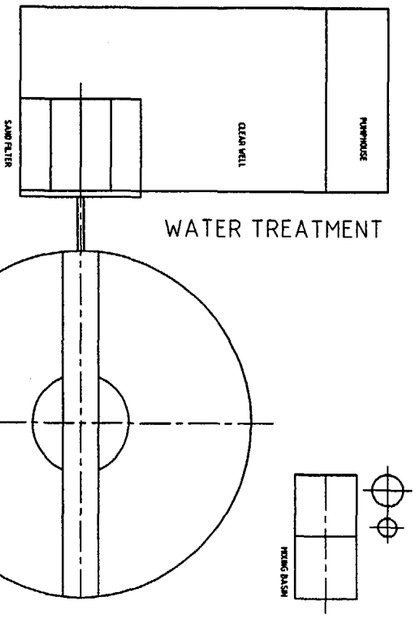


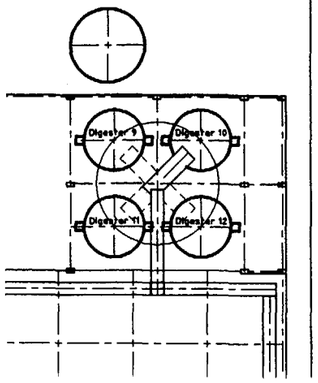


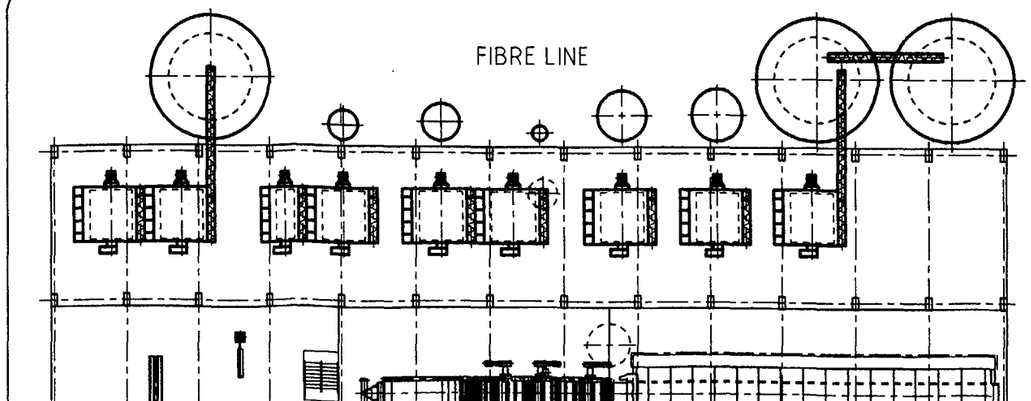
EVAPORATION

CHEMICAL PLANT

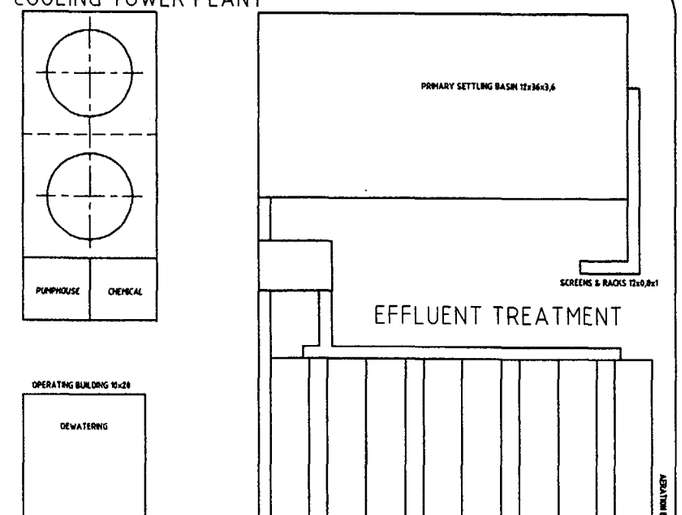








COOLING TOWER PLANT



Section (A) (2)

8 7 6 5

0 10 20 30 40 50 60 70 80 90 100

ERATION BASIN 31x31x5,2 f9 AERATORI

FINAL CLARIFICATION 16x54x4,8

CHEMICALS

THICKENER ø16m

LABORATORY

PULP STORAGE

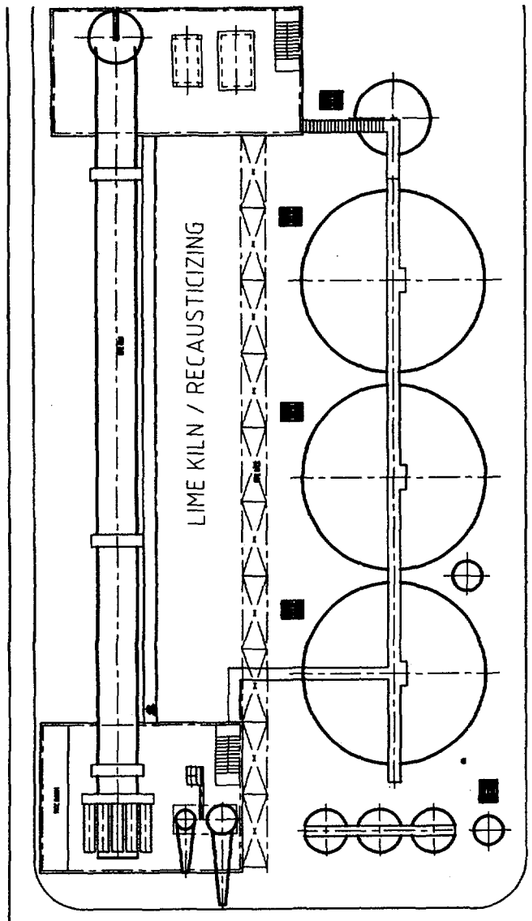
RETENTION BOND

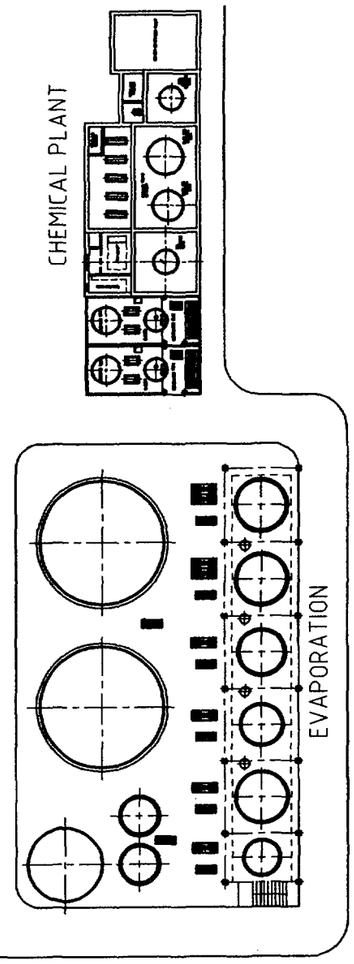
WAREHOUSE

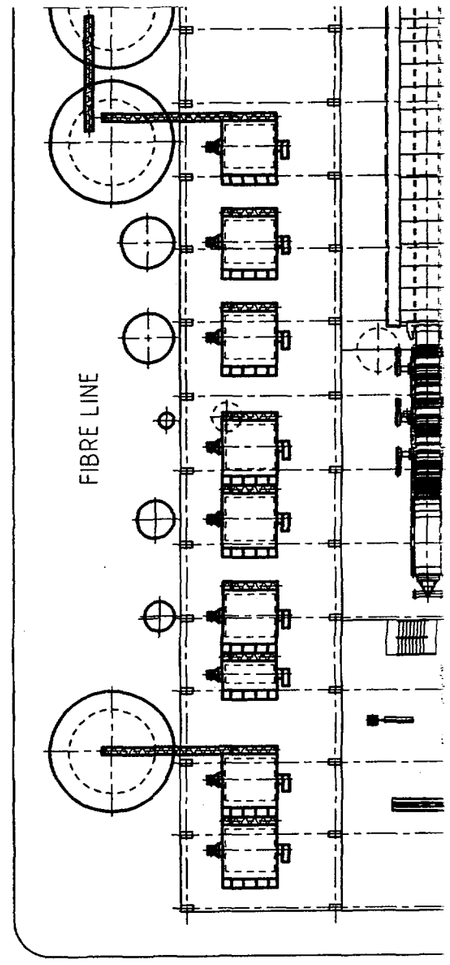
(A) section (3)

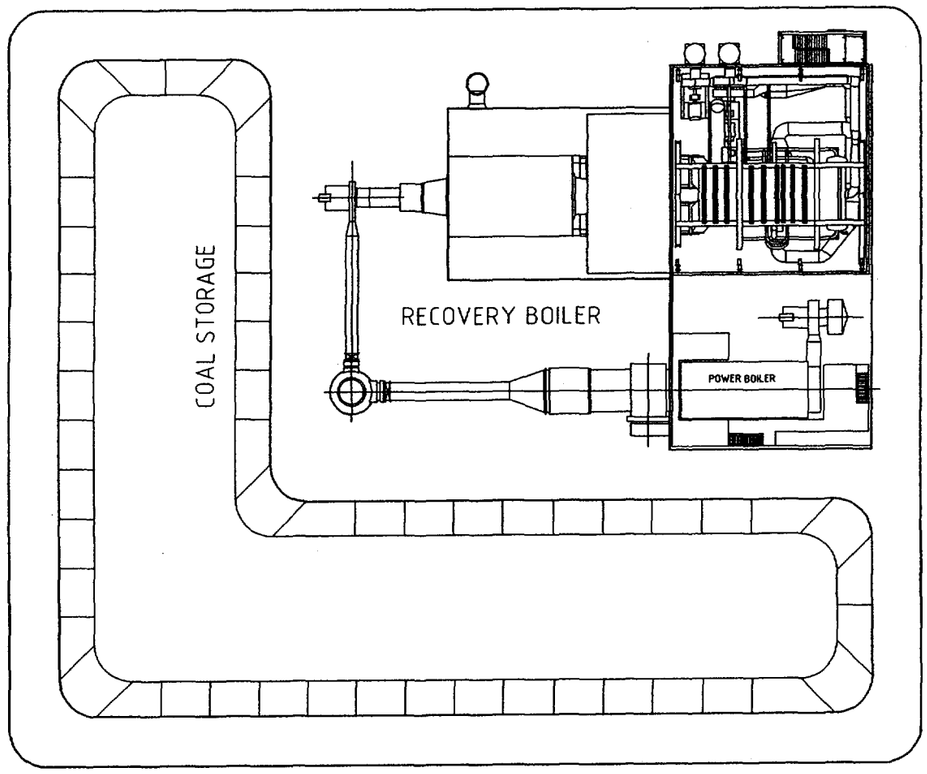
4 3 2 1

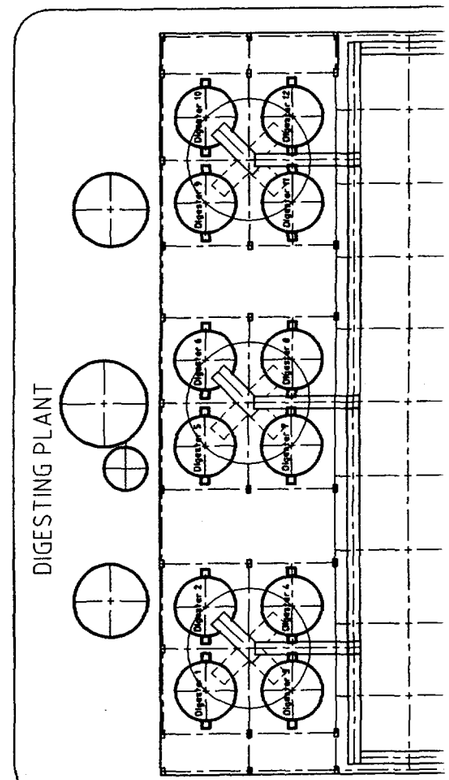
H G F E D











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A section 4

JUTE HANDLING & STORAGE

PULP STORAGE

LABORATORY

MAIN ENTRANCE

ADMINISTRATION

WAREHOUSE

RETENTIO

ENGINEERING

A section

ENGINEERING

PRELIMINARY

Änderung Revision	Anz. d. Änd. No. of Mod.	Änderungsinhalt Modification	Datum Date	Bearbeitet Made by	Geprüft Checked by

	Datum Date	Name Name
Gezeichnet Drawn	27.05.98	NT
Geprüft Checked	27.05.98	KREINDL

Maßstab/Scale 1:500

Hersteller/Manufacturer

Herstellerzeichnungs-Nr./Manufacturer Dwg. No.

IMPCO–VOEST–ALPINE
Pulping Technologies GmbH

Projekt/Customer

JUTE PULP MILL

Benennung/Title

Phase III

GENERAL MILL LAYOUT

Masse/Mass

Werkstoff/Material

Kunden/Customer-Doc-No.:

IVA-Doc-No.:

ITC.Z / ZAL 2101 E

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Änderung Revision

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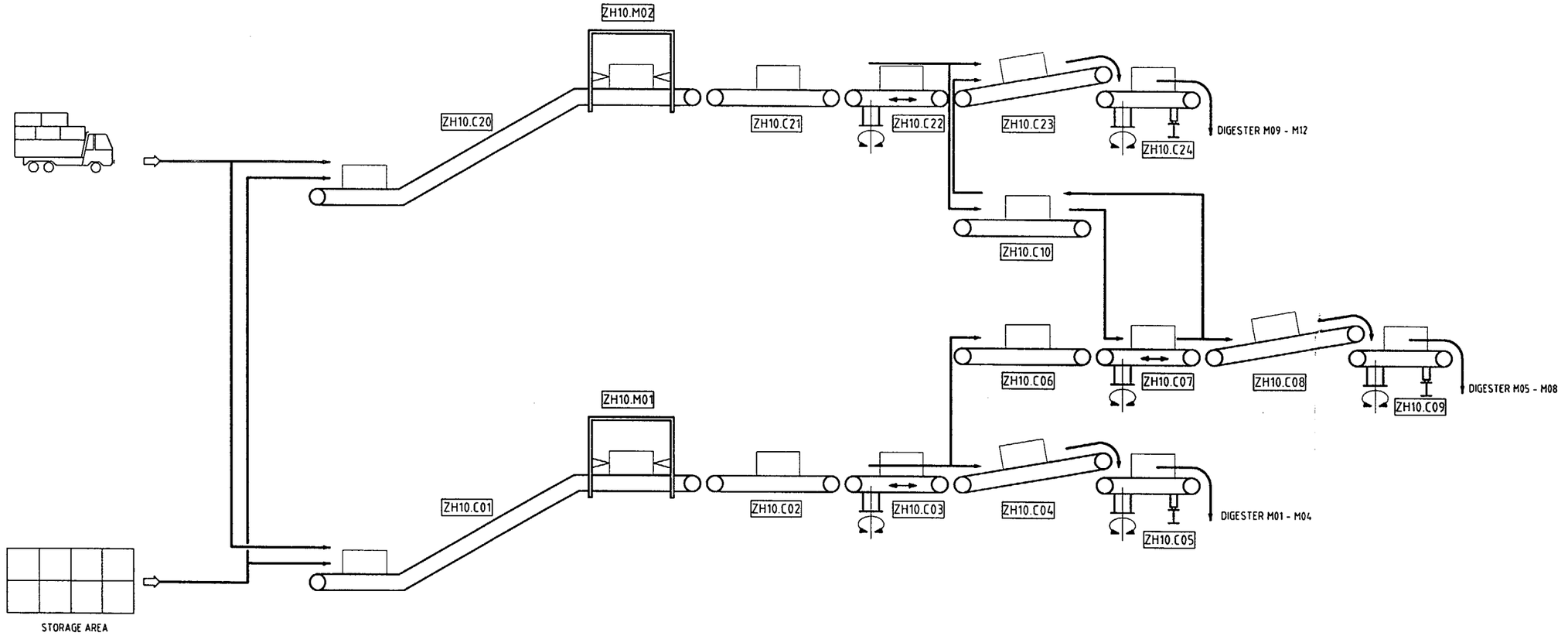
B A

A section (6)

PLOT ZURÜCK AN IVA / STEININGER (BG 39) - TEL. 3694



PRELIMINARY

Änderung Revision	Anz. d. Änd. No. of Mod.	Änderungsinhalt Modification	Datum Date	Bearbeiter Made by	Geprüft Checked by
	Datum Date	Name Name			
Gezeichnet Drawn	19.05.98	NT			
Geprüft Checked	19.05.98	KREINDL			

Hersteller/Manufacturer

Maßstab/Scale

Herstellerzeichnungs-Nr./Manufacturer Dwg. No.

IMPCO-VOEST-ALPINE Pulping Technologies GmbH

Projekt/Customer: **JUTE PULP MILL**

Benennung/Title: PHASE III
JUTE HANDLING
FLOWSHEET

Masse/Mass

Werkstoff/Material

Kunden/Customer-Doc-No.

IVA-Doc-No.: **ITC.ZH10 / ZVV 2101 E**

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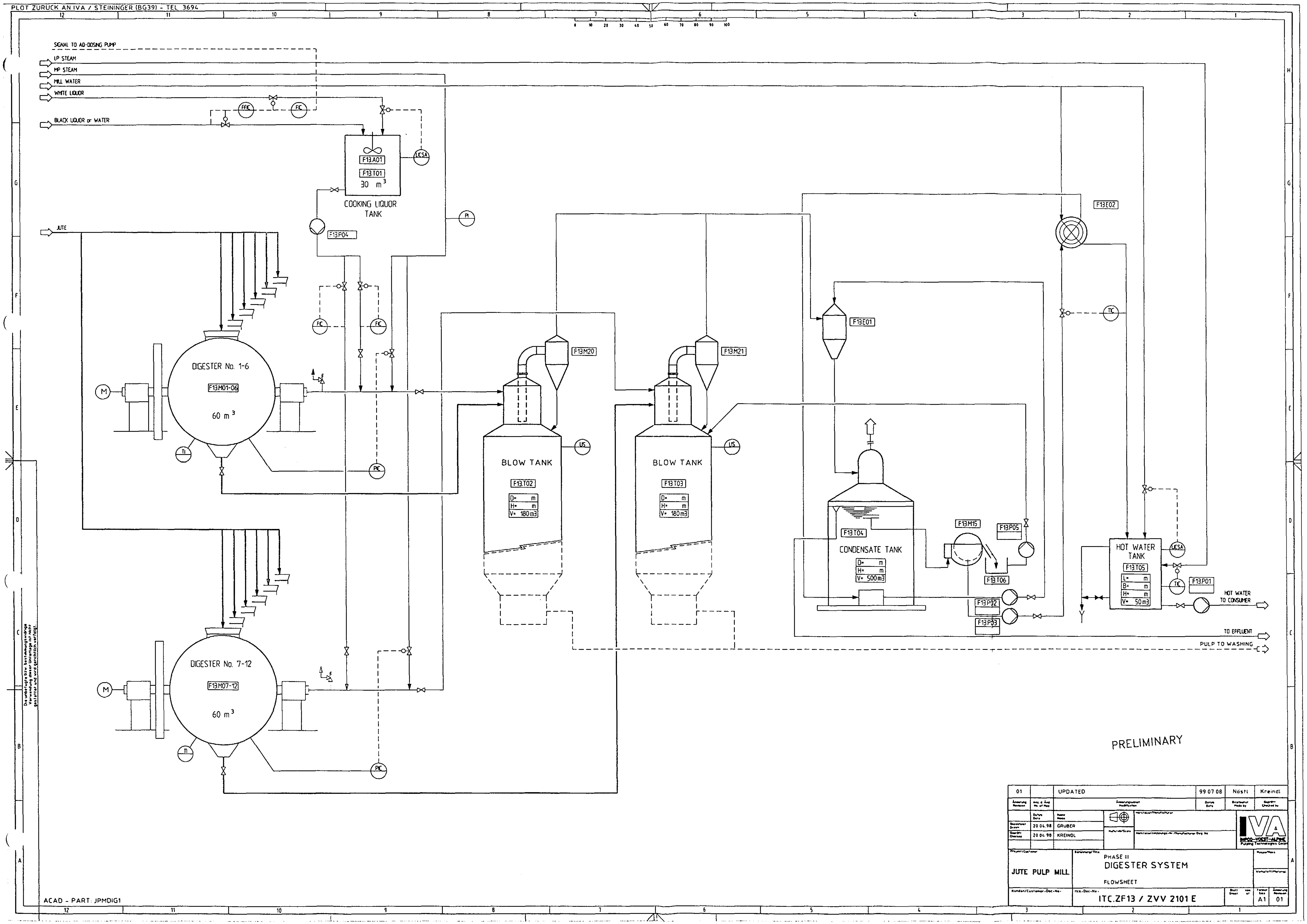
PLOT ZURUCK AN IVA / STEININGER (BG39) - TEL. 3694
SIGNAL TO AQ-DOSING PUMP
LP STEAM
MP STEAM
MILL WATER
WHITE LIQUOR
BLACK LIQUOR or WATER
FFIC
FIC
LICSA
F13.A01
F13.T01
30 m3
COOKING LIQUOR TANK
PI
F13.P04
JUTE
FIC
FIC
DIGESTER No. 1-6
F13.M01-06
60 m3
M
TI
PIC
F13.M20
F13.M21
BLOW TANK
F13.T02
D= m
H= m
V= 180 m3
BLOW TANK
F13.T03
D= m
H= m
V= 180 m3
LIS
LIS
F13.E02
F13.E01
TIC
F13.T04
CONDENSATE TANK
D= m
H= m
V= 500 m3
F13.M15
F13.P05
F13.T06
F13.P02
F13.P03
HOT WATER TANK
F13.T05
L= m
B= m
H= m
V= 50 m3
LICSA
TIC
F13.P01
HOT WATER TO CONSUMER
TO EFFLUENT
PULP TO WASHING
DIGESTER No. 7-12
F13.M07-12
60 m3
M
TI
PIC
PRELIMINARY
01
UPDATED
99 07 08
Nöstl
Kreindl
20.04.98
GRUBER
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KREINDL
IVA
IMPCO-VOEST-ALPINE Pulping Technologies GmbH
JUTE PULP MILL
PHASE III
DIGESTER SYSTEM
FLOWSHEET
ITC.ZF13 / ZVV 2101 E
A1
01
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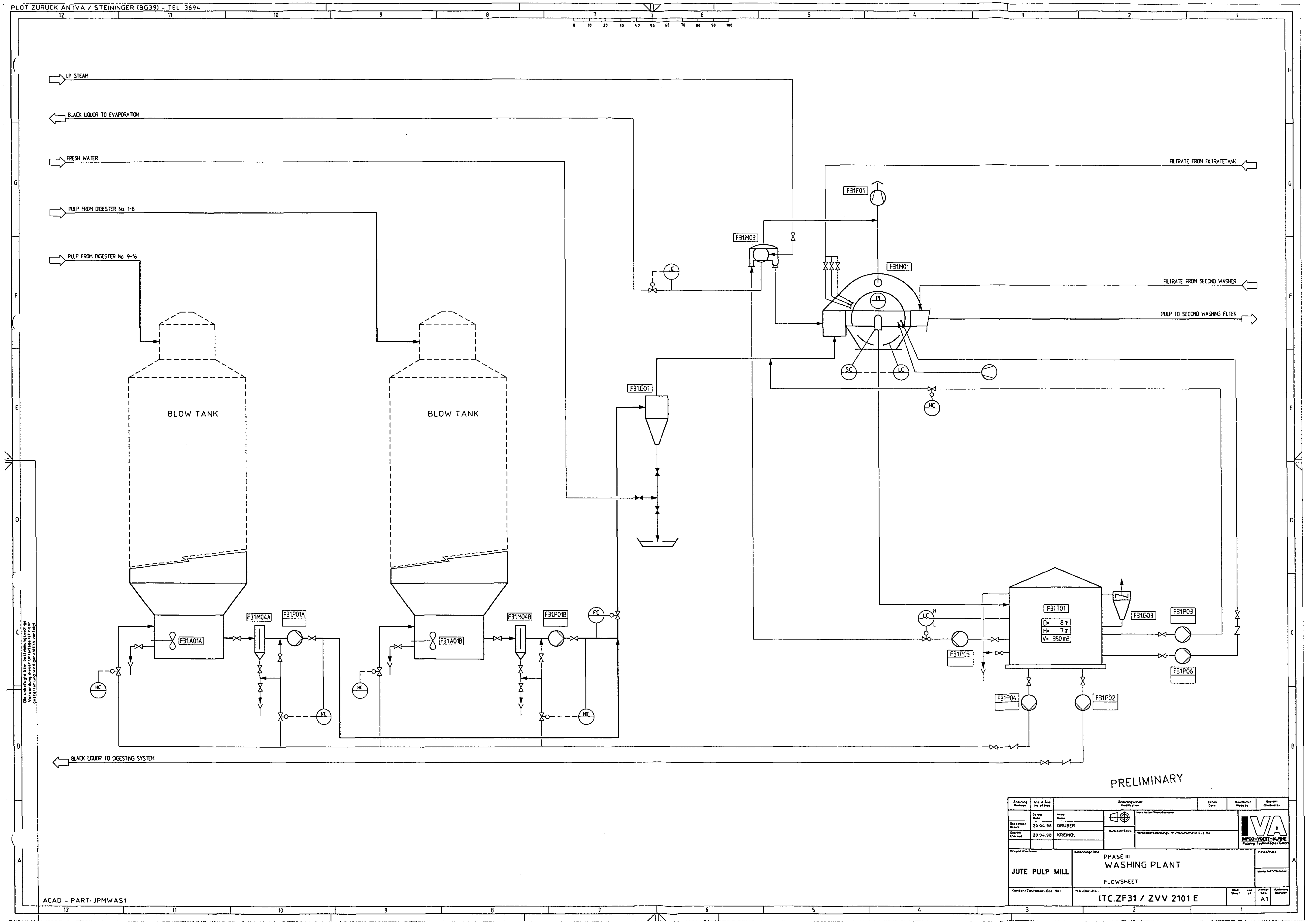
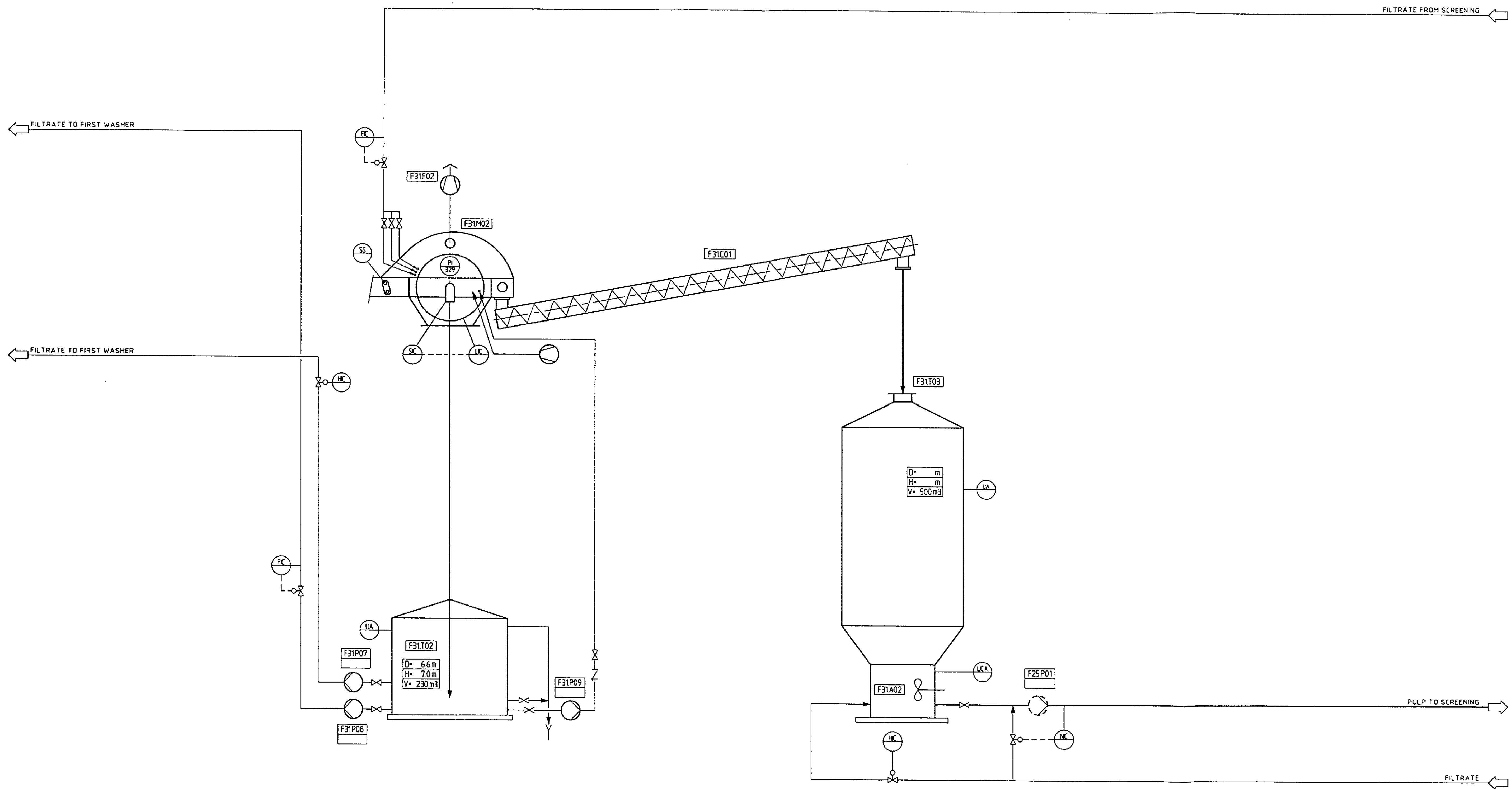


PLOT ZURUCK AN IVA / STEININGER (BG39) - TEL 3694
LP STEAM
BLACK LIQUOR TO EVAPORATION
FRESH WATER
PULP FROM DIGESTER No 1-8
PULP FROM DIGESTER No 9-16
FILTRATE FROM FILTRATETANK
FILTRATE FROM SECOND WASHER
PULP TO SECOND WASHING FILTER
F31F01
F31M03
F31M01
F31G01
BLOW TANK
BLOW TANK
F31A01A
F31M04A
F31P01A
F31A01B
F31M04B
F31P01B
F31T01
D= 8m
H= 7m
V= 350m3
F31G03
F31P03
F31P06
F31P04
F31P02
BLACK LIQUOR TO DIGESTING SYSTEM
Die unbefugte bzw. bestimmungswidrige Verwendung dieser Unterlage ist nicht gestattet und wird gerichtlich verfolgt.
PRELIMINARY
ACAD - PART: JPMWAS1
20.04.98 GRUBER
20.04.98 KREINDL
IMPCO–VOEST–ALPINE Pulping Technologies GmbH
JUTE PULP MILL
PHASE III
WASHING PLANT
FLOWSHEET
ITC.ZF31 / ZVV 2101 E
A1

PLOT ZURÜCK AN IVA / STEININGER (BG39) - TEL. 3694



PRELIMINARY

Änderung Revision	Anz. d. Änd. No. of Mod.	Änderungsinhalt Modification	Datum Date	Bearbeitet Made by	Geprüft Checked by

	Datum Date	Name Name
Gezeichnet Drawn	20.04.98	GRUBER
Geprüft Checked	20.04.98	KREINDL

Maßstab/Scale

Hersteller/Manufacturer

Herstellerzeichnungs-Nr./Manufacturer Dwg. No.

IVA IMPCO-VOEST-ALPINE Pulping Technologies GmbH

Projekt/Customer: **JUTE PULP MILL**

Benennung/Title: PHASE III
WASHING PLANT
FLOWSHEET

Masse/Mass

Werkstoff/Material

Kunden/Customer-Doc-No.

IVA-Doc-No.: **ITC.ZF31 / ZVV 2102 E**

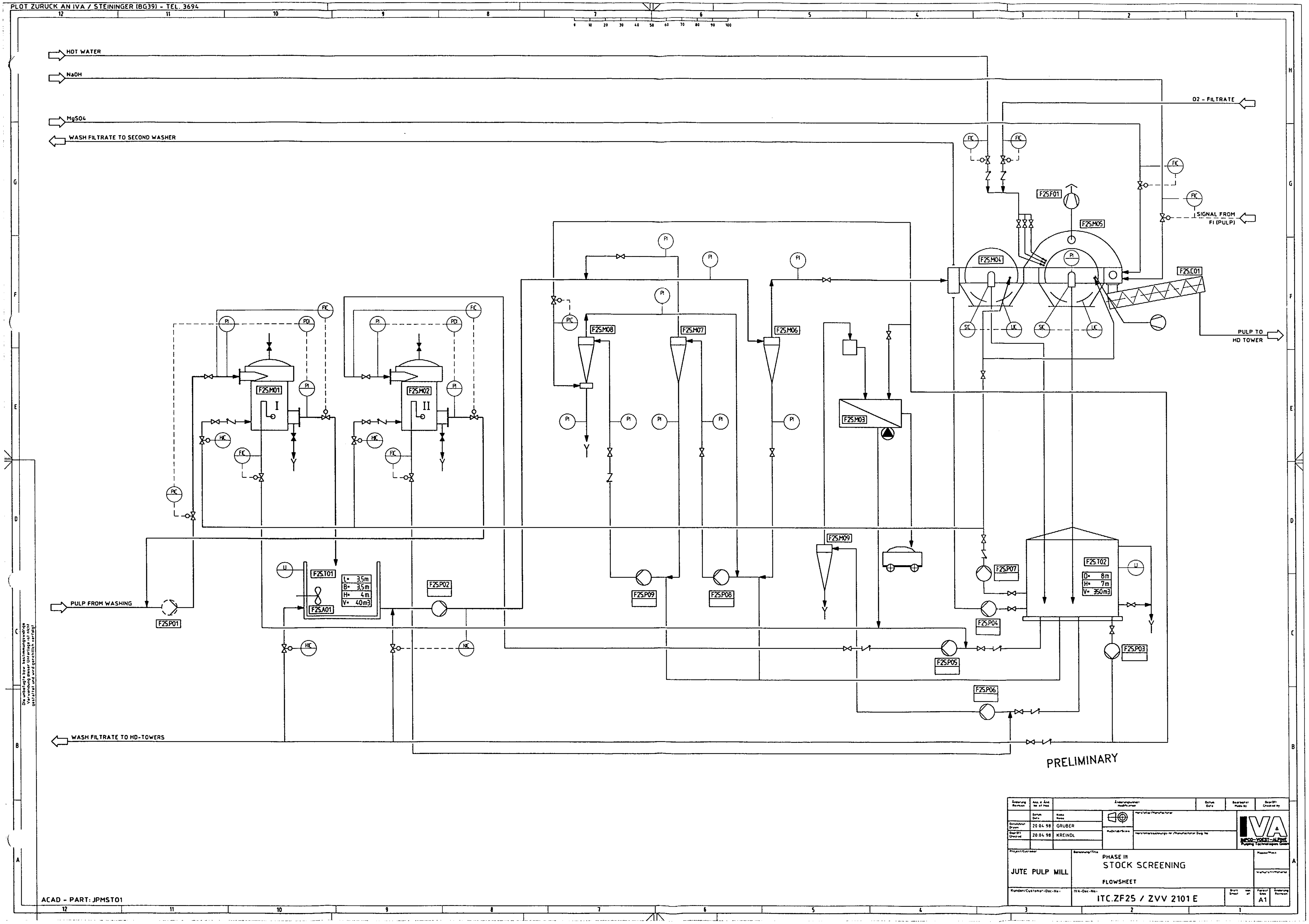
Blatt Sheet von of

Format Size: A1

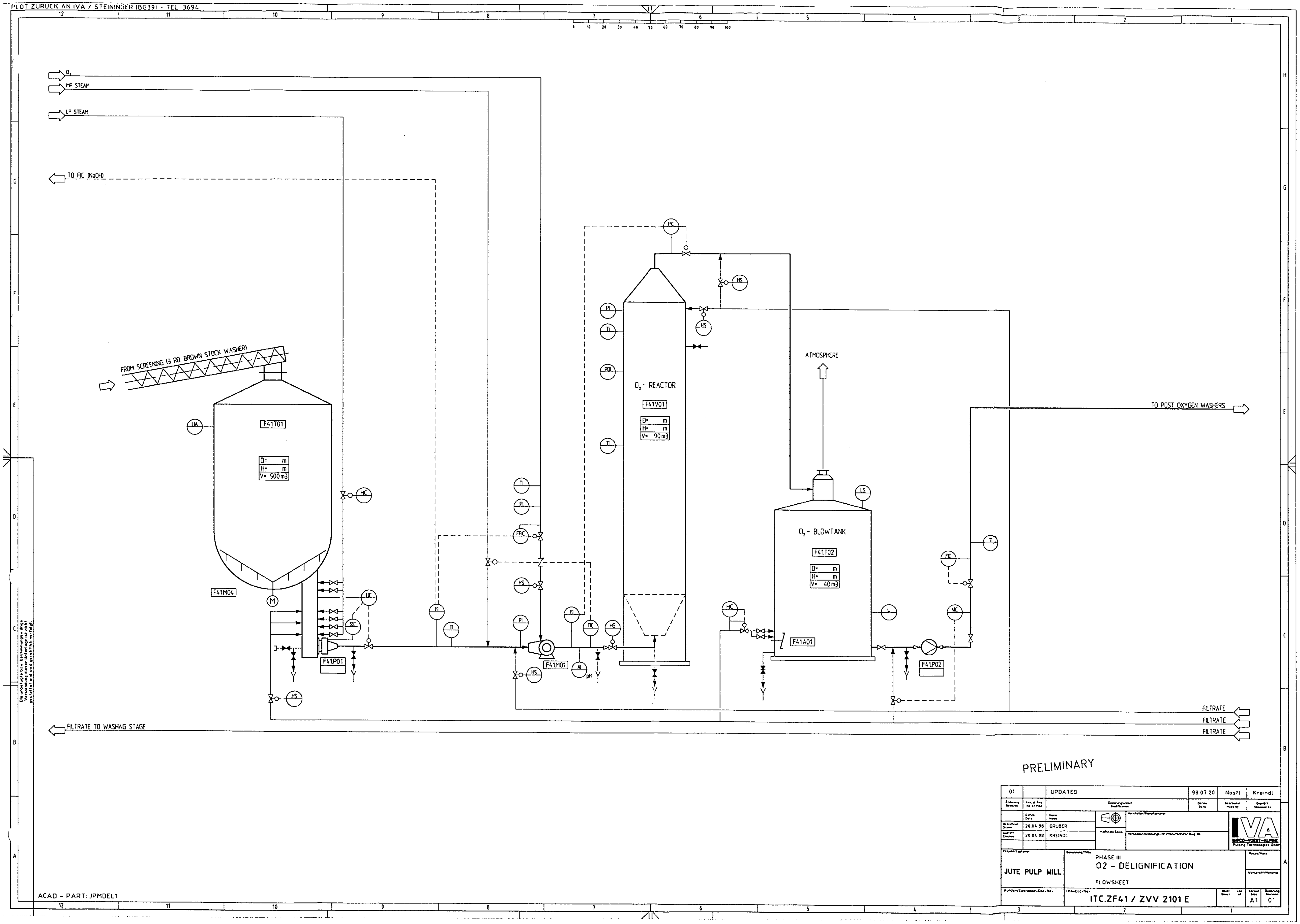
Änderung Revision

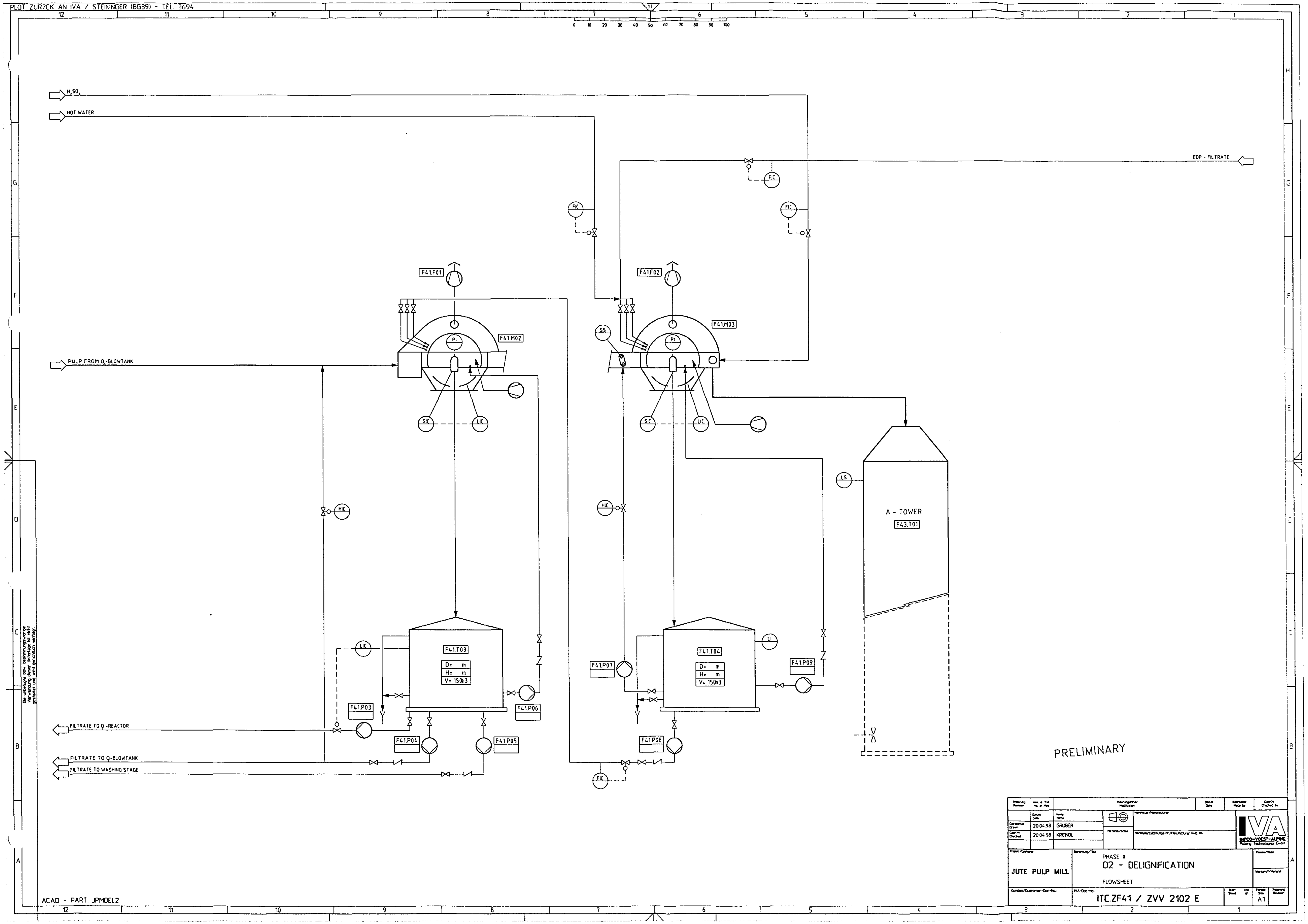
ACAD - PART: JPMWAS2

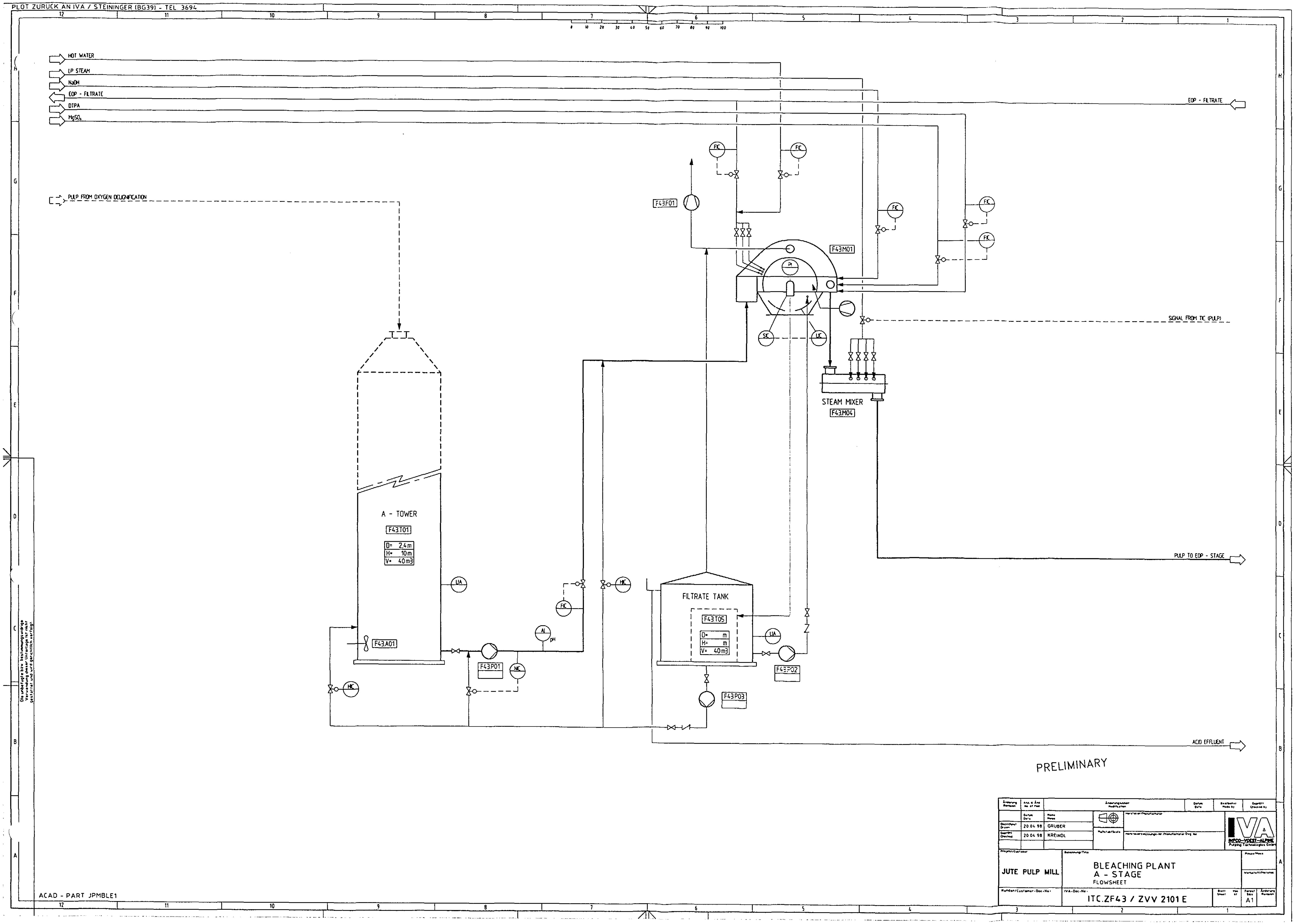
Die unbefugte bzw. bestimmungswidrige Verwendung dieser Unterlage ist nicht gestattet und wird gerichtlich verfolgt



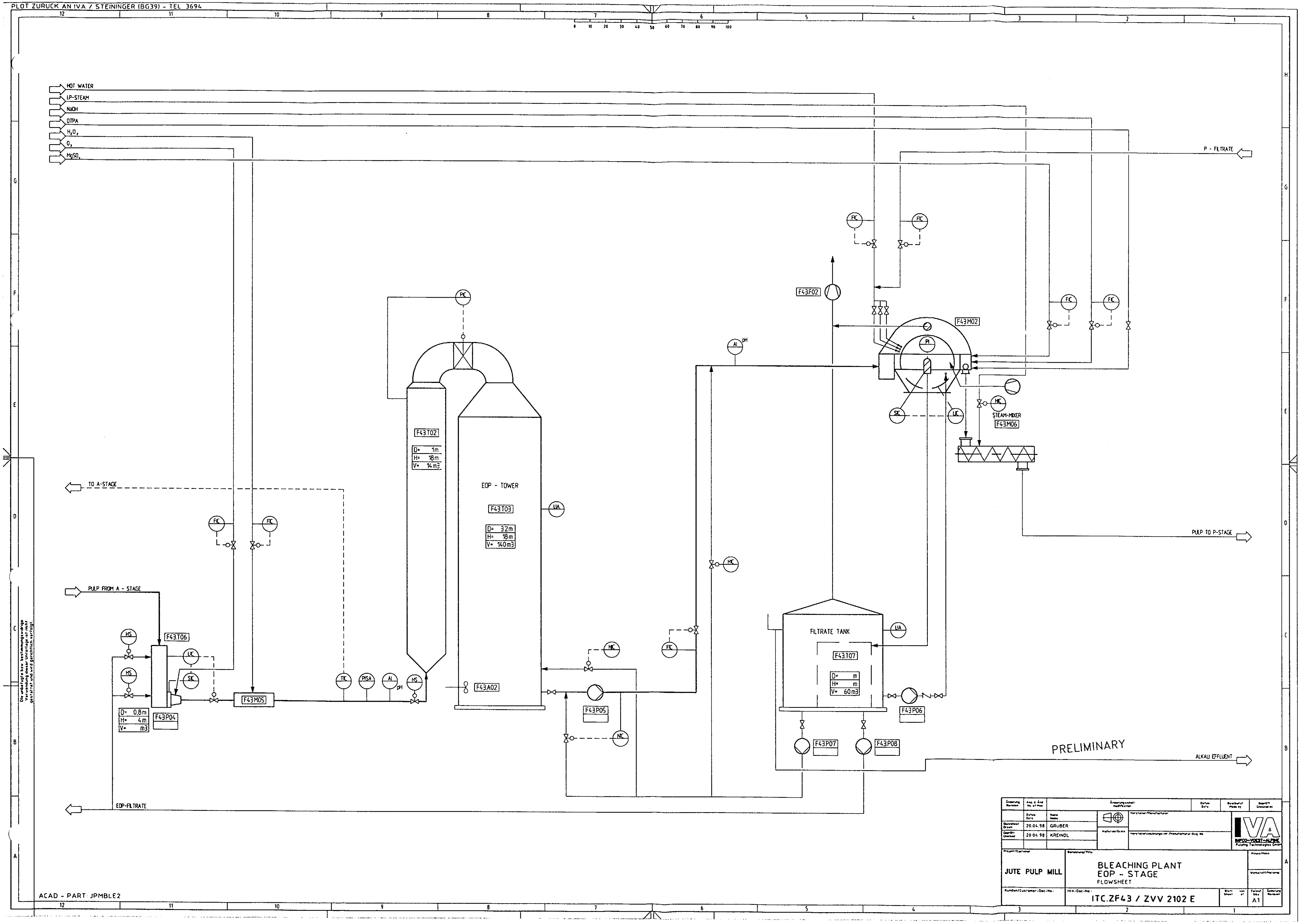
PLOT ZURUCK AN IVA / STEININGER (BG39) - TEL. 3694
HOT WATER
NaOH
MgSO4
WASH FILTRATE TO SECOND WASHER
O2 - FILTRATE
SIGNAL FROM FI (PULP)
PULP TO HD TOWER
PULP FROM WASHING
WASH FILTRATE TO HD-TOWERS
F25.F01
F25.M05
F25.M04
F25.C01
F25.M01
F25.M02
F25.M08
F25.M07
F25.M06
F25.M03
F25.M09
F25.T01
L= 3,5m
B= 3,5m
H= 4m
V= 40m3
F25.A01
F25.P01
F25.P02
F25.P09
F25.P08
F25.P07
F25.P04
F25.P05
F25.P06
F25.P03
F25.T02
D= 8m
H= 7m
V= 350m3
PRELIMINARY
ACAD - PART: JPMST01
GRUBER
KREINDL
20.04.98
IVA
INPCO-VOEST-ALPINE
JUTE PULP MILL
PHASE III
STOCK SCREENING
FLOWSHEET
IVA-Doc-No.
ITC.ZF25 / ZVV 2101 E
A1


PLOT ZURUCK AN IVA / STEININGER (BG39) - TEL 3694
O2
MP STEAM
LP STEAM
TO FIC (NaOH)
FROM SCREENING (3 RD. BROWN STOCK WASHER)
F41T01
D= m
H= m
V= 500m3
F41M04
F41P01
F41M01
O2 - REACTOR
F41V01
D= m
H= m
V= 90m3
ATMOSPHERE
O2 - BLOWTANK
F41T02
D= m
H= m
V= 40m3
F41A01
F41P02
TO POST OXYGEN WASHERS
FILTRATE
FILTRATE
FILTRATE
FILTRATE TO WASHING STAGE
PRELIMINARY
01
UPDATED
98 07 20
Nöstl
Kreindl
20.04.98
GRUBER
20.04.98
KREINDL
IVA
JUTE PULP MILL
PHASE III
02 - DELIGNIFICATION
FLOWSHEET
ITC.ZF41 / ZVV 2101 E
A1
01
ACAD - PART: JPMDEL1

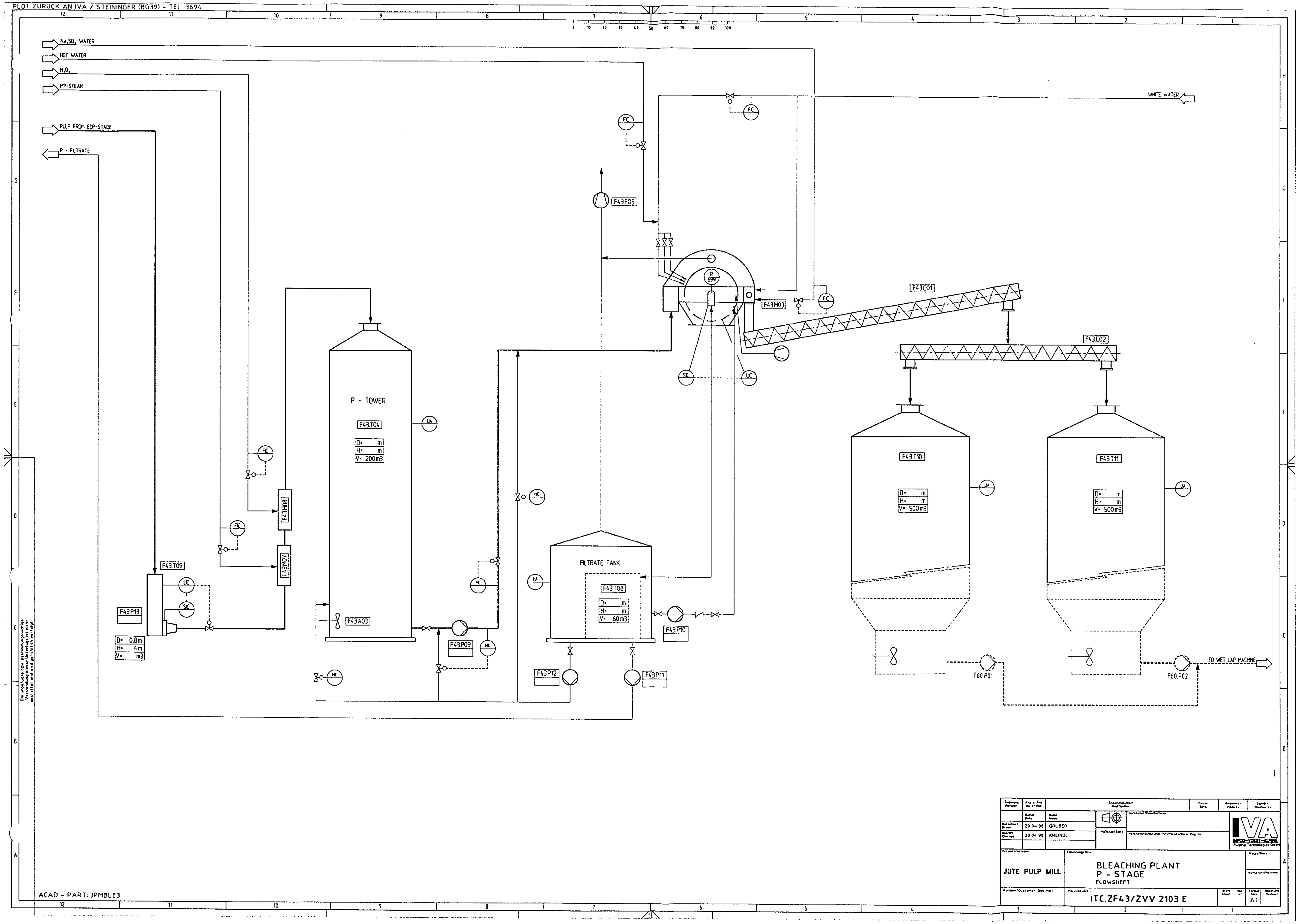

PLOT ZUR?CK AN IVA / STEININGER (BG39) - TEL. 3694
H_2SO_4
HOT WATER
EOP - FILTRATE
FIC
F41.F01
F41.F02
F41.M02
F41.M03
SS
PI
SIC
LIC
PULP FROM Q.-BLOWTANK
LS
A - TOWER
F43.T01
HIC
LIC
F41.T03
D= m
H= m
V= 150m3
F41.T04
D= m
H= m
V= 150m3
LI
F41.P07
F41.P09
F41.P03
F41.P06
F41.P04
F41.P05
F41.P08
FILTRATE TO Q.-REACTOR
FILTRATE TO Q.-BLOWTANK
FILTRATE TO WASHING STAGE
PRELIMINARY
20.04.98 GRUBER
20.04.98 KREINDL
IVA
INPCO-VOEST-ALPINE
Pulping Technologies GmbH
JUTE PULP MILL
PHASE II
02 - DELIGNIFICATION
FLOWSHEET
ITC.ZF41 / ZVV 2102 E
A1
ACAD - PART. JPMDEL2



PLOT ZURÜCK AN IVA / STEININGER (BG39) - TEL 3694
HOT WATER
LP STEAM
NaOH
EOP - FILTRATE
DIPA
MgSO4
PULP FROM OXYGEN DELIGNIFICATION
EOP - FILTRATE
FIC
F43F01
F43M01
PI
SIC
LIC
SIGNAL FROM TIC (PULP)
STEAM MIXER
F43M04
A - TOWER
F43T01
D= 2,4m
H= 10m
V= 40m3
LIA
F43A01
HIC
F43P01
NIC
AI
pH
FILTRATE TANK
F43T05
D= m
H= m
V= 40m3
F43P02
F43P03
PULP TO EOP - STAGE
ACID EFFLUENT
PRELIMINARY
GRUBER
KREINDL
20.04.98
JUTE PULP MILL
BLEACHING PLANT
A - STAGE
FLOWSHEET
ITC.ZF43 / ZVV 2101 E
A1
ACAD - PART JPMBLE1



PLOT ZURUCK AN IVA / STEININGER (BG39) - TEL 3694
HOT WATER
LP-STEAM
NaOH
DTPA
H_2O_2
O_2
$MgSO_4$
P - FILTRATE
FIC
PIC
F43F02
F43M02
PI
AI pH
SIC
LIC
HIC
STEAM-MIXER
F43M06
F43T02
D= 1m
H= 18m
V= 14m3
EOP - TOWER
F43T03
D= 3,2m
H= 18m
V= 140m3
LIA
TO A-STAGE
PULP TO P-STAGE
PULP FROM A - STAGE
F43T06
HS
LIC
SIC
D= 0,8m
H= 4m
V= m3
F43P04
F43M05
TIC
PISA
AI pH
HS
F43A02
HIC
NIC
F43P05
FIC
FILTRATE TANK
F43T07
D= m
H= m
V= 60m3
F43P06
F43P07
F43P08
PRELIMINARY
ALKALI EFFLUENT
EOP-FILTRATE
ACAD - PART: JPMBLE2
Gezeichnet Drawn 20.04.98 GRUBER
Geprüft Checked 20.04.98 KREINOL
IVA IMPCO-VOEST-ALPINE Pulping Technologies GmbH
JUTE PULP MILL
BLEACHING PLANT
EOP - STAGE
FLOWSHEET
IVA-Doc-No.
ITC.ZF43 / ZVV 2102 E
A1


PLOT ZURUCK AN IVA / STEININGER (BG39) - TEL. 3694
Na2SO4-WATER
HOT WATER
H2O2
MP-STEAM
PULP FROM EOP-STAGE
P - FILTRATE
WHITE WATER
F43F03
PI 699
F43M03
F43C01
F43C02
P - TOWER
F43.T04
D= m
H= m
V= 200m3
F43M08
F43M07
F43.T09
F43P13
D= 0,8m
H= 4m
V= m3
F43A03
F43P09
FILTRATE TANK
F43.T08
D= m
H= m
V= 60m3
F43P10
F43P12
F43P11
F43.T10
D= m
H= m
V= 500m3
F43.T11
D= m
H= m
V= 500m3
F60.P01
F60.P02
TO WET LAP MACHINE
ACAD - PART: JPMBLE3
20.04.98 GRUBER
20.04.98 KREINDL
JUTE PULP MILL
BLEACHING PLANT
P - STAGE
FLOWSHEET
ITC.ZF43/ZVV 2103 E
A1
IVA
INDCO-VOEST-ALPINE
Pulping Technologies GmbH

HOT WATER
PRESSURE AIR
PROCESS WATER

PULP FROM BLEACHING

F43.T10
F43.T09

F60.A01
F60.A02
F60.P01
F60.P02

FIC
FRC
NRC

F60.T01
D= m
H= m
V= 40m3
LKSA H
F60.A03
NRC
PIC
F60.P03

PIA H
TIA

F60.M01
F60.P04
F60.P05
F60.P06
PI
F60.M02
DSA

PULP TO DRYER

F60.T02
D= m
H= m
V= 60m3
LKSA H L
F60.P07

F60.T03
HIC
F60.A04
F60.P08
LKSA H L

WHITE WATER

PRELIMINARY

a		UPDATED	19 5 98	NT	KR
Änderung Revision	Anz. d. Änd. No. of Mod.	Änderungsgrund Modification	Datum Date	Bearbeiter Made by	Geprüft Checked by

	Datum Date	Name Name
Gezeichnet Drawn	20.04.98	GRUBER
Geprüft Checked	20.04.98	KREINDL

Herkunft/Manufacturer
Herkunftsbezeichnung des Herstellers/Manufacturer Dwg. No.
Maßstab/Scale

INCO-VOEST-ALPINE Pulping Technologies GmbH

Projekt/Customer: JUTE PULP MILL

Benennung/Title: PHASE III
WET LAP MACHINE
PROCESS FLOW SHEET
FLOWSHEET

Masse/Mass
Werkstoff/Material

Kunden/Customer-Doc-No.:
IVA-Doc-No.: ITC.ZF60 / ZVV 2101 E
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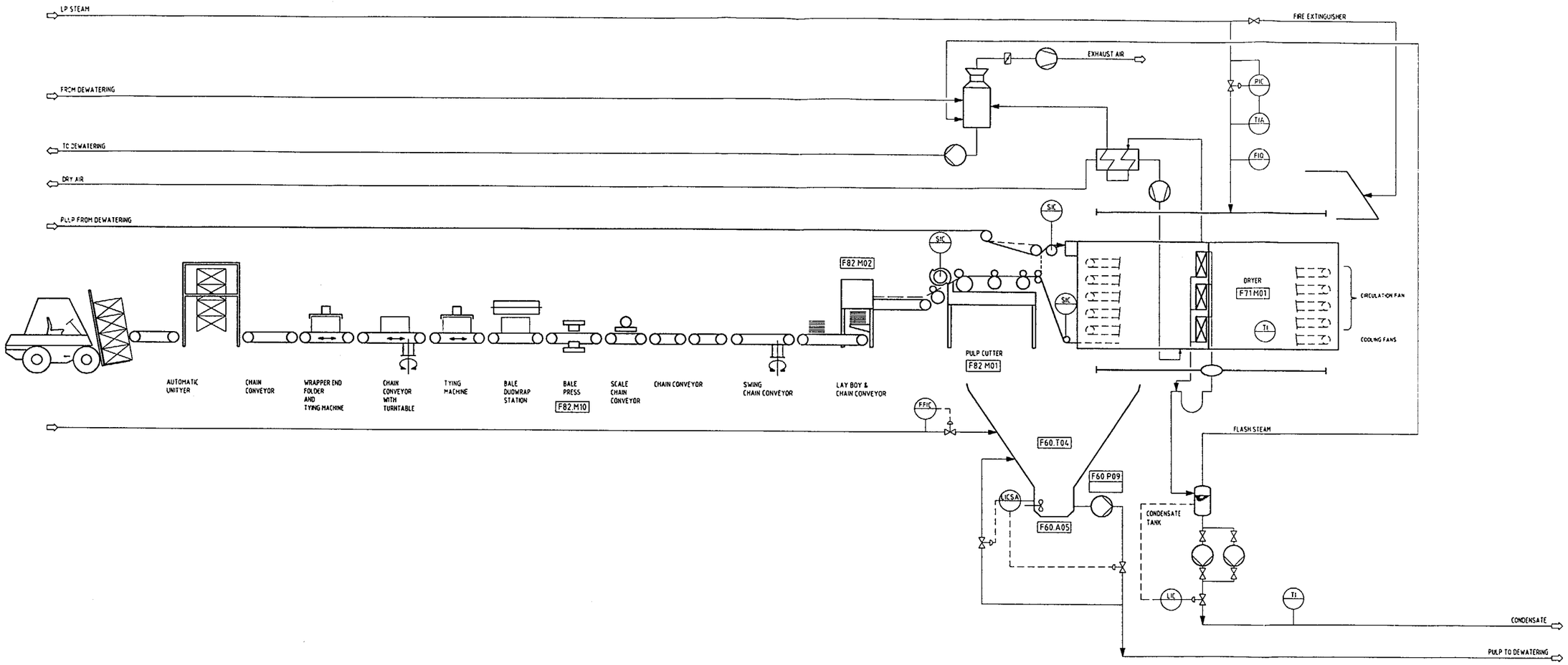
Format Size A1
Änderung Revision a

ACAD - PART: JPMWLP



PRELIMINARY

Änderung Revision	Anz. d. Änd. Nr. of mod.	Änderungsinhalt / Modification		Datum Date	Bearbeitet Made by	Geprüft Checked by
	Datum Date	Name Name				
Gezeichnet Drawn	19.05.98	NT				
Geprüft Checked	19.05.98	KREINDL				

IMPCO-VOEST-ALPINE Pulping Technologies GmbH

Projekt / Customer: JUTE PULP MILL

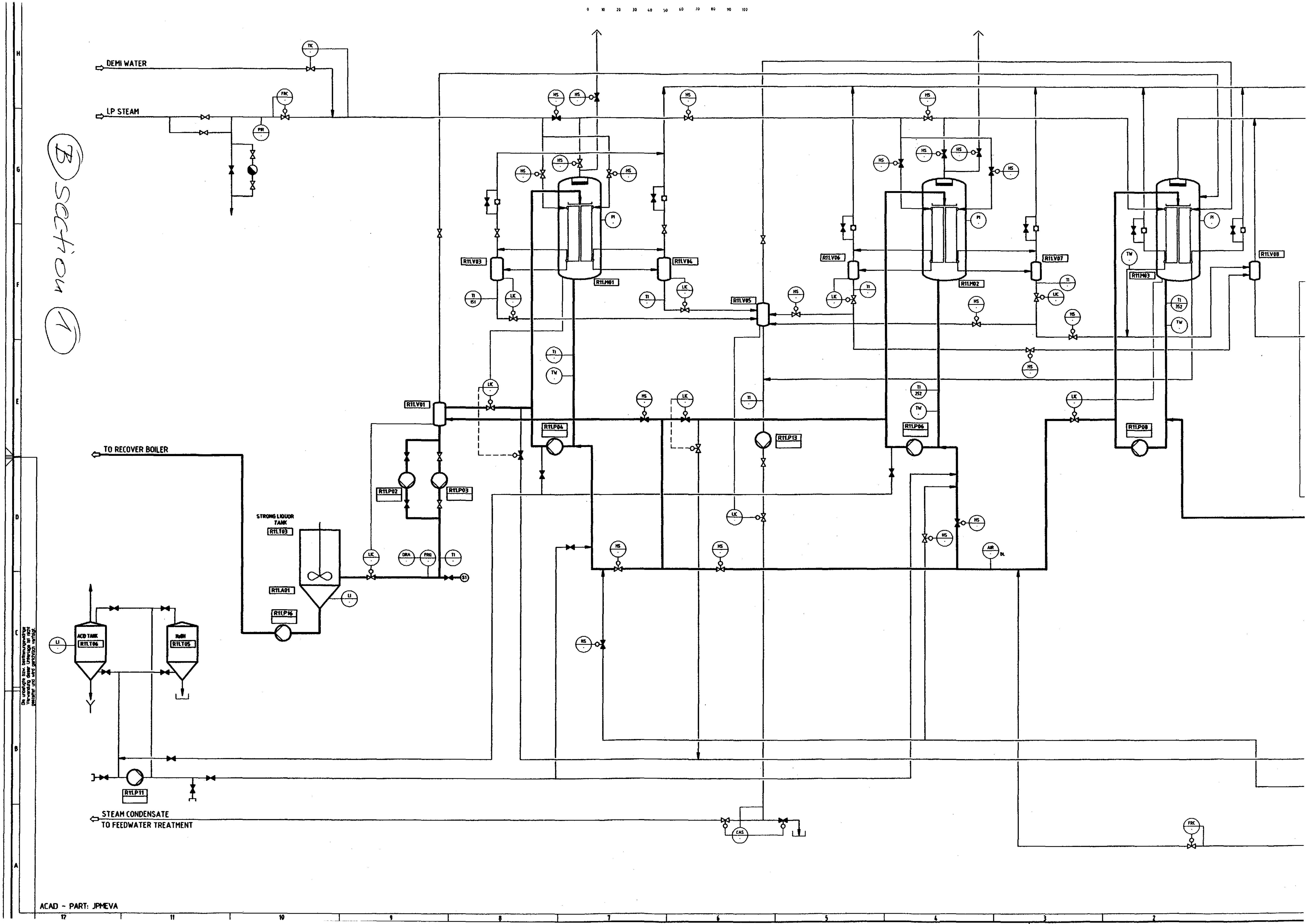
Benennung / Title: PHASE III
DRYING AND BALING
FLOWSHEET

Kunden / Customer - Doc - No.:

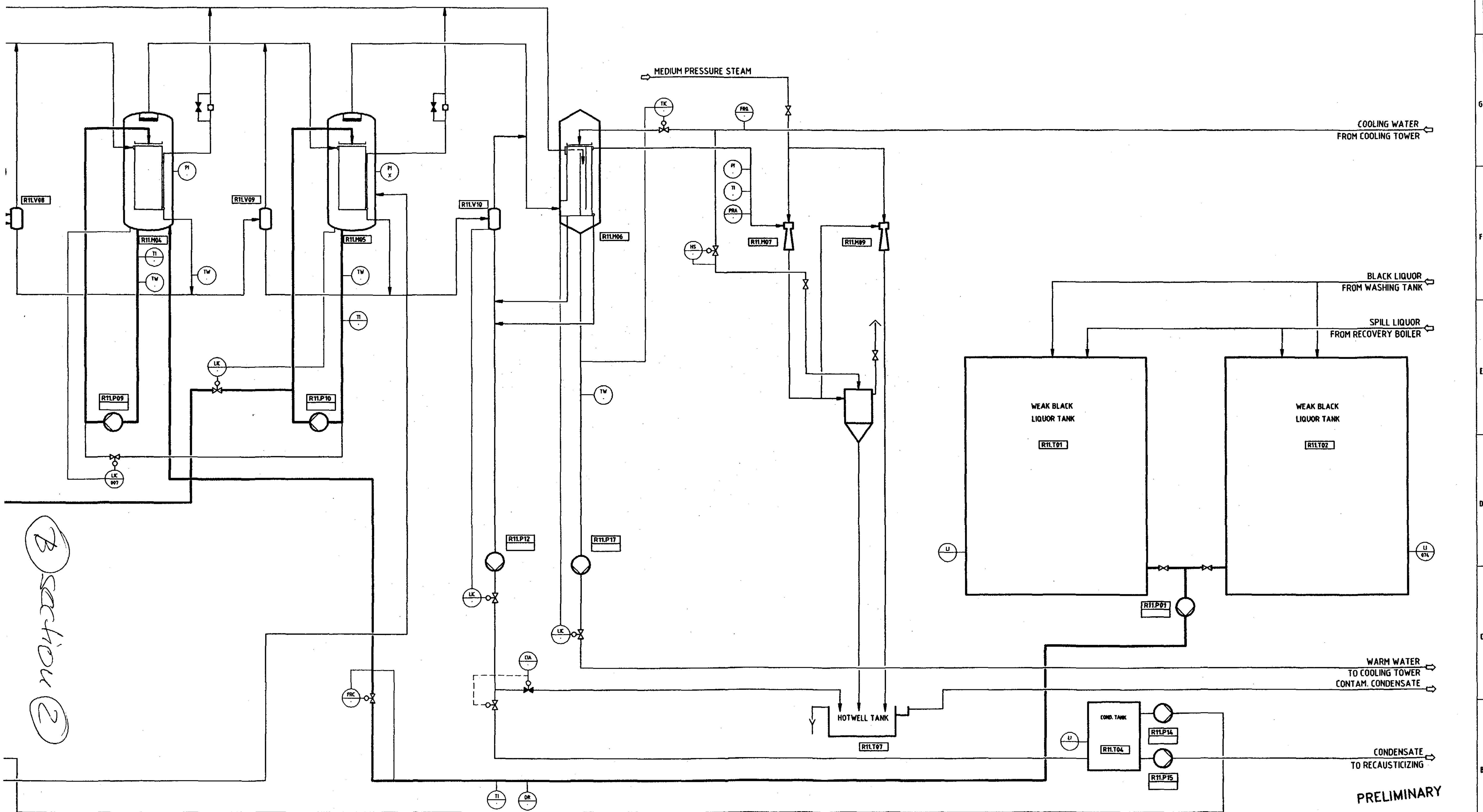
IVA - Doc - No.: ITC.ZF71 / ZVV 2101 E

Blatt Sheet | von of | Format Size: A1 | Änderung Revision: 0

ACAD - PART: JPMDRY



DEMI WATER
LP STEAM
TO RECOVER BOILER
STRONG LIQUOR TANK
R11.T03
R11.A01
R11.P16
ACID TANK
R11.T06
NaOH
R11.T05
R11.P11
STEAM CONDENSATE
TO FEEDWATER TREATMENT
R11.V01
R11.P02
R11.P03
R11.V03
R11.V04
R11.V05
R11.V06
R11.V07
R11.V08
R11.M01
R11.M02
R11.M03
R11.P04
R11.P06
R11.P08
R11.P13
ACAD - PART: JPMEVA



01		UPDATED	98.07.20	Nöstl.	Kreindl
Gezeichnet Drawn	20.04.98	GRUBER			
Geprüft Checked	20.04.98	KREINDL			

JUTE PULP MILL

PHASE III
EVAPORATION
FLOWSHEET

ITC.ZR11 / ZVV 2101 E

BX 01

SILENCER
TO TURBINES
PRQ
PR
PIC
LI
PI
LR
LIC
TR
DRUM
SOOT BLOWER
CONTINUOUS BLOW
SUPERHEATER
SAT BANK
ECONOMIZER
AR
Na3PO4
NaOH
ZR21.P17
*1
R21.C04
R21.G11
R21.C05
LOAD CARRING BURNER
R21.G13
TO MIXING TANK
POW
BOILE
SALT
SPRAY OSCILLATOR
R21.G08
TERTIARY AIR
SECONDARY AIR
AUXILIARY BURNER
R21.G12
PRIMARY AIR
MP STEAM
R21.G02
R21.E06
R21.E05
STEAM AIR HEATER
LP STEAM
DISSOLVING TANK
R21.T05
R21.A02
ALC
OIL HEATER
M.P. STEAM
TERTIARY FORCED DRAFT FAN
R21.F05
SECONDARY FORCED DRAFT FAN
R21.F04
PRIMARY FORCED DRAFT FAN
R21.F03
TO DEAERATOR
R21.T01
DRAIN POT
G.L. TRANSFER PUMP
R21.P10
R21.P11
SMELT SPOUT COOLING WATER HEAD TANK
R21.T03
R21.G02
CONDENSATE PUMP
ZR21.P01
ZR21.P02
GREEN LIQUOR TO RECAUSTICIZING
WEAK LIQUOR FROM RECAUST.
FROM DEAERATOR FEEDWATER PUMPS
section 1
ACAD - PART:JPMRECB1

SILENCER

Na3PO4 NaOH

N2H4

NH3

ZR21.P17

ZR21.P18

ZR21.P19

L.P. STEAM

DEAERATOR ZR21.T10

CONT BLOW

SAT BANK

ECONOMIZER

R21.P20

STEAM TURBINE

R21.P21

BOILER FEED WATER PUMP

R21.C04

R21.G11

R21.C05

POWER BOILER

SALTCAKE

R21.T07

FEEDER

CONVEYOR

R21.C10

R21.C07

FROM BOILER

R21.G1

TO MIXING TANK

M.P. STEAM

R21.C06

MIXING TANK ZR21.T04

R21.P05

R21.E09

DIRECT HEATER

R21.P06

B.L. FUEL PUMP

TO DUMPTANK

M.P. STEAM

R21.G02

DISSOLVING TANK

R21.T05

R21.A02

M.P. STEAM

R21.E10

OIL HEATER

R21.P15

OIL PUMP

R21.P16

OIL TANK

ZD51.T02

G.L. TRANSFER PUMP

R21.P10

R21.P11

SMELT SPOUT COOLING WATER HEAD TANK

C.W.

R21.T03

R21.E08

COOLER

R21.G02

R21.P03

R21.T02

R21.P04

COOLING WATER RESERVOIR TANK

COOLING WATER PUMPS

GREEN LIQUOR TO RECAUSTICIZING

WEAK LIQUOR FROM RECAUST.

FROM DEAERATOR FEEDWATER PUMPS

C section 2

NH3

18 ZR21.P19

TO FEED WATER TREATMENT

FEED WATER

L.P. STEAM

PIC

DEAERATOR ZR21.T10

PRQ

CONTINUOUS BLOW

FLASH TANK ZR21.T11

R21.T12

BLOW TANK

R21.P20

STEAM TURBINE

R21.P21

BOILER FEED WATER PUMP

POWER BOILER TO TURBINE AREA

R21.T07

FEEDER

CONVEYOR

R21.C10

R21.C07

FROM BOILER

R21.G17

TR

PI

R21.F07

STACK R21.G21

M.P. STEAM

R21.C06

MIXING TANK ZR21.T04

LIC

R21.P05

R21.E09

DIRECT HEATER

R21.P06

B.L. FUEL PUMP

TO DUMPTANK

DUMP TANK R21.T06

R21.P14

TO EVAPORATION

DUMP TANK PUMP

BLACK LIQUOR FROM EVAPORATION

R21.P15

OIL TANK ZD51.T02

OIL PUMP R21.P16

C.W.

R21.E08

BOILER

R21.P03

R21.P04

COOLING WATER PUMPS

PRELIMINARY

01		UPDATED	98.07.21	Nöstl.	Kreindl
			20.04.98	GRUBER	
			20.04.98	KREINDL	

JUTE PULP MILL

PHASE III
RECOVERY BOILER
FLOWSHEET

IVA-Doc-No.: ITC.ZR21 / ZVV 2101 E

Format/Size A0 | Änderungsindex/Revision 01

Section 3

BURNT LIME FROM LIME KILN
PROCESSWATER
HOTWATER
CONDENSATE FROM EVAPORATION PLANT
LP STEAM
GREEN LIQUOR
WEAK WHITE LIQUOR
TO DISSOLVING TANK

G01
GREEN LIQUOR HEATER
TRC

R33.G03
XA
R33.C07
LIA H
LIA L
BURNT LIME SILO
R33.T13
BURNT LIME
FROM KILN

R33.T02
SPLITT BOX

GREEN LIQUOR
CLARIFIER
R33.M01
WIA H
M M
FRCQ
PI
R33.P03
R33.P04
LIA H L
R33.T01
LAND
FILLING

R33.C02
R33.C01
WRCQ
R33.M11
R33.M03
G.L. SLAKER
TR
LAND
FILLING
SA

KC
PI
R33.P01
KC
PI
R33.P02

R33.A02
R33.P21
LIME MILK
STORAGE TANK
R33.T12

TO WATER TREATMENT

FI
DREGS FILTER
R33.M02
R33.V01
FILTRATE
RECEIVER
FI

COLLECTING B
R33.T08
LIME MUD MIXE
R33.A01
LIME MUD MIXING
TANK
R33.T09

DREGS
TROLLEY
R33.P20
LIC
R33.P19
VACUUM PUMP

HIC
R33.P12
R33.P11
HIC

(D) section (1)

EEN LIQUOR HEATER

TRC

R33.G03

XA

R33.C07

LIA H

BURNT LIME SILO

LIA L

BURNT LIME FROM KILN

R33.T13

R33.G02

SCRUBBER

R33.T02

SPLITT BOX

R33.C02

R33.C01

WRCO

TR

R33.M11

R33.M03

G.L. SLAKER

SA

LAND FILLING

LAND FILLING

CAUSTICIZER

R33.M04

R33.M05

R33.M06

R33.T03

R33.T04

R33.T05

TI

LAND FILLING

R33.A02

R33.P21

LIME MILK STORAGE TANK

R33.T12

LICA H L

SUMP TANK

R33.T06

R33.P06

PI

HIC

R33.P05

DIR

R33.V01

FILTRATE RECEIVER

FI

COLLECTING BOX

R33.T08

LIME MUD MIXER

R33.A01

LIME MUD MIXING TANK

R33.T09

WRA

ZS

LIME MUD WASHER

R33.M08

R33.P20

R33.P19

VACUUM PUMP

LIC

LIA H L

R33.P13

R33.T10

HIC

R33.P12

R33.P14

R33.P11

HIC

DIR

R33.M09

LIA H L

R33.T11

R33.P16

R33.P15

LIME MUD STORAGE TANK

DIC

PI

FRC

FI

R33.V02

R33.P18

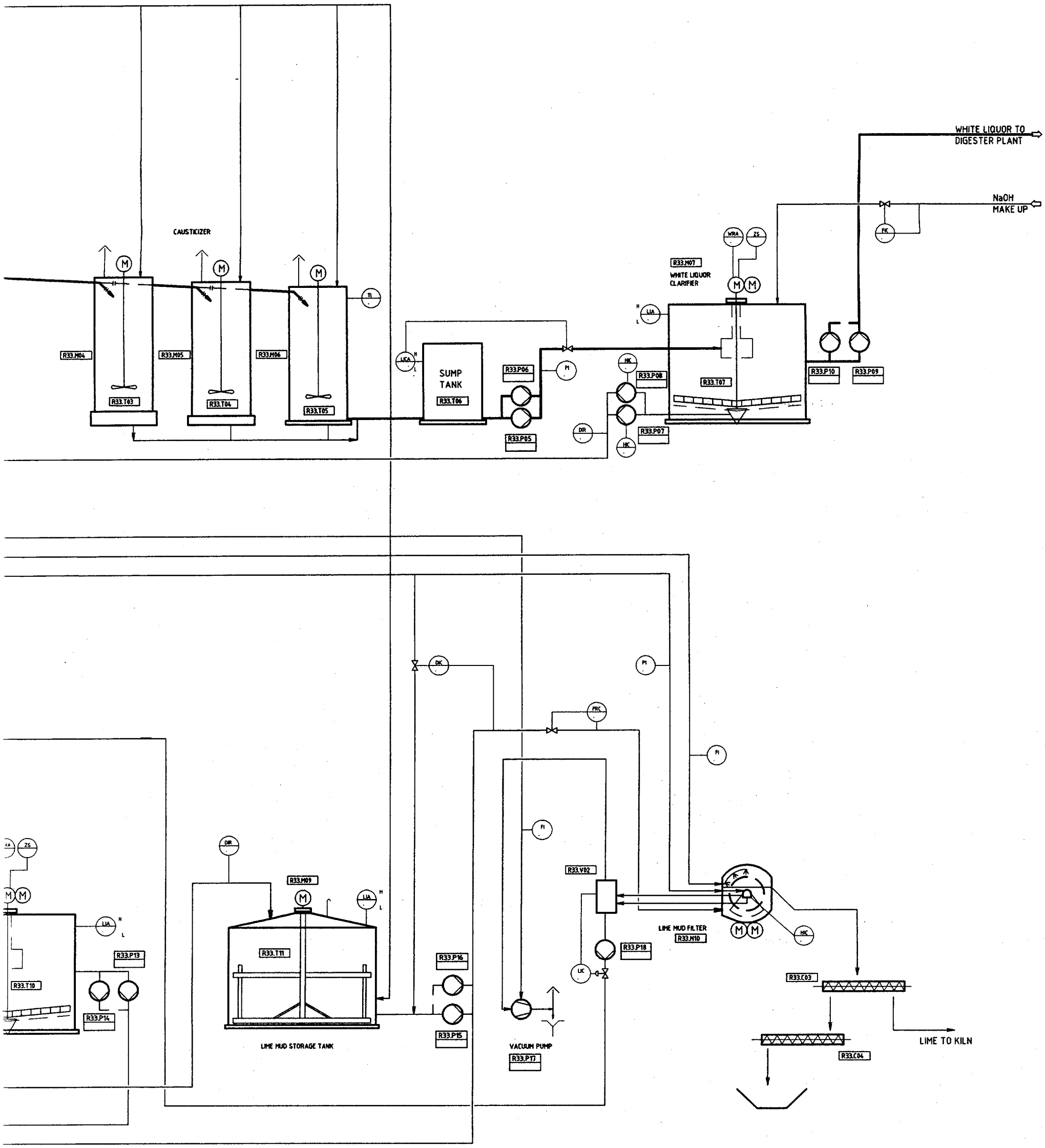
LIC

VACUUM PUMP

R33.P17

D section 2

11 10 9 8 7 6 5 4

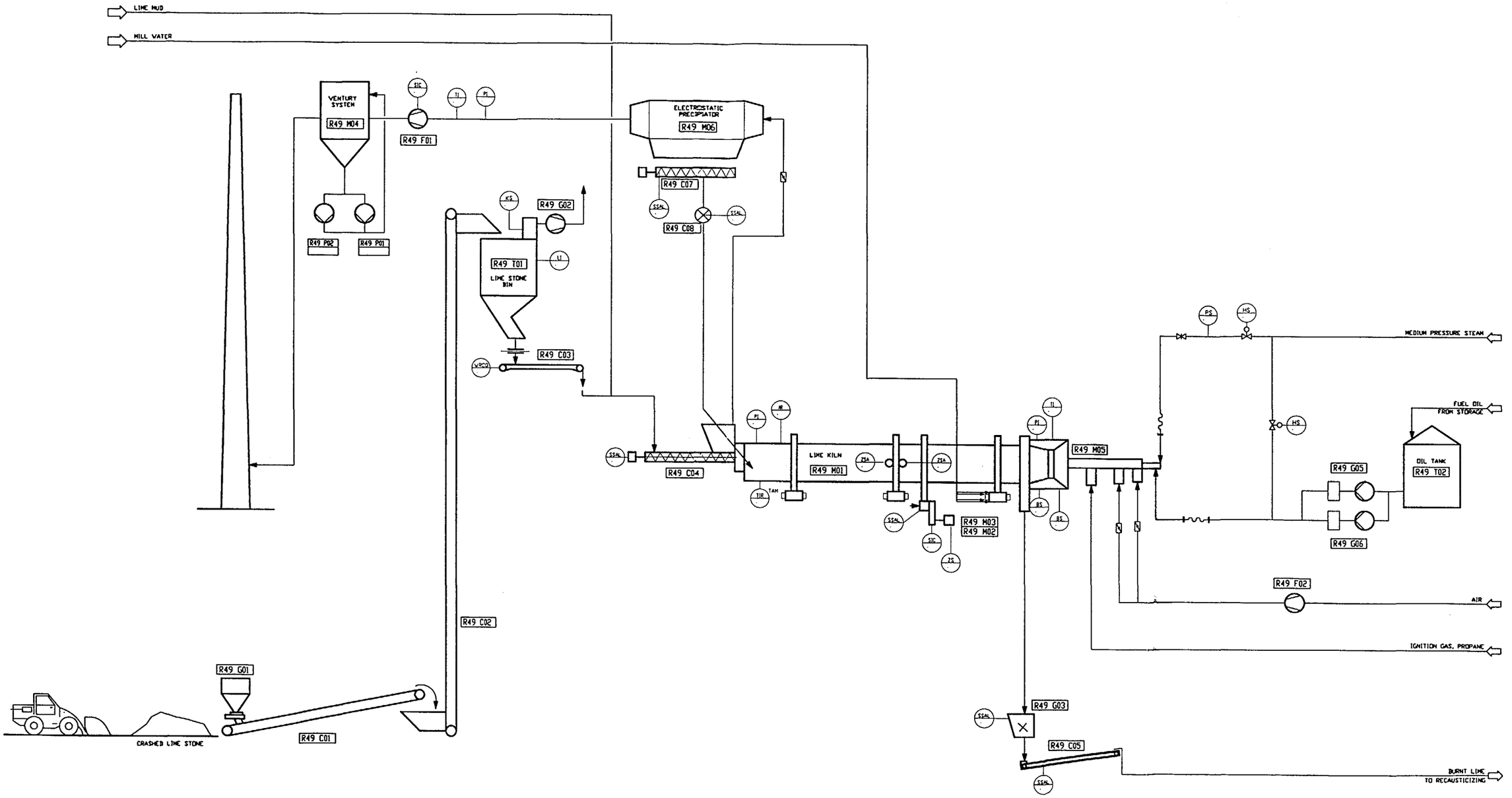


PRELIMINARY

D section 3

Änderung Revision	Anz. d. Änd. No. of Mod.	Änderungsinhalt Modification		Datum Date	Gezeichnet Made by	Geprüft Checked by
	Datum Date	Name Name				
Gezeichnet Drawn	20.04.98	GRUBER				
Geprüft Checked	20.04.98	KREINDL				
Projekt/Customer	JUTE PULP MILL		Benennung/Title	Phase III RECAUSTICIZING FLOWSHEET		Maßstab/Scale
Kunden/Customer-Doc-No.			IVA-Doc-No.	ITC.ZR33 / ZVV 2101 E		Format Size A0

8 7 6 5 4 3 2 1



PRELIMINARY

Änderung Revision	Anz. d. Änd. No. of Mod.	Änderungsinhalt Modification		Datum Date	Bearbeitet Made by	Gepr'ft Checked by	
	Datum Date	Name Name					
Durchgef. Drawn	20.04.98	GRUBER					
Geprüft Checked	20.04.98	KREINDL					
Projekt/Customer			Benennung/Title				Masse/Mass
JUTE PULP MILL			Phase III ZR49 LIME KILN FLOWSHEET				Werkstoff/Material
Kunden/Customer-Doc-No.			IVA-Doc-No.	ITC.ZR49 / ZVV 2101 E		Blatt Sheet	Format Size A1

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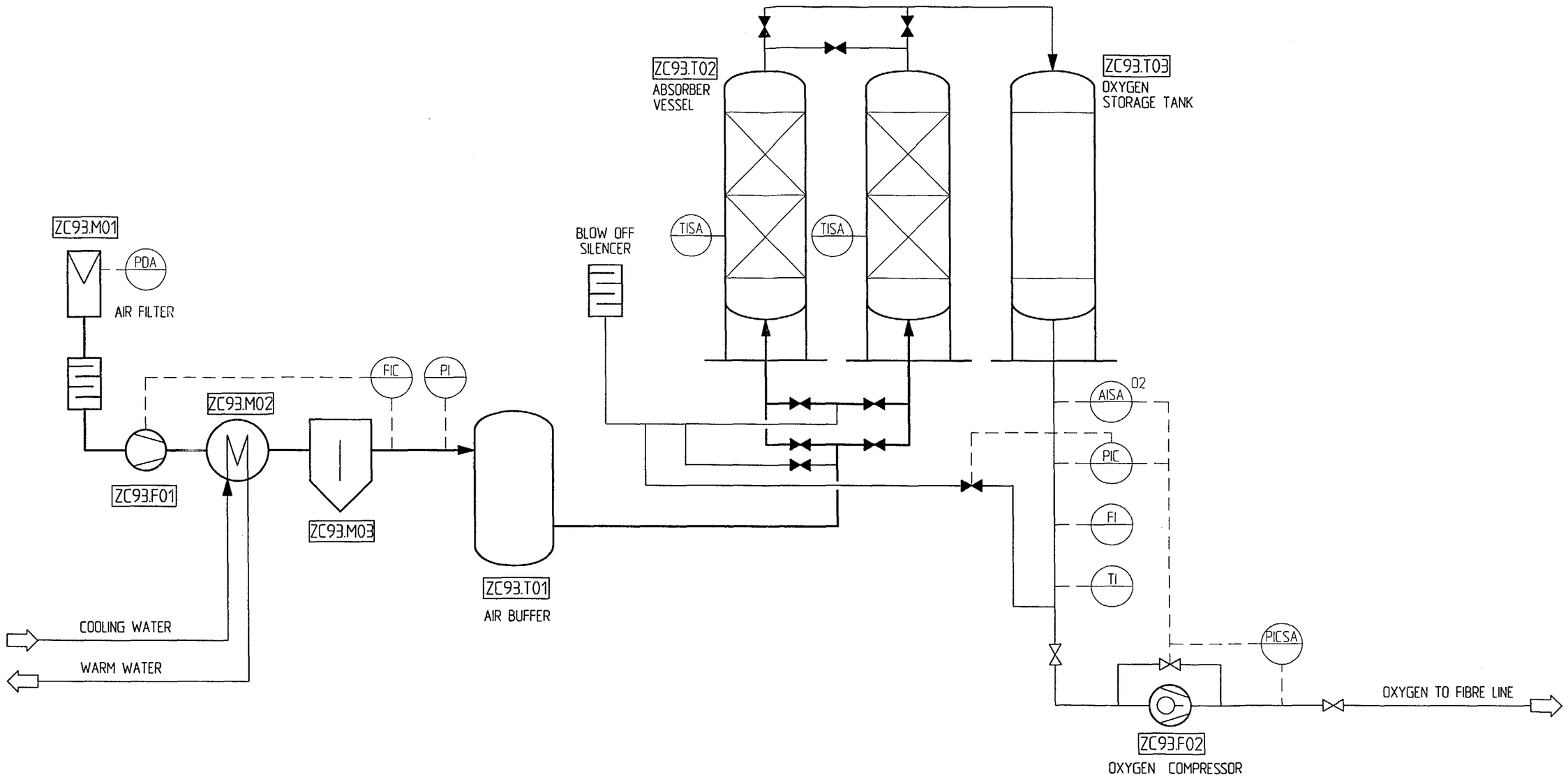

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Änderung Revision	Anz. d. And. No. of Mod.	Änderungsinhalt Modification	Datum Date	Bearbeitet Made by	Geprüft Checked by

	Datum Date	Name Name
Gezeichnet Drawn	98.07.08	Nöstl.
Geprüft Checked	98.07.08	Kreindl

Maßstab/Scale: 1:25

Hersteller/Manufacturer: IMPCO-VOEST-ALPINE Pulping Technologies GmbH

Herstellerzeichnungs-Nr./Manufacturer Dwg. No.

Projekt/Customer: **JUTE PULP MILL**

Benennung/Title: PHASE III
OXYGEN GENERATION PLANT
FLOW SHEET

Masse/Mass

Werkstoff/Material

Kunden/Customer-Doc-No.

IVA-Doc-No.: ITC.ZC93 / ZVV-2101 E

Blatt Sheet	von of	Format Size	Änderung Revision
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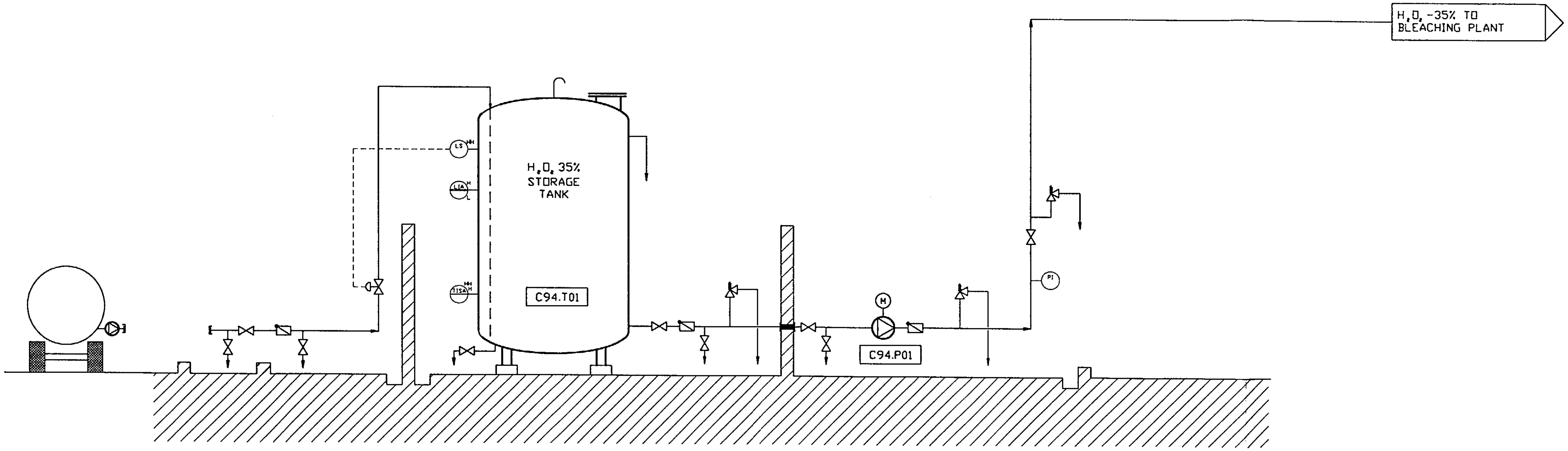
ACAD - PART: JPMOXY1

PLOT ZURÜCK AN IVA / STEININGER (BG39) - TEL. 3694



ACAD - PART: JPMH202

PRELIMINARY

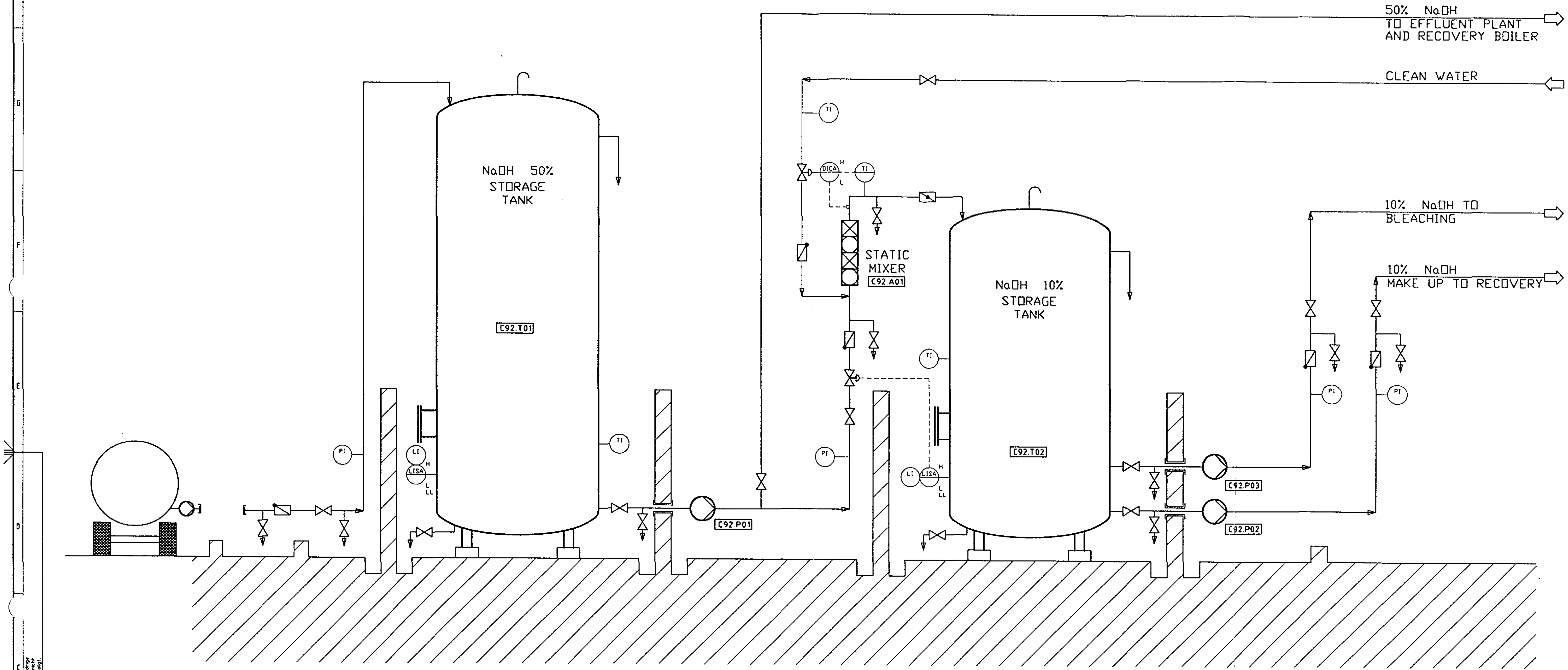
Änderung Revision	Anz. d. Änd. No. of Mod.	Änderungsinhalt Modification	Datum Date	Bearbeitet Made by	Geprüft Checked by
	Datum Date	Name Name			
Gezeichnet Drawn	20.04.98	GRUBER			
Geprüft Checked	20.04.98	KREINDL			

Projekt/Customer	Benennung/Title	Format Size
JUTE PULP MILL	Phase III H_2O_2 - STORAGE FLOWSHEET	A1

Kunden/Customer-Doc-No.

IVA-Doc-No.: ITC.ZC94 / ZVV 2101 E

PLOT ZURUCK AN IVA / STEININGER (BG39) - TEL. 3694



PRELIMINARY

Gezeichnet Drawn	20.04.98	GRUBER
Geprüft Checked	20.04.98	KREINDL

IVA

JUTE PULP MILL

Phase III

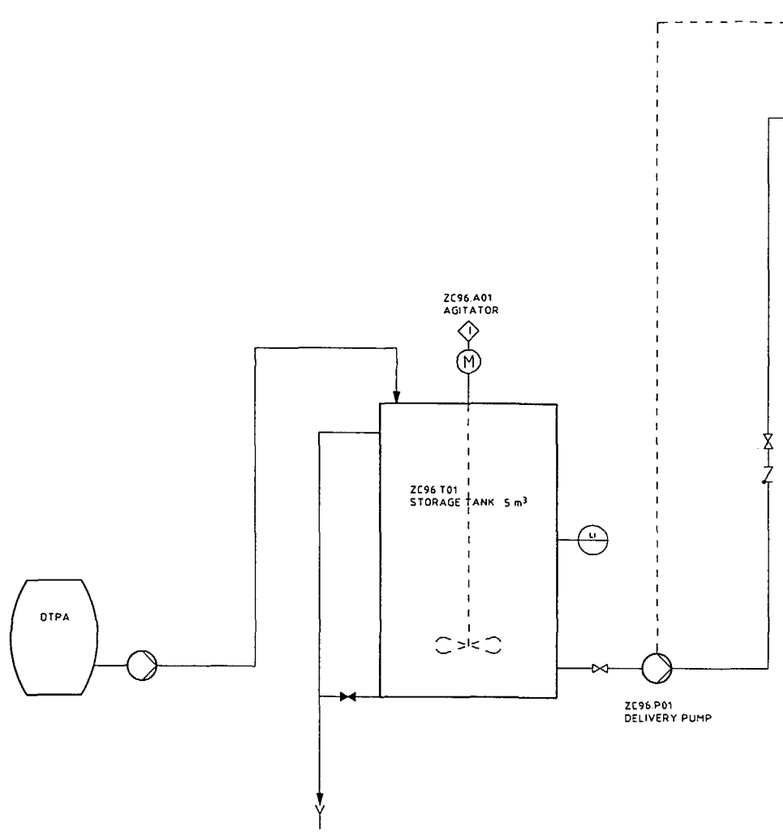
CAUSTIC STORAGE & DILUTION

FLOWSHEET

ITC.ZC92 / ZVV 2101 E

A1

ACAD - PART: JPMCSO



PRELIMINARY

Änderung Revision	Anz. d. Änd. No. of Mod.	Änderungsinhalt Modification	Datum Date	Bearbeitet / Issued by	Geprüft / Checked by	
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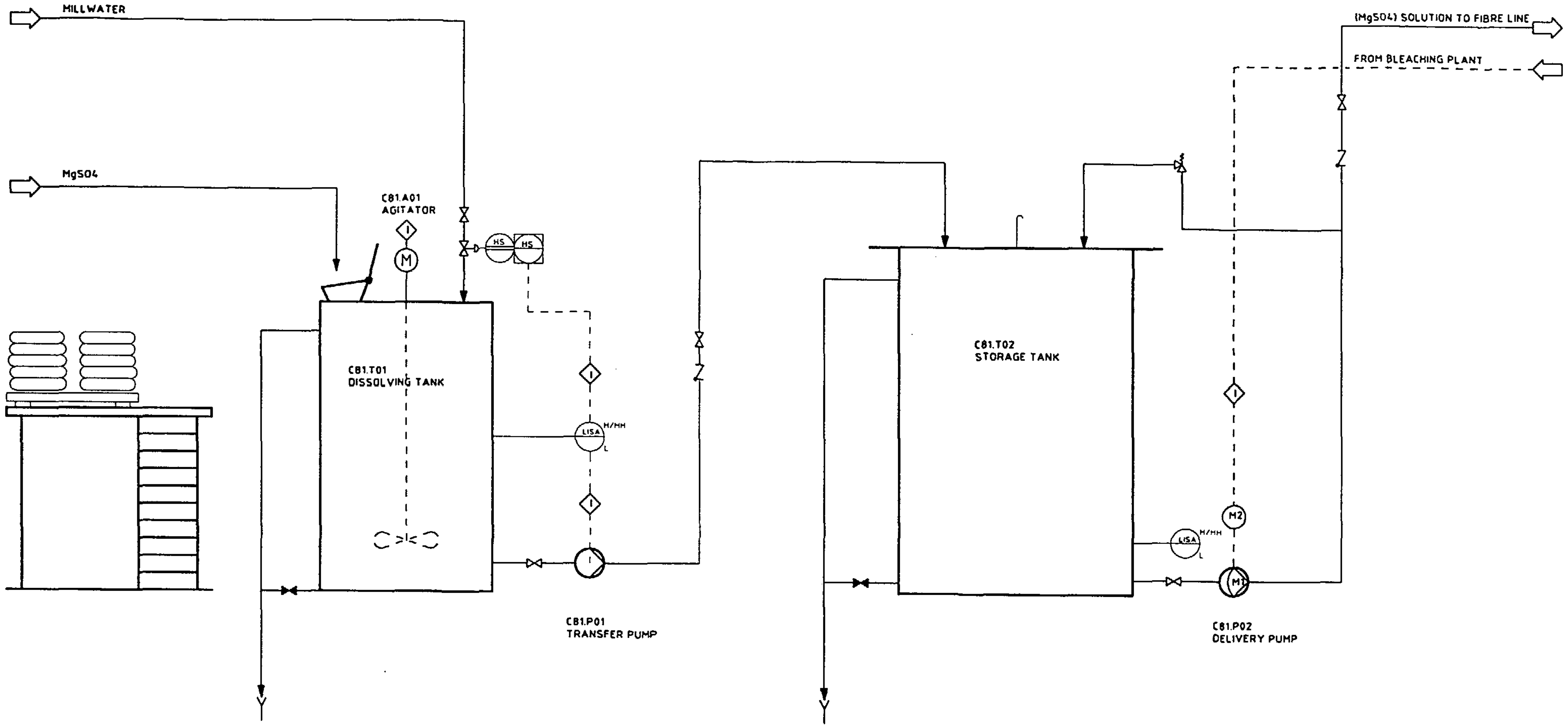
Gezeichnet Drawn	20.04.98	GRUBER				
Geprüft Checked	20.04.98	KREINDL	Maßstab / Scale	Herkunftsbezeichnung / Manufacturer's Dwg. No.		
					IVA	
					IMPCO-VOGT-ALPINE Pumping Technologies GmbH	

Projekt / Customer	Benennung / Title		Masse / Mass
JUTE PULP MILL	Phase III DTPA DOSING STATION FLOWSHEET		Werkstoff / Material
Kunden / Customer - Dwg.-No.	IVA - Dwg.-No.	Blatt / Sheet — von / of	Format / Size
	ITC.ZC96 / ZVV 2101 E		A1

ACAD - PART: JPMDISS4

PLOT ZURÜCK AN IVA / STEININGER (BG39) - TEL. 3694



PRELIMINARY

Gezeichnet / Drawn	20.04.98	GRUBER
Geprüft / Checked	20.04.98	KREINDL

IVA

Projekt/Customer: JUTE PULP MILL

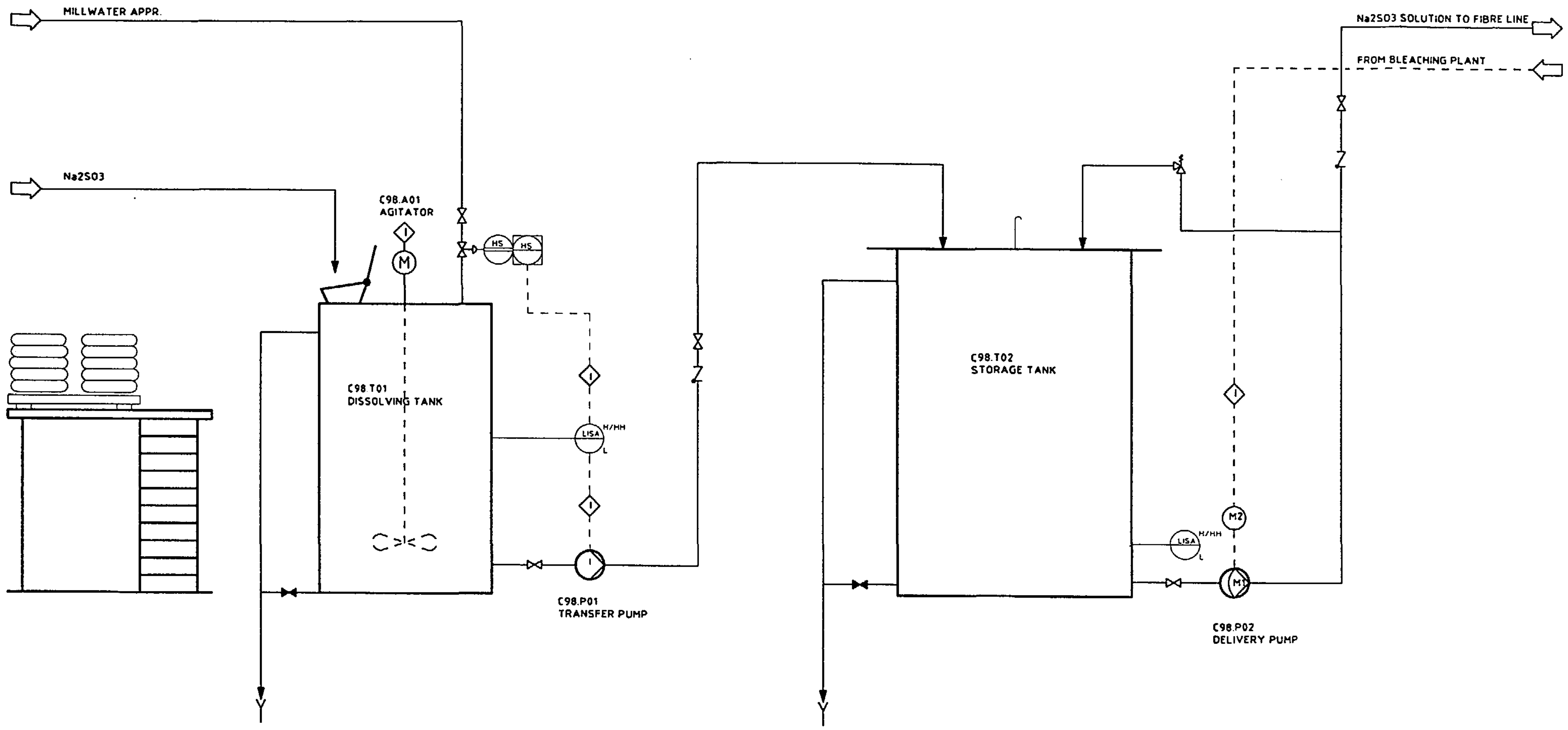
Benennung/Title: Phase III
MgSO DISSOLVING STATION
FLOWSHEET

IVA-Doc-No.: ITC.ZC81 / ZVV 2101 E

Format/Size: A1

ACAD - PART: JPMDISS2

PLOT ZURÜCK AN IVA / STEININGER (BG39) - TEL. 3694

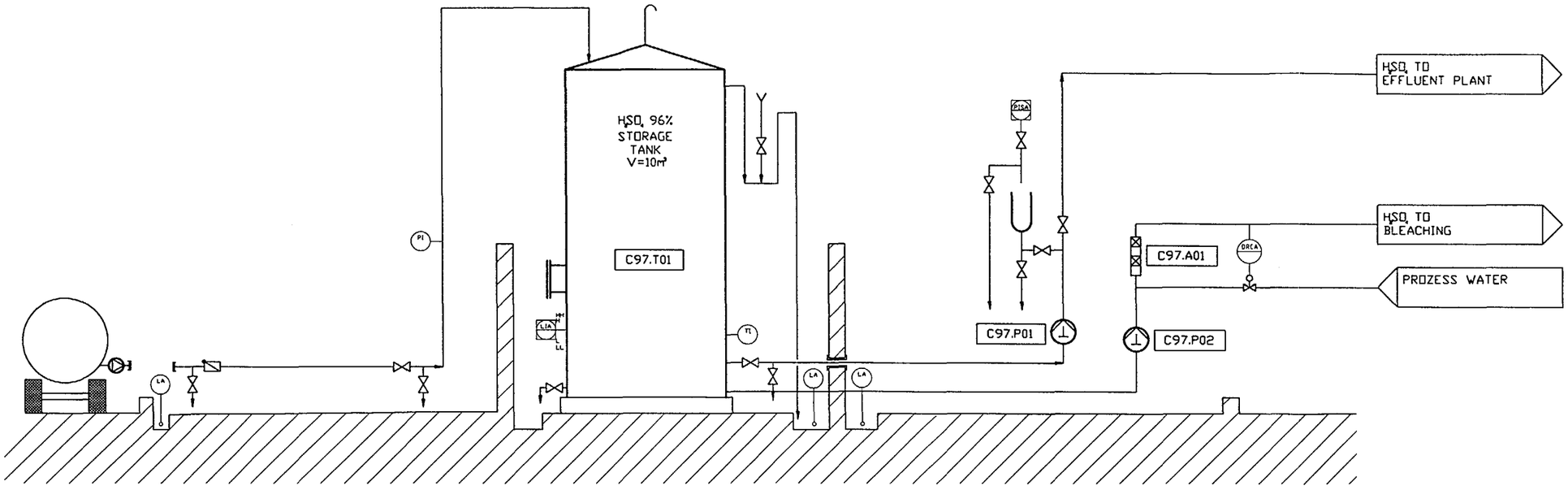


PRELIMINARY

Gezeichnet / Drawn	20 04 98 GRUBER
Geprüft / Checked	20 04 98 KREINDL
Projekt/Customer	JUTE PULP MILL
Benennung/Title	Phase III Na_2SO_3 DISSOLVING STATION FLOWSHEET
IVA-Doc-No.	ITC.ZC98 / ZVV 2101 E
Format/Size	A1

IVA Pulping Technologies GmbH

ACAD - PART: JPMDISS1



PRELIMINARY

Änderung Revision	Anz. d. Änd. No. of mod.	Änderungsgrund Modification	Datum Date	Bearbeitet Made by	Geprüft Checked by
	Datum Date	Name Name			
Bearbeitet Drawn	20.04.98	GRUBER			
Geprüft Checked	20.04.98	KREINDL			

Maßstab/Scale

Hersteller/Manufacturer

IVA

Projekt/Customer: JUTE PULP MILL

Benennung/Title: Phase III
H_2SO_4 - STORAGE
FLOWSHEET

Masse/Mass

Werkstoff/Material

Kunden/Customer-Doc-No

IVA-Doc-No.: ITC.ZC97 / ZVV 2101 E

Blatt Sheet | von of | Format Size: A1 | Änderung Revision

ACAD - PART: JPMH2S04

SIGNAL FROM FIC COOKING LIQUOR

Anthraquinone SOLUTION TO FIBRE LINE

ZC95 A01
AGITATOR

ZC95 T01
STORAGE TANK 5 m³

LI

Anthraquinone

ZC95 P01
DELIVERY PUMP

PRELIMINARY

Änderung Revision	Änd. a. Änd. No. of Mod.	Änderungsinhalt Modification	Datum Date	Bearbeitet Made by	Geprüft Checked by
	Datum Date	Name Name			
Gezeichnet Drawn	20.04.98	GRUBER			
Geprüft Checked	20.04.98	KREINDL			

IMPCO-VOEST-ALPINE Pulping Technologies GmbH

Projekt/Customer: JUTE PULP MILL

Benennung/Title: Phase III
Anthraquinone
DOSING STATION
FLOWSHEET

Kunden/Customer-Doc-No.:

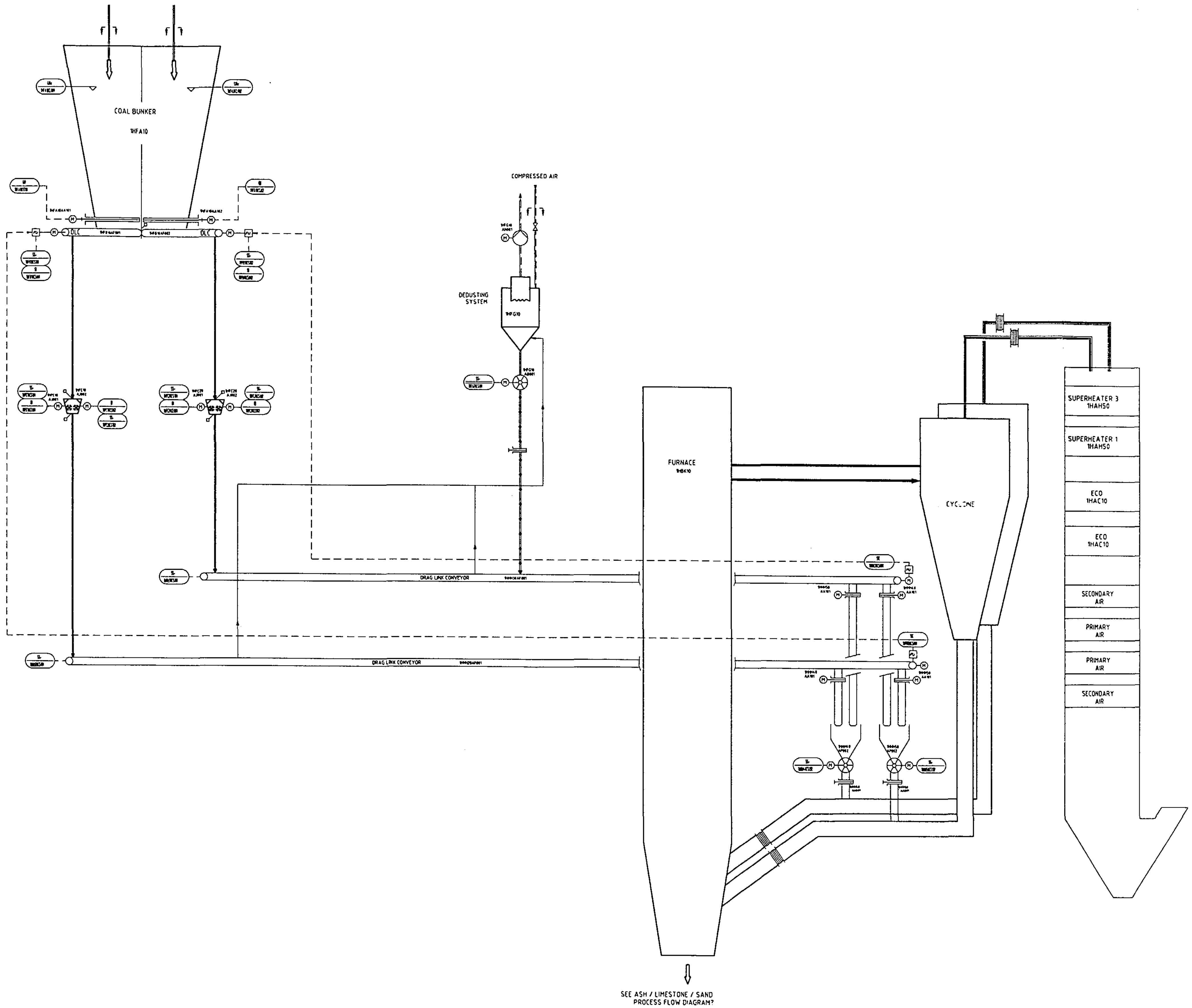
IVA-Doc-No.: ITC.ZC95 / ZVV 2101 E

Blatt Sheet — von of

Format Size A1

ACAD - PART JPMDISS3

PLOT ZURÜCK AN IVA / STEININGER (BG 39) - / TEL 3694



PRELIMINARY

30.04.90	GRUBER	
30.04.90	KRENDL	

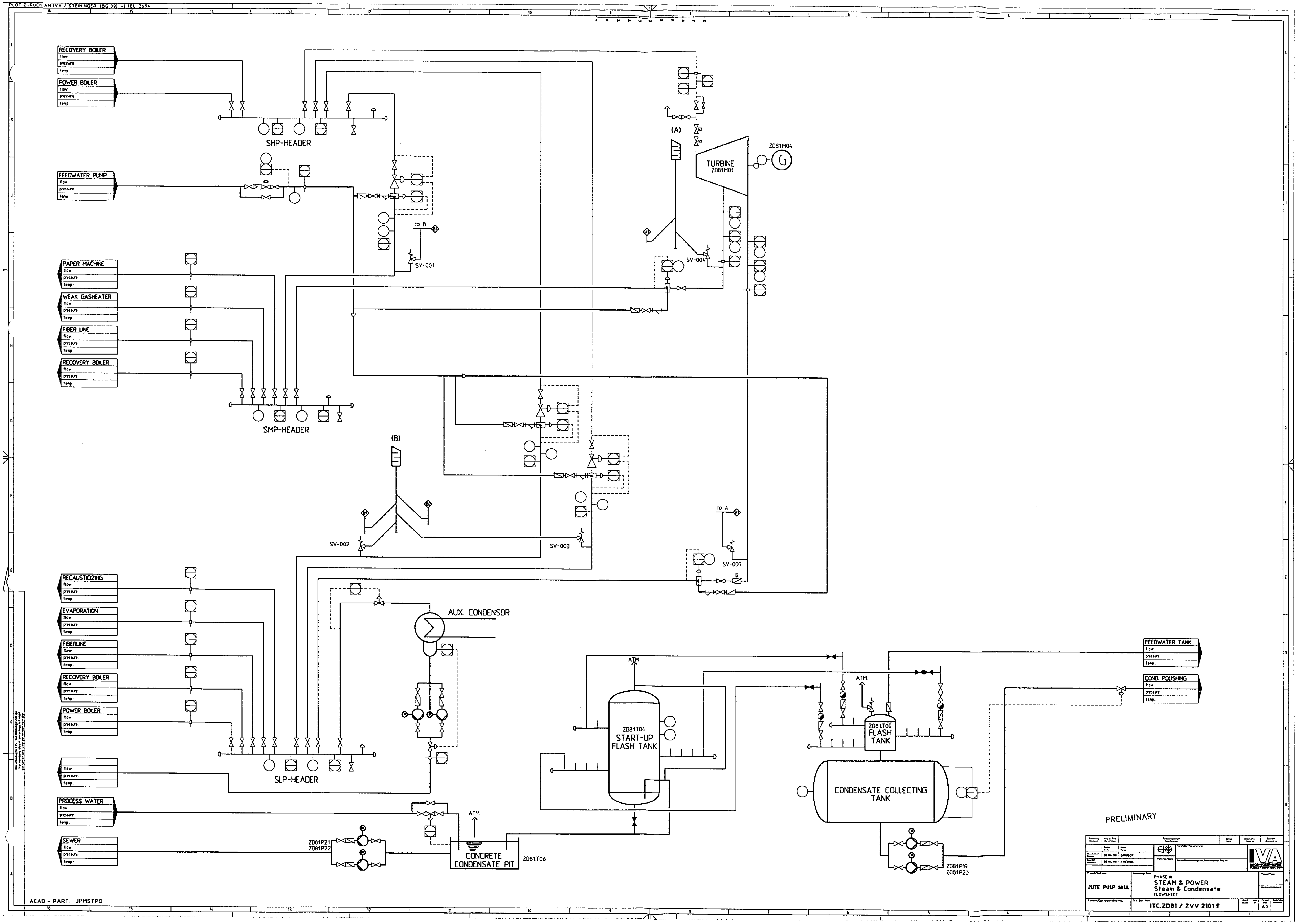
JUTE PULP MILL

PHASE III
POWER BOILER
COAL FEEDING
FLOWSHEET

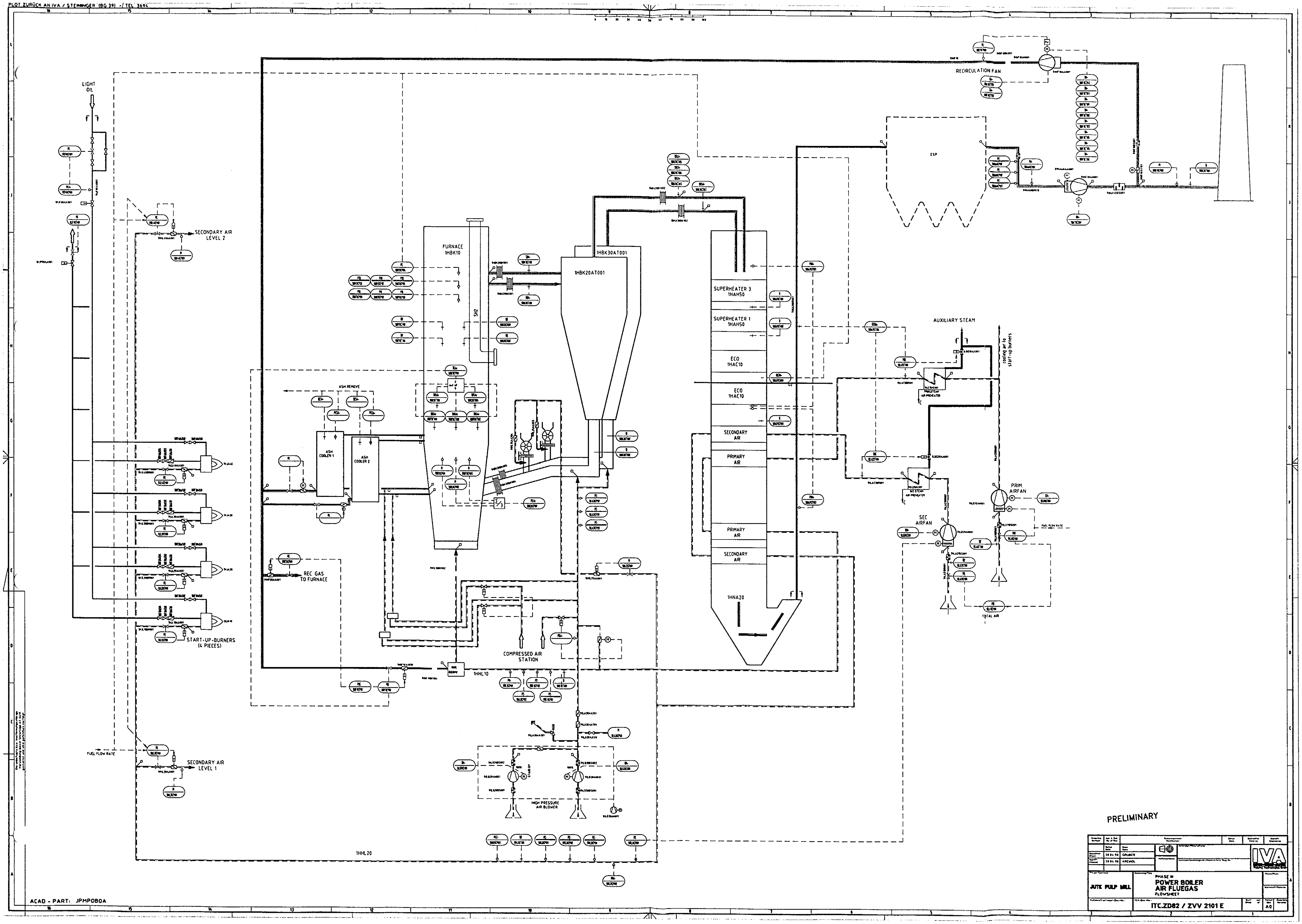
ITC.ZD53 / ZVV 2101 E

A0

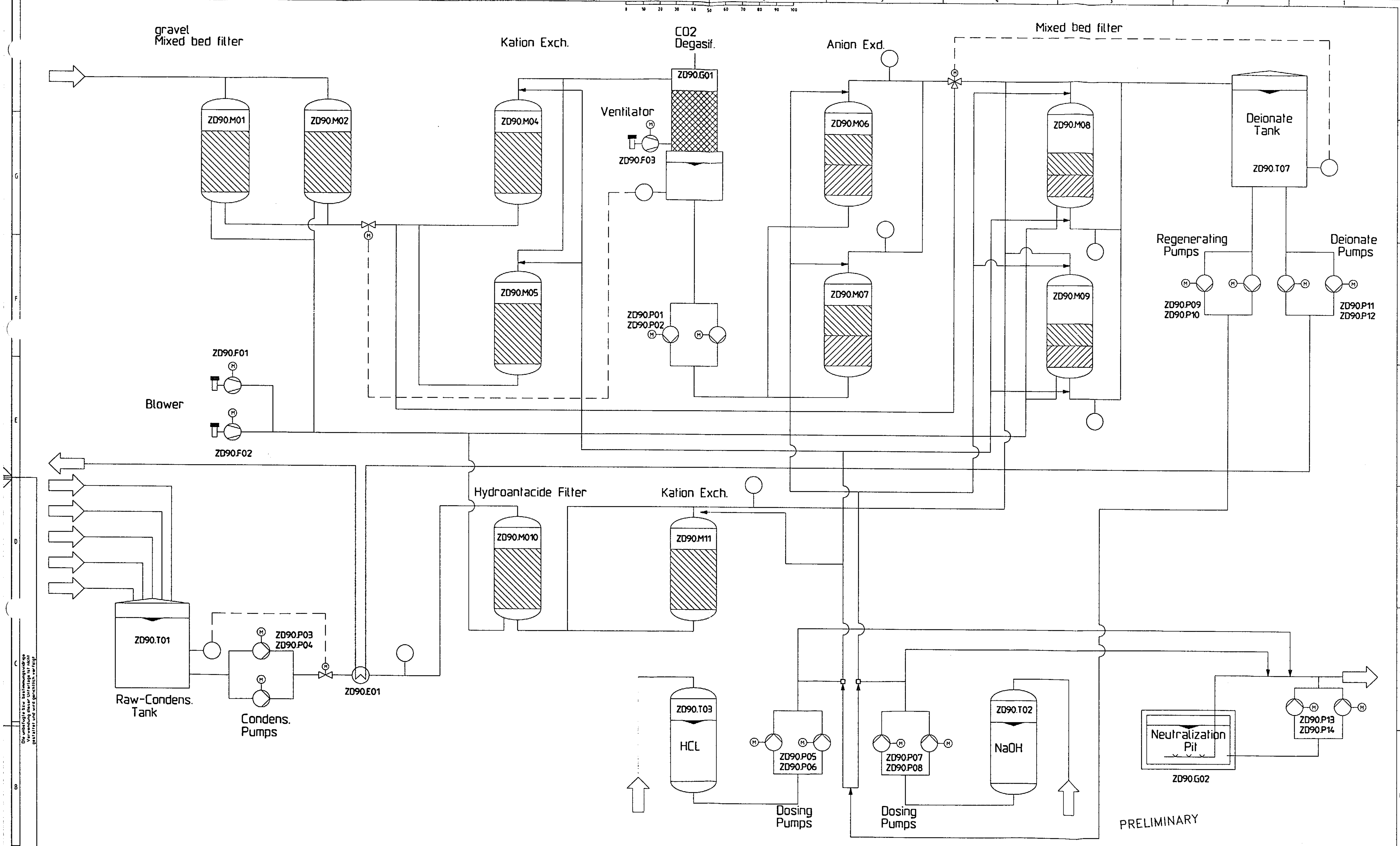
ACAD - PART: JPMPOBOC



PLOT ZURUCK AN IVA / STEININGER (BG 39) - / TEL 3694
RECOVERY BOILER
flow
pressure
temp
POWER BOILER
flow
pressure
temp
SHP-HEADER
FEEDWATER PUMP
flow
pressure
temp
to B
SV-001
(A)
TURBINE
Z081M01
Z081M04
G
SV-004
PAPER MACHINE
WEAK GASHEATER
FIBER LINE
RECOVERY BOILER
SMP-HEADER
(B)
SV-002
SV-003
to A
SV-007
RECAUSTICIZING
EVAPORATION
FIBERLINE
RECOVERY BOILER
POWER BOILER
AUX. CONDENSOR
SLP-HEADER
PROCESS WATER
SEWER
Z081P21
Z081P22
ATM
CONCRETE
CONDENSATE PIT
Z081T06
Z081T04
START-UP
FLASH TANK
Z081T05
FLASH
TANK
CONDENSATE COLLECTING
TANK
Z081P19
Z081P20
FEEDWATER TANK
COND. POLISHING
PRELIMINARY
ACAD - PART: JPMSTPO
30.04.96 GRUBER
30.04.96 KRENDL
IVA
JUTE PULP MILL
PHASE III
STEAM & POWER
Steam & Condensate
FLOWSHEET
ITC.Z081 / ZVV 2101 E
A0


PLOT ZURÜCK AN IVA / STEININGER (BG 39) -/ TEL 3694
LIGHT OIL
SECONDARY AIR LEVEL 2
FURNACE 1HBK10
SH2
1HBK30AT001
1HBK20AT001
SUPERHEATER 3 1HAH50
SUPERHEATER 1 1HAH50
ECO 1HAC10
ECO 1HAC10
SECONDARY AIR
PRIMARY AIR
PRIMARY AIR
SECONDARY AIR
1HNA20
ESP
RECIRCULATION FAN
AUXILIARY STEAM
cooling air to start-up burners
PRIM. AIRFAN
SEC AIRFAN
FUEL FLOW RATE
TOTAL AIR
ASH REMOVE
ASH COOLER 1
ASH COOLER 2
REC GAS TO FURNACE
START-UP-BURNERS (4 PIECES)
COMPRESSED AIR STATION
1HHL10
SECONDARY AIR LEVEL 1
HIGH PRESSURE AIR BLOWER
1HHL20
PRELIMINARY
ACAD - PART: JPMPOBOA
JUTE PULP MILL
PHASE III
POWER BOILER
AIR FLUEGAS
FLOWSHEET
ITC.ZD82 / ZVV 2101 E
A0

PLOT ZURÜCK AN IVA / STEININGER (BG39) - TEL. 3694



Datum / Date	Name		
Gezeichnet / Drawn	30.04.98	GRUBER	
Geprüft / Checked	30.04.98	KREINDL	

IVA — IMPCO-VOEST-ALPINE Pulping Technologies GmbH

Projekt/Customer: JUTE PULP MILL

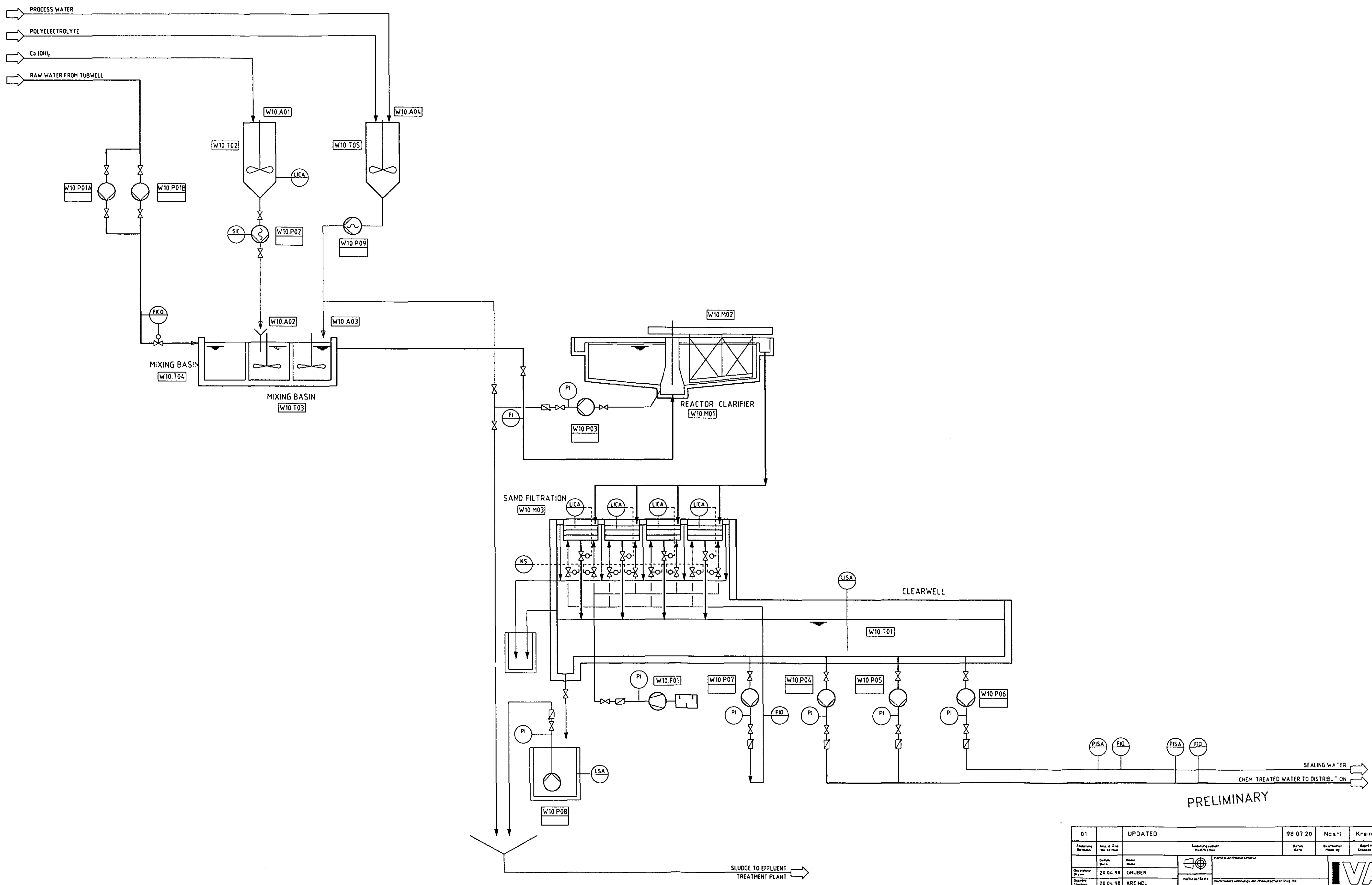
Benennung/Title: PHASE III
DEMINERALIZATION-PLANT
CONDENSATE-POLISHING PLANT
FLOWSHEET

IVA-Doc.-No.: ITC.ZD90 / ZVV 2101 E

Format/Size: A1

ACAD - PART: JPMDEMIN

PLOT ZURUCK AN IVA / STEININGER (BG39) - TEL 3694



PRELIMINARY

01		UPDATED	98 07 20	Nest'l	Kreindl
Änderung Revision	Anz. d. Änd. No. of Mod.	Änderungsinhalt Modification	Datum Date	Bearbeiter Made by	Geprüft Checked by

	Datum Date	Name Name
Gezeichnet Drawn	20 04 98	GRUBER
Geprüft Checked	20 04 98	KREINDL

Maßstab/Scale

Hersteller/Manufacturer

Herstellerzeichnungs-Nr./Manufacturer Dwg. No.

IVA
IMPCO–VOEST–ALPINE Pumping Technologies GmbH

Projekt/Customer: JUTE PULP MILL

Benennung/Title: Phase III
RAW WATER TREATMENT
FLOWSHEET

Kunden/Customer-Doc.-No.:

IVA-Doc.-No.: ITC.ZW10 / ZVV 2101 E

Format Size: A1
Änderung Revision: 01

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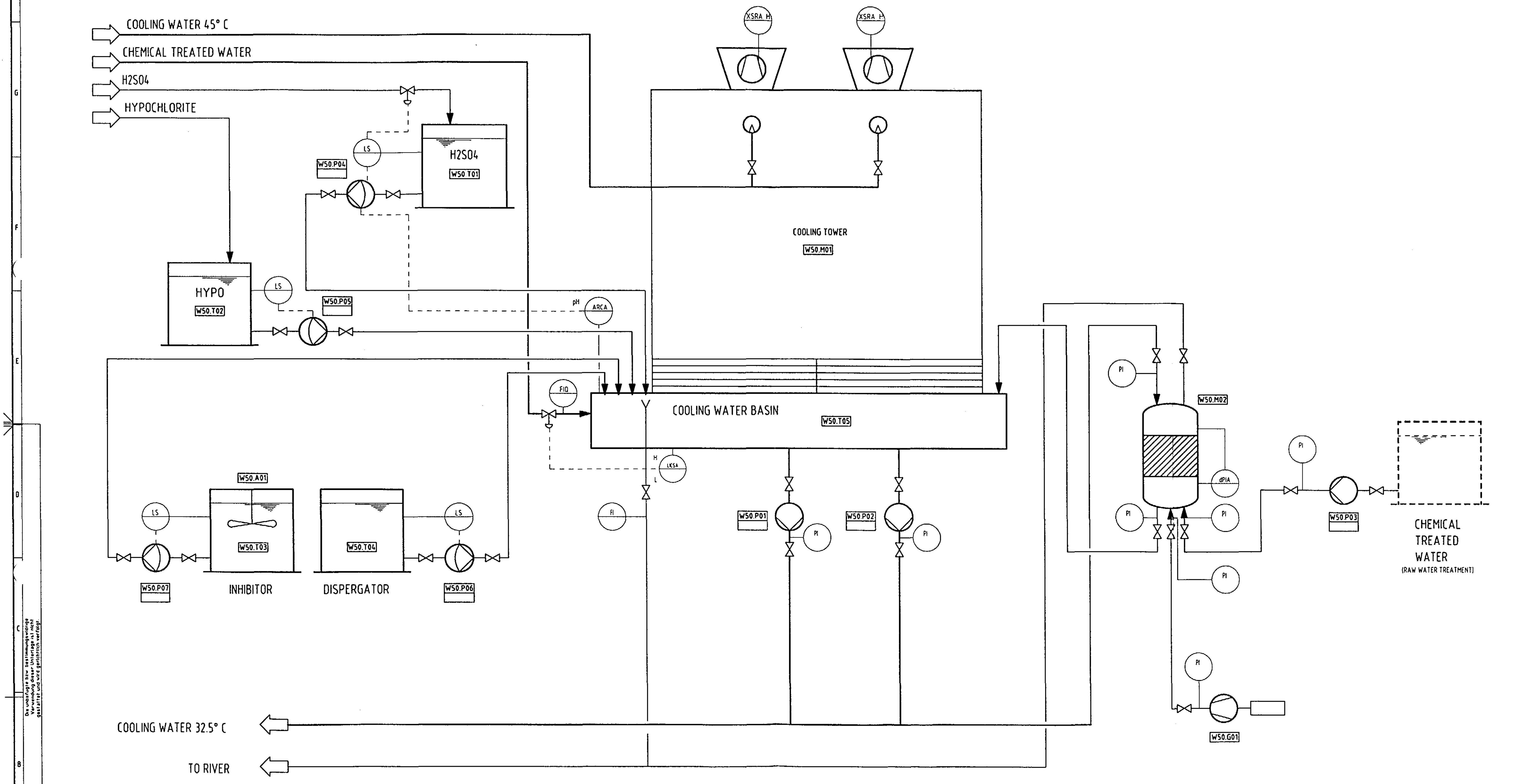
PLOT ZURÜCK AN IVA / STEININGER (BG39) - TEL. 3694



PRELIMINARY

Gezeichnet Drawn	20.04.98	GRUBER
Geprüft Checked	20.04.98	KREINDL

IVA

Projekt/Customer: JUTE PULP MILL

Benennung/Title: PHASE III
COOLING WATER PLANT
FLOWSHEET

IVA-Doc-No.: ITC.ZW50 / ZVV 2101 E

Format Size: A1

ACAD - PART: JPMCWP

POLYELECTROLYTE
WATER
NaOH
H2SO4
UREA
DIAMMONIUM HYDROGEN PHOSPHATE

70-02.01
70-04.03
70-04.04
70-01.03
70-05.01
70-04.01
70-02.02
70-04.02

STORAGE
STORAGE
DE-FOAMING CHEMICALS

CHEMICAL SEWER
(BLEACH PLANT EFFLUENT + CHEMICAL LOSSES)

70-03.01
70-03.02
70-02-10
NEUTRALIZATION
70-09.01
70-02-11
70-04.05
70-04.07

70-09-02
70-04.06
70-04.08
70-01.01
70-09.01
70-01.02
70-08.01
70-09.03
70-04.09
70-04.10

HIGH SOLID SEWER
(MAINLY CONTAINING FIBRE EFFLUENT)
70-09.03
70-02-12
STATIC RAKE
70-09.02
MECH. RAKE
70-02-13
EFFLUENT PUMP STATION

70-04.29
70-09.10
70-04.22
70-01.22
70-03.27
BELT FILTER PRESS
70-08.03

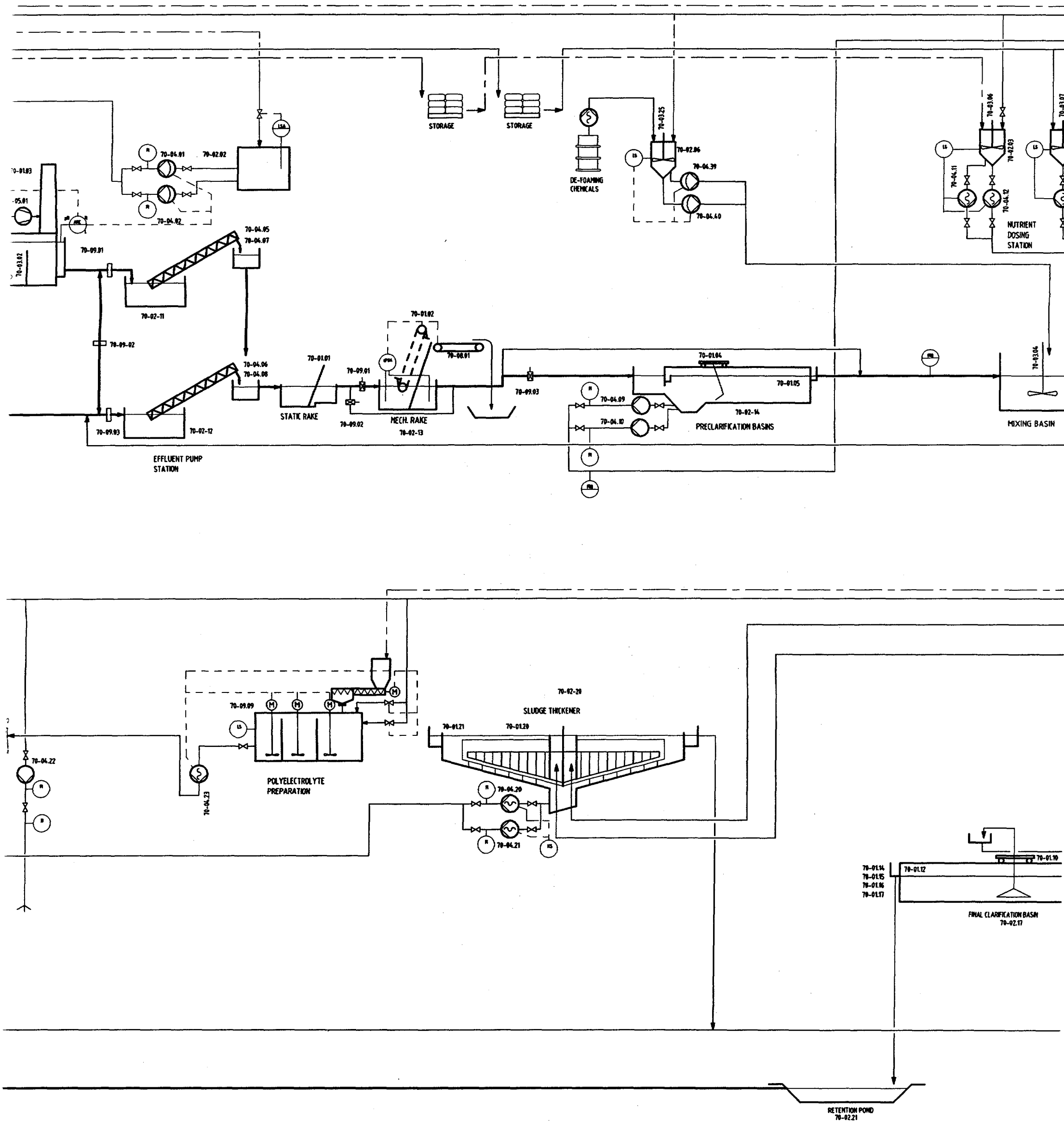
70-09.09
70-04.23
POLYELECTROLYTE PREPARATION

70-02-20
SLUDGE THICKENER
70-01.21
70-01.20
70-04.20
70-04.21

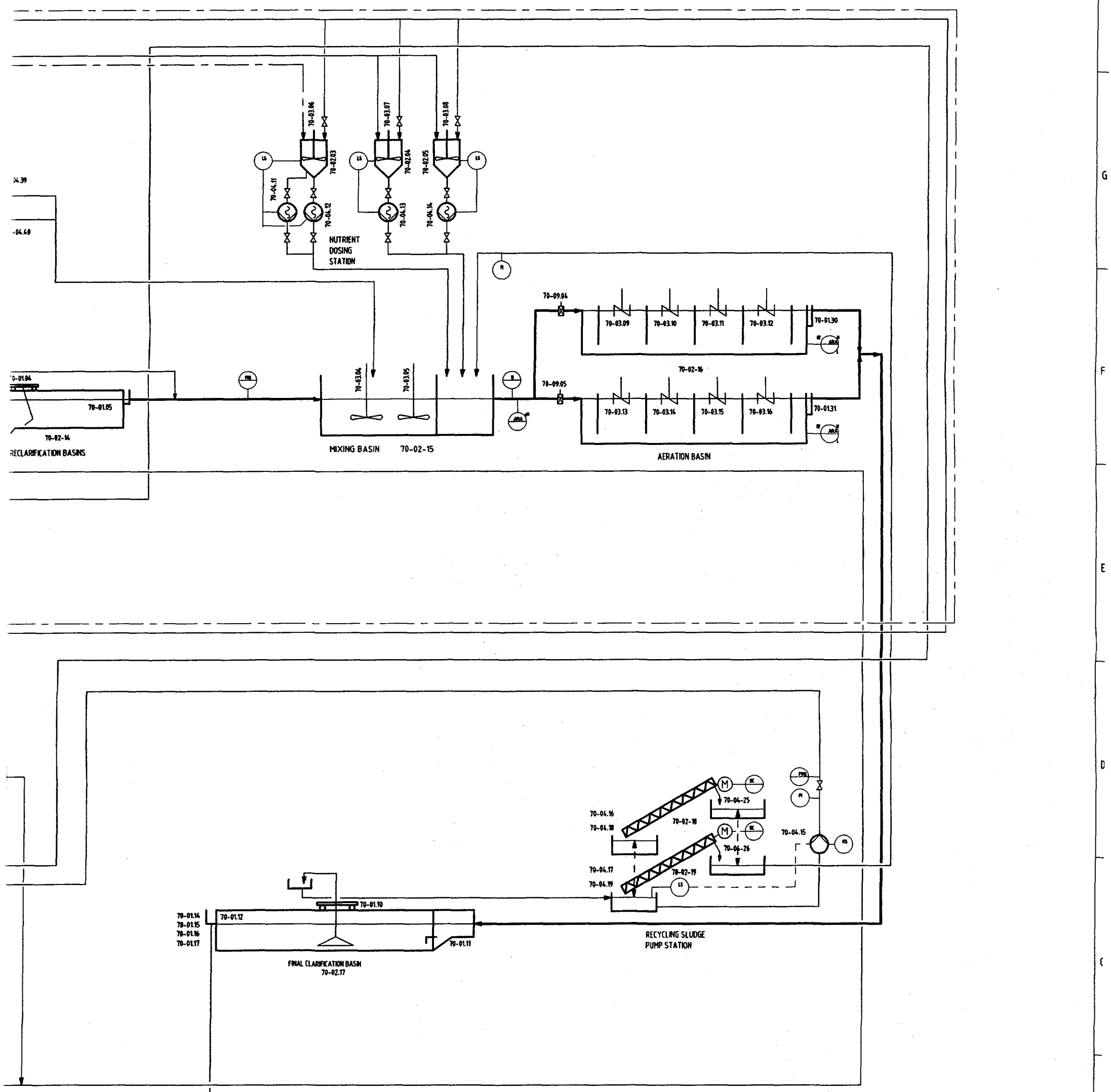
TREATED EFFLUENT
TO RIVER

E section 1

ACAD - PART: JPMEFF


STORAGE
STORAGE
DE-FOAMING CHEMICALS
70-03.25
70-02.06
70-04.39
70-04.60
70-03.06
70-02.03
70-04.11
70-04.12
NUTRIENT DOSING STATION
70-03.07
70-04.01
70-02.02
70-04.02
70-03.02
70-09.01
70-04.05
70-04.07
70-02-11
70-09-02
70-09.03
70-02-12
EFFLUENT PUMP STATION
70-04.06
70-04.08
70-01.01
STATIC RAKE
70-09.01
70-09.02
70-01.02
MECH. RAKE
70-02-13
70-08.01
70-09.03
70-01.04
70-01.05
70-04.09
70-04.10
70-02-14
PRECLARIFICATION BASINS
MIXING BASIN
70-03.04
70-09.09
POLYELECTROLYTE PREPARATION
70-04.23
70-04.22
70-02-20
SLUDGE THICKENER
70-01.21
70-01.20
70-04.20
70-04.21
70-01.10
70-01.12
70-01.14
70-01.15
70-01.16
70-01.17
FINAL CLARIFICATION BASIN
70-02.17
RETENTION POND
70-02.21

(E) section (2)



PRELIMINARY

Section (3)

02		UPDATED	98.11.09	Nöstl.	Kreindl
01		UPDATED	98.07.20	Nöstl.	Kreindl
Änderung Revision	Anz. d. Änd. No. of Mod.	Änderungsinhalt Modification	Datum Date	Bearbeitet Made by	Geprüft Checked by

	Datum Date	Name Name
Gezeichnet Drawn	20.04.98	GRUBER
Geprüft Checked	20.04.98	KREINDL

Maßstab/Scale

Hersteller/Manufacturer

Herstellerzeichnungs-Nr./Manufacturer Dwg. No.

IMPCO-VOEST-ALPINE Pulping Technologies GmbH

Projekt/Customer: **JUTE PULP MILL**

Benennung/Title: PHASE III
EFFLUENT TREATMENT
FLOWSHEET

Masse/Mass

Werkstoff/Material

Kunden/Customer-Doc-No.:

IVA-Doc-No.: **ITC.ZV10 / ZVV 2101 E**

Blatt Sheet von of

Format Size: A1

Änderung Revision: 02

PLOT ZURUCK AN IVA / STEININGER (BG39) - TEL. 3694

RECOVERY BOILER

POWER BOILER

LP STEAM

ZD51.T02
OIL
DAY TANK

LP-HEADER

ZD51.T01
OIL
STORAGE

ZD51.P04

OIL

ZD51.P03

ZD51.P01

ZD51.P02

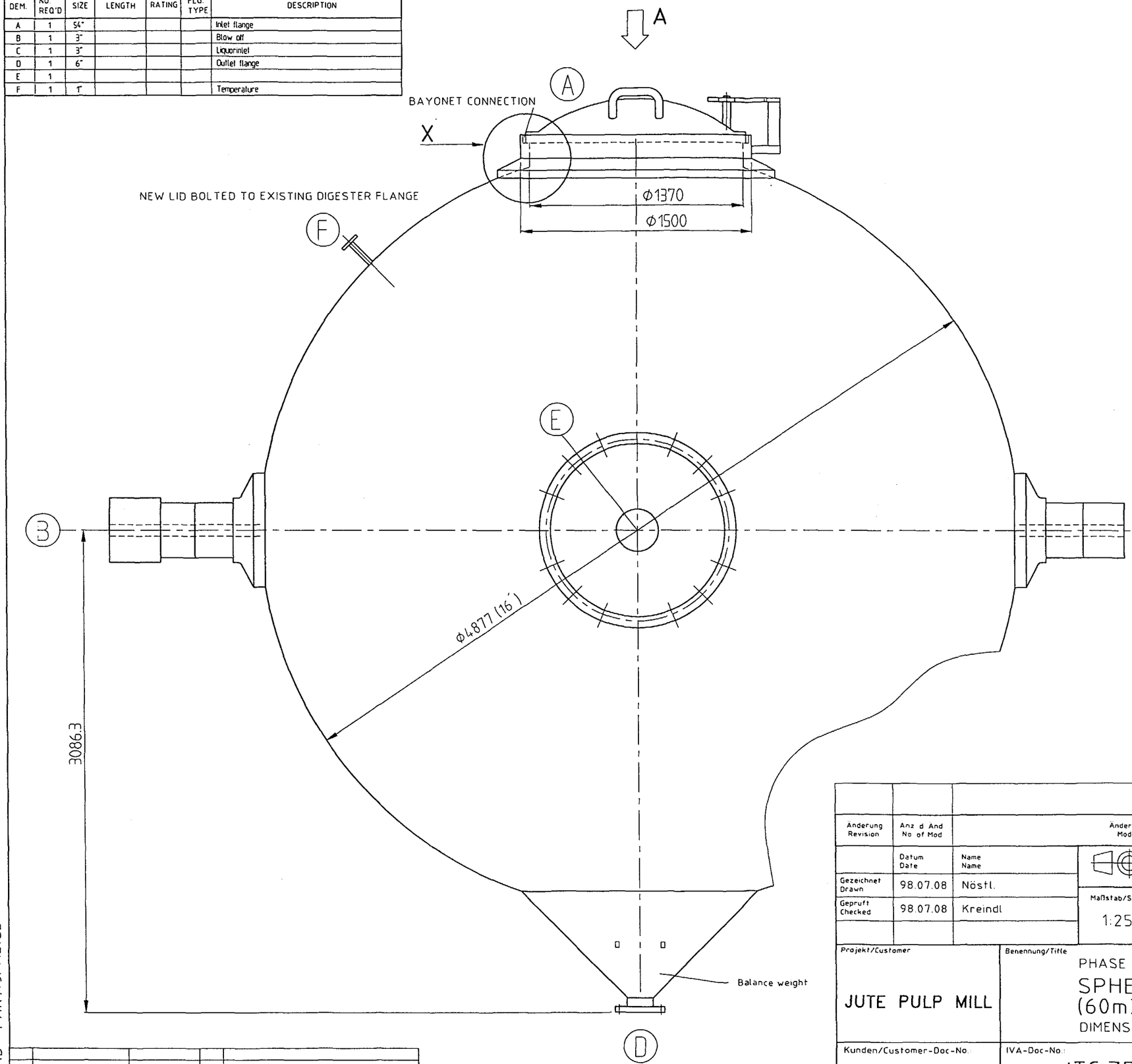
TO LIME KILN DAY TANK

PRELIMINARY

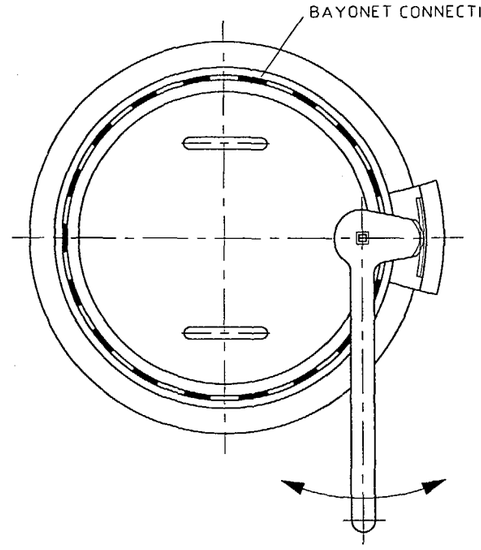
Änderung Revision	Anz. d. Änd. No. of Mod.	Änderungsvermerk Modification		Datum Date	Bearbeitet Made by	Geprüft Checked by	
	Datum Date	Name Name					
Gezeichnet Drawn	20.04.98	GRUBER					
Geprüft Checked	20.04.98	KREINDL					
			Maßstab/Scale	Herstellerbezeichnung/-Nr./Manufacturer Dwg. No.			
Projekt/Customer: JUTE PULP MILL		Benennung/Title: FUEL OIL STORAGE & HANDLING FLOWSHEET				Masse/Mass	
Kunden/Customer-Doc-No.		IVA-Doc-No.: ITC.ZD51 / ZVV 2101 E			Blatt Sheet	von of	Format Size A1	Änderung Revision

ACAD ~ PART: JPMFUELO

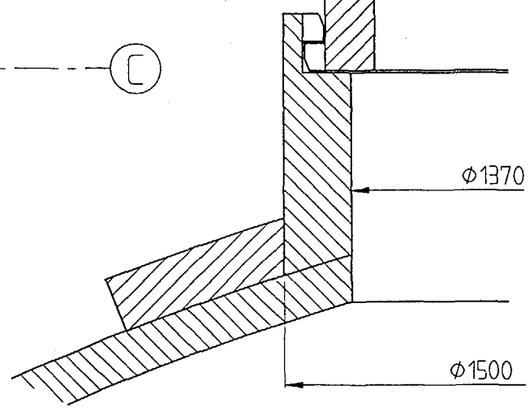
LIST OF NOZZLES						
DEM.	NO. REQ'D	SIZE	LENGTH	RATING	FLG. TYPE	DESCRIPTION
A	1	54"				Inlet flange
B	1	3"				Blow off
C	1	3"				Liquorinlet
D	1	6"				Outlet flange
E	1					
F	1	1"				Temperature



VIEW A



DETAIL X
SC. 1:5



QNT.	MATERIAL	DWG. NO.	ITEM	DESCRIPTION

Änderung Revision	Anz. d. And. No. of Mod.	Änderungsinhalt Modification	Datum Date	Bearbeitet Made by	Geprüft Checked by

	Datum Date	Name Name
Gezeichnet Drawn	98.07.08	Nöstl.
Geprüft Checked	98.07.08	Kreindl

Maßstab/Scale: 1:25

Hersteller/Manufacturer: IMPCO-VOEST-ALPINE Pulping Technologies GmbH

Herstellerzeichnungs-Nr./Manufacturer Dwg. No.:

Projekt/Customer: JUTE PULP MILL

Benennung/Title: PHASE III
SPHERICAL DIGESTER Dia 16' (60m3)
DIMENSION SHEET

Masse/Mass:

Werkstoff/Material:

Kunden/Customer-Doc-No.:

IVA-Doc-No.: ITC.ZF13.M01/ZAM-2101 E

Blatt Sheet	von of	Format Size	Änderung Revision
1	1	A3	

ACAD - PART: JPMDIG2

7. ANNEXES

ATTACHMENTS

- Time Schedule
- List of Potential Suppliers

PROPOSED TIME SCHEDULE for Phase III

Project: JUTE PULP MILL - Greenfield Investment

IMPCO-VOEST-ALPINE Pulping Technologies GmbH

MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	■																															
PROCESS ENGINEERING	—	—	—	—	—	—																										
DETAIL ENGINEERING			—	—	—	—	—	—	—	—	—	—	—	—																		
Plant & Mechanical Engineering			—	—	—	—	—	—	—	—																						
Engineering Piping						—	—	—	—	—	—	—																				
Engineering Electric						—	—	—	—	—	—	—	—	—																		
Detail Civil Engineering							—	—	—	—	—	—	—	—																		
MANUFACTURING						—	—	—	—	—	—	—	—	—	—	—	—	—														
SHIPMENT											—	—	—	—	—	—	—	—	—	—	—											
CIVIL WORKS										—	—	—	—	—	—	—	—	—	—	—	—											
ERECTION												—	—	—	—	—	—	—	—	—	—	—	—	—	—							
MECHANICAL COMPLETION																								■								
START UP																									—	—	—	—	—	—		

LIST OF POTENTIAL SUPPLIERS

Designation	Supplier (outside India)	Supplier (India)
Digester Lid	Schrader Verfahrenstechnik GmbH/D	Nathani International
Vacuum Filter	Beloit Corporation/USA	Hindustan Dorr-Oliver Ltd.
	Sunds Defibrator AB/S	
	A. Ahlstrom Corporation/SF	
Atmospheric Tanks		Devi Hi-Tech Engineers Pvt. Ltd.
		Goutami Engineering
		Aims India
		Profen Filters Pvt. Ltd.
		Jord Engineers India Ltd.
		Tungabadhara Machinery & Tools Ltd.
Pressurized Vessels Digesters		Kakati Karshak Ind. Pvt. Ltd.
		Sri Venkateswara Industries
		Swetha Engineering Ltd.
		Hindustan Dorr Oliver Ltd.
		Larsen & Toubro Ltd.
		Devi Hi-Tech Engineers Pvt. Ltd.
		Nathani International
		Goutami Engineering
		Maschinen Fabrik (India) Pvt.Ltd.
Pumps	ABS-Scanpump AB/S	Larsen & Toubro Ltd.
	Andritz Refinersysteme GmbH/A	Devi Hi-Tech Engineers Pvt Ltd.
	A. Ahlstrom Corporation/SF	KSB Pumps
		Mather & Platt
		Stork Pump (I) Ltd.
		Kirloskar Brothers Ltd.
Screw Conveyors		Hindustan Dorr Oliver Ltd.
		Larsen & Toubro Ltd.
		Devi Hi-Tech Engineers Pvt. Ltd.
		Jord Engineers India Ltd.
		EMCO-KCP Ltd.
		Tungabadhara Machinery & Tools Ltd.
		Remi Process Plant & Machinery Ltd.
Heat Exchangers		Larsen & Toubro Ltd.
		Devi Hi-Tech Engineers Pvt. Ltd.
		Jord Engineers India Ltd.
		Reliance Heat Transfer Pvt. Ltd.
		Maschinen Fabrik (India) Pvt.Ltd.

LIST OF POTENTIAL SUPPLIERS

Designation	Supplier (outside India)	Supplier (India)
Agitators	Beloit Corporation/USA	Hindustan Dorr Oliver Ltd.
	Scaba AB/S	Larsen & Toubro Ltd.
	A. Ahlstrom Corporation/SF	Devi Hi-Tech Engineers Pvt. Ltd.
		Profen Filters Pvt. Ltd.
		Jord Engineers India Ltd.
		Tungabadhara Machinery & Tools Ltd.
		Jessop & Co. Ltd.
		Servall Engineering Works
		Remi Process Plant & Machinery Ltd.
MC Pumps	Andritz Refinersysteme GmbH/A	
	A. Ahlstrom Corporation/SF	
Oxygen Generation	Voest-Alpine Industriean-lagenbau GmbH/A	
	EVT-Mahler GmbH/D	
	Air Products (UK) Ltd./UK	
Pressure Screens	Beloit Corporation/USA	
	Sunds Defibrator AB/S	
	A. Ahlstrom Corporation/SF	
Centrifugal Cleaner	Noss AB/S	
	Celleco Hedemora AB/S	
	Krebs Engineers/USA	
Black Liquor Filter	Beloit Corporation/USA	Hindustan Dorr-Oliver Ltd.
	ÖMV AB/S	
Chemical Mixer	Beloit Corporation/USA	Hindustan Dorr Oliver Ltd.
	Kenics Corporation/USA	Larsen & Toubro Ltd.
	A. Ahlstrom Corporation/SF	Devi Hi-Tech Engineers Pvt. Ltd.
	Komax Systems, Inc./USA	EMCO-KCP Ltd.
		Servall Engineering Works
Evaporation	A. Ahlstrom Corporation/SF	Enmas/Ahlstrom
	Austrian Energy & Environ-ment SGP/Waagner-Biro GmbH/A	
	A.H. Lundberg Associates Inc./USA	

LIST OF POTENTIAL SUPPLIERS

Designation	Supplier (outside India)	Supplier (India)
Recovery Boiler	A. Ahlstrom Corporation/SF	Thermax
	ABB Power Generation Segment/CDN	Tungabadhara Machinery & Tools Ltd.
	Tampella Power Asia Pacific Pte. Ltd./SING	Enmas/Ahlstrom
	Babcock & Wilcox/CDN	
Recausticizing	Goslin-Birmingham/USA	Hindustan Dorr-Oliver Ltd.
	EIMCO/BRD	Enmas/Ahlstrom
	A. Ahlstrom Corporation/SF	
Feed Water Treatment		PEC Boilers Pvt. Ltd.
Boilers		PEC Boilers Pvt. Ltd.
Turbine & Alternator		Bellies & Marcom (I) Ltd.
Generators		National Supply & Co.

LIST OF POTENTIAL SUPPLIERS (INDIA)

AIMS INDIA PVT. LTD.

212/A Jodhpur Park

700068 CALCUTTA
INDIA

Tel.No. *0091/33/4733983*
Fax No. *0091/33/4733206*

ANDREW YULE & CO LTD.

8, Clive Row
---
700 001 CALCUTTA
INDIA

Tel.No. ---
Fax No. ---

BELLIES & MARCOM LTD.

6, Little Russel Street
---
700 071 CALCUTTA
INDIA

Tel.No. *0091/33/2402868*
Fax No.

DEVI HI-TECH ENGINEERS PVT. LTD.

2-54, Kakateeya Nagar, Habsiguda
---
500 007 HYDERABAD
INDIA

Tel.No. *0091/40/673 458*
Fax No. *0091/40/672 110*

EMCO-KCP LTD.

Ramakrishna Building, 2, Victoria Cresent Road
Opp. Commander-in-Chief Road
600 105 MADRAS
INDIA

Tel.No. *0091/*
Fax No. *0091/*

ENMAS AHLSTROM LIMITED

IV Floor, Guna Building Annexe,
304-305 Anna Salai, Teynampet
600 018 CHENNAI
INDIA

Tel.No. *0091/44/4338050*
Fax No. *0091/44/4322412*

FLAKT INDIA LTD.

Jhalkura, Maheshtala
Buz Buz, 24 Paragnas (South)
— WEST BENGAL
INDIA

Tel.No. ---
Fax No. ---

GOUTAMI ENGINEERING

Nachran Industrial Area
---
501 507 HYDERABAD
INDIA

Tel.No. ---
Fax No. ---

LIST OF POTENTIAL SUPPLIERS (INDIA)

HINDUSTAN DORR-OLIVER LIMITED

Dorr-Oliver House, Chakala
Andheri (East)
400099 BOMBAY
INDIA

Tel.No. *0091/22/8325541*
Fax No. *0091/22/8365659*

HINDUSTAN DORR-OLIVER LIMITED

Dohil Chambers 46, Nehru Place

110019 NEW DELHI
INDIA

Tel.No. *0091/11/6412039*
Fax No. *0091/11/6422856*

JESSOP & Co., LTD.
A Subsidiary of BBUNL
21 & 22, Jessore Road
---
700 028 CALCUTTA
INDIA

Tel.No. *0091/33/551-5437*
Fax No. *0091/33/551-2868*

JORD ENGINEERS INDIA LTD.

506, Marble Arch, Race Course Road

390007 BARODA
India

Tel.No. *0091/265/334683*
Fax No. *0091/265/334680*

KAKATI KARSHAK INDUSTRIES
PRIVATE LTD.
Nachram Industrial Area
---
500 076 HYDERABAD
INDIA

Tel.No. *0091/40/853104, 05*
Fax No. *0091/40/671980*

KIRLOSKAR BROTHERS LTD.

No. 2, Shantiniketan Building, 2nd Floor
8, Camac Street
700 017 CALCUTTA
INDIA

Tel.No. *0091/*
Fax No. *0091/*

KSB PUMPS

30, Circus Avenue
---
700 026 CALCUTTA
INDIA

Tel.No. *0091/40/5418-5177*
Fax No. *0091/40*

LARSEN & TOUBRO LIMITED
Engineering Project & Equipment Group
1B, Park Plaza, 71, Park Street
---
700 016 CALCUTTA
INDIA

Tel.No. *0091/293251-54*
Fax No. *0091/33/2449705*

LIST OF POTENTIAL SUPPLIERS (INDIA)

MASCHINEN FABRIK (INDIA) PVT. LTD.

11/45, Panditya Road
---
700 029 CALCUTTA
INDIA

Tel.No. *0091/474/9975*
Fax No. *0091/474/7762*

MATHER & PLATT

11, R.N. Mukherjee Road
---
700 001 CALCUTTA
INDIA

Tel.No. *0091/248/5650-5659*
Fax No. *0091/248*

NATHANI INTERNATIONAL

E-302, Kailash Apartment
293 Bellasis Road
400 008 BOMBAY
INDIA

Tel.No. *0091/22//308/1832*
Fax No. *0091/22//308/*

NATIONAL SUPPLY & CO.

44, Hindustan Park
---
700 029 CALCUTTA
INDIA

Tel.No. *0091/33/4662262*
Fax No.

PEC BOILERS PVT LTD.

13, Camac Street 2nd Floor
---
700 017 CALCUTTA
INDIA

Tel.No. *0091/33/2404561*
Fax No. *0091/33/2407157*

PROFEN FILTERS PVT. LTD.

10/D, High Way Common Centre
Danilimda
--- AHMEDABAD
INDIA

Tel.No. *0091/79/*
Fax No. *0091/79/535 8668*

RELIANCE HEAT TRANSFER PVT. LTD.

46, Veer Nariman Road, Fort
---
400 001 BOMBAY
INDIA

Tel.No. *0091/22/204 7004*
Fax No. *0091/22/*

RELIANCE HEAT TRANSFER PVT. LTD.

14-C, Everest House, 46-C Chowringhee Road
46-C Chowringhee Road
700 071 CALCUTTA
INDIA

Tel.No. *0091/242/8456*
Fax No. *0091/242/*

LIST OF POTENTIAL SUPPLIERS (INDIA)

REMI PROCESS PLANT & MACHINERY LTD.

Plot No. 11, Cama Industrial Estate
Goregeon (East)
400 063 BOMBAY
INDIA

Tel.No. *0091/22/*
Fax No. *0091/22/873 6858*

SERVALL ENGINEERING WORKS

Bharathi Park VII Cross

641911 COIMBATORE
INDIA

Tel.No. *0091/422/441284*
Fax No. *0091/422/440077*

SRI VENKATESWARA INDUSTRIES
---
18 & 18/A-1, K.R. Puram Road
Ganapathy P.O.
641 006 COIMBATORE
INDIA

Tel.No. *0091/422/572930*
Fax No. *0091/422/571619*

STORK PUMP (I) LTD.

Survey No. 320 Odhav
---
382 410 AHMEDABAD
INDIA

Tel.No. *0091/272/870 311*
Fax No. *0091/272/873 184*

SWETHA ENGINEERING LTD.

Plot No. 1961-B, Asiad Colony
Vijaya Complex, 2nd Floor
600 101 MADRAS, Anna Nagar West
INDIA

Tel.No. *0091/44/6268366*
Fax No. *0091/44/6268377*

THERMAX Ltd.

Park Plaza, Block 6A
71, Park Street
700 016 CALCUTTA
INDIA

Tel.No. *0091/29-2423*
Fax No.

TUNGABADHARA MACHINERY & TOOLS LTD.

Flat No. 802&804, Kushal Towers
---
500 004 HYDERABAD
INDIA

Tel.No. *0091/40/*
Fax No. *0091/40/203 100*

LIST OF POTENTIAL SUPPLIERS (outside INDIA)

A. AHLSTROM CORPORATION

Sentnerikuja 2

SF-00441 HELSINKI
FINLAND

Tel.No. *00358/9/503-911*
Fax No. *00358/9/562-6927*

A.H. LUNDBERG Associates, Inc.

3015 112th Avenue N.E., Suite 200

WA 98004 BELLEVUE, Washington
USA

Tel.No. *001/206/827/2250*
Fax No. *001/206/827/2224*

ABB Power Generation
Combustion Service Division
200 Chisholm Drive

L9T 5E7 MILTON, Ontario
USA

Tel.No. *001/905/875-4500*
Fax No. *001/905/875-4624*

ABB Power Generation Segment

1410 Blair Place, Suite 600

K1J 9B9 GLOUCESTER, Ontario
CANADA

Tel.No. *001/613/747-5110*
Fax No. *001/613/747-5880*

ABS-SCANPUMP AB

P.O.Box 2053
S-431 02 MÖLNDAL
SWEDEN

Tel.No. *0046/31/836300*
Fax No. *0046/31/184906*

AIR PRODUCTS (UK) Ltd.
Standard Equipment Group
Molesey Road, Hersham Place
Walton-on-Thames
KT12 4RZ SURREY
GREAT BRITAIN

Tel.No. *0044/1932/249200*
Fax No. *0044/1932/249565*

ANDRITZ REFINERSYSTEME GMBH

Innstraße 23

A-1200 WIEN
ÖSTERREICH

Tel.No. *0222/33113-0*
Fax No. *0222/3325398*

AUSTRIAN ENERGY & ENVIRONMENT
SGP/WAAGNER-BIRO GMBH
Siemensstraße 89

A-1211 WIEN
ÖSTERREICH

Tel.No. *0222/25045-0*
Fax No. *0222/25045-157*

LIST OF POTENTIAL SUPPLIERS (outside INDIA)

BABCOCK & WILCOX
International Division

N1R 5V3 CAMBRIDGE, Ontario
CANADA

Tel.No. *001/519/621-2130*
Fax No. *001/519/622-2409*

BABCOCK & WILCOX INTERNATIONAL
Power Generation Group
20 S. Van Buren Avenue

44203-0351 BARBERTON, Ohio
USA

Tel.No. *001/330/753-4511*
Fax No. *001/330/860-1886*

BELOIT CORPORATION
Beloit Pulping
150 Burke Street

NH 03060-4788 NASHUA
USA

Tel.No. *001/603/882-2711*
Fax No. *001/603/595-0035*

CELLECO HEDEMORA AB

Hans Stahles Väg

S-147 80 TUMBA
SWEDEN

Tel.No. *0046/8/530 664 00*
Fax No. *0046/8/530 656 25*

EIMCO Zweigniederlassung der
Baker Hughes (Deutschland) GmbH
Gothaer Straße 4

D-40880 RATINGEN
BRD

Tel.No. *0049/2102/9454-0*
Fax No. *0049/2102/9454-20*

EVT - Mahler GmbH

Augsburgerstraße 708

D-70329 STUTTGART
BRD

Tel.No. *0049/711/91702*
Fax No. *0049/711/9171966*

GOSLIN-BIRMINGHAM

3401 8th Avenue North

35222 BIRMINGHAM, Alabama
USA

Tel.No. *001/205/324-7511*
Fax No. *001/205/251-0375*

KENICS CORPORATION

Kenics Park

01845 NORTH ANDOVER, Massachusetts
USA

Tel.No. *001/617/687-0101*
Fax No. ---

LIST OF POTENTIAL SUPPLIERS (outside INDIA)

KOMAX SYSTEMS, INC.

1947 E. 223rd Street

90810 LONG BEACH, California
USA

Tel.No. *001/213/830-4320*
Fax No. ---

KREBS ENGINEERS

1205 Chrysler Dr.,

CA-94025 MENLO PARK
USA

Tel.No. *001/415/325-0751*
Fax No. *001/415/326-7048*

NOSS AB

Ingeltag 1

S-60102 NORRKÖPING
SCHWEDEN

Tel.No. *0046/11/231500*
Fax No. *0046/11/135923*

ÖMV AB
Mekaniska Verkstad

P.O. Box 416
S-89128 ÖRNSKÖLDSVIK
SWEDEN

Tel.No. *0046/*
Fax No. *0046/66058278*

SCABA AB

Box 2018
S-183 02 TÄBY
SWEDEN

Tel.No. *0046/8/76802*
Fax No. *0046/8/768 5 1 41*

SCHRADER
VERFAHRENSTECHNIK GMBH
Schleebergstraße 12

D-59306 ENNIGERLOH
BRD

Tel.No. *0049/2524/266-0*
Fax No. *0049/2524/266-50*

SUNDS DEFIBRATOR AB

S-85194 SUNDSVALL
SCHWEDEN

Tel.No. *0046/60/*
Fax No. *0046/60/567527*

TAMPELLA POWER
ASIA PACIFIC PTE LTD
230 Orchard Road, 09-234/236 Faber House

0923 SINGAPORE
SINGAPORE

Tel.No. *0065/732/2100*
Fax No. *0065/732/2133*

LIST OF POTENTIAL SUPPLIERS (outside INDIA)

VOEST-ALPINE Industrieanlagenbau GmbH

Turmstraße 44

A-4031 LINZ
ÖSTERREICH

Tel.No. *0043/70/6592-9677*
Fax No. *0043/70/6980-6303*

8. BASIC FIGURES FOR CALCULATION OF OPERATING COST

GENERAL

Raw Material, Chemicals, Utilities

As a basis actual purchasing cost for raw material and chemicals have been used. For utilities the corresponding cost figures have been given by Tribeni and Ospak.

Manpower

The estimated manpower has been based on IVA's experience for the operation of such plant.

Attachment

- Basic figures for calculation of operating cost
- Manpower Requirements

Jute Pulp Mill Phase III - Manpower Requirements

Department	Mill Manager	Vice President	Manager	Deputy Manger	Supervisor	Staff, Operators	Helper	Total
	A	B	C	D	E	F	G	
MANAGEMENT & ADMINISTRATION	1					4		5
ACCOUNTING, PURCHASING, TRANSPORTATION, MARKETING, HUMAN RESOURCES		1	5		5	20	2	33
MAINTENANCE & ENGINEERING		1	3	3	6	30	40	83
R & D, QUALITY CONTROL		1		3		12	6	22
PRODUCTION		1						1
JUTE CUTTINGS HANDLING			1	4		4	19	28
DIGESTER SYSTEM						4	16	20
SCREENING & WASHING						4	4	8
BLEACHING PLANT				4	4	4		12
WET LAP MACHINE; DRYING						4	4	8
BALING						4	12	16
EVAPORATION PLANT			1	4	4	4	4	17
RECOVERY BOILER						4	4	8
RECAUSTICIZING PLANT						4	4	8
LIME KILN						4	8	12
CHEMICAL HANDLING				4	4	8	16	32
POWER BOILER, STEAM TURBINE & ALTERNATOR; FEED WATER TREATMENT, COOLING TOWER COMPRESSOR STATION, FUEL OIL STORAGE			1	4		8	8	21
RAW WATER TREATMENT						4	4	8
EFFLUENT TREATMENT PLANT						4	4	8
Total	**1**	**4**	**11**	**26**	**23**	**130**	**155**	**350**

CATEGORIES	Description	Example	IND RP/ Year
A	Mill Manager		900.000
B	Vice president	Production manager	600.000
C	Manager	Chief of Accounting	400.000
D	Deputy Manager		250.000
E	Supervisor		150.000
F	Staff	Operators, Secretaries, Accountants, Fork Lift Driver; Fitters, Electrician; Technician	80.000
G	Helper		50.000

NOTES:

1. Shift personnel has been calculated as follows:

   Required personnel per shift x 3 shifts + 15 % Off relieve) + 15 % Leave Relieve

8. BASIC FIGURES FOR CALCULATION OF OPERATING COST (PHASE III)

Case A: Jute Cost Ind. Rs. 14.000

Capacity 135,0 BDMTD	Working days 350		Production 47.250	
150,0 ADMTD	350		52.500	
Description	**Consumption/ BDMT Bleached Pulp**	**Unit Price**	**Cost per Unit in Ind. Rs.**	**Ind. Rs./ BDMT Bleached Pulp**
MATERIAL COST				
Fibre Line				
Jute (with 10 % moisture)	1,72 BDMT	ADT	14.000	26.756
NaOH (100 %)	39,0 kg	t	12.000	468
Anthraquinone	1,0 kg	t	160.000	160
Defoamer	necl.	t		0
Magnesium sulphate	4,0 kg	t	20.607	82
Peroxide	41,0 kg	t	17.938	735
DTPA	4,0 kg	t	10.000	40
H_2SO_4 (Sulfuric Acid 100 %)	10,5 kg	t	3.200	34
Na_2SO_3	6,0 kg	t	60.000	360
Recovery				
NaOH	10,00 kg		12.000	120
Oil	145,00 kg		7.000	1.015
Salt Cake	5,00 kg		4.000	20
Lime Stone	250,00 kg		2.150	538
Na_3PO_4	necl.			
N_2H_2	necl.			
NH_3	necl.			
Acid	necl.			
Ignition gas	necl.			
Steam & Power				
Coal Gr. B	620,00 kg		2.000	1.240
Oil	necl.			
HCl	necl.			
NaOH	necl.			
Water				
$Ca(OH)_2$	15,00 kg		11.000	165
H_2SO_4	1,80 kg		3.200	6
Hypochlorite	necl.			0
Inhibitor	necl.			0
Dispergator	necl.			0
Polyelectrolyte	necl.			0
NaOH	necl.			0
Urea	necl.			0
Defoaming	necl.			0

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OPCOSTF.XLS/CASE A

8. BASIC FIGURES FOR CALCULATION OF OPERATING COST (PHASE III)

Case A: Jute Cost Ind. Rs. 14.000

Capacity	Working days		Production	
135,0 BDMTD	350		47.250	
150,0 ADMTD	350		52.500	
Utilities				
Electric Power	402	KWh	2,1	844
Process water	Produced in Mill	m3	0,7	0
Utility Chemicals	20 kg	t	40.000	800
Steam MP (10 bar)	Produced in Mill	t	293,0	0
Steam LP (5 bar)	Produced in Mill	t	293,0	0
Mill air	Produced in Mill	Nm3	0,1	0
SUB TOTAL MATERIAL COST				**33.383**

PERSONNEL COST- acc. Manpower Requirements List				
	Manpower		**Ind. Rs./year**	**Ind. Rs./ BDMT Bleached Pulp**
Mill Manager	1		900.000,0	19,0
Vice President	4		600.000,0	50,8
Manager	11		400.000,0	93,1
Deputy Manager	26		250.000,0	137,6
Supervisor	23		150.000,0	73,0
Staff	130		80.000,0	220,1
Helper	155		50.000,0	164,0
Total Manpower	350			
SUBTOTAL PERSONNEL COST				**758**

TOTAL PRODUCTION COST (MATERIAL + PERSONNEL)	**34.140**

Remarks:

1) Shift personnel has been calculated as follows:
   (Required personnel per shift X 3 shifts + 15 % Off relieve) + 15 % Leave Relieve

2) For covering costs for chemical where is made the statement "necl." the consumption is rather small an overall consumption figure of 20 kg/BDMT pulp at an average cost of 40.000,-- Ind. Rs. per ton has been used.(under Chemical Utilities)

3) Total energy consumption is 6.062 kWh 3.800 kW are generated from Alternator Remaining 2.262 kWh = 402 kWh/t pulp must be purchased from community.

4) Cost for repairs and Consumables are not included in above calculation

8. BASIC FIGURES FOR CALCULATION OF OPERATING COST (PHASE III)

Case B: Jute Cost Ind. Rs. 7.000

Capacity 135,0 BDMTD	Working days 350		Production 47.250	
150,0 ADMTD	350		52.500	
Description	**Consumption/ BDMT Bleached Pulp**	**Unit Price**	**Cost per Unit in Ind. Rs.**	**Ind. Rs./ BDMT Bleached Pulp**
MATERIAL COST				
Fibre Line				
Jute (with 10 % moisture)	1,72 BDMT	ADT	7.000	13.378
NaOH (100 %)	39,0 kg	t	12.000	468
Anthraquinone	1,0 kg	t	160.000	160
Defoamer	necl.	t		0
Magnesium sulphate	4,0 kg	t	20.607	82
Peroxide	41,0 kg	t	17.938	735
DTPA	4,0 kg	t	10.000	40
H_2SO_4 (Sulfuric Acid 100 %)	10,5 kg	t	3.200	34
Na_2SO_3	6,0 kg	t	60.000	360
Recovery				
NaOH	10,00 kg		12.000	120
Oil	145,00 kg		7.000	1.015
Salt Cake	5,00 kg		4.000	20
Lime Stone	250,00 kg		2.150	538
Na_3PO_4	necl.			
N_2H_2	necl.			
NH_3	necl.			
Acid	necl.			
Ignition gas	necl.			
Steam & Power				
Coal Gr. B	620,00 kg		2.000	1.240
Oil	necl.			
HCl	necl.			
NaOH	necl.			
Water				
$Ca(OH)_2$	15,00 kg		11.000	165
H_2SO_4	1,80 kg		3.200	6
Hypochlorite	necl.			0
Inhibitor	necl.			0
Dispergator	necl.			0
Polyelectrolyte	necl.			0
NaOH	necl.			0
Urea	necl.			0
Defoaming	necl.			0

Rev. 1/ November 1998
OPCOSTF.XLS/CASE B

8. BASIC FIGURES FOR CALCULATION OF OPERATING COST (PHASE III)

Case B: Jute Cost Ind. Rs. 7.000

Capacity	Working days		Production	
135,0 BDMTD	350		47.250	
150,0 ADMTD	350		52.500	
Utilities				
Electric Power	402	KWh	2,1	844
Process water	Produced in Mill	m3	0,7	0
Utility Chemicals	20 kg	t	40.000	800
Steam MP (10 bar)	Produced in Mill	t	293,0	0
Steam LP (5 bar)	Produced in Mill	t	293,0	0
Mill air	Produced in Mill	Nm3	0,1	0
SUB TOTAL MATERIAL COST				**20.005**

PERSONNEL COST- acc. Manpower Requirements List

	Manpower		Ind. Rs./year	Ind. Rs./ BDMT Bleached Pulp
Mill Manager	1		900.000,0	19,0
Vice President	4		600.000,0	50,8
Manager	11		400.000,0	93,1
Deputy Manager	26		250.000,0	137,6
Supervisor	23		150.000,0	73,0
Staff	130		80.000,0	220,1
Helper	155		50.000,0	164,0
Total Manpower	350			
SUBTOTAL PERSONNEL COST				**758**

TOTAL PRODUCTION COST (MATERIAL + PERSONNEL)	**20.762**

Remarks:

1) Shift personnel has been calculated as follows:
   (Required personnel per shift X 3 shifts + 15 % Off relieve) + 15 % Leave Relieve

2) For covering costs for chemical where is made the statement "necl." the consumption is rather small an overall consumption figure of 20 kg/BDMT pulp at an average cost of 40.000,-- Ind. Rs. per ton has been used.(under Chemical Utilities)

3) Total energy consumption is 6.062 kWh 3.800 kW are generated from Alternator Remaining 2.262 kWh = 402 kWh/t pulp must be purchased from community.

4) Cost for repairs and Consumables are not included in above calculation

9. INVESTMENT COST ESTIMATION

Attachment

Spreadsheet: Investment cost estimation

9. Investment cost estimation (Phase III)

Pos.	Department	Assumption for estimate	Estimated investment
1	**Main Equipment, ex Works**		**1340,0 Mio Ind. Rs.**
	Fibre Line	**500,8 Mio Ind. Rs.**	
	Recovery, Chemical Handling	**508,7 Mio Ind. Rs.**	
	Steam & Power, Water, Ancillaries	**330,5 Mio Ind. Rs.**	
1.1	Equipment (locally)	1065,0 Mio Ind Rs.	
1.2	Equipment (imported)	275,0 Mio Ind Rs.	
2	**Steel structure**	approx. 4% of equipment cost	**53,6 Mio Ind. Rs.**
3	**Piping, Interconnecting**	approx. 8% of equipment cost	**107,2 Mio Ind. Rs.**
4	**Electric**	approx. 10% of equipment cost	**134,0 Mio Ind. Rs.**
5	**Instrumentation and DCS**	approx. 15% of equipment cost	**201,0 Mio Ind. Rs.**
6	**Total equipment cost (1- 5)**		**1835,8 Mio Ind. Rs.**
7	**Engineering; Project Management**	approx. 10% of equipment cost	**184,0 Mio Ind. Rs.**
8	**Spare parts for two years, start-up & commissioning**	approx. 4% of equipment cost	**73,0 Mio Ind. Rs.**
9	**Packing and transportation ex works to site**	approx. 4% of equipment cost	**73,0 Mio Ind. Rs.**
10	**Training**	approx. 2% of equipment cost	**37,0 Mio Ind. Rs.**
11	**Erection**	approx. 8% of equipment cost	**147,0 Mio Ind. Rs.**
12	**Supervision of erection/ startup, commissioning**	approx. 4% of equipment cost	**73,0 Mio Ind. Rs.**
13	**Civil works**	approx. 12% of equipment cost	**220,0 Mio Ind. Rs.**
14	**Subtotal 7 - 13**		**807,0 Mio Ind. Rs.**
15	**Total 6 + 14**		**2642,8 Mio Ind. Rs.**

10. ATTACHMENT PANDIA® DIGESTING PLANT

This description is for reference only. As long as no tirals with jute has been undertaken IVA will not quote a PANDIA® Digester System for jute pulping.

PROCESS DESCRIPTION

The purpose of the digesting is to chemically dissolve the lignin from the raw material in order to obtain bleachable grade bagasse pulp.

The most suitable continuous digester for cooking of nonwood raw material like straw and bagasse is the PANDIA®-DIGESTER.

The main components are:
Screw feeder
Inlet chamber with digester stop valve
Tow digester tubes
Cold blow discharger
Blow valves

The cleaned raw material is digested by using the Soda-process. The flow of raw material to the digester is controlled by a pin drum feeder. Cooking liquor is added according to the quantity of raw material. The raw material from the raw material preparation system will be received in the digester house from the transfer conveyor and will be fed to the screw conveyor ahead of the digester screw feeder by a pin drum feeder.

The feeding of the pressurized digester is done by a screw feeder. During feeding the raw material be be dewatered and homogenized.

The filtrate from the screw feeder will be returned to the wet depithing. The digester stop valve placed opposite the screw feeder is provided as a shutdown system for emergency cases to avoid the blow out of the digester content via the screw feeder.

The cooking liquor, a mixture of white liquor and black liquor, is heated up and injected into the inlet chamber. Steam for heating up the raw material will be added to the inlet chamber and to the digester.
Digestion itself is effected in two horizontal tubes equipped with screws which slowly convey the material to be cooked and which ensure a high filling degree of the tube volume.

After digestion the hot pulp will be cooled down by injecting cooled black liquor. Then the pulp is blown out from the cold blow discharger into the top dome of the blow tank. From there the pulp drops into the tank itself and will be diluted to pumpable consistency with black liquor.

The blow tank will be equipped with an agitator and with one pump for pulp transfer.

Hot water from black liquor cooler will be collected in a hot water tank from where it will be pumped to consumer.

Enclosure

Simplified Flowsheet

Pandia® Digester System

Simplified Flowsheet for Cooking of Nonwood Fibers